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**Chemical Constituents and Biological Research on Plants in the Genus *Curcuma***

Wen Sun<sup>1</sup>, Sheng Wang<sup>2</sup>, Wenwen Zhao<sup>1</sup>, Chuanhong Wu<sup>1</sup>, Shuhui Guo<sup>1</sup>, Hongwei Gao<sup>1</sup>,  
Hongxun Tao<sup>1</sup>, Jinjian Lu<sup>1</sup>, Yitao Wang<sup>1</sup>, Xiuping Chen<sup>1</sup>

<sup>1</sup>State Key Laboratory of Quality Research in Chinese Medicine, Institute of Chinese Medical Sciences, University of Macau, Macao, China

<sup>2</sup>State Key Laboratory Breeding Base of Dao-di Herbs, National Resource Center for Chinese Materia Medica, China Academy of Chinese Medical Sciences, Beijing, China

**ABSTRACT**

*Curcuma*, a valuable genus in the family Zingiberaceae, includes approximately 110 species. These plants are native to Southeast Asia and are extensively cultivated in India, China, Sri Lanka, Indonesia, Peru, Australia, and the West Indies. The plants have long been used in folk medicine to treat stomach ailments, stimulate digestion, and protect the digestive organs, including the

intestines, stomach, and liver. In recent years, substantial progress has been achieved in investigations regarding the chemical and pharmacological properties, as well as in clinical trials of certain *Curcuma* species. This review comprehensively summarizes the current knowledge on the chemistry and briefly discusses the biological activities of *Curcuma* species. A total of 720 compounds, including 102 diphenylalkanoids, 19 phenylpropene derivatives, 529 terpenoids, 15 flavonoids, 7 steroids, 3 alkaloids, and 44 compounds of other types isolated or identified from 32 species, have been phytochemically investigated. The biological activities of plant extracts and pure compounds are classified into 15 groups in detail, with emphasis on anti-inflammatory and antitumor activities.

**Keywords** Genus *Curcuma*; Chemical Constituents; Bioactivities; Antitumor

## 1. INTRODUCTION

*Curcuma*, a highly important genus in the family Zingiberaceae, comprises about 100 accepted species (Sasikumar, 2005). The genus was first established by Carl Linnaeus in 1753. The name *Curcuma* is derived from the Arabic word *kurkum*, meaning “yellow,” which refers to the color of the rhizome. *Curcuma* species are mainly distributed in the tropics and subtropics of South and

Southeast Asia and extensively largely cultivated in Bengal, China, Taiwan, Sri Lanka, Indonesia, Peru, Australia, and the West Indies (Ravindran et al., 2007). Several *Curcuma* species possess edible, medicinal, and economical values. *C. longa* (commercially known as turmeric) is the most important among *Curcuma* species (Figure 1). The use of *Curcuma longa* as a culinary spice in Vedic culture in India can date back to nearly 4,000 years ago. The powder of *C. longa* prepared from the dried root of *C. longa* is widely used in the food industry as a condiment and colorant. Furthermore, *C. longa* has been prescribed as a therapeutic herb over centuries in traditional medical systems. In Ayurvedic practices in India, *C. longa* is used to strengthen the overall energy of the body, relieve gas, dispel worms, improve digestion, regulate menstruation, dissolve gallstones, and relieve arthritis. In traditional Chinese medicine (TCM), *C. longa* was first recorded in “Tang Materia Medica” (659 AD), the first pharmacopoeia issued by China and in the world. *C. longa* and three other plants from the genus *Curcuma*, namely, *Curcuma phaeocaulis*, *Curcuma kwangsiensis*, and *Curcuma wenyujin*, were included in the latest version of Chinese Pharmacopoeia (2010). These herbs remove blood stasis, activate vital energy, eliminate stagnated food, and relieve pain. Data related to the phytochemical constituents of *Curcuma* have accumulated for nearly 200 years with the identification of curcumin in 1815 (Lampe et al., 1910). Pharmacological evaluation of extracts and pure compounds isolated from this genus has provided evidence for the multiple bioactivities of these plants in the last 100 years, especially in the recent 20 years. Among more than 100 species in this genus, *C. longa* is the most intensively

investigated, followed by *Curcuma zedoaria* and *Curcuma amada* (Figure 2). Previous phytochemical research on *Curcuma* species revealed the presence of various types of metabolites, which will be comprehensively summarized in this paper. To date, only about 32 *Curcuma* species have been investigated phytochemically according to the published literature. Although more than 700 compounds have been isolated from this genus, only a small fraction of these compounds have been explored in depth. Among these compounds, curcumin, which is mainly found in *C. longa*, is the most widely investigated. In the last several decades, this compound has been studied in numerous comprehensive reviews examining its structure, synthesis, derivatives, and biological activities (Maheshwari et al., 2006; Ryu et al., 2006; Julie and Jurenka, 2009; Agrawal and Mishra, 2010; Hamaguchi et al., 2010; Wilken et al., 2011; Heger et al., 2014).

The dietary, medical, industrial, and agricultural applications of the *Curcuma* genus has gained increasing attention, as evidenced by the massive increase in related publications in the past 10 years (Figure 3). Along with extensive research, several informative and critical reviews have focused on the chemistry and biological activities of *C. longa* (Jayaprakasha et al., 2005; Kumar, 2006; Jain et al., 2007; Niranjan and Prakash, 2008; Agarwal et al., 2009; Li et al., 2010b; Gupta Sandeep et al., 2011; Mehrotra et al., 2013), *C. amada* (Jatoi et al., 2007; Policegoudra et al., 2011), *C. zedoaria* (Lobo et al., 2009), or the natural and synthetic curcuminoids (Anand et al., 2008; Agrawal and Mishra, 2010) and terpenoids (Lu et al., 2012; Afzal et al., 2013) isolated from the genus *Curcuma*. This comprehensive review covers both the chemical profiles and biological activities of all

phytochemically investigated *Curcuma* species. This information is presented in a clear and readable manner to help researchers, especially newcomers in this field, understand the general picture regarding the genus in study.

## 2. CHEMICAL CONSTITUENTS

Phytochemical investigations on *Curcuma* species identified a host of secondary metabolites. Some of these metabolites, such as curcumin and its analogues, have captured worldwide attention for their various biological activities. A total of 720 compounds have been isolated and identified from 32 *Curcuma* species. Most of these compounds have been isolated from dried rhizome, whereas others have been extracted from fresh radix or aerial parts of the plant. Chemically, these diverse compounds can be divided into six subgroups: diphenylalkanoids, phenylpropene derivatives, terpenoids, flavonoids, steroids, and others. The names and plants sources of these compounds are summarized in Table 1.

### 2.1. Diphenylalkanoids

Diphenylalkanoids comprise the most abundant group in the genus *Curcuma*. A total of 102 diphenylalkanoids (**1–102**) have been identified and reported in this genus (Figure 4). Based on the length of carbon chain between two aromatic rings, diphenylalkanoids can be further classified into diphenylheptanoids, diphenylpentanoids, and other diphenylalkanoids. Diphenylalkanoids are

distributed in 13 *Curcuma* species at minimum (Figure 2). Most diphenylheptanoids are obtained from the dried rhizomes of the *Curcuma* species. However, the occurrence of these compounds has been also reported in the dried radix of *C. longa* (Dao et al., 2012) and *Curcuma xanthorrhiza* (Yamada et al., 2009) as well as the dried aerial parts of *Curcuma comosa* (Chokchaisiri et al., 2012), thus indicating their wide distribution in this genus.

### **2.1.1. Diphenylheptanoids**

Diphenylheptanoids are commonly known as curcuminoids and contain an aryl-C7-aryl skeleton. These compounds are the most abundant in the genus *Curcuma*. A total of 96 diphenylheptanoids in this genus are known at present (Figure 4). Structures of diphenylheptanoids differ in substitution patterns in the phenyl rings and the heptane chain. The carbon chain units can cyclize between C3 and C7 or C2 and C5 positions, which form a pyrone or furan ring, respectively. The former structure occurs in 1,5-epoxy-3-carbonyl-1,7-bis(4-hydroxyphenyl)-4,6-heptadiene (**92**), 3'-demethoxycyclocurcumin (**93**), and cyclocurcumin (**94**), whereas the latter is found in *C. longin* A (**95**) and *C. longin* B (**96**). Curcumin (**1**), demethoxycurcumin (**2**), and bisdemethoxycurcumin (**3**), which are also called curcumin I, II, and III, respectively, are the most extensively distributed diphenylheptanoids in the genus.

Curcuminoids from the herb *C. longa* are synthesized by a collaboration among two type III polyketide synthases, diketide-CoA synthase (DCS), and curcumin synthases (CURS1, CURS2,

and CURS3) (Ramirez-Ahumada Mdel et al., 2006; Katsuyama et al., 2009a) (Scheme 1). DCS catalyzes the formation of feruloyldiketide–CoA from feruloyl–CoA and malonyl–CoA, as well as *p*-coumaroyl-diketide–CoA from *p*-coumaroyl–CoA and malonyl–CoA (Kita et al., 2008). CURS1, 2, and 3 catalyze the formation of curcumin from feruloyl–CoA, and the feruloyldiketide–CoA produced by the action of DCS (Ramirez-Ahumada Mdel et al., 2006). These three synthases also catalyze the synthesis of bisdemethoxycurcumin from one molecule each of *p*-coumaroyldiketide–CoA and feruloyl–CoA. New studies on these catalytic processes suggest (Morita et al., 2010a; Katsuyama et al., 2011) that CURS1 mediates the hydrolysis of diketide–CoA to yield a  $\beta$ -keto acid as a diketide intermediate, as well as the decarboxylative condensation of the  $\beta$ -keto acid with feruloyl–CoA to yield curcumin (Morita et al., 2010b; Katsuyama et al., 2011). CURS1 and CURS2 prefer feruloyl–CoA as a starter substrate, whereas CURS3 prefers both feruloyl–CoA and *p*-coumaroyl–CoA (Katsuyama et al., 2009b). Thus, CURS3 can catalyze the formation of bisdemethoxycurcumin from *p*-coumaroyldiketide–CoA using *p*-coumaroyl–CoA and demethoxycurcumin from the reaction of feruloyldiketide–CoA with *p*-coumaroyl–CoA. Overall, the formation of curcumin and demethoxycurcumin can be catalyzed by CURS1, CURS2, and CURS3, but bisdemethoxycurcumin can only be formed from the action of CURS3. In addition to the presence and amount of substrates, *p*-coumaroyl–CoA and feruloyl–CoA, the expression levels of CURS1, CURS2, and CURS3 should be determined for elucidating the composition of the curcuminoid mixture in *C. longa*.

### 2.1.2. Diphenylpentanoids

In contrast to diphenylheptanoids, diphenylpentanoids consist of two phenyl groups that are linked by a five-carbon chain. Only three compounds of this type, namely, (1E,4E)-1,5-bis-(4-hydroxy)-1,4-pentadien-3-one (**97**), (1E,4E)-1,5-bis-(4-hydroxy-3-methoxyphenyl)-1,4-pentadien-3-one (**98**), and (1E,4E)-1-(4-hydroxy-3-methoxyphenyl)-5-(4-hydroxyphenyl)-1,4-pentadien-3-one (**99**), have been found in the radix and rhizome of *C. longa* (Masuda et al., 1993; Park and Kim, 2002; Wang et al., 2008d; Li et al., 2009b; Xiao et al., 2011; Dao et al., 2012) (Figure 5).

### 2.1.3. Other Diphenylalkanoids

From the dried rhizome of *C. amada*, three diphenylalkanoids, namely, amadanoic acid A (aryl-C9-aryl skeleton, **100**), amadanoic acid B (aryl-C9-aryl skeleton, **101**), and amadandiol (aryl-C15-aryl skeleton, **102**), were discovered.

## 2.2. Phenylpropene Derivatives

Phenylpropene derivatives represent a class of natural products that are widely distributed in the plant kingdom. Sixteen monomeric (**103–118**) and three dimeric (**119–121**) types of phenylpropene derivatives obtained from *Curcuma* species have been reported (Figure 7).

### 2.2.1. Monomeric Phenylpropene Derivatives

Sixteen monomeric phenylpropene derivatives have been isolated from *Curcuma* species (Figure 7). Notably, cinnamyl cinnamate (**115**) from *Curcuma oligantha*, calebin A (**116**), 4<sup>"</sup>-(4<sup>"</sup>-hydroxyphenyl-3<sup>"</sup>-methoxy)-2<sup>"</sup>-oxo-3<sup>"</sup>-butenyl-3-(4'-hydroxyphenyl)-propenoate (**117**), and 4<sup>"</sup>-(4<sup>"</sup>-hydroxyphenyl)-2<sup>"</sup>-oxo-3<sup>"</sup>-butenyl-3-(4'-hydroxyphenyl-3'-methoxy)-propenoate (**118**) are four esters that form from the reaction between ferulic acid and a phenyl butane derivative.

### **2.2.2. Dimeric Phenylpropene Derivatives**

Only three dimeric phenylpropene derivatives, namely, 1-*p*-coumaroyl-cinnamic acid (**119**), 1-feruloyloxy-2-methoxycinnamic acid (**120**), and 1-feruloyloxy-cinnamic acid (**121**), have been isolated from *Curcuma chuanyujin* (Huang et al., 2000a).

## **2.3. Terpenoids**

Terpenoids, which are the main constituents of various volatile oils, occupy the largest group of compounds isolated from *Curcuma* species. In total, 526 terpenoids (**122–646**) have been reported from 32 *Curcuma* species, accounting for 74.7% of all the compounds. The essential oils from *Curcuma* are predominantly monoterpene and sesquiterpene in nature, but several dipertene, serterpine, and triterpene forms have been isolated (Mohamed et al., 2003). Among these essential oils, sesquiterpenes are the most numerous and diverse in structure (Figure 2).

### **2.3.1. Biosynthesis of Terpenoids**

The biosynthesis of terpenes proceeds via fusion of isoprenoid units (C5). The C5 units are elongated by prenyltransferases to form geranyl diphosphate (C10), farnesyl diphosphate (C15), and geranyl diphosphate (C20), which are precursors of monoterpenes, sesquiterpenes, and diterpenes, respectively (Schnee et al., 2002; Yu and Utsumi, 2009). Terpene synthases catalyze biochemical modifications, such as oxidation or rearrangement, to produce related monoterpenoids, sesquiterpenes, and diterpenes (Yu and Utsumi, 2009; Zi et al., 2014). Given that sesquiterpenes are the most widespread in *Curcuma*, their biosynthesis is described briefly in this paper (Scheme 2).

Numerous sesquiterpene synthase genes that encode enzymes that produce sesquiterpenes products have been identified. Among investigations on sesquiterpene products, those on the biosynthesis of artemisinin in *Artemisia annua* and gossypol in *Gossypium hirsutum* L. are of particular interest. Sesquiterpene synthases with different functions have been discovered in different plant species.

Upon the expression of terpene synthase 1 (tps1) from maize in a bacterial system, the encoded enzyme produces the acyclic sesquiterpenes (*E*)- $\beta$ -farnesene and (*E,E*)-farnesol (Schnee et al., 2002). The cDNA-encoding (*E,E*)- $\alpha$ -farnesene synthase has been cloned and identified from peel tissue of apple fruit (Pechous and Whitaker, 2004), whereas the cDNA encoding (*E*)- $\beta$ -farnesene synthase has been cloned from peppermint (Crock et al., 1997).

ZoTPS1 in ginger has been suggested to correspond to (*S*)- $\beta$ -bisabolene synthase gene, which can catalyze (*S*)- $\beta$ -bisabolene formation from the conversion of farnesyl diphosphate (Fujisawa et al., 2010). Meanwhile, the recombinant protein product of PmeTPS3 (*Pseudotsuga menziesii*) with farnesyl diphosphate as the substrate has been identified as (*E*)- $\gamma$ -bisabolene (Huber et al., 2005).

### **2.3.2. Monoterpenes**

#### *2.3.2.1. Acyclic Monoterpenoids*

Acyclic monoterpenoids are formed by the head-to-tail arrangement of isoprene units. Twenty-four acyclic monoterpenoids from *Curcuma* species have been previously reported (**122–145**, Figure 8).  $\beta$ -Terpineol (**142**), *trans*-linalool oxide (**143**), elsholtzia ketone (**144**), and perillene (**145**) are four cyclo-2,6-dimethyloctane monoterpenoids.

#### *2.3.2.2. Menthane Monoterpenoids*

Menthane monoterpenoids include three isomeric types, namely, *o*-, *m*-, and *p*-menthanes. *p*-Menthanes are the dominant monoterpenoids that are isolated from *Curcuma* species are *p*-menthanes, whereas only one *m*-menthane (*m*-cymene-8-ol (**149**)) extracted from the flower of *Curcuma pierreana* has been reported (Dung et al., 1998).

#### *2.3.2.3. Bicyclic Monoterpenoids*

Bicyclic monoterpenoids are formed by further cyclization of monocyclic terpenoids followed by various rearrangements. The 37 bicyclic monoterpenoids found in *Curcuma* species can be further divided into six subgroups: camphane-type (**193,194**), fenchane-type (**196–199**),

carane-type (**200–202**), thujane-type (**203–211**), pinane-type (**220–226**), and miscellaneous bicyclic monoterpenoids (**212–219**).

### 2.3.3. *Sesquiterpenes*

Sesquiterpenes comprise a wide variety of C<sub>15</sub> compounds that are formed by the assembly of three isoprenoid units. These compounds are commonly found in the kingdom of medicinal plants. A number of sesquiterpenoid carbon skeletons are found in *Curcuma* species, and 382 sesquiterpenes distributed in 28 *Curcuma* species have been documented (Figure 2). In general, almost 100 natural sesquiterpene skeletons have been found to exist. In *Curcuma* species, 11 subgroups, have been identified to date, with the bisabolane and guaiane types covering the majority (Figure 2).

#### 2.3.3.1. *Farnesane Sesquiterpenoids*

A total of 12 farnesane sesquiterpenoids have been obtained from *Curcuma* species to date (Figure 11). However, only (2Z,6E)-farnesol (**228**) and (E)-β-farnesene (**230**) are widely found in *Curcuma* species.

#### 2.3.3.2. *Bisabolane-type Sesquiterpenes*

Bisabolanes compose the largest group of sesquiterpenes found in *Curcuma* species (Figure 12). Investigation on the dried *C. longa* rhizome has led to the isolation of 16 hybrids that conjugate the curcumin skeleton with a bisabolane-type sesquiterpene. Interestingly, *C. longa* is surmised to be the sole source of bisabolanes. Three cyclobisabolane sesquiterpenoids, namely,

*cis*-sesquisabinene hydrate (**316**), *trans*-sesquisabinene hydrate (**317**), and sesquisabinene (**318**), have been found in *C. longa*, *Curcuma angustifolia*, and *C. angustifolia*, respectively.

#### 2.3.3.3. Cadinane-type Sesquiterpenoids

Cadinane-type sesquiterpenoid skeletons depend on relative stereochemistries at carbons 1, 6, and 7, as indicated. Cadinanane-type sesquiterpenoids that are present in *Curcuma* species can be divided into four subgroups: cadalene (**319–321**), calamenene (**322–323**), cadinane (**324–336**), and muurolane (**337–344**).

#### 2.3.3.4. Carabranes-type Sesquiterpenes

Carabranes constitute a small group of 5,10-cycloxanthanes. Only six sesquiterpenes of this type have been reported from the genus *Curcuma* (Figure 14). Among these carabranes, curcumenone (**347**) extensively occurs in seven species.

#### 2.3.3.5. Curcumane-type Sesquiterpenes

Curcumane-type sesquiterpenes are 4,5-secoguaianes. Five sesquiterpenes of this type (Figure 15) have been isolated from the genus *Curcuma*.

#### 2.3.3.6. Elemane-type Sesquiterpenes

Elemanes belong to a small group of sesquiterpenes. This type possibly refers to artifacts produced during isolation. To date, 12 elemane-type sesquiterpenes have been found in the genus *Curcuma* (Figure 16). Curzerene (**356**), curzerenone (**357**),  $\beta$ -elemene (**364**),  $\gamma$ -elemene (**365**), and  $\delta$ -elemene (**366**) are distributed extensively among *Curcuma* species, whereas

(*5R,6R,7aR*)-5-isopropenyl-3,6-dimethyl-6-vinyl-5,6,7,7*a*-tetrahydro-4*H*-benzofuran-2-one

(359),

(*5R,6R,7aS*)-5-isopropenyl-3,6-dimethyl-6-vinyl-5,6,7,7*a*-tetrahydro-4*H*-benzofuran-2-one

(360), and elema-1,3,7(11),8-tetraen-8,12-lactam (361) are exclusively found in the dried rhizome of *C. wenyujin*.

#### 2.3.3.7. Eudesmane and Furanoeudesmane-type Sesquiterpenes

Eudesmanes are called selinanes in the early literature. Eudesmane sesquiterpenoids in the genus *Curcuma* can be divided into groups that are composed of simple eudesmanes, furanoeudesmane-type sesquiterpenes, and secoeudesmanes. At present, 22 simple eudesmanes (368–389), 20 furanoeudesmane-type sesquiterpenes (390–407), and 1 secoeudesmane (408) have been reported.

#### 2.3.3.8. Germacrane-type Sesquiterpenes

The large germacrane group is subdivided into simple germacrane, which lack a lactone or furan ring (Figure 18), 12,8-germacranolides (443–455), 12,6-germacranolides (456–461), and the sole bicyclogermacrane sesquiterpenoids (462). In total, 54 germacrane-type sesquiterpenes are found to be distributed in 21 *Curcuma* species. Some of these sesquiterpenes are widely present in *Curcuma* species. For example, the contents of furanodiene (448) and curdione (423) in *C. wenyujin* are approximately 15–20 mg/g each (Yang et al., 2006).

#### 2.3.3.9. Guaiane-type Sesquiterpenes

Guaiane-type sesquiterpenes correspond to the second largest group of sesquiterpenes found in *Curcuma* species. Based on the diversity of their structural features, this group can be further classified into the following six categories: simple guaianes (**463–505**), 12,6-guaianolide (**506–529**), 12,8-guaianolides (**530–531**), seco-abeoguaianes (**532**), abeoguaianes (**533–535**), and cycloguaiane (**536–537**). The dried rhizomes of *C. wenyujin* and *C. zedoaria* yield the highest number of guaiane-type sesquiterpenes, with 34 and 28, respectively (Figure 2, Table 1).

#### 2.3.3.10. Sesquiterpene Dimers

Investigations on the dried underground parts of *Curcuma parviflora* have led to the isolation of 10 sesquiterpene dimers, designated as parviflorenes A–J (**538–547**). Another sesquiterpene dimer called difurocumenone (**548**) has been obtained from *Curcuma aeruginosa*.

#### 2.3.3.11. Other Sesquiterpenes

In addition to the main types of sesquiterpenes mentioned above, a minimum of 59 other sesquiterpenes belong to 16 different carbon skeletons, as listed below:

I. aristolane-type (**549**)

II. aromadendrane (**550–552, 604–607**)

III. bourbonane (**553**)

IV. caryophyllane-type (**554–556**)

V. copaane-type (**557–558**)

VI. cubebane (**559–561**)

VII. cyclopentane sesquiterpenoids (**562**)

VIII. daucene: (**563–564**)

IX. himachalane-type (**565–567**)

X. longifolane-type (**568**)

XI. longipinane (**569–570**)

XII. oplopane type (**571**)

XIII. patchoulane: (**572–575**)

XIV. humulene (**596–601**)

XV. santalane (**576–578**)

XVI. Unique type (**579–595, 602, 603**)

#### **2.3.4. Diterpenes**

Fifteen labdane-type diterpenes (**608–622**) have been isolated from *Curcuma* species.

*5S,9S,10S,15R*-(-)-Curcuminol D (**621**) and *5S,9S,10S,15R*-(-)-curcuminol H (**622**) are two

rearranged labdanes from the dried rhizome of *C. kwangsiensis*. Curcumrinol A (**623**) and

curcumrinol B (**624**) are two isopimarane-type diterpenes that have obtained from *C. wenyujin*.

Nineteen other labdane lactones have also been identified (**625–643**).

#### **2.3.5. Sesterterpenoids and Triterpenoids**

Three homosesterterpenoids that have been obtained solely from the dried rhizome of *Curcuma aromatica* are named as curcusesterterpene A, curcusesterterpene B, and curcusesterterpene C.

The *C. longa* rhizome yields three other triterpenoids, namely, hop-17(21)-en-3 $\beta$ -ol (**714**), hop-17(21)-en-3 $\beta$ -yl acetate (**715**), and hopenone I (**716**) (Mohamed et al., 2003).

#### 2.4. Flavonoids

Although flavonoids are widely distributed in the plant kingdom and serve as the main constituents of various medicinal herbs, only 14 flavonoids have been identified in *Curcuma* species. Chokchaisiri and co-workers reported the isolation and identification of seven flavonoid glycosides, including four new ones, termed curcucomosides A–D (X–Y), from the aerial parts of *C. comosa* (Chokchaisiri et al., 2010). In 2013, five other flavonoid glycosides (X–Y) along with one flavonol (quercetin, **659**) obtained from the underground part of *C. longa* have been reported. The only discovered flavanone (naringenin, **660**) has been found in the dried rhizome of *C. zedoaria*. Malvidin 3-rutinoside (**681**), which is isolated from the pink bracts of *Curcuma alismatifolia*, is the only anthocyanin compound reported from the genus *Curcuma*. As of this writing, the sources of flavonoids in the genus *Curcuma* are restricted to *C. longa*, *Curcuma comsa*, and *C. zedoaria*.

#### 2.5. Steroids

A minimum of seven stigmastane-type steroids have been isolated from *Curcuma* species (**661**–**667**).

## 2.6. Alkaloids

Two alkaloids, namely, aurantiamide (**698**) and curcuminol I (**717**), have been isolated from the dried root of *C. wenyujin* (Huang, 2008; Ma et al., 2009). The dried root of *C. longa* yields 2-(2'-methyl-1'-propenyl)-4,6-dimethyl-7-hydroxyquinoline (**718**) (Wang et al., 2008c).

## 2.7. Miscellaneous Compounds

Besides the chemical constituents discussed above, 45 other compounds have been isolated from the genus *Curcuma*. Policegoudra et al. isolated three antimicrobial compounds, namely, difurocumenonol (**683**) (Policegoudra et al., 2007a), amadannulen (**685**) (Policegoudra et al., 2007b), and amadaldehyde (**673**) (Policegoudra et al., 2010), from the chloroform extract of *C. amada* rhizome. Investigation of the chloroform extract of the rhizomes of *C. aromatica* yielded three new phytoconstituents, which are characterized as *n*-heneitriacontan-14-one (**671**), *n*-pentatriacontan-5-one (**669**), and 11-cyclopentyl-*n*-decan-1-ol (*Curcuma pentadecanol*) (**668**). A phloracetophenone glucoside, 4,6-dihydroxy-2-*O*-(fl-D-gluco-pyranosyl) acetophenone, has been isolated from the ethyl acetate and *n*-butanol extracts of *C. comosa* rhizomes (Suksamraran et al., 1997). The water extract of fermented *C. longa* rhizome provides three compounds: 1 $\alpha$ , 4 $\beta$ -dihydroxyeudesman-8-one (**687**), 4-(4-hydroxy-3-methoxyphenyl)-2S-butanol (**688**), and conorarin I (**689**) (Quang et al., 2014). Two novel compounds, namely, (2*R*,

*4R*)-6-(4'-hydroxyphenyl)-hexane-2,4-diol (**695**) and Curcuma-J (**682**), have been obtained from the dried radix of *C. longa* (Qu et al., 2013) (Wu et al., 2008). The only coumarin that has been isolated from the genus *Curcuma* is scopoletin (**670**), which has been obtained from the dried rhizome of *Curcuma mangga* (Abas et al., 2005). Two decalins named 1,1,10-trimethyl-decalin (**691**) and 8-methene-1,1,10-trimethyldecalin (**692**) have been extracted from the fresh rhizome of *C. mangga* (Liu and Nair, 2010). Investigation on dried rhizome of *C. oligantha* yielded oliganthyl cinnamate (**696**) and curoliganthol (**699**) (Ahmad et al., 2010). Wenyujinoside (**697**) and curcuminol F (**703**) have been obtained from the radixes of *C. wenyujin* (Ma et al., 2009). Ten long-chain fatty acid (**704–713**) have been found in various *Curcuma* species.

### 3. Biological Activities

Although the genus *Curcuma* consists of more than 100 species, *C. longa* is the most studied and has been used in folk medicine for more than 2,000 years. *C. longa* has been used to treat fevers, stomach disorders, allergies, diarrhea, cough, bloating, bronchial asthma, and flatulence, as well as jaundice and other liver disorders. Externally, the plant has been used to treat skin diseases to reduce inflammation and swelling. *C. longa* also presents a long history of usage as a dye and flavoring agent because of its yellow color and special taste. Over the past few decades, *C. longa* and other species in the genus have garnered considerable attention for their multiple bioactivities, which are summarized briefly in the following sections.

### 3.1. Curcumin, a Natural Panacea

Among more than 170,000 natural products that are documented in the Dictionary of Natural Products (DNP; <http://dnp.chemnetbase.com>), curcumin is one of the few most well-known star molecules. To date, more than 4,500 publications, including more than 230 reviews, are documented in PubMed with the term “curcumin” in the title. Several journals, such as the *Adv. Exp. Med. Biol.* in 2007 and *Biofactors* in 2013, have published special issues for curcumin as well. Curcumin and its analogues are the representative ingredients of *C. longa*. This substance is widely distributed in *Curcuma* and other genus of *Zingiberaceae*. In *C. longa*, the content of curcumin varies among species and locations. In *C. longa* plants collected from China, curcumin levels reach up to 4.18–31.01 mg/g (Chen et al., 2010; Li and Fu, 2010). However, plants from Salem, Mysore, Erode, Balasore, and Burma reach curcumin levels of 10.6–56.6 mg/g (Chuang et al., 2000; Jayaprakasha et al., 2002). No curcumin was detected in *C. phaeocaulis* (LysiYujin) roots, *C. wenyujin* (Wen-E-Zhu) rhizomes, *C. wenyujin* (Wen-Yu-Jin) roots, *C. kwangsiensis* (Gui-E-Zhu) rhizomes, and *C. kwangsiensis* (Gui-Yu-Jin) roots obtained in China (Li et al., 2011c). Although *C. longa* has been used for thousands of years in India, China, and South Asia, Vogel and Pelletier more recently reported in 1815 regarding the isolation of a “yellow coloring-matter” from the rhizomes of *C. longa* and named the substance as “curcumin.” This substance was discovered not as a pure compound but as a mixture of resin and turmeric oil. Milobedzka and Lampe identified the chemical structure of

curcumin in 1910 and synthesized the compound in 1913 (Gupta et al., 2012). These pioneer works rendered the biological evaluation of curcumin possible. Reports on the biological activity of curcumin date back to 1949, when Schraufstatter and Bernt reported the antibacterial effect of curcumin and related compounds (Schraufstätter and Bernt, 1949). In 1970, Rao and Nigam showed that curcumin decreases the serum and liver cholesterol levels and increases fecal excretion of bile acids in cholesterol-fed rats (Rao and Nigam, 1970). In 1971, Srimal et al. first reported the anti-inflammatory activity of curcumin (Srimal et al., 1971). The following year, Srinivasan showed the hyperglycemic effect of curcumin in a diabetic subject (Srinivasan, 1972). In 1976, Sharma found the antioxidant activity of curcumin and related compounds (Sharma, 1976). In 1980, Deodhar et al. reported the antirheumatic activity of curcumin (Deodhar et al., 1980). Five years later, the anticancer effect of curcumin was first demonstrated by Kuttan et al. by using CHO cells and mice (Kuttan et al., 1985). The antithrombotic effect of curcumin *in vivo* was discovered by Srivastava et al. in the same year (Srivastava et al., 1985). These pioneer discoveries launched a considerable number of succeeding works on curcumin in the last 30 years. Accumulated evidence has demonstrated that curcumin is a notable compound because of its various therapeutic applications and may be considered as a panacea by numerous individuals. The therapeutic list of curcumin includes, but is not limited to, cancer (Agrawal and Mishra, 2010; Shehzad et al., 2013), colorectal cancer (Patel and Shah, 2010), liver cancer (Darvesh et al., 2012), head and neck cancers (Gao et al., 2012), breast cancer (Sinha et al., 2012), lung cancer (Howells et al., 2014), cardiovascular diseases (Wongcharoen

and Phrommintikul, 2009; Kapakos et al., 2012), diabetes and diabetic complications (Soetikno et al., 2013; Zhang et al., 2013a), aging (Shen et al., 2013), Alzheimer's disease (Chin et al., 2013; Ahmed and Gilani, 2014), obesity (Bradford, 2013), digestive diseases (Dulbecco and Savarino, 2013), wound healing (Akbik et al., 2014), liver injury (Rivera-Espinoza and Muriel, 2009), multiple sclerosis (Xie et al., 2011), inflammatory bowel disease (Ali et al., 2012), and stroke (Ovbiagele, 2008). Considerable emphasis was previously focused on the target specificity of lead compounds in drug research and development. Selective, single-target molecular drugs are called "magic bullets," whereas non-selective drugs that interact with several molecular targets are considered as "dirty drugs." Similar to most widely investigated natural products, curcumin is a typical "dirty" compound. In the Therapeutic Target Database, curcumin is considered as an inhibitor of 15 drug targets, such as COX-1, COX-2, and iNOS (<http://bidd.nus.edu.sg/group/cjttd/>). Gupta et al. summarized 55 curcumin targets, which include inflammatory molecules, enzymes, protein kinases, protein reductases, carrier proteins, and metals. These targets can directly interact with curcumin and its analogues (Gupta and Dixit, 2011). In STITCH, the Chemical–Protein Interactions database (<http://stitch.embl.de/>), approximately 400 molecules have been found to interact with curcumin (Figure 28). These multiple molecules, along with multiple layers of signaling pathways, enable a broad spectrum of biological activities of curcumin. In addition, no toxicity has been observed after a single daily oral dose ranging from 500–8000 mg/day for three months, indicating the extremely low toxicity of curcumin (Hatcher et al., 2008). Therefore, the potential drug ability of curcumin has

motivated massive research worldwide. More than 100 clinical trials (mainly in North America and Europe) focusing on the beneficial effect of curcumin in cancer, type 2 diabetes, Alzheimer's disease, dermatitis, familial adenomatous polyposis, podiatric inflammatory bowel disease, rheumatoid arthritis, chronic psoriasis vulgaris, and other ailments are either underway or already completed (<http://clinicaltrials.gov/>). Although most of these trials are still in the early phases, their results in the next few years will provide greater detail on the clinical application of this promising compound. However, data from curcumin investigations are not exclusively supportive of the clinical benefits of this substance. Several disadvantages and concerns also challenge the function of curcumin as a drug. First is the lack of water solubility and low bioavailability *in vivo*, which have been considerably improved with recent pharmaceutical technologies, especially in nanotechnology-based formulations (Mohanty et al., 2012; Yallapu et al., 2012; Naksuriya et al., 2014; Prasad et al., 2014). Second disadvantage that should be considered includes potential adverse effects, such as induction of DNA damage and reactive oxygen species formation in normal cells and animal models (Hatcher et al., 2008).

### ***3.2. Anticancer***

A series of natural products, such as paclitaxel, vinblastine, camptothecin, and etoposide, have been successfully included to the standard repertoire of cancer chemotherapy. Several candidates such as berberine, curcumin, betulinic acid, and gambogic acid are being assessed in clinical trials or

preclinical testing (Koehn and Carter, 2005). In the genus *Curcuma*, the anticancer effects and mechanisms of curcumin both *in vitro* and *in vivo* have been investigated in depth and extensively summarized (Miquel et al., 2002; Maheshwari et al., 2006; Hatcher et al., 2008; Heger et al., 2014). In addition to the anticancer effect of curcumin and its analogues, that of an array of extracts and pure compounds in the genus *Curcuma* has been screened and tested. These effects are listed in Table 2. Among these compounds, ar-turmerone (**269**), zerumin A (**613**), labda-8(17),12-diene-15,16-dial (**614**), 15,16-Bisnorlabdan-8 (**17**), 11-dien-13-one (**702**), coronarin d (**632**), coronarin D (**623**), xanthorrhizol (**274a**), curzerenone (**357**), neocurdione (**434**), and alismol (**487**) show potent cytotoxicity and induces apoptosis in several cancer lines, with IC<sub>50</sub> values of less than 20 µg/mL (Ismail et al., 2005; Malek et al., 2011; Syed et al., 2013; Suthiwong et al., 2014). Furanodiene (**448**) inhibit the proliferation of a variety of cancer line cells, such as MCF-7, MDA-MB231, A549, 95D, Hela, Hep-2, HT-1080, PC3, SGC-7901, HL-60, A549, SMMC-7721, K562, HepG2, 435s, HEF, and HL60, with an IC<sub>50</sub> range of 0.2–20.7 µg/mL (Ma et al., 2008; Sun et al., 2009; Zhong et al., 2012; Zhong et al., 2012c). Furanodiene also induces cell cycle arrest at the G1 phase in 95D cells and demonstrates antiangiogenic effect in the HUVEC model and in zebrafish. Furthermore, furanodiene induces apoptosis in MCF7, HepG-2, and HL60 cells and enhances the effect of paclitaxel (Xiao et al., 2007; Ma et al., 2008; Zhong et al., 2012; Xu et al., 2014). In a MCF-7 tumor xenograft model in nude mice, furanodiene dose-dependently suppressed tumor growth by 32% and 54% after intraperitoneal injection of 15 and 30 mg/kg, respectively, and these values are comparable with that

of cyclophosphamide (30 mg/kg) (Zhong et al., 2012). The State Food and Drug Administration of China has approved of a mixture of elemenes (mainly  $\beta$ -elemene) for cancer therapy in combination with other chemotherapeutic agents. However, the antiproliferative effect of  $\beta$ -elemene is relatively low and inferior to that of furanodiene in several cell lines (Yao et al., 2008; Zhang et al., 2011). In addition, a series of extracts and essential oils obtained from *C. aeruginosa*, *C. aromatica*, *C. longa*, *C. wenyujin*, and *C. zedoaria* demonstrate cytotoxicity and induce apoptosis in multiple cancer line cells. However, the pharmacological efficacy of these extracts is relatively low, and extract components remain unknown. Besides curcumin, antiangiogenic activity is restricted to demethoxycurcumin from *C. aromatica*, essential oil from *C. zedoaria*, furanodiene from *C. wenyujin*, and tetrahydrocurcumin from *C. longa*. The hexane extract of *Curcuma ochrorhiza* and the sesquiterpenes zerumbone and zederone showed strong cytotoxic activities against T-acute lymphoblastic leukemia cells, with IC<sub>50</sub> values of 6.0, 0.6, and 1.6  $\mu$ g/mL, respectively (Sukari et al., 2010).

### 3.3. Anti-inflammation

For centuries, *Curcuma* has been used in Ayurvedic medicine for the treatment of digestive and pain disorders. Epidemiological studies have suggested that *Curcuma* possesses anti-inflammatory effects (Shehzad and Lee, 2013). Compounds and extracts obtained from *Curcuma* species inhibit the generation of nitric oxide (NO) and inflammatory cytokine such as tumor necrosis factor-alpha,

interleukin 6, and prostaglandin E2 (PGE2) *in vitro*. Furthermore, several of these compounds decrease paw/ear edema induced by carrageenan *in vivo*. The anti-inflammatory mechanism of curcumin is mainly focused on the inhibition of the iNOS, COX-2, NF-κB, JNK, and p38MAPK signaling pathways (Matsuda et al., 2001a; Hong et al., 2002a; Lee et al., 2002b; Oh et al., 2007; Lee, 2009a). Zedoalactone B inhibits NO generation, with an IC<sub>50</sub> of 1.3 μM (Liu et al., 2013), and β-turmerone inhibits the secretion of PGE2, with an IC<sub>50</sub> of 7.3 μM. Xanthorrhizol exhibits better inhibition on COX-2 and iNOS expression, with IC<sub>50</sub> of 0.2 and 1.0 μg/mL (Lee et al., 2002b). Aqueous extracts from *C. longa* showed anti-inflammatory activity in two cell lines, namely, RAW 264.7 and endothelial cells. Moreover, these effective extracts exhibited anti-inflammatory activity in a rat model induced by carrageenan (Gupta et al., 2008; Anandakumar et al., 2014).

### 3.4. Antioxidant

The antioxidant activity of *Curcuma* species, especially *C. longa*, has been measured by various methods, such as DPPH radical scavenging activity assay, ferric reducing/antioxidant power assay, and metal chelating activity assay (Singh et al., 2010; Zhao et al., 2010). Given that most herb extracts and natural products show antioxidative potential, this widely reported activity is summarized in Table 2. Luteolin-7-O-(6"-*p*-hydroxybenzoyl-β-D-glucopyranoside), luteolin 7-O-β-D-glucopyranoside, apigenin-7-O-β-D-glucopyranoside, luteolin, apigenin, demethoxycurcumin, bisdemethoxycurcumin, β-myrcene, and α-asarone showed antioxidant effect

in DPPH assay (Vishnupriya et al., 2012; Shabana and Afifi, 2014). In *Curcuma* species, extracts from fresh rhizomes and leaves display higher antioxidant properties, and the *C. longa* extract exhibits the best antioxidant activity (Bhardwaj et al., 2011; Nahak and Sahu, 2011). Furthermore, the ethanol extracts exhibit higher antioxidant activities in comparison with aqueous extracts.

### 3.5. Other bioactivities

The *Curcuma* genus presents a long history of antimicrobial applications (Guttenberg, 1927). The antimicroorganism activity of *Curcuma* is effective against a wide variety of genera, including bacteria, fungi, and viruses. Labda-8(17),12-diene-15,16-dial (I)(Roth et al., 1998), ar-turmerone (Lee et al., 2003), and ethyl p-methoxycinnamate (Gupta et al., 1976) have been identified to selectively inhibit various fungal pathogens. Labda-8(17),12-diene-15,16-dial (I) exhibits antimicrobial activity against *Candida albicans* at 1 µg/mL and against *Candida kruseii* and *Candida parapsilosis* at 25 µg/mL (Roth et al., 1998). The antiviral activity of volatile oils from *C. longa* has been reported as early as 1958 (Wang, 1958). Several sesquiterpenoids from *C. wenyujin* have exhibited anti-influenza viral activities with IC<sub>50</sub> values ranging from 6.80–39.97 µM (Dong et al., 2013). Germacrone, which is extracted from *Curcuma* rhizome, displays an inhibitory effect on H1N1 and H3N2 influenza A viruses, as well as influenza B virus, by inhibiting both the attachment/entry step and the early stages of the viral replication cycle (Liao et al., 2013). The antibacterial activity of *Curcuma* possibly dates back to 1927 (Guttenberg, 1927). *C. longa*, *C.*

*zedoaria*, *C. amada*, and *Curcuma domestica* exhibit board spectra of antibacterial activity (Omoloso and Vagi, 2001; Gerige et al., 2008; Rao et al., 2008; Israr et al., 2012). These antibacterial activities cover various members from Micrococcaceae, Proteobacteria, and Peptococcaceae to Azotobacteraceae (Goutam and Purohit, 1974; Lutomski et al., 1974; Van et al., 1997; Naz et al., 2011).

Numerous studies on plant insecticidal effect have shown the potential of *Curcuma* species as pesticides. Aromatic ketone, turmerone, curcumin, demethoxycurcumin, and bisdemethoxycurcumin, which are isolated from *C. longa*, exhibit insecticidal effects (Su et al., 1982; Sagnou et al., 2012). Among these compounds, *Curcuma* aromatic ketone and turmerone both exert significant repellent activity against *Tribolium castaneum* H. Curcumin shows larvicidal activity against the mosquito *Culex pipiens*, with a LC<sub>50</sub> value of 19.07 mg/L (Sagnou et al., 2012). 9-Oxoneoprocurcumenol and neoprocurcumenol have been isolated from the species (Madhu et al., 2010). 9-Oxoneoprocurcumenol exhibit significant toxicity against mosquito larvae, with LC<sub>50</sub> of 5.81 ppm and LC<sub>90</sub> of 9.99 ppm, whereas those of neoprocurcumenol are 13.69 and 23.92 ppm, respectively (Madhu et al., 2010). Camphor (LD<sub>50</sub> = 207.26 µg/cm<sup>2</sup>) and 1,8-cineole (LD<sub>50</sub> = 1048.75 µg/cm<sup>2</sup>) exhibit significant contact toxicity against *Liposcelis bostrychophila*.

Numerous publications have reported on the protective effect of *Curcuma* extracts on various kinds of liver damage, such as hepatotoxicity, mutagenicity, hepatitis, liver cirrhosis (Salama et al., 2013), liver fibrosis (Li and Cao, 2013; Son et al., 2013), and fatty liver (Nwozo et al., 2014).

Meanwhile,  $\beta$ -elemene,  $\alpha$ -curcumen, xanthorrhizol, sesquiterpenes, curcumol, and diarylheptanoids exhibit hepatoprotective activities (Lin et al., 1995; Matsuda et al., 2001b; Song et al., 2001; Liu et al., 2011; Li et al., 2014a).  $\beta$ -Elemene, which is extracted from *C. wenyujin*, hinders hepatic fibrosis development by downregulating plasma endotoxins, serum TNF- $\alpha$ , and hepatic CD14 expression (Liu et al., 2011). The choleric action of *C. domestica* has been discovered in as early as 1934 (Grabc, 1934).  $\alpha$ -Curcumene, *Curcuma* oil (I), 1-phenylpropanol, turmerone (II), ar-turmerone, *p*-tolylmethylcarbinol, and bisdemethoxycurcumin have been found to contribute to choleric effects.  $\alpha$ -Curcumene exhibits cholagogic action by exerting triglyceride-lowering activity (Yasni et al., 1994), whereas *p*-tolylmethylcarbinol and 1-phenylpropanol could increase bile acid secretion and bile flow (Hirota, 1958; Siegers et al., 1997).

Compounds isolated from *Curcuma* genus also show antidiabetic effects. The curcumin analogues demethoxycurcumin and bisdemethoxycurcumin show PPAR- $\gamma$  ligand-binding activity, whereas disdemethoxycurcumin inhibits human pancreatic  $\alpha$ -amylase *in vitro* (Han et al., 2009). Turmeric oleoresin inhibits high-fat diet-induced blood glucose release and abdominal fat mass elevation in KK-Ay mice by regulating gene expression involved in glycolysis,  $\beta$ -oxidation, cholesterol metabolism, and gluconeogenesis in the liver (Honda et al., 2006). Ar-turmerone inhibits  $\alpha$ -glucosidase, with IC<sub>50</sub> at 0.28  $\mu$ g, and  $\alpha$ -amylase, with IC<sub>50</sub> at 24.5  $\mu$ g *in vitro* (Lekshmi et al., 2012). (3*R*)-1,7-Diphenyl-(4*E*,6*E*)-4,6-heptadien-3-ol, a novel phytoestrogen, markedly reduces total serum cholesterol and low-density lipoprotein levels, improves insulin sensitivity, enhances

insulin-mediated glucose uptake in skeletal muscle, and increases muscle GLUT-4 protein levels in ovariectomized rats (Prasannarong et al., 2012; Na et al., 2013).

*Curcuma* also demonstrates anti-aging, anti-Alzheimer, antidepressant, and anticerebral ischemia effect. The neuroprotective activity of *Curcuma* species has been tested mainly in *in vitro* models, such as PC12 insulted by A $\beta$  and hippocampal neurons. For anti-Alzheimer activity, cell-free assay has been used to inhibit A $\beta$  aggregation and secretion. Xanthorrhizol exhibits an anti-aging effect (Oh et al., 2009). The following compounds also exhibit anti-Alzheimer effects: 1,2,3,4,6-penta-*o*-galloyl- $\beta$ -D-glucose, 4''-(3''-methoxy-4'''-hydroxyphenyl)-2''-oxo-3''-enebutanyl 3-(3'-methoxy-4'-hydroxyphenyl) propenoate (calebin-A), 1-(4-hydroxy-3-methoxyphenyl)-7-(4-hydroxyphenyl)-1,6-heptadiene-3,5-dione, 1,7-bis (4-hydroxyphenyl)-1,6-heptadiene-3,5-dione, 1,7-bis (4-hydroxyphenyl)-1-heptene-3,5-dione, HSS-838, HSS-848, and HSS-888 (Park and Kim, 2002; Shytle et al., 2009; Guo et al., 2010; Shytle et al., 2012). Ethanolic and aqueous extracts show antidepressant effects (Yu et al., 2002; Xia et al., 2006b). Moreover, aqueous extracts showed neurotoxin-inhibiting activity (Cherdchu et al., 1978; Ratanabanangkoon et al., 1993). *Curcuma* oil shows anticerebral ischemia effect (Bansal et al.).

$\alpha$ -Turmerone and aromatic-turmerone from *C. longa* increase the proliferation of human peripheral blood mononuclear cells and cytokine production (Yue et al., 2010b). Ukonan A and ukonan B, two phagocytosis-activating polysaccharides isolated from *C. longa*, show remarkable immunologic activities, which include potentiating the reticulo-endothelial system, inhibiting

components of complement system, and inducing alkaline phosphatase (Gonda et al., 1992; Gonda et al., 1993). Curdione, one of the major sesquiterpene compounds from Rhizome Curcumae (Zhang et al., 2008b), has been shown to exhibit antiplatelet aggregation and antithrombotic activities *in vitro* and *in vivo* (Xia et al., 2006a; Wang et al., 2012). Bisdemethoxycurcumin exhibits antithrombotic activities upon consumption (Kim et al., 2012). Ar-turmerone inhibits alpha-melanocyte stimulating hormone- and 3-isobuty-1-methxlzanthine-induced melanogenesis (Park et al., 2011).

The biological activities of *Curcuma extracts* and pure compounds are summarized in **Tables 2** and **3** respectively.

#### 4. *Toxicology*

Plants in the genus *Curcuma* show low toxicity to both animals and humans. Acute toxicity studies indicated the absence of adverse effects in the liver, kidneys, and heart of adult rats, guinea pigs, and monkeys (*Macacus sp.*) after the administration of turmeric (*C. longa* at 2.5 g/kg) or its alcoholic extract (300 mg/kg) for three weeks (Shankar et al., 1980). By contrast, the subchronic oral toxicity of turmeric oleoresin in pigs caused a reduction in weight gain and food-conversion efficiency (Bille et al., 1985). For long-term toxicity study, Bhavanishankar et al. found that feeding rats and monkeys turmeric at 500 mg/kg body weight and its alcoholic extract at 60 mg/kg body weight for 12 and 9 months, respectively, produced no detrimental physiological or toxicological effects (Bhavanishankar et al., 1986). Acute (24 h) and chronic (90 days) oral toxicity studies on ethanol

extracts of the rhizomes of *C. longa* have been carried out in mice. Acute dosages included 0.5, 1.0, and 3 g/kg body weight, whereas chronic dosage was 100 mg/kg/day of the extract. During the investigation, no significant mortality was observed in comparison with the controls. Chronic *C. longa*-treated animals did not gain significant weight but showed significant changes in heart and lung masses. Hematologic studies revealed a significant decrease in white blood cell and red blood cell levels of animals treated with *C. longa* compared with the control. Gains in weights of sexual organs and increased sperm motility and sperm counts have been observed in mice, and no spermatotoxic effects have been noted (Qureshi et al., 1992). In 1998, the sub-chronic oral toxicity of turmeric (0%, 1%, and 5%) and ethanolic turmeric extract (0, 0.05 and 0.25%) were evaluated in both female mice and rats through diet for 14 and/or 90 days. Results revealed that the administration of a high turmeric dose (5%) for a longer duration (90 days) shows a significant reduction in body weight gain, alterations in absolute and/or relative liver weights, and hepatotoxicity. A recent study evaluating *C. longa* as a therapeutic agent in intestinal motility disorders showed no side effects on the bladder, aorta, trachea, and heart after the use of an effective dose for intestinal treatment. An increase in gallbladder tone and contraction was observed. Serum liver and lipid parameters were normal, whereas a slight increase in serum and liver bile acid concentrations and a decrease in bile content were observed (Micucci et al., 2013).

In a pharmacodynamic and pharmacokinetic study of oral *Curcuma* extract in patients with colorectal cancer, *Curcuma* extract was administered safely to patients at doses of up to 2.2 g daily,

which is equivalent to 180 mg of curcumin (Sharma et al., 2001). Curcumin is not toxic to humans up to 8,000 mg/day when taken orally for three months (Yum et al., 2001). Furthermore, curcumin has been demonstrated to be safe in numerous human trials (Aggarwal et al., 2003; Chainani-Wu, 2003).

Although *Curcuma* essential oil comprises a large proportion of various compound types, this substance is less studied than curcuminoids. In an early human safety study on orally administered turmeric oil (*C. longa* oil), no clinical, hematologic, renal, or hepatic toxicities at one and three months were observed (Joshi et al., 2003). However, a study on the antiarthritic effect of turmeric oil was accompanied with significant morbidity and mortality (Funk et al., 2009). A study conducted by Liju et al. (Liju et al., 2013) evaluated acute and sub-chronic toxicities as well as the mutagenic effect of turmeric essential oil. Results showed no mortality, adverse clinical signs, or changes in body weight, water, and food consumption during acute and sub-chronic toxicity studies.

Besides analyses on the safety profiles of *C. longa*, studies on the safety profiles of other *Curcuma* species have been performed. Thamlikitkul et al. clearly revealed the absence of toxicity from consuming *C. domestica* Val (Thamlikitkul et al., 1989), whereas Latif et al. reported rapid weight loss in rats and chicks that were treated with *C. zedoaria*, thereby indicating possible toxicity (Latif et al., 1979). *C. domestica* exhibited efficacy for dyspepsia treatment in a randomized double-blind study, but mild and self-limited side effects were observed (Thamlikitkul et al., 1989). *C. domestica* extracts are as effective as ibuprofen for the treatment of knee osteoarthritis; however, a similar side effect profile was observed, although fewer gastrointestinal adverse effect have been reported in the *C.*

*dомestica* extracts group (Kuptniratsaikul et al., 2014). The *Curcuma* extract (mainly polysaccharides) has demonstrated safety and efficacy for patients with primary painful knee osteoarthritis in a randomized placebo-controlled trial (Madhu et al., 2013). Notably, Balaji et al. predicted the toxicity of 200 compounds in *Curcuma* by using cheminformatic approaches. A total of 184, 136, 153, and 64 compounds have been projected as toxigenic, mutagenic, carcinogenic, and hepatotoxic, respectively (Balaji and Chempakam, 2010).

### 5. Conclusions

*Curcuma* species present numerous historical applications worldwide. Their medicinal, economic, agricultural, and decorative values have been explored for centuries. Although modern investigations of these plants have achieved considerable progress, especially in recent several decades, only a small proportion has been thoroughly studied phytochemically and pharmacologically. Chemically diversified terpenoids are the dominant constituents, whereas diphenylalkanoids are promising lead compounds. Compared with our phytochemical knowledge on these species, even less is known regarding the pharmacologic activities of these species. Furthermore, only several compounds have been evaluated. Regardless, the multiple bioactivities and safety profile of curcumin prove that the genus *Curcuma* is a potential source for lead compound identification and novel drug discovery.

### DECLARATION OF INTEREST

# ACCEPTED MANUSCRIPT

We declare that none of the authors has any kind of conflict or interest related to the present work.

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**Table 1** Compounds isolated from different species of the genus *Curcuma*.

| Species              | No. | Name                                  | Section      | Reference                                     |
|----------------------|-----|---------------------------------------|--------------|---|
| <i>C. aeruginosa</i> | 123 | linalool                              | FRh          | Jantan et al., 1999;<br>Jirovetz et al., 2000 |
|                      | 124 | myrcene                               | FRh          | Jantan et al., 1999;<br>Jirovetz et al., 2000 |
|                      | 126 | (E)- $\beta$ -ocimene                 | FRh          | Jirovetz et al., 2000                         |
|                      | 127 | (Z)- $\beta$ -ocimene                 | Rh           | Jirovetz et al., 2000                         |
|                      | 132 | (E)-tagetone                          | Lf           | Jirovetz et al., 2000                         |
|                      | 146 | p-cymene                              | Lf           | Jirovetz et al., 2000                         |
|                      | 155 | $\gamma$ -terpinene                   | FRh          | Jantan et al., 1999;<br>Jirovetz et al., 2000 |
|                      | 156 | terpinolene<br>( $\delta$ -terpinene) | Leaf,<br>FRh | Jantan et al., 1999;<br>Jirovetz et al., 2000 |
|                      | 159 | terpinen-4-ol                         | FRh          | Jantan et al., 1999;<br>Jirovetz et al., 2000 |
|                      | 168 | carvone                               | FRh          | Jantan et al., 1999;<br>Jirovetz et al., 2000 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b> | <b>Reference</b>                                  |
|----------------|------------|----------------------------|----------------|---|
|                | 171        | $\alpha$ -terpineol        | FRh            | Jantan et al., 1999;<br>Jirovetz et al., 2000     |
|                | 172        | limonene                   | FRh            | Jantan et al., 1999;<br>Jirovetz et al., 2000     |
|                | 174        | <i>cis</i> -carveol        | Lf             | Jirovetz et al., 2000                             |
|                | 180        | <i>cis</i> -linalool oxide | DRh            | Jirovetz et al., 2000;<br>Srivastava et al., 2006 |
|                | 181        | pulegone                   | Fl             | Jirovetz et al., 2000                             |
|                | 190        | borneol                    | FRh            | Jantan et al., 1999;<br>Jirovetz et al., 2000     |
|                | 192        | isoborneol                 | FRh            | Jantan et al., 1999;<br>Jirovetz et al., 2000     |
|                | 194        | camphor                    | FRh            | Düng et al., 1995; Jantan<br>et al., 1999         |
|                | 196        | $\alpha$ -fenchol          | Lf             | Jirovetz et al., 2000                             |
|                | 203        | $\alpha$ -thujone          | Lf             | Jirovetz et al., 2000                             |
|                | 205        | $\alpha$ -thujene          | FRh            | Jantan et al., 1999                               |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                      | <b>Section</b> | <b>Reference</b>                            |
|----------------|------------|----------------------------------|----------------|---|
|                | 206        | sabinene                         | FRh            | Jantan et al., 1999                         |
|                | 212        | camphene                         | FRh            | Jantan et al., 1999;                        |
|                |            |                                  |                | Jirovetz et al., 2000                       |
|                | 215        | 1, 8-cineole                     | Lf             | Dűng et al., 1995; Jirovetz<br>et al., 2000 |
|                | 215        | 1,8-cineole                      | FRh            | Jantan et al., 1999                         |
|                | 220        | $\alpha$ -pinene                 | Lf             | Jirovetz et al., 2000                       |
|                | 221        | $\beta$ -pinene                  | FRh            | Jantan et al., 1999;                        |
|                |            |                                  |                | Jirovetz et al., 2000                       |
|                | 222        | myrtenal                         | Fl             | Jirovetz et al., 2000                       |
|                | 224        | <i>trans</i> -verbenol           | Lf             | Jirovetz et al., 2000                       |
|                | 225        | <i>trans</i> -pinocarveol        | Lf             | Jirovetz et al., 2000                       |
|                | 230        | ( <i>E</i> )- $\beta$ -farnesene | DRh            | Jantan et al., 1999;                        |
|                |            |                                  |                | Jirovetz et al., 2000                       |
|                | 236        | ( <i>E</i> )-nerolidol           | FRh            | Jantan et al., 1999                         |
|                | 264        | $\alpha$ -curcumene              | FRh            | Jantan et al., 1999                         |
|                | 265        | $\beta$ -curcumene               | FRh            | Jantan et al., 1999                         |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>      |
|----------------|------------|---------------------|----------------|-----------------------|
|                | 270        | $\alpha$ -turmerone | FRh            | Jantan et al., 1999   |
|                | 271        | $\beta$ -turmerone  | FRh            | Jantan et al., 1999   |
|                | 275        | zingiberene         | FRh            | Jantan et al., 1999   |
|                | 279        | curcuphenol         | FRh            | Jantan et al., 1999   |
|                | 347        | curcumene           | FRh            | Zwaving and Bos, 1992 |
|                | 356        | curzerene           | Lf oil         | Düng et al., 1995     |
|                | 357        | curzerenone         | FRh            | Zhang et al., 1986;   |
|                |            |                     |                | Jirovetz et al., 2000 |
|                | 364        | $\beta$ -elemene    | FRh            | Jantan et al., 1999   |
|                | 365        | $\gamma$ -elemene   | FRh            | Jantan et al., 1999   |
|                | 366        | $\delta$ -elemene   | FRh            | Jantan et al., 1999   |
|                | 369        | $\beta$ -eudesmol   | FRh            | Zwaving and Bos, 1992 |
|                | 370        | $\alpha$ -selinene  | FRh            | Jirovetz et al., 2000 |
|                | 371        | $\beta$ -selinene   | FRh            | Jirovetz et al., 2000 |
|                | 412        | aeruginone          | DRh            | Giang et al., 2007    |
|                | 423        | curdione            | UK             | Jirovetz et al., 2000 |
|                | 424        | dehydrocurdione     | FRh            | Zwaving and Bos, 1992 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                    | <b>Section</b> | <b>Reference</b>         |
|----------------|------------|--|----------------|--------------------------|
|                | 427        | germacrone                                     | Leaf,          | Zhang et al., 1986; Dūng |
|                |            |  | FRh            | et al., 1995; Jantan et  |
|                |            |  |                | al., 1999                |
|                | 444        | (1 <i>E</i> ,4 <i>E</i> ,8 <i>R</i> )-8-hydrox | DRh            | Giang et al., 2007       |
|                |            | ygermacra-1(10),4                              |                |                          |
|                |            | ,7(11)-trieno-12,8-                            |                |                          |
|                |            | lactone(aeruginola                             |                |                          |
|                |            | ctone)   |                |                          |
|                | 449        | furanodienone                                  | Uk             | Zheng et al., 1997       |
|                | 450        | furanogermenone                                | Uk             | Zheng et al., 1997       |
|                | 454        | zederone                                       | DRh            | Nasrullah et al., 2010   |
|                | 463        | aerugidiol                                     | Uk             | Zheng et al., 1997       |
|                | 466        | curcumenol                                     | FRh            | Zhang et al., 1986;      |
|                |            |  |                | Jirovetz et al., 2000    |
|                | 469        | isocurcumenol                                  | FRh            | Zhang et al., 1986;      |
|                |            |  |                | Zwaving and Bos,         |
|                |            |  |                | 1992; Bats and           |

| <b>Species</b>          | <b>No.</b> | <b>Name</b>                     | <b>Section</b> | <b>Reference</b>                                  |
|-------------------------|------------|---------------------------------|----------------|---|
|                         |            |                                 |                | Ohlinger, 1999; Jirovetz                          |
|                         |            |                                 |                | et al., 2000                                      |
|                         | 483        | (1S,4S,5S,10R)-zedo<br>arondiol | Rh             | Takano et al., 1995                               |
|                         | 513        | zedoalactone A                  | Rh             | Takano et al., 1995                               |
|                         | 514        | zedoalactone B                  | Rh             | Takano et al., 1995                               |
|                         | 528        | zedoarol                        | DRh            | Sukari et al., 2007a                              |
|                         | 548        | difurocumenone                  | Uk             | Zheng et al., 1997                                |
|                         | 550        | <i>allo</i> -aromadendrene      | Lf             | Jirovetz et al., 2000                             |
|                         | 554        | $\beta$ -caryophyllene          | FRh            | Jantan et al., 1999                               |
|                         | 560        | $\beta$ -cubebene               | Lf             | Jirovetz et al., 2000                             |
|                         | 585        | <i>Curcumanolides A</i>         | FRh            | Zwaving and Bos, 1992                             |
|                         | 586        | <i>Curcumanolides B</i>         | FRh            | Zwaving and Bos, 1992                             |
| <i>C. alismatifolia</i> | 190        | borneol                         | Rh,<br>DRh     | Banerjee et al., 1980;<br>Srivastava et al., 2006 |
|                         | 681        | malvidin 3-rutinoside           | Pink           | Nakayama et al., 2000                             |
|                         |            |                                 | bracts         |   |

| <b>Species</b>  | <b>No.</b> | <b>Name</b>                      | <b>Section</b> | <b>Reference</b>                             |
|-----------------|------------|----------------------------------|----------------|--|
| <i>C. amada</i> | 1          | curcumin                         | FRh            | Gupta et al., 1999                           |
|                 | 2          | demethoxycurcumin                | Rh             | Gupta et al., 1999                           |
|                 | 3          | bisdemethoxycurcum<br>in         | Rh             | Gupta et al., 1999                           |
|                 | 100        | amadanoic acid A                 | DRh            | Mustafa and Ali, 2011                        |
|                 | 101        | amadanoic acid B                 | DRh            | Mustafa and Ali, 2011                        |
|                 | 102        | amadandiol                       | DRh            | Mustafa and Ali, 2011                        |
|                 | 123        | linalool                         | Lf, FRh        | Rao et al., 1989; Padalia et<br>al., 2013    |
|                 | 124        | myrcene                          | FRh            | Singh et al., 2002                           |
|                 | 126        | (E)- $\beta$ -ocimene            | FRh            | Jain and Mishra, 1964;<br>Singh et al., 2002 |
|                 | 127        | (Z)- $\beta$ -ocimene            | FRh            | Singh et al., 2002                           |
|                 | 130        | <i>trans</i> -dihydroocimen<br>e | Rh             | Rao et al., 1989                             |
|                 | 131        | <i>cis</i> -dihydroocimene       | Rh             | Rao et al., 1989                             |
|                 | 133        | lavandulol                       | FRh            | Rao et al., 1989                             |

| <b>Species</b> | <b>No.</b> | <b>Name</b>           | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|-----------------------|----------------|---|
|                | 134        | neral                 | FRh            | Rao et al., 1989  |
|                | 135        | dihydromyrcenol       | Rh             | Rao et al., 1989  |
|                | 137        | linalyl acetate       | Rh             | Dutt and Tayal, 1941  |
|                | 139        | citronellal           | FRh            | Rao et al., 1989  |
|                | 142        | $\beta$ -terpineol    | FRh            | Rao et al., 1989  |
|                | 145        | perillene             | DRh,           | Singh et al., 2002; Singh<br>et al., 2003a; Prakash et<br>al., 2005 |
|                | 146        | p-cymene              | FRh            | Rao et al., 1989  |
|                | 147        | <i>p</i> -cymene-8-ol | FRh            | Rao et al., 1989  |
|                | 150        | cuminal alcohol       | Rh             | Ahuja and Nigam, 1971   |
|                | 151        | thymol                | FRh            | Mustafa et al., 2005  |
|                | 152        | $\alpha$ -terpinolene | FRh            | Rao et al., 1989  |
|                | 153        | $\alpha$ -terpinene   | Lf, FRh,       | Rao et al., 1989; Sharma<br>et al., 1997                            |
|                | 155        | $\gamma$ -terpinene   | FRh            | Rao et al., 1989  |
|                | 157        | <i>d</i> -sabinene    | FRh            | Singh et al., 2002  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                  | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|------------------------------|----------------|---------------------------|
|                | 158        | $\beta$ -phellandrene        | FRh,           | Rao et al., 1989; Behura, |
|                |            |                              | DRh            | 2000                      |
|                | 159        | terpinen-4-ol                | DRh,           | Srivastava et al., 2001;  |
|                |            |                              | FRh            | Singh et al., 2002;       |
|                |            |                              |                | Mustafa et al., 2005      |
|                | 160        | carvomenthene                | FRh            | Rao et al., 1989          |
|                | 167        | <i>p</i> -menth-1,8-dien-9-o | FRh            | Rao et al., 1989          |
|                |            | 1                            |                |                           |
|                | 171        | $\alpha$ -terpineol          | DRh,           | Rao et al., 1989;         |
|                |            |                              | FRh            | Srivastava et al., 2001   |
|                | 172        | limonene                     | DRh,           | Choudhury et al., 1996b;  |
|                |            |                              | FRh            | Srivastava et al., 2001;  |
|                |            |                              |                | Singh et al., 2003a       |
|                | 176        | <i>p</i> -menth-1-en-9-ol    | FRh            | Rao et al., 1989          |
|                | 183        | $\alpha$ -terpineol acetate  | FRh            | Rao et al., 1989          |
|                | 184        | <i>p</i> -menth-4-en-9-ol    | FRh            | Rao et al., 1989          |
|                | 190        | borneol                      | FRh,           | Srivastava et al., 2001;  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                    | <b>Section</b> | <b>Reference</b>         |
|----------------|------------|--------------------------------|----------------|--------------------------|
|                |            |                                | DRh,           | Mustafa et al., 2005;    |
|                |            |                                | Lf             | Prakash et al., 2005;    |
|                |            |                                |                | Padalia et al., 2013     |
| 191            |            | bornyl acetate                 | FRh            | Prakash et al., 2005     |
| 192            |            | isoborneol                     | DRh, Lf        | Srivastava et al., 2001; |
|                |            |                                |                | Padalia et al., 2013     |
| 194            |            | camphor                        | Lf, FRh        | Srivastava et al., 2001; |
|                |            |                                |                | Mustafa et al., 2005;    |
|                |            |                                |                | Padalia et al., 2013     |
| 195            |            | camphene hydrate               | Lf             | Padalia et al., 2013     |
| 200            |            | <i>car-3-ene</i>               | FRh            | Rao et al., 1989         |
| 207            |            | <i>trans</i> -sabinol          | FRh            | Prakash et al., 2005     |
| 209            |            | <i>cis</i> -sabinene hydrate   | FRh            | Padalia et al., 2013     |
| 211            |            | <i>trans</i> -sabinyll acetate | Leaf,          | Padalia et al., 2013     |
|                |            |                                | FR             |                          |
| 212            |            | camphene                       | DRh,           | Srivastava et al., 2001; |
|                |            |                                | FRh            | Singh et al., 2002;      |

| <b>Species</b> | <b>No.</b>              | <b>Name</b> | <b>Section</b> | <b>Reference</b>        |
|----------------|-------------------------|-------------|----------------|-------------------------|
|                |                         |             |                | Prakash et al., 2005    |
| 214            | myrtenol                | Lf          |                | Padalia et al., 2013    |
| 215            | 1, 8-cineole            | Rh          |                | Singh et al., 2002      |
| 220            | $\alpha$ -pinene        | Rh          |                | Dutt and Tayal, 1941;   |
|                |                         |             |                | Ahuja and Nigam, 1971   |
| 221            | $\beta$ -pinene         | FRh,        |                | Singh et al., 2002      |
| 221            |                         | DRh         |                |                         |
| 227            | (2E,6Z)-farnesol        | Lf          |                | Padalia et al., 2013    |
| 229            | (2E,6E)-farnesol        | FRh         |                | Rao et al., 1989        |
| 231            | (Z)- $\beta$ -farnasene | FRh         |                | Mustafa et al., 2005    |
| 237            | cis-farnesal            | FRh         |                | Rao et al., 1989        |
| 238            | trans-farnesal          | FRh         |                | Rao et al., 1989        |
| 244            | $\beta$ -bisabolol      | DRh         |                | Srivastava et al., 2001 |
| 264            | $\alpha$ -curcumene     | Rh          |                | Ahuja and Nigam, 1971;  |
|                |                         |             |                | Srivastava et al., 2001 |
| 265            | $\beta$ -curcumene      | Rh          |                | Jain and Mishra, 1964;  |
|                |                         |             |                | Ahuja and Nigam, 1971   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                 | <b>Section</b> | <b>Reference</b>         |
|----------------|------------|-----------------------------|----------------|--------------------------|
|                | 268        | turmerone                   | FRh            | Behura, 2000             |
|                | 269        | <i>ar</i> -turmerone        | Lf, Rh         | Jain and Mishra, 1964;   |
|                |            |                             |                | Padalia et al., 2013     |
|                | 275        | zingiberene                 | DRh            | Rao et al., 1989         |
|                | 277        | 1,3,5-bisabolatrien-7-      | Lf             | Padalia et al., 2013     |
|                |            | ol                          |                |                          |
|                | 279        | curcuphenol                 | Lf             | Padalia et al., 2013     |
|                | 331        | $\gamma$ -cadinene          | Lf             | Padalia et al., 2013     |
|                | 334        | $\alpha$ -cadinol           | Lf, FRh        | Padalia et al., 2013     |
|                | 337        | $\alpha$ -muurolene         | FRh            | Singh et al., 2002       |
|                | 338        | 14-hydroxy- $\alpha$ -muuro | Lf             | Padalia et al., 2013     |
|                |            | lene                        |                |                          |
|                | 356        | curzerene                   | Lf             | Padalia et al., 2013     |
|                | 357        | curzerenone                 | DRh,           | Srivastava et al., 2001; |
|                |            |                             | FRh,           | Singh et al., 2002;      |
|                |            |                             | Lf             | Prakash et al., 2005;    |
|                |            |                             |                | Padalia et al., 2013     |

| <b>Species</b> | <b>No.</b> | <b>Name</b>        | <b>Section</b> | <b>Reference</b>         |
|----------------|------------|--------------------|----------------|--------------------------|
|                | 363        | $\beta$ -elemenone | Lf             | Padalia et al., 2013     |
|                | 364        | $\beta$ -elemene   | DRh,           | Srivastava et al., 2001; |
|                |            |                    | FRh            | Mustafa et al., 2005;    |
|                |            |                    |                | Padalia et al., 2013     |
|                | 366        | $\delta$ -elemene  | DRh,           | Rao et al., 1989;        |
|                |            |                    | FRh            | Srivastava et al., 2001  |
|                | 370        | $\alpha$ -selinene | FRh,           | Srivastava et al., 2001; |
|                |            |                    | DRh            | Mustafa et al., 2005     |
|                | 371        | $\beta$ -selinene  | DRh,           | Rao et al., 1989;        |
|                |            |                    | FRh            | Srivastava et al., 2001; |
|                |            |                    |                | Mustafa et al., 2005     |
|                | 377        | $\beta$ -costol    | Lf             | Padalia et al., 2013     |
|                | 385        | $\gamma$ -eudesmol | Lf             | Padalia et al., 2013     |
|                | 409        | germacrene D       | FRh, Lf        | Mustafa et al., 2005;    |
|                |            |                    |                | Padalia et al., 2013     |
|                | 427        | germacrone         | DRh,           | Rao et al., 1989;        |
|                |            |                    | FRh            | Srivastava et al., 2001  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b> | <b>Reference</b>                         |
|----------------|------------|----------------------------|----------------|--|
|                | 448        | furanodiene                | Lf             | Padalia et al., 2013                     |
|                | 449        | furanodienone              | FRh            | Padalia et al., 2013                     |
|                | 450        | furanogermenone            | Lf             | Padalia et al., 2013                     |
|                | 466        | curcumenol                 | Lf             | Padalia et al., 2013                     |
|                | 491        | $\alpha$ -guaiene          | FRh            | Mustafa et al., 2005                     |
|                | 501        | $\gamma$ -guaiene          | FRh            | Mustafa et al., 2005                     |
|                | 503        | guaia-6,9-diene            | FRh            | Mustafa et al., 2005                     |
|                | 549        | calarene                   | DRh            | Singh et al., 2002                       |
|                | 550        | <i>allo</i> -aromadendrene | Lf             | Padalia et al., 2013                     |
|                | 552        | $\beta$ -gurjunene         | DRh, lf        | Singh et al., 2002; Padalia et al., 2013 |
|                | 554        | $\beta$ -caryophyllene     | Rh             | Singh et al., 2002                       |
|                | 555        | $\alpha$ -caryophyllene    | DRh,           | Singh et al., 2002;                      |
|                |            |                            | FRh            | Mustafa et al., 2005                     |
|                | 556        | caryophyllene oxide        | Lf, FRh        | Padalia et al., 2013                     |
|                | 557        | $\alpha$ -copaene          | DRh,           | Singh et al., 2002;                      |
|                |            |                            | FRh            | Mustafa et al., 2005                     |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                 | <b>Section</b> | <b>Reference</b>                                   |
|----------------|------------|---|----------------|--|
|                | 558        | $\beta$ -copaene                            | FRh            | Rao et al., 1989                                   |
|                | 559        | humulene epoxide ii                         | Lf, FRh        | Padalia et al., 2013                               |
|                | 560        | $\beta$ -cubebene                           | Lf             | Padalia et al., 2013                               |
|                | 561        | cubebol                                     | FRh            | Prakash et al., 2005                               |
|                | 569        | $\alpha$ -longipinene                       | FRH            | Mustafa et al., 2005                               |
|                | 573        | patchoulane                                 | FRh            | Rao et al., 1989                                   |
|                | 575        | $\beta$ -patchoulene                        | Lf             | Padalia et al., 2013                               |
|                | 598        | zerumbone                                   | DRh, Lf        | Srivastava et al., 2001;<br>Padalia et al., 2013   |
|                | 606        | ledol                                       | FRh, Lf        | Mustafa et al., 2005;<br>Padalia et al., 2013      |
|                | 613        | zerumin a                                   | DRh            | Alan Sheeja and Nair,<br>2012                      |
|                | 614        | (E)-labda-8(17),<br>12-diene-15,<br>16-dial | FRh            | Singh et al., 2010c; Alan<br>Sheeja and Nair, 2012 |
|                | 632        | coronarin d                                 | DRh            | Alan Sheeja and Nair,                              |

| <b>Species</b>         | <b>No.</b> | <b>Name</b>                              | <b>Section</b> | <b>Reference</b>              |
|------------------------|------------|--|----------------|-------------------------------|
|                        |            |  |                | 2012                          |
|                        | 636        | (E)-labda-8(17)-13-d<br>iene-15,16-oxide | DRh            | Alan Sheeja and Nair,<br>2012 |
|                        | 637        | zerumin B                                | DRh            | Alan Sheeja and Nair,<br>2012 |
|                        | 638        | coronarin B                              | DRh            | Alan Sheeja and Nair,<br>2012 |
|                        | 673        | amadaldehyde                             | DRh            | Policegoudra et al., 2010     |
|                        | 683        | difurocumenonol                          | DRh            | Policegoudra et al., 2007b    |
|                        | 685        | amadannulen                              | DRh            | Policegoudra et al., 2007a    |
|                        | 700        | permethyl-4-o-glucos<br>ylisovitexin     | FRh            | Vishnupriya et al., 2012      |
|                        | 701        | myrophine                                | FRh            | Vishnupriya et al., 2012      |
|                        | 708        | myristic acid                            | DRh            | Ahuja and Nigam, 1971         |
| <i>C. angustifolia</i> | 112        | methyl eugenol                           | DRh            | Srivastava et al., 2006       |
|                        | 113        | elemicin                                 | DRh            | Srivastava et al., 2006       |
|                        | 123        | linalool                                 | DRh            | Srivastava et al., 2006       |

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|----------------|------------|--|----------------|-------------------------|
|                | 125        | nerol                                    | DRh            | Srivastava et al., 2006 |
|                | 136        | geranial                                 | DRh            | Srivastava et al., 2006 |
|                | 143        | <i>trans</i> -linalool oxide             | DRh            | Srivastava et al., 2006 |
|                | 143        | <i>trans</i> -linalool oxide             | DRh            | Srivastava et al., 2006 |
|                | 146        | <i>p</i> -cymene                         | DRh            | Srivastava et al., 2006 |
|                | 147        | <i>p</i> -cymene-8-ol                    | DRh            | Srivastava et al., 2006 |
|                | 148        | carvacrol                                | DRh            | Srivastava et al., 2006 |
|                | 151        | thymol                                   | DRh            | Srivastava et al., 2006 |
|                | 161        | 5-hydroxy- <i>p</i> -menth-6-en-2-one    | DRh            | Srivastava et al., 2006 |
|                | 165        | piperitone                               | DRh            | Srivastava et al., 2006 |
|                | 166        | <i>trans</i> - <i>p</i> -menth-2-en-1-ol | DRh            | Srivastava et al., 2006 |
|                | 171        | $\alpha$ -terpineol                      | DRh            | Banerjee et al., 1980   |
|                | 173        | <i>cis</i> -carvotanacetol               | DRh            | Srivastava et al., 2006 |
|                | 180        | <i>cis</i> -linalool oxide               | DRh            | Srivastava et al., 2006 |
|                | 192        | isoborneol                               | DRh            | Srivastava et al., 2006 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                        | <b>Section</b> | <b>Reference</b>        |
|----------------|------------|------------------------------------|----------------|-------------------------|
|                | 193        | isobornyl acetate                  | DRh            | Srivastava et al., 2006 |
|                | 194        | camphor                            | FRh,           | Nguyen et al., 2001a    |
|                |            |                                    | DRh            |                         |
|                | 195        | camphene hydrate                   | DRh            | Srivastava et al., 2006 |
|                | 211        | <i>trans</i> -sabinal acetate      | DR             | Srivastava et al., 2006 |
|                | 212        | camphene                           | DRh            | Srivastava et al., 2006 |
|                | 215        | 1, 8-cineole                       | DRh            | Srivastava et al., 2006 |
|                | 220        | $\alpha$ -pinene                   | Rh,            | Banerjee et al., 1980;  |
|                |            |                                    | DRh            | Srivastava et al., 2006 |
|                | 221        | $\beta$ -pinene                    | Rh,            | Banerjee et al., 1980;  |
|                |            |                                    | DRh            | Srivastava et al., 2006 |
|                | 222        | myrtenal                           | DRh            | Srivastava et al., 2006 |
|                | 228        | (2 <i>E</i> ,6 <i>E</i> )-farnesol | DRh            | Srivastava et al., 2006 |
|                | 234        | ( <i>E,E</i> )-farnesyl            | DRh            | Srivastava et al., 2006 |
|                |            | acetone                            |                |                         |
|                | 236        | ( <i>E</i> )-nerolidol             | DRh            | Srivastava et al., 2006 |
|                | 239        | ( <i>E</i> )- $\alpha$ -atlantone  | DRh            | Srivastava et al., 2006 |

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|----------------|------------|------------------------------|----------------|-------------------------|
|                | 242        | $\beta$ -bisabolene          | DRh            | Srivastava et al., 2006 |
|                | 244        | $\beta$ -bisabolol           | DRh            | Srivastava et al., 2006 |
|                | 264        | $\alpha$ -curcumene          | Rh,            | Banerjee et al., 1980;  |
|                |            |                              | DRh            | Srivastava et al., 2006 |
|                | 269        | <i>ar</i> -turmerone         | DRh            | Srivastava et al., 2006 |
|                | 270        | $\alpha$ -turmerone          | DRh            | Srivastava et al., 2006 |
|                | 274a       | xanthorrhizol                | DRh            | Srivastava et al., 2006 |
|                | 274b       | xanthorrhizol isomer         | DRh            | Srivastava et al., 2006 |
|                | 275        | zingiberene                  | DRh            | Srivastava et al., 2006 |
|                | 278        | <i>ar</i> -turmerol          | DRh            | Srivastava et al., 2006 |
|                | 279        | curcuphenol                  | DRh            | Srivastava et al., 2006 |
|                | 280        | $\beta$ -sesquiphellandrene  | DRh            | Srivastava et al., 2006 |
|                | 316        | <i>cis</i> -sesquisabinene   | DRh            | Srivastava et al., 2006 |
|                |            | hydrate                      |                |                         |
|                | 317        | <i>trans</i> -sesquisabinene | DRh            | Srivastava et al., 2006 |
|                |            | hydrate                      |                |                         |
|                | 327        | cubenol                      | DRh            | Srivastava et al., 2006 |

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|----------------|------------|-------------------------------------|----------------|-------------------------|
|                | 329        | $\alpha$ -cadinene                  | DRh            | Srivastava et al., 2006 |
|                | 337        | $\alpha$ -muurolene                 | DRh            | Srivastava et al., 2006 |
|                | 340        | <i>t</i> -muurolol                  | DRh            | Srivastava et al., 2006 |
|                | 342        | $\delta$ -cadinol                   | DRh            | Srivastava et al., 2006 |
|                | 356        | curzerene                           | Uk             | Dung et al., 1995       |
|                | 357        | curzerenone                         | FRh,           | Nguyen et al., 2001a;   |
|                |            |                                     | DRh            | Srivastava et al., 2006 |
|                | 358        | 5- <i>epi</i> -curzerenone          | DRh            | Srivastava et al., 2006 |
|                | 364        | $\beta$ -elemene                    | F-Lf,          | Srivastava et al., 2006 |
|                |            |                                     | DRh            |                         |
|                | 366        | $\delta$ -elemene                   | DRh            | Srivastava et al., 2006 |
|                | 370        | $\alpha$ -selinene                  | DRh            | Srivastava et al., 2006 |
|                | 371        | $\beta$ -selinene                   | DRh            | Srivastava et al., 2006 |
|                | 378        | 10- <i>epi</i> - $\gamma$ -eudesmol | DRh            | Srivastava et al., 2006 |
|                | 423        | curdione                            | DRh            | Srivastava et al., 2006 |
|                | 427        | germacrone                          | DRh            | Srivastava et al., 2006 |
|                | 449        | furanodienone                       | DRh            | Nguyen et al., 2001b;   |

| <b>Species</b>      | <b>No.</b> | <b>Name</b>             | <b>Section</b> | <b>Reference</b>        |
|---------------------|------------|-------------------------|----------------|-------------------------|
|                     |            |                         |                | Srivastava et al., 2006 |
|                     | 452        | isofuranodienone        | DRh            | Nguyen et al., 2001b    |
|                     | 554        | $\beta$ -caryophyllene  | DRh            | Srivastava et al., 2006 |
|                     | 555        | $\alpha$ -caryophyllene | DRh            | Srivastava et al., 2006 |
|                     | 556        | caryophyllene oxide     | DRh            | Srivastava et al., 2006 |
|                     | 568        | $\alpha$ -longifolene   | DRh            | Srivastava et al., 2006 |
|                     | 574        | $\alpha$ -patchoulene   | DRh            | Srivastava et al., 2006 |
|                     | 599        | humulene epoxide II     | DRh            | Srivastava et al., 2006 |
|                     | 604        | viridiflorol            | DRh            | Srivastava et al., 2006 |
|                     | 705        | tridecanoic acid        | DR             | Srivastava et al., 2006 |
|                     | 709        | oleic acid              | DR             | Srivastava et al., 2006 |
|                     | 711        | pentadecanoic acid      | DR             | Srivastava et al., 2006 |
|                     | 713        | octadecanoic acid       | DR             | Srivastava et al., 2006 |
| <i>C. antinaia</i>  | 616        | labdane dialdehyde      | DRh            | Salama et al., 2012     |
|                     | 643        | labdane lactone         | DRh            | Salama et al., 2012     |
| <i>C. aromatica</i> | 1          | curcumin                | DRh            | Ahmad et al., 2011a     |
|                     | 2          | demethoxycurcumin       | DRh            | Bamba et al., 2011      |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                           | <b>Section</b> | <b>Reference</b>                       |
|----------------|------------|---------------------------------------|----------------|--|
|                | 3          | bisdemethoxycurcum                    | DRh            | DNP, 2014                              |
|                |            | in                                    |                |  |
|                | 106        | <i>p</i> -methoxycinnamic acid        | Uk             | Cheng et al., 1997                     |
|                | 120        | 1-feruloyloxy-2-methoxy cinnamic acid | DRh            | Huang et al., 2000a                    |
|                | 123        | linalool                              | Rh             | Kojima et al., 1998                    |
|                | 129        | 3, 7-dimethyl-1, 7-octadiene          | Lf             | Singh et al., 2004                     |
|                | 144        | elsholtzia ketone                     | petiole        | Choudhury et al., 1996a                |
|                | 146        | p-cymene                              | Lf             | Singh et al., 2002, 2002a              |
|                | 147        | <i>p</i> -cymene-8-ol                 | Rh, Lf         | Singh et al., 2002; Singh et al., 2004 |
|                | 148        | carvacrol                             | Lf, Rh         | Singh et al., 2002; Singh et al., 2004 |
|                | 150        | cuminal alcohol                       | Rh             | Rao and Nigam, 1974                    |
|                | 162        | 8-hydroxy- <i>p</i> -meth-1-          | FRh            | Singh et al., 2002                     |

| <b>Species</b>          | <b>No.</b>                  | <b>Name</b> | <b>Section</b> | <b>Reference</b>        |
|-------------------------|-----------------------------|-------------|----------------|-------------------------|
| en-3-one                |                             |             |                |                         |
| 171                     | $\alpha$ -terpineol         |             | Rh, Lf         | Rao and Nigam, 1974;    |
| Singh et al., 2002      |                             |             |                |                         |
| 172                     | limonene                    |             | Lf             | Choudhury et al., 1996a |
| 174                     | <i>cis</i> -carveol         |             | Lf             | Singh et al., 2004      |
| 177                     | <i>p</i> -menth-1(7)-en-2-o |             | Lf             | Singh et al., 2004      |
| ne                      |                             |             |                |                         |
| 190                     | borneol                     |             | Lf             | Al-Reza et al., 2010    |
| 192                     | isoborneol                  |             | Rh, Lf,        | Rao and Nigam, 1974;    |
| petiol                  |                             |             |                |                         |
| Choudhury et al., 1996a |                             |             |                |                         |
| es                      |                             |             |                |                         |
| 194                     | camphor                     |             | Lf, Rh,        | Choudhury et al., 1996a |
| petiol                  |                             |             |                |                         |
| es                      |                             |             |                |                         |
| 201                     | $\beta$ -3-carene           |             | Lf             | Singh et al., 2004      |
| 212                     | camphene                    |             | Lf, Rh,        | Choudhury et al., 1996a |
| petiol                  |                             |             |                |                         |

| <b>Species</b> | <b>No.</b>            | <b>Name</b>       | <b>Section</b> | <b>Reference</b>          |
|----------------|-----------------------|-------------------|----------------|---------------------------|
|                |                       |                   | es             |                           |
| 215            | 1, 8-cineole          |                   | Leaf, R,       | Choudhury et al., 1996a;  |
|                |                       |                   | petiol         | Singh et al., 2002        |
|                |                       |                   | es             |                           |
| 217            | 2-oxabicyclo(3.2.1)   |                   | Lf             | Singh et al., 2002; Singh |
|                |                       | octane-1.4-dimeth |                | et al., 2004              |
|                |                       | yl-8-methylene    |                |                           |
| 218            | bicyclo(2.2.1)heptan  |                   | Lf             | Singh et al., 2004        |
|                | e,1-acetyl-7-methy    |                   |                |                           |
|                |                       | lene              |                |                           |
| 220            | $\alpha$ -pinene      |                   | Rh, Lf         | Rao and Nigam, 1974;      |
|                |                       |                   |                | Singh et al., 2002;       |
|                |                       |                   |                | Singh et al., 2004        |
| 221            | $\beta$ -pinene       |                   | Rh, Lf         | Rao and Nigam, 1974;      |
|                |                       |                   |                | Singh et al., 2002;       |
|                |                       |                   |                | Singh et al., 2004        |
| 226            | $\beta$ -pinene oxide |                   | Lf             | Al-Reza et al., 2010      |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                   | <b>Section</b> | <b>Reference</b>                                 |
|----------------|------------|-------------------------------|----------------|--|
|                | 230        | (E)- $\beta$ -farnesene       | Lf             | Singh et al., 2002;<br>Al-Reza et al., 2010      |
|                | 235        | nerolidyl acetate             | Lf             | Al-Reza et al., 2010                             |
|                | 236        | (E)-nerolidol                 | Lf             | Al-Reza et al., 2010                             |
|                | 242        | $\beta$ -bisabolene           | DRh            | Singh et al., 2002                               |
|                | 250        | bisacumol                     | DRh            | Zheng et al., 1997                               |
|                | 255        | 1,3,5,10-bisabolatetr<br>aene | Uk             | Zheng et al., 1997                               |
|                | 256        | 1,3,5,11-bisabolatetr<br>aene | Uk             | Zheng et al., 1997                               |
|                | 257        | bisabola-3,10-diene-<br>2-one | Uk             | Zheng et al., 1997                               |
|                | 264        | $\alpha$ -curcumene           | DRh            | Rao et al., 1926; Zwaving<br>and Bos, 1992       |
|                | 265        | $\beta$ -curcumene            | Rh             | Rao and Simonsen, 1928;<br>Zwaving and Bos, 1992 |
|                | 269        | <i>ar</i> -turmerone          | Rh             | Ahmad et al., 2013                               |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                           | <b>Section</b> | <b>Reference</b>                               |
|----------------|------------|---------------------------------------|----------------|--|
|                | 274a       | xanthorrhizol                         | Rh             | Catalan et al., 1989;<br>Zwaving and Bos, 1992 |
|                | 275        | zingiberene                           | Rh             | Rao and Nigam, 1974;<br>Singh et al., 2002     |
|                | 276        | dihydroturmerone                      | Rh, Lf         | Singh et al., 2002; Singh<br>et al., 2004      |
|                | 278        | <i>ar</i> -turmerol                   | FRh            | Singh et al., 2002                             |
|                | 279        | curcuphenol                           | Rh             | Catalan et al., 1989                           |
|                | 296        | <i>trans-Z</i> - $\alpha$ -bisabolene | Lf             | Al-Reza et al., 2010                           |
|                |            | epoxide                               |                |  |
|                | 327        | cubenol                               | Lf             | Al-Reza et al., 2010                           |
|                | 347        | curcumenone                           | FRh,           | Kuroyanagi et al., 1987;                       |
|                |            |                                       | DRh            | Kojima et al., 1998;                           |
|                |            |                                       |                | Phan and Phan, 2000                            |
|                | 351        | curmadione                            | Uk             | Shiobara et al., 1986                          |
|                | 352        | <i>Curcumadione</i>                   | FRh            | Kuroyanagi et al., 1990                        |
|                | 353        | iso <i>Curcumadione</i>               | FRh            | Kuroyanagi et al., 1990                        |

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|----------------|------------|--|----------------|-------------------------|
|                | 356        | curzerene  | Rh             | Catalan et al., 1989    |
|                | 357        | curzerenone  | Rh             | Choudhury et al., 1996a |
|                | 362        | 8-hydroxyisogermafuranolide                        | Rh             | Catalan et al., 1989    |
|                | 364        | $\beta$ -elemene                                   | Rh             | Fu, 1984                |
|                | 370        | $\alpha$ -selinene                                 | Rh             | Phan and Phan, 2000     |
|                | 371        | $\beta$ -selinene                                  | Rh             | Phan and Phan, 2000     |
|                | 409        | germacrene D                                       | Rh, Lf         | Catalan et al., 1989;   |
|                |            |  |                | Al-Reza et al., 2010    |
|                | 410        | (4 <i>S</i> ,<br>5 <i>S</i> )-12-acetoxygermacrone | Uk             | Zheng et al., 1997      |
|                | 411        | (2 <i>S</i> )-2-hydroxycurdione                    | DRh            | Bamba et al., 2011      |
|                | 422        | acetoxyneocurdione                                 | FRh            | Kuroyanagi et al., 1990 |
|                | 423        | curdione   | Rh             | Hu et al., 1986;        |

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|----------------|------------|---------------------|----------------|--------------------------|
|                |            |                     |                | Kuroyanagi et al., 1987  |
|                | 424        | dehydrocurdione     | FRh            |                          |
|                | 425        | (4S)-13-hydroxydehy | FRh            | Kuroyanagi et al., 1990  |
|                |            | drocurdione         |                |                          |
|                | 426        | (4S)-13-acetoxydehy | FRh            | Kuroyanagi et al., 1990  |
|                |            | drocurdione         |                |                          |
|                | 427        | germacrone          | FRh            | Kuroyanagi et al., 1987  |
|                | 431        | (4S,5S)-germacrone  | FRh,           | Kuroyanagi et al., 1987; |
|                |            | 4,5-epoxide         | DRh            | Bamba et al., 2011       |
|                | 433        | 13-hydroxygermacro  | FRh,           | Kuroyanagi et al., 1990; |
|                |            | ne                  | DRh            | Bamba et al., 2011       |
|                | 434        | neocurdione         | FRh            | Ohkura et al., 1986;     |
|                |            |                     |                | Kuroyanagi et al., 1987; |
|                |            |                     |                | Etoh et al., 2003        |
|                | 437        | (4S,5S)-13-hydroxy- | FRh            | Kuroyanagi et al., 1990  |
|                |            | germacrone          |                |                          |
|                |            | 4,5-epoxide         |                |                          |

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|----------------|------------|------------------------------|----------------|--|
|                | 438        | (4S,5S)-13-acecoxygermacrone | FRh            | Kuroyanagi et al., 1990  |
|                |            | 4,5-epoxide                  |                |  |
|                | 448        | furanodiene                  | Rh             | Phan and Phan, 2000  |
|                | 449        | furanodienone                | Rh             | Phan and Phan, 2000  |
|                | 454        | zederone                     | DRh            | Phan and Phan, 2000; Pant et al., 2001                         |
|                | 462        | bicyclogermacrene            | Rh             | Ahmad et al., 2013   |
|                | 463        | aerugidiol                   | DRh            | Bamba et al., 2011   |
|                | 465        | curcumol                     | Rh             | Yang et al., 1979  |
|                | 475        | procurcumenol                | FRh, DRh       | Kuroyanagi et al., 1987; Bamba et al., 2011                    |
|                | 476        | 1- <i>epi</i> -procurcumenol | Rh, DRh        |  |
|                | 478        | isoprocurcumenol             | FRh, DRh       | Kuroyanagi et al., 1990; Etoh et al., 2003; Bamba et al., 2011 |

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|----------------|------------|--|----------------|--------------------------|
|                | 479        | 9-oxo-neoprocum  | FRh            | Etoh et al., 2003        |
|                |            | enol   |                |                          |
|                | 480        | neoprocumeneol   | FRh            | Kuroyanagi et al., 1990  |
|                | 483        | (1 <i>S</i> ,4 <i>S</i> ,5 <i>S</i> ,10 <i>R</i> )-zedo  | FRh,           | Kuroyanagi et al., 1987; |
|                |            | arondiol   | DRh            | Bamba et al., 2011       |
|                | 484        | isozedoarondiol  | FRh,           | Kuroyanagi et al., 1987; |
|                |            |  | DRh            | Bamba et al., 2011       |
|                | 485        | (1 <i>β</i> ,4 <i>β</i> ,5 <i>β</i> ,10 <i>β</i> )-zedoa | FRh            | Kuroyanagi et al., 1987  |
|                |            | rondiol  |                |                          |
|                | 486        | methylzedoarondiol                                       | FRh            | Kuroyanagi et al., 1987  |
|                | 551        | aromadendrene  | Rh             | Revathi and Malathy,     |
|                |            |  |                | 2013                     |
|                | 555        | ( <i>α</i> -humulene)                                    | Rh             | Phan and Phan, 2000      |
|                | 556        | caryophyllene oxide                                      | Lf, Rh,        | Al-Reza et al., 2010;    |
|                |            |  | petiol         | Ahmad et al., 2013       |
|                |            | e  |                | Choudhury et al., 1996a  |
|                | 566        | γ-himachalene  | Rh             | Ahmad et al., 2013       |

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|----------------|------------|--|----------------|---|
|                | 572        | patchouli alcohol                                    | petiole        | Choudhury et al., 1996a                               |
|                | 595        | 6-isopropyl-1,2-dime<br>thy-4-oxo-bicyclo<br>{3.3.1] | DRh            | Revathi and Malathy,<br>2013                          |
|                | 605        | globulol   | Lf             | Al-Reza et al., 2010                                  |
|                | 606        | ledol  | Lf             | Al-Reza et al., 2010                                  |
|                | 607        | <i>epi</i> -globulol                                 | Lf, DRh        | Al-Reza et al., 2010;<br>Revathi and Malathy,<br>2013 |
|                | 644        | curcusesterterpene                                   | DRh            | Ahmad et al., 2011a                                   |
|                |            | A  |                |   |
|                | 645        | curcusesterterpene                                   | DRh            | Ahmad et al., 2011a                                   |
|                |            | B  |                |   |
|                | 646        | curcusesterterpene                                   | DRh            | Ahmad et al., 2011a                                   |
|                |            | C  |                |   |
|                | 661        | stigmasterol   | DRh            | Ahmad et al., 2011b                                   |
|                | 663        | $\beta$ -sitosterol-3- <i>O</i> - $\beta$ -d-        | DRh            | Pant et al., 2013                                     |

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|----------------|------------|--|----------------|------------------------------|
|                |            | glucopyranoside  |                |                              |
| 665            |            | androstan-17-one,<br>3-ethyl-3-hydroxy-,<br>(5 $\alpha$ )- | DRh            | Revathi and Malathy,<br>2013 |
| 668            |            | <i>Curcumapentadecan</i><br>ol                             | DRh            | Ahmad et al., 2011b          |
| 669            |            | <i>n</i> -pentatriacontan-5-o<br>ne                        | DRh            | Ahmad et al., 2011b          |
| 671            |            | <i>n</i> -heneitriacontan-14-<br>one                       | DRh            | Ahmad et al., 2011b          |
| 684            |            | 1,2-benzenedicarbox<br>ylic acid,<br>diisooctyl ester      | DRh            | Revathi and Malathy,<br>2013 |
| 707            |            | 9,12-Octadecadienoic<br>acid ( <i>Z,Z</i> )-               | DRh            | Revathi and Malathy,<br>2013 |
| 713            |            | octadecanoic acid  | DR             | Revathi and Malathy,<br>2013 |

| <b>Species</b>   | <b>No.</b> | <b>Name</b>                           | <b>Section</b> | <b>Reference</b>  |
|------------------|------------|---------------------------------------|----------------|---|
| <i>C. caesia</i> | 111        | estragole                             | FRh            | Pandey and Chowdhury,<br>2003                                 |
|                  | 112        | methyl eugenol                        | Lf             | Behura and Srivastava,<br>2004                                |
|                  | 114        | (E)-methyl<br>isoeugenol              | Lf             | Behura and Srivastava,<br>2004                                |
|                  | 123        | linalool                              | FRh, Lf        | Pandey and Chowdhury,<br>2003; Behura and<br>Srivastava, 2004 |
|                  | 124        | myrcene                               | leaf           | Behura and Srivastava,<br>2004                                |
|                  | 126        | (E)- $\beta$ -ocimene                 | FRh            | Pandey and Chowdhury,<br>2003                                 |
|                  | 146        | <i>p</i> -cymene                      | FRh            | Pandey and Chowdhury,<br>2003                                 |
|                  | 156        | terpinolene<br>( $\delta$ -terpinene) | FRh            | Pandey and Chowdhury,<br>2003                                 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---------------------|----------------|---|
|                | 159        | terpinen-4-ol       | FR             | Pandey and Chowdhury,<br>2003                                 |
|                | 171        | $\alpha$ -terpineol | Lf             | Behura and Srivastava,<br>2004; Srivastava et al.,<br>2006    |
|                | 172        | limonene            | Lf             | Behura and Srivastava,<br>2004                                |
|                | 178        | menthone            | FRh            | Pandey and Chowdhury,<br>2003                                 |
|                | 179        | isomenthone         | FRh            | Pandey and Chowdhury,<br>2003                                 |
|                | 190        | borneol             | FRh            | Pandey and Chowdhury,<br>2003                                 |
|                | 191        | bornyl acetate      | Uk             | Yang et al., 1979   |
|                | 194        | camphor             | FRh, Lf        | Pandey and Chowdhury,<br>2003; Behura and<br>Srivastava, 2004 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                 | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|-----------------------------|----------------|--|
|                | 196        | $\alpha$ -fenchol           | FRh            | Pandey and Chowdhury,<br>2003                            |
|                | 197        | $\alpha$ -fenchyl acetate   | FRh            | Pandey and Chowdhury,<br>2003                            |
|                | 212        | camphene                    | FRh            | Pandey and Chowdhury,<br>2003                            |
|                | 215        | 1, 8-cineole                | Rh, Lf         | Banerjee et al., 1984;<br>Behura and Srivastava,<br>2004 |
|                | 220        | $\alpha$ -pinene            | Lf             | Behura and Srivastava,<br>2004                           |
|                | 221        | $\beta$ -pinene             | Lf             | Behura and Srivastava,<br>2004                           |
|                | 232        | (Z, E)- $\alpha$ -farnesene | FRh            | Pandey and Chowdhury,<br>2003                            |
|                | 264        | $\alpha$ -curcumene         | FRh            | Banerjee et al., 1984;<br>Pandey and                     |

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|----------------|------------|----------------------|----------------|--------------------------|
|                |            |                      |                | Chowdhury, 2003          |
| 266            |            | $\gamma$ -curcumene  | Uk             | Yang et al., 1979        |
| 269            |            | <i>ar</i> -turmerone | FRh            | Pandey and Chowdhury,    |
|                |            |                      |                | 2003                     |
| 347            |            | curcumenone          | DRh            | Vairappan et al., 2013   |
| 356            |            | curzerene            | Rh             | Bjddhasukh et al., 1995  |
| 357            |            | curzerenone          | Rh,            | Bjddhasukh et al., 1995; |
|                |            |                      | DRh            | Vairappan et al., 2013   |
| 364            |            | $\beta$ -elemene     |                |                          |
| 364            |            | $\beta$ -elemene     | Lf, FRh        | Behura and Srivastava,   |
|                |            |                      |                | 2004; Pandey and         |
|                |            |                      |                | Chowdhury, 2003          |
| 365            |            | $\gamma$ -elemene    | FR             | Pandey and Chowdhury,    |
|                |            |                      |                | 2003                     |
| 366            |            | $\delta$ -elemene    | FRh            | Pandey and Chowdhury,    |
|                |            |                      |                | 2003                     |
| 367            |            | elemol               | FRh            | Pandey and Chowdhury,    |

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|----------------|------------|--------------------|----------------|-------------------------|
|                |            |                    |                | 2003                    |
|                | 371        | $\beta$ -selinene  | FRh            | Pandey and Chowdhury,   |
|                |            |                    |                | 2003                    |
|                | 427        | germacrone         | DRh            | Vairappan et al., 2013  |
|                | 429        | germacrene B       | FRh            | Pandey and Chowdhury,   |
|                |            |                    |                | 2003                    |
|                | 431        | (4S,5S)-germacrone | DRh            | Vairappan et al., 2013  |
|                |            | 4,5-epoxide        |                |                         |
|                | 448        | furanodiene        | DRh            | Asem and Laitonjam,     |
|                |            |                    |                | 2012; Vairappan et al., |
|                |            |                    |                | 2013                    |
|                | 451        | glechomanolide     | DRh            | Asem and Laitonjam,     |
|                |            |                    |                | 2012                    |
|                | 452        | isofuranodienone   | DRh            | Vairappan et al., 2013  |
|                | 454        | zederone           | DRh            | Asem and Laitonjam,     |
|                |            |                    |                | 2012; Vairappan et al., |
|                |            |                    |                | 2013                    |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>               |
|----------------|------------|--|----------------|--------------------------------|
|                | 463        | aerugidiol   | DRh            | Vairappan et al., 2013         |
|                | 466        | curcumenol   | DRh            | Vairappan et al., 2013         |
|                | 554        | $\beta$ -caryophyllene   | FRh            | Pandey and Chowdhury,<br>2003  |
|                | 555        | $\alpha$ -caryophyllene  | Lf             | Behura and Srivastava,<br>2004 |
|                | 560        | $\beta$ -cubebene  | FRh            | Pandey and Chowdhury,<br>2003  |
|                | 607        | <i>epi</i> -globulol   | FRh            | Pandey and Chowdhury,<br>2003  |
|                | 719        | 2, 3, 4, 8a, 9,<br>9a-hexamethyl<br>-2,3,3a,4,4a,5,8,8a,<br>9,9a-decahydro-1<br>H-cyclopenta [b]<br>naphthalene-1,2,3a<br>,4a-tetrao | DRh            | Ghosh et al., 2014             |

| <b>Species</b>        | <b>No.</b> | <b>Name</b>                              | <b>Section</b> | <b>Reference</b>    |
|-----------------------|------------|--|----------------|---------------------|
| <i>C. chuanyujin</i>  | 1          | curcumin                                 | DRh            | Huang et al., 2000b |
|                       | 2          | demethoxycurcumin                        | DRh            | Huang et al., 2000a |
|                       | 3          | bisdemethoxycurcum<br>in                 | DRh            | Huang et al., 2000a |
|                       | 119        | 1- <i>p</i> -coumaroyl-cinna<br>mic acid | DRh            | Huang et al., 2000a |
|                       | 120        | 1-feruloyloxy-2-meth<br>oxycinnamic acid | Uk             | Yang et al., 1979   |
|                       | 121        | 1-feruloyloxy-cinna<br>mic acid          | DRh            | Huang et al., 2000a |
| <i>C.</i>             | 215        | 1, 8-cineole                             | Lf             | Dung et al., 1996   |
| <i>cochinchinensi</i> |            |  |                |                     |
| <i>s</i>              |            |  |                |                     |
|                       | 363        | $\beta$ -elemenone                       | FRh            | Dung et al., 1996   |
|                       | 423        | curdione                                 | Lf, FRh        | Dung et al., 1996   |
|                       | 427        | germacrone                               | FRh            | Dung et al., 1996   |
|                       | 465        | curcumol                                 | Rh             | Phan and Phan, 2002 |

| <b>Species</b>   | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|------------------|------------|---|----------------|---|
|                  | 466        | curcumenol  | Rh             | Phan and Phan, 2002   |
|                  | 468        | 4- <i>epi</i> -curcumenol   | Uk             | Yang et al., 1979   |
|                  | 469        | isocurcumenol   | Rh             | Phan and Phan, 2002   |
| <i>C. comosa</i> | 9          | ( <i>E</i> )-1-(3,4-dihydroxy phenyl)-7-(4-hydroxyphenyl)-1-hepten-5-ol     | DRh            | Kaewamatawong et al., 2009  |
|                  | 10         | ( <i>E</i> )-1-(3,4-dihydroxyphenyl)-7-(3-hydroxyphenyl)-5-methoxy-1-hepten | DRh            | Kaewamatawong et al., 2009  |
|                  | 11         | ( <i>E</i> )-1,7-diphenyl-1-hepten-5-ol                                     | DRh, DAp       | Jurgens et al., 1994; Suksamrarn et al., 2008; Chokchaisiri et al., 2010; Chokchaisiri et al., 2012 |
|                  | 12         | ( <i>E</i> )-5-acetoxy-1,7-dihydroxy-1-hepten                               | DRh            | Jurgens et al., 1994  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>          | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|----------------------|----------------|---------------------------|
|                |            | phenyl-1-heptene     |                |                           |
| 13             |            | (E)-7-(3,4-dihydroxy | DRh            | Suksamraran et al., 1997; |
|                |            | phenyl)-5-hydroxy    |                | Suksamrarn et al., 2008;  |
|                |            | -1-phenyl-1-hepte    |                | Kaewamatawong et al.,     |
|                |            | ne                   |                | 2009                      |
| 14             |            | (E)-5-hydroxy-7-(4-h | DRh,           | Suksamraran et al., 1997; |
|                |            | ydroxyphenyl)-1-p    | DAp            | Suksamrarn et al., 2008;  |
|                |            | henyl-1-heptene      |                | Chokchaisiri et al., 2012 |
| 15             |            | (E)-1,7-diphenyl-1-h | DRh            | Jurgens et al., 1994      |
|                |            | epten-5-one          |                |                           |
| 16             |            | (E)-1,7-diphenyl-3-h | DRh            | Jurgens et al., 1994;     |
|                |            | ydroxy-1-hepten-5    |                | Suksamrarn et al., 2008   |
|                |            | -one                 |                |                           |
| 17             |            | (E)-7-(4-hydroxyphe  | DRh,           | Suksamrarn et al., 2008;  |
|                |            | nyl)-1-heptene-5-o   | DAp            | Chokchaisiri et al., 2012 |
|                |            | ne                   |                |                           |
| 18             |            | (1E,                 | DRh            | Suksamrarn et al., 2008   |

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|----------------|--|---|----------------|--|
|                |  | 5 <i>S</i> )-7-(4-methoxyphenyl)-1-phenyl-1-hepten-5-ol |                |  |
| 19             | (1 <i>E</i> ,  |   | DRh            | Suksamrarn et al., 2008                      |
|                |  | 5 <i>R</i> )-7-(4-methoxyphenyl)-1-phenyl-1-hepten-5-ol |                |  |
| 20             | ( <i>E</i> )-1,7-bis(4-hydroxyphenyl)-1-hepten-5-one                 |   | DRh            | Matsumoto et al., 2013                       |
|                |  |   |                |  |
| 21             | diarylcomosols II  |   | DRh            | Matsumoto et al., 2013                       |
| 40             | (3 <i>R</i> )-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptan-3-ol |   | DRh            | Matsumoto et al., 2013                       |
|                |  |   |                |  |
| 45             | 3,5-dihydroxy-1-(4-hydroxy-3,5-dimethylphenyl)heptan-3-ol            |   | DRh            | Matsumoto et al., 2013; Fuentes et al., 2014 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>       |
|----------------|------------|---|----------------|------------------------|
|                |            | oxyphenyl)-7-(4-h                                   |                |                        |
|                |            | ydroxyphenyl)hept                                   |                |                        |
|                |            | ane   |                |                        |
| 46             |            | <i>rel</i> -(3 <i>R</i> ,5 <i>S</i> )-3,5-dihyd DRh |                | Matsumoto et al., 2013 |
|                |            | roxy-1-(3,4-dihydr                                  |                |                        |
|                |            | oxyphenyl)-7-(4-h                                   |                |                        |
|                |            | ydroxyphenyl)                                       |                |                        |
|                |            | heptane   |                |                        |
| 49             |            | (3 <i>R</i> ',5 <i>S</i> ')-3,5-dihyd DRh           |                | Matsumoto et al., 2013 |
|                |            | oxy-1-(4-hydroy-                                    |                |                        |
|                |            | 3,5-dimethoxyphe                                    |                |                        |
|                |            | nyl)-7-(4-hydroxy-                                  |                |                        |
|                |            | 3-methoxyphenyl)                                    |                |                        |
|                |            | -heptane  |                |                        |
| 50             |            | (3 <i>R</i> ,                                       | DRh            | Kaewamatawong et al.,  |
|                |            | 5 <i>R</i> )-1-(3,4-dihydro                         |                | 2009                   |
|                |            | xyphenyl)-7-pheny                                   |                |                        |

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|----------------|------------|--|----------------|---|
|                |            | 1-heptane-3,5-diol   |                |   |
|                | 52         | (3 <i>R</i> ,<br>5 <i>R</i> )-3,5-dihydroxy<br>-1,7-bis(4-hydroxy<br>phenyl)heptane<br>(hannokinol)        | DRh            | Matsumoto et al., 2013;<br>Fuentes et al., 2014 |
|                | 53         | ( <i>-</i> )-(3 <i>S</i> ,<br>5 <i>S</i> )-3-acetoxy-5-h<br>ydroxy-1,7-bis(4-h<br>ydroxyphenyl)hept<br>ane | DRh            | Fuentes et al., 2014                            |
|                | 55         | (3 <i>R</i> ,<br>5 <i>R</i> )-3,5-dihydroxy<br>-1-(3,4-dihydroxy<br>phenyl)-7-(4-hyd<br>oxyphenyl)heptane  | DRh            | Matsumoto et al., 2013                          |
|                | 57         | (3 <i>R</i> ,  | DRh            | Matsumoto et al., 2013                          |

| <b>Species</b> | <b>No.</b>    | <b>Name</b>   | <b>Section</b> | <b>Reference</b>       |
|----------------|---------------|---|----------------|------------------------|
|                |               | 5 <i>R</i> )-3-acetoxy-5-hydroxy-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptane | DRh            | Matsumoto et al., 2013 |
| 58             | (3 <i>R</i> , |   |                |                        |
| 59             | (3 <i>R</i> , | 5 <i>R</i> )-3-acetoxy-5-hydroxy-1,7-bis(3,4-dihydroxyphenyl)heptane                | DRh            | Fuentes et al., 2014   |
| 61             | (3 <i>R</i> , | 5 <i>R</i> )-3,5-diacetoxy-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptane       | DRh            | Fuentes et al., 2014   |

| <b>Species</b> | <b>No.</b>  | <b>Name</b>                            | <b>Section</b>                               | <b>Reference</b> |
|----------------|---|--|--|------------------|
|                |   | 1,7-bis(3,4-dihydronoxyphenyl)-heptane | e  |                  |
| 66             | (5 <i>R</i> )-5-hydroxy-1-(4-hydroxyphenyl)-7-(4-hydroxy-3-methoxyphenyl)-3-heptanone | DRhh                                   | Matsumoto et al., 2013                       |                  |
| 69             | 5-hydroxy-1-(4-hydroxy-3-methoxyphenyl)-7-(4-hydroxyphenyl)-3-heptanone               | DRh                                    | Fuentes et al., 2014                         |                  |
| 70             | (5 <i>S</i> )-5-hydroxy-1,7-bis(4-hydroxyphenyl)-3-heptanone                          | DRh                                    | Matsumoto et al., 2013; Fuentes et al., 2014 |                  |
| 72             | (1 <i>E</i> )-3-heptanone   | DRh                                    | Jurgens et al., 1994;                        |                  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                            | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|--|----------------|---------------------------|
|                |            | 3 <i>E</i> )-1,7-diphenyl-             |                | Suksamrarn et al., 2008   |
|                |            | 1,3-heptadien-5-ol                     |                |                           |
| 73             |            | (1 <i>E</i> ,                          | DRh            | Suksamrarn et al., 2008   |
|                |            | 3 <i>E</i> )-1,7-diphenyl-             |                |                           |
|                |            | 1,3-heptadien-5-on                     |                |                           |
|                |            | e                                      |                |                           |
| 74             |            | 7-(4-hydroxyphenyl)                    | DRh,           | Suksamrarn et al., 2008;  |
|                |            | -1-phenyl-(1 <i>E</i> ,                | DAp            | Chokchaisiri et al., 2012 |
|                |            | 3 <i>E</i> )-1,3-heptadien-            |                |                           |
|                |            | 5-one                                  |                |                           |
| 75             |            | 1,7-bis(4-hydroxyph                    | DRh            | Matsumoto et al., 2013;   |
|                |            | enyl)hepta-1 <i>E</i> ,                |                | Fuentes et al., 2014      |
|                |            | 3 <i>E</i> -dien-5-one                 |                |                           |
| 83             |            | diarylcomosols I                       | DRh            | Matsumoto et al., 2013    |
| 88             |            | 1,7-diphenyl-(1 <i>E</i> ,3 <i>E</i> , | DRh            | Suksamrarn et al., 2008   |
|                |            | 5 <i>E</i> )-1,3,5-triene              |                |                           |
| 156            |            | terpinolene                            | Rh             | Palanuvej and             |

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|----------------|------------|----------------------------|----------------|-----------------------|
|                |            | ( $\delta$ -terpinene)     |                | Ruangrungsi, 2007     |
| 163            |            | 1-(2-hydroxy-2-prop        | DRh            | Nakamura et al., 2008 |
|                |            | anyl)-4-methyl-3-c         |                |                       |
|                |            | cyclohexen-1-ol            |                |                       |
| 164            |            | 6-hydroxy-3-(1-hydr        | DRh            | Nakamura et al., 2008 |
|                |            | oxy-1-methylethyl          |                |                       |
|                |            | ) -6-methyl-2-cyclo        |                |                       |
|                |            | hexen-1-one                |                |                       |
| 186            |            | comososide                 | DRh            | Nakamura et al., 2008 |
| 187            |            | comosoxide A               | DRh            | Nakamura et al., 2008 |
| 188            |            | comosoxide B               | DRh            | Nakamura et al., 2008 |
| 213            |            | (1 <i>S</i> , 2 <i>S</i> , | DRh            | Nakamura et al., 2008 |
|                |            | 4 <i>R</i> )-2-hydroxy-1,8 |                |                       |
|                |            | -cineole                   |                |                       |
|                |            | $\beta$ -d-glucopyranosi   |                |                       |
|                |            | de                         |                |                       |
| 215            |            | 1, 8-cineole               | Rh             | Palanuvej and         |

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|----------------|------------|------------------------------------|----------------|-------------------|
|                |            |                                    |                | Ruangrungsi, 2007 |
|                | 332        | comosone I                         | DRh            | Xu et al., 2008   |
|                | 333        | comosone II                        | DRh            | Xu et al., 2008   |
|                | 347        | curcumenone                        | DRh            | Qu et al., 2009   |
|                | 349        | dimethoxycurcumen<br>one           | DRh            | Xu et al., 2008   |
|                | 350        | comosone III                       | DRh            | Xu et al., 2008   |
|                | 352        | <i>Curcumadione</i>                | DRh            | Qu et al., 2009   |
|                | 357        | curzerenone                        | DRh            | Qu et al., 2009   |
|                | 393        | curcolonol                         | DRh            | Qu et al., 2009   |
|                | 413        | (-)-comosol                        | DRh            | Xu et al., 2008   |
|                | 414        | (+)-comosol                        | DRh            | Xu et al., 2008   |
|                | 415        | 7 $\beta$ -hydroxycurdione         | DRh            | Qu et al., 2009   |
|                | 416        | 7 $\alpha$ -hydroxyneocurdi<br>one | DRh            | Qu et al., 2009   |
|                | 423        | curdione                           | DRh            | Qu et al., 2009   |
|                | 424        | dehydrocurdione                    | DRh            | Qu et al., 2009   |

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|----------------|------------|--------------------|----------------|---------------------------------------|
|                | 427        | germacrone         | DRh            | Qu et al., 2009                       |
|                | 433        | 13-hydroxygermacro | DRh            | Qu et al., 2009                       |
|                |            | ne                 |                |                                       |
|                | 434        | neocurdione        | DRh            | Qu et al., 2009                       |
|                | 441        | germacrone-1(10),  | DRh            | Qu et al., 2009                       |
|                |            | 4-diepoxide        |                |                                       |
|                | 446        | zederone epoxide   | DRh            | Qu et al., 2009                       |
|                | 447        | 1(10)Z,            | DRh            | Qu et al., 2009                       |
|                |            | 4Z-furanodiene-6-  |                |                                       |
|                |            | one                |                |                                       |
|                | 449        | furanodienone      | DRh            | Qu et al., 2009                       |
|                | 451        | glechomanolide     | DRh            | Qu et al., 2009                       |
|                | 452        | isofuranodienone   | DRh            | Qu et al., 2009                       |
|                | 454        | zederone           | DRh            | Qu et al., 2009; Fuentes et al., 2014 |
|                | 463        | aerugidiol         | DRh            | Qu et al., 2009; Fuentes et al., 2014 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|---|----------------|---------------------------|
|                | 464        | alismoxide  | DRh            | Qu et al., 2009           |
|                | 475        | procurcumenol   | DR             | Qu et al., 2009           |
|                | 478        | isoprocurcumenol  | DRh            | Qu et al., 2009           |
|                | 483        | (1 <i>S</i> ,4 <i>S</i> ,5 <i>S</i> ,10 <i>R</i> )-zedo<br>arondiol   | DRh            | Qu et al., 2009           |
|                | 484        | isozedoarondiol   | DRh            | Qu et al., 2009           |
|                | 487        | alismol   | DRh            | Qu et al., 2009           |
|                | 509        | (1 <i>R</i> , 4 <i>R</i> , 5 <i>S</i> ,<br>10 <i>S</i> )-zedoalactone | DRh            | Qu et al., 2009           |
|                |            | B   |                |                           |
|                | 625        | curcucomosin a<br>(3-oxolabda-8(17),<br>11,13-trien-15(16)<br>-olide) | Ap             | Chokchaisiri et al., 2010 |
|                | 626        | villosin  | Ap             | Chokchaisiri et al., 2010 |
|                | 627        | curcucomosin c<br>((12 <i>R</i> )-hydroxylab                          | Ap             | Chokchaisiri et al., 2010 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                          | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|--------------------------------------|----------------|---------------------------|
|                |            | da-8(17),13-dien-1                   |                |                           |
|                |            | 5(16)-oxide)                         |                |                           |
| 628            |            | coronarin E                          | Ap             | Chokchaisiri et al., 2010 |
| 629            |            | curcucomosin b                       | Ap             | Chokchaisiri et al., 2010 |
|                |            | ((3 <i>S</i> )-hydroxylabd           |                |                           |
|                |            | a-8(17),11,13-trien                  |                |                           |
|                |            | -15(16)-oxide)                       |                |                           |
| 630            |            | isocoronarin D                       | Ap             | Chokchaisiri et al., 2010 |
| 631            |            | zerumin                              | Ap             | Chokchaisiri et al., 2010 |
| 647            |            | curcucomosides A                     | Ap             | Chokchaisiri et al., 2012 |
| 648            |            | curcucomosides B                     | Ap             | Chokchaisiri et al., 2012 |
| 649            |            | curcucomosides C                     | Ap             | Chokchaisiri et al., 2012 |
| 650            |            | curcucomosides D                     | Ap             | Chokchaisiri et al., 2012 |
| 651            |            | kaempferol                           | Ap             | Chokchaisiri et al., 2012 |
|                |            | 3- <i>o</i> - $\alpha$ -l-arabinosid |                |                           |
|                |            | e                                    |                |                           |
| 652            |            | quercetin                            | Ap             | Chokchaisiri et al., 2012 |

| <b>Species</b>    | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>          |
|-------------------|------------|---|----------------|---------------------------|
|                   |            | 3- <i>o</i> -arabinopyranoside (guaijaverin)  |                |                           |
|                   | 653        | kaempferol  | Ap             | Chokchaisiri et al., 2012 |
|                   |            | 3- <i>o</i> - $\alpha$ -l-rhamnopyranosyl-(1→2)- <i>o</i> - $\alpha$ -l-arabinopyranoside |                |                           |
|                   | 677        | 4,6-dihydroxy-2- <i>o</i> -( <i>d</i> -gluco-pyranosyl)acetophenone                       | DRh            | Suksamraran et al., 1997  |
| <i>C. elata</i>   | 678        | phloracetophenone   | Uk             | Yang et al., 1979         |
|                   | 215        | 1,8-cineole   | Stem, Lf       | Phanj et al., 1998        |
|                   | 220        | $\alpha$ -pinene  | Lf, stem       | Phanj et al., 1998        |
|                   | 242        | $\beta$ -bisabolene   | Rh, Rx         | Phanj et al., 1998        |
|                   | 264        | <i>ar</i> -curcumene  | Rh, Rx         | Phanj et al., 1998        |
|                   | 454        | zederone  | Uk             | Pimkaew et al., 2013      |
| <i>C. haritha</i> | 123        | linalool  | FRh, Lf        | Raj et al., 2008          |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>                   |
|----------------|------------|---------------------|----------------|------------------------------------|
|                | 124        | myrcene             | FRh, Lf        | Raj et al., 2008                   |
|                | 155        | $\gamma$ -terpinene | Lf             | Raj et al., 2011                   |
|                | 159        | terpinen-4-ol       | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 168        | carvone             | FRh            | Raj et al., 2008                   |
|                | 171        | $\alpha$ -terpineol | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 172        | limonene            | FRh, Lf        | Raj et al., 2008                   |
|                | 174        | cis-carveol         | FRh            | Raj et al., 2008                   |
|                | 190        | borneo              | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 191        | bornyl acetate      | FRh            | Raj et al., 2008                   |
|                | 192        | isoborneol          | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 194        | camphor             | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 195        | camphene hydrate    | FRh, Lf        | Raj et al., 2008; Raj et al.,      |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>              |
|----------------|------------|---------------------|----------------|-------------------------------|
| 2011           |            |                     |                |                               |
|                | 205        | $\alpha$ -thujene   | FRh            | Raj et al., 2008              |
|                | 206        | sabinene            | FRh, Lf        | Raj et al., 2008              |
|                | 212        | camphene            | FRh, Lf        | Raj et al., 2008              |
|                | 215        | 1,8-cineole         | FRh, Lf        | Raj et al., 2008              |
|                | 220        | $\alpha$ -pinene    | FRh            | Raj et al., 2008              |
|                | 221        | $\beta$ -pinene     | FRh, Lf        | Raj et al., 2008              |
|                | 265        | $\beta$ -curcumene  | Lf             | Raj et al., 2011              |
|                | 330        | $\delta$ -cadinene  | FRh, Lf        | Raj et al., 2008; Raj et al., |
| 2011           |            |                     |                |                               |
|                | 331        | $\gamma$ -cadinene  | FRh            | Raj et al., 2008              |
|                | 334        | $\alpha$ -cadinol   | FRh            | Raj et al., 2008              |
|                | 337        | $\alpha$ -muurolene | FRh            | Raj et al., 2008              |
|                | 339        | $\alpha$ -muurolol  | FRh            | Raj et al., 2008              |
|                | 341        | $\gamma$ -muurolene | FRh            | Raj et al., 2008              |
|                | 344        | 1,10-di-epicubenol  | FRh            | Raj et al., 2008              |
|                | 356        | curzerene           | FRh, Lf        | Raj et al., 2008; Raj et al., |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>              |
|----------------|------------|---------------------|----------------|-------------------------------|
|                |            |                     |                | 2011                          |
| 363            |            | $\beta$ -elemenone  | Lf             | Raj et al., 2011              |
| 364            |            | $\beta$ -elemene    | FRh, Lf        | Raj et al., 2008; Raj et al., |
|                |            |                     |                | 2011                          |
| 366            |            | $\delta$ -elemene   | FRh            | Raj et al., 2008; Raj et al., |
|                |            |                     |                | 2011                          |
| 370            |            | $\alpha$ -selinene  | Lf             | Raj et al., 2011              |
| 409            |            | germacrene D        | FRh, Lf        | Raj et al., 2008; Raj et al., |
|                |            |                     |                | 2011                          |
| 423            |            | curdione            | FRh, Lf        | Raj et al., 2008; Raj et al., |
|                |            |                     |                | 2011                          |
| 427            |            | germacrone          | FRh, Lf        | Raj et al., 2008              |
| 429            |            | germacrene B        | FRh, Lf        | Raj et al., 2008; Raj et al., |
|                |            |                     |                | 2011                          |
| 430            |            | germacrene A        | FRh, Lf        | Raj et al., 2008              |
| 431            |            | (4S, 5S)-germacrone | FRh, Lf        | Raj et al., 2008; Raj et al., |
|                |            | 4,5-epoxide         |                | 2011                          |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b> | <b>Reference</b>                   |
|----------------|------------|----------------------------|----------------|------------------------------------|
|                | 434        | neocurdione                | FRh            | Raj et al., 2008                   |
|                | 448        | furanodiene                | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 450        | furanogermenone            | FRh            | Raj et al., 2008                   |
|                | 465        | curcumol                   | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 533        | guaiol                     | Lf             | Raj et al., 2011                   |
|                | 550        | <i>allo</i> -aromadendrene | FRh            | Raj et al., 2008                   |
|                | 551        | aromadendrene              | FR, Lf         | Raj et al., 2008; Raj et al., 2011 |
|                | 553        | $\beta$ -bourbonene        | Lf             | Raj et al., 2011                   |
|                | 554        | $\beta$ -caryophyllene     | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 555        | $\alpha$ -humulene         | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
|                | 556        | caryophyllene oxide        | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |

| <b>Species</b>      | <b>No.</b> | <b>Name</b>                  | <b>Section</b> | <b>Reference</b>                   |
|---------------------|------------|------------------------------|----------------|------------------------------------|
|                     | 561        | cubebol                      | FRH            | Raj et al., 2008                   |
|                     | 599        | humulene epoxide ii          | FRh, Lf        | Raj et al., 2008; Raj et al., 2011 |
| <i>C. harmandii</i> | 123        | linalool                     | Lf,            | Dung et al., 1997                  |
|                     |            |                              | stem,          |                                    |
|                     |            |                              | Rh,            |                                    |
|                     |            |                              | Rx, Fl         |                                    |
|                     | 124        | myrcene                      | Lf,            | Dung et al., 1997                  |
|                     |            |                              | stem,          |                                    |
|                     |            |                              | Rh,            |                                    |
|                     |            |                              | Rx             |                                    |
|                     | 126        | (E)- $\beta$ -ocimene        | Rh             | Dung et al., 1997                  |
|                     | 127        | (Z)- $\beta$ -ocimene        | Rh             | Dung et al., 1997                  |
|                     | 143        | <i>trans</i> -linalool oxide | Fl             | Dung et al., 1997                  |
|                     | 146        | <i>p</i> -cymene             | Lf,            | Dung et al., 1997                  |
|                     |            |                              | stem,          |                                    |
|                     |            |                              | Rh             |                                    |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|----------------------------|----------------|-------------------|
|                | 155        | $\gamma$ -terpinene        | Lf, stem       | Dung et al., 1997 |
|                | 156        | terpinolene                | Lf, stem       | Dung et al., 1997 |
|                | 159        | terpinen-4-ol              | Lf,            | Dung et al., 1997 |
|                |            |                            | stem,          |                   |
|                |            |                            | Rh,            |                   |
|                |            |                            | Rx             |                   |
|                | 168        | carvone                    | Lf and         | Dung et al., 1997 |
|                |            |                            | stem           |                   |
|                | 171        | $\alpha$ -terpineol        | Lf,            | Dung et al., 1997 |
|                |            |                            | stem,          |                   |
|                |            |                            | Rh,            |                   |
|                |            |                            | Rx             |                   |
|                | 172        | limonene                   | Lf,            | Dung et al., 1997 |
|                |            |                            | stem,          |                   |
|                |            |                            | Rh,            |                   |
|                |            |                            | Rx             |                   |
|                | 180        | <i>cis</i> -linalool oxide | Fl             | Dung et al., 1997 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>      | <b>Section</b>                | <b>Reference</b>  |
|----------------|------------|------------------|-------------------------------|-------------------|
|                | 182        | menthol          | Fl                            | Dung et al., 1997 |
|                | 190        | borneol          | Lf,<br>stem,<br>Rh,<br>Rx     | Dung et al., 1997 |
|                | 192        | isoborneol       | Lf,<br>stem,<br>Rh,<br>Rx     | Dung et al., 1997 |
|                | 194        | camphor          | Rh, Rx,<br>Fl,<br>Lf,<br>stem | Dung et al., 1997 |
|                | 195        | camphene hydrate | Rh, Rx,<br>Lf,<br>stem        | Dung et al., 1997 |
|                | 204        | $\beta$ -thujone | Lf, stem                      | Dung et al., 1997 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>      | <b>Section</b>                | <b>Reference</b>  |
|----------------|------------|------------------|-------------------------------|-------------------|
|                | 206        | sabinene         | Lf,<br>stem,<br>Rh,<br>Rx     | Dung et al., 1997 |
|                | 212        | camphene         | Lf,<br>stem,<br>Rh,<br>Rx     | Dung et al., 1997 |
|                | 214        | myrtenol         | Stem,<br>Rh                   | Dung et al., 1997 |
|                | 215        | 1,8-cineole      | Lf,<br>stem,<br>Rh,<br>Rx, Fl | Dung et al., 1997 |
|                | 220        | $\alpha$ -pinene | Lf,<br>stem,<br>Rh,           | Dung et al., 1997 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>             | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|-------------------------|----------------|-------------------|
|                |            |                         | Rx             |                   |
| 221            |            | $\beta$ -pinene         | Lf,            | Dung et al., 1997 |
|                |            |                         | stem,          |                   |
|                |            |                         | Rh,            |                   |
|                |            |                         | Rx             |                   |
| 222            |            | myrtenal                | Rh             | Dung et al., 1997 |
| 230            |            | (E)- $\beta$ -farnesene | Lf, stem       | Dung et al., 1997 |
| 242            |            | $\beta$ -bisabolene     | Lf, stem       | Dung et al., 1997 |
| 264            |            | $\alpha$ -curcumene     | Fl, Lf,        | Dung et al., 1997 |
|                |            |                         | stem,          |                   |
|                |            |                         | Rh,            |                   |
|                |            |                         | Rx             |                   |
| 281            |            | bisabolone              | Lf, stem       | Dung et al., 1997 |
| 320            |            | $\alpha$ -calacorene    | Leaf,ste       | Dung et al., 1997 |
|                |            |                         | m              |                   |
| 322            |            | cis-calamenene          | Lf,            | Dung et al., 1997 |
|                |            |                         | stem,          |                   |

| Species | No. | Name                | Section | Reference         |
|---------|-----|---------------------|---------|-------------------|
|         |     |                     | Rh      |                   |
|         | 328 | epicadinol          | Lf,     | Dung et al., 1997 |
|         |     |                     | stem,   |                   |
|         |     |                     | Rh,     |                   |
|         |     |                     | Rx, Fl  |                   |
|         | 330 | $\delta$ -cadinene  | Lf,     | Dung et al., 1997 |
|         |     |                     | stem,   |                   |
|         |     |                     | Rh,     |                   |
|         |     |                     | RX      |                   |
|         | 334 | $\alpha$ -cadinol   | Fl      | Dung et al., 1997 |
|         | 341 | $\gamma$ -muurolene | Lf,     | Dung et al., 1997 |
|         |     |                     | stem,   |                   |
|         |     |                     | Rh,     |                   |
|         |     |                     | Rx      |                   |
|         | 343 | epicubenol          | Fl      | Dung et al., 1997 |
|         | 363 | $\beta$ -elemenone  | Lf,     | Dung et al., 1997 |
|         |     |                     | stem,   |                   |

| Species | No. | Name              | Section  | Reference         |
|---------|-----|-------------------|----------|-------------------|
|         |     |                   | Rh,      |                   |
|         |     |                   | Rx,      |                   |
|         |     |                   | Fl,      |                   |
|         |     |                   | DRh      |                   |
| 364     |     | $\beta$ -elemene  | Lf,      | Dung et al., 1997 |
|         |     |                   | stem,    |                   |
|         |     |                   | Rh,      |                   |
|         |     |                   | Rx, Fl   |                   |
| 365     |     | $\gamma$ -elemene | Rh, Rx   | Dung et al., 1997 |
| 366     |     | $\delta$ -elemene | Lf,      | Dung et al., 1997 |
|         |     |                   | stem,    |                   |
|         |     |                   | Rh,      |                   |
|         |     |                   | Rx       |                   |
| 371     |     | $\beta$ -selinene | L, stem, | Dung et al., 1997 |
|         |     |                   | R, Rx    |                   |
| 409     |     | germacrene D      | Rh, Rx   | Dung et al., 1997 |
| 423     |     | curdione          | Lf,      | Dung et al., 1997 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---------------|----------------|-------------------|
|                |            |               | stem,          |                   |
|                |            |               | Rh,            |                   |
|                |            |               | Rx, Fl         |                   |
| 427            |            | germacrone    | Lf,            | Dung et al., 1997 |
|                |            |               | stem,          |                   |
|                |            |               | Rh,            |                   |
|                |            |               | Rx, Fl         |                   |
| 429            |            | germacrene b  | Lf,            | Dung et al., 1997 |
|                |            |               | stem,          |                   |
|                |            |               | Rh,            |                   |
|                |            |               | Rx             |                   |
| 465            |            | curcumol      | Lf,            | Dung et al., 1997 |
|                |            |               | stem,          |                   |
|                |            |               | Rh,            |                   |
|                |            |               | Rx, Fl         |                   |
| 466            |            | curcurnenol   | Rh, Rx         | Dung et al., 1997 |
| 469            |            | isocurcumenol | Rh, Rx         | Dung et al., 1997 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b>            | <b>Reference</b>  |
|----------------|------------|----------------------------|---------------------------|-------------------|
|                | 550        | <i>allo</i> -aromadendrene | Lf and<br>stem            | Dung et al., 1997 |
|                | 553        | $\beta$ -bourbonene        | Lf and<br>stem            | Dung et al., 1997 |
|                | 554        | $\beta$ -caryophyllene     | Lf,<br>stem,<br>Rh,<br>Rx | Dung et al., 1997 |
|                | 555        | $\alpha$ -humulene         | Lf,<br>stem,<br>Rh,<br>Rx | Dung et al., 1997 |
|                | 556        | caryophyllene oxide        | Lf,<br>stem,<br>Fl        | Dung et al., 1997 |
|                | 559        | $\alpha$ -cubebene         | Lf and<br>stem            | Dung et al., 1997 |

| <b>Species</b>     | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>                       |
|--------------------|------------|---------------------|----------------|--|
|                    | 561        | cubebol             | Fl             | Dung et al., 1997                      |
|                    | 563        | daucene             | Lf, Rh,        | Dung et al., 1997                      |
|                    |            |                     | Rx             |  |
|                    | 567        | widdrol             | Rh, Rx         | Dung et al., 1997                      |
|                    | 571        | oplopanone          | Fl             | Dung et al., 1997                      |
| <i>C. heyneana</i> | 1          | curcumin            | Rh             | Chen et al., 1983a; Jitoe et al., 1992 |
|                    | 2          | demethoxycurcumin   | Rh             | Jitoe et al., 1992                     |
|                    | 3          | bisdemethoxycurcum  | Rh             | Jitoe et al., 1992                     |
|                    |            | in                  |                |  |
|                    | 154        | $\beta$ -terpinene  | Rh             | Amini et al., 1996                     |
|                    | 155        | $\gamma$ -terpinene | Rh             | Amini et al., 1996                     |
|                    | 168        | carvone             | Rh             | Amini et al., 1996                     |
|                    | 215        | 1, 8-cineole        | Rh             | Zwaving and Bos, 1992                  |
|                    | 347        | curcumenone         | Rh             | Zwaving and Bos, 1992                  |
|                    | 366        | $\delta$ -elemene   | Rh             | Amini et al., 1996                     |
|                    | 369        | $\beta$ -eudesmol   | Rh             | Zwaving and Bos, 1992                  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---|----------------|---|
|                | 373        | cyperusol c   | DRh            | Saifudin et al., 2013   |
|                | 418        | heyneanones a   | DRh            | Saifudin et al., 2013   |
|                | 419        | heyneanones b   | DRh            | Saifudin et al., 2013   |
|                | 420        | heyneanones c   | DRh            | Saifudin et al., 2013   |
|                | 421        | heyneanones d   | DRh            | Saifudin et al., 2013   |
|                | 424        | dehydrocurdione   | Rh             | Firman et al., 1988   |
|                | 427        | germacrone  | Rh             | Firman et al., 1988   |
|                | 463        | aerugidiol  | DRh            | Saifudin et al., 2013   |
|                | 466        | curcumenol  | DRh            | Firman et al., 1988; Sukari<br>et al., 2010                           |
|                | 469        | isocurcumenol   | DRh            | Firman et al., 1988; Sukari<br>et al., 2010; Saifudin et<br>al., 2013 |
|                | 470        | oxycurcumenol   | Rh             | Firman et al., 1988   |
|                | 475        | procurcumenol   | DR             | Saifudin et al., 2013   |
|                | 482        | 7 $\alpha$ ,11 $\alpha$ -epoxy-5 $\beta$ -hydroxy-9-guaiaen-8 | DRh            | Sukari et al., 2010   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                             | <b>Section</b> | <b>Reference</b>           |
|----------------|------------|---|----------------|----------------------------|
|                |            | -one                                    |                |                            |
| 483            |            | (1 <i>S</i> , 4 <i>S</i> , 5 <i>S</i> , | DRh            | Cho et al., 2009; Saifudin |
|                |            | 10 <i>R</i> )-zedoarondiol              |                | et al., 2013               |
| 484            |            | isozedoarondiol                         | DRh            | Saifudin et al., 2013      |
| 485            |            | (1 <i>β</i> , 4 <i>β</i> , 5 <i>β</i> , | DRh            | Saifudin et al., 2013      |
|                |            | 10 <i>β</i> )-zedoarondiol              |                |                            |
| 488            |            | guaiazulene                             | Rx             | Amini et al., 1996         |
| 489            |            | 15-hydroxyprocurcu                      | DRh            | Saifudin et al., 2013      |
|                |            | menol                                   |                |                            |
| 492            |            | guaidiol A                              | DRh            | Saifudin et al., 2013      |
| 493            |            | epiguaidiol A                           | DRh            | Saifudin et al., 2013      |
| 495            |            | oxycurcumenol                           | DRh            | Sukari et al., 2010;       |
|                |            | epoxide                                 |                | Saifudin et al., 2013      |
| 500            |            | 12-hydroxycurcumen                      | DRh            | Saifudin et al., 2013      |
|                |            | ol                                      |                |                            |
| 557            |            | <i>α</i> -copaene                       | Rh             | Amini et al., 1996         |
| 585            |            | <i>Curcumanolide A</i>                  | DRh            | Firman et al., 1988        |

| <b>Species</b>    | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>                              |
|-------------------|------------|--|----------------|---|
|                   | 585        | <i>Curcumanolides A</i>                            | DRh            | Firman et al., 1988;<br>Saifudin et al., 2013 |
|                   | 586        | <i>Curcumanolides B</i>                            | DRh            | Saifudin et al., 2013                         |
|                   | 587        | <i>Curcumanolides C</i>                            | DRh            | Saifudin et al., 2013                         |
|                   | 588        | <i>Curcumanolides D</i>                            | DRh            | Saifudin et al., 2013                         |
|                   | 589        | gajutsulactone A                                   | DRh            | Saifudin et al., 2013                         |
|                   | 593        | caulolactone B                                     | DRh            | Saifudin et al., 2013                         |
|                   | 611        | (E)-15,16-bisnorlabd<br>a-8(17),11-dien-13<br>-one | DRh            | Saifudin et al., 2013                         |
|                   | 613        | zerumin A  | DRh            | Saifudin et al., 2013                         |
|                   | 614        | (E)-labda-8(17),12-di<br>ene-15,16-dial            | Rh             | Firman et al., 1988; Sirat<br>and Meng, 2009  |
|                   | 661        | stigmasterol                                       | DRh            | Sukari et al., 2010                           |
| <i>C. inodora</i> | 123        | linalool   | Lf             | Malek et al., 2006                            |
|                   | 124        | myrcene  | FRh, Lf        | Malek et al., 2006                            |
|                   | 134        | neral  | FRh            | Malek et al., 2006                            |

| <b>Species</b> | <b>No.</b> | <b>Name</b>           | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|-----------------------|----------------|--------------------|
|                | 136        | geranal               | FRh            | Malek et al., 2006 |
|                | 140        | myrcenol              | FRh            | Malek et al., 2006 |
|                | 146        | <i>m</i> -cymenene    | FRh            | Malek et al., 2006 |
|                | 146        | <i>p</i> -cymene      | FRh            | Malek et al., 2006 |
|                | 147        | <i>p</i> -cymene-8-ol | FRh            | Malek et al., 2006 |
|                | 155        | $\gamma$ -terpinene   | FRh            | Malek et al., 2006 |
|                | 156        | terpinolene           | FRh            | Malek et al., 2006 |
|                | 159        | terpinen-4-ol         | Lf             | Malek et al., 2006 |
|                | 168        | carvone               | FRh, Lf        | Malek et al., 2006 |
|                | 171        | $\alpha$ -terpineol   | FRh, Lf        | Malek et al., 2006 |
|                | 172        | limonene              | FRh            | Malek et al., 2006 |
|                | 174        | <i>cis</i> -carveol   | FRh            | Malek et al., 2006 |
|                | 175        | <i>trans</i> -carveol | FRh            | Malek et al., 2006 |
|                | 192        | isoborneol            | FRh, Lf        | Malek et al., 2006 |
|                | 194        | camphor               | FRh, Lf        | Malek et al., 2006 |
|                | 212        | camphene              | FRh            | Malek et al., 2006 |
|                | 215        | 1,8-cineole           | FRh, Lf        | Malek et al., 2006 |

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|----------------|------------|-----------------------------|----------------|--------------------|
|                | 220        | $\alpha$ -pinene            | FRh            | Malek et al., 2006 |
|                | 221        | $\beta$ -pinene             | FRh, Lf        | Malek et al., 2006 |
|                | 230        | (E)- $\beta$ -farnesene     | FRh,           | Malek et al., 2006 |
|                |            |                             | DRh            |                    |
|                | 236        | (E)-nerolidol               | FRh            | Malek et al., 2006 |
|                | 280        | $\beta$ -sesquiphellandrene | FRh            | Malek et al., 2006 |
|                | 337        | $\alpha$ -muurolene         | FRh, Lf        | Malek et al., 2006 |
|                | 356        | curzerene                   | FRh, Lf        | Malek et al., 2006 |
|                | 357        | curzerenone                 | FRh, Lf        | Malek et al., 2006 |
|                | 363        | $\beta$ -elemenone          | FRh, Lf        | Malek et al., 2006 |
|                | 364        | $\beta$ -elemene            | FRh, Lf        | Malek et al., 2006 |
|                | 365        | $\gamma$ -elemene           | FRh, Lf        | Malek et al., 2006 |
|                | 366        | $\delta$ -elemene           | FRh, Lf        | Malek et al., 2006 |
|                | 369        | $\beta$ -eudesmol           | DRh, Lf        | Malek et al., 2006 |
|                | 371        | $\beta$ -selinene           | FRh, Lf        | Malek et al., 2006 |
|                | 409        | germacrene D                | FRh, Lf        | Malek et al., 2006 |
|                | 423        | curdione                    | FRh            | Malek et al., 2006 |

| <b>Species</b>         | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>   |
|------------------------|------------|--|----------------|--------------------|
|                        | 427        | germacrone   | FRh, Lf        | Malek et al., 2006 |
|                        | 491        | $\alpha$ -guaiene                                    | Lf             | Malek et al., 2006 |
|                        | 528        | zedoarol   | DRh            | Malek et al., 2006 |
|                        | 536        | spathulenol  | FRh            | Malek et al., 2006 |
|                        | 550        | <i>allo</i> -aromadendrene                           | FRh, lf        | Malek et al., 2006 |
|                        | 552        | $\beta$ -gurjunene                                   | Lf, FRh        | Malek et al., 2006 |
|                        | 554        | $\beta$ -caryophyllene                               | FRh, Lf        | Malek et al., 2006 |
|                        | 555        | $\alpha$ -humulene                                   | FRh, Lf        | Malek et al., 2006 |
|                        | 556        | caryophyllene oxide                                  | FRh            | Malek et al., 2006 |
|                        | 559        | $\alpha$ -cubebene                                   | Lf             | Malek et al., 2006 |
|                        | 570        | $\beta$ -longipinene                                 | FR, Lf         | Malek et al., 2006 |
|                        | 575        | $\beta$ -patchoulene                                 | FRh, lf        | Malek et al., 2006 |
|                        | 604        | viridiflorol   | FRh            | Malek et al., 2006 |
| <i>C. kwangsiensis</i> | 17         | (E)-7-(4-hydroxyphe<br>nyl)-1-heptene-5-o<br>ne      | DRh            | Li et al., 2010a   |
|                        | 20         | (E)-1,7-bis(4-hydrox<br>yphenyl)-1-heptene-5-o<br>ne | DRh            | Li et al., 2010a   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b> | <b>Reference</b> |
|----------------|------------|----------------------------|----------------|------------------|
|                |            | yphenyl)-1-hepten          |                |                  |
|                |            | -5-one                     |                |                  |
| 22             |            | ( <i>1E, 5S</i> )-7-(3,    | DRh            | Li et al., 2010a |
|                |            | 4-dihydroxyphenyl          |                |                  |
|                |            | )-1-(4-hydroxyphe          |                |                  |
|                |            | nyl)-1-hepten-5-ol         |                |                  |
| 23             |            | ( <i>1E</i> ,              | DRh            | Li et al., 2010a |
|                |            | <i>5R</i> )-7-(3,4-dihydro |                |                  |
|                |            | xyphenyl)-1-(4-hy          |                |                  |
|                |            | droxyphenyl)-1-he          |                |                  |
|                |            | pten-5-ol                  |                |                  |
| 24             |            | ( <i>1E</i> ,              | DRh            | Li et al., 2010a |
|                |            | <i>5S</i> )-5-acetoxy-7-(3 |                |                  |
|                |            | ,4-dihydroxypheny          |                |                  |
|                |            | l)-1-(4-hydroxyp           |                |                  |
|                |            | enyl)-1-heptene            |                |                  |
| 25             |            | ( <i>1E</i> ,              | DRh            | Li et al., 2010a |

| <b>Species</b> | <b>No.</b>    | <b>Name</b>  | <b>Section</b> | <b>Reference</b> |
|----------------|---------------|--|----------------|------------------|
|                |               | 5 <i>R</i> )-5-acetoxy-7-(<br>3,4-dihydroxyphen<br>yl)-1-(4-hydroxyp<br>henyl)-1-heptene |                |                  |
| 26             | (1 <i>E</i> , |  | DRh            | Li et al., 2010a |
|                |               | 5 <i>S</i> )-1,7-bis(4-hydr<br>oxyphenyl)-1-hept<br>en-5-ol                              |                |                  |
| 27             | (1 <i>E</i> , |  | DRh            | Li et al., 2010a |
|                |               | 5 <i>S</i> )-1,7-bis(4-hydr<br>oxyphenyl)-1-hept<br>en-5-ol                              |                |                  |
| 28             | (1 <i>E</i> , |  | DRh            | Li et al., 2010a |
|                |               | 5 <i>S</i> )-7-(3,4-dihydro<br>xyphenyl)-1-pheny<br>l-1-hepten-5-ol                      |                |                  |
| 29             | (1 <i>E</i> , |  | DRh            | Li et al., 2010a |

| <b>Species</b> | <b>No.</b>  | <b>Name</b>  | <b>Section</b>   | <b>Reference</b> |
|----------------|---|--|------------------|------------------|
|                |   | 5 <i>R</i> )-7-(3,4-dihydroxyphenyl)-1-phenylhepten-3-ol |                  |                  |
| 39             | (3 <i>S</i> )-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptan-3-ol        | DRh  | Li et al., 2010a |                  |
| 40             | (3 <i>R</i> )-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptan-3-ol        | DRh  | Li et al., 2010a |                  |
| 41             | (3 <i>S</i> )-3-acetoxy-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptanes | DRh  | Li et al., 2010a |                  |
| 42             | (3 <i>R</i> )-3-acetoxy-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)heptanes | DRh  | Li et al., 2010a |                  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b> |
|----------------|------------|---|----------------|------------------|
|                |            | ) <i>-7</i> -(4-hydroxyphe<br>nyl)heptanes  |                |                  |
| 46             |            | <i>rel</i> -(3 <i>R</i> ,<br>5 <i>S</i> )-3,5-dihydroxy<br>-1-(3,4-dihydroxy<br>phenyl)-7-(4-hydr<br>oxyphenyl)<br>heptane.       | DRh            | Li et al., 2011b |
| 47             |            | <i>rel</i> -(3 <i>R</i> ,<br>5 <i>S</i> )-3,5-dihydroxy<br>-1-(4-hydroxy-3-m<br>ethoxyphenyl)-7-(<br>4-hydroxyphenyl)-<br>heptane | DRh            | Li et al., 2011b |
| 48             |            | <i>rel</i> -(3 <i>R</i> ,<br>5 <i>S</i> )-3,5-dihydroxy<br>-1-(3-methoxy-4,5  | DRh            | Li et al., 2011b |

| <b>Species</b> | <b>No.</b>    | <b>Name</b>  | <b>Section</b>   | <b>Reference</b> |
|----------------|---------------|--|------------------|------------------|
|                |               | -dihydroxyphenyl)  |                  |                  |
|                |               | -7-(4-hydroxyphenyl)heptane  |                  |                  |
| 51             | (3 <i>R</i> , | DRh  | Li et al., 2011b |                  |
|                |               | 5 <i>S</i> )-3,5-dihydroxy   |                  |                  |
|                |               | -1,7-bis(4-hydroxyphenyl)-heptane  |                  |                  |
| 52             | (3 <i>R</i> , | DRh  | Li et al., 2011b |                  |
|                |               | 5 <i>R</i> )-3,5-dihydroxy   |                  |                  |
|                |               | -1,7-bis(4-hydroxyphenyl)heptane   |                  |                  |
| 54             | (3 <i>S</i> , | DRh  | Li et al., 2011b |                  |
|                |               | 5 <i>S</i> )-3-acetoxy-5-hydroxy-1-(3,4-dihydroxyphenyl)-7-(4-hydroxyphenyl)-heptane |                  |                  |

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|----------------|------------|--|----------------|------------------|
|                | 55         | ( <i>3R</i> ,<br>5 <i>R</i> )-3,5-dihydroxy<br>-1-(3,4-dihydroxy<br>phenyl)-7-(4-hyd<br>oxyphenyl)heptane            | DRh            | Li et al., 2011b |
|                | 56         | ( <i>3R</i> ,<br>5 <i>R</i> )-3-acetoxy-5-h<br>ydroxy-1-(3,4-dih<br>ydroxyphenyl)-7-(<br>4-hydroxyphenyl)<br>heptane | DRh            | Li et al., 2011b |
|                | 58         | ( <i>3R</i> ,<br>5 <i>R</i> )-3-acetoxy-5-h<br>ydroxy-1,7-bis(3,4<br>-dihydroxyphenyl)<br>heptane                    | DRh            | Li et al., 2011b |
|                | 59         | ( <i>3R</i> ,  | DRh            | Li et al., 2011b |

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|----------------|---------------|---|------------------|------------------|
|                |               | 5 <i>R</i> )-3,5-diacetoxy-<br>1-(3,4-dihydroxyp<br>henyl)-7-(4-hydro<br>xyphenyl)heptane |                  |                  |
| 60             | (3 <i>R</i> , | DRh   | Li et al., 2011b |                  |
|                |               | 5 <i>R</i> )-3-acetoxy-5-h<br>ydroxy-1,7-bis(4-h<br>ydroxyphenyl)hept<br>ane              |                  |                  |
| 61             | (3 <i>R</i> , | DRh   | Li et al., 2011b |                  |
|                |               | 5 <i>R</i> )-3,5-diacetoxy-<br>1,7-bis(3,4-dihydr<br>oxyphenyl)-heptan<br>e               |                  |                  |
| 62             | (3 <i>R</i> , | DRh   | Li et al., 2011b |                  |
|                |               | 5 <i>R</i> )-3,5-dihydroxy<br>-1-(4-hydroxy-3-m   |                  |                  |

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|----------------|------------|---|----------------|------------------|
|                |            | ethoxyphenyl)-7-(<br>3,4-dihydroxyphen<br>yl)-heptane |                |                  |
| 63             |            | 1,7-bis(4-hydroxyph                                   | DRh            | Li et al., 2010a |
|                |            | enyl)-3-heptanone                                     |                |                  |
| 64             |            | 1-(4-hydroxy-3-meth                                   | DRh            | Li et al., 2010a |
|                |            | oxyphenyl)-7-(4-h                                     |                |                  |
|                |            | ydroxyphenyl)-3-h                                     |                |                  |
|                |            | eptanone  |                |                  |
| 67             |            | (5 <i>S</i> )-5-hydroxy-1-(4-                         | DRh            | Li et al., 2011b |
|                |            | hydroxyphenyl)-7-                                     |                |                  |
|                |            | phenyl-3-heptanon                                     |                |                  |
|                |            | e   |                |                  |
| 68             |            | 5-hydroxy-1-(4-hydr                                   | DRh            | Li et al., 2011b |
|                |            | oxyphenyl)-7-(3,4-                                    |                |                  |
|                |            | dihydroxyphenyl)-                                     |                |                  |
|                |            | 3-heptanone   |                |                  |

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|                | 69         | 5-hydroxy-1-(4-hydronoxy-3-methoxyphenyl)-7-(4-hydroxyphenyl)-3-heptanone        | DRh            | Li et al., 2011b |
|                | 70         | (5S)-5-hydroxy-1,7-bis(4-hydroxyphenyl)heptan-3-one                              | DRh            | Li et al., 2011b |
|                | 71         | (5S)-5-hydroxy-1-(4-hydroxy-3-methoxyphenyl)-7-(3,4-dihydroxyphenyl)heptan-3-one | DRh            | Li et al., 2011b |
|                | 75         | 1,7-bis(4-hydroxyphenyl)hepta-1e,3e-dien-5-one                                   | DRh            | Li et al., 2010a |
|                | 91         | 1-(4-hydroxy-3-methoxyphenyl)-7-(4-hydroxyphenyl)heptan-3-one                    | DRh            | Li et al., 2010a |

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|----------------|------------|--|----------------|--------------------------------------|
|                |            | oxyphenyl)-7-(4-hydroxyphenyl)-(4E)-4-hepten-3-one |                |                                      |
| 172            |            | limonene   | UGp            | Zeng et al., 2009                    |
| 190            |            | borneol  | Ugp            | Zeng et al., 2009                    |
| 192            |            | isoborneol   | Ugp            | Zeng et al., 2009                    |
| 194            |            | camphor  | Ugp            | Zeng et al., 2009                    |
| 212            |            | camphene   | Ugp            | Zeng et al., 2009                    |
| 215            |            | 1, 8-cineole                                       | Ugp            | Zeng et al., 2009                    |
| 220            |            | $\alpha$ -pinene                                   | Rh, Rx         | Zeng et al., 2009                    |
| 356            |            | curzerene  | DRh            | Yang et al., 2005; Zeng et al., 2009 |
| 357            |            | curzerenone  | Ugp            | Zeng et al., 2009                    |
| 363            |            | $\beta$ -elemenone                                 | Ugp            | Zeng et al., 2009                    |
| 364            |            | $\beta$ -elemene                                   | Ugp            | Zeng et al., 2009                    |
| 365            |            | $\gamma$ -elemene                                  | DRh            | Yang et al., 2005                    |
| 366            |            | $\delta$ -elemene                                  | Ugp            | Zeng et al., 2009                    |

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|                | 409        | germacrene D  | DRh            | Yang et al., 2005  |
|                | 423        | curdione  | DRh            | Yang et al., 2005; Zeng et al., 2009                     |
|                | 427        | germacrone  | DRh            | Chen et al., 1983c; Yang et al., 2005; Zeng et al., 2009 |
|                | 434        | neocurdione   | DRh            | Yang et al., 2005  |
|                | 448        | furanodiene   | DRh            | Yang et al., 2005  |
|                | 449        | furanodienone   | DRh            | Yang et al., 2005  |
|                | 454        | zederone  | DRh            | Zhu et al., 2009   |
|                | 465        | curcumol  | DRh            | Yang et al., 2005; Zeng et al., 2009                     |
|                | 466        | curcumenol  | DRh            | Yang et al., 2005  |
|                | 469        | isocurcumenol   | DRh            | Chen et al., 1983c; Yang et al., 2005                    |
|                | 522        | (1 <i>R</i> , 4 <i>R</i> , 5 <i>S</i> , 8 <i>S</i> , 9 <i>Z</i> )-4-hydroxy-1,8 | DRh            | Phan et al., 2014  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>             | <b>Section</b> | <b>Reference</b>                      |
|----------------|------------|-------------------------|----------------|---------------------------------------|
|                |            | -epoxy-5h-guaia-7       |                |                                       |
|                |            | (11),9-dien-12,8-ol     |                |                                       |
|                |            | ide                     |                |                                       |
| 525            |            | 2-oxoguaia-1(10),3,5    | DRh            | Phan et al., 2014                     |
|                |            | ,7(11),8-pentaen-1      |                |                                       |
|                |            | 2,8-oxide               |                |                                       |
| 526            |            | gweicurculactone        | DRh            | Jiang et al., 1989; Phan et al., 2014 |
| 531            |            | linderazulene           | DRh            | Chen et al., 1983c                    |
| 554            |            | $\beta$ -caryophyllene  | Ugp            | Zeng et al., 2009                     |
| 555            |            | $\alpha$ -caryophyllene | Ugp            | Zeng et al., 2009                     |
| 608            |            | calcaratarin B          | DRh            | Schramm et al., 2013                  |
| 609            |            | 5S, 9S,                 | DRh            | Schramm et al., 2013                  |
|                |            | 10S-(+)-(E)-labda-      |                |                                       |
|                |            | 8(17),12-diene-15,      |                |                                       |
|                |            | 16-dioic acid           |                |                                       |
| 610            |            | (E)-labda-8(17),12,1    | DRh            | Schramm et al., 2013                  |

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|----------------|------------|--|----------------|----------------------|
|                |            | 4-trien-16-oic acid                                  |                |                      |
| 613            |            | zerumin A  | DRh            | Schramm et al., 2013 |
| 621            |            | 5S, 9S, 10S,<br>15R-(-)-curcumino                    | DRh            | Schramm et al., 2013 |
|                |            | 1 D  |                |                      |
| 622            |            | 5S, 9S, 10S, 15R<br>-(-)-curcuminol H                | DRh            | Schramm et al., 2013 |
| 632            |            | coronarin D  | DRh            | Schramm et al., 2013 |
| 639            |            | (E)-16-hydroxylabda<br>-8(17),11,13-trien-           | DRh            | Schramm et al., 2013 |
|                |            | 15,16-oxide  |                |                      |
| 640            |            | (E)-15-hydroxylabda<br>-8(17),11,13-trien-           | DRh            | Schramm et al., 2013 |
|                |            | 16,15-oxide  |                |                      |
| 641            |            | 5S, 9S,<br>10S-(-)-(E)-labda-<br>8(17),11,13-trien-1 | DRh            | Schramm et al., 2013 |

| <b>Species</b>        | <b>No.</b> | <b>Name</b>                  | <b>Section</b> | <b>Reference</b>                      |
|-----------------------|------------|------------------------------|----------------|---------------------------------------|
|                       |            | 6,15-olide                   |                |                                       |
|                       | 642        | (E)-labda-7,11,13-tri        | DRh            | Schramm et al., 2013                  |
|                       |            | en-16,15-olide               |                |                                       |
|                       | 662        | $\beta$ -sitosterol          | DRh            | Jiang et al., 1989; Phan et al., 2014 |
|                       | 710        | palmitic acid                | DR             | Jiang et al., 1989                    |
| <i>C. leucorrhiza</i> | 123        | linalool                     | DRh, Lf        | Devi et al., 2012                     |
|                       | 124        | myrcene                      | DRh, Lf        | Devi et al., 2012                     |
|                       | 128        | (E)- $\beta$ -ocimene        | DRh, Lf        | Devi et al., 2012                     |
|                       | 143        | <i>trans</i> -linalool oxide | DRh, Lf        | Devi et al., 2012                     |
|                       | 146        | <i>p</i> -cymene             | DRh, Lf        | Devi et al., 2012                     |
|                       | 155        | $\gamma$ -terpinene          | DRh,           | Devi et al., 2012                     |
|                       |            | leaf                         |                |                                       |
|                       | 159        | terpinen-4-ol                | DRh, Lf        | Devi et al., 2012                     |
|                       | 171        | $\alpha$ -terpineol          | DRh, Lf        | Devi et al., 2012                     |
|                       | 172        | limonene                     | DRh, Lf        | Devi et al., 2012                     |
|                       | 180        | <i>cis</i> -linalool oxide   | DRh, Lf        | Devi et al., 2012                     |

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|----------------|------------|-----------------------------------|----------------|-------------------|
|                | 190        | borneol                           | DRh, Lf        | Devi et al., 2012 |
|                | 191        | bornyl acetate                    | DRh            | Devi et al., 2012 |
|                | 192        | isoborneol                        | DRh, Lf        | Devi et al., 2012 |
|                | 194        | camphor                           | DRh, Lf        | Devi et al., 2012 |
|                | 195        | camphene hydrate                  | DRh, Lf        | Devi et al., 2012 |
|                | 205        | $\alpha$ -thujene                 | DRh, Lf        | Devi et al., 2012 |
|                | 206        | sabinene                          | DRh, Lf        | Devi et al., 2012 |
|                | 209        | <i>cis</i> -sabinene hydrate      | Lf             | Devi et al., 2012 |
|                | 210        | <i>trans</i> -sabinene<br>hydrate | Lf             | Devi et al., 2012 |
|                | 212        | camphene                          | DRh, Lf        | Devi et al., 2012 |
|                | 215        | 1,8-cineole                       | DRh, Lf        | Devi et al., 2012 |
|                | 220        | $\alpha$ -pinene                  | DRh, Lf        | Devi et al., 2012 |
|                | 221        | $\beta$ -pinene                   | DRh, Lf        | Devi et al., 2012 |
|                | 356        | curzerene                         | DRh, Lf        | Devi et al., 2012 |
|                | 363        | $\beta$ -elemenone                | DRh, Lf        | Devi et al., 2012 |
|                | 364        | $\beta$ -elemene                  | DRh, Lf        | Devi et al., 2012 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>              | <b>Section</b> | <b>Reference</b>                               |
|----------------|------------|--------------------------|----------------|--|
|                | 365        | $\gamma$ -elemene        | DRh, Lf        | Devi et al., 2012                              |
|                | 366        | $\delta$ -elemene        | DRh            | Devi et al., 2012                              |
|                | 369        | $\beta$ -eudesmol        | DRh            | Devi et al., 2012                              |
|                | 371        | $\beta$ -selinene        | DRh, Lf        | Devi et al., 2012                              |
|                | 384        | $\alpha$ -eudesmol       | DRh, Lf        | Devi et al., 2012                              |
|                | 408        | curcuzederone            | DRh            | Asem and Laitonjam,<br>2014                    |
|                | 409        | germacrene D             | DRh, Lf        | Devi et al., 2012                              |
|                | 423        | curdione                 | DRh, Lf        | Devi et al., 2012                              |
|                | 424        | dehydrocurdione          | DRh            | Asem and Laitonjam,<br>2014                    |
|                | 427        | germacrone               | DRh, Lf        | Devi et al., 2012; Asem<br>and Laitonjam, 2014 |
|                | 429        | germacrene b             | Dr, leaf       | Devi et al., 2012                              |
|                | 430        | germacrene a             | DRh, Lf        | Devi et al., 2012                              |
|                | 433        | 13-hydroxygermacro<br>ne | DRh            | Asem and Laitonjam,<br>2014                    |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>            |
|----------------|------------|---|----------------|-----------------------------|
|                | 434        | neocurdione   | DRh, Lf        | Devi et al., 2012           |
|                | 448        | furanodiene   | DRh            | Asem and Laitonjam,<br>2014 |
|                | 449        | furanodienone   | DRh            | Asem and Laitonjam,<br>2014 |
|                | 451        | glechomanolide  | DRh            | Asem and Laitonjam,<br>2014 |
|                | 454        | zederone  | DRh            | Asem and Laitonjam,<br>2014 |
|                | 465        | curcumol  | DRh, Lf        | Devi et al., 2012           |
|                | 466        | curcumenol  | DRh            | Asem and Laitonjam,<br>2014 |
|                | 483        | (1 <i>S</i> ,4 <i>S</i> ,5 <i>S</i> ,10 <i>R</i> )-zedo<br>arondiol | DRh            | Asem and Laitonjam,<br>2014 |
|                | 530        | guai-1(10),5,7(11),8-<br>tetradien-12,8-olid                        | DRh            | Asem and Laitonjam,<br>2014 |
|                |            | e   |                |                             |

| <b>Species</b>  | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>  |
|-----------------|------------|--|----------------|---|
|                 | 554        | $\beta$ -caryophyllene   | DRh, Lf        | Devi et al., 2012   |
|                 | 556        | caryophyllene oxide  | DRh, Lf        | Devi et al., 2012   |
|                 | 594        | kessane  | DRh, Lf        | Devi et al., 2012   |
|                 | 599        | humulene epoxide ii  | DRh, Lf        | Devi et al., 2012   |
| <i>C. longa</i> | 1          | curcumin   | Rh, Rx         | Sastry, 1970; Kiuchi et al.,<br>1993; Park and Kim,<br>2002     |
|                 | 2          | demethoxycurcumin  | Rx,<br>DRh     | Kiuchi et al., 1993; Park<br>and Kim, 2002; Dao et<br>al., 2012 |
|                 | 3          | bisdemethoxycurcum<br>in   | Rx, Rh         | Chen et al., 1983a; Kiuchi<br>et al., 1993; Dao et al.,<br>2012 |
|                 | 4          | (1 <i>E</i> ,<br>6 <i>E</i> )-1-(4-hydroxy-<br>3-methoxyphenyl)<br>-7-(3,4-dihydroxy | DRh            | Nakayama et al., 1993;<br>Dao et al., 2012                      |

| Species | No. | Name  | Section | Reference   |
|---------|-----|---|---------|---|
|         |     | phenyl)<br>-1,6-heptadiene-3,<br>5-dione  |         |   |
| 6       |     | 4'-hydroxybisdemeth<br>oxycurcumin  | FRh     | Awasthi and Dixit, 2009;<br>Li et al., 2009b; Dao et<br>al., 2012 |
| 7       |     | <i>Curcumalongin C</i>  | DRh     | Dao et al., 2012  |
| 8       |     | 1,7-bis(3,4-dihydrox<br>yphenyl)-1,6-hepta<br>diene-3,5-dione                     | DRh     | Dao et al., 2012  |
| 30      |     | 1-(4-hydroxy-3-meth<br>oxyphenyl)-7-(4-h<br>ydroxyphenyl)-1-h<br>epten-3, 5-dione | FRh     | Jiang et al., 2006; Kita et<br>al., 2009                          |
| 31      |     | ( <i>E</i> )-1-(4-hydroxy-3-<br>methoxyphenyl)-7<br>-hydroxy-7-(4-hyd             | FRh     | Jiang et al., 2006  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>          | <b>Section</b> | <b>Reference</b>            |
|----------------|------------|----------------------|----------------|-----------------------------|
|                |            | roxyphenyl)-1-hep    |                |                             |
|                |            | ten-3,5-dione*       |                |                             |
| 32             |            | (E)-1-(4-hydroxy-3-  | FRh            | Jiang et al., 2006          |
|                |            | methoxyphenyl)-7     |                |                             |
|                |            | -(3,4-dihydroxyph    |                |                             |
|                |            | enyl)-1-hepten-3,5   |                |                             |
|                |            | -dione*              |                |                             |
| 33             |            | (E)-5-hydroxy-1,7-bi | DRh            | Li et al., 2009b            |
|                |            | s-(4-hydroxypheny    |                |                             |
|                |            | l)-1-heptene-3,7-di  |                |                             |
|                |            | one?                 |                |                             |
| 34             |            | (E)-1-(4-hydroxyphe  | FRh            | Jiang et al., 2006; Kita et |
|                |            | nyl)-7-(4-hydroxy-   |                | al., 2009                   |
|                |            | 3-methoxyphenyl)     |                |                             |
|                |            | -1-hepten-3,         |                |                             |
|                |            | 5-dione              |                |                             |
| 35             |            | 5-hydroxy-1,7-bis(3, | FRh            | Jiang et al., 2006          |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|--|----------------|--|
|                |            | 4-dihydroxyphenyl<br>)-1-hepten-3-one  |                |  |
| 36             |            | ( <i>E</i> )-7-hydroxy-1,7-bi<br>s-(4-hydroxy-3-me<br>thoxyphenyl)-1-he          | Rh             | Park and Kim, 2002; Jiang<br>et al., 2006; Li et al.,<br>2009b |
|                |            | ptene-3,5-dione  |                |  |
| 37             |            | ( <i>E</i> )-1,7-bis-(4-hydro<br>xy-3-methoxyphen<br>yl)-1-heptene-3,5-<br>dione | Rh             | Park and Kim, 2002   |
|                |            |  |                |  |
| 38             |            | ( <i>E</i> )-1,7-bis-(4-hydro<br>xyphenyl)-1-hepte<br>n-3,5-dione                | Rh             | Park and Kim, 2002   |
|                |            |  |                |  |
| 43             |            | 1,7-bis(4-hydroxyph<br>enyl)-3,5-heptane<br>diol*                                | FRh            | Jiang et al., 2006   |
|                |            |  |                |  |
| 65             |            | tetrahydrobisdemeth  | FRh            | Jiang et al., 2006   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|--|----------------|--------------------|
|                |            | oxycurcumin  |                |                    |
| 70             |            | (5 <i>S</i> )-5-hydroxy-1,7-b<br>is(4-hydroxypheny<br>l)heptan-3-one                                 | FRh            | Jiang et al., 2006 |
| 76             |            | 1-(4-hydroxy-3,5-di<br>methoxyphenyl)-7<br>-(4-hydroxy-3-met<br>hoxyphenyl)-1,3-h<br>eptadien-5-one* | FRh            | Jiang et al., 2006 |
| 77             |            | 1,7-bis(4-hydroxy-3-<br>methoxyphenyl)-1<br>e,3e-heptadien-5-o<br>ne*                                | FRh            | Jiang et al., 2006 |
| 78             |            | 1-(4-hydroxy-3-meth<br>oxyphenyl)-7-(4-h<br>ydroxyphenyl)-1,3<br>-heptadien-5-one                    | FRh            | Jiang et al., 2006 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>                   |
|----------------|------------|--|----------------|------------------------------------|
|                | 79         | 3-hydroxy-1,7-bis(4-hydroxyphenyl)-1,3-heptadiene-5-one                              | DRh            | Li et al., 2009b; Dao et al., 2012 |
|                | 80         | 1,7-bis(4-hydroxyphenyl)-3,7-dihydroxy-1,3-heptadiene-3-one                          | DRh            | Li et al., 2009b; Dao et al., 2012 |
|                | 81         | 3,7-dihydroxy-7-(4-hydroxy-3-methoxyphenyl)-1-(4-hydroxyphenyl)-1,3-heptadiene-5-one | DRh            | Li et al., 2009b                   |
|                | 82         | 3,5-dihydroxy-7-(4-hydroxyphenyl)-1-(4-hydroxy-3-methoxyphenyl)-1,3-heptadiene-5-one | DRh            | Li et al., 2009b                   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>            | <b>Section</b> | <b>Reference</b>         |
|----------------|------------|------------------------|----------------|--------------------------|
|                |            | oxyphenyl)-1,3-he      |                |                          |
|                |            | ptadiene-5-one         |                |                          |
| 84             |            | 3,5-dihydroxy-1,7-bi   | Rx, Rh         | Ravindranath and         |
|                |            | s                      |                | Satyanarayana, 1980;     |
|                |            | (4-hydroxy-3-meth      |                | Jiang et al., 2006; Wang |
|                |            | oxyphenyl)-1,3-he      |                | et al., 2008d            |
|                |            | ptadien-5-one          |                |                          |
| 85             |            | (1e,4e,6e)-1,7-bis-(4- | DRh,           | Nakayama et al., 1993;   |
|                |            | hydroxyphenyl)-1,      | Rx             | Park and Kim, 2002;      |
|                |            | 4,6-heptatrien-3-o     |                | Wang et al., 2008d; Li   |
|                |            | ne                     |                | et al., 2009b; Xiao et   |
|                |            |                        |                | al., 2012                |
| 86             |            | 1-(4-hydroxyphenyl)    | FRh            | Jiang et al., 2006       |
|                |            | -7-(4-hydroxy-3-m      |                |                          |
|                |            | ethoxyphenyl)-1,4,     |                |                          |
|                |            | 6-heptatrien-3-one     |                |                          |
|                |            | *                      |                |                          |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|---|----------------|--|
|                | 87         | (1e,4e,6e)-1,7-bis-(4-hydroxy-3-methoxyphenyl)-1,4,6-heptatrien-3-one | Rh             | Park and Kim, 2002; Jiang et al., 2006                     |
|                | 92         | 1,5-epoxy-3-carbonyl-1,7-bis(4-hydroxyphenyl)-4,6-hepta diene         | Rx             | Wang et al., 2008d   |
|                | 94         | cyclocurcumin   | DRh            | Kiuchi et al., 1993  |
|                | 95         | <i>Curcumalongin A</i>  | DRh            | Dao et al., 2012   |
|                | 96         | <i>Curcumalongin B</i>  | DRh            | Dao et al., 2012   |
|                | 97         | (1 <i>E</i> ,4 <i>E</i> )-1,5-bis-(4-hydroxy-1,4-penta dien-3-one)    | Rx             | Wang et al., 2008d; Dao et al., 2012                       |
|                | 98         | (1 <i>E</i> ,4 <i>E</i> )-1,5-bis-(4-hydroxy-1,4-penta dien-3-one)    | Rh, FRh        | Masuda et al., 1993; Park and Kim, 2002; Xiao et al., 2006 |

| <b>Species</b> | <b>No.</b>              | <b>Name</b>                | <b>Section</b> | <b>Reference</b>          |
|----------------|-------------------------|----------------------------|----------------|---------------------------|
|                |                         | ydroxy-3-methoxy           |                | al., 2011                 |
|                |                         | phenyl)-1,4-pentad         |                |                           |
|                |                         | ien-3-one                  |                |                           |
| 99             | (1 <i>E</i> ,           |                            | Rx, FRh        | Masuda et al., 1993; Wang |
|                |                         | 4 <i>E</i> )-1-(4-hydroxy- |                | et al., 2008d; Li et al., |
|                |                         | 3-methoxyphenyl)           |                | 2009b; Xiao et al., 2011  |
|                |                         | -5-(4-hydroxyphen          |                |                           |
|                |                         | yl)-1,4-pentadien-         |                |                           |
|                |                         | 3-one                      |                |                           |
| 103            | caffeic acid            |                            | DRh            | Roth et al., 1998         |
| 104            | cinnamic acid           |                            | DRh            | Roth et al., 1998         |
| 105            | <i>p</i> -coumaric acid |                            | DRh            | Roth et al., 1998         |
| 109            | et ferulate             |                            | Rx             | Yi et al., 2003           |
| 110            | ferulic acid            |                            | Rx             | Yi et al., 2003           |
| 113            | elemicin                |                            | FRh, Lf        | Sharma et al., 1997       |
| 116            | calebin A               |                            | Rh             | Park and Kim, 2002        |
| 117            | 4"--(4"-hydroxypheny    | DR                         |                | Zeng et al., 2007b        |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|---|----------------|---------------------------|
|                |            | l-3'''-methoxy)-2"-<br>oxo-3"-butenyl-3-(<br>4'-hydroxyphenyl)<br>-propenoate |                |                           |
| 118            |            | 4"--(4"-hydroxypheny  | DRh            | Zeng et al., 2007b        |
|                |            | l)-2"-oxo-3"-buten  |                |                           |
| 123            |            | yl-3-(4'-hydroxyph  |                |                           |
|                |            | enyl-3'-methoxy)-<br>propenoate   |                |                           |
| 123            |            | linalool  | Ugp            | Chen et al., 1983b        |
| 123            |            | linalool  | Lf, FRh,       | Dung et al., 1995;        |
|                |            |   | Fl             | Chane-Ming et al., 2002   |
| 124            |            | myrcene   | Lf, FRh,       | Dung et al., 1995; Sharma |
|                |            |   | Fl             | et al., 1997; Jantan et   |
|                |            |   |                | al., 1999; Chane-Ming     |
|                |            |   |                | et al., 2002; Behura and  |
|                |            |   |                | Srivastava, 2004; Pande   |

| <b>Species</b> | <b>No.</b>                   | <b>Name</b> | <b>Section</b>  | <b>Reference</b>  |
|----------------|------------------------------|-------------|-----------------|---|
|                |                              |             |                 | and Chanotiya, 2006                                     |
| 126            | (E)- $\beta$ -ocimene        |             | Lf, Fl          | Chane-Ming et al., 2002;                                |
|                |                              |             |                 | Behura and Srivastava,<br>2004; Pande and               |
|                |                              |             |                 | Chanotiya, 2006   |
| 138            | geranyl acetate              |             | Fl              | Chane-Ming et al., 2002                                 |
| 141            | linalyl 2-methyl<br>butyrate |             | FRh             | Jantan et al., 1999                                     |
| 146            | <i>p</i> -cymene             |             | Lf, FRh,        | Sharma et al., 1997; Jantan<br>et al., 1999; Behura and |
|                |                              |             | Fl              | Srivastava, 2004  |
| 147            | <i>p</i> -cymene-8-ol        |             | Lf, Fl,<br>DRh, | Dung et al., 1995;<br>Chane-Ming et al.,                |
|                |                              |             | FRh             | 2002; Singh et al.,<br>2010; Pande and                  |
|                |                              |             |                 | Chanotiya, 2006   |
| 148            | carvacrol                    |             | Lf              | Sharma et al., 1997                                     |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                           | <b>Section</b>         | <b>Reference</b>   |
|----------------|------------|---------------------------------------|------------------------|--|
|                | 151        | thymol                                | Lf, FRh                | Sharma et al., 1997;<br>Usman et al., 2009   |
|                | 152        | $\alpha$ -terpinolene                 | Lf, FRh                | Dung et al., 1995; Sharma<br>et al., 1997  |
|                | 153        | $\alpha$ -terpinene                   | FRh                    | Dung et al., 1995; Jantan<br>et al., 1999;<br>Chane-Ming et al.,<br>2002; Pande and<br>Chanotiya, 2006 |
|                | 155        | $\gamma$ -terpinene                   | Lf, Fl                 | Dung et al., 1995;<br>Chane-Ming et al.,<br>2002; Pande and<br>Chanotiya, 2006                         |
|                | 156        | terpinolene<br>( $\delta$ -terpinene) | Lf, FRh,<br>Fl,<br>DRh | Dung et al., 1995;<br>Chane-Ming et al.,<br>2002; Behura and<br>Srivastava, 2004; Pande                |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                           | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|---------------------------------------|----------------|--|
|                |            |                                       |                | and Chanotiya, 2006;   |
|                |            |                                       |                | Singh et al., 2010   |
| 157            |            | <i>d</i> -sabinene                    | DRh            | Roth et al., 1998  |
| 158            |            | $\beta$ -phellandrene                 | FRh            | Jantan et al., 1999  |
| 159            |            | terpinen-4-ol                         | FRh, Lf        | Sharma et al., 1997; Jantan et al., 1999;  |
| 161            |            | 5-hydroxy- <i>p</i> -menth-6-en-2-one | Lf             | Dung et al., 1995; Sharma et al., 1997   |
| 165            |            | piperitone                            | Lf             | Sharma et al., 1997  |
| 168            |            | carvone                               | FRh            | Jantan et al., 1999  |
| 170            |            | <i>p</i> -menth-1,3,8-triene          | Lf, Fl         | Chane-Ming et al., 2002  |
| 171            |            | $\alpha$ -terpineol                   | Lf, FRh, Fl    | Dung et al., 1995; Sharma et al., 1997; Jantan et al., 1999; Chane-Ming et al., 2002 |
| 172            |            | limonene                              | Lf, Ugp,       | Chen et al., 1983b;  |

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|----------------|------------|---|----------------|--|
|                |            |   | FRh,           | Sharma et al., 1997;                                       |
|                |            |   | Fl             | Chane-Ming et al.,   |
|                |            |   |                | 2002; Behura and   |
|                |            |   |                | Srivastava, 2004   |
| 173            |            | <i>cis</i> -carvotanacetol                              | Lf             | Sharma et al., 1997  |
| 185            |            | 2-(2,5-dihydroxy-4-methylcyclohex-3-enyl)propanoic acid | Rh             | Li et al., 2009a   |
| 189            |            | $\alpha$ -phellandrene                                  | FRh, Lf,       | Jantan et al., 1999; Behura et al., 2002;                  |
|                |            |   |                | Chane-Ming et al., 2002                                    |
| 190            |            | borneol   | UGp,           | Chen et al., 1983b; Roth et al., 1998; Jantan et al., 1999 |
| 192            |            | isoborneol  | UGp            | Chen et al., 1983b   |
| 194            |            | camphor   | UGp            | Chen et al., 1983b; Jantan                                 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>        | <b>Section</b> | <b>Reference</b>           |
|----------------|------------|--------------------|----------------|----------------------------|
|                |            |                    |                | et al., 1999               |
| 198            |            | $\alpha$ -fenchene | Lf, Fl         | Chane-Ming et al., 2002    |
| 201            |            | $\beta$ -3-carene  | Lf, Fl,        | Dung et al., 1995; Sharma  |
|                |            |                    | FRh            | et al., 1997;              |
|                |            |                    |                | Chane-Ming et al.,         |
|                |            |                    |                | 2002; Pande and            |
|                |            |                    |                | Chanotiya, 2006; Singh     |
|                |            |                    |                | et al., 2011               |
| 202            |            | $\delta$ -2-carene | Lf, Fl         | Chane-Ming et al., 2002;   |
|                |            | (car-2-ene)        |                | Pande and Chanotiya,       |
|                |            |                    |                | 2006                       |
| 205            |            | $\alpha$ -thujene  | Lf             | Dung et al., 1995; Sharma  |
|                |            |                    |                | et al., 1997; Garg et al., |
|                |            |                    |                | 2002                       |
| 206            |            | sabinene           | Lf, Fl,        | Dung et al., 1995; Sharma  |
|                |            |                    | FRh,           | et al., 1997;              |
|                |            |                    | DRh            | Chane-Ming et al.,         |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b>   | <b>Reference</b>  |
|----------------|------------|---------------------|------------------|---|
|                |            |                     |                  | 2002; Singh et al., 2010  |
| 208            |            | <i>cis</i> -sabinol | Lf               | Dung et al., 1995   |
| 212            |            | camphene            | Lf, FRh          | Chen et al., 1983b; Dung et al., 1995; Sharma et al., 1997  |
| 214            |            | myrtenol            | Lf               | Sharma et al., 1997; Pande and Chanotiya, 2006  |
| 215            |            | 1,8-cineole         | Lf, FRh, Fl, DRh | Dung et al., 1995; Sharma et al., 1997; Jantan et al., 1999; Behura et al., 2002; Chane-Ming et al., 2002 |
| 220            |            | $\alpha$ -pinene    | Lf, FRh, Rx      | Chen et al., 1983b; Dung et al., 1995; Sharma et al., 1997  |
| 221            |            | $\beta$ -pinene     | Lf, Fl, FRh,     | Chen et al., 1983b; Dung et al., 1995; Sharma et al., 1997  |

| <b>Species</b> | <b>No.</b>                  | <b>Name</b> | <b>Section</b> | <b>Reference</b>                              |
|----------------|-----------------------------|-------------|----------------|---|
|                |                             |             | DRh            | al., 1997; Chane-Ming                         |
|                |                             |             |                | et al., 2002; Garg et al.,                    |
|                |                             |             |                | 2002; Behura and                              |
|                |                             |             |                | Srivastava, 2004                              |
| 222            | myrtenal                    |             | DRh, FRh       | Dung et al., 1995; Sharma et al., 1997        |
| 228            | (2Z, 6E)-farnesol           |             | Lf             | Behura and Srivastava, 2004                   |
| 230            | (E)- $\beta$ -farnesene     |             | FRh, Lf, Fl    | Sharma et al., 1997; Jantan et al., 1999;     |
|                |                             |             |                | Chane-Ming et al.,                            |
|                |                             |             |                | 2002; Singh et al.,                           |
|                |                             |             |                | 2002; Pande and                               |
|                |                             |             |                | Chanotiya, 2006; Singh et al., 2011           |
| 233            | (E, E)- $\alpha$ -farnesene |             | Lf, FRh, DRh   | Pande and Chanotiya, 2006; Singh et al., 2010 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>               | <b>Section</b>  | <b>Reference</b>   |
|----------------|------------|---------------------------|-----------------|--|
|                | 236        | (E)-nerolidol             | Lf, FRh,<br>Fl, | Sharma et al., 1997; Jantan<br>et al., 1999; Pande and             |
|                |            |                           | DRh             | Chanotiya, 2006; Singh<br>et al., 2010                             |
|                | 239        | (E)- $\alpha$ -atlantone  | FRh,<br>DRh     | Sharma et al., 1997; Jantan<br>et al., 1999; Singh et al.,<br>2010 |
|                | 240        | $\beta$ -atlantone        | DRh             | Roth et al., 1998  |
|                | 241        | (Z)- $\gamma$ -atlantone  | Lf, Fl          | Chane-Ming et al., 2002  |
|                | 242        | $\beta$ -bisabolene       | FRh, Lf,<br>Fl, | Sharma et al., 1997;<br>Chane-Ming et al.,                         |
|                |            |                           | DRh             | 2002; Singh et al.,<br>2010; Singh et al., 2011                    |
|                | 243        | (E)- $\gamma$ -bisabolene | FRh,<br>DRh     | Chane-Ming et al., 2002;<br>Singh et al., 2010                     |
|                | 244        | $\beta$ -bisabolol        | DRh             | Singh et al., 2010   |
|                | 245        | bisacurone                | DRh             | Ohshiro et al., 1990; Li et  |

| <b>Species</b> | <b>No.</b>  | <b>Name</b> | <b>Section</b> | <b>Reference</b>     |
|----------------|---|-------------|----------------|----------------------|
|                |   |             |                | al., 2009a           |
| 246            | bisacurone a  | Rh          |                | Li et al., 2009a     |
| 249            | bisacurol   | FRh         |                | Ishii et al., 2011   |
| 250            | bisacumol   | DRh         |                | Ohshiro et al., 1990 |
| 252            | 1,10-bisaboladiene-3,<br>4-diol                     | Rh          |                | Ohshiro et al., 1990 |
| 253            | 2,10-bisaboladiene-1,<br>4-diol                     | Rh          |                | Ohshiro et al., 1990 |
| 257            | bisabola-3,10-diene-<br>2-one                       | DR          |                | Ohshiro et al., 1990 |
| 258            | 2,5-dihydroxybisabol<br>a-3,10-diene                | DR          |                | Ohshiro et al., 1990 |
| 259            | 4,5-dihydroxybisabol<br>a-2,10-diene                | DRh         |                | Ohshiro et al., 1990 |
| 260            | 4-hydroxy-3-methox<br>y-2,10-bisaboladie<br>n-9-one | Rh          |                | Ohshiro et al., 1990 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                   | <b>Section</b>  | <b>Reference</b>   |
|----------------|------------|---|-----------------|--|
|                | 261        | 3-hydroxy-1,10-bisaboladien-9-one             | Rh              | Ohshiro et al., 1990   |
|                | 262        | 4-hydroxybisabola-2,10-dien-9-one             | DRh             | Ohshiro et al., 1990   |
|                | 263        | 4-methoxy-5-hydroxy-bisabola-2,10-diene-9-one | DRh             | Ohshiro et al., 1990   |
|                | 264        | $\alpha$ -curcumene                           | FRh, Lf, Fl, DR | Sharma et al., 1997; Jantan et al., 1999; Chane-Ming et al., 2002; Pande and Chanotiya, 2006; Singh et al., 2010; Singh et al., 2011 |
|                | 265        | $\beta$ -curcumene                            | Uk              | Yang et al., 1979  |
|                | 267        | curlone ( $\beta$ -tumerone)                  | FRh             | Naz et al., 2010; Singh et al., 2011   |

| Species | No. | Name                 | Section  | Reference   |
|---------|-----|----------------------|----------|---|
|         | 268 | turmerone            | Ugp,     | Chen et al., 1983b; Naz et al., 2010; Singh et al., |
|         |     |                      | FRh,     |   |
|         |     |                      | DRh      | 2010  |
|         | 269 | <i>ar</i> -turmerone | Ugp, Lf, | Chen et al., 1983b;                                 |
|         |     |                      | FRh,     | Sharma et al., 1997;                                |
|         |     |                      | DRh      | Chane-Ming et al.,                                  |
|         |     |                      |          | 2002; Singh et al.,                                 |
|         |     |                      |          | 2002; Singh et al.,                                 |
|         |     |                      |          | 2010; Ishii et al., 2011;                           |
|         |     |                      |          | Singh et al., 2011                                  |
|         | 270 | $\alpha$ -turmerone  | FRh,     | Sharma et al., 1997;                                |
|         |     |                      | leaf     | Chane-Ming et al., 2002                             |
|         | 271 | $\beta$ -turmerone   | DRh,     | Golding and   |
|         |     |                      | FRh,     | Pombo-Villar, 1992;                                 |
|         |     |                      | Lf       | Sharma et al., 1997;                                |
|         |     |                      |          | Jantan et al., 1999;                                |
|         |     |                      |          | Chane-Ming et al.,                                  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b>   | <b>Reference</b>  |
|----------------|------------|---------------------|------------------|---|
|                |            |                     |                  | 2002; Ishii et al., 2011  |
|                | 272        | turmeronol A        | DRh              | Imai et al., 1990; Zeng et al., 2007a; Li et al., 2009a   |
|                | 273        | turmeronol B        | DRh              | Imai et al., 1990; Zeng et al., 2007a; Zeng et al., 2007b   |
|                | 275        | zingiberene         | FRh, Lf, Fl, DRh | Sharma et al., 1997; Chane-Ming et al., 2002; Singh et al., 2002; Singh et al., 2010                      |
|                | 278        | <i>ar</i> -turmerol | FRh, DRh         | Sharma et al., 1997; Jantan et al., 1999; Chane-Ming et al., 2002; Singh et al., 2002; Singh et al., 2010 |
|                | 279        | curcuphenol         | FRh              | Sharma et al., 1997; Jantan   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                 | <b>Section</b> | <b>Reference</b>            |
|----------------|------------|-----------------------------|----------------|-----------------------------|
|                |            |                             |                | et al., 1999; Singh et al., |
|                |            |                             |                | 2010                        |
| 280            |            | $\beta$ -sesquiphellandrene | FRh, Lf,       | Sharma et al., 1997; Jantan |
|                |            |                             | Fl,            | et al., 1999;               |
|                |            |                             | DRh            | Chane-Ming et al.,          |
|                |            |                             |                | 2002; Pande and             |
|                |            |                             |                | Chanotiya, 2006; Singh      |
|                |            |                             |                | et al., 2010; Singh et al., |
|                |            |                             |                | 2011                        |
| 281            |            | bisabolone                  | FRh,           | Sharma et al., 1997; Zeng   |
|                |            |                             | DRh            | et al., 2007a; Zeng et      |
|                |            |                             |                | al., 2007b                  |
| 282            |            | bisabolone-9-one            | DRh            | Zeng et al., 2007a          |
| 283            |            | bisabolone-4-one            | DRh            | Zeng et al., 2007b          |
| 284            |            | (6S)-2-methyl-6-[(1R        | DRh            | Zeng et al., 2007a          |
|                |            | ,                           |                |                             |
|                |            | 5S)-(4-methene-5-           |                |                             |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                    | <b>Section</b> | <b>Reference</b>            |
|----------------|------------|--|----------------|-----------------------------|
|                |            | hydroxyl-2-cyclohexen)-2-hepten-4-one          |                |                             |
| 285            |            | 5 $\beta$ -hydroxyl-1 $\beta$ -bisabolone      | DRh            | Zhang et al., 2014          |
|                |            | bolon-9-one                                    |                |                             |
| 286            |            | 5 $\alpha$ -hydroxyl-1 $\beta$ -bisabolone     | DRh            | Zhang et al., 2014          |
|                |            | bolon-9-one                                    |                |                             |
| 287            |            | 4-methylene-5-hydroxybisabola-2,10-diene-9-one | Rh             | Li et al., 2009a            |
|                |            |  |                |                             |
| 288            |            | 2,7,(14),10-bisabolatriene-1,9,12 triol        | DRh            | Ghosh et al., 2013          |
|                |            |  |                |                             |
| 289            |            | 2-methoxy-5-hydroxybisabola-3,10-diene-9-one   | Rh             | Li et al., 2009a            |
|                |            |  |                |                             |
| 290            |            | 5-hydroxyl- <i>ar</i> -turmerone               | DRh            | Zeng et al., 2007a; Zeng et |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                      | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|--|----------------|--------------------|
|                |            | one  |                | al., 2007b         |
| 291            |            | bisacurol B                                      | FRh            | Ishii et al., 2011 |
| 294            |            | (6S)-2-methyl-6-(4-hydroxyphenyl)-2-hepten-4-one | DRh            | Zeng et al., 2007b |
| 295            |            | (6S)-2-methyl-6-(4-formylphenyl)-2-hepten-4-one  | DRh            | Zeng et al., 2007b |
| 297            |            | 2,8-epoxy-5-hydroxybisabola-3,10-dien-9-one      | Rh             | Li et al., 2009a   |
| 300            |            | bisabocurcumin                                   | DRh            | Xiao et al., 2011  |
| 301            |            | terpecurcumins A                                 | DRh            | Lin et al., 2012   |
| 302            |            | bisabolocurcumin ether                           | DRh            | Lin et al., 2012   |
| 303            |            | demethoxybisabolocurcumin ether                  | DRh            | Lin et al., 2012   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>         | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|---------------------|----------------|--------------------|
|                | 304        | didemethoxybisabolo | DRh            | Lin et al., 2012   |
|                |            | curcumin ether      |                |                    |
|                | 305        | terpecurcumins C    | DRh            | Lin et al., 2012   |
|                | 306        | terpecurcumins C    | DRh            | Lin et al., 2012   |
|                | 307        | terpecurcumins D    | DRh            | Lin et al., 2012   |
|                | 308        | terpecurcumins E    | DRh            | Lin et al., 2012   |
|                | 309        | terpecurcumins F    | DRh            | Lin et al., 2012   |
|                | 310        | terpecurcumins G    | DRh            | Lin et al., 2012   |
|                | 311        | terpecurcumins H    | DRh            | Lin et al., 2012   |
|                | 312        | terpecurcumins I    | DRh            | Lin et al., 2012   |
|                | 313        | demethoxybisaboloc  | DRh            | Xiao et al., 2012  |
|                |            | urcumin ether       |                |                    |
|                | 314        | bisabolocurcumin    | DRh            | Xiao et al., 2012  |
|                |            | ether               |                |                    |
|                | 315        | didemethoxybisabolo | DRh            | Xiao et al., 2012  |
|                |            | curcumin ether      |                |                    |
|                | 316        | cis-sesquisabinene  | DRh,           | Singh et al., 2010 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>                           |
|----------------|------------|--|----------------|--|
|                |            | hydrate  | FRh            |  |
| 318            |            | sesquisabinene   | DRh,           | Singh et al., 2010                         |
|                |            |  | FRh            |  |
| 324            |            | 4 $\alpha$ -acetoxycadina-2,9<br>-diene-1,8-dione                  | DUgp           | Sadhu et al., 2009                         |
| 325            |            | 1 $\alpha$ ,3 $\alpha$ ,4 $\beta$ -trihydroxy-<br>9-cadinene-8-one | DUgp           | Sadhu et al., 2009                         |
| 347            |            | curcumeneone   | DRh            | Ohshiro et al., 1990                       |
| 356            |            | curzerene  | Uk             | Yang et al., 1979                          |
| 357            |            | curzerenone  | Ugp            | Chen et al., 1983b                         |
| 363            |            | $\beta$ -elemenone   | FRh            | Singh et al., 2010                         |
| 417            |            | longanone A  | Ferment        | Quang et al., 2014                         |
|                |            |  | ed Rh          |  |
| 423            |            | curdione   | Ugp, Lf        | Chen et al., 1983b;<br>Sharma et al., 1997 |
| 424            |            | dehydrocurdione  | DRh            | Ohshiro et al., 1990                       |
| 427            |            | germacrone   | Lf, Fl,        | Sharma et al., 1997;                       |

| <b>Species</b> | <b>No.</b>                         | <b>Name</b> | <b>Section</b>                                    | <b>Reference</b>         |
|----------------|------------------------------------|-------------|---|--------------------------|
|                |                                    |             | DRh,  | Chane-Ming et al.,       |
|                |                                    |             | FRh   | 2002; Singh et al., 2010 |
| 428            | germacrone-13-al                   | DRh         | Ohshiro et al., 1990                              |                          |
| 431            | (4S, 5S)-germacrone<br>4,5-epoxide | DRh         | Ohshiro et al., 1990                              |                          |
| 449            | furanodienone                      | DRh         | Sukari et al., 2010                               |                          |
| 454            | zederone                           | DRh         | Sirat et al., 2009; Sukari et<br>al., 2010        |                          |
| 466            | curcumenol                         | DRh,<br>Rx  | Ohshiro et al., 1990; Yi et<br>al., 2003          |                          |
| 467            | <i>epi</i> -curcumenol             | Uk          | Yang et al., 1979                                 |                          |
| 469            | isocurcumenol                      | Rx          | Yi et al., 2003                                   |                          |
| 473            | proCurcumadiol                     | DRh         | Ohshiro et al., 1990                              |                          |
| 475            | procurcumenol                      | DRh         | Ohshiro et al., 1990                              |                          |
| 476            | 1- <i>epi</i> -procurcumenol       | DRh         | Kuroyanagi et al., 1990;<br>Ohshiro et al., 1990; |                          |
|                |                                    |             |   | Bamba et al., 2011       |

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|----------------|------------|---|-----------------------|--|
|                | 478        | isoprocurcumenol  | DRh                   | Ohshiro et al., 1990   |
|                | 483        | (1 <i>S</i> , 4 <i>S</i> , 5 <i>S</i> ,<br>10 <i>R</i> )-zedoarondiol | DR,<br>ferme<br>nted  | Ohshiro et al., 1990;<br>Quang et al., 2014  |
|                | 554        | $\beta$ -caryophyllene  | FR, Lf,<br>Fl,<br>DRh | Jantan et al., 1999;<br>Chane-Ming et al.,<br>2002; Singh et al.,<br>2002; Singh et al.,<br>2010; Singh et al., 2011 |
|                | 555        | $\alpha$ -humulene  | FRh, Lf               | Sharma et al., 1997; Jantan<br>et al., 1999;<br>Chane-Ming et al., 2002  |
|                | 556        | caryophyllene oxide   | Lf                    | Sharma et al., 1997  |
|                | 576        | $\alpha$ -santalene   | Fr, DRh               | Singh et al., 2010   |
|                | 577        | <i>epi</i> - $\beta$ -santalene                                       | Fr, DRh               | Singh et al., 2010   |
|                | 578        | santalenone   | Fr, DRh               | Singh et al., 2010   |

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|----------------|------------|--|----------------|--------------------------------------|
|                | 582        | <i>trans</i> - $\alpha$ -bergamotene   | DRh,           | Singh et al., 2010                   |
|                |            |  | FRh            |                                      |
|                | 583        | <i>cis</i> - $\alpha$ -bergamotene   | FRh,           | Chane-Ming et al., 2002;             |
|                |            |  | DRh            | Singh et al., 2010                   |
|                | 591        | (6 <i>S</i> )-2-methyl-6-(4-hydroxyphenyl-3-methyl)-2-hepten-4-one             | DRh            | Zeng et al., 2007b; Li et al., 2009a |
|                | 592        | curcumin 1   | DRx            | Liu et al., 2007a                    |
|                | 598        | zerumbone  | DRh            | Sukari et al., 2010                  |
|                | 614        | ( <i>E</i> )-labda-8(17),12-diene-15,16-dial                                   | DRh            | Roth et al., 1998                    |
|                | 654        | kaempferol-3-o- $\alpha$ -l-rhamnopyranosyl(1→2)- $\alpha$ -l-rhamnopyranoside | Ugp            | Ahn et al., 2013b                    |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>    |
|----------------|------------|---|----------------|---------------------|
|                | 655        | quercetin-3- <i>o</i> - $\alpha$ -l-rha<br>mnopyranosyl(1ha<br>mnop $\alpha$ -l-rhamnop<br>yranoside  | Ugp            | Ahn et al., 2013b   |
|                | 656        | quercetin-3- <i>o</i> - $\beta$ -d-glu<br>copyranoside-7- <i>o</i> - $\alpha$ -l-rhamnopyrano<br>side | Ugp            | Ahn et al., 2013b   |
|                | 657        | kaempferol-3- <i>o</i> - $\alpha$ -l-rhamnopyranoside   | Ugp            | Ahn et al., 2013b   |
|                | 658        | quercetin-3- <i>o</i> - $\alpha$ -l-rha<br>mnopyranoside  | Ugp            | Ahn et al., 2013b   |
|                | 659        | quercetin   | Ugp            | Ahn et al., 2013b   |
|                | 661        | stigmasterol  | DRh            | Sukari et al., 2010 |
|                | 663        | $\beta$ -sitosterol-3- <i>o</i> - $\beta$ -d-g<br>lucopyranoside                                      | Rx             | Yi et al., 2003     |
|                | 664        | $\alpha$ -sitosterol  | DRh            | Sukari et al., 2010 |

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|----------------|------------|--|----------------|--|
|                | 675        | eugenol                                  | Lf, Ugp        | Chen et al., 1983b; Behura<br>and Srivastava, 2004 |
|                | 676        | 1-(4-methylphenyl)ethanol                | DRh            | Roth et al., 1998                                  |
|                | 679        | vanillic acid                            | DRh            | Roth et al., 1998                                  |
|                | 680        | syringic acid                            | DRh            | Roth et al., 1998                                  |
|                | 682        | <i>Curcuma-J</i>                         | DRx            | Wu et al., 2008                                    |
|                | 686        | 2-(hydroxymethyl)anthraquinone           | DRh            | Ogbeide et al., 1985                               |
|                | 687        | $1\alpha,4\beta$ -dihydroxyeudeman-8-one | Ferment ed Rh  | Quang et al., 2014                                 |
|                | 688        | 4-(4-hydroxy-3-methoxyphenyl)-2-butanol  | Ferment ed Rh  | Quang et al., 2014                                 |
|                | 689        | conorarin I                              | Ferment ed Rh  | Quang et al., 2014                                 |
|                | 693        | cyclodocosalactone                       | DRh            | Yi et al., 2003                                    |

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|----------------|------------|---|----------------|---------------------------------------|
|                | 694        | 6-methyl-7-(3-oxobutyl)-bicyclo[4.1.0]heptan-3-one* | Rx             | Yi et al., 2003                       |
|                | 695        | (2r,4r)-6-(4'-hydroxyphenyl)-hexane-2,4-diol        | DRx            | Qu et al., 2013                       |
|                | 706        | eicosenoic acid                                     | FR             | Paul et al., 2011                     |
|                | 708        | myristic acid                                       | FR             | Paul et al., 2011                     |
|                | 709        | oleic acid  | FR             | Paul et al., 2011                     |
|                | 710        | palmitic acid                                       | FR             | Singh et al., 2005; Paul et al., 2011 |
|                | 712        | linolenic acid                                      | FR             | Paul et al., 2011                     |
|                | 714        | hop-17(21)-en-3 $\beta$ -ol                         | DRh            | Mohamed et al., 2003                  |
|                | 715        | hop-17(21)-en-3 $\beta$ -yl acetate                 | DRh            | Mohamed et al., 2003                  |
|                | 716        | hopenone I  | DRh            | Mohamed et al., 2003                  |

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|------------------|------------|---|----------------|---------------------|
|                  | 718        | 2-(2'-Methyl-1'-prop<br>enyl)-4,6-dimethyl<br>-7-hydroxyquinoli<br>ne   | DRx            | Wang et al., 2008c  |
| <i>C. mangga</i> | 2          | demethoxycurcumin   | DRh            | Abas et al., 2005   |
|                  | 3          | bisdemethoxycurcum<br>in  | DRh            | Abas et al., 2005   |
|                  | 85         | (1e,4e,6e)-1,7-bis-(4-<br>hydroxyphenyl)-1,<br>4,6-heptatrien-3-o<br>ne | DRh            | Abas et al., 2005   |
|                  | 123        | linalool  | FRh            | Jantan et al., 1999 |
|                  | 124        | myrcene   | FRh            | Jantan et al., 1999 |
|                  | 126        | (E)- $\beta$ -ocimene   | FRh            | Jantan et al., 1999 |
|                  | 127        | (Z)- $\beta$ -ocimene   | FRh            | Jantan et al., 1999 |
|                  | 134        | neral   | FRh            | Wong et al., 1999   |
|                  | 136        | geranal   | FRh            | Wong et al., 1999   |

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|----------------|------------|-----------------------------|----------------|-----------------------|
|                | 137        | linalyl acetate             | FRh            | Jantan et al., 1999   |
|                | 140        | myrcenol                    | FRh            | Wong et al., 1999     |
|                | 145        | perillene                   | FRh            | Wong et al., 1999     |
|                | 146        | cymene                      | FRh            | Wong et al., 1999     |
|                | 153        | $\alpha$ -terpinene         | FRh            | Wong et al., 1999     |
|                | 155        | $\gamma$ -terpinene         | DRh            | Wong et al., 1999     |
|                | 156        | terpinolene                 | FRh            | Jantan et al., 1999   |
|                | 159        | terpinen-4-ol               | FRh            | Jantan et al., 1999   |
|                | 171        | $\alpha$ -terpineol         | FRh            | Jantan et al., 1999   |
|                | 172        | limonene                    | FRh            | Jantan et al., 1999   |
|                | 183        | $\alpha$ -terpineol acetate | DRh            | Kamazeri et al., 2012 |
|                | 189        | $\alpha$ -phellandrene      | FRh            | Jantan et al., 1999   |
|                | 190        | borneol                     | FRh            | Wong et al., 1999     |
|                | 194        | camphor                     | FRh            | Jantan et al., 1999   |
|                | 196        | $\alpha$ -fenchol           | FRh            | Wong et al., 1999     |
|                | 205        | $\alpha$ -thujene           | FRh            | Jantan et al., 1999   |
|                | 210        | <i>trans</i> -sabinene      | FRh            | Wong et al., 1999     |

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|----------------|------------|-----------------------------|----------------|---|
|                |            | hydrate                     |                |   |
|                | 212        | camphene                    | FRh            | Jantan et al., 1999                       |
|                | 214        | myrtenol                    | FRh            | Jantan et al., 1999                       |
|                | 215        | 1,8-cineole                 | FRh            | Jantan et al., 1999                       |
|                | 220        | $\alpha$ -pinene            | FRh            | Jantan et al., 1999                       |
|                | 221        | $\beta$ -pinene             | FRh            | Jantan et al., 1999                       |
|                | 222        | myrtenal                    | FRh            | Wong et al., 1999                         |
|                | 225        | <i>trans</i> -pinocarveol   | FRh            | Wong et al., 1999                         |
|                | 230        | (E)- $\beta$ -farnesene     | FRh, Lf        | Jantan et al., 1999; Padalia et al., 2013 |
|                | 230        | (E)- $\beta$ -farnesene     | FRh            | Jantan et al., 1999                       |
|                | 233        | (E, E)- $\alpha$ -farnesene | FR             | Wong et al., 1999                         |
|                | 236        | (E)-nerolidol               | FRh            | Jantan et al., 1999                       |
|                | 356        | curzerene                   | FRh            | Wong et al., 1999                         |
|                | 364        | $\beta$ -elemene            | FRh            | Wong et al., 1999                         |
|                | 427        | germacrone                  | FRh            | Wong et al., 1999                         |
|                | 554        | $\beta$ -caryophyllene      | FRh            | Jantan et al., 1999                       |

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|----------------|------------|---|----------------|--|
|                | 555        | $\alpha$ -humulene                                  | FRh            | Wong et al., 1999                        |
|                | 556        | caryophyllene oxide                                 | DRh            | Kamazeri et al., 2012                    |
|                | 614        | (E)-labda-8(17),12-di<br>ene-15,16-dial             | DRh            | Abas et al., 2005; Liu and<br>Nair, 2010 |
|                | 615        | calcaratarin A                                      | DRh            | Abas et al., 2005; Liu and<br>Nair, 2010 |
|                | 617        | 14,15,16-trinor-labda<br>n-8,12-diol                | FRh            | Liu and Nair, 2010                       |
|                | 618        | (E)-15,15-diethoxyla<br>bda-8(17),12-dien-<br>16-al | DR             | Kaewkroek et al., 2010                   |
|                | 619        | communic acid                                       | FRh            | Liu and Nair, 2010                       |
|                | 620        | copallic acid                                       | FRh            | Liu and Nair, 2010                       |
|                | 635        | curcumanggoside                                     | DRh            | Abas et al., 2005                        |
|                | 636        | zerumin B   | FRh,<br>DRh    | Liu and Nair, 2010<br>Abas et al., 2005  |
|                | 670        | scopoletin  | DRh            | Abas et al., 2005                        |

| <b>Species</b>           | <b>No.</b> | <b>Name</b>                                   | <b>Section</b> | <b>Reference</b>                          |
|--------------------------|------------|---|----------------|---|
|                          | 691        | 1,1,10-trimethyl-deca<br>lin                  | FRh            | Liu and Nair, 2010                        |
|                          | 692        | 8-methylene-1,1,10-tri<br>methyldelcalin      | FRh            | Liu and Nair, 2010                        |
|                          | 702        | 15,16<br>bisnorlabda-8(17),<br>11-dien-13-one | DRh            | Kaewkroek et al., 2010                    |
| <i>C. neilgherrensis</i> | 146        | <i>p</i> -cymene                              | Rh             | Maridass, 2009                            |
|                          | 267        | curlone                                       | Rh             | Maridass, 2009                            |
|                          | 269        | <i>ar</i> -turmerone                          | Rh             | Maridass, 2009                            |
| <i>C. ochrorhiza</i>     | 156        | terpinolene                                   | FRh            | Sirat et al., 1997                        |
| ( <i>longa</i> )         |            |   |                |   |
|                          | 190        | borneol                                       | FRh            | Sirat et al., 1997                        |
|                          | 192        | isoborneol                                    | FRh            | Sirat et al., 1997                        |
|                          | 194        | camphor                                       | FRh            | Sirat et al., 1997                        |
|                          | 364        | $\beta$ -elemene                              | FRh,<br>DRh    | Sirat et al., 1997; Singh et<br>al., 2010 |

| <b>Species</b>      | <b>No.</b> | <b>Name</b>                       | <b>Section</b> | <b>Reference</b>                           |
|---------------------|------------|-----------------------------------|----------------|--|
|                     | 371        | $\beta$ -selinene                 | FRh            | Sirat et al., 1997                         |
|                     | 427        | germacrone                        | FRh            | Sirat et al., 1997                         |
|                     | 449        | furanodienone                     | DRh            | Sukari et al., 2010                        |
|                     | 450        | furanogermenone                   | FRh            | Sirat et al., 1997, 2009                   |
|                     | 454        | zederone                          | DRh            | Sukari et al., 2010                        |
|                     | 598        | zerumbone                         | DRh            | Sukari et al., 2010                        |
|                     | 452        | isofuranodiene                    | FRh            | Sirat et al., 1997, 2009                   |
|                     | 661        | stigmasterol                      | DRh            | Sukari et al., 2010                        |
|                     | 664        | $\alpha$ -sitosterol              | DRh            | Sukari et al., 2010                        |
| <i>C. oligantha</i> | 1          | curcumin                          | DRh            | Ahmad et al., 2010;<br>Shamim et al., 2011 |
|                     | 107        | ethyl- <i>p</i> -methoxycinnamate | FRh            | Ahmad et al., 2012                         |
|                     |            | amate                             |                |  |
|                     | 111        | estragole                         | FRh            | Ahmad et al., 2012                         |
|                     | 115        | cinnamyl cinnamate                | FRh            | Ahmad et al., 2012                         |
|                     | 124        | myrcene                           | FRh            | Ahmad et al., 2012                         |
|                     | 146        | <i>p</i> -cymene                  | FRh            | Ahmad et al., 2012                         |

| <b>Species</b> | <b>No.</b> | <b>Name</b>            | <b>Section</b> | <b>Reference</b>    |
|----------------|------------|------------------------|----------------|---------------------|
|                | 158        | $\beta$ -phellandrene  | FRh            | Ahmad et al., 2012  |
|                | 159        | terpinen-4-ol          | FRh            | Ahmad et al., 2012  |
|                | 212        | camphene               | FRh            | Ahmad et al., 2012  |
|                | 221        | $\beta$ -pinene        | FRh            | Ahmad et al., 2012  |
|                | 228        | (2Z, 6E)-farnesol      | FRh            | Ahmad et al., 2012  |
|                | 266        | $\gamma$ -curcumene    | FRh            | Ahmad et al., 2012  |
|                | 269        | <i>ar</i> -turmerone   | FRh            | Ahmad et al., 2012  |
|                | 334        | $\alpha$ -cadinol      | FRh            | Ahmad et al., 2012  |
|                | 366        | $\delta$ -elemene      | FRh            | Ahmad et al., 2012  |
|                | 369        | $\beta$ -eudesmol      | FRh            | Ahmad et al., 2012  |
|                | 370        | $\alpha$ -selinene     | FRh            | Ahmad et al., 2012  |
|                | 371        | $\beta$ -selinene      | FRh            | Ahmad et al., 2012  |
|                | 502        | $\gamma$ -gurjunene    | FRh            | Ahmad et al., 2012  |
|                | 554        | $\beta$ -caryophyllene | FRh            | Ahmad et al., 2012  |
|                | 557        | $\alpha$ -copaene      | FRh            | Ahmad et al., 2012  |
|                | 661        | stigmasterol           | DRh            | Shamim et al., 2011 |
|                | 696        | oliganthyl cinnamate   | DRh            | Ahmad et al., 2010  |

| <b>Species</b>       | <b>No.</b> | <b>Name</b>          | <b>Section</b> | <b>Reference</b>                               |
|----------------------|------------|----------------------|----------------|--|
|                      | 699        | curoliganthol        | DRh            | Ahmad et al., 2010                             |
| <i>C. parviflora</i> | 269        | <i>ar</i> -turmerone | Rh             | Nguyen, 2011                                   |
|                      | 270        | $\alpha$ -turmerone  | Rh             | Nguyen, 2011                                   |
|                      | 319        | cadalenequinone      | DUgp           | Toume et al., 2004                             |
|                      | 321        | 8-hydroxycadalene    | DUgp           | Toume et al., 2004                             |
|                      | 538        | parviflorene A       | DUgp           | Takahashi et al., 2003;<br>Toume et al., 2004; |
|                      |            |                      |                | Toume et al., 2005                             |
|                      | 539        | parviflorene B       | DUgp           | Toume et al., 2004;<br>Toume et al., 2005      |
|                      | 540        | parviflorene C       | DUgp           | Toume et al., 2004                             |
|                      | 541        | parviflorene D       | DUgp           | Toume et al., 2004;<br>Toume et al., 2005      |
|                      | 542        | parviflorene E       | DUgp           | Toume et al., 2004                             |
|                      | 543        | parviflorene F       | DUgp           | Toume et al., 2004;<br>Toume et al., 2005      |
|                      | 544        | parviflorenes G      | DUgp           | Toume et al., 2005                             |

| <b>Species</b>        | <b>No.</b> | <b>Name</b>                                | <b>Section</b> | <b>Reference</b>        |
|-----------------------|------------|--|----------------|-------------------------|
|                       | 545        | parviflorenes H                            | DUgp           | Toume et al., 2005      |
|                       | 546        | parviflorenes I                            | DUgp           | Toume et al., 2005      |
|                       | 547        | parviflorene J                             | DUgp           | Tamaki et al., 2007     |
| <i>C. petiolata</i>   | 356        | curzerene                                  | Uk             | Yang et al., 1979       |
|                       | 465        | curcumol                                   | DRh            | Thakam and Saewan, 2012 |
|                       | 611        | (E)-15,16-bisnorlabd<br>a-8(17),11-dien-13 | DRh            | Suthiwong et al., 2014  |
|                       |            | -one                                       |                |                         |
|                       | 614        | (E)-labda-8(17),12-di<br>ene-15,16-dial    | DRh            | Suthiwong et al., 2014  |
|                       | 632        | coronarin d                                | DRh            | Suthiwong et al., 2014  |
|                       | 633        | coronarin D<br>methylether                 | DRh            | Suthiwong et al., 2014  |
| <i>C. phaeocaulis</i> | 1          | curcumin                                   | DRh            | Hou et al., 1997        |
|                       | 192        | isoborneol                                 | Uk             | Yang et al., 1979       |
|                       | 193        | isobornyl acetate                          | Uk             | Yang et al., 1979       |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>                      |
|----------------|------------|---|----------------|---------------------------------------|
|                | 194        | camphor   | Uk             | Yang et al., 1979                     |
|                | 269        | <i>ar</i> -turmerone                                  | DRh            | Han and Seo, 2014                     |
|                | 347        | curcumeneone  | DRh            | Yang et al., 2006                     |
|                | 356        | curzerene   | DRh            | Yang et al., 2006                     |
|                | 357        | curzerenone   | FR             | Li et al., 2001; Han and<br>Seo, 2014 |
|                | 364        | $\beta$ -elemene                                      | FRh,<br>DRh    | Li et al., 2001; Yang et al.,<br>2006 |
|                | 373        | cyperusol C   | DRh            | Liu et al., 2014c                     |
|                | 374        | eudesm-11-ene-4 $\alpha$ ,6 $\alpha$ -diol            | DRh            | Liu et al., 2014c                     |
|                | 375        | 1 $\beta$ -hydroxyeudesma-4,11-dien-3-one             | DRh            | Liu et al., 2014c                     |
|                | 376        | 1 $\alpha$ ,4 $\beta$ -dihydroxyeudesm-7(11)-en-8-one | DRh            | Liu et al., 2014c                     |
|                | 379        | phaeusmanes A   | DRh            | Liu et al., 2014c                     |
|                | 380        | phaeusmanes B   | DRh            | Liu et al., 2014c                     |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---|----------------|-------------------|
|                | 381        | phaeusmanes C   | DRh            | Liu et al., 2014c |
|                | 382        | phaeusmanes D   | DRh            | Liu et al., 2014c |
|                | 383        | phaeusmanes E   | DRh            | Liu et al., 2014c |
|                | 386        | 1-hydroxyeudesma-4<br>(14),7(11)-dien-8-<br>one           | DRh            | Liu et al., 2014c |
|                | 387        | 1-hydroxyeudesma-3<br>,7(11)-dien-8-one                   | DRh            | Liu et al., 2014c |
|                | 388        | 9-hydroxyeudesma-3<br>,7(11)-dien-6-one                   | DRh            | Liu et al., 2014c |
|                | 390        | phaeusmanes H   | DRh            | Liu et al., 2014c |
|                | 391        | phaeusmanes G   | DRh            | Liu et al., 2014c |
|                | 392        | phaeusmanes F   | DRh            | Liu et al., 2014c |
|                | 393        | curcolonol  | DRh            | Liu et al., 2014c |
|                | 394        | curcolone   | DRh            | Liu et al., 2014c |
|                | 398        | 1 $\beta$ ,8 $\beta$ -dihydroxyeude<br>sma-4(15),7(11)-di | DRh            | Liu et al., 2014c |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                          | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|--------------------------------------|----------------|-------------------|
|                |            | en-8 $\alpha$ ,12-olide              |                |                   |
| 399            |            | (7Z)-1 $\beta$ ,4 $\alpha$ -dihydrox | DRh            | Liu et al., 2014c |
|                |            | y-5 $\alpha$ ,8 $\beta$ (H)-eudes    |                |                   |
|                |            | m-7(11)-en-8,12-o                    |                |                   |
|                |            | lide                                 |                |                   |
| 400            |            | (7Z)-1 $\beta$ ,4 $\beta$ -dihydrox  | DRh            | Liu et al., 2014c |
|                |            | y-5 $\alpha$ ,8 $\beta$ (H)-eudes    |                |                   |
|                |            | m-7(11)-en-8,12-o                    |                |                   |
|                |            | lide                                 |                |                   |
| 401            |            | curcolide                            | DRh            | Liu et al., 2014c |
| 402            |            | chlomultin B                         | DRh            | Liu et al., 2014c |
| 403            |            | curcodione                           | DRh            | Liu et al., 2014c |
| 404            |            | myrrhterpenoid                       | DRh            | Liu et al., 2014c |
| 405            |            | 1 $\beta$ ,8 $\beta$ -dihydroxyeude  | DRh            | Liu et al., 2014c |
|                |            | sma-3,7(11)-dien-                    |                |                   |
|                |            | 8 $\alpha$ ,12-olide                 |                |                   |
| 406            |            | 1 $\beta$ ,8 $\beta$ -dihydroxyeude  | DRh            | Liu et al., 2014c |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                          | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|--------------------------------------|----------------|---|
|                |            | sma-4,7(11)-dien-                    |                |   |
|                |            | 8 $\alpha$ ,12-olide                 |                |   |
| 423            |            | curdione                             | Uk             | Chen et al., 2001; Yang et al., 2006; Han and Seo, 2014 |
| 427            |            | germacrone                           | DRh            | Yang et al., 2006; Han and Seo, 2014                    |
| 431            |            | (4S,5S)-germacrone                   | DRh            | Han and Seo, 2014                                       |
|                |            | 4,5-epoxide                          |                |   |
| 440            |            | (1S,10S)-(+)-germacrone-1,10-epoxide | DRh            | Han and Seo, 2014                                       |
| 448            |            | furanodiene                          | DRh            | Yang et al., 2006                                       |
| 449            |            | furanodienone                        | DRh            | Yang et al., 2006; Han and Seo, 2014                    |
| 452            |            | isofuranodienone                     | DRh            | Han and Seo, 2014                                       |
| 454            |            | zederone                             | DRh            | Hou et al., 1997  |
| 466            |            | curcumenol                           | DRh            | Hou et al., 1997; Li et al.,                            |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                    | <b>Section</b> | <b>Reference</b>           |
|----------------|------------|--|----------------|----------------------------|
|                |            |  |                | 2001; Chen and Lu,         |
|                |            |  |                | 2006; Yang et al., 2006    |
|                | 469        | isocurcumenol                                  | DRh            | Yang et al., 2006          |
|                | 469        | isocurcumenol                                  | DRh            | Hou et al., 1997; Chen and |
|                |            |  |                | Lu, 2006                   |
|                | 490        | phaeocaulisins E                               | DRh            | Liu et al., 2013           |
|                | 494        | phaeocaulisins D                               | DRh            | Liu et al., 2013           |
|                | 504        | phaeocaulisins F                               | DRh            | Liu et al., 2013           |
|                | 505        | phaeocaulisins J                               | DRh            | Liu et al., 2013           |
|                | 506        | phaeocaulisins G                               | DRh            | Liu et al., 2013           |
|                | 507        | phaeocaulisins H                               | DRh            | Liu et al., 2013           |
|                | 508        | phaeocaulisins I                               | DRh            | Liu et al., 2013           |
|                | 511        | phaeocaulisins B                               | DRh            | Liu et al., 2013           |
|                | 512        | phaeocaulisins C                               | DRh            | Liu et al., 2013           |
|                | 519        | phaeocaulisins A                               | DRh            | Liu et al., 2013           |
|                | 585        | <i>Curcumanolide A</i>                         | DRh            | Han and Seo, 2014          |
|                | 663        | $\beta$ -sitosterol-3- <i>o</i> - $\beta$ -d-g | DRh            | Chen and Lu, 2006          |

| <b>Species</b>      | <b>No.</b> | <b>Name</b>                  | <b>Section</b> | <b>Reference</b>   |
|---------------------|------------|------------------------------|----------------|--------------------|
|                     |            | lucopyranoside               |                |                    |
|                     | 666        | $\alpha$ -spinasterol        | DRh            | Chen and Lu, 2006  |
|                     | 710        | palmitic acid                | DR             | Hou et al., 1997   |
| <i>C. pierreana</i> | 123        | linalool                     | Fl             | Dung et al., 1998  |
|                     | 143        | <i>trans</i> -linalool oxide | Fl             | Dung et al., 1998  |
|                     | 146        | <i>p</i> -cymene             | Fl             | Dung et al., 1998  |
|                     | 147        | <i>p</i> -cymene-8-ol        | Fl             | Dung et al., 1998  |
|                     | 149        | <i>m</i> -cymene-8-ol        | Fl             | Dung et al., 1998  |
|                     | 159        | terpinen-4-ol                | Fl             | Dung et al., 1998  |
|                     | 168        | carvone                      | Fl             | Dung et al., 1998  |
|                     | 171        | $\alpha$ -terpineol          | Fl             | Dung et al., 1998  |
|                     | 172        | limonene                     | Fl             | Dung et al., 1998  |
|                     | 175        | <i>trans</i> -carveol        | Fl             | Dung et al., 1998  |
|                     | 180        | <i>cis</i> -linalool oxide   | Fl             | Dung et al., 1998  |
|                     | 190        | borneol                      | Fl, FRh        | Dung et al., 1998; |
|                     |            |                              |                | Nguyen, 2011       |
|                     | 191        | bornyl acetate               | Fl             | Dung et al., 1998  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>               | <b>Section</b> | <b>Reference</b>                   |
|----------------|------------|---------------------------|----------------|------------------------------------|
|                | 192        | isoborneol                | Fl             | Dung et al., 1998                  |
|                | 193        | isobornyl acetate         | Fl             | Dung et al., 1998                  |
|                | 194        | camphor                   | Fl, FRh        | Dung et al., 1998;<br>Nguyen, 2011 |
|                | 196        | $\alpha$ -fenchol         | Fl             | Dung et al., 1998                  |
|                | 197        | $\alpha$ -fenchyl acetate | Fl             | Dung et al., 1998                  |
|                | 199        | fenchone                  | Fl             | Dung et al., 1998                  |
|                | 205        | $\alpha$ -thujene         | Fl             | Dung et al., 1998                  |
|                | 206        | sabinene                  | Fl             | Dung et al., 1998                  |
|                | 212        | camphene                  | Fl             | Dung et al., 1998                  |
|                | 215        | 1,8-cineole               | Fl, FRh        | Dung et al., 1998;<br>Nguyen, 2011 |
|                | 220        | $\alpha$ -pinene          | Fl             | Dung et al., 1998                  |
|                | 221        | $\beta$ -pinene           | Fl, FRh        | Dung et al., 1998;<br>Nguyen, 2011 |
|                | 222        | myrtenal                  | Fl             | Dung et al., 1998                  |
|                | 223        | <i>cis</i> -verbenol      | Fl             | Dung et al., 1998                  |

| <b>Species</b>         | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|------------------------|------------|---|----------------|-------------------|
|                        | 224        | <i>trans</i> -verbenol                                    | Fl             | Dung et al., 1998 |
|                        | 225        | <i>trans</i> -pinocarveol                                 | Fl             | Dung et al., 1998 |
|                        | 230        | ( <i>E</i> )- $\beta$ -farnesene                          | Fl             | Dung et al., 1998 |
|                        | 372        | 5 $\beta$ H,7 $\beta$ ,10 $\alpha$ -selina-4(14),11-diene | Fl             | Dung et al., 1998 |
|                        | 556        | caryophyllene oxide                                       | Fl             | Dung et al., 1998 |
|                        | 710        | palmitic acid   | Fl             | Dung et al., 1998 |
| <i>C. sichuanensis</i> | 146        | <i>p</i> -cymene  | FRh            | Zhou et al., 2007 |
|                        | 147        | <i>p</i> -cymen-8-ol                                      | FRh            | Zhou et al., 2007 |
|                        | 152        | $\alpha$ -terpinolene                                     | FRh            | Zhou et al., 2007 |
|                        | 171        | $\alpha$ -terpineol                                       | FRh            | Zhou et al., 2007 |
|                        | 172        | limonene  | FRh            | Zhou et al., 2007 |
|                        | 190        | borneol   | FRh            | Zhou et al., 2007 |
|                        | 191        | bornyl acetate  | FRh            | Zhou et al., 2007 |
|                        | 192        | isoborneol  | FRh            | Zhou et al., 2007 |
|                        | 194        | camphor   | FRh            | Zhou et al., 2007 |
|                        | 212        | camphene  | FRh            | Zhou et al., 2007 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                 | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|-----------------------------|----------------|-------------------|
|                | 214        | myrtenol                    | FRh            | Zhou et al., 2007 |
|                | 220        | $\alpha$ -pinene            | FRh            | Zhou et al., 2007 |
|                | 221        | $\beta$ -pinene             | FRh            | Zhou et al., 2007 |
|                | 225        | <i>trans</i> -pinocarveol   | FRh            | Zhou et al., 2007 |
|                | 242        | $\beta$ -bisabolene         | FRh            | Zhou et al., 2007 |
|                | 264        | <i>ar</i> -curcumene        | FRh            | Zhou et al., 2007 |
|                | 269        | <i>ar</i> -turmerone        | FRh            | Zhou et al., 2007 |
|                | 275        | zingiberene                 | FR             | Zhou et al., 2007 |
|                | 280        | $\beta$ -sesquiphellandrene | FRh            | Zhou et al., 2007 |
|                | 323        | <i>trans</i> -calamenene    | FRh            | Zhou et al., 2007 |
|                | 356        | curzerene                   | FRh            | Zhou et al., 2007 |
|                | 357        | curzerenone                 | FRh            | Zhou et al., 2007 |
|                | 358        | 5- <i>epi</i> -curzerenone  | FRh            | Zhou et al., 2007 |
|                | 363        | $\beta$ -elemenone          | FRh            | Zhou et al., 2007 |
|                | 364        | $\beta$ -elemene            | FRh            | Zhou et al., 2007 |
|                | 365        | $\gamma$ -elemene           | FRh            | Zhou et al., 2007 |
|                | 366        | $\delta$ -elemene           | FRh            | Zhou et al., 2007 |

| <b>Species</b>      | <b>No.</b> | <b>Name</b>            | <b>Section</b> | <b>Reference</b>   |
|---------------------|------------|------------------------|----------------|--|
|                     | 370        | $\alpha$ -selinene     | FRh            | Zhou et al., 2007  |
|                     | 371        | $\beta$ -selinene      | FRh            | Zhou et al., 2007  |
|                     | 409        | germacrene D           | FRh            | Zhou et al., 2007  |
|                     | 427        | germacrone             | FRh            | Zhou et al., 2007  |
|                     | 429        | germacrene B           | FRh            | Zhou et al., 2007  |
|                     | 430        | germacrene A           | FRh            | Zhou et al., 2007  |
|                     | 469        | isocurcumenol          | FR             | Zhou et al., 2007  |
|                     | 551        | aromadendrene          | FRh            | Zhou et al., 2007  |
|                     | 553        | $\beta$ -bourbonene    | FRh            | Zhou et al., 2007  |
|                     | 554        | $\beta$ -caryophyllene | FRh            | Zhou et al., 2007  |
|                     | 555        | $\alpha$ -humulene     | FRh            | Zhou et al., 2007  |
|                     | 556        | caryophyllene oxide    | FRh            | Zhou et al., 2007  |
| <i>C. sylvatica</i> | 127        | (Z)- $\beta$ -ocimene  | Lf, Fl,<br>FRh | Dung et al., 1995;<br><br>Chane-Ming et al.,<br><br>2002; Angel et al., 2014 |
|                     | 198        | $\alpha$ -fenchene     | FRh            | Angel et al., 2014   |
|                     | 212        | camphene               | FRh            | Angel et al., 2014   |

| <b>Species</b>     | <b>No.</b> | <b>Name</b>                    | <b>Section</b> | <b>Reference</b>                       |
|--------------------|------------|--------------------------------|----------------|--|
|                    | 220        | $\alpha$ -pinene               | FRh            | Angel et al., 2014                     |
|                    | 228        | (2Z,6E)-farnesol               | FRh            | Angel et al., 2014                     |
| <i>C. wenyujin</i> | 1          | curcumin                       | DRh            | Chen et al., 1983a; Wang et al., 2008a |
|                    | 2          | demethoxycurcumin              | DRh            | Chen et al., 1983a; Wang et al., 2008a |
|                    | 3          | bisdemethoxycurcum in          | DRh            | Chen et al., 1983a; Wang et al., 2008a |
|                    | 123        | linalool                       | FRh            | Fang et al., 1982; Liu et al., 2012    |
|                    | 169        | <i>p</i> -menth-2-ene-1,8-diol | DRh            | Liu et al., 2007b                      |
|                    | 172        | limonene                       | FRh            | Fang et al., 1982                      |
|                    | 194        | camphor                        | FRh            | Liu et al., 2012                       |
|                    | 215        | 1,8-cineole                    | FRh            | Dang et al., 2010; Liu et al., 2012    |
|                    | 216        | dehydro-1,8-cineole            | DRh            | Liu et al., 2007b                      |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                                 | <b>Section</b> | <b>Reference</b>                         |
|----------------|------------|---|----------------|--|
|                | 219        | wenyujinin 1                                | DRh            | Yin et al., 2014                         |
|                | 220        | $\alpha$ -pinene                            | FRh            | Fang et al., 1982                        |
|                | 326        | 7-hydroxy-5 (10),<br>6,8-cadinatriene-4-one | DRh            | Dong et al., 2013                        |
|                | 347        | curcumenone                                 | Stem,<br>Lf,   | Wang et al., 2008b; Lou et<br>al., 2010b |
|                |            |   | DRh            |  |
|                | 348        | 4S-dihydrocurcumen<br>one                   | DRh            | Lou et al., 2010b                        |
|                | 352        | curcumadione                                | stem, Lf       | Wang et al., 2008b                       |
|                | 354        | curcumadionol                               | DRh            | Lou et al., 2010b                        |
|                | 355        | wenyujinin E                                | DRh            | Yin et al., 2014                         |
|                | 356        | curzerene                                   | FRh            | Dang et al., 2010; Liu et<br>al., 2012   |
|                | 357        | curzerenone                                 | FRh            | Liu et al., 2012                         |
|                | 359        | (5R,6R,7 $\alpha$ R)-5-isopr                | DRh            | Liu et al., 2007b; Qiu et                |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>                     |
|----------------|------------|--|----------------|--------------------------------------|
|                |            | openyl-3,6-dimethyl-6-vinyl-5,6,7,7 $\alpha$ -tetrahydro-4H-benzofuran-2-one   |                | al., 2013                            |
| 360            |            | (5 <i>R</i> ,6 <i>R</i> ,7 $\alpha$ <i>S</i> )-5-isopropenyl-3,6-dimethyl-6-vinyl-5,6,7,7 $\alpha$ -tetrahydro-4H-benzofuran-2-one | DRh            | Liu et al., 2007b                    |
| 361            |            | elema-1,3,7(11),8-tetrahydron-8,12-lactam  | DRh            | Qiu et al., 2013                     |
| 362            |            | 8-hydroxyisogermafuran-8,12-lactam   | DRh            | Liu et al., 2007b; Lou et al., 2010b |
| 363            |            | $\beta$ -elemenone   | DRh            | Liu et al., 2012                     |
| 364            |            | $\beta$ -elemene   | FRh            | Guo et al., 1983; Dang et al., 2010  |
| 365            |            | $\gamma$ -elemene  | Rh             | Guo et al., 1983                     |

| <b>Species</b> | <b>No.</b> | <b>Name</b>        | <b>Section</b> | <b>Reference</b>                      |
|----------------|------------|--------------------|----------------|---------------------------------------|
|                | 366        | $\delta$ -elemene  | Rh             | Guo et al., 1983                      |
|                | 389        | voleneol           | DAp            | Tao et al., 2007                      |
|                | 393        | curcolonol         | DRh            | Lou et al., 2010a; Lou et al., 2010b  |
|                | 396        | wenyujinlactone A  | DRh            | Wang et al., 2007                     |
|                | 397        | neolitamone A      | DRh            | Wang et al., 2007                     |
|                | 401        | curcolide          | DRh            | Lou et al., 2010b; Dong et al., 2013  |
|                | 403        | curcodione         | DRh            | Lou et al., 2010b                     |
|                | 407        | codonolactone      | DAp            | Tao et al., 2007                      |
|                | 423        | curdione           | DR,            | Inayama et al., 1985;                 |
|                |            |                    | stems          | Harimaya et al., 1991;                |
|                |            |                    | and            | Wang et al., 2007;                    |
|                |            |                    | Lf,            | Wang et al., 2008b; Lou et al., 2009b |
|                | 427        | germacrone         | Stem, Lf       | Wang et al., 2008b                    |
|                | 431        | (4S,5S)-germacrone | DRh            | Liu et al., 2007b; Lou et             |

| <b>Species</b> | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>           |
|----------------|------------|--|----------------|----------------------------|
|                |            | 4,5-epoxide  |                | al., 2009b                 |
| 432            |            | (1 <i>S</i> ,10 <i>S</i> ),(4 <i>S</i> ,5 <i>S</i> )-ger | DRh            | Gao et al., 1989; Harimaya |
|                |            | macrone-1(10),4-d  |                | et al., 1991; Lou et al.,  |
|                |            | iepoxide   |                | 2009b                      |
| 434            |            | neocurdione  | DRh,           | Ohkura et al., 1986;       |
|                |            | stems  |                | Harimaya et al., 1991;     |
|                |            | and  |                | Liu et al., 2007b          |
|                |            | Lf   |                |                            |
| 435            |            | 3,4-epoxy-6,9-germa                                      | DRh            | Gao et al., 1991           |
|                |            | cranedione   |                |                            |
| 436            |            | (1 <i>R</i> ,10 <i>R</i> )-epoxy-(-)-1                   | DRh,           | Gao et al., 1988; Harimaya |
|                |            | ,10-dihydrocurdio  | stem           | et al., 1991; Wang et al., |
|                |            | ne   | and            | 2007; Wang et al.,         |
|                |            | Lf   |                | 2008b                      |
| 439            |            | (1 $\alpha$ ,4 $\beta$ ,5 $\alpha$ ,10 $\beta$ )         | Uk             | Yang et al., 1979          |
|                |            | 1,10:4,5-diepoxy-7                                       |                |                            |
|                |            | (11)-germacren-8-  |                |                            |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                              | <b>Section</b> | <b>Reference</b>          |
|----------------|------------|--|----------------|---------------------------|
|                |            | one                                      |                |                           |
|                | 440        | germacrone-1,10-epo                      | DRh            | Liu et al., 2007b         |
|                |            | xide                                     |                |                           |
|                | 442        | wenyujinin J                             | DRh            | Yin et al., 2014          |
|                | 443        | $1\beta,4\alpha$ -dihydroxy- $5\alpha$ , | DRh            | Lou et al., 2010a; Lou et |
|                |            | $8\beta(H)$ -eudesm-7(1                  |                | al., 2010b                |
|                |            | 1z)-en-12,8-oxide                        |                |                           |
|                | 444        | (1E,4E,8R)-8-hydroxygermacra-1(10),4     | DRh            | Lou et al., 2009b; Lou et |
|                |            | ,7(11)-trieno-12,8-                      |                | al., 2010a                |
|                |            | lactone(aeruginola                       |                |                           |
|                |            | ctone)                                   |                |                           |
|                | 451        | glechomanolide                           | Stem           | Wang et al., 2008b        |
|                |            | and                                      |                |                           |
|                |            | Lf                                       |                |                           |
|                | 453        | wenjine                                  | DRh            | Gao et al., 1989; Gao et  |
|                |            |  |                | al., 1991                 |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---|----------------|---|
|                | 455        | wenyujinin K  | DRh            | Yin et al., 2014  |
|                | 456        | curdionolides A   | DRh            | Lou et al., 2009b   |
|                | 457        | curdionolides B   | DRh            | Lou et al., 2009b   |
|                | 458        | curdionolide C  | DRh            | Lou et al., 2009b   |
|                | 459        | (1E,4Z)-8-hydroxy-6<br>-oxogermacra-1(1<br>0),4,7(11)-trieno-1<br>2,8-lactone | DRh            | Lou et al., 2009b   |
|                | 460        | curcuminol G  | DRx            | Ma et al., 2009   |
|                | 461        | (1E,4Z)-8-hydroxy-6<br>-oxogermacra-1(1<br>0),4,7(11)-trieno-1<br>2,8-lactone | DRh            | Lou et al., 2010a   |
|                | 463        | aerugidiol  | DRh            | Wang et al., 2007; Lou et<br>al., 2009a; Dong et al.,<br>2013 |
|                | 464        | alismoxide  | DRh            | Lou et al., 2010a; Dong et                                    |

| <b>Species</b> | <b>No.</b> | <b>Name</b>               | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---------------------------|----------------|---|
|                |            |                           |                | al., 2013   |
|                | 465        | curcumol                  | DRh            | Inayama et al., 1984;                                   |
|                |            |                           |                | Harimaya et al., 1991;                                  |
|                |            |                           |                | Liu et al., 2007b; Wang et al., 2007                    |
|                | 466        | curcumenol                | DRx,           | Wang et al., 2008a; Lou et al., 2009a                   |
|                | 468        | 4- <i>epi</i> -curcumenol | DRx,           | Wang et al., 2008a; Qiu et al., 2013                    |
|                | 471        | neocurcumenol             | DRh            | Qiu et al., 2013  |
|                | 472        | wenyujinin i              | DRh            | Yin et al., 2014  |
|                | 474        | <i>curcumadiol</i>        | DRx            | Wang et al., 2008a                                      |
|                | 475        | procurcumenol             | DRh            | Lou et al., 2009a; Lou et al., 2010a; Dong et al., 2013 |
|                | 477        | wenyujinin H              | DRh            | Yin et al., 2014  |
|                | 478        | isoprocurcumenol          | Stem           | Wang et al., 2008b                                      |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---|----------------|---|
|                |            |   | and            |   |
|                |            |   | Lf             |   |
| 483            |            | (1 <i>S</i> ,4 <i>S</i> ,5 <i>S</i> ,10 <i>R</i> )-zedo<br>arondiol   | DRh            | Wang et al., 2007; Hu et<br>al., 2008; Lou et al.,<br>2009a |
| 484            |            | isozedoarondiol   | DRh            | Wang et al., 2007; Hu et<br>al., 2008; Lou et al.,<br>2009a |
| 496            |            | 8,9-seco-4 $\beta$ -hydroxy<br>-1 $\alpha$ ,5 $\beta$ H-7(11)-gua<br>en-8,10-olate                              | DRh            | Dong et al., 2013   |
| 497            |            | 7 $\beta$ ,8 $\alpha$ -dihydroxy-1 $\alpha$ ,<br>4 $\alpha$ H-guai-9,11-die<br>n-5 $\beta$ ,8 $\beta$ -endoxide | DRh            | Qiu et al., 2013  |
| 498            |            | 8 $\alpha$ -hydroxy-1 $\alpha$ ,4 $\beta$ ,7 $\beta$<br>H-guai-10(15)-en-<br>5 $\beta$ ,8 $\beta$ -endoxide     | DRh            | Dong et al., 2013   |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---|----------------|---|
|                | 499        | 7 $\beta$ ,8 $\alpha$ -dihydroxy-1 $\alpha$ ,<br>4 $\alpha$ H-guai-10(15)-e<br>n-5 $\beta$ ,8 $\beta$ -endoxide | DRh            | Dong et al., 2013                                       |
|                | 509        | (1 <i>R</i> ,4 <i>R</i> ,5 <i>S</i> ,10 <i>S</i> )-zedo<br>alactone B   | DRh            | Yin et al., 2013  |
|                | 510        | zedoalactones D   | DRh            | Lou et al., 2009a                                       |
|                | 513        | zedoalactone A  | DRh            | Hu et al., 2008; Lou et al.,<br>2009a; Yin et al., 2013 |
|                | 514        | zedoalactone B  | DRh            | Hu et al., 2008; Lou et al.,<br>2009a; Yin et al., 2013 |
|                | 515        | zedoalactone G  | DRh            | Yin et al., 2013  |
|                | 516        | zedoarolide B   | DRh            | Hu et al., 2008; Lou et al.,<br>2009a; Yin et al., 2013 |
|                | 517        | zedoalactones E   | DRh            | Lou et al., 2009a                                       |
|                | 518        | zedoalactone C  | DRh            | Hu et al., 2008; Lou et al.,<br>2009a                   |
|                | 520        | wenyujinin G  | DRh            | Yin et al., 2014  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>                            |
|----------------|------------|---|----------------|---|
|                | 521        | $1\alpha,8\alpha$ -epidioxy-4 $\alpha$ -hydroxy-5 $\alpha$ H-guai-7(11),9-dien-12,8-oxide | DRh            | Dong et al., 2013                           |
|                | 524        | (4S)-4-hydroxy-gwei curculactone  | DRh            | Yin et al., 2013                            |
|                | 526        | gweicurculactone  | DRx            | Wang et al., 2008a                          |
|                | 527        | zedoalactones F   | DRh            | Lou et al., 2009a                           |
|                | 529        | wenyujinin F  | DRh            | Yin et al., 2014                            |
|                | 534        | wenyujinin A  | DRh            | Yin et al., 2014                            |
|                | 535        | wenyujinin B  | DRh            | Yin et al., 2014                            |
|                | 562        | (6R)-dehydroxysipan dinolide  | DRh            | Lou et al., 2010b                           |
|                | 564        | daucosterol   | DAp            | Tao et al., 2007                            |
|                | 584        | <i>curcumalactone</i>   | Uk, DRh        | Inayama et al., 1985; Harimaya et al., 1991 |
|                | 602        | wenyujinin C  | DRh            | Yin et al., 2014                            |

| Species                | No. | Name                           | Section | Reference              |
|------------------------|-----|--------------------------------|---------|------------------------|
|                        | 603 | wenyujinin D                   | DRh     | Yin et al., 2014       |
|                        | 612 | curcumrinols C                 | DRx     | Huang et al., 2008     |
|                        | 621 | 5S,9S,10S,15R-(-)-curcuminol D | DRx     | Zhang et al., 2008b    |
|                        | 623 | curcumrinols A                 | DRx     | Huang et al., 2008     |
|                        | 624 | curcumrinols B                 | DRx     | Huang et al., 2008     |
|                        | 634 | curcuminol E                   | DRx     | Zhang et al., 2008b    |
|                        | 662 | $\beta$ -sitosterol            | DRh     | Tao et al., 2007       |
|                        | 667 | mangdesisterol                 | DAp     | Tao et al., 2007       |
|                        | 672 | crotepoxide                    | DRx     | Wang et al., 2008a     |
|                        | 697 | wenyujinoside                  | DRx     | Ma et al., 2009        |
|                        | 698 | aurantiamide                   | DRx     | Ma et al., 2009        |
|                        | 703 | curcuminol F                   | DRx     | Ma et al., 2009        |
|                        | 704 | octacosanoic acid              | DAp     | Tao et al., 2007       |
|                        | 717 | curcuminol I                   | DRx     | Huang, 2008            |
| <i>C. xanthorrhiza</i> | 1   | curcumin                       | Rh      | Uehara et al., 1992    |
|                        | 2   | demethoxycurcumin              | FRh     | Kuroyanagi and Natori, |

| <b>Species</b> | <b>No.</b> | <b>Name</b>          | <b>Section</b> | <b>Reference</b>        |
|----------------|------------|----------------------|----------------|-------------------------|
|                |            |                      |                | 1970; Uehara et al.,    |
|                |            |                      |                | 1992                    |
| 3              |            | bisdemethoxycurcum   | FRh            | Uehara et al., 1992     |
|                |            | in                   |                |                         |
| 5              |            | 5'-methoxycurcumin   | DRh            | Masuda et al., 1992     |
| 11             |            | (E)-1,7-diphenyl-1-h | DRh            | Claeson et al., 1993    |
|                |            | epten-5-ol           |                |                         |
| 13             |            | (E)-7-(3,4-dihydroxy | DRh            | Suksamrarn et al., 1994 |
|                |            | phenyl)-5-hydroxy    |                |                         |
|                |            | -1-phenyl-1-hepte    |                |                         |
|                |            | ne                   |                |                         |
| 14             |            | (E)-5-hydroxy-7-(4-h | DRh            | Suksamrarn et al., 1994 |
|                |            | ydroxyphenyl)-1-p    |                |                         |
|                |            | henyl-1-heptene      |                |                         |
| 36             |            | (E)-7-hydroxy-1,7-bi | DRh            | Masuda et al., 1992     |
|                |            | s-(4-hydroxy-3-me    |                |                         |
|                |            | thoxyphenyl)-1-he    |                |                         |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                             | <b>Section</b> | <b>Reference</b>     |
|----------------|------------|---|----------------|----------------------|
|                |            | ptene-3,5-dione                         |                |                      |
| 36             |            | ( <i>E</i> )-7-hydroxy-1,7-bi           | DRh            | Uehara et al., 1987  |
|                |            | s-(4-hydroxy-3-me                       |                |                      |
|                |            | thoxyphenyl)-1-he                       |                |                      |
|                |            | ptene-3,5-dione                         |                |                      |
| 44             |            | (3 <i>S</i> ,5 <i>S</i> )-1,7-bis(4-hyd | DRh            | Uehara et al., 1987  |
|                |            | roxy-3-methoxyph                        |                |                      |
|                |            | enyl)-heptane-3,5-                      |                |                      |
|                |            | diol                                    |                |                      |
| 72             |            | (1 <i>E</i> ,3 <i>E</i> )-1,7-diphenyl  | DRh            | Claeson et al., 1993 |
|                |            | -1,3-heptadien-5-o                      |                |                      |
|                |            | 1                                       |                |                      |
| 73             |            | (1 <i>E</i> ,3 <i>E</i> )-1,7-diphenyl  | DRh            | Claeson et al., 1993 |
|                |            | -1,3-heptadien-5-o                      |                |                      |
|                |            | ne                                      |                |                      |
| 84             |            | 3,5-dihydroxy-1,7-bi                    | DRh            | Uehara et al., 1987  |
|                |            | s                                       |                |                      |

| <b>Species</b>    | <b>No.</b> | <b>Name</b>           | <b>Section</b> | <b>Reference</b>          |
|-------------------|------------|-----------------------|----------------|---------------------------|
| (4-hydroxy-3-meth |            |                       |                |                           |
|                   |            | oxyphenyl)-1,3-he     |                |                           |
|                   |            | ptadien-5-one         |                |                           |
| 93                |            | 3'-demethoxycyclocu   | DRx            | Yamada et al., 2009       |
|                   |            | rcumin                |                |                           |
| 108               |            | cinnamaldehyde        | DRh            | Claeson et al., 1993      |
| 123               |            | linalool              | FRh            | Jantan et al., 1999       |
| 124               |            | myrcene               | FRh            | Jantan et al., 1999       |
| 152               |            | $\alpha$ -terpinolene | Uk             | Yang et al., 1979         |
| 158               |            | $\beta$ -phellandrene | Uk             | Yang et al., 1979         |
| 159               |            | terpinen-4-ol         | FRh            | Jantan et al., 1999       |
| 168               |            | carvone               | FRh            | Jantan et al., 1999       |
| 171               |            | $\alpha$ -terpineol   | FRh            | Jantan et al., 1999       |
| 172               |            | limonene              | FRh            | Jantan et al., 1999       |
| 190               |            | borneol               | FRh            | Jantan et al., 1999       |
| 192               |            | isoborneol            | FRh            | Jantan et al., 1999       |
| 194               |            | camphor               | FRh            | Malingre, 1975; Jantan et |

| <b>Species</b> | <b>No.</b> | <b>Name</b>             | <b>Section</b> | <b>Reference</b>     |
|----------------|------------|-------------------------|----------------|----------------------|
|                |            |                         |                | al., 1999            |
|                | 195        | camphene hydrate        | FRh            | Jantan et al., 1999  |
|                | 205        | $\alpha$ -thujene       | FRh            | Jantan et al., 1999  |
|                | 212        | camphene                | FRh            | Jantan et al., 1999  |
|                | 215        | 1,8-cineole             | FRh            | Jantan et al., 1999  |
|                | 220        | $\alpha$ -pinene        | FRh            | Jantan et al., 1999  |
|                | 221        | $\beta$ -pinene         | FRh            | Jantan et al., 1999  |
|                | 230        | (E)- $\beta$ -farnesene | DRh            | Jantan et al., 1999  |
|                | 240        | $\beta$ -atlantone      | DRh            | Itokawa et al., 1985 |
|                | 242        | $\beta$ -bisabolene     | FRh            | Jantan et al., 1999  |
|                | 244        | $\beta$ -bisabolol      | DRh            | Park et al., 2014    |
|                | 245        | bisacurone              | DRh            | Uehara et al., 1989  |
|                | 246        | bisacurone A            | DRh            | Uehara et al., 1990  |
|                | 247        | bisacurone B            | DRh            | Uehara et al., 1990  |
|                | 248        | bisacurone C            | DRh            | Uehara et al., 1990  |
|                | 249        | bisacurol               | DRh            | Uehara et al., 1989  |
|                | 250        | bisacumol               | DRh            | Uehara et al., 1989  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                       | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|-----------------------------------|----------------|--|
|                | 251        | bisacurone epoxide                | DRh            | Uehara et al., 1990  |
|                | 254        | 1,3,5,10-bisabolapent<br>aen-9-ol | Uk             | Yang et al., 1979  |
|                | 264        | $\alpha$ -curcumene               | FRh,           | Itokawa et al., 1985;  |
|                |            |                                   | DRh            | Jantan et al., 1999  |
|                | 264        | $ar$ -curcumene                   | FRh            | Malingre, 1975   |
|                | 265        | $\beta$ -curcumene                | FRh,           | Malingre, 1975; Jantan et<br>al., 1999; Park et al.,<br>2014 |
|                | 267        | curlone                           | DRh            | Uehara et al., 1989  |
|                | 268        | turmerone                         | Uk             | Yang et al., 1979  |
|                | 269        | $ar$ -turmerone                   | DRh,           | Itokawa et al., 1985;<br>FRh      Uehara et al., 1992        |
|                | 270        | $\alpha$ -turmerone               | FRh            | Uehara et al., 1992; Jantan<br>et al., 1999                  |
|                | 271        | $\beta$ -turmerone                | FRh            | Uehara et al., 1992; Jantan<br>et al., 1999                  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>   |
|----------------|------------|---|----------------|--|
|                | 274a       | xanthorrhizol   | FRh            | Rimpler et al., 1970;<br>Malingre, 1975; John<br>and Rao, 1985; Jantan<br>et al., 1999 |
|                | 275        | zingiberene   | FRh            | Jantan et al., 1999  |
|                | 280        | $\beta$ -sesquiphellandrene                                 | FRh            | Uehara et al., 1992; Jantan<br>et al., 1999  |
|                | 292        | 13-hydroxyxanthorrh<br>izol                                 | DRh            | Park et al., 2014  |
|                | 293        | 12,13-epoxyxanthorr<br>hizol                                | DRh            | Park et al., 2014  |
|                | 298        | (7R,10R)-10,11-dihy<br>dro-10,11-dihydro<br>xyxanthorrhizol | DRh            | Park et al., 2014  |
|                |            | 3-o- $\beta$ -d-glucopyra<br>noside                         |                |  |
|                | 299        | (-)-curcuhydroquinon  | DRh            | Park et al., 2014  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                          | <b>Section</b> | <b>Reference</b>                              |
|----------------|------------|--------------------------------------|----------------|---|
|                |            | e                                    |                |   |
|                |            | 2,5-di-o- $\beta$ -d-glucopyranoside |                |   |
| 356            |            | curzerene                            | Uk             | Yang et al., 1979                             |
| 357            |            | curzerenone                          | FRh            | Uehara et al., 1992;<br>Claeson et al., 1993; |
|                |            |                                      |                | Jantan et al., 1999                           |
| 364            |            | $\beta$ -elemene                     | FRh            | Jantan et al., 1999                           |
| 365            |            | $\gamma$ -elemene                    | FRh            | Jantan et al., 1999                           |
| 366            |            | $\delta$ -elemene                    | FR             | Jantan et al., 1999                           |
| 427            |            | germacrone                           | FRh            | Uehara et al., 1992; Jantan<br>et al., 1999   |
| 491            |            | $\alpha$ -guaiene                    | FRh            | Jantan et al., 1999                           |
| 554            |            | $\beta$ -caryophyllene               | FRh            | Jantan et al., 1999                           |
| 555            |            | $\alpha$ -humulene                   | FRh            | Jantan et al., 1999                           |
| 556            |            | caryophyllene oxide                  | FRh            | Jantan et al., 1999                           |
| 568            |            | $\alpha$ -longifolene                | FRh            | Jantan et al., 1999                           |

| <b>Species</b>     | <b>No.</b> | <b>Name</b>  | <b>Section</b> | <b>Reference</b>                                 |
|--------------------|------------|--|----------------|--|
| <i>C. zedoaria</i> | 1          | curcumin   | DRh            | Kuroyanagi and Natori,<br>1970; Syu et al., 1998 |
|                    | 2          | demethoxycurcumin  | DRh            | Syu et al., 1998                                 |
|                    | 3          | bisdemethoxycurcum<br>in   | DRh            | Kuroyanagi and Natori,<br>1970; Syu et al., 1998 |
|                    | 84         | 3,5-dihydroxy-1,7-bi<br>s<br>(4-hydroxy-3-meth<br>oxyphenyl)-1,3-he<br>ptadien-5-one | DRh            | Matsuda et al., 2004                             |
|                    | 85         | (1E,4E,6E)-1,7-bis-(<br>4-hydroxyphenyl)-<br>1,4,6-heptatrien-3-<br>one              | DRh            | Jang et al., 2001                                |
|                    | 89         | tetrahydro-bis-demet<br>hoxycurcumin   | DRh            | Matsuda et al., 2004                             |
|                    | 90         | tetrahydrodemethoxy  | DRh            | Matsuda et al., 2004                             |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                       | <b>Section</b> | <b>Reference</b>                              |
|----------------|------------|-----------------------------------|----------------|---|
|                |            | curcumin                          |                |   |
|                | 107        | ethyl- <i>p</i> -methoxycinnamate | DRh            | Gupta et al., 1976; Joshi et al., 1989        |
|                | 122        | citronellol                       | FRh            | Singh et al., 2002                            |
|                | 123        | linalool                          | FRh            | Singh et al., 2002                            |
|                | 124        | myrcene                           | DRh, FR        | Singh et al., 2003b; Purkayastha et al., 2006 |
|                | 125        | nerol                             | FRh            | Singh et al., 2002                            |
|                | 126        | (E)- $\beta$ -ocimene             | FRh            | Singh et al., 2002; Purkayastha et al., 2006  |
|                | 127        | (Z)- $\beta$ -ocimene             | FRh            | Singh et al., 2002; Purkayastha et al., 2006  |
|                | 146        | <i>p</i> -cymene                  | FRh            | Singh et al., 2002                            |
|                | 147        | <i>p</i> -cymene-8-ol             | FRh            | Singh et al., 2002                            |
|                | 152        | $\alpha$ -terpinolene             | FRh            | Singh et al., 2002                            |
|                | 153        | $\alpha$ -terpinene               | Rh             | Singh et al., 2002; Singh et al., 2003b       |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                           | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|---------------------------------------|----------------|---|
|                | 155        | $\gamma$ -terpinene                   | FRh            | Singh et al., 2002  |
|                | 156        | terpinolene<br>( $\delta$ -terpinene) | FRh            | Singh et al., 2002  |
|                | 157        | <i>d</i> -sabinene                    | FRh            | Singh et al., 2002;<br>Purkayastha et al., 2006             |
|                | 158        | $\beta$ -phellandrene                 | FRh            | Singh et al., 2002  |
|                | 159        | terpinen-4-ol                         | FRh            | Singh et al., 2002;<br>Purkayastha et al., 2006             |
|                | 171        | $\alpha$ -terpineol                   | DRh,<br>FRh    | Mau et al., 2003;<br>Purkayastha et al., 2006               |
|                | 172        | limonene                              | FRh            | Purkayastha et al., 2006                                    |
|                | 180        | <i>cis</i> -linalool oxide            |                | Singh et al., 2002  |
|                | 189        | $\alpha$ -phellandrene                | Rh             | Singh et al., 2003b   |
|                | 190        | borneol                               | Lf, FRh        | Behura and Srivastava,<br>2004; Purkayastha et<br>al., 2006 |
|                | 192        | isoborneol                            | FRh            | Le et al., 2004;  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>          | <b>Section</b> | <b>Reference</b>           |
|----------------|------------|----------------------|----------------|----------------------------|
|                |            |                      |                | Purkayastha et al., 2006   |
|                | 194        | camphor              | DRh,           | Purkayastha et al., 2006   |
|                |            |                      | FRh            |                            |
|                | 195        | camphene hydrate     | FRh            | Purkayastha et al., 2006   |
|                | 201        | $\beta$ -3-carene    | FRh            | Singh et al., 2002; Singh  |
|                |            |                      |                | et al., 2003b              |
|                | 205        | $\alpha$ -thujene    | Rh             | Singh et al., 2002; Singh  |
|                |            |                      |                | et al., 2003b              |
|                | 209        | cis-sabinene hydrate | Rh             | Singh et al., 2002         |
|                | 212        | camphene             | DRh,           | Mau et al., 2003;          |
|                |            |                      | FRh            | Purkayastha et al., 2006   |
|                | 215        | 1, 8-cineole         | Lf ,           | Singh et al., 2002; Mau et |
|                |            |                      | DRh            | al., 2003; Behura and      |
|                |            |                      |                | Srivastava, 2004           |
|                | 220        | $\alpha$ -pinene     | FRh,           | Singh et al., 2002; Mau et |
|                |            |                      | DRh            | al., 2003                  |
|                | 221        | $\beta$ -pinene      | DRh            | Singh et al., 2002; Mau et |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                     | <b>Section</b> | <b>Reference</b>         |
|----------------|------------|---------------------------------|----------------|--------------------------|
|                |            |                                 |                | al., 2003                |
|                | 229        | (2e,6e)-farnesol                | DRh            | Mau et al., 2003         |
|                | 230        | (E)- $\beta$ -farnesene         | DRh            | Mau et al., 2003         |
|                | 242        | $\beta$ -bisabolene             | DRh            | Mau et al., 2003         |
|                | 245        | bisacurone                      | DRh            | Matsuda et al., 2001a    |
|                | 250        | bisacumol                       | DRh            | Matsuda et al., 2001a    |
|                | 252        | 1,10-bisaboladiene-3,<br>4-diol | Rh             | Ohshiro et al., 1990     |
|                | 264        | $\alpha$ -curcumene             | DRh            | Mau et al., 2003         |
|                | 269        | <i>ar</i> -turmerone            | DRh            | Hong et al., 2001        |
|                | 271        | $\beta$ -turmerone              | DRh            | Hong et al., 2001        |
|                | 275        | zingiberene                     | DRh,           | Mau et al., 2003;        |
|                |            |                                 | FRh            | Purkayastha et al., 2006 |
|                | 320        | $\alpha$ -calacorene            | DR             | Mau et al., 2003         |
|                | 333        | Comosone II                     | DRh            | Ahmed et al., 2014       |
|                | 334        | $\alpha$ -cadinol               | DRh            | Mau et al., 2003         |
|                | 335        | curzeone                        | DRh            | Shiobara et al., 1986    |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|----------------------------|----------------|---|
|                | 336        | pyrocurzerenone            | DRh            | Hikino et al., 1975   |
|                | 345        | curcarabranol A            | DRh            | Matsuda et al., 2001a   |
|                | 346        | curcarabranol B            | DRh            | Matsuda et al., 2001a   |
|                | 347        | curcumenone                | DRh            | Shiobara et al., 1985;<br>Makabe et al., 2006                         |
|                | 348        | 4S-dihydrocurcumen<br>one  | DRh            | Matsuda et al., 2001a   |
|                | 352        | curcumadione               | DRh            | Matsuda et al., 2001a   |
|                | 356        | curzerene                  | DRh,<br>FRh    | Hikino et al., 1970; Mau et<br>al., 2003; Purkayastha<br>et al., 2006 |
|                | 357        | curzerenone                | DRh            | Fukushima et al., 1970;<br>Matsuda et al., 2001a                      |
|                | 358        | 5- <i>epi</i> -curzerenone | DRh            | Fukushima et al., 1968;<br>Hikino et al., 1975;<br>Mau et al., 2003   |
|                | 363        | $\beta$ -elemenone         | DRh,           | Mau et al., 2003;   |

| <b>Species</b> | <b>No.</b>            | <b>Name</b> | <b>Section</b>           | <b>Reference</b>         |
|----------------|-----------------------|-------------|--------------------------|--------------------------|
|                |                       |             | FRh                      | Purkayastha et al., 2006 |
| 364            | $\beta$ -elemene      | DRh,        | Mau et al., 2003;        |                          |
|                |                       |             | FRh                      | Purkayastha et al., 2006 |
| 365            | $\gamma$ -elemene     | DRh,        | Mau et al., 2003;        |                          |
|                |                       |             | FRh                      | Purkayastha et al., 2006 |
| 366            | $\delta$ -elemene     | FRh         | Purkayastha et al., 2006 |                          |
| 367            | elemol                | DRh         | Mau et al., 2003         |                          |
| 368            | $\beta$ -dictyopetrol | DRh         | Matsuda et al., 2001a    |                          |
| 369            | $\beta$ -eudesmol     | DRh,        | Phan et al., 1997        |                          |
|                |                       |             | FRh                      |                          |
| 370            | $\alpha$ -selinene    | DRh         | Mau et al., 2003         |                          |
| 371            | $\beta$ -selinene     | DRh,        | Mau et al., 2003;        |                          |
|                |                       |             | FRh                      | Purkayastha et al., 2006 |
| 385            | $\gamma$ -eudesmol    | FRh         | Purkayastha et al., 2006 |                          |
| 393            | curcolonol            | DRx         | Syu et al., 1998         |                          |
| 394            | curcolone             | DRh         | Hikino et al., 1968c     |                          |
| 395            | 1,4-dihydroxyfurano   | DRx         | Syu et al., 1998         |                          |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                       | <b>Section</b> | <b>Reference</b>  |
|----------------|------------|-----------------------------------|----------------|---|
|                |            | eremophilan-6-one                 |                |   |
| 408            |            | curcuzederone                     | DRh            | Eun et al., 2010  |
| 409            |            | germacrene D                      | FRh            | Purkayastha et al., 2006  |
| 423            |            | curdione                          | DRh            | Hikino et al., 1967; Mau et al., 2003                           |
| 424            |            | dehydrocurdione                   | DRh            | Hikino et al., 1972; Matsuda et al., 2001a; Makabe et al., 2006 |
| 427            |            | germacrone                        | DRh, FRh       | Zhao et al., 1991; Purkayastha et al., 2006                     |
| 429            |            | germacrene B                      | DRh, FRh       | Mau et al., 2003; Purkayastha et al., 2006                      |
| 431            |            | (4S,5S)-germacrone<br>4,5-epoxide | DRh            | Yoshihara et al., 1984; Matsuda et al., 2001a                   |
| 433            |            | 13-hydroxygermacro<br>ne          | DRh            | Shiobara et al., 1986; Makabe et al., 2006                      |
| 434            |            | neocurdione                       | FRh,           | Matsuda et al., 2001a;  |

| <b>Species</b> | <b>No.</b>   | <b>Name</b>          | <b>Section</b> | <b>Reference</b>                          |
|----------------|--|----------------------|----------------|---|
|                |  |                      | DRh            | Etoh et al., 2003                         |
| 440            | germacrone-1,10-epo                                      | xide                 | DRh            | Ahmed et al., 2014                        |
| 445            | (E)-3,10-dimethyl-6-methylene-5,6,7,8-tetrahydrocyclodec | a[b]furan-4(11H)-one | DRh            | Makabe et al., 2006                       |
| 448            | furanodiene  |                      | DRh            | Hikino et al., 1968a; Hikino et al., 1970 |
| 449            | furanodienone  |                      | DRh            | Hikino et al., 1969b; Hikino et al., 1975 |
| 450            | furanogermenone  |                      | DR             | Shibuya et al., 1982                      |
| 451            | glechomanolide   |                      | DRh            | Matsuda et al., 2001a                     |
| 452            | isofuranodienone   |                      | DRh            | Hikino et al., 1969b; Hikino et al., 1975 |
| 454            | zederone   |                      | DRh            | Hikino et al., 1966b;                     |

| Species | No. | Name                         | Section | Reference                                      |
|---------|-----|------------------------------|---------|--|
|         |     |                              |         | Hikino et al., 1968e;                          |
|         |     |                              |         | Hikino et al., 1971b;                          |
|         |     |                              |         | Shibuya et al., 1987                           |
|         | 463 | aerugidiol                   | DRh     | Masuda et al., 1991                            |
|         | 464 | alismoxide                   | DRh     | Matsuda et al., 2001a                          |
|         | 465 | curcumol                     | DRh     | Hikino et al., 1965; Hikino<br>et al., 1966a   |
|         | 466 | curcumenol                   | DRh     | Hikino et al., 1968b;<br>Matsuda et al., 2001a |
|         | 468 | 4- <i>epi</i> -curcumenol    | DRh     | Matsuda et al., 2001a                          |
|         | 469 | isocurcumenol                | DRh     | Hikino et al., 1969a;<br>Matsuda et al., 2001a |
|         | 471 | neocurcumenol                | DRh     | Matsuda et al., 2001a                          |
|         | 474 | <i>curcumadiol</i>           | DRh     | Hikino et al., 1971a                           |
|         | 475 | procurcumenol                | DRh     | Hikino et al., 1968d; Jang<br>et al., 2001     |
|         | 476 | 1- <i>epi</i> -procurcumenol | DRh     | Jang et al., 2001                              |

| <b>Species</b> | <b>No.</b> | <b>Name</b>   | <b>Section</b> | <b>Reference</b>       |
|----------------|------------|---|----------------|------------------------|
|                | 478        | isoprocurcumenol  | FRh,           | Matsuda et al., 2001a; |
|                |            |   | DRh            | Etoh et al., 2003;     |
|                |            |   |                | Ahmed et al., 2014     |
|                | 479        | 9-oxo-neoprocurcum<br>enol  | FRh            | Etoh et al., 2003      |
|                | 481        | 4-hydroxy-7(11),10(14)-guaiadien-8-one                            | Uk             | Yang et al., 1979      |
|                | 482        | 7 $\alpha$ ,11 $\alpha$ -epoxy-5 $\beta$ -hydroxy-9-guaiaen-8-one | Rh             | Matsuda et al., 2001a  |
|                | 483        | (1S,4S,5S,10R)-zedoarondiol                                       | Rh             | Matsuda et al., 2001a; |
|                |            |   |                | Makabe et al., 2006    |
|                | 484        | isozedoarondiol   | DRh            | Matsuda et al., 2001a  |
|                | 509        | (1R,4R,5S,10S)-zedoalactone B                                     | Bark,          | Matsuda et al., 2001a; |
|                |            |   | DRh            | Kasahara et al., 2005  |
|                | 513        | zedoalactone A  | Bark           | Kasahara et al., 2005  |

| <b>Species</b> | <b>No.</b> | <b>Name</b>            | <b>Section</b> | <b>Reference</b>                                |
|----------------|------------|------------------------|----------------|---|
|                | 516        | zedoarolide B          | DRh            | Matsuda et al., 2001a                           |
|                | 518        | zedoalactone C         | Bark           | Kasahara et al., 2005                           |
|                | 523        | zedoarolide A          | DRh            | Matsuda et al., 2001a                           |
|                | 526        | gweicurculactone       | DRh            | Ahmed et al., 2014                              |
|                | 528        | zedoarol               | DRh            | Shiobara et al., 1986                           |
|                | 532        | curcuzedoalide         | DRh            | Park et al., 2012a                              |
|                | 536        | spathulenol            | DRh            | Mau et al., 2003                                |
|                | 537        | isospathulenol         | DRh            | Mau et al., 2003                                |
|                | 549        | calarene               | DRh            | Mau et al., 2003                                |
|                | 554        | $\beta$ -caryophyllene | FRh            | Singh et al., 2002;<br>Purkayastha et al., 2006 |
|                | 555        | $\alpha$ -humulene     | DRh,<br>FRh    | Phan et al., 1998;<br>Purkayastha et al., 2006  |
|                | 556        | caryophyllene oxide    | FRh            | Phan et al., 1997                               |
|                | 565        | $\beta$ -himachalene   | DRh            | Mau et al., 2003                                |
|                | 579        | curcumenolactone A     | DRh            | Matsuda et al., 2001a                           |
|                | 580        | curcumenolactone B     | DRh            | Matsuda et al., 2001a                           |

| <b>Species</b> | <b>No.</b> | <b>Name</b>                  | <b>Section</b> | <b>Reference</b>                         |
|----------------|------------|------------------------------|----------------|--|
|                | 581        | curcumenolactone C           | DRh            | Matsuda et al., 2001a                    |
|                | 585        | <i>curcumanolide A</i>       | DRh            | Shiobara et al., 1985                    |
|                | 586        | <i>curcumanolides B</i>      | DRh            | Shiobara et al., 1985                    |
|                | 589        | gajutsulactone A             | DRh            | Matsuda et al., 2001a                    |
|                | 590        | gajutsulactone B             | DRh            | Matsuda et al., 2001a                    |
|                | 596        | humulene-8-hydrope<br>roxide | DRh            | Giang, 2003                              |
|                | 597        | zerumbone-2,3-epoxi<br>de    | DRh            | Phan et al., 1998; Ahmed<br>et al., 2014 |
|                | 598        | zerumbone                    | FRh,           | Phan et al., 1997, 1998                  |
|                |            |                              | DRh            |  |
|                | 599        | humulene epoxide II          | FRh            | Phan et al., 1997                        |
|                | 600        | humulene epoxide I           | FRh            | Phan et al., 1997                        |
|                | 601        | humulene epoxide III         | FRh            | Phan et al., 1997                        |
|                | 613        | zerumin A                    | DRh            | Ahmed et al., 2014                       |
|                | 615        | calcaratarin A               | DRh            | Ahmed et al., 2014                       |
|                | 621        | 5S,9S,10S,15R-(-)-cu         | DRh            | Park et al., 2012a                       |

| <b>Species</b>        | <b>No.</b> | <b>Name</b>          | <b>Section</b> | <b>Reference</b>    |
|-----------------------|------------|----------------------|----------------|---------------------|
|                       |            | rcuminol D           |                |                     |
|                       | 660        | naringenin           | DRh            | Eun et al., 2010    |
|                       | 674        | 3,7-dimethyl-5-indan | DRx            | Syu et al., 1998    |
|                       |            | ecarboxylic acid     |                |                     |
|                       | 690        | labda-8(17),12       | DRh            | Ahmed et al., 2014  |
|                       |            | diene-15,16 dial     |                |                     |
| <i>C. zedoaroides</i> | 616        | labdane dialdehyde   | DRh            | Salama et al., 2012 |

DR, dried radix; DRh, dried rhizome; FR, fresh radix; FRh, fresh rhizome; Lf, leaf; Fl, flower; Uk, unknown parts; (D)Ap, dried aerial parts; (D)Ugp, dried under ground parts; \*, strutures have been identified incompletely.

**Table 2** Biological Activity of Various *Curcuma* Extracts

| <b>Plant</b>         | <b>Extraction part</b> | <b>Bioactivity</b> | <b>Reference</b>                                    |
|----------------------|------------------------|--------------------|---|
| <i>C. aeruginosa</i> | Aq. ext.               | anti-oxidan<br>t   | Wan-Ibrahim et al., 2010                            |
|                      | Aq. ext.               | anti-inflammation  | Angel et al., 2013                                  |
|                      | CHCl <sub>3</sub> ext. | anti-proliferation | Sukari et al., 2007b                                |
|                      | MeOH ext.              | anti-proliferation | Sukari et al., 2007b                                |
|                      | PE ext.                | anti-proliferation | Sukari et al., 2007b                                |
|                      | MeOH ext.              | anti-oxidant       | Akter et al., 2010                                  |
| <i>C. amada</i>      | Aq. ext.               | anti-oxidant       | Gacche et al., 2010;<br>Venugopalan et al.,<br>2014 |
|                      | Aq. ext.               | anti-inflammation  | Angel et al., 2013                                  |
|                      | EO                     | fungicidal         | Ghosh et al., 1980                                  |
|                      | MeOH ext.              | anti-oxidant       | Prakash et al., 2007;<br>George et al., 2013        |

| <b>Plant</b>        | <b>Extraction<br/>part</b> | <b>Bioactivity</b>                | <b>Reference</b>   |
|---------------------|----------------------------|-----------------------------------|--|
|                     |                            |                                   |  |
| <i>C. aromatica</i> | n-hexane ext.              | anti-hypercholesterolemic         | Pachauri and Mukherjee,<br>1970; Kim et al.,<br>2008; Srinivasan et<br>al., 2008 |
|                     | 70% EtOH ext.              | anti-Helicobacter pylori activity | Zaidi et al., 2009   |
|                     | EO                         | antimicrobial                     | Rao and Nigam, 1970;<br>Ghosh et al., 1980                                       |
|                     | MeOH ext.                  | hepatoprotective                  | Sivapraksha et al., 2012   |
|                     | MeOH ext.                  | anti-Alzheimer                    | Kim et al., 2007b  |
|                     | Aq. Ext.                   | NO inhibition                     | Baliga et al., 2003  |
|                     | EO                         | anti-oxidant                      | Al-Reza et al., 2010   |
|                     | Aq. ext.                   | anti-proliferation                | Hu et al., 2011  |
|                     | Aq. ext.                   | anti-oxidant                      | Lee et al., 2007   |
|                     | Aq. ext.                   | anti-inflammation                 | Angel et al., 2013   |
|                     | EA ext.                    | insecticidal                      | Madhu et al., 2010   |

| <b>Plant</b>     | <b>Extraction</b>         |                     | <b>Reference</b>             |
|------------------|---------------------------|---------------------|------------------------------|
|                  | <b>part</b>               | <b>Bioactivity</b>  |                              |
| <i>C. sativa</i> | EA ext.                   | anti-inflammation   | Sudharshan et al., 2010      |
|                  | EO                        | anti-proliferation  | Wu et al., 2000              |
|                  | EO                        | chemoprotective     | Li et al., 2009c             |
|                  | EO                        | hypoglycemic        | Hong et al., 2006            |
|                  | EO                        | hepatoprotective    | Jiang et al., 2005           |
|                  | EO                        | antifungal          | Singh et al., 2004           |
|                  | EtOH ext.                 | anti-oxidant        | Lee et al., 2007             |
|                  | EtOH ext.                 | antitussive         | Marina et al., 2008          |
|                  | polyxyloses ext.          | cytotoxicity        | Niyomploy et al., 2010       |
|                  | EtOH ext.                 | anti-oxidant        | Panich et al., 2010          |
| <i>C. brog</i>   | Aq. ext.                  | anti-inflammation   | Angel et al., 2013           |
| <i>C. caesia</i> | Aq. ext.                  | anti-inflammation   | Angel et al., 2013           |
| <i>C. sativa</i> | Enzymic and<br>crude ext. | anti-oxidant        | Dhal et al., 2012            |
|                  | EtOH ext.                 | antiemetic activity | Mohtasheemul et al.,<br>2012 |

| Extraction       |                     | Bioactivity               | Reference  |
|------------------|---------------------|---------------------------|--|
| Plant            | part                |                           |  |
|                  | hydroalcoholic ext. | hypolipidemic             | Ramirez et al., 2000                                     |
|                  | EO                  | fungicidal                | Banerjee and Nigam, 1976                                 |
|                  | EO                  | antimicrobial             | Banerjee and Nigam, 1976                                 |
|                  | EtOH ext.           | antiemetic activity       | Mohtasheemul et al., 2012                                |
| <i>C. comosa</i> | Aq. ext.            | anti-oxidant              | Boonmee et al., 2011                                     |
|                  | Butanol and EA ext. | cholagogic                | Piyachaturawat et al., 1996                              |
|                  | EA ext.             | anti-hypercholesterolemic | Piyachaturawat et al., 1999                              |
|                  | EA ext.             | hypolipidemic             | Piyachaturawat et al., 1997; Piyachaturawat et al., 1999 |

| <b>Plant</b>        | <b>Extraction</b>    |                     | <b>Reference</b>  |
|---------------------|----------------------|---------------------|---|
|                     | <b>part</b>          | <b>Bioactivity</b>  |   |
|                     | EtOH ext.            | nephroprotective    | Jariyawat et al., 2009  |
|                     | hexane ext.          | anti-Alzheimer      | Su et al., 2010   |
|                     | hexane ext.          | anti-diabates       | Prasannarong et al.,<br>2012  |
|                     | Hexane ext.          | hepatoprotective    | Weerachayaphorn et al.,<br>2010   |
|                     | Hexane ext.          | anti-arthritis      | Weerachayaphorn et al.,<br>2011   |
|                     |                      |                     | Winuthayanon et al.,<br>2009b; Su et al., 2013;                             |
|                     | Diarylheptanoid<br>s | estrogenic activity | Tantikanlayaporn et<br>al., 2013a;<br><br>Tantikanlayaporn et<br>al., 2013b |
| <i>C. domestica</i> | Aq. ext.             | anti-ulcerogenic    | Mutmainah et al., 2014  |
|                     | Aq. ext.             | anti-oxidant        | Saputri and Jantan, 2011  |

| <b>Plant</b>           | <b>Extraction</b> |   | <b>Reference</b>             |
|------------------------|-------------------|---|------------------------------|
|                        | <b>part</b>       | <b>Bioactivity</b>                        |                              |
|                        | crude powder      | hypolipidemic                             | Ahmad-Raus et al., 2001      |
|                        | EtOH ext.         | anti-arthritis                            | Kuptniratsaikul et al., 2009 |
|                        | EtOH ext.         | antifungal                                | Mohamed et al., 1996         |
|                        | MeOH ext.         | anti-oxidant                              | Chen et al., 2008            |
|                        | powdered rhizome  | hypolipidemic                             | Ahmad-Raus et al., 2001      |
| <i>C. haritha</i>      | Aq. ext.          | anti-oxidant                              | Rajan et al., 2014           |
|                        | EO                | antimicrobial                             | Umesh et al., 2003           |
| <i>C. kwangsiensis</i> | polysaccharides   | anti-proliferation                        | Zeng et al., 2012            |
|                        | polysaccharides   | hypolipidemic                             | Xu et al., 2009              |
|                        |                   | GABAA receptor                            |                              |
|                        | EA ext.           | of the $\alpha 1\beta 2\gamma 2S$ subtype | Schramm et al., 2013         |
|                        | EO                | antifungal                                | Zhang et al., 2008a          |
|                        | EtOH ext.         | hepatoprotective                          | Xiang et al., 1989           |

| <b>Plant</b>    | <b>Extraction</b> |                           | <b>Reference</b>   |
|-----------------|-------------------|---------------------------|--|
|                 | <b>part</b>       | <b>Bioactivity</b>        |  |
| <i>C. longa</i> | 80% MeOH ext.     | urease inhibitor          | Biglar et al., 2014  |
|                 | Aq. ext.          | anti-oxidant              | Vankar, 2008; Manda et al., 2009; Dinesha et al., 2010; Ramadas and Srinivas, 2011 |
|                 | Aq. ext.          | hypoglycemic              | Mohankumar and McFarlane, 2011   |
|                 | Aq. ext.          | antimutagenic             | Azuine et al., 1992  |
|                 | Aq. ext.          | anti-atherosclerosis      | Jin et al., 2011   |
|                 | Aq. ext.          | hypolipidemic             | Jin et al., 2011   |
|                 | Aq. ext.          | cardiovascular protective | Zhang et al., 1999   |
|                 | Aq. ext.          |                           | Rafatullah et al., 1990;   |
|                 | Aq. ext.          | anti-ulcerogenic          | Sumanth and Vakili, 2012   |

| <b>Plant</b> | <b>Extraction<br/>part</b> | <b>Bioactivity</b>  | <b>Reference</b>       |
|--------------|----------------------------|---------------------|------------------------|
|              |                            |                     | Adhvaryu et al., 2007; |
|              |                            |                     | Yamamoto et al.,       |
|              | Aq. ext.                   | hepatoprotective    | 2009; Kim et al.,      |
|              |                            |                     | 2011; Sengupta et al., |
|              |                            |                     | 2011                   |
|              | Aq. ext.                   | antiviral           | Kim et al., 2009       |
|              | Aq. ext.                   | immunomodulating    | Al-Taee et al., 2001   |
|              |                            |                     | Cherdchu et al., 1978; |
|              |                            | neurotoxin-inhibito |                        |
|              | Aq. ext.                   |                     | Ratanabanangkoon et    |
|              |                            | r                   |                        |
|              |                            |                     | al., 1993              |
|              |                            |                     | Agarwal et al., 2013;  |
|              | Aq. ext.                   | anti-inflammation   | Chandrasekaran et al., |
|              |                            |                     | 2013                   |
|              | Aq. ext.                   | anti-depressant     | Yu et al., 2002        |
|              | Aq. ext.                   | anti-inflammation   | Madan et al., 2001     |
|              | Benzene extract            | insecticidal        | Chander H, 1991        |

| <b>Plant</b> | <b>Extraction<br/>part</b> | <b>Bioactivity</b>          | <b>Reference</b>                            |
|--------------|----------------------------|-----------------------------|---|
|              | Butanol ext.               | immunomodulating            | Liu et al., 2014b                           |
|              | crude ext.                 | calcium channel blocker     | Gilani et al., 2005                         |
|              | curcuminoid                |                             |   |
|              | crude ext.                 | immunomodulating            | Abu-Rizq et al., 2008                       |
|              | Curcuminoids               | anti-diabates               | Na et al., 2013                             |
|              | Diarylheptanoid            |                             |   |
|              | s                          | hepatoprotective            | Song et al., 2001                           |
|              | EtOH ext.                  | anti-oxidant                | Prakash et al., 2007;<br>Idris et al., 2008 |
|              | DMSO ext.                  | radioprotection             | Pal and Pal, 2005                           |
|              | EA ext.                    | anti-invasion and migration | Rao et al., 2012                            |
|              | EA ext.                    | anti-allergic               | Yano et al., 2000a; Yano et al., 2000b      |

| <b>Plant</b> | <b>Extraction<br/>part</b> | <b>Bioactivity</b>                        | <b>Reference</b>                            |
|--------------|----------------------------|---|---|
|              |                            |   | Manosroi et al., 2006;                      |
| EO           |                            | anti-proliferation                        | Jacob and Toloue,<br>2013; Yan et al., 2013 |
| EO           |                            | insecticidal                              | Thavara et al., 2007                        |
| EO           |                            | anti-oxidant                              | Singh et al., 2010; Liju<br>et al., 2011    |
| EO           |                            | hypoglycemic<br>$\alpha$ -glucosidase and | Honda et al., 2006                          |
| EO           |                            | $\alpha$ -amylase<br>inhibitors           | Lekshmi et al., 2012                        |
| EO           |                            | hypolipidemic                             | Hayashi, 2014                               |
| EO           |                            | anti-ulcerogenic                          | Liju et al., 2014                           |
| EO           |                            | cholagogic                                | Takahashi and et, 1957                      |

| <b>Plant</b> | <b>Extraction</b> | <b>Bioactivity</b> | <b>Reference</b>                          |
|--------------|-------------------|--------------------|---|
|              | <b>part</b>       |                    |   |
|              |                   |                    | Sawada et al., 1971;                      |
|              |                   |                    | Apisariyakul et al.,                      |
|              |                   |                    | 1995; Behura et al.,                      |
| EO           |                   | fungicidal         | 2000; Singh et al.,                       |
|              |                   |                    | 2002; Li et al., 2009c;                   |
|              |                   |                    | Pandey et al., 2010                       |
| EO           |                   | antiviral          | Wang, 1958                                |
| EO           |                   | antimicrobial      | Garg and Jain, 2003                       |
| EO           |                   | anti-inflammation  | Iyengar et al., 1994                      |
| EtOH ext.    |                   | anti-depressant    | Xia et al., 2006b                         |
| EtOH ext.    |                   | NO inhibitor       | Chakravarty and Yasmin, 2008              |
| Ether ext.   |                   | insecticidal       | Murugan and Jeyabalan, 1999; Ding W, 2003 |
| Ether ext.   |                   | fungicidal         | Thakur et al., 1987                       |
| Ether ext.   |                   | antimicrobial      | Thakur et al., 1987                       |

| <b>Plant</b> | <b>Extraction</b> | <b>Bioactivity</b>     | <b>Reference</b>                          |
|--------------|-------------------|------------------------|---|
|              | <b>part</b>       |                        |   |
|              |                   |                        | Chakravarty and Yasmin, 2005              |
|              | EtOH ext.         | anti-proliferation     |   |
|              |                   |                        | Murugan and Jeyabalan, 1999; Ding W, 2003 |
|              | EtOH ext.         | insecticidal           |   |
|              |                   |                        | Dohare et al., 2008                       |
|              | EtOH ext.         | anti-cerebral ischemia |   |
|              |                   |                        | Ahn et al., 2012                          |
|              | EtOH ext.         | anti-oxidant           |   |
|              |                   |                        | Kuroda et al., 2005; Kalekar et al., 2013 |
|              | EtOH ext.         | hypoglycemic           |   |
|              |                   |                        | El-Sweedy et al., 2007;                   |
|              | EtOH ext.         | anti-obesity           |   |
|              |                   |                        | Ho et al., 2012; Ho et al., 2013          |
|              | EtOH ext.         | hypolipidemic          |   |
|              |                   |                        | Kam et al., 2012; Qinna et al., 2012      |

| <b>Plant</b>   | <b>Extraction<br/>part</b> | <b>Bioactivity</b>           | <b>Reference</b>                 |
|----------------|----------------------------|------------------------------|----------------------------------|
|                |                            |                              | El-Sweedy et al., 2007;          |
|                | EtOH ext.                  | anti-obesity                 | Ho et al., 2012; Ho et al., 2013 |
|                | EtOH ext.                  | cardiovascular protective    | Ramirez-Tortosa et al., 1999     |
|                | EtOH ext.                  | calcium channel blocker      | Bleu et al., 2011                |
|                | EtOH ext.                  | hepatoprotective             | Salama et al., 2013              |
|                | EtOH ext.                  | nephroprotective             | Ravipati et al., 2012            |
|                | EtOH ext.                  | antimicrobial                | Chauhan et al., 2003             |
|                | EtOH ext.                  | anti-allergic                | Bak et al., 2011                 |
| Hexane ext.    | hepatoprotective           | Weerachayaphorn et al., 2010 |                                  |
| hydroethanolic | immunomodulating           | Krasovsky et al., 2009       |                                  |

| <b>Plant</b> | <b>Extraction</b> | <b>Bioactivity</b>          | <b>Reference</b>                                   |
|--------------|-------------------|-----------------------------|--|
|              | <b>part</b>       |                             |  |
|              |                   | pancreatic                  |  |
|              | isopropanol ext.  | $\alpha$ -amylase inhibitor | Ponnusamy et al., 2011                             |
|              | MeOH and PE ext.  | anti-gout activity          | Mohamed and Al-Okbi, 2008                          |
|              | MeOH ext.         | anti-proliferation          | Atjanasuppat et al., 2009<br>Prakash et al., 2007; |
|              |                   |                             | Surveswaran et al.,                                |
|              | MeOH ext.         | anti-oxidant                | 2007; Chan et al.,<br>2008; Chen et al.,<br>2008   |
|              |                   |                             | Lee et al., 2010; Rai et                           |
|              | MeOH ext.         | hypoglycemic                | al., 2010; Ahmad et<br>al., 2014                   |

| <b>Plant</b> | <b>Extraction<br/>part</b> | <b>Bioactivity</b>           | <b>Reference</b>                               |
|--------------|----------------------------|------------------------------|--|
|              |                            |                              | Lee and Jun, 2009;                             |
|              | MeOH ext.                  | anti-obesity                 | Yuliana et al., 2011;                          |
|              |                            |                              | Park et al., 2013                              |
|              |                            | cardiovascular               |  |
|              | MeOH ext.                  | protective                   | Adaramoye et al., 2009                         |
|              |                            |                              |  |
|              | MeOH ext.                  | antimicrobial                | Mazumder et al., 2000                          |
|              |                            | excitant or                  |  |
|              | multi-ext.                 | antagonist of                | Xiao et al., 2002                              |
|              |                            | gastrin receptor             |  |
|              | olive oil ext.             | Anti-arthritis               | Taty et al., 2011                              |
|              |                            |                              |  |
|              | PE ext.                    | Insecticidal                 | Su et al., 1982; Jilani,<br>1983; Jilani, 1988 |
|              |                            |                              |  |
|              | polyphenolic<br>compounds  | cardiovascular<br>protective | El-Sayed et al., 2011                          |
|              |                            |                              |  |
|              | polysaccharides            | immunomodulating             | Yue et al., 2010a                              |

| <b>Extraction</b> |                  | <b>Bioactivity</b>             | <b>Reference</b>                          |
|-------------------|------------------|--------------------------------|---|
| <b>Plant</b>      | <b>part</b>      |                                |   |
|                   | powdered         | anti-inflammation              | Ghalaut et al., 2012                      |
|                   | rhizome          |                                |   |
|                   | powdered         | nephroprotective               | Abd El-Ghany et al., 2012                 |
|                   | rhizome          |                                |   |
|                   | sesquiterpenoids | hepatoprotective               | Lee et al., 2002a; Miyakoshi et al., 2004 |
|                   | sesquiterpenoids | antioxidant                    | Li et al., 2014b                          |
|                   | sesquiterpenoids | anti-inflammatory              | Li et al., 2014b                          |
|                   | sesquiterpenoids | anti-carcinogenic              | Li et al., 2014b                          |
|                   | starch           | anti-Candida albicans activity | Ahmed et al., 2013                        |
|                   | unknown ext.     | anti-arthritis                 | Funk et al., 2006                         |
|                   | unknown ext.     | anti-inflammation              | Aldini et al., 2012                       |
|                   | unknown ext.     | hypolipidemic                  | Kam et al., 2012                          |
|                   | EtOH ext.        | anti-oxidant                   | Mohd Nor et al., 2009; Jung et al., 2012  |

| <b>Plant</b>         | <b>Extraction</b>                 |                              | <b>Reference</b>                    |
|----------------------|-----------------------------------|------------------------------|-------------------------------------|
|                      | <b>part</b>                       | <b>Bioactivity</b>           |                                     |
| <i>C. malabarica</i> | Aq. ext.                          | anti-inflammation            | Angel et al., 2013                  |
| <i>C. manga</i>      | EtOH ext.                         | antifungal                   | Mohamed et al., 1996                |
|                      | unknown ext.                      | anti-analgesic               | Ruangsang et al., 2010              |
|                      | Aq. ext.                          | inhibit platelet aggregation | Purwanto et al., 2005               |
|                      | Aq. ext.                          |                              | Tewtrakul and Subhadhirasakul, 2007 |
|                      | Aq. ext.                          | anti-allergic                |                                     |
|                      | DLBS4847                          | anti-oxidant                 | Wan-Ibrahim et al., 2010            |
|                      | (standardized bioactive fraction) | anti-proliferation           | Karsono et al., 2014                |
|                      | EA ext.                           | cytotoxicity                 | Malek et al., 2011                  |

| <b>Plant</b>          | <b>Extraction</b> |                              | <b>Reference</b>                    |
|-----------------------|-------------------|------------------------------|-------------------------------------|
|                       | <b>part</b>       | <b>Bioactivity</b>           |                                     |
|                       |                   |                              | Tewtrakul and Subhadhirasakul, 2007 |
|                       | EtOH ext.         | anti-allergic                |                                     |
|                       | hexane ext.       | cytotoxicity                 | Malek et al., 2011                  |
|                       | MeOH ext.         | anti-oxidant                 | Chan et al., 2008                   |
|                       | n-hexane ext.     | hypolipidemic                | Srinivasan et al., 2008             |
|                       | Uk                | anti-inflammation            | Kaewkroek et al., 2010              |
| <i>C. mutabilis</i>   | Aq. ext.          | anti-oxidant                 | Rajan et al., 2014                  |
| <i>C.</i>             |                   |                              |                                     |
| <i>neilgherrensi</i>  | Aq. ext.          | anti-oxidant                 | Rajan et al., 2014                  |
| <i>s</i>              |                   |                              |                                     |
| <i>C. ochrorhiza</i>  | hexane ext.       | cytotoxicity                 | Sukari et al., 2010                 |
| <i>C. phaeocaulis</i> | EtOH ext.         | anti-proliferation           | Chen et al., 2011b                  |
|                       | EtOH ext.         | antifungal                   | Li et al., 2011a                    |
|                       | Uk ext.           | inhibit platelet aggregation | Mao et al., 2000                    |

| <b>Plant</b>           | <b>Extraction</b> |                    | <b>Reference</b>         |
|------------------------|-------------------|--------------------|--------------------------|
|                        | <b>part</b>       | <b>Bioactivity</b> |                          |
|                        | hexane ext.       | anti-ulcerogenic   | Rouhollahi et al., 2014  |
| <i>C. rakthakanta</i>  | Aq. ext.          | anti-inflammation  | Angel et al., 2013       |
| <i>C. sylvatica</i>    | Aq. ext.          | anti-inflammation  | Angel et al., 2013       |
| <i>C. vamana</i>       | Aq. ext.          | anti-oxidant       | Rajan et al., 2014       |
| <i>C. viridiflora</i>  | MeOH ext.         | anti-oxidant       | Chen et al., 2008        |
|                        |                   |                    | Xiao et al., 2008; Ba et |
| <i>C. wenyujin</i>     | EO                | anti-proliferation | al., 2009; Lim et al.,   |
|                        | EO                | insecticidal       | 2010                     |
|                        | EtOH ext.         | anti-oxidant       | Liu et al., 2012         |
|                        | Sesquiterpenoid   | antiviral          | Lou et al., 2012         |
|                        | s                 |                    | Dong et al., 2013        |
| <i>C. xanthorrhiza</i> | Aq. ext.          | hepatoprotective   | Lin et al., 1995         |
|                        | Aq. ext.          | anti-oxidant       | Qader et al., 2011       |
|                        | crude ext.        | cholagogic         | Isaac, 1959              |
|                        | EtOH ext.         | anti-ulcerogenic   | Rahim et al., 2014       |

| <b>Plant</b>       | <b>Extraction</b> |                    | <b>Reference</b>               |
|--------------------|-------------------|--------------------|--------------------------------|
|                    | <b>part</b>       | <b>Bioactivity</b> |                                |
| <i>C. zedoaria</i> |                   |                    | Surveswaran et al.,            |
|                    | MeOH ext.         | anti-oxidant       | 2007; Saputri and Jantan, 2011 |
|                    | polysaccharide    | immunomodulating   | Kim et al., 2007a              |
|                    | MeOH ext.         | anti-oxidant       | Chan et al., 2008              |
|                    | Aq. ext.          | anti-metastatic    | Seo et al., 2005               |
|                    | Aq. ext.          | anti-mutagenic     | Lee and Lin, 1988              |
|                    | Aq. ext.          | anti-inflammation  | Ullah et al., 2014             |
|                    | aq. ext.          | hypolipidemic      | Kim et al., 2005b              |
|                    | aq. ext.          | antihypertensive   | Goto et al., 2005              |
|                    | Aq. ext.          | anti-inflammation  | Hong et al., 2002a             |
| chloroform ext.    |                   |                    | Bajracharya et al., 2009       |
|                    | crude ext.        | cytotoxicity       | Anggakusuma et al., 2009       |
|                    |                   | anti-ulcerogenic   | Ahmed Hamdi et al., 2014       |

| <b>Plant</b> | <b>Extraction<br/>part</b> | <b>Bioactivity</b>        | <b>Reference</b>                               |
|--------------|----------------------------|---------------------------|--|
|              | EA ext.                    | cytotoxicity              | Syed et al., 2013                              |
|              | EA ext.                    | anti-ulcerogenic          | Kim et al., 2005a                              |
|              | EO                         | anti-angiogenic           | Chen et al., 2011a                             |
|              | EO                         | anti-proliferation        | Chen et al., 2013a; Guo et al., 2013           |
|              | EO                         | fungicidal                | Rao and Rao, 1972;<br>Singh et al., 2003b      |
|              | EO                         | antimicrobial             | Rao and Nigam, 1970;<br>Banerjee et al., 1978  |
|              | EtOH ext.                  | cytotoxicity              | Hossain et al., 2012                           |
|              | hexane ext.                | cytotoxicity              | Syed et al., 2013;<br>Ahmed Hamdi et al., 2014 |
|              | hexane ext.                | antifungal                | Chen et al., 2013b                             |
|              | lectin                     | hemagglutinating activity | Tipthara et al., 2007                          |

| <b>Plant</b> | <b>Extraction<br/>part</b>        | <b>Bioactivity</b>                  | <b>Reference</b>                       |
|--------------|-----------------------------------|-------------------------------------|--|
|              | MeOH ext.                         | cytotoxicity                        | Syed et al., 2013                      |
|              |                                   |                                     | Prakash et al., 2007;                  |
|              |                                   |                                     | Surveswaran et al.,                    |
|              | MeOH ext.                         | anti-oxidant                        | 2007; Chen et al.,                     |
|              |                                   |                                     | 2008                                   |
|              | PE ext.                           | cytotoxicity                        | Gao et al., 2014                       |
|              | PE: EA (60:40)                    | cytotoxicity                        | Lakshmi et al., 2011                   |
|              | phenolic acids                    |                                     |  |
|              | and pectic<br>polysaccharid<br>es | anti-ulcerogenic                    | Siddaraju and<br>Dharmesh, 2007        |
|              | polysaccharides                   | cytotoxicity                        | Moon et al., 1985; Kim<br>et al., 2000 |
|              | polysaccharides                   | macrophage-stimul<br>ating activity | Kim et al., 2001                       |

| <b>Plant</b>          | <b>Extraction<br/>part</b> | <b>Bioactivity</b> | <b>Reference</b> |
|-----------------------|----------------------------|--------------------|------------------|
|                       |                            |                    |                  |
| <i>Radix Curcumae</i> | radix curcumae             | gastric protective | Lu et al., 2010  |
|                       |                            |                    |                  |

Aq, aqueous; EO, essential oil; PE, petroleum ether; EA, ethyl acetate; DCM, dichloromethane;

Uk, unkown.

**Table 3** Biological activities of purified compounds isolated from the genus *Curcuma*.

| <b>Compound</b>                          | <b>Bioactivity</b> | <b>Reference</b>                     |
|--|--------------------|--------------------------------------|
| aerugidiol                               | anti-metastatic    | Zhong et al., 2014                   |
|  | anti-proliferation | Xiao et al., 2007; Ma et al., 2008;  |
|  |                    | Ba et al., 2009; Zhong et al., 2012; |
|  |                    | Xu et al., 2014                      |
|  | liverprotective    | Morikawa et al., 2002                |
| alismol                                  | anti-proliferation | Syed et al., 2013                    |
| alismoxide                               | anti-inflammation  | Liu et al., 2013                     |
| amadannulen                              | anti-oxidant       | Policegoudra et al., 2007a           |
| apigenin                                 | anti-oxidant       | Shabana and Afifi, 2014              |
| apigenin-7-O- $\beta$ -D-glucopyranoside | anti-oxidant       | Shabana and Afifi, 2014              |
| $\alpha$ -asarone                        | anti-oxidant       | Vishnupriya et al., 2012             |
|  | anti-inflammatory  | Raj et al., 2008                     |
|  | antimicrobial      | Ajaiyeoba et al., 2008               |
| $\alpha$ -atlantone                      | antioxidant        | Braga et al., 2003                   |
| $\beta$ -atlantone                       | anti-proliferation | Paek et al., 1996                    |

| <b>Compound</b>  | <b>Bioactivity</b>  | <b>Reference</b>  |
|--|---|---|
|  | cytotoxicity  | Itokawa et al., 1985  |
| bis (4-hydroxy cinnamoyl) methane                                    | anti-inflammation   | Rao et al., 1982  |
| bis (4-hydroxyphenyl)-1-h<br>eptene-3,5-dione1,7-                    | anti-Alzheimer  | Park and Kim, 2002  |
| bis(4-hydroxy-3-methoxy phenyl)-penta-(1E,4E)-<br>1,4-dien-3-one1,5- | anti-inflammation   | Masuda et al., 1993   |
| $\beta$ -bisabolene  | antibacterial<br>antifungal<br>antioxidant                        | Zellagui et al., 2012<br>Maxia et al., 2009<br>Okoh et al., 2011                  |
| bisabolone   | anti-inflammatory<br>cytotoxic<br>anti-inflammatory<br>antifungal | Mevy et al., 2002<br>Mevy et al., 2002<br>Sun et al., 2008<br>Ragasa et al., 2005 |
| bisdemethoxycurcumin   | anti-Alzheimer  | Park and Kim, 2002; Shytle et al.,  |

| <b>Compound</b>                             | <b>Bioactivity</b>          | <b>Reference</b>                      |
|---|-----------------------------|---------------------------------------|
|   |                             | 2009                                  |
|   | anti-oxidant                | Shabana and Afifi, 2014               |
|   | anti-proliferation          | Wang et al., 2008a; Yue et al., 2010b |
|   | cholagogic                  | Siegers et al., 1997                  |
|   | human pancreatic            | Ponnusamy et al., 2012                |
|   | $\alpha$ -amylase inhibitor |                                       |
|   | hypoglycemic                | Kuroda et al., 2005                   |
|   | anti-inflammation           | Kertia et al., 2012                   |
| 15,16-bisnorlabdan-8(17),<br>11-dien-13-one | cytotoxicity                | Suthiwong et al., 2014                |
| borneol                                     | antimicrobial               | Elaissi et al., 2012                  |
|   | antioxidant                 | Amiri, 2011                           |
|   | hepatoprotective            | Horváthová et al., 2012               |
|   | larvical                    | Waliwitiya et al., 2009               |
| calcaratarin A                              | cytotoxicity                | Liu and Nair, 2010                    |
| calebin-A                                   | anti-Alzheimer              | Park and Kim, 2002                    |
| calebin- $\alpha$                           | anti-proliferation          | Li et al., 2008                       |

| <b>Compound</b>          | <b>Bioactivity</b>    | <b>Reference</b>  |
|--------------------------|-----------------------|---|
| camphene                 | antimicrobial         | Magwa et al., 2006  |
|                          | antioxidant           | Yang et al., 2009   |
| camphor                  | insecticidal          | Liu et al., 2012  |
| $\beta$ -caryophyllene   | anticancer            | Legault and Pichette, 2007                                    |
|                          | anti-inflammatory     | Legault and Pichette, 2007                                    |
|                          | antioxidant           | Legault and Pichette, 2007                                    |
| 1,8-cineole              | insecticidal          | Liu et al., 2012  |
| communic acid            | cytotoxicity          | Liu and Nair, 2010  |
| copallic acid            | cytotoxicity          | Liu and Nair, 2010  |
| coronarin d              | cytotoxicity          | Suthiwong et al., 2014  |
| coronarin D methyl ether | cytotoxicity          | Suthiwong et al., 2014  |
| curcumadionol            | anti-inflammation     | Liu et al., 2013  |
| $\alpha$ -curcumene      | cholagogic            | Yasni et al., 1994  |
|                          | cytotoxicity          | Itokawa et al., 1985; Kim et al., 2003;<br>Shin and Lee, 2013 |
|                          | triglyceride-lowering | Yasni et al., 1994  |
|                          | activity              |   |

| <b>Compound</b> | <b>Bioactivity</b> | <b>Reference</b>                       |
|-----------------|--------------------|--|
| curcumenol      | anti-analgesic     | de Fatima Navarro et al., 2002;        |
|                 | anti-inflammation  | Pamplona et al., 2006                  |
|                 | antimicrobial      | Liu et al., 2013                       |
|                 | cytotoxicity       | Phan and Phan, 2002                    |
| curcumine       | anti-inflammation  | Sukari et al., 2007b; Sukari et al.,   |
|                 |                    | 2010                                   |
| curcuminoid     | anti-oxidant       | Toda et al., 1985; Masuda et al., 1992 |
| curcuminol D    | cytotoxicity       | Zhang et al., 2008b                    |
| curcuminol E    | cytotoxicity       | Zhang et al., 2008b                    |
| curcumins I     | fungicidal         | Chowdhury et al., 2008                 |
| curcumins II    | fungicidal         | Chowdhury et al., 2008                 |
| curcumins III   | fungicidal         | Chowdhury et al., 2008                 |
| curcumol        | anti-seizure       | Ding et al., 2014                      |
|                 | hepatoprotective   | Jiang et al., 2005                     |
| curcumrinols A  | cytotoxicity       | Huang et al., 2008                     |
| curcumrinols B  | cytotoxicity       | Huang et al., 2008                     |

| <b>Compound</b>   | <b>Bioactivity</b>           | <b>Reference</b>                        |
|-------------------|------------------------------|---|
| curcumrinols C    | cytotoxicity                 | Huang et al., 2008                      |
| curdione          | inhibit platelet aggregation | Xia et al., 2006a; Wang et al., 2012    |
|                   | antibacteria                 | Phan and Phan, 2000                     |
| curzerenone       | antibacteria                 | Phan and Phan, 2000                     |
|                   | anti-proliferation           | Syed et al., 2013                       |
|                   | gastric protection           | Gonda et al., 1992                      |
| cyclocurcumin     | anti-inflammation            | Kertia et al., 2012                     |
| dehydrocurdione   | anti-analgesic               | Pamplona et al., 2006                   |
| demethoxycurcumin | anti-Alzheimer               | Park and Kim, 2002; Shytle et al., 2009 |
|                   | anti-angiogenic              | Kim et al., 2002                        |
|                   | anti-inflammation            | Kertia et al., 2012                     |
|                   | anti-oxidant                 | Shabana and Afifi, 2014                 |
|                   | anti-proliferation           | Yue et al., 2010b                       |
|                   | cytotoxicity                 | Wang et al., 2008a                      |
|                   | human P451 enzymes           | Bamba et al., 2011                      |

| Compound  | Bioactivity       | Reference                |
|---|-------------------|--------------------------|
|   | inhibitor         |                          |
|   | hypoglycemic      | Kuroda et al., 2005      |
| diacetyl curcumin   | anti-analgesic    | Jacob et al., 2013       |
| diglutaryl curcumin   | anti-analgesic    | Jacob et al., 2013       |
| <i>rel</i> -(3 <i>R</i> ,5 <i>S</i> )-3,5-dihydroxy<br>-1-(3,4-dihydroxyphenyl)<br>yl)-7-(4-hydroxyphenyl)<br>) heptane     | anti-inflammation | Li et al., 2011b         |
| <i>rel</i> -(3 <i>R</i> ,5 <i>S</i> )-3,5-dihydroxy<br>-1-(3-methoxy-4,5-dihy<br>droxyphenyl)-7-(4-hyd<br>oxyphenyl)heptane | anti-inflammation | Li et al., 2011b         |
| <i>rel</i> -(3 <i>R</i> ,5 <i>S</i> )-3,5-dihydroxy<br>-1-(4-hydroxy-3-metho<br>xyphenyl)-7-(4-hydrox<br>yphenyl)-heptane   | anti-inflammation | Li et al., 2011b         |
| 7-(3,4-dihydroxyphenyl)-  | cholagogic        | Suksamraran et al., 1997 |

| Compound   | Bioactivity                     | Reference                  |
|--|---------------------------------|----------------------------|
| 5-hydroxy-1-phenyl-(1<br><i>E</i> )-1-heptene                                      | hypolipidemic                   | Suksamrarn et al., 1994    |
| (3 <i>S</i> )-1-(3,4-dihydroxyphe<br>nyl)-7-phenyl-(6 <i>E</i> )-6-h<br>epten-3-ol | anti-proliferation              | Jariyawat et al., 2011     |
| (3 <i>R</i> )-1,7-diphenyl-(4 <i>E</i> ,<br>6 <i>E</i> )-4,6-heptadien-3-ol        | anti-inflammation               | Chaturapanich et al., 2013 |
| (3 <i>R</i> )-1,7-diphenyl-(4 <i>E</i> ,6 <i>E</i> )<br>-4,6-heptadien-3-ol        | anti-inflammation               | Thampithak et al., 2009    |
| (3 <i>R</i> )-1,7-diphenyl-(4 <i>E</i> ,6 <i>E</i> )<br>-4,6-heptadien-3-ol        | anti-diabates                   | Prasannarong et al., 2012  |
| (3 <i>R</i> )-1,7-diphenyl-(4 <i>E</i> ,6 <i>E</i> )<br>-4,6-heptadien-3-ol        | estrogen receptor<br>antagonist | Winuthayanon et al., 2009a |
| <i>E</i> -1,7-diphenyl-1,3-heptad<br>ien-4-one                                     | anti-inflammation               | Claeson et al., 1993       |
| <i>E,E</i> -1,7-diphenyl-1,3-hept<br>ien-4-one                                     | anti-inflammation               | Claeson et al., 1993       |

| Compound                                      | Bioactivity        | Reference   |
|---|--------------------|---|
| adien-5-ol                                    |                    |   |
| <i>E</i> -1,7-diphenyl-1-hepten-5-ol          | anti-inflammation  | Claeson et al., 1993  |
| 1,7-diphenyl-5-hydroxy-( <i>E</i> )-1-heptene | cholagogic         | Suksamraran et al., 1997  |
| $\beta$ -elemene                              | anti-proliferation | Yao et al., 2008; Zhang et al., 2011;<br>Zhu et al., 2011a; Zhu et al.,<br>2011b; Bao et al., 2012; Zhao et<br>al., 2012; Dai et al., 2013; Yao et<br>al., 2014; Zhu et al., 2014 |
| $\delta$ -elemene                             | hepatoprotective   | Liu et al., 2011  |
|   | anti-invasion      | Zhang et al., 2013b   |
|   | anti-proliferation | Xie et al., 2009; Ying et al., 2011a;<br>Ying et al., 2011b   |
| 4-epicurcumenol                               | anti-inflammation  | Liu et al., 2013  |
| 7 $\alpha$ ,                                  | anti-inflammation  | Liu et al., 2013  |
| 11 $\alpha$ -epoxy-5 $\beta$ -hydroxy         |                    |   |

| <b>Compound</b>            | <b>Bioactivity</b> | <b>Reference</b>                       |
|----------------------------|--------------------|--|
| -9-guaiaen-8-one           |                    |  |
| ethyl                      | antimicrobial      | Gupta et al., 1976                     |
| <i>p</i> -methoxycinnamate |                    |  |
|                            | fungicidal         | Gupta et al., 1976                     |
| ferulic acid               | anti-oxidant       | Kumar et al., 2006                     |
| furanodiene                | anti-angiogenic    | Zhong et al., 2012c                    |
|                            | antibacteria       | Phan and Phan, 2000                    |
| furanodienone              | anticancer         | Li et al., 2011e                       |
|                            | anti-inflammatory  | Makabe et al., 2006                    |
|                            | antioxidant        | Mau et al., 2003                       |
|                            | anti-proliferation | Li et al., 2011d                       |
|                            | COX2 inhibitor     | Lobo et al., 2009                      |
| germacrone                 | antibacteria       | Phan and Phan, 2000                    |
|                            | anti-proliferation | Zhong et al., 2011; Liu et al., 2013c; |
|                            |                    | Liu et al., 2014a                      |
|                            | antiviral          | Liao et al., 2013                      |
|                            | androgen receptor  | Suphrom et al., 2012                   |

| <b>Compound</b>          | <b>Bioactivity</b> | <b>Reference</b>                         |
|--------------------------|--------------------|--|
|                          | ntagonist          |  |
| germacrone-13-al         | anticancer         | Chen et al., 2011b                       |
| (4S,5S)-germacrone-4,5-e | human P450 enzymes | Bamba et al., 2011                       |
| poxide                   | inhibitor          |  |
| cis-guai-6-en-10-ol      | anti-inflammation  | Liu et al., 2013                         |
| gweicurculactone         | cytotoxicity       | Wang et al., 2008a                       |
| HSS-838 (standardized    | anti-Alzheimer     | Shytle et al., 2009                      |
| turmeric exts.)          |                    |  |
| HSS-848 (standardized    | anti-Alzheimer     | Shytle et al., 2009                      |
| turmeric exts.)          |                    |  |
| HSS-888 (standardized    | anti-Alzheimer     | Shytle et al., 2009; Shytle et al., 2012 |
| turmeric exts.)          |                    |  |
| 4-hydroxy cinnamoyl      | anti-inflammation  | Rao et al., 1982                         |
| methane                  |                    |  |
| 15-hydroxy curcumol      | antiviral          | Zhang et al., 2005                       |
| 1-(4-hydroxy-3-methoxyp  | anti-inflammation  | Masuda et al., 1993                      |
| henyl)-5-(4-hydroxyph    |                    |  |

| <b>Compound</b>                                      | <b>Bioactivity</b> | <b>Reference</b>  |
|--|--------------------|---|
| enyl)-penta-(1 <i>E</i> ,4 <i>E</i> )-1,4-dien-3-one |                    |   |
| 5-hydroxy-7-(4-hydroxyphe                            | hypolipidemic      | Suksamrarn et al., 1994   |
| henyl)-1-phenyl(1 <i>E</i> )-1-heptene               |                    |   |
| 5-hydroxy-7-(4-hydroxyphe                            | cholagogic         | Suksamraran et al., 1997  |
| henyl)-1-phenyl-(1 <i>E</i> )-1-heptene              |                    |   |
| 13-hydroxygermacrone                                 | anti-inflammatory  | Makabe et al., 2006   |
| 13-hydroxygermacrone                                 | hepatoprotective   | Morikawa et al., 2002   |
| isocurcumenol  | anti-inflammation  | Liu et al., 2013  |
|  | antimicrobial      | Phan and Phan, 2002   |
|  | cytotoxicity       | Sukari et al., 2007b; Sukari et al., 2010; Lakshmi et al., 2011 |
| isofuranodienone                                     | anticancer         | Chokchaisiri et al., 2014                                       |
|  | antimicrobial      | Hikino et al., 1975   |
| isozedoarondiol                                      | anti-inflammation  | Liu et al., 2013  |

| <b>Compound</b>   | <b>Bioactivity</b>  | <b>Reference</b>   |
|---|---|--|
| ( <i>E</i> )-labda-8(17),12-dien-1<br>5,16-dial   | cytotoxicity<br>antimicrobial<br>cytotoxicity<br>fungicidal<br>cytotoxicity | Malek et al., 2011<br>Roth et al., 1998<br>Suthiwong et al., 2014<br>Roth et al., 1998<br>Liu and Nair, 2010 |
| luteolin  | anti-oxidant  | Shabana and Afifi, 2014  |
| luteolin  | anti-oxidant  | Shabana and Afifi, 2014  |
| 7- <i>O</i> - $\beta$ -D-glucopyranosi<br>de<br>Luteolin-7- <i>O</i> -(6''- <i>p</i> -hydro<br>xybenzoyl- $\beta$ -D-glucopy<br>ranoside) |   | Shabana and Afifi, 2014  |
| 8-methene-1,1,10-trimeth<br>yldelcalin  | cytotoxicity  | Liu and Nair, 2010   |
| $\beta$ -Myrcene  | anti-oxidant  | Vishnupriya et al., 2012   |
| neocurdione   | cytotoxicity  | Syed et al., 2013  |

| <b>Compound</b>         | <b>Bioactivity</b> | <b>Reference</b>  |
|-------------------------|--------------------|---|
| neoprocurcumenol        | insecticidal       | Madhu et al., 2010  |
| non-phenolic linear     | anti-inflammation  | Claeson et al., 1996  |
| 1,7-diarylheptanoids    |                    |   |
| 9-oxoneoprocummenol     | insecticidal       | Madhu et al., 2010  |
| oxycurcumenol epoxide   | cytotoxicity       | Sukari et al., 2010   |
| parviflorene A          | cytotoxicity       | Takahashi et al., 2003; Toume et al.,<br>2005                   |
| parviflorene J          | cytotoxicity       | Tamaki et al., 2007   |
| parviflorenes B         | cytotoxicity       | Toume et al., 2004  |
| parviflorenes C         | cytotoxicity       | Toume et al., 2004  |
| parviflorenes D         | cytotoxicity       | Toume et al., 2004  |
| parviflorenes E         | cytotoxicity       | Toume et al., 2004  |
| parviflorenes F         | cytotoxicity       | Toume et al., 2004; Toume et al.,<br>2005; Ohtsuki et al., 2008 |
| parviflorenes G         | cytotoxicity       | Ohtsuki et al., 2008  |
| parviflorenes I         | cytotoxicity       | Ohtsuki et al., 2008  |
| <i>p</i> -coumaric acid | anti-oxidant       | Kumar et al., 2006  |

| <b>Compound</b>   | <b>Bioactivity</b> | <b>Reference</b>  |
|---|--------------------|-------------------|
| 1,2,3,4,6-penta- <i>O</i> -galloyl-<br>$\beta$ -D-glucose | anti-aging         | Ahn et al., 2013a |
| 1,2,3,4,6-penta- <i>O</i> -galloyl-<br>$\beta$ -D-glucose | anti-Alzheimer     | Guo et al., 2010  |
| 1,2,3,4,6-penta- <i>O</i> -galloyl-<br>$\beta$ -D-glucose | anti-oxidant       | Ahn et al., 2013a |
| phaeocaulisin A   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin B   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin C   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin D   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin E   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin F   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin G   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin H   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin I   | anti-inflammation  | Liu et al., 2013  |
| phaeocaulisin J   | anti-inflammation  | Liu et al., 2013  |
| phaeusmanes A   | anti-inflammation  | Liu et al., 2014c |

| Compound                      | Bioactivity                                      | Reference              |
|-------------------------------|--|------------------------|
| phaeusmanes B                 | anti-inflammation                                | Liu et al., 2014c      |
| phaeusmanes C                 | anti-inflammation                                | Liu et al., 2014c      |
| phaeusmanes D                 | anti-inflammation                                | Liu et al., 2014c      |
| phaeusmanes E                 | anti-inflammation                                | Liu et al., 2014c      |
| phaeusmanes F                 | anti-inflammation                                | Liu et al., 2014c      |
| phaeusmanes G                 | anti-inflammation                                | Liu et al., 2014c      |
| phaeusmanes H                 | anti-inflammation                                | Liu et al., 2014c      |
| 1-phenylpropanol              | cholagogic                                       | Hirota, 1958           |
| polysaccharide                | reticuloendothelial system-potentiating activity | onda and Tomoda, 1991  |
| procumadiol                   | anti-inflammation                                | Liu et al., 2013       |
| procumenol                    | anti-inflammation                                | Liu et al., 2013       |
| $\beta$ -sesquiphellandrene   | anti-proliferation                               | Ahn and Lee, 1989      |
| tetrahydrocurcumin            | anti-Alzheimer                                   | Shytle et al., 2009    |
| tetrahydrocurcumin            | hypoglycemic                                     | Pari and Murugan, 2007 |
| <i>p</i> -tolylmethylcarbinol | cholagogic                                       | Kawanaka, 1959         |

| <b>Compound</b>                      | <b>Bioactivity</b>             | <b>Reference</b>   |
|--------------------------------------|--------------------------------|--|
| 1,1,10-trimethyl-decalin             | cytotoxicity                   | Liu and Nair, 2010   |
| 14,15,16-trinor-labdan-8,<br>12-diol | cytotoxicity                   | Liu and Nair, 2010   |
| $\beta$ -tumerone                    | induce PCD                     | Kim et al., 2003   |
| $\beta$ -turmerin                    | anti-oxidant                   | Smitha et al., 2009  |
| turmerone                            | insecticidal                   | Su et al., 1982  |
| <i>ar</i> -turmerone                 | antifungal                     | Ragasa et al., 2005  |
|                                      | anti-inflammation              | Claeson et al., 1996; Hong et al.,<br>2002b; Lee et al., 2002b; Park et<br>al., 2012b  |
|                                      | anti-invasion and<br>migration | Park et al., 2012c   |
|                                      | antimicrobial                  | Lee et al., 2003   |
|                                      | anti-proliferation             | Itokawa et al., 1985; Paek et al.,<br>1996; Aratanechemuge et al., 2002;<br>Ji et al., 2004; Lee, 2009b; Cheng<br>et al., 2012 |

| <b>Compound</b>     | <b>Bioactivity</b>                                     | <b>Reference</b>                      |
|---------------------|--|---------------------------------------|
|                     | fungicidal   | Lee et al., 2003                      |
|                     | hypoglycemic   | Kuroda et al., 2005                   |
|                     | inhibit platelet aggregation                           | Lee, 2006                             |
|                     | $\alpha$ -glucosidase and $\alpha$ -amylase inhibitors | Lekshmi et al., 2012                  |
| $\alpha$ -turmerone | antifungal   | Ragasa et al., 2005                   |
|                     | anti-oxidant   | Singh et al., 2010                    |
|                     | anti-proliferation                                     | Yue et al., 2010b                     |
| $\beta$ -turmerone  | antifungal   | Ragasa et al., 2005                   |
|                     | anti-inflammation                                      | Hong et al., 2002b; Lee et al., 2002b |
| $\beta$ -turmerone  | anti-oxidant   | Singh et al., 2010                    |
| wenyujinlactone A   | anesthetic activity                                    | Wang et al., 2007                     |
| xanthorrhizol       | anti-aging   | Oh et al., 2009                       |
|                     | anti-inflammation                                      | Lee et al., 2002b                     |
|                     | anti-metastatic  | Choi et al., 2004, 2005               |

| <b>Compound</b> | <b>Bioactivity</b>           | <b>Reference</b>   |
|-----------------|------------------------------|--|
|                 | cytotoxicity                 | Itokawa et al., 1985; Ismail et al.,<br>2005; Cheah et al., 2006;  |
|                 |                              | Handayani et al., 2007; Cheah et<br>al., 2008; Kang et al., 2009; Tee et<br>al., 2012; Kim et al., 2013; |
|                 |                              | Musfiroh et al., 2013  |
|                 | estrogen receptor<br>agonist | Winuthayanon et al., 2009b   |
|                 | hepatoprotective             | Deshpande et al., 2003   |
|                 | nephroprotective             | Kim et al., 2005c  |
| zederone        | antifeedant activity         | Pant et al., 2001  |
|                 | cytotoxicity                 | Sukari et al., 2010  |
|                 | antibacteria                 | Phan and Phan, 2000  |
| zedoalactone A  | anti-inflammation            | Liu et al., 2013   |
| zedoalactone B  | anti-inflammation            | Liu et al., 2013   |
| zedoalactone C  | anti-inflammation            | Liu et al., 2013   |
| zedoalactone D  | anti-inflammation            | Liu et al., 2013   |

| <b>Compound</b>   | <b>Bioactivity</b> | <b>Reference</b>                             |
|---|--------------------|--|
| zedoarolide A   | anti-inflammation  | Liu et al., 2013                             |
| zedoarolide B   | anti-inflammation  | Liu et al., 2013                             |
| zedoarondiol  | anti-inflammation  | Cho et al., 2009                             |
| zedoarondiol  | anti-inflammation  | Liu et al., 2013                             |
| (1 <i>S</i> , 4 <i>S</i> , 5 <i>S</i> ,<br>10 <i>R</i> )-zedoarondiol | anti-inflammation  | Liu et al., 2013                             |
| zerumbone   | cytotoxicity       | Matthes et al., 1980; Sukari et al.,<br>2010 |
|   | antibacteria       | Phan and Phan, 2000                          |
| zerumbone epoxide   | cytotoxicity       | Matthes et al., 1980                         |
| zerumbone-2,3-epoxide   | antibacteria       | Phan and Phan, 2000                          |
| zerumin A   | cytotoxicity       | Malek et al., 2011                           |
| zerumin B   | cytotoxicity       | Liu and Nair, 2010                           |
| zingiberene   | anti-inflammatory  | Qu et al., 2009                              |

PCD, programmed cell death.

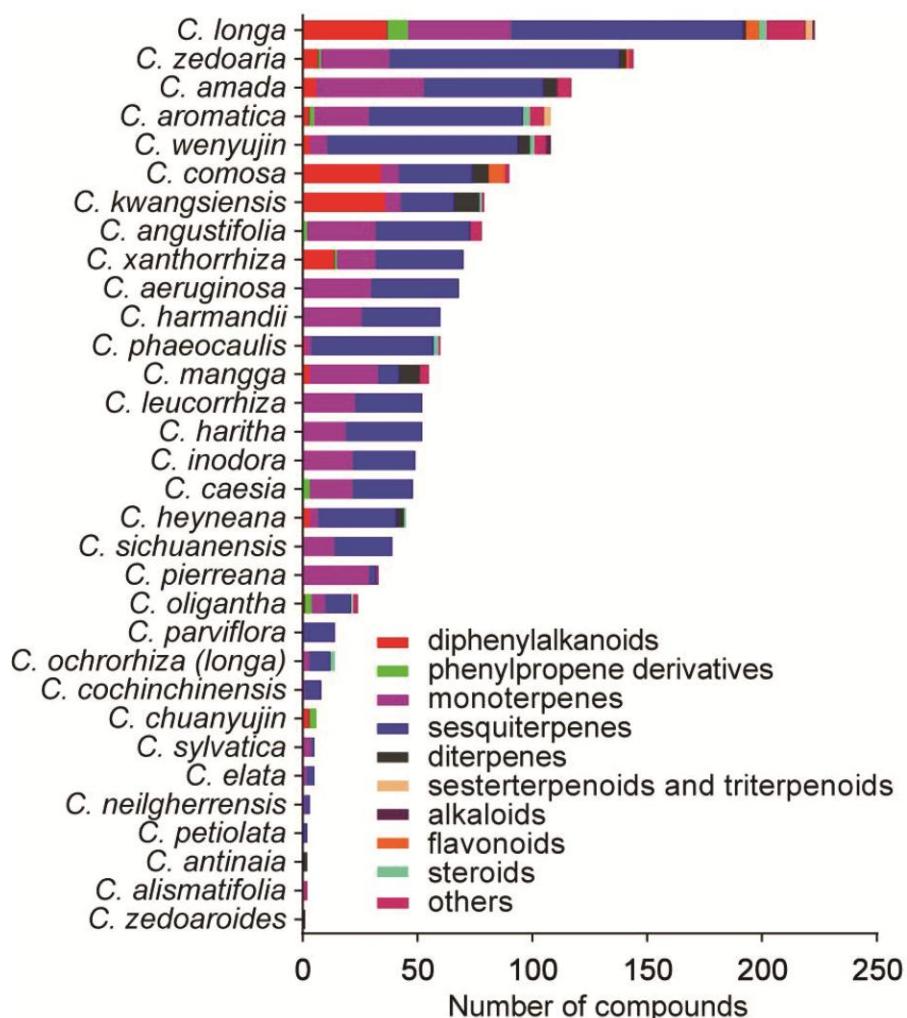
**Figure legends**

**Scheme 1. Curcuminoid biosynthesis in *C. longa*.** hydroxycinnamoyl transferase (HCT), cinnamate-3-hydroxylase (C3H), *o*-methyltransferase (OMT), diketide-CoA synthase (DCS) and curcumin synthase (CURS)

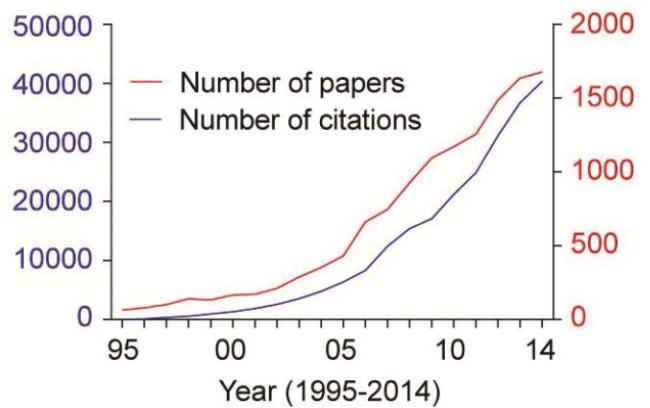
**Scheme 2. Biosynthesis of sesquiterpenes in *Curcuma*.** TPS1, acyclic sesquiterpene synthase (Schnee et al., 2002); FLDH, farnesol dehydrogenase (Bhandari et al., 2010); FLR, farnesal reductase (Bhandari et al., 2010); AFS1, alpha-farnesene synthase (Pechous and Whitaker, 2004); TPS10, beta-farnesene synthase (Crock et al., 1997); (*S*)- $\beta$ -bisabolene synthase (Fujisawa et al., 2010); (*E*)- $\gamma$ -bisabolene synthase (Huber et al., 2005); SSTLH1, (*E,E*)-germacrene B synthase (van Der Hoeven et al., 2000); GERD, (-)-germacrene D synthase (Lucker et al., 2004); GAS, germacrene-A synthase (Bouwmeester et al., 2002); QHS1, beta-caryophyllene synthase (Cai et al., 2002); TPS21, alpha-humulene/beta-caryophyllene synthase (Chen, 2003); CDN1, (+)-delta-cadinene synthase (Chen et al., 1995); SBS, santalene and bergamotene synthase (Sallaud et al., 2009); TPS-LON, longifolene synthase (Martin et al., 2004); and patchoulol synthase (Munck and Croteau, 1990).



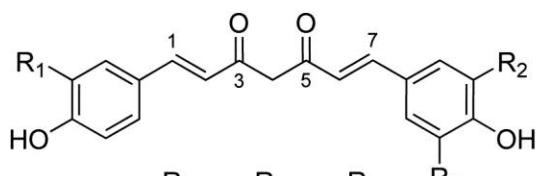
**Figure 1** (a) Whole plant, (b) rhizomes, (c) roots and (d) commercial capsules of *C. longa*  
(Photographs taken by F. Yang)



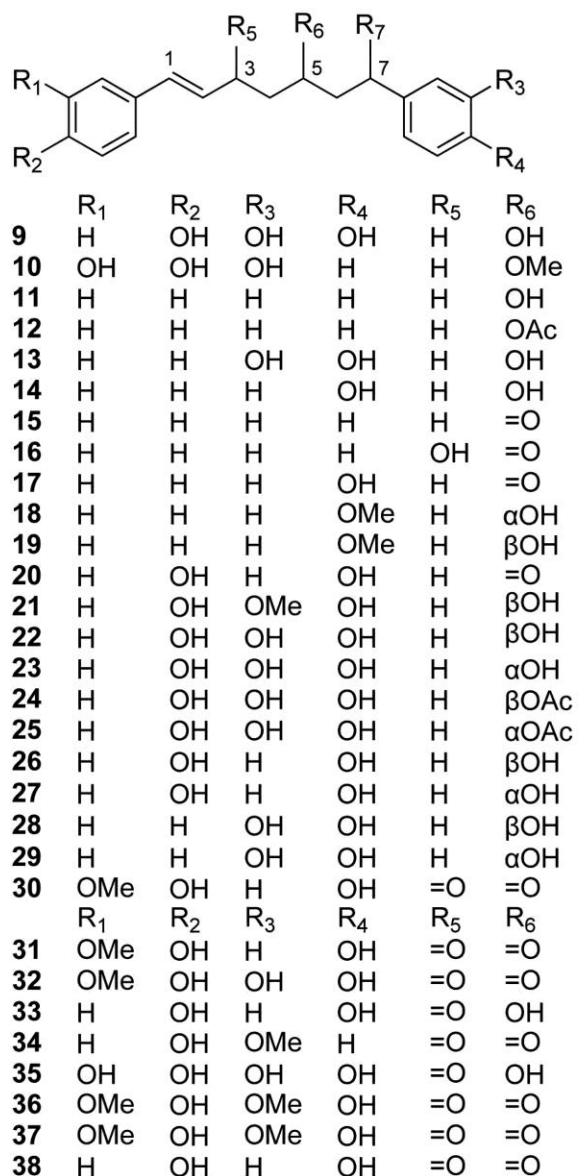
**Figure 2** Distribution of various compound types in *Curcuma* species. Data were obtained from literature published in 1815-2014.

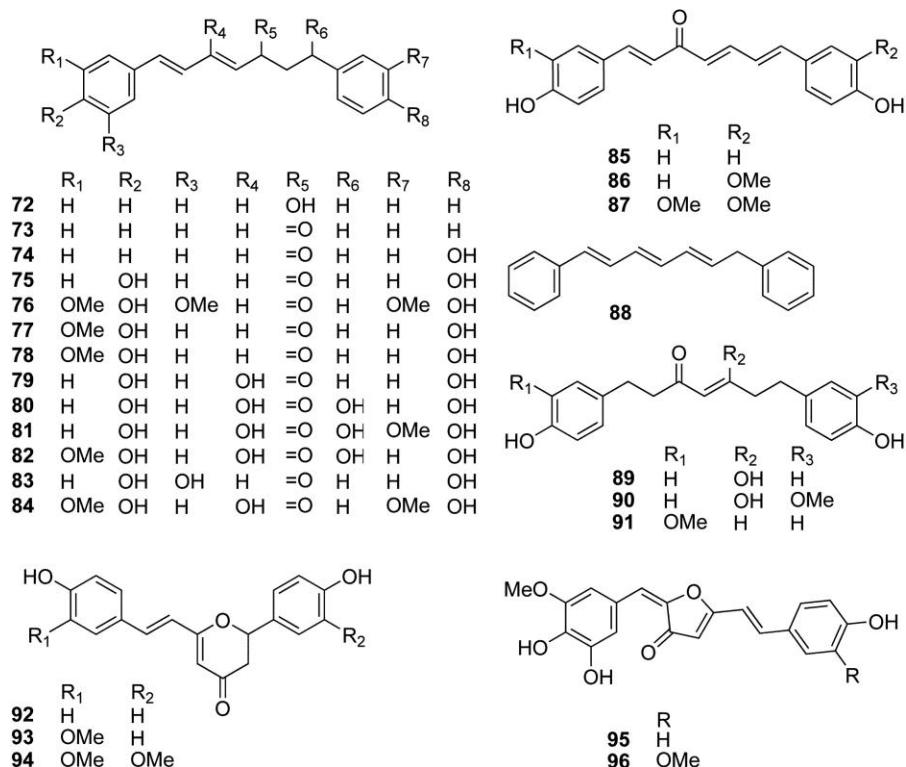


**Figure 3** Publications and citations of *Curcuma* genus in the last 20 years (1995-2014) “*Curcuma*” or “curcumin” were used as topic words. Data were obtained from Web of Science.

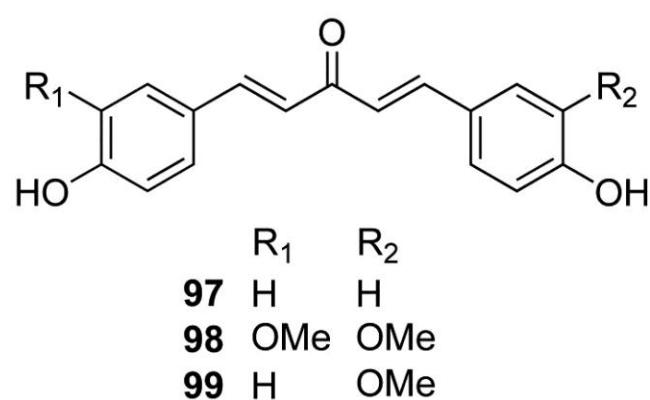


|   | $\text{R}_1$ | $\text{R}_2$ | $\text{R}_3$ |
|---|--------------|--------------|--------------|
| 1 | OMe          | OMe          | H            |
| 2 | H            | OMe          | H            |
| 3 | H            | H            | H            |
| 4 | OMe          | OH           | H            |
| 5 | OMe          | OMe          | OMe          |
| 6 | H            | OH           | H            |
| 7 | OMe          | OMe          | OH           |
| 8 | OH           | OH           | H            |

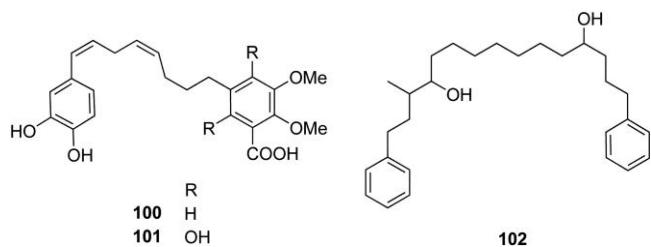
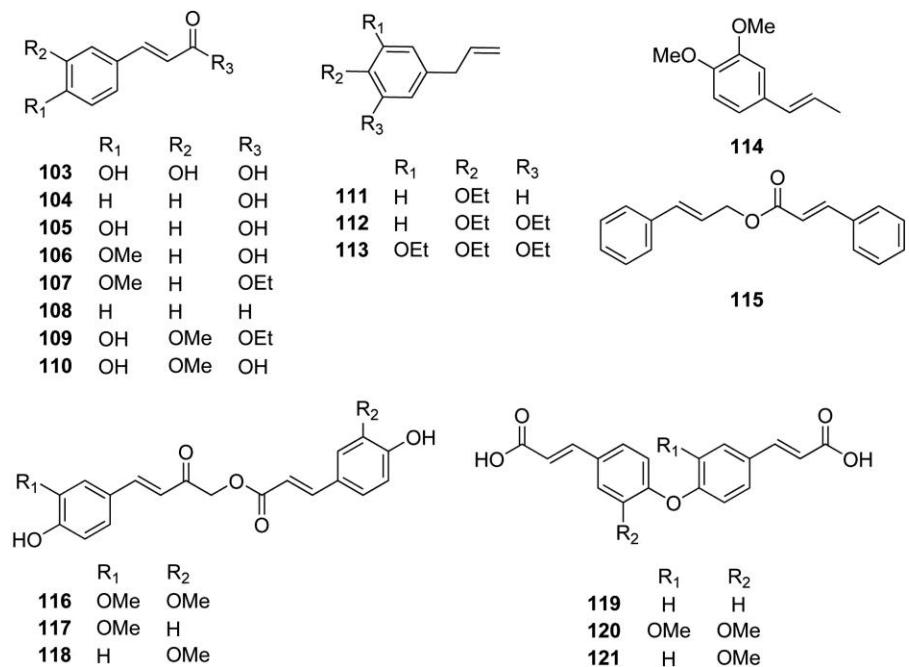


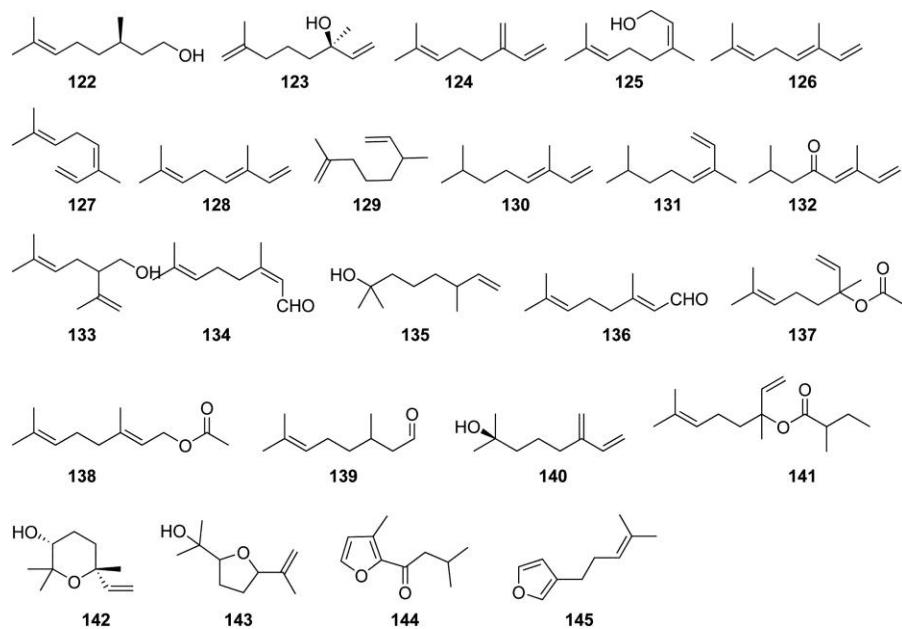


**Figure 4** Diphenylheptanoids from the genus *Curcuma*.

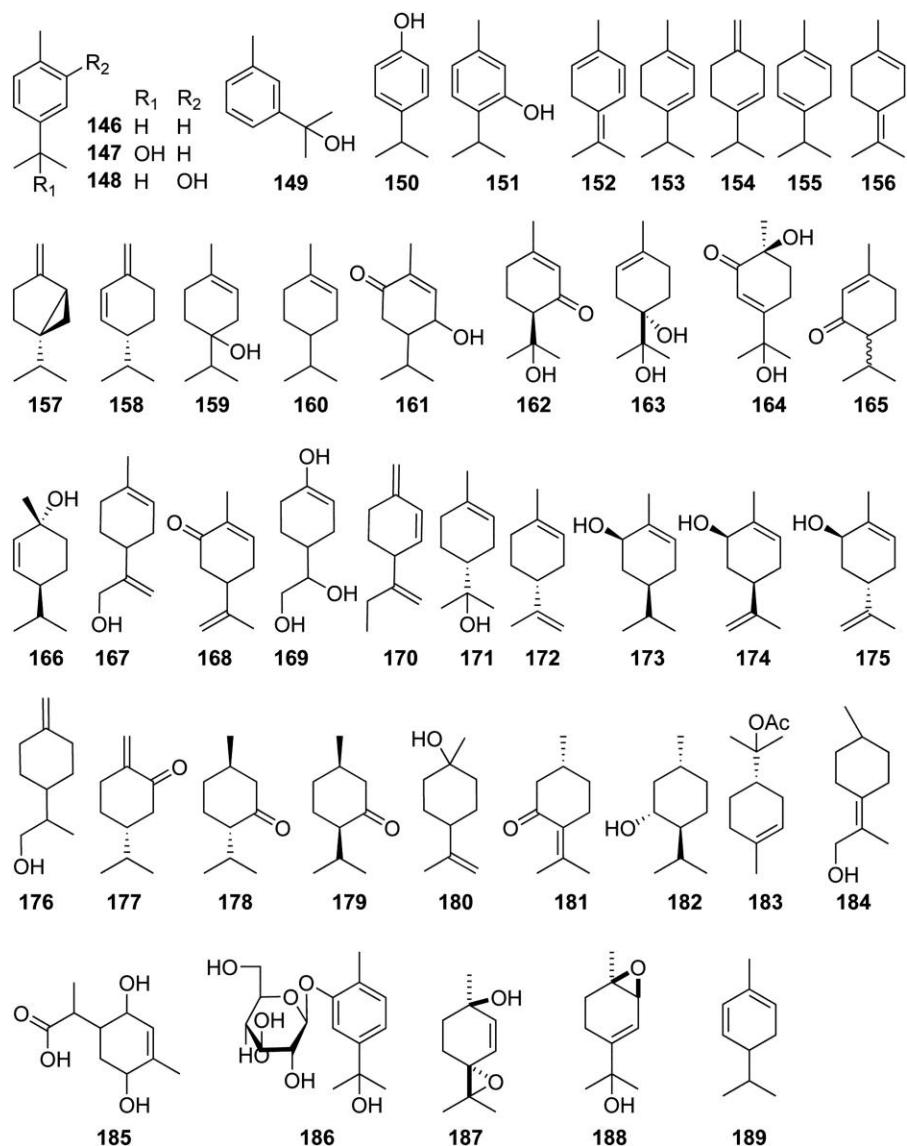


**Figure 5** Diphenylpentanoids from the genus *Curcuma*.

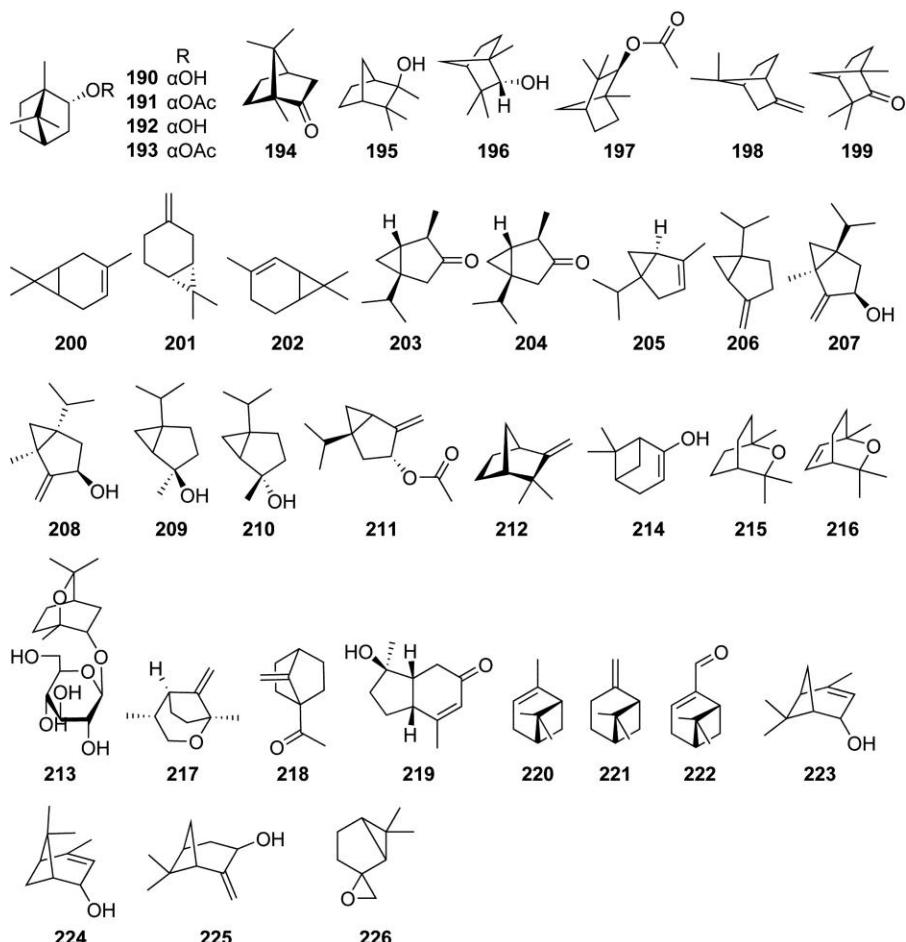
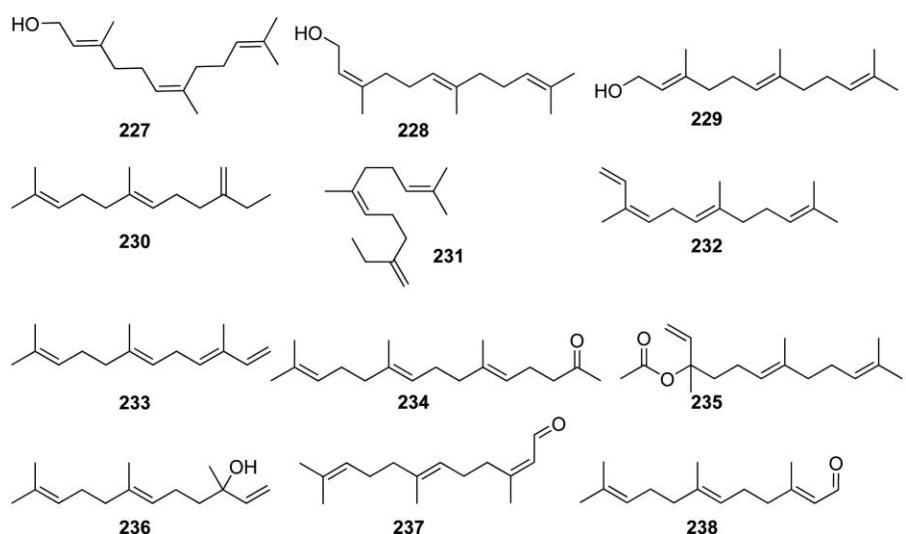
**Figure 6** Other diphenylalkanoids from the genus *Curcuma*.**Figure 7** Phenylpropene derivatives from the genus *Curcuma*.

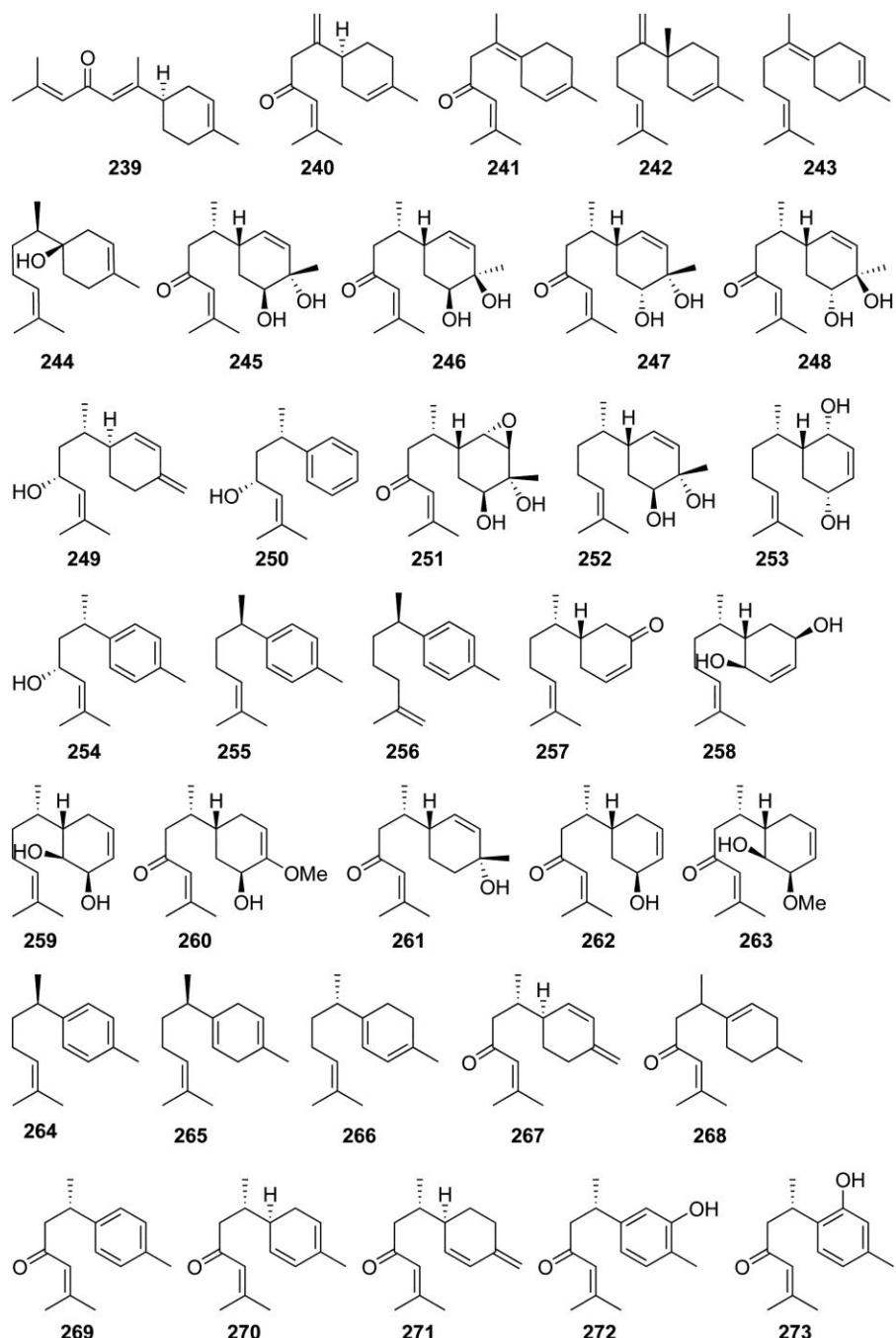


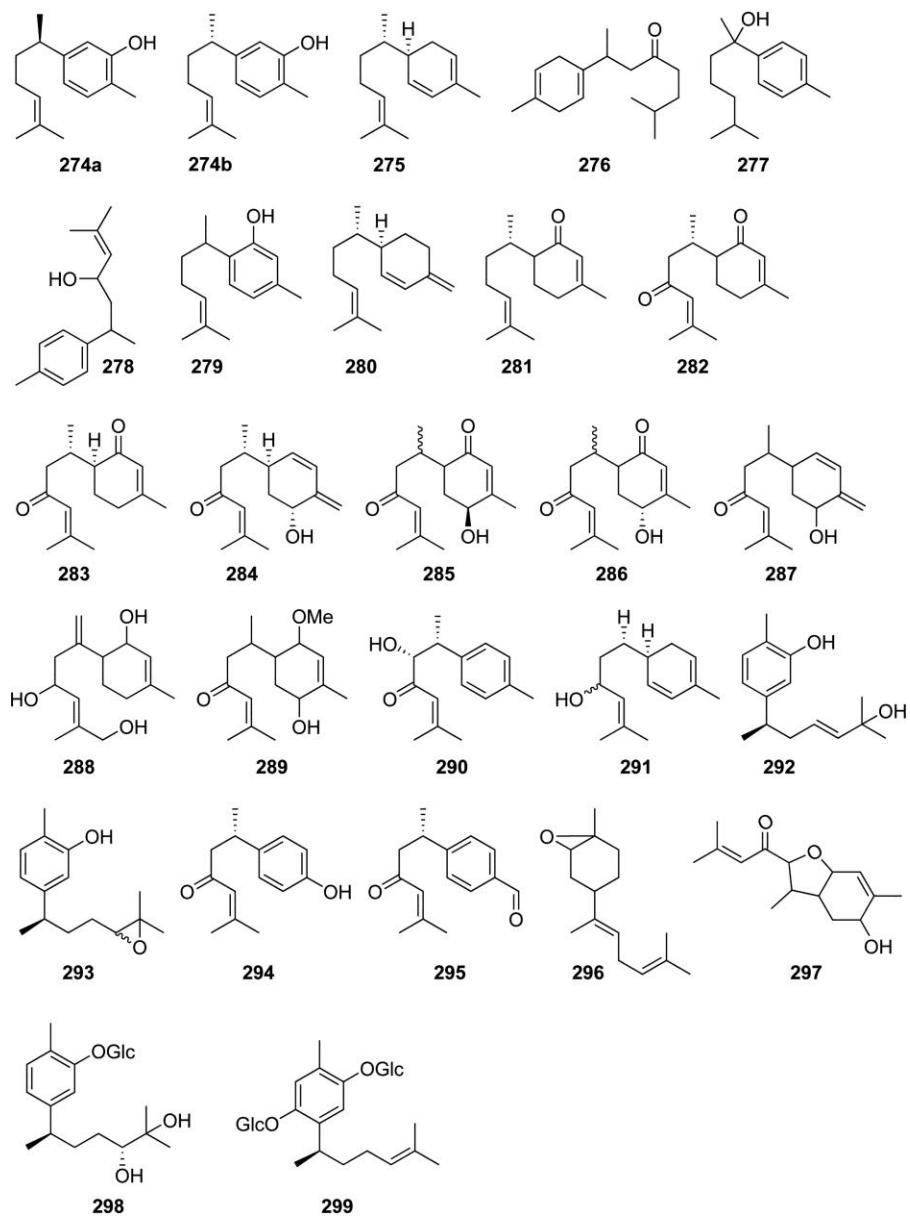
**Figure 8** Acyclic monoterpenoids from the genus *Curcuma*.

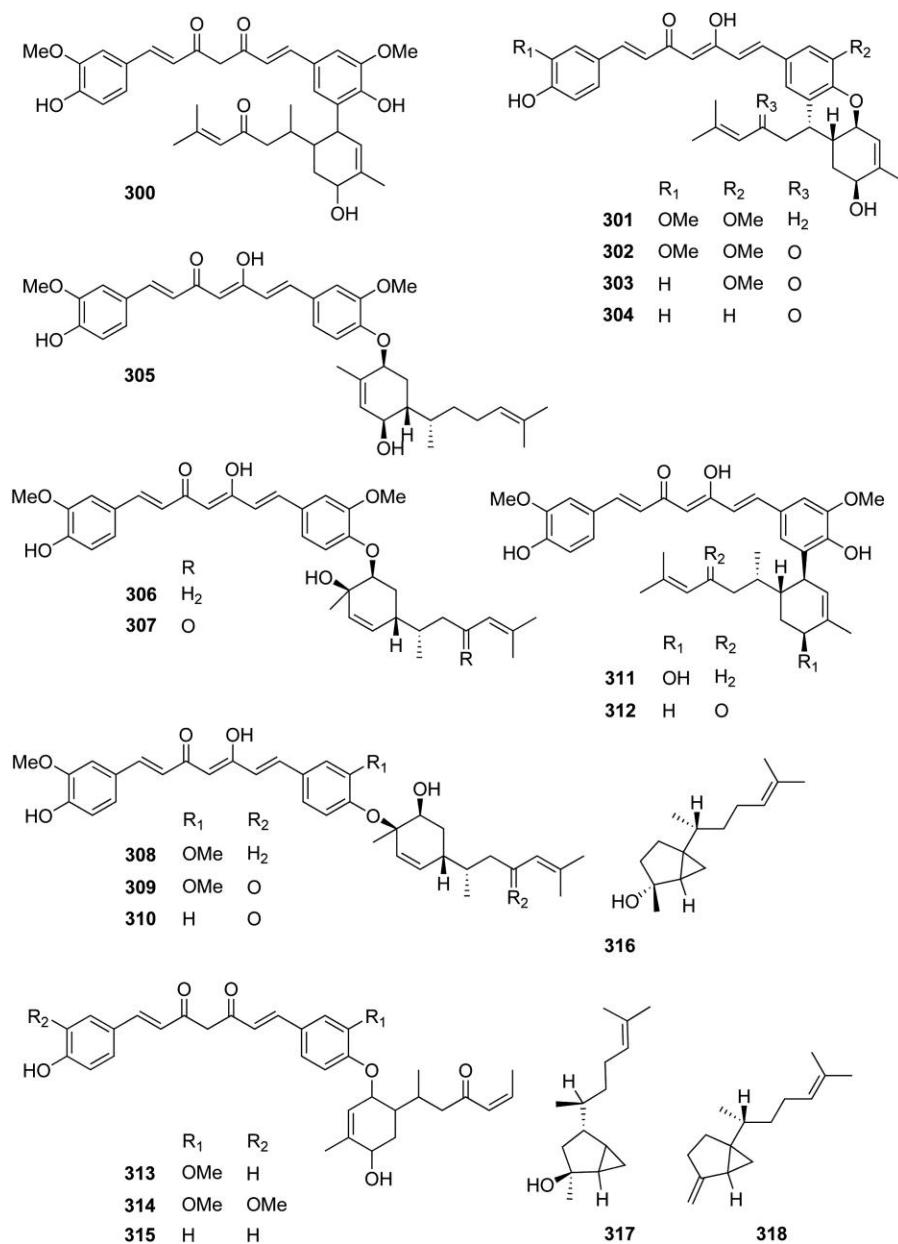


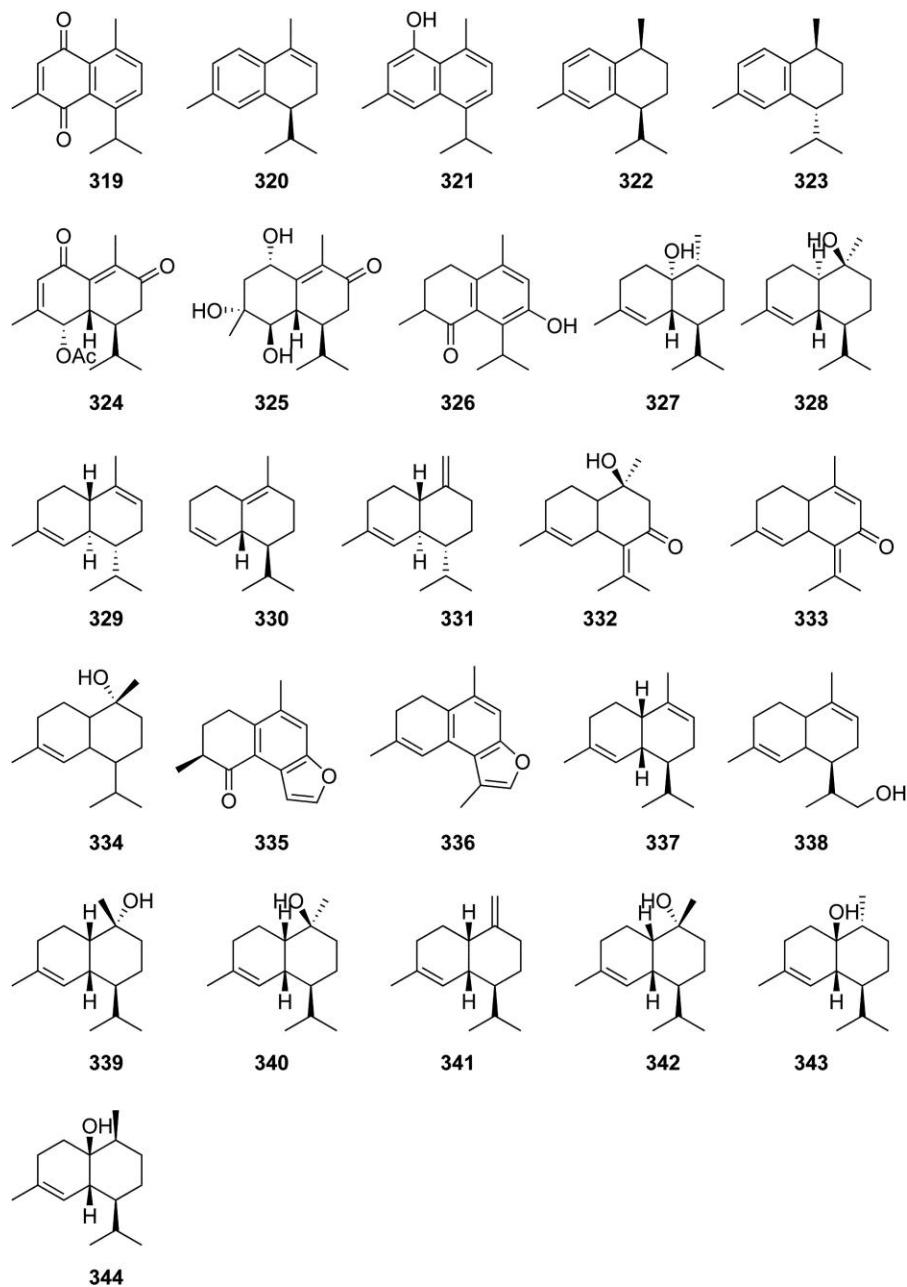
**Figure 9** Menthane monoterpenoids from the genus *Curcuma*.

**Figure 10** Bicyclic monoterpenoids from the genus *Curcuma*.**Figure 11** Farnesane sesquiterpenoids from the genus *Curcuma*.

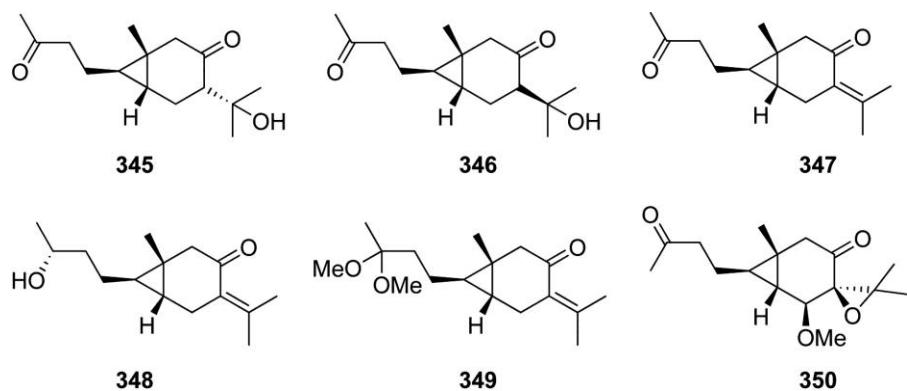




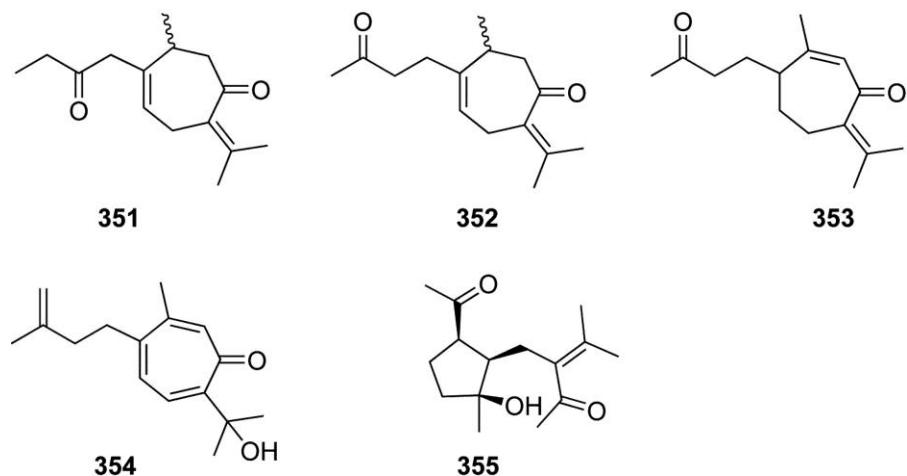
**Figure 12** Bisabolane-type sesquiterpenes from the genus *Curcuma*.



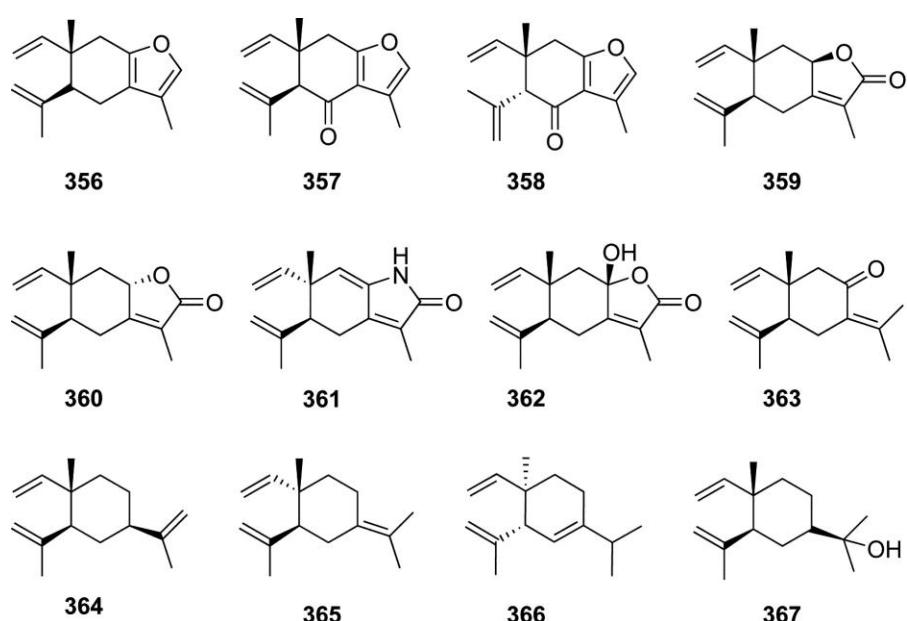
**Figure 13** Cadinane-type sesquiterpenoids from the genus *Curcuma*.



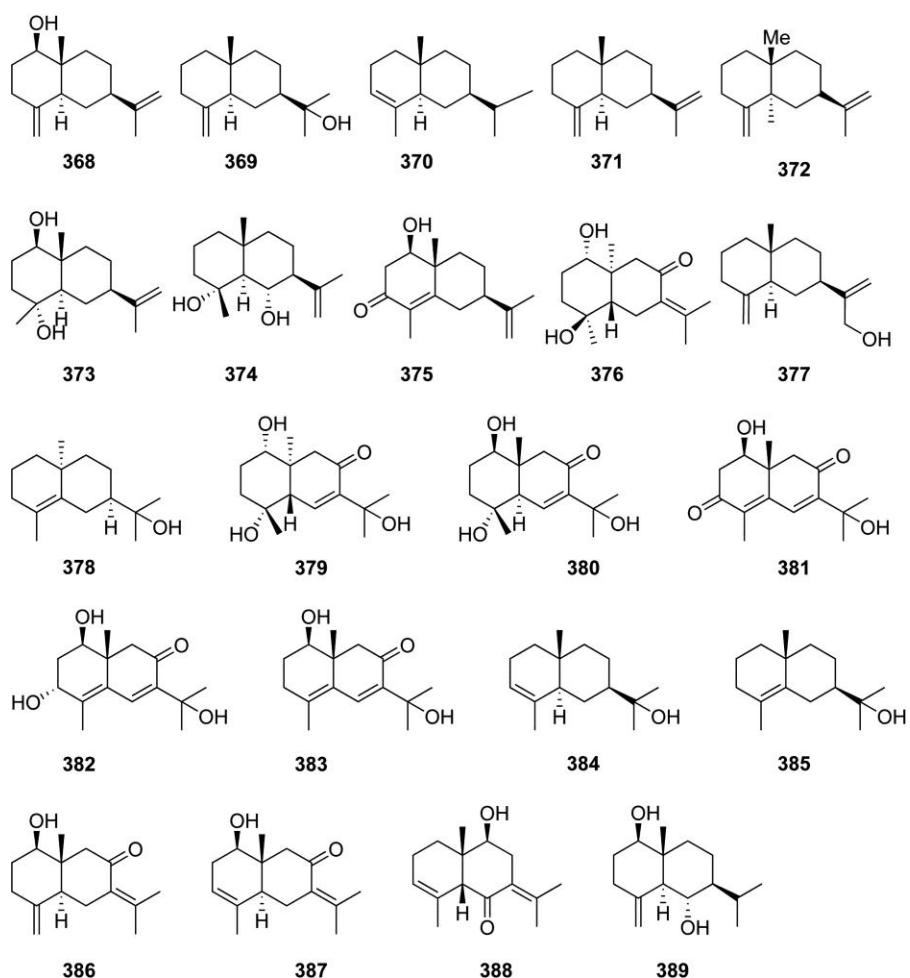
**Figure 14** Carabbrane-type sesquiterpenes from the genus *Curcuma*.

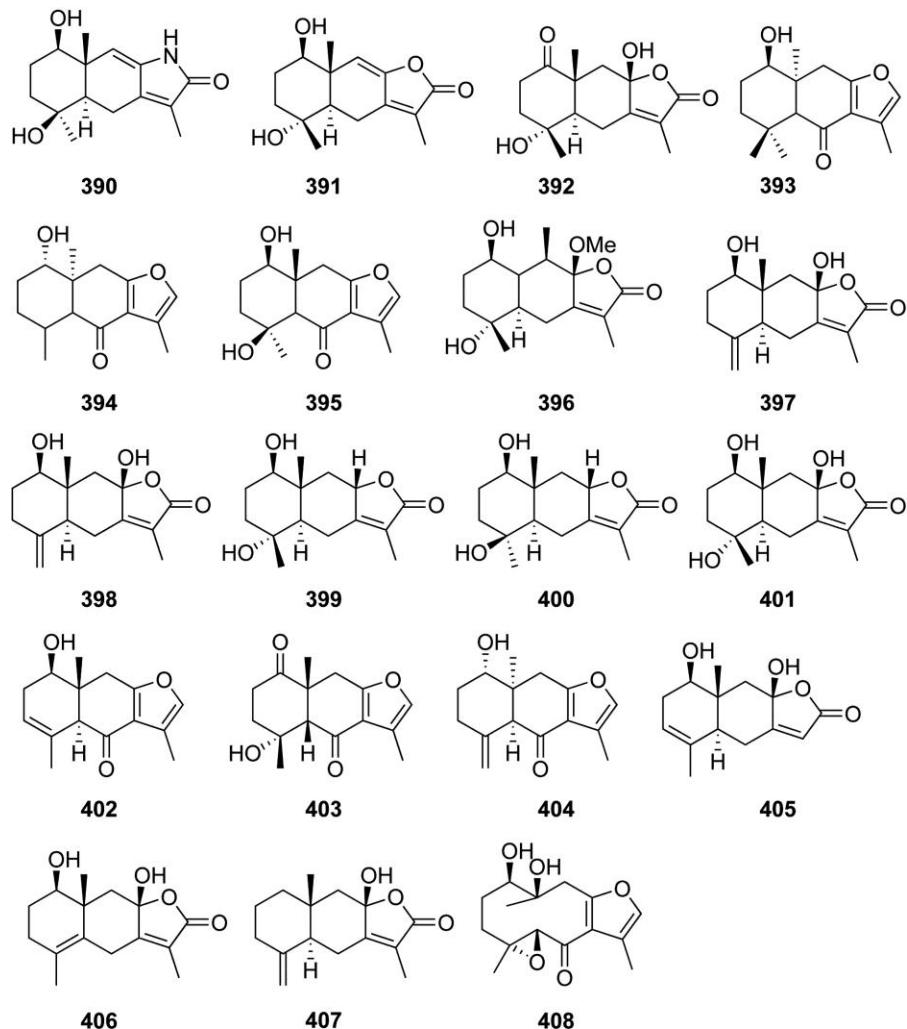


**Figure 15** Curcumane-type sesquiterpenes from the genus *Curcuma*.

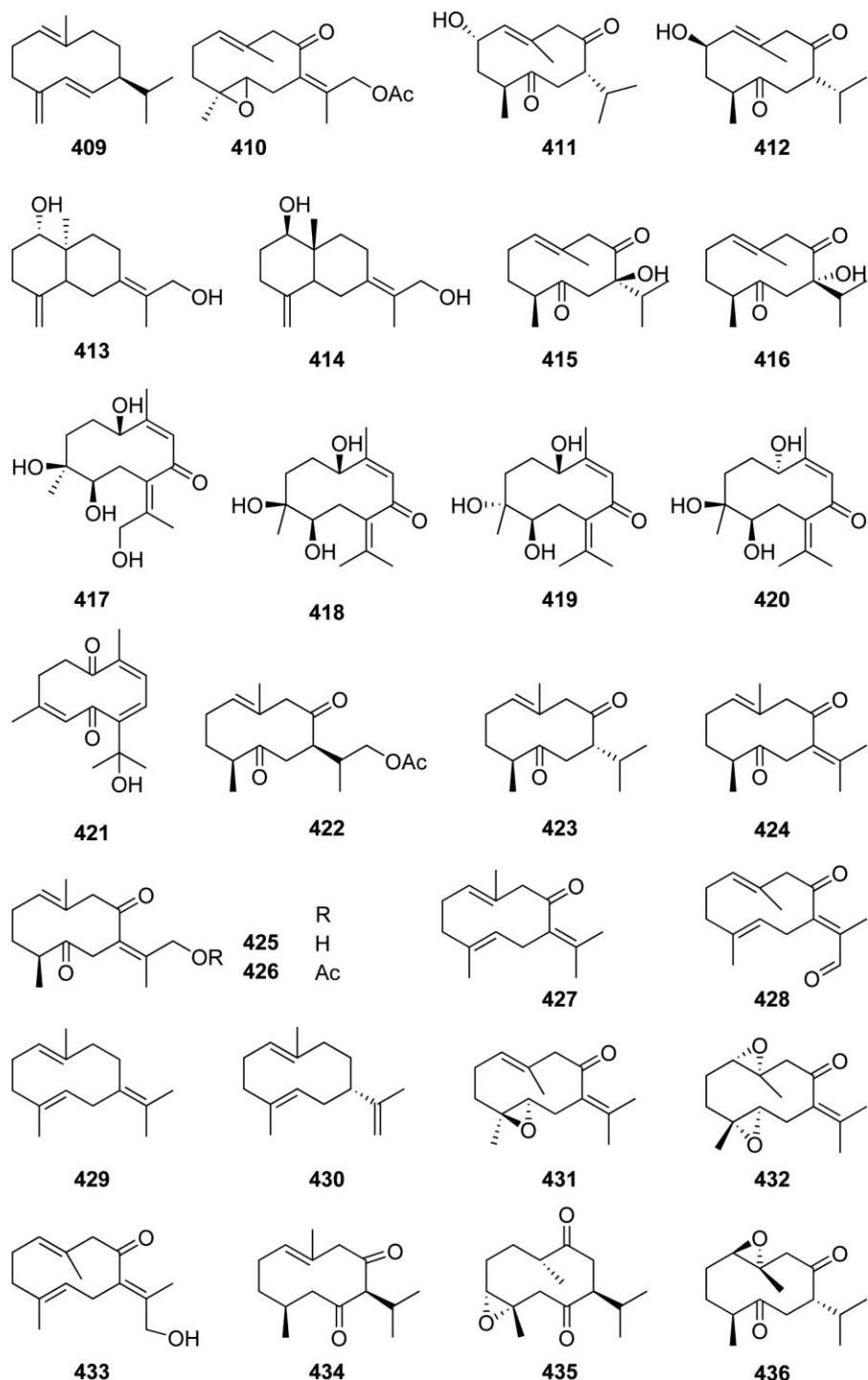


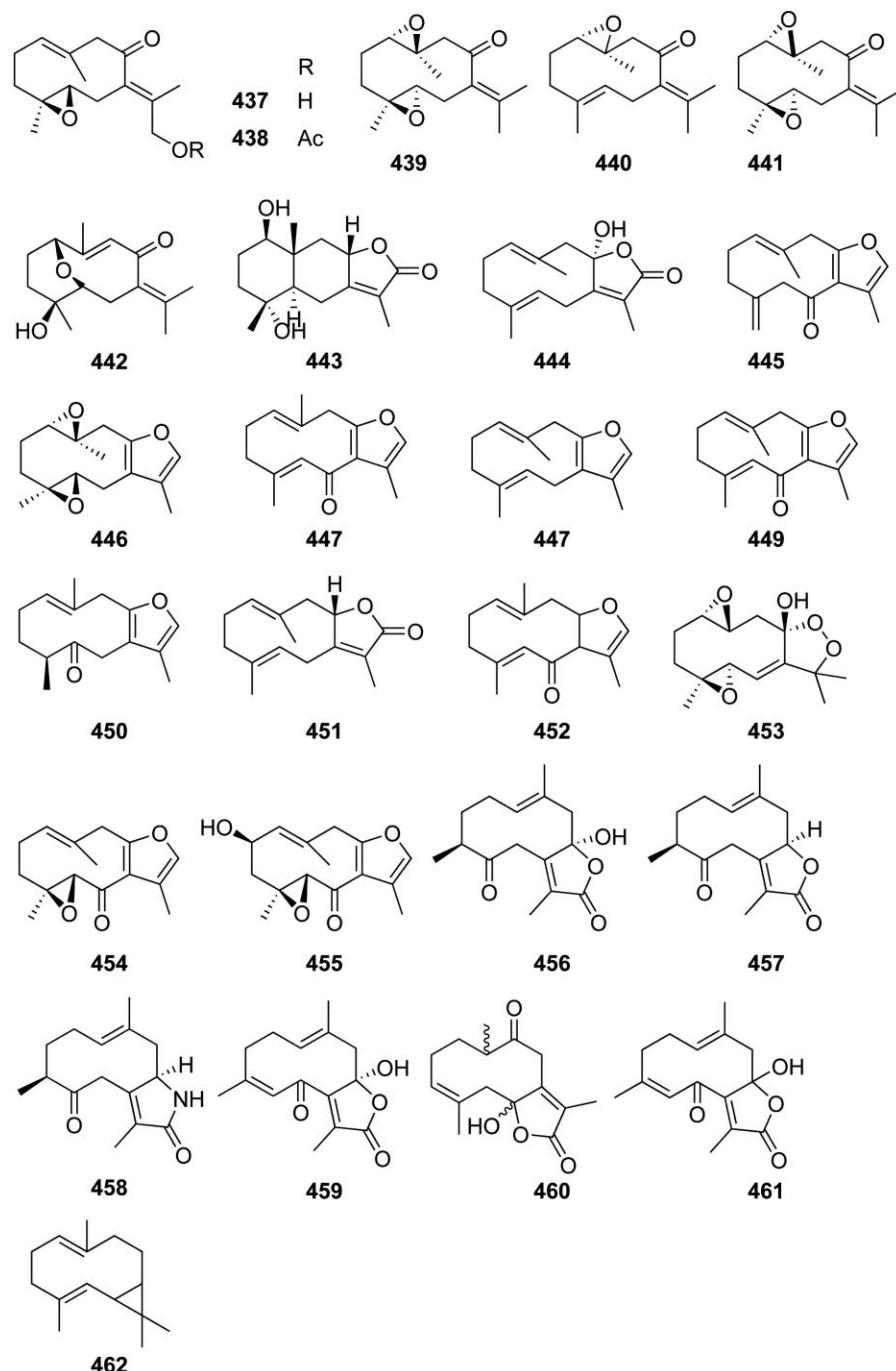
**Figure 16** Elemane-type sesquiterpenes from the genus *Curcuma*.



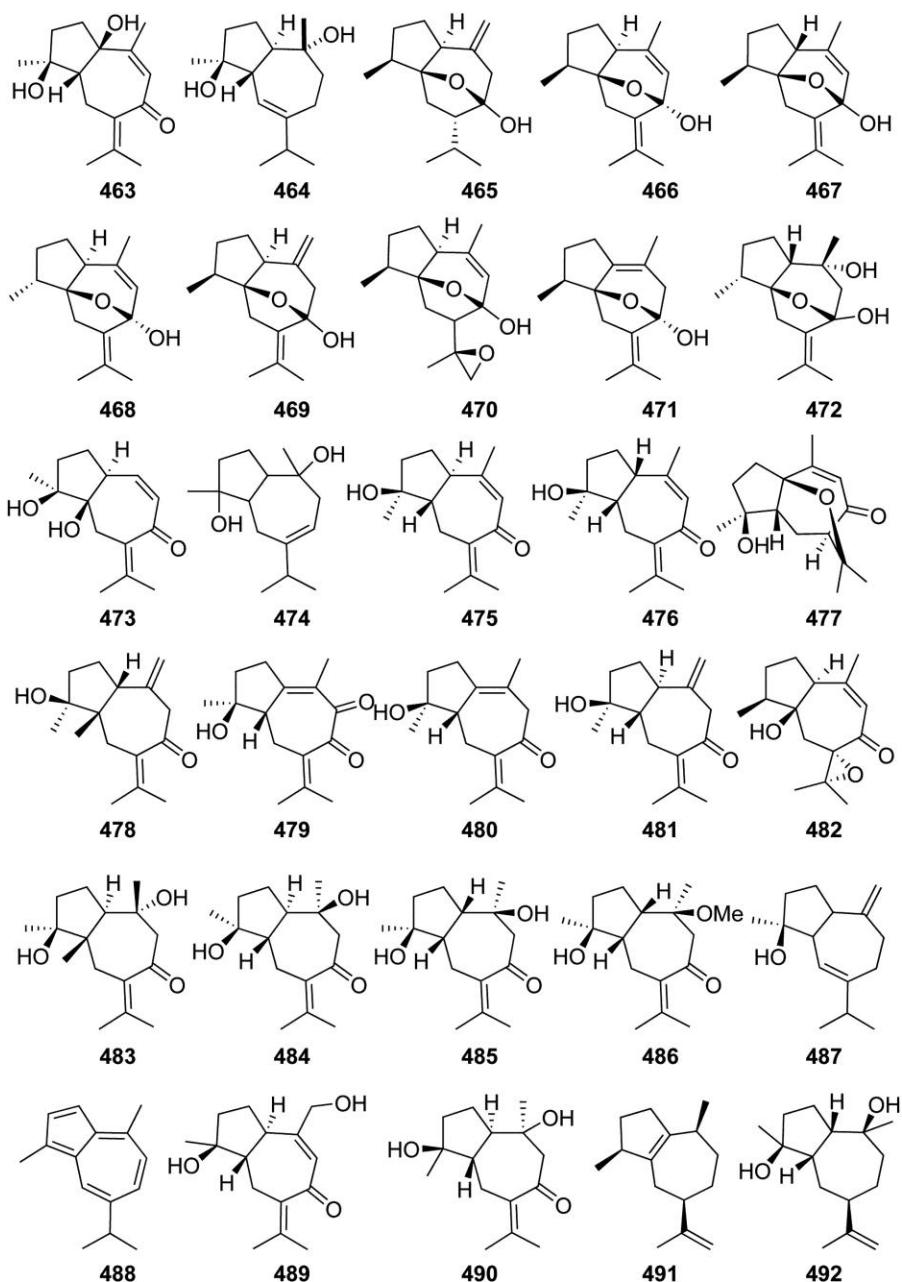


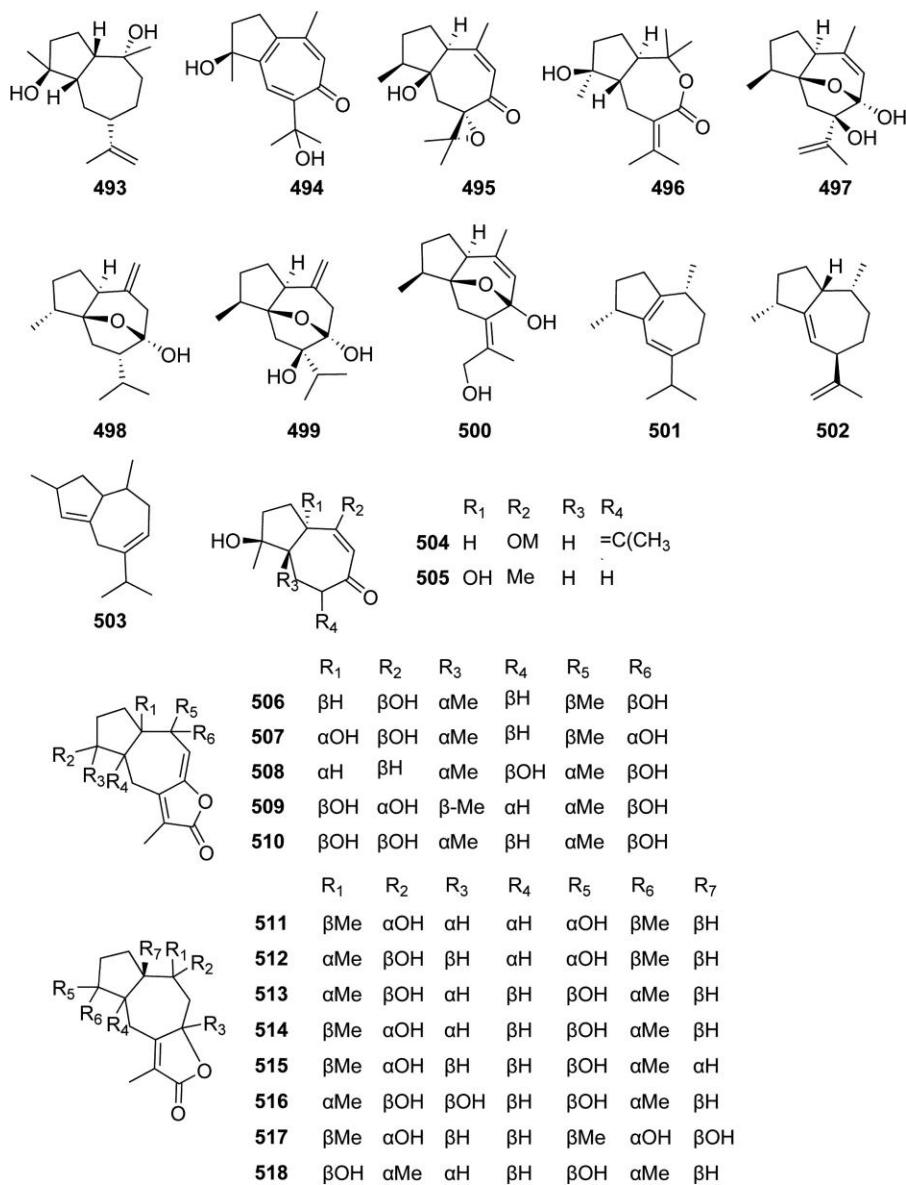
**Figure 17** Eudesmane and furanoeudesmane-type sesquiterpenes.

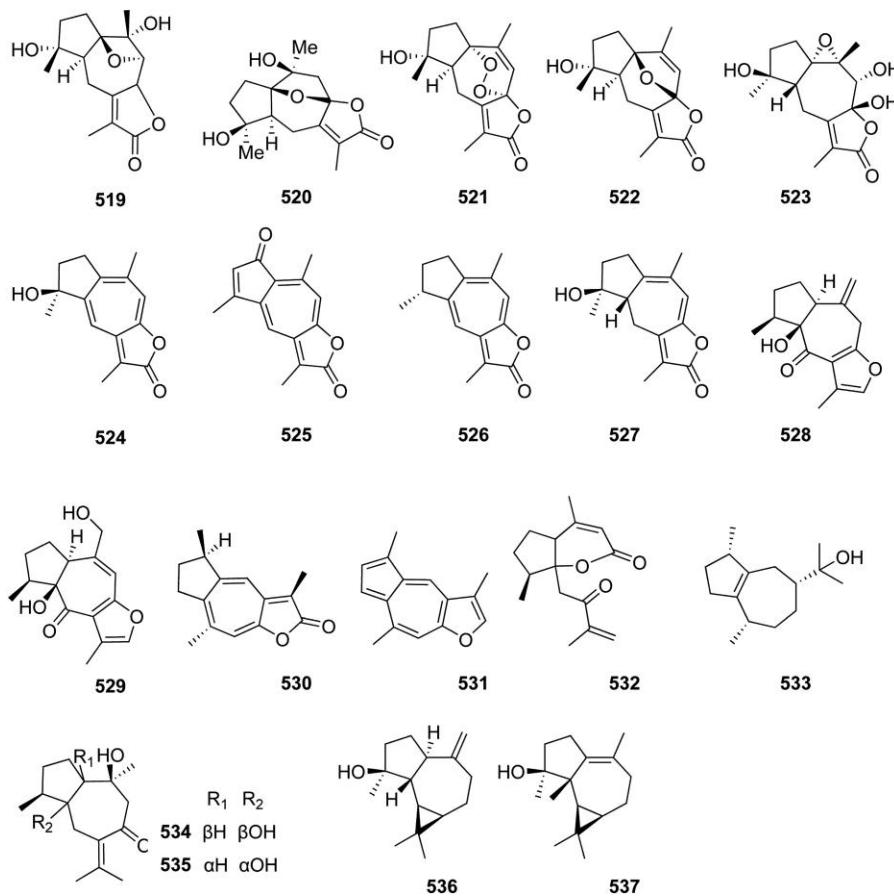




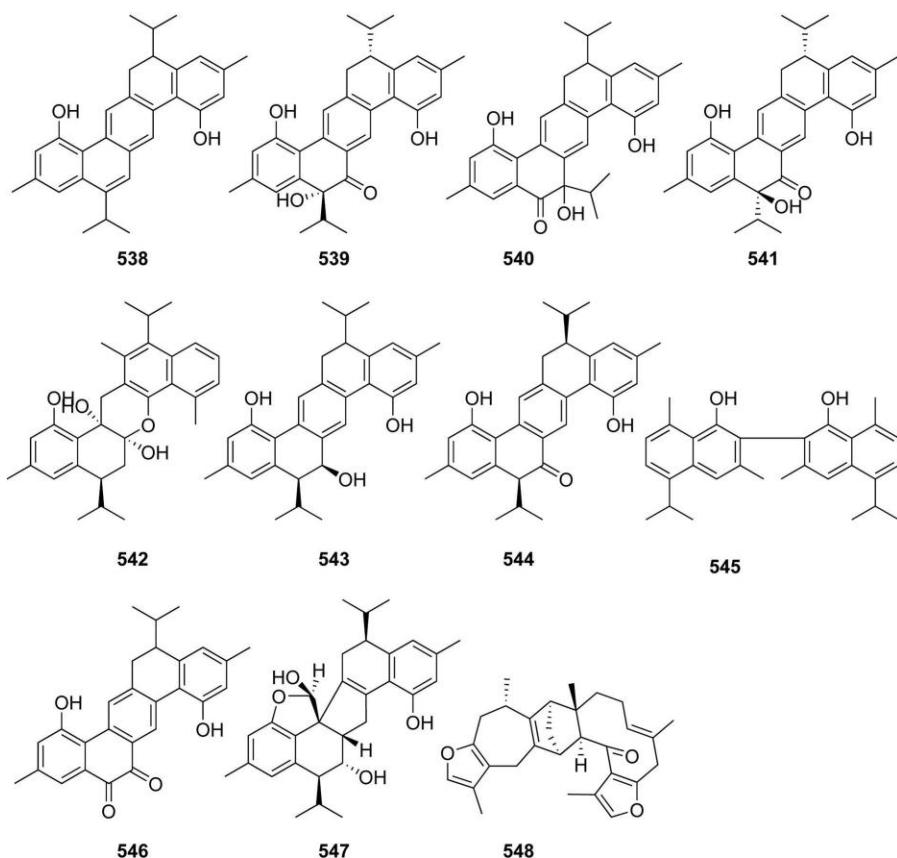
**Figure 18** Germacrane-type sesquiterpenes from the genus *Curcuma*.



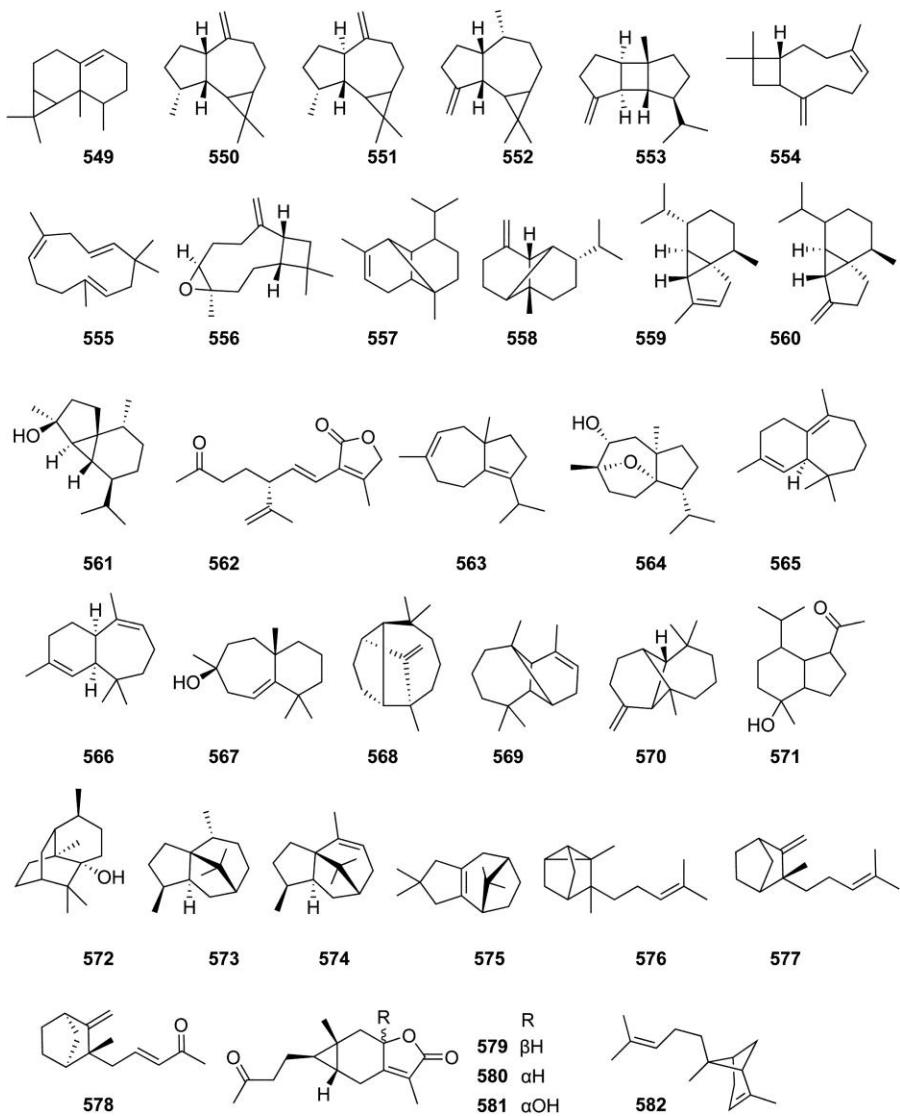


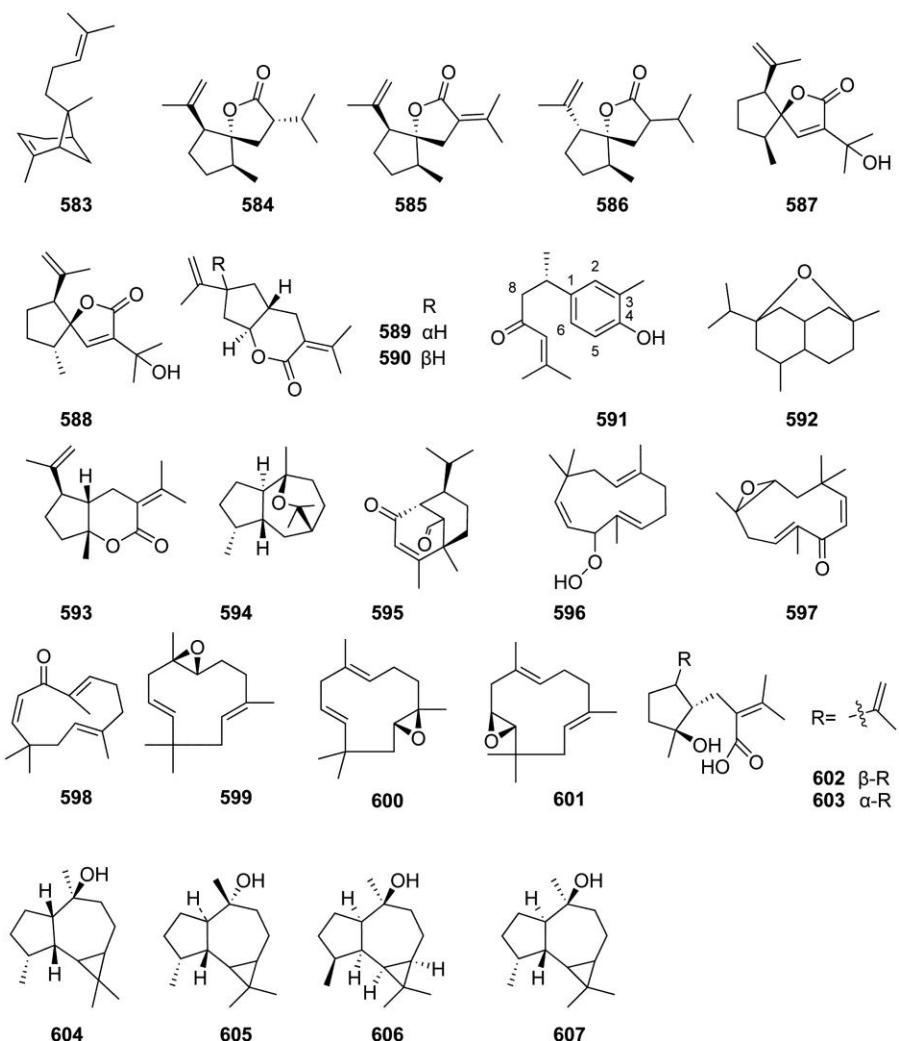


**Figure 19** Guaiane-type sesquiterpenes from the genus *Curcuma*.



**Figure 20** Sesquiterpene dimers from the genus *Curcuma*.





**Figure 21** Other sesquiterpenes from the genus *Curcuma*.

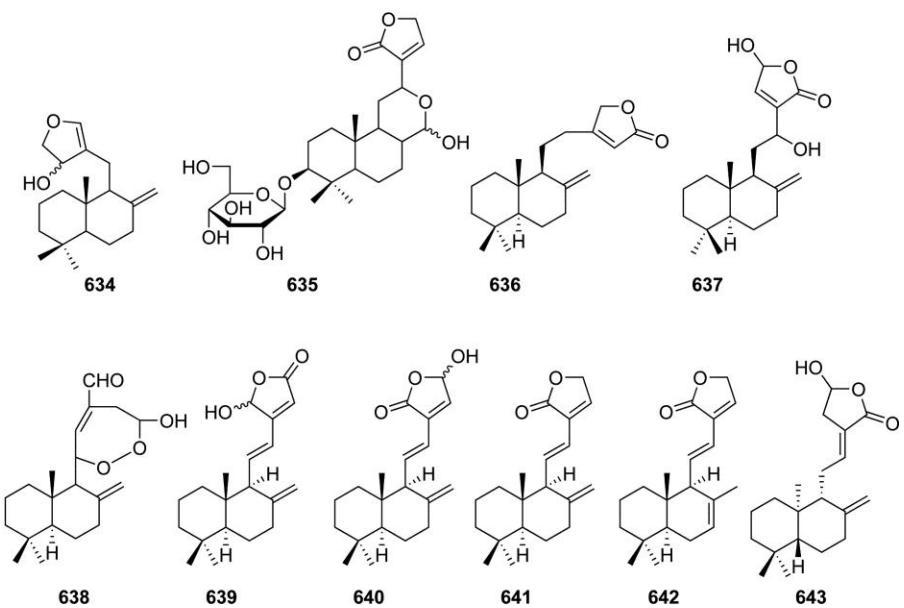
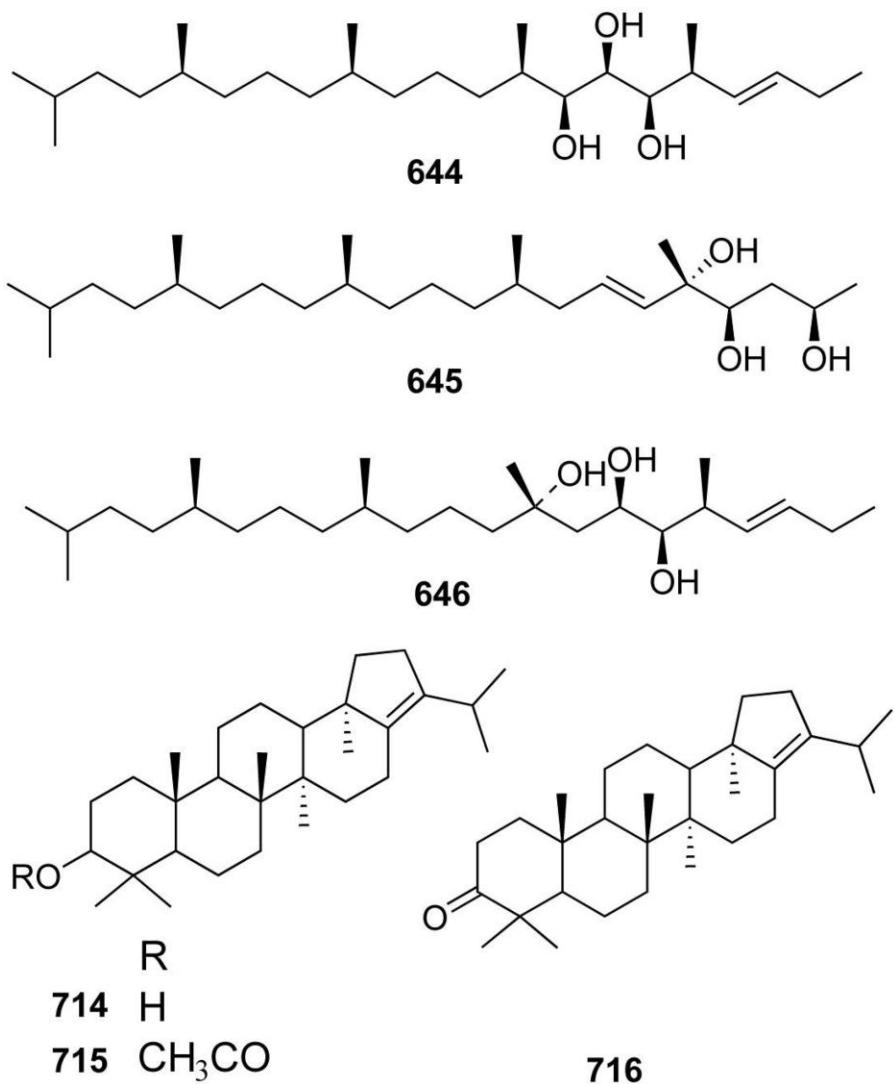
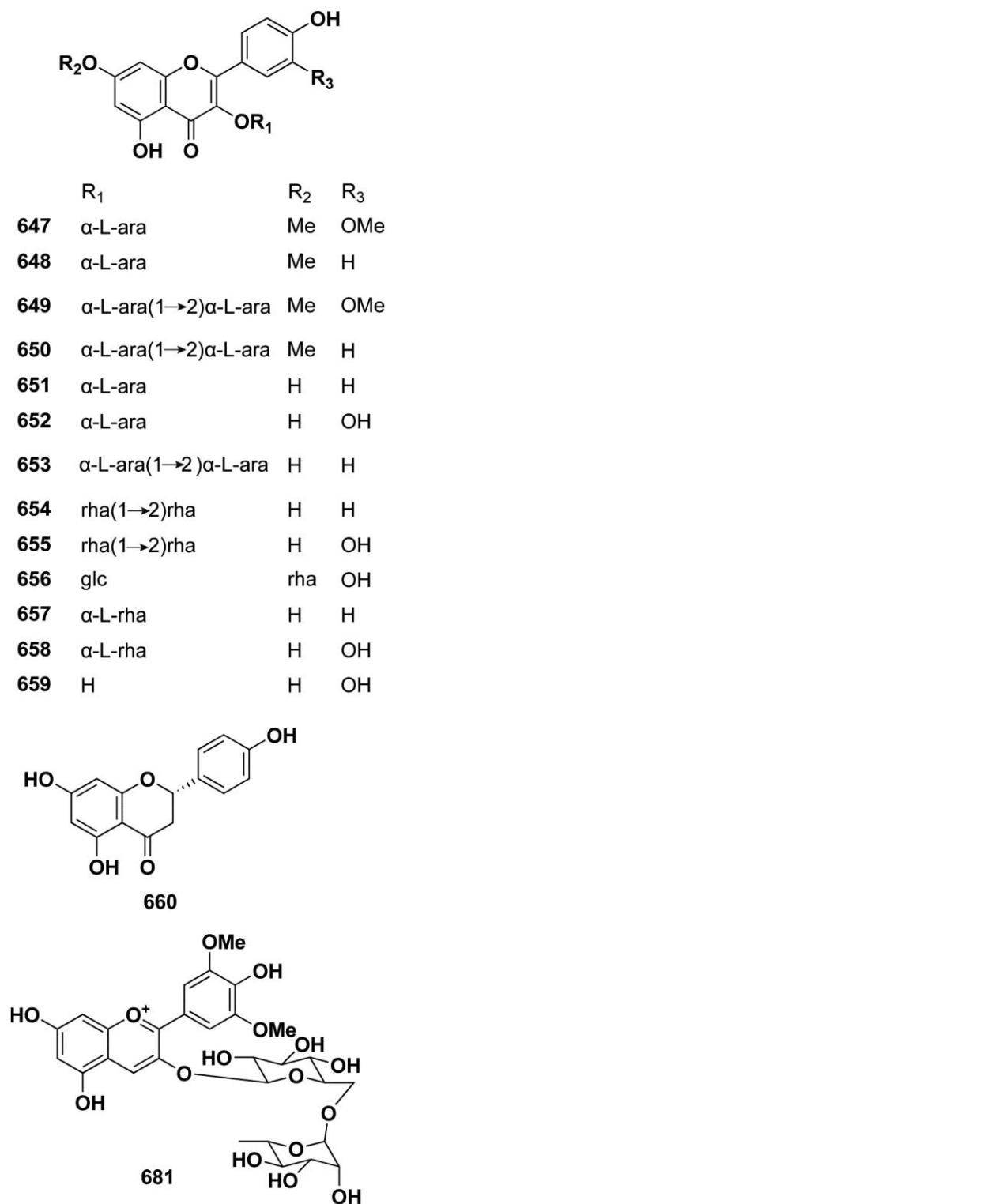


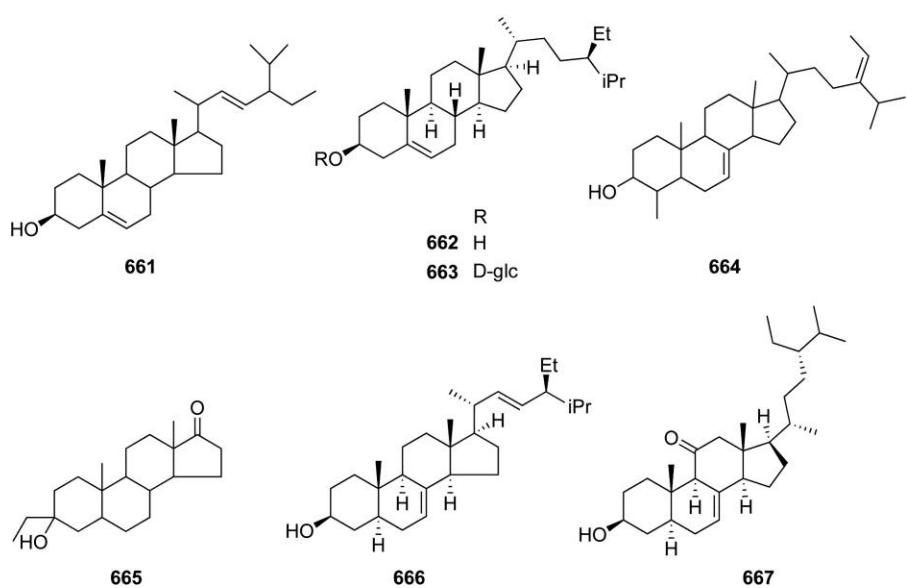
Figure 22 Diterpenes from the genus *Curcuma*.



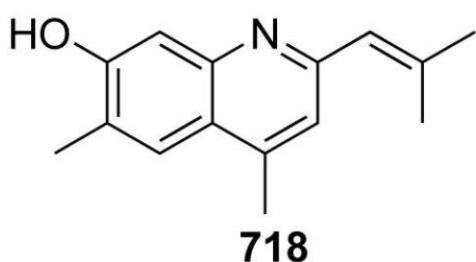
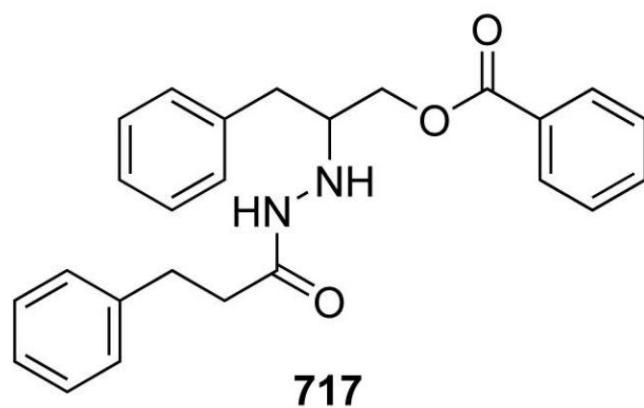
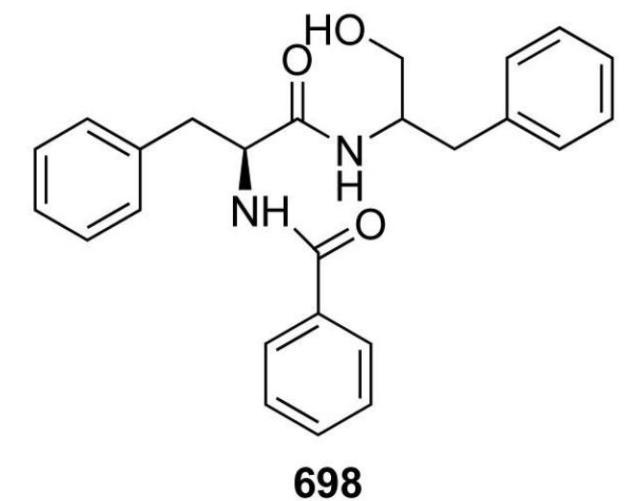
**Figure 23** Sesterterpenoids and triterpenoids from the genus *Curcuma*.



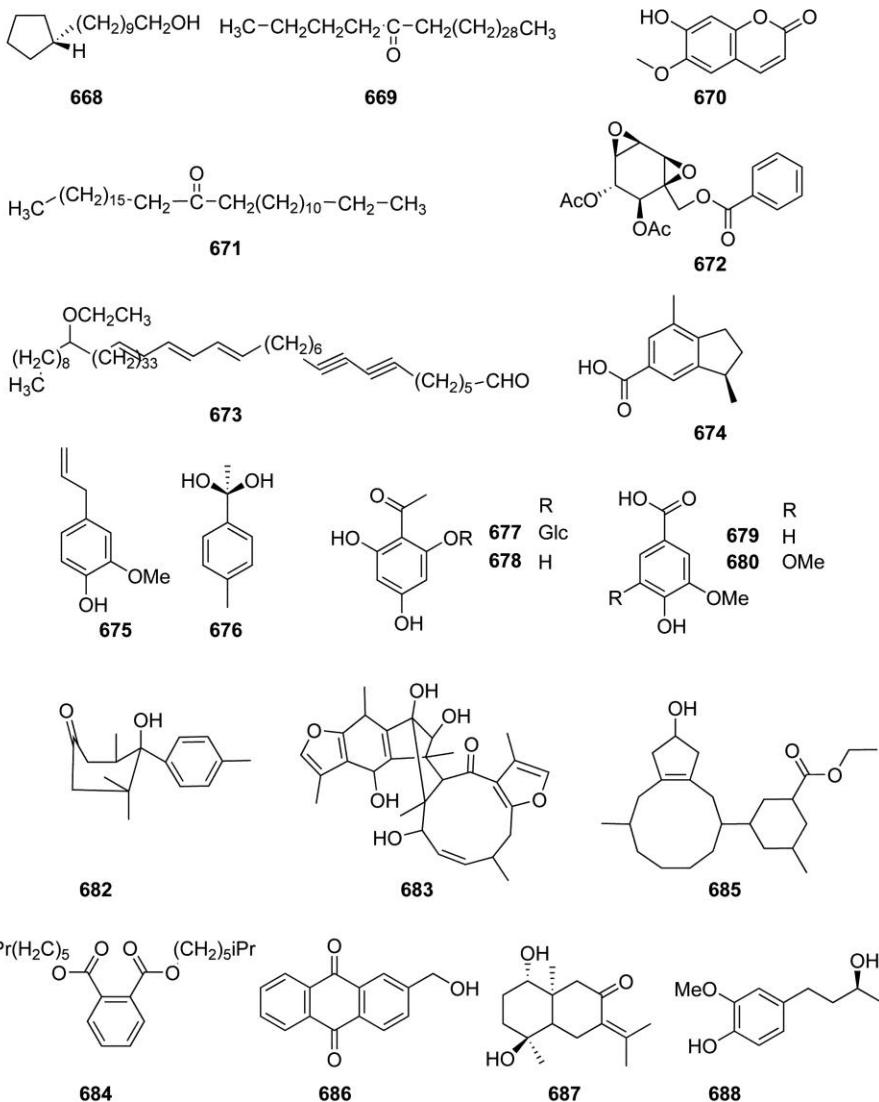
**Figure 24** Flavonoids from the genus *Curcuma*.

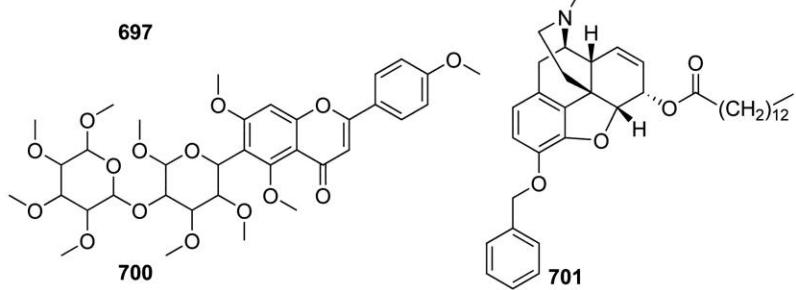
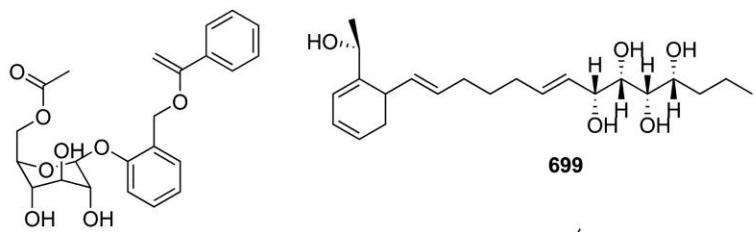
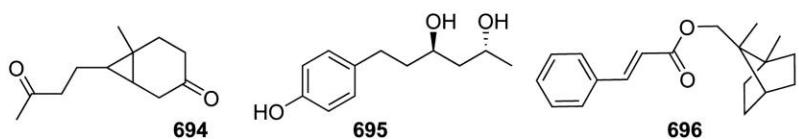
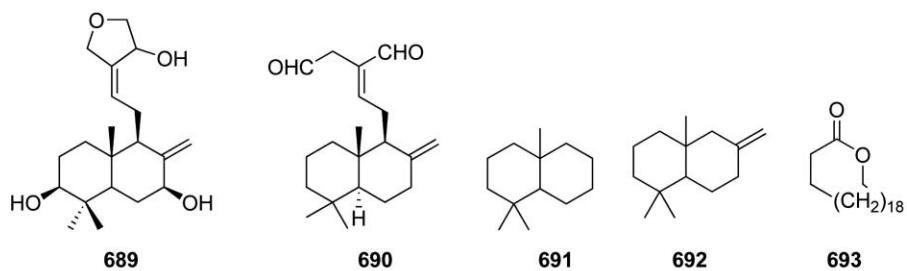


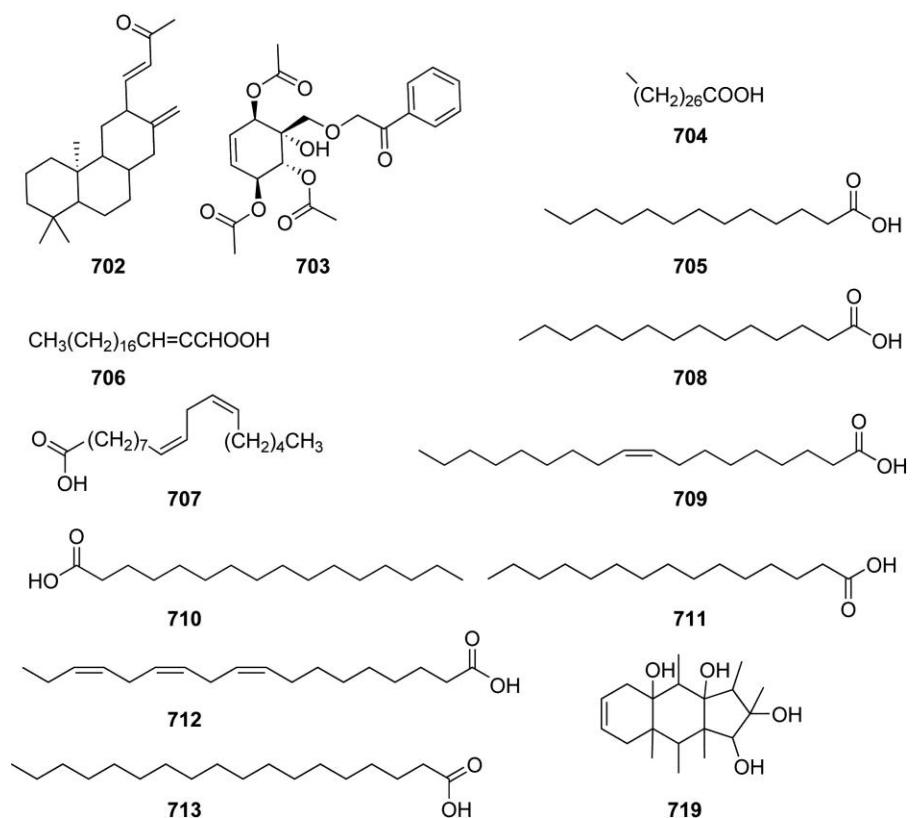
**Figure 25** Steroids from the genus *Curcuma*.



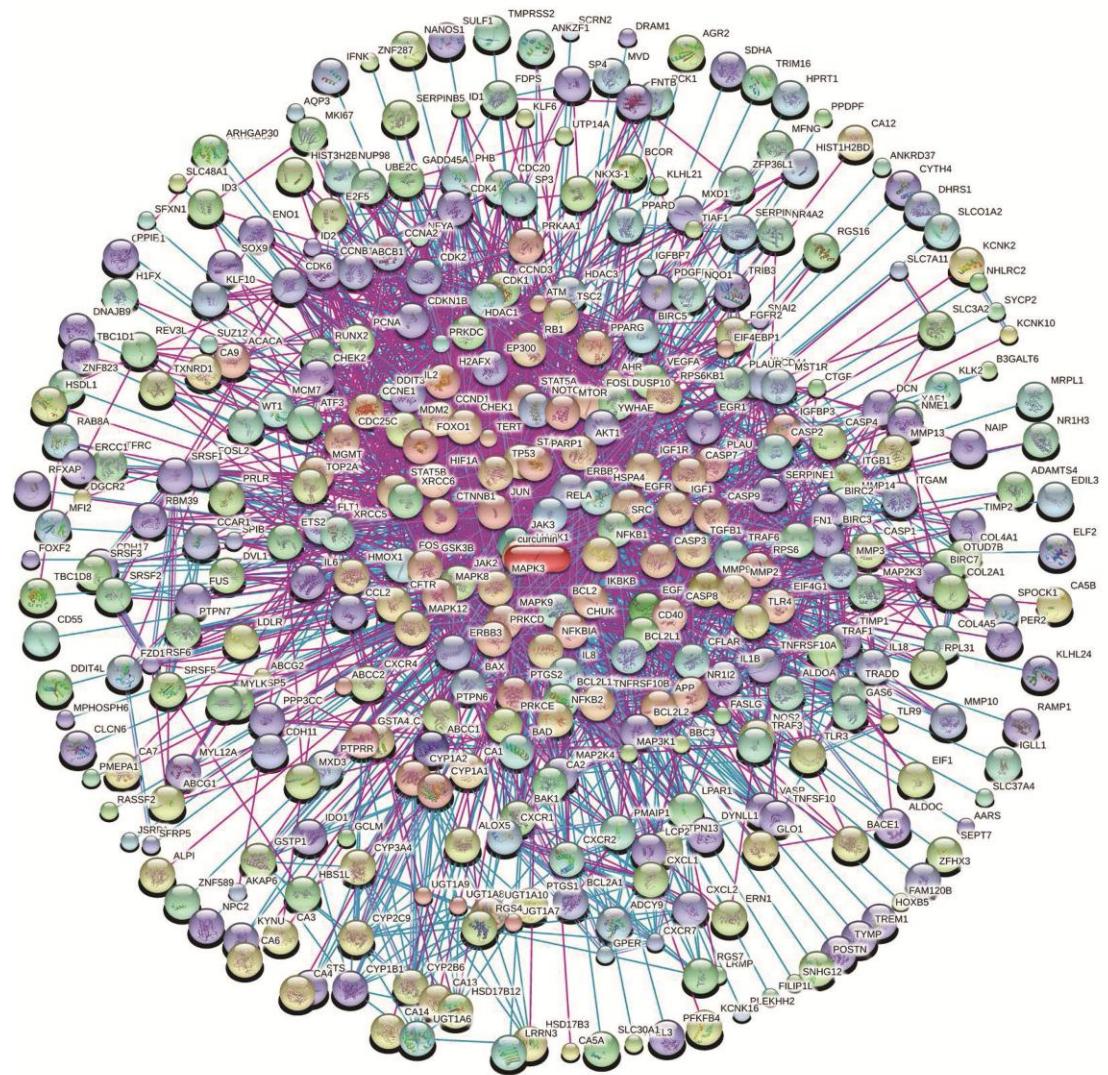
**Figure 26** Alkaloids from the genus *Curcuma*.







**Figure 27** Miscellaneous compounds from the genus *Curcuma*.



**Figure 28** Drug-protein interaction analysis of curcumin