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MINI REVIEW

Distribution of betulinic acid in plant kingdom

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Abstract

Betulinic acid (3β-hydroxy-lup-20(29)-en-28-oic acid) is a ubiquitous pentacyclic triterpenoid found in the plants. It is highly valued for its role in wide array of ailments *viz*. anti-HIV, anti-malarial, anti-cancerous, hepatoprotective, and many more. In lights of tremendous interest in recent years on chemistry and pharmacological properties of betulinic acid (BA), comprehensive data have been collected in this review to present its distribution in plant kingdom.

Keywords: Betulinic acid; Triterpenoids

Introduction

Plants are well known for their medicinal value with the finding of cinchona in 17th century, followed by digitoxin, morphine, introduction of synthetic asprin, a derivative of a plant-based drug, are wonders of the diverse floristic wealth (Raskin & Ripoll, 2004). Natural products offer large structural diversity and techniques for separation, structure elucidation, screening and combinatorial synthesis have led to revitalization of these secondary metabolites as sources of new drugs (Saklani & Kutty, 2008).

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Betulinic acid (BA) (3β-hydroxy-lup-20(29)-en-28-oic acid molecular formula: $C_{30}H_{48}O_3$ and molecular weight: 456.7) is a pentacyclic triterpenoid (Fig. 1). It is moderately soluble in water and relatively nontoxic, found in many plants, especially in tree species. It is a biologically active compound, mainly known for its selective inhibitor of human melanoma (Pisha *et al*., 1995). The compound gains its name because of its prevalence in the family Betulaceae, which includes *Betula alba*, *B. pubescens, B. platyphylla B. maximowicziana, B. mandshurica* and others. The family still serves as a major source of betulinic acid. Also its congener betulin, is one of the first natural products isolated in 1788 from the bark of white birch, *Betula alba* (Krasutsky, 2006).

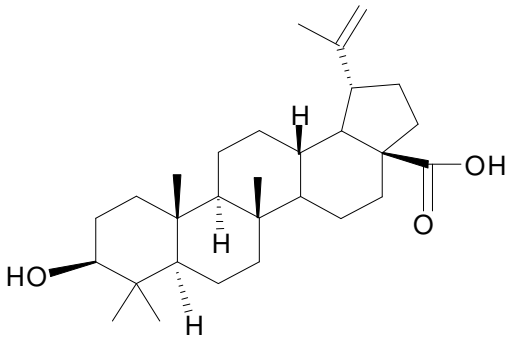

Fig 1. Chemical Structure of betulinic acid

Search tools including, Google Scholar®, PubMed® and Scopus® were used to generate the literature on BA. Over ~800 hits were spotted which are related to betulinic acid. Out of which the reports related to the subject matter of this review were considered.

Distribution of BA in plant species

Betulinic acid is widely distributed in nature and its occurrence across a wide multitude of taxonomically different genera has been reported. Therefore, in this review, attempt has been made to list the plant species in which the compound BA has been accounted (Table 1).

Table 1. Distribution of betulinic acid in various plant species

Plant name	Family	Part	Reference
Achyranthes aspera	Amaranthaceae	Leaf	Pai, Upadhya, Hegde, Joshi, & Kholkute, 2014
Ampelozizyphus amazonicus	Rhamnaceae	Stem	Rosas *et al*., 2007
Ancistrocladus heyneanus	Ancistrocladaceae	Roots	Bringmann *et al*., 1997
Ancistrocladus heyneanus	Ancistrocladaceae	Leaf	Pai, Nimbalkar, Pawar, & Dixit, 2011
Arbutus menziesii	Ericaceae	Stem Bark	Yogeeswari & Sriram, 2005
Berlinoa grandiflora	Leguminoceae	Stem Bark	Yogeeswari & Sriram, 2005
Betula platyphylla	Betulaceae	Stem Bark	Zhang, Yu, & Wang, 2003
Betula pubescens	Betulaceae	Stem Bark	Abyshev, Zhurkovich, Agaev, Abdulla-zade, & Guseinov, 2006; Abyshev, Agaev, & Guseinov, 2007
Betula pendula	Betulaceae	Stem Bark	Holonec, Ranga, Crainic, Truta, & Socaciu, 2012; Galgon, Hoke, & Drager, 1999
Betula maximowicziana	Betulaceae	Stem Bark	Abyshev *et al*., 2007
Betula mandshurica	Betulaceae	Stem Bark	Abyshev *et al*., 2007
Caesalpinia paraguariensis	Fabaceae	Arial	Woldemichael, Singh, Maiese, & Timmermann, 2003
Callicarpa macrophylla	Lamiaceae	Herb	Pan, Jia, & Sun, 2008
Cichorium intybus	Asteraceae	Seeds	Atta-ur-Rahman, Zareen, Choudhary, Akhtar, & Khan, 2008
Clerodendrum mandarinorum	Verbenaceae	Root	Zhu, Phillipson, Greengrass, & Bowery, 1996
Coussarea paniculata	Rubiaceae	Stem	Chaturvedula, Schilling, Johnson, & Kingston, 2003
Diospyros leucomelas	Ebenaceae	Stem	Recio *et al.*, 1995
Diospyros melanoxylon	Ebenaceae	Stem	Kantamreddi & Wright, 2007
Diospyros peregrina	Ebenaceae	Stem	Kantamreddi & Wright, 2007
Diospyros sylvatica	Ebenaceae	Stem	Kantamreddi & Wright, 2007
Diospyros tomentosa	Ebenaceae	Stem	Kantamreddi & Wright, 2007
Dichapetalum gelonioides	Dichapetalaceae	Stem Bark	Fang *et al*., 2006
Dillenia papuana	Dilleniaceae	Leaves, Stem	Nick, Wright, Rali, & Sticher, 1995
Doliocarpus schottianus	Dilleniaceae	Arial	De Oliveira, Santos, & Espindola, 2002
Eucalyptus camaldulensis	Myrtaceae	Leaves	Begum, Sultana, Siddiqui, Shaheen, & Gilani, 2002
Henriettella fascicularis	Melastomataceae	Stem	Calderon *et al*., 2002
Ipomea pescaprae	Convolvuleaceae	Root bark	Yogeeswari & Sriram, 2005
Licania arianeae	Chrysobalanaceae	Stem, Leaves	De Carvalho *et al*., 2008
Melaleuca leucadendron	Myrtaceae	Leaves	Lee, 1998
Morus alba	Moraceae	Stem, Root	Nattapong and Omboon, 2008
Morus australis	Moraceae	Roots	Ko, Yu, Ko, Teng, & Lin, 1997
Nepeta nuda	Lamiaceae	Arial	Kokdil, Yalçin, & Topçu, 1999
Nerium oleander	Apocynaceae	Leaves	Fu *et al*., 2005
Oenothera biennis	Onagraceae	Arial	Hamburger *et al*., 2002
Paeonia suffruticosa	Ranunculaceae	Roots	Lin, Ding, & Wu, 1998
Physocarpus intermedium	Rosaceae	Stem Bark	Yogeeswari & Sriram, 2005
Prunus dulcis	Rosaceae	Hull	Takeoka *et al*., 2000
Quercus suber	Fagaceae	Stem Bark	Sousa, Pinto, Silvestre, & Neto, 2006
Rosmarinus officinalis	Lamiaceae	Arial Leaves	R azborek, Voncina, Dolecek, & Voncina, 2007; 2008
Salvia officinalis	Lamiaceae	Leaves	Razborek *et al*., 2008
Salvia glutinosa	Lamiaceae	Leaves	Razborek *et al*., 2008
Salvia sclarea	Lamiaceae	Leaves	Razborek *et al*., 2008
Satureja montana	Lamiaceae	Leaves	Razborek *et al*., 2008
Strychnos vanprukii	Loganiaceae	Arial	Chien *et al*., 2004
Syncarpa glomulifera	Myrtaceae	Stem Bark	Yogeeswari & Sriram, 2005
Syzigium claviflorum	Myrtaceae	Leaves	Fujioka *et al.*, 1994
Syzigium formasanum	Myrtaceae	Leaves	Chang, Wu, Hsieh, Kuo, & Lee Chao, 1999
Tabernaemontana cathariensis	Apocynaceae	Root	Pereira *et al*., 2008
Tetracentron sinense	Trochodendraceae	Stem bark	How, Wu, Ko, & Chen, 1982
Triphyophyllum peltatum	Dioncophyllaceae	Roots	Bringmann *et al*., 1997
Ugni molinae	Myrtaceae	Leaves	Goity *et al*., 2013
Vitex negundo	Verbenaceae	Leaves	Yogeeswari & Sriram, 2005
Vitex negundo	Verbenaceae	Leaves	Taralkar & Chattopadhyay, 2012
Viscum album	Viscaceae	Arial	Jäger, Winkler, Pfüller, & Scheffler, 2007
Ziziphus jujuba	Ramnaceae	Fruits	Guo *et al*., 2009
Zizyphus xylopyrus	Ramnaceae	Stem	Jagadeesh, David Krupadanam, & Srimannarayana, 1998

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