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A Review on Alternate-leaved Butterfly-bush: *Buddleja alternifolia*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Review Article

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ABSTRACT

The current review sheds light on plants of the genus Buddleja, specifically *Buddleja alternifolia*, due to it not mentioned much and its medicinal qualities and uses thanks to its chemical components. Our review comprises these aspects include specie belonging to the genus Buddleja and the important chemical compounds such as steroids, Sesquiterpenes, iridoids, lignans, flavonoids and others. In addition, listing and reviewing the studies that have been done on a group of these plants on biological competencies, including many of the potent biologically active natural products isolated from Genus Buddleja, which is known for having many important pharmacologically active substances.Traditionally, species of the genus are reported to be used for healing, treatment of liver diseases, bronchial complaints, preventing several other diseases by exhibiting diuretic properties, sedative functions, analgesic potential, antirheumatic actions, antimicrobial activities, anti hyperglycemic functions and antioxidant properties. A very small number of common species of the Genus Buddleja have been investigated for their biological potential. So for, purposes of the review is shedding light on the plants of the genus Buddleja and *Buddleja alternifolia* being promising plants and conducting further examination, study and investigation of their chemical components and biological efficiency.

Keywords: Alternate-leaved butterfly-bush; Buddleja alternifolia; chemical constituents; traditional medicine; antimicrobial; antispasmodic; antioxidant.

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1. INTRODUCTION

Buddleja genus is belongs to family Scrophulariaceae [former Buddlejaceae (synonym: Oftiaceae) and Loganiaceae] and comprising over 140 species, nearly all are shrubs [1-3]. The genus is found in four continents. Over 60 species are native through the southern United States south to Chile, while many other species are found in the Africa, and parts of Asia, but all are absent as natives from Europe and Australia. The species are divided into three groups based on their floral type: those in the United States south to Chile are mostly dioecious (occasionally hermaphrodite or trioecious), while those in the Africa, and parts of Asia are exclusively hermaphrodite with perfect flowers [2]. Genus Buddleja are evergreen or deciduous shrubs, occasionally trees or scrambling climbers with simple leaves and panicles of small, tubular fragrant flowers [4].

From previous literature, Genus Buddleja plants are considered to be active against various diseases such as healing of wounds, colds, ulcer, against liver disfunctions, bronchial complaints, displaying diureticactions, antioxidant properties, sedative, antirheumatic, analgesic and antioxidant functions [5-9]. Also, have shown anti-inflammatory, antimicrobial, anticataratic, antipyretic, antihepatotoxic, hypoglycaemic, neuroprotective, molluscicidal and amoebicidal activities and uses against skin problems, ulcer, clustered nebulae, conjunctival congestion and anti-cancer [10-14].

Also, Buddleja plants have traditional uses against asthma, curing coughs, bronchitis, antispasmodic, and for treatment of cholagogue, and several ophthalmic problems and as substituteto soap [15, 16]. In Chinese traditional medicines some species has been used as to cure fever, ache, diarrhea, and articular rheumatism [17]. Some of their compounds display antiprliferative activity [18].

2. BIOACTIVE CONSTITUENTS FORM BUDDLEJA SPECIES

Previous studies results reveals that many constituents have been isolated from genus Buddleja that includes iridoids, lignin irdidoids. Also lignans, phenylethanoid, phenylpropanoid, terpenoids (sesquiterpen, di and tri-terpens along withtheir glycosides), neolignans, flavonoids, steroids, aromatic esters, phenolic fatty acid esters and several saponins has been reported [17, 19. 20].

Iridoids are isolated from *B.globosa*, *B. japonica*, *B.asiatica*, and *B.davidi* [21, 22]. Caryophyllane, humulene, benzofuran are achieved from *B.davidii*, *B.globosa*, *B. sessiliflora*, *B. cordata*, *B. crispa* and *B. lindleyana* [23-28]. Saponins had been assumed for some time since the leaves have been used for cleansing, washing purposes, and as fish poisons [15]. Saikosaponin A, buddlejosid A, buddlejasaponin I, buddlejasaponin II, buddlejasaponin III, buddlejasaponin IV have been reported from *B.japonica* and *B.* m*adagascariensis* [29, 30]. A range of saponines, mimangosides and Songaroside A had been isolated from flowers of *B. officinalis* Maxim [31-34]. Compounds 13,28-epoxy-23-dihydroxy-11-oleanene-3-one and 13,28-epoxy-21β,23-dihydroxy-11-oleanene-3-one have also been published form *B. Asiatica* [35].

Flavonoids, The genus Buddleja contains many flavonoids and alsoglycosides. A set of luteolin and its derived compounds (eriodictyol, glucohesperetin and pyracanthoside have been isolated from *B .officinalis*, *B. Perviflora*, *B. asiatica*, *B. globosa* and *B.Davidii* [11, 21, 36-39] ,while , Hesperetin and Scutellarin 7-O-glucoside were reported by Emam et al. [29] in *B. Perviflora;* zerumbone and buddledone A form *B. madagascariensis*. Rutin was isolated from the leaves of *B. Asiatica* [40]. Lignans are also reported from Buddleja species, Houghton [41] isolated (Buddlenol A-F) and compounds balanophonin and syringaresinol from *B.davidiistem* [32, 41]. Sterols such as glutinol and chondrillasterol have been isolated from *B. globosa* and *B. Asiatica* [42]. Free sugarcompounds, benzoic acids, fatty acid esters, several alkaloids and sphingolipids are reported from the *Buddleja* species [41-48]. The most popular cultivated species is *Buddleja davidii*, *Buddleja globosa* and *Buddleja alternifolia* [49].

Buddleja alternifolia Maxim., known as alternate-leaved butterfly-bush [4] is a species of flowering plant, which is endemic to Gansu, China and is widely distributed in west China, are well known as perennial garden plants. It is a woody perennial shrub which grows up to 4 m in height and sprouts from May to July. It is scattered in northwest of China, and has been widely used for and medicinal and ornamental purpose [50-52]. *B. alternifolia* is a vigorous large deciduous shrub which can be trained into a small tree, with

arching branches bearing narrow, grey-green leaves and sweetly scented lilac-purple flowers, borne in clusters along the previous year's shoots. Flowering occurs in early summer [53-55]. In 1880, it was first described in the West by the Russian botanist Carl Maximowicz in the West [56], and then it was cultivated for the first time in 1915 in the West by Purdom and Farrer [53, 57]. *Buddleja alternifolia* has become very common in cultivation, a popular shrub for the larger garden, and is readily available from most garden centres in the UK. Pruning should immediately follow flowering. It is easily propagated from cuttings. *B. alternifolia* cultivar is *Buddleja alternifolia* argentea [53, 55, 58]. The chemistry of *Buddleja alternifolia* has been observed by Jensen [59] is iridoids: fresh foliage gave aucubin (0.1 %), catalpol (0.05 %), and methylcatalpol (0.01 %), as well as geniposidic acid (0.03 %).Also, 6-O-cinnamoylcatalpol, specioside, and cis-p-coumaroylcatalpol (= cis-form of specioside). CPG's: verbascoside (0.4 %) and decaffeoylverbascoside (0.03 %) was found.

3. BIOLOGICAL ACTIVITY

Studies conducted on several species of *B. asiatica*, *B. cordata* and *B. globosa* plants and showed the biological effectiveness of the chemical compounds extracted from these species, as they had anti-bacterial, anti-fungal and also against yeasts as a result of the components of the volatile oil or various plant extracts [44, 60-63]. Antioxidant potential has also been reported for the extracts of *B. officinalis* and *B. globosa* [64, 65]. Also, the crude extracts from *B.crispa* and *B. asiatica* exhibted as antispasmodic effects [63, 66] *B. crispa* also showed antihypertensive function [67]. Ding et al. [30] reported that *B. officinalis* have shown inhibition potential against HL-60 leukemia cells. *B. officinalis* extracts were found to possess neuroprotective properties and microglial activating inhibition properties that possibly participatein brain ischemia [37]. The *B. asiatica* essential oil revealed for excellentanthelmintic effect against tapeworms [61], while its petroether extract showedrepellent actions against mosquitoes [68]. Different extractsfrom many of the Buddleja species have been reported for possessing antihepatotropic properties [69]. The *B.asiatica'*polar fractionshave shown significant antihapatotoxic propertiescompared to lignan silymarin [14]. The iridoid; methylscutelloside exert potential inhibition properties on PDGF-BB-induced proliferation in rat aortic VSMCs [48].

4. CONCLUSIONS

The light was shed on the genus of Buddleja, a review of some species and their distribution and cultivation, as well as a compilation of the medical importance and the various uses of plants belonging to the genus Buddleja. Also shedding light on one of the species, which is *Buddleja alternifolia*, and researching everything that has been published regarding this species specifically and its importance and chemical components. The available biological capabilities were also reviewed, which are due to the various chemical components found in plants of this genus Buddleja. We concluded that *Buddleja alternifolia* plant needs more research and study to explore more chemical compounds and its biological activities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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