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Ethnobotany, Phytochemistry and Pharmacology of *Mussaenda* Species (Rubiaceae)

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Abstract

The genus *Mussaenda* is an important source of medicinal natural products, particularly iridoids, triterpenes and flavonoids. The purpose of this paper is to cover the more recent developments in the ethnobotany, pharmacology and phytochemistry of this genus. The species in which the largest number of compounds has been identified is *Mussaenda pubescens*. Pharmacological studies have also been made, however, of other species in this genus. These lesser known plants of the genus are described here according to their cytotoxicity, anti-inflammatory, antiviral, antioxidant and antibacterial properties. The information given here is intended to serve as a reference tool for practitioners in the fields of ethnopharmacology and natural products chemistry.

Key words: *Mussaenda*; Rubiaceae; Mussaein; antifertility.

Introduction

One way in which the study of medicinal plants has progressed is in the discovery of bioactive compounds from new promising drug species. In this respect, the genus *Mussaenda* has been important in providing us with several natural products of interest to workers in the field of pharmacology. The species of this genus have the further advantage of being easy to grow. They are pest and disease free and can withstand heavy pruning.

Very few species have been explored for chemical and biological studies. This review focuses on the different species of *Mussaenda* and their chemical constituents and biological activity. Thus, it includes all compounds known to *Mussaenda* species, and is intended as a guide for future research. The depth and breadth of research involving *Mussaenda* plants has been organized into easily accessible and comparable units of information.

Ethnobotanical uses of *Mussaenda* species

They are members of the Rubiaceae (madder or coffee family) and are native to the Old World tropics, from West Africa through the Indian sub-continent, South East Asia and into Southern China. Some species of *Mussaenda* have been used in Chinese and Fijian traditional medicine. More details are given below.

Mussaenda frondosa

Mussaenda frondosa is distributed in Central Nepal, India and Srilanka. The juice of the root is used to treat blemishes on the tongue and the sepals are diuretic (Jayasinghe *et al.*, 2002).

Mussaenda macrophylla

Mussaenda macrophylla is found widely in Central and Eastern Nepal to about 1800 m in moist places in association with herbs and other shrubs. It is also found to occur in northern India, Southeastern China and Myanmar (Narayan Manandhar, 2002).

Mussaenda raiatensis

Mussaenda raiatensis, a native of Tonga occurs in open places on ridges, in coastal to lowland forests, and is occasionally cultivated for its medicinal properties. The infusion of the bark is sometimes given to an infant believed to be ill or malnourished (WHO, 1998).

Mussaenda pubescens

Mussaenda pubescens is a liana-like shrub, distributed in shady hillside, valley and shrub jungle of East, South and Southwest China. It has been used in Chinese folk medicine as a diuretic, antichloristic and antipyretic agent. The whole plant of *Mussaenda pubescens* has been used against laryngopharyngitis, acute gastroenteritis, and dysentery and as a contraceptive agent (Dictionary of Chinese traditional medicine, 1986).

Mussaenda roxburghii

It is distributed in the Eastern and Central Nepal at an altitude of height 200-1200 m in moist shady places of Bhutan, Bangladesh, and Myanmar. A paste of the root is applied to the tongue to treat boils (Narayan Manandhar, 2002).

***Mussaenda frondosa* (Dhobi tree)**

It is found from Indo-China to Malaysia. It is somewhat smaller and more upright than the above two species, 6 to 9 ft tall, with an equal spread. The foliage is a lighter green, and the terminal flower clusters have orange to yellow, tubular corollas with a single white enlarged calyx lobe. This species is often grown in clumps (Huxley *et al.*, 1999).

Mussaenda incana

It is native from India to Malaysia and is much smaller than the above mussaendas, growing to no more than 3 ft tall. It has flat-topped flower clusters (corymbs), with bright yellow corollas and a single enlarged calyx lobe that is yellow to cream. In the landscape it is most effective in mass plantings (Whistler, 2000).

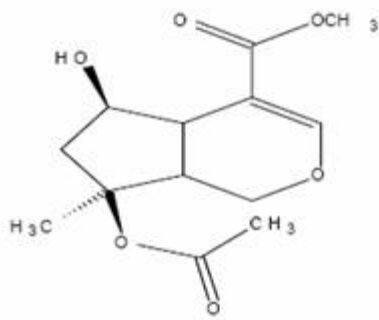
Phytochemistry of *Mussaenda* species

The phytochemistry of *Mussaenda* species has been studied extensively since 1990s. Iridoids, flavonoids and triterpenes are the common chemical ingredients distributed in *Mussaenda* species. The most recognized compounds in Mussaendas are the iridoids and triterpene saponins.

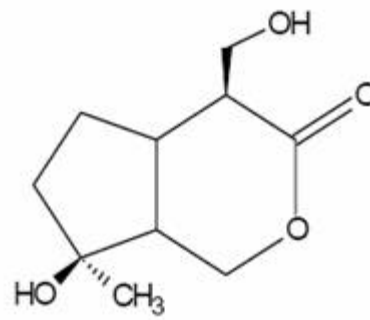
Iridoid glycosides, Mussaenoside and shanzhiside methyl ester **1** have been reported from *Mussaenda parviflora* and *Mussaenda shikokiana* (Yoshio Takeda *et al.*, 1977). The leaves of *M. arcuata* yield Astragalin, isoquercitrin, kaempferol-3-O-beta-Drutinoside and the two phenylpropanoid derivatives as melilotoside and dihydromelilotoside (Ranarivelo *et al.*, 1990). Mussaendosides M **2** and N **3** are the saponins from *M. pubescens* (Jun-Ping Xu and Ren-Sheng Xu, 1992). Mussaein A **4**, Mussaein B **5** and Mussaein C **6** (Weimin Zhao *et al.*, 1996) are the monoterpenes from *M. pubescens*. *Mussaenda pubescens* is reported to contain several triterpenes and triterpenoid saponins namely mussaendosides U, V, M, O, P and Q (Weimin Zhao *et al.*, 1997). *M. macrophylla* afforded Mussaenoside W **7** (Kim *et al.*, 1999). A new compound Sanzhilactone **8** along with mussaenoside, barlerin, lupeol and beta-D-glucose has been obtained from the stem of *M. incana* (Biswanath Dinda *et al.*, 2005). Quercetin, rutin, hyperin, ferulic acid, sinapic acid, beta sitosterol, saponin occurs in *M. raiatensis* (WHO, 1998).

Pharmacology

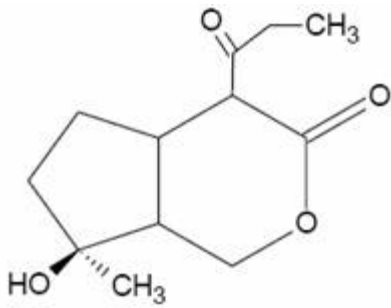
Mussaenda pubescens Ait.f is a liana-like shrub, distributed in shady hillside, valley and shrub jungle of east, south and southwest China. It has been used in Chinese folk medicine as a diuretic, antiphlogistic and antipyretic. It is also used to detoxify mushroom poisons and terminate early pregnancy (Dictionary of Chinese medicine, Encyclopedia of Fujian Plant Medicines). Triterpene glycosides from the stem bark of *M. macrophylla* has been shown to be active against oral pathogens (Kim *et al.*, 1999). *M. frondosa* has been found to possess antibacterial effect (Jayasinghe *et al.*, 2002). The sepals of *Mussaenda philippica* cultivars are active (Vidyalakshmi *et al.*, 2007). Sanshiside methyl ester possess antiviral property (Sunit Suksamram *et al.*, 2003). Non glycosidic iridoids like Mussaein are cytotoxic (Jing-Qiu Dai *et al.*, 2002). *Mussaenda pubescens* exhibited anti-RSV activity with 50% inhibition (Yaolan Li *et al.*, 2004).



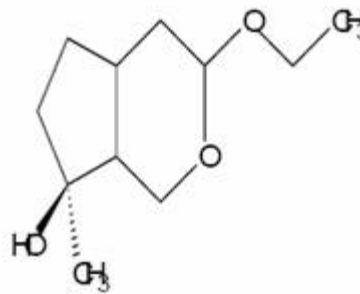
1. Sanshiside methyl ester



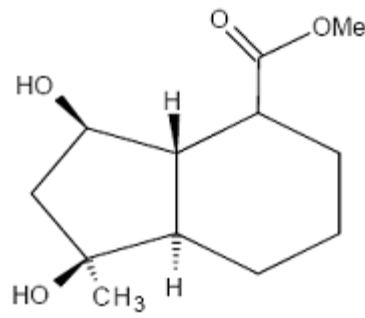
5. Mussaein A



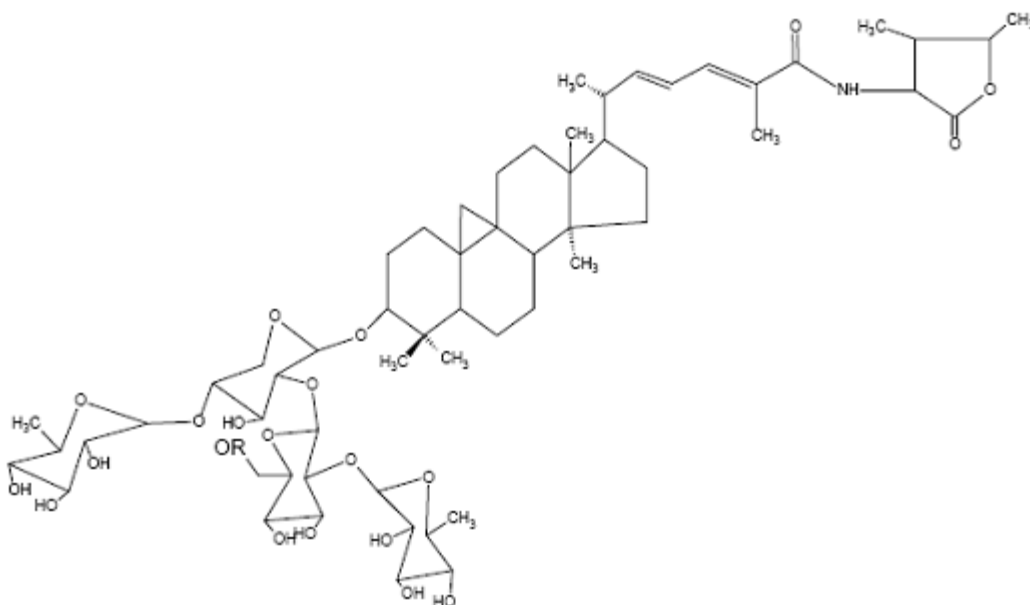
6. Mussaein B



7. Mussaein C

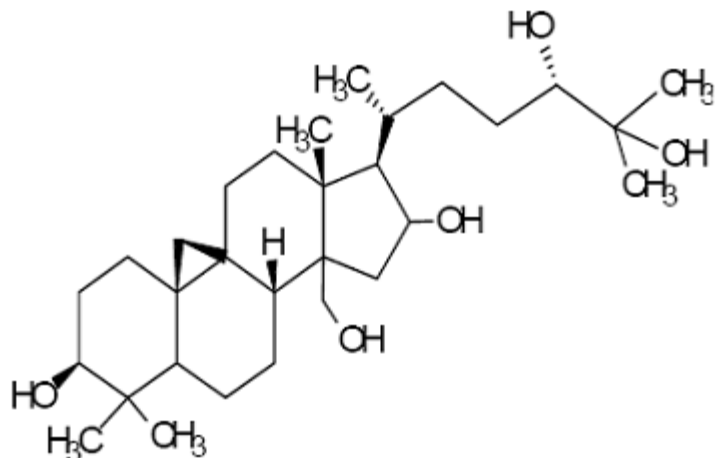


8. Sanshilactone



2. **Mussaenoside M; R=H**

3. **Mussaenoside N; R=Glu**



4. **Mussaenoside W**

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