



A phytopharmacological review on an Arabian medicinal plant: *Caralluma flava* N.E.Br

Muhammad Adil Raees

Abstract

Caralluma flava (N.E.Br.) is a medicinal plant which is gaining renowned attention in scientific community due to its potential curative powers. Traditionally, it is used in Arab regions as an anti-diabetic and anti-ulcer. It is also used as an anti-inflammatory, anti-parasitic and anti-pyretic. Due to its pharmacological values, initial biological activities of *C. flava* have been carried out recently and some pregnane glycoside molecules have been isolated and identified from its sap. The plant lacks the reports of phytochemical studies and pharmacological activities which support its further investigation and validation of the traditional therapeutic claims. The compiled data in this review is intended to serve as a reference to many researchers and may help them to focus on the priority areas of research yet to be discovered.

Keywords: Caralluma flava; pregnane glycoside; anticancer activity; Desmidorchis flava

Introduction

Caralluma flava (N.E.Br.) Meve & Liede is a succulent herb which grows wildly in many regions of Sultanate of Oman, Yemen and United Arab Emirates [1-5]. It burgeons after rain and mainly found on stony sides of the wadies, dry riverbeds, and hillsides. The fresh juicy stems of this cactus-like plant are collected by the natives and consumed as food. Due to its extremely bitter taste, it is eaten with an addition of spices and lemon. It has bright yellow flowers which are quite unmistakable to identify and are also edible. These flowers have an unpleasant odor and a distinctive flavor with a sweet aftertaste [6-8]. The plant is available in the vegetable and local markets of Arab regions in fresh and dried powdered forms. It is very well known for its medicinal properties [9]. Taxonomical classification of *C. flava* is given in Table-1.

Table 1 Taxonomic Classification of *C. flava*

Kingdom	: Plantae
Phylum	: Magnoliophyta
Class	: Magnoliopsida
Order	: Gentianales
Family	: Apocynaceae
genus	: Caralluma
specie	: flava
Plant's Name	: Caralluma flava (N.E.Br.) Meve & Liede
Synonyms	: Desmidorchis flava (N.E.Br.) Meve & Liede : <i>Crenulluma flava</i> (N.E.Br.) Plowes : <i>Desmidorchis flavus</i>
Vernacular names	: Zoja (Jibbali Arabic) : Duru-el-kebeh (Dhofari Arabic)

Botanical description

C. flava is a succulent stemmed herb forming clumps up to 30 cm high and 50 cm across. The stems are greyish-green often red-tinged, erect, branched and 4-angled with prominent white callus scars frequent on the stem edges. Young stems are covered with disk-shaped trichomes and more or less grow straight. Inflorescences are umbellate with 15-30 flowers [2,10]. Its pedicels are slender and 1-2 cm long. The flowers are yellow in color, all about 0.8-1.0 cm in diameter. The calyxes are five-lobed and

Correspondence: adil.raees@lums.edu.pk

Department of Chemistry, SBA School of Science and Engineering (SSE), Lahore University of Management Sciences (LUMS), Lahore, 54792, Pakistan

Full list of author information is available at the end of the article.

Received: 03 Apr 2018, Accepted: 09 Aug 2018



each lobe is 2-3 mm long and free almost to base. Its bright yellow to greenish yellow corollas are shortly cup-shaped below with 5 spreading narrowly triangular lobes. It has pale yellow coronas which are 1-2 mm across. Fruits are straight, narrow cylindrical bladders up to 10 cm long. Seeds are brown with a tuft of long white hairs at the tip [10-13].

Traditional Uses

The plant of *C. flava* is traditionally used in Arabian medicine to treat peptic ulcer and diabetes. It is consumed freshly by many people in the treatment of leprosy, gastric ulcer, rheumatism and as antipyretic. Drops of its juice are used for ear inflammation [13-15]. The sap inside its stems is externally applied to cuts and wounds to speed convalescence. The succulent stems are rubbed on burns to soothe them and used as a cooling agent on sunburns and itchy-skin. Fresh stems are eaten raw with an addition of lemon and salt for constipation. Tea prepared from the powdered dried plant is taken for liver disorders, gas trouble, high blood pressure and diabetes. It is also used by the natives to suppress hunger and quench thirst [16-18].

Phytochemical studies

The phytochemistry of several species of *Caralluma* is reported with pregnane and its glycosides [19]. In common with other *Caralluma* species, many pregnane glycoside molecules are identified from this species. In 2015, Raees et al. and his coworkers published the first phytochemical report on *C. flava* in which two new pregnane glycosides, namely desmiflavasides A (**1**) and B (**2**) (Figure 2), were isolated from the plant sap [20]. Later on, the same group reported seven more new pregnane glycosides viz., desmiflavasides C (**3**) and D (**4**), nizwaside (**5**) and desflavasides A-D (**6-9**) from the same source [21-23]. Glucose, digitalose, cymarose, allomerose and thevetose sugar units were detected in these molecules. Compounds **3-8** had a pair of benzoyl groups attached to the aglycon portion. The structural characterization of all the isolates was achieved by using different multidimensional NMR techniques. 1D-TOCSY experiments were performed to determine the correlations between all protons within each sugar units. So far, no phytochemical constituent has been reported from the crude extract of the plant.

Pharmacological studies

Anti-proliferative activity

Anti-proliferative effects of isolated chemical constituents from the sap of *C. flava* were studied using MTT assays and results confirmed their worth in the treatment of cancer [20-22]. Compounds **3** and **4** showed concentration-dependent anti-proliferative effects on MDA-MB231 breast cancer cells and

demonstrated significant growth inhibition of the malignant cells, after 24 hours, with apparent IC₅₀ values of 19.97 μ M and 25.84 μ M, respectively. Compound **5** possessed strong anti-proliferative activity (IC₅₀:23.5 μ g/ml) on the same cancer cell line and was found to be more active than the standard doxorubicin. Treatment of normal breast epithelium cells (MCF10-2A) with these compounds (**3-5**) demonstrated no remarkable growth inhibition and indicated selective cytotoxicity towards the cancer cells only [21-22].

Anti-ulcer activity

In 2017, Al-Naqeb published the first report on the anti-ulcerative potential of the methanolic extract of *C. flava* against ethanol-induced gastric ulcer in rats model. The results showed significant anti-ulcerative effect comparable to omeprazole used as a standard. The extract reduced the incidence and severity of ulceration by 68.39% protection at a dose of 500mg/kg. Whereas, omeprazole exhibited 47.11% of inhibition at a dose of 20mg/kg. In PH examination, the treated rats with *C. flava* methanolic extract (3.74 \pm 0.42) showed significant less acidity as compared to the control rats (1.56 \pm 0.04) which revealed its protective behavior against gastric ulcer [14].

Anti-hyperglycemic activity

C. flava is reported to possess hypoglycemic activity. Its aqueous extract showed significant effects in adjusting the raised blood glucose level in streptozotocin-induced diabetic rats. After 28 days of extract administration, the blood glucose level was lowered from 14.23 mg/100 ml to 8.45 mg/100 ml at a dose of 0.5g/kg [15].

Acute toxicity

Although, *C. flava* is consumed freshly by many people in Oman, Yemen, and the United Arab Emirates as a traditional but no scientific research was performed until recently to evaluate the toxicity of the plant. In 2017, Al-Naqeb evaluated the safety profile of *C. flava* plant for the very first time by treating rats with a single dose of its methanolic extract (3 g/kg) for 14 days. The results showed no significant toxicological symptoms and signs of abnormalities such as behavioral changes and alteration in body weight [14].

Antioxidant activity

According to a study undertaken by Karthishwaran et al., *C. flava* possesses strong antioxidant activity. The antioxidant potential of its ethanolic extract was evaluated *in-vitro* by using 2, 2'-diphenyl-1-picrylhydrazyl (DPPH), 2,2-azino-bis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS), nitric oxide radi-



Figure 1 *Caralluma flava* N.E.Br. Meve & Liede (Snapshot was taken in the mountains of Jebel Akhdar in Sultanate of Oman by Rashid Al-Harrasi; 11hr 45min/16 April 2016)

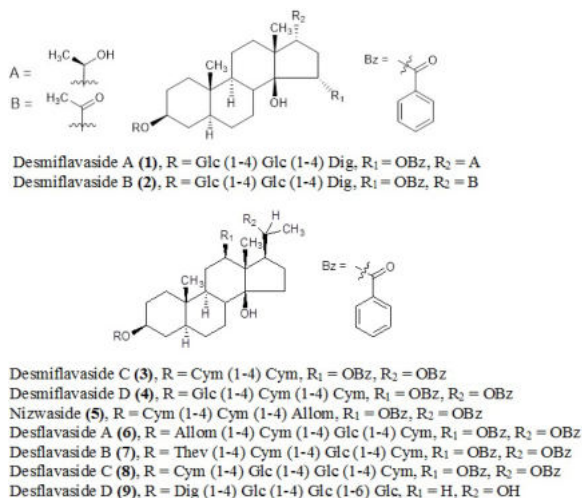


Figure 2 Structures of pregnane glycosides (1-9) isolated from *C. flava*

cal and hydroxyl radical scavenging assays [24]. The methanolic extract of the plant also reduced DPPH radical very strongly and the results were similar to the standard L-ascorbic acid [14].

Conclusion

The review of literature signifies the medicinal importance of *C. flava* which is being used as an antidiabetic and antiulcer in the

Arab traditional medicine. The phytoconstituents present in the plant are mainly pregnane glycosides which can be attributed to its medicinal actions. Further pharmacological studies of *C. flava* crude extract and its active compounds need to be carried out in order to confirm its medicinal potentials and also to discover its other pharmacological actions. Less information is available regarding the chemical constituents of the plant. So,

there is a good scope to isolate and identify new compounds from *C. flava* considering its wide pharmacological profile.

Acknowledgments

The author is grateful to Professor Ahmed Al-Harrasi and Mr. Mohammad Abdullah Al-Broumi for their support.

References

- [1]. Feulner GR. The Olive Highlands: A unique island of biodiversity within the Hajar Mountains of the United Arab Emirates. *Tribulus*. 2014;22:9-35.
- [3]. Ghazanfar SA. Status of the flora and plant conservation in the Sultanate of Oman. *Biol. Cons.* 1998;85(3):287-95. DOI: 10.1016/S0006-3207(97)00162-6
- [4]. Bruyns PV, Jonkers HA. The genus *Caralluma* R.Br. (Asclepiadaceae) in Oman. *Bradleya*. 1993;11:51-69. DOI: 10.25223/brad.n11.1993.a3
- [5]. Patzelt A. Oman plant: Red Data Book. Muscat, Oman: Oman botanic Garden; 2015.
- [6]. Miller AG, Morris M. Plants of Dhofar: the southern region of Oman, traditional, economic and medicinal uses. Oman: Office of the Adviser for Conservation of the Environment, Diwan of Royal Court Sultanate of Oman; 1988. p. 52.
- [7]. Formisano C, Senatore F, Della Porta G, Scognamiglio M, Bruno M, Maggio A, Rosselli S, Zito P, Sajeve M. Headspace volatile composition of the flowers of *Caralluma europaea* N.E.Br. (Apocynaceae). *Molecules*. 2009;14(11):4597-613. DOI: 10.3390/molecules14114597
- [8]. Jürgens A, Dötterl S, Meve U. The chemical nature of fetid floral odours in stapeliads (Apocynaceae-Asclepiadoideae-Ceropegieae). *New Phytol.* 2006;172(3):452-68. DOI: 10.1111/j.1469-8137.2006.01845.x
- [9]. Raees MA: Phytochemical investigation on the chemical constituents of *Caralluma flava*. Ph.D. Thesis. Federal Urdu University of Arts, Science and Technology, Chemistry Department; 2017.
- [10]. Mosti S, Raffaelli M. *Desmidorchis tardellii* (Asclepiadaceae), a new species from Dhofar, southern Oman. *Webbia*. 2004;59(2):285-91. DOI: 10.1080/00837792.2004.10670773
- [11]. Baker JG. Botany of the Hadramaut expedition. *Bull. Misc. Inform. Kew*. 1894;1894:328-43. DOI: 10.2307/4118301
- [12]. Albers F, Meve U. Illustrated Handbook of Succulent Plants: Asclepiadaceae. Springer Science & Business Media; 2004 DOI:10.1007/978-3-642-56370-6
- [13]. Bruyns PV, Jonkers HA. The genus *Caralluma* R.Br. (Asclepiadaceae) in Oman. *Bradleya*. 1993 Feb;11:51-69. DOI: 10.25223/brad.n11.1993.a3
- [14]. Al-Naqeb G. Acute toxicity and anti-ulcerative potential of *Caralluma flava* N.E.Br. methanolic extract against ethanol-induced gastric ulcers in rats. *J. Med. Plants. Stud.* 2017;5(6):21-5.
- [15]. Al-Naqeb G. *Caralluma flava* N.E.Br. extract reduces plasma glucose level and improves plasma antioxidant enzymes in hyperglycemic rats. *J. Med. Plants. Stud.* 2017;5(6):39-43.
- [16]. Divakar MC, Al-Siyabi A, Varghese SS, Al Rubaie M. The practice of ethno-medicine in the Northern & Southern provinces of Oman. *Oman Med. J.* 2016 Jul;31(4):245. DOI: 10.5001/omj.2016.49
- [17]. Ghazanfar SA. Handbook of Arabian medicinal plants. CRC press; 1994 Aug 24. DOI: 10.1201/b14834
- [18]. Adnan M, Jan S, Mussarat S, Tariq A, Begum S, Afroz A, Shinwari ZK. A review on ethnobotany, phytochemistry and pharmacology of plant genus *Caralluma* R.Br. *J. Pharm. Pharmacol.* 2014;66(10):1351-68. DOI: 10.1111/jphp.12265
- [19]. Dutt HC, Singh S, Avula B, Khan IA, Bedi YS. Pharmacological review of *Caralluma* R.Br. with special reference to appetite suppression and anti-obesity. *J. Med. food.* 2012;15(2):108-19. DOI: 10.1089/jmf.2010.1555
- [20]. Raees MA, Hussain H, Rehman NU, Khan HY, Abbas G, Al-Rawahi A, Elyassi A, Al-Amri IS, Green IR, Al-Broumi MA, Mahmood T. Desmiflavasides A and B: Two new bioactive pregnane glycosides from the sap of *Desmidorchis flava*. *Phytochem. Lett.* 2015;12:153-7. DOI:10.1016/j.phytol.2015.03.013
- [21]. Raees MA, Hussain H, Al-Rawahi A, Csuk R, Muhammad SA, Khan HY, Rehman NU, Abbas G, Al-Broumi MA, Green IR, Elyassi A. Anti-proliferative and computational studies of two new pregnane glycosides from *Desmidorchis flava*. *Bioorg. Chem.* 2016;67:95-104. DOI: 10.1016/j.bioorg.2016.05.008
- [22]. Hussain H, Raees MA, Rehman NU, Al-Rawahi A, Csuk R, Khan HY, Abbas G, Al-Broumi MA, Green IR, Elyassi A, Mahmood T. Nizwaside: a new anticancer pregnane glycoside from the sap of *Desmidorchis flava*. *Arch. Pharm. Res.* 2015;38(12):2137-42. DOI: 10.1007/s12272-015-0653-0
- [23]. Raees MA, Hussain H, Al-Rawahi A, Csuk R, Al-Ghafri A, Rehman NU, Elyassi A, Green IR, Mahmood T, Al-Harrasi A. Desflavasides A-D: Four new tetrasaccharide pregnane glycosides from *Desmidorchis flava*. *Phytochem. Lett.* 2016;16:230-5. DOI: 10.1016/j.phytol.2016.04.012

[24]. Karthishwaran K, Shamisi SO, Kurup SS, Sakkir S, Cheruth AJ. Free radical scavenging and antioxidant capacities with special emphasis on enzyme activities and *in-vitro* studies in *Caralluma flava* N.E.Br. Biotechnol. Biotechnol. Equip. 2017;1-7. DOI: 10.1080/13102818.2017.1379362