

# A Review on Ethnopharmacology of *Verbascum chinense* (*Scrophulariaceae*)

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## Abstract

**Background:** This review comprises morphology, phytoconstituents and ethnopharmacological aspects of *Verbascum chinense*. A few species of this genus have medicinal value, among these *Verbascum chinense* is traditionally used as a sedative, astringent, febrifuge, and for skin eruptions. The plant is also used in treatment of diarrhoea and dysentery, cuts, wound healing, jaundice, skin disorders, as an anti-inflammatory, anticancer. The aim of present review is to highlight the beneficial effects of the *Verbascum chinense* in human health, explore diverse pharmacological uses.

**Method:** This is a review article, which was obtained by a search in databases such as Pub Med and Google Scholar.

**Result:** *Verbascum* species contain biologically active compounds, such as flavonoids, phenylethanoid and neolignan glycosides, saponins, iridoid and monoterpene glycosides. This review emphasizes the traditional uses of *Verbascum chinense*.

**Conclusion:** The review is intended to attract the attention of natural product researchers to focus on the unexplored potential of *Verbascum chinense*. This genus needs to be investigated systematically so that potential species can be exploited as therapeutic agents.

**Keyword(s):** *Verbascum chinense*, morphology, phytoconstituents, jaundice, skin disorders, anti-inflammatory, anticancer, ethnopharmacology

## INTRODUCTION

The *Verbascum* species are being used in many countries all over the world. There are about 360 species known of which 6 *Verbascum* species are found in India. *Verbascum* species contain a wide range of compounds, such as glycosides [2, 3, 4, 5] alkaloids and saponin [6, 7]. *Verbascum* belongs to the family Scrophulariaceae, is an erect, pubescent herb. The plant *Verbascum chinense* (*Celsia coromandeliana*) (Scrophulariaceae) is commonly known as “Gidar Tambaku”. It is annual, sparsely pubescent simple or branched herb with a height of about 30-90 cm [8].

## Synonyms:

Hindi :Kulahal, Gadar or Gidar tambakhu

Sanskrit :Kulahal, Sundika, Bhootkeshi

Marathi :Kolhal, Kutki

Gujrati :Kalhar, Kulhar

Latin :*Celsia coromandeliana*

Botanical name:*Verbascum chinense*

Family :Scrophulariaceae

## Habitat and distribution

It is distributed in India from Punjab ascending to 5000 feet in altitude, Afghanistan, Cambodia, China, Laos, Myanmar, Pakistan, Sri Lanka and Thailand. In Bangladesh, this species is found in Chittagong and Dhaka.

It is found along roadsides, waste places near Nainital, Kotdwara, Satpuli, Srinagar and throughout Himalayan region up to 1200 m. It appears as weed, in the garden or cultivated land during the dry season [9, 10].

## Plant description

Stems are annuals or biennials. They are 50–100 cm, branched apically and are sparsely glandular pilose. Petiole of stem leaves is 3–8 mm in length; leaf blade is pandurate and approximately 5–8 cm in length; there are 3–5 lobes, the terminal lobe is either ovate, elliptic, or oblong, margin is serrate distally, usually double serrate or proximally lobed. The leaves of a stem are short petiolate or sessile and leaf blade is ovate, elliptic, or ovate-triangular. The inflorescence is raceme either simple or branched. Rachises, bracts, pedicels, and calyces are glandular pilose. Flowers are solitary at each node. The pedicel is 5 mm, elongated to 1 cm in fruit. Calyx is 3–4.5 mm in length; lobes are elliptic-oblong. Corolla is yellow. There are 4 stamens, filaments are woolly and anthers are reniform. Flowers and fruits occur during March-August. [10]

## Pharmacological activities of *Verbascum chinense*

### Antibacterial Activity

Kaur *et al* studied the antibacterial activity and phytochemical analysis of various extracts of *Verbascum chinense*. The antibacterial activity of various extracts of *V. chinense* was determined with agar-well diffusion method. The results provide evidence that the extracts of *V. chinense* contained glycosides, flavonoids, saponins and phenolic compounds which may be responsible for the substantial antibacterial activity. Among different solvent extract, chloroform and n-butanol extracts exhibited a broad spectrum of antimicrobial activity. It showed strong antibacterial activity against Gram-positive bacteria strain like *Klebsiella pneumoniae*, *Bacillus subtilis* and Gram-negative strains like *Escherichia coli*. The ethanolic and ethyl acetate extract showed low antibacterial activity against the bacterial strains [28]

**Table 1: Ethnopharmacology of *Verbascum chinense***

Part used	Medicinal uses	Location	References
Whole plant	Fever	India	Dutt, Uday Chand. (2013) [11]
Roots	Goiter	Bangladesh	Mohammed Rahmatullah 2010 [12]
Juice of leaves	Sedative	India	Umberto Quattrocchi ,2012 [13]
Juice of leaves	Diarrhea	India	Alka Gupta 2014 [14]
Juice of leaves	Astringent	India	Kirtikar, K. R, 2010 [15]
Juice of leaves	Inflammation	India	Kataria Sandeep, 2001 [16]
Juice of leaves	Febrifuge	India	Umberto Quattrocchi ,2012 [13]
Powder of leaves and seeds	Piles	Maharashtra, India	Kamble S Y, 2010 [17]
Leaves	Skin Disorders, Cuts	Uttarakhand India	Jyotsana Sharma, 2013 [18]
Leaves	Jaundice	Uttarakhand India	Jyotsana Sharma,2012 [19]
Infusion of leaves	Gout	Aurangabad district (M. S.) India.	Mali PY and Bhadane VV (2011) [20]
Leaf poultice	Reduce Swelling Of Joints	Aurangabad district (M. S.) India.	Mali PY and Bhadane VV (2011) [20]
Leaves	Jaundice	Uttarakhand India	Kachare, S.V, 2010 [21,22]
Leaves	Multipurpose	Bangladesh	A.K.M. Golam Sarwar, 2015 [23]
Decoction of plant	Helmenthitic Infections, Skin Disease, Decrease Inflammation Of Hands And Feet	Bhola district, Bangladesh	Ahmed Abrar Muttaki 2014 [24]
Bark	Skin Disease	South Western Maharastra, India	T. Pullaiah [25]
Root	Menorrhoea	South Western Maharastra, India	T. Pullaiah [25]
Juice of leaves	Acute And Chronic Dysentery, Astringent, Sedative	South Western Maharastra, India	T. Pullaiah [25]
Juice of whole plant	Sphylitic Eruptions	South Western Maharastra, India	T. Pullaiah [25]
Juice of leaves, roots stem	Bleeding Piles, Emetic, Expectorant, Capillary Bronchitis If Children	India	T. Pullaiah [25]
Roots	Dysentery, Cholagouge	India	George Watt C ,2012 [26]
Crushed leaves and plant	Fish Poison	India	Rajendran A, 1997 [27]

**Antifungal activity**

Effect of extract of 18 plant species, viz., *Acorus calamus*, *Adhatoda vasica*, *Amomum subulatum*, *Andrographis paniculata*, *Boerhaavia diffusa*, *Cassia occidentalis*, *Centella asiatica*, *Cymbopogon citratus*, *Hemidesmus indicus*, *Hyptis suaveolens*, *Malvestrum sp.*, *Passiflora edulis*, *Pergularia daemia*, *Peristrophe bicalyculata*, *Shuteria hirsuta*, *Solanum nigrum*, *Tecoma stans*, and *Verbascum chinense* on the growth of *Microsporum gypseum*, *Chrysosporium tropicum* and *Trichophyton terrestre* was evaluated and discussed. The sensitivity of the keratinophilic fungi was evaluated by the dry-weight method. The maximum inhibition of mycelial growth was shown by *M. gypseum* (86.62%) followed by *T. terrestre* (81.86%) and *C. tropicum* (74.06%) when treated with *S. hirsuta* whereas the minimum inhibition was exhibited by *M. gypseum* (0.29%), *C. tropicum* (0.16%) and *T. terrestre* (1.76%) when tested with the extract of *P. edulis*, *A. vasica* and *B. diffusa* respectively [29].

**Anticancer activity**

*Verbascum chinense* possess activity against Walker 256, sarcoma 180 and human epidermoid carcinoma of

nasopharynx; cell culture. An anticancer compound Celsioside C was isolated. The plant phytoconstituents celioides II and III exhibited anticancer activity [30].

**CNS activities**

The methanol extract of aerial part of *V. chinense* was reported to cause significant depression in general as well as exploratory behavioral profiles in mice. The petroleum ether extract of aerial parts of *V. chinense* had significant analgesic properties and protection against strychnine- and lepta zol-induced convulsions in rats [31].

**Anthelmintic activity**

The anthelmintic activities of different extracts of aerial parts of *V. chinense* were evaluated on adult Indian earthworm (*Pheritima posthuma*). Petroleum ether (PECC), chloroform (CCC), ethanol (ECC) extracts of *V. chinense* showed anthelmintic activities and were comparable with that of the effects produced by the reference standards albendazole (10 mg/ml) and piperazine citrate (10 mg/ml) [32].

**Antioxidant activity**

The *in vitro* antioxidant activity of aerial parts of *V. chinense* had been investigated by estimating the degree of non-enzymatic hemoglobin glycosylation. It was found that chloroform extract of *V. chinense* had the highest antioxidant activity and comparable to that of standard antioxidant compounds D- $\alpha$ -tocopherol (vitamin E) and ascorbic acid (vitamin C) [33].

#### Antifertility effect

Petroleum ether extract of aerial parts of *C. coromandelina* (*V. chinense*) (PECC) and a fractionate stigmasterol derivative was tested for the onset of reproductive maturity and the ovarian steroidogenesis in immature female mice. Total cholesterol and ascorbic acid content in ovaries and carbonic anhydrase activity in uterus were increased significantly (low dose by 49.3, 424.6 and 82.4%, respectively) along with a reduction in the weight of ovary, uterus and pituitary in comparison to that of control [33].

Ontogeny, structure, and differentiation of anther tapetum was studied in *Celsia coromandeliana* (*V. chinense*) [34].

#### Phytochemical studies of *Verbascum chinense*

*Verbascum chinense* is reported to contain celsianol a mixture of 6-dihydrostigmasterol and  $\alpha$ -spinasterol, saponins and celsiosides I, II, III. Other constituents are  $\beta$ -sitosterol- $\beta$ -D-glucoside. New sterol sigmasta - 5, 9 (11) - dien - 3b - ol, three new saponins: celsiogenin a [olean - 12, 17 (18) - dien - 3b, 23 - diol], celsiogenin B [olean - 11, 13 (18) - dien - 3b, 23, 28 - triol ], celsiogenin C [olean -

11, 13 (18) - dien - 3b, 22b, 23, 28 - tetriol ]. The seed oil was found to contain 22.0% 9-hydroxyoctadec-cis-12-enoic acid (isoricinoleic acid) previously unknown in the scrophulariaceae family. It also consists of other normal fatty acids such as lauric acid (1.3%), myristic acid (2.6%), palmitic acid (8.2%), stearic acid (3.2%), oleic acid (17.2%), and linoleic acid (45.5%) [35,36,37,38].

Along with these chemical constituents some iridoid glycosides such as aucubin, catalpol, 6-xylosylaucubin and 6-xylosylcatalpol 6-(4''-p-coumaroyl)- xylosylaucubin (named phlomoide) and iridoid ester glycoside, specioside, occur in *V. phlomoides*, *V. densiflorum*, flowers [39]. In *V. densiflorum* flower, apigenin and luteolin and their 7-glucosides, quercetin 7-glucoside, 3, 7-diglucoside, tamarixetin 7-rutinoside and diosmin (diosmetin 7-rutinoside) have been reported whereas glycosides of luteolin and quercetin are predominant in the flower of *V. Thapsus* [40]. In *V. phlomoides* flowers contain tamarixetin 7-rutinoside (predominant), tamarixetin 7-glucoside, apigenin and luteolin and their 7-glucosides, diosmin, chrysoeriol, eriodictyol, kaempferol, quercetin and rutin [41]. Phenylethanoid glycosides such as verbascoside (acteoside), forsythoside B (verbascoside 6'-apioside) were present in *V. densiflorum* flower [42]. Phenolic acids such as vanillic, p-hydroxybenzoic; p-coumaric, ferulic, protocatechuic and p- hydroxycinnamic acids have been identified in the flowers of *V. densiflorum* and *V. phlomoides*. Also p-coumaric acid glucoside has been found in *V. phlomoides* flowers [43, 44].

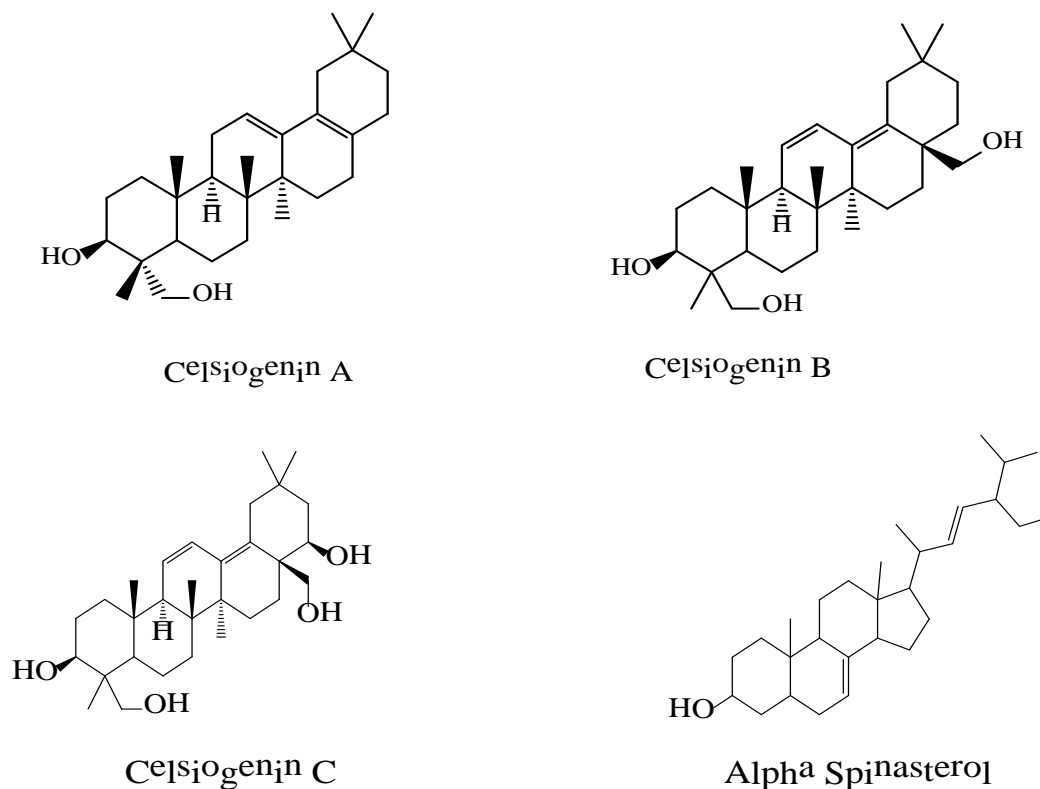
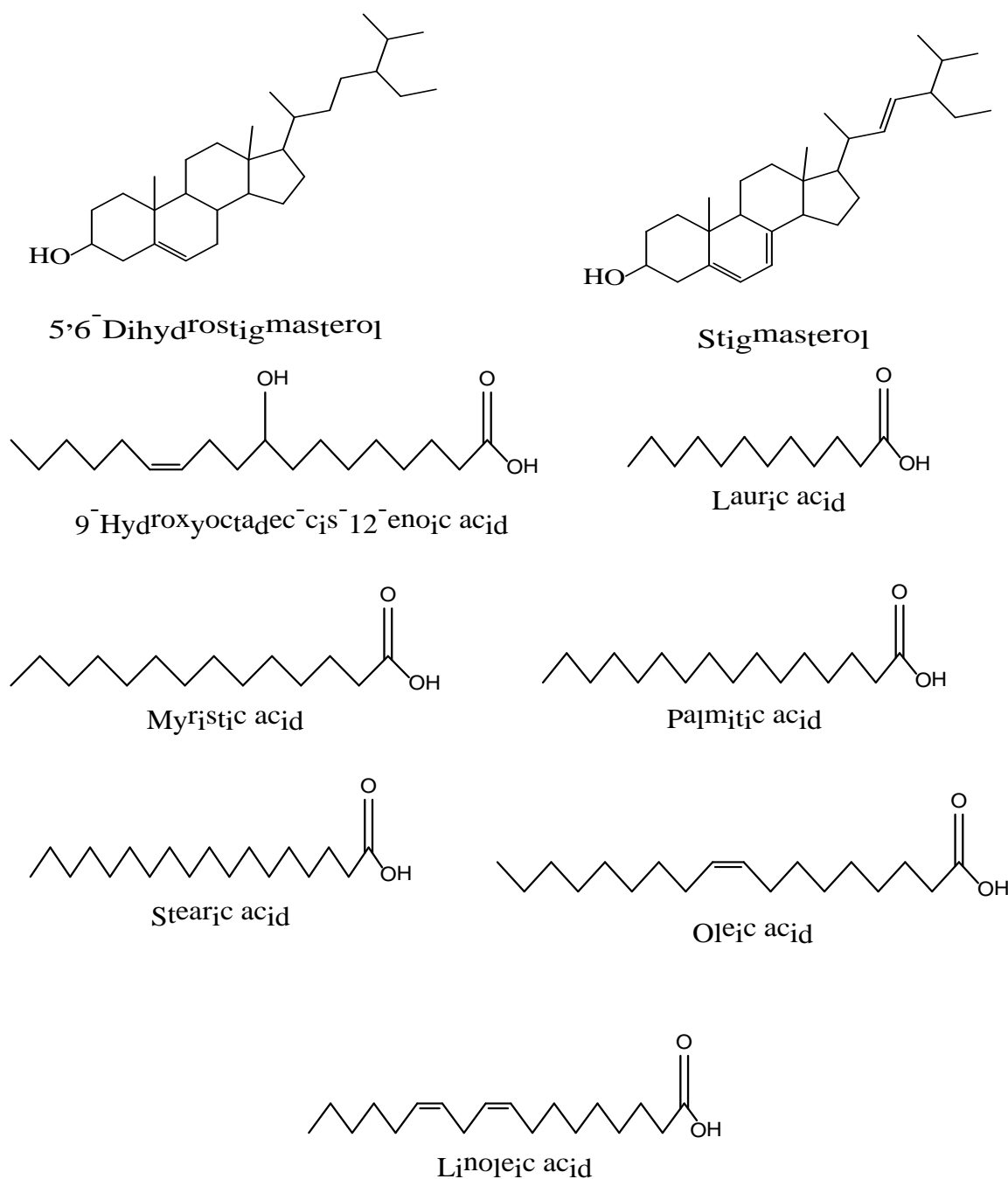


Fig. 1(a): Phytochemicals Isolated From *Verbascum chinense*



**Fig.1 (b) Phytochemicals Isolated From *Verbascum chinense***

#### CONCLUSION

The present review reveals that the plant is used in the treatment of various disorders. Keeping in view the phytochemical and ethnopharmacological reports, the frequency of use, *Verbascum chinense* seems to hold great potential for in-depth investigation of various biological activities. Few preliminary ethnopharmacological reports support the medicinal potential of *Verbascum chinense*. This need to be investigated systematically with a view to establishing their varied pharmacological activities and mode of actions.

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#### REFERENCES

1. Gaur RD, Flora of the District Garhwal North West Himalaya, Trans Media Ed. Srinagar (Garhwal); 1999.
2. Klimek B, Hydroxy cinnamoyl ester glycosides and saponins from flowers of *Verbascum phlomoides*. *Phytochemistry*, 43(1) (1996) 1281-1284.
3. Skaltsounis AL, Tsitsa-Tzardis E, Demetzos C, Harvala C. Unduloside, a new iridoid glycoside from *Verbascum undulatum*, *J Nat Prod*, 59(1) (1996) 673-675.

4. Elgindi MR, Mabry TJ, Phenyletanoid glycosides from *Verbascum sinaticum*, Asian J Chem, 12(1) (2000) 27–130.
5. Kalpoutzakis E, Aliannis N, Mitakou S, Skaltsounis AL. Verbaspinoside, a new iridoid glycoside from *Verbascum spinosum*, J Nat Prod, 62(2) (1999) 342-344.
6. Youhnovski N, Dandarov K, Guggisberg A, Hesse M, Macrocyclic spermine alkaloids from *Verbascum*: Isolation, structure elucidation and synthesis of the (E/Z)-isomeric pairs(S)-verbasikrine/(S)-isoverbasikrine and (S)-verbamekrine/(S)-isoverbamekrine, Helv Chim Acta, 82(2) (1999) 1185–1194.
7. Mohammad Oliur Rahman, Scrophulariaceae Taxa in Bangladesh, J. Plant Taxon, 13(2) (2006) 139-154.
8. Santappau H, Henry AN, A Dictionary of the Flowering Plants in India. CSIR. New Delhi: 1973.
9. Léveillé H, Giraud. *Scrophularia Chinensis Linnaeus*. Mant. 2(1) (1971) 250.
10. Gaur RD. Flora of the District Garhwal North West Himalaya. Srinagar (Garhwal), Trans Media, 1999.
11. Dutt, Uday Chand, The Materia Medica of The Hindus: Compiled From Sanskrit Medical Works. London: Forgotten Books, (2013) 38-9. (Original Work Published 1877)
12. Rahmatullah M, Ariful HMM, Harun-or-Rashid M, Tanzin R, Ghosh KC, Rahman H, Alam J, Omar FM, Mahamudul HM., Jahan R, Khatun MA, A Comparative Analysis of Medicinal Plants Used by Folk Medicinal Healers in Villages Adjoining the Ghaghot, Bangali and Padma Rivers of Bangladesh, American-Eurasian Journal of Sustainable Agriculture, 4(1) (2010) 70-85.
13. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names By Umberto Quattrocchi 3881-2.
14. Gupta A and Pandey VN, Herbal Remedies of Aquatic Macrophytes of Gorakhpur District, Uttar Pradesh (India), Int J Pharm Bio Sci, 5(1) (2014) 300 - 308.
15. Kirtikar, KR, Mhaskar, KS, Blatter, E, Caius, JF (Eds), Indian Medicinal Plants, Sri Satguru Publications, Delhi, Vol 8, (2001) 2401.
16. Kataria S and Kaur D, Ethnopharmacological Approaches to Inflammation-Exploring Medicinal Plants, Indian Journal of Natural Product and Resources, 4(3) (2012) 295-305.
17. Kamble SY Patil SR, Sawant PS, Pawar SG, Singh EA. Studies on Plants Used In Traditional Medicine By Bhilla Tribe Of Maharashtra, Indian Journal Of Traditional Knowledge, 9(3) (2010) 591-598.
18. Sharma J, Gaur RD, Gairola S, Painuli RM, Siddiqi TO, Traditional herbal medicines used for the treatment of skin disorders by the Gujjar tribe of Sub-Himalayan tract, Uttarakhand, Indian Journal of Traditional Knowledge 12(4) (2013) 736-746.
19. Sharma J, Gairola S, Gaur RD, Painuli RM, The Treatment of Jaundice with Medicinal Plants in Indigenous Communities Of The Sub-Himalayan Region Of Uttarakhand, India Journal of Ethnopharmacology, 14(3) (2012) 262–291.
20. Mali PY and Bhadane VV, Ethno-medicinal wisdom of tribals of Aurangabad district (M. S.) India, Indian Journal of Natural Products and Resources, 2(1) (2011) 102-109.
21. Kachare SV, Surywanshi SR, Raut KS, Ethnomedicinal plants of Beed and Nanded District from Marathwada, International Journal of Current Research, 5(1) (2010) 14–16.
22. Kachare SV, Surywanshi SR, Ethnomedicines on jaundice from district Nanded, International Journal of Current Research, 10(1) (2010) 25–27.
23. Golam S AKM, Medicinal plant genetic resources of Bangladesh – Genera represented by single species and their Conservation needs, Journal of Medicinal Plants Studies, 3(2) (2015) 65-74.
24. Ahmed AM, Ahmed Z, Shahidul IM, Ahmed S, Khaton SM, Ahmed Istieake KM, Das PR, Tabibul IM and Rahmatullah M, Medicinal plants and formulations of a Unani folk medicinal practitioner of Bhola district, Bangladesh Journal of Chemical and Pharmaceutical Research, 6(10) (2014) 231-238.
25. Medicinal Plants of South Western Maharashtra, Biodiversity in India, Edited By T. Pullaiah, Volume 4, 326-29.
26. A Dictionary of the Economic Products of India, By George Watt C, Volume 2 879-80
27. Rajendran A, Rao NR, Hemy AN, J Eco Taxo Bot, 21(1) (1997) 99.
28. Kaur V, Upadhyaya K Antibacterial Activity of *Verbascum chinense* (Scrophulariaceae) Extracts Int.J.Curr.Microbiol.App.Sci, 5(4) (2016) 578-584.
29. Qureshi S, Rai MK, Agrawal SC, *In vitro* evaluation of inhibitory nature of extracts of 18-plant species of Chhindwara against 3-keratinophilic fungi , 39(1-4) (1997) 56-60.
30. Jonathan L. Hartwell. Cancer Treatment Reports. 1976; 60(8).
31. Pal DK, Nandi M, CNS activities of *Celsia coromandeliana* Vahl in mice. *Acta Pol Pharm Drug Res*, 62(1) (2005) 355-361.
32. Pal DK, Mazumder A, Bandyopadhyaya PK, Jena A, Pandey R, Evaluation of anthelmintic activities of aerial parts of *Celsia coromandeliana* Vahl and *Mollugo pentaphylla* Linn *Drug Res*, 62 (2005) 355-361.
33. Pal DK Halder P, Bhuniya A, A Study on the *In Vitro* Antioxidant Activity of Aerial Parts of *Celsia coromandeliana* Vahl and Bark of *Mesua ferrea* Linn. *Pharmacologyonline*, 3(1) (2009) 200-203.
34. Kapoor T, Vijayaraghavan MR and Parulekar NK, Ontogeny, structure and differentiation of anther tapetum in *Celsia coromandeliana*, *Phyton*, 18(1) (1978) 209-216.
35. Agarwal SK, Rastogi RP, Celsiogenin-C, a new genin from celsiosides isolated from *Celsia coromandeliana* Vahl., *Indian J. Chem* 12(1) (1974) 907-10.
36. Agarwal SK, Rastogi RP. Chemical constituents of *Celsia coromandeliana* Vahl, *Indian J. Chem*, 12(1) (1974) 304-06.
37. Rastogi RP, Mehrotra BM. Compendium of Indian Medicinal Plants (1970-1979). New Delhi: CDRI Lucknow and Publication and Information Directorate; 1993.
38. Kallapa M. Hosamani and Raviraj S. Pattanashettar. Industrial Utilisation of *Celsia Coromandeliana* Seed Oil: A Moderate Source of Isoricinoleic Acid, *Ind. Eng. Chem. Res*, 39(12) (2000) 5017–5019.
39. Skaltsounis AL, Tsitsa-Tzardis E, Demetzos C, Harvala C. Unduloside, a new iridoid glycoside from *Verbascum densiflorum*, *J Nat Prod* 59(1) (1996) 673- 675.
40. Seifert KH, Jahne S, Hesse M, Verbascenine, einma crocycliche spermin alkaloidaus *Verbascum*, *Helv Chim Acta* , 65(1) (1982) 2540-2547.
41. Klimek B, Hidroxy cinnamoyl ester glycosides and phenyl ethanoid from flowers of *Verbascum phlomoides*. *Phytochemistry*, 43(1) (1996) 1281-1284.
42. Hartleb I, Seifert K, Sangarosaponin-D a triterpenoidsaponin from *Verbascum songaricum*, *Phytochemistry*, 35(1) (1994) 1009-1011.
43. Koblikova Z, Turecek F, Ninova P, Trojanek J, Blaha K. Verbaskine, a macrocyclic sperminalcholoide of a novel type and polysaccharides from *Verbascum pseudonobile* (Scrophulariaceae), *Tet Lett*, (1983) 4381-4384.
44. Kalpoutzakis E, Aliannis N, Mitakou S, Skaltsounis AL, Different types of phenolic acids from *Verbascum spinosum*, *J Nat Prod* 62(1) (1999) 342-344.