



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)**

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

COMPARATIVE REVIEW WRITING OF GENUS POGOSTEMON AND GENUS GLOBBA

RAMYA M*, BARIK RK AND LAXMI B

Dept of Pharmacognosy and Phytochemistry, Gitam School of Pharmacy, Gitam deemed to
be University, Hyderabad, Telangana, India

*Corresponding Author: Mrs. Ramya Madhiri: E Mail: madhiriramya2709@gmail.com

Received 24th March 2024; Revised 30th April 2024; Accepted 27th Aug. 2024; Available online 1st July 2025

<https://doi.org/10.31032/IJBPAS/2025/14.7.9248>

ABSTRACT

Pogostemon and Globba were widely distributed medicinal Genus. Varied chemical classification, pharmacological indication has been reported by literature. The present study is about the structure of chemicals present, pharmacological indication and various studies performed by different researchers is given. This review study might be helpful for the future research for the understanding and development of formulations by the utilization of secondary metabolites identified by the above Genus.

Keywords: Pogostemon, Globba, Secondary metabolites, chemical class

INTRODUCTION:

Plants have been used as sources of condiments, food and aromatics for the well-being of human beings throughout history [1]. Genus pogostemon and Genus globba are two distinct genera within the family Lamiaceae and Zingiberaceae respectively, encompassing a variety of species with unique characteristics. Chemical constituents of medicinal plants are one of the richest hot spots for significant new drug

discoveries and lead to the pharmacological and physiological efficiency of some treatment regimens [2]. Currently, there is an increasing interest in using medicinal plants, their extracts and essential oils due to the potentially harmful effects exerted by synthetic substances [3]. It is estimated that 80% of the world's population living in developing countries rely on herbal medicines as a primary source of healthcare.

The practice of complementary and alternative medicine and traditional medicine is becoming popular [4-6]. The benefits of herbal medicines are considerably higher than that of allopathic medicines. It is predicted that herbal medicines will eventually regain their value and importance in the medical field [7]. Medicinal plants contain secondary metabolites such as alkaloids, glycosides, polyphenols, flavanols/flavonoids, terpenoids, or their oxygen-substituted derivatives⁸. Due to the presence of various types of bioactive compounds, the potency of medicinal plants in therapeutic usage is varied viz antibacterial, anti-inflammatory, analgesic, anticancer, antioxidant, etc. [7]. Biological activities and uses of medicinal plants with special emphasis on the mode of action were reviewed and summarized [3]. Moreover the synergism of bioactive compounds may enhance their activity. Essential oils are secondary metabolites synthesized by medicinal plants and are volatile in nature [9]. The oils play an important role in plants by conferring protection. The oils make the plant resist pathogens and herbivores and attract insects to facilitate pollination. And, essential oils play an important role in allelopathic communication between plants [9, 10]. The biological activities of essential oils are well documented and possess antimicrobial, antioxidant, anticancer, anti-inflammatory

activities, gastroprotection, etc. [11, 12].

Distribution of botanical description:

Pogostemon is a large genus from the family Lamiaceae, first described as a genus in 1815. It is native to warmer parts of Asia, Africa, and Australia [13]. The best known member of this genus is patchouli, *Pogostemon cablin*, widely cultivated in Asia for its scented foliage, used for perfume, incense, insect repellent, herbal tea, etc. e.g. *Pogostemon erectus*, *Pogostemon stellatus*, *Pogostemon helferi* are grown ornamentally in the aquarium hobby and are used for aquascaping. *Pogostemoni Herba* which is widely used in the cosmetic and hygiene industries. Chinese traditional formulae, such as Baoji Pill and Houdan Pill containing patchouli herb are used in treating inflammatory diseases [6, 7]. The plant is included in the preparations of Indian Ayurvedic treatments such as Rasa, Guna and Virya. In China, Japan and Malaysia, these plants are used to treat colds, headaches, nausea, vomiting, diarrhoea, abdominal pain, insect and snake bites. The plant family Zingiberaceae or ginger family (Genus Globba) includes about 50 genera and roughly 1,600 known species of flowering perennial plants that are distributed throughout tropical Africa, Asia, and the Americas [14]. The highest diversity is encountered in south-eastern Asia, and the greatest concentration in the north-eastern region of India with 19 genera and 88

species [14]. The majority of the Zingiberaceae members grows in humid and shady places. Most are small to large herbaceous plants with distichous leaves having basal sheaths that overlap to form a pseudostem [14]. They are characterized by aromatic and creeping horizontal or tuberous rhizomes, hermaphroditic flowers consisting of a single functional stamen (pollen-producing part of the flower) that runs through the pistil (ovule producing part of the flower), and petals that are sterile stamens called staminodes. Many members of the Zingiberaceae are economically important as spices, ornamental plants, traditional medicines, cosmetics and ingredients of religious rituals.

Traditional uses of ethnopharmacology

Generally, genus *Pogostemon* was used by tribal people for its roots and leaves [15]. Different plant parts were used in formulations like decoction, fresh extract, poultice, and infusion etc. to get rid of health ailments. The plant is used as an antidepressant, antiseptic, aphrodisiac and to cure skin problems in aromatherapy [16]. It has been widely used in folk medicine for the treatment of intestinal disorder and intermittent fever [17]. Tribal peoples also used the plant as an antidote to treat snakebite. The paste of leaves and fresh roots was applied to the snake bites. Boiled root extract was orally given to the patient [18]. Traditionally, leaf and root juice have been

given to cure cough and cold [19, 20], haemorrhage [21], malaria pneumonia, tuberculosis [22], fever [23, 24], vomiting, food poisoning, stomach problems [25] and respiratory tract infections [20]. Leaves are used to cure scabies and ringworms [26] and burning [27]. Its leaves are also used as vegetable [28]. A decoction of fresh leaves is given orally to cure dyspepsia [29]. Decoction of roots of *Pogostemon* plant along with the root of the plant of *Ageratum conyzoides* was used to cure typhoid by the local people of Nawalparasi district, Nepal [30]. Zingiberaceae plants (rhizomes, leaves, flowers or fruits) were carried out. Nevertheless, the spread of those plants that commonly grow as wild type in the forest makes this family interesting to study. Thailand exports some *Globba* species as commercial ornamental bulbs in global ornamental plant markets. *G. winitii* C.H. Wright, *G. rosea* Gagnep., *G. sherwoodiana* W.J. Kress & V. Gowda and *G. schomburgkii* Hook.f. are *Globba* species commonly sold as cut flowers and in pot plants. *G. sherwoodiana* was originally known as *G. magnifica* [31] new species in the genus *Globba* Section, *Globba* with a combination of white, sharply reflexed and imbricate inflorescence bracts and glabrous bright-green leaves [32]. *G. sherwoodiana* has been available through the ornamental plant market since 1990 as *G. magnifica* 'White

Dragon' [33], and is the main cut-flower Globba species in Thailand exports some Globba species some globba species are used as medicine like *Globba clarkei* Treatment of cough [34], *Globba marantina* Used in the management of asthma, rheumatoid arthritis, cough, cold, snakebite and others [35], *Globba multiflora* Crushed rhizome applied locally on the wound. Analgesic and Antipyretics activities [34], *Globba racemosa* Heart pain, stomach pain [36].

VI Phytochemical constituents

Genus Pogostemon and Genus Globba are plant genera that have attracted attention due to their pharmacological and aromatic properties. While Pogostemon is commonly known for its essential oil production, Globba species are recognized for their ethnobotanical uses. Various studies on its chemistry and biological activities are well documented and more recent research studies are focused on isolating individual compounds to understand their mechanism involved in various pharmacological activities. The title plant contains various phytochemicals This review aims to compare the phytochemical constituents within these genera, highlighting similarities and differences. Both Pogostemon and Globba exhibit a rich diversity of terpenoids, including monoterpenes and sesquiterpenes. Essential oils derived from these plants are often dominated by compounds such as menthol, pulegone, and limonene,

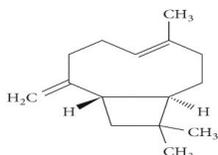
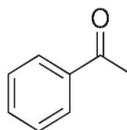
contributing to their aromatic and medicinal qualities.

Phenolic compounds play a crucial role in the antioxidant and anti-inflammatory activities of these genera. Pogostemon species are known to contain flavonoids, phenolic acids, and tannins, while Globba species exhibit a distinct profile with compounds like curcuminoids and gingerols. Alkaloids, known for their diverse biological activities, are present in varying concentrations in both genera. Pogostemon species are reported to contain pyridine alkaloids, while Globba species may exhibit alkaloids with potential pharmacological significance. Medicinal Significance: The comparative analysis of phytochemical constituents provides insights into the medicinal potential of Pogostemon and Globba species. Both genera have been traditionally used for treating ailments such as digestive disorders, respiratory conditions, and skin diseases. The diverse array of bioactive compounds contributes to their therapeutic versatility. Ecological Implications: Understanding the phytochemical constituents in Pogostemon and Globba is crucial for elucidating their ecological roles. These compounds may serve as defense mechanisms against herbivores and pathogens, influencing the plant's adaptation to its environment.

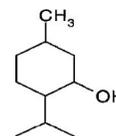
Table 1

	benzofuran-2-carboxaldehyde isoandrographolide, indirubin, vanillin, vanillic acid, 2(3H)-benzoxazolone,	7 α -hydroxysitosterol		
<i>Globba candida</i>	levoglucosan, allylhydrazide acetaldehyde, trans-2,3- epoxybutane, butan-3-enoic acid methyl ester, 2-Methylcyclopentanone, and 2-N-Propyl-Oxetan pinostrobin chalcone. like cytotoxic and anticancer, antimicrobial, antioxidant, gastroprotective	Butan-3-enoic acid Methyl Ester, Diacetyl, Acetic Acid Trans-2,3-Epoxybutane, MethylPyruvate, Dioxadiene Allyl butyrate Methallylacetone, 3,4-Dimethyl-4-penten-1yn- 3-ol, 2-Methylcyclopentanone Pinacolone, 3-Methyl-2- cyclopentenone, Methylcyclopentenolone Ethylcetyl, 1-Acetylcyclohexene, m- cresol, 2-Propyloxetane.	Etanol	[40]
<i>Pogostemon strigosus</i>	dalkaloids, carbohydrates, flavonoids, resins, glycosides, reducing sugar, steroids, tannins, and terpenoids	Menthol, menthone, pulegone, limonene.	Methanolic extract	[40]
<i>Pogostemon auricularis</i>	Alkaloids Saponins Phenolic compounds Tannins, Flavonoid's Glycosides, Cardiac Glycosides, Phytosterols Fixed Oils and fats	α -pinene β -caryophyllene, germacrene, spathulenol, caryophyllene oxide.	EPS: Ethenolic extract of <i>P. strigosus</i> , CPS: Chloroform extract of <i>P. strigosus</i> , HPS: n-Hexane extract of <i>P. strigosus</i> , SK: Streptokinase cetophenone	[41]

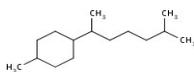
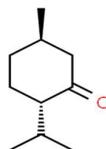
Chemical structure:

 β -caryophyllene

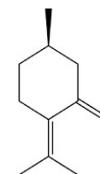
Acetophenone



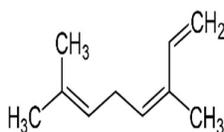
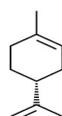
Menthol

 β -bisabolene

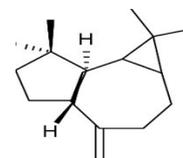
Menthone



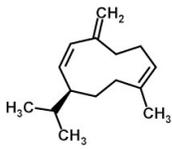
Pulegone

 β -ocimene

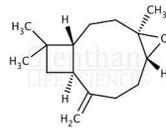
limonene



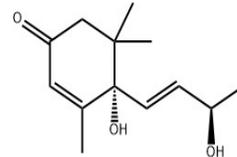
Spathulenol



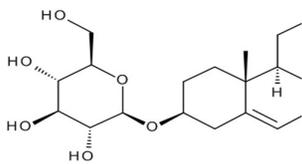
Germacrene



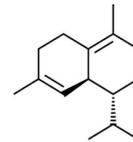
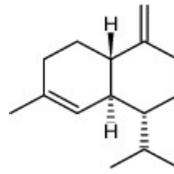
caryophyllene oxide
β-sitosteryl-β-D-Valencene



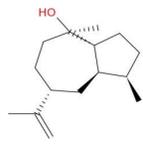
Sesquiterpenes



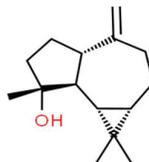
glucopyranoside



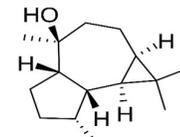
δ-Cadinene



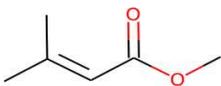
Pogostol



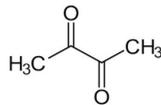
Spathulenol



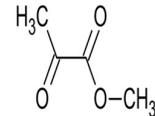
Viridiflorol



Butan-3-enoic acid



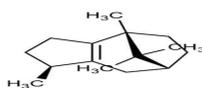
Methyl Ester



Diacetyl Methyl pyruvate



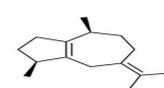
Patchoulol



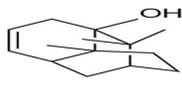
β-patchoulene



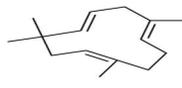
α-guaiene



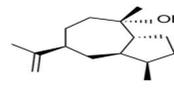
β-guaiene



Norpatchoulene



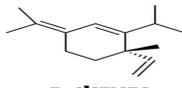
α-humulene



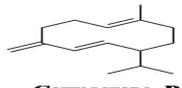
Pogostol



Seychellene



α-elemene



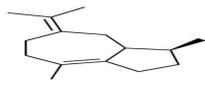
Germacrene-D



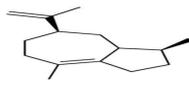
α-pinene



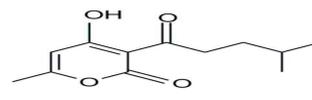
β-pinene



α-bulnesene



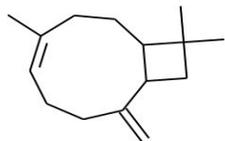
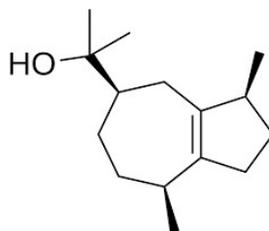
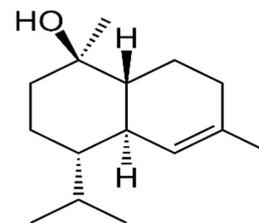
β-bulnesene



Pogostone

β-Bourbonene

β-Elemene

**E-caryophyllene****Guaiol-****Cadinol****Pharmacological Activities:**

Pogostemon and Globba have been traditionally used in various medicinal systems. Recent scientific investigations have unveiled their pharmacological potential, prompting a comparative review to elucidate and compare their therapeutic properties

A meticulous literature search was conducted using reputable databases to identify relevant studies on the pharmacological activities of Pogostemon and Globba species. Articles were selected based on their experimental methodologies, emphasizing *in vitro* and *in vivo* studies, clinical trials, and ethnopharmacological evidence.

Both Pogostemon and Globba are rich sources of bioactive compounds, including terpenoids, flavonoids, alkaloids, and essential oils. This section outlines the diverse chemical constituents identified in each genus, highlighting their potential contributions to pharmacological activities. Pogostemon species have demonstrated anti-inflammatory effects attributed to

compounds such as pogostone, while Globba extracts exhibit inhibition of pro-inflammatory cytokines. Comparative analysis reveals distinct antioxidant mechanisms, with Pogostemon relying on flavonoids and Globba utilizing curcuminoids and other phenolic compounds.

Table 2

Plant species	Plant parts	Activity studies	In vitro /In vivo	Tested extract	Observed effect	References
<i>Pogostemon cablin</i>	Nodal stem with axillary buds	pogostemon cablinhas immense ethnobotanical importance	In vitro	stem segments	proportion rates of shoot generation, leaf, rooting, callus formation was maximum	[50]
<i>Pogostemon strigosus</i>	whole plant	Anti- atherothrombosis, anti-diarrheal, Anti-inflammatory, analgesic, anxiolytic, anti-pyretic, neuropharmacological activities	In vitro	Plant extracts	dose-dependet astheaqueous extract exhibited significant thrombolytic properties.	[50]
<i>Pogostemon quadrifolius</i>	Crude leaf extracts	antioxidant activityusing 2,2-diphenyl-2picrylhydrazyl (DPPH) and reducing power assay. Antiproliferative activity of the plantextract was evaluated in breast cancer cell lines of MCF-7 using 3-4, 5dimethylthiazol-2-yl]-2,5-diphenyltetrazolium (MTT) assay	in vitro	Crudeleaf	high antioxidant activity, ethylacetate, chloroform and aqueous extracts	[41]
<i>Pogostemon heyneanus</i>	Leaves and twigs roots	Insecticidal, Gastro protective, Antioxidant, Antifungal activity	in vivo	Leaves and twigs	different drying temperatures on the yield of the essential oil, The highest oil recovery was observed at 55°C, while a considerable loss in bioactive compoundsand antioxidant activity was observed at the same temperature.	[39, 50]
<i>Globba sessilifora</i>	Aerial and rhizome	herbicidal activity	in vitro	root part	Oleoresins good insecticidal, nematocidal, and herbicidal agents	
<i>Globba globulifera</i>	Rhizome, root, leaves, pseudostem	antioxidative	In vitro	Root	Flavonoid, phenol, free radical scavenging activities	

CONCLUSION:

The comparative review of Genus *Pogostemon* and Genus *Globba* provides a comprehensive insight into the distinctive characteristics, ecological roles, and potential applications of these two plant genera. a thorough examination of their

morphological features, growth habits, and ecological preferences, it becomes evident that each genus occupies a unique niche in the plant kingdom. The analysis highlights the diverse uses of these genera in horticulture, landscaping, and traditional medicine. Genus *Pogostemon*, with its

aromatic species, is often valued for its essential oils and ornamental qualities, while Genus *Globba*, with its unique inflorescence structures, understanding these differences and similarities not only contributes to our botanical knowledge but also aids in making informed decisions in utilization of these plants. Furthermore, the review underscores the importance of continued research to explore the untapped potential of these genera, whether for medicinal breakthroughs, ecological restoration, or novel horticultural applications. It encourages botanists, horticulturists, and conservationists to collaborate in the ongoing efforts to document, conserve, and sustainably manage the diversity within Genus *Pogostemon* and Genus *Globba*.

In essence, this comparative review serves as a valuable resource for researchers, educators, and enthusiasts interested in the intricacies of plant biology. By shedding light on the unique attributes of these genera, it contributes to the broader understanding of biodiversity and underscores the significance of preserving and appreciating the rich tapestry of plant life on our planet.

REFERENCES:

[1] Astutik S, Pretzsch J and Kimengsi J N, Asian medicinal plants' production and utilisation potentials: A review, *Sustainability*, 2019, 11(19), 5483. doi:

org/10.3390/su11195483.

- [2] Ahmed N, Mahmood A, Mahmood A, Sadeghi Z and Farman M, Ethnopharmacological importance of medicinal flora from the district of Vehari, Punjab province, Pakistan, *J Ethnopharmacol*, 2015, 168, 66-78. doi:org/10.1016/j.jep.2015.02.048.
- [3] Christaki E, Bonos E, Giannenas I and Flrou-Paneri P, Aromatic plants as a source of bioactive compounds, *Agriculture*, 2012, 2(3), 228-243. doi.org/10.3390/agriculture 2030228.
- [4] Hassan B A R, Medicinal plants (importance and uses), *Pharm Anal Acta*, 2012, 3(10), 2153- 2435. doi:org/10.4172/2153-2435.1000e139.
- [5] Dhakal D, Joshi S, Dhakal PD. Chemical composition of the essential oil of *Pogostemon bengalensis* (Burm.f.) Kuntze from Nepal. *Nat Prod Commun*. 2014;9: 1-2.
- [6] Karunamoorthi K, Jegajeevanram K, Vijayalakshmi J and Mengistie E, Traditional medicinal plants: A source of phytotherapeutic modality in resource-constrained health care settings, *J Evid-Based Complement Altern Med*, 2013, 18(1), 67-74. doi:org/10.1177/215658721246024 1.

- [7] Jeelani S M, Rather G A, Sharma A and Lattoo S K, Inperspective: Potential medicinal plant resources of Kashmir Himalayas, their domestication and cultivation for commercial exploitation, *J Appl Res Med Aromat Plants*, 2017, 8, 10-25 doi: org/10.1016/j.jarmap.2017.11.001.
- [8] Raina H, Soni G, Jauhari N, Sharma N and Bharadvaja N, Phytochemical importance of medicinal plants as potential sources of anticancer agents, *Turk J Bot*, 2014, 38(6), 1027–1035. doi:org/10.3906/bot-1405-93
- [9] Jain C, Khatana S and Vijayvergia R, Bioactivity of secondary metabolites of various plants: A review, *Int J Pharm Sci Res*, 2019, 10(2), 494-504. doi:org/10.13040/IJPSR.0975-8232.10(2).494-04. [http://dx.doi.org/10.13040/IJPSR.0975-8232.10\(2\).494-04](http://dx.doi.org/10.13040/IJPSR.0975-8232.10(2).494-04)
- [10] Rozza A L and Pellizzon C H, Essential oils from medicinal and aromatic plants: A review of the gastroprotective and ulcer-healing activities, *Fundam Clin Pharmacol*, 2013, 27, 51–63. doi: org/10.1111/j.1472-8206.2012.01067.x.
- [11] Oliveira M S de, Almeida M M, Salazar M de LAR, Pires FC S, Bezerra F W F, *et al.*, Potential of medicinal use of essential oils from aromatic plants, In: *Potential of Essential Oils*, edited by HE Shemy (Intech Open, London, UK), 2018, 1–20. doi: 10.5772/intechopen.78002.
- [12] Properzi A, Angelini P, Bertuzzi G and Venanzoni R, Some biological activities of essential oils, *Med Aromat Plants*, 2013, 2(5), 136. doi:org/10.4172/2167-0412.1000136.
- [13] Mancianti F and Ebani V V, Biological activity of essential oils, *Molecules*, 2020, 25(3), 678. doi: org/10.3390/molecules25030678.
- [14] Leung A, Foster S *Encyclopedia of common natural ingredients used in food, drugs and cosmetics* John Wiley and Sons 1996
- [15] Kress WJ, Prince LM, Williams KJ. The phylogeny and a new classification of the gingers (Zingiberaceae): evidence from molecular data. *Am J Bot*. 2002;89: 1682-96.
- [16] Muthuraj K, Shalimol A, Sivapriya KT, Nagarajan N. Screening of active phytochemicals by GC-MS analysis and in vitro antibacterial activity of endemic plant *Pogostemon mollis benth.* *International Journal of Recent*

- Advances in Multidisciplinary Research. 2015;2(7):534-9.
- [17] Naise MG, Bhadaange DG. In-vitro antibacterial activity of *Pogostemon benghalensis* (N. Burman) Kuntz. Lamiaceae plant from Melghat (M.S.) India. Int J Appl Res. 2017; x:228-9.
- [18] Khyade MS, Takate YA, Divekar MV. Plants used as an antidote against snakebite in Akole Taluka of Ahmednagar district (MS), India. J Nat Rem. 2011;11(2):182-92. doi:10.18311/jnr/2011/443.
- [19] Saikia P, Khan ML. Diversity of medicinal plants and their uses in homegardens of upper Assam, Northeast India. Asian J Pharm Biol Res. 2011;1:296-309.
- [20] Taylor RS, Manandhar NP, Towers GH. Screening of selected medicinal plants of Nepal for antimicrobial activities. J Ethnopharmacol. 1995;46(3):153-9. doi: 10.1016/0378-8741(95)01242-6.
- [21] Rai MB. Medicinal plants of Tehrathum district, Eastern Nepal. Our Nature. 2003;1(1):42-8.
- [22] Magar DT, Regmi PP, Dutta JP, Pandit BH, Paudel IH, Subedi MS. Natural resources utilization: a case of non-timber forest products in Chepang community of Chitwan district, Nepal. Agric Dev. 2011; 8:97-108.
- [23] Dangol DR. Traditional uses of plants of Commonl and habitats in Western Chitwan, Nepal. J Inst Agric Anim Sci. 2008; 29:71-8.
- [24] Padal SB, Ramakrishna H, Devender R. Ethnomedicinal studies for endemic diseases by the tribes of Munchingiputtu Mandal, Visakhapatnam district, Andhra Pradesh, India. Int J Med Arom Plants. 2012;2(3):453-9.
- [25] Gautam TP. Indigenous uses of some medicinal plants in Panchthar district, Nepal. Nepalese J Biosci. 2011; 1:125-30. doi: 10.3126/njbs.v1i0.7479.
- [26] Sen P, Dollo M, Choudhury MD, Choudhury D. Documentation of traditional herbal knowledge of hamptis of Arunachal Pradesh. Indian J Tradit Know. 2008;7(3):438-42.
- [27] Dutt B. Ethnobiology in Human Welfare. In: SK Jain, ed. New Delhi: Deep Publications; 1996. p. 400-2.
- [28] Lokho K, Narasimhan D. Ethnobotany of Mao-Naga Tribe of Manipur, India. Pleione. 2013;7(2):314-24.
- [29] Bhatia H, Sharma YP, Manhas RK, Kumar K. Ethnomedicinal plants

- used by the villagers of district Udhampur, J& K, India. *J Ethnopharmacol.* 2014; 151(2): 1005-18. doi: 10.1016/j.jep.2013.12.017.
- [30] Bhattarai S, Chaudhary RP, Taylor RS. Ethno-medicinal plants used by the people of Nawalparasi District, Central Nepal. *Our Nature.* 2009;7(1):82-99.
- [31] William, J.K., Kress J.W., Manos, P.S. 2004. The phylogeny, evolution, and classification of the genus *Globba* and tribe *Globbeae* (Zingiberaceae): Appendages do matter. *Amer. J. Bot.* 91: 100–114. doi.org/10.3732/ajb.91.1.100
- [32] Gowda, V., Kress, W. J., Htun, T. 2012. Two new species of gingers (Zingiberaceae) from Myanmar. *PhytoKeys* 13: 5–14. doi.org/10.3897/phytokeys.13.2670
- [33] Paz, M.P., Kuehny, J.S., Criley, R. 2004. Ornamental gingers as potted plants. *OFA Bull.* 883:6–9.
- [34] Basak S, Sarma GC, Rangan L (2010) Ethnomedical uses of Zingiberaceous plants of Northeast India. *J. Ethnopharmacol* 132(1):286–296.
- [35] Roy *et al.* (2016) roy S, Acharya RN, Harisha CR, Shukla VJ (2016) Macro, microscopic and preliminary analytical evaluation of root and leaf of *Globba marantina* Lin.-an extra pharmacopoeial drug of Ayurveda. *Ind J Pharma Sci* 78(4):469–478.
- [36] Rao JK, Suneetha J, Reddi TS, Kumar OA (2011) Ethnomedicine of the Gadabas, a primitive tribe of Visakhapatnam district, Andhra Pradesh. *Int Multidiscip Res J* 1(2).
- [37] Pal A, *Biotechnology; Secondary Metabolites; Plants and Microbes.* Science Publishers, Portland. Page 70, 2007
- [38] Mallappa Kumara Swamy and Uma Rani Sinniah, A Comprehensive Review on the Phytochemical Constituents and Pharmacological Activities of *Pogostemon cablin* Benth.: An Aromatic Medicinal Plant of Industrial Importance, Department of Crop Science, Faculty of Agriculture, Universiti Putra Malaysia, Serdang, Selangor, Darul Ehsan 43400, Malaysia; 12 May 2015.
- [39] Himanshi Rathnasekara¹, W.J.A. Banukie Jayasuriya¹, L.D.A. Menuka Arawwawala² and T. Sugandhika Suresh³, Ethnomedicinal, phytochemical and pharmacological properties of *Pogostemon heyneanus* Benth: A review, Sri Lanka 10250, 30 May

- 2023
- [40] Shamim Molla, Chandan Sarkar, Rajib Hossain, Farhana Zaman, Apu Kumar Das, Sarmin Jamaddar, Phytochemical and pharmacological activities of *Pogostemon strigosus* Benth, Gopalganj 8100, Bangladesh; Shamim Molla; (22 April 2022).
- [41] K Kamaleswari, V Nandagopalan, Phytochemical analysis of secondary metabolites on *Pogostemon auricularis* (L.) Hassk. and *Anisomeles malabarica* (L.) R. BR. Ex Sims, E-ISSN: 2278-4136, 20-10-2017.
- [42] Itokawa H, Morita H, Katou I, Takeya K, Cavalheiro AJ, de Oliveira RCB, Ishige M, Motidome M. (1988) Cytotoxic diterpenes from the rhizomes of *Hedychium coronarium*. *Planta Medica*, 54, 311-315.
- [43] Putri Sri Andila, Distribution and Phytocomponent in the Ethanol Extract of *Globba candida* Gagnep. (Zingiberaceae) by GC-MS Analysis, Indonesian Institute of Science, Tabanan 82191, Indonesia, September 2018.
- [44] Narasinga Rao V and DSVGK Kaladhar, Phytochemical And Biochemical Studies of Medicinal Plant *Globba bulbifera*, Dept. of Biochemistry, GIS, GITAM University, Visakhapatnam, Andhra Pradesh, February 2014.
- [45] Shahnaz Naznin, Mahmuda Ferdous, Mohammad Sarowar Uddin, Farjana Yeasmin, AFM Shahid Ud Daula and Mohammad Anwarul Basher, Phytochemical investigation and evaluation of antioxidant activities of methanolic extract of *Globba marantina* leaves, Noakhali-3814, Bangladesh, MPS 2019; 7(6): 147-153.
- [46] Elizabeth George, Muniyandi Kasipandi, Mudili Venkataramana, Kalagatur Naveen Kumar, Joseph Anthuvan Allen, Thangaraj Parimelazhagan, Natarajan Gopalan, In vitro antioxidant and cytotoxic analysis of *Pogostemon mollis* Benth, Department of Botany, Bharathiar University, Coimbatore, India, Vol 11 No 1 (2016).
- [47] Sangeeta Dahiya, Daizy R. Batish, Harminder Pal Singh, Ethnobotanical, phytochemical and pharmacological aspects of Bengal *Pogostemon* (*Pogostemon benghalensis*), Department of Botany, Panjab University, Chandigarh 160014, India, 29 September 2019, J Herbmед

- Pharmacol. 2020; 9(4): 318-327
- [48] Narasinga Rao V and DSVGK Kaladhar, Phytochemical and Biochemical Studies of Medicinal Plant *Globba bulbifera*, Dept. of Biochemistry, GIS, GITAM University, Visakhapatnam, Andhra Pradesh, India. February 2014, Inter. J. of Phytotherapy / Vol 4 / Issue 1 / 2014 / 50-53.
- [49] Bhawna Verma, Himani Karakoti, Ravendra Kumar, Sonu Kumar Mahawer, Om Prakash, Ravi Mohan Srivastava, Satya Kumar, Shilpi Rawat, Dharmendra Singh Rawat, and Mozaniel Santana de Oliveira, Phytochemical Screening and Evaluation of Pesticidal Efficacy in the Oleoresins of *Globba sessiliflora* Sims and In Silico Study, Department of Chemistry, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar 263145, U.S. Nagar, Uttarakhand, India, 3 January 2023, Volume 2023, Article ID 5936513, 16 page.
- [50] Mallappa Kumara Swamy and Uma Rani Sinniah, A Comprehensive Review on the Phytochemical Constituents and Pharmacological Activities of *Pogostemon cablin* Benth. An Aromatic Medicinal Plant of Industrial Importance, Department of Crop Science, Faculty of Agriculture, Universiti Putra Malaysia, Serdang, Selangor, Darul Ehsan 43400, Malaysia; 12 May 2015.
- [51] Amadoru I J, Abeysinghe D C, Gunathilaka H A W S, Kulathilaka S H C and Dharmadasa R M, Effect of different drying temperatures on oil yield, antioxidant capacity and bioactive compounds of *Pogostemon heyneanus* Benth (Lamiaceae), 15th Agricultural Research Symposium of Wayamba University Research Congress 2017, (Makandura, Sri Lanka), 2017, 470-474.