Crimson Publishers
Wings to the Research

Mini Review

Herbal Expectorants for the Pandemic Period: A Review

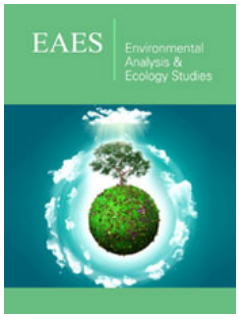
Justin R Nayagam Saira George* and Sagna A

Department of Botany, India

Abstract

As the ongoing COVID 19 pandemics has become a global health crisis and it mainly affects respiratory tract. An effort for presenting the traditional expectorents of the herbal medicine gains its attention, which is promising for the world population from the plant genetic resources to reduce the pressure on pharmacy for medicine. Herbal expectorants are proved to be environmentally safe and are available in around any habitats. Forty-eight species of plants used traditionally as expectorants from six continents are included in the present study. Plant parts used, its dosage forms, bioactive compounds having expectorant activities are evaluated in the study. Abies *webbiana Lindl*. belongs to *gymnosperm, Adiantum capillus-veneries L*. is a *pteridophyte* and 42 others are flowering plants. These plants were distributed and used as herbal expectorants in different continents of the world except *Antartica*. Forty-two species studied are distributed in Asia, thirteen species in Europe, six species from South America, five species in Africa and three species each in Australia and North America. Distribution pattern with respect to different continent is considered, which is an added attraction. During this dreadful situation people can rely on herbal expectorants to subside respiratory infections and increase immunity.

ISSN: 2578-0336



***Corresponding author:** Justin R Nayagam Saira George, Department of Botany, Union Christian College, Aluva-2, Kerala, India

Submission: May 11, 2020

Published: March 04, 2021

Volume 8 - Issue 1

How to cite this article: Justin R Nayagam Saira George, Sagna A. Herbal Expectorants for the Pandemic Period: A Review. Environ Anal Eco stud. 8(1). EAES. 000677. 2021.
DOI: 10.31031/EAES.2021.08.000677

Introduction

The initial symptoms of COVID-19 patients include were fever, myalgia, sore throat and dry cough which are common to any acute respiratory virus infection. Pneumonia were consistent with the manifestation of lower respiratory tract infections. By contrast, upper respiratory tract symptoms were less common in these patients. Non-specific symptoms included dizziness, diarrhoea, vomiting, headache, and generalised weakness [1-20].

Chloroquine, a widely used anti-malarial and autoimmune disease drug, was reported as a potential broad-spectrum antiviral drug [2-38]. Remdesivir is an adenosine analogue, which incorporates into nascent viral RNA chains and results in pre-mature termination [3-42]. It was repoted that remdesivir and chloroquine are highly effective in the control of 2019-nCoV infection *in vitro* [4-44]. Azithromycin added to hydroxychloroquine was significantly more efficient for virus elimination [5-48]. Development of its preventive and treatment is still an ongoing process by scientists from all over the world. It is in this contest an effort for presenting the traditional expectorants of the herbal medicine gains its attention, which is promising for the world population when enough quantity of medicine is not available. When world is in the hands of terrifying infection, people with mild symptoms can exist with herbal solutions.

Herbal Expectorants

Forty-eight species of plants used traditionally as expectorants in different parts of the world are critically avaluated and presented in Table 1. Among these species Abies *webbiana Lindl*. belongs to *gymnosperm*, *Adiantum capillus-veneries L*. is a *pteridophyte* and rest other species are flowering plants that include six monocot speceis belong to four families and forty species are dicotyledons from twenty-six families. These plants are distributed and used as herbal expectorants in different continents of the world except *Antartica*. Forty-two species studied are distributed in Asia, thirteen species in Europe, six species from South America, five species in Africa and three species each in Australia and North America. *Eucalyptus globulus Labill*. is widely distributed in all the six continents either by natural occurance

or by way of cultivation. *Marrubium vulgare Linn*. and *Origanum majorana Linn*. are scattered in three continents; Africa, Europe and Asia, while *Borago officinalis Linn*., is distributed in South America, Europe and Asia. Other species are limited to one or two continent in distribution and used as herbal expectorants.

Table 1: List of plant species used as expectorants from different parts of the world and key source of information.

SL No	Botanical Name	Common Name	Family Name	Distribution - Continent/ Country	Part and Form of Use as Expectorant	Bioactive Chemicals Detected	Reference
1	*Abies webbianaLindl.*	Indian Silver	Pinaceae	Asia - India	Dried leaves - powdered leaves along with the juice of Adathoda vasica and honey	Flavonoids, biflavonoid glycosides and phytosterols	[8]
2	*Acacia concinna (Willd.) DC.*	Indian Acalypha	Euphorbiaceae	Asia - India	Leaves - Decoction	Saponin, lupeol, aspinasterol, acacic acid lactone, hexacosanol and aspinasterone	[9], [10]
3	*Adiantum capillus-veneries L.*	American Maidenhair Fern, Venus Hair, Rock Fern.	Adiantaceae	Asia - India	Leaves - Decoction is filtered and honey or sugar is added; Infusion	Flavonoid, glucosides, terpenoids, adiantone, isoquercetin, astragalin, kaempferol	[11], [12], [13]
4	*Allium cepaLinn.*	Onion	Liliaceae/Alliaceae	Asia - India	Bulb - Decoction, infusion, fresh juice, raw, cooked, or roasted bulb	Thiosulphinates, cepaenes	[14]
5	*Amygdalus persica-Linn.*	Peach tree	Rosaceae	Asia - China, Korea, Japan, India	Bark, seeds, leaves	Amygdalin	[15], [16], [17], [18], [19], [20]
6	*Anisochilus carnosus Wall.*	Karpuravalli (Folk name- southern region)	Labiatae/Lamiaceae	Asia - India	Leaves and stem - Fresh juices of leaves mixed with sugar and gingelly oil; Leaves and stems in infusion	Glucosides of luteolin and apigenin.	[14], [21]
7	*Barleria prionitis Linn.*	Common Yellow Nail Dye Plant	Acanthaceae	Asia - India	Leaves and dried stem bark	Glycosides such as 6-O-trans-p-coumaroyl-8-O-acetylshanzhiside, barlerin and acetylbarlerin	[14], [22]
8	*Blumea balsamiferaDC.*	Ngai Camphor	Compositae/ Asteraceae	Asia - India	Leaves - Infusion	Borneol, caryophyllene, ledol phytol, caryophyllene oxide, guaiol.	[23]
9	*Boerhavia diffusa-Linn.*	Horse-purslane, Hogweed	Nyctaginaceae	Asia - India	Whole plant -Infusion	Phenolics glycosides, terpenoids, rotenoids,	[24], [25]
10	*Borago officinalis-Linn.*	Borage, Cow's Tongue Plant	Boraginaceae	South America - Argentina; Europe - Spain - Canary Island; Asia	Leaf, dried pedicel, dried flowers - Leaf and dried flower infusion; decoction of the dried pedicels	Gamma linolenic acid, ascorbic acid, lycopsamine, supindine viridiflorate, pyrrolizidine alkaloid	[13], [26], [27], [28], [29]
11	*Brunella vulgaris-Linn.*	Self-heal	Labiatae/Lamiaceae	Europe - Germany; Asia - India, Turkey	Aerial aprts, infloresence - infusions mixed with honey	Flavonoids, rutin.	[30], [31], [32]
12	*Carum carvi Linn.*	Caraway	Umbelliferae/ Apiaceae	Europe; Asia	Seeds	Volatile oil consisting of carvone (40-60%), and limonene	[33], [34]
13	*Cassia occidentalisLinn.*	Coffee Senna, Foetid Cassia, Negro Coffee	Cealsalpiniaceae	Sout America -Peruvian Amazon	Seeds and flower - seeds brewed into a coffee-like beverage; flower infusion	Physcion and its glucosides, emodin, betasitosterol and sennosides	[35], [36], [37]
14	*Centipeda orbicularisLour.*	Sneezewort	Compositae / Asteraceae	Australia; Asia - India	Leaves and wood ash - pituri	Flavonoids, sesquiterpenes and amide	[38], [19]
15	*Cephaelis ipecacuanha (Brot.) A. Rich.*	Ipecac, Ipecacuanha	Rubiaceae	America; Asia-India	Roots and rhizome - Extract	Emetine, cephaeline, ipecacuanhic acid, and nauseating ethereal oil.	[39], [40]
16	*Cheiranthus cheiri Linn.*	Wall-flower, Gilli Flower	Cruciferae / Brassicaceae	Europe; Asia	Leaves, flowers and seeds	Glycosides and cherinine (a glucoside of the digitalis group)	[19], [14], [41], [42]

17	*Cinnamomum camphora (Linn.) Nees & Eberm.*	Camphor tree.	Lauraceae	Asia - China, Japan	Wood and leaves - Infusion	Camphor, safrol, linalool, eugenol	[43], [44]
18	*Cordia myxaRoxb. nonLinn.*	Sabestan Plum	Boraginaceae	Asia - India	Fruits	Alkaloids, flavanoids, coumarins	[45], [46]
19	*Cressa creticaLinn.*	Rudanti, Rudantikaa, Rudravanti (Ayurvedic)	Convolvulaceae	Asia - Bahrain, India	Whole plant	Alkaloid, β sitosterol, scopoletin, quercetin glycosides, umbelliferone	[47]
20	*Curcuma amadaRoxb.*	Mango-ginger, Wild Turmeric	Zingiberaceae	Asia - India	Rhizome	Curcuminoid	[42], [48]
21	*Datisca cannabina L.*	False hemp	Datiscaceae	Asia - Iraq, Nepal, India	Whole plant - Decoction	Flavonoids (datiscin and datiscanin)	[49], [50]
22	*Dorema ammoniacum D. Don.*	Ammoniacum, Gum ammoniac	Umbelliferae / Apiaceae	Europe; Northern Asia - Siberia; Asia - India, Iran	Gum-resin	Amino-resinol, ferulene, coumarins and Ammoniacum	[19], [51], [52]
23	*Eriobotrya japonica Lindl.*	Loquat, Japanese Medlar	Rosaceae	Asia - China, India	Dried leaves - Ingredient in Shini-seihai-to and Biwayo-to	Flavanoid componds	[53], [54]
24	*Eucalyptus globulusLabill.*	Blue-Gum tree, Australian	Myrtaceae	Europe -Italy, France; Australia; S. America - Venezuela; N. America - Jamaica and Guaremala; Asia	Leaves, root bark - Infusion and decoction	Crystallized resin, cymenes, terpenes, flavonoids -quercetin, tannins, volatile oils	[30], [55], [56]
25	*Ficus carica Linn.*	Common Fig	Moraceae	Africa - Morocco; Asia - India	Leaf - Infusion and decoctions	Bergapten, quercetin, luteolin, and 4 ‘,5’-dihydropsoralen	[57]
26	*Glycyrrhiza glabra-Linn.*	Licorice, Liquorice	Papilionaceae / Fabaceae	Africa; Asia - India	Underground stem and root	Glycyrrhizin, Glycosides -glycyrrhizol, glabrins A and B	[58], [59]
27	*Hibiscus mutabilis-Linn.*	Cotton-Rose, Chinese-Rose, Confederate Rose	Malvaceae	Asia - Bangladesh, China	Flower	Quercetin, kaempferol, betulinic acid, hexyl stearate, tetratriacontanol, nonacosane	[19], [60], [61]
28	*Iris germanicaLinn.*	Orris, Iridis Rhizome, German Iris	Iridaceae	Africa - Morocco	Root - Infusion	Irigenin S, iriside A, stigmasterol (I), irone, irilone, irigenin, iridin	[62]
29	*Lilium candidum-Linn.*	Madona Lily, Annunciation Lily, White Lily	Liliaceae	Europe - Romania; Asia - Anatolia, India	Bulb and flower - Infusion	Jatropham and etioline	[63], [64]
30	*Liquidambar orientalisMill.*	Fragrant Maple	Altingiaceae / Hamamelidaceae	Asia - Turkey, Anatolia	Resin from trunk	Cinnamic acid, cinnamin acid esters, cinnamyl cinnamate (styracin), phenylpropyl cinnamate; triterpene acids; vanillin; styrene	[14], [65]
31	*Lobelia inflataLinn.*	Indian Tabacco, Pukeweed	Campanulaceae/ Lobeliaceae	North America	Leaves - used in teas and tinctures	Lobeline, Lobelachrin, Lobelia acid.	[66]
32	*Marrubium vulgareLinn.*	Horehound	Labiatae /Lamiaceae	Africa - Algeria; Europe; Central Asia	Whole plant - combined with other herbs such as Inula helenium L. and Glycyrrhiza glabra L.	Marrubiin	[67], [68]
33	*Melaleuca leucadendronLinn.*	Cajeput tree, Swamp Tea tree, White Tea tree	Myrtaceae	Asia - Burma,Cambodia, Thailand, Malay, Indonasia; Australia	Essential oil	Terpenoids,nerolidol, limonene, benzaldehyde, valeraldehyde, and dipentene	[69], [70], [71]
34	*Morus albaLinn.*	Chinese-White-Mulberry	Moraceae	Asia - Turkey, China, India	Root bark, fruit	Phenolic compounds, triterpinoids and a glyceride	[72], [73]
35	*Mucuna monospermaDC.*	Kaakaandolaa (Ayurveda)	Papilionaceae / Fabaceae	Asia - Nepal, Andaman	Seeds	Luteolin, acacetin	[74]
36	*Myroxylon balsamumHarms.*	Tolu Balsam tree	Leguminosae	S. America - Colombia, Venezuela, Peru	Essential oil - used in cough syrups and pills	Benzoic acid and Cinnamic acid	[75], [76], [77]

37	*Origanum majoranaLinn.*	Sweet Marjoram.	Labiatae /Lamiaceae	Asia - Iran; Africa - Morocco; Europe	Seeds , aerial parts, branches - Infusion	Thymol, rosmarinic acid, caffeic acid; and triterpenoids	[14], [78], [62]
38	*Pilocarpus microphyllusStapf.*	Jaborandi	Rutaceae	South America - Brazil	Leaves	Pilocarpine	[79]
39	*Pimpinella anisumLinn.*	Anise, Aniseed	Umbelliferae / Apiaceae	Asia - India, Turkey	Seeds - powder and decoctions; used in traditional tea	Volatile oil, coumarin, β amyrin, stigmasterol, flavonoid glycosides	[28], [80]
40	*Polygala chinensisauct. non Linn.*	Senega	Polygalaceae	Asia - India, Andaman	Root and leaves - Decoction of roots; infusion of leaves	Senegin	[14], [81], [82]
41	*Saponaria officinalisLinn.*	Bouncing Bet, Soapwort	Caryophyllaceae	Europe - Romania; Asia - Turkey	Leaves, root and rhizome - Decoction prepared from leaves; Infusion of root and rhizome	Saporubrinic acid and Saponin	[14], [28], [83], [84]
42	*Scindapsus officinalisSchott.*	Ayurvedic- Gajakrishna, Hastipippali, Gajapippali	Araceae	Asia - India, Andaman	Whole plant - used in medicated oils; Decoction of green leaves	Scindapsin A and B	[11], [14], [85], [86]
43	*Styrax benzoin Dry.*	True Gum Benzoin, Sumatra Benzoin or Gum Benjamin	Styraceae	South-East Asia and East Indies	Stem exudates	Cinnamic, benzoic and sumaresinolic acid esters	[87], [88]
44	*Thymus serpyllumLinn.*	Mother-of-thyme, Wild Thyme	Labiatae /Lamiaceae	N. America - Britain; Asia - India, Nepal	Aerial parts - combining it with other plants like Tussilago farfara L., or Marrubium vulgare L.	Thymol	[89], [90], [91]
45	*Tussilago farfaraLinn.*	Coughwort, Coltsfoot, Asses' Foot	Compositae / Asteraceae	Europe - Italy, Balkans; Asia - India, Nepal	Aerial parts, leaves and flowers - Infusion	Chlorogenic acid, isochlorogenic acid A, B and C, 3,5-dicaffeoylquinic acid, and rutin	[92], [93]
46	*Viola odorataLinn.*	Sweet violet	Violaceae	Europe; Asia - Iran, India	Roots	Volatile oil, salicylic acid methyl ester, saponins, alkaloids.	[19], [93], [94]
47	*Viola tricolorLinn.*	Heartsease, Wild Pansy	Violaceae	Europe; Asia, Turkey	Aerial parts - Infusion	Rutin, violin and salicylic acid	[19], [28], [93]
48	*Zingiber officinale Rosc.*	Ginger	Zingiberaceae	Asia - India	Rhizome - Juice mixed with honey; Boil ginger in milk	Zingiberene, camphene, ß-pinene, myrcene, limonene, 1,8-cineole , ß-phellandrene.	[95], [96]

Herbal drugs in crude form or in polyherbal formulations for the treatment of cough are better alternatives of modern cough drugs [6-50]. Decoctions or infusions of different parts of the plants studied are used individually or in combinations to cure cough, sore throat, bronchitis, asthma and other respiratory tract problems. In *Dorema ammoniacum, Liquidambar orientalis* and *Styrax benzoin*, stem exudates are used as expectorant. Researches on herbal medicines have reported that bio active components like saponin, alkaloids, flavonoids, terpinoids and phenolic compounds are used in the treatment of cough [7]. Terpinoids and flavonoids are found to be major bio active compounds having expectorant action in the selected plant species. Phenols, alkaloids and saponins are also components of these plants involved in cough remedies. Limonene an expectorant is a monoterpene present in three plants Carum carvi, Melaleuca leucadendron and Zingiber officinale. Flavanoid luteolin is a cough suppresser isolated from *Anisochilus carnosus*, *Ficus carica* and *Mucuna monosperma* [51-66]. *Cressa cretica, Eucalyptus globulus* and *Ficus carica* contain flavonoid quercetin which is an expectorant theraputic. Flavonoid rutin has an expectorant activity obtained from *Brunella vulgaris*, *Tussilago farfara* and *Viola tricolor*. *Origanum majorana* and *Thymus serpyllum* yield natural terpinoid thymol with expectorant property. Bio active components of the plants included in the present study shows there relevance to be used as expectorant in folk medicines [65-72].

Conclusion

Based on the present understanding of novel coronavirus pathogenesis and symptoms known so far, an attempt has been made to enunciate the various medicinal herbs from the plant genetic resources in different continents of earth [73-82]. The plants and its parts, which are used as its decoctions and infusions and their combinations could be done as a treatment benefit for COVID-19 patients and those with seasonal flu and health issues. This may also increase immunity of the patients and provide resistance and safety of them against the viral infection [83-96].

References

1. Shi H, Han X, Jiang N, Cao Y, Alwalid O, et al. (2020) Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. The Lancet Infectious Diseases 20(4): 425-434.

2. Yan Y, Zou Z, Sun Y, Li X, Xu KF, et al. (2013) Anti-malaria drug chloroquine is highly effective in treating avian influenza A H5N1 virus infection in an animal model. Cell Res 23(2): 300-302.

3. Warren TK, Jordan R, Lo MK, Ray AS, Mackman RL, et al. (2016) Therapeutic efficacy of the small molecule GS-5734 against Ebola virus in rhesus monkeys. Nature 531(7594): 381-385.

4. Wang M, Cao R, Zhang L, Yang X, Liu J, et al. (2020) Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) *in vitro*. Cell Res 30(3): 269-271.

5. Gautret P, Lagier JC, Parola P, Meddeb L, Mailhe M, et al. (2020) Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial. Int J Antimicrob Agents 56(1): 105949.

6. Jahan Y, Mahmood T, Bagga P, Kumar A, Singh K, et al. (2015) Future prospects of cough treatment; herbal medicines v/s modern drugs. Int J Pharm Sci Res 6(9): 3689-3697.

7. Chakraborty R, Biplab ND, Sen S (2013) Antitussive, expectorant activity of *Marsilea minuta L*, an Indian vegetable. Journal adv pharm technol res 4(1): 61-64.

8. Watt G (1883) Economic products of India. The superintendent of Government Printing, India, pp. 652-653.

9. Dineshkumar B, Vigneshkumar P, Bhuvaneshwaran SP, Mitra A (2010) Phyto-pharmacology of Acalypha indica: A Review. International Journal of BioSciences, Alternative and Holistic Medicine 1(2): 27-32.

10. Dineshkumar B, Vigneshkumar P, Bhuvaneshwaran SP, Mitra A (2010) Phyto-pharmacology of Acalypha indica: A Review. International Journal of BioSciences, Alternative and Holistic Medicine 1(2): 27-32.

11. Savithramma N, Sulochana C, Rao KN (2007) Ethnobotanical survey of plants used to treat asthma in Andhra Pradesh, India. Journal of Ethnopharmacology 113(1): 54-61.

12. Natale A, Pollio A (2007) Plants species in the folk medicine of Montecorvino Rovella (inland Campania, Italy). J Ethnopharmacol 109(2): 295-303.

13. Hammond GB, Fernández ID, Villegas LF, Vaisberg AJ (1998) A survey of traditional medicinal plants from the Callejón de Huaylas, Department of Ancash, Perú. Journal of Ethnopharmacology 61(1): 17-30.

14. Khare CP (2007) Indian medicinal plants: An illustrated dictionary. (1st edn), Springer Science, New York, USA, pp. 82-83.

15. Mhaskar KS, Blatter E, Caius JF, Asha VR (2000) Kirtikar and Basu's illustrated indian medicinal plants: their usage in ayurveda and unani medicines. Sri Satguru Publications. Delhi, India.

16. Kirtikar KR, Basu BD (2001) Indian medicinal plant. (2nd edn), International Book Distributors, Dehradun, India.

17. Lim TK (2012) Edible medicinal and non-medicinal plants. Fruits, Springer Science & Business Media, London, UK, 4: 492-509.

18. Gaur RD (1999) Flora of the district Garhwal north west Himalayas. Transmedia, Srinagar Garhwal, India, pp. 227.

19. Gairola S, Gupta V, Bansal P, Singh R, Maithani M (2010) Herbal antitussives and expectorants-A review. International Journal of Pharmaceutical Sciences Review and Research 5(2): 5-9.

20. Sang S, Kikuzaki H, Lapsley K, Rosen RT, Nakatani N, et al. (2002) Sphingolipid and other constituents from almond nuts (Prunusamygdalus-Batsch). J Agric Food Chem 50(16): 4709-4712.

21. Sirsi M, Natarajan S, Tirunarayanan M, Murthy PS (2013) Studies on Indian medicinal plants: Pharmacological actions & antibacterial activity of *Anisochilus carnosus* [No Labiatae]. Journal of the Indian Institute of Science 37(2): 98.

22. Chopra RN, Nayar SL, Chopra IC (1956) Barleria prionitis Linn. Glossary of Indian medicinal plants. Council of Scientific and Industrial Research Publication. New Delhi, India. pp. 33-34.

23. Ruangrungsi N, Tantivatana P, Tappayuthpijarn P, Borris RP, Cordell GA (1985) Traditional medicinal plants of Thailand vi. Isolation of cryptomeridiol from *Blumea balsamifera*. Sci Asia 11(1): 47-50.

24. Kumar M, Bussmann RW, Mukesh J, Kumar P (2011) Ethnomedicinal uses of plants close to rural habitation in Garhwal Himalaya, India. Journal of Medicinal Plants Research 5(11): 2252-2260.

25. Nayakpranati, Thirunavoukkarusu M (2016) A review of the plant *Boerhaaviadiffusa*: its chemistry, pharmacology and therapeutic potential. The journal of Phytopharmacology 5(2): 83-92.

26. Anesini C, Perez C (1993) Screening of plants used in Argentine folk medicine for antimicrobial activity. Journal of Ethnopharmacology 39(2): 119-128.

27. Darias V, Bravo L, Barquin E, Herrera DM, Fraile C (1986) Contribution to the ethnopharmacological study of the Canary Islands. J Ethnopharmacol 15(2): 169-193.

28. Ugulu I, Baslar S, Yorek N, Dogan Y (2009) The investigation and quantitative ethnobotanical evaluation of medicinal plants used around Izmir province, Turkey. J Med Plant Res 3(5): 345-367.

29. Leung AY, Foster S, (1996) Encyclopedia of common natural ingredients-Used in food, drugs and cosmetics. (2nd edn), A Wiley- Interscience Publication, USA, pp. 98-99.

30. Garnier G, Beauquesne LB, Debraux G (1961) Resources medicinales de la flore française. Vigot Frères, Paris, Volume I & II: 1115.

31. Yesilada E, Honda G, Sezik E, Tabata M, Goto T, Ikeshiro Y (1993) Traditional medicine in Turkey IV. Folk medicine in the Mediterranean subdivision. J Ethnopharmacol 39(1): 31-38.

32. Bai Y, Xia B, Xie W, Zhou Y, Xie J, et al. (2016) Phytochemistry and pharmacological activities of the genus Prunella. Food chemistry 204: 483-496.

33. Chevallier A (1996) The encyclopedia of medicinal plants. Dorling Kindersley, London, UK.

34. Robert T, Rodney Y (2014) Essential oil safety 2nd (Edn), Churchill Livingstone, London, UK, pp. 483-647.

35. Rutter RA (1990) Catalogo de plantas utiles de la amazonia peruana. Instituto Linguistico de Verano, Yarinacocha, Peru.

36. Longman O (1996) Indian medicinal plants. 1st (edn), Orient Longman-pvt ltd., Anna Salai, Chennai, India 1: 488.

37. Al-Snafi Ali (2015) The therapeutic importance of *Cassia occidentalis*-An overview. Indian Journal of Pharmaceutical Science & Research 5(3): 158-171.

38. Latz PK (1995) Bushfires and bushtucker. IAD Press, Alice Springs, Northern Territory, Australia.

39. Gupta R (1971) Ipecac a promising subsidiary crop for north-eastern plantation regions. Indian Farming 21: 19-21.

40. Solis PN, Langat C, Gupta MP, Kirby GC, Warhurst DC, et al. (1995) Bio-active compounds from Psychotria camponutans. Planta Med 61(1): 62-65.

41. Evans WC, Evans D, Trease GE (2002) Trease and evans' pharmacognosy. (16th edn), WB Saunders, Edinburgh, Scotland.

42. Kirtikar KR, Basu BD (1984) Indian medicinal plants. Lalit Mohan Basu, Allahabad, India 4: 2422.

43. Asmaa SS, Ayman AF, Souria MD, Fawzia S (2012) Protective effect of *Cinnamomum Camphora* leaves extract against atrazine induced genotoxicity and biochemical effect on Mice. Journal of American Science 8(1): 190-196.

44. Yeung Him-Che (1985) Handbook of Chinese herbs and formulas. Institute of Chinese Medicine, Los Angeles, California, USA.

45. Rechinger KH, (1997) Cordia. Flora Iranica. Akademische Durck-u Verlangsantalt, Graz, Austria, 48: 6.

46. Matias EFF, Alves EF, Silva MKN, Carvalho AVR, Coutinho HDM, et al. (2015) The genus Cordia: botanists, ethno, chemical and pharmacological aspects. Revista Brasileira de Farmacognosia 25(5): 542-552.

47. Rizk AFM, Ghazaly GA (1995) Medicinal and poisonous plants of Qatar. Qatar, UAE: Scientific and Applied Research Centre, University of Qatar, Qatar.

48. Ravindran PN, Pillai GS, Divakaran M (2012) Other herbs and spices: mango ginger to wasabi. Handbook of Herbs and Spices, pp. 557-582.

49. Al-douri NA (2000) A survey of medicinal plants and their traditional uses in Iraq. Pharm biol 38(1): 74-79.

50. Ijaz S, Perveen A, Kousar S, Ghaffar N (2019) Physico-chemical and preliminary phytochemical study of seeds of *Datisca cannabina* Linn (Datiscaceae) from himalaya region in pakistan. Pharmaceut Reg Affairs 8(1): 2-4.

51. Langenheim JH (2004) Plant resins: chemistry, evolution, ecology, and ethnobotany. Ann Bot 93(6): 784-785.

52. Thomson AT (1830) The London dispensatory, apreactical synopsis of materia medica, pharmacy, and therapuetics. p. 361.

53. Wu YX, Jian TY, Lv H, Ding XQ, Zuo YY, et al. (2018) Antitussive and expectorant properties of growing and fallen leaves of loquat *(Eriobotrya japonica)*. Revista Brasileira de Farmacognosia, 28(2): 239-242.

54. Hamada A, Yoshioka S, Takuma D, Yokota J, Cui T, et al. (2004) The effect of *Eriobotrya japonica* seed extract on oxidative stress in adriamycin-induced nephropathy in rats. Biological and Pharmaceutical Bulletin 27(12): 1961-1964.

55. Loi MC, Maxia L, Maxia A (2005) Ethnobotanical comparison between the villages of Escolca and Lotzorai (Sardinia, Italy). Journal of Herbs, Spices & Medicinal Plants 11(3): 67-84.

56. Konoshima T, Takasaki M (2002) Chemistry and bioactivity of the non-volatile constituents of eucalyptus. Eucalyptus p. 269.

57. Fatiha BA, Ouafae B, Souad S, Jamila D, Allal D, et al. (2017) Ethnobotany study of medicinal plants used in the treatment of respiratory diseases in the middle region of oum rbai. International Journal of Environment, Agriculture and Biotechnology 2(4):

58. Chitale PK (1997) A comparative study of Ayurveda and treatment by indian drugs. Indian Books Centre-Sri Satguru Publications.

59. Gupta R (2016) Yastimadhu (Glycyrrhiza glabra) an important plant of ayurvedic system of medicine. J Med Plants Stud 4(4): 30-31.

60. Rahman AHMM, Gondha R (2014) Taxonomy and traditional medicine practices on malvaceae (mallow family) of rajshahi, Bangladesh. Open Journal of Botany 1(2): 19-24.

61. Raut DN, Mandal SC, Pal SC (2014) Phytochemical and pharmacological overview of *Hibiscus mutabilis* Linn. Int J Pharm Res Bio Sci 3: 236-241.

62. Hilaly J, Hmammouchi M, Lyoussi B (2003) Ethnobotanical studies and economic evaluation of medicinal plants in Taounate province (Northern Morocco). J Ethnopharmacol 86(2-3): 149-158.

63. Gazi JFP (2000) Alkaloids from the bulbs of *Lilium candidum*. of Turkish origin. J Fac Pharm Gazi 17(1): 25-28.

64. Papp N, Sali N, Csepregi R, Toth M, Gyergyák K, et al. (2019) Antioxidant potential of some plants used in folk medicine in Romania. Farmacia 67(2): 323-330.

65. Yeşilada E, Sezik E, Honda G, Takaishi Y, Takeda Y (1999) Traditional medicine in Turkey IX: Folk medicine in north-west Anatolia. J Ethnopharmacol 64(3):195-210.

66. Stansbury J, Saunders PR, Zampieron E (2013) The use of lobelia in the treatment of asthma and respiratory illness. Journal of Restorative Medicine 2(1): 94-100.

67. Boudjelal A, Henchiri C, Siracusa L, Sari M, Ruberto G (2012) Compositional analysis and *in vivo* anti-diabetic activity of wild Algerian *Marrubium vulgare* L infusion. Fitoterapia 83(2): 28-292.

68. Lodhi S, Vadnere GP, Sharma VK, Usman M (2017) *Marrubium vulgare* L A review on phytochemical and pharmacological aspects. Journal of Intercultural Ethnopharmacology 6(4): 429.

69. Pujiarti R, Ohtani Y, Ichiura H (2011) Physicochemical properties and chemical compositions of *Melaleuca leucadendron* leaf oils taken from the plantations in Java, Indonesia. J Wood Sci 57: 446-451.

70. Khan SS (2015) Exotic arboreal plants of Bhopal, their therapeutic potential and conservation. Indian J Applied & Pure Bio 30(1): 89-95.

71. Fall R, Ngom S, Sall D, Sembène M, Samb A (2017) Chemical characterization of essential oil from the leaves of *Callistemon viminalis* (DR) and *Melaleuca leucadendron* (Linn). Asian Pacific Journal of Tropical Biomedicine 7(4): 347-351.

72. Yamatake Y, Shibata M, Nagai M (1976) Pharmacological studies on root bark of mulberry tree (Morus alba L). The Japanese Journal of Pharmacology 26(4): 461-469.

73. Baytop T (1999) Türkiyede bitkiler ile tedavi İstanbul Eczacılık Fakültesi Yayınları. İstanbul p. 444.

74. Khory NR, Katrak NN (1999) Materia medica of India and their therapeutics 380. BDH Printers, New Delhi, India.

75. Rose J (2002) Herbs used as oils used from herbs©.

76. Rizzini CT, Mors WB (1995) Botânica Econômica Brasileira. Âmbito Cultural.

77. Van Wyk BE, Wink M (2018) Medicinal plants of the world. Briza Publications, CABI, p. 230

78. Bahmani M, Khaksarian M, Rafieian KM, Abbasi N (2018) Overview of the therapeutic effects of *Origanum vulgare* and *Hypericum perforatum* based on Iran's ethnopharmacological documents. Journal of Clinical and Diagnostic Research 12(7):

79. Vieira RF (1999) Conservation of medicinal and aromatic plants in Brazil. Perspectives on new crops and new uses pp: 152-159.

80. Müller Limmroth W, Fröhlich HH (1980) Effect of various phytotherapeutic expectorants on mucociliary transport. Fortschr Med 98(3): 95-101.

81. Sekharan R, Jagadeesan M (1997) An ethnobotanical survey of javvadhu hills, tamil nadu. Ancient science of life 16(3): 206-214.

82. Singh MK, Arya M, Bharti KA, Singh K (2018) Exploration of some folk medicinal herbs in forest fringe villages of Assam (India): A study amid Nagaon and Golaghat districts. Journal of Pharmacognosy and Phytochemistry 7(1): 2362-2368.

83. Tita I, Mogosanu GD, Tita MG (2009) Ethnobotanical inventory of medicinal plants from the South-West of Romania. Farmacia 57(2): 141-156.

84. Kregiel D, Berlowska J, Witonska I, Antolak H, Proestos C, et al. (2017) Saponin-based, biological-active surfactants from plants. Application and Characterization of Surfactants pp. 183-205.

85. Bhattacharya S (2006) Anticancer botanicals. Daya Publishing House, New delhi, India.

86. Kaushik D, Kaushik P (2012) Scindapsus officinalis: A comparhensive review. Int J Pharm 2(2):18-27.

87. Jain SK, Srivastava S (2005) Traditional uses of some Indian plants among islanders of the Indian Ocean. India.

88. Atia Sharif HN, Rehman R, Mushtaq A, Rashid U (2016) A review on bioactive potential of Benzoin Resin. International Journal of Chemical and Biochemical Sciences 10: 106-110.

89. Pharmacopoeia B (2009) The british pharmacopoeia secretariat of the medicines and healthcare products regulatory agency. UK.

90. Fachini QFC, Kummer R, Estevão SCF, Carvalho MD, Cunha JM, et al. Cuman RK (2012) Effects of thymol and carvacrol, constituents of *Thymus vulgaris* L essential oil, on the inflammatory response. Evid Based Complement Alternat Med.

91. Pina VC, Gonçalves RA, Pinto E, Costade OS, Tavares C, et al. (2004) Antifungal activity of thymus oils and their major compounds. J Eur Acad Dermatol Venereol 18(1): 73-78.

92. Bellia G, Pieroni A (2015) Isolated, but transnational: the glocal nature of Waldensian ethnobotany, Western Alps, NW Italy. Journal of ethnobiology and ethnomedicine 11(1): 37.

93. Tasić S (2012) Ethnobotany in SEE-WB countries; traditional uses of indigenous plants. Lekovite sirovine 32: 71-81.

94. Mahboubi M, Kashani LMT (2018) A Narrative study about the role of *viola odorata* as traditional medicinal plant in management of respiratory problems. Advances in Integrative Medicine 5(3): 112-118.

95. Shende JJ, Rajurkar BM, Mhaiskar MN, Dalal LP (2014) Ethnobotanical studies of samudrapur tahsil of wardha district. IOSR J Pharm Biol Sci 9(6): 16-23.

96. Salam S, Jamir NS, Roma M (2016) Ethnobotanical remedies to cough and cold as practiced by the Tangkhul tribe in the Ukhrul District of Manipur, India. Pleione 10(1): 66-70.