Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Medicinal plants used for the management of respiratory diseases in Zimbabwe: Review and perspectives potential management of COVID-19

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ABSTRACT

Respiratory diseases have in the recent past become a health concern globally. More than 523 million cases of coronavirus disease (COVID19), a recent respiratory diseases have been reported, leaving more than 6 million deaths worldwide since the start of the pandemic. In Zimbabwe, respiratory infections have largely been managed using traditional (herbal) medicines, due to their low cost and ease of accessibility. This review highlights the plants' toxicological and pharmacological evaluation studies explored. It seeks to document plants that have been traditionally used in Zimbabwe to treat respiratory ailments within and beyond the past four decades. Extensive literature review based on published papers and abstracts retrieved from the online bibliographic databases, books, book chapters, scientific reports and theses available at Universities in Zimbabwe, were used in this study. From the study, there were at least 58 plant families comprising 160 medicinal plants widely distributed throughout the country. The Fabaceae family had the highest number of medicinal plant species, with a total of 21 species. A total of 12 respiratory ailments were reportedly treatable using the identified plants. From a total of 160 plants, colds were reportedly treatable with 56, pneumonia 53, coughs 34, chest pain and related conditions 29, asthma 25, tuberculosis and spots in lungs 22, unspecified respiratory conditions 20, influenza 13, bronchial problems 12, dyspnoea 7, sore throat and infections 5 and sinus clearing 1 plant. The study identified potential medicinal plants that can be utilised in future to manage respiratory infections.

1. Introduction

Respiratory diseases are among the top ten major causes of mortality and morbidity worldwide (FIRS, 2017; WHO, 2018). The spectrum of these respiratory ailments ranges from acute communicable infections to chronic non-communicable diseases (Xie et al., 2020). Zimbabwe is predominantly affected by acute respiratory infections, chronic obstructive pulmonary disease, asthma, tuberculosis (TB), and lung cancer (Boutayeb, 2006; Rivera-Ortega and Molina-Molina, 2019). Both adults and children alike have over the years been vulnerable to respiratory diseases. A review by Salim et al. (2008) reported the most common recorded causes of respiratory mortality in Zimbabwean children were *Pneumocystis carinii* pneumonia, acute pyogenic pneumonia and TB with underreporting in asthma and other atopic conditions.

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Adults on the other hand were reportedly most vulnerable to acute respiratory infections, chronic obstructive pulmonary disease COPD, asthma, lung cancer, and nasopharyngeal and laryngeal cancer associated with exposure to indoor air pollution from burning biomass fuels Zimbabwe. Chronic cough and TB are the most commonly diagnosed conditions among HIV-positive adults with lower respiratory tract infections and asthma more common among HIV-negative patients.

The Coronavirus disease 2019 (COVID-19) is a new infectious respiratory disease caused by a novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was discovered between November and December 2019 in Wuhan China (Chen et al., 2020; Di Gennaro et al., 2020; Rothan and Byrareddy, 2020). As at June 14, 2022, this disease had resulted in 541,124,794 confirmed cases globally with at 6, 332,729 deaths worldwide (Worldometer, 2022); Zimbabwe has reported 254,155 confirmed cases and 5521 deaths (Worldometer, 2022). This disease has so far been contagious and lethal to the extent that it has become a global emergency. As such, there has been a rising need for the urgent development of an effective treatment to address this pandemic. So far, nations in the global south such as India, China, Malaysia and Africa have taken a unique approach to drug repurposing and antiviral development by leveraging their extensive traditional medicines portfolios and mining them for potential anti-coronaviral drug candidates (Ren et al., 2020).

The study of ethnomedicine has in the past revealed that plant based remedies can ease chest and nasal congestion, soothing irritated airways, suppressing symptoms such as sneezing, coughing and swollen glands (WHO, 2001). Other studies have reported that herbal remedies also exhibit antihistamine and antioxidant properties which are important in alleviating respiratory disorders (Cunningham, 1988; Taur and Patil, 2011). With the background of plant secondary metabolites having been used in the past as sources of lead compounds for the development of effective and valuable conventional drugs such as chloroquine phosphate, originally extracted from the bark of cinchona trees (Redeploying plant defences, 2020), the reason why people turn towards herbal medicine for therapeutic intervention makes logical sense.

Organic herbal remedies are widely used as alternative medicines for primary health care management by 80% of the populations living in low- and medium-income countries (LMICs) (Mahomoodally, 2013; Oyebode et al., 2016; James et al., 2018). As such, most low-income societies in Zimbabwe rely, to a greater extent, on these low cost and easy-to-access alternative medicines (Maroyi, 2013a; Batisai, 2016). In Zimbabwe, indigenous knowledge systems (IKS) provide alternative medicines used to manage a variety of ailments in primary health care (Dimene et al., 2020). A vast repository of these diverse indigenous medicinal plants is consumed as nutraceuticals (Maroyi, 2013a; Bhebhe et al., 2015). While this is so, there still remains a plethora of indigenous knowledge systems to be explored. The highly infectious COVID-19 causes respiratory illness similar to the normal flu with symptoms such as cough, fever and in most severe cases the patients have difficulty in breathing (Cascella et al., 2020). Most infected people usually experience mild to moderate respiratory illness and they are able to recover from the disease without any special treatment (Singhal, 2020).

The respiratory system is a delicate system crucial for gaseous exchange, but it is vulnerable to infectious agents like bacteria, viruses and air pollution (Kim et al., 2018). The emergence of new highly contagious respiratory infections, as well as the high incidence of antimicrobial resistance (AMR) to current drugs against agents causing respiratory infections has led to the increased prevalence of patients with respiratory disorders (Ayukekbong et al., 2017; MacIntyre and Bui, 2017). This, coupled with the high cost of pharmaceuticals (Gronde et al., 2017), has necessitated the need to identify new targets for the development of novel, effective, safe, affordable and accessible alternative medications (Olorunnisola et al., 2011).

Unfortunately, maximum utilization of indigenous knowledge systems especially relating to medicinal plants is seriously hampered by the unavailability of scientific studies to validate the folklore claims as well as their limited scale of domestication and documentation (Maroyi, 2013a). According to (Shoko, 2018) only a handful of studies have been carried out to unravel the full medicinal property spectrum in Zimbabwean plants. This study sought to profile the plant species that are used for the management of existing respiratory ailments in Zimbabwe and modes of formulation. The study also focused on the respiratory conditions that are most commonly managed using the medicinal plant species in Zimbabwe. Moreover, the previous phytochemical profiling studies that were conducted to identify bioactive compounds, pharmacological and toxicological studies were also considered.

Constraints have been cited on the limited active plantation of indigenous medicinal plants which include the lack of tree nurseries, lack of processing facilities and poorly developed marketing pathways, lack of biodiversity studies and inadequate information about the nutritional and therapeutic benefits (Bodeker et al., 1997; Kehlenbeck et al., 2013). In view of a potential need to grow the candidate plants on a large scale, the current study also sought to find out whether agricultural and biotechnological studies have been conducted especially relating to the cultivation and propagation of the candidate traditional medicinal plants. The economic and conservation status of each plant species under consideration was also considered.

In a quest to identify the potential alternative medicines for further exploration in mitigation of the COVID-19 pandemic and future outbreaks, the available ethno-medicinal data of plants used to treat respiratory infections in Zimbabwe was gathered for the identification of under-investigated plant species that have the potential to be explored. This study sought to establish the plant species that are most often used for the management of respiratory disorders in Zimbabwe and their modes of preparation. The study also touched on the respiratory conditions that are most commonly managed using the medicinal plant species in Zimbabwe. The previous phytochemical profiling studies that have already been conducted to identify the bioactive compounds in medicinal plants, pharmacological and toxicological studies that have been recorded were considered. In light of a potential need to grow the candidate plants on a large scale, the current study sought to find out whether agricultural and biotechnological studies have been conducted especially relating to the cultivation and propagation of the candidate traditional medicinal plants. The economic and conservation status of each plant species under consideration was also considered. The plant species with the highest potential for prioritisation for the development of herbal preparations and ultimately drug development for the management of COVID-19 were then identified. This study aimed to identify Zimbabwean plants used traditionally to treat respiratory diseases in humans.

2. Materials and methods

2.1. Research protocol and reporting

The Preferred Reporting Items for the Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used in the reporting of this study (Fig. 1). The protocol used in this systematic review was based on Moher et al., 2009.

2.2. Literature search

A systematic search was undertaken using a variety of published papers and abstracts up to March 31, 2020 that were retrieved from the online bibliographic databases that included PubMed, Google Scholar, and ScienceDirect. These databases were searched using the following search terms: “traditional use of plants”, “medicinal uses of plants”, “indigenous use of plants”, “herbs to treat respiratory disorders”, “ethnobotanical surveys” and “ethno-pharmacological studies’’ and “Zimbabwe”. (For search terms used see: https://docs.google.com/document/d/1ivetFJI0TdAbshvuoagblaqC6nbXlLF3/edit?usp=sharing&oui

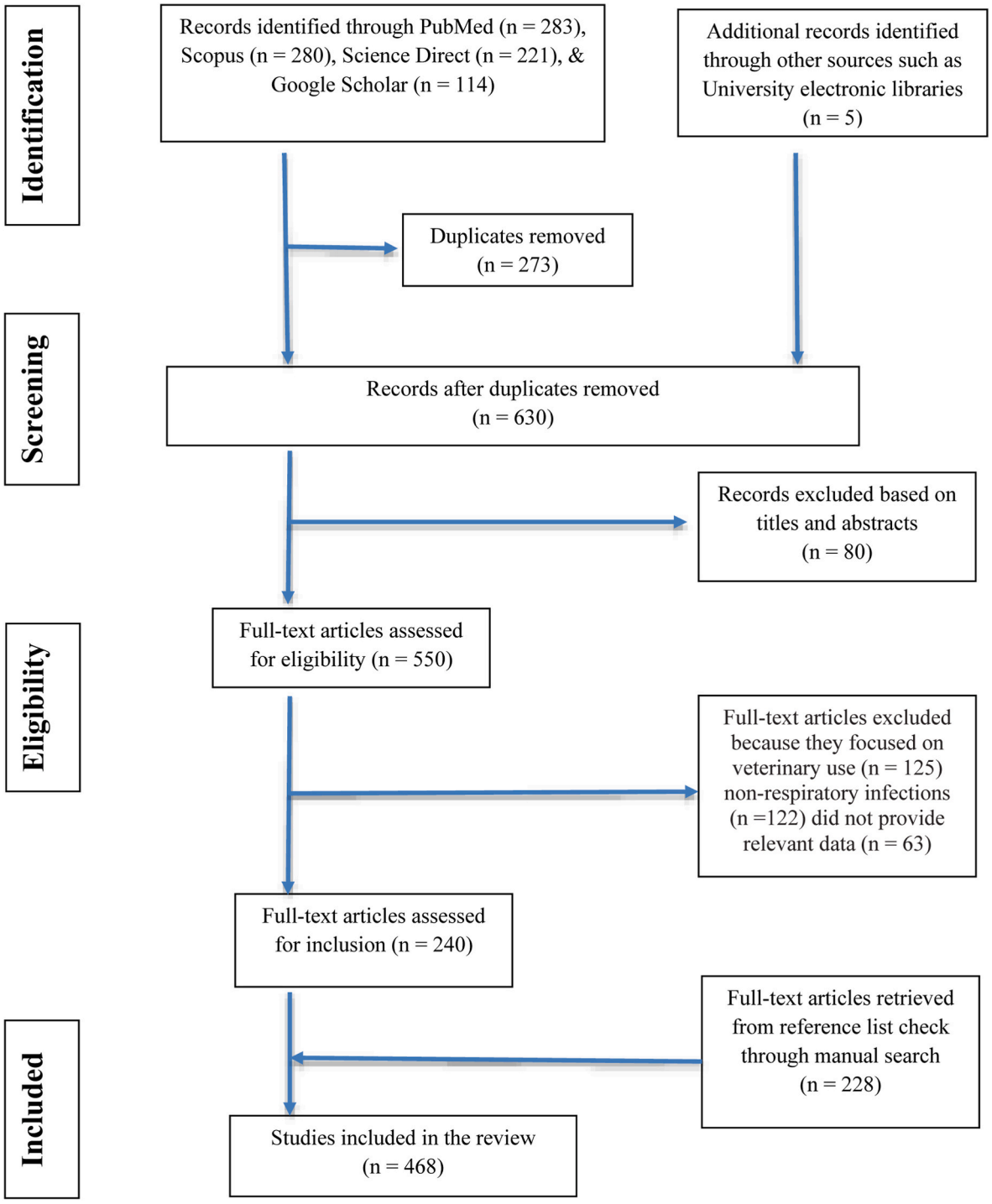

Fig. 1. PRISMA Flow diagram showing the search and retrieval steps of the study.

d=10702694829217112480 0&rtpof=true&sd=true. Other sources utilised in this study included books (Wild and Gelfand, 1959; Watt and Breyer-Brandwijk, 1962; Williamson, 1975; Chavunduka et al., 1978; Gelfand et al., 1985; Van Wyk et al., 2009; Neffati et al., 2017), book chapters, scientific reports and theses available at universities (Matongo, 2012; Viol, 2013) and National Herbarium and Botanic Gardens (SRGH) libraries. The search was limited to studies published in English or containing at least an abstract written in English. The plant names have been verified with http://www.theplantlist.org and https://www.zimbabweflora.co.zw. Plants with the reported traditional usage against respiratory diseases were identified from the data gathered. A master list was generated enlisting all the medicinal plants used in Zimbabwe for the treatment of respiratory disorders (Table 1). The above-mentioned databases were also searched for pharmacological studies providing supporting evidence of medicinal uses for each species. Only reference(s) were provided because of the massive number of studies being consulted and complete information on pharmacological properties can be retrieved from the original studies. All the data has been summarized in five tables (Tables 1–5) and six figures (Figs. 1–6).

Table 1
Medicinal plants used for the management of respiratory disorders in Zimbabwe.

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
Acanthaceae	*Barleria spinulosa* Klotzsch	Shrub	No information	Whole plant	Applied to incision made on chest	Pneumonia		N, W, C, E, S	Least Concern	Gelfand et al. (1985)
Acanthaceae	*Thunbergia oblongifolia* Oliv.	Herb	Mufurambudzi, Mukuvamvura, Musvisvinwa (Sh) Early blue thunbergia (Eng)	Roots	Decoction taken orally	Asthma	Diarrhoea, abdominal pain, depressed fontanelle, nausea, dysmenorrhoea, to prevent abortion, headache and swollen stomach (Dropsy)	N, C, E		Gelfand et al. (1985)
Alliaceae	*Tulbaghia leucantha* Baker	Herb	Mhondya (Sh) Wild garlic (Eng)	Whole plant	Decoction taken orally	Asthma		W, C, S		Gelfand et al. (1985)
Anacardiaceae	**Mangifera indica* L.	Tree	Mumango (Sh) Mango (Eng)	Leaves and twigs	Roasted, powdered decoction drunk and ash licked Decoction and powder	Asthma, colds, cough and tuberculosis	Diarrhoea, astringent, gonorrhoea, asthma, prolongs ejaculation, anthelmintic	N, W, C, E, S	Least Concern	Chimponda and Mukanganyama (2010); Mangoyi et al. (2014); Maroyi (2018b)
Anacardiaceae	*Lannea discolor* (Sond.) Engl.	Tree	Chizhenje, Mugan'acha, Muhumbukumbu, Mumbumbu, Mupuri, Mushamba (Sh) Tree grape, Live-long (Eng)	Roots		Cough	Constipation, diarrhoea, dysentery, stomach ailments, convulsions, cough, fever, female infertility, gonorrhea, menstrual problems, bilharzia, bladder problems, and malaria	N, W, C, E, S		Maroyi (2018d)
Anacardiaceae	*Lannea edulis* (Sond.) Engl.	Shrub	Mutsambatsi, Tsombori (Sh) Intakubomvu (Nd) Wild grape (Eng)	Roots	Hot water extract drunk three times a day Decoction	Cough and Bronchitis	Abdominal pains, amenorrhea, dysmenorrhea, dizziness, hematuria, wounds, rheumatism, bilharziasis and Sexually transmitted infections (gonorrhea, syphilis, and venereal disease)	N, W, C, E, S	Least concern	Maroyi (2011, 2019c)
Anacardiaceae	*Searsia chirindensis* (Baker f.) Moffett	Shrub	Mubikasadza, Mutsodzo (Sh) Red currant rhus (Eng)	Leaves and Roots		Chest pains and cough	Measles and syphilis	W, C, E, S	Least Concern	Viol (2013)
Anacardiaceae	*Searsia lancea* (L.f) F. A.Barkley	Tree	Mufokosiana (Sh) Bastard willow (Eng) Uchane, InHlokoshiyane (Nd)	Roots	Infusion taken orally	Chest pains	Abdominal pain, diarrhoea with blood, measles	N, W, E, S		Gelfand et al. (1985)
Anacardiaceae	*Searsia longipes* (Engl.) Moffett	Tree	Mudzambuya, Mufokosiana, Mutungahove (Sh) Large-leaved rhus (Eng) Inhlokotshiyane (Nd)	Leaves	Decoction taken orally	Cough	Abdominal pains, aphrodisiac for women, diarrhoea, syphilis, infertility in women, to dilate the birth canal	N, C, E		Gelfand et al. (1985)
Anacardiaceae		Tree		Roots		Cough		W, C, E, S	Least Concern	Maroyi (2011, 2014)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
	Searsia pyroides (Burch.) Moffett		Mufokosiana (Sh) Common wild currant, (Eng)		Extract drunk as cough medicine. Decoction					
Annonaceae	*Annona stenophylla* Engl. & Diels	Shrub	Muroro (Sh) Dwarf custard-apple (Eng)	Roots	Crushed, mixed with water, extract drunk. Infusion	Chest pains	Boils and Sexually transmitted diseases	N, W, C, E, S	Not Evaluated	Maroyi (2011, 2014)
Annonaceae	*Hexalobus monopetalus* (A. Rich.) Engl. & Diels	Shrub	Muhodzongwa, mukorongwa, mukwingiziri, munyani, mupodzongo, mupodzongwa, musakama (Sh) Baboons' breakfast, Shakama plum (Eng)	Stems, Roots, bark, leaves, fruit		Colds, bronchitis and pulmonary troubles	Stomach pains, snakebites, headaches, diabetes, diuretic, laxative, antipyretic, insomnia, colic, constipation and venereal diseases, cataracts, expectorant, bloody vomiting, diarrhoea, dysentery, naso-pharyngeal affections	N, W, C, E, S		Dzoyem et al. (2016)
Apiaceae	*Alepidea amatymbica* Eckl. & Zeyh	Herb	Kataza (Sh) Giant alepidea, larger tinsel flower (Eng) Inkatsankatsa (Swazi)	Leaves and roots	Chewed or decoction drunk.	Asthma, chest pains, influenza, colds and cough	Rheumatism and wounds	E	Critically Endangered	Gelfand et al. (1985)
Apiaceae	*Alepidea cordifolia* B.-E. van Wyk	Herb	Kataza (Sh)	Rhizome and Roots		Colds and influenza		E		Neffati et al. (2017)
Apiaceae	*Diplolophium zambesianum* Heirn	Herb	Ruvhuniti (Sh)	Roots	Infusion taken orally	Pneumonia	Constipation, diarrhoea and sore eyes.	N, W, C, E, S		Gelfand et al. (1985)
Apiaceae	*Heteromorpha arborescens* (Spreng.) Cham. & Schltdl	Tree	Mhingano (Sh) Livelong, Parsley tree (Eng) Imfenkulu (Nd)	Bark, leaves, and Roots	Infusion taken orally and roasted the chewed and juice is swallowed	Respiratory problems (asthma, chest pains, coughs, and tuberculosis)	Aphrodisiac, abdominal pains in infants, infertility, cancer, backache, headache and fever.	N, W, C, E		Gelfand et al. (1985); Maroyi (2018g)
Apocynaceae	*Carissa edulis* (Forssk.) Vahl	Shrub	Mudyabveni, Mudzambara, Muhlababzunzi, Mumbingwa, Muruguru, Mutsamviringa (Sh) Simple-spined num-num (Eng) Umlugulu (Nd)	Roots	Crushed, mixed with hot water, extract drunk Decoction	Cough, chest pains, pneumonia and tuberculosis	Diarrhoea	N, W, C, E, S	Least Concern	Maroyi (2011, 2013a); Sharifi-Rad et al. (2020)
Apocynaceae	*Carissa bispinosa* (L.) Desf. ex Brenan	Shrub	Muruguru, Mudyabveni, Mudzambara, Mumbingwa, Murambamhunga, Mutsamviringa (Sh) Y-thorned carissa, Forest num-num (Eng)	Roots	Hot water extract drunk three times a day. Decoction	Cough	Diarrhoea	W, C, S	Least Concern	Maroyi (2011, 2014)
Apocynaceae	*Diplorhynchus condylocarpon* (Muell. Arg.) Pich.	Tree	Musikanyimo, Mutohwa, Tsowa (Sh) Rhodesian rubber tree, horn-	Roots	Infusion taken orally and salt added to	Cough, pneumonia	Abdominal pain, venereal diseases, infertility, measles	N, W, C, E, S		Gelfand et al. (1985)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
			pod tree, wild rubber (Eng) Inkamamasane (Nd)		decoction and drunk.		anorexia and to rest sterility in men.			
Apocynaceae	*Holarrhena pubescens* Wall. ex G. Don	Shrub	Chigafusi, Mugashu, Muhatsu, Mukashumukono, Mukashumurume (Sh) Fever-pod, Jasmine-tree (Eng)	Roots		Asthma	Aphrodisiac, galactagogue, laxative, constipation, abdominal pains and infertility	N, W, C, E, S		Maroyi (2012a)
Apocynaceae	**Nerium oleander* L	Shrub	Oleander (Eng)			Pneumonia		Cultivated		Gelfand et al. (1985)
Apocynaceae	*Tabernaemontana elegans* Stapf	Tree	Muchanga (Sh) Toad tree (Eng) UmKhahlwana, umKhadlu (Zulu)	Sap, leaves, Roots, rhizome		Lung ailments and tuberculosis	Styptic, aphrodisiac, stomach ache, venereal diseases, cancer	E, S		Dzoyem et al. (2016)
Asclepiadaceae	*Ectadiopsis oblongifolia* (Meisn.) Bullock	Shrub	Rukangadza (Sh) Inkamamasane enduna (Nd)	Roots	Paste applied to painful parts.	Pneumonia	Abdominal pain, diarrhoea, constipation, aphrodisiac, gonorrhoea, sore eyes, cataracts, antiemetic in infants and medicine for premature infants to strengthen them.	N, W, C, E, S		Gelfand et al. (1985)
Asclepiadaceae	*Gomphocarpus glaucophyllus* Sclechter	Herb	Gwendere (Sh) Blue milkweed (Eng)	Roots	Infusion taken orally	Asthma	Antiemetic in infants	N, W, C, E		Gelfand et al. (1985)
Asparagaceae	*Asparagus africanus* Lam.	Climber	Rukato (Sh) Bush asparagus (Eng)	Roots	Crushed, mixed with hot water, extract drunk Decoction or infusion taken orally	Pneumonia and tuberculosis.	Diarrhoea and to dilate birth canal	N, W, C, E, S	Least Concern	Gelfand et al. (1985); Maroyi (2011, 2013a); Sharifi-Rad et al. (2020)
Asphodelaceae	*Aloe ferox* Mill.	Succulent	Gavakava (Sh) Bitter aloe, Red aloe (Eng) iNhlaba (Zulu) iKhala (Xhosa)	Leaves		Tuberculosis	Skin afflictions (burns, wounds, abrasions, irritations), cardiovascular diseases, cancer, neuro-degeneration, and diabetes	C, E, S	Least Concern	Chigora et al. (2007)
Asphodelaceae	*Aloe vera* (L.) Burm. f.	Succulent	Gavakava (Sh) Aloe (Eng)	Leaves		Tuberculosis	Minor wounds and inflammatory skin disorders.	C, E, S	Not Evaluated	Chimponda and Mukanganyama (2010); Maroyi (2013a); Mangoyi et al. (2014)
Asphodelaceae	*Aloe excelsa* Berger	Succulent	Gavakava (Sh) Tree aloe (Eng) Ihlaba (Nd)	Leaves	Infusion of ashes	Asthma		N, W, C, E, S		Gelfand et al. (1985)
Asphodelaceae	*Aloe* spp.	Succulent	Gavakava (Sh) Aloe (Eng) Icena (Nd)	Leaves	Infusion	Cough		N, W, C, E, S		Gelfand et al. (1985)
Asteraceae		Shrub		Leaves			Digestive ailments	N, C, E, S		Neffati et al. (2017)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
	Artemisia afra Jacq. ex Willd.		Wild wormwood, African wormwood (Eng) Umhlonyane (isiXhosa) Mhlonyane (isiZulu) Lengana (Tswana)		Extract drunk Infusion	Respiratory ailments				
Asteraceae	*Aspilia pluriseta* Schweinf. subsp. *pluriseta*	Herb	Mukushamvura, Mumharadzi, Ruhwati (Sh) Dwarf aspilia (Eng)	Roots	Burnt and smoke inhaled	Dyspnoea (shortness of breath)	Abdominal pains, diarrhoea, delirium, body pains, poor appetite, cessation of senses, prolonged labour, pains during pregnancy and swelling of body	N, C, E		Gelfand et al. (1985)
Asteraceae	*Laggera crispata* (Vahl) Hepper & J. R.I. Wood	Herb	Rutapatsikidzi (Sh) Bug catcher (Eng)	Roots	Infusion taken orally and applied to incisions made around the chest.	Pneumonia	Convulsions, headache, bleeding from nose, abdominal pains, fever, painful legs, madness, heart pains and to fatten infants.	N, W, C, E		Gelfand et al. (1985)
Asteraceae	*Dicoma anomala* Sond.	Herb	Fever bush, stomach bush (Eng) Isihlabamakhondlwane, Umuna (Zulu)	Roots	Decoction taken orally Infusion taken orally	Colds, cough and pneumonia	Abdominal pains, antidote for poison, bladder problems in women, sore throat, cataracts, diarrhoea, dysentery, induce labour, pain, painful uterus, malaria, madness, skin sores schistosomiasis, stomach problems and wasting in infants.	N, W, C, E, S		Gelfand et al. (1985); Maroyi (2018f)
Asteraceae	*Helichrysum caespititium* (DC.) Harv.	Herb	Golden everlasting (Eng)	Leaves, Roots and whole plant		Cough and pulmonary tuberculosis Respiratory infections (chest pains, colds, cough, flu, pneumonia, sinuses and tuberculosis)	Depressed fontanelle, sexually transmitted infections, nausea, headache, wounds, ulceration, and used as an aphrodisiac	C, E		Watt and Breyer-Brandwijk (1962); Gelfand et al. (1985); Maroyi (2019b)
Asteraceae	*Helichrysum kraussii* Schultz Bip.	Shrub	Mupumhanhuka, Mutsvairo, Rusakadzi (Sh) Umawewana (Nd) Curry bush (Eng)	Whole plant	Burnt ashes mixed with salt and taken orally	Cough		N, W, C, E, S		Gelfand et al. (1985)
Asteraceae	*Inula glomerata* Oliv. & Hiern	Herb	Zeveratsuro, Zheveratsuro (Sh) Hare's ears (Eng)	Roots	Infusion taken orally and rubbed on incisions made on painful parts.	Pneumonia	Constipation, abdominal pain around the umbilicus, ear ache infertility in women, tonic for premature	N, W, C, E, S		Gelfand et al. (1985)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
							babies, to dilate the birth canal			
Asteraceae	*Lopholaena coriifolia* (Sond.) Phillips & C. A.Sm. *Lopholaena dehniae* Merxm.	Shrub	Chigunguru, Mugakatombo, Mukwiradundu, Nyakatondo (Sh) Small-leaved fluff-bush (Eng)	Roots	Burnt ashes taken orally in porridge	Cough, pneumonia	Abdominal pains, diarrhoea with blood, measles, convulsions and burns	W, C, S		Gelfand et al. (1985)
Asteraceae	*Vernonia adoensis* Walp. var. *adoensis*	Shrub	Musikavakadzi (Sh) Bitter leaves, Common bitter leaves (Eng)	Leaves		Tuberculosis		N, C	Not Evaluated	Chimponda and Mukanganyama (2010); Mangoyi et al. (2014)
Asteraceae	*Vernonia amygdalina* Del.	Shrub	Dembezeko, Musikavakadzi, Muzhozho, Nyareru (Sh) Tree vernonia, Bitter-tea vernonia (Eng) Inyathelo (Nd)	Roots	Infusion taken orally	Cough	Painful uterus, infertility in women, abdominal pain, venereal diseases, cessation of menses, aphrodisiac, weak joints, bilharziasis, fever, diarrhoea and swelling of the body.	N, W, C, E, S		Gelfand et al. (1985)
Bignoniaceae	*Kigella africana* (Lam.) Benth	Tree	Mubveve, Musonya, Muvhumati (Sh) Sausage tree (Eng) Umvebe (Nd)	Bark and Roots	Infusion taken orally and applied to incision made on painful part.	Pneumonia	Tropical ulcers, backache, toothache, fits (epilepsy) and antidote for snake bite.	N, W, C, E, S		Gelfand et al. (1985)
Bignoniaceae	*Stereospermum kunthianum* Cham.	Tree	Kabvevesango, Mutandangozi (Sh) Pink jacaranda (Eng)	Pod	Chewed with salt	Cough		N, W, C, E		Gelfand et al. (1985)
Canellaceae	*Warburgia salutaris* (Bertol. f.) Chiov.	Tree	Muranga (Sh) Pepper-bark tree (Eng) Isibhaha (Zulu)	Bark	Infusion or decoction	Colds, cough, influenza, sinus clearing, spots in the lungs and chest pains	Panacea(remedy), venereal disease, to increase blood in the body abdominal pains, headache, to cause abortion, aid to divination	E	Critically Endangered	Maroyi (2008, 2013b); Viol (2013)
Cannabaceae	*Trema orientalis* (L.) Blume	Tree	Elm, Pigeonwood (Eng) Umdindwa, Umsekeseke, Umvangazi (Zulu)	Fruit, Stems, leaves, bark, twigs and seeds		Coughs, sore throats, asthma, bronchitis	Gonorrhea, yellow fever, toothache, antidote, dysentery	N, W, C, E, S		Dzoyem et al. (2016)
Celastraceae	*Elaedendron matabelicum* Loes.	Tree	Murunganyama, Murungamunyu (Sh) Condiment saffron (Eng) Umgugudu (Nd)	Roots	Infusion taken orally	Chest complaints	Aphrodisiac, menorrhagia, diarrhoea with blood, to reduce size of orifice, cavity, venereal diseases, syphilis, abdominal pain, diarrhoea, abscesses, carbuncles,	N, W, C, E, S	Least Concern	Gelfand et al. (1985); Viol (2013)

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Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
							purgative and dysentery remedy			
Celastraceae	*Gymnosporia senegalensis* (Lam.) Loes	Tree	Chishuzhu, Chivhunabadza, Musosawafa (Sh) Confetti tree, Red spike-thorn (Eng) Isihlangu (Nd)	Leaves, twigs and Roots		Coughs, pneumonia and tuberculosis	Chickenpox, measles, varicella, mumps, fever and malaria	N, W, C, E, S	Least Concern	Chimponda and Mukanganyama (2010)
Celastraceae	*Sclerocarya birrea* subsp. *caffra* (Sond.) Kokwaro.	Tree	Mupfura, Mutsomo (Sh) Marula (Eng) Umganu (Nd)	Bark		Cough, pneumonia	Heart pains, diarrhoea, bilharziasis, malaria and antiemetic	N, W, C, E, S		Viol (2013)
Chenopodiaceae	**Chenopodium ambrosiodes* L.	Herb	Munhuhwenhuhwe (Sh) Wormseed (Eng)	Leaves	Infusion taken orally	Chest pains		N, W, C, E, S (Introduced)		Gelfand et al. (1985)
Chrysobalanaceae	*Parinari curatellifolia* Benth.	Tree	Muhacha, Mubuni, Muchakata, Muisha (Sh) Hissing tree, Mobola plum (Eng) Umkhuna (Nd)	Roots, leaves and bark		Tuberculosis	Fever, toothache, wounds, sores and cuts	N, W, C, E, S	Least Concern	Chimponda and Mukanganyama (2010)
Clusiaceae	*Garcinia huillensis* Welw	Tree	Mutunduru (Sh) Granite garcinia, Granite mangosteen (Eng)	Leaves		Treatment of cough, pneumonia and tuberculosis		N, C, E, S	Not Evaluated Lower risk – Near threatened (Zambia)	Chimponda and Mukanganyama (2010)
Clusiaceae	*Psorospermum febrifugum* Spach	Tree	Mumhinu, Munyamharadzi, Muparadzamusha, Musvasva (Sh) Christmas berry (Eng) Umchithamuzi (Nd)	Roots and Leaves	Ground into powder and added to porridge	Dyspnoea (shortness of breath), pneumonia	Head wound, diarrhoea, earache, syphilis and constipation	N, C, E, S		Gelfand et al. (1985)
Combretaceae	*Combretum apiculatum* Sond.	Tree	Muruka, Chikukute, Mudziyaishe, Mugodo, Mugoro, Tsingidzi (Sh) Red bushwillow (English) Umbhondo (Nd)	Leaves		Cough	Snake bites stomach ache	N, W, C, E, S	Least Concern	Maroyi (2013a); Mangoyi et al. (2014); Sharifi-Rad et al. (2020)
Combretaceae	*Combretum platypetalum* subsp. *oatesii* (Rolfe) Exell *Combretum oatesii* Rolfe	Shrub	Bepu (Sh) Dwarf red combretum, Red wings (Eng)	Roots	Porridge prepared with the infusion is applied over painful area	Pneumonia	To dilate birth canal, abdominal pain, diarrhoea, dysmenorrhoea, infertility in women, ear ache, burns, bleeding of the nose, kidney pain, vomiting blood and dilated veins around the umbilicus.	N, W, C, E		Gelfand et al. (1985)
Combretaceae	*Combretum zeyheri* Sond.	Tree	Muruka, Mupembere-kono, Muchenja (Sh) Large-fruited bushwillow (Eng) Umbhondo, Umbula (Nd)	Leaves		Cough	Diarrhoea, rectal prolapse, snake bites and stomach ache	N, W, C, E, S	Least Concern	Mangoyi et al. (2014)
Combretaceae	*Terminalia sericea* DC.	Tree	Mangwe, Mukonono, Mususu, Mutabvu (Sh)	Roots	Infusion	Sore throat	Wounds, diarrhoea, abdominal pains,	N, W, C, E, S		Gelfand et al. (1985)

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	Terminalia velutina sensu Eyles		Silver cluster-Leaves, Silver terminalia (Eng) Umangwe (Nd)				worms in anus, antiemetic, infertility in women, to dilate the birth canal, to prevent abortion, tonic, general body weakness, gonorrhoea, bilharziasis, bleeding from nose and depressed fontanelle.			
Convolvulaceae	*Astripomoea malvacea* (Klotzsch) Meesu	Herb	Umdandanyane (Nd)	Roots	Decoction	Cough	Abdominal pains in infants, madness, headache and dizziness	N, C, E, S		Gelfand et al. (1985)
Crassulaceae	*Kalanchoe* spp.	Herb	Kalanchoe (Eng)	Leaves	Ground into powder	Pneumonia		W, C, E, S		Gelfand et al. (1985)
Cucurbitaeae	**Cucurbita pepo* L.	Herb	Nhanga, Muboora (Sh) Pumpkin, Squash (Eng)	Leaves	Boiled and used as hot compress on painful parts	Pneumonia	Rheumatism	Cultivated		Gelfand et al. (1985)
Cyperaceae	*Coleochloa setifera* (Ridl.) Gilly.	Herb	Rufuri (Sh)	Roots	Ground into powder and taken orally.	Pneumonia		W, C, E, S		Chigora et al. (2007); Van Wyk (2011); Maroyi (2014)
Ebenaceae	*Diospyros lycioides* Desf.	Shrub	Eastern blue-bush, Red star-apple (Eng) Mumbune, Mushawa, Mushumadombo, Musvotamhungu, Mutsvirikiti, Mutsvitsva, Nyatsvipa (Sh) Umbongisa, Umqathuva, Umsungampule (Nd)	Roots	Infusion	Pneumonia and sore throat	Infertility in women	N, W, C, E, S		Maroyi (2018a)
Ebenaceae	*Euclea crispa* (Thunb.) Sond. ex Gürke	Shrub	Muvhinji (Sh) Blue guarri, Blue-leaved euclea (Eng)	Roots	Hot water extract drunk three times a day Decoction	Cough		N, W, C, E, S	Least Concern	Maroyi (2011, 2013a)
Ebenaceae	*Euclea natalensis* A. DC.	Shrub	Murunze, Nyakabvuri, Mushangura, Chipambati (Sh) Large-leaved guarri, Natal guarri (English)	Roots and leaves		Asthma, bronchitis, tuberculosis	Anthelminthic, chewing sticks, gonorrhoea, hookworm, malaria, mouthwash, rabies, schistosomiasis, scrofulous swellings, sexually transmitted infections (STIs), toothache, venereal diseases, yellow fever	N, W, C, E, S		Maroyi (2017g)
Euphorbiaceae	**Ricinus communis* L.	Tree	Mupfuta (Sh) Castor oil, Castor bean (Eng)	Leaves		Pneumonia	Sore eyes and toothache	N, W, C, E, S		Maroyi (2012a)
Euphorbiaceae		Herb		Roots		Asthma		N, W, C, E, S		Gelfand et al. (1985)

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	Acalypha petiolaris Hoschst.		Chitambura (Shona) Heart-leaved Brooms and Brushes (English) Ubukubelo (Ndebele) Umsekezelo (Ndebele)		Infusion mixed with salt and taken orally					
Euphorbiaceae	*Antidesma membranaceum* Muell. Arg.	Shrub	Mungamunyu (Sh) Pink tassle-berry (Eng)	Roots and leaves	Infusion taken orally	Cough		E		Gelfand et al. (1985)
Euphorbiaceae	*Bridellia mollis* Hutch.	Shrub	Mutuzvidzembwa, Mudenhanyani, Mufukusi, Muhumbakumba, Munzvarawauya, Musosoriondo (Sh) Umkumbakumba, Umwane (Nd) Velvet sweetberry, Velvet-leaved bridelia (Eng)	Roots	Hot water extract drunk three times a day Decoction	Cough		N, W, C, E, S	Least Concern	Maroyi (2011, 2019d)
Euphorbiaceae	*Croton gratissimus* Burch	Shrub	Gunukira, Mufandemenge, Mugugu, Mubangwa, Mufarata (Sh) Lavender croton (Eng)	Roots and bark		Respiratory disorders		N, W, C, E, S	Least Concern	Chimponda and Mukanganyama (2010)
Euphorbiaceae	*Euphorbia ingens* E. Mey. ex Boiss.	Tree	Candelabra tree (Eng) Mugonde, Muhonde, Mukonde (Sh) Umhlonho (Ndebele)	Latex		Bronchitis and asthma		N, W, C, E, S		Maroyi (2012a)
Euphorbiaceae	*Euphorbia matabelensis* Pax.	Tree	Chisimbo, Murimbo (Sh) Musambamacheche (Tonga) Three-forked euphorbia (Eng) Umhlanziso, Hamwamwa (Nd)			Cough and respiratory infections	Lactation and antidote for poison.	N, W, C, E, S		Gelfand (1956); Gelfand et al. (1985)
Euphorbiaceae	*Flueggea virosa* (Roxb. ex Willd.) Voigt	Shrub	Mushagahuwe, Muchagauwe, Mudyambuzi, Mugurumhanda, Musangaoma, Mushikiti, Musosoti, Muzurumbu (Sh) Snowberry tree, White berry bush (Eng) Umhagawuwe, Umklankomo (Nd) Musosoti (Ndau)	Roots, fruit,bark and leaves	Crushed, mixed with hot water, extract drunk Decoction	Pneumonia, respiratory tract infections, bronchitis, cough and pneumonia	Snakebite, contraceptive, syphilis, diarrhoea, rheumatism, sterility, rashes and malaria	N, W, C, E, S	Least Concern	Gelfand et al. (1985); Maroyi (2011, 2014); Dzoyem et al. (2016)
Euphorbiaceae	*Margaritaria discoidea* (Baill.) Webster var. *nitida* (Pax) Radcliffe-Smith *Phyllanthus discoideus* (Baill.) Müll. Arg.	Tree	Bushveld peacock-berry (English) Common pheasant-berry (English)	Roots	Applied on incisions	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)

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Euphorbiaceae	*Monadenium lugardiae* N.E.Br. *Euphorbia lugardiae* (N.E. Br.) Bruyns	Succulent	Chitsvotsvo (Sh)	Whole plant	Taken orally	Chest pains		N, W, E, S		Gelfand et al. (1985)
Fabaceae	*Albizia amara* (Roxb.) Biov. subsp. *sericocephala* (Benth.) Brenan	Tree	Muchangiza, Mugarahanga, Mugunduzi, Muora (Sh) Bitter albizia (Eng) Umbola (Ndebele)	Roots	Infusion taken orally	Pneumonia, TB		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Indigofera* spp.	Shrub	Rambatuku, Mukatapeta (Sh)	Roots	Ground into powder and mixed with porridge	Chest pains, cough		N, C, S		Gelfand et al. (1985)
Fabaceae	*Vigna unguiculata* (L.) Walp.	Herb	Nyemba (Sh) Cow peas (Eng)	Roots	Infusion taken orally	Chest pains	Cessation of menses, dysmenorrhoea, constipation in infants, epilepsy, and snake bites	N, W, E, S		Gelfand et al. (1985)
Fabaceae	*Pericopsis angolensis* (Bak.) van Meeuwen *Afrormosia angolensis* (Baker) De Wild. *Ormosia angolensis* Baker	Tree	Chivanga, Muwanga, Muanga (Sh) Mubanga (Tonga) Afrormosia (Engl) Ubanga (Nd)	Roots	Infusion taken orally. Burnt and ashes mixed with water. Decoction taken orally.	Cough, Asthma, TB and dyspnoea (shortness of breath).		N, C, E	Near threatened	Gelfand et al. (1985)
Fabaceae	Bauhinia fassoglensis Schweinf.	Tree	Mutukutupasi (Sh) Umdabule (Nd)	Tuber	Decoction taken orally	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Bauhinia petersiana* Bolle	Tree	Mubondo, Mumwando, Mun'ando, Mupondo (Sh) Large white bauhinia (Eng) Imonddo (Nd)	Roots, leaves		Cough	Dysmenorrhea female infertility, wounds, diarrhoea	N, W, C, E		Dzoyem et al. (2016)
Fabaceae	*Burkea africana* Hook.	Tree	Mukarati (Sh) Umnondo (Nd) False ash, Burke, Wild syringa (Eng)	Roots	Infusion taken orally	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Cassia abbreviata* Oliv.	Tree	Murumanyama, Muremberembe, Muvheneka (Sh) Long-tail cassia (Eng) Isihaqa (Ndebele)	Roots or bark	Crushed, mixed with cold water, extract drunk Infusion	Cough and Pneumonia	Abortion, aphrodisiac constipation diarrhoea, back ache, menorrhagia and gonorrhoea	N, C, E	Least Concern	Kambizi and Afolayan (2001); Maroyi (2011); Ngarivhume et al. (2015)
Fabaceae	*Dalbergia melanoxylon* Guill. & Perr.	Shrub	Mugwiti (Sh) Blackwood dalbergia, Zebrawood (Eng)	Leaves	Dried and smoked as cigarette	Bronchitis, asthma and inflammation in throat		N, W, C, E, S	Near Threatened	Chigora et al. (2007); Maroyi (2013a)
Fabaceae	*Dichrostachys cinereal* (L.) Wight & Arn.	Shrub	Mupangara, Musekera, Mumhangara (Sh) Ugagu (Nd) Chilitsenge (Tonga)	Leaves and Roots		Pneumonia	Venereal diseases, impotence, syphilis, eye diseases, wounds and injuries.	N, W, C, E, S		Viol (2013)

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			Chinese lantern (Eng) Sickle bush (Eng)							
Fabaceae	**Leucaena leucocephala* (Lam.) De Wit	Tree	Wild tamarind, White lead tree, Lead tree, Horse tamarind, Jumbie bean, White popinac (Eng.)	Bark, leaves, seeds		Colds, flu and tuberculosis	Internal pain, contraceptive, ecbolic, depilatory, fevers, circulatory problems, to calm nerves, reduce back pain and menstrual cramps	C (Introduced)		Dzoyem et al. (2016)
Fabaceae	*Peltophorum africanum* Sond.	Tree	Muzeze, Dzedze, Mudjiza, Mupumhamauva, Zeze, Musambanyoka, Mutandarombo, Nyakambariro, Nyamanyoka (Sh) African wattle (Eng) Umkahla, Umsehla (Nd)	Leaves		Flu	Diarrhoea, sore eyes, Sexually transmitted infections-syphilis and toothache	N, W, C, E, S	Least Concern	Shoko (2007)
Fabaceae	*Piliostigma thonningii* (Schumach.) Milne-Redh.	Tree	Musekesa, Mubaba, Muhuku, Musakasa, Mutukutu (Sh) Camel-foot, Monkey bread (English) Ihabahaba (Nd)	Bark, leaves or Roots	Hot water extract drunk three times a day Decoction	Cough	Menorrhagia, convulsions, bilharziasis	N, W, C, E, S	Not Evaluated	Gelfand et al. (1985); Maroyi (2011, 2013a, 2014); Sharifi-Rad et al. (2020)
Fabaceae	*Pterocarpus angolensis* DC.	Tree	No information	Roots	Infusion taken orally	Chest pains		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Acacia rehmanniana* (Schinz) Kyal. & Boatwr.	Tree	Muunga (Sh) Silky acacia, Silky thorn (Eng) Iphucula, Mona (Nd)	Roots	Rubbed on incision	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Albizia antunesiana* Harms	Tree	Muriranyenze (Sh) Purple-leaved albizia (Eng) Umnonjwana (Nd)	Roots	Rubbed on incision	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Albizia tanganyicensis* Bak.f.	Tree	Paperbark albizia (Eng) Umphaphama (Nd)	Bark	Decoction taken orally	Cough		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Aeschynomene mimosifolia* Vatke	Shrub	Rutapatsikidzi (Sh) Bug catcher (Eng)	Roots	Decoction taken orally	Chest pains		N, C, E, S		Gelfand et al. (1985)
Fabaceae	*Crotalaria laburnifolia* L. subsp. *laburnifolia*	Herb	Dodzidunhu (Sh) Oldland rattlepod, Wild sunhemp (Eng) Amahlwayi (Nd)	Roots	Infusion taken orally	Cough		N, W, C, E, S		Gelfand et al. (1985)
Fabaceae	*Erythrina abyssinica* Lam. DC *Erythrina tomentosa* R.Br. ex A. Rich.	Tree	Munhimbiti, Mutete, Mutiti, Mutsiti (Sh) Lucky-bean tree, Red-hot-poker tree (Eng) Umgqogqogqo (Nd)	Roots and Bark	Infusion taken orally	Cough		N, C, E, S		Gelfand et al. (1985)
Fabaceae	*Xeroderris stuhlmanni* (Taub.) Mendonca & E.P Sousa	Tree	Muchemavanhu, Mudzugu, Mumwambizi, Muriravanhu, Murumanyama (Sh) Wing pod (Eng) Umthundulu (Nd)	Roots	Decoction taken orally	Chest pains		N, W, C, E, S		Gelfand et al. (1985)

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Flacourtiaceae	*Flacourtia indica* (Burm.f.) Merr.	Tree	Mududwe, Munhunguru, Mutombototo, Mutudza, Mutunguru (Sh) Batoka plum, Governor's plum (Eng)	Leaves and Roots	Browsed by mouth Eaten raw	Cough, chest pains and pneumonia	Venereal disease, bilharziasis, diarrhoea	N, W, C, E, S	Least Concern	Viol (2013); Mangoyi et al. (2014)
Heteropyxidaceae	*Heteropyxis natalensis* Harv.	Tree	Lavender tree, natal lavender (Eng) Mudededede (Venda) Inkunzi, Inkhuzwa (Zulu)	Bark, leaves and Roots		Colds and respiratory disorders	Aphrodisiac, bleeding disorders, bleeding gums, blood purifier, gum infections, toothache, wounds, weaning and menorrhagia	E		Maroyi (2019f)
Hyacinthaceae	*Urginea sanguinea* (Schinz) Jessop	Herb	Chitupatupa (Sh) Isigenama (Nd)	Bulb	Decoction taken orally	Pneumonia		W, C, S		Gelfand et al. (1985)
Kirkiaceae	*Kirkia acuminata* Oliv.	Tree	Mubvumira, Mutsakatidze, Mutuhwa, Mutuva (Sh) White seringa (Eng) Modumela (Tswana) Mubvumala (Venda)	Roots	Extract drunk Infusion	Cough	Diarrhoea, malaria, cholera, dysentery, constipation and wounds	N, W, C, E, S	Least Concern	Maroyi (2011, 2016, 2017a)
Lamiaceae	**Mentha longifolia* (L.) Huds	Herb	Horsemint (Eng)	Leaves	Extract Infusion	Colds and cough		N, W, C, E	Least Concern	Chigora et al. (2007); Maroyi (2011, 2014)
Lamiaceae	**Mentha spicata* L.	Herb	Spearmint (Eng)	Leaves	Added to tea or hot infusion taken by mouth Tea and Infusion	Cough and flu		N, W, C, E	Least Concern	Maroyi (2017c, 2018b)
Lamiaceae	*Ocimum obovatum (Benth.)* N.E.Br.	Herb	Chikomamatadza (Sh)	Leaves	Burnt and smoke inhaled	Chest pains	Epistaxis, tropical ulcers, abdominal pain in infants and infertility in men.	E		Gelfand et al. (1985)
Lamiaceae	*Leucas milanjiana* Gürke	Herb	No information	Leaves	Applied on incisions made on painful parts	Pneumonia	Swelling on the body (edema)	N, W, C, E, S		Gelfand et al. (1985)
Lamiaceae	*Tetradenia riparia* (Hochst.) Codd	Shrub	Chororwe (Sh) Ginger bush, misty plume bush (Eng) Iboza, ibozane (Zulu)	Leaves		Cough, colds, bronchitis, respiratory ailments	Stomach ache, diarrhoea, dropsy, angina pectoris, fever, malaria and dengue fever, yaws, headache and toothache	N, W, C, E, S		Neffati et al. (2017)
Lamiaceae	*Vitex payos* (Lour.) Merr.	Shrub	Chikubai, Chikubvusike, Mudyagava, Muhubva, Muhubvu, Mukubvu, Mutsere, Mutsubvu (Sh) Umtshwankela (Nd) Chocolate berry (Eng)	Leaves	Burnt and smoke inhaled Smoke	Cough, colds, respiratory ailments	Lost appetite	N, W, C, E, S		Chigora et al. (2007); Maroyi (2014)
Loganiaceae	*Strychnos potatorum* L.f.	Tree	Mudanhapfunye, Mudyagudo, Mudyakuwe, Mudyambira (Sh) Umlombelombe (Nd) Black	Roots and leaves	Decoction taken orally	Cough		N, W, C, E, S		Gelfand et al. (1985)

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			bitterberry, Grape strychnos (Eng)							
Loganiaceae	*Strychnos spinosa* Lam	Tree	Mutamba-mun'ono (Sh) Spiny monkey-orange (Eng) Umhahli, Umngono (Nd)	Bark and leaves.	The dose is orally administered by boiling fresh Bark in water and drink. Besides, the unripe fruits are broken, opened, mixed with water and boiled.	Pneumonia, bronchitis and chest problems. Caffeine in leaves can help breathing in premature babies.	Immune boosting, stomach-ache, diarrhoea, gastro-intestinal problems, venereal diseases like syphilis and gonorrhea, rushes, skin problems, irritation., bleeding and genital warts.	N, W, C, E, S		Mawere and Nhemachena (2016)
Loranthaceae	*Loranthus* spp *on Brachystegia spiciformis* Benth.	Mistletoe	Gomarara, Koma (Sh) Inofi (Nd)	Whole plant	Smoke inhaled	Asthma		N, W, C, E, S		Gelfand et al. (1985)
Loranthaceae	*Loranthus* spp. *on Berchemia discolor* (Klotzsch) Hemsl.	Mistletoe	Gomarara, Koma (Sh) Inofi (Nd)	Whole plant	Powder taken in porridge	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)
Loranthaceae	*Loranthus* spp. *on Cordyla africana* Lour.	Mistletoe	Gomarara, Koma (Sh) Inofi (Nd)	Whole plant	Applied in incisions in powder form	Pneumonia		N, W, C		Gelfand et al. (1985)
Malvaceae	**Abelmoschus esculentus* (L.) Moench	Herb	Derere rechipudzi, Derere (Sh) Okra, Lady's finger (Eng) Idelele (Nd)	Fruit		Bronchitis and tuberculosis	Heart diseases	N, W, E (Introduced)	Least Concern	Chimponda and Mukanganyama (2010)
Malvaceae	*Azanza garckeana* (F. Hoffm.) Exell & Hillc.	Tree	Mugurura (Sh) Mutohwe (Sh) Snot apple (Eng) Uxakuxaku (Nd)	Roots		Chest pains and cough	Other- menstruation, retained placenta, mental illness, earache, antiemetic	N, W, C, E, S		Maroyi (2017e)
Malvaceae	*Sida acuta* Burm.f.	Shrub	Common wireweed (Eng) Isinama (Nd)	Roots	Decoction taken orally	Chest pains		N, C, E, S		Gelfand et al. (1985)
Meliaceae	*Ekebergia benguelensis* C.DC.	Tree	Mudyamhofu, Mudyavarungu, Munyimonyimo, Mupumhanhuka, Mupuri (Sh) Woodland dogplum (Eng)	Leaves	Infusion taken orally	Pneumonia		N, C, E, S		Gelfand et al. (1985)
Meliaceae	*Khaya anthotheca* (Welw.) C.DC.	Tree	Muwawa, Mubarwa, Mururu (Sh) Red mahogany (Eng)	Bark and Roots	Infusion taken orally	Pneumonia and colds	Venereal diseases, abdominal pains, antihelmentic antiemetic	N, E, S	Vulnerable (VU)	Gelfand et al. (1985); Viol (2013)
Meliaceae	*Turraea nilotica* Kotschy & Peyr.	Shrub	Chipindura, Chirambagavakava Chitsvimbovarisa, Chitunguru, Mudyakuwe, Mukondanyoka, Muzaramhanga (Sh)	Roots	Applied to incision, infusion taken orally, burnt or smoked. Ground into powder and	Dyspnoea (shortness of breath), pneumonia and respiratory disorders		N, W, C, E, S		Gelfand (1956); Gelfand et al. (1985)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
			Miombo honeysuckle-tree, Bushveld honeysuckle-tree, Small mahogany (Eng) Isidlamvundala (Nd)		taken in porridge					
Moraceae	*Ficus ingens* (Miq.) Miq.	Tree	Mutsamvi (Sh) Red-leaved rock fig (Eng) Idotsi, Inkiwane (Nd)	Roots	Crushed, mixed with hot water, extract drunk Decoction	Cough	Fever	N, W, C, E, S	Least Concern	Maroyi (2011, 2013a)
Moraceae	*Ficus sycomorus* L.	Tree	Muonde, Mukuyu (Sh) Sycomore fig, Mulberry Fig (Eng) Umkhiwa (Nd)	Roots	Crushed, mixed with hot water, extract drunk Decoction	Tuberculosis, cold and other chest problems	Laxative	N, W, S	Least Concern	Maroyi (2011, 2013a); Maroyi and Cheikhyoussef (2015)
Moraceae	*Ficus thonningii* Blume	Tree	Mutsamvi (Sh) Small fig tree, Strangler Fig (Eng)	Roots, Stems and leaves		Respiratory infections, bronchitis, treating influenza, sore throat, colds, pneumonia and chest pains.	Prevent abortion and stop nose bleed.	N, W, C, E, S	Least Concern	Dangarembizi et al. (2013)
Myrothamnaceae	*Myrothamnus flabellifolius* Welw.	Shrub	Rufandichimuka, Mufandichimuka (Sh) Resurrection bush (Eng) Umazifisi (Nd)	Leaves and twigs	Boiled and drunk as remedy for cold Decoction	Colds and chest complaints	Nosebleeds and fainting	N, W, C, E, S	Least Concern	Chigora et al. (2007); Semenya and Maroyi (2013)
Myrsinaceae	*Rapanea melanophloeos* (L.) Mez	Tree	Mudonera, Mudongera, Mufuro, Mukwiramakoko, Murwiti, Mutomo (Sh) Umhluti-wentaba, Ulvukwabafile (Zulu) Cape beech (Eng)	Bark, Roots and leaves		Respiratory problems	Stomach, muscular and heart complaints	N, C, E		Dzoyem et al. (2016)
Myrtaceae	**Eucalyptus camaldulensis* Dehnh	Tree	Mugamutiri (Sh) Gum Tree (Eng)	Leaves	Extract drunk with *Citrus limon* fruits and *Psidium guajava* L. leaves as cough, flu and fever medicine Decoction or Infusion	Sore throat, flu, asthma, cough	Fever	N, W, C, E, S	Near Threatened	Maroyi (2011); Semenya and Maroyi (2013a, 2017c, 2018b)
Myrtaceae	**Psidium guajava* L.	Shrub	Mugwavha (Sh) Guava (Eng)	Leaves	Extract drunk with *Citrus limon* fruits and *Eucalyptus camaldulensis* leaves as cough, flu and fever medicine Decoction or Infusion	Cough and flu	Fever and diarrhoea	N, W, C, E, S	Least Concern	Maroyi (2011, 2013a, 2014, 2017c, 2018b)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
Myrtaceae	*Syzigium guineense* (Willd.) D.C	Tree	Mukute (Sh) Forest waterberry (Eng) Gihlu (Nd)	Bark and leaves		Tuberculosis and chest complaints	Stomach ailments and diarrhoea	N, W, C, E, S	Least Concern	Van Wyk (2011); Chimponda and Mukanganyama (2010); Mangoyi et al. (2014)
Myrtaceae	*Syzygium cordatum* Hochst. ex C. Krauss	Tree	Mukute, Muisu (Sh) Waterberry (Eng) Gihlu (Hlengwe) Munonyamansi (Tonga: Zimbabwe) Umdoni, Imiswi (Nd)	Bark	Extract drunk as tuberculosis medicine Infusion	Cold and fever	Herpes zoster, herpes simplex, skin rashes	N, W, C, E, S	Least Concern	Chigora et al. (2007); Van Wyk (2011); Maroyi (2013a)
Nymphaeaceae	*Nymphaea nouchali* Burm. f.	Aquatic	Hapa, Hobvwe (Sh) Kwibu (Tonga) Waterlily (Eng) Ikalala, Amalebo-emfula (Nd)	Roots	Ground into powder and mixed with porridge	Asthma		N, W, C, E, S		Gelfand et al. (1985)
Phyllanthaceae	*Bridelia micrantha* (Hochst.) Baill.	Tree	Mitzeerie (Eng) Mudzinza, Mufukusi, Mukodokodo, Mukwandu, Mushungunu, Mutorarwizi, Mutsetsauta, Mutugusi (Sh)	Bark, leaves and Roots	Infusion taken orally	Cough	Abortifacient	N, C, E, S		Gelfand et al. (1985); Maroyi (2017f)
Pittosporaceae	*Pittosporum viridiflorum* Sims	Tree	Mubanda, Muchemedzambuya, Mugarambinga, Mukwenukwenu, Murambatsvina, Murunganyama (Sh) Cheesewood (Eng) Iyoyi (Nd)	Roots	Infusion taken orally	Chest pains		N, W, C, E, S		Gelfand et al. (1985)
Plumbaginaceae	*Plumago zeylanica* L.	Grass	Wild white plumbago (Eng)	Roots	Infusion taken orally	Dyspnoea (shortness of breath)	Aphrodisiac	N, W, C, E, S		Gelfand et al. (1985)
Poaceae	*Phragmites mauritianus* Kunth	Reed	Reed grass (Eng)	Stems	Ground into powder and rubbed on incision.	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)
Polygalaceae	*Securidaca longipedunculata* Fresen.	Tree	Chipvufanana, Mufufu Munyapunyapu, Munyazvirombo, Mutangeni (Sh) Umfufu (Nd) Violet tree (Eng)	Roots		Tuberculosis and pneumonia	Epilepsy, venereal diseases, pains, fevers, syphilis and snake repellent.	N, W, C, E, S		Maroyi (2012a); Viol (2013)
Polygonaceae	*Oxygonum sinuatum* (Hochst. & Steud. ex Meisn.) Dammer	Herb	Oxygonum (Eng)			Cough		N, W, C, E, S		Gelfand et al. (1985)
Proteaceae	*Faurea saligna* Harv.	Tree	Kapfutsana, Mugarahungwe, Munyaganza, Mushangwa, Muzazati (Sh) African beech, Willow beechwood (Eng) Isidwadwa, Umpembele (Nd)	Roots	Infusion taken orally	Pneumonia		N, W, C, E, S		Gelfand et al. (1985)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
Pteridaceae	*Pellaea* spp.	Fern	Mumvuriwedombo, Mudziwebwe (Sh) Purple Cliffbrake, Purple Stems Cliffbrake, Hairy Cliffbrake (Eng)	Leaves and Roots	Burnt and smoke inhaled as remedy for chest pains Smoke	Chest pains		E	Least Concern	Chigora et al. (2007), Semenya and Maroyi (2013a, 2014); Neffati et al. (2017)
Ranunculaceae	*Clematis villosa* DC	Herb	Shock-headed peter (Eng)	Roots	Burnt and smoke inhaled	Cough and colds		N, W, C, E, S		Gelfand et al. (1985)
Rhamnaceae	*Rhamnus prinoides* L'Hérit	Tree	Musvosvadziva (Sh) Camdeboo, Dogwood, Glossy-Leaves, Shiny Leaves, Stinkwood (Eng) Ulenyenye, Umgilindi, Umhlinye, Umnyenye (Zulu).	Fruit, leaves, bark, Stems, twigs, seeds, Roots		Pneumonia, cold and respiratory infections	Blood cleaning, rheumatism, sprains, stomach ache, gargle, skin complaints, sexually transmitted disease, arthritis, back pains, stomach ache, headache	N, C, E		Dzoyem et al. (2016)
Rhamnaceae	*Ziziphus mucronata* Willd.	Tree	Muchechen, Chinanga (Sh) Buffalo-thorn, Bog-wood, Cat-thorn (Eng) Umpasamala, Umphafa (Nd) Umlahlankosi, Umlahlabantu, Umkhobobonga, Umphafa (Zulu)	Leaves	Infusion	Chest complaints, Cough	Skin infections and wounds, body pains, infertility in women, boils, carbuncles, sores and swellings	N, W, C, E, S	Least Concern	Chimponda and Mukanganyama (2010); Dzoyem et al. (2016)
Rubiaceae	*Agathisanthemum bojeri* Klotzsch	Herb	Muwanazvapora (Sh) Velabahleka (Nd)	Leaves	Burnt and smoke inhaled	Asthma, chest conditions, relieve cough and diffulty in breathing		N, C, E		Watt and Breyer-Brandwijk (1962); Gelfand et al. (1985)
Rubiaceae	*Catunaregam taylorii* (S.Moore) Bridson	Shrub	Mutsvairachuru, Murovaduri (Sh) Mountain pomegranate (Eng)	Leaves, bark and Roots		Respiratory ailments and pulmonary infections		N, W, C, E, S	Least Concern	Chimponda and Mukanganyama (2010)
Rubiaceae	*Fadogia ancylantha* Schweinf.	Shrub	Makoni tea bush (Eng)	Leaves	Decoction taken orally	Cough, pneumonia	Abdominal pain, constipation, swelling of the body, hiccoughs, antiemetic, tropical ulcers, to prevent conception and bulging fontanelle.	N, C, E, S		Gelfand et al. (1985)
Rubiaceae	*Gardenia resiniflua* Hiern subsp. *resiniflua*	Shrub	Mutara, Mutarara (Sh) Chigalamatongo, Chigonondo (Tonga) Gummy gardenia (Eng) Umjalanatanga, Umvalasangwana (Nd)	Roots	Burnt and applied on incision on chest	Pneumonia, asthma	Headache, convulsions, earache, madness, fits, infertility in women and dysmenorrhoea.	N, W, C, E, S		Gelfand et al. (1985)
Rubiaceae	*Gardenia ternifolia* Schuamch. & Thonn. subsp. *jovistonantis* (Welw.) Verdc. *var goetzei*	Shrub	Mutara, Mutarara, Mutarura (Shona) Powder-bark gardenia, Wild gardenia (Eng) Umvalasangwana (Nd)	Roots	Burnt and applied on incision on chest	Pneumonia, asthma	Dysmenorrhoea, convulsions, earache, madness, fits, infertility in women and headache.	N, C, E, S		Gelfand et al. (1985)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
	(Stapf & Hutch.) Verdc									
Rubiaceae	*Gardenia volkensii* K. Schum. subsp. *spatulifolia* (Stapf and Hutch.) Verdc.	Tree	Mutara (Sh) Umvalasanganwa (Nd)	Roots	Burnt and applied on incision on chest	Pneumonia, asthma	Infertility in women, headache, earache, madness, fits, dysmenorrhoea and convulsions.	E, S		Gelfand et al. (1985)
Rubiaceae	*Mussaenda arcuata* Poir.	Climber	Muridzameso, Musikawakakadzi (Sh) Forest star (Eng)	Leaves	Boiled and the strained liquid taken by mouth as required	Influenza		N, C, E, S		Chinemana et al. (1985)
Rubiaceae	*Pavetta schumanniana* F. Hoffm.	Shrub	Chifukawi, Chinama, Chipindura chiduku, Chitunguru, Chityorabadza, Mufuramhembwe, Murambagaka, Murunganyama, Musauti, Muwana, Mwenje, Nyapuna, Nyaputa (Sh) Poison bride's-bush, Poison pavetta (Eng) Umbodzani (Nd)	Leaves	Decoction or infusion, ground into powder or chewed and juice swallowed. Applied to incisions.	Chest pains, cough, pneumonia	Abdominal pains, diarrhoea, nausea, headache, aphrodisiac, venereal disease and infertility in women.	N, W, C, E, S		Gelfand et al. (1985)
Rubiaceae	*Spermacoce dibrachiata* Oliv.	Herb	Chiparurangoma (Sh) Winged forget-me-not (Eng)	Roots	Infusion taken orally	Pneumonia, cough	Depressed fontanelle, hoarseness, dizziness, dysmenorrhoea and aphrodisiac.	N, W, C, E		Gelfand et al. (1985)
Rubiaceae	*Vangueria infausta* Burch. subsp. *infausta*	Tree	False medlar, Velvet wild medlar (English) Umthofu, Umviyo (Nd) Mudzvirungombe, Munjiro, Munzviro, Munzirwa, Munzvirwa, Mutsviru (Sh)	Leaves, Roots, seed		Pneumonia	Abdominal pains, diarrhoea and stomach problems, inflammation of umbilical cord, menstrual problems	W, C, E, S		Maroyi (2018e)
Rubiaceae	*Vangueriopsis lanciflora* (Hiern) Robyns	Shrub	Mutufu, Mutupfu (Sh) False wild medlar (Eng) Umsomosomo, Umviyo, Amadumbutshenene (Nd)	Roots	Decoction taken orally	Cough	Abdominal pains, constipation, infertility in women, neck pains, to dilate the birth canal, backache, swelling on the body and madness.	N, W, C		Gelfand et al. (1985)
Rubiaceae	*Xeromphis obovata* (Hochst.) Keay	Shrub	Chizhuzhu-chitsuku (Sh) Isitalagwa (Nd)	Roots	Infusion or ground into powder and mixed with porridge	Cough, pneumonia	Antidote for snake bite, nausea, depressed fontanelle, fever, hoarseness, toothache, bile emesis, emetic, heavy menstruation, fits and dizziness	N, W, C, E, S		Gelfand et al. (1985)
Rutaceae	**Citrus limon* (L.) Burm. f.	Tree	Muremoni (Sh) Lemon Tree (Eng)	Fruit	Extract of Citrus lemon Infusion, Tea, Decoction, Juice	Throat infections, cough and flu	Tonsil	N, W, C, E, S		Maroyi (2011, 2013a, 2014); Semenya and Maroyi (2013)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
Rutaceae	*Zanthoxylum humile* (E.A. Bruce) P.G. Waterman	Shrub	Hairy knobwood (Eng)	Roots	Aqueous extracts are used to treat chest pains and flu.	Chest pains and flu	Erectile dysfunction diarrhoea, hypertension, diabetes, wounds and as antivenins against snake bites	W, S		Pamhidzai and Isaac (2013)
Sapindaceae	*Zanha africana* (Radlk) Exell.	Tree	Muchenya (Sh) Velvet-Fruitszanha (Eng)	Bark, leaves and Roots	Applied to painful parts	Respiratory problems (asthma, chest pains, colds, cough, flu, pneumonia and tuberculosis)	Gastro-intestinal problems (abdominal pains, constipation, diarrhoea, dysentery and stomach ache), STD, headache, migraine, body pains, dizziness, female reproductive problems (abortion, dysmenorrhoea, facilitating childbirth, infertility, menorrhagia, pregnancy edema and disorders), fever, typhoid fever, painful legs, nausea, rheumatoid arthritis rheumatism and malaria	N, W, C, E, S		Gelfand et al. (1985); Maroyi (2019f)
Solanaceae	**Capsicum* spp.	Herb	Green pepper, Sweet pepper (Eng)	Fruits	Pulverised and a little salt added and in water	Respiratory infections		Cultivated		Gelfand et al. (1985)
Solanaceae	**Nicotiana tabacum* L.	Herb	Chikwarimba, Fodya, Hunga (Sh) Igwayi (Nd) Tobacco (Eng)	Leaves		Asthma, respiratory problems		Cultivated		Maroyi (2012a)
Solanaceae	**Datura stramonium* L	Shrub	Chowa (Sh) Jimson weed, Thorn apple (Eng)	Leaves	Burnt and smoke inhaled while covered with a blanket	Asthma and cough	Sexual Transmitted Infections	N, W, C, E, S	Not Evaluated	Maroyi (2012a, 2017c, 2018b)
Solanaceae	**Solanum incanum* L.	Herb	Munhomboro, Munhundurwa (Sh) Poison apple, Snake apple, Bitter apple, Sodom apple, Thorn apple (Eng) Umdulukwa, Intume (Nd)	Roots	Infusion taken orally and applied to incisions on painful parts.	Pneumonia	Venereal diseases, dysmenorrhoea, sore eyes, diarrhoea, antiemetic, headache, tropical ulcers, general body pains, sore throat, toothache, swelling on the body and snake bite.	N, W, C, E, S		Gelfand et al. (1985)
Thymelaeaceae	*Gnidia capitata* L.f	Herb	Muwito, Katonje (Sh)	Roots	Smoke inhaled	Asthma	Tonsillitis and venereal diseases	N, W, C, E, S		Gelfand et al. (1985)

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Table 1 (*continued*)

Family	Scientific Name	Growth form	Local name Shona- Sh Ndebele- Nd English- Eng	Parts used	Modes of preparation	Ethnomedicinal uses for respiratory disorders	Ethnomedicinal uses for non- respiratory disorders	General distribution North (N), West (W), Central (C), East (E), South (S)	Conservation status	References
hymelaeaceae	*Gnidia kraussiana* Meisn.	Herb	Chitupatupa (Sh) Isidikili (Nd) Yellow-heads (Eng)	Tuber	Freshly crushed tuber applied to boil	Cough	Measles, swollen stomach, anorexia, depressed fontanelle, boils, earache, emetic, madness, constipation, stomach ailments and weaknesses in joints.	N, W, C, E, S		Gelfand et al. (1985)
Tiliaceae	*Triumfetta welwitschii* Mast.	Herb	Ibofane (Nd)	Tuber	Ground into powder	Asthma	Venereal disease, fever, generalised body pain, swelling on the body, painful uterus, to prevent abortion, antidote, tropical ulcers, depressed fontanelle, aphrodisiac, diarrhoea and abdominal pain.	N, W, C, E, S		Gelfand et al. (1985)
Ulmaceae	*Chaetachme aristata* Planch	Tree	Thorny-Elm, Basterwitpeer (Eng)	Leaves		Tuberculosis	Back wounds and spinal weakness	C, E, S		Dzoyem et al. (2016)
Verbenaceae	*Clerodendrum eriophyllum* Gürke	Shrub	Munyakachembere, Ruwudziwudzi (Sh) Tinderwood, White cat's whiskers (Eng) Moswaapeba, Umhlahlampethu, Umnukanja, Umxothanja (Nd)	Roots, leaves, Bark		Cough and colds	Snakebites, prolapse, wounds and diarrhoea	W, C, E, S		Dzoyem et al. (2016)
Verbenaceae	*Lippia javanica* (Burm.f.) Spreng	Shrub	Zumbani, Kachigwere, Mumara, Mushani mukuru, Musumba (Sh) Umsuzwane (Nd) Lemon bush, Fever Tea (Eng)	Leaves and twigs	Ointment rubbed on chest and abdomen Decoction taken orally or body washed with decoction Ointment and Decoction	Cold, cough, shortness of breath (dyspnoea), respiratory complaints, bronchial problems, fever, asthma, chronic coughs	Measles, malaria and stomach ache	N, W, C, E, S		Gelfand et al. (1985); Chigora et al. (2007); Chimponda and Mukanganyama (2010); Van Wyk (2011); Semenya and Maroyi (2013a, 2017b); Neffati et al. (2017)
Zingiberaceae	**Zingiber officinale* Roscoe	Herb	Tsangamidzi (S) Ginger (Eng)	Rhizome	Rhizome-extract Raw and Infusion	Cough, flu and colds	Stomach pains, indigestion, colic, abdominal chills	Cultivated		Matongo (2012)

2.3. Screening

The titles and abstracts were subsequently examined by two reviewers, independently to identify articles reporting medicinal plants used in Zimbabwe to manage respiratory infections. In the case of any discrepancy in their reports, a third reviewer was brought in to resolve the issue. Relevant papers were equally manually cross-checked to identify further references. Articles that reported on veterinary use of medicinal plants were excluded. The eligible articles were then assessed further for inclusion in the study using the inclusion/exclusion criteria.

2.3.1. Research questions

a. What is the role of medicinal plants in Zimbabwe in the prevention and treatment of respiratory tract infections?
b. Is there any evidence suggesting the efficacy and safety of medicinal plants used in Zimbabwe for management of respiratory disorders?

2.4. Inclusion and exclusion criteria

Full-text articles that at least reported on ethnobotany of Zimbabwean medicinal plants published in peer reviewed journals, reports, books, theses, and dissertations dated until June 17, 2022 were considered. All publishing years were included without any geographical restrictions. Articles that reported data not relevant to the study and not written in English were excluded from the study.

2.5. Data extraction

A data collection tool was designed in Microsoft Excel (Microsoft Corporation, USA) to capture data on different aspects of Zimbabwean medicinal plants. Three reviewers independently extracted relevant data from the included articles regarding the ethnobotany of Zimbabwean medicinal plants used for respiratory disorders. For ethnobotanical data, the diseases or ailments managed, parts used, and mode of preparation and administration were captured. The collected data were checked for completeness and processed independently by three reviewers.

2.6. Data analysis

Respiratory disorders were divided into 15 categories according to the diseases enlisted in published research articles on ethnobotanical surveys conducted in Zimbabwe. Disease categories consisting of similar disorders or pharmacological effects were grouped as a single category. Each plant that is found in more than one province in the country is listed once for each ailment that it works on. The conservation status of plant species was determined following the IUCN Red List categories and criteria version 3.1 (IUCN Red List categories and criteria; Dombo et al., 2002; Golding, 2002). Economic value of the plant species was determined using scientific literature based on the commercial value of medicinal plants in Zimbabwe. Descriptive statistical methods were used to analyse the collected data. Results were expressed as percentages and frequencies and subsequently presented as tables and charts. The analyses were performed using SPSS statistical software (version 20, IBM Inc.).

3. Results and discussion

3.1. Assessment of literature

The PRISMA flow chart (Fig. 1) demonstrates the identification and screening of records for this review.

Several scientific papers were reviewed based on ethno-botanical surveys of different areas of Zimbabwe and are presented in the sections below. Although the numbers could be higher, there is increasing knowledge on the use of plant based medicines and these have been documented (Gelfand et al., 1985; Kambizi and Afolayan, 2001; Dombo et al., 2002; Mapaura and Timberlake, 2004; Chigora et al., 2007; Shoko, 2007; Shumba et al., 2009; Matongo, 2012; Mukamuri and Kozanayi, 2014; Bhebhe et al., 2015; Maroyi and Cheikhyoussef, 2015; Ngarivhume et al., 2015; Maroyi, 2008, 2009, 2011, 2012a, 2012b, 2013a, 2017c, 2018c; Dimene et al., 2020).

Table 2
Families of medicinal plant species used to treat and manage respiratory diseases in Zimbabwe.

Family	Number of families	Number of species in each family
Alliaceae, Asparagaceae, Canellaceae, Cannabaceae, Chenopodiaceae, Chrysobalanaceae, Convolvulaceae, Crassulaceae, Cucurbitaeae, Cyperaceae, Flacourtiaceae, Heteropyxidaceae, Hyacinthaceae, Kirkiaceae, Myrothamnaceae, Myrsinaceae, Nymphaeaceae, Phyllanthaceae, Pittosporaceae, Plumbaginaceae, Poaceae, Polygalaceae, Polygonaceae, Proteaceae, Pteridaceae, Ranunculaceae, Sapindaceae, Tiliaceae, Ulmaceae, Zingiberaceae	30	1
Acanthaceae, Annonaceae, Asclepiadaceae, Bignoniaceae, Clusiaceae, Loganiaceae, Rhamnaceae, Rutaceae, Thymelaeaceae, Verbenaceae	10	2
Celastraceae, Ebenaceae, Loranthaceae, Malvaceae, Meliaceae, Moraceae	6	3
Apiaceae, Asphodelaceae, Combretaceae, Myrtaceae, Solanaceae	5	4
Apocynaceae, Lamiaceae	2	6
Anacardiaceae	1	7
Asteraceae, Euphorbiaceae	2	10
Rubiaceae	1	12
Fabaceae	1	21

3.2. Ethnobotanical surveys and distribution of medicinal plants traditionally used against respiratory disorders in Zimbabwe

The current review indicates that there are at least 58 plant families and 160 plant species used to treat respiratory diseases in Zimbabwe (Table 1). Ethnobotanical surveys are important pre-screening tools for the search of pharmacological interests of plants. While numbers of species in Zimbabwe are lower than those documented in Pakistan and South Africa, where 85 and 86 families with 384 and 306 plant species respectively were noted to treat respiratory disorders (Alamgeer et al., 2018; Semenya and Maroyi, 2018), these numbers suggest that Zimbabwe is a vast repository of medicinal plants for respiratory ailments. From the information in Table 1, it appears that several options of plants can be used to treat a single particular respiratory ailment. It is also true from the same Table 1 that a single particular plant has been used to treat several respiratory problems. For example, asthma can be treated with *Thunbergia oblongifolia* Oliv., *Tulbaghia leucantha* Baker, *Holarrhena pubescens* Wall. ex G.Don and *Aloe excelsa* A. Berger among several other plants. This is a parallel reflection of how conventional drugs have been used in managing disease.

The proportions of plant families found to treat respiratory diseases in Zimbabwe is shown in Table 2. Zimbabwe appears to be endowed with a diverse array of plant families with an ability to treat respiratory conditions. Within each plant family in Table 2, there is a range between 1 and 21 plant species that were identified. While in most cases there were fewer species within each family, the Apocynacea, Lamiacea, Anacardiaceae, Asteraceae, Euphorbiaceae, Rubiaceae and Fabaceae had the highest species diversity. This suggests that these diverse ranges may be distributed in different geographical locations according to their environmental preferences. Fabaceae family appears to be the most

Table 3
Pharmacological and toxicological evaluation of medicinal plants used to treat and manage respiratory diseases.

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
Acanthaceae	*Barleria spinulosa* Klotzsch	Pneumonia	no records found	no records found	
Acanthaceae	*Thunbergia oblongifolia* Oliv.	Asthma	Antioxidant, antimicrobial, anti-diabetic, anti-proliferative, hepatoprotective, anti-inflammatory and detoxifying activities.	Safe $LD_{50} > 8000$ mg/kg	Chan et al. (2011); Wonkchalee et al. (2012); Sultana et al. (2015); Rana et al. (2020)
Alliaceae	*Tulbaghia leucantha* Baker	Asthma	Antioxidant, anti-inflammatory, antiulcer, anti-splasmodic, antiviral, antidiarrheal, and antitumor activities.	no records found	Takaidza (2018)
Anacardiaceae	**Mangifera indica* L.	Asthma, colds, cough and tuberculosis	Antibacterial, anti-inflammatory, antioxidant, radioprotective, antitumor, immunomodulatory, anti-allergic, antidiabetic, lipolytic, analgesic, antibone resorption, monoamine oxidase inhibiting, antifungal, anti-diabetic, anti HIV, antibone resorption, antiviral, gastroprotective, anti-spasmodic, antihyperlipemic, antipyretic, antidiarrheal and anti-parasitic activities.	Safe $LD_{50} > 2000$ mg/kg in rats	Wauthoz et al. (2007); Maroyi (2013a); Parvez (2016); Ediriweera et al. (2017); Ahomadegbe et al. (2018); Reddeman et al. (2019)
Anacardiaceae	*Lannea discolor* (Sond.) Engl.	Cough	Anthelmintic, antibacterial, antifungal, anti-mycobacterial, antioxidant, anti-plasmodial, nematicidal and cytotoxicity activities.	No records found	Kabongo-Kayoka et al. (2016); Maroyi (2018d); Mwamatope et al. (2020)
Anacardiaceae	*Lannea edulis* (Sond.) Engl.	Cough and Bronchitis	Anthelmintic, antimicrobial, antioxidant, anti-HIV and antimalarial.	Weak or low toxicity $LC_{50} = 971 \pm 86$ µg/mL	Maroyi (2019c)
Anacardiaceae	*Searsia chirindensis* (Baker f.) Moffett	Chest pains and cough	Antiviral, antifungal, antioxidant, analgesic, antibacterial, and anti-inflammatory activities.	Safe LC_{50} value of 1023.26 ± 161.69 µg/ml	Ojewole (2007); Viol et al. (2016)
Anacardiaceae	*Searsia lancea* (L.f) F.A Barkley	Chest pains	Antibacterial, anti-inflammatory, cytotoxic, healing properties antifungal and antioxidant activities.	Weak or low toxicity $LC_{50} = 600$ µg/ml	McGaw et al. (2007); Gundidza et al. (2008); Mulaudzi et al. (2012); Mangoyi et al. (2014); Madzinga and Kritzinger (2020)
Anacardiaceae	*Searsia longipes* (Engl.) Moffet	Cough	Schistosomacidal, antitussive, cytotoxic and antioxidant activities.	Safe $LD_{50} > 5000$ mg/kg body weight	Šutovská et al. (2009); Olorunnisol et al. (2017); Chacha (2019); Chacha and Mbugi (2019); Olasunkanmi and Adegbola (2019)
Anacardiaceae	*Searsia pyroides* (Burch.) Moffett	Cough	Antioxidant activity.	Safe $LD_{50} > 2000$ mg/kg body weight	Mtunzi et al. (2017); Chacha and Mbugi (2019)
Annonaceae	*Annona stenophylla* Engl. & Diels	Chest pains	Antibacterial, antifungal, anti-inflammatory, antioxidant and hypoglycaemic activities.	Safe LC_{50} µg/ml - 1190 ± 212 - 2300 ± 276 µg/ml Non-toxic $LD_{50} >$ 2000 mg/kg in rats	Maroyi (2019a); Munodawafa et al. (2016)
Annonaceae	*Hexalobus monopetalus* (A. Rich.) Engl. & Diels	Colds, bronchitis and pulmonary troubles	Antimycobacterial, antimicrobial and antimalarial activities.	Highly toxic LC_{50} values ranging from 0.56 to 66.07 µg/mL	Malebo et al. (2014); Dzoyem et al. (2016); Chauke et al. (2016); Taderera et al. (2016); Souham et al. (2018)
Apiaceae	*Alepidea amatymbica* Eckl. & Zeyh	Asthma, influenza, colds and cough	Antimicrobial, anti-inflammatory and antiviral activities.	Highly toxic LC50–0.002 µg/ml	Wintola and Afolayan (2014)
Apiaceae	*Alepidea cordifolia* B.-E. van Wyk	Colds and influenza	no records found	no records found	
Apiaceae	*Diplolophium zambesianum* Heirn	Pneumonia	no records found	no records found	
Apiaceae	*Heteromorpha arborescens* (Spreng.) Cham. and Schltdl.	Respiratory problems (asthma, chest pains, coughs, and tuberculosis)	Anthelmintic, anti-arthritic, antibacterial, antifungal, anti-inflammatory, antiviral, anti-mycobacterial, antinociceptive, contractile effects, antioxidant, anti-peptic ulcer, anti-scabies, antispasmodic, cytotoxicity, genotoxicity, and uterotonic activities.	Highly toxic LC_{50} value of 81.0 µg/ml	Katerere and Parry (2000); Maroyi (2018g)
Apocynaceae	*Carissa edulis* (Forssk.) Vahl	Cough, chest pains, pneumonia and tuberculosis	Anti-plasmodial, antioxidant, diuretic, anti-inflammatoty, antimicrobial, anti-herpetic and antiviral activities.	Safe LD_{50} - 2154.1 mg/kg. Non-toxic $LD_{50} >$ 2000 mg in rats	Woode et al. (2007); Ibrahim et al. (2010, 2015); Osseni et al. (2016); Kaunda and Zhang (2017)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
Apocynaceae	*Carissa bispinosa* (L.) Desf. ex Brenan	Cough	Analgesic, antioxidant, antimicrobial, anti-inflammatory, antiviral and diuretic activities.	no records found	Maroyi (2013a); Muleya et al. (2014a)
Apocynaceae	*Diplorhynchus condylocarpon* (Muell. Arg.) Pich.	Cough, pneumonia	Sympatholytic activity.	no records found	Moura et al. (2018b)
Apocynaceae	*Holarrhena pubescens* Wall. ex G. Don	Asthma	Analgesic, antibacterial, antiviral, antidiabetic, anti-amoebic, anti-inflammatory, antimalarial and antioxidant activities.	Safe 30% mortality rate was reported in 96 h after administration of doses 500, 1000 and 2000 mg/kg.	Beuscher et al. (1994); Sinha et al. (2013); Singh (2018); Zahara et al. (2020)
Apocynaceae	**Nerium oleander* L.	Pneumonia	Antinociceptive, anti-inflammatory, antiviral, antioxidant, anti-asthmatic, anticancer, hepatoprotective, antibacterial, diuretic, anti-diarrhoeal, antimicrobial, antileukemic, immunomodulatory, larvicidal, antiulcer, antibacterial, anti-diabetic and molluscicidal activities.	Highly toxic LC_{50} - 142 ± 68.2 µg/ml	Garima and Amla (2010); Avci and Dik (2014); Hase et al. (2016); Munodawafa et al. (2016)
Apocynaceae	*Tabernaemontana elegans* Stapf	Lung ailments and tuberculosis	Antibacterial activity	no records found however studies revealed that it is relatively safe	Pallant et al. (2012); Dzoyem et al. (2016)
Asclepiadaceae	*Ectadiopsis oblongifolia* (Meisn.) Bullock	Pneumonia	no records found	no records found	
Asclepiadaceae	*Gomphocarpus glaucophyllus* Sclechter	Asthma	no records found	no records found however the leaves and tubers are sources of toxic cardiac glycosides.	Bester and Condy (2017)
Asparagaceae	*Asparagus africanus* Lam.	Pneumonia and tuberculosis.	Analgesic, anti-inflammatory and antimicrobial activities.	Safe LD_{50} > 5000 mg/kg in rats	Hassan et al. (2008); Kebede et al. (2016)
Asphodelaceae	*Aloe ferox* Mill.	Tuberculosis	Anti-inflammatory, antimicrobial, analgesic, calming, antiseptic, antioxidant, germicidal, antiviral, anti-parasitic, anti-tumour and anticancer activities.	Safe LD_{50} - 3000 mg/kg	Kambizi et al. (2005); Loots et al. (2007); Mahomoodally (2013); Añibarro-Ortega et al. (2019); Hęś et al. (2019); Sánchez et al. (2020)
Asphodelaceae	*Aloe vera* (L.) Burm.f.	Tuberculosis	Antiviral, antibacterial, laxative, protection against radiation, antioxidant, anticancer, anti-inflammation, antidiabetic, antiallergic, immunostimulation antiviral, antimicrobial, immunomodulatory and anti-tussive activities.	Safe LC_{50} – 3590 µg/ml. LD_{50} - 3000 mg/kg	Hamidi et al. (2014); Sharma et al. (2014b); Al-Snafi (2015); Taukoorah and Mahomoodally (2016); Guo and Mei (2016); Hęś et al. (2019), Añibarro-Ortega et al. (2019); Sánchez et al. (2020)
Asphodelaceae	*Aloe excelsa* Berg.	Asthma	Anti-mycological, antibacterial, antifungal and antiseptic activities.	no records found however reported to be safe.	Coopoosamy and Magwa (2007); Coopoosamy (2010); Cock (2015)
Asphodelaceae	*Aloe* spp.	Cough	Antiviral, antibacterial, anti-inflammatory, immunomodulatory, antioxidant, antifungal, gastro-protective and hypoglycemic activities.	Safe LD_{50} - 2000 mg/kg	Steenkamp and Stewart (2007); Mukherjee et al. (2013)
Asteraceae	*Artemisia afra* Jacq. Ex Willd.	Respiratory ailments	Antioxidant, antimicrobial, anti-HIV, anti-TB, anti-inflammatory and antimalarial activities.	Moderately toxic The LC_{50} - 206.97, 277.16, 406.48, and 669.30 µg/ml.	Patil et al. (2011); Muleya et al. (2014b); Van de Venter et al. (2014); Adeogun et al. (2018)
Asteraceae	*Aspilia pluriseta* Schweinf. *subsp.* pluriseta	Dyspnoea (shortness of breath)	Antimicrobial, cytotoxicity, antiviral, antimalarial, healing of dermal excision wounds (mouse model) and skin sensitization activities.	no records found	Cos et al. (2002); Sebisubi et al. (2010); Kuria (2014); Kuria et al. (2015); Njeru and Muema (2020)
Asteraceae	*Laggera crispata* (Vahl) Hepper & J.R.I Wood	Pneumonia	Antibacterial and antifungal activities.	no records found	Kazembe and Nkomo (2012)
Asteraceae	*Dicoma anomala* Sond.	Colds, cough and pneumonia	Anthelmintic, anticancer, antimicrobial, anti-hyperglycemic, anti-inflammatory, antioxidant, anti-plasmodial and hepatoprotective activities	Safe LC_{50} value of 3040 ± 1060 µg/ml	Becker et al. (2011); Munodawafa et al. (2016); Maroyi (2018f)
Asteraceae	*Helichrysum caespititium* (DC.) Harv	Cough and pulmonary tuberculosis	Antibacterial, anti-gonorrhoea, antioxidant, anti-mycobacterial,	Safe non-toxic - 3.3% and 40.7% mortality	Mamabolo et al. (2018); Maroyi (2019b)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
			antifungal and cytotoxicity activities.	was recorded in aqueous and organic extracts	
Asteraceae	*Helichrysum kraussii* Schultz Bip.	Cough	Antibacterial activity.	no records found	Bougastos et al. (2003)
Asteraceae	*Inula glomerata* Oliv. & Hiern	Pneumonia	no records found	no records found	
Asteraceae	*Lopholaena coriifolia* (Sond.) Phillips & C.A. Sm. *Lopholaena dehniae* Merxm.	Cough, pneumonia	Potent antioxidant and anti-inflammatory activities.	no records found	Wijaya et al. (2012)
Asteraceae	*Vernonia amygdalina* Del.	Cough	Antimicrobial, antimalarial, antithrombotic, antioxidant, antipyretic, analgesic, anti-diabetic, laxative, immunomodulatory, hypoglycemic, anti-inflammatory, antiviral, antifertility, anticancer, antihelmintic, cathartic, antifungal and antibacterial activities	Safe LD_{50} - 5152.3 mg/kg LD_{50} - 3721 mg/kg.	Momoh et al. (2012); Chan et al. (2016); Alara et al. (2017); Tijjani et al. (2017); Danladi et al. (2018); Inusa et al. (2018); Asante et al. (2019)
Bignoniaceae	*Kigella africana* (Lam.) Benth	Pneumonia	Anti-plasmodial, antiviral, anticancer, antiulcer, antidiarrheal, antimicrobial, analgesic, antimicrobial, antioxidant, anti-trypanosomal, wound healing and anti-inflammatory activities.	Moderately toxic LC_{50} value of less than 300 μg/ml. LD_{50} -785.65 ± 24 mg/kg	Akah, (1996); Atawodi and Olowoniyi (2015); Bello et al. (2016); Viol et al. (2016)
Bignoniaceae	*Stereospermum kunthianum* Cham.	Cough	Antibacterial, anti-plasmodial, analgesic, anti-inflammatory, anti-diarrhoeal, anticonvulsant and antioxidant activities.	Safe LD_{50} up to 8000 mg/kg b. wt.	Ching et al. (2008, 2009a, 2009b); Oloche et al. (2016)
Canellaceae	*Warburgia salutaris* (Bertol. f.) Chiov.	Colds, cough, influenza, sinus clearing, spots in the lungs and chest pains	Antimicrobial, antioxidant, cytotoxic, anti-inflammatory, phytotoxic, piscicidial and molluscicidal activities.	Moderately toxic LC_{50} - 351.41 ± 29.58 μg/ml and 359.66 ± 14.33 μg/ml.	Viol (2013); Lawal et al. (2014); Maroyi (2012a), Viol et al. (2016); Soyingbe et al. (2018)
Cannabaceae	*Trema orientalis* (L.) Blume	Coughs, sore throats, asthma, bronchitis	Antimicrobial, anti-plasmodial, antioxidant, anti-inflammatory, diuretic, laxative, thrombolytic, anticancer and antidiabetic activities.	Highly toxic LC_{50} - 11.67 μg/ml and 48.62 μg/ml.	Adinortey et al. (2013); Parvez et al. (2019)
Celastraceae	*Elaedendron matabelicum*	Chest complaints	Antimicrobial and antioxidant activities.	Safe LC_{50} - 1012.31 ± 217.69 μg/ml	Viol (2013); Viol et al. (2016)
Celastraceae	*Gymnosporia senegalensis* (Lam.) Loes	Coughs, pneumonia and tuberculosis	Antioxidant, antiviral, antibacterial, and antifungal activities.	Safe LC_{50} value of 2185.61 ± 872 μg/ml LD_{50} > 1600 mg/kg in mice	Viol (2013); Malebo et al. (2015); Viol et al. (2016); Makgatho et al. (2018)
Celastraceae	*Sclerocarya birrea* (A. Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro	Cough, pneumonia	Anti-diarrhoeal, anti-diabetic, anti-inflammatory, antimicrobial, antiviral, anti-plasmodial, antihypertensive, antioxidant,. anticonvulsant and antinociceptive activities.	Safe LC_{50} - 1112.37 ± 210.04 μg/ml.	Ojewole et al. (2010); Viol (2013); Russo et al. (2013); Viol et al. (2016)
Chenopodiaceae	**Chenopodium ambrosiodes* L.	Chest pains	Antimicrobial, anti-inflammatory, anti-aflatoxigenic, antioxidant, analgesic, antiasthmatic, carminative, stomachic and vermifuge activities.	Safe Acute toxicity, rats were administered 300, 1000 or 3000 mg/kg.	Kumar et al. (2007); Kokanova-Nedialkova et al. (2009); Sousa et al. (2012); da Silva et al. (2014); Degenhardt et al. (2016)
Chrysobalanaceae	*Parinari curatellifolia* Benth.	Tuberculosis	Antioxidant, antibacterial and anti-diabetic activities.	Safe LC_{50} > 1000 μg/ml.	Chirisa and Mukanganyama (2016); Mbunde et al. (2017)
Clusiaceae	*Garcinia huillensis* Welw	Treatment of cough, pneumonia and tuberculosis	Chemotherapeutical, antibacterial, anti-mycobacteria, antifungal, antiviral, and anti-trypanosomal activities.	no records found	Bakana et al. (1987); Magadula and Mbwambo (2014)
Clusiaceae	*Psorospermum febrifugum* Spach	Dyspnoea (shortness of breath), pneumonia	Antibacterial, antiprotozoal, anti-acne, antifungal, antiviral, anticancer, anti-psoriatic, immunomodulatory antioxidant, and neuroprotective activities.	Safe LD_{50} > 2000 mg/kg body weight.	Epifano et al. (2013); Elufioye et al. (2016); AbdAbomey-Calavi et al. (2019); Asogwa et al. (2020)
Combretaceae	*Combretum apiculatum* Sond.	Cough	Antibacterial, anticancer, antimicrobial antioxidant, antiviral, anti-inflammatory, anthelmintic, anti-schistosomal, antifungal and anti-inflammatory activities.	no records found	McGaw et al. (2001); Aderogba et al. (2012); de Morais Lima et al. (2012); Mangoyi et al. (2012); de Dieu Tamokou et al. (2013); Epifano et al. (2013)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
Combretaceae	*Combretum platypetalum* subsp. *oatesii* (Rolfe) Exell *Combretum oatesii* Rolfe	Pneumonia	Cytotoxic, anti-tuberculosis, anticancer, antibacterial, antioxidant, antifungal, anti-proliferative and anti-inflammatory activities.	no records found	Magwenzi et al. (2014); Chiramba and Mukanganyama (2016),Chirisa and Mukanganyama (2016); Wende et al. (2021)
Combretaceae	*Combretum zeyheri* Sond.	Cough	Antibacterial, anti-inflammatory, cytotoxicity against human cancer cell line, antioxidant, antifungal and anti-proliferative activities.	Highly toxic LC_{50} - 16 μg/ml to 159 μg/ml	de Morais Lima et al. (2012); Mapfunde et al. (2016); Moura et al. (2018a)
Combretaceae	*Terminalia sericea* DC. *Terminalia velutina* sensu Eyles	Sore throat	Antibacterial, antifungal, anti-HIV, anti-fungal, antibacterial, anticancer, lipolytic, wound healing, anti-parasitic, anti-inflammatory, antioxidant and antiviral activities.	Highly toxic $LC_{50} < 300$ μg/ml. LC_{50} ranging from 5.4 (3.5–8.4) to 17.4 (11.4–26.5) μg/ml,	Moshi and Mbwambo (2005); Mongalo et al. (2016); Viol et al. (2016)
Convolvulaceae	*Astripomoea malvacea* (Klotzsch) Meesu	Cough	no records found	no records found	
Crassulaceae	*Kalanchoe* spp.	Pneumonia	Antimicrobial, anti-inflammatory, anti-allergic, antioxidant, antihistamine, antimalarial and immunomodulatory activities.	Weak or low toxicity LD_{50} - 1925 mg/kg	Costa et al. (2008)
Cucurbitaeae	**Cucurbita pepo* L.	Pneumonia	Anti-hypercholesterolemia, antioxidant, anti-hypertensive, anti-inflammatory, anti- parasitic, anti-tumor, antiviral, anti-diabetic, anti-carcinogenic, antimicrobial, anti-bacterial, intestinal and anti-inflammatory activities..	Safe $LD_{50} > 5000$ mg/kg	Sener et al. (2007); Badr et al. (2011); Malgwi et al. (2014); Adnan et al. (2017)
Cyperaceae	*Coleochloa setifera* (Ridl.) Gilly	Pneumonia	no records found	no records found however studies show that its relatively safe.	Dzoyem et al. (2016); Maroyi (2013a)
Ebenaceae	*Diospyros lycioides* Desf.	Pneumonia and sore throat	Antibacterial, anti-inflammatory, anti-metastatic, antioxidant, anti-adhesive, antifungal and anti-proliferative activities.	no records found	Cai et al. (2000); Maroyi (2013a, 2018a)
Ebenaceae	*Euclea crispa* (Thunb.) Sond. ex Gürke	Cough	Antibacterial, antioxidant, amyloid β-peptide lowering effects, antifungal, and cell membrane disruption activities.	no records found	(Magama et al. (2003); Pretorius et al. (2003); Maroyi (2017d, 2018h)
Ebenaceae	*Euclea natalensis* A.DC.	Asthma, bronchitis, tuberculosis	Antibacterial, anti-diabetic, antifungal, anti-mycobacterial, antiviral, antioxidant, anti-plasmodial, dentin permeability and hepatoprotective activities.	Highly toxic LC_{50} value of 19.33 μg/mL	Maroyi (2017d)
Euphorbiaceae	**Ricinus communis* L.	Pneumonia	Antioxidant, immunomodulatory, lipolytic, antimicrobial, anti-asthmatic, diuretic, antiinfertility, laxative, hepatoprotective, antiviral and anti-inflammatory activities. Major phytochemical with include saponins and flavonoids that have been isolated from the plant have bronchodilatory, mast cell stabilizing and smooth muscle relaxation activities.	Safe LD_{50} - 2000 mg/kg	Burgess et al. (1988); Ilavarasan et al. (2011); Ahmad et al. (2016); Kumar (2017), El-Toumy et al. (2018)
Euphorbiaceae	*Acalypha petiolaris* Hoschst.	Asthma	no records found	no records found	
Euphorbiaceae	*Antidesma membranaceum* Muell. Arg.	Cough	Anti-mycobacterial and antibacterial activity.	Highly toxic LC_{50} - 36.13 μg/ml	Magadula et al. (2012); Gitu (2013)
Euphorbiaceae	*Bridellia mollis* Hutch.	Cough	Antioxidant, antimicrobial, antiviral, immunomodulatory and anti-inflammatory activities.	Highly toxic LC_{50} values of 51.4 μg/mL	Maroyi (2019d)
Euphorbiaceae	*Croton gratissimus* Burch	Respiratory disorders	Good antioxidant, anti-inflammatory, antimicrobial and antiviral activities.	no records found	Grace et al. (2003); Mulholland et al. (2010); Njoya et al. (2018)
Euphorbiaceae	*Euphorbia ingens* E. Mey. ex Boiss.	Bronchitis and asthma	no records found	no records found	Grace et al. (2003)
Euphorbiaceae	*Euphorbia matabelensis* Zahlbr.	Cough and respiratory infections	Antiproliferative (on C33a, HeLa, MCF-7, and MDA-MB-231 cell lines) and GIRK channel blocking activities.	no records found	Hammadi et al. (2019)
Euphorbiaceae	*Flueggea virosa* (Roxb. ex Willd.) Voigt	Pneumonia, respiratory tract infections,	Analgesic, anti-inflammatory, aphrodisiac, sedative, anti-	Safe $LD_{50} > 10000$ mg/kg	Tatematsu et al. (1991); Moshi et al. (2000); Magaji et al. (2007, 2008a,

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
		bronchitis, cough and pneumonia.	arrhythmic, anti-diabetic, anti-malarial, anti-HIV, anti-hepatitis C, anti-diarrheal, cytotoxic, antimicrobial, antifungal, antioxidant, laxative, cytotoxic, antispasmodic, antibacterial, antidiabetic, CNS behavioural effects, analgesic, anti-ulcerogenic, anticancer, anticonvulsant, sedative, antisickling, antivenin, anti-depressant, anti-trypanosomal, FSH and testosterone augmentative effect on LH activities.	in rats. LD_{50} range of 20000–50000 mg/kg body weight	b); Tanko et al. (2008); Sanogo et al. (2009); Yerima et al. (2009); Aiyelero et al. (2012); Garba et al. (2013, 2015); Abere et al. (2014); Sempombe et al. (2014); Zhang et al. (2015); Shehu et al. (2017); Ahmad et al. (2018); Ajaib and Wahla (2018); Renu et al. (2018); Misonge et al. (2019); Salawu et al. (2019)
Euphorbiaceae	*Margaritaria discoidea* (Baill.) Webster var. *nitida* (Pax) Radcliffe-Smith	Pneumonia	Anti-inflammatory, antibacterial, antifungal, analgesic, cytotoxicity, gastroprotective and antioxidant activities.	Safe $LD_{50} > 3200$ mg/kg	Adedapo et al. (2009); Dickson et al. (2010); Diallo et al. (2015); Sofidiya et al. (2015)
Euphorbiaceae	*Monadenium lugardiae* N. E.Br. *Euphorbia lugardiae* (N.E. Br.) Bruyns	Chest pains	no records found	no records found	El Badwi and Bakhiet (2012)
Fabaceae	*Acacia rehmanniana* (Schinz) Kyal. & Boatwr.	Pneumonia	no records found	no records found	
Fabaceae	*Aeschynomene mimosifolia* Vatke	Chest pains	no records found	no records found	
Fabaceae	*Albizia amara* (Roxb.) Biov. subsp. *sericocephala* (Benth.) Brenan	Pneumonia, TB	Antibacterial, antifungal, antioxidant, antiviral, antihyperlipidimic, astringent, antiarthritic, antihyperlipidemic, anti-inflammatory anticancer, analgelsic and hepatoprotective activities.	Safe LD_{50} - 2000 mg/kg	Indravathi et al. (2016); Nivetha et al. (2017)
Fabaceae	*Albizia antunesiana* Harms	Pneumonia	Anthelmintic and antioxidant activities.	no records found	Maroyi (2013a); Chipiti et al. (2015)
Fabaceae	*Albizia tanganyicensis* Bak.f. *Albizia lebbeck* (L.) Benth. var. australis Burtt Davy *Albizia rhodesica* Burtt Davy	Cough	Anti-inflammatory, antioxidant, antimicrobial, nootropic antidiarrheal, anti-helminthic, anti-asthmatic, antipyretic, anti-anaphylactic, ulcer healing, anticonvulsant, anti-allergic and wound healing activities.	Safe $LD_{50} > 5000$ mg/kg	Resmi et al. (2006); Meshram et al. (2016); Ali et al. (2018); Jahangir (2018)
Fabaceae	*Bauhinia fassoglensis* Schweinf.	Pneumonia	Antifungal, antibacterial, antioxidant, anti-plasmodial and cytotoxicity activity	Highly toxic LC_{50} above 100 μg/ml	Adongo et al. (2012); Owuor et al. (2012); Ochanga and Chacha (2016a, 2016b); Dzoyem et al. (2016); Ochanga and Kilonzo (2018)
Fabaceae	*Bauhinia petersiana* Bolle	Cough	no records found	no records found however it has been reported to be relatively safe	Dzoyem et al. (2016)
Fabaceae	*Burkea africana* Hook.	Pneumonia	Antioxidant, anti-diarrhoeal, antibacterial, analgesic, anti-inflammatory, antiviral and anticholinesterase activities.	Safe $LD_{50} > 5000$ mg/kg non-toxic	Mair et al. (2018); Moura et al. (2018b); Namadina et al. (2020)
Fabaceae	*Cassia abbreviata* Oliv.	Cough and Pneumonia	Antiviral, antioxidant, abortifacient, anti-diabetic, anti-inflammatory, hepatoprotective and antimicrobial activities.	Weak or low toxicity LC_{50} values of 454.93 ± 18.60 μg/ml LC_{50} values of 445.72 ± 22.15 μg/m. LC_{50} values of 1319.37 ± 356.63 μg/ml	Parry and Matambo (1992); Okeleye et al. (2013); Mongalo and Mafoko (2013); Viol et al. (2016); Sobeh et al. (2018)
Fabaceae	*Crotalaria laburnifolia* L.	Cough	Antimicrobial, analgesic and anthelmintic activities.	no records found	Shankar et al. (2008)
Fabaceae	*Dalbergia melanoxylon* Guill. & Perr.	Bronchitis, asthma, cough and inflammation in throat	Antimicrobial, antiviral, anti-diarrhoeal, antioxidant, analgesic, antipyretic and anti-inflammatory activities.	Highly toxic LC_{50} – 6.8 μg/ml	Maroyi (2013a); Kiondo et al. (2014); Matata et al. (2018); Najeeb et al. (2018)
Fabaceae	*Dichrostachys cinereal* (L.) Wight & Arn.	Pneumonia	Antioxidant, antiviral, antiashmatic, anti-inflammatory, anticonvulsant, analgesic and antimicrobial activities. Bronchoconstriction and bronchodilation activity in the smooth muscle airway.	Safe LC_{50} value of 4304.59 ± 685.69 μg/ml.	Aworet-Samseny et al. (2011); Viol (2013); Viol et al. (2016); Irie-N'guessan et al. (2017, 2018)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
Fabaceae	*Erythrina abyssinica* DC	Cough	Anti-mycobacterial, antidiarrheal, anti-HIV 1, anti-diabetic, anti-inflammatory, hepatoprotective, anti-plasmodial, antibacterial, antioxidant, anti-proliferative, antifungal, anti-obesity and antimicrobial activities.	Safe LC_{50} - 5440 μg/ml.	Bunalema et al. (2011); Nkeh-Chungag et al. (2013); Nasimolo et al. (2014); Munodawafa et al. (2016); Chitopo et al. (2019); Macharia et al. (2019)
Fabaceae	*Indigofera* spp.	Chest pains, cough	Antimicrobial, insecticidal, phytotoxic, antiulcergenic, hepatotoxic, teratogenic, cytotoxicity, lipoxygenase and gastrointestinal activities.	no records found however reported to be safe/non-toxic	Rahman et al. (2018)
Fabaceae	**Leucaena leucocephala* (Lam.) De Wit	Colds, flu and tuberculosis	Antimicrobial, diuretic, antiviral, cytotoxicity, antioxidant and anti-inflammatory activities.	no records found however some studies have reported it to be relatively safe.	Ono et al. (2003); Zarin et al. (2016); Dzoyem et al. (2016); Deivasigamani (2018); Zayed et al. (2018)
Fabaceae	*Peltophorum africanum* Sond.	Flu	Antibacterial, antifungal, antiviral, anti-inflammatory, antioxidant and anthelmintic activities.	Weak or low toxicity LC_{50} - leaves 913 ± 7.32 μg/ml and 1060 ± 106 μg/ml	Mongalo (2013); Munodawafa et al. (2016); Adebayo et al. (2017)
Fabaceae	*Pericopsis angolensis* (Bak.) van Meeuwen	Cough, Asthma, TB and dyspnoea (shortness of breath).	Antimicrobial activity.	no records found	Constance et al. (2019)
Fabaceae	*Piliostigma thonningii* (Schumach.) Milne-Redh	Cough	Antioxidant, antiviral, antimalarial, antipyretic, anti-leishmanial, analgesic, antibacterial, anxiolytic, anti-pyrectic, nootropic, anthelminthic, cognitive-enhancing, anti-inflammatory, hypocholesterolemic, hematopoietic, immunomodulatory, anti-lipidaemic, anti-cholesterolaemic and hypoglycemic activities.	Safe $LD_{50} > 5000$ mg/kg in rats.	Koné et al. (2007); Madara et al. (2010); Ighodaro and Omole (2012); Adamu et al. (2013); Afolayan et al. (2018); Alagbe et al. (2019); Moriasi et al. (2020); Olela et al. (2020)
Fabaceae	*Pterocarpus angolensis* Sond.	Chest pains	Antioxidant, antibacterial, antifungal, anti-tumor, antiviral and anti-inflammatory activities.	no records found	Beuscher et al. (1994); Okeleye et al. (2013); Mazimba (2014); Sigidi et al. (2016); Chipinga (2018)
Fabaceae	*Vigna unguiculata* (L.) Walp.	Chest pains	Anthelmintic, antibacterial, antioxidant, anti-nociceptive, antimicrobial, anti-diabetic, antiviral, anti-inflammatory, hypocholesterolemic, antifungal, anti-sickling and thrombolytic activities.	Safe $LD_{50} > 2000$ mg/kg body weight	Nwoke et al. (2008); GV et al. (2017); Sayeed et al. (2017); Hus et al. (2019); Zaheer et al. (2020)
Fabaceae	*Xeroderris stuhlmanni* (Taub.) Mendonca & E.P Sousa.	Chest pains	Anti-proliferative, antimicrobial and anti-mycobacterial activities.	no records found	Mukanganyama et al. (2012); Mangoyi et al. (2014); Selemani et al. (2020)
Flacourtiaceae	*Flacourtia indica* (Burm. f.) Merr.	Cough, chest pains and pneumonia	Antimicrobial, antioxidant, pro-apoptotic, anti-inflammatory, anti-proliferative and antiviral activities.	Moderately toxic LC_{50} - 467.31 ± 39.01 μg/ml	Viol (2013); Park et al. (2014); Taderera et al. (2015); Hussain et al. (2016); Viol et al. (2016); Perera et al. (2018)
Heteropyxidaceae	*Heteropyxis natalensis* Harv	Colds and respiratory disorders	Anti-inflammatory, antiviral, pro-inflammatory, antioxidant, antifungal, anti-mycobacterial and antibacterial activities.	Safe $LD_{50} > 5000$ mg/kg in rats	Hurinanthan (2013); Henley-Smith et al. (2018); Maroyi (2019e)
Hyacinthaceae	*Urginea sanguinea* (Schinz) Jessop	Pneumonia	No antibacterial and antioxidant activity.	Safe 1000 mg in 10 ml of solvent showed no mortality in shrimps.	Naidoo et al. (2004)
Kirkiaceae	*Kirkia acuminata* Oliv.	Cough	Antibacterial, antiviral, anti-inflammatory, anti-mycobacterial, antioxidant and anti-plasmodial activities.	no records found	Recio et al. (1995); Maroyi (2016, 2017a)
Lamiaceae	**Mentha longifolia* (L.) Huds	Colds and cough	Anti-oxidative, anti-microbial, anti-inflammatory, hepatoprotective, antiviral, antispasmodic and antibacterial activities.	Safe LD_{50} - 3200 mg/kg in rats	Mikaili et al. (2013); Dawang (2015); Farzaei et al. (2017); Sevindik (2018)
Lamiaceae	**Mentha spicata* L.	Cough and flu	Strong antioxidant, anti-inflammatory, antimicrobial, antiviral, carminative, antispasmodic, antiradical, chelating and diuretic activities.	Weak or low toxicity $LD_{50} > 1000$ mg/kg	Kee et al. (2017); Caro et al. (2018); Sevindik (2018)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
Lamiaceae	*Ocimum obovatum* (Benth) N.E.Br	Chest pains	Antibacterial, antifungal, antioxidant and radio-protective activities.	no records found	Naidoo et al. (2016)
Lamiaceae	*Leucas milanjiana* Gurke	Pneumonia	no records found	no records found	
Lamiaceae	*Tetradenia riparia* (Hochst.) Codd	Cough, colds, bronchitis, respiratory ailments	Antiviral, antifungal, anti-inflammatory, wound healing, antileishmanial, antioxidant and antibacterial activities.	Weak or low toxicity The general toxicity with dose 1000 mg/kg.	Cardoso et al. (2015); Njau and Ndakidemi (2017); Ghuman et al. (2019)
Lamiaceae	*Vitex payos* (Lour.) Merr.	Cough, colds, respiratory ailments	no records found	no records found however reported to be safe.	Tufts et al. (2015)
Loganiaceae	*Strychnos potatorum* L.f.	Cough	Hypotensive activity, anticonvulsant, anti-inflammatory, antidiarrheal, anti-HIV, antinociceptive, antipyretic, antioxidant, antiprotozoal, antimicrobial and antimalarial activities.	Safe LD_{50} - 2000 mg/kg body weight orally in mice.	Yadav et al. (2014); Palshetkar et al. (2020)
Loganiaceae	*Strychnos spinosa* Lam.	Pneumonia, bronchitis and chest problems. Caffeine in leaves can help breathing in premature babies.	Antimicrobial, anti-inflammatory, antiviral, antioxidant, anti-allergic, hepatoprotective, antithrombotic and anti-carcinogenic activities.	Safe $LD_{50} > 5000$ mg/kg.	Isa et al. (2014); Sadau and Eloff et al. (2014)
Loranthaceae	*Loranthus* spp *on Brachystegia spiciformis* Benth	Asthma	no records found	no records found	
Loranthaceae	*Loranthus* spp. *on Berchemia discolor* (Klotzsch) Hemsl.	Pneumonia	no records found	no records found	
Loranthaceae	*Loranthus* spp. *on Cordyla africana* Lour	Pneumonia	no records found	no records found	
Malvaceae	**Abelmoschus esculentus* Moench	Bronchitis and tuberculosis	Antioxidant, anti-inflammatory, laxative, anti-hyperlipidemic, antifungal, organ protective, analgesic, antioxidant, anti-diabetic, antimicrobial, immunomodulatory, antibacterial, anticancer and neuropharmacological activities.	Safe $LD_{50} > 2000$ mg/kg	Doreddula et al. (2014); Chen et al. (2016); Petropoulos et al. (2017); Islam (2019)
Malvaceae	*Azanza garckeana (F. Hoffm.)* Exell & Hillc.	Chest pains and cough	Antibacterial, antifungal, antimalarial, anti-hyperglycemic, antimicrobial, analgesic, wound healing, anti-inflammatory, anti-arthritic, antioxidant and ion absorption activities.	Highly toxic LC_{50} - 3.98 µg/ml acetone extract, 47.66 µg/ml methanol, 100 µg/ml ethyl acetate and 138 µg/ml water.	Dikko et al. (2016); Mshelia et al. (2016); Maroyi (2017e); Chowdhury et al. (2019); Yusuf et al. (2020)
Malvaceae	*Sida acuta* Burm. f.	Chest pains	Antioxidant, antimicrobial, antibacterial, antimalarial, cardiovascular, antiulcer, antiviral, analgesic and anti-inflammatory, anticancer, antipyretic, hepatoprotective, hypoglycemic and insecticidal activities.	Safe LD_{50} - 2000 mg/kg body weight.	Hudson et al. (2000); Ekpo and Etim (2009); Tcheghebe et al. (2017); Singh and Navneet (2018)
Meliaceae	*Ekebergia benguelensis* C. DC.	Pneumonia	Antioxidant, cytotoxic and antimalarial activities.	no records found	Chávez et al. (2001); Kinghorn et al. (2003); Chiribagula et al. (2020)
Meliaceae	*Khaya anthotheca* (Welw.) C.DC.	Pneumonia and colds	Antimicrobial, anticancer, antioxidant and antiviral activities.	Moderately toxic LC_{50} - 482.19 ± 43.49 µg/ml.	Viol (2013); Viol et al. (2016)
Meliaceae	*Turraea nilotica* Kotschy & Peyr.	Dyspnoea (shortness of breath), pneumonia and respiratory disorders	Anti-plasmodial activity.	Weak or low toxicity LC_{50} - 701 ± 25.650 µg/ml.	Munodawafa et al. (2016)
Moraceae	*Ficus ingens* (Miq.) Miq.	Cough	Immunoprotective and antioxidant.	Safe $LD_{50} > 4000$ mg/kg in rats	Abd El Raheim et al. (2013)
Moraceae	*Ficus sycomorus* L.	Tuberculosis, cold and other chest problems	Antiviral, analgesic, antimicrobial, anti-inflammatory, antioxidant, antitussive and immunomodulatory activities.	Weak or low toxicity LD_{50} - 1500 mg/kg	Bello et al. (2015); Ramdé-Tiendrébéogo et al. (2015); El-Beltagi et al. (2019a,b); Hossain (2019)
Moraceae	*Ficus thonningii* Blume	Respiratory infections, bronchitis, treating influenza, sore throat, colds, pneumonia and chest pains.	Anti-inflammatory, antimicrobial and antioxidant activities.	Safe $LD_{50} > 5000$ mg/kg	Coker et al. (2009); Dangarembizi et al. (2013); Badiora et al. (2016); Isyaku et al. (2016); Coker and Oaikhena (2020)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
Myrothamnaceae	*Myrothamnus flabellifolius* Welw.	Colds and chest complaints	Anti-inflammatory, antioxidant, analgesic, antimicrobial and antiviral activities.	Highly toxic LC_{50} at 136 μg/ml,	Viljoen et al. (2002); Bussmann et al. (2011); Bhebhe et al. (2015); Erhabor et al. (2020)
Myrsinaceae	*Rapanea melanophloeos* (L.) Mez	Respiratory problems	Expectorant, emetic, antioxidant, anti-diabetic, astringent, anti-inflammatory, analgesic, anthelmintic, fungicidal, anti-coagulation, antiviral, antifungal and anti-mycobacterial activities.	Weak or low toxicity $LD_{50} > 1000$ mg/kg body weight,	Ohtani et al. (1993); Amenya et al. (2016); Mehrbod et al. (2018); Lotter et al. (2019)
Myrtaceae	**Eucalyptus camaldulensis* Dehnh	Sore throat, flu, asthma, cough	Anti-inflammatory, antimicrobial, antiviral, antioxidant, antidiarrheal and analgesic activities.	Safe $LD_{50} \geq 5000$ mg/kg in rats.	Adeniyi et al. (2015); Abu-Jafar and Huleihel (2017); Upreti et al. (2018)
Myrtaceae	**Psidium guajava* L.	Cough and flu	Antimicrobial, anti-inflammatory, antiviral, analgesic, antioxidant and antitussive activities.	Safe $LD_{50} \geq 5000$ mg/kg in rats	Chen and Yen (2007); Daswani et al. (2017); Kafle et al. (2018)
Myrtaceae	*Syzigium guineense* (Willd.) DC.	Tuberculosis and chest complaints	Anti-inflammatory, antiviral, antibacterial and antioxidant activities.	Safe $LD_{50} > 5000$ mg/kg in rats.	Tsakala et al. (1996); Moll et al. (2013); Okwuofu et al. (2017); Oladosu et al. (2017); Ezenyi and Igoli (2018)
Myrtaceae	*Syzygium cordatum* Hochst. ex C. Krauss	Cold and fever	Antibacterial, anti-plasmodial, antifungal, antidiarrheal, anti-sexually transmitted infections, anti-diabetic, antioxidant, anti-inflammatory, anti-leishmanial, anti-proteus and anticholinesterase activities.	Safe $LD_{50} > 4000$ mg/kg in mice	Cordier et al. (2013); Maroyi (2014, 2018c)
Nymphaeaceae	*Nymphaea nouchali* Burm. f.	Asthma	Anti-inflammatory, anti-spasmodic, anti-cancer, antimicrobial, anti-analgesic, antioxidant and anti-diuretic activities.	Moderately toxic LD_{50} - 681 mg/kg in albino mice.	Raja et al. (2010); Parimala and Shoba (2014); Prasad and Savithramma (2016)
Phyllanthaceae	*Bridelia micranatha* (Hochst.) Baill.	Cough	Anthelmintic, antimicrobial, anticonvulsant, sedative, anti-diabetic, anti-diarrhoeal, anti-nociceptive, antioxidant, insecticidal, anti-plasmodial, anti-schistosomal, anti-inflammatory, hepatoprotective and β-lactamase inhibitory activities.	Highly toxic LC_{50} of 77 μg/mL	Nwaehujor Chinaka et al. (2014); Maroyi (2017f)
Pittosporaceae	*Pittosporum viridiflorum* Sims.	Chest pains	Antimicrobial, anti-diarrhoeal, antimalarial, anticancer, anti-inflammatory, antiviral, antioxidant and acaricidal activities.	Safe LC_{50} values - 700 μg/ml and 2440 μg/ml.	Mehrbod et al. (2018); Madikizela and McGaw (2019)
Plumbaginaceae	*Plumago zeylanica* L.	Dyspnoea (shortness of breath)	Anti-inflammatory, anti-malarial, antiviral, antifertility, antimicrobial, antioxidant, blood coagulation, wound healing, memory enhancer and anti-cancer activities.	Toxic LD_{50} – 65 mg/kg	Parker et al. (2007); Mandavkar and Jalalpure (2011); Ganesan and Gani (2013); Jain et al. (2014); Sharma and Kaushik (2014); Singh et al. (2017); Jain et al. (2020)
Poaceae	*Phragmites mauritianus* Kunth	Pneumonia	no records found	no records found	
Polygalaceae	*Securidaca longipedunculata* Fresen.	Tuberculosis and pneumonia	Antiviral, antifungal, antimicrobial, antioxidant, anti-inflammatory and antibacterial activities.	Moderately toxic LC 50–351.89 ± 35.79 μg/ml, giving readings close to 300 μg/ml.	Muanda et al. (2010); Viol (2013); Sanusi et al. (2015); Viol et al. (2016); Nguta (2019)
Polygonaceae	*Oxygonum sinuatum* (Hochst. & Steud. Ex Meisn.) Dammer	Cough	no records found	no records found	
Proteaceae	*Faurea saligna* Harv.	Pneumonia	Antifungal activity.	no records found	Mangoyi and Mukanganyama (2011)
Pteridaceae	*Pellaea* spp.	Chest pains	Antioxidant and anti-inflammatory activities.	no records found	Baskaran et al. (2018)
Ranunculaceae	*Clematis villosa* DC.	Cough and colds	no records found	no records found	
Rhamnaceae	*Rhamnus prinoides* L'Hérit	Pneumonia, cold and respiratory infections	Antimalarial, antioxidant, antiviral, antimicrobial, and anti-inflammatory activities.	Highly toxic Chloroform - LC_{50} - 133.33 μg/ml and methanol/water extract - LC_{50} - 214.33 μg/ml.	Parker et al. (2007); Amabye (2015); Molla et al. (2016); Kamanja et al. (2018); Chen et al. (2020)
Rhamnaceae	*Ziziphus mucronata* Willd.	Chest complaints, Cough	Antimicrobial, antiviral, anti-diabetic, anti-inflammatory, antioxidant, anti-plasmodial,	Safe Leaf extracts LC_{50} of 4560 ± 1540 μg/ml	Munodawafa et al. (2016); Adebayo and Masoko (2019); Mongalo et al. (2020)

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Table 3 (*continued*)

Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
			anthelmintic, and anti-anaemic activities.	and roots 1180 ± 144 μg/ml.	
Rubiaceae	*Agathisanthemum bojeri* Klotzsch	Asthma, chest conditions, relieve cough and diffulty in breathing	no records found	no records found	
Rubiaceae	*Catunaregam taylorii* S. Moore) Bridson	Respiratory ailments and pulmonary infections	Anti-allergic, anti-inflammatory, analgesic, immunomodulatory activity, antibacterial, antioxidant, emetic, antipyretic, human cyclooxygenase (COX)-2 inhibitory effects and a prominent protection of DNA activities.	Safe LD_{50} up to 2000 mg/kg.	Patil and Khan et al. (2017); Moura et al. (2018b); Saini et al. (2019)
Rubiaceae	*Fadogia ancylantha* Schweinf.	Cough, pneumonia	Antidiabetic, anti-oxidant and antimicrobial activities.	no records found	Nyirenda et al. (2012)
Rubiaceae	*Gardenia resiniflua* Hiern subsp. *resiniflua*	Pneumonia, asthma	no records found	no records found	
Rubiaceae	*Gardenia ternifolia* Schuamch. & Thonn. subsp. *jovis-tonantis* (Welw.) Verdc. *var goetzei* (Stapf & Hutch) Verdc.	Pneumonia, asthma	Antimalarial, antioxidant, anticancer and antimicrobial activity.	Safe LD_{50} > 2000 mg/kg	Agbodjento et al. (2018); Nureye et al. (2018)
Rubiaceae	*Gardenia volkensii* K. Schum. subsp. *spatulifolia* (Stapf and Hutch.) Verdc.	Pneumonia, asthma	no records found	no records found	
Rubiaceae	*Mussaenda arcuata* Poir.	Influenza	no records found	no records found	
Rubiaceae	*Pavetta schumanniana* F. Hoffm.	Chest pains, cough, pneumonia	Cytotoxicity and anti-mycobacterial activity.	no records found	Aro et al. (2015)
Rubiaceae	*Spermacoce dibrachiata* Oliv.	Pneumonia, cough	no records found	no records found	
Rubiaceae	*Vangueria infausta* Burch. subsp. *infausta*	Pneumonia	Antibacterial, antioxidant, antileishmanial, antimycobacterial, antifungal, anti-TB, anti-inflammatory, and anti-plasmodial activities.	Moderately toxic LC_{50} values of 338 ± 23.4 μg/mL (leaf) and 416 ± 28.3 μg/mL (root).	Munodawafa et al. (2016); Maroyi (2018e)
Rubiaceae	*Vangueriopsis lanciflora* (Hiern) Robyns	Cough	no records found	no records found	
Rubiaceae	*Xeromphis obovata* (Hochst.) Keay	Cough, pneumonia	no records found	no records found	
Rutaceae	**Citrus limon* (L.) Burm. f.	Throat infections, cough and flu	Antiviral, anti-inflammatory, antioxidant, analgesic, antimicrobial and antitussive activities.	Safe $LD_{50} \geq 5000$ mg/kg in rats.	Otang and Afolayan (2016); Makni et al. (2018); Klimek-Szczykutowicz et al. (2020)
Rutaceae	*Zanthoxylum humile* (E.A. Bruce) P.G. Waterman	Chest pains and flu	Antibacterial and anti-inflammatory activities.	no records found	Pamhidzai and Isaac (2013)
Sapindaceae	*Zanha africana* (Radlk) Excell.	Respiratory problems (asthma, chest pains, colds, cough, flu, pneumonia and tuberculosis)	Antibacterial, antifungal, antiviral, antidiabetic, anti-inflammatory, insecticidal, anti-trypanosomal and cytotoxicity activities.	Highly toxic LC_{50} values ranging from 41.1 μg/mL and 240.0 μg/mL	Maroyi (2019g)
Solanaceae	**Capsicum* spp.	Respiratory infections in chickens.	Antimicrobial, immuno-modulatory, anti-inflammatory, antiviral, cytotoxicity, antioxidant, insecticidal and anthelmintic activities.	Highly toxic LD_{50} values of Capsaicin ranging 97.4–118.8 mg/kg in mice, and 148.1 mg/kg and 161.2 mg/kg in rats.	Al-Snafi (2015); Ordaz-Trinidad et al. (2018)
Solanaceae	**Nicotiana tabacum* L.	Asthma, respiratory problems	Antimicrobial, antispasmodic, antioxidant, emetic, purgative, sedative, analgesic, insecticidal, anti-inflammatory, antiviral, anti-rheumatic and anthelmintic activities.	Safe LD_{50} > 2000 mg/kg	Iqbal et al. (2006); Shang et al. (2016); Batoro and Ekowati (2017); Ameya et al. (2017); Khaleel (2019); Popova et al. (2019); Sulaiman et al. (2020)
Solanaceae	**Datura stramonium* L	Asthma and cough	Anti-inflammatory, antimicrobial, antiviral, analgesic, antioxidant and anti-asthmatic activities. Patients exhibiting mild airway obstruction are treated with isolate atropine from the plant due to its bronchodilatory activity.	Safe LC_{50} - 12860 μg/ml	Gaire and Subedi (2013); Sayyed and Shah (2014, Sharma et al. (2014a)
Solanaceae	**Solanum incanum* L.	Pneumonia	Antinociceptive effect, antipyretic, antioxidant, anti-inflammatory,	Safe LD_{50} > 2000 mg/kg body weight.	Indhumathi et al. (2014); Mwonjoria et al. (2014); Dakone and Guadie (2016); Anwar (2018)

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Family	Scientific Name	Ethnomedicinal uses for respiratory disorders	Pharmacology properties	Toxicological evaluations	References
			antimicrobial, analgesic and anti-cytotoxic activities.		
Thymelaeaceae	*Gnidia capitata* L.f	Asthma	no records found	no records found	
Thymelaeaceae	*Gnidia kraussiana* Meisn.	Cough	Antibacterial, antifungal and molluscicidal activities.	no records found	El Kheir and El Tohami (1979); Ndhlala et al. (2013)
Tiliaceae	*Triumfetta welwitschii* Mast.	Asthma	Antibacterial activities.	no records found	Moyo and Mukanganyama (2015)
Ulmaceae	*Chaetachme aristata* Planch	Tuberculosis	no records found	no records found	
Verbenaceae	*Clerodendrum eriophyllum* Gürke	Cough and colds	Antimicrobial, antioxidant, anti-inflammatory, antihypertensive and immunostimulatory activities.	no records found	Machumi et al. (2010); Fouad et al. (2013); Ogundajo et al. (2019)
Verbenaceae	*Lippia javanica* (Burm.f.) Spreng.	Cold, cough, shortness of breath (dyspnoea), respiratory complaints, bronchial problems, fever, asthma, chronic coughs	Anti-inflammatory, antioxidant, anti-amoebic, antimicrobial, antibacterial, antifungal, anti-mycobacterial, antiviral and anti-plasmodial activities.	Safe LC_{50} 1138 ± 1.33 μg/ml	Endris et al. (2016); Maroyi (2017b); Osunsanmi et al. (2019)
Zingiberaceae	**Zingiber offinale* Roscoe	Cough, flu and colds	Antioxidant, anticancer, anti-inflammatory, anti-apoptotic, antiviral, antiemetic, antimicrobial, immunomodulatory, anti-tumorigenic, antilipidemic, and anti-hyperlipidemic activities. Isolated essential oils from the plant was reported to initiate a relaxing property on rat's airway and tracheal contraction.	Safe $LD_{50} > 5000$ mg/kg.	Mascolo et al. (1989); Rehman et al. (2011); San Chang et al. (2013); Bellik (2014); Rahmani (2014); Teles et al. (2019); Mahboubi (2019)

diverse and carries the most prevalent species in the country. Typical examples of Fabaceae are usually trees or shrubs which are found throughout the country. These include *Xeroderris stuhlmannii* Mendonça & E.P. Sousa, *Dichrostachys cinerea* (L.) Wight & Arn., *Piliostigma thonningii* (Schumach.) Milne-Redh. and among several others. According to Table 1, most of the Fabaceae plants are distributed throughout the country, which explains their high species diversity. Of note, it is therefore highly likely to make a mistake in classifying the Fabaceae family, hence, extra caution may need to be taken.

Zimbabwe is divided into 5 agro ecological regions, based on rainfall regime, soil and several other factors. About 57% of plants reported in this review are widely distributed throughout Northern, Eastern, Central, Western, Southern regions of Zimbabwe as represented in Fig. 1. The remaining population of plant species are specific to particular regions. About 19% were distributed in 4 regions, 13% in 3 regions, 3% in 2 regions and 5% in 1 region. A remainder 3% of the medicinal plant species (i.e. *Nerium oleander* L., *Nicotiana tabacum* L., *Zingiber officinale* Roscoe, *Capsicum* spp. and *Cucurbita pepo* L.) were reported to be cultivated. (Table 1; Mapaura and Timberlake, 2004).

According to Table 1 it is apparent that plant remedies have been relatively useful in managing human ailments. While these listed plants appear to solve respiratory ailments, some have multi-purpose potencies. Generally, the plants identified seem to be evenly distributed throughout the country hence the different names from each ethnic group distributed in the country.

3.3. Diversity, habit and part used, of medicinal plants traditionally used in the management of respiratory disorders in Zimbabwe

According to Fig. 2, the frequency and type of plants used to treat and or manage respiratory disorders is as follows; trees (n = 66), shrubs (n = 44), herbs (n = 36), succulents (n = 5), mistletoes (n = 3), climbers (n = 2), aquatics (n = 1), grass (n = 1), reed (n = 1) and fern (n = 1). Differences in abundance, socio-cultural beliefs, location, ethnic group, ecological status and variations in the practices of the traditional healers are some of the factors which contribute to the use of a particular plant (Shumba et al., 2009).

The high frequency use of trees in Zimbabwe as a source of herbal therapies is often attributed to their abundance and ease of availability throughout the year. According to Mapanda et al. (2012) Zimbabwe is made up of roughly 40% Miombo woodlands which is predominantly savanna largely characterised by trees and shrubs which grow during the wet summer. Zimbabwe is also a landlocked country, hence the very low frequency use of aquatic plants as medicine.

The plant parts that are frequently used are shown in Fig. 3. It appears the roots, leaves and bark are the main target plant parts used for respiratory treatment in Zimbabwe. While use of the root is the least environmentally sustainable, it is the most preferred source of medicine. However, in some instances a whole plant, fruit, twig, stem or any other plant part are used. This suggest that roots have the most potent antimicrobial and other bioactive properties in general as evidenced by these other authors Kambizi and Afolayan (2001) 53%; Maroyi (2011, 2013a) 61.3%; Ngarivhume et al. (2015) 55.3%.

Abundance, ease of collection, conservation policies or ethnic beliefs of local people are some of the factors that may affect choice of plant parts being acquired and used to treat respiratory illnesses. The second most predominantly used plant part is the leaf. Leaves are relatively abundant and have been largely reported to contain pharmacologically active compounds (Adeyemi et al., 2010). Moreover, leaves are preferred in ethno-preparations because collecting them does not adversely affect the life cycle of the plant (Bhat et al., 2013). The bark was found to be the third most frequently used plant part. The bark from trees is relatively abundant since it comes from trees which are predominant. It should be noted that the collection of bark by completely ring barking the tree leads to death due to lack of connecting cambium tissue (Shumba et al., 2009). Most traditional healers and herbal vendors ring-bark the trees and, in some cases, uproot the plant to get as much bark and root as possible which leads to the death of the plant therefore threatening the species to extinction. Fruits are rarely used as plant parts for treatment of respiratory illnesses. The low use of fruit is probably attributed to the seasonal availability from the plant part and they are largely consumed more as food than medicine.

Table 4
Supplementary table of pharmacological activities.

Pharmacological activities	No of plants	Names of the plant species
Antioxidant, antimicrobial, antiviral and anti-inflammatory	57	*Albizia amara* (Roxb.) Boivin., *Aloe ferox* Mill, *Aloe* spp., **Aloe vera* (L.) Burm.f., *Artemisia afra* Jacq. ex Willd., *Bridellia mollis* Hutch., *Burkea africana* Hook., *Carissa bispinosa* (L.) Desf. ex Brenan., *Cassia abbreviata* Oliv., *Carissa edulis* (Forssk.) Vahl, **Citrus limon* (L.) Burm. f., *Combretum apiculatum* Sond., *Croton gratissimus* Burch., **Cucurbita pepo* L., *Dalbergia melanoxylon* Guill. & Perr., **Datura stramonium* L., *Dichrostachys cinerea* (L.) Wight & Arn., *Erythrina abyssinica* Lam., **Eucalyptus camaldulensis* Dehnh., *Kigella africana* (Lam.) Benth., *Kirkia acuminata* Oliv., *Ficus sycomorus* L., *Flacourtia indica* (Burm.f.) Merr., *Flueggea virosa* (Roxb. ex Willd.) Voigt, *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl., *Heteropyxis natalensis* Harv., *Holarrhena pubescens* Wall. ex G.Don., *Leucaena leucocephala* (Lam.) de Wit., *Lippia javanica* (Burm.f.) Spreng., **Mangifera indica* L., **Mentha longifolia* (L.) L., **Mentha spicata* L., *Myrothamnus flabellifolius* Welw., **Nerium oleander* L., **Nicotiana tabacum* L., *Peltophorum africanum* Sond., *Piliostigma thonningii* (Schumach.) Milne-Redh., *Pittosporum viridiflorum* Sims., *Plumago zeylanica* L., *Pterocarpus angolensis* DC., *Rapanea melanophloeos* (L.) Mez,**Ricinus communis* L., *Rhamnus prinoides* L'Hér., *Sclerocarya birrea* (A. Rich.) Hochst., *Searsia chirindensis* (Baker f.) Moffett, *Securidaca longipedunculata* Fresen., *Sida acuta* Burm.f., *Strychnos potatorum* L.f., *Strychnos spinosa* Lam., *Syzygium cordatum* Hochst. ex C. Krauss, *Syzigium guineense* (Willd.) DC., *Terminalia sericea* Burch. ex DC., *Tetradenia riparia* (Hochst.) Codd., *Vernonia amygdalina* Delile, *Vigna unguiculata* (L.) Walp., **Zingiber offinale* Roscoe, *Ziziphus mucronata* Willd.,
Antioxidant, antimicrobial and anti-inflammatory	22	**Abelmoschus esculentus* (L.) Moench., *Albizia tanganyicensis* Baker f., *Annona stenophylla* Engl. & Diels, *Azanza garckeana* (F.Hoffm.) Exell & Hillc., *Bridelia micranatha* (Hochst.) Baill., *Catunaregam taylorii* (S. Moore) Bridson, **Chenopodium ambrosiodes* L., *Clerodendrum eriophyllum* Gürke, *Combretum platypetalum* Welw. ex M. A. Lawson, *Combretum zeyheri* Sond., *Dicoma anomala* Sond., *Diospyros lycioides* Desf., *Ficus thonningii* Blume, *Kalanchoe* spp, *Margaritaria discoidea* (Baill.) G.L.Webster, *Searsia lancea* (L.f.) F.A.Barkley, **Solanum incanum* L., *Stereospermum kunthianum* Cham., *Thunbergia oblongifolia* Oliv., *Trema orientalis* (L.) Blume, *Vangueria infausta* Burch., *Warburgia salutaris* (G. Bertol.) Chiov.,
Antioxidant, antimicrobial and antiviral	4	*Euclea natalensis* A.DC., *Khaya anthotheca* (Welw.) C. DC., *Lannea edulis* (Sond.) Engl., *Psorospermum febrifugum* Spach,
Antimicrobial, anti-inflammatory and antiviral	2	*Alepidea amatymbica* Eckl. & Zeyh., *Zanha africana* (Radlk.) Exell,
Anti-inflammatory and antimicrobial	3	*Asparagus africanus* Lam., *Chenopodium ambrosiodes* L., *Zanthoxylum humile* (E.A. Bruce) P.G. Waterman,
Antioxidant and antimicrobial	10	*Bauhinia fassoglensis* Kotschy ex Schweinf., *Elaedendron matabelicum* Loes., *Euclea crispa* (Thunb.) Gürke, *Fadogia ancylantha* Schweinf., *Gardenia ternifolia* Schumach., *Helichrysum caespititium* (DC.) Sond., *Lannea discolor* Engl., *Ocimum obovatum* E.Mey. ex Benth., *Parinari curatellifolia* Planch. ex Benth., *Vernonia adoensis* Sch. Bip. ex Walp.,
Antioxidant and anti-inflammatory	2	*Lopholaena coriifolia* (Sond.) E.Phillips & C.A.Sm., *Pellaea* spp.
Antimicrobial and antiviral	2	*Aspilia pluriseta* Schweinf., *Garcinia huillensis* Welw. ex Oliv.
Antibacterial	4	*Helichrysum kraussii* Sch. Bip., *Tabernaemontana elegans* Stapf., *Triumfetta welwitschii* Mast., *Antidesma membranaceum* Müll.Arg.,
Antimicrobial	8	*Aloe excelsa* A. Berger, *Crotalaria laburnifolia* L., *Gnidia kraussiana* Meisn., *Hexalobus monopetalus* (A.Rich.) Engl. & Diels, *Indigofera* spp, *Laggera crispata* (Vahl) Hepper & J.R.I.Wood, *Pericopsis angolensis* (Baker) Meeuwen, *Xeroderris stuhlmanni* (Taub.) Mendonça & E.P.Sousa
Anti-asthmatic, bronchodilatory, mast cell stabilizing and smooth muscle relaxation	6	*Albizia tanganyicensis* Baker f., *Chenopodium ambrosiodes* L., **Datura stramonium* L., *Dichrostachys cinerea* (L.) Wight & Arn., **Nerium oleander* L., **Ricinus communis* L.
Antifungal	1	*Faurea saligna* Harv.
Anti-tussive	6	*Aloe* spp., [a]*Aloe vera* (L.) Burm.f., **Citrus limon,* (L.) Burm. f., *Ficus sycomorus* L., **Psidium guajava* L., *Searsia longipes* (Engl.) Moffett
Antioxidant	5	*Albizia antunesiana* Harms, *Ekebergia benguelensis* Welw. ex C.DC., *Ficus ingens* (Miq.) Miq., *Searsia longipes* (Engl.) Moffett, *Searsia pyroides* (Burch.) Moffett
Immunomodulatory	17	**Abelmoschus esculentus* (L.) Moench, *Aloe* spp., *Aloe vera* (L.) Burm.f., *Bridellia mollis* Hutch., *Catunaregam taylorii* (S. Moore) Bridson, **Capsicum* spp., *Clerodendrum eriophyllum* Gürke, *Ficus ingens* (Miq.) Miq., *Ficus sycomorus* L., *Kalanchoe* spp., **Mangifera indica* L., **Nerium oleander* L., **Ricinus communis* L., *Piliostigma thonningii* (Schumach.) Milne-Redh., *Psorospermum febrifugum* Spach, *Vernonia amygdalina* Delile., **Zingiber offinale* Roscoe
Anti-mycobacterial	15	*Aloe excelsa* A. Berger, *Antidesma membranaceum* Müll. Arg., *Artemisia afra* Jacq. ex Willd., *Combretum platypetalum* Welw. ex M.A. Lawson, *Erythrina abyssinica* Lam., *Kirkia acuminata* Oliv., *Helichrysum caespititium* (DC.) Sond., *Heteromorpha arborescens* (Spreng.) Cham. & Schltdl., *Heteropyxis natalensis* Harv., *Hexalobus monopetalus* (A.Rich.) Engl. & Diels, *Lippia javanica* (Burm.f.) Spreng., *Pavetta schumanniana* F.Hoffm. ex K. Schum., *Rapanea melanophloeos* (L.) Mez, *Vangueria infausta* Burch., *Xeroderris stuhlmanni* (Taub.) Mendonça & E.P.Sousa

[a] Exotic plants.

3.4. Use and mode of preparation of medicinal plants traditionally used in the management of respiratory disorders in Zimbabwe

The different modes of preparation of the plants are shown in Table 1 and Fig. 4. The different formulations used by local people for medicinal plant preparations, starting with the most common mode of preparations of phytomedicines, include infusions (n = 62), decoctions (n = 50), powder (n = 14), smoke (n = 12), ashes (n = 8), raw (n = 4), juice (n = 3), ointment (n = 2), cigarette (n = 1) and paste (n = 1). The increased and continuous use of the various methods has perfected the processing of the preparations over the years and the experience has led to greater efficiency and a decrease in the toxicity of the preparations used (Shumba et al., 2009).

Methods of preparation of plant medicines seem to vary according to area and subculture of people in that region. Plant materials may be used fresh or dry. Decoctions are usually prepared by boiling the plant in water until the volume of water is reduced to half, whereas an infusion is a less concentrated version of a decoction. Studies by Maroyi (2011); Ngarivhume et al. (2015) reported predominant use of decoctions and infusions which may be attributed to these preparations being quicker, low cost and easy to administer. When smoke is used, two ways were employed for administration; either as a cigarette or inhalation of the smoke from a burning plant. The high frequency of infusion and decoction use might be related to their efficiency and the efficacy of indigenous medicinal knowledge acquired over many years of such preparations. A paste seems to be the least common method of

Table 5
Toxicological profile of plants used for respiratory diseases.

Toxicological profile	No of plants	Names of the plant species
Safe or nontoxic $LC_{50} \geq 1000$ μg/ml $2000 \leq LD_{50} \geq 5000$ mg/kg body weight	56	[a]*Abelmoschus esculentus; Albizia amara; Albizia tanganyicensis; Aloe ferox;* [a]*Aloe vera; Aloe* spp.*; Annona stenophylla; Asparagus africanus; Burkea africana; Carissa edulis; Catunaregam spinosa;* [a]*Citrus limon; Chenopodium ambrosiodes;* [a]*Cucurbita pepo;* [a]*Datura stramonium; Dichrostachys cinerea; Dicoma anomala; Elaedendron matabelicum; Erythrina abyssinica;* [a]*Eucalyptus camaldulensis; Ficus ingens; Ficus thonningii; Flueggea virosa; Gardenia ternifolia; Gymnosporia senegalensis; Helichrysum caespititium; Heteropyxis natalensis; Holarrhena pubescens; Lippia javanica;* [a]*Mangifera indica; Margaritaria discoidea; Mentha longifolia;* [a]*Nicotiana tabacum; Parinari curatellifolia; Piliostigma thonningii; Pittosporum viridiflorum;* [a]*Psidium guajava; Psorospermum febrifugum;* [a]*Ricinus communis; Sclerocarya birrea; Searsia chirindensis; Searsia longipes; Searsia pyroides; Sida acuta; Solanum incanum; Stereospermum kunthianum; Strychnos potatorum; Strychnos spinosa; Syzygium cordatum; Syzigium guineense; Thunbergia oblongifolia; Urginea sanguinea; Vernonia adoensis; Vernonia amygdalina; Vigna unguiculata;* [a]*Zingiber offinale; Ziziphus mucronata;*
Weak or low toxicity or mildly toxic $500 \leq LC_{50} \geq 999$ μg/ml $1000 \leq LD_{50} \geq 2000$ mg/kg body weight	10	*Cassia abbreviata; Ficus sycomorus; Kalanchoe* spp.*; Lannea edulis;* [a]*Mentha spicata; Peltophorum angolensis; Rapanea melanophloeos; Searsia lancea; Tetradenia riparia; Turraea nilotica;*
Moderately toxic $250 \leq LC_{50} \geq 499$ μg/ml $300 \leq LD_{50} \geq 1000$ mg/kg body weight	9	*Artemisia afra; Flacourtia indica; Khaya anthotheca; Kigella africana; Nymphaea nouchali; Securidaca longipedunculata; Vangueria infausta; Warburgia salutaris;*
Toxic $50 \leq LD_{50} \geq 300$ mg/kg body weight	1	*Plumago zeylanica*
Highly toxic $LC_{50} \leq 249$ μg/ml $0 \leq LD_{50} \geq 50$ mg/kg body weight	18	*Alepidea amatymbica; Antidesma membranaceum; Azanza garckeana; Bauhinia fassoglensis; Bridelia micranatha; Bridellia mollis;* [a]*Capsicum* spp.*; Combretum zeyheri; Dalbergia melanoxylon; Euclea natalensis; Heteromorpha arborescens; Hexalobus monopetalus; Myrothamnus flabellifolius;* [a]*Nerium oleander; Rhamnus prinoides; Terminalia sericea; Trema orientalis; Zanha africana;*
No records found	66	*Acacia rehmannia; Acalypha petiolaris; Aeschynomene mimosifolia; Agathisanthemum bojeri; Albizia antunesiana; Alepidea cordifolia; Aloe excelsa; Aspilia pluriseta; Astripomoea malvacea; Barleria spinulosa; Bauhinia petersiana; Berchemia discolor; Brachystegia spiciformis; Carissa bispinosa; Chaetachme aristata; Clematis villosa; Clerodendrum eriophyllum; Coleochloa setifera; Combretum apiculatum; Combretum platypetalum; Cordyla africana; Crotalaria laburnifolia; Croton gratissimus; Lannea discolor; Diospyros lycioides; Diplolophium zambesianum; Diplorhynchus condylocarpon; Ectadiopsis oblongifolia; Ekerbergia benguelensis; Euphorbia ingens; Euphorbia matabelensis; Euclea crispa; Fadogia ancylantha; Faurea saligna; Garcinia huillensis; Gardenia resiniflua; Gardenia volkensii; Gnidia capitata; Gnidia kraussiana; Gomphocarpus glaucophyllus; Helichrysum kraussii; Indigofera* spp.*; Inula glomerata; Kirkia acuminata; Laggera crispata; Lopholaena coriifolia; Leucaena leucocephala; Leucas milanjiana; Loranthus* spp.*; Monadenium lugardiae; Mussaenda arcuata; Ocimum obovatum; Oxygonum sinuatum; Pavetta schumanniana; Pellaea* spp.*; Pericopsis angolensis; Phragmites mauritianus; Pterocarpus africanum; Spermacoce dibrachiata; Tabernaemontana elegans; Triumfetta welwitschii; Tulbaghia leucantha; Vangueriopsis lanciflora; Vitex payos; Xeroderris stuhlmanni; Xeromphis obovata; Zanthoxylum humile;*

[a] Exotic plants.

preparation for most respiratory diseases, possibly because of its intricacy in preparation. While it was possible to pick out how most of these ethno-medicines were prepared it was notable that some papers do not always intrinsically highlight the mode of preparation of the medicinal plants (Chigora et al., 2007; Viol, 2013; Chimponda and Mukanganyama, 2010; Maroyi, 2012a, 2018d; Dangarembizi et al., 2013; Mangoyi et al., 2014; Dzoyem et al., 2016; Neffati et al., 2017).

There are at least 12 common respiratory conditions in Zimbabwe which can be treated using plant based medicine. Fig. 5 below shows the relative frequency of plant solutions for each condition. Respiratory diseases with the highest ethno-medicinal solutions include colds > pneumonia > coughs > chest pains > asthma > tuberculosis.

It is interesting to note that while Zimbabwe is highly endemic of tuberculosis, a common killer disease, there seems to be a relatively high number of plant medicine solutions. While sinuses and sore throats are relatively common diseases in Zimbabwe, the information in Fig. 5 reveals that there are fewer herbal solutions for them. This profile of Zimbabwean medicinal plants therefore suggests that there are more herbal solutions for tuberculosis than there are for sinuses and sore throats. More investment in herbal medicine research for tuberculosis management and treatment may need to be emphasised.

3.5. Conservation status of medicinal plants traditionally used in the management of respiratory disorders in Zimbabwe

While availability of medicinal plants is pertinent, their conservation and sustainable use must also be kept in perspective. Most medicinal plant species traditionally used to manage respiratory diseases in Zimbabwe are categorised as Least Concern according to the IUCN Red data listings (Table 1; Golding, 2002). Two species, *A. amatymbica* Eckl. & Zeyh and *W. salutaris* (G. Bertol.) Chiov. belonging to the two families: Apiaceae and Canellaceae respectively are "Critically Endangered" (Golding, 2002; Maroyi, 2008; Semenya and Maroyi, 2019). Maroyi (2008) reported that *A. amatymbica* and *W. salutaris* were non-existent in the wild in Mutema Highlands and Engwe farm in the Eastern Highlands of Zimbabwe. The population loss is due to the destruction of their habitats by extensions of human settlements and agricultural practices that are not sensitive to biodiversity conservation (Maroyi, 2008). These two critically endangered medicinal plants have a limited distribution, only occurring in the Eastern part of Zimbabwe.

According to Mapaura and Timberlake (2004), *Dalbergia melanoxylon* Guill. & Perr. (Fabaceae) is categorised as "Near Threatened" (Golding, 2002) although it has a wide distribution throughout Zimbabwe. *Khaya anthotheca* (Welw.) C. DC. (Meliaceae) is "Vulnerable" and it occurs in the Northern, Central and Western areas of Zimbabwe. Special attention needs to be given to such threatened species for traditional medicinal plants to be harvested and exploited sustainably.

While it seems that plants stand as one of the critical sources for human health, several competing factors pose a threat to their existence. These include destructive collection of plant species by traditional healers/herbalists, forest decline, invasion by exotic species that compete, industrialization, increased spread of diseases and excessive use of agrochemicals (Hunter, 2007; Morris, 2010; FAO, 2015).

Benefits that can be derived from medicinal plants and herbs in Zimbabwe are diverse as has been highlighted in the illustrations above. Hence, there is a serious need to strike a balance between conservation and utilization of these medicinal plants (Rajasekharan and Ganeshan, 2002). There has been growing worry over the years some of the very

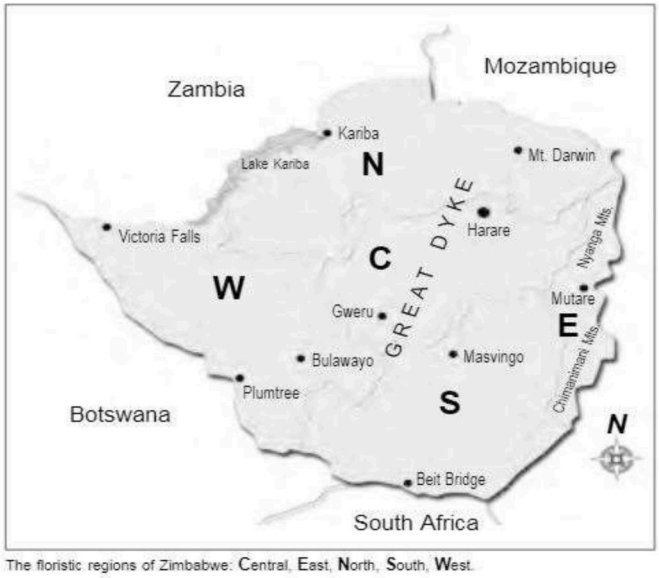

Fig. 2. General distribution of medicinal plants in different floristic regions of Zimbabwe (Source: Mapaura and Timberlake, 2004 p. 4 p. 4).

important plants, especially indigenous trees and herbs are almost going extinct due to agricultural expansion and human settlements (Maroyi, 2008). Moreover, the younger generations largely shun traditional knowledge systems due to increasing religious inclinations, which have resulted in many of the locals opting for the conventional medicines, thereby downplaying the wealth of resources in the form of affordable and locally obtainable trees and herbs that are locally available in Zimbabwe (Maroyi, 2012b, 2013a). Of commendable note, traditional leaders have been given authority to put in measures that protect some of the endangered medicinal species. One notable measure has been to arrest anyone found cutting down a tree without authority from the traditional leaders or Forestry Commission. Over the years, plant conservationists have made conscious efforts to protect and conserve medicinal plants and thus prevent their extinction. This has not been a straightforward programme due to many problems that militate against it. The alarming rate at which various plant species are removed from their natural habitats has been documented (Orji et al., 2013). However, in the fight for conservation, probably the single most important 'role' for medicinal plants in biological and ecological conservation stems

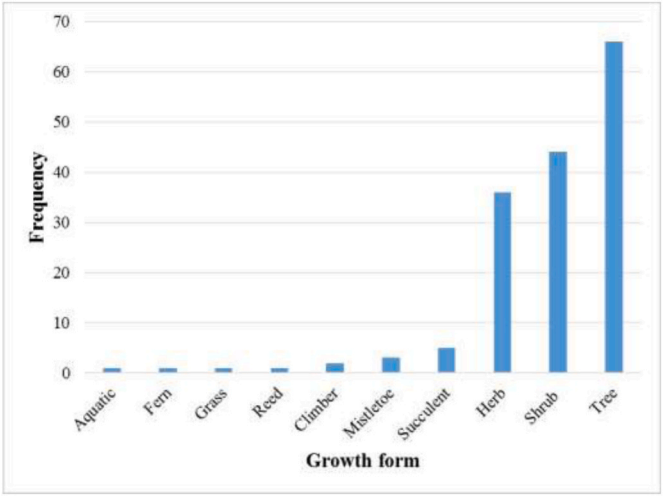

Fig. 3. Growth habit of medicinal plant species used for treatment of respiratory diseases in Zimbabwe.

from the foundations that they can provide for the involvement of people in conservation of natural habitats (Schopp-Guth and Fremuth, 2001).

Cultures around the world have developed methods on how to benefit from indigenous plants to maintain health and suppress illnesses for many centuries. These ethnically significant traditional medicinal plants are readily obtainable from an inexpensive and accessible healthcare system and are an essential basis of livelihood, mainly for indigenous and rural populations. While these indigenous medicinal plants have established growing commercial and scientific consideration in recent years, there is increasing pressure from which most of these medicinal plants are harvested. There is an ever-increasing risk of overharvesting, bio-prospecting for new sources, and destruction of the habitats of known medicinal plant species. It is estimated that every two years we lose at least one important potential drug. At present, nearly 15,000 medicinal plant species may be threatened with extinction worldwide. Hence, the conservation and study of indigenous medicinal plant species has turned out to be increasingly urgent.

There are various propagation techniques that are used in trees and herbs (Davies et al., 2017). These include: budding, grafting, air and ground layering, use of cuttings, suckers, corms, bulbs to mention but a few. Most propagation techniques have only been focusing on exotic fruit trees like mango, guava, litchi, apples, bananas and others (Davies et al., 2017), yet we have vast indigenous trees and herbs that are well adapted to the local environmental conditions and have been used by generations that have passed on. It is widely agreed that the conservation of medicinal plants and biodiversity in general can be achieved through an integrated approach balancing *in situ* and *ex situ* conservation strategies. In Zimbabwe, *in situ* conservation has been achieved both by setting aside areas as nature reserves and national parks (collectively termed "Protected Areas") and by ensuring that as many wild species as possible can continue to survive in managed habitats such as plantation forests. This is the best means of conservation to ensure that the populations of species of plants continue to grow and evolve in the wild or in their natural habitats. The conservation of the indigenous medicinal plant genetic resources has long been recognized as an integral part of biodiversity conservation. Traditionally, conservation of medicinal plants was regulated by management practices such as taboos, seasonal and social restrictions on harvesting of medicinal plants, which served to limit medicinal plant harvesting. Studies by Cunningham (1993) as well as Mavi and Shava (1997) done in Zimbabwe shows that other factors that limited pressure on the species from being overexploited included: restricted removal of the bark of a tree, sparing collection of roots for medicinal use and use of taboos to regulate over-harvesting. Literature reviewed showed that the traditional conservation measures of medicinal plants have not been well documented among local communities. This is due to the secretive nature of herbalists when it comes to their knowledge. However, these species are also conserved *ex situ*. The primary purpose of this is as an insurance policy, but it has the advantage that it is usually easier to supply plant material for propagation, for re-introduction, for agronomic improvement, for research and for education purposes from *ex situ* collection than from *in situ* reserves. Approaches to *ex situ* techniques involves; tissue culture or *in vitro* regeneration, cryopreservation of plant cells and meristems, low temperature germplasm storage, and seed storage models.

3.6. Economic value of commercially available important medicinal plants traditionally used in the management of respiratory disorders in Zimbabwe

Traditional herbal medicines offer an avenue for potential new drug discovery due to their untapped potential, vastness, diversity and inferred efficacy that has been generated through its use for centuries. The widespread use of medicinal plants, their extracts, formulations and chemicals derived from them, in different traditional and modern systems of medicine, nutraceuticals, cosmeceuticals and functional foods is

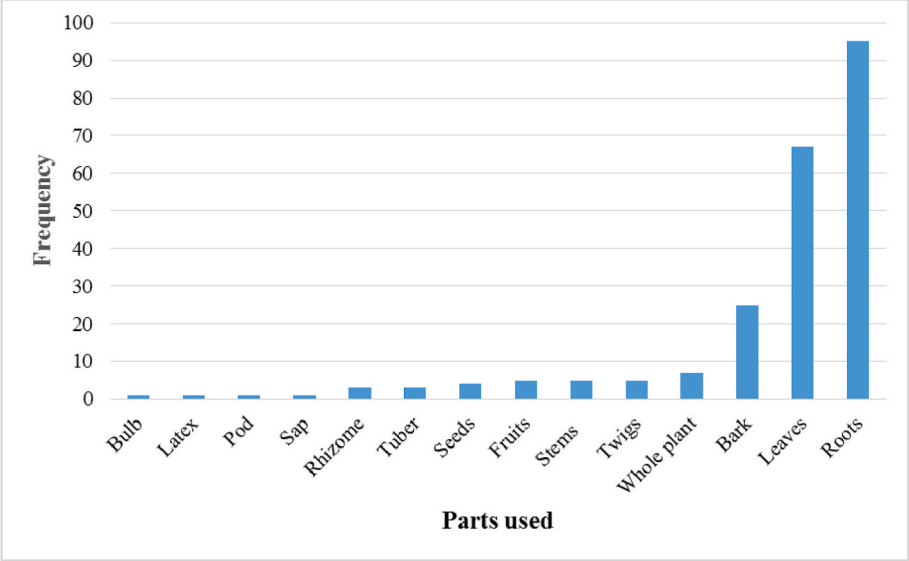

Fig. 4. Plant parts used for medicinal preparations used for the management of respiratory diseases in Zimbabwe.

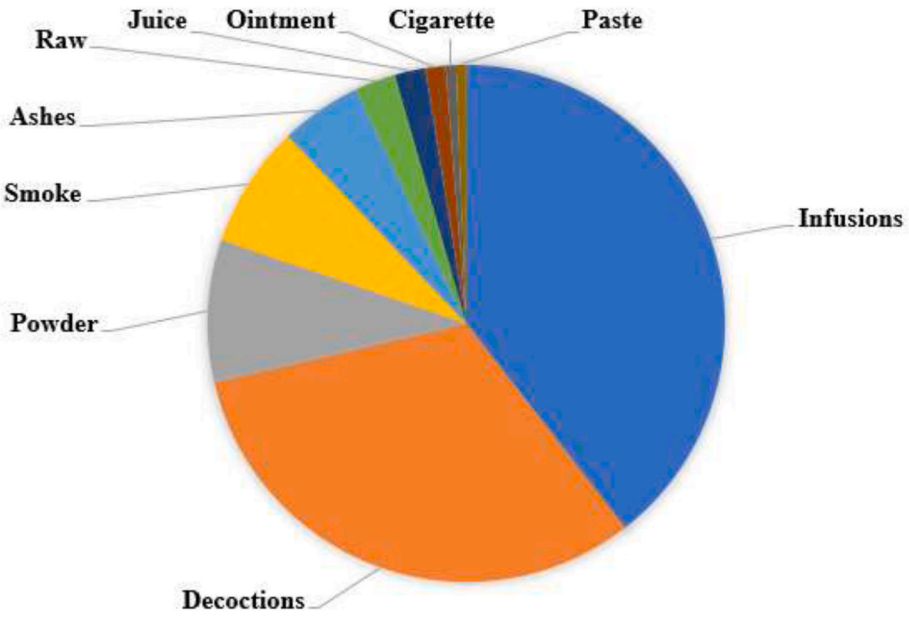

Fig. 5. Mode of preparation of plants used for the management of respiratory diseases in Zimbabwe.

increasing the demand for medicinal plants internationally. As more people realise the beneficial effects of herbal medicines, the demand for these medicinal plants has been increasing steadily (Bhebhe et al., 2015). The adoption of medicinal plants in everyday usage has also resulted in an increase in their economic value. Many people in the world, especially in developing countries, rely chiefly on herbal medicines, while others alternatively gain income from their wild harvest, trading or processing.

A 1995 analysis estimated that each new plant-derived drug is worth an average of US$94 million to drug companies and US$449 million to society (Mendelsohn and Balick, 1995 cited in Daily, 1997). Other estimates have reported sales ranging from US$1.5 to US$5.7 billion annually for non-prescription medicinal plants in the United States, and US$24.4 billion in sales worldwide. The reported market value of prescription and over-the-counter plant-based drugs in 1985 was US$19.8 billion in the United States, and US$84.3 billion worldwide (Pearce and Moran, 1994; Tuxhill, 1999). The annual value of the global export of the thousands of plants with suspected medicinal characteristics and properties was projected to be 2.2 billion USD in 2012 (Awuchi, 2019). In 2017, the potential global market for the botanical medicines and extracts was projected at several hundred billion US dollars; hence, this is an untapped resource (Awuchi, 2019).

The COVID-19 pandemic has opened up opportunities for herbal medicine producers to inevitably produce herbal medicines that have immunomodulatory properties. Its intended growth is supported by an increase in the focus on herbal products that offer relief in stress, support digestion and enhance immunity health with further increasing attention on personalized medicines and easily affordable and available herbal products. In the year 2020, with the ravaging COVID-19 pandemic, the global market for Herbal Medicines was about US $110.2 billion and is estimated to reach a revised size of US$178.4 billion by 2026, growing at a Compound Annual Growth Rate (CAGR) of 8.1%. Last year alone the Herbal Medicines market in the U.S. was estimated at US$22.8 billion accounting for an 18.4% share in the global

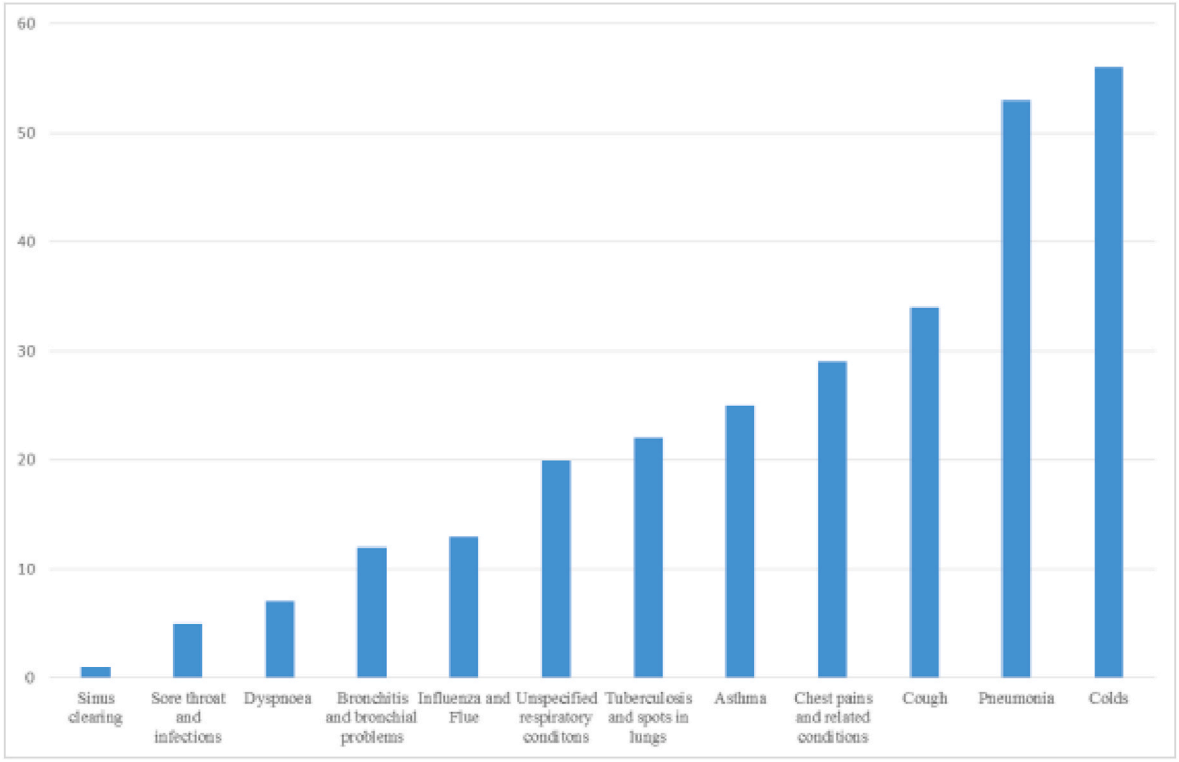

Fig. 6. Common respiratory diseases treated traditionally by medicinal plants in Zimbabwe.

market. China is estimated to reach a market size of US$32.9 billion by 2026. Canada and Japan geographic markets, each estimated to grow at 7.1% and 7.4% respectively. In Europe, Germany is estimated to grow at about 6.5% CAGR with the rest of the European market reaching a staggering US$35.8 billion. Continuous growth in these regions is increasing due to cultural and social use of herbal products and improved customer confidence in the efficacy and safety of herbal products (Research and Markets, 2022).

Therefore, if Zimbabwe fully exploits indigenous knowledge system-based medicinal plants, a multi-billion-dollar industry will be created from the sale and distribution of traditional herbal medicine across the globe thereby boosting the country's economy. Furthermore, we recommend that the government should establish plantations which will lead to sustainable harvest, uphold medicinal heritage and conservation of the medicinal plants as well as creation of manufacturing companies resulting in creation of employment, improvement of livelihoods and restoration of health of the general public.

3.7. Pharmacological properties of medicinal plants traditionally used in the management of respiratory disorders in Zimbabwe

Pharmacological properties which have been investigated on each of the 160 medicinal plants used in the management of respiratory conditions in Zimbabwe is shown in Tables 3 and 4 The properties profiled included antioxidant, anti-inflammatory, immuno-modulatory, analgesic, antiviral, anti-tussive, antimicrobial, bronchodilator, mast cell stabilizing, anti-allergic, antihistaminic and smooth muscle relaxant activities in medicinal plants as these have been reported to be key in the treatment of respiratory disorders (Younis et al., 2018). Out of all the plants found, 129 of them (80.6%) have been proven to exhibit pharmacological properties which aid in treating respiratory conditions (Table 4). Antioxidant, anti-inflammatory, antiviral and antimicrobial activities were the most common properties among these medicinal plants which suggests why these medicinal plants' traditional use in alleviating respiratory illnesses has been effective. Antimicrobial activity was the most evaluated property exhibited by 110 plants (85.3%), followed by antioxidant activity which was shown in 96 plants (74.4%), anti-inflammatory activity exhibited by 85 plants (65.9%), while antiviral activity demonstrated in 65 plants (50.4%). Fewer plants demonstrated immuno-modulatory properties (17 plants or 13.2%) and only 6 plants exhibited anti-asthmatic and anti-tussive properties (4.65%) (Table 4).

Noteworthy in the pharmacological evaluation studies explored were antiviral, anti-inflammatory, antioxidant and antimicrobial properties exhibited by some of the medicinal plants. These properties were identified to be present in 57 medicinal plants with 45 of them being of indigenous origin and 12 of exotic origin (Table 4). The potency of these 57 medicinal plants was wide as several of them were scientifically reported to exhibit antitussive, immunomodulatory, anti-mycobacterial and anti-asthmatic properties. Smooth muscle relaxation, mast cell stabilizing and bronchodilator properties were exclusive to a few, namely *Zingiber officinale* Roscoe, *Dichrostachys cinerea* (L.) Wight & Arn., *Datura stramonium* L. and *Ricinus communis* L. The traditional use of these 57 medicinal plants in ailments like Influenza, herpes simplex, HIV, pneumonia, tuberculosis and asthma therefore attribute much to their reported pharmacological properties (Tables 3 and 4). The effectiveness of such concoctions may be attributed to synergistic antioxidant, anti-inflammatory, antibacterial and antiviral properties of these medicinal fruits and herbs.

The recent review study by Cock and Van Vuuren (2020) found that of the 257 medicinal plants used in Southern African to treat viral respiratory diseases, only 22 (of these plants have been examined for antiviral activity reported in 9 studies only. However, in addition to the review by the former, this study found that 65 out of 160 plants used in Zimbabwe to manage respiratory diseases exhibited antiviral properties. Only 6 of these 65 plants were also described recently by Cock and Van Vuuren (2020). Thus, this study found 59 more plants with antiviral activity which were not described by the recent review by (Cock and Van Vuuren, 2020). This is evidence that there is still a wealth of knowledge on plant medicine that awaits to be unearthed. So far, there have been a

handful of ethno-botanical surveys of this nature carried out specifically for Zimbabwe. There is a growing need to unearth more of the Zimbabwean plant species.

3.8. Toxicological profile of medicinal plants traditionally used for the management of respiratory disorders in Zimbabwe

Of all the medicinal plants listed for respiratory conditions (Table 1), 94 species (58.75%) had toxicological evaluation studies documented, meanwhile, no studies were recorded for the remaining 66 species (41.25%) (Table 5). Among these 94 plants which had toxicological profiles, numerous toxicological activities were evaluated, such as effect of medicinal extracts on liver chang cells, cytotoxic activities on human monocyte cells, genotoxicity and anticancer properties among others. However, of all the toxicological evaluations, Brine Shrimp Lethality Test (BSLT) and rodent acute toxicity test were the most prominent among the studies. These two toxicity tests were common possibly because they give reasonably accurate results, are simple and cost-effective frontline indices on the safety of herbal extracts (Munodawafa et al., 2016). While approximately 59% of plants unveiled had their toxicity evaluated, it is concerning that toxicity of more than 40% of these plants which are already being used ethno-medicinally is still not known. There is a need to carry out toxicological screening on the remaining 41% of plants.

In BSLT, toxicity is classified based on herbal plant extract concentration that causes 50% mortality in brine shrimps (LC_{50}) and 50% mortality in mice/rats (LD_{50}) for rodent acute toxicity studies (Munodawafa et al., 2016; Erhabor et al., 2020) and these provide an early hint on the toxicity of plant extracts. Toxic extracts have been reported to elicit pharmacological activities at low non-toxic doses. For BSLT classification is highly toxic if the LC_{50} is less than 249 μg/mL, moderately toxic- 250 – 499 μg/mL, while values between 500 and 999 μg/mL are considered weak or low in toxicity and those ≥1000 μg/kg safe (Bussmann et al., 2011; Erhabor et al., 2020). Meanwhile, in rodent acute toxicity tests LD_{50} of: $0 \leq 50$ mg/kg body weight – was classified as highly toxic; $50 \leq 300$ mg/kg body weight - toxic; $300 \leq 1000$ mg/kg body weight - moderately toxic; $1000 \leq 2000$ mg/kg body weight – mildly toxic; and $2000 \leq 5000$ mg/kg body weight – non-toxic (Malebo et al., 2015). Therefore, of the 94 medicinal plants with toxicological profiles, 56 (59.57%) are regarded as safe/non-toxic; 10 plants (10.64%) are weak or low toxicity or mildly toxic; 9 plants (9.57%) are moderately toxic; 1 plant (1.06%) is toxic and 18 plants (19.15%) are highly toxic (Table 5). Variations in medicinal plants toxicity depend on dosage, type of phytochemical constituents (cardiac glycosides and tropane alkaloids), environmental exposure, mode of extraction, preparation and administration, solvent extraction (organic and non-organic solvents), tested animal species and other factors. To combat toxicity, herbalists use lower dosages, prolonged boiling of herbs, preparing mixtures with other plants, avoiding prescribing any herbal medicines to pregnant women and exercising caution in immunocompromised patients.

3.9. Recommendations for future research

While some mileage has been covered on available medicinal plants, more precise profiles on the specific distribution of medicinal plants may need to be carried out in Zimbabwe. This task may be achieved through use of location data from the plant specimens at the National Herbarium and Botanic Gardens (SRGH) or other herbaria housing Zimbabwean specimens. Ethnobotanical surveys need to be carried out in under-investigated areas as this might yield new information on traditional medicinal plants that have potential to curb and treat the emerging respiratory diseases. Local communities, organisations and institutions are encouraged to participate in the *ex situ* conservation of medicinal plants by establishing nurseries, herbal gardens and even estates. Natural product development of the 56 prioritised medicinal plants requires further toxicological evaluation tests and clinical research. COVID-19, a highly contagious viral respiratory disease, has symptoms that include dyspnoea, nasal congestion, fever, cough, chest pain, diarrhoea, throat and lung infections; complications of the disease may lead to kidney failure and severe respiratory distress. Preliminary reported activities exhibited by these 56 medicinal plants on viral and bacterial infectious respiratory diseases, symptomatic treatment and prophylaxis against COVID-19 and/or any future infectious respiratory diseases is thus recommended.

4. Conclusions

Zimbabwe is a vast repository of medicinal plants which can be used to manage or treat respiratory ailments. So far there are 58 families of medicinal plants with 160 species used to treat respiratory diseases in Zimbabwe. Fabaceae family is the most predominant plant for managing respiratory conditions. A total of 12 different respiratory illnesses have been reported to be treatable by these medicinal plants in Zimbabwe with coughs > pneumonia > coughs > chest pains > asthma and tuberculosis being the most treatable. There has been a gradual increase in scientific research output on the plants found in Zimbabwe and used to treat respiratory conditions. Both indigenous and exotic plant species found have been documented to be in use in Zimbabwe for the management of human diseases. The conservation status of most medicinal plant species traditionally used to manage respiratory diseases in Zimbabwe are categorised as least concern. However, only two species, *A. amatymbica* and *W. salutaris* are classified as Critically Endangered. A total of 44 indigenous and 12 exotic medicinal plant species have been identified from this review as candidate targets for further toxicological evaluations and clinical research in terms of their potential to manage COVID-19 and other respiratory conditions.

Authors' contributions

Elliot Nyagumbo and Michael Bhebhe collated the paper, coordinated the cohesion of information into a manuscript and created an active voice on the manuscript. William Pote was responsible for the design of the manuscript and conceived the idea of carrying out the study. Elliot Nyagumbo, Cephas Mawere, Ian Mutasa, Emmanuel Kademeteme, Bridgett Shopo, and Ruvimbo J. Mapaya undertook the literature review on ethnobotanical surveys and distribution of medicinal plants and assisted in writing the manuscript. Trust Nyirenda and Elliot Nyagumbo carried out the literature review on pharmacological and toxicological evaluation of the medicinal plants and assisted in writing the manuscript. Ignatius Chagonda and Ruvimbo J. Mapaya, undertook the literature review on conservation status and economic status of the medicinal plants and assisted in writing the manuscript. Alfred Maroyi, Fabian Maunganidze, Tafadzwa Taderera and William N. Mavengere verified the consistency of the information in literature reviewed, assisted in analysing and revised the manuscript providing important perspectives.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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