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Plants used in Traditional Chinese Medicine (TCM) for the treatment of Covid-19 in 2020: A synoptic review

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Abstract

Since December 2019, the world has experienced an unprecedented pandemic due to COVID-19 viral infection, but little information has been reported on the plants that have contributed to its management. In this study, we report on medicinal plants used in China to combat this pandemic, some of which may be found in Congolese traditional medicine. The compilation of different articles reported in different search engines made it possible to collect different information on the medicinal plants used during this crisis in China. 45 plants were listed in 9 recipes. These plants, most of which are Asteraceae and of which *Glycyrrhiza uralensis* Fisch (Fabaceae) [Jing Jie or (Zhi) Gan Cao] is the most cited, are used at several stages of covid-19 and have several pharmacological activities, the most frequent of which are anti-inflammatory (71%), antioxidant (55.6%) and immunomodulatory (33.3%). This study shows that several plants used in traditional Chinese medicine have made it possible to manage covid-19 in China and show serious indications of subsequent anti-covid-19 therapeutic potential. This Chinese experience should inspire other non-conventional medicines in the fight against new pathologies.

Keywords: SARS-Cov-2; TCM; Plants; *Glycyrrhiza uralensis*

1. Introduction

The rapid spread of COVID-19 has affected 99.3% of countries worldwide, with nearly 800 million confirmed cases and a mortality rate close to 10%. In China, 81,601 cases were officially reported [1], with a recorded mortality rate of 0.3% [2]. However, these figures have been questioned by several countries, citing concerns over the transparency of China's communication during the pandemic. In the Democratic Republic of Congo (DRC), as of October 7, 2022, a total of 92,893 cases had been recorded, including 1,443 deaths, reflecting a mortality rate higher than the global average [3].

The most common clinical manifestations of this pathology include fever, cough, fatigue, sputum production, shortness of breath, as well as pharyngeal pain and headaches. Additionally, some patients have exhibited gastrointestinal symptoms such as diarrhea (3.8%) and vomiting (5.0%) [4,5]. Elderly individuals and those with comorbidities—hypertension, chronic obstructive pulmonary disease, diabetes, and cardiovascular diseases—frequently progress to acute respiratory distress syndrome, often accompanied by septic shock, difficult-to-correct metabolic acidosis, and coagulation disorders that may result in fatal outcomes [6].

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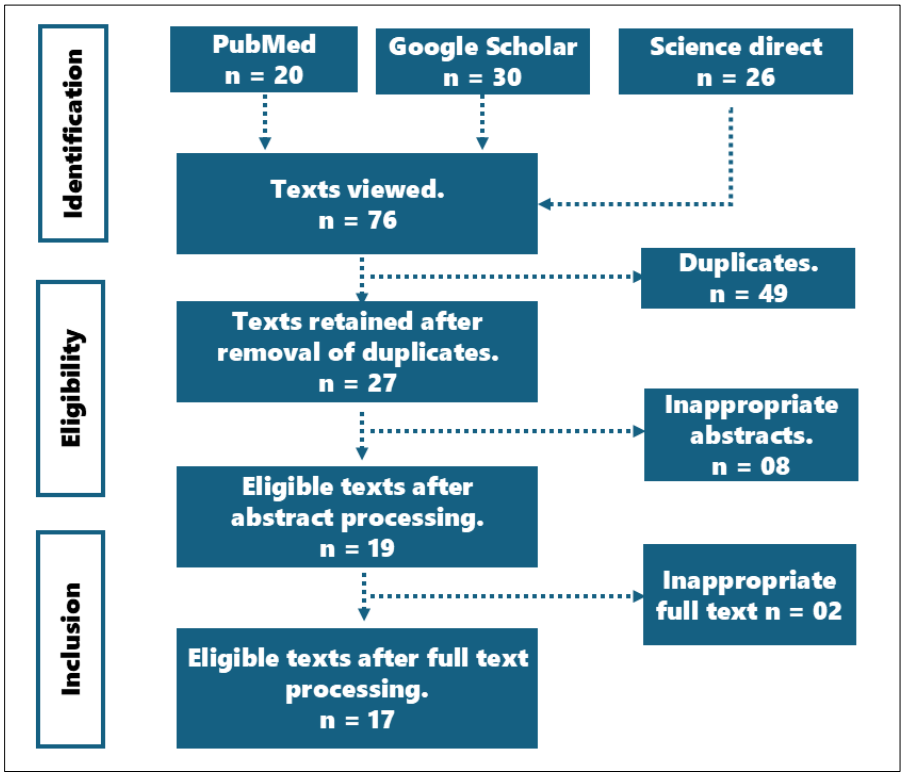
In response to the pandemic, several traditional medicine remedies have been spontaneously proposed for the treatment of respiratory conditions. Among them, the decoction of garlic (*Allium sativum* L., Liliaceae) in Tunisia, whose antiviral properties had been previously demonstrated [7,8], and the infusion of basil (*Ocimum basilicum* L., Lamiaceae) in Algeria, which also exhibits antiviral properties [9,10]. However, to date, no study has conclusively confirmed their efficacy against COVID-19 or their actual use in the treatment of this infection.

In Côte d'Ivoire, some plants were reported as symptomatic for Covid-19, such as *Acacia nilotica* (L.) Delile, *Azadirachta indica* A. Juss , *Zingiber officinale* Roscoe, and, *Citrus limon* L [11]. *Eucalyptus globulus* Labill, *Thymus vulgaris* L, and *Ptychotis verticillata* Duby were the most frequently mentioned plants against Covid-19 in Algeria [12], and Morocco [13]. A study in Ethiopia found that 111 medicinal plants that are used locally for the treatment of viral diseases [14] could be used as an alternative to Covid-19. In addition, a literature review identified 17 plants with potential anti-Covid-19 activity in Nigerian traditional medicine [15].

Among all available data on anti-COVID-19 phytotherapy, the plants used in the Chinese pharmacopoeia appear to be the most extensively studied, particularly regarding their clinical outcomes. Given the relevance of integrating phytotherapy into local pharmacopoeias, it seems appropriate to draw inspiration from the model of Traditional Chinese Medicine. Consequently, conducting a bibliographic review of studies published in 2020 on medicinal plants used in China for COVID-19 treatment was deemed necessary.

2. Methodology

This study was conducted between January 2020 and February 2021 and is a retrospective, descriptive, cross-sectional analysis. The bibliographic review was made possible through the following scientific databases: PubMed, ScienceDirect and Google Scholar. The documents selected for the review were retrieved using the following keywords: Medicinal plant, COVID-19, Traditional Chinese Medicine (TCM). The articles obtained were then examined at three levels: title, abstract and full text. Some texts were excluded due to language accessibility constraints if they were written in an inaccessible language. The PRISMA diagram below illustrates the document selection process (Figure 1).



The inventoried plant species were standardized using the following databases: Plants of the World Online (https://powo.science.kew.org/) and The World Flora Online (http://www.worldfloraonline). The Pinyin names were formatted in accordance with the 2016 edition of the Chinese Pharmacopoeia.

Figure 1 PRISMA diagrams for selecting bibliographic review documents.

3. Results and Discussion

3.1. Recipes and herbs used to treat covid-19 in TCM.

Table 1 Recipes used in China to treat Covid-19 and indications.

NPM	Botanical names of plants (families) [nom mandarin] (Mandarin name)	ICOVID-19	Source
Baihe Gujin Tang	*Angelica sinensis* (Oliv.) Diels (Apiaceae) [Dang Gui] *Fritillariae Thunbergii* Miq. (Liliaceae) [Zhe Bei Mu] *Glycyrrhiza uralensis* Fisch (Fabaceae) [Gan Cao] *Lilium lancifolium* Thunb. (Liliaceae) [Bai He] *Ophiopogon japonicus* (Thunb.) Ker-Gawl. (Asparagaceae) [Mai Men Dong] *Paeonia lactiflora* Pall. (Paeoniaceae) [Bai Shao Yao] *Platycodon grandiflorus* (Jacq.) A. DC. (Campanulaceae) [Jié Gěng] *Rehmannia glutinosa* (Gaertn.) DC. (Orobanchaceae) [Di Huang] *Rehmannia glutinosa* Libosch. (Orobanchaceae) [Shu Di Huang] *Scrophularia ningpoensis* Hemsl. (Scrophulariaceae) [Xuan Shen]	APS Anti-cancer drugs PSA MPOC	[16–18]
Gan Cao Gan Jiang Tang	*Glycyrrhiza uralensis* Fisch (Fabaceae) [Gan Cao] *Zingiber officinalis* Roscoe (Zingiberaceae) [Gan Jiang]	APS Lung wash FPA	[18,19]
Ma Xin Shigan Tang	*Ephedra Sinica* Stapf (Ephedraceae) [Ma Huang] *Glycyrrhiza uralensis* Fisch (Fabaceae) [Gan Cao] *Prunus dulcis* [Mill.] D. A. Webb. (Rosaceae) [Xing Ren]	APS	[16]
Qingfei Touxie fu zheng	*Coix lacrymajobi var. ma-yuen* (Rom.Caill.) Stapf *Cryptotympana pustulata* Fabricius *Curcuma longa* L. *Ephedra sinica* Stapf *Forsythia suspensa* (Thunb.) Vahl *Glycyrrhiza uralensis* Fisch. ex DC.*Gypsum Fibrosum* *Lonicera japonica* Thunb. *Paeonia lactiflora* Pall. *Phragmites australis* (Cav.) Trin. ex Steud *Prunus armeniaca* L *Pseudostellaria heterophylla* (Miq.) Pax *Reynoutria japonica* Houtt *Scutellariae radix* [Huangqin]	Moderate and severe lung disease	[20–22]
Qingfei Paidu	*Agastache rugosa* Fisch. & C.A.Mey.) Kuntze (Lamiaceae) [Huo Xiang] *Alisma orientalis (Sam.) Juzep.* (Alismataceae) [Ze Xie] *Asarum sieboldii* Miq. (Aristolochiaceae) [Xi Xin] *Aster tataricus* L. f. (Compositae). [Zi Wan] *Atractylodis macrocephala* Koidz (Asteraceae) [Bai Zhu] *Bupleurum chinense* DC. (Apiaceae) [Chai Hu] *Cinnamomum cassia* (L.) J.Presl (Lauraceae) [Gui Zhi]	APM and APS Covid-19 Prevention	[22–24]

NPM	Botanical names of plants (families) [nom mandarin] (Mandarin name)	ICOVID-19	Source
	Citrus × aurantium L. (Rutaceae) [Zhi Shi] *Dioscorea opposita* Thunb. (Dioscoreaceae) [Shan Yao] *Dipsacus inermis* Wall. (Caprifoliaceae) [Huang Qin] *Ephedra Sinica* Stapf (Ephedraceae) [Ma Huang] *Glycyrrhiza uralensis* Fisch (Fabaceae) [Zhi Gan Cao] *Gypsum fibrosum* L [Sheng Shi Gao] *Iris domestica* (L.) Goldblatt & Mabb.(Iridaceae) [She Gan] *Pericarpium citri reticulata* Viride (Rutaceae) [Chen Pi] *Pinellia ternata* (Thub.) Breit. (Araceae) [Jiang Ban Xia] *Polyporus umbellatus* (Pers.) Fr. (Polyporaceae) [Zhu Ling] *Prunus dulcis* [Mill.] D. A. Webb. (Rosaceae) [Xing Ren] *Tussilago farfara* L. (Asteraceae) [Kuan Dong Hua] Wolfiporia extensa (Peck) (Polyporaceae) [Fu Ling] *Zingiberis Recens* Willd. Rosc (Zingiberaceae)[Sheng Jiang]		
Sang Ju Yin	*Chrysanthemum × morifolium* (Ramat.) Hemsl. (Asteraceae) [Ju Hua] *Forsythia suspensa* (Thunb.) Vahl (Oleaceae) [Pin Yin] *Morus alba* L (Moraceae) [Sang Ye] *Prunus amygdalus* Batsch (Rosaceae) [Xing Ren]	APM Acute bronchitis, cough, mild fever	[16,25,26]
Shuang Huang Lian	*Forsythia suspensa* (Thunb.) Vahl (Oleaceae) [Pin Yin] *Lonicera japonica* Thunb. (Caprifoliaceae) [Jin Yin Hua] *Scutellaria baicalensis* Georgi [Lamiaceae] [Huang Qin]	APA	[27,28]
Yin Qiao San	*Arctii fructus* L (astéraceae) [Niu Bang Zi] *Fructus forsythiae* (Thunb.) Vahl Oleaceae [Lian Qiao] *Glycine max* (L.) Merr. (Fabaceae) [Dan Dou Chi] *Glycyrrhiza uralensis* Fisch (Fabaceae) [Jing Jie] Lonicerae flos DC. (Caprifoliaceae) [Jin Yin Hua] *Lophatherum gracile* Brongn. (Poaceae) [Dan Zhu Ye] *Mentha haplocalycis* Briq (Labiatae) [Bo he] *Platycodon Grandiflorum* (Jacq.) A. DC. (Campanulaceae) [Jie Geng] *Rhizoma Phragmitis* Trin. (Poaceae) [Lu Gen]	APM Immunomodulator Antiviral activity Antipyretic	[16,29–31]
Yu Ping Feng San	*Astragalus mongholicus* Bunge (Fabaceae) [Huang Qi] *Atractylodes macrocephala* Koidz. (Asteraceae) [Bai Zhu] *Saposhnikovia divaricata* (Turcz. ex Ledeb.) Schischk. (Apiaceae) [Fang Feng]	PAP Respiratory tract infections, bronchitis Immunodeficiency Immunomodulator Antiviral activity	[26,32,33]

Legend, ICOVID-19: ; indication in Covid-19 disorders; APF: acute pulmonary fibrosis; COPD: chronic obstructive pulmonary disease; APS: advanced stage pulmonary disease; APA: acute pulmonary disease; APM : medium lung disease cov-19; Almond= almond tree, Licorice= gan cao, White peony: bai shao yao; lily:Bai He, zhi gan Cao : Gan Cao, Xing ren : Ku xing ren (Semen Armeniacae Amarum) ; Cinnamomi Cassiae = *Ramulus Cinnamomi*, Polyporus Sclerotium= *Polyporus Umbellatus* ; *Belamcanda chinensis* (L.)= *Iris domestica* (L.) Goldblatt & Mabb. Scutellaria radix= *Scutellaria baicalensis* Georgi [Lamiaceae], *Astragalus mongholicus* Bunge [Fabaceae] = *Astragalus membranaceus*, Saposhnikovia divaricata (Turcz. ex Ledeb.) Schischk. [Apiaceae] = *Saposhnikovia divaricata* Turcz, Sang Ye= Mulberry, *Prunus amygdalus* Batsch [Rosaceae] = *Prunus dulcis*, Fructus forsythiae= *Forsythia suspensa* (Thunb.) Vahl [Oleaceae], *Radix platycodi* = Platycodon Grandiflorum, *Dioscorea japonica* Thunb= Dioscoreae Rhizoma = *Dioscorea opposita* Thunb.

Among the plants reportedly used in TCM, 9 anti-covid-19 formulas were listed, each containing at least two plants, making a total of 45 plants inventoried in this literature review. The Qingfei Paidu formula is the most complex with 21 plants (Table 1).

Of the 9 recipes identified in this literature review, two are found in the Chinese pharmacopoeia, Sang Ju Yin and Yu Ping Feng San, where they are used in the management of respiratory ailments caused by bad wind (Table1), and three have no previous application (Ma Xin Shigan Tang, Qingfei Touxie fu zheng, and Qingfei Paidu), suggesting that they were prepared primarily for covid-19. The composition of one recipe, Qingfei Touxie fu zheng, is not reported in any other accessible source. According to a report by the National Administration of Traditional Chinese Medicine, Qingfei Paidu showed the most promising clinical results, with 90% of cases showing remission of signs of infection [24]. However, some scientists express reservations about the efficacy of these recipes, criticizing the methodological approaches used to report the results [34].

It is nevertheless crucial to highlight the risks associated with the concurrent use of multiple medicinal plants in traditional Chinese medicine formulations for COVID-19. Such combinations pose a significant danger of accumulating the toxic effects inherent to each individual plant, ultimately compromising the patient's health. Therefore, conducting comprehensive clinical studies to assess the specific efficacy of each plant would be advisable. This approach would help minimize the risk of exposure of vital organs to potentially harmful substances and ensure a safer and more effective therapeutic strategy.

These 45 plants belong to 27 families, dominated by the Asteraceae with 4 occurrences (Figure 2). *Glycyrrhiza uralensis* Fisch (Fabaceae) [Jing Jie or (Zhi) Gan Cao], with 4 occurrences, is the most widely used plant. It is followed by 4 others, each with 2 hits: *Atractylodis macrocephala* Koidz (Asteraceae) [Bai Zhu], *Forsythia suspense* (Thumb.) Vahl [Pin Yin], *Platycodon grandiflorus* (Jacq.) A. DC. (Campanulaceae) [Jié Gěng] and *Prunus dulcis* [Mill.] D. A. Webb. (Rosaceae) [Xing Ren].

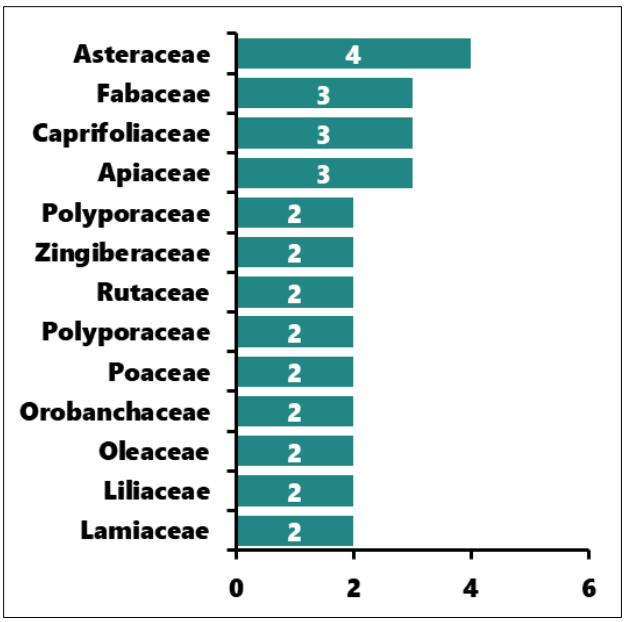


Figure 2 Botanical families with at least two species.

3.2. Pharmacological activities related to covid-19 of 45 listed plants.

The 45 plants identified in this study showed 14 activities potentially involved in the management of covid-19 symptoms, of which anti-inflammatory (71%), antioxidant (55.6%), and immunomodulatory (33.3%) activities were the most frequently reported (Figure 3).

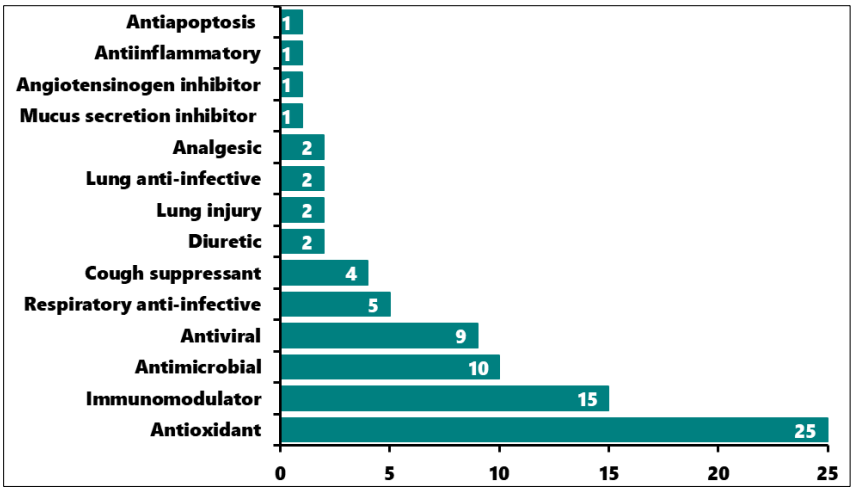


Figure 3 Distribution of the plants (n = 45) according to their biological activity**.**

All 45 plants display at least two of the 14 activities indirectly involved in the management of covid-19, and *Glycyrrhiza uralensis* Fisch (Fabaceae) [Jing Jie or (Zhi) Gan Cao] has the highest number of these activities, with 6 pharmacological activities reported (Table 2).

Table 2 Pharmacological properties that justify the choice of plants in anti-covid-19 formulas.

Species	**Indication in a covid-19 sign**	**Source**
Agastache rugosa Fisch. & C.A.Mey.) Kuntze (Lamiaceae) [Huo Xiang]	Antiviral as HIV-1 protease inhibitor Pulmonary anti-inflammatory Antimicrobial Immunomodulator	[35,36] [37] [38] [39]
Alisma orientalis (Sam.) Juzep. (Alismataceae) [Ze Xie]	Anti-inflammatory & antioxidant Antiviral inhibitor of picormavirus Promotes urinary excretion	[40,41] [42] [43,44]
Angelica sinensis (Oliv.) Diels (Apiaceae) [Dang Gui]	Immunomodulator, anti-inflammatory and antioxidant	[45,46]
Arctii fructus L (astéraceae) [Niu Bang Zi]	Anti-inflammatory for throat and other respiratory conditions	[47,48]
Asarum sieboldii Miq. (Aristolochiaceae) [Xi Xin]	Cough suppressant	[49,50]
Aster tataricus L. f. (Compositae). [Zi Wan]	Anti-lung lesions in murine model Anti-inflammatory	[51,52] [53,54]
Astragalus mongholicus Bunge (Fabaceae) [Huang Qi]	Against respiratory ailments	[55,56]
Atractylodes macrocephala Koidz. (Asteraceae) [Bai Zhu]x2	Antiinflammatory, antioxydant	[57–59]
Bupleurum chinense DC. (Apiaceae) [Chai Hu]	Immunomodulator Preventive effect on nasal inflammation	[60,61] [62,63]
Chrysanthemum × morifolium (Ramat.) Hemsl. (Asteraceae) [Ju Hua]	Antibacterial activity Anti-inflammatory, antioxidant	[64] [65]
Cinnamomum cassia (L.) J.Presl (Lauraceae) [Gui Zhi]	Anti-inflammatory, analgesic, antibacterial and antiviral immunostimulant	[66,67] [68]

Species	Indication in a covid-19 sign	Source
Citrus × aurantium L. (Rutaceae) [Zhi Shi]	Anti-inflammatory, antioxidant, immunomodulator	[69,70]
Dioscorea opposita Thunb. (Dioscoreaceae) [Shan Yao]	Immunomodulator, antioxidant	[71] [72]
Dipsacus inermis Wall. (Caprifoliaceae) [Huang Qin]	Modulator of inflammation	[73]
Ephedra Sinica Stapf (Ephedraceae) [Ma Huang]x2	Anti-inflammatory	[74]
Forsythia suspensa (Thunb.) Vahl (Oleaceae) [Pin Yin]x2	Anti-inflammatory, antioxidant, antibacterial, antiviral	[75]
Fritillariae thunbergii Miq. (Liliaceae) [Zhe Bei Mu]	Antioxidant, anti-inflammatory, cough suppressant	[76]
Fructus forsythiae (Thunb.) Vahl Oleaceae [Lian Qiao]	Activity against viral pneumonia Anti-inflammatory	[77] [78]
Glycine max (L.) Merr. (Fabaceae) [Dan Dou Chi]	Antioxidant, antimicrobial	[79]
Glycyrrhiza uralensis Fisch (Fabaceae) [Jing Jie ou (Zhi) Gan Cao]x4	Anti-inflammatory Angiotensinogen inhibitor Immunostimulant, antimicrobial Lung detoxification, diuretic	[80] [81] [82] [83]
Gypsum fibrosum L [Sheng Shi Gao]	Purifying the body	[84]
I*ris domestica* (L.) Goldblatt & Mabb.(Iridaceae) [She Gan]	Anti-inflammatory, antioxidant	[85]
Lilium lancifolium Thunb. (Liliaceae) [Bai He]	Immunomodulator	[86]
Lonicera japonica Thunb. (Caprifoliaceae) [Jin Yin Hua]	Antioxidant	[87]
Lonicerae flos DC. (Caprifoliaceae) [Jin Yin Hua]	Anti-inflammatory, anti-infectious	[88]
Lophatherum gracile Brongn. (Poaceae) [Dan Zhu Ye]	Pulmonary antiviral Immunomodulator	[88] [89,90]
Mentha haplocalycis Briq (Labiatae) [Bo he]	Antioxidant Antiviral	[91] [92]
Morus alba L (Moraceae) [Sang Ye]	Antioxidant, anti-inflammatory, antimicrobial, immunomodulator	[93,94]
Ophiopogon japonicus (Thunb.) Ker-Gawl. (Asparagaceae) [Mai Men Dong]	Anti-inflammatory, antioxidant, antimicrobial, immunomodulator	[95]
Paeonia lactiflora Pall. (Paeoniaceae) [Bai Shao Yao]	Antioxidant, antiviral, anti-inflammatory antimicrobial	[96]
Pericarpium citri reticulata Viride (Rutaceae) [Chen Pi]	Antioxidant Anti-respiratory infections	[97]
Pinellia ternata (Thub.) Breit. (Araceae) [Jiang Ban Xia]	Antioxidant Inhibits mucus secretion and inflammation	[98] [99,100]
Platycodon grandiflorus (Jacq.) A. DC. (Campanulaceae) [Jié Gěng]x2	Antioxidant, anti-inflammatory, cough suppressant Antiapoptotic	[101]

Species	Indication in a covid-19 sign	Source
Polyporus umbellatus (Pers.) Fr. (Polyporaceae) [Zhu Ling]	Antioxidant, immunomodulator	[102]
Prunus amygdalus Batsch (Rosaceae) [Xing Ren]	Antioxidant, immunomodulator	[103]
Prunus dulcis [Mill.] D. A. Webb. (Rosaceae) [Xing Ren]x2	Antimicrobial Antioxidant	[104]
Rehmannia glutinosa (Gaertn.) DC. (Orobanchaceae) [Shu Di Huang]	Antioxidant, immunomodulator	[105]
Rehmannia japonica (Thunb.) Makino ex T.Yamaz. (Orobanchaceae) [Sheng Di Huang]	Antioxidant	[106]
Phragmitis rhizoma Trin. (Poaceae) [Lu Gen]	Anti-inflammatory Immunomodulator	[107]
Saposhnikovia divaricata (Turcz. ex Ledeb.) Schischk. (Apiaceae) [Fang Feng]	Anti-inflammatory, analgesic, antioxidant, immunomodulator	[108]
Scrophularia ningpoensis Hemsl. (Scrophulariaceae) [Xuan Shen]	Anti-inflammatory	[109]
Scutellaria baicalensis Georgi [Lamiaceae] [Huang Qin]	Anti-inflammatory, anti-pulmonary lesions	[110]
Tussilago farfara L. (Asteraceae) [Kuan Dong Hua]	Antioxidant Anti-inflammatory, cough suppressant	[111]
Wolfiporia extensa (Peck) (Polyporaceae) [Fu Ling]	Antioxidant	[112]
Zingiber officinalis Roscoe (Zingiberaceae) [Gan Jiang]	Antioxidant and anti-inflammatory antiviral	[113]
Zingiberis Recens Willd. Rosc (Zingiberaceae) [Sheng Jiang]	Anti-inflammatory	[114]

Several factors may explain the selection of plants with anti-inflammatory, antioxidant, and immunomodulatory properties in the management of COVID-19 in traditional Chinese medicine. Indeed, during COVID-19 infection, patients have exhibited markedly exacerbated oxidative stress, partly due to the overproduction of cytokines, as observed in most respiratory diseases [115]. This oxidative stress may contribute to worsening the clinical condition of patients. The administration of high doses of antioxidants, such as vitamin C, has been suggested as a possible means to mitigate this effect [116,117]. Therefore, it is understandable that many of the plants used against COVID-19, including more than half of the species examined in this study, possess antioxidant potential.

Moreover, it has been reported that pathogenic T lymphocytes and inflammatory monocytes contribute to an inflammatory storm in patients with severe forms of COVID-19[118]. Consequently, it has been suggested that antivirals should be combined with anti-inflammatory agents—excluding non-steroidal anti-inflammatory drugs: NSAIDs [119]—for the management of this disease [120]. This approach may explain the predominant presence of anti-inflammatory plants in the formulations documented in this study.

Furthermore, COVID-19, like other coronavirus-induced diseases, is known to trigger an increase in certain T-helper 1 (Th1) cells as well as inflammatory cytokines and chemokines, including interleukins IL-1 and IL-6, CCL2 protein, and CXCL10 protein. In the absence of approved antiviral treatments or an effective vaccine, substances with immunomodulatory properties may help inhibit inflammatory cytokines and Th1 cells, or alternatively promote an anti-inflammatory and/or Th2 immune response, thereby mitigating symptoms and disease severity [121]. Consequently, the immunomodulatory plants identified in this study (Figure 2) could represent a valuable asset in managing the COVID-19 pandemic.

Few of the plant species inventoried in this study are reported in the literature as having antiviral activity (Figure 2), and none have demonstrated unequivocal in vivo efficacy against COVID-19 [34]. However, the various documented

biological properties of each species, as identified in this research, suggest that these plants may play a role in the symptomatic management of COVID-19 and contribute to the clinical stabilization of co-infected patients.

Data on the toxicity of these plants remain limited; however, a Chinese report states that these species are recommended, as they have not been associated with toxic manifestations during previous use [122]. Moreover, most of these plants exhibit hepatoprotective properties. Although these treatments have been successfully employed in the management of COVID-19 in China, it remains essential to conduct comprehensive toxicological studies to assess their limitations and determine optimal conditions for their use.

4. Conclusion

Various plant species have been used in combination for the management of COVID-19 infection in China. Among them, the most complex formulation, consisting of 21 species and considered the most effective, is Qingfei Paidu. *Glycyrrhiza uralensis* Fisch (Fabaceae) appears to be the most frequently utilized species, exhibiting the highest frequency of pharmacological activities related to respiratory conditions. These plants warrant further investigation through clinical trials to assess their specific contribution to COVID-19 treatment. Their use could also serve as inspiration for the pharmacopoeias of other countries, encouraging the development of therapeutic formulations aimed at combating this emerging pandemic. Thus, this study highlights the potential of Traditional Chinese Medicine (TCM) in developing anti-COVID-19 treatments that could be utilized in various regions worldwide.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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