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Research Article

PhytoResp : A Database for Medicinal Plants of Darjeeling, Against Respiratory Ailments

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Abstract

PhytoResp is a digital, manually curated database developed at the Department of Botany, University of North Bengal (NBU). The database has been created with the help of 200 published research articles and the eleven volumes of 'Chiranjib Banousadhi' series, written by Shibakali Bhattacharya. Here, we provide the names of 329 medicinal plants that are available in the Darjeeling district region of North Bengal and are traditionally used in the treatment of respiratory diseases. The list of reported plants is included, along with their parts used. They are known to cure 38 respiratory diseases. Among these, 113 plants have already been reported as a cure for COVID-19 (in silico or in vivo). Also, we have taken a step to evaluate the efficiency of the phytocompounds through in-silico methods.

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Introduction

In last few years, the world experienced an unprecedented pandemic called COVID-19. According to WHO, the pandemic took 6,850,594 lives and 757,264,511 positive cases were reported worldwide, as of 21st February 2023 (https://covid19.who.int). It has been experienced that the people who had comorbidity, especially respiratory problems, were particularly vulnerable to COVID-19 pandemic (Beltramo et al., 2021).

One of the main causes of respiratory problems is viral infection. Mainly upper respiratory tract infections such as Common cold is a large burden on society, economically and socially. The most common causative viruses are rhinovirus, influenza virus, adenovirus, enterovirus, and respiratory syncytial virus (Thomas and Bomar, 2022). Moreover, in a study conducted by Beltramo et al. (2021) on whether patients with chronic respiratory diseases (CRDs) had a higher risk of COVID-19 than that of patients with influenza, it was concluded that patients with prior respiratory diseases were globally at higher risk of developing severe COVID-19. They also had a higher mortality rate (except for asthma) when compared with patients who had COVID-19 but did not have prior CRDs or influenza. On the other hand, patients who survived COVID-19 may develop respiratory complications ranging from persistent symptoms and radiologically observable changes to impaired respiratory physiology, vascular complications, and pulmonary fibrosis (Al-Jahdhami et al., 2022).

In cases of respiratory viral infection, no effective medicines are available so far except for symptom relief (Thomas and Bomar, 2022). Herbal drugs on the other hand showed promise in giving relief to respiratory ailments and have been recommended in such conditions related to COVID-19 (Pranskuniene et al., 2022). As a result, more and more researchers are tilting towards phytocompounds as a remedy to such problems. Ayurvedic herbal remedies have also been reported as therapeutic adjuvants in the management of COVID-19 (Borse et al., 2021).

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It is in this context, we, at University of North Bengal decided to create a database which will provide valuable information on the plants, as well as their constituent compounds, that are essentially effective against respiratory diseases. North Bengal is a biodiversity hotspot and University of North Bengal plays significant role in conservation of a number of these plants (Chowdhury et al., 2019). Traditionally, several of these locally available plants are used in treatment of various respiratory diseases (Moktan and Rai, 2019; Panda and Thami, 2022).

In our study, we aim to explore the traditional knowledge on medicinal plants found in the Darjeeling district of West Bengal to find a side-effect free solution to post-COVID respiratory complications. Our study brought into focus a list of 329 medicinal plants and their phytocompounds that may have potential in treatment such complication. Based on this knowledge we developed PhytoResp: a digital, manually curated database which has been created with the help from 200 published research articles and the book series Chiranjib Banousadhi (Vol. 1-11) by Shibakali Bhattacharya. In our database, we tried to document as many of these plants as possible.

Materials and Methods

Tools and databases

Google sites: *Google Sites* is a structured wiki and web page creation tool included as part of the free, web-based Google Docs Editors suite offered by Google (https://sites.google.com/).

Google Scholar: Google Scholar is a freely accessible web search engine that indexes the full text or metadata of scholarly literature across an array of publishing formats and disciplines (http://scholar.google.com/).

Dr. Duke's Phytochemical and Ethnobotanical databases: The database facilitate in-depth plant, chemical, bioactivity, and ethnobotany searches using scientific or common names. (https://phytochem.nal.usda.gov/phytochem/search)

Tropicos: Tropicos is an online botanical database containing taxonomic information on plants, mainly from the Neotropical realm. It is maintained by the Missouri Botanical Garden and was established over 25 years ago (https://www.tropicos.org/).

Plant of the World Online: It delivers information on the taxonomy, identification, images, distribution, traits, threat status, molecular phylogenies and uses of vascular plants worldwide. The data are sourced from the Royal Botanic Gardens, Kew as well as its partners and collaborators (https://powo.science.kew.org/).

e-Flora of India: e-Flora of India is an open-access online database of India's plant diversity to document over 18,000 flowering plant species of India. This portal makes the information in the Flora of India volumes published by BSI available in the digital format (https://efloraofindia.com/).

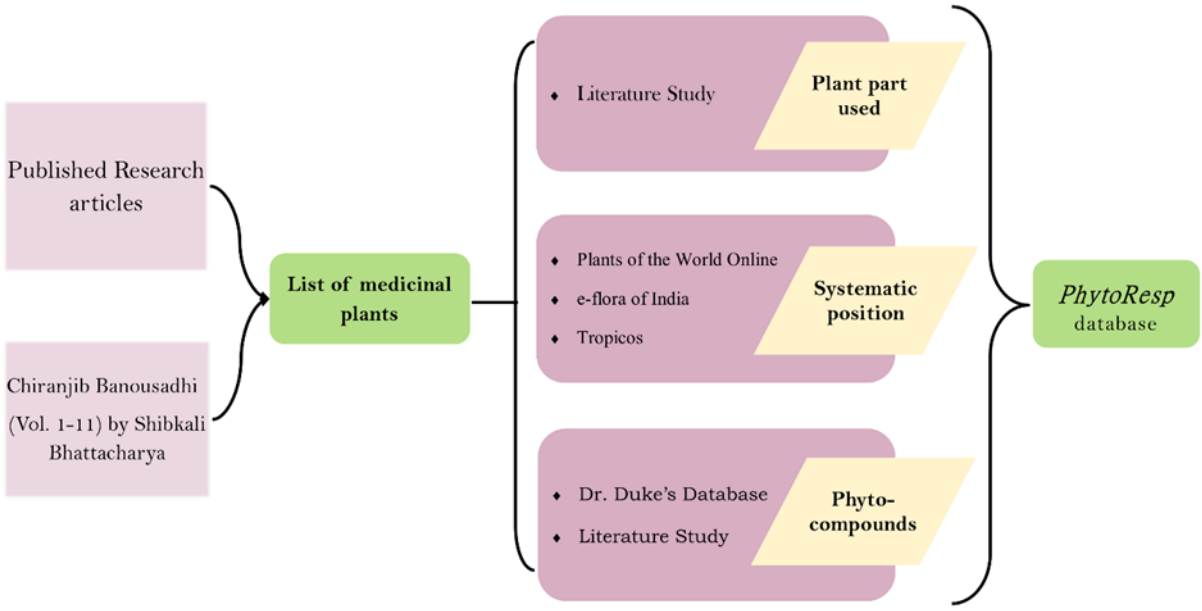

Fig. 1 Schematic overview of the PhytoResp database construction.

Curated list of Traditionally used Medicinal plants in Darjeeling region

The list of plants that are traditionally used against respiratory diseases, and are found in Darjeeling district of West Bengal were compiled through literature study of available research articles from this region and from the book series Chiranjib Bonousadhi (Vol. 1-11) by Shibkali Bhattacharya. Literature search was conducted through *Google sites* with the keywords: respiratory disorders, Darjeeling, cough, cold, fever, traditionally used plants, etc.

After compiling a comprehensive list of all the plants, we mined literature to gather information regarding the various respiratory diseases they are used against and the plant part that is used (Fig. 1).

Taxonomy of the listed plants

The database has a page dedicated to each listed plant that contains the respiratory disease it is used against, the plant part used, the systemic position of the plant, picture and the list of constituent phytocompounds. The databases: Plants of the World Online, e-flora of India and Tropicos were consulted regarding the systemic position and accepted scientific names of the plants. Photographs of the plants were used from Tropicos and Plants of the World Online with proper citation. The data was further validated by Prof. Manoranjan Chowdhury, Department of Botany, University of North Bengal.

Phytochemical composition of the plants

Next the phytochemical constituents of the listed plants were determined. Initially the plants were searched in the Dr. Duke's Phytochemical and Ethnobotanical databases for the list of constituent phytocompounds of each plant. For the plants that were not available in the database, their constituent phytocompounds were determined through literature study. Available research articles were mined through Google scholar and list of the phytocompounds were created manually.

Online Database development

The database has been developed on the *Google Sites* platform. We used the computational languages: CSS, Python and HTML to design the website. The database main page consists of the following interfaces:

PhytoResp: Introduction to our group members who have been instrumental in developing the database.

Home: The homepage provides an idea regarding the significance of our focus on respiratory disorders. It also describes how medicinal plants may have a role in management of respiratory disorders. The page also contains a tutorial on browsing the database.

Browse: Displays an alphabetic list of all the plants that have been studied. Each plant name opens to a page consisting the details and phytocompound list of the plant.

Contact us: Contact information of corresponding author and institute details.

Results and Discussion

Curated list of medicinally used plant

In the beginning of the database construction, we compiled a comprehensive list of 329 medicinal plants of Darjeeling region with the help from 200 published research articles and the 11 volumes of Chiranjib Bonousadhi. These plants belong to 109 different families with the highest number belonging to Fabaceae (23 plants), followed by Asteraceae (13 plants). The top 15 plant families are shown in **Fig. 2**. The plants were reported to be used against 38 respiratory diseases. From the data it was seen that a large number (119) of the plants are being used in treatment of cough (**Fig. 3**). The research articles also reported plants used against bronchitis, tuberculosis, sinusitis, asthma, etc. From our analysis it was also determined that in most cases the administered plant parts are the leaves of the plants (24.5%), followed by root (15.5%) and fruit (14.5%) (**Fig. 4**).

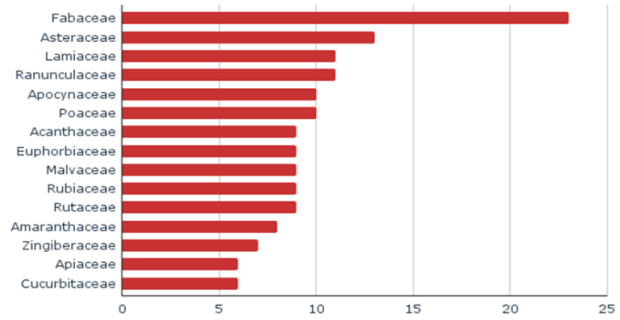

Fig. 2 Top 15 families on the basis of number of plants in our database that belong to them.

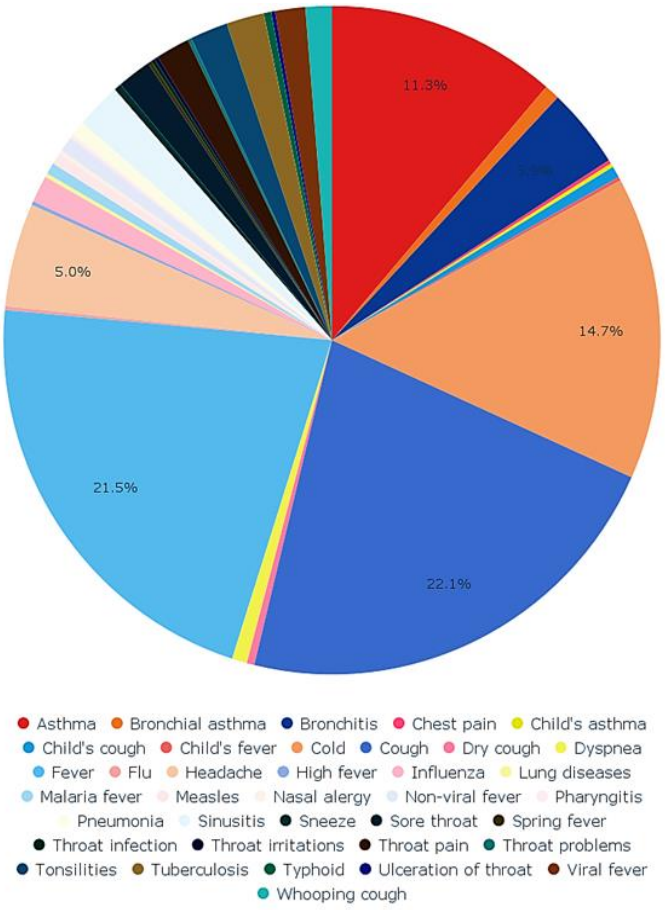

Fig. 3 Chart representing the diseases against which the plants are reported.

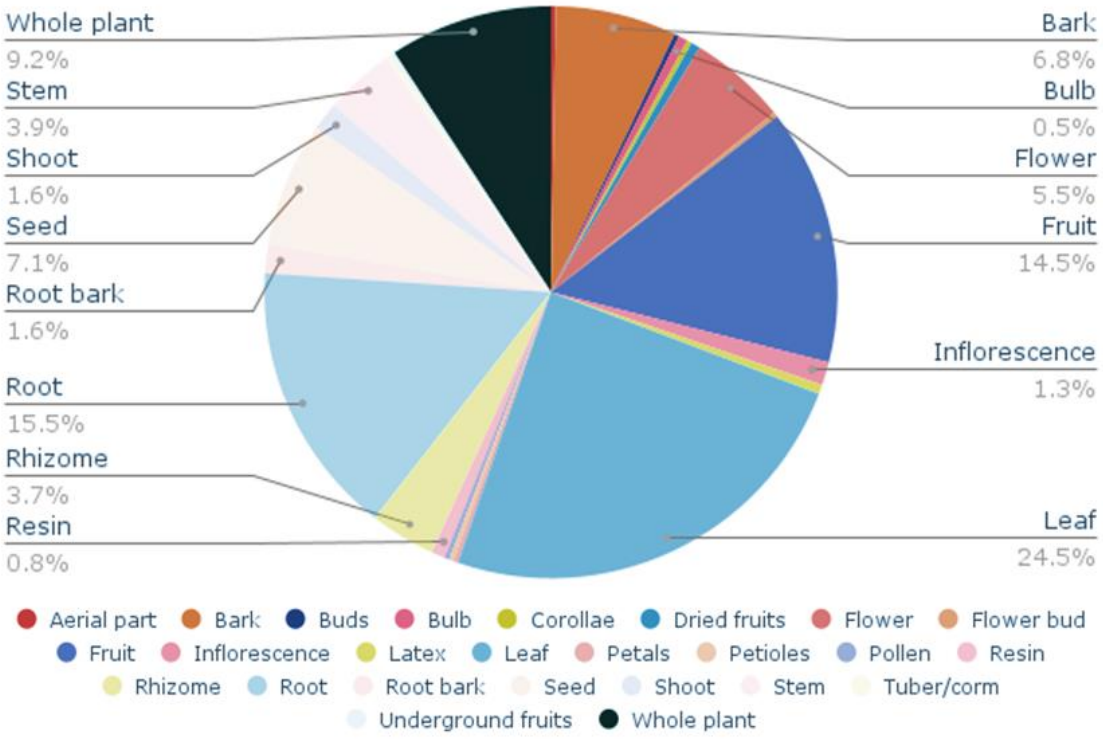

Fig. 4 Chart representing the plant part used in treatment of respiratory diseases.

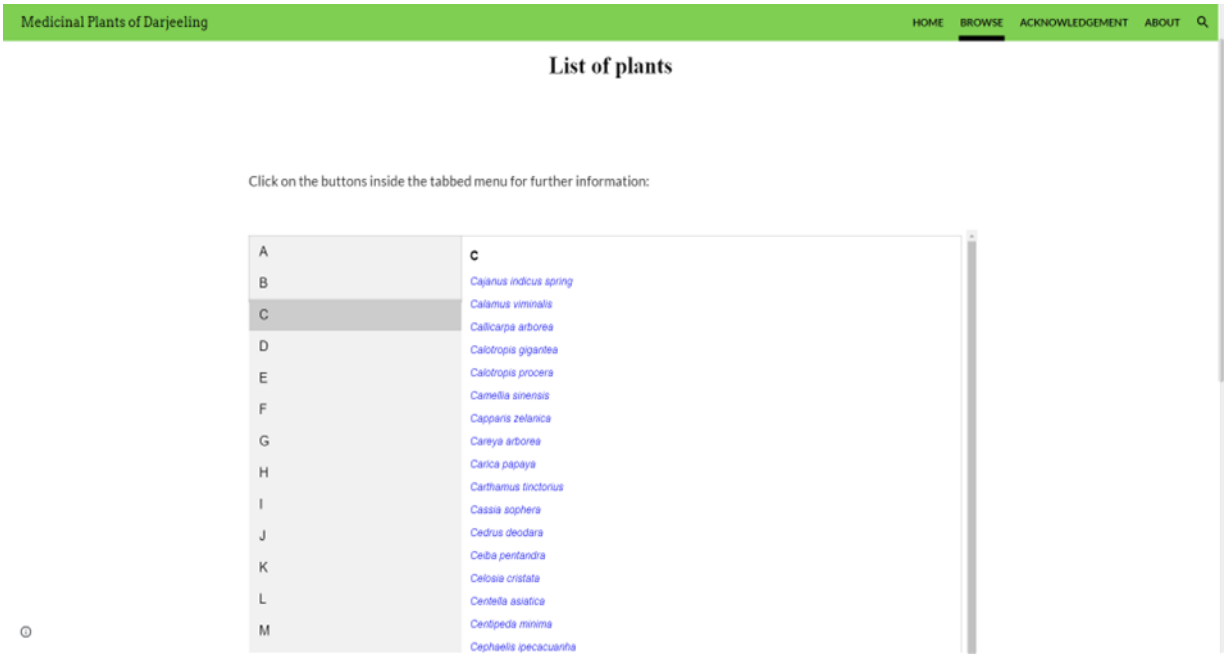

Fig. 5 Snapshot of Browse page of PhytoResp showing list of plants in the database.

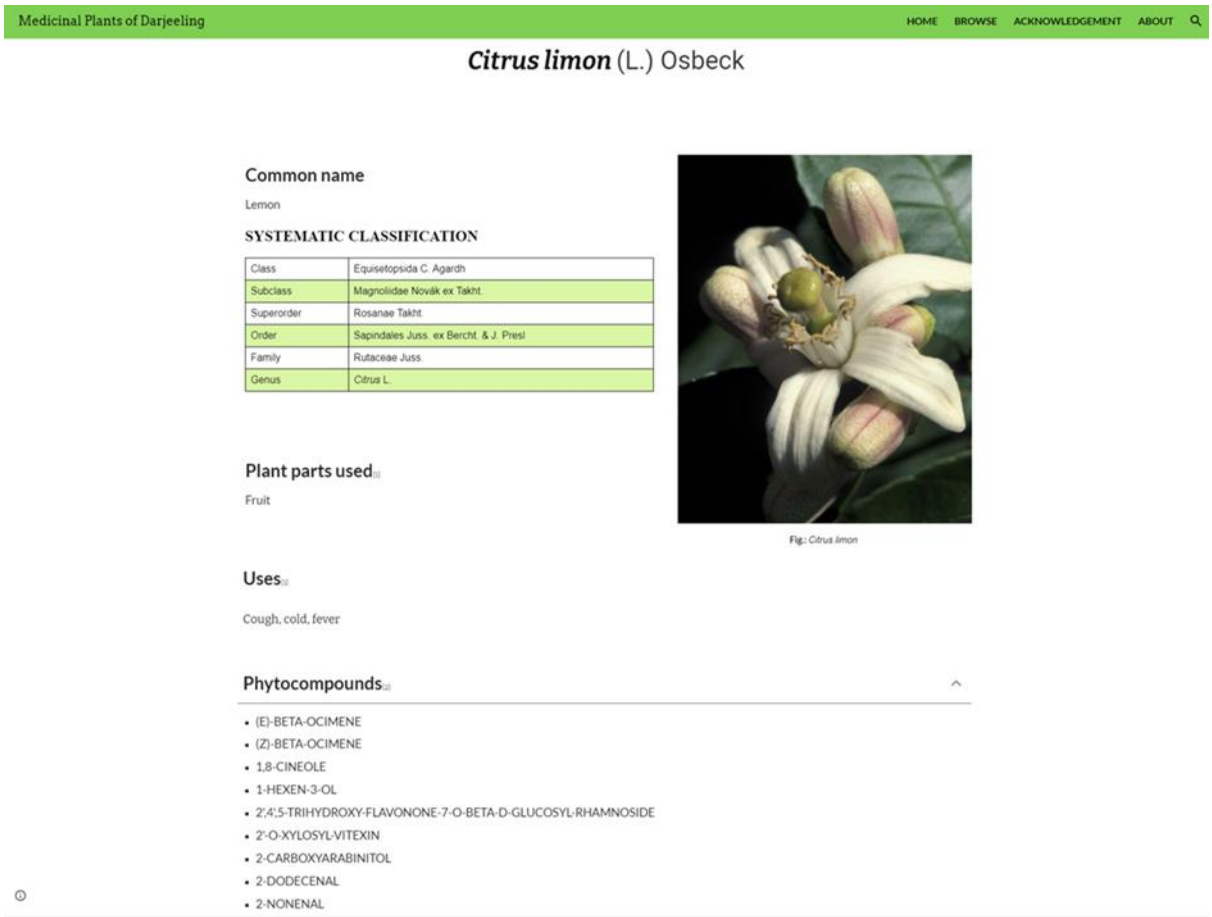

Fig. 6 Snapshot of a page of one of the plants in PhytoResp showing its common name, systematic classification, plant part used, disease treated and list of constituent phytocompounds.

Phytocompounds associated with the plants

The online database constitutes 329 plants, each of which has a webpage dedicated to them (Fig.5). The constituent phytocompounds of all these plants are included in our study. Phytoconstitients of plants have played a role in human health from time immemorial (Dillard and German, 2000). Thus, exploration of the constituents of the studied plants will give an insight into their mechanism of action in treatment of respiratory diseases.

The list of constituent phytocompounds of 108 plants available in Dr. Duke's Phytochemical and Ethnobotanical databases were downloaded. The phytoconstituents of the remaining plants were obtained through literature study. However, articles regarding constituent phytochemicals of some plants were not available.

The available phytocompounds of each plant are listed in the webpage of the respective plants (Fig. 6). The details regarding the phytocompounds will be further added in the database.

Plants in treatment of SARS-CoV-2

Out of the 329 listed plants, 113 are already validated to have therapeutic efficacy against SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2), that emerged as a serious human pathogen in late 2019 (Muralidar et al., 2020). The plants were manually searched for their efficacy against SARS-CoV-2. Rest of the traditionally used plants may also have such potential. Thus, proper exploration of the therapeutic efficacy of these plants is needed.

Conclusion

It has been experienced that the people who had chronic respiratory problems were particularly vulnerable to COVID-19 pandemic. Moreover, survivors of the pandemic experienced long-term complications of COVID-19 pneumonia and the main treatment for such respiratory complications is still symptomatic and supportive-care oriented. In this database, we provide the names of 329 medicinal plants found in the Darjeeling district of West Bengal, as well as their parts used, which are known to cure 38 respiratory diseases in Darjeeling region. Among these 329 plants, 113 plants are already reported as a cure to COVID-19 (in silico or in vivo). As a future prospect, we have taken a step to evaluate the efficiency of the remaining plants in treatment of post-COVID respiratory complication through in silico methods.

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Authors' Contribution

AS conceived the idea. AS and SD designed the experiment. AD, AB, and SD executed the study. AD and AB constructed the database. All the authors contributed equally in drafting the manuscript.

Conflict of Interest

No potential conflict of interest was reported by the authors.

References

Muralidar, S., Ambi, S.V., Sekaran, S. and Krishnan, U.M., 2020. The emergence of COVID-19 as a global pandemic: Understanding the epidemiology, immune response and potential therapeutic targets of SARS-CoV-2. Biochimie, 179, pp.85-100.

Dillard, C.J. and German, J.B., 2000. Phytochemicals: nutraceuticals and human health. Journal of the Science of Food and Agriculture, 80(12), pp.1744-1756.

Thomas, M., Bomar, P.A., 2022. Upper Respiratory Tract Infection. [Updated 2022 Jun 27]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing https://www.ncbi.nlm.nih.gov/books/NBK532961/

Pranskuniene, Z., Balciunaite, R., Simaitiene, Z. and Bernatoniene, J., 2022. Herbal medicine uses for respiratory system disorders and possible trends in new herbal medicinal recipes during COVID-19 in pasvalys district, Lithuania. International Journal of Environmental Research and Public Health, 19(15), p.8905.

Borse, S., Joshi, M., Saggam, A., Bhat, V., Walia, S., Marathe, A., Sagar, S., Chavan-Gautam, P., Girme, A., Hingorani, L. and Tillu, G., 2021. Ayurveda botanicals in COVID-19 management: An in silico multi-target approach. Plos one, 16(6), p.e0248479.

Beltramo, G., Cottenet, J., Mariet, A.S., Georges, M., Piroth, L., Tubert-Bitter, P., Bonniaud, P. and Quantin, C., 2021. Chronic respiratory diseases are predictors of severe outcome in COVID-19 hospitalised patients: a nationwide study. European Respiratory Journal, 58(6).

Chowdhury, M., Pal, A., Mondal, S., Paul, P., Basak, M., Chettri, D. and Chowdhury, R., 2019. Conservation of germplasm and role of Centre for Conservation & Utilization of Medicinal and Aromatic Plant of NBU, West Bengal, India. NBU Journal of Plant Sciences 11, pp. 32-84.

Moktan, S. and Rai, P., 2019. Ethnobotanical approach against respiratory related diseases and disorders in Darjeeling region of Eastern Himalaya. NeBIO 10(2), pp. 99-105.

Panda, S. and Thami, J.K., 2022. An ethnomedicinal field survey report on traditionally used plants by the Nepalese of Alubari Jungle Busty in Darjeeling Himalaya as potential immunity booster and fever-related herbal drugs. Indian Journal of Traditional Knowledge (IJTK), 21(1), pp.157-167.

Al-Jahdhami, I., Al-Naamani, K., Al-Mawali, A. and Bennji, S.M., 2022. Respiratory complications after COVID-19. Oman medical journal, 37(1), p.e343.