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Ethnomedicinal Study of Plants as a Traditional Medicine on Respiratory System Disease in Cilongok, Banyumas, Indonesia

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ABSTRACT

Indonesia is one of the most geologically complex regions globally which makes it one of the greatest of the world's biodiversity centers. But the primary data on medicinal plants in Indonesia is still lacking. Cilongok is a district in Banyumas located on the slope of Slamet mountain. It is one of the biodiversity areas in Java, Indonesia. Respiratory System Disease has become one of the top ten diseases in Banyumas Indonesia. This study aimed to explore information about the type of medicinal plants used for respiratory system disease and how to process it in Cilongok District, Banyumas Regency, Central Java. This study was descriptive survey research with semi-structured interviews of 68 informants. Data were qualitatively analyzed by interpreting the interview transcript and quantitatively to calculate the Species Use Value of those medicinal plants. The result showed that in Cilongok District, there were 40 medicinal plant species from 25 families used as traditional medicine in respiratory system disease and pounded as the most used method of preparation. *Citrus aurantiifolia* (Christm.) Swingle is the most used medicinal plant with SUV were 0.235, followed by *Amomum compactum* Sol. ex Maton (SUV 0.206), *Zingiber officinale* Roscoe (SUV 0.176), *Kaempferia galanga* L (SUV 0.176), and *Zingiber officinale* var Rubrum (SUV 0.147).
Keywords: Ethnomedicine; traditional medicine; respiratory; Banyumas

INTRODUCTION

Indonesia is one of the most geologically complex regions globally which makes it one of the greatest of the world's biodiversity centers (Sodhi *et al*. 2004). Indonesia is home to about 30.000 plant species that have the potential for pharmaceutical research (Elfahmi *et al*., 2014). Most Indonesian plants are used as a traditional medicine to treat many diseases. The use of plants as traditional medicine is undocumented and poorly integrated into primary healthcare in Indonesia. Even so, the Indonesian community still applied it. Documentation of traditional medicine in Indonesia constitutes an important step in preserving the local traditions and improving access to and participation in improving community health conditions. Documentation of traditional medicine could facilitate future research on the safety and efficacy of medicinal plants. It could provide a starting point for identifying single chemical entities, which could lead to the development of standardized phytomedicines.

The chronic respiratory disease becomes a major cause of morbidity and mortality. It is reported that this disease ranks fourth most cause of death globally, and it is predicted that it will change to third rank next year (Global Initiative for Chronic Obstructive Lung Disease, 2018).

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Respiratory System Disease has become one of the top ten diseases in Banyumas Indonesia. In 2014, there were 12,951 Acute Respiratory Tract Infection cases, 727 pharyngitis cases, and 566 asthma cases in Banyumas. Cilongok is a district in Banyumas that is located on the slope of Slamet mountain, and it is one of the biodiversity areas in Java, Indonesia. About 60% of its area are state-owned forest and farm. There are so many medicinal plants that grow well in this area. However, there are only two community health centers in this sub-district, and Limited physicians, besides geographical conditions make the community in this sub-district use plants as medicine to treat various diseases.

So far, there is no study has been conducted in Cilongok sub-district on traditional's healer's use of the medicinal plant for respiratory system diseases. This study aimed to collect comprehensive data from traditional healers on medicinal plant-based remedies commonly used to treat respiratory system diseases to document their methods of preparation and administration. In this study, the species used value was determined to know the importance of each medicinal plant.

METHODOLOGY

Study area

This explorative study was conducted in Cilongok sub-district, Banyumas regency, Central Java, Java island, Indonesia. It covers an area of

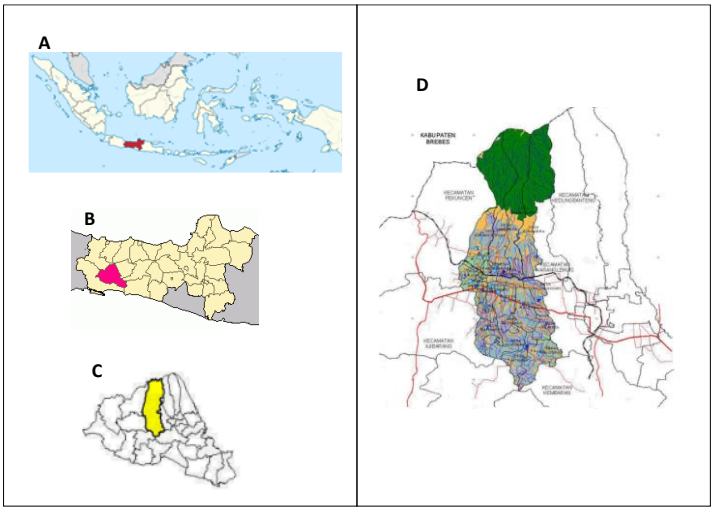

Figure 1. Maps of the study area; (A) Indonesia; (B) Central Java Province; (C) Banyumas Regency; (D) Cilongok

105.34 km2 and makes this sub-district the largest sub-district in Banyumas regency. The area is bordered by Pemalang regency in the north, Purwojati subdistrict in the south, Karanglewas subdistrict in the east, and Ajibarang subdistrict in the west (Figure 1). This area has poorly developed infrastructure. About 30% of its area is forest, and 25% is a plantation. The population is 115.819. The people belong to the Javanese, and the main language spoken is the Javanese language. The communities are well known for their traditional beliefs and use of plants for primary healthcare and are located near Slamet mountain.

Data collection

Ethnopharmacology fieldwork for this explorative study was conducted from November 2018-January 2019. The protocol of this study was approved by the Ethical Commission of Faculty of Medicine Universitas Jenderal Soedirman (Ref: 318/KEPK/XII/2018). A total of 68 traditional healers were interviewed. Data was collected through a survey employing open-ended semi-structured interviews with all informants providing information on biodata and medicinal plant used to treat respiratory system diseases. All traditional healers involved in this research were selected by purposive sampling technique (Jumiarni and Komalasari 2017). The inclusion criteria resided in the studied area, have the knowledge of the use of plants in traditional medicine, and are willing to be involved in this study. The semi-structured interviews have been analyzed, and responses grouped into classes expressing similar ideas. The information collected from the informants were demographic data (ethnicity, gender, age, education, job) and utilization of medicinal plants data (local name, plant organ used, preparation method, and source of knowledge). The interviews were supplemented by direct observation. Plants mentioned during interviews were photographed and collected under the supervision of the informants. Plant names have been checked and updated with the online website (www.theplantlist.org).

Data analysis

The use-value; a quantitative method that demonstrates the relative importance of species known locally, was calculated according to the following formula:

$$UV = \Sigma U/N,$$

Where UV refers to the Use Value of a species; U to the number of citations per species; and N to the number of informants (Faruque *et al*. 2018; Ferreira *et al*. 2009).

RESULTS AND DISCUSSION

Socio-demographic details of respondents

All traditional healers belong to the Javanese ethnic (table I). They comprised 17.65 % men and 83.35 % women and were between the age of 30 and 70 (the majority were between 40 and 70 years old). The healers had little formal education (mostly up to the primary level only). The informants in this study were dominated by the female gender (85.35%), with the age group spread from 21 to 94 years. Based on the level of education, most informants have no formal education (58.82%). The source of the informant's knowledge regarding the use of plants as traditional medicine for respiratory system

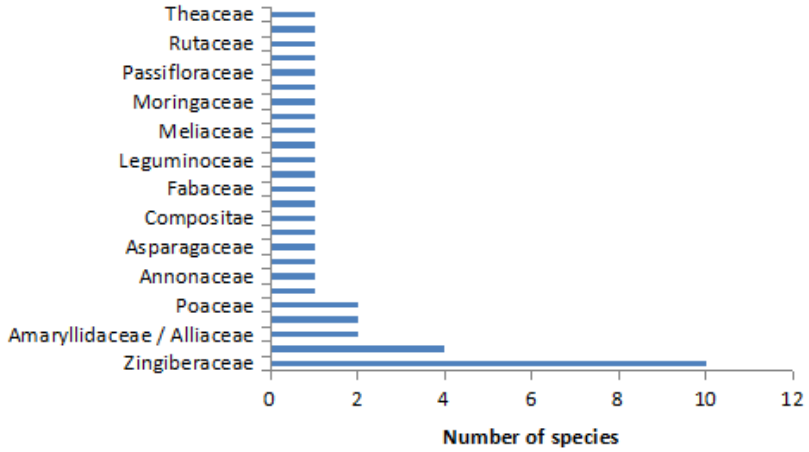

Figure 2. Family of the medicinal plant used by traditional healers

Table I. Demographic characteristic of respondents (n=68)

Characteristic	Frequency	Percentage (%)
Javanese ethnicity	68	100
Gender		
Men	12	17.65
Women	56	85.35
Age group (years)		
≤ 30	2	2.94
31-40	5	7.35
41-50	16	23.53
51-60	20	29.42
61-70	18	26.47
≥ 71	7	10.30
Education		
No formal education	40	58.82
Elementary school	26	32.24
Junior high school	1	1.47
Senior high school	1	1.47
University	-	-
Occupation		
Baby shaman	18	26.47
Jamu seller	8	11.76
Masseur	19	27.95
Herbalist	12	17.65
Others	11	16.18
Source of knowledge		
hereditary	63	92.65
Based on experience	3	4.41
Books/formal education	2	2.94

disorders, the majority came from generation to generation (92.65%). This happens because traditional healers will pass on knowledge to their children, that will be able to continue and carry out their responsibility as traditional healers.

Diversity of medicinal plants and their uses

A total of 40 plant species from 25 families were recorded to be used in respiratory system diseases. The medicinal plants are used as single remedies and also in combination with another

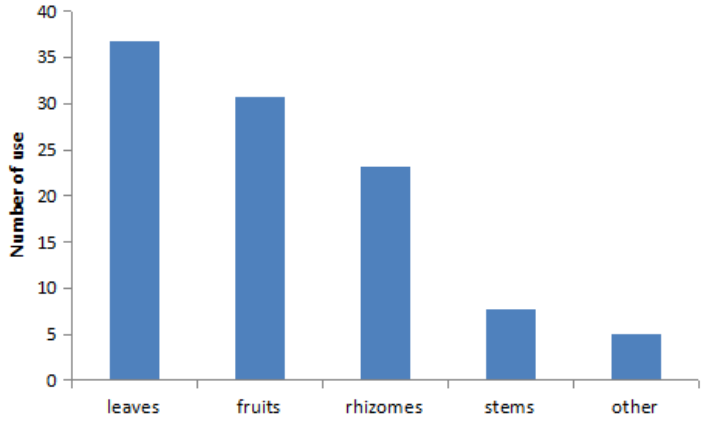

Figure 3. Plant part used in remedies

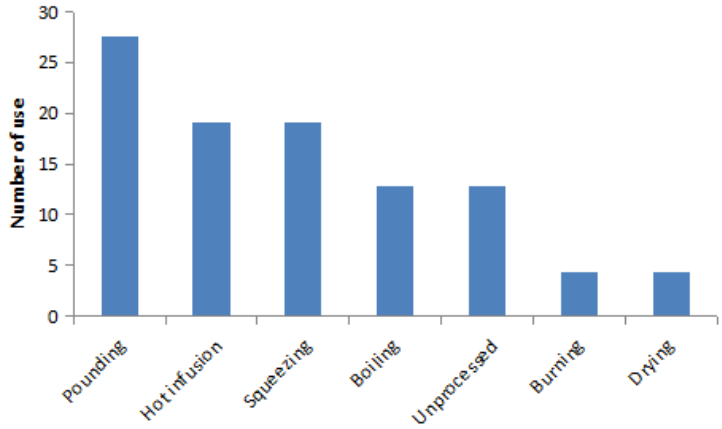

Figure 4. Mode of traditional medicine preparation

plant. Most plant species belong to Zingiberaceae (25 %), followed by Piperaceae (10%), Amaryllidaceae (5%), Arecaceae (5%), Poaceae (5%), and other families (less than 5%). Zingiberaceae become the most used family by traditional healers in Cilongok because plant species in this family are easy enough to cultivate in this area (figure 2). A study of plant utilization as traditional medicines at Tolai village, torue subdistrict, Parigi moutong district found 53 species and 29 families used for traditional medicines (Lestaridewi and Jamhari 2017).

The result of this study was different from data from Pakistan, in which most of the plants used as a traditional medicine to treat respiratory disorders belong to the Asteraceae and Solanaceae family (Alamgeer *et al*. 2018). The plants of Zingiberaceae are easy to cultivate and are widely planted by the people of Cilongok District in their gardens. People in Cilongok District also believe that plants from this family have many medicinal benefits. Zingiberaceae is a family that is most widely used as a medicinal plant and most cultivated by society. The plants are very frequently found in the Indonesian region due to the tropical climate in Indonesia is very suitable for the growth of various types of the Zingiberaceae plants (Marpaung 2018).

Plant part used in remedies

The plant part that was mostly used was leaves (36.69%) and then followed by fruits (30.76%), rhizome (23.08%), stem (7.69%), and other parts of plants used less than 5% (figure 3). Leaves become the most plant part used in remedies because this part is the easiest obtained. Leaves are also easier to prepare when used in traditional medicine.

Most Traditional healers in Cilongok cited that they prepare a recipe from the leaves of the medicinal plants (36.69%). This result was similar to data from Pakistan (Alamgeer *et al*. 2018) and Iran (Ghorbani 2005). Cock and Van Vuuren (2020) also reported that leaves are the most frequently used plant part for the treatment of respiratory infections in South Africa. Leaves are mostly used due to the reason that they are very easy to collect, and they are a place where

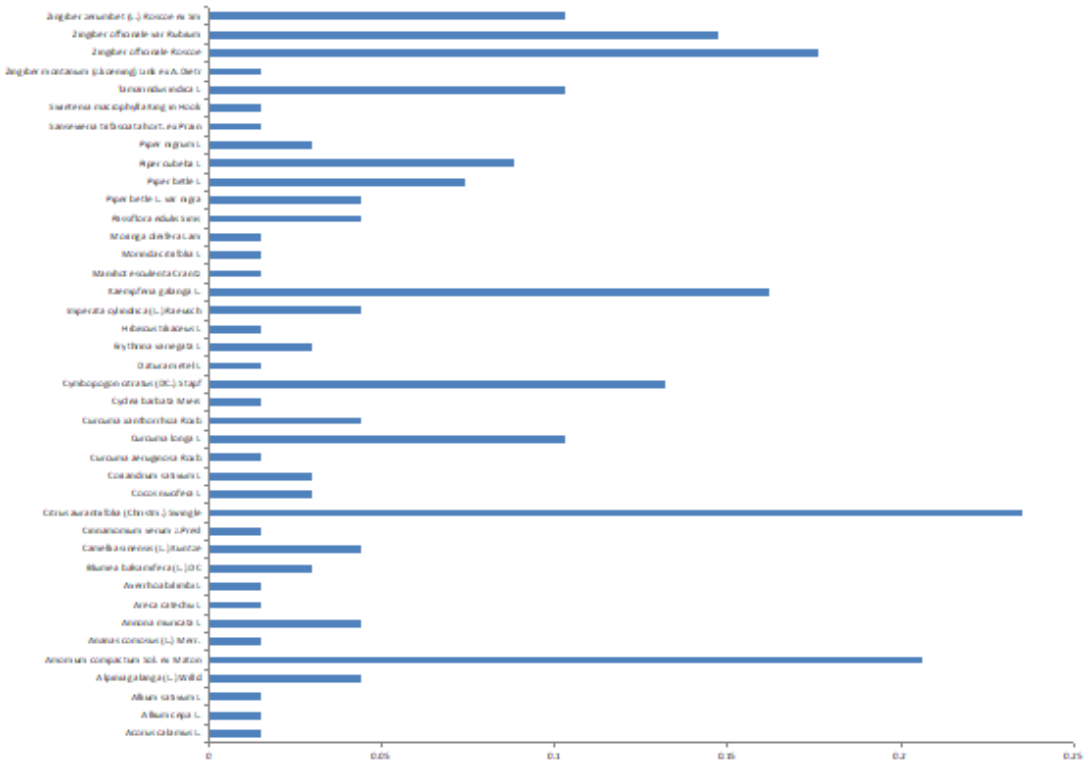

Figure 5. Species Use Value (SUV) of plants utilized as traditional medicine on respiratory system disease in Cilongok

photosynthesis and metabolites production takes place (Alamgeer *et al*., 2018; Ghorbani 2005).

Preparation methods

There were some preparation methods of medicinal plants that were used to treat respiratory system diseases in Cilongok district (figure 4). Most species were prepared by pounding the simplicia (27.66%), hot infusion (19.15%), and squeezing the simplicia (19.15%). The other preparation was boiling, burning, and drying the simplicia. One of the examples used is Ginger, which is pounded and placed on the chest to make it warm. The other method that is mostly used is infusion. In this method, plant materials were boiled with water until their volume was half of the original volume. Squeezing is also one of the methods of traditional medicine preparation. Plant material that is prepared by squeezing is *Citrus aurantifolia* fruit. The lime fruit was squeezed to get the extract, and it's used to ease a cough.

Species Use Value (SUV)

The use-values of recorded plant species were calculated. The SUV of the plants ranged from 0.015 to 0.235 (Table II, figure 5). There were 17 plants that had SUV 0.015. The highest use value in this research was Lime with SUV was 0.235. Lime (*Citrus aurantiifolia*) was a widespread plant in this area. These fruits are also very easy to get in the traditional market. Lime is a plant that is very easy to cultivate in a tropical regions, including Indonesia. That's why this plant is very widely used by the community (Chusniah dan Muhtadi, 2015). The top five plants with high use value were *Citrus aurantiifolia* (0.235), *Amomum compactum* (0.206), *Zingiber officinale* (0.176), *Kaempferia galanga* (0.162), and *Zingiber officinale* var Rubrum (0.147).

Citrus aurantiifolia (Christm.) Swingle (local name: jeruk nipis) is the most widely used medicinal plant by the traditional healers in Cilongok District with the highest SUV. It is used for treating many respiratory system disorders such as laryngitis, pharyngitis, cough, influenza, asthma, tuberculosis, COPD, and rhinitis. Lime contains numerous beneficial chemical compounds, e.g., citric acid, amino acids (tryptophan, lysine), essential oils (citral, limonene, phellandrene, camphor lemon, cadinene, geranyl acetate, linalyl acetate, acetaldehyde, nonaldehyde), resin, glycoside, and citric acid. Lime juice contains saponins and flavonoids, namely, hesperidin (hesperetin 7-rutinoside), tangeretin, naringin,

Table IIa. Plants used as traditional medicine on respiratory system disease in Cilongok

Scientific name	Family	Local name	SUV	Uses	Single/Combination
Acorus calamus L.	Acoraceae	Dingo	0.015	Tuberculosis	Combination
Allium cepa L.	Amaryllidaceae	Bawang Merah	0.015	Influenza	Single
Allium sativum L	Amaryllidaceae Alliaceae	Bawang Putih	0.015	Cough	Combination
Alpinia galanga (L.) Willd	Zingiberaceae	Lengkuas	0.044	Pharyngitis, laryngitis, tonsilitis	Combination
Amomum compactum Sol. ex Maton	Zingiberaceae	Kapulaga	0.206	Cough	Single and combination
Ananas comosus (L.) Mar.	Bromeliaceae	Nanas	0.015	Tonsilitis	Single
Annona muricata L	Annonaceae	Sirsak	0.044	Pharyngitis, laryngitis, tonsilitis	Combination
Areca catechu L	Arecaceae	Pinang	0.015	Cough	Single
Averrhoa bilimbi L	Passifloraceae	Belimbing wuluh	0.015	Tonsilitis	Single
Blumea balsamifera (L.) DC	Compositae	Sembung	0.03	Asthma, cough	Single and combination
Camellia sinensis (L.) Kuntze	Theaceae	The	0.044	Influenza, rhinitis allergic	Single
Cinnamomum Verum J.Presl	Lauraceae	Kayu Manis	0.015	Cough	Combination
Citrus aurantiifolia (Christm.) Swingle	Rutaceae	Jeruk nipis	0.235	Cough, asthma, tuberculosis, laryngitis, pharyngitis	Single and combination
Cocos nucifera L	Arecaceae	Kelapa	0.03	Chronic obstructive pulmonary disease, pharyngitis	Single
Coriandrum sativum L	Apiaceae	Kumar	0.03	Influenza, rhinitis allergic	Single
Curcuma aeruginosa Roxb	Zingiberaceae	Temu hitam	0.015	Cough	Combination
Curcuma longa L	Zingiberaceae	Kunyit	0.103	Asthma, pharyngitis, cough, tuberculosis	Single and combination
Curcuma xanthorrhiza Roxb	Zingiberaceae	Temulawak	0.044	Tuberculosis	Single and combination
Cyclea barbata Miers	Menispermaceae	Cincau	0.015	Asthma	Single
Cymbopogon citratus (DC.) Stapf	Poaceae	Sereh	0.132	Cough	Single and combination
Datura metel L	Solanaceae	Kecubung	0.015	Asthma	Single
Erythrina variegata L	Leguminosae	Dadap	0.03	Asthma, cough	Single
Hibiscus tiliaceus L	Malvaceae	Waru	0.015	Asthma	Single

Table IIb. Plants used as traditional medicine on respiratory system disease in Cilongok

Scientific name	Family	Local name	SUV	Uses	Single/Combination
Imperata cylindrica (L.) Raeusch	Poaceae	Alang-Alang	0.044	Pharyngitis, laryngitis, tonsilitis	Combination
Kaempferia galanga L.	Zingiberaceae	Kencur	0.162	Tuberculosis, cough, asthma	Single and combination
Manihot esculenta Crantz	Euphorbiaceae	Singkong	0.015	Chronic obstructive pulmonary disease	Single
Morinda citrifolia L	Rubiaceae	Mengkudu	0.015	Asthma	Single
Moringa oleifera Lam	Moringaceae	Kelor	0.015	Tuberculosis	Combination
Passiflora edulis Sims	Passifloraceae	Markisa	0.044	Asthma, cough, laryngitis	Single
Piper betle L. var nigra	Piperaceae	Sirih hitam	0.044	Cough, tonsilitis	Single
Piper betle L	Piperaceae	Sirih	0.074	Cough, pharyngitis, tuberculosis	Single and combination
Piper cubeba L	Piperaceae	Kemukus	0.088	Influenza, rhinitis allergic	Single and combination
Piper nigrum L	Piperaceae	Lada Hitam	0.03	Influenza, rhinitis allergic	Single
Sansevieria trifasciata hort. ex Prain	Asparagaceae	Lidah mertua	0.015	Cough	Single
Swietenia macrophylla King in Hook	Meliaceae	Mahoni	0.015	Cough	Combination
Tamarindus indica L	Fabaceae	Asam Jawa	0.103	Pharyngitis, laryngitis	Single and combination
Zingiber montanum (J.koening) Link ex A.Dietr	Zingiberaceae	Bangle	0.015	Tuberculosis	Combination
Zingiber officinale Roscoe	Zingiberaceae	Jahe	0.176	Cough, asthma, pharyngitis	Single and combination
Zingiber officinale var Rubrum	Zingiberaceae	Jahe Merah	0.147	Cough, cold, pharyngitis, tuberculosis	Combination
Zingiber zerumbet (L.) Roscoe ex Sm	Zingiberaceae	Lempuyang	0.103	Influenza, cough	Single and combination

eriocitrin, and eriocitrocide (Asmah *et al*. 2020). The mixture of aqueous extract of *Aframomum melegueta* and *C. aurantiifolia* was reported to have spasmolytic properties on tracheal smooth muscle isolated from rats (Ahounou *et al*. 2012). It has been reported that *C. aurantiifolia* exhibited activity against the drug-resistant variants of *Mycobacterium tuberculosis* H37Rv, the bacteria that caused tuberculosis (Camacho-Corona *et al*., 2008). Tuberculosis (TB) remains a major health problem. It is an infectious disease that causes the widest death in the world (Chinsembu 2016).

Amomum compactum (local name: kapulaga) was the second widely used plant to treat respiratory disorders in Cilongok. This plant belongs to Zingiberaceae. The *A. compactum* treatment dose-dependently decreased the level of reactive oxygen species (ROS) and T helper (Th)2 cytokines, including interleukin (IL)-4 and IL-5, in the bronchoalveolar laval fluid. A high dose of *A. compactum* lowered the level of total immunoglobulin E in the serum effectively. It was indicated that *A. compactum* might have a therapeutic effect on allergic asthma or

inflammatory disease (Lee *et al*., 2010). This plant also has the potential as a natural antimicrobial (Hartady and Balia 2020).

Zingiber officinale (local name: Jahe) was used to treat respiratory disorders in Cilongok with SUV 0.176. This plant is widely used in bronchial asthma and cough therapy. This effect was scientifically proved. It has been reported that the macromolecular isolate from *Z. officinale* rhizome, which is made up mostly of glucan together with a small number of polygalacturonan, demonstrated a significant antitussive effect in guinea pigs (Bera *et al*. 2016). The extract of *Z. officinale* rhizome exhibited antibacterial activity against pathogenic respiratory bacteria, e.g., *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus pneumonia*, and *Haemophilus influenza* (Akoachere *et al*. 2002). In the Himalayas, the plant from Zingiberaceae, *Curcuma longa*, is a medicinal plant that is traditionally used in the Himalayas region to treat pneumonia and has good potential against *Staphylococcus aureus* and *Streptococcus pneumonia* (Adnan *et al*. 2019). Ginger is also one of the natural products used to treat the symptoms of Covid-19 infection (Thota, Balan, and Sivaramakrishnan 2020).

Kaempferia galanga (local name: kencur) is another plant from Zingiberaceae that is also used widely in the treatment of respiratory disorders in Cilongok. It is also a popular medicinal plant in some countries, e.g., China, Myanmar, Indonesia, Malaysia, and Thailand. The activities of this plant have been investigated scientifically. It has been reported that ethyl-p-cinnamate, the major compound of *K. galanga*, had vasorelaxant activity (Srivastava *et al*., 2021). Various crude extracts and some compounds exhibited some potential pharmacological activities, in particular antitumor, anti-inflammatory, antioxidant (Wang *et al*. 2021). Many compounds have been identified from the rhizome of *K. galanga*, including terpenoids, phenolics, cyclic dipeptides, flavonoids, diarylheptanoids, fatty acids, and esters (Kumar 2020; Wang *et al*. 2021).

Zingiber officinale var Rubrum (local name: jahe Merah) is also a plant belonging to Zingiberaceae. It is also extensively studied for its medicinal use. The rhizome of this plant had many pharmacological activities, e.g., anti-inflammatory, antioxidant, antidiabetic, antibacterial, and cytotoxic activity (Syafitri *et al*., 2018). This plant also reported exhibiting an immunomodulatory effect. It has been reported that the ethanolic extract of the rhizome increased macrophage activity (Ys 2010).

These plants were used to treat some diseases in the respiratory system. Cough, asthma, tuberculosis, influenza, pharyngitis, and laryngitis were diseases in the respiratory system. These diseases have different pathogenesis dan caused by the different pathogens. So, plants that are used to treat diseases have different mechanisms. Anti-inflammatory activity is associated with the use of plants in the treatment of respiratory disorders. Asthma is an inflammatory disease in which eosinophils are the key cells of allergic inflammation (He *et al*., 2015). Another activity of plants that are associated with its use of it on respiratory system diseases is antimicrobial. Tuberculosis is caused by *M. tuberculosis*, an intracellular obligate and aerobic bacteria that multiplies within the macrophage. Plants that have antibacterial activity against *M. tuberculosis* can use to treat infected people.

CONCLUSION

Local traditional knowledge and the practice of plant-based medicine to treat respiratory system diseases are still widespread in rural areas such as in Cilongok district. Traditional healers play an important role in primary health care. Easy access to the plants and the simplicity of preparing medicines plants are essential as well. There were 40 medicinal plant species from 25 families used as traditional medicine in respiratory system disease. *Citrus aurantiifolia* (Christm.) Swingle is the most used medicinal plant with SUV were 0.235, followed by *Amomum compactum* Sol. ex Maton (SUV 0.206), *Zingiber officinale* Roscoe (SUV 0.176), *Kaempferia galanga* L (SUV 0.176), and *Zingiber officinale* var Rubrum (SUV 0.147).

REFERENCES

Adnan, Muhammad, Shandana Ali, Khushboo Sheikh, and Rahila Amber. 2019. "Review on Antibacterial Activity of Himalayan Medicinal Plants Traditionally Used to Treat Pneumonia and Tuberculosis." *Journal of Pharmacy and Pharmacology* 71(11):1599–1625.

Ahounou, Jf, Gg Ouedraogo, Jd Gbenou, S. Ouedraogo, Wkdd Agbodjogbe, Ph Dansou, and M. Moudachirou. 2012. "Spasmolytic Effects of Aqueous Extract of Mixture from Aframomumum Melegueta (K Schum) – Citrus Aurantifolia (Christm and Panzer) on Isolated Trachea from Rat." *African Journal of Traditional, Complementary and Alternative Medicines* 9(2):228–32.

Akoachere, J. F. T. K., R. N. NDIP, E. B. Chenwi, L. M.

NDIP, T. E. NJOCK, and D. N. ANONG. 2002. "Antibacterial Effect of Zingiber Officinale and Garcinia Cola on Respiratory Tract Pathogens." *East African Medical Journal* 79(11):588–92.

Alamgeer, Waqas Younis, Hira Asif, Amber Sharif, Humayun Riaz, Ishfaq Ali Bukhari, and Asaad Mohamed Assiri. 2018. "Traditional Medicinal Plants Used for Respiratory Disorders in Pakistan: A Review of the Ethno-Medicinal and Pharmacological Evidence." *Chinese Medicine* 13(1):48.

Asmah, Nur, DewiFatma Suniarti, Anggraini Margono, ZAlim Mas'ud, and EndangWiniati Bachtiar. 2020. "Identification of Active Compounds in Ethyl Acetate, Chloroform, and N-Hexane Extracts from Peels of Citrus Aurantifolia from Maribaya, West Java, Indonesia." *Journal of Advanced Pharmaceutical Technology & Research* 11(3):107.

Bera, K., G. Nosalova, V. Sivova, and B. Ray. 2016. "Structural Elements and Cough Suppressing Activity of Polysaccharides from *Zingiber Officinale* Rhizome: An Antitussive Glucan from *Zingiber Officinale*." *Phytotherapy Research* 30(1):105–11.

Camacho-Corona, María del Rayo, Mónica A. Ramírez-Cabrera, Omar González- Santiago, Elvira Garza-González, Isidoro de Paz Palacios, and Julieta Luna-Herrera. 2008. "Activity against Drug Resistant-Tuberculosis Strains of Plants Used in Mexican Traditional Medicine to Treat Tuberculosis and Other Respiratory Diseases." *Phytotherapy Research* 22(1):82–85.

Chinsembu, Kazhila C. 2016. "Tuberculosis and Nature's Pharmacy of Putative Anti-Tuberculosis Agents." *Acta Tropica* 153:46–56. DOI: 10.1016/j.actatropica.2015.10.004.

Elfahmi, Herman J. Woerdenbag, and Oliver Kayser. 2014. "Jamu: Indonesian Traditional Herbal Medicine towards Rational Phytopharmacological Use." *Journal of Herbal Medicine* 4(2):51–73.

Faruque, Mohammad O., Shaikh B. Uddin, James W. Barlow, Sheng Hu, Shuang Dong, Qian Cai, Xiaohua Li, and Xuebo Hu. 2018. "Quantitative Ethnobotany of Medicinal Plants Used by Indigenous Communities in the Bandarban District of Bangladesh." *Frontiers in Pharmacology* 9:40.

Ferreira, Felipe S., Samuel V. Brito, Samuel C. Ribeiro, Waltécio O. Almeida, and Rômulo RN Alves. 2009. "Zootherapeutics Utilized by Residents of the Community Poço Dantas, Crato-CE, Brazil." *Journal of Ethnobiology and Ethnomedicine* 5(1):21.

Ghorbani, Abdelbaset. 2005. "Studies on Pharmaceutical Ethnobotany in the Region of Turkmen Sahra, north of Iran." *Journal of Ethnopharmacology* 102(1):58–68.

Hartady, Tyagita, and Roostita Lobo Balia. 2020. "Bioactivity of Amomum Compactum Soland ex Maton (Java Cardamom) as a Natural Antibacterial." *Systematic Reviews in Pharmacy* 11(9):4.

He, Yan, Yuan Yue, Xi Zheng, Kun Zhang, Shaohua Chen, and Zhiyun Du. 2015. "Curcumin, Inflammation, and Chronic Diseases: How Are They Linked?" *Molecules* 20(5):9183–9213.

Jumiarni, Wa Ode dan Oom Komalasari. 2017. "Eksplorasi Jenis Dan Pemanfaatan Tumbuhan Obat Pada Masyarakat Suku Muna Di Permukiman Kota Wuna." *Traditional Medicine Journal*. 22(1): 45-56.

Kumar, Ajay. 2020. "Phytochemistry, Pharmacological Activities and Uses of Traditional Medicinal Plant Kaempferia Galanga L. – An Overview." *Journal of Ethnopharmacology* 253:112667.

Lee, Jin-Ah, Mee-Young Lee, Chang-Seob Seo, Da Young Jung, Nam-Hun Lee, Jung-Hun Kim, Hyekyung Ha, and Hyun Kyoo Shin. 2010. "Anti-Asthmatic Effects of an *Amomum Compactum* Extract on an Ovalbumin (OVA)-Induced Murine Asthma Model." *Bioscience, Biotechnology, and Biochemistry* 74(9):1814–18.

Lestaridewi, Ni Ketut, and Mohammad Jamhari. 2017. "Kajian Pemanfaatan Tanaman Sebagai Obat Tradisional Di Desa Tolai Kecamatan Torue Kabupaten Parigi Moutong.". *Jurnal Ilmiah Pendidikan Biologi*. 5(2): 92-108.

Marpaung, Dwi Ratna Anjaning Kusuma. 2018. "TUMBUHAN OBAT DAN KEARIFAN LOKAL MASYARAKAT DI SEKITAR KAWASAN TNBG, DESA SIBANGGOR JULU, KABUPATEN MANDAILING NATAL." *JURNAL BIOSAINS* 4(2):85.

Sodhi, Navjot S., Lian Pin Koh, Barry W. Brook, and Peter K. L. Ng. 2004. "Southeast Asian Biodiversity: An Impending Disaster." *Trends in Ecology & Evolution* 19(12):654–60.

Srivastava, Nupur, Sonali Mishra, Hina Iqbal, Debabrata Chanda, and Karuna Shanker. 2021. "Standardization of Kaempferia Galanga L. Rhizome and Vasorelaxation

Effect of Its Key Metabolite Ethyl p-Methoxycinnamate." *Journal of Ethnopharmacology* 271:113911.

Syafitri, Dina Mulyana, Jutti Levita, Mutakin Mutakin, and Ajeng Diantini. 2018. "A Review: Is Ginger (Zingiber Officinale Var. Roscoe) Potential for Future Phytomedicine?" *Indonesian Journal of Applied Sciences* 8(1).

Thota, Sai Manohar, Venkatesh Balan, and Venketesh Sivaramakrishnan. 2020. "Natural Products as Home-based Prophylactic and Symptom Management Agents in the Setting of COVID -19." *Phytotherapy Research* 34(12):3148–67.

Wang, Si-Yu, Hui Zhao, Hong-Tao Xu, Xiao-Dong Han, Yun-Shan Wu, Fang-Fang Xu, Xiao-Bo Yang, Ulf Göransson, and Bo Liu. 2021. "Kaempferia Galanga L.: Progresses in Phytochemistry, Pharmacology, Toxicology and Ethnomedicinal Uses." *Frontiers in Pharmacology* 12:675350.

Ys, Bintari, Sudarsono, Ag. Yuswanto. 2010. "Pengaruh Pemberian Ekstrak Etanolik Rimpang Jahe Merah Terhadap Fagositosis Makrofag Pada Mencit Jantan Yang Diinfeksi Dengan Listeria monocytogenes. " *Majalah Obat Tradisional*.15(2); 80-88