



DIVERSITY OF ANTITUSSIVE PLANTS IN PURWOREJO REGENCY, CENTRAL JAVA PROVINCE

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Abstract

Purworejo is one of the regencies in Central Java Province that has biodiversity, including plants. This study aims to identify the diversity of plants that have potential as antitussive (cough-suppressing) agents in Purworejo Regency. The research was conducted using observation and identification methods, followed by a literature review to determine the potential of the plant species found as antitussives. Based on the study, there are 10 plant species that have potential as antitussives, namely: Zingiber officinale (ginger), Kaempferia galanga (kencur), Curcuma longa (turmeric), Curcuma xanthorrhiza (temulawak), Alpinia galanga (galangal), Piper betle (betel leaf), Citrus aurantiifolia (lime), Citrus hystrix (kaffir lime), Ocimum sanctum (holy basil), and Orthosiphon aristatus (cat's whiskers).

Keywords: biodiversity, flora, cough suppressant, traditional

INTRODUCTION

Cough is a protective reflex mechanism that removes foreign substances and secretions from the bronchi and bronchioles of the respiratory tract. Cough can be inappropriately stimulated in various situations such as inflammation of the respiratory tract or neoplasia. In these cases, cough has a pathological character and sometimes requires the use of cough suppressant drugs (antitussives). The antitussive drugs most commonly used in clinical settings produce side effects such as central respiratory depression, reduced secretion in the bronchioles and inhibition of ciliary activity, increased sputum viscosity, decreased sputum expulsion, hypotension, and constipation, which limit their therapeutic use. The use of herbal medicines is increasing worldwide for various diseases including antitussive activity because they are safe and have no side effects. Medicinal plants are an important source for the discovery of new bioactive compounds, which have been and continue to serve as key molecules for the development of new drugs (Saraswathy et al., 2014).

Purworejo is one of the regencies in Central Java Province that has biodiversity, including plants. Until now, there has been no research focusing on the diversity of plants with potential as antitussives in Purworejo Regency. Therefore, this study needs to be conducted with the aim of identifying the diversity of plants that have potential as antitussives in Purworejo Regency, Central Java Province.

METHODS

This research was conducted using observation methods in Guyangan Village, Purwodadi Subdistrict, Purworejo Regency, Central Java Province. Identification was then carried out followed by a literature review to determine

the potential of the plant species found as antitussives. The observation method for plants with potential antitussive properties began with the identification and selection of species based on ethnobotany or traditional literature reports. Observations were made by recording plant morphology, such as leaf, flower, and fruit shapes, as well as the plant parts commonly used (e.g., leaves, roots, or stems). Next, the selected plants were systematically observed in their natural habitats to determine growth conditions, flowering season, and availability of materials. After that, representative samples were collected and traditional processing methods were recorded. Data analysis was carried out descriptively to determine the potential of various plant species as antitussives.

RESULTS AND DISCUSSION

Based on the study, there are 10 plant species that have potential as antitussives, namely: *Zingiber officinale* (jahe), *Kaempferia galanga* (kencur), *Curcuma longa* (kunyit), *Curcuma xanthorrhiza* (temulawak), *Alpinia galanga* (lengkuas), *Piper betle* (sirih), *Citrus aurantiifolia* (jeruk nipis), *Citrus hystrix* (jeruk purut), *Ocimum sanctum* (kemangi), dan *Orthosiphon aristatus* (kumis kucing).

***Zingiber officinale* (jahe)**

Zingiber officinale (ginger) is a perennial herbaceous plant with a clump-forming habitus that grows upright and reaches about 50–100 cm in height. The plant has a fibrous root system that develops from the rhizome, functioning mainly in water and nutrient absorption. Its stem is a pseudostem formed by the tightly overlapping leaf sheaths rather than a true woody stem. The leaves are simple, lanceolate to linear-lanceolate in shape, arranged alternately, with smooth margins, an acute tip, and a distinct midrib; they are green and elongated, measuring approximately 15–30 cm in length. The most distinctive morphological feature is the rhizome, which is thick, fleshy, and branched, growing horizontally underground. The rhizome is yellowish to pale brown in color, aromatic, and serves as a storage organ for nutrients as well as the main structure for vegetative propagation.

Ginger has anti-inflammatory, expectorant, and antimicrobial properties that can help relieve cough, especially cough caused by flu or throat irritation. Pharmacologically, ginger contains various active compounds such as gingerol, shogaol, zingerone, as well as essential oils consisting of zingiberene, camphene, and borneol. Gingerol and shogaol are known to have anti-inflammatory and analgesic activities that can reduce inflammation in the respiratory tract and suppress the cough reflex. In addition, the essential oil content in ginger helps warm the respiratory tract and facilitate mucus expulsion, thereby helping the cough subside more quickly. In traditional practice, ginger is often used as a decoction or infusion. A common method is to cut 2–3 cm of fresh ginger rhizome, boil it with 2 glasses of water until about 1 glass remains, then add honey or lime juice to drink warm 1–2 times a day. Ginger can also be chewed directly or mixed with honey as a natural remedy to soothe the throat. Kou et al. (2018) stated that ginger's antitussive activity is associated with the presence of compounds such as β -phellandrene, 1,8-cineole, limonene, myrcene, β -pinene, champene, zingiberene, and 6-shogaol isolated from this plant, which are reported to have antitussive activity.

***Kaempferia galanga* (kencur)**

Kaempferia galanga is a small perennial herb with a low-growing and compact habitus, typically reaching a height of about 15–30 cm. The plant has fibrous roots that arise from the rhizome and function in anchorage and nutrient absorption. Its stem is very short and reduced, forming a pseudostem that is mostly concealed at ground level. The leaves are simple, broad, and ovate to elliptic in shape, arranged in a basal rosette; they have entire margins, a smooth surface, and prominent veins, with a dark green upper surface that is often marked by purplish or brownish patterns. The rhizome is the most prominent part of the plant, being short, thick, and fleshy, growing horizontally beneath the soil. It is brownish on the outside, whitish inside, strongly aromatic, and serves as a storage organ as well as the main means of vegetative propagation.

K. galanga is an aromatic medicinal herb. It originates from India and is distributed in China, Myanmar, Indonesia, Malaysia, and Thailand. *K. galanga* is a traditional herbal medicine that has been used to treat flu, dry cough, toothache, rheumatism, hypertension, and so on (Wang et al., 2021). Kencur has anti-inflammatory, expectorant, and antimicrobial properties that help soothe the throat, reduce irritation of the respiratory tract, and facilitate mucus expulsion. Pharmacologically, kencur contains active compounds such as essential oils (mainly methyl chavicol), flavonoids, phenylpropanoids, as well as alkaloids and saponins. Methyl chavicol acts as the main component providing antimicrobial and anti-inflammatory effects, while flavonoids and phenylpropanoids support antioxidant and anti-inflammatory activities that can relieve inflammation in the respiratory tract. In traditional practice, kencur is often used by processing it into jamu or herbal remedies. A common method of use is to crush 2–3 cm of kencur rhizome, then boil it with one glass of water until half remains, and drink it warm 1–2 times a day. Another alternative is to mix the crushed kencur with honey or palm sugar to reduce the spicy taste and enhance the throat-soothing effect.

***Curcuma longa* (kunyit, kunir)**

Curcuma longa (turmeric) is a perennial herbaceous plant with an erect and clump-forming habitus, typically growing to a height of 60–100 cm. The plant has a fibrous root system that develops from the rhizome and functions in water and nutrient absorption. Its stem is a pseudostem formed by tightly overlapping leaf sheaths, as the true stem is short and located underground. The leaves are simple, large, and oblong to lanceolate in shape, arranged alternately, with entire margins, a pointed apex, and a prominent midrib; they are bright green and can reach 30–45 cm in length. The rhizome is the most distinctive morphological feature, being thick, branched, and fleshy, growing horizontally beneath the soil. It is yellow to orange in color, aromatic, and rich in curcuminoids, serving as a storage organ and the primary structure for vegetative propagation.

This plant has traditionally been used to treat various diseases, including the common cold, cough, anorexia, arthritis, gallbladder disorders, diabetes, eye care, urinary tract diseases, wound healing, and others. The plant supports the activity of immune cells and the body's natural cellular defense system (Satpathy and Parida, 2024). Turmeric has anti-inflammatory, antibacterial, and antioxidant properties that can help reduce irritation and inflammation in the

respiratory tract, thereby alleviating the cough reflex. Pharmacologically, turmeric contains the main active compound curcumin, as well as essential oils (such as turmerone, atlantone, and zingiberene), and phenolic and flavonoid compounds. Curcumin is known to have anti-inflammatory and immunomodulatory activities that can suppress inflammation in the respiratory tract, while the essential oils help loosen mucus and speed up recovery from mild infections. In traditional practice, turmeric is often used as a jamu or herbal remedy by boiling it. A common method of use is to grate or cut 2–3 cm of turmeric rhizome, then boil it with 1–2 glasses of water until about 1 glass remains, and drink it warm 1–2 times a day. To enhance its antitussive effect and soothe the throat, turmeric decoctions are often mixed with honey or lime juice.

***Curcuma xanthorrhiza* (temulawak)**

Curcuma xanthorrhiza (Javanese turmeric) is a perennial herbaceous plant with an upright, robust, and clump-forming habitus, commonly reaching a height of 1–2 meters. The plant possesses a fibrous root system that emerges from the rhizome and functions in anchorage as well as water and nutrient uptake. Its stem is a pseudostem formed by the overlapping leaf sheaths, while the true stem remains short and underground. The leaves are simple, large, and oblong to lanceolate in shape, arranged alternately, with entire margins, an acute apex, and a prominent midrib; they are bright green and can grow up to 50–70 cm in length. The rhizome is thick, large, and extensively branched, growing horizontally beneath the soil surface. It is yellowish-brown on the outside and deep yellow to orange inside, aromatic, and serves as a storage organ for nutrients and bioactive compounds as well as the main means of vegetative propagation.

Curcuma xanthorrhiza, locally known as Temulawak, has long been used in Indonesia as a medicinal and nutritional plant since ancient times. The rhizome of this plant is an important ingredient in the preparation of jamu (traditional Indonesian medicine). To date, more than 40 active compounds, including terpenoids, curcuminoids, and other phenolic compounds, have been isolated and identified from *C. xanthorrhiza* (Rahmat et al., 2021). This plant has traditionally been used as a remedy for indigestion, diarrhea, hemorrhoids, cough, asthma, and mouth ulcers (Kustina et al., 2020). Temulawak has anti-inflammatory, antimicrobial, and expectorant properties that help reduce inflammation in the respiratory tract, soothe throat irritation, and facilitate mucus expulsion. Pharmacologically, temulawak is rich in active compounds such as xanthorrhizol, curcuminoids (including curcumin), and essential oils (e.g., ar-turmerone and zingiberene). Xanthorrhizol is known to have antimicrobial and anti-inflammatory activities that can help address mild infections that cause cough, while curcuminoids act as antioxidants and inflammation suppressors. In addition, the essential oils in temulawak can provide a warming effect and help loosen mucus. In traditional practice, temulawak is often used by boiling it or making jamu. A common method of use is to grate or cut 2–3 cm of temulawak rhizome, boil it with 1–2 glasses of water until about 1 glass remains, and drink it warm 1–2 times a day. To enhance flavor and improve throat-soothing effects, temulawak decoctions are also often mixed with honey or ginger.

***Alpinia galanga* (lengkuas, laos)**

Alpinia galanga (greater galangal) is a perennial herbaceous plant with a tall, erect, and clump-forming habitus, typically growing to a height of 1.5–3 meters. The plant has a fibrous root system that develops from the rhizome and functions in anchorage and nutrient absorption. Its stem is a strong pseudostem formed by tightly overlapping leaf sheaths, giving the appearance of a true stem. The leaves are simple, large, and lanceolate to oblong-lanceolate in shape, arranged alternately, with entire margins, a pointed apex, and a prominent midrib; they are glossy green and may reach 30–60 cm in length. The rhizome is thick, hard, and extensively branched, growing horizontally beneath the soil surface. It is reddish-brown on the outside and pale yellow to whitish inside, aromatic, and serves as a storage organ as well as the main structure for vegetative propagation.

Alpinia galanga is one of the important herbal plants found worldwide (Mohsina et al., 2022). Galangal is used as an expectorant, to treat stomach ache, as a bitter tonic, appetite stimulant, for diabetes, heart disorders, as an aphrodisiac, for lower back pain, as a disinfectant, for rheumatic pain, chest pain, burning sensation in the liver, and kidney diseases (Abubakar et al., 2018). Galangal has anti-inflammatory, antimicrobial, and expectorant properties that help relieve throat irritation, reduce inflammation of the respiratory tract, and facilitate mucus expulsion. Pharmacologically, galangal contains various active compounds such as essential oils (including 1,8-cineole, eugenol, and galangol), flavonoids, phenylpropanoids, and diarylheptanoid compounds. The compounds 1,8-cineole and eugenol play roles in providing expectorant and anti-inflammatory effects, while flavonoids and phenylpropanoids contribute as antioxidants and antimicrobials that help address mild infections causing cough. In traditional practice, galangal rhizomes are often used by boiling or grating them. A common method is to cut or grate 2–3 cm of galangal rhizome, then boil it with 1–2 glasses of water until about 1 glass remains, and drink it warm 1–2 times a day. Additionally, galangal is often mixed with honey or palm sugar to reduce the spicy taste and soothe the throat.

***Piper betle* (sirih)**

Piper betle (betel vine) is a perennial climbing plant with a creeping and twining habitus that grows by attaching itself to supporting structures. The plant has fibrous roots and numerous adventitious roots that arise from the stem nodes, which function in anchorage and water absorption. Its stem is slender, green, and jointed, with clearly visible nodes and internodes, becoming slightly woody as it ages. The leaves are simple, alternate, and broadly ovate to cordate in shape, with entire margins, an acuminate apex, and a glossy, dark green surface; they are aromatic and show prominent reticulate venation. *Piper betle* reproduces both sexually and vegetatively; sexual reproduction occurs through flowers arranged in spike inflorescences that produce small fruits, while vegetative reproduction is more common and is achieved through stem cuttings, as new plants readily grow from nodes that develop roots when in contact with soil.

Piper betle is an economically and medicinally important commercial plant, belonging to the Piperaceae family, often known as “green gold” (Biswas et al., 2022). Betel leaves are beneficial for treating lung diseases experienced in childhood and old age. Betel leaves soaked in mustard oil and warmed can be applied to the chest to relieve cough or difficulty breathing (More et al., 2023).

Betel leaves have antimicrobial, anti-inflammatory, and antiseptic properties that help soothe throat irritation and suppress mild infections in the respiratory tract that can trigger coughing. Pharmacologically, betel leaves contain active compounds such as essential oils consisting of eugenol, chavicol, chavibetol, and safrole, as well as flavonoids, tannins, and saponins. Eugenol and chavicol act as anti-inflammatory and analgesic agents that can soothe the throat, while tannins provide an astringent effect that helps reduce irritation and excessive secretion in the respiratory tract. In traditional practice, betel leaves are usually used by boiling them. A common method is to boil 3–5 betel leaves in 2 glasses of water until about 1 glass remains, then drink it warm 1–2 times a day to relieve cough. In addition to drinking it, betel leaf decoction is sometimes used as a gargle to help reduce throat irritation.

***Citrus aurantiifolia* (jeruk nipis)**

Citrus aurantiifolia (key lime) is a perennial woody plant with a shrub to small tree habitus, typically growing 2–5 meters tall with a dense and spreading canopy. The plant has a taproot system with numerous lateral roots that function in anchorage and efficient absorption of water and nutrients. Its stem is woody, branched, and often armed with short thorns, while young branches are green and flexible, becoming brown and hardened with age. The leaves are simple, alternate, and ovate to elliptic in shape, with entire to slightly serrated margins, a pointed apex, and a glossy green surface; they are aromatic due to the presence of oil glands. The fruit is a small, round to oval berry (hesperidium) with a thin green to yellowish rind, juicy acidic pulp, and several seeds inside. *Citrus aurantiifolia* reproduces sexually through seeds formed after pollination and fertilization, and it is also commonly propagated vegetatively through grafting or budding to maintain desirable traits.

Lime has been traditionally used to treat coughs (Ekasari et al., 2025). Lime has antimicrobial, anti-inflammatory, and mucolytic properties that help relieve throat irritation, thin mucus, and inhibit the growth of microorganisms that cause respiratory tract infections. Pharmacologically, lime contains various active compounds such as vitamin C, flavonoids (hesperidin, naringin), citric acid, as well as essential oils consisting of limonene, linalool, and citral. Flavonoids and vitamin C act as antioxidants and immunomodulators that help speed up recovery from infections, while the essential oils provide a refreshing effect and help loosen phlegm. In traditional practice, lime is usually used by squeezing the fruit and mixing the juice with honey or soy sauce to drink 1–2 times a day. In addition, lime juice is often mixed with warm water or brewed together with ginger to enhance the throat-soothing effect.

***Citrus hystrix* (jeruk purut)**

Citrus hystrix (kaffir lime) is a perennial woody plant with a shrub to small tree habitus, typically growing to a height of 2–6 meters with a dense, bushy canopy. The plant has a strong taproot system accompanied by many lateral roots that function in anchorage and nutrient absorption. Its stem is woody, highly branched, and often equipped with sharp thorns, while young stems are green and become brown and hardened as they mature. The leaves are simple and distinctive, appearing double-lobed due to the broadly winged petiole; they are dark green, glossy, aromatic, and have entire to slightly crenate margins. The fruit is round with a rough, bumpy rind, green when immature and turning

yellowish as it ripens, containing acidic pulp and several seeds. *Citrus hystrix* reproduces sexually through seeds produced after pollination and fertilization, and it is also widely propagated vegetatively through grafting, budding, or cuttings to preserve desirable characteristics.

Citrus hystrix is a common herbal plant in tropical regions. Its essential oil is now widely studied and applied due to its high economic value and safety for humans, making it an attractive ingredient for future trends (Long & Quoc, 2023). Kaffir lime has antimicrobial, anti-inflammatory, and expectorant properties that help soothe throat irritation and assist in thinning and expelling mucus. Pharmacologically, kaffir lime contains various active compounds, especially essential oils rich in citronellal, citronellol, limonene, and linalool, as well as flavonoids and vitamin C. The compounds citronellal and limonene have antimicrobial and anti-inflammatory activities that can help address mild infections causing cough, while flavonoids and vitamin C function as antioxidants that support the immune system. In traditional practice, kaffir lime is usually used by squeezing its juice or boiling its peel and leaves. A common method is to mix kaffir lime juice with honey or palm sugar, then drink it 1–2 times a day to relieve cough. In addition, boiled kaffir lime leaf water is sometimes used as a warm drink or for steam inhalation to help relieve the respiratory tract.

***Ocimum sanctum* (kemangi)**

Ocimum sanctum (holy basil) is an aromatic herbaceous plant with an erect and bushy habitus, typically growing 30–75 cm in height. The plant has a well-developed taproot system with numerous lateral roots that function in anchorage and nutrient uptake. Its stem is erect, quadrangular, and branched, green to purplish in color, and covered with fine hairs. The leaves are simple, opposite, ovate to elliptic in shape, with serrated margins, an acute to obtuse apex, and a slightly hairy surface; they are green to purplish and strongly aromatic. The fruit is a small nutlet formed after flowering, usually containing four tiny seeds enclosed within the persistent calyx. *Ocimum sanctum* reproduces sexually through seeds, which are the primary means of reproduction, and it can also be propagated vegetatively through stem cuttings under suitable conditions.

O. sanctum is a staple cough remedy among traditional medicine practitioners. The leaves and roots of *O. sanctum* have cough suppressant and expectorant activities (Billah et al., 2021). This plant is believed to have antitussive effects due to its bioactive compounds that can soothe throat irritation, reduce inflammation, and help loosen mucus. Pharmacologically, *O. sanctum* contains various important compounds, including eugenol, linalool, ursolic acid, rosmarinic acid, flavonoids (such as apigenin and luteolin), as well as tannins and saponins. Eugenol and linalool are known to have anti-inflammatory and analgesic effects that can suppress the cough reflex, while rosmarinic acid and flavonoids act as antioxidants and antiallergic agents, helping to relieve irritation in the respiratory tract. In traditional practice, the leaves of this plant are often used by boiling or infusing them to make a cough remedy. The most common method is to boil 10–15 tulsi leaves with 2 glasses of water until about 1 glass remains, then drink it warm 1–2 times a day. Another alternative is to chew fresh leaves or mix them with honey and ginger to enhance the throat-soothing effect.

***Orthosiphon aristatus* (kumis kucing)**

Orthosiphon aristatus (Java tea) is a perennial herbaceous plant with an erect, bushy habitus, commonly reaching heights of 30–90 cm. The plant has a fibrous root system that provides anchorage and facilitates efficient absorption of water and nutrients. Its stem is square-shaped (quadrangular), erect, and branched, often covered with fine hairs and displaying a green to purplish color. The leaves are simple, opposite, and ovate to lanceolate in shape, with serrated margins, an acute apex, and a slightly rough surface; they are green and aromatic. The fruit is a small nutlet, typically produced in clusters after flowering, containing tiny seeds. *Orthosiphon aristatus* reproduces sexually through seeds formed after pollination, and it can also be propagated vegetatively through stem cuttings, which root easily under suitable conditions.

Orthosiphon aristatus is one of the commonly used medicinal plants and is known to have many benefits. The main secondary metabolites of *O. aristatus* are sinensetin, rosmarinic acid, and eupatorin (Faramayuda et al., 2021). This plant has anti-inflammatory, antimicrobial, and antioxidant properties that help reduce irritation in the respiratory tract and soothe the cough reflex. Pharmacologically, cat's whiskers contains various active compounds such as flavonoids (sinensetin, eupatorin), phenolic acids (rosmarinic acid, caffeic acid), essential oils, and saponins. Flavonoids and rosmarinic acid act as anti-inflammatory and antioxidant agents that help relieve inflammation in the throat, while saponins can help loosen mucus, making it easier to expel phlegm. In traditional practice, the leaves and stems of cat's whiskers are usually used by boiling them. A common method is to boil a handful of fresh or dried leaves with 2 glasses of water until about 1 glass remains, then drink it warm 1–2 times a day. To improve its taste and effectiveness, cat's whiskers decoctions are often combined with honey or other herbal plants such as ginger. With its supportive chemical constituents and widespread traditional use, *Orthosiphon aristatus* has the potential to be used as a natural antitussive.

CONCLUSION

Based on the study, there are 10 plant species that have potential as antitussives, namely: *Zingiber officinale* (jahe), *Kaempferia galanga* (kencur), *Curcuma longa* (kunyit), *Curcuma xanthorrhiza* (temulawak), *Alpinia galanga* (lengkuas), *Piper betle* (sirih), *Citrus aurantiifolia* (jeruk nipis), *Citrus hystrix* (jeruk purut), *Ocimum sanctum* (kemangi), and *Orthosiphon aristatus* (kumis kucing).

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