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Review: Phytochemistry and ethnopharmacology of *Dracaena trifasciata*

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Abstract. *Dewatisari WF, To'bungan N. 2024. Review: Phytochemistry and ethnopharmacology of* Dracaena trifasciata. *Nusantara Bioscience 16: 169-184. Dracaena trifasciata* (Prain) Mabb. (syn. *Sansevieria trifasciata* Prain.) or mother-in-law's tongue, is a species belonging to the genus *Dracaena*, widely cultivated and used by various communities. This plant is recognized as an ornamental, pollutant-absorbing, and textile material. Its leaves and roots have also been used as traditional remedies across Asia and Africa for cough, flu, respiratory tract inflammation, diarrhea, wound healing, and snakebites. Bioactive compounds found in the roots and leaves include alkaloids, tannins, terpenoids, saponins, steroids, phenols, methyl glucuronate acid, glycosides, cardenolides, polyphenols, carbohydrates, and abamagenin. Therefore, this review aims to provide insights into the phytochemical constituents and pharmacological potential of *D. trifasciata*. It also explores its use in traditional medicine and prospects for further advancement to promote the broader application. Comprehensive literature studies showed that the attributes of *D. trifasciata* can be applied as an antibacterial, antioxidant, and anticancer agent, having a promising source of natural compounds for novel drug development. Further investigations are needed to assess the long-term and short-term toxicity associated with the use of this plant material, thereby making it a potential source for the development of modern drugs from natural sources. Considering the extensive application of *D. trifasciata* as a natural remedy, further investigations are crucial to assess the pharmacological potential and safety.

Keywords: Anti-toxic, antibacterial, anticancer, antioxidant, *Sansevieria*

INTRODUCTION

Dracaena trifasciata (Prain) Mabb. (syn. *Sansevieria trifasciata* Prain.) or mother-in-law's tongue, is categorized under the Genus *Dracaena*, featuring sword-shaped leaves with attractive patterns and colors (Figure 1). The *D. trifasciata* has been cultivated since the 16th century. It later became popular for cultivation as an ornamental plant in Indonesia starting from the 19th century.This plant is known as the snakeplant or mother-in-law's tounge among international ornamental plant traders. This ornamental plant is extensively cultivated in gardens or pots and widely used for decorative purposes in gardens and homes (Tinggi 2018; Aref et al. 2023; Dewatisari and Nuryandani 2024). The cultivation is driven by its high economic value, primarily due to the abundant fiber content, which serves as a natural textile raw material (Adeniyi et al. 2020; Papaj 2022; Raj et al. 2023). The elastic, white, and strong fibers derived from *D. trifasciata* are used in the production of ropes, clothing, fishing lines, bowstrings, fine weaves, and binding cords due to their high strength (Sathishkumar 2016; Widyasanti et al. 2020).

The *D. trifasciata* is recognized for its capability to absorb pollutants both indoors and outdoors, functioning as an air purifier, effectively absorbing harmful gases including formaldehyde, xylene, and total volatile organic compounds (Ullah et al. 2021; Guo et al. 2023; Sutrisno et al. 2023; Weerasinghe et al. 2023). The well-established knowledge regarding *D. trifasciata* plants is their ability to effectively remove toluene within confined indoor setting. Furthermore, these plants exhibit toluene (Gunasinghe et al. 2023). Additionally, this plant shows the ability to accumulate heavy metals (Gabriel et al. 2023; Pandiyarajan et al. 2024). In addition, *D. trifasciata* can improve indoor air quality and is very effective in reducing computer radiation (Dewatisari and Lyndiani 2015; Mardiyati et al. 2016; Yu et al. 2020; Panduwinata et al. 2021; Permana et al. 2023).

The *D. trifasciata* has also been used as a traditional medicine across various communities in Asia and Africa by consuming the juice or decoction from its leaves for the treatment of gonorrhea, earaches, toothaches, respiratory tract inflammation, flu, diarrhea, coughs, hemorrhoids, and influenza. The leaf latex of this plant is applied externally to treat bruises, sprains, wounds, abscesses, scabs, itchiness, and ear diseases, alongside being used as a natural antibiotic, hair tonic, and pain reliever (Sunilson et al. 2009; Andhare et al. 2012; Berame et al. 2017; Aseptianova 2019; Hijrah et al. 2019; Nahdi and Kurniawan 2019; Sun et al. 2019; Hartanti and Budipramana 2020; Thu et al. 2020; Pathy et al. 2021). In Africa, the latex from this plant can be used as a snake and insect repellent (Umoh et al. 2020; Sharma et al. 2023). Antibacterial agents are also derived from *D. trifasciata*. In tropical countries, *D. trifasciata* is used for treating inflammatory diseases and is sold in markets as a crude oil for treating snake bites, earaches, swelling, boils, and fever (Aliero et al. 2008; Anbu et al. 2009).

The medicinal properties of *D. trifasciata* are attributed to the diverse bioactive compounds including alkaloids, tannins, terpenoids, cardenolides, polyphenols, methyl glucuronate acid, glycosides, saponins, steroids, phenols, carbohydrates, and abamagenin, found in the roots, rhizomes, and leaves (Aliero et al. 2008; Narendhiran et al. 2014; Dewatisari et al. 2018; Megantika et al. 2020). The ethanolic extract phytochemical content of *D. trifasciata* includes compounds from the group of fatty acids, sugars, cyclic ketones, alkaloids, aliphatic nitro compounds, and citric acid. Flavonoids are one of the abundant compounds found in *D. trifasciata* leaves, which act as antioxidants (Adhityaxena et al. 2020; Van Kleinwee et al. 2022; Marjoni et al. 2023). Several studies have shown that the leaves and rhizomes of *D. trifasciata* contain saponins, cardenolins, polyphenols, methyl glucuronate acid, and abamagenin. Gas chromatography-mass spectrometry (GC-MS) data from the leaves of various *Sansevieria* species indicate the presence of antioxidant and antibacterial compounds such as 3,4-Dimethoxybenzoic anhydride, 2,5-Dimethoxybenzhydrazide, Diallyl Acetal, 1,2-Benzenedicaboxylic Acid, BIS (2-Ethylhexyl) ester, 1-Butyl 2-(8-Methylnonyl) Phthalate, Palmitaldehyde, Delta-Undecalactone, n-Hexadecanoic acid, Dodecanoic acid, and 6,10,14-trimethyl-2-Pentadecanone. These phytochemical compounds have the potential to treat various diseases such as wounds, antiseptic applications, hemorrhoids, chickenpox, parasitic infections, eye and ear diseases, cough, snake bites, and as a refreshing beverage (Baldwin and Webb 2016; Saxena et al. 2022).

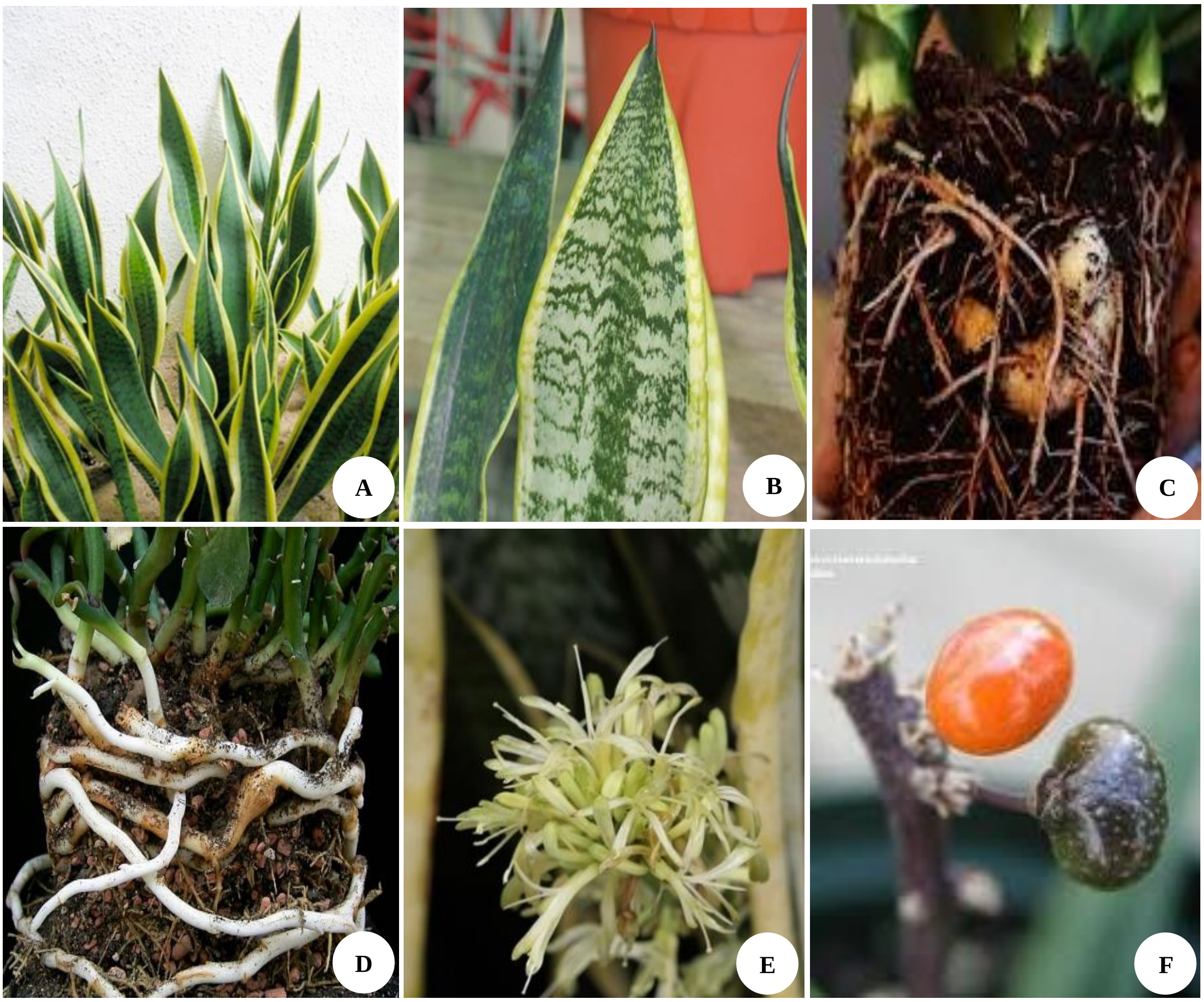

Figure 1. *Dracaena trifasciata* (Prain) Mabb.: A. Plants, B. Leaf, C-D. Roots, E. Flowers, F. Fruits (Source: lucidcentral.org & NParks | *Dracaena trifasciata* 'Prain')

Information from the literature shows, *D. trifasciata* has numerous benefits for medicinal purposes and contains active compounds that benefit the environment and health. The pharmacological activities of *D. trifasciata* have been investigated, including its antioxidant, anticancer, antidiabetic, antianaphylaxis, and antibacterial properties (Bhattacharjee et al. 2016; Damen et al. 2018). Nevertheless, research is rare on the ethnopharmacological aspects of this plant in the existing literature. Consequently, conducting a comprehensive investigation in this ethnopharmacological domain provides valuable insights into the potential compounds derived from this plant, and identifies subject for further natural medicine development (Figure 2). Therefore, a systematic review of its traditional uses in various countries is needed. Furthermore, information from the literature regarding the pharmacological properties of *D. trifasciata* should be studied and analyzed.

DISTRIBUTION AND HABITAT

The Genus *Dracaena* originates from Africa and partly from Asia, with cultivars reaching over 600 globally, of which approximately 100 are identified in Indonesia (Stover 1983). These cultivars exhibit leaf shape, size, color, and texture variations. Moreover, *Dracaena* is widely naturalized in South Asia (India) to Southeast Asia (Indonesia, Malaysia, Thailand, Vietnam), Australia, America, and several Pacific islands. The extensively commercialized species in the nursery trade include *D. trifasciata* and *D. cylindrica* (Dewatisari et al. 2008).

The *D. trifasciata*, commonly found in wild tropical and subtropical regions, is also cultivated as an ornamental plant in many places in Indonesia. Due to invasive and aggresive nature, it can survive in various habitats (Tallei et al. 2016). This plant's ability to grow under full sunlight or in shaded areas facilitates its global thriving in moist, fertile soil with high organic content and minimal care (Appell 2001). The *D. trifasciata* exhibits high salt tolerance and low nutrient requirements (Brown 2011).

The distribution and habitat of *D. trifasciata* reflect its wide adaptation and species' success in various environments. Its primary origin in Africa and parts of Asia, with extensive spread to South Asia, Southeast Asia, Australia, America, and some Pacific islands, demonstrates its adaptability to diverse ecological conditions. Its presence in varying conditions, from tropical and subtropical regions to naturalized lands, confirms its resilience to different light intensities, soil types, and water availability. The success of *D. trifasciata* in adapting to different habitats, both under full sunlight and in shaded areas, as well as in moist and organically rich soils with minimal care, indicates great potential for further dispersal and naturalization. Its high tolerance to salt levels and low nutrient requirements also support its ability to survive in less-than-ideal conditions, making it an intriguing species from both ecological and horticultural perspectives (Stover 1983; Swinbourne and Robert 2007; Dewatisari et al. 2008).

The interpretation regarding the distribution of *D. trifasciata's* habitat reveals how this species exemplifies adaptation success and survival in various geographic and ecological environments. With origins spanning from Africa to Asia and naturalization in diverse regions such as South Asia, Southeast Asia, Australia, America, and the Pacific islands, *D. trifasciata* demonstrates exceptional flexibility in adapting to different habitats. Its ability to thrive under varying light conditions, and in moist and nutrient-rich soils, reaffirms its resilience as a species. Tolerance to diverse soil conditions and resistance to high salt levels prove its adaptability. This phenomenon not only showcases the genetic and ecological diversity that enables *D. trifasciata* to thrive outside its native habitat but also its potential invasiveness in new habitats, where it can impact local ecosystems (Damen et al. 2018; Adeniyi et al. 2020; Witthayaphirom and Nuansawan 2023).

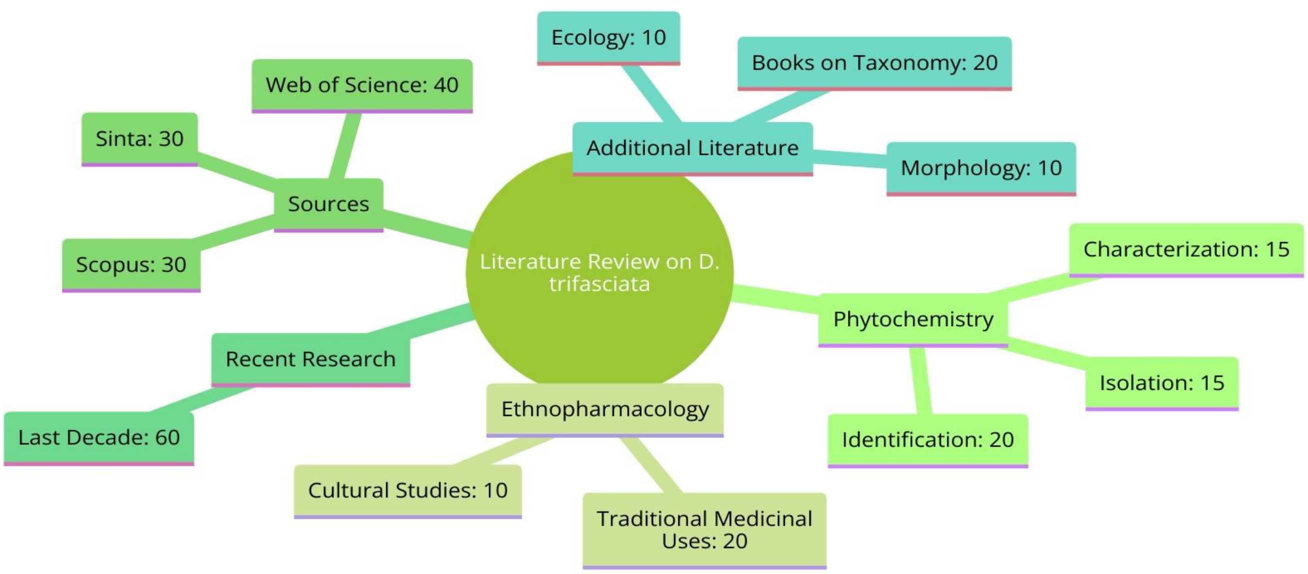

Figure 2. Systematical review diagram of phytochemistry and ethnopharmacology of *Dracaena trifasciata*

Comparing the distribution of *D. trifasciata's* habitat with other plant species reveals unique characteristics that distinguish it as a highly adaptive and widely distributed species. The *D. trifasciata* has spread to various parts of the world, showcasing its remarkable adaptability compared to other species that may have more limited or specific habitat distributions. For example, many endemic plant species can only be found in specific locations and are unable to adapt to diverse environments like *D. trifasciata*. The *D. trifasciata* is a hardy and low-maintenance plant that can be easily cultivated both indoors and outdoors. It prefers well-drained soil and moderate sunlight. It can be propagated through division, leaf cuttings, or rhizome cuttings. The ease of cultivation makes it a popular choice for indoor greenery and landscaping (Tallei et al. 2016; Tungmunnithum et al. 2018).

The *D. trifasciata*, a perennial plant with erect growth habit and broad evergreen leaves, is commonly cultivated as a popular indoor houseplant. It thrives in partially shaded areas that receive 2 to 6 hours of daily direct sunlight, although it can tolerate low light conditions (Denk et al. 2014; El Mokni and Verloove 2022). Providing well-drained soil and practicing careful watering is crucial to prevent root rot. During the spring to autumn seasons, it is advisable to allow the soil to dry between waterings, while in winter, watering once every one to two months is sufficient. With its ability to tolerate low humidity and cool temperatures around 50 degrees Fahrenheit, *D. trifasciata* demonstrates resilience and remains undamaged under various conditions (Freiberg et al. 2020; Ghaderi 2023). Although it naturally produces blooms during winter in its native habitat, flowering is rare when grown as a houseplant. One notable feature of this plant is its capacity to enhance air quality, making it a suitable choice for indoor environments. In the 1970s, NASA discovered that certain common houseplants, including *D. trifasciata*, effectively remove pollutants like formaldehyde, benzene, and ammonia from indoor spaces. Subsequent studies have corroborated these findings. As a result, *D. trifasciata* is often cultivated in containers and utilized as a ground cover filler in interior landscape designs (Husti et al. 2016; Pamonpol et al. 2020).

MORPHOLOGICAL CHARACTERS

The *D. trifasciata* is a species of evergreen perennial plant in the family Asparagaceae. The genus *Dracaena* encompasses various species of evergreen plants known for their ornamental foliage. The specific epithet "trifasciata" refers to the three longitudinal stripes or bands often present on this species's leaves. The *D. trifasciata* is commonly known by various names, including Snake Plant, Mother-in-Law's Tongue, Saint George's Sword, Viper's Bowstring Hemp, and more. These names are inspired by their appearance and the shape of their leaves (Rwawiire and Tomkova 2015). Numerous cultivars and varieties of *D. trifasciata* have been developed, featuring variations in leaf color, size, and pattern. Some popular cultivars include 'Golden Hahnii' with yellow-edged leaves, 'Laurentii' with yellow bands along the leaf edges, and 'Bantel's Sensation' with narrow white stripes running through the leaves (Wetterer and Wetterer 2022).

The *D. trifasciata* consist of two to six linear-oblanceolate leaves from fleshy underground rhizomes with pointed tips. They are often arranged in artistic clusters due to their striped, erect, and stiff nature. The 40-90 cm long and 5-7 cm wide sword-shaped leaves, resembling zebra skin, exhibit dark to light green coloration with yellow margins. Furthermore, they appear in ribbons ranging from 0.3 to 1 m in length, featuring whitish-green or grayish-white flowers attached to upright stalks, which are shorter than the leaves and approximately 30-75 cm long. The plant blooms during the spring and summer seasons (from September to February). The rhizomatous or creeping and relatively thick stem commonly grows underground. The rhizomes, which usually have a bright orange external part and a whitish inner portion, often grow horizontally on the soil surface or underground (Swinbourne and Robert 2007; Stover 1983). The wild roots are fibrous in shape and known to originate from the stem base, while normal roots possess a white pattern and appear full. The small round fruits, with a 7-9 mm diameter and two seed components, often turn bright orange once ripe. The seeds are pale brown and elongated, measuring around 6-7 mm in length and approximately 5 mm in width (Stover 1983; Acevedo-Rodríguez and Strong 2005; Dewatisari 2009).

ECOLOGICAL ASPECT

This species is known for its capacity to withstand various environmental conditions (Papaj 2022). It can adjust to various lighting situations, from dim indirect to strong light, and may additionally withstand periods of dry soil and be fairly drought-resistant. Therefore, the plan tis an increasingly common indoor landscaping and gardening choice. With a clumping growth style, this plant produces several rosettes of leaves that branch off a single base. The plant may eventually form dense colonies or clusters (Indirasetyo and Kusmono 2022).

The *D. trifasciata* plants are used as phytoremediation (Iswoyo et al. 2023). This plant can be a solution to environmental problems, one of which is reducing the bad effects of acid rain on the environment (Papaj 2022). Apart from being beneficial in reducing soil pollution, placing *D. trifasciata* in a closed room also contributes to improving indoor air quality, by reducing carbon dioxide concentrations by 10.47-19.29% (Pamonpol et al. 2020).

TRADITIONAL MEDICAL USES

Traditional medicinal use of *D. trifasciata* includes its application in wound healing. The plant extracts have been reported to promote wound closure, reduce inflammation, and accelerate tissue regeneration. These effects may be beneficial in managing various types of wounds (Yuniarsih et al. 2023). In traditional medicinal systems such as traditional Chinese medicine (TCM) and Ayurveda, *D. trifasciata* has been used to alleviate bronchitis, coughs, colds, and cold. The plant's mucilaginous properties help soothe throat irritation and promote expectoration. In traditional African medicine, various parts of the plant, including the leaves and rhizomes, have been used to treat skin infections, gastrointestinal disorders, and respiratory conditions. The *D. trifasciata* has been used as a traditional medicinal for treating influenza, cough, respiratory problems, inflammation, earaches, stomach ulcers, jaundice, pharyngitis, skin itching, and urinary diseases in India, Nigeria, Ghana, Congo, Indonesia, the Philippines, Myanmar, Yemen, China, Vietnam, Cambodia, Thailand, and Malaysia (Andhare et al. 2012; Berame et al. 2017; Abdullah et al. 2018; Dewatisari 2019). Additionally, it functions as an analgesic and antipyretic, and all the traditional uses in various countries can be seen in Table 1.

Table 1. The use of *Dracaena trifasciata* as traditional medicine in various countries

Continent & Country	Etnomedicinal Use/Ethnopharmacological Significance/Potential	Plant Part Used	Form Usage	References
Africa				
West Africa, Nigeria	Hemorrhage, dysentery, diarrhea, stomach and external ulcers, wounds, leucorrhea, fractures, piles, diabetes, and even tumors	Leaves and rhizomes	Brewed, decoction, pasted	Wambugu and Waweru (2016); Thu et al. (2020)
Congo	Rheumatism and gynecological problems	Leaves	Brewed	Machala et al. (2001); Sun et al. (2019); Sunilson et al. (2009); Thu et al. (2020)
Asia				
Indonesia	Snake bite, cough, cold, diarrhea, and treat wound	Leaves and rhizomes	Crushed, infusion, decoction	Aseptianova 2019); Wakhidah and Sari (2019); Hartanti and Budipramana 2020); Gita and Danuji 2021); Dewatisari 2022); Dewatisari and To'bungan 2023); Lestari et al. (2023); Dewatisari and Nuryandani (2024)
Philipines	Asthma, abdominal pains, colic, diarrhea, hemorrhoids, hypertension, menorrhagia, piles, sexual weakness, wounds of the foot, cough, leprosy, rheumatism, glandular Enlargement, nutritional deficiencies and treatment of snake bite	Leaves and rhizomes	No remark	Berame et al. (2017
India	Bronchitis, asthma, food poisoning, toxemia, cough, snake bite, insect bite	Leaves and rhizomes	Brewed, decoction, pasted	Machala et al. (2001); Sun et al. (2019); Thu et al. (2020)
Myanmar	Blood Forming Organs and Immune Mechanism Cancerous tumour 1 Digestive Constipation 1 Skin	Leaves and rhizomes	No remark	Machala et al. (2001); Andhare et al. (2012); Myint and Swe (2019); Sun et al. (2019); Thu et al. (2020); Kyaw et al. (2021); Nguyen et al. (2023)
Yemen	Hemorrhage, dysentery, diarrhea, stomach and external ulcers, wounds, leucorrhea, fractures, piles, diabetes, and even tumors	Leaves and rhizomes	Brewed, decoction, pasted	Machala et al. (2001); Sun et al. (2019); Thu et al. (2020)
China	Treating pain and stopping hemorrhages, and used as the substitute for the traditionally imported dragon's blood, called Long-Xue-Jie	Leaves and rhizomes	Brewed, decoction	Bratu et al. (2006); Thu et al. (2020)
Vietnam, Cambodia, Thailand	Cough, leprosy, rheumatism, glandular Enlargement, nutritional deficiencies and treatment of snake bite	Leaves and rhizomes	Brewed, decoction, pasted	Luu-Dam et al. (2016)
Malaysia	Ear pain, swellings, boils and fever	Leaves and rhizomes	Pasted, brewed, decoction	Anbu et al. (2009); Sunilson et al. (2009); Afrasiabian et al. (2017); Kee et al. (2020)
Yemen	Enhance immune function, promote skin repair, stop bleeding, and enhance blood circulation	Leaves and rhizomes	Pasted, brewed, decoction	Thu et al. (2020)

In Ghana, the roots are reportedly used for abortion and are often applied during childbirth. In Nigeria, the leaves and roots serve as traditional medicinal including asthma, stomach aches, colic, diarrhea, eczema, gonorrhea, hypertension, hemorrhoids, menorrhagia, snake bites, sexual weakness, and foot wounds (Okunlola et al. 2018; Tamanna et al. 2021; Permana et al. 2023). In Bangladesh, the whole plant is a tonic for treating alopecia, malaria, and snake bites. The leaves and rhizomes also treat bronchitis, asthma, cough, snake bites, and insect bites. The roots and leaves contain secondary metabolites such as saponins, which are applied as a cough medicine for snake bites, sprains, bruises, boils, abscesses, respiratory inflammation, and hair tonic. The plant also has antidiabetic, anti-allergic, anti-anaphylactic, and thrombolytic properties. The leaf extracts exhibit antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* bacteria. Recent studies have shown the anti-alopecia activity of the leaves (Babu and Prabhu 2023; Dewatisari et al. 2023). In Indonesia, the roots and leaves are boiled to treat diarrhea, cough, and flu among the Buton, Lampung, Purwakarta, and Yogyakarta communities (Hamidu 2009; Wakhidah and Sari 2019; Hartanti and Budipramana 2020; Gita and Danuji 2021). In Central Sulawesi, the roots and leaves are ground to treat snake bites and wounds (Aseptianova 2019; Hijrah et al. 2019; Nahdi and Kurniawan 2019; Hartanti and Budipramana 2020).

These findings highlight the extensive traditional uses of *D. trifasciata* in various countries to treat various ailments. The plant's bioactive compounds and medicinal properties became a subject of interest for further research and exploration of its potential applications in modern medicine. The *D. trifasciata* has a long history of traditional medicinal use in multiple countries. Its utilization in various regions for treating different ailments suggests that it possesses diverse medicinal properties (Maheshwari et al. 2017; Maroyi 2019). The plant is commonly employed to address respiratory issues like cough, bronchitis, and influenza, indicating its potential as a respiratory remedy. Additionally, its use in treating gastrointestinal problems such as stomach ulcers, diarrhea, and colic suggests its effectiveness in soothing digestive ailments. The *D. trifasciata* is also utilized for managing inflammatory conditions, including respiratory inflammation and skin itching. Its application as a traditional remedy for urinary diseases and jaundice indicates its potential diuretic and hepatoprotective properties. Furthermore, the plant's use in treating conditions like earaches, pharyngitis, and snake bites indicates its analgesic and anti-inflammatory characteristics. The secondary metabolites, such as saponins, in the roots and leaves of *D. trifasciata* may contribute to its medicinal properties. These metabolites are known for their expectorant, anti-inflammatory, and antimicrobial activities. The antibacterial activity against *E. coli* and *S. aureus* bacteria exhibited by leaf extracts highlights its potential as an antimicrobial agent (Bratu et al. 2006; Dewatisari et al. 2021). The findings also suggest that *D. trifasciata* holds promise in the management of certain chronic conditions. Its reported antidiabetic, anti-allergic, and anti-alopecia activities indicate potential therapeutic applications in diabetes, allergies, and hair loss (Aseptianova 2019; Hijrah et al. 2019; Nahdi and Kurniawan 2019; Hartanti and Budipramana 2020).

The integration of traditional knowledge and modern analytical methods offers a promising approach to uncover the medicinal properties of plants, including *D. trifasciata* (Walker et al. 2014; Krishna et al. 2020). By combining these resources, researchers can effectively identify and isolate bioactive compound for the plant's therapeutic effects. However, it is crucial to acknowledge the potential safety concerns associated with *D. trifasciata*. While the plant has a long history of traditional medicinal use, certain parts, contain toxic compounds if consumed in large quantities, particulary the leaves (Krishna et al. 2020). Therefore, it an imperative to exercise caution when utilizing *D. trifasciata* for medicinal or therapeutic purposes. It is advisable to seek guidance from healthcare professionals or subject matter experts before incorporating it into any treatment regimen.

Traditional preparations of *D. trifasciata* vary among different cultures and regions. Common preparation methods include decoctions, infusions, poultices, and topical applications. The traditional use of *D. trifasciata* is passed down through generations often based on empirical. Indigenous communities have developed specific knowledge and practices related to the plant, including its identification, collection, preparation, and administration. This knowledge is often deeply intertwined with local cultural beliefs, rituals, and healing systems. Many traditional uses of *D. trifasciata* have been documented, it is important to note that not all traditional claims have been scientifically validated. Modern scientific research aims to explore the plant’s bioactive compounds and pharmacological properties to verify its traditional uses and identify potential new therapeutic applications (Takawira-Nyenya et al. 2018; Rezgui et al. 2015). These studies can help bridge the gap between traditional and modern medicine and contribute to developing evidence-based healthcare practices.

ANTIOXIDANT ACTIVITY

The *D. trifasciata* extracts have been found to possess antioxidant properties. These properties are attributed polyphenols, flavonoids, and other bioactive compounds (Huang et al. 2024). As presented in Table 2, the 2,2-diphenyl-1-picrylhydrazyl (DPPH) method was commonly used to assess the antioxidant activity of *D. trifasciata*. The use of the DPPH method to assess antioxidant activity is a common approach in research. This method involves measuring the ability of a sample to neutralize or reduce the DPPH radical, which is a stable free radical. A lower IC_{50} value indicates a stronger antioxidant activity, as it represents the sample required concentration to scavenge 50% of the DPPH radicals (Baliyan et al. 2022).

Despite limited studies related to this, preliminary investigations have revealed high antioxidant activity, with an IC_{50} value <100 µg/mL, influenced by the phytochemical compounds in the plant (Lontoc et al. 2018; Pinky and Hossain 2020; Sarjani et al. 2021). Phenolic compounds are a group of phytochemicals known for their antioxidant attributes. These compounds are likely responsible for scavenging free radicals and protecting against oxidative stress (Tungmunnithum et al. 2018; Yu et al. 2020; Dohre and Yadav 2021). The leaf extracts have been reported to contain phenolic compounds, including flavonoids such as pyrano-isoflavones, which possess antioxidant potential (Swinbourne and Robert 2007; Abdullah et al. 2018; Lontoc et al. 2018; Yumna et al. 2018; Pinky and Hossain 2020). While the research results provide preliminary evidence of the antioxidant activity of *D. trifasciata*, further studies are crucial to explore the specific phenolic compounds and their mechanisms of action. Other methods and assay could also be employed to evaluate the plant's antioxidant activity and validate its potential as a natural antioxidant source. The *D. trifasciata* extracts may help protect cells from oxidative damage caused by free radicals. By reducing oxidative stress, the extracts may prevent DNA mutations and damage leading to cancer development (Maheshwari et al. 2017; Dewatisari et al. 2023).

ANTICANCER ACTIVITY

The cytotoxic or anticancer effects of *D. trifasciata* may be attributed to its phytochemical composition. Studies have identified various bioactive compounds in *D. trifasciata* extracts, including saponins, flavonoids, phenolic compounds, and alkaloids, known for their potential anticancer properties.The anticancer potential exploration of *D. trifasciata* is currently limited. As depicted in Table 3, investigations into the cytotoxic attributes of this plant focused on breast (T47D), liver (HepG2), and cervical cancer cells (HeLa). Based on the classification criteria of the US National Cancer Institute (Abdel-Hameed et al. 2012; Srisawat et al. 2013), the ethanol leaf extract of *D. trifasciata* induced weak cytotoxic activity in T47D cells (IC_{50} 537 µg/mL), while it stimulated moderate cytotoxicity in HepG-2 cells (IC_{50} 81±18.8 µg/mL). This is consistent with Trifasciatosides which exhibited moderate cytotoxicity against HeLa cells (Indrayanto et al. 2021). Although limited, some studies have explored the potential anticancer effects of *D. trifasciata* extracts. The plant extracts have shown cytotoxic activity against certain cancer cell lines in vitro. Overall, while the initial findings suggest some cytotoxic activity of *D. trifasciata* against certain cancer cell lines, further research is required to comprehensively evaluate its anticancer potential, optimize extraction methods, and elucidate the underlying mechanisms of action. The *D. trifasciata* extracts may induce apoptosis in cancer cells by activating signaling pathways that lead to cell death. This mechanism helps eliminate cancer cells without causing damage to healthy cells. The *D. trifasciata* extracts may interfere with the cell cycle progression of cancer cells, leading to cell cycle arrest. By halting cell division at specific checkpoints, the plant extracts prevent cancer cells from proliferating uncontrollably, inhibiting tumor growth. The bioactive compounds in *D. trifasciata* extracts may modulate various signaling pathways involved in cancer progression. These compounds have the potential to impede cellular pathways involved in processes such as cell proliferation, cell survival, angiogenesis (the formation of new blood vessels to supply tumors), and metastasis (the spread of cancer to other parts of the body) (Baldwin and Webb 2016; Krishna et al. 2022).

Further studies must be conducted on anticancer properties, specifically concerning the solvent type, extraction methods, and specific plant parts such as rhizomes, roots, and flowers. The anticancer mechanisms of the ethanol leaf extract of *D. trifasciata* and Trifasciatosides should be examined to understand their effects on the hallmarks of cancer. Future studies should focus on elucidating the bioactive compounds responsible for the anticancer effects, investigating their mechanisms of action, assessing their efficacy in animal models and clinical trials, and evaluating potential side effects and safety profiles.

Table 2. Antioxidant activity of *Dracaena trifasciata*

Sample	IC_{50} value	Method	References
Ethanolic extract of *D. trifasciata* leaves	93.15 and 50.84 mg/mL,	DPPH	Onah et al. (1994)
Ethanolic extract of *D. trifasciata* leaves	9.44 ppm	DPPH	Sarjani et al. (2021)
Ethanolic extract of *D. trifasciata* leaves	2.19 µg/mL	DPPH	Pinky and Hossain (2020)
Aqueous extract of *D. trifasciata* leaves	94.84 µg/mL	DPPH	Lontoc et al. (2018)

Table 3. Anticancer activity of *Dracaena trifasciata* in various cell models using in vitro methods

Sample	Cell model	IC_{50} (µg/mL) value	References
Ethanolic extract of *D. trifasciata* leaves	T47D	537 µg/mL	Saribanon et al. (2021)
Ethanolic extract of *D. trifasciata* aerial part nonflowering	HepG-2	81 ± 18.8 µg/mL	El-Hawary et al. (2021)
Trifasciatosides isolated from metanol extract aerial part of *D. trifasciata*	HeLa	26.5 µM	Teponno et al. (2017)

ANTIBACTERIAL ACTIVITY

The antibacterial potential of *D. trifasciata* is presented in Table 4. Bioactive compounds responsible for antibacterial activity include saponins, polyphenols, triterpenoids, alkaloids, and flavonoids (Hartono 2009; Oomariyah and Van Dijk 2022). Alkaloids, tannins, anthraquinones, terpenoids, saponins, flavonoids, steroids, and phenols found in the roots and leaves exhibit antiseptic and antibacterial properties by inhibiting the growth of *S. aureus*, *E. coli*, and *Pseudomonas aeruginosa* (Ahamad et al. 2017; Berame et al. 2017; Halyna et al. 2017; Buyun 2018).

Methanol, ethyl acetate, and ethanol extracts of *D. trifasciata* leaves can restrain pathogenic bacteria such as *S. aureus*, *P. aeruginosa*, *Bacillus cereus*, *Klebsiella pneumoniae, E. coli,* and *Salmonella* sp. (Table 4). According to Dewatisari et al. (2022), the active fraction of the leaves inhibits biofilm formation and virulence-related genes of *P. aeruginosa*. Biofilms are complex communities of bacteria enclosed in a self-produced extracellular matrix. They can enhance bacterial resistance to antibiotics and contribute to chronic infections. The active fraction derived from *D. trifasciata* leaves has been found to inhibit biofilm formation in *P. aeruginosa*, a bacterium commonly associated with biofilm-related infections (Dewatisari et al. 2021). Although research suggests the antibacterial potential of *D. trifasciata* and its bioactive compounds, additional investigations are warranted extraction techniques must be optimized and stable, and effifacy and safety in clinical setting must be evaluated. These further studies are essential for a comprehensive understanding of the therapeutic potential of *D. trifasciata* and its bioactive constituents in combating bacterial infections.

Review analysis has demonstrated the antibacterial efficacy of *D. trifasciata* extracts against specific bacterial strains. The study reported the inhibitory effects of the plant's methanol extract on the growth of *S. aureus*, *E. coli*, *P. aeruginosa*, *B. cereus*, *K. pneumoniae*, and *Salmonella* species. Another study found that the ethanol leaf extract of *D. trifasciata* exhibited antibacterial activity against *S. aureus*, *E. coli*, *P. aeruginosa*, and *Bacillus subtilis*. The *D. trifasciata* extracts have shown promise in combating multi-drug resistant bacteria, which are strains that have developed resistance to multiple antibiotics. A study reported that the ethanol extract of *D. trifasciata* leaves exhibited antibacterial activity against Methicillin-Resistant *S. aureus* (MRSA), a notorious multi-drug resistant pathogen. In some cases, combining *D. trifasciata* extracts with conventional antibiotics has demonstrated synergistic effects, enhancing the antibacterial activity (Kulkarni et al. 2023). This suggests that the plant extracts may augment existing antibacterial treatsments' efficacy.

The *D. trifasciata* has been traditionally used for wound healing purposes. Its antibacterial properties may contribute to its effectiveness in treating wounds by preventing or inhibiting bacterial growth at the injury site. While *D. trifasciata* extracts have shown antibacterial potential, it is important to consider safety aspects. Therefore, further research is needed to evaluate these extracts' toxicity, dosage, and potential side effect to ensure their safety in therapeutic applications. Future studies can focus on exploring the specific bioactive compounds inhibiting the antibacterial activity of *D. trifasciata* and understanding their action mechanisms (Huang et al. 2024). Additionally, investigations can be conducted to assess the extracts' efficacy in animal models and clinical trials to determine their potential use as antimicrobial agents. It is important to note that while the antibacterial potential of *D. rifasciata* extracts is promising, more research is needed to fully understand their mechanisms of action, optimize their extraction methods, evaluate their safety, and determine their efficacy in various bacterial infections.

TOXICITY

The toxicity of *D. trifasciata* has been extensively evaluated as indicated in Table 5. Several animal subjects previously used for this assessment included *Artemia salina*, Guinea pigs, Female Wistar Rats, Male Wistar Rats, and Swiss mice. The brine shrimp lethality test conducted using *A. salina* showed the toxic effects of various plant extracts with an LC_{50} value <1000 µg/ml (Meyer et al. 2018; El-Hawary et al. 2021).

Table 4. Antibacterial activity of *Dracaena trifasciata*

Sample	Tested Microorganism	MIC	References
Methanolic extract of *D. trifasciata* leaves	*S. aureus* *P. aeruginosa* *B. cereus* *K. pneumoniae* *E. coli*	50 µg/mL	Kingsley et al. (2013)
Ethyl acetate extract of *D. trifasciata* leaves	*E. coli*	12.5 mg/mL	Febriani et al. (2019)
Methanolic extract of *D. trifasciata* leaves	*S. aureus*	25 mg/mL	Febriani et al. (2019)
Ethanolic extract *D. trifasciata* leaves	*P. aeruginosa*	8 mg/mL	Dewatisari et al. (2021, 2023)
Potential fraction of ethanolic extract *D. trifasciata* leaves	*P. aeruginosa*	4 mg/mL	Dewatisari et al. (2021)

Table 5. Toxicity of *Dracaena trifasciata*

Sample	Toxicity	Value	References
Chloroform extract of *D. trifasciata* leaves	Toxic effect on female Wistar rats (*Rattus norvegicus* Berkenhout, 1769)	2000 mg/kg	Fitria et al. (2022)
Fresh leaves of *D. trifasciata*	Toxic effect on Brine shrimp (*A. salina*)	10 mg/mL	Berame et al. (2017)
Fresh roots of *D. trifasciata*	Toxic effect on Brine shrimp (*A. salina*)	44.49 μg/mL	Berame et al. (2017)
Ethanolic extract of *D. trifasciata* leaves	Toxic effect on Swiss mice (18-20 g) and Wistar rats (150-200 g)	1513.5±21.5 mg/kg; 1426± 43.6 mg/kg	Sunilson et al. (2009)
Ethanolic extract of *D. trifasciata* leaves	Toxic effect on Brine Shrimp (*A. salina)*	29.646 ppm	Mawardi and Siregar (2021)
Ethanolic extract of *D. trifasciata* leaves	Toxic effect on Brine Srimp (*A. salina)*	58.67 μg/mL	Pinky and Hossain (2020)
Ethanolic extract of *D. trifasciata* leaves	Toxic effect on Male rats of the Wistar strain	774.60 mg/kg	Ighodaro et al. (2017)

However, during testing with vertebrates comprising Female Wistar Rats, Male Wistar Rats, and Swiss mice, different results were obtained, as evidenced by higher LC_{50} values compared to *A. salina*. This indicated the lower toxicity effects experienced in vertebrate laboratory animals upon exposure to *D. trifasciata* preparations. Previous studies on Female Wistar Rats categorized the effect of the ethanol extract as the lowest hazardous (Fitria et al. 2022). The lower toxicity in the vertebrate test animals suggested its safety as a potential medicinal ingredient for human consumption, and further safety investigations are a must to consider the impacts on the kidneys, liver, and reproductive organs. Therefore, further dedicated studies are needed to comprehensively understand the impact of *D. trifasciata* extracts on these organs. These studies would involve rigorous toxicological evaluations, including histopathological examinations of organ tissues, assessment of organ function, and investigation of potential biochemical and molecular changes. Natural products, including plant extracts, can exhibit varying effects on different organs and individuals. Factors such as the dosage, exposure duration administration route, and individual susceptibility can influence the potential impacts on specific organs. These investigations are crucial to fully understand the safety and potential side effects of using *D. trifasciata* extracts as medicinal ingredients.

PHYTOCHEMISTRY

The *D. trifasciata* contains phytoconstituents such as flavonoids, sapogenin steroids including 25S-ruscogenin and sansevierigenin, pregnane glycosides, steroid saponins, methyl pyropheophorbide A, oliveramine, (2S)-3′,4′-methylenedioxy-5,7-dimethoxyflavane, 1-acetyl-β-carboline, digiprolactone, trichosanic acid, and methyl gallate (Tchegnitegni et al. 2017; Kasmawati et al. 2022; Dewatisari et al. 2023; Nguyen et al. 2023). Two known saponins, namely (24S,25R)-1b-[(β-D-fucopyranosyl)oxy]-3b -hydroxyspirost- 5-en-24-yl β-D-glucopyranoside (1) and 26- [(β-D-glucopyranosyl) oxy] -3 β, 22α - dihydroxyfurosta -5, 2 5(27)-dien-1β-yl-O-α-L-rhamnopyranosyl-(1→2)-α-L arabinopyranoside (2), were isolated and structurally characterized through an examination of the roots of *D. trifasciata* (Tchegnitegni et al. 2017; Nguyen et al. 2023). Phytochemical analysis of the whole plant revealed the presence of 1β,3β-dihydroxypregna-5,16-dien-20-one glycoside (Mimaki et al. 1997). These results provide insights into the diverse chemical composition of *D. trifasciata* and the geographical variations in the identified compounds. It highlights the potential for further exploration of the plant's phytochemical properties and potential applications in various fields such as medicine, agriculture, and industry.

The *D. trifasciata* leaves contain active ingredients, such as pregnane glycosides, alongside other compounds, including carotenoids, phytates, saponins, and tannins (Ikewuchi et al. 2011). A previous study reported high vitamin C content in Snake Plants (El-Hawary et al. 2021). A mature Snake Plant, comprising four to five leaves, can effectively purify the air within a $20m^2$ room area (Li and Yang 2020; Dewatisari and Nuryandani 2024).

The phytochemical constituents presented in Table 6 indicated the presence of tannins, glucogallin, gallic acid, corilagin, ellagic acid, terchebin, chebulagic acid, chebulinic acid, mucic acid, phyllembic acid, emblicol in leaves and rhizomes of *D. trifasciata* (Hariana 2013). A particular study identified several compounds from the ethanol leaf extract using GC-MS analysis. The results showed linoleic acid, palmitic acid (fatty acids), quinolone, steroid (campesterol), alkaloid (pyridine), terpenoid (phytol and cycloeucalenol), tocopherol (vitamin E), and flavonoid (pyrano-isoflavone). Additionally, squalene, L-(+)-ascorbic acid 2,6-dihexadecanoate, 1-heptacosanol, hexadecanoic acid 2-hydroxy-1-(hydroxymethyl)ethyl ester, p-cymene, Z-13-docosenamide, pentadecanoic acid, 1-iodo-2-methylundecane, 1-iodotridecane, isosorbide, Z-9-octadecenamide, 3,4-dimethoxybenzoic acid, palmitaldehyde, 1,2-benzene-dicarboxylic acid, delta-undecalactone, n-hexadecanoic acid, 6,10,14-trimethyl-2-pentadecanone, and dodecanoic acid were observed (Abdullah et al. 2018; Yumna et al. 2018). The obtained active compounds belonging to the fatty acid group included Cyclopropanebutanoic acid, 2-\[\[2-\[\[2-\ [(2-pentyl cyclopropyl) methyl\] cyclopropyl\] methyl\] cyclopropyl\] methyl\]-, methyl ester, n-hexadecanoic acid, hexadecanoic acid, ethyl ester, 11-octadecenoic acid, methyl ester, vitamin B5 (2-myristoyl pantetheine), strigol (2H-Indeno\[1,2-b\]furan-2-one, 3,3a,4,5,6,7,8,8b-octahydro-8,8-dimethyl), and diterpenoid (neophytadiene) (Dewatisari et al. 2021; Dewatisari and To'bungan 2023). These compounds have shown inhibitory effects on biofilm growth and gene expression in *P. aeruginosa*, reducing its pathogenecity (Dewatisari et al. 2023). Squalene, campesterol, neophytadiene, palmitic acid, and linoleic acid were also reported to possess anticancer properties (To'bungan et al. 2022a,b,c; Zhu et al. 2022). Furthermore 6,10,14-trimethyl-2-pentadecanone is predicted to act as a natural larvicidal against *Culex quinquefasciatus* larvae (To'bungan and Jati 2022).

The composition of phytochemicals can vary between different plants and within the same plant species. In the case of *D. trifasciata*, genetic variations, environmental conditions, and cultivation practices can influence the specific phytochemical composition. Phytochemicals are molecules that give plants their odor, color, and flavor while also being an important part of their defense system. Plants naturally manufacture these chemicals to protect themselves from external threats such as pathogenic microorganisms. This benefit can be extended to humans and is the foundation for plant-based medicine. There are over 6,000 phytochemical substances that have been isolated and identified.

Table 6. Phytochemical component of *Dracaena trifasciata*

Isolated/Detected Chemical Compound	Plant Part	Solvent	Analysis Methods	Plant Sources	Reference
Fatty acid (Cyclopropanebutanoic acid, 2-[[2-[[2-[(2-pentylcyclopropyl) methyl] cyclopropyl] methyl] cyclopropyl]methyl]-, methyl ester, n-Hexadecanoic acid, hexadecanoic acid, ethyl ester, 11-Octadecenoic acid, methyl ester), vitamin B5 (2-myristynoyl pantetheine), strigol (2H-Indeno [1,2-b] furan-2-one, 3,3a, 4,5,6,7,8, 8b-octahydro-8,8-dimethyl) dan diterpenoid (neophytadiene)	Leaves	Ethanol	GC-MS	Indonesia	Dewatisari (2022)
Alkaloids, tannins and cardiac glycosides	Leaves	Methanol	Observation on qualitative phytochemical screening	Nigeria	Umoh et al. (2020)
Steroidal saponins/Trifasciatune: 1,2-(dipalmitoyl)-3-*O*-*β*-D-galactopyranosylglycerol (6), aconitic acid (7), and 1-methyl aconitic acid	Leaves	Ethanol	NMR	Germany	Tchegnitegni et al. (2017); Teponno et al. (2017)
Sappanin-type homoisoflavonoids, named trifasciatine A and (-)-(3*R*)-trifasciatine B Dihydrochalcone (+)-(8*S*)-trifasciatine C	Whole plant	Methanol &Ethanol	NMR	Myanmar	Thu et al. (2020)
Alkaloids (1-Acetyl-β carboline, methyl pyrophaeophorbide A and oliveramine, flavonoids such as (2S)-3′, 4′-methylenedioxy-5, 7-dimethoxyflavane, monoterpenes digiprolactone, phenolic methyl gallate, and fatty acid trichosanic acid) 1,2-(dipalmitoyl)-3-O-β-D-galactopyranosylglycerol, Sansevierigenin, and Spirosta-5,25(27)dien-1b,3b-diol-1-O-a-L-rhamnopyranosyl-(1,2)-a-L-arabinopyranoside steroids or terpenoids	Leaves	Ethanol	LC-MS/MS	Indonesia	Kasmawati et al. (2022)
Phytol, stigmasterol, linoleic acid, oleic acid, stearic acid, palmitic acid, methyl linoleate, phytol, linoleic acid, oleic acid, stearic acid, stigmasterol, 2,3-Dyhidro-3,5-dihydroxy-6methyl-4H-pyran-4-one, Methyl14methylpentadecanoate and (23S)-ethylcholest-5-en3.beta.-ol	Leaves	Methanol	GC-MS	Indonesia	Oomariyah and Van Dijk (2022)
Tanin, glukogalin, gallic acid, korilagin, ellagic acid, terchebin, chebulagic acid, chebulinic acid, mucid acid, phyllembic acid, and emblicol	Leaves	Methanol and Ethanol	GC-MS	Russia	Karamova et al. (2016); Yumna et al. (2018)
Alkaloid, tannin, terpenoid, saponin, steroid, fenol, kardenolin, polifenol, asam metil glukoronat, glikosida, karbohidrat dan abamagenin	Leaves and rhizomes	Methanol	GC-MS	India	Philip (2011)
Alkaloids, tannins, antraquinnons, saponins, flavonoids, glycosides, sterols and triterpenes	Leaves and roots	Ethanol	GC-MS	Philippines	Bañez and Castor (2013); Berame et al. (2017)
Lignin, fatty material, cellulose	Leaves	Ethanol	LC-MS	Bangladesh	Abdullah et al. (2018)

These chemicals are used as medicinal agents and in manufacturing pharmaceuticals. Alkaloids can interfere with DNA and protein synthesis, causing cell death. They are utilized to kill cancer cells, and their antimicrobial activity is attributed to their capacity to block ATP-binding cassette (ABC) transporters. Anthraquinones stimulate the release of gastrointestinal hormones and the creation of histamine, serotonin, and prostaglandin PGE2. They also reduce water absorption and enhance intestinal peristalsis. Plants with these chemicals are used as purgatives (Klimko et al. 2018). Some carotenoids have the ability to block ABC transporters, which are typically overexpressed in drug-resistant tumor cells (Martin et al. 2019). Isoflavones are phytoestrogens that prevent some malignancies in menopausal women by blocking tyrosine kinases and expressing antioxidant and estrogenic activities. Furanocoumarins crosslink with proteins and DNA bases when exposed to UV light (Sreenivasan et al. 2015).

As a result, those phytochemicals play a crucial role in treating vitiligo and psoriasis by helping to eliminate growing keratinocytes in the skin. Lignins and lignans have cytotoxic and immunomodulatory properties that impede cell division by inhibiting microtubule formation. Saponins are amphiphilic chemicals that interact with cholesterol in the biomembrane, causing leakage and cell death. As a result, they play an important role in traditional medicine for infection treatment. Terpenes have antibacterial activity against various human diseases, including fungi and bacteria. Sansevieria is classified into the Nolinoideae subfamily of the Asparagales order and has approximately 70 species. These plants are primarily found in Africa but grow in subtropical and tropical regions around the world. *Dracaena* species can grow in locations with low rainfall due to the plants's ability to store a large amount of water in their leaves. The roots and leaves of Sansevieria plants are used to treat ear infections, diarrhea, viral hepatitis, jaundice, asthma, and other conditions (Sriprapat et al. 2014; Wei et al. 2021).

Therefore, it is important to consider these factors when studying or utilizing the plant for its potential health benefits, extracting phytochemicals from *D. trifasciata* requires appropriate extraction methods. Various techniques, such as maceration, Soxhlet extraction, and solid-phase extraction, can isolate and concentrate the desired compounds. The choice of extraction method can impact the extract's efficiency, selectivity, and overall phytochemical profile. The phytochemical-rich extracts of *D. trifasciata* have been explored for their potential applications in different fields. For instance, the antimicrobial properties of the plant extracts have been investigated for use in natural preservatives or disinfectants. The antioxidant and anti-inflammatory properties of the phytochemicals may have implications for the development of dietary supplements or skincare products. Additionally, the plant's traditional medicinal uses in certain cultures have sparked interest in further exploring its potential therapeutic applications (Dewatisari et al. 2018; Dewatisari 2019).

The *D. trifasciata* contains alkaloids, flavonoids, saponins, steroids, terpenoids, and tannins. At the same time, the linoleic acid component can interact with 5α-reductase receptors to prevent alopecia by prolonging the anagen phase of hair growth (Kasmawati et al. 2022), while steroid can affect the ability to eat *A. salina* larvae, so they are called as antifeedant (To'bungan et al. 2021). Alkaloids are nitrogen-containing compounds found in *D. trifasciata*. Some alkaloids present in the plant may have pharmacological activities, such as antimicrobial or analgesic effects. However, specific alkaloids identified in *D. trifasciata* and their exact biological activities are less well-studied than other phytochemical groups. Flavonoids are a group of polyphenolic compounds found in *D. trifasciata*. These compounds are known for their antioxidant and anti-inflammatory properties. They have been studied for their potential protective effects against chronic diseases, including cardiovascular diseases, certain types of cancer, and neurodegenerative disorders. Flavonoids are also been associated with immune-modulating effects and may contribute to the plant's therapeutic potential. Saponins are bioactive compounds found in *D. trifasciata*. These compounds have been associated with various biological activities, including antimicrobial, anti-inflammatory, and antioxidant effects. Saponins are known for their ability to form a foamy lather when shaken with water, and they are often responsible for the bitter taste of plants. They have been studied for their potential benefits in cardiovascular health, immune modulation, and cancer prevention. The *D. trifasciata* contains various phenolic compounds, including phenolic acids and tannins. These compounds possess antioxidant properties and have been shown to scavenge free radicals, reduce oxidative stress, and protect against cellular damage. Phenolic compounds have been studied for their potential role in preventing chronic diseases, like cardiovascular diseases, cancer, and neurodegenerative disorders. Terpenoids, including terpenes and sterols, are present in *D. trifasciata*. These compounds have diverse biological activities, including antimicrobial, anti-inflammatory, and antioxidant effects. Terpenoids have been investigated for their potential therapeutic applications, such as cancer treatment, infectious diseases, and inflammatory conditions (Maheshwari et al. 2017; Maroyi 2019).

The extract from *D. trifasciata* leaves shows promise as a herbal remedy for wound healing and could be formulated into hydrogel preparations to create a medicinal drug (Ahmed et al. 2022; Yuniarsih et al. 2023). The *D. trifasciata* also has therapeutic prospects in liver fibrosis (Raslan et al. 2021). These phytochemical compounds strengthens the potential of *D. trifasciata* as a medicinal plant, capable of providing antibacterial, antioxidant, and anticancer effects. The *D. trifasciata* has been investigated for potential hepatoprotective (liver-protective) and neuroprotective effects. Some studies have suggested that the plant's phytochemicals may help protect liver cells from damage and support liver function. Additionally, certain compounds may possess neuroprotective properties, which could have implications for managing neurodegenerative diseases. The *D. trifasciata* has a promising antiulcerative potential, and is safe for use in folk medicine. This valuable medicinal property is probably due to the array of important phytochemicals contained in the plant (Ighodaro et al. 2017).

The chemical compounds in different parts of *D. trifasciata* exhibit various properties and bioactive potential. Some of the compounds identified include fatty acids like cyclopropane butanoic acid, hexadecanoic acid, and 11-octadecenoic acid, which are known to have various biological activities. These fatty acids can affect inflammation, cell signaling, and lipid metabolism. Other compounds detected in *D. trifasciata* include alkaloids, tannins, cardiac glycosides, steroidal saponins, homoisoflavonoids, terpenoids, and flavonoids. These compounds have been studied for their potential pharmacological properties, such as antimicrobial, antioxidant, anti-inflammatory, antitumor, and immunomodulatory effects. The presence of these chemical compounds in different parts of the plant, such as leaves, roots, and rhizomes, suggests that *D. trifasciata* possesses a diverse array of bioactive constituents. This diversity may contribute to its traditional uses in various cultures for medicinal purposes. The abundance of compounds within natural sources provides excellent drug discovery and development opportunities, specifically serving as a guide for modern medicine. Natural compounds possess unique chemical structures and various pharmacological properties (Atanasov et al. 2015; Dewatisari 2015, et al. 2017; Mathur et al. 2022). The *D. trifasciata* has the potential to be applied as an antioxidant, antibacterial, and anticancer agent.

It is important to note that the specific composition and concentration of phytochemicals in *D. trifasciata* can vary. Several factors influence this variability, including plant age, growing conditions, and extraction methods, plant age can affect the accumulation of phytochemicals. Younger plants may have lower concentrations of certain compounds compared to mature plants. Similarly, the growing conditions, such as the availability of nutrients, light exposure, temperature, and humidity, can influence the plant's synthesis and accumulation of phytochemicals. Extraction methods also play a significant role in determining the composition and concentration of phytochemicals in *D. trifasciata*. Different extraction techniques, such as solvent extraction, steam distillation, or supercritical fluid extraction, can yield different results regarding the phytochemical profile. Factors like the choice of solvent, extraction time, temperature, and pressure can impact the efficiency and selectivity of the extraction process. Therefore, when studying the phytochemical profile of *D. trifasciata* or utilizing its extracts for various applications, it is crucial to consider these factors and account for the potential variations in composition and concentration. This understanding can contribute to more accurate and reliable research outcomes and effectively ensure the utilization of *D. trifasciata* in various fields, including medicine, cosmetics, and agriculture.

The chemical composition of *D. trifasciata* highlights its potential as a source of bioactive compounds with possible applications in medicine, cosmetics, and other industries. The effectiveness and safety of using *D. trifasciata* or its extracts for medicinal purposes should be evaluated through rigorous scientific investigations. Further safety investigations are needed to assess the long-term and short-term toxicity associated with using this plant material, making it a potential source for the development of modern drugs from natural sources. It's important to note that while *D. trifasciata* shows promise in various traditional uses and preliminary studies, more scientific research is necessary to understand and validate its potential health benefits fully.

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