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Comparative Analysis of the Phytochemical Contents of Dry and Fresh Leaves of *Sansevieria trifasciata* Prain

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In the Comparative analysis of the phytochemical contents of dry and fresh leaves of *Sansevieria trifasciata* Prain, the methanol extract from the plant materials revealed the presence of the alkaloids, flavonoids, tannins, saponins and cardiac glycosides in all the samples. However, In the fresh leaves, alkaloids and saponin were found to be abundant, flavonoids, tannins and cardiac glycosides were moderate. In the oven dry leaves, Alkaloids, tannins and cardiac glycosides were moderate, flavonoids and saponin were trace. In the room temperature dry leaves, flavonoids were in trace amount, alkaloids, tannins, saponins, and cardiac glycosides were moderate. The usefulness of *S. trifasciata* in traditional medicine could be traced to its rich phytochemical constituents especially of alkaloid, tannin and flavonoid. *S. trifasciata* which is a known ornamental plant in the Akwa Ibom State have certain medicinal constituents which would make it better pharmaceutical raw material and it is hereby recommended that more research should be carried out on this plant to find out it medicinal potency by treating more specimen organisms with their extracts and then placing them in the list of effective and high level pharmaceuticals.

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1. INTRODUCTION

Phytochemicals are naturally occurring plant chemicals found in fruits, vegetables, legumes, grains, plant leaves, and so on. They give plants its colour, flavor, smell and are part of a plants defense system [1]. Eating lots of plant foods rich in phytochemicals may help to prevent at least one in every five case of cancer, as well as other serious ailments such as heart disease. Plants produced these chemicals to protect themselves, but recent researches demonstrate that they can also protect humans against diseases [2,3]. There are about 6000 known phytochemicals in natural products and they have been isolated and characterized from fruits, vegetables, spices, beverages and many other sources [4].

Medicinal plants continue to be an important therapeutic aid for alleviating the ailments of humankind [5]. Natural products are known to play an important role in both drug discovery and chemical biology [5]. Although some therapeutic benefits can be traced to specific plant compounds, many herbs contain dozens of active constituents that, together, combine to give the plant its therapeutic value. Any part of the plant may contain active components [6,7,8,9]. The acceptance of traditional medicine as an alternative forms of health care and the usefulness of phytochemicals in the efficacy of these plants has led researches to investigate the phytochemical contents of medicinal plants [10].

1.1 Botany of *Sansevieria trifasciata* Prain

Sansevieria trifasciata is a species of flowering plant in the family Agavaceae, native to tropical West Africa from Nigeria east to the Congo. It is most commonly known as the snake plant, mother-in-law's tongue, and viper's bowstring hemp, among other names [11]. *Sansevieria trifasciata* is a thin leaf tropical plant often forming dense clumps of a spreading rhizome or stolons. [12,13]. The creeping underground stem (i.e. rhizomes) is relatively thick and somewhat fleshy (i.e. succulent) in nature. They are usually bright orange in colour on the outside and whitish on the inside. The large sword-shaped (i.e. ensiform) or elongated (i.e. lanceolate) leaves are borne upright (i.e. erect) and are usually arranged in small clusters of 2-6 leaves. These leaves (30-175 cm long and 2.5-9 cm wide) are rather thick and somewhat fleshy (i.e. succulent) in nature with sharply-pointed tips (i.e. acute apices). They have entire margins, are hairless (i.e. glabrous), and are usually quite long-lived. Both leaf surfaces are dark green in colour and irregularly striped and banded with pale green or whitish-green (i.e. they are variegated). The upright flowering stem (i.e. erect scapes) is relatively slender and are usually shorter than the leaves (30-75 cm long). They bear numerous flowers in an elongated cluster near their tip (i.e. in a terminal raceme). The flowers (2.5-3 cm long) are white, yellowish-white or greenish-white in colour and are usually arranged groups of 1-3 along the flowering stems. These flowers have six 'petals' (i.e. perianth segments) that are partially fused into a tube (i.e. perianth tube) 6-12 mm long and separate from six spreading lobes (15-20 mm long) at their tips. These lobes (i.e. perianth lobes) are quite narrow (i.e. linear) and are usually bent backwards (i.e. they are recurved) when the flowers are fully open. Each flower is borne on a stalk (i.e. pedicel) 6-8 mm long and also has six stamens (7-8 mm long) and a long style (15-18 mm long) topped with a small stigma. Flowering occurs mostly during spring and summer (i.e. from September to February). The small rounded (i.e. globose) fruit is a berry that turns from green to bright orange in colour as it matures. These fleshy fruits (7-9 mm across) contain two seeds. The seeds (6-7 mm long and about 5 mm wide) are pale brown and oblong shaped. This species reproduces by seed and also vegetatively via its creeping underground stems (i.e. rhizomes). The seeds are mainly dispersed by birds and other animals that eat the brightly coloured fruit. The creeping underground stems (i.e. rhizomes) can spread some distance and greatly increase the size of colonies. However, the main means of dispersal of this species to new areas is via the dumping of pieces of the underground stems (i.e. rhizome segments) in garden waste. *Sansevieria trifasciata* is regarded as an environmental weed in Queensland, New South Wales and the Northern Territory, and as a "sleeper weed" in other parts of Australia [14]. *Sansevieria trifasciata* is commonly called "mother-in-law's tongue" or "snake plant", because of the shape and sharp margins of its leaves. It is also known as the "viper's bowstring hemp", because it is one of the sources of plant fibers used to make bowstrings [15].

Fig. 1. *Sansevieria trifasciata* Prain

The objectives of this work is to investigate the phytochemical constituents of dry and fresh leaves of *Sansevieria trifasciata* and to compare and contrast the phtyochemical constituents of dry and fresh leaves of *Sansevieria trifasciata.*

1.2 Economic Importance of *Sansevieria trifasciata* Prain

1. In Africa, the leaves of *S. trifasciata* are used for fiber production which is used in making traditional ropes [16].
2. *S. trifasciata* is the most widely used and popular houseplants in temperate regions. In China, the plant is usually kept potted in a pot often ornamented with dragons and phoenixes [17].
3. In Korea, potted *S. trifasciata* is commonly presented as a gift for opening ceremonies of businesses or other auspicious events. In Barbados, *S. trifasciata* is also popularly referred to as the "money plant", with the belief that the person having it will always have money. The belief seems to be based on an association with the colour (green) with the US bills.
4. *S. trifasciata* has frequently been used as a set decoration in many films and TV shows, both in Hollywood and internationally, since at least the 1930s, including A Serbian Film, Being John Malkovich, Blue Velvet, Duck Soup, Groundhog Day, Homegrown, The Paper, and These Final Hours.
5. *S. trifasciata* is capable of purifying air by removing some toxins such as formaldehyde, xylene, and toluene. *S. trifasciata* use the crassulacean acid metabolism process, which absorbs carbon dioxide at night, although oxygen is released during daylight. Nighttime absorption of CO_2 purportedly makes them especially suitable bedroom plants. However, since the leaves are potentially poisonous if ingested, *Sansevieria* is not usually recommended for children's bedrooms [18].
6. According to feng shui, because the leaves of *S. trifasciata* grow upwards, the plants can be used for feng shui purposes [19]. Some believe that having *S. trifasciata* near children helps reduce coarseness, although care must be taken to ensure the child cannot reach the plant's poisonous leaves. Others recommend placing pots near the toilet tank to counter the drain-down vibrations [19]. Such placement appears in the 1986 film Blue Velvet.

2. MATERIALS AND METHODS

2.1 Plant Samples

I. Fresh leaves of *Sansevieria trifasciata*
II. Oven dry leaves of *Sansevieria trifasciata*
III. Room Temperature dry leaves *Sansevieria trifasciata*

2.2 Plant Samples Collection

The fresh samples of *Sansevieria trifasciata* used for this research work were collected from itam, in Uyo Local Government Area of Akwa Ibom State on August, 2018.

The plant materials were identified and authenticated by a taxonomist in the Department of Botany and Ecological studies, faculty of science, University of Uyo, Uyo Nigeria. The plant material was collected and processed for storage in the University of Uyo herbarium of the Department of Botany and Ecological Studies.

2.3 Plant Samples Preparation

The fresh leaves of *Sansevieria trifasciata* were washed and cut into pieces and separated in two, one was dry under room temperature and the other was oven dry for 5 days at 50°C.

The fresh leaves were cut and pounded using mortar and pestle into tiny pieces.

Maceration method was used with 99.5% methanol allowed for 4 days, a liquid methanol extract was obtained by filtration and evaporated to dryness in a water bath at 60%.

2.4 Materials

Digital water bath, masking tape, cotton wool, mortar and pestle, drying oven, digital weighing balance, filter paper, test tubes, dropper, spatula, sample bottles, beakers 50 ml, funnel, test tubes rack, pan, knife.

2.5 Chemicals and Reagents

Methanol, chloroform, ethylacetate, magnesium metal, dragendorff's reagent, distilled water, hydrochloric acid, ammonia, acetic anhydride, ferric chloride, glacial acetic acid, toluene, sodium hydroxide, potassium hydroxide, sulphuric acid, tetraoxosulphate (vi) acid.

2.6 Phytochemical Screening

The phytochemical screening was carried out on the crude extract of *Sansevieria trifasciata* leaves according to standard methods to identify the classes of bioactive compounds present [20,21].

3. RESULTS

The methanol extract from the plant on preliminary phytochemical screening of the plant materials revealed the presence of the alkaloids, flavonoids, tannins, saponins and Cardiac glycosides in all the samples.

In the fresh leaves, alkaloids and saponin were found to be abundant, flavonoids, tannins and cardiac glycosides were moderate. See Table 1.

In the oven dry leaves, Alkaloids, tannins and cardiac glycosides were moderate, flavonoids and saponin were trace. See Table 2.

In the room temperature dry leaves, flavonoids were in trace amount, alkaloids, tannins, saponins, and cardiac glycosides were moderate. See Table 3.

Table 1. Results of phytochemical screening of methanol extract of fresh *S. trifasciata* leaves

Metabolites	Test	Observation	Inference
Alkaloids	Dragendroff's reagent	Orange precipitate	+++
Flavonoid	Magnesium metal test	Orange precipitate	+
	Sodium hydroxide test	Yellow colour layers were formed with yellow colouration at ammonia layer	++
	Ammonia test	Two layers were formed with yellow colouration at ammonia layer	+
Tannins	Ferric chloride	Blue-black precipitate	++
Saponins	Frothing test	Persistent frothing	+++
Cardiac glycoside	Salkowski's test	Brown ring at interphase	++
	Keller killiani test	Brown ring at interphase	+++
	Lieberman's test	Dark brownish ring at interphase	+++
Anthraquinones	Combine anthraquinones	No red, pink or violet colouration	-
	Free anthraquinones	No red, pink or violet colouration	-

Abundant: +++; Moderate: ++
Trace: +; No trace: -

Table 2. Result of phytochemical screening of methanol extract of oven dry *S. trifasciata* leaves

Metabolites	Test	Observation	Inference
Alkaloids	Dragendroff's reagent	Orange precipitate	++
Flavonoids	Magnesium metal test	No colour change	-
	Sodium hydroxide test	Yellow colour	+
	Ammonia Test	No colour change	-
Tannins	Ferric chloride	Blue-black precipitate	++
Saponins	Frothing test	Persistent frothing	+
Cardiac glycoside	Salkowski's test	Brown ring at interphase	++
	Keller killiani test	Brown ring at interphase	+++
	Lieberman's test	Dark brownish ring at interphase	+++
Anthraquinones	Combine anthraquinones	No red, pink or violet colouration	-
	Free anthraquinones	No red, pink or violet colouration	-

Abundant: +++; Moderate: ++
Trace: +; No trace: -

Table 3. Result of phytochemical screening of methanol extract of room temperature dry leaves of *S. trifasciata*

Metabolites	Test	Observation	Inference
Alkaloids	Dragendroff's reagent	Orange precipitate	++
Flavonoids	Magnesium metal test	Orange precipitate	+
	Sodium hydroxide test	Yellow colour	++
	Ammonia Test	No colour change	-
Tannins	Ferric chloride	Blue-black precipitate	++
Saponins	Frothing test	Persistent frothing	++
Cardiac glycoside	Salkowski's test	Brown ring at interphase	++
	Keller killiani test	Brown ring at interphase	+++
	Lieberman's test	Dark brownish ring at interphase	+++
Anthraquinones	Combine anthraquinones	No pink, red or violet colouration	-
	Free anthraquinones	No red, pink or violet colouration	-

Abundant: +++; Moderate: ++
Trace: +; No trace: -

4. DISCUSSION

Since the extract from the fresh leaves of *S. trifasciata* has revealed the presence of alkaloids in abundance, it can be said that antibacterial activity of this plant as reported by [22] is as a result of the abundance of alkaloids which have antibacterial activity similar to the evaluated antibacterial activity of alkaloid of *Datura metel* leaves against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus mirabis*, *Salmonella typhi*, *Bacillus subtilis* and *Klebsiella pneumonia* but could not inhibit *Escherichia coli*. The fresh leaves are hereby the recommended sample for this pharmaceutical process. However, the fresh leaves have shown a higher composition of alkaloid compared to the dry sample. The abundance of alkaloid in the fresh leaves justifies its poisonous nature when ingested by children as reported by [18].

Flavonoids were moderate in the Fresh leaves extract. Flavonoids are ubiquitous in photosynthesizing cells and are commonly found in fruit, vegetables, nuts, seeds, stems, flowers, tea, wine, propolis and honey. For centuries, preparations containing these compounds as the principal physiologically active constituents have been used to treat human diseases [23]. This justifies its moderate occurrence in the fresh leaves extract compared to the trace occurrence of other extracts. Increasingly, this class of natural products is becoming the subject of anti-infective research, and many groups have isolated and identified the structures of flavonoids possessing antifungal, antiviral and antibacterial activity [24].

The n-butanol purified saponin which was abundant in fresh leaves, trace in oven dry leaves and moderate in room temperature dry leaves have been reported to be extracted from

sorghum bicolor where it was screened for antibacterial activity against three pathogenic microbes; *Escherichia coli*, *Staphylococcus aureus* and *Candida albicans*. The extract inhibited the growth of the *S. aureus*. It was found out that saponins have inhibitory effect on gram-positive organism but not on gram negative organism and the fungi [25]. Saponin extract from Sider (*Ziziphus spina* christi) were evaluated using antibacterial activity against gram negative bacteria like *E. coli, Proteus mirabilis* and gram positive like *Staphylococcus aureus* and *Streptococcus pneumoniae.*

Compounds of pharmacological interest (tannins) were isolated from the plant samples at the same moderate quantity were also isolated from species of *Solanum trilobatum* Linn and assayed against the bacteria, *Staphylococcus aureus*, *Streptococcus pyrogens*, *Salmonella typhi*, *Pseudomonas aeruginosa*, *Proteus vulgaris* and *Escherichia coli* where tannins exhibited antibacterial activities against all the tested microorganisms [26].

The presence of important compounds which were obtained from fresh, oven dry and room temperature dry leaves of the *Sansevieria trifasciata* showed potent antimicrobial activity in various literatures. The secondary metabolites in the plant extract was found out through its phytochemical analysis or screening process of which extract could be used for the treatment of various infections possessed as it possesses effective zone of inhibition.

The effect of the extract was experimented on pain models which indicated that it might be centrally acting. The extracts inhibited both phases of the formalin induced pain with a more potent effect on the second than the first phase. The formalin pain test was useful for evaluating the mechanism of pain and analgesia. Drugs which act centrally, such as narcotic analgesics, inhibits both phases of pain in this model peripherally acting drugs, such as acetylsalicylic acid or indomethacin, only inhibit the late phase [27]. The extract significantly reversed yeast-induced pyrexia. However, the extracts possess mild analgesic properties. This seems to provide a rationale for the use of this plant in fever and inflammatory disorders by local herbalists.

5. CONCLUSION

The phytochemical analysis of *S. trifasciata* revealed the presence of certain secondary metabolites which made the plant a significant medicinal plant and as such it uses in traditional medicine could be traced to its rich phytochemical constituents especially of alkaloid, tannin and flavanoid. *S. trifasciata* which is a known ornamental plant in the Akwa Ibom State have certain medicinal constituents which would make it better pharmaceutical raw material and it is hereby recommended that more research should be carried out on this plant to find out it medicinal potency by treating more specimen organisms with their extracts and then placing them in the list of effective and high level pharmaceuticals.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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