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Research Article

Phytochemical Screening of Aloe Elegans Leaf Skin

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Abstract

Aloe species can store water and chemical compositions in their swollen and succulent leaves. This makes the genus Aloe a unique source of phytochemicals. The various compounds of the Aloe species can be used in preparing medicinal and pharmaceutical, beauty and cosmetics, personal care and toiletry products, and bittering agents in alcoholic drinks. Aloe elegans is one of the indigenous plants in Ethiopia. Concerning the phytochemical content of Aloe species, the existent literature data is mostly focused on leaf gel, leaf latex, whole leaf, and fewer on flower extracts, and root. However, as far as I know, no work has been done on leaf skin, in this context; my study came to announce the phytochemical content of Aloe elegans leaf skin. Methanol extracts of leaf skin revealed the presence of flavonoids, tannins, anthraquinones, alkaloids, and terpenoids while saponin was absent. Generally, the presence of these phytochemicals has various applications mainly medicinal and industrial applications in the species. Therefore, further analysis is needed to isolate these constituents and test their biological activities.

Key words: aloe elegans; leaf skin; medicinal; and phytochemicals

1. Introduction

Aloe species can store water and chemical compositions in their swollen and succulent leaves because of their ability to survive in conditions such as dry and hot. This makes the genus *Aloe* a unique source of phytochemicals [**1**]. The various compounds of the *Aloe* species can be used in preparing medicinal and pharmaceutical, beauty and cosmetics, personal care and toiletry products, and bittering agents in alcoholic drinks, and they are also grown as ornamental plants **[2].** The phytochemicals and bioactivity of *Aloe* spp. have attracted research interest since the trade-in 'drug *Aloes*', prepared from the leaf exudate, expanded rapidly in the 19th century [**3**]. Aloes have various parts like leaf, stem, root, and flowers. *Aloe* plant leaves, **Figure 1**, **[4**], which are the most commonly used are heterogeneous and can be divided into three major parts, namely: (i) the outer green epidermis, which majorly consists of structural components of the leaf; (ii) the outer pulp region below the epidermis, consists of vascular bundles are placed where the bitter latex or sap is obtained part; and (iii) the inner leaf pulp, which consists of *Aloe* gel and containing parenchyma cells **Figure 2, [5].** The chemical constituents that have been identified in *Aloe* plants include vitamins, minerals, enzymes, simple and complex polysaccharides, fatty acids, indoles, hydrocarbons, dicarboxylic acids, aldehydes, ketones, phenolic compounds, phytosterols, pyrimidines, etc. with potential biological and toxicological activities [**6-8**].

A. elegans is found in Eritrea and Ethiopia **[9].** This species is one of the indigenous plants in Ethiopia and is found in most regions of the country like the Tigray, Welo, Gojam, Shewa, and Harerge regions [**10**], and they are used for different to cure various ailments and prevent the cause of diseases **[11].** The phytochemical analyses of this species have been checked for the presence/absence of phytochemicals. The preliminary phytochemical analysis of leaf gel [**2**, **12-13**] and root [**14**] revealed the presence of various phytochemicals which are used as a guide to isolate the compound that is used for many purposes. The difference in presence/absence of medicinally active constituents from the same *Aloe* might vary due to water stress, climate change, seasonality, growth period, light intensity as well as processing techniques, such as drying procedures **[15]**. In addition to this the solvent system used for extraction also affects the presence/absence of *Aloe* phytochemicals. Concerning the phytochemical content of *Aloe* species, the existent literature data is mostly focused on leaf gel [**2**], leaf latex **[16**], whole-leaf [**17**], fewer flower extracts [**18**], and root [**14**]. However, as far as I know, no work has been done on leaf skin extracts. In this context, my study came to announce the phytochemical content of *Aloe elegans* leaf skin. Therefore, the present study reports the detail of the phytochemical analysis of *A. elegans* leaf skin for further analysis.

Figure 1: *Aloe elegans*

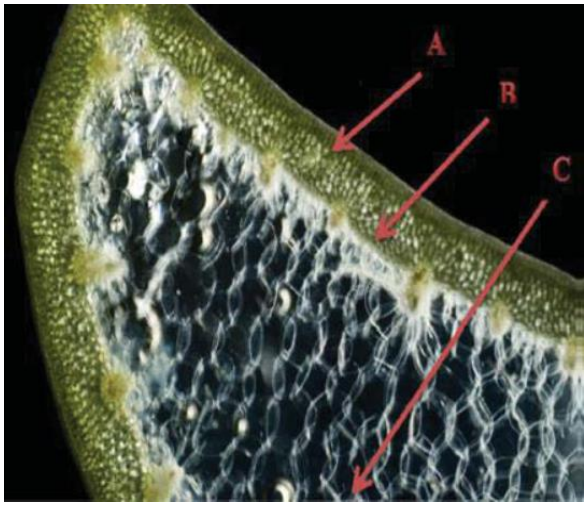

Figure 2: A cross-section illustration of *Aloe* leaf; A: epidermis or the outer rind, B: the outer leaf pulp, sap/exudate (latex) C: mesophyll or the inner leaf pulp (gel).

2. Methodology

2.1 Collection and specimen of plant materials

The leaves of *A. elegans* Todaro were collected from Mekelle city around Messebo Mountain Tigray Region, Northern Ethiopia (located at an altitude of 2140 m). The fully expanded and matured leaves of *A. elegans* Todaro (7-9) parts were selected by counting top to bottom. Then, they were cut by knife and brought to the Organic Research Laboratory of Mekelle University. The plant identification was done at the Department of Biology, Addis Ababa University.

2.2. Separating the skin part

The plant material was washed with water to remove dirt particles. The leaf latex of *A. elegans* Todaro was collected by cutting the leaves transversally near the base and arranging them concentrically around a plate. The collection of leaf latex was to make the skin part of leaf froe from latex. The gel of the leaf was separated by cutting the leaves' edge and skin with a sharp knife. The skin part was collected and dried under the shadow. The dried skin was ground by an electric machine. The powder of the sample was kept for further analysis. Generally, the procedure of sample preparing, starting from the plant selection to making it powder has been shown in the **Figure 3.**

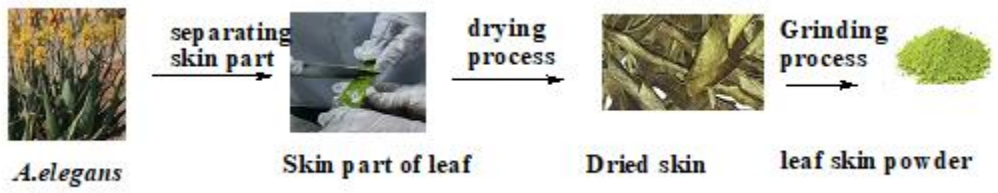

Figure 3: Separating and preparing powder of the *Aloe* leaf skin.

2.3. Extracting with solvent

To get the crude extract, solvent extraction was taken place as described in the literature [**19**] with modification. A 200.0 g powder of skin was extracted with 400 mL of methanol (3 times for 24 hr each). The samples were then filtered and concentrated using a rotary evaporator. The obtained sample was kept for further analysis.

2.4. Medicinally active constituents test

Crude extracts of leaf skin were preliminarily evaluated to determine the presence and/ or absence of flavonoids, tannins, anthraquinones, alkaloids, saponins, and terpenoids according to standard methods. Any change of colors or the precipitate formation was used as indicative of a positive response to these tests.

2.4.1. Flavonoid test

The flavonoids test was taken place by the method known as the alkaline reagent test**.** About 3 drops of sodium hydroxide were added to the extracts to give an intense yellow color. Then diluted hydrochloric acid was added. The disappearance of the yellow color indicates the presence of flavonoids [**20**].

2.4.2. Tannin test

The tannin test was taken place by the method known as the ferric chloride test. A 0.15 g of methanol extract was mixed with water and heated in the water bath. The mixture was filtered and 0.15 g solid $FeCl_3$ was added to the filtrate. The formation of dark-green color indicates the presence of tannin [**21**].

2.4.3. Anthraquinone test

The anthraquinone test was taken place by the method known as Borntrager's test. A 3 mL of aqueous extract was mixed with 3 mL of benzene; filtered and 5 mL of 10% ammonia was added to the filtrate. The mixture was shaken. The formation of pink, red, or violet color indicates the presence of anthraquinones **[22].**

2.4.4. Alkaloid test

The alkaloids test was taken place by the method known as Wagner's test. A 0.15 g of extract was stirred with 2.0 mL of dil. HCl and filtered. Then, 6 drops of Wagner's reagent were added. The presence of alkaloids is confirmed by the formation of reddish-brown precipitate **[23].**

2.4.5. Saponin test

The saponin test was taken place by the method known as the froth test. A 0.2 g extract was shaken with 10.0 mL of distilled water in a test tube and heated in the water bath for 15 min. The formation of the froth shows the presence of saponin [**24**].

2.4.6. Terpenoid test

The terpenoids test was taken place by the method known as Salkowski's test. A 0.1 g of extract was shaken with 2.0 mL of $CHCl_3$ followed by the addition of concentrated 2.0 mL H_2SO_4 along the side of the test tube; a reddish-brown coloration of at interface indicates the presence of terpenoid [**25**].

3. Results

Since the leaves of *Aloe* species have three parts and these parts can be analyzed separately. Therefore, the study has been focused on the skin of the leaf. The preliminary phytochemical screening of *A. elegans* leaf skin was tested for flavonoids, tannins, anthraquinones, alkaloids, saponin, and terpenoids showed the tested constituents are medicinally active. The crude extracts of methanol were used. Based on the organic solvent methanol and the methods used for each phytochemical, the leaf skin of *A.elegans* revealed a positive result for flavonoids, tannins, anthraquinones, alkaloids, and terpenoids while the negative result for saponin (**Table 1**).

Tested phytochemicals	Method of tests	Positive result inspection	Results
Flavonoids	Alkaline reagent test	Disappearance of yellow color	+
Tannins	Ferric chloride test	Dark-green color	+
Anthraquinons	Borntrager's test	Pink, red or violet color	+
Alkaloids	Wagner's test	Reddish-brown precipitate	+
Saponin	Froth test	Formation of the froth	-
Terpenoids	Salkowski's test	A reddish-brown coloration	+

"+" and "-" indicate the presence and absence of phytochemicals respectively.

Table 1: Result of phytochemical screening of *A. elegans* leaf skin

4. Discussion

There are various factors that determine the presence or presence of phytochemicals. In the present study, the leaf skin of *A.elegans* has been tested with methanol. The presence of biologically active constituents has been investigated. These constituents have various applications mainly medicinal and industrial applications in the genus *Aloe*. The presence of phenolic compounds in the plants like flavonoids has pharmacological and biochemical actions viz., antioxidant, anti-allergic, anti-inflammatory, hepatoprotective, anti-carcinogenic, anti-viral, and antithrombotic activities [**26, 27**]. They exist widely in the plant kingdom and displayed a positive correlation between increased consumption of flavonoids and reduced risk of cardiovascular and cancer diseases **[28].** Anthraquinones have wide medicinal applications such as antimicrobials, analgesics, [**29**], anti-inflammatories, varicella-zoster, herpes simplex type I and II, influenza, and pseudo rabies [**30**], and many others [**31**]. The phytochemicals such as tannins are used in anti-hemorrhoidal, hemostatic, and anti-diarrheal preparations [**32**]. Terpenoids such as triterpenes, sesquiterpenes, and diterpenes have been referred to as antibiotics, insecticidal, anthelmintic, and antiseptic in the pharmaceutical industry [**22**, **33**]. Terpenoids are naturally occurring organic molecules found in all living organisms like plants. They have antibacterial properties. Terpenoids play an active role in wound healing, strengthen the skin, increase the concentration of antioxidants in wounds, and restore inflamed tissues by increasing blood supply [**34**, **35**]. Alkaloids in plants have been extensively researched because of their biological activities. Studies on a number of these alkaloids have demonstrated that many of them have many pharmacological activities such as anticancer, antibacterial, antiviral, antioxidant, and antifungal [**36**].

Generally, the presence of phytochemicals/medicinally active constituents in *Aloe* species has the medicinal activities of wound healing and cell proliferation, intestinal absorption and purgative action, anti-inflammatory and immunomodulatory effects, hepatoprotective activity, antioxidant effect, antibacterial activity, antifungal activity, antiviral activity, antimalarial activity, anthelmintic activity, anticancer activity, antidiabetic activity, antihyperlipidemic activity, effect on estrogen status, antiulcer activity, treatment of cardiovascular disorders, skin use, anti-aging effect, antiallergic activity, effect on central and peripheral nervous systems [**5, 37-40**]. These constituents can show therapeutic effects whether in the form of crude extracts (synergetic effect) or by isolating a single compound and testing against diseases.

5. Conclusion

Most of the time investigations of *Aloe* leaf skins are underestimated and the skins are disposed of as waste materials. However, the leaf skin of the *Aloe* species is also rich in phytochemicals like other parts. The current phytochemical analysis of *A. elegans* leaf skin revealed the medicinally active constituents. The presence of flavonoids, tannins, anthraquinones, saponin, and terpenoids from methanol extracts was confirmed. Therefore, this result shows that the skin is a source of phytochemicals even if alkaloids are absent.

In another way, methanol can be used to isolate the presented compounds from *A.elegans* leaf skin. Based on the present finding, *A.elegans* might be taken into consideration for further study. Hence, more work should be studied to extract, isolate and characterize the presented phytochemicals. In addition to that, the biological activities of these compounds whether from extracts or by isolating them are another recommended work.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

The data that used are included in this manuscript.

Competing interests

The author declares that he has no competing of interests

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Authors' contributions

All parts were written by the corresponding author.

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