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Phytochemicals Screening in Four Solvent Extractions of Pulverized Witchweed (*Striga asiatica*)

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ABSTRACT: *Striga asiatica*, commonly known as Witchweed, is a parasitic plant that significantly impacts cereal crops such as maize, sorghum, and millet, leading to severe agricultural losses. Besides its agricultural threat, *S. asiatica* has a rich history of use in traditional medicine for treating various ailments. This research focuses on analyzing the phytochemical composition of *S. asiatica* using four different solvent extracts: ethyl acetate, methanol, chloroform, and N-hexane from pulverized plant material. The goal is to identify the primary bioactive constituents and explore their potential medicinal properties. Standard analytical techniques were employed to evaluate the phytochemical profiles of the different solvent extracts. The study consistently identified alkaloids, cardiac glycosides, and triterpenes across all extracts. Flavonoids, saponins, and tannins were specifically present in the ethyl acetate and methanol extracts but were absent in chloroform and N-hexane extracts. Notably, anthraquinones and steroids were not detected in any of the solvent extracts, suggesting a unique phytochemical profile for *S. asiatica*. An important finding is the significant activity of the N-hexane extract against pathogenic organisms such as *Culex quinquefasciatusaa*, indicating potential antifungal and antihelminthic properties. These results underscore the diverse phytochemical profile of *S. asiatica* and its potential therapeutic applications. The study highlights the need for further research to fully understand the bioactive compounds and their mechanisms of action, which could lead to new applications in medicine and agriculture.

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Striga asiatica (L.) O. Kuntze, also known locally as Talakh or Taukla, is a herbaceous parasitic flowering plant. It is an obligate hemiparasite, meaning it requires a host for most of its life cycle. Despite this, it does contain chlorophyll (Gwatidzo *et al*., 2020). Striga species primarily affect monocotyledonous cereals such as sorghum, rice, maize, and millet, except *Striga gesneroides* (Gwatidzo *et al*., 2020). Striga plants are characterized by opposite leaves, irregular-coloured flowers, herbaceous habitat, small seeds, and parasitism (Vurro *et al*., 2019). *Striga hermonthica*, a related species, has bright to dark green leaves and erect, usually branched stems that can grow up to 77 cm or taller. The stems are stout and quadrangular, and the leaves are linear, lanceolate, or lanceolate with acute or acuminate tips, ranging from 1-3 inches in length and very scabrous. The inflorescence has 6-10 open flowers measuring 1-2 cm across, which can be pink, red, white, purple, or yellow. The spike may occasionally have more than 10 open flowers, and the corolla typically falls off a few days after fertilization. *S. asiatica*, despite being considered a significant weed that affects most crops and vegetables in Africa, also has beneficial applications in traditional African medicine (Dafaallah, 2019). It is used by African people to treat hypertension, as a stimulant and an appetizer. Its antibacterial, antifungal, and antihelminthic

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properties have been proven (Kpakure and Rothe, 2012). Phytochemical evaluation of *S. asiatica* involves identifying the presence and concentration of bioactive components in various solvent extracts (Kandasamy *et al*., 2023). This evaluation is crucial for determining the potential therapeutic properties of the plant and its importance in traditional medicine. Research typically focuses on identifying chemicals such as alkaloids, flavonoids, tannins, and saponins that may contribute to the plant's therapeutic properties. Different solvents can extract different phytochemicals, underscoring the importance of solvent selection in optimizing yield and efficacy (Bitwell *et al*., 2023). This study aims to analyze the phytochemicals in four solvent extractions of powdered Witchweed (*S. asiatica*) to identify the constituents of the plants, isolate the predominant ones, and identify the bioactive agents supporting its traditional applications using appropriate standard techniques.

MATERIALS AND METHODS

The *S. asiatica* (Whole plant) was collected from its natural environment in Kundu village, Giwa Local Government Area (110 071 14.77'' N 70 241 20.34''E), Nigeria. The plant was then taken to the Herbarium unit at the Department of Botany, Faculty of Life Sciences, Ahmadu Bello University Zaria for proper identification, authentication, and allocation of voucher number 24389. The plant material was air-dried on wooden tables at room temperature in the laboratory until it became brittle. Afterwards, it was pulverized using a mortar and pestle, and stored in labeled polythene bags until needed. The pulverized plant material underwent Soxhlet extraction with methanol, ethyl acetate-hexane, and chloroform successively, starting with N-hexane, chloroform, ethyl acetate, and methanol in increasing order of solvent polarity. The condensed extracts were then screened for phytochemicals based on the methods outlined by Kokates (1988) and Anonymous (2008). A rotary evaporator was used to remove excess solvents from the extracts until solidification. The solidified extracts were then stored in labelled vials at room temperature until they were ready for qualitative phytochemical screening.

The various solvent extracts were subjected to preliminary phytochemical screening according to the procedures and methods described by Harborne (1973) and Trease and Evans (2002).

Test for Alkaloids: (a) Mayer's test: A creamy white precipitate upon the addition of a few drops of Mayer's reagent to a portion of the extract indicated the presence of alkaloids (Trease and Evans, 2002).
(b) Dragendorff's Test: A reddish-brown precipitate upon the addition of a few drops of Dragendoff reagent to a portion of the extract indicated the presence of alkaloids (Trease and Evans, 2002).

Test for Flavonoids: Sodium hydroxide Test: A yellow colouration resulting from the addition of a few drops of 10% sodium hydroxide to a portion of the extract indicated the presence of flavonoids (Trease and Evans, 2002).

Test for Saponins: Frothing Test: The formation of a honeycomb froth that persisted for 10-15 minutes upon vigorous shaking of a portion of the extract with 10ml of distilled water indicated the presence of saponins (Trease and Evans, 2002).

Test for Unsaturated Steroid and Triterpenes: Liebermann-Buchard Test: Immediate observation of color changes such as blue to blue-green in the upper layer, and reddish, pink, or purple in the lower layer upon the addition of an equal volume of acetic acid anhydride to a portion of the extract, followed by the addition of 1 ml of concentrated sulfuric acid down the side of the test tube, indicated the presence of triterpenes (Trease and Evans, 2002).

Test for Tannins: Ferric chloride Test: The formation of a blue or brownish precipitate upon the addition of 3-5 drops of ferric chloride solution to a portion of the extract indicated the presence of hydrolysable tannins (Trease and Evans, 2002).

Test for Anthraquinone family of quinine: Bornträger's Test: The absence of colour change upon shaking a portion of the extract with 5ml of chloroform and subsequently with an equal volume of 10% ammonia solution indicated the absence of anthraquinone (Trease and Evans, 2002).

Test for Cardiac Glycosides: Keller-Kiliani Test: Observation of a purple-brown ring at the interphase and a pale green colour in the upper acetic layer upon dissolving a portion of the extract in 1ml of glacial acetic acid containing traces of ferric chloride solution and subsequently adding 1ml of concentrated sulfuric acid down the side of the test tube indicated the presence of desoxy sugars and cardiac glycosides, respectively (Trease and Evans, 2002).

RESULTS AND DISCUSSION

The table below lists the phytochemical occurrences in all four solvent extractions of *S. asiatica*.

Phytochemicals were identified in the n-hexane, chloroform, ethyl acetate, and methanol solvent extractions of *S. asiatica*. Alkaloids were detected in all four solvent extractions, while anthraquinones and steroids were not detected in any of them.

Cardiac glycosides and triterpenes were identified in all four solvent extractions, and flavonoids, saponins, and tannins were found only in the ethyl acetate and methanol solvent extractions of *S. asiatica*. *S. asiatica* contains high levels of alkaloids, flavonoids, cardiac glycosides, triterpenes, and saponins. Anthraquinones and steroids were not present in the solvent extractions of *S. asiatica*. These phytochemical compounds could potentially be responsible for the larvicidal activity of *Striga asiatica* against *C. quinquefasciatusa*. Plants produce various chemical compounds such as alkaloids, glycosides, flavonoids, tannins, triterpenoids, steroids, saponins, diterpenes, resins, and volatile oils as mentioned by Gunjals (2020).

This statement is in line with the findings of Kakpure and Rothe (2012) that the chloroform and ethanol solvent extractions of *S. asiatica* indicated the presence of phytochemical constituents such as alkaloids, flavonoids, tannins, cardiac glycosides, and saponins. The presence of alkaloids, cardiac glycosides, and triterpenes in the four solvent extractions of *S. asiatica* supports the findings of Koua (2011) showing the presence of these compounds in the related *S. hermonthica*. The presence of flavonoids, saponins, and tannins in the ethyl acetate and methanol solvent extractions of *Striga asiatica* also aligns with the findings of Koua 2011 in the related *S. hermonthica* (Koua, 2011).

S. asiatica is rich in alkaloids, cardiac glycosides, triterpenes, flavonoids, saponins, and tannins, with no detection of anthraquinones and steroids in any of the solvent extractions. Previous studies have shown that medications containing flavonoids possess antifertility properties (Kakpure and Rothe, 2012). Recent studies have demonstrated that plants containing phytochemical compounds such as flavonoids have anti-inflammatory, antimutagenic, antiallergic, antiviral, and anticarcinogenic properties (Roy *et al*., 2022). Although comprehensive information on the pharmacological activities of *Striga asiatica* is limited, previous research has indicated that plants containing alkaloids have exhibited significant anticancer potential (Dar *et al*., 2023).

Table 1: Qualitative phytochemical components of the four solvent extracts of *Striga asiatica*

Extracts Type	Alkaloids	Anthraquinones	Cardiac glycosides	Flavonoids	Saponins	Steroids	Tannins	Triterpenes
N hexane	+	-	+	-	-	-	-	+
Chloroform	+	-	+	-	-	-	-	+
Ethyl acetate	+	-	+	+	+	-	+	+
Methanol	+	-	+	+	+	-	+	+

Conclusion: The Striga genus is the most economically significant member of the Scrophulariaceae plant family that parasitizes various crops, such as sorghum, pearl millet, rice, maize, and sugarcane in Africa, India, Asia, Australia, and some parts of the USA. This poses a threat to food security in these regions. However, it also has beneficial applications in traditional African medicine. Phytochemical analysis using hexane, chloroform, ethyl acetate, and methanol revealed the presence of terpenes, alkaloids, and cardiac glycosides in all the extracts. Additionally, flavonoids, saponins, and tannins were detected in all the extracts except in hexane and chloroform extracts, while anthraquinones and steroids were not found. Nevertheless, further comprehensive research on the use of *Striga asiatica* in traditional medicine is necessary.

Declaration of Conflict of Interest: The authors declare no conflict of interest.

Data Availability Statement: Data are available upon request from the first author (corresponding author).

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