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Phytochemical screening and antifungal activity of *Cassia alata* (Linn.) crude leaf extracts

Emmanuel Edegbo[1], Martin-Luther Oseni Okolo[1], Adetunji Sunday Adegoke[1], Cornelius Arome Omatola[1]*, Benjamin Mudi Idache[2], Joseph Oyiguh Abraham[1], Monday Eneojo Akor[1], David Adeiza Zakari[1], Adebayo Zainab Alaba[1], Sunday Omale[3], Abdulrazaq Yahaya[3], Qasim Musa[4] and Danjuma Muhammed[5]

[1]Department of Microbiology, P.M.B.1008, Prince Abubakar Audu University, Anyigba, Nigeria.
[2]Department of Health and physical kinetics, Prince Abubakar Audu University, Anyigba, Nigeria.
[3]Department of Pure and Industrial Chemistry, Prince Abubakar Audu University, Anyigba, Kogi State, Nigeria.
[4]Department of Chemical Engineering, Ahmadu Bello University, Zaria, Nigeria.
[5]Department of Biology, Epidemiology and Public Health Unit, Universiti Putra Malaysia.

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The antimycotic effect of *Casia alata* (Linn.) commonly used for the treatment of skin diseases by local people in Nigeria was evaluated against dermatophytes (*Trichophyton tonsurans*, *Trichophyton rubrum, Trichophyton mentagrophytes, Microsporum audouinii*, *Microsporum canis*, *Microsporum gypseum, Epidermophyton floccosum*). Ten-fold serially diluted extract concentrations were subjected to phytochemical screening and the antimycotic activity of the phytochemicals was evaluated via broth microdilution. The percentage yield of crude aqueous, n-hexane, chloroform, ethanol, and methanol leaf extracts of *Cassia alata* Linn was 5.6, 5.7, 1.6, 4.8, and 2.8%, respectively. Important phytochemicals including glycosides, anthraquinone, proteins, cardiac glycosides, steroids, alkaloids, phlabotannin, phenols, saponins, tannins, flavonoids, and carbohydrates were present in all the extracts. All the extracts inhibited the dermatophytes but at varying degrees. Similar minimum inhibitory concentration (MIC) values ranging from 1.56 to 3.125 mg/mL each for n-hexane and chloroform leaf extracts and MIC of 0.78 to 1.56 mg/mL each for ethanol and methanol leaf extracts were estimated. The minimum fungicidal concentration (MFC) of 6.25 mg/mL, 3.125 to 6.25 mg/mL, 1.56 to 6.25 mg/mL, 0.78 to 1.56 mg/mL for n-hexane, chloroform, ethanol, and methanol leaf extracts were observed and all the extracts were maximally active against *E. floccosum.* In conclusion, the potent anti-dermatophytic effect of the leaf extract of *Casia alata* Linn may be driven by their numerous phytochemicals, which justify its traditional uses for the treatment of skin diseases and could considerably illicit interest for the development of new drug leads.

Key words: Dermatophytes, *Cassia alata* Linn., Crude leaf extract, Phytochemicals, Antifungal.

INTRODUCTION

Over the centuries, medicinal plants have served as remedies for infectious diseases due to the presence of bioactive components with therapeutic value (Fatmawati et al., 2020). Besides the nutrients such as vitamins, carbohydrates, lipids, proteins, and essential minerals that are provided by plants, man has long realized that the consumption of some plants offered additional benefits through improved health conditions (Lim, 2014),

hence the birth of the medicinal application of plants. Importantly, the parts of the plant used for medicinal purposes differ among plant species. For some plants, the bioactive component is in the roots while others have theirs in leaves, seeds, fruits, flowers, or stem bark (Selvi et al., 2012).

Cassia alata Linn (family, Fabaceae) is a tropical shrub, though can also grow well in the temperate. *C. alata* serves the purpose of both an ornamental and medicinal plant (Fatmawati et al., 2020). Bioactive compounds such as flavonoid, tannin, saponin, alkaloid, Phenol, steroid, alatinon, alanonal, and β-sitosterol-β-D-glucoside have been isolated from *C. alata* (Fatmawati et al., 2020) and the anti-inflammatory, anti-allergic, antioxidant, antidiabetic, anticancer, and antifungal potentials of the plants have been credited to the bioactive compounds (also called phytochemical substances) in different studies (Reezal et al., 2002; Sule et al., 2011; Akinmoladun et al., 2010; Patrick-Iwuanyanwu et al., 2011; Chatterjee et al., 2013; Fatmawati et al., 2020). The stem bark of *Cassia alata* Linn *(*C. *alata* L.*)* is used in the treatment of parasitic skin diseases, and fungal infections like ringworm and used as a common chemical ingredient in shampoos, lotions, and soaps due to the antifungal properties (Sule et al., 2011). In addition, the leaf extract of *Cassia alata* is credited for the treatment of intestinal parasitosis, constipation, inguinal hernia, venereal diseases (syphilis and gonorrhea), and diabetes (Dutta and Chatterjee, 2012). In Nigeria, the leaves of the plant in the form of an infusion are used as a purgative, and a strong decoction is sometimes given as an abortifacient or during labor to hasten delivery. Usually, the juice from the fresh leaves is taken alongside lime juice to treat worms (Dalziel, 1937).

Globally, health statistics have shown that conventional antimicrobial agents currently in use have met numerous challenges due to the increased drug resistance in human pathogens and the undesirable side effects associated with most drugs (WHO, 2020). Further, antimicrobial resistance contributes to an increase in health care costs owing to longer duration of illness, the requirement for additional tests, use of more expensive drugs as well as intensive care (WHO, 2020). Thus, there is a need to develop alternative, efficient, safe, and cost-effective natural medicines from plants (Toh et al., 2023). Over the last decades, human dependence on natural products from plants for maintaining health has increased dramatically (Samson et al., 2021). Therefore, studies to discover more medicinal plants and/ or highlight the scientific basis for the efficacy of plants employed in herbal medicine have become a priority globally. In this study, we evaluated the phytochemical properties and *in vitro* antifungal activity of crude leaf extract of *C. alata* (Linn.) on field strain dermatophytes.

MATERIALS AND METHODS

Collection and identification of plant materials

Fresh leaves in the upper part of *C. alata* plants (Figure 1) were collected from three different locations (7°15'-7°29'' N, 7°11'-7°32'' E) of the eastern part of Kogi State, Nigeria (Omatola et al., 2020). The leaf samples from the under one-year matured plants were obtained in 2019 from Anyigba, Egume and Ochaja. The leaves were carefully plucked from the stem using a sharp knife and were transported to the Department of Plant Science and Biotechnology, Prince Abubakar Audu University, where they were identified and authenticated by Mr. Momoh Theophilus.

Test organism

The dermatophyte isolates namely**,** *Trichophyton tonsurans*, *Trichophyton rubrum, Trichophyton mentagrophytes, Microsporum audouinii*, *Microsporum canis*, *Microsporum gypseum, Epidermophyton floccosum* were field isolates obtained from previous (M. Sc) work in the Department of Microbiology, Prince Abubakar University Anyigba, Kogi State (Edegbo and Odama, 2015).

Preparation of plant materials

The leaves of each plant sample were separated from the stalk, spread separately on clean tarpaulins, and air-dried for about 10 days on the workbench. Using the Grindomix GM 200 grinding machine, the properly dried plant materials were pulverized individually into a fine powder (about 143 microns) and then packed in an airtight container made from plastic for further processing.

Sample processing

Aqueous extraction

The modified method of Adegoke et al. (2010) was used. Briefly, one hundred grams (100 g) of the powdered leaf of *Cassia alata* was macerated in 400 ml of sterile distilled water for 72 h. The resulting extract was filtered through Whatman no 1 filter paper and then concentrated using a water bath following the procedure described by Timothy et al. (2012). Further, the extract was placed in a desiccator to dry to a constant weight and then weighed. The extract was kept for further use following the determination of the percentage yield.

Gradient extraction of the powdered plant materials (soxhlet extraction)

Five hundred grams (500 g) of powdered leaves of *Cassia alata* were packaged into a cellulose thimble in the Soxhlet extractor compartment. Four extraction solvents (hexane, Chloroform, Ethanol, and Methanol) of different polarities were used to extract bioactive compounds from the plant material. An exhaustive

*Corresponding author. E-mail: omatolac@gmail.com. Tel. 08061259317.

Figure 1. Field image of *Cassia alata* Linn.
Source: Fatmawati et al., 2020.

extraction of the plant material was carried out with each solvent until the extracting solvent was clear showing no extracted materials were visible again. In between the solvent and the next, the powdered material in the cellulose thimble was emptied onto filter paper spread out, and then dried to a constant weight. It was then repacked into thimble and exhaustive extraction with the next solvent continued. After the extraction process, the hexane, chloroform, ethanol, and methanol extracts of the plant material were subjected to rotary evaporation in a water bath to concentrate the extracts. The residue or dried extracts were transferred into pre-weighed sample bottles, labeled appropriately, and placed in a desiccator, to remove any excess solvent and moisture. These extracts were weighed periodically until a constant weight was obtained for each. Then the final weights were taken for the purpose of determining the percentage yield of each solvent.

Determination of the extracts yields

Extract yield (X_3) = $X_1 – X_2$
Where; X_1 = weight of beaker + crude extract
X_2 = weight of beaker only

Percentage yield (%) = ($X_1 – X_2 \div$ weight of powder used) × 100 (Samson et al., 2021)

Preliminary phytochemical screening of plant extracts

Employing the standard qualitative procedures described by Evans and Trease (2002), Harborne (1998), and Sule et al. (2011), the powdered crude leaf extracts of *Cassia alata* Linn. were screened for phytochemical compounds and secondary metabolites such as Alkaloids, glycosides, carbohydrates, cyanogenic glycosides, Anthraquinones, Flavonoids, cardiac glycosides, Saponins, Steroids, phlobatannins proteins, Tannins, and Terpenoids. Briefly, for alkaloids detection, half-gram (0.5 g) of crude extracts of *Cassia alata* was dissolved in 10 ml of aqueous HCl in a steam bath and filtered. Two (2) drops of Mayer's reagent were added to 2 ml of the filtrates and the presence of alkaloids was indicated by a yellowish precipitate. For carbohydrate detection, 0.5 g of crude extracts of *Cassia alata* were dissolved in 10 ml of water and filtered. Two drops of Benedict's reagent were added to 2 ml of the filtrate and heated in a water bath. The presence of carbohydrates was indicated by an orange-red precipitate. For glycosides detection, half a gram (0.5 g) of crude extracts of *Cassia alata* were dissolved in 10 ml of water and hydrolyzed with aqueous HCl. Ten (10) ml of Fehling's solutions A and B were added to the resultant solution and heated for 15 min. Glycoside presence was indicated by the formation of a brick-red precipitate. For the detection of Anthraquinone, half a gram (0.5 g) of crude extracts of *Cassia alata* dissolved in 10 ml of water were hydrolyzed with aqueous HCl. Two drops of ferric chloride solution were added to 2 ml hydrolysates and the mixture was heated for 5 min in boiling water. After cooling, the solution was shaken with an equal volume of benzene.

Furthermore, the separated benzene layers were treated with half of its volume of ammonia solution and observed for the formation of rose-pink or cherry red. For Cardiac glycoside, half a gram (0.5 g) of crude extracts of *Cassia alata* dissolved in 10 ml of water was hydrolyzed with aqueous HCl. The hydrolysates (2 ml) were dissolved in 2 ml of glacial acetic acid containing one drop of ferric chloride solutions and then underlaid with 1 ml of concentrated H_2SO_4 and observed for a brown ring. For cyanogenic glycosides detection, half a gram (0.5 g) of crude extracts of *Cassia*

alata dissolved in 10 ml of water were hydrolyzed with aqueous HCl. A piece of filter paper was saturated in a freshly prepared solution of guaiac resin and was dissolved in absolute ethanol and dried completely in the air. The filter paper was carefully moistened with a dilute solution of $CUSO_4$ and placed in contact with the hydrolysates and observed for the distinct strain of paper. For saponins, half a gram (0.5 g) of crude extracts of *Cassia alata* was diluted with 20 ml of distilled water separately and further shaken for 15 min in a graduated cylinder and observed for the formation of foam. For the detection of phytosteroids, 2 drops of concentrated Sulfuric acid were added to a solution containing 0.5 g extracts of *Cassia alata* and 5 ml of chloroform. After vigorous shaking, the solution was allowed to stand for some time. The presence of phytosteroids was indicated by the appearance of red or yellow colour. For flavonoids, half a gram (0.5 g) of crude extracts of *Cassia alata* dissolved in 10 ml of water was filtered and 2 drops of sodium hydroxide solution was added to 2 ml of the filtrates. The presence of flavonoids was indicated by a yellow color which becomes colourless with the addition of dilute acid. For phenols, a half gram (0.5 g) of crude extracts of *Cassia alata* dissolved in 10 ml of water were filtered and 2 drops of $FeCl_3$ solution were added to the 2 ml of the filtrates Presence of phenols was indicated by colour change, from green to black. For detection of tannins, 0.5 g of crude extracts of *Cassia alata* treated with 2 drops of vanillin hydrochloride reagent was observed for a pink to red colour formation. For proteins and amino acids, half a gram (0.5 g) of crude extracts of *Cassia alata* first dissolved in 10 ml of distilled water was filtered and 2 drops of concentrated Nitric acid were added to the filtrates (2 ml) and then observed for the presence of yellow colour. For fixed oils and fats detection, 0.1 g of the crude extract of *Cassia alata* was pressed between two filter papers separately and observed for an oily stain on the filter paper.

Evaluation of the antimycotic activity of various crude extracts of *Cassia alata* leaves

Preparation of inoculum

Stock inoculum suspension of dermatophytes isolates was prepared from a 7 to 15-day-old culture grown on SDA at ambient temperature (28 ± 2^0C). Matured colonies were covered with 10 ml of sterile saline (0.85%) with a drop of polysorbate (tween 80 sigma). The surfaces were scraped using the tip of a pasture pipette. The resulting mixture of conidial and hyphal fragments was withdrawn and transferred to sterile test tubes. Heavy particles were allowed to settle for 15 min at room temperature (28±2°C). The upper suspension was mixed with a vortex mixer for 15 sec. The turbidity of the supernatants was measured using a spectrophotometer at a wavelength of 530 nm and transmission was adjusted to 65-70%. Each suspension was diluted 1:50 in SDA to obtain conidia suspension of 0.5 Mcfarland (approximately 10^6 SFU / ml) standards respectively. Plate counts were performed to verify the conidial concentration by plating 0.0 1 ml of the adjusted conidial suspension to determine the viable number of conidia and millimeters (NCCLS, 2002).

Preliminary antimycotic screening of aqueous, n-hexane, chloroform, ethanol, and methanol crude leaf extracts of *Cassia alata*

The preliminary screening for antimycotic activity of aqueous leaf extracts of *Cassia alata* was carried out using the agar incorporation method as described by Zacchino et al. (1999) and Hassan et al. (2007). 0.5 g/ ml of the aqueous extracts of *Cassia alata* was aseptically mixed with 15 ml of Sabouraud dextrose agar after cooling and solidification of the medium. The seeding was carried out by inoculating the test organisms on the plates. A control plate which contains the organism and the medium alone was also set up. The treated and control Petri dishes were incubated at ambient laboratory conditions for 72 h. The presence of growth (+) is a negative test (indicating the non-potency of the extracts) and the absence of growth (-) is a positive test (indicating potency of the extracts).

Determination of the antimycotic activity of various crude leaf extracts of *Cassia alata* Linn.

Preparation of Extracts

The stock solutions of all the extracts were prepared in water at varying concentrations. All the extracts were ten-fold serially diluted as described by National Committee for Clinical Laboratory Standards (NCCLS) (2002) followed by a further two (2) fold dilution in Sabouraud dextrose broth to yield the final concentrations required for testing.

Determination of Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC) of the extracts

The NCCLS broth microdilution reference method was performed according to the NCCLS M27-P (National Committee for Clinical Laboratory Standards (1992) and the modified method of Adegoke et al. (2013). A total number of 11 test tubes (Khan Tubes) were used for the determination of MIC. 1 ml of SDB was dispensed into test tubes 2-11 each. From the stock solution of the extracts (100 mg/mL), 1 ml was dispensed into tube 1 and another ml into tube 2. From the content in tube 2, two-fold serial dilutions were carried out up to tube 9. From tube 9, 1 ml was pipetted out and discarded. The concentrations in the tubes were 100, 50, 25, 12.5, 6.25, 3.125, 1.563, 0.78, and 0.39 mg/mL. A total of 0.05 ml of dermatophytes spore suspension of each organism previously diluted to give 0.5 spore/ ml was dispensed into tubes 1 to 11 except for tube 10. To tube 10 1 ml of sterile SDB was added. Tube 1 which contained 1 ml of the extract and 1 ml of the spore solution of the test organism served as the control for the extract, tube 10 which contained 1 ml of sterile SDB served as the control for the sterility of the medium, and tube 11 which contain 1 ml of the spore solution of the test organism and 1 ml of sterile SDB served as control for the viability of the test organism. All tubes were incubated at ambient temperature for 72 h or until growth was apparent in the growth control tubes. Tubes were observed visually for growth based on turbidity or cloudiness. The lowest concentration of extract which produced complete inhibition was regarded as the MIC. After the MIC determination, 0.05 ml of broth was transferred from all tubes showing no growth and from the first tube in which growth was detectable to plates of SDA. The plates were incubated at ambient laboratory conditions for 72 h. The lowest concentration of extracts for which subculture did not show any growth was regarded as the MFC.

RESULTS AND DISCUSSION

The extracts from plants have demonstrated a significant level of activity against important microbial pathogens because of their numerous phytochemicals. The risen trends in antibiotic resistance, serious side effects, costs of hospital care, and the high costs of developing synthetic drugs are driving the focus to natural medicine from plants (Fatmawati et al., 2020; Samson et al., 2021; Toh et al., 2023).

Table 1. Percentage yields of aqueous n-hexane, chloroform, ethanol and methanol leaf extracts of *Cassia alata.*

Extracts	Aqueous	N-hexane	Chloroform	Ethanol	Methanol
Yield g (%)	4.6 (5.6)	25.5 (5.7)	7.0 (1.6)	21.3 (4.8)	12.4 (2.8)

Source: Authors

Table 2. Qualitative phytochemical constituents of n-hexane, chloroform, ethanol and methanol leaf extracts of *Cassia alata.*

Phytochemicals	N-hexane	Chloroform	Ethanol	Methanol
Glycosides	+	+	+	+
Terpenoids	-	+	+	+
Steroids	+	+	+	+
Saponins	+	+	+	+
Tannins	+	+	+	+
Flavonoids	+	+	+	+
Alkaloids	+	+	+	+
Phenols	+	+	+	+
Carbohydrates	+	+	+	+
Essential oils	+	-	-	-
Anthraquinone	+	+	+	+
Cardiac glycodides	+	+	+	+
Phlabotannins	+	+	+	+
Cyanogenic glycosides	-	-	-	-

+ (present); - (absent).
Source: Authors

In the current study, the percentage yield (%) of crude aqueous, n-hexane, chloroform, ethanol, and methanol leaf extracts of *Cassia alata* was 4.6 g (5.6%), 25.5 g (5.7%), 7.0 g (1.6%), 21.3 g (4.8%), and 12.4 g (2.8%), respectively (Table 1). Various phytochemical compounds such as glycosides, anthraquinone, proteins, cardiac glycosides, steroids, alkaloids, phlabotannin, phenols, saponins, tannins, flavonoids, and carbohydrates were present in all the extracts. All the metabolites found in this study have been credited to the therapeutic action of *C. alata* plants in different studies (Akinmoladun et al*.,* 2010; *Sule* et al., 2011; Patrick-Iwuanyanwu et al., 2011; Chatterjee et al., 2013). However, terpenoids present in the chloroform, ethanol, and methanol extracts were not detected in the hexane extracts, contrary to reports of Saha et al. (2020) who detected terpenoids in all the extracts. This observation is likely pointing to the high volatility of the terpenoid solvent. Likewise, essential oil was detected in the n-hexane extracts only while cyanogenic glycosides were absent in all the extracts (Table 2). This finding is not unusual as a similar study by Ndukwe et al. (2020) in another geographical location did not detect most of the bioactive compounds in *C. alata*. Previously, differences in phytochemicals detection were ascribed to variations in geographical location because of soil mineral concentration (Samson et al*.,* 2021). Similar to our study, variations in bioactive substance detection in the same species of plant have been observed (Ndukwe et al. 2020), probably a result of process differential in the plant biomolecular or secondary metabolites extraction or due to variation in bio-responsiveness in plant estrogen levels which may affect their detection.

In our preliminary screening for antidermatophytic activity of the crude aqueous, n-hexane, ethanol, and methanol leaf extracts of *Cassia alata* shown in Table 3, all the extracts demonstrated antimycotic activity against the tested organisms. Further, the result of the minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of aqueous, n-hexane, ethanol, and methanol leaf extracts of *Cassia alata* against the test organisms shown in Table 4 confirmed the results of the preliminary screening as it showed that none of the selected organism plated on Sabouraud dextrose agar plates incorporated with the crude extracts preparations could grow against the controls (pure SDA plates) where normal growth was observed. The inhibited growth by the crude extracts suggested the presence of some phytoconstituents with antimicrobial potential. The antifungal activity of the aqueous extract of *Cassia alata*

Table 3. Preliminary qualitative antimycotic activity of aqueous, n-hexane, chloroform, ethanol and methanol leaf extracts of *Cassia alata*.

Organisms	Extracts					
	Aqueous	n-hexane	Chloroform	Ethanol	Methanol	Control
Epidermophyton floccosum	-	-	-	-	-	+
Trichophyton mentagrophytes	-	-	-	-	-	+
Trichophyton tonsurans	-	-	-	-	-	+
Trichophyton rubrum	-	-	-	-	-	+
Microsporum canis	-	-	-	-	-	+
Microsporum audouinni	-	-	-	-	-	+
Microsporum gypseum	-		-	-	-	+

- = Inhibitory (that is, no growth); + = Not inhibitory.
Source: Authors

Table 4. Minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of leaf extracts of *Cassia alata*.

Organisms	Extracts (mg/ml)							
	n-hexane		Chloroform		Ethanol		Methanol	
	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC
Epidermophyton floccosum	1.56	6.25	1.56	3.13	0.78	1.56	0.39	0.78
Trichophyton mentagrophytes	3.13	6.25	3.13	6.25	1.56	3.13	1.56	1.56
Trichophyton tonsurans	3.12	6.25	3.13	6.25	1.56	3.13	1.56	1.56
Trichophyton rubrum	3.13	6.25	1.56	3.13	1.56	3.13	0.78	1.56
Microsporum canis	1.56	6.25	1.56	6.25	1.56	3.13	0.78	1.56
Microsporum audouinni	3.13	6.25	3.13	6.25	1.56	3.13	1.56	1.56
Microsporum gypseum	3.13	6.25	3.13	6.25	1.56	6.25	1.56	1.56

MIC – minimum inhibitory concentration, MFC – minimum fungicidal concentration.
Source: Authors

reported in this present study is in agreement with the findings of Hassan et al. (2007), in which aqueous extracts of *Casia alata* were active against some fungal isolates including dermatophytes (*T. rubrum* and *M. gypseum*). Inhibition of fungal cell walls due to pore formation in the cell and leakage of cytoplasmic constituents by the active components of leaf extracts of *Cassia alat*a has been suggested (Hassan et al., 2007).

Cassia alata leaves extract obtained using n-hexane demonstrated high antifungal activity with MIC values ranging from 1.56 to 3.125 mg/mL and MFC values of 6.25 mg/mL and *E. floccosum* and *M. canis* were the most susceptible. A low susceptibility level was observed for *T. mentagrophyte, T. tonsurans, T. rubrum, M. audouinii* and *M. gypseum*. This agrees with Sujatha and Asokan (2018), who reported the antifungal activity of hexane extract of *Cassia alata* leaves against strains of *M. canis, T. mentagrophytes, T. rubrum, E. floccosum,* and *M. audouinii* but with varying concentrations.

Cassia alata leaves extract obtained using chloroform showed a high antifungal activity with MIC values ranging from 1.56 to 3.125 mg/ml and MFC values ranging from 3.125 to 6.25 mg/ml. Its highest activity was observed against *E. flocossum* and *T. rubrum*. Other tested isolates had similar activities. This finding corroborates the report of Selvi et al. (2012), which indicated high antimycotic activity of *Cassia alata* leaves extracts of chloroform on fungal isolates including *E. floccosum, M.gypseum,* and *T. mentagrophyte. Cassia alata* leaf extract obtained using ethanol showed a high antifungal activity with MIC values ranging from 0.78 to 1.56 mg/ml and MFC values ranging from 1.56 to 6.25 mg/ml. The *E. floccosum* was the most susceptible to this extract, closely followed by *T. mentagrophyte, T. tonsurans, T. rubrum, M. canis, M. audouinii,* and *M. gypseum*. This antifungal activity level recorded is in direct agreement with the report of Sule et al. (2011) who marked a good antifungal effect of ethanol extract of *Casia alata* leaf on *Microsporum canis, T. mentagrophytes, Epidermophyton fluccossum* and *Trichophyton verrucosum*.

Cassia alata leaf extract obtained using methanol solvent showed the highest antifungal activity among all

other plant extracts with MIC values ranging from 0.39 to 1.56 mg/mL and MFC values ranging from 0.78 to 1.56 mg/mL of which *E. floccosum* was the most susceptible to this extract. All other isolates tested showed considerable susceptibility levels. Methanol by these findings has proven not only to be the best solvent for extraction but also the solvent that yielded the most active antimycotic agent. This could be attributed to its relatively higher polarity and ability to extract both lipophilic and hydrophobic substances (Fawehinmi et al., 2013). Hence a better extraction of the phytoconstituents of the plants is obtainable. Therefore, methanol is undoubtedly a good solvent source for the extraction of potent pharmacological agents.

CONCLUSION

This study revealed that leaf extracts of *Cassia alata* contain several phytoconstituents such as glycosides, anthraquinone, terpenoids, steroids, alkaloids, saponins, tannin, flavonoids, phenols, carbohydrates, proteins, and essential oil. From this study, it was deduced that the presence of these active compounds in the leaf extracts may be responsible for the antidermatophytic activity exhibited by the plant. Aqueous, n-hexane, chloroform, ethanol, and methanol leaf extracts of *Cassia alata* showed activity on all the tested dermatophytes. Both the minimum inhibitory concentration and minimum fungicidal concentration of the n-hexane, chloroform, ethanol, and methanol leaf extracts of *Cassia alata* revealed that the methanol extract exhibited the highest antimycotic activity. Finally, the *in vitro* antimycotic activity of *Cassia alata* (Linn.) against the field strain dermatophytes observed in our study depict the plants as promising vegetal drug candidate and viable alternative to conventional drugs.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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