Science World Journal Vol. 19(No 4) 2024 https://dx.doi.org/10.4314/swj.v19i4.44
www.scienceworldjournal.org
ISSN: 1597-6343 (Online), ISSN: 2756-391X (Print)
Published by Faculty of Science, Kaduna State University

Full Length Research Article

DETERMINATION OF THE PHYTOCHEMICAL PROPERTIES OF ETHANOLIC AND AQUEOUS PLANT EXTRACTS OF *EUPHORBIA HIRTA* TOWARDS THE INHIBITION OF DERMATOPHYTES

*Sheriff S.S., Emere M.C. and Dibal D.M.

Department of Biological Sciences, Nigerian Defence Academy, Kaduna, Nigeria

*Corresponding Author Email Address: sanmilosheriff1@gmail.com

ABSTRACT
Medicinal plants have evolved as essential preventive and therapeutic aids for various ailments. Approximately 2.5 million species of higher plants remain unexplored for their pharmacological activities. This study was aimed at screening of phytochemical properties of ethanolic and aqueous extracts of leaves, stem, flower, and whole parts of *Euphorbia hirta* extract. Fresh leaves, stem, flower and the whole plant of *Euphorbia hirta* were collected from the Centenary Park, opposite 44 Reference Army Hospital, Kaduna North, Kaduna, Nigeria. The entire plant was identified and authenticated by a Botanist from the department of Biological Sciences, NDA. The collected plant parts were processed in the laboratory using standard procedure. Qualitative and quantitative analyses of the phytochemical properties of the leaves stem, and flower of *Euphorbia hirta* was carried out using standard method. Results obtained from this study indicated that aqueous extracts yielded mean values of 7.93 mg/g for flowers, 8.18 mg/g for leaves, 8.65 mg/g for stems, and 6.3 mg/g for the whole plant. For the ethanolic extracts, the highest value was observed in the stem with 5.8 mg/g, followed by the whole plant with 6.43 mg/g, the leaves with 5.35 mg/g, and the flowers with the lowest value at 0.84 mg/g. Phytochemical properties *of E. hirta* could be employ in the pharmacological studies as these compounds have been known to possess antimicrobial properties..

Keywords: Determination, Phytochemical properties, *Euphorbia hirta*, and extraction.

INTRODUCTION

Phytochemical properties of plants, particularly secondary metabolites, have been extensively investigated for their antifungal activity (Uddin *et al*., 2019). Herbal medicines, being cheap, easily available, and relatively safe, have received significant attention as sources of lead compounds (Ahmad *et al*., 2019). The World Health Organization (WHO) estimates that about three quarter of the world population currently uses herbs and other forms of traditional system of medicines for treating their diseases. Plants possess antimicrobial substances such as essential oils, peptides, phenols, tannins, alkaloids, and flavonoids, which have therapeutic applications against fungi, bacteria, and viruses (Kumar *et al*., 2010; Ghosh *et al*., 2019; Meda *et al*., 2023).

Pharmacological studies have shown that extracts of *Euphorbia hirta* exhibit antimicrobial, sedative, anxiolytic, antioxidant, anti-inflammatory, antiepileptic, antipyretic, analgesic, antiasthmatic, antihistaminic, antidiabetic, wound healing, anticancer, diuretic, gastrointestinal, antiparasitic, hepatoprotective, immunological, galactogenic, angiotensin-converting enzyme inhibiting, and anti-dipsogenic activities (Kshetrimayum, 2017; Alexandra *et al*., 2018; Al-Snafi, 2017; Uddin *et al*., 2019).

Euphorbia hirta has been traditionally used for various treatments, including earache (Igoli *et al*., 2005), asthma (Auwal *et al*., 2016), pregnancy-birth disorders, digestive issues, diabetes, bacterial infections, visual disturbances, scorpion sting, hypertension, parasitosis, and allergies (Nadembega *et al*., 2011; Zerbo *et al*., 2011). Perumal *et al*. (2012) confirmed its use for asthma, skin problems, gastrointestinal disorders, and intestinal parasitosis. The plant has also demonstrated antibacterial (Sudhakar *et al*., 2006), anticancer, antioxidant (Mothana *et al*., 2009), and antifungal (Masood and Rajan, 1991) activities.

The use of *Euphorbia hirta* in African communities often relies on a trial-and-error approach without scientific validation. Reports on the antifungal effects of different parts of *Euphorbia hirta* from various locations sometimes produce inconsistent results. Medicinal plants have evolved as essential preventive and therapeutic aids for various ailments. Dermatophytosis, a zoonotic disease caused by dermatophytes, is a significant public health problem, especially in African countries (Diso *et al*., 2020). Dermatophytes are a group of closely related fungi that affect keratinous tissue (skin, hair, and nails) of humans and other vertebrates, causing superfacial infections, dermatophytosis, commonly known as ringworm or tinea. They belong to three anormophic (asexual or imperfect genera, *Epidermophyton*, *Microsporum*, and *Trichopyton* (Weitzman and Summerbell, 1995). Dermatophytes, including species of *Trichophyton*, *Microsporum*, *Aspergillus*, *Epidermophyton*, and *Candida*, infect both sexes and all ages, influenced by factors such as age, hygiene level, or physiological conditions (Alexandra *et al*., 2018). Plants with phytochemicals play crucial roles in treating cutaneous infections, gastrointestinal disorders, urinary tract infections, respiratory diseases, and other conditions (Kshetrimayum, 2017; Alexandra *et al*., 2018). *Euphorbia hirta*, in particular, has shown potential in treating various ailments. This present study was therefore, carried out to determine the phytochemical properties of the ethanolic and aqueous extracts of *Euphorbia hirta* plant towards the inhibition of dermatophytes.

MATERIALS AND METHODS

Plant Collection and Preparation

Fresh leaves, stem, flower and the whole plant of *Euphorbia hirta* were collected from the Centenary Park, opposite 44 Reference Army Hospital, Kaduna North, Kaduna, Nigeria. The entire plant was identified and authenticated by a Botanist (NDA/BIOH/2024/43) from the Department of Biological Sciences, Nigerian Defence Academy. The experiment was conducted in

various stages across different laboratories in the Departments of Biochemistry and Microbiology, Faculty of Pure and Applied Sciences, Kaduna State University. The collected plant parts were rinsed with tap water and air-dried under shade for 14 days, then reduced to coarse powder using a pestle and mortar, and further ground to fine powder using a Kenwood electric blender. The powdered samples were stored in airtight bottles for further studies.

Plant Extraction

Thirty grams (30 g) of each of the powdered samples (leaves, stem, flower and whole plant) were soaked in 200 ml of ethanol and water in a 1-liter sterile conical flask covered with cotton wool, plugged, and wrapped with aluminum foil. The mixture was shaken vigorously and left to stand for 24 hours in a shaking water bath maintained at 29°C. For the aqueous plant extraction, same procedure as described above was repeated in 1100 ml. The mixtures were filtered using muslin cloth and Whatman No. 1 filter paper. Each extracts was placed on the water bath at 40°C and allowed to evaporate leaving pure extract (Sosa *et al*., 2016). The percentage yields of the crude extracts were determined using the formula:

$$\text{The percentage extract yield} = \frac{\text{Dry Weight (DW)}}{\text{Dry Material Weight (DMW)}} \text{ X } 100$$

Determination of Phytochemical Properties of Extracts of *Euphorbia hirta*

Qualitative and quantitative analyses of the phytochemical properties of the leaves stem, and flower of *Euphorbia hirta* was carried out as described by Sosa *et al*. (2016). Total phenols were estimated using the method of Edeoga *et al*. (2005). Saponin was determined by the method of Obdoni and Ochuko (2001). Flavonoid was determined by the method of Boham and Kocipai-Abyazan (1994).

Data Analysis

The data were collected, recorded, and analyzed using Microsoft Excel and SPSS (Version 25.0). All data were expressed as mean ± SD. A probability of P > 0.05 was considered significant. Results were presented in tables, graphs, figures, and pictures, which formed the basis for discussion, conclusion, and recommendation.

RESULTS

The results of qualitative analysis of aqueous extracts indicated the presence of various phytochemicals in different parts of the plant. Saponins were found in the leaves, stem, flowers, and whole plant extracts. Tannins were only present in the leaves, while flavonoids were detected in both the leaves and the whole plant. Phenols were observed in all analyzed parts. Terpenoids were present in all parts except the stem. Anthraquinones and alkaloids were found throughout the plant, whereas cardiac glycosides were absent in all aqueous extracts of the stem, whole plant, flower, and leaves of *E. hirta*, as shown in (Table 1). The leaves contained seven phytochemicals, the whole plant had six, the stem had four, and the flowers had five.

The result of qualitative screening of ethanolic extracts from various parts of *E. hirta* is presented in (Table 2). Tannins and Flavnoids were found in all four parts analyzed. Alkaloids, and phenols were present in the leaves, stem, and whole plant extracts but were absent in the flowers. Saponins and terpenoids were detected only in the whole plant and stem. Cardiac glycosides were found exclusively in the leaves, while anthraquinones were not present in any part of the plant. The results showed that only one phytochemical was present in the flowers, six phytochemicals in both the stem and the whole plant, and five phytochemicals in the leaves.

The mean values of present in the ethanolic and of aqueous extract of different part of *Euphorbia hirta* (stem, leaves, flowers, and whole plant) were displayed in Table 3 and Table 4 respectively. The aqueous extracts yielded mean values of 7.93 mg/g for flowers, 8.18 mg/g for leaves, 8.65 mg/g for stems, and 6.3 mg/g for the whole plant. For the ethanolic extracts, the highest value was observed in the stem with 5.8 mg/g, followed by the whole plant with 6.43 mg/g, the leaves with 5.35 mg/g, and the flowers with the lowest value at 0.84 mg/g.

Table 1: Phytochemicals present in Aqueous Extracts of different parts of *Euphorbia hirta*

Phytochemicals	Leaves	Stem	Flower	Whole plant
Saponins	++	+	+	+
Tannins	+	-	-	-
Flavonoids	+	-	-	+
Phenols	++	+	+	+
Anthraquinones	+	+	+	+
Terpenoids	+	-	+	+
Alkaloid	+	+	+	+
Cardiac glycosides	-	-	-	-

Key: **-** indicates absent; **+** represents turbid; ++ indicates moderate, +++ indicates heavy

Table 2: Phytochemicals present in Ethanolic Extract of different part of *Euphobia hirta*

Phytochemicals	Leaves	Stem	Flower	Whole plant
Saponins	-	+	-	+
Tannins	+	+	-	++
Flavonoids	+	+	+	++
Phenols	+	+	-	+
Anthraquinones	-	-	-	-
Terpenoids	-	+	-	+
Alkaloid	+	+	-	+
Cardiac glycosides	+++	-	-	-

Key: **-** indicates absent; **+** represents turbid; ++ indicates moderate, +++ indicates heavy

Table 3: Mean values of phytochemicals present in the ethanolic extract of different part of *E.hirta*

Plant parts	Polyphenols	Saponins	flavonoids	Alkaloids	Tanins
Flower	0.84^{a}	4.28^{a}	44.3^{a}	12.13^{a}	18.58^{ab}
Leaves	5.35^{b}	3.85^{ac}	165.58^{b}	276.04^{b}	30.75^{ab}
Stem	5.8^{b}	6.82^{b}	89.18^{a}	92.66^{c}	26.82^{b}
whole plant	6.43^{b}	3.59^{c}	67.58^{a}	10.8^{a}	11.98^{a}

Values with superscripts are statistically significance (*p*-value <0.05)

Table 4: Mean values of phytochemicals present in the aqueous extract of different part of *E.hirta*

Plant parts	Polyphenols	Saponins	flavonoids	Alkaloids	Tannins
Flower	7.93[a]	3.06[a]	27.68[a]	728.00[a]	22.3[a]
Leaves	8.18[a]	3.00[a]	154.31[b]	964.00[b]	48.16[b]
Stem	8.65[a]	6.10[b]	28.97[a]	137.90[c]	13.65[c]
Whole plant	6.3[a]	1.8[c]	96.03[c]	478.67[d]	34.62[d]

Values with superscripts are statistically significance (*p*-value <0.05)

DISCUSSION

Euphorbia hirta holds significant medicinal value and is used ethno-pharmacologically to treat various ailments, including respiratory and bronchial disorders such as hay fever, bronchitis, and asthma, as well as fungal diseases respectively. The findings of this study showed that whole plants of *Euphorbia hirta* contain significant levels of alkaloids, tannins, flavonoids, polyphenols, and saponnins, with the aqueous extract showing higher yields of these compounds than the ethanolic extract. The highest polyphenol content was found in the aqueous stem extract compared to the ethanolic extract. The ethanolic stem extract had higher saponnin contents compared to the aqueous extract. The ethanolic leaf extract had higher flavonoid and tannin content than the aqueous extract respectively. The aqueous leaf extract had the highest alkaloid content compared to the ethanolic extract. These findings are similar to previous studies by Khursheed *et al*. (2016), Khursheed and Jain (2021), and Suresh (2008), which also noted that *Euphorbia hirta* contains a wide variety of phytochemicals. Additionally, reports showed that leaf extract of *Euphorbia hirta* contains total polyphenolic (206.17±1.95 mg GAE/g dry weight) and flavonoid (37.970±0.003 mg CE/g dry weight) content (Igwe *et al*., 2016; Al-Snafi, 2017; Khursheed *et al*., 2022). Phytochemical studies have revealed that *Euphorbia hirta* contains phenolic compounds with diverse biological activities, including anti-inflammatory, antiulcer, antioxidant, cytotoxic, antispasmodic, and antidepressant effects (Velavan, 2015; Ghasemzadeh *et al*., 2010). Al-Huqail *et al*. (2019) noted that flavonoids exert various biological properties, including cytotoxicity, coronary heart disease prevention, hepatoprotective, antimicrobial, antitumor, and anti-inflammatory activities. De Bruyne *et al*. (1999) and Dolara *et al*. (2005) reported that tannins in *Euphorbia hirta* serve as astringents, diuretics, and anti-inflammatory agents, among other properties. Quercetin, a flavonoid isolated from *Euphorbia hirta* leaves, was found to reduce the viability of human breast adenocarcinoma cells (Paulpandi *et al*., 2013). Alkaloids in the plant exhibit significant antifungal activities, and saponins are part of the plant's defense system (Molyneux *et al*., 1996; Morrissey and Osbourn, 1999; Lacaille-Dubois and Wagner, 2000; Traore *et al*., 2000). Widharna *et al*. (2010) examined the antidiabetic properties of *Euphorbia hirta* extracts, demonstrating antioxidant effects, α-glucosidase inhibitory effects, and increased insulin release from β cells.

Conclusion

Euphorbia hirta contains a diverse range of phytochemicals, including alkaloids, terpenoids, flavonoids, tannins, and phenolic compounds. The aqueous stem extract exhibited the highest polyphenol content, while the ethanolic stem extract had a higher concentration of saponins. The ethanolic leaf extract showed the highest levels of flavonoids and tannins, whereas the aqueous leaf extract recorded the highest alkaloid content. Further studies on both the ethanolic and aqueous extracts of *Euphorbia hirta* are recommended for their phytopharmaceutical value.

REFERENCES

Ahmad, W., Singh, S., & Kumar, S. (2019). Phytochemical screening and antimicrobial study of *Euphorbia hirta* extracts. *Journal of Medicinal Plants Studies*, 2:183-6.

Alexandra N. W., Emberger-Klein, A., & Menrad, K. (2018). Why people use herbal medicine: insights from a focus group study in Germany. *BMC Complementary and Alternative Medicine*; 18(92): 1-9

Al-Huqail, A. A., Said, I. B., Mohamed, Z. M. S., Hayssam, M. A., Manzer, H. S., & Abdelfattah, Z. M. S. (2019). Antifungal, Antibacterial, and Antioxidant Activities of Acacia saligna (Labill.) H. L. Wendl. Flower Extract: HPLC Analysis of Phenolic and Flavonoid Compounds. *Molecules*, 24: 700, 2-14.

Al-Snafi, A. E. (2017) Pharmacology and Therapeutic Potential of *Euphorbia hirta* (Syn: Euphorbia pilulifera)—A Review. IOSR Journal of Pharmacy, **7:** 7-20

Auwal, M.S., Uvu, S.U., Shuaibu, A., Ibrahim, A., Mustapha, M, & Kumar, N. (2016). Phytochemical and antibacterial properties of ethanolic leaves extract of *Euphorbia hirta* (*euphorbiaceae*). *Haryana Veterinary*, 55(1): 62-65

Boham, B. A., & Kocipai-Abyazan, R. (1974). Flavonoids and condensed tannins from leaves of Vaccinium vaticulatum and V. calycinium. *Journal of Pacific Science*, 48: 458-463

De Bruyne, T., Pieters, L., Deelstra, H., & Vlietinck, A. (1999). Condensed vegetables tannins: biodiversity in structure and biological activities. *Biochemical System Ecology*, **27**: 445– 59

Diso, S. U., Adam, J. S., Mu'azu, L., Abdallah, M. S., & Ali, M. (2020). Isolation and Characterization of Some Fungi Associated with Superficial Fungal Infections. *ARC Journal of Dermatology*, 5(1), 12-16

Dolara, P., Luceri, C., De Filippo, C., Femia, A. P., Giovannelli, L., Carderni, G., Cecchini, C., Silvi, S., Orpianesi, C., & Cresci, A. (2005). Red wine polyphenols influence carcinogenesis, intestinal microflora, oxidative damage and gene expression profiles of colonic mucosa in F344 rats. *Mutation Research*, 591: 237–46

Edeoga, H. O., Okwu, D. E., & Mbaebie, B. O. (2005) Phytochemical constituents of some Nigerian medicinal plants. *African Journal of Biotechnology*. 4(7): 685-688

Ghasemzadeh, A., Jaafar, H. Z. E., & Rahmat, A. (2010). Antioxidant activities, total phenolics and flavonoids Content in two varieties of malaysia young ginger (Zingiber officinale Roscoe). *Molecules*, 15: 4324–4333

Ghosh, P., Chandreyi, G., Shaktijit, D., Chandrima, D., Suprodip, M., & Sirshendu, C. (2019). Botanical Description, Phytochemical Constituents and Pharmacological Properties of Euphorbia hirta Linn: A Review. *International Journal of Health Sciences & Research,* 9: 273-286

Igoli, J. O., Ogaji, O. G., Tor-Anyiin, T. A., and Igoli, N. P. (2005) Traditional Medicine Practice amongst the Igede People of Nigeria. Part II. *African Journal of Traditional,*

Complementary and Alternative Medicines, 2: 134-152

Igwe, K. K., Madubuike, A. J., Akomas, S. C., Otuokere, I. E., & Ukwueze, C. S. (2016). Studies of the medicinal plant *Euphorbia hirta* methanol leaf extract phytocomponents by GCMS analysis. *International Journal of Science and Technology Research England,* **1**(4): 9–16

Khursheed, A., & Jain, V. (2021). Phytochemical screening, antioxidant, and antimicrobial activity of different Portulaca oleracea L. extracts growing in Kashmir Valley. *Journal of Biochemical Technology,* 12(3):1–8.

Khursheed, A., Jain, V., & Wani, A. R. (2022). *Euphorbia hirta* as a gold mine of high-value phytochemicals: A comprehensive review of its pharmacological activities and possible role against SARS-CoV-2. *Biomedical Research and Therapy,* 9(2):4930-4949

Khursheed, A., Rather, M. A., & Rashid, R. (2016). Plant-based natural compounds and herbal extracts as promising apoptotic agents: their implications for cancer prevention and treatment. *Advanced Biomedical Pharmacy*, 3(04):245–69.

Kshetrimayum, B. (2017). Ethnomedicinal Uses, Phytochemistry and pharmacology of *Cissampelos pareira*: A Review. *Medicinal Plants and its Therapeutic Uses, First Edition* 2017

Kumar, S., Malhotra, R., and Kumar, D. (2010). *Euphorbia hirta*: Its Chemistry, Traditional and Medicinal Uses, and Pharmacological Activities. *Pharmacognosy Reviews*, **4**: 58-61.

Lacaille-Dubois, M. A., & Wagner, H. (2000). Bioactive saponins from plants: An update. In Studies in Natural Products Chemistry; Atta-Ur-Rahman, ed. *Elsevier Science*. *Amsterdam*, 21: 633-687.

Masood, A., & Rajan, K. S., (1991). The effect of aqueous plant extracts on growth and aflatoxin production by *Aspergillus flavus*. *Letter in Applied Microbiology*, 13: 32–34

Meda, R. N. T., Kam, S. E., Kagambega, W., Zongo, E., Ouedraogo, C., Segda, A., Koama, B. K., Somda, F. T., Zongo, E. & Ouedraogo, G. A. (2023). A Review on Bioactive Compounds Isolated from Euphorbia hirta L. *American Journal of Plant Sciences*, 14, 710-726

Molyneux, R. J., Nash, R. J., & Asano, N. (1996). Alkaloids: Chemical and Biological Perspectives, Vol. 11, Pelletier SW, ed. Pergamon, Oxford, 303

Morrissey, J. P., & Osbourn, A. E. (1999). Fungal resistance to plant antibiotics as a mechanism of pathogenesis. *Microbiological and Molecular Biological Reviews*, 63: 708–724

Mothana, R. A., Lindequist, U., Gruenert, R., & Bednarski, P. J. (2009). Studies of the in vitro anticancer, antimicrobial and antioxidant potentials of selected Yemeni medicinal plant from the island Soqotra. *BMC Complementary and Alternative Medicine*, 9: 7-11.

Nadembega, P., Boussim, J. I., Nikiema, J. B., Poli, F., & Antognoni, F. (2011) Medicinal Plants in Baskoure, Kourittenga Province, Burkina Faso: An Ethnobotanical Study. *Journal of Ethnopharmacology, 133,* 378-395

Obdoni, B. O., & Ochuko, P. O. (2001). Phytochemical studies and comparative efficacy of the crude extracts of some Homostatic plants in Edo and Delta States of Nigeria. *Global Journal of Pure and Applied Science*, 8: 203-208

Perumal, S., Mahmud, R., Pillai, S., Lee, W. C., & Ramanathan, S. (2012). Antimicrobial Activity and Cytotoxicity Evaluation of *Euphorbia hirta* (L.) Extracts from Malaysia. *Asia-Pacific Chemical, Biological & Environmental Engineering Society*, 2: 80 – 85.

Sosa, A. A., Bagi, S. H., & Hameed, I. H. (2016). Analysis of bioactive chemical compounds of *Euphorbia lathyrus* using gas chromatography-mass spectrometry and Fourier transform infrared spectroscopy. *International Journal of Pharmacognosy and Phytochemical Research*, 8(5): 109-126.

Sudhakar, M., Rao, C. V., Rao, P. M., Raju, D. B., & Venkateswarlu, Y. (2006): Antimicrobial activity of *Caesalpinia pulcherrima, Euphorbia hirta* and *Asystasia gangeticum*. *Fitoterapia*, **77**: 378–380.

Suresh, K. (2008). Antimicrobial and Phytochemical Investigation of the Leaves of *Carica papaya* L., *Cynodon dactylon* (L.) Pers., *Euphorbia hirta* L., *Melia azedarach* L. and *Psidium guajava* L. *Ethnobotanical Leaflets.* 12:1184–1191

Traore, F., Faure, R., Ollivier, E., Gasquet, M., Azas, N., Debrauwer, L., Keita, A., Timon- David, P., & Balansard, G. (2000). Structure and antiprotozoal activity of triterpenoid saponins from Glinus oppositifolius. *Planta Medica*, 66: 368–371.

Uddin, S., Billah, M. & Nuri, Z.N. (2019). Pharmacological Actions of *Euphorbia hirta* : A Review. *International Journal of Horticulture and Food Science*, 1: 84-89.

Velavan, S. (2015) Phytochemical Techniques - A Review. *World Journal of Science and Research*. **1**(2): 80-91

Weitzman, I., & Summerbell, R. C. (1995). The dermatophytes. *Clinical Microbiology Review*, 8: 240–259

Widharna, R. M., Soemardji, A. A., Wirasutisna, K. R., & Kardono, L. B. S. (2010). Anti Diabetes Mellitus Activity in vivo of Ethanolic Extract and Ethyl Acetate Fraction of *Euphorbia hirta* L. Herb. *International Journal of Pharmacology*. 6(3):231-240.

Zerbo, P., Millogo-Rasolodimby, J., Ouedraogo, O. N., & Van Damme, P. (2011). Plantes medicinales et pratiques medicales au Burkina Faso: Cas des Sanan. *Bois et Forets des Tropiques*, 307, 41-53