

Research Article

Antifungal activity of *Erigeron floribundus* (Asteraceae) from Côte d'Ivoire, West Africa

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Abstract

Purpose: *Erigeron floribundus* is a reputed medicinal plant used in Côte d'Ivoire, West Africa for the treatment of skin disorders. The aim of this study was to evaluate the antifungal activity of this plant against fungi from human origin.

Method: Dichloromethane, methanol 80% and aqueous extracts from the leaves with stem were tested for their antifungal activity against 7 strains of dermatophytes (*Epidermophyton floccosum*, *Microsporum canis*, *M. gypseum*, *M. langeronii*, *Trichophyton mentagrophytes*, *T. rubrum*, *T. soudanense*) and one strain of the filamentous fungus, *Scopulariopsis brevicaulis*. The assays were performed using the agar dilution method at serial concentrations ranging from 2 to 0.06 mg/ml.

Result: Only the dichloromethane extract exhibited an activity against *Microsporum canis* and a broad spectrum of good antifungal activity against all the remaining fungi tested.

Conclusion: To the best of our knowledge, this is the first report of the antifungal activity of *Erigeron floribundus* against a wide range of dermatophytes, including *Microsporum langeronii* and *Trichophyton soudanense*, the most frequent dermatophytes in Côte d'Ivoire. *E. floribundus* might be potential sources for improved traditional medicines or new antidermatophyte agents for the treatment of dermatomycoses.

Keywords: *Erigeron floribundus*, dermatophytes, antifungal activity, Côte d'Ivoire.

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INTRODUCTION

Dermatophytes are fungi that can cause infections of the skin, hair, and nails due to their ability to utilize keratin. The organisms are transmitted by either direct contact with infected host (human or animal) or by direct or indirect contact with infected exfoliated skin or hair. The most common clinical manifestations are beard, glabrous skin, scalp, groin, hand, feet, and nails. These infections, which constitute the most frequent fungal diseases in human¹, are widespread in tropical countries. Dermatophytes due to *Epidermophyton floccosum*, *Microsporum gypseum*, *Trichophyton mentagrophytes* and *T. rubrum* are commonly worldwide. Dermatoses caused by *Trichophyton soudanense* are limited to Africa. For instance, tinea capitis are endemic problem in Africa where they constitute a serious public health problem, particularly in children² and immunodeficient patients^{3,4}. In Côte d'Ivoire, the most frequent etiologic agents in school children are *Microsporum langeronii* and *Trichophyton soudanense* that infect scalp and hair⁵.

Despite the existence of antifungal agents effective on dermatophytes, there is a need to search for alternatives. The relative high cost and constraints due to the length of the modern treatment curb the control of the dermatophytes in developing countries like Côte d'Ivoire. Patients, in particular, the resource-poor people from remote areas still use traditional medicine for the treatment of various diseases from microbial and non microbial origin^{6,7}. So people know a lot about medicinal plants that can cure diseases of the skin, hair and nails. One of such plants is *Erigeron floribundus* (Kunth) Sch. Beep. (Asteraceae) known as a reputed medicinal plant traditionally used for the treatment of skin disorders by the rural populace as well as those from the urban areas of Côte d'Ivoire⁸. This species is widespread in Africa. The present study investigates the effects of *E. floribundus* against fungi from human origin.

EXPERIMENTAL

Plant material

E. floribundus is an herbaceous plant growing in tropical areas and can reach 2 m. This species belongs to the family of Asteraceae. The leaf is simple, linear, pubescent and dentate. The inflorescences are yellow panicles. Fruits are dry indehiscent.

The plant material (leaves) was harvested in July 2005 in Abidjan (Southern Côte d'Ivoire). Samples were identified at the herbarium of Botanical Garden (University of Cocody-Abidjan) where voucher specimens (375 TB) were deposited. The botanical nomenclature of Hutchinson and Dalziel⁹ as revised by Lebrun and Stork^{10, 11} was adopted to name the species.

Preparation of plant extracts

Powdered portions of the plant material (100 g) were successively extracted with five times their weight of water, dichloromethane and methanol (80%) at room temperature for 15 h. The filtrates were evaporated on a rotary evaporator (40 °C) to yield the crude extracts. For the aqueous extracts, 10 g of powder in 250 ml distilled water were boiled during 15 min. Each of the extracts was lyophilized and weighed. The yield was 4.20, 15.05 and 1.86 %, respectively, for the dichloromethane, methanol and aqueous extracts.

Fungi cultures

The antifungal activity of *E. floribundus* was evaluated against 8 strains of fungi, provided by the Medical Analysis Laboratory of Marseille (France). Seven of the strains were clinical isolates of the following dermatophyte species: *Epidermophyton floccosum*, *Microsporum canis*, *M. gypseum*, *M. langeronii*, *Trichophyton mentagrophytes*, *T. rubrum* and *T. soudanense*. One strain (*Scopulariopsis brevicaulis*) was an environmental filamentous fungus.

Antifungal assay

The antifungal activity was assessed according to the agar dilution method¹² on Sabouraud agar (Difco). Plant extracts were dissolved in dimethylsulfoxide and diluted to give serial twofold dilutions that were incorporated into growth medium. The

resulting concentrations ranged from 2 to 0.06 mg/ml. Sabouraud agar plates were inoculated with 0.2 ml of a particular dermatophyte or fungi strain. The plates were incubated in duplicate over a period of 15 days at 30 °C. The minimal inhibitory concentration (MIC), defined as the lowest concentration that produced no visible fungal growth after the incubation time, was recorded.

RESULTS

The antifungal activity of dichloromethane, methanol (80 %) and aqueous extracts obtained from *Erigeron floribundus* revealed that only the dichloromethane extract showed a good antifungal activity against the dermatophytes and filamentous fungus used (Table 1). The MIC values were 0.25 mg/ml against the strains of *Epidermophyton floccosum*, *Microsporum gypseum*, *M. langeronii*, *T. rubrum*, *T. sudanense* and *S. brevicaulis*. The extract was effective on *Trichophyton mentagrophytes* with MIC value of 0.5 mg/ml and exhibited a moderate activity against *Microsporum canis*, with MIC value of 1 mg/ml. No antifungal activity was observed for both methanol and aqueous extracts.

DISCUSSION

In the present study, *Erigeron floribundus* was investigated for its antifungal activity against dermatophytes and filamentous fungus. *E. floribundus* is a medicinal plant commonly used in traditional medicine in Côte d'Ivoire as well as in other African countries to cure skin infections. The result indicated that the dichloromethane extract was the most effective on clinical isolates of dermatophytes. This crude extract exhibited a broad spectrum antifungal activity with MIC values ranging between 1 and 0.25 mg/ml against *Microsporum canis*, *M. gypseum*, *M. langeronii*, *Trichophyton mentagrophytes*, *T. rubrum*, *T. soudanense*, *Epidermophyton floccosum* and *Scopulariopsis brevicaulis*. To the best of our knowledge, this is the first time the antifungal activity of *E. floribundus* has been reported against *M. langeronii* and *T. soudanense*, the most frequent

dermatophytes causing dermatomycoses in Côte d'Ivoire. In a previous screening of 100 plants from Rwanda¹³ and 228 from Uganda¹⁴ for their antimicrobial activity, the ethanol (80%) extract of *E. floribundus* was shown to display antifungal activity against *Microsporum canis* and *Trichophyton mentagrophytes* with a MIC of 500 mg/ml.

Both methanol and aqueous extracts of *E. floribundus* did not exert antifungal activity against the fungi tested. Previous antifungal screening carried out by Tra Bi et al.¹⁵ on several ivorian medicinal plants indicated that the same dichloromethane extract tested here was active on yeast while the methanol extract was not effective. This observation may be attributed to the nature of the biological active compounds. The antifungal activity observed for the dichloromethane extract suggests that the active metabolites of *Erigeron floribundus* are mostly lipophilic (dichloromethane).

E. floribundus from Cameroon was chemically screened and yielded saponins, flavonoids, tannins, phenols, alkaloids and essential oils¹⁶. Among these compounds, the essential oils and flavonoids can be incriminated in the antifungal activity of *E. floribundus*. Some of these groups of compounds are lipophilic due to the presence of a prenyl chain. Therefore these components can be extracted by non polar solvents such as dichloromethane. The prenylated groups render the active molecules more lipophilic inducing antimicrobial activity within interactions with cell membranes. This may probably explain the lack of activity observed with the polar (ethanol, methanol and water) extracts. However, there is a need to test the saponins, flavonoids, tannins, phenols, alkaloids from *E. floribundus* for their antidermatophyte activity.

CONCLUSION

Our results offer a scientific basis for the use of *Erigeron floribundus* in traditional medicine in Côte d'Ivoire for treatment of skin disorders. The dichloromethane extract of this plant showed promising antifungal activity against dermatophytes, some of which are the most frequent species implicated in

Table 1: Antifungal activity of *Erigeron floribundus* against dermatophytes (mg/ml)

STRAINS	EXTRACTS		
	Dichloromethane	Methanol (80%)	Water
<i>Epidermophyton floccosum</i>	0.25	nd	nd
<i>Microsporum canis</i>	1	> 2	> 2
<i>Microsporum gypseum</i>	0.25	> 2	> 2
<i>Microsporum langeroniise</i>	0.25	nd	nd
<i>Trichophyton mentagrophytes</i>	0.50	> 2	> 2
<i>Trichophyton rubrum</i>	0.25	nd	nd
<i>Trichophyton soudanense</i>	0.25	nd	nd
<i>Scopulariopsis brevicaulis</i>	0.25	nd	nd

nd = non determined

dermatomycoses in Côte d'Ivoire. This plant may also find application in veterinary medicine as some of the tested dermatophytes like *Microsporum canis* and *Trichophyton mentagrophytes* are zoophilic¹⁷. A study is underway in order to identify the precise active principles and understand the mode of action of *E. floribundus*.

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REFERENCES

1. Midgley G, Clayton YM, Hay JR. Atlas de poche de mycologie, Paris, Médecine-Science, 1998.
2. Menan EIH, Zongo-Bonou O, Rouet F, Kiki-Barro PC, Yavo W, N'Guessan FN, Koné M. *Tinea capitis* in schoolchildren from Ivory Coast (western Africa). A 1998-1999 cross-sectional study. *Int J Dermatol* 2002; 41: 204-207.
3. ONUSIDA. Maladies opportunistes liées au VIH: Actualisation ONUSIDA, Genève (Suisse), Collection Meilleures Pratiques de l'ONUSIDA 1999.
4. OMS. VIH/SIDA: couverture de certains services de prévention et de soins dans les pays peu développés en 2001, Genève, OMS, 2003.
5. Adou-Bryn KD, Assoumou A, Haddad RN, Aka BR, Ouon J. Epidemiology of *Tinea capitis* in Abidjan, Côte d'Ivoire. *Med Trop* 2004; 64:171-175.
6. Tra Bi FH, Kouamé NF, Traoré D. Utilisation of climbers in two forest reserves in West Côte d'Ivoire. In: Bongers F. P.M., Traoré D., Ed. *Forest Climbing Plants of West Africa: Diversity, Ecology and Management*. CABI Publishing, Oxfordshire (UK): 2005.
7. Koné M, Atindehou Kamanzi K, Traoré D. Plantes et médecine traditionnelle dans la région de Ferkessédougou (Côte d'Ivoire). *Ann Bot Afr O* 2002; 2: 13-21.
8. Tra Bi FH. Utilisations des plantes, par l'homme, dans les forêts classées du Haut-Sassandra et de Scio, en Côte d'Ivoire, Thèse 3ème cycle, Université d'Abidjan-Cocody, Abidjan, 1997.
9. Hutchinson J, Dalziel JM. *Flora of West Tropical Africa*, London, Crown Agents for Oversea Government and Administrations Millbank, 1954.

10. Lebrun J-P, Stork AL. *Énumération des plantes à fleurs d'Afrique Tropicale: Chrysobalanaceae à Apiaceae*, Genève, Conservatoire et Jardin Botaniques, 1992.
11. Lebrun J-P, Stork AL. *Énumération des plantes à fleurs d'Afrique Tropicale. Gamopétales: Ericaceae à Lamiaceae*, Genève, Conservatoire et Jardin Botaniques, 1997.
12. Favel A, Steinmetz MD, Regli P. *In vitro* antifungal activity of triterpenoid saponins. *Planta Med* 1994; 60: 50-53.
13. Vlietinck AJ, Van Hoof L, Totté J, Lasure A, Vanden Berghe D, Rwigyabo PC, Mvukiyumwami J. Screening of hundred Rwandese medicinal plants for antimicrobial and antiviral properties. *J Ethnopharmacol* 1995; 46: 31-47.
14. Hamill FA, Apio S, Mubiru NK, Bukenya-Ziraba R, Mosango M, Maganyi OW, Soejarto DD. Traditional herbal drugs of Southern Uganda, II: literature analysis and antimicrobial assays. *J Ethnopharmacol* 2003; 84: 57-78.
15. Tra Bi FH, Kouamé NF, Favel A, Fallague K. Activité antifongique de quelques plantes de la flore ivoirienne. *Sci Nat* 2007; 4: 117-122.
16. Asongalem EA, Foyet HS, Ngogang J, Folefoc GN, Dimo T, Kamtchouing P. Analgesic and antiinflammatory activities of *Erigeron floribundus*. *J Ethnopharmacol* 2004; 91: 301-308.
17. Krol AL. *World of Dermatophytes: A Pictorial* Canadian National Centre for Mycology. Provincial Laboratory for Public Health, University of Alberta Hospitals Edmonton, Alberta, <http://www.provlab.ab.ca>