

In- Vitro Evaluation of Antifungal Effects of *Euphorbia abyssinica* Extract

Running Title: Anti-fungal Effects of *Euphorbia abyssinica* Extracts

Abstract

Euphorbia abyssinica is a cactus-like plant of the family *Euphorbiaceae* commonly called desert candle or Kechiebih by the kendem people of south-West Cameroon. The stem-bark and latex of this plant were extracted using 50%-methanol, water and absolute methanol. Antifungal effect of the extracts was evaluated using agar, and macro-broth dilution methods. Strains of *Aspergillus*, *Rhizopus*, *Mucor*, *Rodotorula*, *Geotrichum*, *Basidiobolus*, *Trichophyton*, *Microsporum*, *Epidermophyton* and *Candida* species were used as test fungi for the study. The extraction of the stem-bark yielded 18%, 15% and 25% for absolute methanol, water and 50% methanol, respectively, while the latex yielded 13%, 12% and 15% for absolute methanol, water and 50% methanol extracts respectively. The growth inhibition of the fungi tested lasted for 7-14 or more days of incubation on Sabouraud dextrose agar plates. MIC range was 0.39-50.0 mg/ml for the stem bark extracts and 1.95- 50.0 for the latex extracts. There was a highly significant difference in the growth inhibition by the 50% methanol extracts and the absolute methanol and aqueous extracts of the stem-bark and latex ($P < 0.01$). *Candida albicans* was the most susceptible of the yeasts tested (MIC₉₀ 0.313 mg/ml), *Geotrichum species* was the least susceptible of the fungi tested (MIC₉₀ 100 mg/ml). In the time kill assay the results observed with the 50% methanol extract of the stem-bark showed that *T. mentagrophytes*, *M. gypseum* and *E. floccosum* cells were killed by the higher concentrations (4MIC and 2MIC) of the plant extracts. Results authenticated the ethno-medicinal applications of *Euphorbia abyssinica* for the treatment of skin infections.

Key words: Evaluation, Antifungal, Effects, *Euphorbia abyssinica* Extracts.

25 Introduction

26 The diseases caused by multidrug resistant fungal pathogens(e. g dermatophytes like
 27 *Trichophyton*, *Microsporum* and *Epidermophyton* as well as opportunistic fungi like *Aspergillus*
 28 *species*, *Candida albicans*, *Mucor* and *Rhizopus* species) are becoming the world`s leading cause
 29 of health complications if not death, especially in immunosuppressed patients(Sultanet *al.*,
 30 2016). Though fungal diseases (especially superficial and systemic) appear to be rare, they are
 31 not easily treated when contacted and *thus* most often, some cases of HIV AIDs, Hepatitis B,
 32 Cancer etc. and other immunosuppressive diseases become complicated by some of these fungal
 33 infections (Ogunnusi, 2015). The treatment of immunocompromised, AIDS and cancer patients
 34 becomes sometimes difficult due to this problem(Saravanasinghet *al.*,2016). This is even worst
 35 in under developed countries like Nigeria, where healthcare facilities are not easily assessable by
 36 the vast majority of the population. A greater part of the population in the interior areas of these
 37 countries therefore, rely on plant sources for treatment of skin diseases and other mycotic
 38 infections. The investigation of these plants used in folklore medicine for skin infections could
 39 invariably be a source of the antimycotic agents urgently needed in less developed world today.
 40 Some plants of the genus *Euphorbia*, have been used in folklore medicine from creation till
 41 today e. g *Euphorbia kamerunica* and other plants belonging to the family *Euphorbiaceace* have
 42 been used to treat skin infections such as ulcers, warts, cancers, tumors (Kirbaget *al.*,
 43 2013;Ogunnusi, 2015). *E. tirucalli* has been used for treatment of swelling, asthma, cough, skin
 44 problems and rheumatism. Also its latex is used as treatment for sexual impotence, warts,
 45 toothache, hemorrhoids, and snake bites. *Euphorbia granulata* has also shown inhibitory activity
 46 against Human immunodeficiency virus (HIV-1) protease (Ahmad *et al.*,2012).

This study therefore seeks to explore the largely unexplored rich natural constituents of *Euphorbia abyssinica*, with the aim of evaluating the antimycotic activity.

Materials and Method

Description of *Euphorbia abyssinica*

Euphorbia abyssinica is an erect, eight-angled branched tree with deep angles edged with a border of closely packed paired spines (about 1cm long) (Carter and Eggli, 2003). It belongs to succulent *Euphorbia* taxa (*Euphorbiaceae*) and is commonly found in most African countries; E. Sudan, Eritrea, Nigeria, N. Ethiopia, Somalia, inhabiting well drained stony soils of hills and slopes in montane evergreen wood-lands and bush lands at 1300 to 2200m in altitude. Among the Anyang-Kendem people of Mamfe, south West Cameroon it is known as Kechieh Bih. *Euphorbias* are recorded in international trade first place from Madagascar to France and Candle wax produced from *E. antisiphilitica* in Northern Mexico is internationally traded under CITES. *E. tirucalli* Linne¹⁷⁵³ and *E. miliare* extensively used for hedging purposes in the tropics, Africa and Brazil (Cartar, 1997). Some of the non-succulent *Euphorbias*, for example, *E. pulcherrima* (Poinsettia, flame leaf, Christmas star) native to Southern Mexico and Central America are used as ornamental plants (CITES, 2008).

Collection of Plant Materials

The plant parts used for this study were *Euphorbia abyssinica* stem bark and the latex. These were collected from Kendem in the Mamfe, south West region of Cameroon. In the Department of Botany, University of Nigeria Nsukka the plant was authenticated and the voucher specimen also deposited. The latex or sap of *Euphorbia abyssinica* was collected by cutting open, parts of the

bark on the stem and branches. A container was connected to the bottom of the opening from which the latex dripped into the container. It was then allowed to dry in the water bath at 56°C and stored in a close capped bottle pending its use.

The plant stem-bark was rinsed thoroughly in running tap water, cut into tiny pieces and air dried in the dark. The dried material was then ground to powder in a mortar, weighed and stored in plastic bags in the dark.

Extraction of Plant Materials

Approximately 400 ml of solvent (absolute methanol, water or 50% methanol in water) in a 1 L conical flask was used to soak a 100 g weight of powdered plant material and then covered with cotton wool plugs. After vigorous shaking, the flask was intermittently shaken for 24 hours leaving it in a water bath maintained at 40°C between the intervals of shaking. Three layers of clean muslin cloth were first of all used to filter the mixture before passing it through Whatman no 1 filter-paper. The filtrates were evaporated to dryness in a water bath at 56°C and the percentage yields of the crude extract determined (Tarhet *et al.*, 2015).

Test organisms

Trichophyton mentagrophytes, *Trichophyton tonsurans*, *Trichophyton violaceum*, *Microsporum gypseum*, *Microsporum canis*, *Epidermophyton floccosum*, *Candida albicans*, species of *Aspergillus*, *Basidiobolus*, *Rodotorula*, *Mucor*, *Rhizopus* and *Geotrichum*, were the fungi used for the study. They were cultured on Sabouraud Dextrose Agar plates at 25-35°C for 48 hours or more and the resultant pure mature colonies were sub-cultured on Sabouraud Dextrose Agar slants and stored as stock cultures.

Standardization of Fungal Inocula

Fungal stock cultures were sub cultured on Sabouraud Dextrose Agar and incubated at 25-35°C for 7 to 14 days. The matured fungal growths were covered with 2ml of distilled water and gently probed with a sterile loop or the tip of a Pasteur pipette. The resulting suspensions were transferred to sterile test tubes and allowed to settle for about 3-5 minutes. The resultant supernatant suspensions were drained into sterile bottles and the colony forming units (CFU) in the suspensions counted using a haemocytometer. The suspensions were then diluted with Sabouraud dextrose broth to correspond to the final standard inocula suspension (spores or yeast cells) of approximately 1×10^5 colony forming unit per ml (Tarh and Iroegbu, 2017).

Susceptibility Testing of Fungi by Pour-Plate Method

The Susceptibility testing of fungi was done using pour-plate method of (Tarh and Iroegbu, 2017). A 2.0ml amount of each reconstituted plant extract at the concentration of 1000mg/ml was pipetted into sterile glass test tube containing 18mls of molten Sabouraud Dextrose Agar (at about 45°C). The mixtures were swirled carefully for the contents and agar to be thoroughly mixed. Then 100µl of the standard fungal inocula were seeded onto each of the tubes. Again they were thoroughly mixed and poured into each of the plates and allowed to set. They were then incubated at about 25-35°C. A sterile plate without the extract served as the positive control for growth while another plate containing 2.0ml of 16µg/ml voriconazole as the negative control. As soon as growth was observed at the positive control plates the test plates were checked for growth daily and the period of inhibition of growth was recorded in days.

Determination of Minimum Inhibitory Concentration (MIC) of the Plant Extracts on the Fungi by Macro-Broth Dilution Method

A two-fold serial dilution of the plant extract was carried out in tubes of Sabouraud Dextrose broth to obtain dilutions ranging from 200mg/ml down to 0.39 mg/ml. The 11th tube, which was used as positive growth control culture, did not contain any extract. The control antimycotic agent, voriconazole, was similarly serially diluted but to attain concentrations ranging from 0.125-128µg/ml. Each dilution was seeded with 100µl of the standardized suspensions of the test fungal spores and incubated at 25-35°C for ≥48 hours. The lowest dilutions without visible growth in the tube cultures, compared to the positive and negative controls were considered as the MICs. The tests were carried out in quadruplets and the means of the MICs calculated (Tarh and Iroegbu, 2017).

Determination of Minimum Concentration at which 90% Fungal Growth Inhibition was Observed (MIC₉₀) from Broth Dilution Tubes

A 100µl volume of the fungal test suspensions from all the tubes showing no visible fungal growth was sub-cultured on Sabouraud Dextrose agar plates and incubated at 25-35°C. Positive growth control plates were also included and checked simultaneously in comparison with the test plates for fungal growth. The Minimum Fungicidal Concentration (MFC) was considered as the minimum concentration of the test substances that yielded 99%-100% visible growth inhibition on sub-culture of 100 µl of serial dilutions and incubation at 35°C for more than 48hours. Any dilution showing 90% growth inhibition was recorded as MIC₉₀ (Tarh and Iroegbu, 2017).

Determination of the Effects of Plant Extracts on Viable Colony Forming Units (CFU) of the Fungi Using Time-Kill (Inhibition) Assay

The effects of 50% methanol extracts of *Euphorbia abyssinica* were evaluated by a time-kill assay using the macrobroth dilution technique. The extracts were reconstituted in 20% Dimethyl Sulfoxide (DMSO) and appropriately diluted to the required concentrations. The inoculums size was determined according to the type of fungus, (e.g. 1 x10⁶ for *Candida albicans*; and 1 x10⁵ for

dermatophytes). About 1.00ml of the extract was added to 9ml of Saboraud dextrose broth, seeded with the appropriate concentrations of the test fungus to achieve concentrations equivalent to 0.5 x MIC, 1 x MIC, 2 x MIC, or 4 x MICs values. Two sets of control tubes were included for each experiment. One set was seeded with the organism in broth without extract, and the other set contained broth without organism and extract. The control drug voriconazole was similarly diluted. All the fungal cultures were incubated at 25-35°C for ≥ 48 hours. Immediately after inoculation of the tubes, aliquots of 100 μ l of the negative control tubes contents were taken, serially diluted in saline and seeded on nutrient agar plates to determine the zero hour counts. The same was done for the tubes which contained the test fungi after 0 hour, 3 hours, 6 hours, 24 hours and 48 hours, respectively. After incubation, the emergent colonies were counted and the mean count (CFU) of each test organism was determined and expressed as $\log_{10}$. The Minimum Lethal Concentrations (MLCs) of the extract were the lowest concentrations that gave 99.9% to 100% killing (Tarhet *et al.*, 2015)

Statistical Analysis

The Randomised Complete Block Design (Two-way analysis of variance) was used to analyze the data obtained in the study. The means that were significantly different were separated using Duncan's New Multiple Range Test.

Results

Antifungal Activities of *Euphorbia abyssinica* Extracts

The results of the antifungal activities of 100mg of *E. abyssinica* stem- bark showed that the extract inhibited the growth of all the fungi tested. However, the 50% methanol extract showed

165 better activity (14days or more) than the absolute methanol and aqueous extract (12days or more)
166 (Table 1).

167 *Euphorbia abyssinica* latex extracts, also showed similar activity on the fungi tested like the
168 stem bark but inhibition of growth was for lesser number of days. The 50% methanol extract
169 inhibited the growth of all the dermatophytes for 12days or more (Table 1). The control anti
170 mycotic agent (voriconazole) inhibited the growth of all the fungal isolates tested for over
171 14days, including *Aspergillus*, *Mucor*, *Rhizopus* and *Geotricum species* (Table 1).

172

173 **The MICs and MIC₉₀s (mg/ml) of 50 % Methanol Extract of Plants on the Fungi**

174 The MICs and MIC₉₀s were evaluated using the 50% methanol extract of *E. abyssinica* stem-
175 bark. was more active on the yeasts, with *Candida albicans* showing MIC value of 0.39mg/ml
176 and MIC₉₀ of 1.56mg/ml, followed by *Rhodotorulla* species (MIC 0.49mg/ml, MIC₉₀ 3.13mg/ml)
177 and *B. haptosporus* (MIC 0.59mg/ml, MIC₉₀ 3.13mg/ml). *E. floccosum* was the most susceptible
178 of the dermatophytes with MIC of 0.98mg/ml and MIC₉₀ of 1.56mg/ml. This was closely
179 followed by *Trichophyton rubrum* (MIC 0.195 mg/ml, MIC₉₀ 3.13mg/ml), *M. canis* (MIC
180 3.9mg/ml, MIC₉₀ 3.13mg/ml) and *T. mentagrophytes* (MIC 0.39mg/ml, MIC₉₀ 6.25mg/ml)
181 respectively. The least susceptible of the fungi were *Microsporum gypseum* (MIC 25mg/ml,
182 MIC₉₀ 25mg/ml) and *T. tonsurans* (MIC 12mg/ml, MIC₉₀ 25mg/ml) respectively (Table 2).
183 Extracts of *E. abyssinica* latex showed its lowest MIC (1.95mg/ml) on, *B. haptosporus* and *E.*
184 *floccosum* respectively and least MIC₉₀ (3.13mg/ml) on *E. floccosum* and *C. albicans*
185 respectively). The least susceptible of the fungi tested to this extract was *Microsporum gypseum*
186 (MIC /MIC₉₀ of 25mg/ml) (Table 2). For the control drug (voriconazole), *C. albicans* (MIC 0.313
187 µg/ml, MIC₉₀ of 0.5µg/ml), and *T. rubrum* (MIC 0.375 µg/ml, MIC₉₀ of 0.5µg/ml), were the

most susceptible fungi while the least susceptible of the fungi was *B. haptosporus* with MIC of 1.25µg/ml, and MIC₉₀ of 4µg/ml (Table 2).

Antimicrobial Effect of 50% Methanol Extract of *E. abyssinica* Stem- Bark on Viable Cell Count of Fungi Using Time-Kill (Inhibition) Assay.

The inhibition of the fungal cells was estimated as the reduction of viable cell count following exposure to a given concentration of plant extract or control drug (voriconazole) over a period of time (hours).

E. abyssinica 50% Methanolextract, even at its multiples of MICs did not inhibit *C. albicans* completely in 48hours but the cell count was reduced to very significant levels by the 4MIC and 2MIC (1.56mg and 0.78mg/ml,) respectively (Fig. 1).The control drug (voriconazole 0.5 µg/ml) killed *C. albicans* in 48hours.

The, 4MIC (15mg/ml,) concentration inhibited *T. mentagrophytes* in 3hours, while the 2MIC (7.8mg/ml) inhibited it in 6hours. The 1MIC (3.9 mg/ml) reduced the viable cell count to 2.1 log₁₀ in 48 hours but 0.5MIC (1.95mg/ml) concentration had no effect on *T. mentagrophytes*(Fig. 2). It was inhibited by the control drug (1µg /ml) in 48hours.*M. gypseum*was inhibited by 4MIC and 2MIC (100 mg/ml and 50 mg/ml) concentrations in 3hours respectively but 1MIC (25mg/ml) concentration as well as the sub inhibitory concentration (12.5mg/ml) did not totally inhibit *M. gypseum*cells in 48hours (fig.3). The *M. gypseum*cells were inhibited by the control drug (Voriconazol 2 µg /ml) in 48hours.

The exposure of *E. floccosum*to 4MIC (3.9mg/ml) concentration of *E. abyssinica* 50% methanolextract reduced the viable cell count to undetectable levels of growth in 3 hours, and 2 MIC (1.96mg/ml) inhibited it to about 99% in 48 hours respectively (fig. 4). But the cells exposed to1MIC (0.98mg/ml) and 0.5 MIC (0.49mg/ml) were inhibited to greater than 2log₁₀ in 48hours.These concentrations could do better if aloud to have contact with the cells for much

212 longer periods of time. *E. floccosum* cells were also inhibited by the control drug (voriconazole
213 1µg/ml) in 48hours (fig.4).

214 **Table 1: Periods of inhibition (in days) of the growth of some pathogenic fungi by plant extracts**

	<i>B. h</i>	<i>R. s</i>	<i>C. a</i>	<i>T. m</i>	<i>T. r</i>	<i>T. t</i>	<i>T. v</i>	<i>M. g</i>	<i>M. c</i>	<i>E. f</i>	<i>A. fl</i>	<i>A. fu</i>	<i>M. s</i>	<i>A. n</i>	<i>G. s</i>	<i>R. n</i>
Stem-bark																
A.methanol	>12	>12	>12	>12	>12	>12	>12	>12	>12	>14	>14	>12	>12	12	7	12
Aqueous	12	12	12	12	12	12	12	12	12	>12	12	12	12	12	7	12
50% Methanol	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>12	>12	>12	>12	>7	>12
Latex																
A. metha	12	12	>12	>12	12	12	12	12	12	>12	12	12	12	12	7	12
nol																
Aqueous	12	12	12	12	12	12	12	12	12	12	12	12	12	12	7	12
50% Methanol	>14	>14	>14	>14	14	14	14	>14	14	>14	14	12	12	12	7	>12
Voriconazole	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14	>14
16µg/ml																

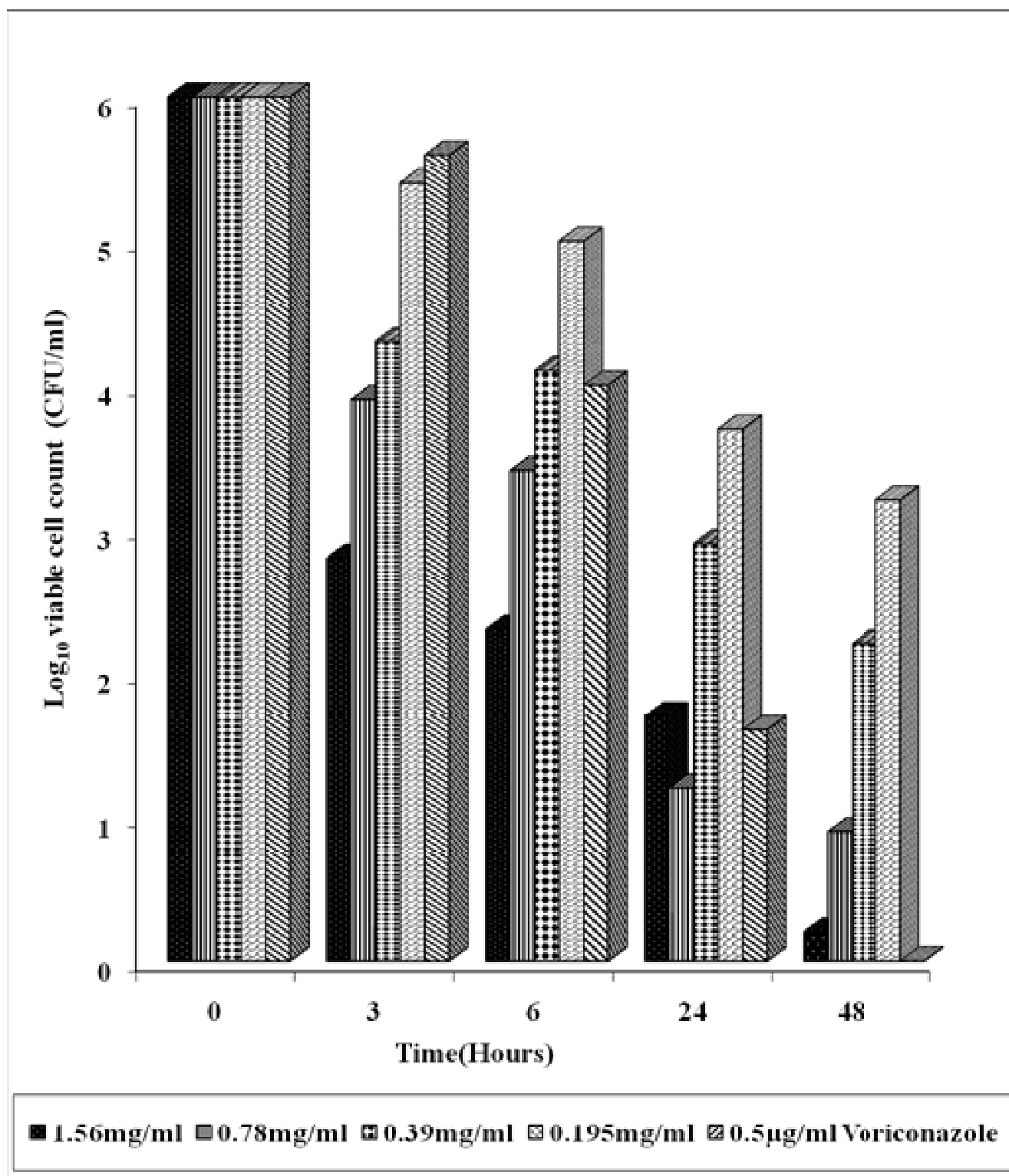
215 ***B. h***=*Basidiobolushaptosporus*, ***R. s***= *Rhodotorulla species*, ***C.a***= *Candida albicans*, ***T. m***= *Trichophytonmentagrophytes*, ***T.***
216 ***r***=*Trichophytonrubrum*, ***T.t***=*Trichophytontonsurans*, ***T.v***=*Trichophytonviolaceum*, ***M.g***, *Microsporumgypseum*, ***M.c***= *Microsporumcanis*,
217 ***E.f***= *Epidermophytonfloccosum*, ***A.fl.*** *Aspergillusflavus*, ***A.fu***=*Aspergillusfumigatus*, ***M.s***= *Mucor species*, ***G.S***=*Geotricum species*,
218 ***R.n***=*Rhizopusnigricans*,>=more than A. *n*= *Aspergillusniger*.A.methanol=Absolute methanol

219

220

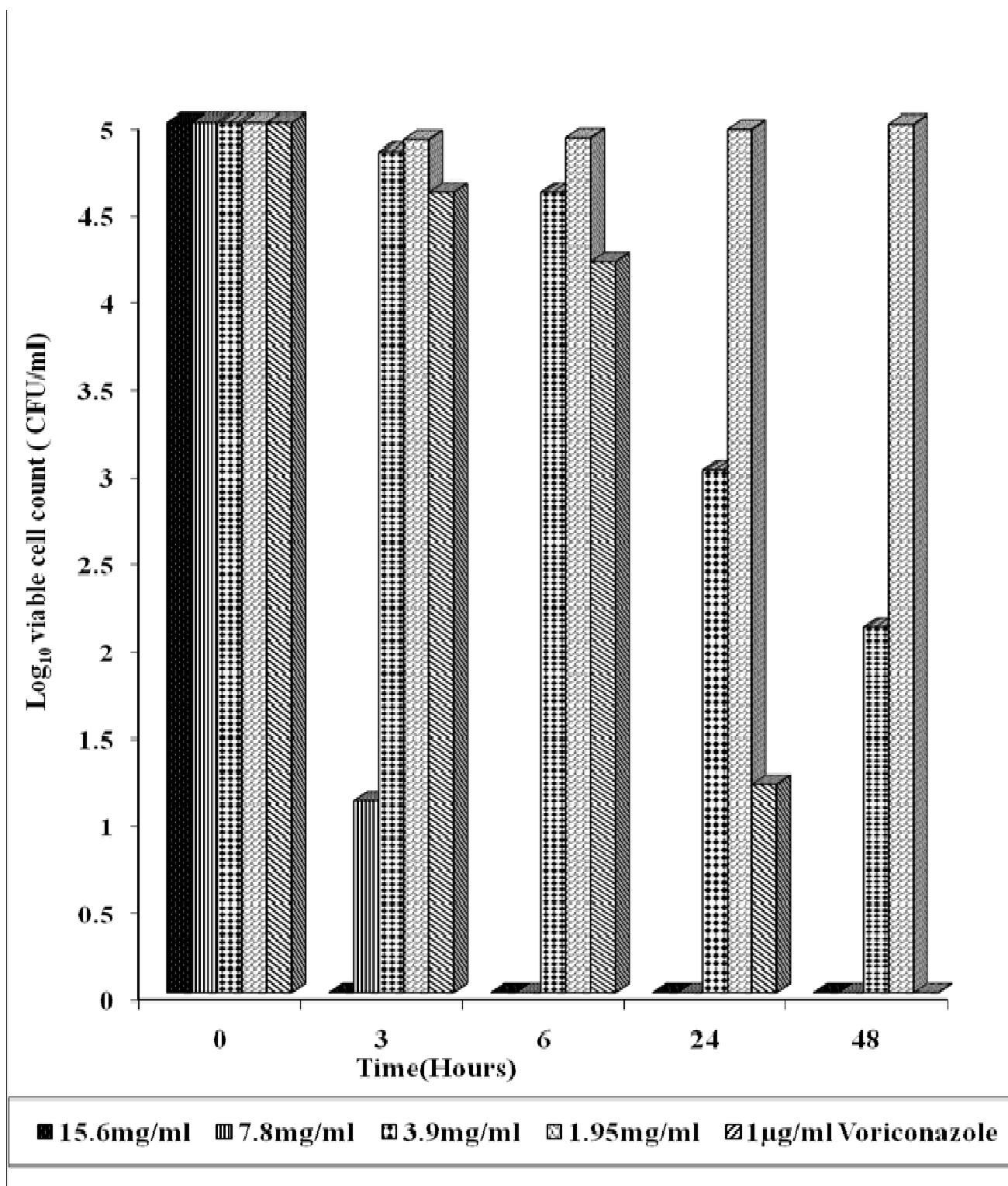
	<i>E. abyssinica</i> Stem-bark Extract		<i>E. abyssinica</i> Latex Extract		Voriconazole (µg/ml)	
Fungal Species	MIC±SD (mg/ml)	MIC ₉₀ (mg/ml)	MIC±SD (mg/ml)	MIC ₉₀ (mg/ml)	MIC±SD (µg/ml)	MIC ₉₀ (µg/ml)
<i>C. albicans</i>	0.39±0.00	1.56	2.73±0.78	3.13	0.313±0.13	0.50
<i>Rhodotorullaspecies</i>	0.49±0.19	3.13	2.34±0.90	6.25	0.75±0.29	2.00
<i>B. haptosporus</i>	0.59±0.23	3.13	1.95±0.78	6.25	1.25±0.50	4.00
<i>E. floccosum</i>	0.98±0.39	3.13	1.95±0.78	3.13	0.313±0.13	1.00
<i>T. mentagrophytes</i>	3.9±1.6 0	6.25	6.25±0.00	12.5	0.189±0.07	1.00
<i>T. rubrum</i>	1.95±1.36	3.13	3.91±1.56	12.5	0.375±0.14	0.50
<i>T. violaceum</i>	3.91±1.56	6.25	5.476±1.56	12.5	0.50±0.00	0.50
<i>M. canis</i>	3.91±2.70	3.13	2.73±2.3	6.25	0.25±0.00	0.50
<i>T. tonsurans</i>	12.5±0.00	6.25	18.7±57.20	25	0.25±0.00	1.00
<i>M. gypseum</i>	25.0±0.00	25	25.0±0.00	25	0.75±0.29	2.00
<i>Aspergillusfavus</i>	12.5±0.00	25	15.63±6.30	25	0.25±0.00	0.50
<i>Aspergillus Niger</i>	6.25±0.78	25	12.5±0.00	25	0.25±0.00	1.00
<i>Aspergillusfumigatus</i>	6.25±0.59	25	12.5±0.00	25	0.25±0.00	1.00
<i>Rhyzopusnigrcans</i>	12.5±0.78	25	25.0±0.39	50	0.189±0.07	1.00
<i>Mucor species</i>	25.0±0.39	50	25.0±0.39	50	0.375±0.14	1.00
<i>Geotricum species</i>	50.0±0.195	100	50.0±0.195	100	0.75±0.29	2.00

Table 2: MICs and MIC₉₀s of plant extracts (mg/ml) on some pathogenic fungi



223

224 **Figure 1: Effect of 50% Methanol Extract of *Euphorbia abyssinica* Stem-Bark on Viable**
 225 **Cell count of *Candida albicans*.**



226

227 **Figure 2: Effect of 50% Methanol Extract of *Euphorbia abyssinica* Stem-Bark on Viable Cell**
 228 **Count of *Trichophyton mentagrophytes***

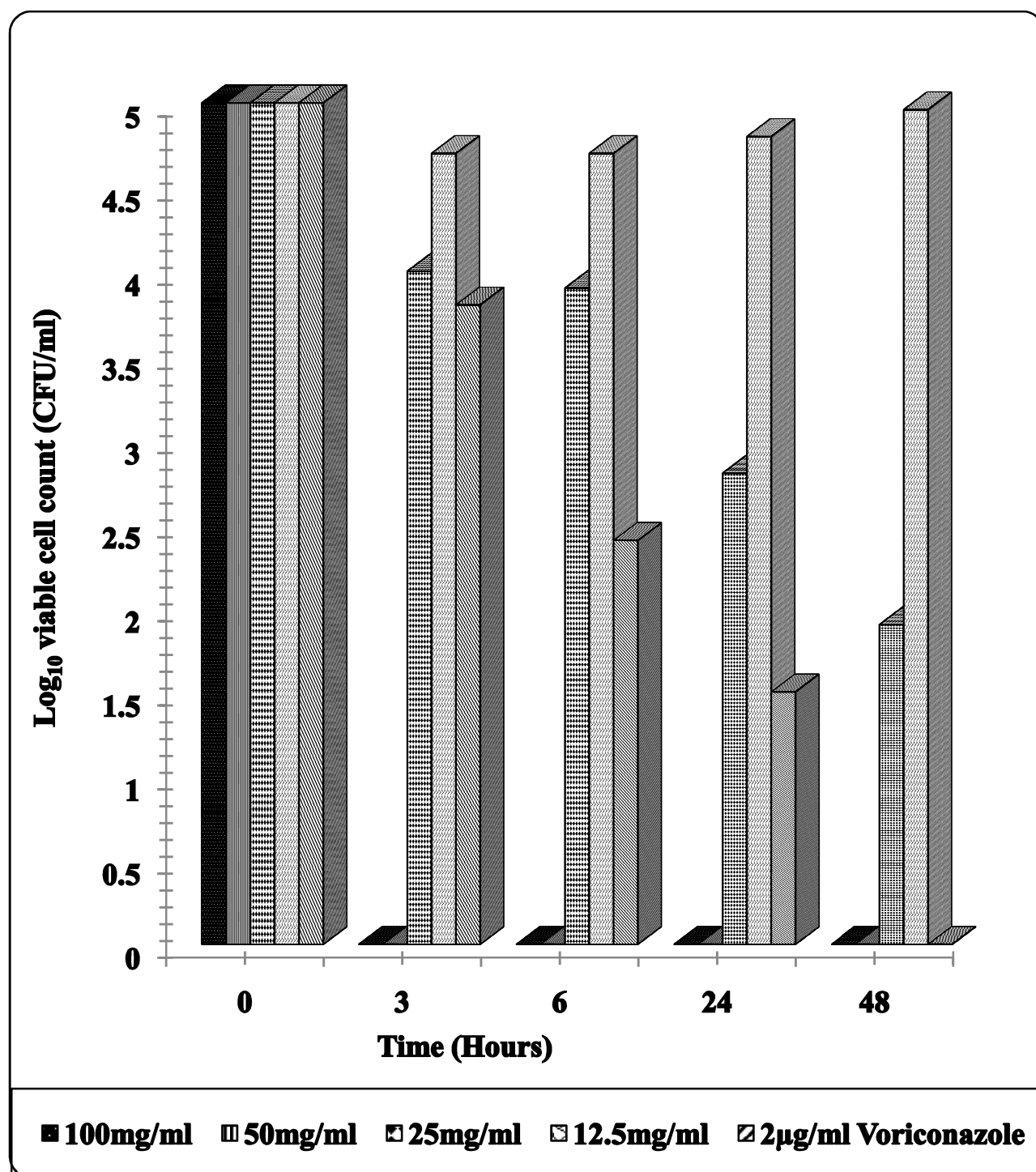


Figure 3: Effect of 50% Methanol Extract of *Euphorbia abyssinica* Stem-Bark on Viable Cell Count of *Microsporiumgypseum*

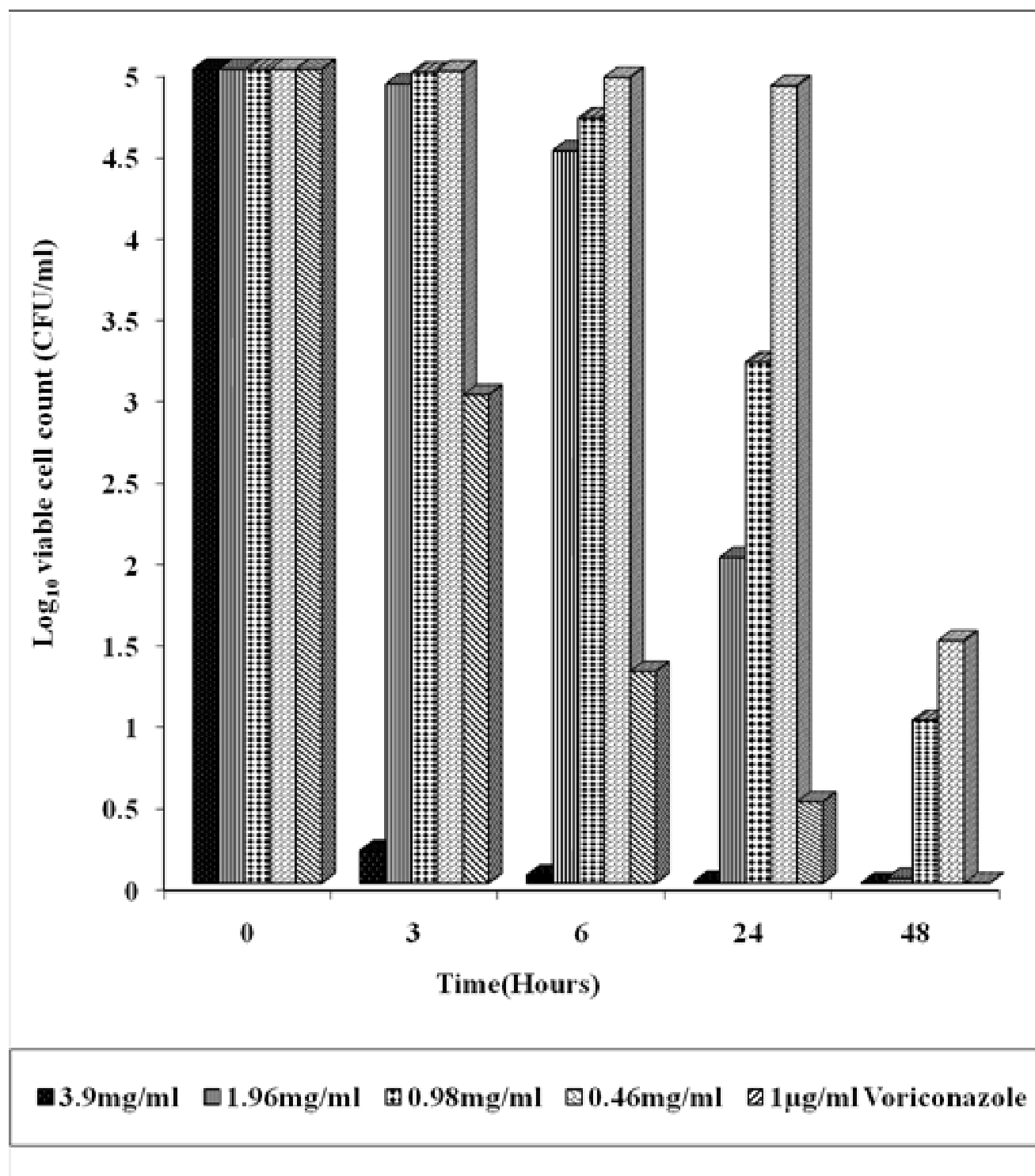


Figure 4: Effect of 50% Methanol Extract of *Euphorbia abyssinica* Stem- Bark on Viable Cell Count of *Epidermophyton floccosum*.

DISCUSSION

The study of antifungal activity of crude extracts (absolute methanol, water and 50% methanol) of *Euphorbia abyssinica* by agar dilution and macrobroth dilution method showed that the extracts inhibited the growth of the test organisms. In the agar dilution, there was no significant difference between the activity of the stem-bark and that of the latex extracts. Also there was no significant difference between the activity of the absolute methanol and the aqueous extracts even though the methanol extract were more active when compared with the aqueous extract. The slight difference in the activity might have been probably due to the solubility of the chemical and bioactive constituents in the extracting solvents (methanol and water). Sultan *et al.* (2016) reported the significant antifungal activity of methanol and aqueous extracts of *Euphorbia tirucalli* with mean inhibition zone of 15.33 ± 0.88 mm and 17.33 ± 0.33 mm respectively for *C. albicans* (ATCC9002) and *A. niger* 14.67 ± 0.67 and 16.33 ± 0.33 for methanol and aqueous respectively. The antifungal activity of methanol and aqueous extracts of other *Euphorbia* species have also been reported by other researchers (Bhaskara *et al.*, 2010; Khan *et al.*, 2011; Yazdani *et al.*, 2012; Lagnika *et al.*, 2012; Gayathri & Ramesh, 2013; Shivakumar & Vidyasagar, 2015; Vimal & Manohar Das, 2015; Reddy & Babu, 2016).

The 50% methanol extracts of the two plant parts (stem-bark and latex) showed significantly higher antifungal activity than the absolute methanol and aqueous plant extracts. In the macrobroth dilution method the results showed that at a significant value of $\alpha = 0.01$ the 50% methanol extract of the stem-bark was more active than the 50% methanol extract of the latex. They were significant at mean values of 5.361 for stem-bark extract and 7.109 for the latex extract.

260 This activity was dose dependent as greater inhibition of growth was observed at high
261 concentrations than at lower concentrations in the Time kill assay. Similar observations as these,
262 have also been reported with other *Euphorbia* species extracts by other researchers (Bharti
263 &Vidyasagar, 2012; Shivakumar&Vidyasagar, 2014, 2015).

264 Cowan in 1999,observed that organic solvents extract better than water
265 (Shivakumar&Vidyasagar, 2015). However a mixture of the two solvents yielded better results in
266 this study.

267 Both yeasts and moulds, dematophytes and opportunistic pathogens were inhibited by extracts of
268 the two plant parts studied. *Epidermophytonflocossum* and *Candida albicans* were the most
269 susceptible of the moulds and yeasts tested respectively.Though, the differences between the
270 means was highly significant. The more susceptibility pattern of the yeasts showed that they
271 were more susceptible than the moulds at $P<.01$ and significant mean values of .896 for *Candida*
272 *albicans*and 1.053 for*Epidermophytonflocossum*. Kirbaget al. (2013) also in their research on *E.*
273 *szovitsi*istatedthat the latex extracts of the plant showed inhibitory effects at different ratios
274 against yeasts and dermatophyteswith the lowest MIC shown by *Epidermophyton*sp.In a similar
275 study byOgunnusi, (2015)*Euphorbiakamerunica*inhibitedthe growth of*Microsporumaudouinii*
276 for 9 days. He also reported thatthe growth of *Aspergillusniger*was inhibitedby aqueous and
277 methanol extracts of this plant while*Microsporumcanisvar.distortum*was also inhibited byethanol
278 extract at 2.5 mg/ml and 5 mg/ml in the same experiment.

279 From this experiment crude extracts of *Euphorbia abyssinica* plant were efficaciousagainst some
280 dermatophytes, yeasts and opportunistic pathogenswhich supportsits ethno medicinal uses as a
281 broad spectrum herbal remedy.Further research on the fractions of these plant extracts to reveal

the actual bioactive compounds will be of great value. This plant might thereafter be used as treatment for infections caused by these fungi.

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