

EFFECT OF *ECBALLIUM ELATERIUM* FRUIT ON *CANDIDA ALBICANS*, *ASPERGILLUS FUMIGATUS* AND *ESCHERCHIA COLI*

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ABSTRACT

The fruit juice of *Ecballium elaterium* was used as a traditional medicine in Iran and in folk medicine. This plant, which is endemic to Turkey, is applied for the treatment of sinusitis in the countries of the region including Iran. The ethanolic extracts of three parts of *E. elaterium* fruit (seeds, liquid contents and flesh of the fruit) were tested against *Candida albicans*, *Aspergillus fumigatus* and *Escherichia coli* at the concentration range from 7.8 to 1000 microgram per milliliter by microbroth dilution method. This is the first report showing the activity of the extracts of 3 parts of *E. elaterium* fruit, include seeds, liquid contents and flesh that are effective against *E. coli*, *C. albicans* and *A. fumigatus* at the concentration of 1000 µg/ml.

KEYWORDS: *Aspergillus fumigatus*, *Candida albicans*, *E. coli*, *Ecballium elaterium*, Ethanolic extract.

INTRODUCTION

Ecballium elaterium (L.) A. Rich., the squirting cucumber or spitting cucumber, from the Cucurbitaceae family, is a medicinal plant, widely found in the wild South-West Europe, North Africa, the Mediterranean region and North-West of Iran in stony ground, in the rubble and downhill (Greige-Gerges *et al.*, 2007). This plant is recognized as grass officinal herb and in the Mediterranean valley has a lengthy traditional use. It is often applied in edema, particularly pulmonary edema and also as a revulsive in brain diseases (Felter and Loyd, 1905). Cucurbitacins and their glycosylated derivatives have been responsible for many biological activities of this species such as antiproliferative activity on various types of cancer cells (Blaskovich *et al.*, 2003; Sun *et al.*, 2005). But the most interesting potential activity of *E. elaterium* can be antiviral (Boullard, 2001). On the other hand, there is a previous report on *In vitro* antimicrobial activity of extracts of *E. elaterium* fruit that screened against *C. albicans* and *Staphylococcus aureus*. This study showed that the combination of *E. elaterium* and penicillin can be more effective than penicillin alone, and *E. elaterium* can be more effective than bifonazole in *C. Albicans* (Adwan *et al.*, 2011; Yesilada *et al.*, 1988). Here we report the activity of the *E. elaterium* fruit against fungi and a bacterium.

MATERIALS AND METHODS

Ecballium elaterium fruits were collected from its natural habitat in the region of Ahar (North of Tabriz) during the months of September (2012), and seeds, fleshy and liquid content of fruit were separated. The fleshy and seeds parts were dried away from direct sunlight. A dry powder of the plant of each part (fleshy and seeds of fruit) and liquid content was extracted by the mixture ethanol-water (70:30, v/v). The extracts were carried under percolation. The ethanolic extracts were evaporated to dryness at 50°C under reduced pressure in rotary evaporator. For defatted extracts, the drying process was carried out by freeze-drying.

Minimum inhibitory concentration (MIC) of ethanolic extracts of three parts of *E. elaterium* fruit, which were dissolved in Dimethyl sulfoxide (DMSO), were determined by the micro dilution broth method as described by National Committee for Clinical Laboratory Standards (NCCLS) (NCCLS, 2000). *E. elaterium* ethanolic extracts were serially diluted in Sabouraud Maltose broth for *C. albicans*, *A. fumigatus* and in Nutrient Broth for *E. coli* and then each micro-organisms inoculum size of 1×10^5 CFU/mL was added to each well. Controls with broth, DMSO, broth without anything (negative control), and broth with micro-organism (positive control) were included in the experiments. In these tests, amphotricin B and fluconazol are the standard controls for *C. albicans* and *A. fumigatus*, and streptomycin is the standard control for *E. coli*. Each test strain of micro-organism was run in duplicate. The test plates were incubated at 37°C for 24 and 48 h. The MIC was taken as the minimum concentration of the dilutions that inhibited the growth of the test micro-organism.

RESULTS AND DISCUSSION

Results showed that *A. fumigatus*, *C. albicans* and *E. coli* are responsive organisms to ethanolic extract of *E. elaterium* fruits. The MIC values of 3 parts of *E. elaterium* fruit extracts against *A. fumigatus*, *E. coli* and *C. albicans* were shown in Table 1.

Plants are the major sources of natural products and extensively use in under developing countries due to low cost, affect a broad range of microorganisms, and these herbal medicine have fewer adverse effects (Boullard, 2001). In the present study, ethanolic fruit extracts of *E. elaterium* showed strong antifungal and antibacterial activity against *A. fumigatus*, *C. Albicans* and *E. coli*. Similar results were reported by Oskay *et al.* (2010) who found that ethanolic extract of *E. elaterium* have antibiotic activity against multidrug resistant bacteria. According to Dougruoz *et al.* (2008), aqueous extract of *E. elaterium* did not show antibacterial activity against different bacterial species using agar well diffusion method. The variation in the results may be due to different genera of bacteria and methodology. Furthur study is needed to identify the active compounds, the mode of action and possible toxic effect of fruit extract of *E. elaterium* *In vitro* on a range of bacteria and fungi.

Table 1. MIC of ethanolic extracts of seeds, fleshy and liquid content of *E. elaterium* fruit and amphotericin B, fluconazole and streptomycin against *C. albicans*, *A. fumigatus* and *E. coli* after 24 hrs.

Micro-organisms	Seed extract	Flesh extract	Liquid content extract	Amphotericin B	Fluconazole	Streptomycin	Positive control	Negative control
<i>C. albicans</i>	1000	1000	1000	1.56	1000	nt ^a	+ ^b	- ^c
<i>A. fumigatus</i>	1000	1000	1000	1.56	1000	nt	+	-
<i>E. coli</i>	1000	1000	1000	nt	nt	31.25	+	-

^a not tested (not the target organism); ^b shows growth; ^c no growth

REFERENCES

- Adwan, G., Y. Salameh and K. Adwan. (2011). Effect of ethanolic extract of *Ecballium elaterium* against *Staphylococcus aureus* and *Candida albicans*. *Asian Pacific J. Trop. Biomedicine*, 1(6): 456-460.
- Blaskovich, M.A., J. Sun, A. Cantor, J. Turkson, R. Jove and S.M. Sebti. (2003). Discovery of JSI-124 (cucurbitacin I), a selective Janus kinase/signal transducer and activator of transcription 3 signaling pathway inhibitor with potent antitumor activity against human and murine cancer cells in mice. *Cancer Res.*, 63(6): 1270-1279.
- Boullard, B. (2001). Medicinal plants of the world. Beliefs and realities. Editions Estem, pp. 636.
- Dogruoz, N., Z. Zeybek and A. Karagoz. (2008). Antibacterial activity of some plant extracts. *IUFS J. Biol.*, 67(1): 17-21.
- Felter, H.W. and J.U. Lloyd. (1905). *King's American Dispensatory*. 19th edition, volume II. The Ohio Valley Company, 317-321 Race Street. pp. 1295.
- Greige-Gerges, H., R.A. Khalil, E.A. Mansour, J. Magdalou, R. Chahine and N. Ouaini. (2007). Cucurbitacins from *Ecballium elaterium* juice increase the binding of bilirubin and ibuprofen to albumin in human plasma. *Chemico-Biological Interactions*, 169(1): 53-62.
- NCCLS, National Committee for Clinical Laboratory Standards. (2006). *Methods for dilution antimicrobial susceptibility tests for bacteria that grow aerobically*. Clinical Laboratory Standards Institute, pp. 64.
- Oskay, M., D. Oskay and F. Kalyoncu. (2010). Activity of some plant extracts against multi-drug resistant human pathogens. *Iranian J. of Pharm. Res.*, 8(4): 293-300.
- Ozolua, R.I., S.E. Idogun and G.E. Tafamel. (2010). Acute and sub-acute toxicological assessment of aqueous leaf extract of *Bryophyllum pinnatum* (Lam.) in Sprague-Dawley rats. *Amer. J. Pharm. & Toxicol.*, 5(3): 145-151.
- Sun, J., M.A. Blaskovich, R. Jove, S.K. Livingston, D. Coppola and S.M. Sebti. (2005). Cucurbitacin Q: a selective STAT3 activation inhibitor with potent antitumor activity. *Oncogene*, 24(20): 3236-3245.
- Yesilada, E., S. Tanaka, E. Sezik and M. Tabata. (1988). Isolation of an anti-inflammatory principle from the fruit juice of *Ecballium elaterium*. *J. Natur. Produ.*, 51(3): 504-508.

(Received December 2015; Accepted January 2016)