Arabian Journal of Chemistry (2014) xxx, xxx–xxx

King Saud University

Arabian Journal of Chemistry

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ORIGINAL ARTICLE

Chemical composition, antibacterial and repellent activities of *Azorella trifurcata*, *Senecio pogonias*, and *Senecio oreophyton* essential oils

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Received 7 March 2014; accepted 3 November 2014

Dedicated to the memory of Ing. Francisco Benavente (Facultad de Ingeniería, Universidad Nacional de San Juan, Argentina).

KEYWORDS

Azorella trifurcata;
Senecio oreophyton;
Essential oil;
Triatoma infestans;
Chagas disease;
Escherichia coli

Abstract The antibacterial and insect-repellent activities of the essential oils (EOs) from Argentinian medicinal plants *Azorella trifurcata* (Gaertn.) Pers., *Senecio cfr. oreophyton* J. Remy and *Senecio cfr. pogonias* Cabrera, were investigated. All EOs showed good repellent properties against *Triatoma infestans* Klug, the vector of the Chagas disease, with percent repellence values between 60% and 70% at 24 h compared with positive control *N-N* diethyl-*m*-methylbenzamide (DEET) and moderate activity against the bacteria tested with minimum inhibitory concentration (MIC) values between 31.2 and 2000 μg/ml. The *A. trifurcata*, *Senecio pogonias* and *Senecio oreophyton* EOs, obtained by hydrodistillation, were characterized by GC-FID and GC/MS analyses. Spathulenol (38.2%), myrtenyl acetate (8.4%), α-terpineol (4.5%), limonene (9.8%) and α-thujene (5.4%) were

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.arabjc.2014.11.022

the main constituents in the EO of *A. trifurcata*. The *S. pogonias* and *S. oreophyton* EOs are characterized by a high content of monoterpene hydrocarbons (92% and 95.1%, respectively) with α-pinene, the main component in both oils. To our knowledge, the essential oil composition from Andean medicinal plants *A. trifurcata*, *S. pogonias* and *S. oreophyton* collected in central Andean slopes are reported for the first time.

1. Introduction

The Province of San Juan is located in the central-western part of Argentina, centred at the intersection of 31° S latitude and 69° W longitudes to the western Andean slopes. The province has a rich tradition in folk medicine including the use of medicinal plants. The flora from ecosystem Andino in Argentine comprises a large number of species distributed in different ecosystems, characterized by particular edaphic and climatic conditions. Plants of the high mountains have been used as medicines since pre-hispanic times and are still used for their reputed therapeutic properties, including *Azorella*, *Senecio*, *Baccharis* and *Larrea* genus, to treat mainly digestive and hepatic disorders, fever, coughs and colds (Bustos et al., 1996; Feresin et al., 2002).

The *Azorella* genus comprises about 30 species growing in the Andean mountains and Patagonia, Argentina, and only 15 species are recognized in this country (Martinez, 1989). Several authors have reported the chemical composition of the Chilean species *A. madreporica*, *A. yareta*, and *A. compacta* (Loyola et al., 1997a,b,c, 1998a,b, 2002). The biological activities such as: antiplasmodial, trichonomicidal, antituberculosis and antibacterial, have been evaluated by azorellane and mulinane diterpenoids, and isolated by the different *Azorella* species (Wächter et al., 1999; Loyola et al., 2001, 2004; Molina-Salinas et al., 2010). *Azorella trifurcata*, commonly known as "yareta" distributed in Argentina and Chile is used to treat digestive disorders. Recently, triterpenoids isolated from *A. trifurcata* (Gaertn.) Pers and their effect against the enzyme acetylcholinesterase were reported (Areche et al., 2010). Also, their in vitro spermatostatic activity of mulinane- and azorellane-type diterpenes on human spermatozoa (Chiaramello et al., 2011) was reported.

Regarding *Senecio* genus, there are about 3000 species around the world, mainly in hilly areas. In Argentina there are more than 270 species; most of them in the Andes Mountain and in Patagonia (Cabrera, 1971). The chemical composition of the essential oils of some *Senecio* species including *S. trapezuntinus*, *S. platyphyllus*, *S. vernalis*, *S. glaucus*, *S. leucostachys*, *S. squalidus*, *S. aegyptius*, *S. graveolens*, *S farfarifolius*, *S. nutans*, *S. rufinervis*, and *S. longipenicillatus* are reported (Kahriman et al., 2011; Mishra et al., 2011). The species, *Senecio cfr pogonias*, and *S. cfr oreophyton* n.v. "chachacoma" are used in traditional medicine of Argentine to treat hepatic disorders, fever, coughs and colds. To our knowledge, so far, the biological activities and chemical composition of *A. trifurcata*, *Senecio oreophyton* and *S. pogonias* essential oils (EOs) collected in the central Andean zone of Argentina have not yet been reported.

Is recognized, that the infectious diseases caused by bacteria, virus, fungi, and parasites, are a significant threat to public health (WHO, 2014). Thus, the natural products, specially the EOs and their components, are an alternative for this type of affections.

We report the chemical composition, repellent against *T. infestans* "Chagas disease" vector and antimicrobial activity of essential oils of *A. trifurcata*, *S. oreophyton*, and *S pogonias* collected in the central Andean mountain from San Juan Province, Argentine.

2. Materials and methods

2.1. Plant materials

Samples of *A. trifurcata* (Gaertn.) Pers. (Apiaceae), *Senecio cfr. oreophyton* J. Remy and *Senecio cfr. pogonias* Cabrera (Asteraceae) were collected from Iglesia (Quebrada de Romo) district in the Central Andes area, from San Juan Province, Argentina, during the flowering period (2011). Species were identified by Dr. Luis Ariza Espinar (Instituto Multidisciplinario de Biología Vegetal, CONICET, and Universidad Nacional de Córdoba). Voucher specimens were deposited with the Museo Botánico de Córdoba, Argentina and were identified as CORD 9745, CORD 9748 and CORD 9747 code, respectively.

2.2. Isolation of essential oils

Fresh aerial parts (500 g) were finely grinded and subjected to hydro distillation in a Clevenger apparatus for 1 h, according to the method recommended by the European Pharmacopoeia (Council of Europe (COE, 2005). Yields were averaged over four distillations and calculated according to dry weight of the plant material. Essential oils (EOs) were stored at −18 °C in airtight micro tubes prior to analysis by gas chromatography (GC) and chromatography–mass spectrometry (GC/MS).

2.2.1. Chemical characterization of the essential oils. GC Analysis

GC analyses were performed with a Shimadzu GC-R1A apparatus equipped with a flame ionization detector (FID) and a DB-5 fused-silica cap. Column (30 m × 0.25 mm i.d., film thickness 0.25 mm) is coated with a non polar 5% phenyl/95% dimethylpolysiloxane phase. The oven temp was programmed from 40 to 2308 at 28/min; injector and detector temp., 2408; carrier gas, N_2 (0.9 ml/min). The identification of the components was based on the comparison of their retention indices (RIs) with those of a homologous series of *n*-alkanes (C_9–C_{25}) and of pure authentic samples.