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Phytochemical screening, antioxidant and antibacterial activities of ethanol extracts of *Asparagus suaveolens* aerial parts

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ABSTRACT

This study was aimed at investigating the phytochemical constituents, antioxidant activities and antibacterial activities of *Asparagus suaveolens* (*A. suaveolens*) aerial parts. Antioxidant properties were assessed by 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, hydrogen peroxide scavenging assay and reducing power assay. Antibacterial activity of the extract was assessed by micro-dilution method and 2008 WHO *Neisseria gonorrhoea* (*N. gonorrhoea*) reference strains were used for this purpose. Qualitative phytochemical analysis showed the presence of alkaloids, saponins, flavonoids, glycosides, anthraquinones, terpenoids and steroids, reducing sugar, proteins and coumarins. An effective free radical scavenging activity of 71% was observed for chloroform fraction at 2.5 mg/mL. Butan-1-ol fraction had 79% inhibition of hydrogen peroxide and 55% reducing power at 2.0 mg/mL compared to all other fractions but less than the standards. The *n*-hexane fraction had moderate growth inhibition against F, O and P 2008 WHO *N. gonorrhoea* reference strains with MIC values of 1.3 mg/mL, 0.12 mg/mL and 1.63 mg/mL, respectively. The MBC values of the same fraction had moderate activities against the same strains. This promising anti-*N. gonorrhoea* properties of *A. suaveolens* aerial parts observed confirms its traditional use in the treatment of gonorrhoea infections by Bolahlakgomo Village commuters of the Limpopo Province, South Africa.

1. Introduction

The continuous widespread use of traditional medicine is attributable not only to cultural and poverty reasons but also to the inefficiency of many of the existing drugs to deal with the growing burden of disease (Tenover, 2006). Most of the current drugs are unable to eradicate, reduce and/or inhibit some illnesses that affect mankind. Illnesses such as HIV/AIDS, cancer, diabetes, tuberculosis and many other diseases are still without effective management and curative therapies. Mankind, in his attempts to find solutions to his healthcare problems, has resorted to using plant-derived therapies to remedy the shortage of reliable cures. Phytochemicals or secondary metabolites are chemical compounds formed during normal metabolic developments of plants for a variety of functions such as defence against parasites, pests and herbivory (Ning et al., 2009). Lack of effective cures and resistance developed by pathogens against current antibiotics, and oxidative stress caused by free radicals in human body system have triggered the search for new therapeutic alternatives from plants (Pervival, 1997; Aruoma, 1998; Michael et al., 2006; Berrino et al., 2009). Crude extracts from plants can be a solution to mankind's struggle and a remedy to the catastrophic situation that the world of pharmaceuticals is facing.

Asparagus is a plant species which belongs to the subfamily of Asparagae in the family of Liliaceae (Kole, 2011; Mashele and Fuku, 2011; Ntsoelinyane and Mashele, 2014). Recently, researchers estimated 120–400 members of the Asparagae family distributed into two genera: *Asparagus* and *Hemiphylacus* (Kole, 2011; Norup et al., 2015). *Asparagus* is divided into three subgenera including *Asparagus*, *Protoasparagus* and *Myrsiphyllum*, of which all originate from the Eastern Mediterranean region, Asia and Africa (especially in Southern Africa region, where more than half of them are native) (Kole, 2011). *Asparagus* can be found as herbaceous, perennial, tender woody shrubs or as vines; usually with thorny and spindle-shaped roots and they can grow from 20 cm to more than 5 m in length (Kole, 2011). *Asparagus* are mostly considered as medicinal plants (Fouche et al., 2008; Van Wyk et al., 2009; Kubota et al., 2012).

Leaves of *Asparagus suaveolens* are used as traditional medicine for treating epilepsy by Northern Sotho-speaking tribe in South Africa (Van Wyk et al., 2009). *A. suaveolens* has also been used as traditional medicine and classified among useful medicinal plant species by Ga-Sekgopo community members in Limpopo Province, South Africa (Rasethe et al., 2013) and the targeted illnesses are not specified. *A. suaveolens* is also known to treat diseases affecting livestock (Dold and Cocks, 2001; Van der Merwe et al., 2001; McGaw and Eloff, 2008). To our knowledge, *A. suaveolens*'

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aerial parts extract have not been qualitatively and quantitatively investigated for antioxidant, antibacterial activities and phytochemical screening. Therefore, in the present study, *A. suaveolens* aerial parts (leaf, stem and bark) were collected to study the antibacterial activities, antioxidant activities and to establish the phytochemical profile of the plant with the idea to discover resources for new lead compounds. According to a local traditional healer, Gololo, from Bolahlakgomo Village of Limpopo Province, South Africa; three parts of the plant (leaf, stem and bark) are always combined to treat patients with gonorrhoea infections. In order to maintain the combination and hopefully to obtain the same results as traditional healers, these three parts (leaf, stem and bark) were combined and assayed.

2. Materials and methods

2.1. Plant

The plant was botanically identified by the South African National Biodiversity Institute (SANBI) under the specimen number PREART 0001903 in the Pretoria herbarium, Gauteng Province, South Africa. The aerial parts of *A. sauveolens* were collected after the spring period on the 6th November, 2013 as advised by Liu (2011) at Bolahlakgomo Village situated at 24.451218° south latitude, 29.326738° east longitude and at 922 m above sea level in the Zebediela sub-region of Limpopo Province, South Africa (Fig. 1). After collection, plant material was cut into small pieces and dried at room temperature for a period of about two months. Thereafter, dried plant material was pounded using Retsch cutting mills SM 100 machine, resulting in a fine powder. The powder was kept in the dark until usage.

2.2. Extraction methods

Absolute ethanol (95%) was used to extract secondary metabolites from aerial parts of *A. suaveolens* (Tiwari et al., 2011; Pandey and Tripathi, 2014).

Briefly, 500 g of powdered aerial parts material was macerated at room temperature in 5000 mL of ethanol (ratio of 1:10) for 24 h on a shaker (Labotec 262, South Africa) at 150 rpm. The process was repeated three times using the same volume of fresh ethanol with the same plant material. The mixture was settled down before being filtered using Whatman No. 1 filter paper before solvent evaporation using a rotary evaporator under reduced pressure at 20 °C to 40 °C. The filtrates were transferred into pre-weighed beakers and then ventilated to dryness.

2.3. Fractionation of ethanol extract

The ethanol extract was dissolved into a mixture of methanol and water (9:1) and then fractionated further using separating funnel (liquid–liquid separation method). Solvents used for liquid–liquid fractionation were *n*-hexane, chloroform and butan-1-ol, following the procedure suggested by Liu (2011). Each solvent was used several times until convinced that 90% to 95% of soluble chemical components had been extracted. Thereafter, fractionation solvents were evaporated using reduced pressure to a minimal volume at 20 °C to 40 °C and then ventilated to dryness. The fractions were kept in the fridge in the dark until usage.

2.4. Microorganisms

The microorganisms used were a donation from the National Health Laboratories Services (NHLS) in Johannesburg, South Africa. The strains used were eight WHO *Neisseria gonorrhoea* strains comprising the 2008 WHO reference strains panel (Unemo et al., 2009). The 2008 WHO panel strains represent important susceptible and resistant phenotypes and the range of resistances currently seen for the antimicrobials recommended in different guidelines and/or used in the gonorrhoea treatment globally (Unemo et al., 2009).

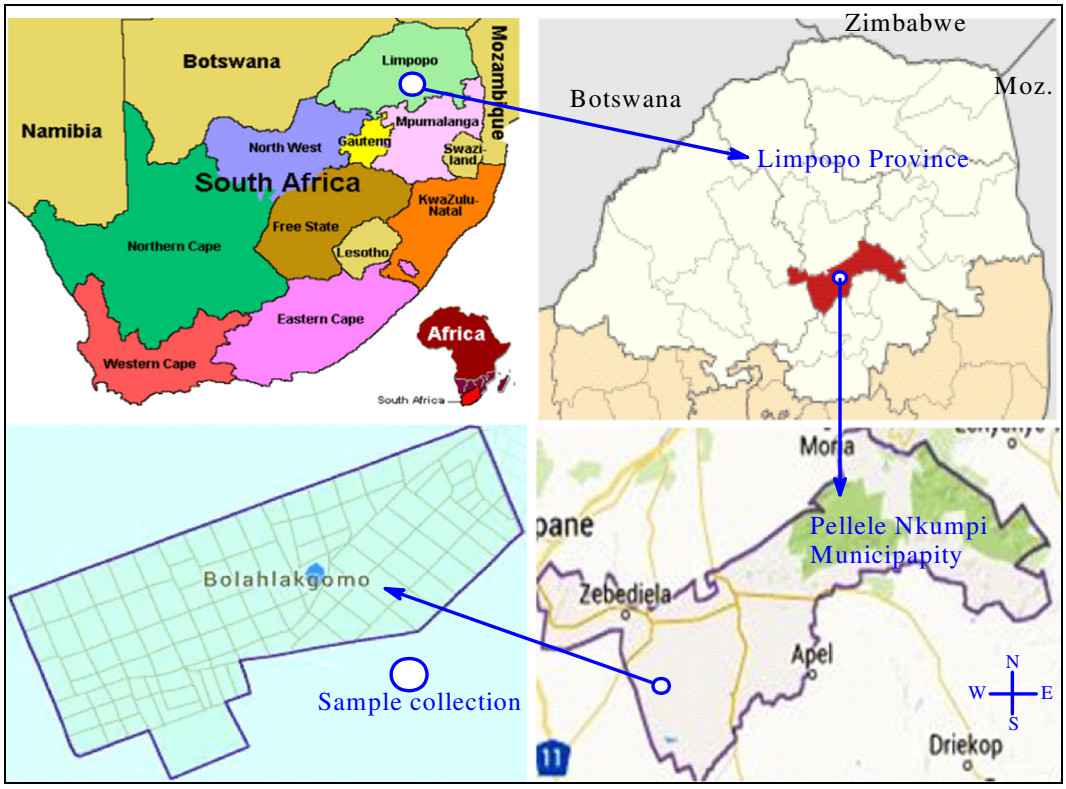

Fig. 1. Maps showing sample collection side, near Bolahlakgomo Village in Pellele Nkumpi Municipality, Limpopo Province, South Africa.