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Review

Anti-trypanosomal activity of African medicinal plants: A review update

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ABSTRACT

Ethnopharmacological relevance: African trypanosomiasis is one of the neglected tropical diseases caused by different species of trypanosomes that affect both human and livestock with devastating consequences in the continent. Most of the affected populations commonly use traditional medicinal plants for the treatment of the disease. Consequently, this prompted ethnopharmacological research activities on the anti-trypanosomal activity of a number of these African medicinal plants in order to validate their ethnomedicinal use. Furthermore, such studies could lead to the identification of chemical leads for the development of newer anti-trypanosomal agents from those plants. This review aims to provide updated information on the ethnopharmacological evidence of African medicinal plants with anti-trypanosomal activity.

Methods: Literature was collected via electronic search (PubMed, Sciencedirect, Medline and Google Scholar) from published articles that report on the *in vitro* or *in vivo* anti-trypanosomal activity of plants that were collected from different parts of Africa.

Results: African medicinal plants investigated for *in vitro* and *in vivo* anti-trypanosomal activity from January 1993 to October 2013 are systematically compiled and all the *in vivo* studies are critically discussed. A total of 264 plant species belonging to 79 families were investigated for anti-trypanosomal activity. However, only 48 bioactive anti-trypanosomal compounds were successfully isolated in pure forms. Furthermore, some of the plants were investigated for possible ameliorative effects on the trypanosome-induced pathological changes out of which 18 plants were reported to be effective while a few others were not. In spite of interesting preclinical ethnopharmacological evidence for anti-trypanosomal activity, not a single African medicinal plant was investigated in a clinical study.

Conclusion: Several African medicinal plants have demonstrated promising anti-trypanosomal effects but the studies on the anti-trypanosomal potentials of these plants are not taken beyond proof of concept stage. It is hoped that the article would stimulate future clinical studies because of the paucity of knowledge in this area.

Contents

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1. Introduction

Plants have been a source of medication to human and livestock diseases since ancient times (Odhiambo et al., 2011). This is a result of ancestral observations that plant parts possess healing abilities. With advancement in pharmaceutical and allied sciences, phytochemicals were later confirmed to be responsible for the therapeutic properties of plants. Currently, modern scientific techniques have led to the isolation and identification of thousands of these phytochemicals. Many of which had served as chemical leads for the development of chemotherapeutic drugs against several diseases (infectious and non-infectious) (Kasilo et al., 2010). Indeed, 75% of the anti-infectious disease drugs approved from 1981 to 2002, could be traced to natural origins (Newman et al., 2003) whereas 61% of all new chemical entities introduced worldwide as drugs during the same period could be traced to natural products (Gupta et al., 2005).

Apart from this impressive role of medicinal plants in drug discovery, the use of local preparations of these medicinal plants still provide the only option to large number of the African population for therapeutic purposes. This is mainly due to the lack of good health care systems in many parts of the continent which makes the population highly vulnerable to many infections (Elujoba et al., 2005). Indeed, 80% of the population in African countries depend almost entirely on herbal medicine for their primary health care needs (Kasilo et al., 2010).

An important infection that greatly affects humans and livestock in Africa is African trypanosomiasis also known as "sleeping sickness" in humans or "nagana" in animals (Atawodi, 2005; Welburn et al., 2009). It is one of the neglected parasitic diseases that affects human health and also largely accounts for the low livestock productivity of the African continent (Welburn et al., 2006). It is estimated that about 70 million people distributed over 1.55 million km^2 in Africa are at risk of the disease (Simarro et al., 2012). On the other hand, animal trypanosomiasis is distributed over approximately 25 million km^2 in Africa, where it reduces livestock productivity by up to 50%. The disease is caused by extracellular parasites called trypanosomes and the important species include *Trypanosoma brucei*, *Trypanosoma evansi*, *Tryponosoma congolense* and *Tryponosoma vivax* (Mbaya et al., 2009). At present, the chemotherapy of African trypanosomiasis remains far from satisfactory because the clinically available drugs have limitations such as toxicity, parasite resistance, high cost and poor availability as well as the need for parenteral administration of treatments (Welburn et al., 2009). Fortunately, the continent is endowed with tremendous medicinal plant resources that are traditionally utilized for the treatment of the disease.This is evident by the propensity of the ethnobotanical utilization of the medicinal plants for the management of the disease from different African sub-regions (Atawodi et al., 2002; Ntie-Kang et al., 2013). Interestingly, scientific investigations have confirmed the efficacy of many of these African medicinal plants as anti-trypanosomal agents under *in vitro* and/or *in vivo* conditions. Therefore, a critical review of these investigated (anti-trypanosomal) African medicinal plants is needed to provide a focus on the achievement so far recorded in the investigations of different African plants as well as to identify gaps in knowledge which might provide basis for strategies to address such gaps.

At present, the only available review on anti-trypanosomal medicinal plants from Africa is limited to the Nigerian flora (Mbaya and Ibrahim, 2011) and even within the Nigerian medicinal plants, majority of the investigated Nigerian plants were missing in that review. Other authors attempted to review all natural products with anti-trypanosomal activity reported between mid-1980s and 2003 and the data was not limited to Africa in addition to being too skewed on the chemistry aspect with little or no information on the plants (Hoet et al., 2004b).

In this article, available data on scientifically investigated African medicinal plants with anti-trypanosomal potentials was reviewed from January 1993 to October 2013. This could be used as an updated source of the progress or success achieved so far in the scientific investigations of anti-trypanosomal activity of different African medicinal plants. Furthermore, the article could also be relevant for other areas of biomedical interest such as identification of bioactive anti-trypanosomal compounds from African plants. In addition, this review may motivate researchers to undertake comparative *in vivo* studies using the bioactive extracts against the best anti-trypanosomal medicine *vis-à-vis* toxicity and efficacy profiles.

2. Methods

Relevant literature was collected by searching the major scientific databases including PubMed, Sciencedirect, Medline and Google scholar for medicinal plants of African origin that have been studied and investigated *vis-a-vis* their anti-trypanosomal therapeutic potentials. Some articles were found through tracking citations from other publications or by directly accessing the journals' web-site. They were considered on the basis of the geographical region of their origin. The literature considered is the one available covering the period, January 1993–October 2013. The keywords combinations for the search were: anti-trypanosomal, trypanocidal, medicinal plant and Africa. All the research articles obtained on the *in vitro* and *in vivo* antitrypanosomal activities are presented in this review. The plants were also categorized and presented based on their regional origins.