Research Article

Trace Metals and Antimicrobial Studies on Indian Medicinal Plant of *Nyctanthes arboritis*

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ABSTRACT

Medicinal plants were the strong source of therapeutic molecules to heal various diseases in the globe. The amount of heavy metals in the plants was examined to establish the likely menace of their effects to the animals and human beings who eat them as such or their derived products. In the present work, the trace metals level and antimicrobial activities were estimated in medicinal plant of Nyctanthes arbors. The cadmium concentration was more eminent in the test sample than other metals and is also crossing the stock points. In antimicrobial activity, the test sample was most effective against *Micrococcus luteus* NCIM 2871 while smaller effect was noticed from *Microsporum canis* MTCC 3270. All the microbial strains depict higher sensitivity to the higher concentration (40 µl) for the plant sample when compared to the positive control except *Shigella flexneri* MTCC 1457 and *Micrococcus luteus* NCIM 2871.

Keywords: *Nyctanthes arboritis*, heavy metal, antimicrobial activity, cadmium

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INTRODUCTION

The trace heavy metals like Fe, Cu, Zn, Cu, Mn and Ni are essential nutrients, but they become harmful to plants, animals and man, and it may toxic when their concentration exceeds the recommended measures. Health-making attributes of plants are due to their nutrient content (e.g. Vitamins, minerals, antioxidants) and the presence of bioactive components (e.g. Essential oils), however, due to a potential contamination with heavy metals their use may cause certain health problems. Heavy metal toxicity and the risk of their bioaccumulation in the food chain, particularly in plants, represent one of the major environmental and health problems of the contemporary order. Plants can be polluted by heavy metals via root uptake or by direct deposition of contaminants from the atmosphere onto plant surfaces. Farming is one of the anthropogenic origins of pollution. Namely, inorganic and organic plant foods are the most significant sources of heavy metals in agricultural soil, since they include pesticides, irrigation waters and sewage sludge. Considering the industrial origins of hard metals, they include mining, processing of plastics, textiles, microelectronics, wood conservation, report processing, etc [1].

The contamination of medicinal herbs by heavy metals can be ascribed to environmental pollution and can pose clinically relevant dangers for the wellness of the user and hence should be restricted. These trace metals in herbal plants play a vital function as structural and working elements of metal proteins and enzymes in a living cell [2]. The addition of herbs that may contaminate with trace and heavy metals to food as a habit may result in accrual of these metals in human organs. Subjecting to trace and heavy metals above the permissible limit affect the human health and may result in illness to the human fetus, abortion and preterm labor and mental retardation in babies. Adults too may have high blood pressure, fatigue and

kidney and brain troubles [3]. Thus, the control of heavy metals in medicinal plants and their wares should be such that the safety and efficacy of herbal products are ensured [4]. In this subject field, plant samples were collected for heavy metals and antimicrobial analysis and are really important parameters in medical and environmental fields. Simultaneously, the research is to measure and understand the impacts of the heavy metal on the plants and their antimicrobial efficacy.

MATERIALS AND METHODS

Trace metals estimation in plants

The Nyctanthes arbors plant leaves were gathered up from the Western Ghats of southern India. The plant leaves were carefully taken out and washed with sterile distilled water, one by one. The cleaned leaves were dried in shadow fields and were grinning with mortar and pestle. The powered plant samples were stored in a sterile plastic container. The 1 g of powdered plant samples was processed with the aqua - regia mixture in Teflon bomb and was incubated at 100 °C for 2-3 days. After incubation, the reaction mixture was filtered with Whatman No.1 filter paper. And so the extraction was tested for trace metals (Fe, Cu, Zn, Pd, Cd, Cr and Ni) analysis. The descent of the studied metals in the solutions was fixed by the 797 VA Computrace voltametry, Metrohm. To avoid the pollution, the devices were rinsed with acidified water (10% HNO3) and weighted to dissolve metals before analysis. All the equipments and containers were soaked in 10% NHO3 for 24 h then rinsed thoroughly in de-ionized water before exercise. The below detectable limit of the instruments were also examined.

Tone control and data analyses

Caution was required to avoid metal contamination in the process of sampling, extracting and analysis. Before analysis, the devices were rinsed with acidified water (10% HNO_3) and weighted to dissolve metals. Likewise, all equipments and containers were soaked in 10% NHO3 for 24 h then rinsed thoroughly in de-ionized water before exercise. Moreover, character control was ensured by performing duplicate analyses on all samples and by using reagent blanks and standards. Also the values of the studying metals below the detection limits of the 797 VA Computrace voltametry, Metrohm were refused.

Testing of antimicrobial activity

The test strains were: *Enterococcus faecalis* MTCC 439 (B1), *Shigella flexneri* MTCC 1457 (B2), *Micrococcus luteus* NCIM 2871 (B3), *Candida glabrata* MTCC 3984 (F1) and *Microsporum canis* MTCC 3270 (F2). The cultures were obtained from MTCC, Chandigarh and NCIM, Pune, India. Microbial strains were tested for antimicrobial sensitivity using the disc diffusion method [5,6,7,8]. The antibacterial and fungicidal activity of plant sample was analyzed against certain microorganisms on muller Hinton agar (MHA) and potato dextrose agar (PDA), respectively [9,10]. A sterile cotton swab was used to inoculate the bacterial suspension on the airfoil of the agar plate. The 20 and 40 µL of test sample (leaf - ethanol extract) coated disc were placed on agar plates, one by one. For the negative control study, the sterile triple distilled water was applied. The plates were incubated at 37±1 °C for 24-48 h (for bacteria) and 25 ±1°C for 48-72 h (for fungus). After incubation, the zone of inhibition was measured with ruler / HiAntibiotic ZoneScale-C [11]. The assays were performed in triplicate and the average values are presented. Methicillin – 10mcg (for bacteria) and Itraconazole – 10mcg (for fungus) was applied as positive control. All the media, standard discs and sterile disc were purchased from Hi-Media (Mumbai, India).

RESULT AND DISCUSSION

Antibacterial and Antifungal screening

The potential for developing antimicrobials from higher plants appears rewarding, as it will contribute to the growth of a Phyto-medicine to act against germs. Many plants have been applied because of their antimicrobial traits, which are due to compounds synthesized in the secondary metabolism of the flora. The antimicrobial activity of *Nyctanthes arboritis* was examined with various microorganisms using the disc diffusion test. The consequences of the antimicrobial activities are summarized in (**Figure 1**). The two tested concentrations such as 20 and 40 µl /disc produce a zone of inhibition on MHA

and PDA plates for bacteria and fungi, respectively. In the present survey, higher (40 µl/disc) concentration of the sample got greater sensitivity than (20 µl/disc) lower concentration in most of the microorganisms. In bacteria, the test sample was most effective against *Micrococcus luteus* NCIM 2871 (B3) while the smaller effect was noticed from *Enterococcus faecalis* MTCC 439 (B1). In fungi, which was effective against *Candida glabrata* MTCC 3984 (F1) than *Microsporum canis* MTCC 3270 (F2). All the microbial strains depict higher sensitivity to the higher concentration (40 µl) for the test sample when compared to the positive control except B2 and B3. In that location is no antimicrobial activity in solution devoid of sample used as a vehicle control (sterile triple distilled water), reflecting that antimicrobial activity was directly touched to the sample.

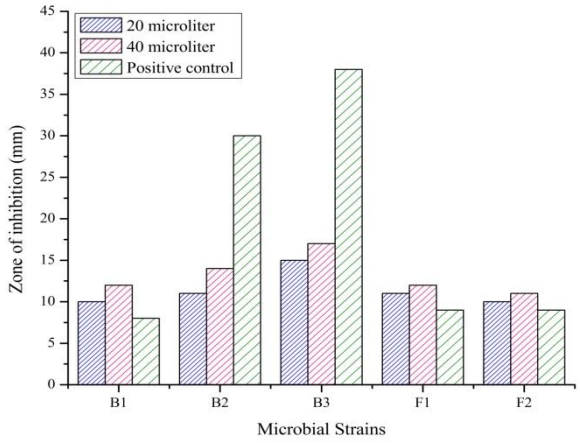

Figure 1: Zone of inhibition graph against microbial strains for *Nyctanthes arboritis* plant sample

Trace metals detection in plants species

The role of medicinal plants grown in the polluted site may be one of the dangerous potential entry pathways in man and other creatures. Specially, the role of trace metal pollutants causing injury to plants either by direct toxic effect or modifying the host physiology rendering it more susceptible to infection [12] which leads to affects the photosynthesis process, development and their efficiency [13]. The content of Cu over 15 milligram/kg indicates high concentration of this ingredient. If the absorption of copper in plants is greater than 20 mg/kg, it is considered toxic. The Cu concentration, as an environmental component, should be viewed from two views. The foremost facet is the need of plants and animals for this component, and the moment is the toxicity at high concentrations. Metal contents of plant samples, Cd, Cu, Fe, Pb and Zn concentrations are between BDL – 0.81, BDL – 0.20, BDL – 0.06, BDL – 0.66 and BDL – 0.40 mg kg^{-1}, respectively. Contaminated sites often support some plant species, which are capable to accumulate or tolerate high concentrations of metals such as Pb and Zn [14]. The high heavy metal content in plant species, where concentrations are more eminent than the toxic stories, can be linked to the anthropogenic factors (mine flotation and heavy traffic, respectively). These plants are known as hyper accumulators [15] and a low number of species are capable of growing on soils containing high levels of metals which may as well cause severe threats to plants. The consumption of these heavy metals by plants is an avenue of their introduction into the human food chain with harmful effects on health [16].

CONCLUSION

The assiduity of the some trace metals in Nyctanthes arbors plant exceeded the allowable levels. The contaminated Agricultural/ industrial/ sewage soil, soil water and dust are expected to be major

significant sources for their sorption in the works. They can pile up in the plant through the leaf and root scheme. Although it was affected by trace metals contamination, it showed good activity against certain microorganisms.

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