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A REVIEW ON PHARMACOLOGICAL ACTIVITY OF *BORRERIA ARTICULARIS*

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ABSTRACT

A detailed study on the plant *Borreria articularis* has been done and explained in this review. This review includes plant profile, traditional uses, various activities of the plant extracts like Petroleum ether, chloroform, ethyl acetate, ethyl alcohol obtained from aerial parts of *Borreria articularis*. Various pharmacological activities like antioxidant, hepatoprotective, antibacterial, antifungal have been performed on this plant and these have been reviewed in detail in this article. So this will be certainly helpful and well accepted by those who want to know a detailed study of this plant.

Keywords: Antioxidant, Antifungal, Antibacterial, Chloroform

1. INTRODUCTION

Plants are still extensively used in ancient medicine across the world. In modern China, Traditional medicine-based herbsare used significantly as a tool of health care. Due to the resistance developed by various microorganisms to many antibiotics, createda major clinical problem in the treatment of many infectious diseases **[1]**. So, the scientists are forced to searchfor new antimicrobial substances from different sources. Secondary metabolites are the most important group of compounds having wide ranges of antibacterial, antioxidant, hepatoprotective, and antifungal activity **[2-4]**. So, there is a regular need for these types of new agents without any side effects. Currently, the natural products are accepted as important sources of biologically active (antimicrobial) substances and the major sources of which are still unknown. India is well-known for a plethora of medicinal

plants **[5]**. *Borreria articularis* Linn. (Rubiaceae) is a known medicinal plant which is used widely as traditional medicine. *Borreria articularis* is an annual, procumbent herb with opposite leaves, small flowers and dehiscent fruits of two coriaceous mericarps. The chemical constituents which are present in the plant are alkaloids, glycosides, sterols, D-mannitol, ursolic acid, triterpenoid constituents along with steroids, flavonoids and tannins **[6]**. These have been identified as beta-amyrin and 3-acetoxy-oleana-12-en-29-oic acid **[7]**. The leaf extract is used against haemorrhoids, gall stones, jaundice, and conjunctivitis, roots are used to mouthwash to relieve toothache, the decoction of the herb used to relieve headache, while seeds are used as demulcent in diarrhoea and dysentery **[8-9]**.

2. PLANT PROFILE

Botanical Name: *Borreria articularis* L f.

Synonyms: *Borreria articularis* (L.f.) F.N. Will., *Borreria hispida* (L.) K. Schum

Common Name: Ganthiyu, Madaughanti, Gondi, Kharsat Shankhlo, Jointed Button weed, False Button weed, Madhuri-Jadi

Plant Family: *Rubiaceae*

Plant Form: *Herb*

Figure 1: Whole plant of *Borreria articularis*

About *Borreria articularis* Plant:

Whole plant of *Borreria articularis* is shown in **(Figure 1)**.

Habit: A herb that trail along the ground surface in which the branches bearing the inflorescence are erect, the younger parts are hispidly hairy.

Leaves: Leaves are Oblong or elliptic, pubescent, scabrid, acutemargins are ciliate and scabrid, stipules are membranous with a few long bristles.

Flowers: Occasionally white, more often pink, with several concentric circles inside the stipular cup and therefore axillary, sub-sessile with small corolla.

Fruit: Capsule, oblong, apiculate.

Seeds: Seeds are half-ellipsoid, rounded at both ends, sometimes at one end rounded the other with truncate, the inner side is flat, the middle part is deep groove and the surface is finely granulate.

Flowering and Fruiting Time: August - January

Significance: The seeds are used as a substitute for coffee.

3. MATERIAL AND METHODS

Collection and extraction of plant material

Collection and extraction of plant material i,e. aerial or whole parts of *Borreria articularis* can be collected in fresh condition. The collected and cleaned samples should cut into very small pieces of 1-2cm, air dried to make it suitable for grinding.

Extraction and Isolation

The samples can be grounded to fine powder mechanically generally, the dried powder (20g)should be taken and soaked it for 72 h in petroleum ether, chloroform, ethyl alcohol and ethyl acetate separately. The extracts thus obtained should be separately filtered and the filtrates are centrifuged at 2,000 rpm for 20 min. and concentrated until a gummy material is obtained (under reduced pressure at 50°C) by rotary vacuum evaporator then collected in a small vial and well dried as usual. Thus, the crude extracts can be obtained.

Or

The Air-dried defatted powdered materials of whole plants (1.5 kg) of *B. articularis* can be extracted with chloroform in a Soxhlet apparatus for 60 hrs. The concentrated extract should be then subjected to column chromatography on silica gel (60-120 mesh, 200 g).

Purification of crude extract

Solvent-solvent partitioning of concentrated crude ethanol extract can be done using the protocols. All the fractions should be collected separately, dried as usual and of these, only which extract is suitable for pharmacological screening should be selected and that extract fraction is subjected to fractionation by column chromatography using silica gel (200-300 mesh) as the adsorbent. From it, some numbers of fractions can be collected separately using mixtures containing different proportions of ethyl acetate and methanol with increasing polarity as the eluants. Thefractions thus obtained should be examined using the Thin Layer Chromatography (TLC) technique and the fluorescent compound can be detected by using ultraviolet light (254 and 366 nm). The Rf -values for each should be calculated as usual. The Fractions of same Rf -value should bemixed with each other and grouped into some numbers offractions. From These fractions, the pure fractions can be obtained by using GC-MS analysis and it can be used for further desired pharmacological screening. Some of the journals have published pharmacological activities and followed the methods which are explained below for further references.

Determination of antibacterial activity

Test organisms

The pure compound thus obtained from *Borreria articularis* should be tested for its antibacterial activity against thesebacteria like *Shigella dysenteriae, S. sonnei, Salmonella typhi, S. Para typhi, Bacillus subtilis, B. cereus, B. megaterium, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli and Vibrio cholerae*, and human pathogenic fungi, viz., *Aspergillus niger, A. ochraceus, A.ustus* and *Candida albicans*.

Determination of antimicrobial and antifungal activity

Both in vitro antibacterial and antifungal activities can be determined by two methods

1) Disc diffusion method **[10]** and

2) Poisoned food technique **[11]** respectively.

Mueller-Hinton (agar and broth) medium is generally used for culture of bacteria and Sabouraud (agar and broth) medium is used for culture of fungi. Ethanolic solution (5%) of pure and crude extracts can be taken as the test material. All the results found from test material should be compared with the standard antibacterial antibiotic. The parameters like Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC) and Minimum Fungicidal Concentration (MFC) values should be calculated by using the Macro dilution broth technique **[12]**.

Antioxidant activity Determination

Chemicals

The antioxidant activity should be determined by using these chemicals generally. Those are DPPH, DMSO, quercetin, tripyridyl triazine (TPTZ) and Folin-Ciocalteau (F-C).

DPPH Assay

20 µL of extractsshould be diluted accurately in DMSO and mixed well with DPPH in methanol (180:40 µg/mL) of a 96-well plate. The plate should be kept in the dark for 15 min, and at 540nm, the absorbance of the solution should be measured.After that an accurate blank (DMSO) and standard (quercetin solutions in DMSO) should run simultaneously. At first the extracts should be tested at one concentrationof 4 mg/mL, after that the extract showing good antioxidant activity canbe tested to so many concentrations to find the EC50 value i.e. (the reduced absorbance concentration of DPPH should be by 50%) **[13-16]**.

FRAP Assay

20 µL of extract should be diluted appropriately in DMSO and mixed with FRAP reagent (180 µL) in 96 numbers of well plate, after 6 minutes at 595nm, the absorbance should be measured. The freshly prepared FRAP reagent should be mixed with 300 mM acetate buffer (pH 3.6), 10 mM TPTZ in 40 mM HCl, and 20 mM $FeCl_3$.6H20 with a volume ratio of (10:1:1). Appropriate blanks and FRAP reagent lacking TPTZ (to correct for colour of the extracts) should run together with quercetin in DMSO and FeSO4 as a standard. FRAP activity and the concentration of extract/quercetin should bemeasured as Ferrous Equivalents (FE)and the absorbance value should be equal to that of 1 mM FeSO4.At first the extracts should be tested at a single concentration (4 mg/ML) and after that good antioxidant activity showing extracts

should be tested over a range of concentrations to produce the FE.

TPC Assay

By reacting with F-C reagent,the total phenolics contentcan be determined. 10 µL of extract should be taken and diluted appropriately in DMSO.Then it should be mixed with freshly diluted (1/10 with distilled water)100 µL F-C reagent. After five minutes, the solution which is prepared can be mixed with 100 µL 7.5% Na_2CO_3 solution, and kept for 60 min. Then the absorbance should becalculated at 650 nm. Then an accurate blank (DMSO) and standard (quercetin in DMSO) solution should run simultaneously, after that the Total Phenolics Content should be calculated as equivalent (µg) quercetin per mg extract.

Data Analysis

Correlation and regression analysis of the data must be performed.

Hepatoprotective Studies

The total animals should be divided into 5 groups of six animals each and subjected to the following treatments. Group-I should be treated as the control and given 2% gum acacia (1ml/kg p.o) on daily basis upto 7 days. GroupII will be treated as the toxic and given 25% CCl_4 in olive oil (1ml/kg. p.o) on daily basis upto 7 days. Group-III will be treated as the standard and given (100 mg/kg. p.o) on daily basis up to 7 days. Group-IV and V should be treated withBAME extract at 250 and 500mg /kg. p.o respectively for 7 days. All the administrations should be done by oral route only. After completion of 6 days of experiment i, e. On the 7th day, theGroups II-V should be administered 25% CCl_4 in olive oil at a dose of (1ml/kg.p.o.) after serving 30 Silymarin.Blood samples should be collected from the animals after 36 hours of administration of CCl_4 through the common carotid artery **[17]**.

Biochemical estimation

At first the animals should be anaesthetized by administering thiopentone sodium (60 mg/kg.p.o.) and they are scarified on the 7th day after 36 hours of administration of CCl_4 and blood should be collected through the common carotid artery with utmost care while opening the neck region of the rat. Serum will be separated from the coagulated blood samples by centrifuge (3000rpm for 15 min) at room temperature and then it should be used for the analysis of biochemical hepatic markers. The Total Bilirubin (TB), Alanine Amino Transferase (ALT), Aspartate Aminotransferase (AST), Alkaline Phosphatase (ALP), Total Protein (TP) and Albumin (ALB) should be estimated by their specific methods.

Histopathological examination

From each group of animals, very smallportion of liver tissueshould be carefully dissected out and washed with 0.9% normal saline solution and should be

preserved in a Formaldehyde solution of 10% for this study. A small Sections of (4-5mm thick) can be prepared and stained with haemotoxylin and Eosin dye for photo microscopic observation. The above microscopic slides should be photographed at a magnification of x100. The toxic group will show the excessive formation of connective tissue with nodules and scarred tissue, cell necrosis, fatty changes, degeneration of hyaline and balloons, infiltration of Kupffer cells and lymphocytes. The most effective pre-treated group *Borreria articularis*500 and Silymarin group should have the most effective hepatic cytoprotective action with near-normal histology.

Reduction in CCl_4-Induced Prolongation of Pentobarbitone Induced Sleeping Time

This method is used to analyse the anti-CCl_4 toxicity of drugs in animals. The hepatotoxic chemicals like CCl_4decreases the level of enzymes which metabolizes the drug in the liver. Therefore, Pentobarbitone metabolism should be reduced which results in anincrease of pentobarbitone induced sleeping time. If theCCl_4-induced prolongation of sleeping time is reduced by a drug then the drug should be considered as hepatoprotective against CCl_4toxicity. The Pentobarbitone induced sleeping time will bemeasured in Swiss albino mice (50%v/v) CCl_4 in olive oil at a dose of 50µl/kg/p.oand it should be used as the toxic substance for induced liver damage. The animals of all groupsshould be given Pentobarbitone (60mg/kg.p.o.) for 2h and after that CCL_4 (50%v/v in olive oil) is administered. The difference in time between loss of righting reflex and its recovery will be recorded.

Data analysis

The data should be expressed as Mean (± SEM) anddetermined by one-way analysis of variance (ANOVA) and applied to Dennett's test. The $p<0.05$ should be considered as significant.

4. RESULTS AND DISCUSSION

A detailed review of plant *Borreria articularis* has been done and it is observed that the plant usually gives above pharmacological activities but there is a further scope of other activities also which can be performed with regarding its traditional uses.

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DATA AVAILABILITY

Not Declared.

CONFLICT OF INTEREST

The authors affirm that they have no conflict of interest. The article does not include any studies with animals or human participants performed by any of the authors.

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