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Pharmacological aspect of *Croton bonplandianus* Baill: A comprehensive review

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Abstract

The use of phytomedicine or traditional medicine is the oldest medical practice known to man. Various plant resources are used to cure different diseases and also for a long and healthy life. The traditional knowledge of plant based medicine has transferred from generations to generations. This traditional knowledge accumulated as ethnopharmacological knowledge among different ethnic groups in India and worldwide. Still today, in various other countries of South-Eastern Asia, South America, and in Arabian countries, a great number of people depend primarily on phytomedicines to cure different diseases. *Croton bonplandianus* is one such plant which is famed for its therapeutic efficiency in different diseases globally in the complementary and alternative medicinal systems. Therefore, this review comprehensively covers the medicinal and pharmacological activities of different parts of the plant *C. bonplandianus*.

Keywords: *Croton bonplandianus*, medicinal plant, wound healing activity, phytochemicals

Introduction

The traditional medicine all over the world is now days evaluated by an extensive activity of research on different plant species consumed by the local or tribal populations of different parts of the world and their therapeutic principles. Based on indigenous theory, Herbal medicines are belief and experiences that are handed down from generation to generation [1]. Practices of traditional medicine have been developed accordance with the life style and cultural practices of the society. Hands on practical training with traditional knowledge of herbal medicines have enriched throughout the globe. Herbal medicine have evolved as a complementary and alternative medicines to treat various kind of diseases caused by different kinds of stresses, anxious, industrial hazards, pathogenic bacteria etc. In spite of modern synthetic drugs and antibiotics, herbal drugs still have their place in modern medicinal field and day to day therapy. There are many properties like effectiveness, ease in access, low cost and comparative freedom from serious side effects, makes herbal medicine not only popular but also an acceptable mode of treating diseases even in modern times.

The knowledge for long life, Ayurveda is originated in India in the Vedic period [2]. Susrata Sanhita and Charaka Sanhita the core of the Ayurvedic medicinal system, mentioned therapeutic uses of different medicinal plants. One of such plant mentioned in Ayurveda is *Croton bonplandianus* Baill. The review is therefore, based on the medicinal and therapeutic properties of *C. bonplandianus*.

Methods

University of North Bengal web portal and google search was performed using the key words '*Croton bonplandianus* and Herbal Medicine', '*Croton bonplandianus* and Antioxidant', '*Croton bonplandianus* and Ethnomedicine' etc. In addition, references and bibliographies of numerous published articles are searched for the key words of *Croton bonplandianus*.

Croton bonplandianus

Croton bonplandianus Baill. (Euphorbeaceae) commonly known as 'ban tulsi' is a perennial herb grows mainly as a bush, profoundly grows around the canal, river bank, wastelands and road side area. The plant is native to the southern Bolivia, Paraguay, South Western Brazil and Northern America but also found in the Sub-Himalayan region of West Bengal, India [3].

Botanical Description

C. bonplandianus was collected from the garden and road side areas of the campus of University of North Bengal (NBU) and identified by the taxonomist Prof. A. P. Das, of the Department of Botany, NBU. The voucher specimen was stored at the NBU herbarium of

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Department of Botany with an accession number 09870. The plant *C. bonplandianus* (synonym *Croton bonplandianum*, *Croton sporsiflorus* Morong) commonly known as Ban-tulsi, Kala bhanghra or Paitiya (Marma). *C. bonplandianus* is a much branched, woody herb, 22-50 cm tall, branches stellate hairy to glabrous. Flowers of this plant are tiny, peach color, tiny globe shaped, flower buds arranged in up right spikes with green fruits [3].

Ethnopharmacology and traditional use of *C. bonplandianus*

C. bonplandianus has many medicinal usages including the repellent property against the insect [4]. It has also anti-bacterial [5], anti-fungal [6], anti-oxidant [7], analgesic [8], nematicide [9], anti-coronary [10, 11, 12], hepatoprotective [13] and wound healing activities [14, 15]. In the remote areas of West Bengal, local people use its root as a medicine against snake venom and the leaf extract used as a medicine for high fever [16]. *C. bonplandianus* have been used to cure liver diseases against ring worm and skin diseases. Leaves of this plant have got high medicinal value and are used for controlling blood pressure, cuts and wounds. The seeds of *C. bonplandianus* are used for the treatment of jaundice, acute constipation, abdominal dropsy and internal abscesses. The fresh juice of this plant is used by tribal populations to cure head acne [7]. The plant is also used by some migratory workers for the treatment of skin disorders. Less commonly, the juice of this plant is used against helminthiasis and toothache [17].

Bio-molecules of *C. bonplandianus*

There are several bio-molecules or bio-active compounds present in *C. bonplandianus*, responsible for preventing many diseases. Phyto-chemically the plant has been reported to contain rutin, crotosporinine, crotosparine and its methyl derivatives aphorbol play a key role in wound healing activity [7]. *C. bonplandianus* is a good source of steroids, unsaturated steroids, phenolics, alkaloids, flavon, flavonols, carotinoids, leuco-anthocyanine and flavonoids [18]. The plant also contains two groups of compounds, terpinoids and glycosides. *C. bonplandianus* is rich in bio-polymers such as cellulose, hemi-cellulose and lignin. Oil and ethanol can be obtained from this plant. 3- α hydroxyl-urs 12, 15-dien of ursane skeleton, oleanolic acid, ursolic acid and β -sitosterol are the isolated compounds from the root of *C. bonplandianus* [16], and 3-methoxy 4, 6-hydroxymorphinandien-7-one, norsinoacutin are the alkaloids isolated from the extract of *C. bonplandianus*.

Bioactivity of *C. bonplandianus*

Antimicrobial and genotoxic activity

A wide range of diseases are caused by bacteria such as cholera, tetanus, diphtheria, tuberculosis, typhoid fever, etc. Numerous antibiotics derived from plant extract have displayed potent antimicrobial activity against a vast spectrum of pathogenic bacteria. *C. bonplandianus* has genotoxic and anti-microbial activities. The aqueous extract of leaf produced 24.17% aberration in the root tip cells allium at the stage of anaphase and telophase. On the other hand methanolic and acetone extract produced 22.08% and 21.55% aberration. Methanolic extract of leaf and fruit of *C. bonplandianus* are more effective against microorganisms like *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* [8]. Leaf extract of *Croton bonplandianus* made in chloroform and benzene were

most effective against *Bacillus subtilis*, *B. megaterium*, *Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* [8].

Anti-fungal activity

A vast array of diseases such as athlete's foot, pneumocystis pneumonia, candidiasis, chronic pulmonary aspergillosis, etc. occurs due to the fungal infections. Under complementary and alternative medicinal approaches various plants are tested for their antifungal efficiency. *C. bonplandianus* has antifungal activity against two ringworm fungi like *Microsporum gypseum* and *Trichophyton mentagrophytes* [6]. Jeeshna *et al.* 2011 proposed that the methanolic extract of leaf of *C. bonplandianus* was very active against the fungus *Rhizopus* sp. and *Fusarium lycopersici*. *C. bonplandianus* aqueous extract inhibis the growth of *Aspergillus niger* approximately MIC 100 mg/ml according to Singh *et al.* 2011. Divya *et al.* 2011 suggested that the latex of *C. bonplandianus* (1.5 v/v in 50 % acetone) showed anti-fungal activity against *Microsporum gypseum* and *Trichophyton mentagrophytes*.

Anti-tumor activity

Anti-tumor activity of *C. bonplandianus* was established by potato disc and radish disc bioassay, which showed that the root length and percent of seed germination was decreased [18]. They have shown that the methanolic extract of *C. bonplandianus* was evaluated for antitumor activity with phytotoxic analysis. During the study of antitumor activity test, it was observed that tumor was formed when *Agrobacterium* strains were alive on living potato disc.

Cytotoxic and pro-apoptotic activity

Acetone extract of *C. bonplandianus* was used for the study of cytotoxic and pro-apoptotic study using MTT assay, acridine orange/ ethidium bromide (AO/EB) staining and cell cycle analyses [19]. They proposed that the number of cells in G₂/M phase increases with concurrent accumulation of cells in sub G₀/G₁ phase and this indicates the induction of apoptosis at G₂M phase. They also suggested that A549 cells were more sensitive to acetone extract of *C. bonplandianus* with an IC₅₀ of 15.68 \pm 0.006 μ g/ml compared to the standard drug cisplatin (2.20 \pm 0.008 μ g/ml).

Antioxidant activity

'Oxidative stress' is the effect of free radicals, reactive oxygen species (ROS) and reactive nitrogen species (RNS), causing potential biological damage. It is nothing but the imbalance between oxidants and antioxidants in favor of the oxidants which are formed as a normal product of aerobic metabolism. Reactive oxygen species (ROS) are the causative agents behind a wide range of disorders. Several plant based products possess tremendous ROS scavenging capacity. Antioxidant activity of *C. bonplandianus* was evaluated by Sridhar *et al.* 2013 [20]. They proposed that the plant extract has DPPH scavenging activity with IC 50 value 416.82 μ g/ml when compared to standard BHT.

Larvicidal activity

The level of larvicidal activity of methanolic extract of *C. bonplandianus* at different concentration has been investigated. It is observed that IC 50 value obtained at 124 ppm is effective against the mosquito *Aedes aegypti* [4]. They proposed that the leaf extract of *C. bonplandianus* at 124 ppm is better for mosquito control.

Wound healing activity

S divya *et al.* 2011 proposed that *C. bonplandianus* contain Rutin (C₁₈H₃₆O₁₉) together with crotosparine and its methyl derivatives aphorbol play a key role in wound healing activity [7]. The studies carried out S divya *et al.* showed that both aqueous and alcoholic extract of *C. bonplandianus* have wound healing activities. In case of aqueous extract, the percent of wound concentration was observed 29.2 % in 14 days, 63.1% in 21 days and 89.2 % in 28 days respectively. On the other hand in case of alcoholic extract, the percent of wound concentration was observed 36.6 % in 14 days, 66.2 % in 21 days and 91.6 % in 28 days. Finally Divya *et al.* suggested that on the basis of their study alcoholic extract of *C. bonplandianus* is more effective in wound healing than the aqueous extract.

Phytochemical Analysis

Dutta *et al.* performed the phytochemical analysis of leaf of *C. bonplandianus* [3] and identified the presence of a wide range of phytochemicals such as phenolics, glycosides, alkaloids, tannin, flavonoid, etc. Quantification of these phytochemicals revealed the presence of 59.60 ± 4.79 g/100 g alkaloid, 75.29 ± 3.19 mg/g phenolics and 4.36 ± 0.48 mg/g flavonoid in the leaves.

Conclusion

Phytomedicine is the oldest therapeutic known to mankind. *Croton bonplandianus* is one such plant which is used extensively in ethnomedicinal practices all over the world for the treatment of various diseases. The traditional and ethnomedicinal literatures proved that the plant is very effective and safe for medicinal uses against different types of diseases. A potent and safe drug can be investigated from the plant by using the reverse pharmacological approaches in natural drug discovery.

References

1. World Health Organization. Development of national policy on traditional medicine: a report of the workshop on development of national policy on traditional medicine. Beijing, China, 2000.
2. AYUSH. Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy, Ministry of Health and Family Welfare, Govt of India. Available from: <http://www.indianmedicine.nic.in/ayurveda.asp>, 2013.
3. Dutta S, Dey P, Chaudhuri TK. Quantification and correlation of the bioactive phytochemicals of *croton bonplandianum* leaves of sub-Himalayan region of west Bengal. Asian journal of pharmaceuticals and clinical research. 2013; 6(3).
4. Jeeshna MV, Mallikadevi T, Paulsamy S. Screening of the weed plant species, *Croton bonplandianum* Baill. for larvicidal activity of *Aedes aegypti*. Journal of Bio pesticides. 2010; 3(1):192-194.
5. Vadlapudi V. In vitro antimicrobial activity of methanolic extract of selected Indian medicinal plants. Pharmacophore. 2010; 1(3):214-219.
6. Asthana A, Mall HV, Dixit K, Gupta S. Fungitoxic properties of latex of plants with special reference to that of *Croton bonplandianum* Baill. Pharmaceutical Biology. 1989; 27(1):25-28.
7. Divya S, Naveen Krishna K, Ramachandran S, Dhanaraju MD. Wound healing and In vitro antioxidant activities of

- Croton bonplandianum* leaf extract in rats. Global Journal of Pharmacology. 2011; 5(3):159-163.
8. Saggoo MIS, Walia S, Kaur R. Evaluation of genotoxic and antimicrobial potential of *Croton bonplandianum* Baill. Archives of Applied Science Research. 2010; 2(2):211-216.
9. Maria CMT, Joao CA, Gilvandete MPS, Manoel AN, Edilberto RS, Leticia VCL, Daniel *et al.* Larvicidal and nematocidal activities of the leaf essential oil of *Croton regelianus*. Chemistry & Biodiversity. 2008; 5(12):2724-2728.
10. Bhakat RK, Sen UK. Ethno medicinal plant conservation through sacred groves. Tribes and Tribals. 2008; 2:55-58.
11. Chaudhuri AB. Endangered medicinal plants. Daya publishing House, Delhi. 2007; 226.
12. Nishanta R, Harris CS, Towers GHN. Antimicrobial activity of plants collected from serpentine outcrops in Sri Lanka. Pharmaceutical Biology. 2002; 40(3):235-244.
13. Das AJ, Dutta BK, Sharma GD. Medicinal plants used by different tribes of Cachar district, Assam. Indian Journal of Traditional Knowledge. 2008; 7(3):446-454.
14. Chandel KPS, Shukla G, Sharma N. Biodiversity in medicinal and aromatic plants in India. National Bureau of Plant Genetic Resources, New Delhi, 1996.
15. Reddy KR. Folk medicines from Chittor District Andhra Pradesh, used in treatment of jaundice. Pharmaceutical Biology. 1995; 26:137-140.
16. Ghosh P, Mandal A, Rasul MG. A new bioactive ursane-type triterpenoid from *Croton bonplandianum* Baill. Journal of Chemical Sciences. 2013; 125(2):359-364.
17. Singh B, Dutt N, Kumar D, Singh S, Mahajan R. Taxonomy, ethnobotany and antimicrobial activity of *Croton bonplandianum*, *Euphorbia hirta* and *Phyllanthus fraternus*. Journal of Advances in Developmental Research. 2011; 2(1):21-9.
18. Islam MS, Rahman MM, Rahman MA, Qayum MA, Alam MF. In vitro evaluation of *Croton bonplandianum* Baill. As potential antitumor properties using *Agrobacterium tumefaciens*. Journal of agriculture technology. 2011; 7(3):711-719.
19. Bhavana J, Kalaivani MK, Sumathy A. Cytotoxic and pro-apoptotic activities of leaf extract of *Croton bonplandianus* Baill. against lung cancer cell line A549. Indian journal of experimental biology. 2016; 54:379-385.
20. Sridhar N, Surya kiran BVVS, Sasidhar D, Kantha LK. Comparative Anti-Inflammatory and Anti-Oxidant Evaluation of *Jatropha gossypifolia* and *Croton bonplandianum*. International Journal of Research in Pharmacy and Science. 2013; 4(1):16-27.