

CHAPTER 2

Qualitative phytochemical analysis of leaves of *Croton bonplandianus* Baill.

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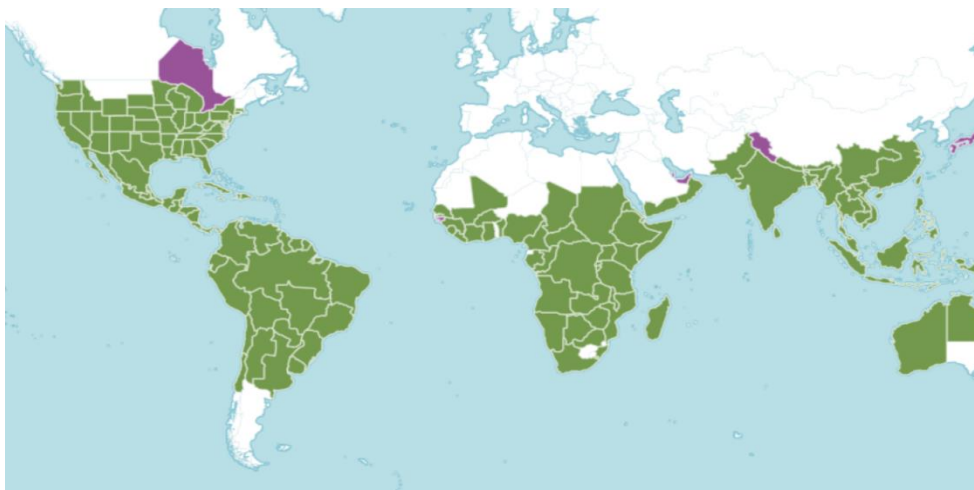
Abstract: Qualitative phytochemical screening of *Croton bonplandianus* leaves was carried out, and results are presented in this chapter. In the aqueous extract, tannin, saponin, and reducing sugar were detected. Tannin and saponin were observed in the methanol extract, whereas tannin, saponin, and reducing sugar were detected in the ethanol extract. The detected bioactive compounds showed the pharmacological potential of *C. bonplandianus* leaves, and they may be responsible for curing microbial infections.

Keywords: *Croton*, bioactive compounds, skin infections

Introduction

Croton L., is an important genus in medicinal plants and plant diversity (Nayak and Kumar, 2023). It has about 1175 accepted species and distributed globally (Figure 1). It is reported from Alabama, Angola, Argentina Northeast, Argentina Northwest, Arizona, Arkansas, Aruba, Assam, Bahamas, Bangladesh, Belize, Benin, Bermuda, Bismarck Archipelago, Bolivia, Borneo, Botswana, Brazil North, Brazil Northeast, Brazil South, Brazil Southeast, Brazil West-Central, Burkina, Burundi, Cabinda, California, Cambodia, Cameroon, Cape Provinces, Caprivi Strip, Caroline Is., Cayman Is., Central African Republic, Chad, Chile Central, Chile North, China South-Central, China Southeast, Christmas I., Colombia, Colorado, Comoros, Congo, Connecticut, Costa Rica, Cuba, Delaware, District of Columbia, Djibouti, Dominican Republic, East Himalaya, Ecuador, El Salvador, Eritrea, Ethiopia, Fiji, Florida, French Guiana, Gabon, Galápagos, Gambia, Georgia, Ghana, Guatemala, Guinea,

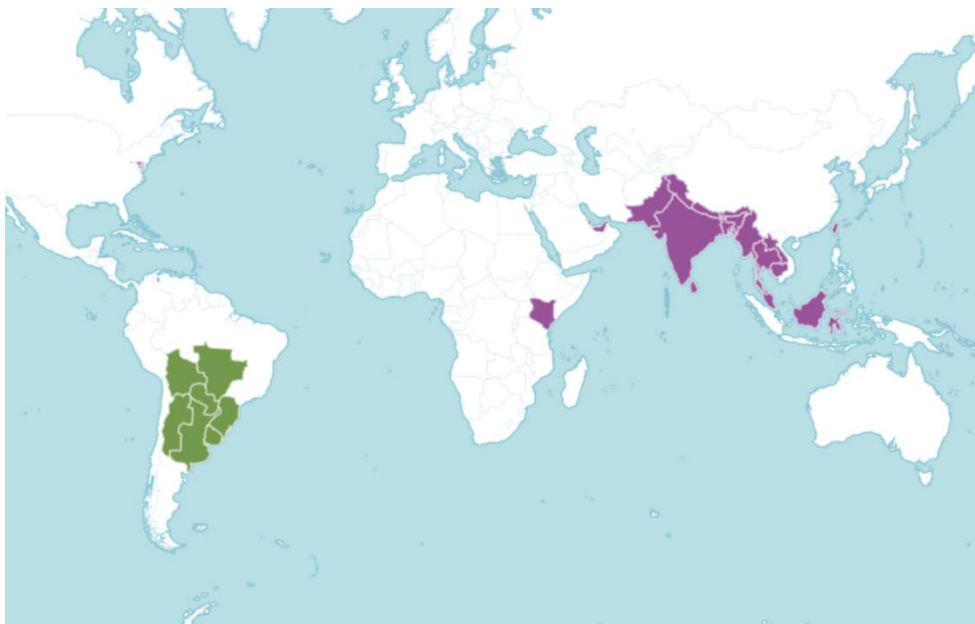
Gulf of Guinea Is., Guyana, Hainan, Haiti, Honduras, Idaho, Illinois, India, Indiana, Iowa, Ivory Coast, Jamaica, Jawa, Kansas, Kentucky, Kenya, KwaZulu-Natal, Laos, Leeward Is., Lesser Sunda Is., Liberia, Louisiana, Madagascar, Malawi, Malaya, Maldives, Mali, Maluku, Marianas, Maryland, Massachusetts, Mauritius, Mexican Pacific Is., Mexico Central, Mexico Gulf, Mexico Northeast, Mexico Northwest, Mexico Southeast, Mexico Southwest, Michigan, Minnesota, Mississippi, Missouri, Mozambique, Myanmar, Namibia, Nebraska, Nepal, Netherlands Antilles, Nevada, New Caledonia, New Guinea, New Jersey, New Mexico, New South Wales, New York, Nicaragua, Nicobar Is., Nigeria, North Carolina, Northern Provinces, Northern Territory, Ohio, Oklahoma, Oman, Oregon, Pakistan, Panama, Paraguay, Pennsylvania, Peru, Philippines, Puerto Rico, Queensland, Rwanda, Reunion, Senegal, Sierra Leone, Socotra, Solomon Is., Somalia, South Carolina, South Dakota, Southwest Caribbean, Sri Lanka, Sudan, Sulawesi, Sumatera, Suriname, Taiwan, Tanzania, Tennessee, Texas, Thailand, Tonga, Trinidad-Tobago, Turks-Caicos Is., Uganda, Uruguay, Utah, Vanuatu, Venezuela, Venezuelan Antilles, Vietnam, Virginia, Washington, West Virginia, Western Australia, Windward Is., Wisconsin, Wyoming, Yemen, Zambia, Zaire and Zimbabwe (Figure 1; <https://powo.science.kew.org/taxon/327708-2>).



(Source: <https://powo.science.kew.org/taxon/327708-2>)

Figure 1: Distribution of *Croton* species in world

Croton bonplandianus Baill., (Figure 3) first published in *Adansonia* 4: 339 (1864). This species is accepted. The native range of this species is South Bolivia to Uruguay. It is a subshrub or shrub and grows primarily in the seasonally dry tropical biome. It is native to Argentina Northeast, Argentina Northwest, Bolivia, Brazil South, Brazil West-Central, Paraguay and Uruguay. It is introduced in India, Bangladesh, Borneo, Cambodia, Comoros, East Himalaya, Gulf States, India, Kenya, Laos, Malaya, Maryland, Mauritius, Myanmar, Nepal, Nicobar Is., Pakistan, Rodrigues, Reunion, Sri Lanka, Sulawesi, Taiwan, Thailand, and West Himalayas (Figure 2; <https://powo.science.kew.org/taxon/342170-1>).



(Source: <https://powo.science.kew.org/taxon/342170-1>)

Figure 2: Distribution of *C. bonplandianus* in world



Figure 3: Plant parts of *C. bonplandianus* in wild



Figure 4: Jewel bug on *C. bonplandianus* in wild

Usually, it grows as weed in the road side, waste land and river sides. It has very good population and attract lot of pollinators and insects. It is an important host plant of Jewel bug and do ecological services (Present study; Figure 4). It has medicinal values (Singh *et al.*, 2011). It is commonly known as antifungal agent and used to cure skin infections (Rosa *et al.*, 2021). Keeping the importance and its abundance, an attempt has been made to document the bioactive compounds present in the leaves through phytochemical screening.

Methodology

Collection of plant sample and preparation of extracts

The leaves of *C. bonplandianus* were collected from the roadsides of CDA 13 of Cuttack district of Odisha state in June 2024 (Figures 5-6). The plant was identified by the senior author. The Soxhlet method of extraction was adopted using different solvents for phytochemical analysis (Devi *et al.*, 2023; Topno *et al.*, 2024). Detection of nine secondary metabolites was carried out using standard methods. An herbarium specimen is deposited to the Herbarium unit of Biodiversity and conservation of APRF, Cuttack, Odisha, India (Figure 7).

Qualitative phytochemical analysis

Test for tannin

About 1 ml of the filtrate of leaf extract was taken. Added about 3-5 drops of 0.1% lead acetate solution into it. The gelatinous precipitate formation confirmed the presence of tannin (Behera *et al.*, 2024).



Figure 5: Collection of *C. bonplandianus* leaves in the field



Figure 6: Collected leaves of *C. bonplandianus* for experimental work

Test for saponin

About 1 ml of the filtrate of leaf extract was taken and mixed with 1 ml of distilled water and allowed to shake it vigorously. The persistent froth formation after shaking confirmed the presence of saponin (Das *et al.*, 2024; Tripathi *et al.*, 2024).

Test for flavonoids

About 1 ml of the filtrate of leaf extract was taken and added 2 ml of 2 % NaOH solution followed by H₂SO₄ into it. The colour initially turned to an intense yellow colour with the addition of NaOH solution and later become colourless with sulphuric acid. This change in colour confirmed the presence of flavonoids (Jena *et al.*, 2024).

Test for terpenoids

About 2 ml of the filtrate of leaf extract was added with 6 drops of chloroform and place it in the water bath for few minutes. Then 6 drops of concentrated H₂SO₄ were added. The appearance of reddish-brown interface confirmed the presence of terpenoids (Landge *et al.*, 2024).

Test for phenolic compounds

About 1 ml of the filtrate of leaf extract was taken. Few drops of 5% Ferric chloride solution were added into the filtrate extract. The appearance of bluish black colour provides the positive result of the phenolic compounds (Mety *et al.*, 2024).

Test for reducing sugar

About 1 ml of the filtrate of leaf extract was taken and 2 drops of Fehling's solution A followed by Fehling's solution B were added and kept it in water bath for few minutes. The presence of red orange precipitate confirmed the positive result of the test for reducing sugar (Sharma *et al.*, 2024).

Test for steroids

About 1 ml of the filtrate of leaf extract was taken. 1 ml of chloroform and 1 ml of concentrated sulphuric acid was added into it. The appearance of upper red and lower yellow with green fluorescence provide the positive result for the presence of steroids (Soni *et al.*, 2024).

Test for alkaloids

About 1 ml of the filtrate of leaf extract was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids (Kumar *et al.*, 2013).

Test for carbonyl compounds

About 1 ml of the filtrate of leaf extract was taken and added 3 to 4 drops of 2,4- Dinitrophenyl hydrazine reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds (Devi *et al.*, 2023).

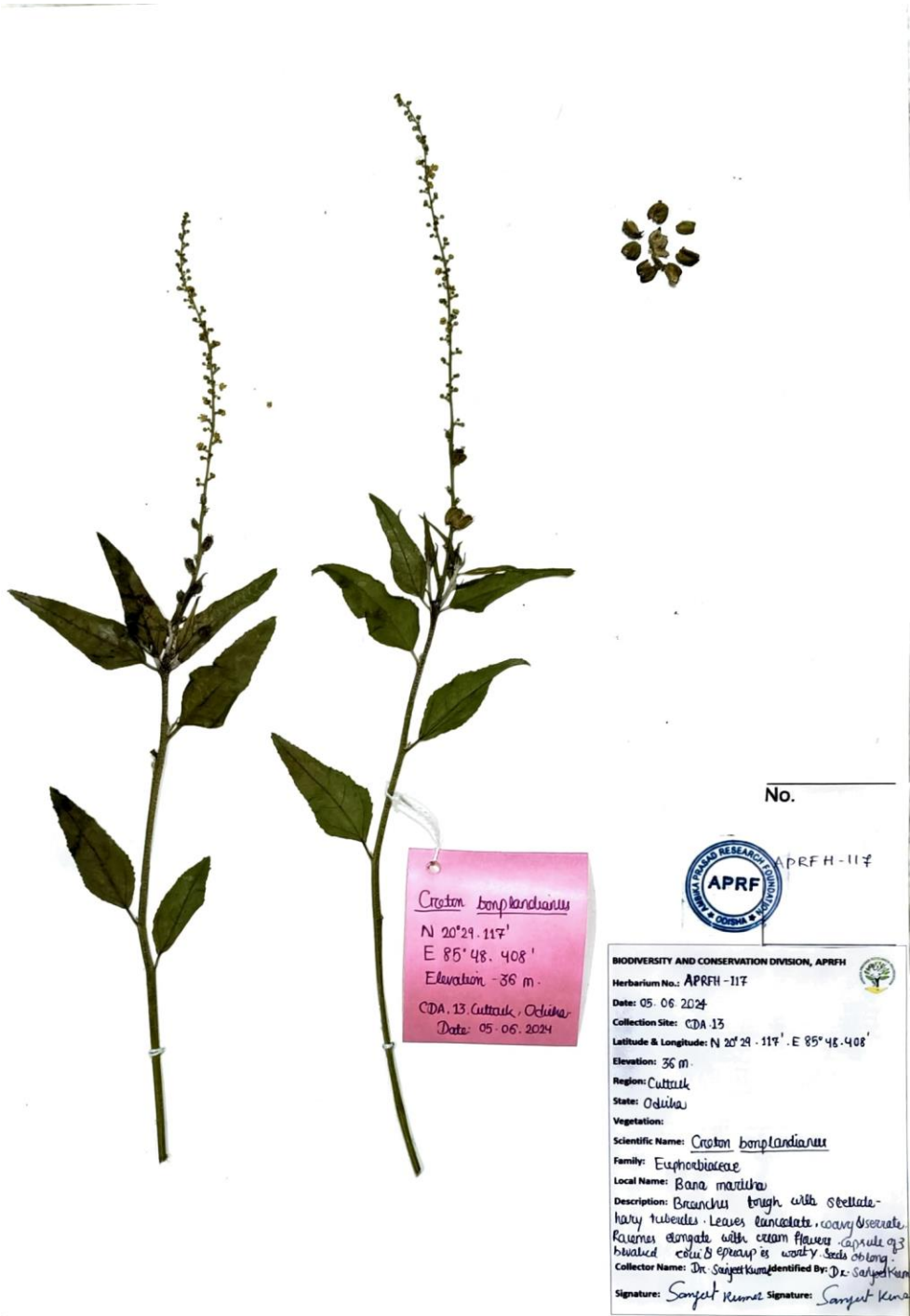


Figure 7: Herbarium specimen of *C. bonplandianus*

Results and discussion

The literature survey revealed that plant parts of *C. bonplandianus* are used to treat skin infections. Therefore, phytochemical screening was carried out and found that tannin, saponin and reducing sugar were presents in aqueous extract while only saponin and tannin were detected in methanol extract. It was noticed that tannin, saponin and reducing sugar were detected in ethanol extract (Figures 8-10; Table 1).

Table 1: Phytochemical screening of secondary metabolites using different extracts of *C. bonplandianus* leaf

Bioactive compounds	Aqueous	Methanol	Ethanol
Tannin	+ve	+ve	+ve
Saponin	+ve	+ve	+ve
Flavonoids	-ve	-ve	-ve
Terpenoids	-ve	-ve	-ve
Phenolic compounds	-ve	-ve	-ve
Reducing sugar	+ve	-ve	+ve
Steroids	-ve	-ve	-ve
Alkaloids	-ve	-ve	-ve
Carbonyl compounds	-ve	-ve	-ve



Figure 8: Detection of secondary metabolites using aqueous extract of *C. bonplandianus* leaf

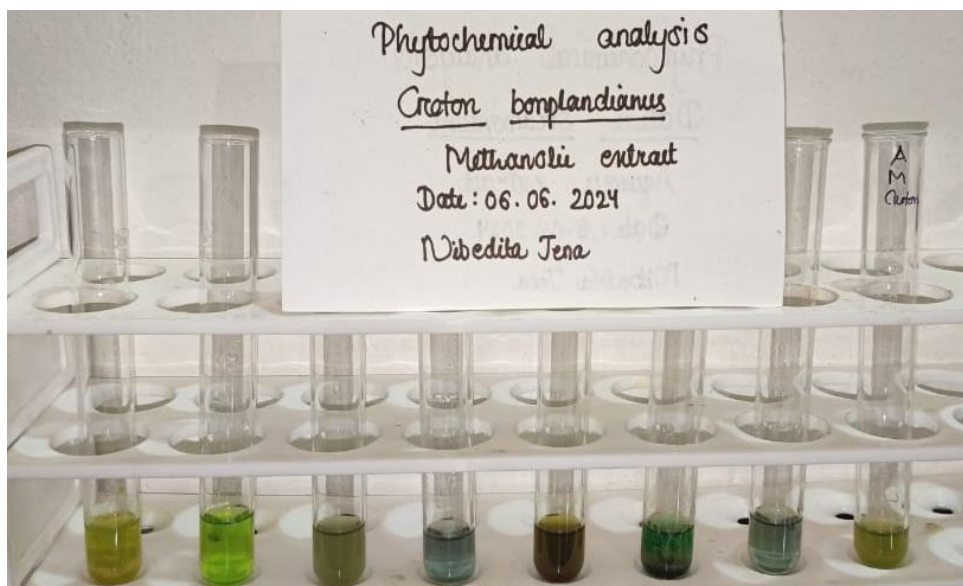


Figure 9: Detection of secondary metabolites using methanolic extract of *C. bonplandianus* leaf



Figure 10: Detection of secondary metabolites using ethanolic extract of *C. bonplandianus* leaf

Vijayamuthuramalingam *et al.*, (2017) documented anti-hyperglycemic and antioxidant potential of *C. bonplandianus* while Javed *et al.*, (2023) documented anti-arthritis potential of *C. bonplandianus* leaves extract. There is a lack of works in pharmacological aspects on other parts of *C. bonplandianus*. Hence, need more works in ethnopharmacological aspects from field to lab.

Conclusion

The therapeutic potential of the *C. bonplandianus* leaf was shown by phytochemical investigation. The study suggests conducting additional research in the pharmacological aspects, and the presence of tannin and saponin in all extracts supports the therapeutic claims that plant parts are used to cure skin infections.

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