

QUANTITATIVE ANALYSIS OF PHYTOCHEMICAL CONSTITUENTS OF *HARDWICKIA BINATA* ROXB. -AN ENDEMIC MEDICINAL PLANT

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ABSTRACT

Hardwickia binata belongs to family Fabaceae and commonly known as 'Anjan'. Present study was to estimate polyphenols, flavonoids, proteins, carbohydrates (reducing sugar, total soluble sugar and starch), proline and tannin content of leaves, seeds and husk of *H. binata*. Shade dried powdered leaves, seeds and husk of *H. binata* were used for phytochemical analysis. Polyphenols and tannins were assessed using Folin and Denis (1915) method. Total flavonoids were estimated by Luximon-Ramma *et al.* (2002) while proteins were determined by Lowry's (1951) method. Carbohydrates were estimated by Dinitrosalicylic acid method and proline was estimated with the help of Bates *et al.* (1973) method. The overall quantitative analysis showed that the leaves shows higher content of starch, flavonoids, tannins and proline than seeds and husk. The seeds

shows maximum amount of polyphenols, reducing sugar and total soluble sugar as compared to leaves and husk while protein content was found higher concentration in husk. These studies showed that phytochemical constituents of leaves, seeds and husk of *H. binata* as a prosperous source of pharmaceutically and biologically important bioactive compounds that may contribute to the development of novel and effective pharmaceutical formulations.

KEYWORDS: *Hardwickia binata*, phytochemicals, medicinal, endemic.

INTRODUCTION

Hardwickia binata belongs to the family Fabaceae and commonly known as 'Anjan.' It is a wild, endemic, multipurpose tree species suitable for agroforestry and dryland regions.^[1] It is ethnobotanical species and used very well in Ayurveda and siddha medicines. All the parts of *H. binata* holds precious medicinal properties. It has widely used as medicinal purposes like leaves used in headache, purgative as well as eye and skin infections.^[2] The leaves of *H. binata* added in bath water was used to reduce kid's body heat.^[3] Leaves are used as cattle fodder and root bark extracts reported anticancer property in *H. binata*.^[4] The outwardly applied gum to cure gonorrhea and decoction of bark is used in treatment of dysentery, diarrhea, toxemia, worms, piles and skin diseases.^[5] The tannins from bark of this species are used in medicines for the treatment of diarrhoea, worms, indigestion, leprosy and appetizer.^[6] The use of *H. binata* against dog bite additionally leaf and bark parts were used in rheumatism.^[7] The balsam resin from *H. binata* tree is used for treatment of sexually transmitted diseases and leucorrhoea.^[8] The resin of *H. binata* used for sores dressing of domestic animals.^[9] Hence, present study were undertaken to work out quantitative analysis of *H. binata*.

MATERIALS AND METHODS

Collection, authentication and preparation of plant material

The plant materials viz. leaves and pods of *H. binata* were collected from Swatantrapur village, Tal- Atpadi, Dist- Sangli, Maharashtra, India. Taxonomic identification of the plant was done and herbarium was deposited with voucher specimen (DSV 001) in the Department of Botany, Shivaji University, Kolhapur. The leaves and pods of *H. binata* were cleaned and separately shade dried. The dried material of leaves, seeds and husk were powdered in a mixer grinder, sieved and used for analysis.

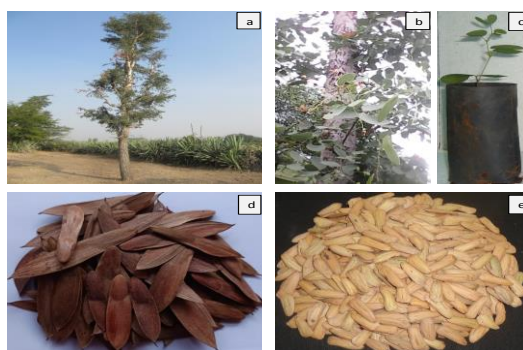


Fig. 1: a) Habit of *H. binata*, b) Flowers with immature pods, c) Seedling, d) Mature pods, e) Seeds.

Quantitative Phytochemical Analysis

Polyphenols Estimation: Polyphenols were estimated by the Folin-Denis (1915) method.^[10] 1 g leaves were crushed with 80% pre-chilled acetone and a pinch of MgCO_3 in dark conditions. Leaf extract (2 ml) was mixed with 20% sodium carbonate and Folin-Denis reagent, and the volume was made to 50 ml with distilled water. After 20 min incubation, absorbance was measured at 660 nm using a UV-1800 spectrophotometer. Tannic acid was used for standard curve preparation, and polyphenols were expressed as mg/gm fresh plant material.

Flavonoids Estimation: Flavonoids were estimated by the method of Luximon-Ramma *et al.* (2002).^[11] 0.5 gm of dried powder of leaves, seeds and husk were extracted with 80% acetone and filtered, and the final volume was made to 50 ml. 1.5 ml extract was mixed with 2% methanolic aluminium chloride, and absorbance was recorded at 368 nm using a UV-spectrophotometer. Rutin was used as the standard, and flavonoid content was expressed as mg/gm dried plant material.

Protein Estimation: Proteins were determined by Lowry's (1951) method.^[12] 0.5 gm of dried powder of leaves, seeds and husk were homogenized in cold tris buffer, centrifuged, and filtered. Sample extract was mixed with alkaline copper reagent and Folin-Ciocalteu reagent, then incubated in dark for 30 min. Absorbance was measured at 660 nm using a UV-spectrophotometer. Bovine Serum Albumin (BSA) was used as the standard, and protein content was expressed as mg/gm dried plant material.

Carbohydrates Estimation: Carbohydrates were estimated by Dinitrosalicylic acid method. 0.1 gm dried powder of leaves, seeds and husk were homogenized and extracted with hot 80% alcohol. This filtrate was used to estimate reducing sugar while residue was used for starch estimation.

Reducing Sugar: Reducing sugar was estimated by Dinitrosalicylic acid method proposed by Miller (1959).^[13] The extract was evaporated, dissolved in distilled water, and reacted with DNS reagent. After heating in a boiling water bath and adding potassium sodium tartrate, absorbance was measured at 510 nm using a UV-spectrophotometer. Glucose was used as the standard, and reducing sugar content was expressed as mg/gm dried plant material.

Total Soluble Sugars: To determine total soluble sugars, Anthrone method proposed by Hedge and Hofreiter in 1962 was followed.^[14] 0.1 gm of dried powder of leaves, seeds and husk were hydrolysed with HCl, neutralized with sodium carbonate, and centrifuged. The extract was reacted with anthrone reagent and heated in a boiling water bath. Absorbance was recorded at 630 nm using a UV-spectrophotometer. Glucose was used as the standard, and total soluble sugars were expressed as mg/gm dried plant material.

Starch: Starch was estimated by the Anthrone method proposed by Hedge and Hofreiter (1962).^[14] The residue was treated with perchloric acid, centrifuged, and the extract volume was made to 100 ml. Sample extract was reacted with anthrone reagent and heated in a boiling water bath. Absorbance was measured at 630 nm using a UV-spectrophotometer. Glucose was used as the standard, and starch content was expressed as mg/gm dried plant material.

Proline Estimation: Proline was estimated with the help of Bates *et al.* (1973).^[15] 0.1 gm of dried powder of leaves, seeds and husk were homogenized in 3% sulphosalicylic acid and filtered. The extract was reacted with acid ninhydrin and glacial acetic acid, heated in a boiling water bath, and cooled. Toluene was added for layer separation, and absorbance of the red colour was measured at 520 nm using a UV-spectrophotometer. Proline content was calculated using a standard proline curve and expressed as mg/gm dried plant material.

Tannin Estimation: Tannin estimation was carried out by Folin-Denis method determined by Schanderl (1970).^[16] 0.5 gm of powdered material of leaves, seeds and husk were boiled in distilled water, centrifuged, and the extract volume was made to 100 ml. Sample extract was mixed with Folin-Denis reagent and sodium carbonate, incubated for 30 min, and absorbance was measured at 700 nm using a UV-1800 spectrophotometer. Tannic acid was used as the standard, and tannin content was expressed as mg/gm dried plant material.

RESULTS AND DISCUSSION

The quantitative phytochemical analysis in different plant parts of *H. binata* is highlighted in Fig.2. These figure shows that, the phytochemical analysis of *H. binata* revealed variation in biochemical constituents among leaves, seeds, and husk. The polyphenol content was recorded as 8.125 mg/gm in leaves, 11.375 mg/gm in seeds, and 7.25 mg/gm in husk, with the highest amount observed in seeds. In previous work reported that, the phytochemical studies on root bark exudates of *H. binata* showed that 1.39 mg/gm phenols were found in

root bark exudates on the dry weight basis.^[4] Flavonoid content was highest in leaves (29.28 mg/gm), followed by husk (12.532 mg/gm) and seeds (11.72 mg/gm). The phytochemical analysis on root bark exudates of *H. binata* showed 1.08 mg/gm flavonoids on dry weight basis.^[4] Protein content was found to be maximum in husk (40.0 mg/gm), followed by leaves (38.4 mg/gm) and seeds (36.8 mg/gm). In *Bauhinia purpurea* leaf the protein content was found 5.19 mg/gm and in flower it was 13.39 mg/gm.^[17] Reducing sugars were highest in seeds (55.2 mg/gm), while leaves and husk contained 15.2 mg/gm and 14.8 mg/gm, respectively. Total soluble sugars were highest in leaves (102.0 mg/gm) while seeds and husk contained 114.0 mg/gm and 112.0 mg/gm, respectively whereas starch content was highest in leaves (360.0 mg/gm) compared to seeds and husk (330.0 mg/gm each). The total carbohydrate was found to be 50.0 mg/gm in *Bauhinia purpurea* leaf.^[17] Proline content was maximum in leaves (0.5 mg/gm), while husk and seeds contained 0.055 mg/gm and 0.05 mg/gm, respectively. In leaves of *Bauhinia variegata*, 7.07 µg/gm proline was found on the fresh weight basis.^[18] Tannin content was also highest in leaves (7.5 mg/gm), followed by seeds (6.6 mg/gm) and husk (6.5 mg/gm). The tannin content in aqueous leaf extracts was found to be 21.46 mg/gm while it was found 56.30 mg/gm in ethanolic extract of *Bauhinia variegata*.^[19] In present study, the overall quantitative analysis the leaves of *H. binata* shows higher content of starch, flavonoids, tannins and proline than seeds and husk. The seeds show maximum amount of polyphenols, reducing sugar and total soluble sugar as compared to leaves and husk. while protein content was found higher concentration in husk. Overall, starch was the major carbohydrate component, whereas proline was present in the least quantity.

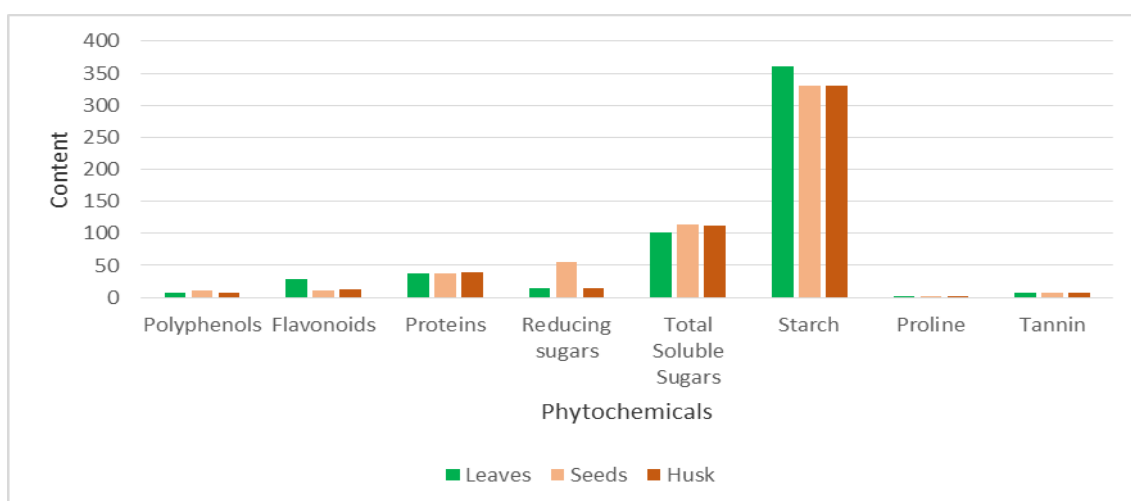


Fig. 2: Quantitative phytochemical analysis in different plant parts of *Hardwickia binata*.

CONCLUSION

The study exhibited that the leaves of *H. binata* were found to contain their maximum concentrations, but seeds and husk were also found to have considerable amount. Thus, it can be revealed that phytochemical constituents of leaves, seeds and husk of *H. binata* as a prosperous source of pharmaceutically and biologically important bioactive compounds that may contribute to the development of novel and effective pharmaceutical formulations.

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REFERENCES

1. Korwar GR. *Hardwickia binata* a promising MPTS, for agroforestry in dry land areas. multipurpose Tree species for Agroforestry in India., 1994; 72-75.
2. Singh A, Satanker N, Kushwaha, M, Disoriya, R, GuptaAK. Ethno-botany and uses of non- graminaceous forage species of Chitrakoot region of Madhya Pradesh. Indian Journal of Natural Products and Resources, 2011; 4(4): 425-431.
3. Pawar S, Patil DA. Indigenous phytotherapy for paediatric disease in Jalgaon district (Maharashtra). Journal of Natural Remedies, 2010; 10(1): 61-63.
4. Prabakaran R, Senthil kumar T, Rao MV. GC-MS analysis and in vitro cytotoxicity studies of root bark exudates of *Hardwickia binata* Roxb. American Journal of Phytomedicine and Clinical Therapeutics, 2014; 2(6): 723-733.
5. Quattrocchi U. (2012). CRC World dictionary of medicinal and poisonous plants: Common names, scientific names, eponyms, synonyms and etymology. Published by CRC Press, Vol. 4.
6. Ranganathan R, Vijayalakshmi R, Parameswari P. Ethnomedicinal survey of Jawadhu hills in Tamil Nadu. Asian Journal of Pharmaceutical and Clinical Research, 2012; 5(2): 45-49.
7. Kanaka Rajesham Ch, Narasinga Rao N, Venkteshwarlu M, Sammahiah D, Anitha U, Ughandhar A. Studies on the medicinal plant biodiversity in forest ecosystem of Mahadevpur forest of Karimnagar (A. P.) India. Bioscience Discovery, 2013; 4(1): 82-88.

8. Vaidyanathan D, Sisubalan N, Ghouse Basha M. Survey of ethnomedicinal plants and folklore studies on Malayali Tribals of Vellakadai village a part of Shervaroy Range in Eastern Ghats, Tamil Nadu. *International Journal of Recent Scientific Research*, 2014; 5(7): 1368-1380.
9. Pawar NB. Ethno-veterinary plants of Baglan region from Nashik district Maharashtra. *International Journal of Research and Analytical Reviews*, 2020; 7(1): 809-813.
10. Folin O, Denis W. A calorimetric estimation of phenols (and phenolic derivatives) in urine. *Journal of Biological Chemistry*, 1915; 22: 305-308.
11. Luximon-Ramma A, Bahorum T, Soobratee MA, Aruoma OI. Antioxidant activities of flavonoid compounds in extracts of *Cassia fistula*. *Journal of Agricultural and Food Chemistry*, 2002; 50: 5042-5047.
12. Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurements with folin phenol reagent. *Journal of Biological Chemistry*, 1951; 193(1): 265-275.
13. Miller GL. Use of dinitrosalicylic acid reagent for determination of reducing sugar. *Analytical Chemistry*, 1959; 31: 426-428.
14. Hedge JE, Hofreiter BT. In: Whistler RL, Bemiller JN (Eds.). *Carbohydrates Chemistry*, 17, academic press, New York. 1962.
15. Bates LS, Waldeen RP, Teare ID. Rapid determination of free proline for water stress studies. *Plant and Soil*, 1973; 39: 205-207.
16. Schanderl SH. In: *method in food analysis*, academic press, New York. 1970; 709.
17. Marimuthu K, Dhanalakshmi R. A study on phytochemicals in *Bauhinia purpurea* L. leaf and flower. *International Journal of Pharmaceutical Sciences Review and Research*, 29(2): 72-76.
18. Singh R, Bachheti RK, Saraswat S, Singh SK. Assessment of phytochemical and biological potentials of *Bauhinia variegata* L. *International Journal of Pharmaceutical Research*, 2012; 4(1): 95-100.
19. Mamillapalli V, Khantamneni PL, Mohammad Z, Mathangi A, Nandigam N, Namburi, SM, Katta V. Phytochemical and in vitro antiurolithiatic studies on the leaf extracts of *Bauhinia variegata* Linn. *International Journal of Pharmaceutical Sciences and Research*, 2016; 7(10): 4074-4084.