

Chapter 8

Qualitative phytochemical analysis of *Datura stramonium* L. fruits

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Abstract

Datura flowers are used to worship Lord Shiva in almost all parts of India and abroad. Lord Shiva adores this plant, and hence it can be used to treat several health problems, and pastes of plant parts are used to treat different skin infections. Therefore, a qualitative phytochemical analysis of *Datura stramonium* was carried out, and the results revealed that tannin, saponin, reducing sugar, and alkaloids are detected in the aqueous extract of *D. stramonium* fruits, which could be responsible for treating different skin infections.

Keywords: *Datura*, skin infections, phytochemicals

Introduction

India has a rich mythology. In every mythological belief, there is a science behind it (Das *et al.*, 2020; Das *et al.*, 2022; Kumar, 2023). In Sanatan dharma, Lord Shiva is known to take all bitter and toxic things. The flowers of toxic plants are used to worship him. It is believed that Lord Shiva absorbs all bad energy and returns positive energy to sustain life. Toxic meaning, in herbal medicine, not simply anything that kills, but something that can be applied externally or used in very little amounts as a medication. In medicinal plants research, toxic means not only deadly, but they are used externally or in very low concentrations as medicinal agents (Brima, 2017). In this aspect, *Datura stramonium* (Figures 1-3) is a plant with toxic components, and plant parts are used to worship Lord Shiva. It is a shrub belonging to the family Solanaceae. It is commonly known as Umatta virkshaha in Sanskrit, Datura in Hindi, Kananka in Marathi, and Thornapple in English. The leaves of *D. stramonium* are used for the relief of headaches, and the vapours of leaf infusion are used to relieve the pain of rheumatism and gout.



Figure 1: Habit and Habitat of *D. stramonium*



Figure 2: Flower of *D. stramonium*



Figure 3: Fruit of *D. stramonium*



Figure 4: Collection of *D. stramonium* fruits in the field

The smoke from the burning leaf is inhaled for the relief of asthma and bronchitis. The fruit juice is applied to the scalp for the treatment of falling hair and dandruff. It is also applied to smooth painful wounds and sores. Seeds and leaves of *D. stramonium* are used to sedate hysterical and psychotic patients, as well as to treat insomnia. It is also used to relax the smooth muscles of the bronchial tube and treat asthmatic bronchial spasms. It was reported that *D. stramonium* was used internally to treat madness, epilepsy, and depression. Externally, it forms the basis of ointment for burns and rheumatism (Paolo, 2001; Soni *et al.*, 2012). Keeping the importance in ethnomedicinal practices, an attempt has been made to document the bioactive compounds available in the fruits of *D. stramonium* through phytochemical analysis.

Methodology

Collection of plant sample and preparation of extracts

The fruits of *Datura stramonium* were collected from the bank of Mahanadi River area in Naraj, Cuttack district of Odisha state in June 2024 (Figures 4-5). 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; Sharma *et al.*, 2024). Detection of nine secondary metabolites was carried out using standard methods (Kumar *et al.*, 2013; Landge *et al.*, 2024). An herbarium specimen is deposited to the herbarium unit of Biodiversity and Conservation Lab, APRF, Odisha, India (Figure 6).



Figure 5: Collected fruits of *D. stramonium* for experimental work

Qualitative phytochemical analysis

Test for tannin

About 1 ml of the filtrate of fruit 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.

Test for saponin

About 1 ml of the filtrate of fruit 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 (Soni *et al.*, 2024).

Test for flavonoids

About 1 ml of the filtrate of fruit extract was taken and added 2 ml of 2 % NaOH solution followed by H_2SO_4 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.

Test for terpenoids

About 2 ml of the filtrate of fruit extract was added with 6 drops of chloroform and place it in the water bath for few minutes. Then 6 drops of concentrated H_2SO_4 were added. The appearance of reddish-brown interface confirmed the presence of terpenoids.

Test for phenolic compounds

About 1 ml of the filtrate of fruit 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.

Test for reducing sugar

About 1 ml of the filtrate of fruit 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.

Test for steroids

About 1 ml of the filtrate of fruit 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.

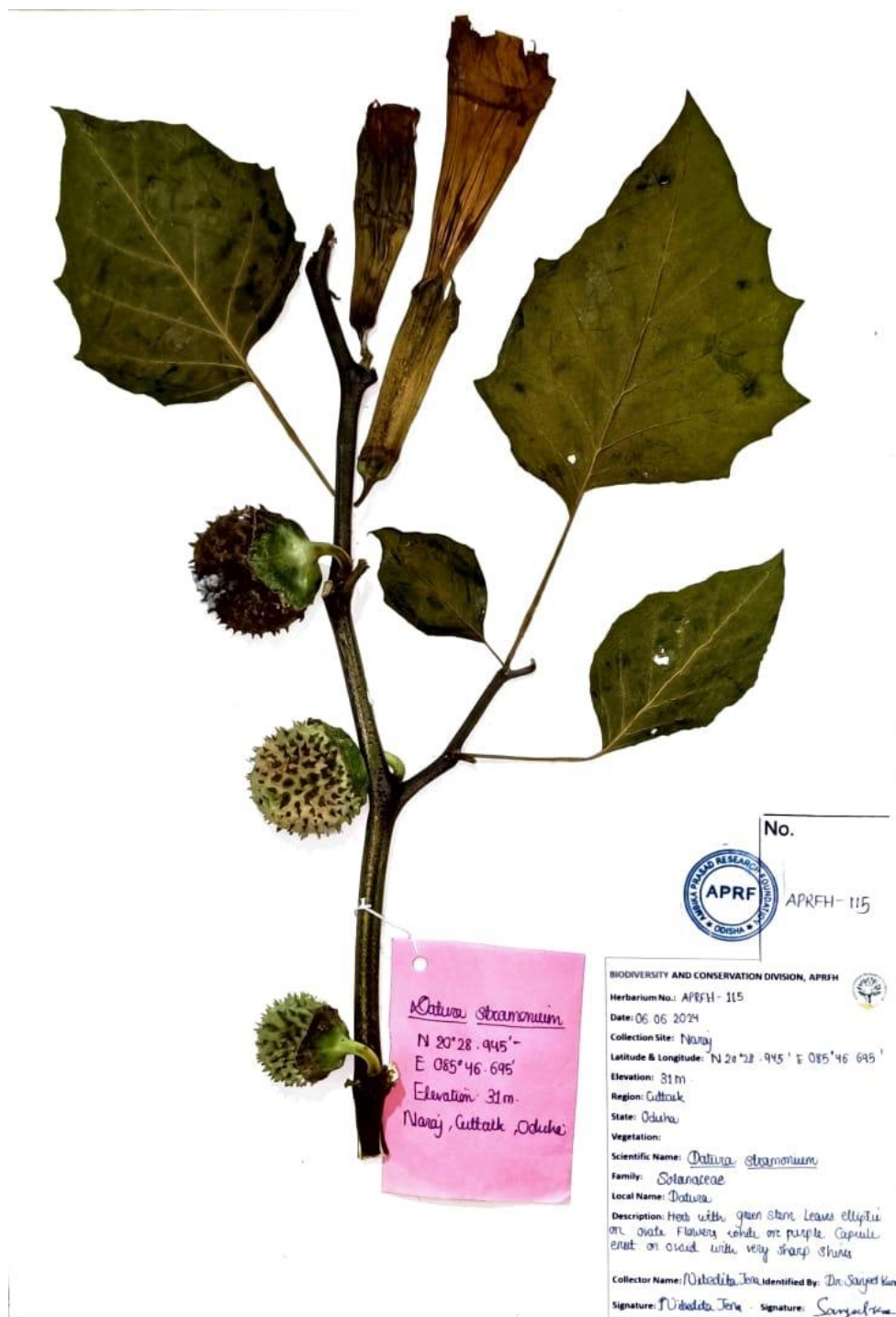


Figure 6: Herbarium specimen of *D. stramonium*

Test for alkaloids

About 1 ml of the filtrate of fruit extract was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds

About 1 ml of the filtrate of fruit extract was taken and added 3 to 4 drops of 2,4- Di-nitrophenylhydrazine reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.

Results and discussion

Field survey revealed that fruits paste is used to cure fungal infections. Phytochemical screening showed the presence of tannin, saponin, reducing sugar and alkaloids in aqueous extract of fruits (Figure 7). It was noticed that tannin, saponin, flavonoids, phenolic compounds and reducing sugar was observed in methanol and ethanol extracts (Table 1; Figures 8-9). The presence of tannin and saponin might be responsible to cure fungal infections (Latte and Kolodziej, 2000; Yang *et al.*, 2006; Kumar *et al.*, 2013).

Table 1: Phytochemical screening of secondary metabolites using different extracts of *D. stramonium* fruit

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

(+ve: positive; -ve: negative)

Recently, Sharma *et al.*, (2021) documented pharmacological values of *D. stramonium* in details as review. Several works are documented on *Datura* species and their parts (Usha *et al.*, 2009) but still there is need to do extensive works on ethnobotany and experimental works on fruit extracts.

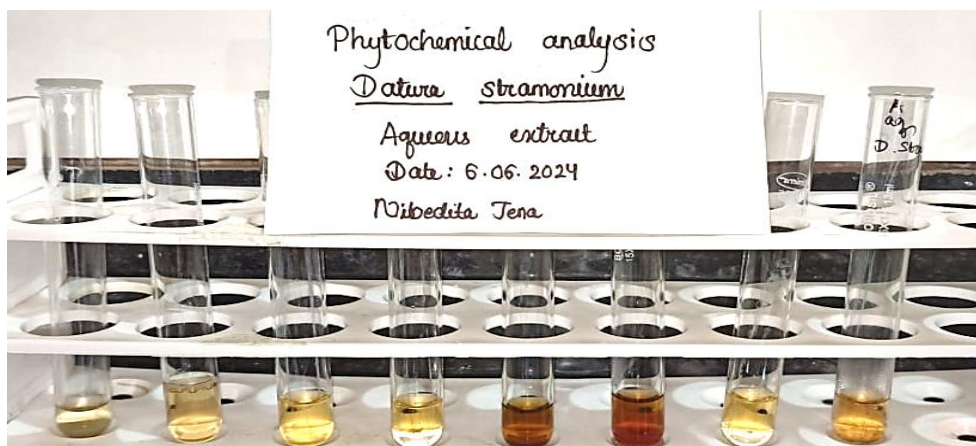


Figure 7: Detection of secondary metabolites using aqueous extract of *D. stramonium* fruit

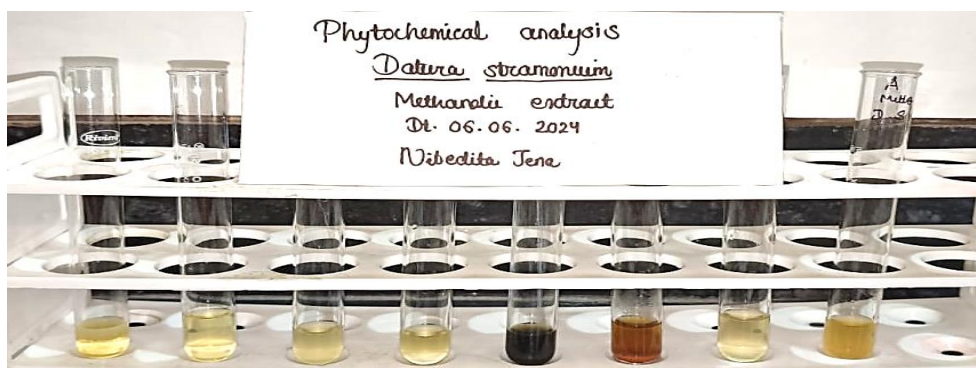


Figure 8: Detection of secondary metabolites using methanolic extract of *D. stramonium* fruit

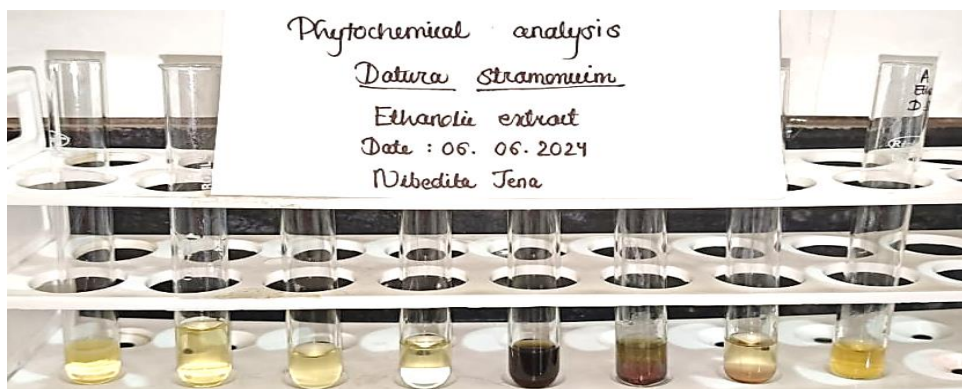


Figure 9: Detection of secondary metabolites using ethanolic extract of *D. stramonium* fruit

Conclusion

With applications in mythology and ethnomedicine, *Datura stramonium* is a highly well-liked medicinal herb. According to the present study's findings, further research into fruit-based therapeutic practices is necessary, and then pharmacological analysis experiment design is required. Because of its healthy population, it can be utilized to produce herbal remedies that fight fungus-related infections.

References

- Brima El. (2017). Toxic Elements in Different Medicinal Plants and the Impact on Human Health. Int Journal of Environ Res Public Health. 14(10):1209. DOI: 10.3390/ijerph14101209
- Das L, Mishra S, Das A, Dimri R and Kumar S. (2022). Some common flora of temple city of Odisha, India: source for ethno-medico-cultural values. Indian Forester. 148(2): 207-212.
- Das MK, Das PK, Kumar S and Singh NR. (2020). Flora of Khandagiri & Udayagiri, an urban heritage of Odisha. Indian Forester. 146(6): 509-518.
- Devi RS, Bihari SK and Kumar S. (2023). Validation of tribal claims for formulation of future drugs through evaluation of ethno-pharmacological values of *Ludwigia adscendens*. Medicinal Plants. 15(4): 691-697.
- Kumar S, Behera SP and Jena PK. (2013). Validation of tribal claims on *Dioscorea pentaphylla* through phytochemical screening and evaluation of antibacterial activity. Plant Science research. 35: 55-61.
- Kumar S. (2023). Medicinal wealth of Jamtara Forest Division, Jamtara, Jharkhand. Journal of Biodiversity and Conservation. 7(2): E1-E2.
- Landge MM, Basumatary M, Soni P, Tripathi G, Jena N, Kumar S and Sahu LM. (2024). Qualitative phytochemical analysis of *Schleichera oleosa* (Lour.) Oken fruits. Biological Archives. APRF Publishers. 1: 10.
- Latte KP and Kolodziej H. (2000). Antifungal effects of hydrolysable tannins and related compounds on dermatophytes, mould fungi and yeasts. Zeitschrift fur Naturforschung. C, Journal of Biosciences. 55(5-6): 467-472.
- Paolo MG. Traditional antihelmintic, antiparasitic and repellent uses of plants in Central Italy. Journal of Ethnopharmacology. 2001;68(1-3):183-192.
- Sharma BP, Das A, Singh B, Lyngdoh D, Jena N, Kumar S and Saradar B. (2024). Analysis of primary and secondary metabolites of *Coccinia grandis* (L.) Voigt. Leaf: a nutraceutical of tribals. Biological Archives. APRF Publishers. 1: 45-59.

- Sharma M, Dhaliwal I, Rana K, Delta AK and Kaushik P. (2021). Phytochemistry, Pharmacology, and Toxicology of *Datura* Species-A Review. *Antioxidants* (Basel).10(8):1291. DOI: 10.3390/antiox10081291
- Soni P, Mahendru N, Dimri R, Hamdy R, Jena N and Kumar S. (2024). Qualitative phytochemical analysis of *Cascabela thevetia* fruits. *Biological Archives*. APRF Publishers. 1: 29-37.
- Soni P, Siddiqui AA, Dwivedi J and Soni V. (2012). Pharmacological properties of *Datura stramonium* L. as a potential medicinal tree: an overview. *Asian Pacific Journal of Tropical Biomedicine*.2(12):1002-8.
- Usha K, Singh B, Praseetha P, Deepa N, Agarwal DK, Agarwal R, et al. (2009). Antifungal activity of *Datura stramonium*, *Calotropis gigantea* and *Azadirachta indica* against *Fusarium mangiferae* and floral malformation in mango. *Eur Journal of Plant Pathol*. 124(4):637–657.
- Yang CR, Zhang Y, Jacob MR, Khan SI, Zhang YJ and Li XC. (2006). Antifungal activity of C-27 steroidal saponins. *Antimicrobial Agents Chemotherapy*. 50(5):1710-1714.