

Chapter 12

Phytochemical and toxicity evaluation of hydroethanolic extract of *Trichosanthes costata* fruits

Arti Sharma¹, Saraswati Majhi², Subhalakshmi Rout^{3*} and Sanjeet Kumar³

¹Freedom Fighter Pandit Susheel Rattan Govt. Degree College, Jawalamukhi, Himachal Pradesh, India

²P.G. Department of Botany, Shailabala Women's Autonomous College, Cuttack affiliated to Ramadevi Women's University, Bhubaneswar, Odisha, India

³Ambika Prasad Research Foundation, Odisha, India

*Email-Id: subhalakshmirout98@gmail.com



Licensed under a Creative Commons Attribution 4.0 International License

Abstract: Current research explores the phytochemical profile and cytotoxic effects of *Trichosanthes costata* fruit extract, identifying key compounds like tannins, saponins, flavonoids, phenolic compounds, and reducing sugars, and demonstrating strong cytotoxic activity against brine shrimp nauplii, indicating possible uses in therapy.

Keywords: Bioactive compounds, brine shrimp, cytotoxic effect

INTRODUCTION

Wild cucurbits, belonging to the Cucurbitaceae family, have been a valuable resource for traditional medicines and foods (Tripathy et al., 2015; Kumar et al., 2017). These plants are rich in bioactive compounds, including flavonoids, phenolic acids, and terpenoids, which contribute to their medicinal properties. Wild cucurbits have been used to treat various ailments, highlighting their potential as a source of therapeutic agents (Chakroborthy et al., 2017). *Trichosanthes costata*, a wild cucurbit species, has been used in traditional medicine for its reported health benefits (Kumar et al., 2017). Despite its potential, there is limited scientific

research on the bioactive compounds and biological activities of this plant (Kumar and Tripathy, 2017).



Figure 1: Fruit of *T. costata*

Exploring the phytochemical profile and bioactivity of *T. costata* (Figure 1) can provide valuable insights into its medicinal properties and potential applications. Present study of wild cucurbits like *T. costata* can lead to the discovery of new bioactive compounds with pharmaceutical and medicinal applications. With the

growing interest in natural products and traditional medicine, research on wild cucurbits can contribute to the development of novel therapeutic agents and promote the conservation and sustainable use of these valuable plant resources.

METHODOLOGY

The fruits of *T. costata* were collected from the Khordha district of Odisha (Figure 2). The Soxhlet extraction method was adopted for phytochemical screening to get a hydroethanolic extract. Nine secondary metabolites were detected using standard methods (Devi et al., 2023; Devi et al., 2024; Jena et al., 2024; Marndi et al., 2024).

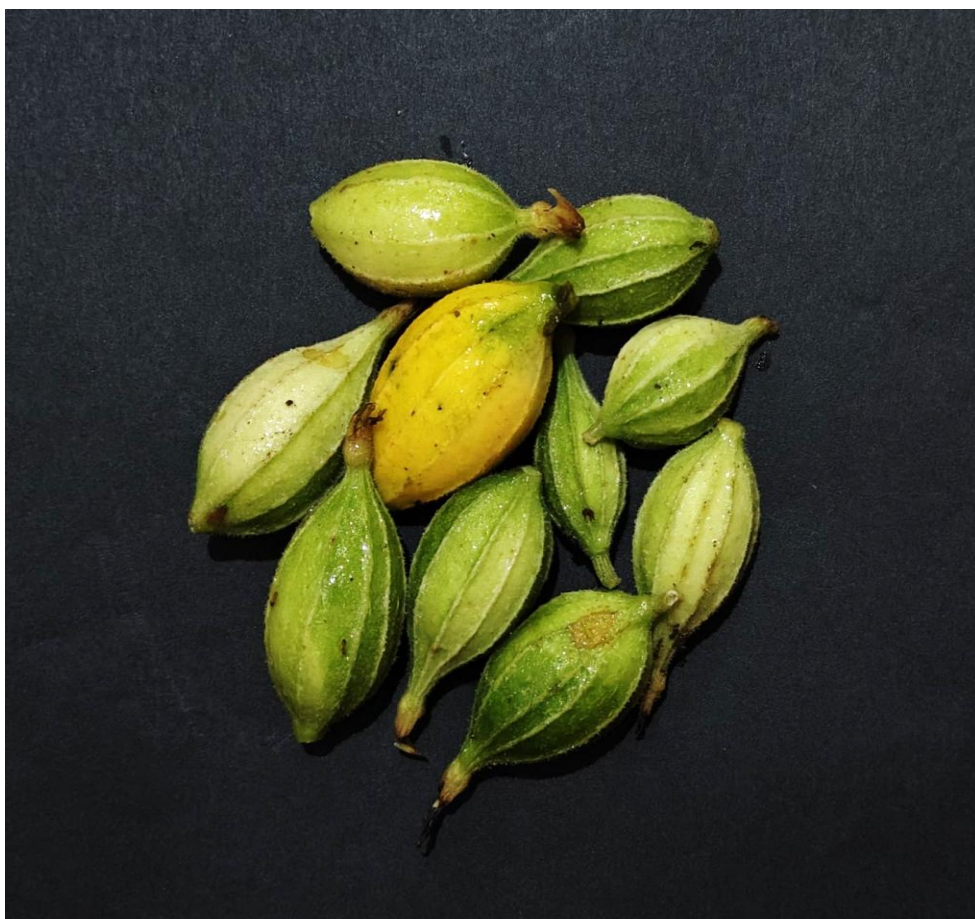


Figure 2: Collection of *T. costata* fruits for experimental works

Test for tannin: About 1 ml of the fruit extract was taken. 3-5 drops of 10% lead acetate solution were added to it. The gelatinous precipitate formation confirmed the presence of tannin.

Test for saponin: About 1 ml of distilled water was added to 1 ml of the fruit extract and shaken well. The formation of persistent froth confirmed the presence of saponin.

Test for flavonoids: About 1 ml of the fruit extract was taken. About 2 ml of NaOH solution and 3-5 drops of dilute HCl were added. The colour initially turned to an intense yellow colour with NaOH solution, and later became colourless, which confirmed the presence of flavonoids.

Test for terpenoids: To 1 ml of the fruit extract, 5-6 drops of chloroform were added. Then, 4-6 drops of concentrated sulphuric acid were added. The reddish-brown interface confirmed the presence of terpenoids.

Test for phenols: About 1 ml of the fruit extract was taken. A few drops of 5% ferric chloride solution were added. The dark bluish-black appearance confirmed the presence of phenolic compounds.

Test for reducing sugars: About 1 ml of the fruit extract was taken. 2 drops of Fehling's solution A, followed by Fehling's solution B, were added and kept in the water bath for a few minutes. The presence of red-orange precipitate confirmed the presence of reducing sugars.

Test for steroids: To 1 ml of the fruit extract, about 1 ml of chloroform, followed by 1 ml of concentrated sulphuric acid, was added. The appearance of upper red and lower yellow with green fluorescence indicates the presence of steroids.

Test for alkaloids: About 1 ml of the fruit extract was taken. About 3-4 drops of Dragendroff's reagent were added to it. The formation of a reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds: About 1 ml of fruit extract was taken, and 3-4 drops of 2,4-Dinitrophenylhydrazine (DNPH) reagent were added. The formation of yellow crystals confirmed the presence of carbonyl compounds.

Cytotoxicity analysis: For toxicity analysis, hatching of brine cysts was the initial process. Standardisation of the optimum was done at 2.0, 3.5, and 5.0 % saline concentration to check the optimum salinity for proper hatching of Brine shrimp (*Artemia salina*) cysts (Kumar et al., 2012). The brine shrimp cysts are then incubated in 3.5% saline water with proper aeration, room temperature between 28-35°C and light for 48 hours. Proper hatching could be observed within 24-48 hours, depending upon the quality of cysts, proper aeration, and light provided. Different concentrations (12.5 mg/ml, 25 mg/ml, 50 mg/ml, 100 mg/ml, and 200 mg/ml) of the fruit extract were taken, and 3.5% saline water was used to make the volume 2 ml in each test tube. 1% DMSO was used to dissolve the crude extracts. Ten nauplii were selected and introduced to five test tubes of the extracts. Positive and negative controls were prepared using vincristine sulphate (5 mg/ml) and 3.5% saline water, respectively, with a volume of 2 ml. The live larvae are highly mobile and thus differentiate from the unhatched cysts. The survivor nauplii were counted and analysed for the death percentage (Kumar et al., 2012).

RESULTS AND DISCUSSION

The phytochemical analysis of *T. costata* fruit extract revealed the presence of tannins, saponins, flavonoids, phenolic compounds, and reducing sugars, while terpenoids, steroids, alkaloids, and carbonyl compounds were absent (Table 1). The cytotoxicity analysis showed 100% mortality of brine shrimp nauplii at all

tested concentrations (12.5-200 mg/ml), indicating potent cytotoxic activity comparable to the positive control vincristine sulphate (Table 2).

Table 1: Phytochemical analysis of fruits of *T. costata* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	+ve
Saponin	+ve
Flavonoids	+ve
Terpenoids	-ve
Phenolic compounds	+ve
Reducing sugar	+ve
Steroids	-ve
Alkaloids	-ve
Carbonyl compounds	-ve

(+ve: Presence; -ve: Absence)

Table 2: Cytotoxicity analysis of fruits of *T. costata* using hydroethanolic extract

Extract	Concentration (in mg/ml)	Initial number of Nauplii	Number of deaths of Nauplii (After 1 hour)	Death rates (%)
Hydro-ethanolic extract	12.5	10	10	100
	25	10	10	100
	50	10	10	100
	100	10	10	100
	200	10	10	100
	3.5% Saline	10	0	0
	Vincristine sulphate	10	10	100

Kumar et al., (2017) studied about a lesser-known climber of Eastern Ghats i.e., *Gymnopetulum chinense*, which leaf extracts have significant antimicrobial activity against selected human pathogenic bacteria. Saradar et al., (2024) have reported in their study that *T. costata* fruits have been consumed as a vegetable and as

condiment. The plant has potential medicinal values for the treatment of ophthalmia, rheumatism, and tetanus.

CONCLUSION

In conclusion, present study demonstrates the presence of bioactive compounds in *T. costata* fruit extract and its potent cytotoxic activity, suggesting its potential as a source of therapeutic agents. Further research is warranted to isolate and characterize the bioactive compounds and explore their applications in pharmaceutical and medicinal fields.

REFERENCES

- Chakroborthy S, Dash PK, Kumari M, Ofoeze MA, Kumar S and Jena PK. (2017). Pragmatic traditional uses and correlation with secondary metabolites: Scrutiny of chemical composition on selected wild cucurbits of Odisha, India. Studium Press LLC, USA. 101-116.
- Devi RS, Satapathy KB, and Kumar S. (2023). Validation of tribal claims for formulation of future drugs through evaluation of ethnopharmacological values of *Ludwigia adscendens*. Medicinal Plants. 15(4): 691-697.
- Devi RS, Satapathy KB, Manjula BL, Sharma BP and Kumar S (2024). Evaluation of ethnopharmacological potential of *Oenanthe javanica* DC. Annals of Biology. 40(1): 135-139.
- Jena N, Rout S, Devi RS and Kumar S. (2024). Phytochemical and cytotoxicity analysis of fruits of *Zanthoxylum asiaticum* (L.) Appelhans, Groppo & J.Wen: A minor fruit plant of Odisha, India. e-planet. 22(1): 62-70.
- Kumar S and Tripathy PK. (2017). Wild cucurbits: source of traditional therapeutic systems & medicine. LAMBART Academic Publishing. Pp-102.
- Kumar S, Das G, Shin HS, Kumar P and Patra JK. (2017). Evaluation of medicinal values of *Gynopetalum chinense* (Lour.) Merr., a lesser-known cucurbit from Eastern Ghats of India. Brazilian Archives of Biology and Technology. 60: 1-10.
- Kumar S, Tripathy PK and Jena PK. (2012). Ethnobotany and bioactive compounds in leaf of *Bixa orellana* L. and its toxicity to *Artemia salina* L. Plant Science Research. 34(1&2): 93-96.
- Marndi S, Barik M and Kumar S. (2024). Phytochemical and cytotoxicity analysis of *Eulophia explanata* Lindl. (Tuber extracts). African Journal of Biological Sciences. 6(4): 2751-2756.

Sharma et al., (2025). Plants and Secondary Metabolites, Volume 7; ISBN: 978-81-984754-9-7

Saradar B, Dimri R, Rout S, Kumar S and Nichat AR. (2024). Phytochemical evaluation of fruits of *Trichosanthes costata* Blume: a medicinal cucurbit of India. In: *Medico Biowealth of India, Volume 17*. Ambika Prasad Research Foundation, India.

Tripathy PK, Kumar S and Jena PK. (2015). Comparison of antibacterial activities of some selected wild cucurbits collected from Similipal Biosphere Reserve. *Plant Science Research*. 37(1&2): 18-23.