

Chapter 2

Ruellia tuberosa L.: a medicinal plant of India

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ABSTRACT

Ruellia tuberosa L. is an herb belonging to the family Acanthaceae. Due to the presence of active chemical compounds such as alkaloids, flavonoids, triterpenoids, etc., it cures different ailments such as gonorrhea, eye diseases, diabetes, and bronchitis. It also attracts many pollinators and has significant economic value. Therefore, the present study highlights its pharmacological, ethnomedicinal, ecological, and economic importance.

Keywords: *Ruellia*, traditional knowledge, secondary metabolites, pharmacological uses

INTRODUCTION

Acanthaceae is a taxon of dicotyledonous flowering plants containing almost 250 genera and about 2500 species (Elgindi et al. 2015). The *Ruellia* genus, which comprises 250 species, is found in both tropical and temperate regions of both hemispheres. Most people use *Ruellia tuberosa* for ornamental purposes worldwide. Its origins can be traced back to tropical America and Southeast Asia, specifically Thailand, Peninsular Malaysia, and Java, as well as the tropics of India, Sri Lanka, and Africa (Chothani et al. 2020; Sharma et al. 2024). *Ruellia tuberosa* L. is an herb with tuberous roots. It belongs to the family Acanthaceae. It is

commonly known as the Mexican bluebell, a large bellflower. The flowering and fruiting period is from June to February. It is easily identifiable due to its striking funnel-shaped, violet-colored, 5-lobed corolla flower. It primarily inhabits moist and shady areas. It grows near the roadside, in grasslands, cultivated fields, and in xerophiles. It is widely distributed in Southeast Asia. It also attracts many pollinators such as butterflies and insects. Some butterflies, like the lemon pansy (*Junonia lemonias*) and mangrove buckeye (*Junonia genoveva*), pollinate *R. tuberosa* (Harinath et al. 2016). Apart from ecological significance, it also holds medicinal value, such as in diabetes, gonorrhea, urinary problems, and analgesics (Pandey and Singh 2018). Flowers of *R. tuberosa* are light bluish-purple due to the presence of the flavonoid pigment of anthocyanin, which is used as a natural dye in industries (Kampeerappun et al. 2010).

DESCRIPTION

It is a glabrous or glabrescent herb up to 30-40 cm, much branched from a rootstock of numerous fleshy tubers. Leaves elliptic-obovate, obovate-oblong or elliptic-oblong, entire or undulate-crenate; petiole 1-2.2 cm long. Flowers are blue and 3 cm long in axillary and terminal cymes; bracts and bracteoles are narrow. Calyx segments are long, setaceous, hairy, or glandular. Capsule linear, 2-2.8 cm. Fruits a pod with 7-8 seeds (Saxena and Brahmam 1995; Figure 1 & 2).

BIOACTIVE COMPOUNDS

It possesses bioactive compounds such as alkaloids, benzoxazinoids, flavonoids, lignans, phenolic compounds, saponins, tannins, triterpenoids, and sterols (Pandey and Singh 2018; Samy et al. 2015; Ariridran et al. 2011).

Table 1: Some bioactive compounds reported from the *R. tuberosa* and their probable utilization

Bioactive Components	Utilization	References
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Flavonoids	Antioxidants help reduce oxidative stress and have anti-inflammatory and anti-cancer potential.	Wagner et al. (1971) Teng et al. (2005) Lin et al. (2006) Chen et al. (2006) Xu et al. (2020)
Alkaloids	These are known for their analgesic (pain-relieving) and anti-inflammatory effects.	
Tannins	Possess astringent properties, which are beneficial for wound healing and treating infections.	
Saponins	Known for their immune-boosting properties and may help reduce cholesterol levels.	
Steroids	Exhibit anti-inflammatory and antimicrobial effects	
Phenolic acids	These have strong antioxidant properties, which may help protect against cellular damage	

These reported bioactive compounds are responsible for therapeutic uses. Details are listed in **Table 1**

ETHNOMEDICINAL USES

Researchers use the leaves to treat diabetes (**Xu et al. 2020**). Rajan et al. (2012) uses the roots to treat kidney diseases and whooping cough. Pandey and Singh (2018) use the leaves' decoction to treat gonorrhea and ear diseases. Karle et al. (2022) use it to treat abdominal pain. People use the dried and ground root to treat sore eyes. You can use the decoction of leaves to treat bronchitis. You apply a paste of leaves externally to treat skin diseases, wounds, and boils. People use the seeds to treat spermatorrhea and leucorrhoea. Chothani et al. (2010) use the whole plant to treat bladder diseases. Alam et al. (2009) use the root to reduce toxicity and heal urinary tract inflammation.

PHARMACOLOGICAL ACTIVITY

It possesses anti-diabetic, antipyretic, analgesic, antioxidant, anti-hypertensive, anti-ulcer, anti-microbial, antinociceptive, anti-inflammatory, and gastroprotective properties (Afzal et al. 2015; Samy et al. 2015; Pandey and Singh 2018). Flowers of *R. tuberosa* possess anticancer activity (Guha et al. 2024).



Figure 1: Habit and habitat of *R. tuberosa*



Figure 2: Flower of *R. tuberosa*

OTHER USES

The flower is used as a natural dye for textiles (Kampeerapappun et al. 2010). In Taiwan, it is used as an herbal drink (Arirudran et al. 2011).

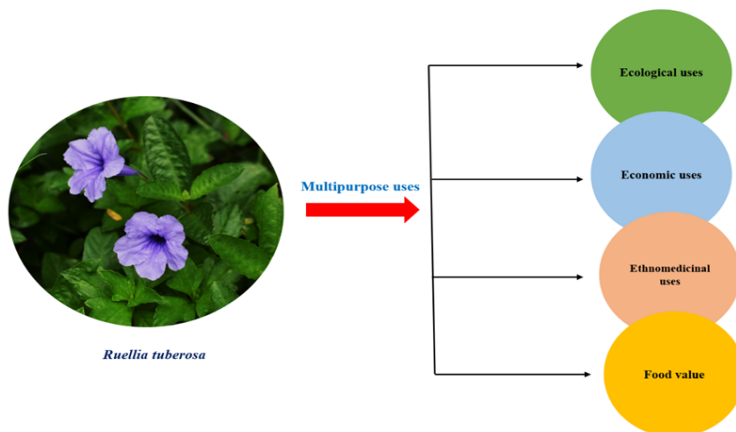


Figure 3: Uses of *R. tuberosa*

CONCLUSION

Ruellia tuberosa L. is a medicinal plant widely recognized for its bioactive components and potential therapeutic uses. Also known as *Cracker Plant* or *Minnieroot*, this herb is native to tropical areas and is often found in regions of Asia, South America, and Africa. Here's an overview of its bioactive components and medicinal uses (Figure 3). In traditional practices, *Ruellia tuberosa* is used as a tea or poultice, depending on the intended therapeutic effect. More research is ongoing to validate these medicinal uses and potentially expand its applications in modern medicine.

REFERENCES

- Afzal K, Uzair M, Chaudhary A, Ahmad A, Afzal S, and Saadullah M. (2015). Genus *Ruellia*: Pharmacological and phytochemical importance in ethnopharmacology. *Acta Poloniae Pharmaceutica*. 72(5): 821-827.
- Alam MA, Subhan N, Awal MA, Alam MS, Sarder M, Nahar L and Sarker SD. (2009). Antinociceptive and anti-inflammatory properties of *Ruellia tuberosa*. *Pharmaceutical Biology*. 47(3): 209-214.

- Arirudhan B, Saraswathy A, Krishnamurthy V. (2011). Pharmacognostic and preliminary phytochemical studies on *Ruellia tuberosa* L. (Whole plant). Pharmacognosy Journal. 3(22): 29-34.
- Chen FA, Wu AB, Shieh P, Kuo DH and Hsieh CY. (2006). Evaluation of the antioxidant activity of *Ruellia tuberosa*. Food Chem. 94: 14-18.
- Chothani DL, Patel MB, Mishra SH and Vaghasiya HU. (2010). Review on *Ruellia tuberosa* (Cracker plant). Pharmacognosy Journal. 2(12): 506-512.
- Elgindi MR, Hagag EG and Mohamed SE. (2015). Phytochemical and Biological studies of *Ruellia Brittoniana*. Research Journal of Pharmaceutical, Biological and Chemical. 6(2): 926- 933.
- Guha S, Talukdar D, Mandal GK, Mukherjee R, Ghosh S, Naskar R, Saha P, Murmu N, Das G. (2024). Crude extract of *Ruellia tuberosa* L. flower induces intracellular ROS, promotes DNA damage and apoptosis in triple-negative breast cancer cells. Journal of Ethnopharmacology. 332: 118389.
- Harinath P, Suryanarayana K, Sreekanth B, Ramana SPV. (2016). Life history, phenology, host plant selection and utilization in the lemon pancy *Junonia lemonias* in the Eastern Ghats of Southern Andhra Pradesh. Conference: AP Science Congress. Journal of Andhra Pradesh Akademi of Science
- Kampeerappun P, Phattararittigul T, Jitrong S and Kullachod D. (2010). Effect of Chitosan and Mordants on Dyeability of Cotton Fabrics with *Ruellia tuberosa* Linn. Chiang Mai Journal of Science. 38(1): 95-104.
- Karle B, Rote K, Kumari P, Gagotia R, Choudhari S, Manjula BL, and Kumar S. (2022). Common wild ethnomedicinal tuberous plants of Asia. Ecology Environment and Conservation. 28(Nov): S353-S361.
- Lin CF, Huang YL, Cheng LY, Sheu SJ and Chen CC. (2006). Bioactive flavonoids from *Ruellia tuberosa* J Chin Med. 17(3): 103-109.

- Pandey RP and Singh BK. (2018). Phytochemical studies on *Ruellia tuberosa*: a review. International Journal of Pharmacy and Biological Sciences. 8(3): 1190-1195.
- Rajan M, Kumar VK, Kumar PS, Swathi KR, Haritha S. (2012). Antidiabetic, antihyperlipidaemic and hepatoprotective activity of methanolic extract of *Ruellia tuberosa* Linn leaves in normal and alloxan induced diabetic. Journal of Chemical and Pharmaceutical Research. 4(6): 2860-2868.
- Samy MN, Sugimoto S, Matsunami K, Otsuka H, and Kamel MS. (2015). Chemical constituents and biological activities of Genus *Ruellia*. International Journal of Pharmacognosy. 2(6): 270-279.
- Saxenna HO and Brahmam M (1995). The Flora of Orissa. Orissa Forest Department Corporation Ltd & Regional Research Laboratory, Bhubaneswar, Odisha.
- Sharma A, Kumar A, Singh AK, Kumar KJ, Narasimhan B, Kumar P, (2024). Ethnomedicinal uses, phytochemistry, pharmacology and toxicology of *Ruellia tuberosa* L.: a review. Chem Biodivers. 21(8): e2024002292.
- Teng WY, Huang YL, Shen CC, Huang RL, Chung RS and Chen CC. (2005). Cytotoxic acridone alkaloids from the stem bark of *Citrus maxima*. J. Chin. Chem. Soc. 52: 1253-1255.
- Wagner H, Danninger H, Iyengar MA, Seligmann O, Farkas L, Subramanian SS and Nair AGR. (1971). Synthesis of glucuronides in the flavonoid-series 3. Isolation of apigenin-7-D-glucuronide from *Ruellia tuberosa* L. and its synthesis. Chem. Ber. 104: 2681-2687.
- Xu JH, Lo YM, Chang WC, Huang DW, Wu JSB, Jhang YY, Huang WC, Ko CY, and Shen SC. (2020). Identification of bioactive components from *Ruellia tuberosa* L. on improving glucose uptake in TNF- α – induced insulin – resistant Mouse FL83B hepatocytes. Evid Based Complement Alternat Med. 1: 6644253.