Chapter 7

Evaluation of medicinal values of bark of *Zanthoxylum rhetsa* (Roxb.) DC.: a less known tree species of India

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Abstract

Zanthoxylum rhetsa is a medicinal plant that has been used by traditional healers to treat several diseases for decades. Less work has been done on the bark of *Z. rhetsa* than on other parts of the plant to document the phytochemical and pharmacological values of the plant. However, the tribal claims have not been validated till now. Therefore, observing the declining population of the tree species, an attempt has been made to document the bioactive compounds present in the bark of *Z. rhetsa* through phytochemical screening using 3 different extracts (aqueous, ethanol, and acetone). The results revealed that tannins, saponins, flavonoids, and reducing sugars were present in different extracts of *Z. rhetsa*. The results indicate that the plant might have anti-diarrheal, anti-rheumatic, anti-diabetic, and anti-inflammatory properties among others due to the presence of the above-mentioned secondary metabolites.

Keywords: Indian Prickly Ash, bark, phytochemical screening, spices, antibacterial, bioactive compounds

Introduction

The Indian therapeutic system is the richest in the world. Several formulations in different treatment methods are formulated using Indian Ayurveda and Indian Traditional Knowledge of natural therapeutic agents (**Pandey et al., 2013**). Different plant parts are used for formulation in single or multiple forms to treat several types

of health problems. Usually leaves, fruits, seeds, seed oil, flowers, roots, tubers, rhizomes, and bark are used. Among the plant parts, less documentation on bark is available. It may be due to the loss of tree diversity and difficulty to identify wild trees in general. Keeping this in view, an attempt has been made to document the bioactive compounds available in the bark of *Zanthoxylum rhetsa* through qualitative phytochemical screening using three extracts. This tree is not commonly available and has a low population. The plant has been used to treat fever, dysentery, eczema, rheumatism, etc. by traditional healers (**Maduka and Ikpa, 2021**). *Z. rhetsa* is a tree with pale corky bark; stem and branches covered with conical prickles and sometimes a few small ones on the leaf-rachis, young prickles upward (**Fig. 1**). Leaves clustered towards the ends of the branchlets, imparipinnate, 20-60 cm long; petiole and rachis not winged; leaflets 4-16 pairs opposite or subopposite or alternate, oblong or lanceolate, 7-14 cm long, entire to remotely crenate, caudate, glabrous, with or without pellucid dots, base acute to cuneate (**Fig. 2**). Flowers yellow, 4-merous, unisexual, in terminal panicles with opposite branches. Seed blue-black. The flowering season is from March to May and the fruiting season is from July to October (**Saxena and Brahmam, 1994**).

Methodology

Collection of plant samples and preparation of extracts

The bark of *Z. rhetsa* was collected for experimental works from Rourkela Forest Division (RFD) of the Sundargarh district of Odisha state in April 2024. The senior author identified the plant. The Soxhlet extraction method was adopted for phytochemical analysis using different solvents (**Murmu et al., 2016**). Nine secondary metabolites were detected using standard methods (**Dwibedy et al., 2015**).

Qualitative phytochemical analysis

Test for tannin

About 1 ml of the filtrate of the bark extract was taken. About 3-5 drops of 0.1% lead acetate solution were added to the filtrate. The formation of a gelatinous precipitate confirmed the presence of tannin (**Kumar et al., 2013**).



Figure 1: Bark of *Zanthoxylum rhetsa*



Figure 2: Leaves of *Zanthoxylum rhetsa*

Test for saponin

About 1 ml of distilled water was added to 1 ml of the filtrate of the bark extract and shaken vigorously. The persistent froth formation after shaking confirmed the presence of saponin (**Kumar et al., 2017**).

Test for flavonoids

About 1 ml of the filtrate of the bark extract was taken and 2 ml of 2 % NaOH solution was added to it followed by H_2SO_4. The colour initially turned to an intense yellow colour with the addition of NaOH solution and later became colourless with sulphuric acid. This colour change confirmed the presence of flavonoids (**Sahoo et al., 2021**).

Test for terpenoids

About 2 ml of the filtrate of the bark extract was added with 6 drops of chloroform and kept in the water bath for a few minutes. Then 6 drops of concentrated H_2SO_4

were added. The appearance of a reddish-brown interface confirmed the presence of terpenoids (**Aradhana et al., 2022**).

Test for phenolic compounds

About 1 ml of the filtrate of the bark extract was taken. A few drops of 5% Ferric chloride solution were added to the filtrate. The appearance of bluish-black colour provided a positive result for the phenolic compounds (**Singh et al., 2022**).

Test for reducing sugars

About 1 ml of the filtrate of the bark extract was taken and 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 (**Kumar et al., 2012**).

Test for steroids

1 ml of chloroform and 1 ml of concentrated sulphuric acid were added to 1 ml of the filtrate of the bark extract. The appearance of upper red and lower yellow with green fluorescence provided a positive result for the presence of steroids (**Marndi et al., 2024**).

Test for alkaloids

About 1 ml of the filtrate of the bark extract was taken and 3 to 4 drops of Dragendroff's reagent were added. The formation of a reddish-brown precipitate confirmed the presence of alkaloids (**Devi et al., 2023**).

Test for carbonyl compounds

About 1 ml of the filtrate of the bark extract was taken and 3 to 4 drops of 2,4-Di-nitrophenylhydrazine reagent were added. The formation of yellow crystals confirmed the presence of carbonyl compounds (**Verma et al., 2024**).

Results and discussion

Phytochemical screening revealed that the aqueous extract of the bark of *Z. rhetsa* showed the presence of only saponins. It was noticed that tannins, flavonoids, and

reducing sugars were detected in ethanol and acetone extracts of the bark of *Z. rhetsa* (**Table 1**).

Table 1: Phytochemical screening of secondary metabolites using different extracts of bark of *Z. rhetsa*

Bioactive compounds	Aqueous	Ethanol	Acetone
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)

Researchers have reported the food value and pharmacological potential of *Z. rhetsa* in treating inflammation, pain, hypertension, and brain diseases (**Okagu et al., 2021**). Several works on the fruits of this plant have been done and are associated with treating diabetes, diarrhoea, microbial diseases, toothache, balding, etc. due to the presence of essential oils, and several bioactive phytochemicals (**Yaipharembi et al., 2022**). Some works on the bark of *Z. rhetsa* were done to document the bioactive compounds present in the bark of the plant to treat many diseases like diabetes, rheumatism, diarrhoea, etc., and have anti-cancer properties (**Santhanam et al., 2016**). However, from the above-mentioned works of researchers, it can be considered that less work has been done on the bark of *Z. rhetsa* compared to the fruits of the plant.

Conclusion

The present study reveals the presence of tannins, saponins, flavonoids, and reducing sugars in the bark of *Z. rhetsa* which indicates to the medicinal and pharmacological potential of the plant. The plant has antioxidant, anti-inflammatory, anti-cancer, anti-diarrheal, anti-diabetic, anti-microbial, and anti-rheumatic activities which may be due to the presence of flavonoids, saponins, and tannins. The study

recommends the bark of *Z. rhetsa* in future drug formulations for its medicinal potential.

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