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Research Article



Flavonoid Bioactivities in *Thespesia populnea*: A Focus on Rutin

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Abstract

Rutin, a dietary flavonoid glycoside is present in various vegetables, fruits, plant-based foods and various ethnomedicinal herbs. The chemical nature of rutin is flavonol-type polyphenol. It is having various therapeutic properties such as anti-oxidant, anti-inflammatory, anti-bacterial, anti-microbial, anti-carcinogenic and various other properties. The compound rutin is eluted from the bark of *Thespesia populnea* (L.) Sol. ex Corrêa by using HPLC as extraction technique. It is also known as vitamin P or rutoside. Rutin is also considered as a glycoside of quercetin. The main motive behind opting the medicinal herb *Thespesia populnea* for this study is their phytochemical profiles (especially flavonoids such as Rutin, Quercetin and Kaempferol) which are collectively known for their anti-inflammatory and anti-oxidant property which can be used to treat Asthama. Various other studies on rutin show protective effects against skin cancer, gastrointestinal diseases, and diabetes, neurodegenerative disorders and cardiovascular diseases.

INTRODUCTION

A large tree that grows in tropical regions and coastal forests in India, *Thespesia populnea* sol. ex. correa (family Malvaceae) is also grown in gardens. Every part of the plant is utilized in conventional medicine. Scabies, psoriasis, eczema, ringworm, and guinea worm are among the cutaneous infections that can be treated with the bark, leaves, flowers, and fruits. The bark's decoction is frequently used to treat liver, asthma and skin conditions. A bark and capsule compound oil helps with gonorrhoea and urethritis. The fruits, bark, and root were used to treat hemorrhoids, cholera, and dysentery. As a part of traditional medicine, leaves and bark of the tree will still be used to create oil

which is used to treat fracture wounds and serves as an anti-inflammatory poultice to be used on ulcer and boils.

Thespesia populnea

Kingdom : Plantae

Division : Magnoliophyta

Class : Magnoliopsida

Order : Malvales

Family: Malvaceae

Genus: *Thespesia*

Species : *Thespesia populnea* L.

The compound Rutin, also known as Vitamin P because of its capacity to make capillaries stronger and less permeable, a characteristic first discovered in the 1930s by Albert Szent-Györgyi while studying the medicinal actions of plant extracts on capillary fragility. Although not a vitamin, this

bioflavonoid was dubbed a "vitamin" for its "P-factor" action "P" was a compliment to the plant extracts as well as to Hungarian "paprika" (red pepper) from which some of the first extracts were derived, according to some references, although others state it represents 'permeability'.

Fig .1. *Thespesia populnea* (L.) Sol. Ex Corrêa Tree



Fig.2. *Thespesia populnea* Bark Sample



Rutin is also considered as a glycoside of quercetin. Rutin is having various therapeutic properties such as anti-oxidant, anti-inflammatory, anti-bacterial, anti- microbial, anti-carcinogenic and various other properties. Previous study on rutin shows protective effects against skin cancer, gastrointestinal diseases, and diabetes, neurodegenerative disorders and cardiovascular diseases (Hosseinzadeh & Nassiri-Asl, 2014). The present study is an effort to show quantitative estimation of Rutin from *Thespesia populnea* and to study it's anti inflammatory and anti-oxidant properties which can be helpful in treating Asthama patient.

II. Geographical Distribution of the Plant

Thespesia populnea (L.) Sol. ex Corrêa is native to the tropical and subtropical coastlines of the Old World, and its natural range encompasses Africa, tropical Asia, and northern Australia. It is abundant, producing dense thickets along the coastline and mangrove, and is also extensively naturalized elsewhere.

III. Material and Methodology

Plant Material: Bark of *Thespesia populnea*, shade-dried and powdered in mortar and pestle, Standard Rutin Hydrate, Methanol (HPLC grade), Milli-Q water or HPLC-grade water, *Thespesia populnea* bark powder, Ultrasonicator, Syringe filters (0.45 µm), Micropipettes, volumetric flasks, vials, analytical balance, centrifuge tubes, etc.

A. Instrumentation

HPLC System: With Diode Array Detector (DAD), Detector Wavelength: 360 nm, Column: C18 reverse-phase (250 mm × 4.6 mm, 5 µm), Software: ChemStation or equivalent.

B. Chromatographic Conditions

Parameter	Value
Column	C18 (Reverse Phase)
Mobile Phase	Methanol: Water (approx. 60:40 v/v)
Flow Rate	1.0 mL/min
Detection Wavelength	360 nm
Injection Volume	20 µL
Run Time	10 minutes
Column Temperature	Ambient

C. Preparation of Standard Solution:-

A standard stock solution of Rutin was prepared by dissolving 10 mg of Rutin hydrate in 10 mL of

methanol to make a 1000 ppm solution. From this, a 10-ppm working solution was prepared by diluting 1 mL of the stock to 100 mL with methanol. The solution was filtered through a 0.45 µm syringe filter before injection.

D. Sample Preparation using Ultrasonication:-

i. Extraction

A total of 1.0 g of *Thespesia populnea* bark powder was weighed and transferred into a conical flask. To this, 20 mL of methanol was added. The mixture was subjected to ultrasonication for 30 minutes at room temperature to aid in the extraction of Rutin.

ii. Filtration

After sonication, the extract was allowed to cool and was filtered using Whatman filter paper, followed by filtration through a 0.45 µm syringe filter. The filtrate was then transferred to HPLC vials for analysis.

E. HPLC Analysis

Both the standard and sample solutions were injected in 20 µL volumes under identical chromatographic conditions. The retention time and peak areas were recorded. Rutin was identified in the sample by matching its retention time with that of the standard (approximately 6.04 minutes).

V. Calculations

The amount of Rutin in the sample was calculated using the external standard method:

Rutin concentration (µg/mL) = $\frac{\text{Area}_{\text{sample}}}{\text{Area}_{\text{standard}}} \times \text{Concentration}_{\text{standard}}$

Rutin concentration (µg/mL) = $\frac{(22.541)}{597.019} \times 10 = 0.378 \text{ µg/mL}$

VI. Result

The concentration of Rutin in the prepared methanolic extract of *Thespesia populnea* bark was found to be approximately 0.378 µg/mL.

VII. Discussion

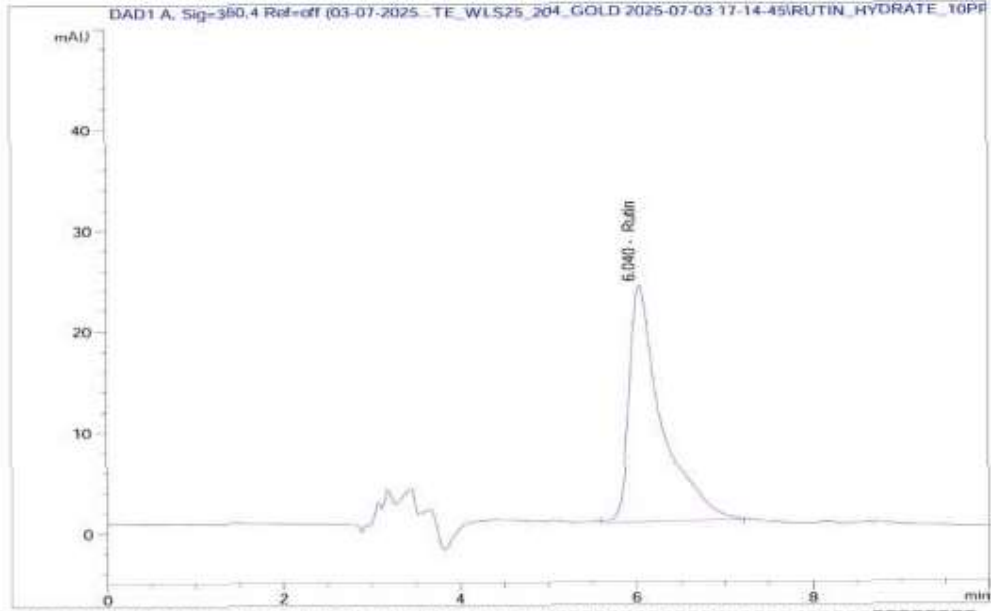
This is the first time that Rutin is reported in the bark of *Thespesia populnea* (L.) Sol. Ex Corrêa, as majority of previous study on the plant reveals that ample amount of Rutin is found only in leaves of *Thespesia populnea* (Rangani et al., 2019). As this might be because of the organic compounds from leaves travels through the plant's vascular system, specifically via the phloem tissues into the bark of the plant. For therapeutic purposes Rutin has been found to have potential for the treatment of metabolic disorders, neurological diseases, cancer, and cardiovascular diseases owing to its antioxidant, anti-inflammatory, and neuroprotective activities. A research study on the compound Rutin shows anti-asthmatic effects in an ovalbumin-induced asthmatic mouse model (Lv, H.-Y., Chen, J., & Wang, T. 2017). The present research work is an honest attempt to show quantitative estimation of Rutin by HPLC and along with Rutin, antioxidant and anti-inflammatory properties of other flavonoid compounds present in bark of *Thespesia populnea* i.e. Rutin, Quercetin and Kaempferol. Although further research and trials are required to study the effect of anti-inflammatory and antioxidant properties present in these organic compounds on asthma patients. Therapeutic applications are also for various ailments such as varicose veins, internal hemorrhage, may reduce blood pressure, inflammation and can help maintain skin health by preventing UV damage and stimulating the synthesis of collagen.

I. Chromatograms

Data File : C:\CHEM32\1\DATA\03-07-2025_RUTIN_HYDTE_WLS25_204_GOLD_2025->
 Sample Name: Rutin_Hydrate_10ppm_Meoh 1

Injection Date : Thu. 3. Jul. 2025 Seq Line : 2
 Sample Name : Rutin_Hydrate_10ppm_Meoh Location : Vial 2
 Acq Operator : Inj. No. : 1
 Inj. Vol. : 20 µl

Acq. Method : C:\Chem32\1\DATA\03-07-2025_RUTIN_HYDTE_WLS25_204_GO->
 Analysis Method : C:\CHEM32\1\METHODS\RUTIN_FINAL_GOLD.M
 Last Changed : Tue. 15. Jul. 2025, 04:54:51 pm
 (modified after loading)



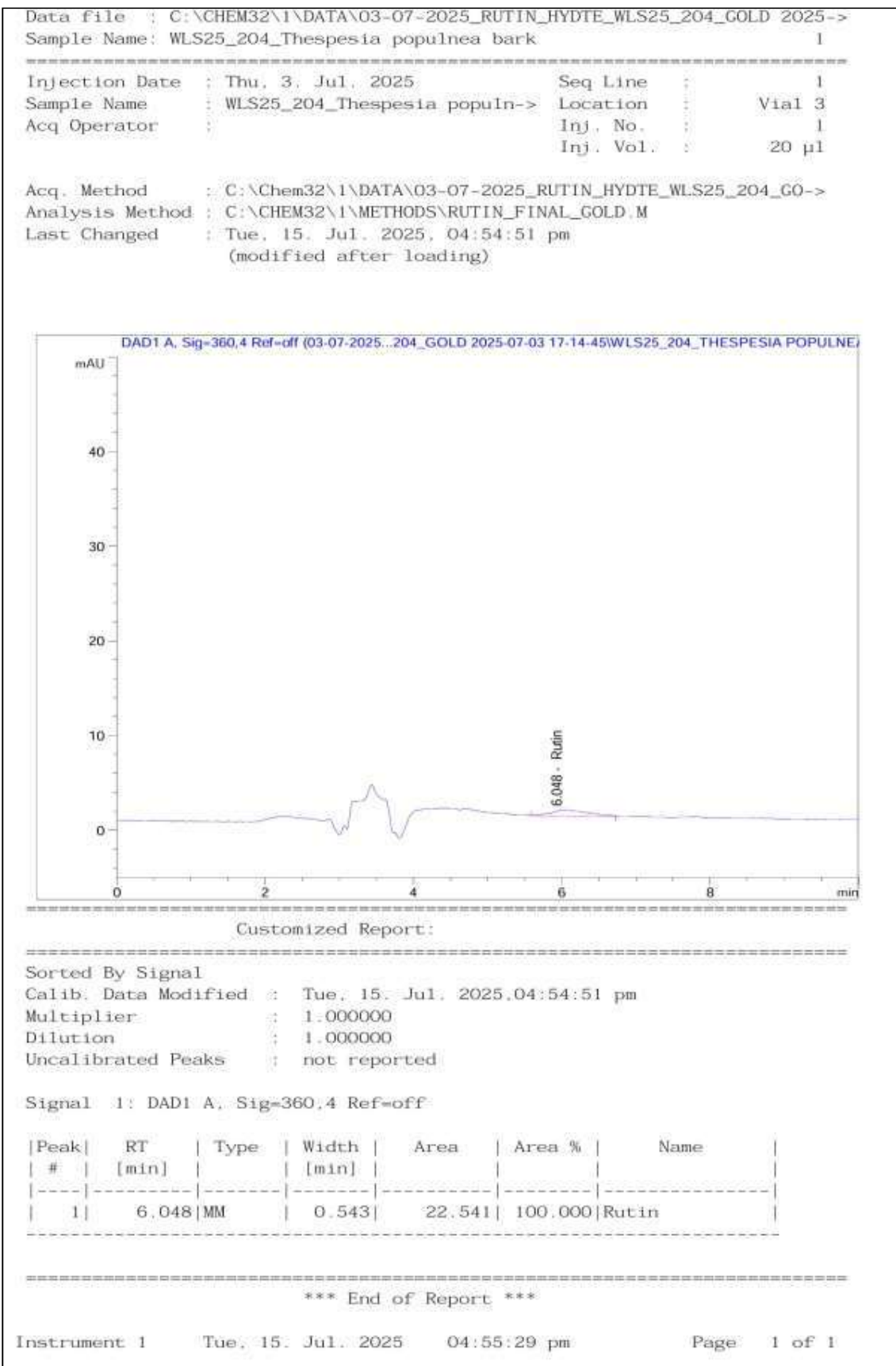
Customized Report:

Sorted By Signal
 Calib. Data Modified : Tue. 15. Jul. 2025, 04:54:51 pm
 Multiplier : 1.000000
 Dilution : 1.000000
 Uncalibrated Peaks : not reported

Signal 1: DAD1 A, Sig=360.4 Ref=off

Peak #	RT [min]	Type	Width [min]	Area	Area %	Name
1	6.040	MM	0.425	597.019	100.000	Rutin

*** End of Report ***



VIII. Conclusion

The main motive behind opting the medicinal herb *Thespesia populnea* for this study is its phytochemical profile (especially flavonoids such as Rutin, Quercetin and Kaempferol) which are known for their anti-inflammatory and anti-oxidant property which can be used to treat Asthama. Although Rutin is found in ample amount in leaves of *Thespesia populnea* but decoction of bark of the plant is made and given to asthma patients because of the broader phytochemical profile of the bark, not solely Rutin but many other flavonoid compounds such as Rutin, Quercetin and Kaempferol are present in the bark and they collectively show anti-inflammatory and anti-oxidant properties which can be helpful in treating asthma. Rutin also shows various therapeutic properties such as anti-oxidant, anti-inflammatory, anti-bacterial, anti-microbial, anti-carcinogenic and various other properties. Secondary metabolites can move from leaves to the bark through the plant's vascular tissues, specifically the phloem. These mobile compounds, which contain different chemical defense substances, are sent to the bark to serve as a defense against pests and microbes. This process helps the plant survive in the long term. The previous study on rutin shows protective effects against skin cancer, gastrointestinal diseases, and diabetes, neurodegenerative disorders and cardiovascular diseases (María José Frutos et al., 1946; Hosseinzadeh & Nassiri-Asl, 2014). The methodology opted for this research has successfully enabled the detection and quantification of Rutin for the first time in *Thespesia populnea* bark extract using ultrasonication-assisted HPLC analysis. Rutin was identified by retention time and quantified through comparison with a standard.

IX. Acknowledgment

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X. Conflict of Interest

The authors declare that there are no conflicts of interest.

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