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Comparative Analysis of the Pericarp Extracts of Garcinia Gummi-Gutta (L.) Robson and Garcinia Mangostana L.,

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Abstract
The present study examines the phytochemical profile of Garcinia gummi-gutta (L.) Robson and Garcinia mangostana L., collected from Chavakkad, Guruvayur, Thrissur district, Kerala, India (10°35'44.9556" N, 76°1'58.5984" E; elevation 12 m). The pericarp of both species was shade-dried, powdered, and extracted using acetone, ethanol, and aqueous solvents for qualitative phytochemical analysis. The extracts were examined for the presence of bioactive constituents including carbohydrates, proteins, tannins, flavonoids, reducing sugars, coumarins, phenols, and sterols. Comparative evaluation unveiled that G. gummi-gutta contained plenty of secondary metabolites, specifically in the acetone extract, followed by ethanol and aqueous extracts. In contrast, G. mangostana exhibits relatively lower amounts of phytocompounds, with moderate levels in the aqueous extract. The analysis highlight acetone as the most effective solvent for phytochemical extraction in Garcinia species and underscore the higher phytochemical richness of G. gummi-gutta compared to G. mangostana. The results imply significant pharmacological potential, warranting further spectroscopic and chromatographic studies to isolate and characterize the bioactive compounds.
Keywords: *Phytochemical Analysis, Garcinia gummi-gutta (L.) Robson, Garcinia mangostana L.*

1. Introduction
The family Clusiaceae is recognized as a rich source of secondary metabolites, particularly xanthones, coumarins, biflavonoids, and benzophenones, which are synthesized largely as defense compounds (Acuña, 2009). Within this family, the genus Garcinia represents one of the most important groups of fruit-bearing plants, comprising approximately 200 species distributed across tropical Asia and Africa. In India, 35 species of Garcinia have been reported, of which 17 are endemic—seven restricted to the Western Ghats, six to the Andaman and Nicobar Islands, and four to the northeastern states (Arora, 1981; George, 1988). Members of the genus Garcinia are evergreen trees or shrubs that have long been valued for their ethnomedicinal and nutritional applications. They yield edible fruits, culinary spices, resins, seed fats, and other products of cultural and economic importance (Anonymous, 2002). Phytochemical analyses of several Garcinia species have revealed the presence of diverse bioactive compounds, including hydroxycitric acid (HCA), flavonoids, terpenes, xanthones, benzophenones, biflavonoids, alkaloids, tannins, phenols, and saponins (Anilkumar et al., 2023). These constituents have been associated with wide-ranging pharmacological activities such as antimicrobial, antioxidant, anticancer, anti-obesity, and anti-inflammatory properties (Tripathi, 2021). Among the various species, two are of particular significance: Garcinia gummi-gutta (L.) Robson, commonly known as Malabar tamarind or Kachampuli, and Garcinia mangostana L., popularly referred to as the Mangosteen or the Queen of Fruits. G. gummi-gutta is native to the Western Ghats and adjacent regions, where its acidic fruits are traditionally dried and used as condiments in place of tamarind or lime. The species is valued for its high HCA content, which inhibits lipogenesis and has been implicated in the

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Page No: 3084 - 3091

regulation of obesity, as well as for its garcinol derivatives with potent anti-inflammatory and antimicrobial activities (Tripathi, 2021; Anilkumar et al., 2023). On the other hand, G. mangostana is native to Southeast Asia but cultivated in humid tropical zones of India, particularly in Kerala, Karnataka, and Tamil Nadu. It is esteemed both as a high-value fruit crop and as a source of traditional medicines. Historical records indicate the use of mangosteen pericarp extracts for the treatment of gastrointestinal disorders, skin infections, and inflammatory diseases (Descourtilz et al., 1821; Mahabusarakam et al., 1987; Pierce, 2003). Modern pharmacological studies have confirmed its richness in prenylated xanthones, which exhibit strong antioxidant, neuroprotective, and immunomodulatory properties, with potential applications in the management of metabolic, inflammatory, and psychiatric disorders (Pedraza et al., 2008; Ashton et al., 2019). Given their ethnomedicinal heritage, phytochemical diversity, and pharmacological potential, G. gummi-gutta and G. mangostana have attracted considerable scientific and industrial interest. The present study aims to provide a comparative account of these two species, focusing on their traditional uses, phytochemical constituents, and pharmacological activities, thereby highlighting their role as promising resources for drug discovery and therapeutic development. Garcinia gummi-gutta(L.)Robson and Garcinia mangostana L. were the selected species for the present study. Taxonomic identification of the plants was carried out by classical method. Pericarp of Garcinia gummi-gutta, Garcia mangostana collected and dried under light.shade after drying it powdered.

2. Powder Analysis

Shade dried and coarsely powdered fruit were used for powder analysis which included both macro and micro characterization and behaviour of the dry powder with different chemical reagent or acids. Behaviour of the powder with dry powder was observed by treating the powder with different reagent and colour changes were noticed under normal day light. Acids or chemical reagent are: Con.H2SO4, Con. Hel, Glacial acetic acid, iodine solution, Aqu. Ferric chloride, aqua NaOH solution (5%), aqua KOH solution (5%). Ammonium solution, distilled water, acetone, Ethyl acetate.

3. Determination of pH Value

Fine powder of pericarp weigh out 1g and dissolved in 10% solution. The pH of the liquid was determined with the help of an electronic pH meter.

4. Phytochemical studies

Preliminary phytochemical analysis involves the identification of the bioactive
components present in the samples by using a standard method.

5. Extraction

80 gm of powdered pericarp of two plants were sequentially extracted in solvents with increasing polarity viz., acetone, ethanol and water separately. A soxhlet apparatus was used for extracting fruit pericarp for 48 hrs at 31oC until the complete extraction of materials. The solvent was removed using a rotary evaporator unit to produce a concentrated extract in order to reduce the volume into 50 ml. Extracts were filtered using Whatman No.1 filter paper. The concentrated extract was stored in pre-weighed screw capped bottle and kept in refrigerator at 40oC.

6. Preliminary Phytochemical studies

Phytochemical screening of the Acetone, Ethanol, and Aqueous extracts of pericarp of the selected plants were carried out according to the methods prescribed by Peach and Tracey (1956), Gibbs (1974), Harborne (1984), Trease and Evans (1985), Edeoga et al., (2005), Khandewal (2008), Kokate et al., (2001), Sofowara (2009), Tiwari et al., (2014), etc. The bioactive secondary metabolites such as carbohydrates, flavonoids, steroids, terpenoids, saponins, proteins, phenols, tannin, glycosides, resins, coumarins and quinones were screened. The procedures and the chemical reagents used for phytochemical tests are discussed below.

6.1. Test for Flavanoids

Shinoda Test: - 2 ml extract was treated with few fragments of magnesium metal
turnings followed by drop wise addition of conc. HCl. Formation of crimson or green to blue colour indicated the presence of flavonoids (Kokate et al., 2001).

6.2. Test for Coumarins

A little amount of extract was dissolved in methanol

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Page No: 3084 - 3091

or ethanol and 3-4 ml alcohol KOH or NaOH was formation of a yellow colour which disappears on addition on of Con.Hcl indicates the presence of coumarins (Patil et al., 2012).

6.3. Test for tannins

Ferric chloride test: To a little amount of the extract. A few drop of ferric chloride were added green colour reveals the presence of tannin.

6.4. Detection of steroids / terpenoids

Salkowski test: A few drop of Con. H_2SO4 were added to a little amount of the extract and was shaken for a few minutes. The development of red brown colour indicates the presence of sterols (Watal et al., 2014).

6.5. Test for Saponins

Foam Test: - Small amount of powdered extract was shaken with 2 ml of distilled water. Formation of persistent foam for ten minutes indicated the presence of saponins (Tiwari et al., 2014).

6.6. Test for Quinines

To the test sample few drops of sodium hydroxide were added formation of blue, green or red colour indicates the presence of quinines.

6.7. Test for Anthraquinones

The extract was shaken with aqueous ammonia or caustic soda. Formation of pink, red or violet colour in the aqueous layer indicates the presence of anthraquinones.

6.8. Test for phenols

A few drop of alcohol ferric chloric solution were added to the sample dissolved in alcohol or water. Formation of violet, bluish, green or bluish black colour indicates the presence of phenol.

6.9. Test for resin

A little amount of extract was dissolved in 5ml of distilled water and petroleum ether to it.Respectively The development of white turbidity indicates the presence of resin.

6.10. Test for detection of glycosides / reducing sugar

Benedicts test: The extract was mixed with Benedict's reagent in equal amount and the mixed was heated for 2 minutes. The appearance of brown to red colour indicates the presence of Glycoside.

6.11. Test for protein

- **Xantho protein test:** A small amount of the reagent was of white or yellow precipitate reveal the presence of protein.
- **Biuret test:** A small amount of extract was added to 0.5ml of 4% sodium hydroxide

Solution the development of violet pink indicates the presence of protein.

6.12. Test for carbohydrates

Molischi's test: 100mg of the substance was dissolved in Iml water and 2 drop of 1% alcoholic solution of alpha naphthol was added to it. Iml of concentrated sulphuric acid was added along the side of the test tube. So that it formed a heavy layer at the bottom. A deep violet ring at the liquid junction indicated the presence of carbohydrates.

7. Results and Discussion

Figure 1 Species : Garcinia gummi-gutta(L.)Robson and Garcinia mangostana L.

7.1. Collection of the Plant Material

Garcinia gummi-gutta(L.)Robson and Garcinia mangostana L. were collected from Chavakkad, Guruvayur, Thrissur district, Kerala. Guruvayur is a town in India, with GPS coordinates of 10° 35' 44.9556" N and 76° 1' 58.5984" E and an elevation of 12 meters height that is e qual to 39 feet.

- **Extraction:** The pericarp of fruits was shade dried and powdered using mechanical grinder. The powder sample was stored in an air tight container and the portion of the powder was taken in test tube and solvents

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Page No: 3084 - 3091

(Acetone, Ethanol, and Aqueous) were added to it such that plant powder soaked in it and shaken well.

Figure 2 Powdering Procedure

The solution then filtered with the help of muslin cloth and filtered extract was taken and used for phytochemical analysis.

Table1 Treatment of fruit powder with different reagent

Reagents	Garicinia Gummi – Gutta Pericarp Powder	Garcinia Mangostana Pericarp Powder
Con.H2SO4	Brown	Black
Con.Hcl	No colour change	No colour change
Acetic acid	No colour change	No colour change
Iodine solution	Red	Red
Aqueous ferric chloride	No colour change	Black
Aqueous NaOH	No colour change	No colour change
KOH	No colour change	No colour change
Ammonium solution	No colour change	No colour change
Distilled water	No colour change	No colour change

Table 2 Phytochemical screening of G. gummi-gutta & G. mangostana with acetone.

Ti	Test	Reagent	G. gummi - gutta	G.mangostana
1	Flavanoids	Alkaline reagent	+ve	-ve
2	Coumarins	Methanol +KOH	-ve	-ve
3	Tannins	Ferric chloride	+ve	+ve
4	Steroids	Con. Sulphuric acid	+ve	-ve
5	Saponins	Water+ shakes	-ve	-ve
6	Quinines	NaOH	+ve	+ve
7	Anthraquinones	Aqueous ammonia	-ve	-ve
8	Phenols	Alcoholic ferric chloride	+ve	+ve
9	Resin	Water+ petroleum ether	-ve	-ve
10	Reducing sugar	Benedict's reagent	+ve	-ve
11	Protein	Con. Nitric acid+4%NAOH+1%cuso4	+ve	-ve
12	Carbohydrates	Water+alcoholic alpha naphthol+ con. Sulphuric acid	+ve	-ve

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Volume: 03
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Page No: 3084 - 3091

Table 3 Phytochemical screening of G.gummi-gutta & G.mangostana with ethanol

No	Test	Reagent	G. gummi gutta	G.mangostana
1	Flavanoids	Alkaline reagent	-ve	-ve
2	Coumarins	Methanol + KOH	+ve	-ve
3	Tannins	Ferric chloride	+ve	+ve
4	Steroids	Con. Sulphuric acid	+ve	-ve
5	Saponins	Water + shakes	-ve	-ve
6	Quinines	NaOH	-ve	+ve
7	Anthraquinones	Aqueous ammonia	-ve	-ve
8	Phenols	Alcoholic ferric chloride	+ve	+ve
9	Resin	Water + petroleum ether	-ve	-ve
10	Reducing sugar	Benedict's reagent	-ve	-ve
11	Proteins	Con. Nitric acid +4%NaOH +1%CuSO4	+ve	-ve
12	Carbohydrates	Water +alcoholic alpha naphthol+con.sulphuric acid	+ve	-ve

Table 4 Phytochemical screening of G. gummi-gutta & G.mangostana with water

No	Test	Reagent	G. gummi-gutta	G. mangostana
1	Flavnoids	Alkaline reagent	+ve	-ve
2	Coumarins	Methanol+KOH	-ve	-ve
3	Tannins	Ferric chloride	+ve	+ve
4	Steroids	Con.sulpuric acid	-ve	+ve
5	Saponins	Water+shakes	-ve	-ve
6	Quinines	NaOH	-ve	+ve
7	Anthraquinones	Aqueous ammonia	-ve	-ve
8	Phenols	Alcoholiic ferric chloride	+ve	+ve
9	Resin	Water+ petroleum ether	-ve	-ve
10	Reducing sugar	Benedict’s reagent	+ve	-ve
11	Protein	Con.nitric acid+4%NAOH+1%CUSO4	-ve	-ve
12	Carbohydrates	Water+alcoholic alpha naphthol+con. Sulphuric acid	+ve	-ve

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Issue: 10 October 2025
Page No: 3084 - 3091

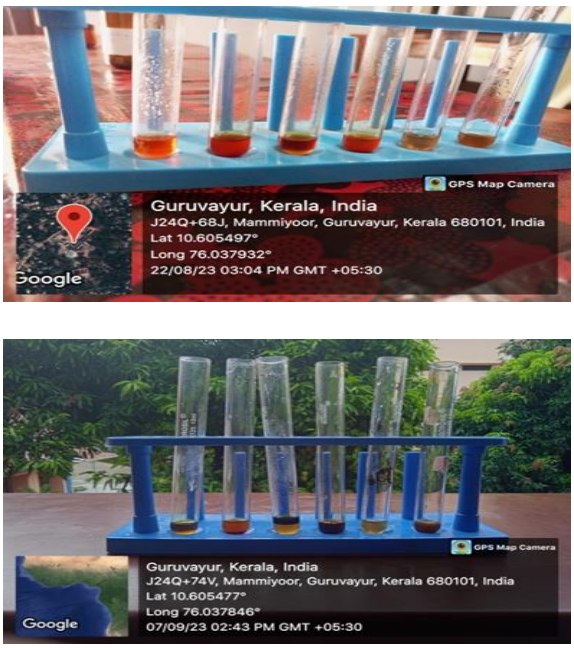

Figure 3 Result

8. Phytochemical Analysis

Phytochemicals are the chemicals produced by various parts of the plants and have been reported as responsible for various pharmacological activities. Qualitative Phytochemical screening helps to portray a variety of chemical compounds produced by plants and quantification of those metabolites will help to extract, purify and identify the phytocompounds used in pharmacology (Santhi and Sengottuvel, 2016). The selected plants were substantially screened to detect the presence or absence of bioactive components. The results of the evaluation of various phyto-constituents of acetone, ethanolic, and aqueous extracts of pericarp of the plants were graded based on the intensity of the coloured reaction product of the tests. Qualitative analysis of acetone, ethanolic, and aqueous extracts of pericarp of Garcinia mangostana L. revealed the presence of carbohydrates, protein, tannin, flavonoids, reducing sugars, coumarins, phenol and sterols in lesser amount when compared to the other species. In case of G. mangostana L. the aqueous extract comprises the moderate amount of secondary metabolites (Table 3). The comparative analysis of these two species revealed that the presence of phytocompounds are more in G. gummi-gutta(L.)Robson. The acetone extract of pericarp of G. gummi-gutta(L.)Robson showed high amount of secondary metabolites than the other extracts. This study revealed high amount of secondary metabolites extracted using acetone solvent followed by ethanol and least in aqueous extractives. These tests also facilitate the quantitative estimation and qualitative separation of pharmacologically active chemical compounds. However, it is necessary to carry out further advanced spectroscopic studies in order to elucidate the structure of these compounds.

Conclusion

Herbal plants are used for medicinal and therapeutic purposes like curing of diseases and improving human health. The World Health Organization (WHO) reported that 4 billion people (80% of the world's population) use herbal medicines at least for some aspects of primary healthcare. Genus Garcinia is widely known for its medicinal effects and has been used in Indian traditional system of medicine. Different phytochemicals are obtained from the extracts. Alkaloids are used in pharmacological activities, antimalarial, antiasthma anticancer, analgesic, In agriculture field we can used as a insecticide. Coumarins are obtained from Garcinia gummi-gutta pericarp extract. It is used as anticoagulant, flavorant in soap, rubber products and in tobaco industry, treatment of asthma, lymphedema, skin disease like psoriasis, eczem. Steroids are obtained from Garcinia gummi-gutta and Garcinia mangostena used in controlling inflammation in chronic disease, treatment of diarrhoea, fever. Quinine present in Garcinia mangostena is used as to medication to treat malaria. Diarrhea, urinary tract infections (UTIs), gonorrhea, thrush, tuberculosis, menstrual disorders, cancer, osteoarthritis, and an intestinal infection called dysentery. It is also used for stimulating the immune system and improving mental health. Tannin active substances contained in mangosteen pericarp have antibacterial properties by coagulating or agglomerating bacterial protoplasms to form stable bonds with bacterial proteins. Resin present in Garcinia gummi gutta, it protected the plant from insect and pathogens. Protein are present in Garcinia gummi gutta, it is essential nutrients for the human body. Carbohydrates are present in garcinia gummy gutta, they are the hydrates of carbon, which contain

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Page No: 3084 - 3091

hydrogen &oxygen 2:1 ratio. Main function of carbohydrates is providing energy& regulation of blood glucose. Mangosteen pericarp is a rich source of phenolic compounds such as xanthones, condensed tannins and anthocyanins. They are related with defending system against pathogen and stress.Based on the available data, there are 750 species of Garcinia were reported. Out of these, Garcinia gummi-gutta(L.)Robson and Garcinia mangostana L. was selected for the present study. These species was collected from the Chavakkad,Thrissur and identified by classical method. Pericarp of thr fruits were selected for powder and phytochemical analysis.

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