

## A narrative review of the nutritional, medicinal, and ethnopharmacological properties of *Grewia flava* DC. (Malvaceae family).

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### Abstract

*Grewia flava* DC., commonly known as “velvet raisin” in southern Africa, is a wild plant species with high socio-economic potential. Its fruits are edible, and various organs of *G. flava* are used in traditional medicine. This study was undertaken aimed at reviewing nutritional, medicinal, and ethnopharmacological properties of *G. flava*. This study is based on literature obtained from scientific databases such as SpringerLink, PubMed, Scopus, Web of Science, Google Scholar, ScienceDirect, and SciELO, as well as literature obtained from pre-electronic sources such as books, book chapters, and other scientific publications obtained from the university library. This research showed that the fruit flesh and skin of *G. flava* are a good source of energy, classic nutrients, and minerals. The bark, fruits, leaves, roots, stems, and stem bark of *G. flava* are used as charm and ethnoveterinary medicine, and traditional medicine for sexually transmitted infections, burns, cough, diarrhoea, kidney problems, stomach problems, and tuberculosis. The species is characterized by alkaloids, flavonoids, phenols, saponins, glycosides, steroids, anthraquinones, fatty acids, fatty acid esters, terpenoids, tannins, and reducing sugars. The crude extracts of leaves, fruits, bark, roots, and twigs of *G. flava* and phytochemical compounds isolated from the species demonstrated antibacterial, antifungal, anti-inflammatory, antioxidant, antiparasitic, and cytotoxic activities. Future research involving *G. flava* should focus on detailed nutritional, phytochemical, pharmacological, and toxicological evaluations of the species.

**Keywords:** *Grewia flava*, Indigenous knowledge systems, Malvaceae, materia medica, southern Africa, Tiliaceae

**Submitted:** September 07, 2026 **Accepted:** September 20, 2026 **Published:** September 24, 2026

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### Introduction

Southern Africa is home to numerous wild edible plant species with potential to alleviate nutrition-related needs and primary health problems (Welcome and Van Wyk, 2020; Shackleton et al., 2025). There is a growing body of evidence indicating that the collection and consumption of wild edible plants play an important role in local diets and in traditional medicine, especially in low-income countries and marginalized communities (Ocho et al., 2026). Moreover, wild edible plants represent an important source of household income and a sustainable component of subsistence and traditional food systems (Gomes et al., 2020; Ghanbari et al., 2022; Ocho et al., 2026). Within this context, *Grewia flava* DC. (Figure 1), popularly known as “velvet raisin”, emerges as an intriguing subject of study, given the food and medicinal significance of the species (Mashungwa et al., 2019). Almost every part of *G. flava*, that is, bark, wood, leaves, roots and/or fruits, is used by humans or eaten by mammals and birds (Palmer and Pitman, 1972;

Van Wyk and Gericke, 2018). Despite their small size and thin flesh layer, the fruits of *G. flava* are an important food item in southern Africa (Van Wyk and Gericke, 2018), often eaten fresh or dried and stored for later use (Leffers, 2003; Setshogo and Venter, 2003), or the fruits are mashed, soaked in water for a while, and eaten as porridge (Lamola et al., 2017). Most of the volume of the *G. flava* fruit is made up of the pips, with only a thin layer of sweet flesh (Van Wyk and Gericke, 2018). The fruits are also fermented into an alcoholic drink known to have a distinct fruity aroma and is explored commercially (Festus, 2019; Bultosa et al., 2020; Sileshi et al., 2023; Molapisi et al., 2024). Fruits of *G. flava* provide income and food to local communities in southern Africa; therefore, fruits of the species are extensively traded in informal local markets in the region, that is, in cities, towns, and rural areas (Mmopelwa et al., 2009; Neudeck et al., 2012; Badimo et al., 2015; Nko et al., 2025). In Botswana, the leaves of *G. flava* are boiled as herbal tea with medicinal value and used as an important traditional

beverage (Mainah, 2006; Mashungwa et al., 2019). Research by Van Wyk (2011) showed that the fruits of *G. flava* have potential in the development and production of beverages such as jam, juice, wine, dried, and other

processed products. It is on this basis that trial plantings of the species have been undertaken in the Negev Desert in Israel (Van Wyk and Gericke, 2018).

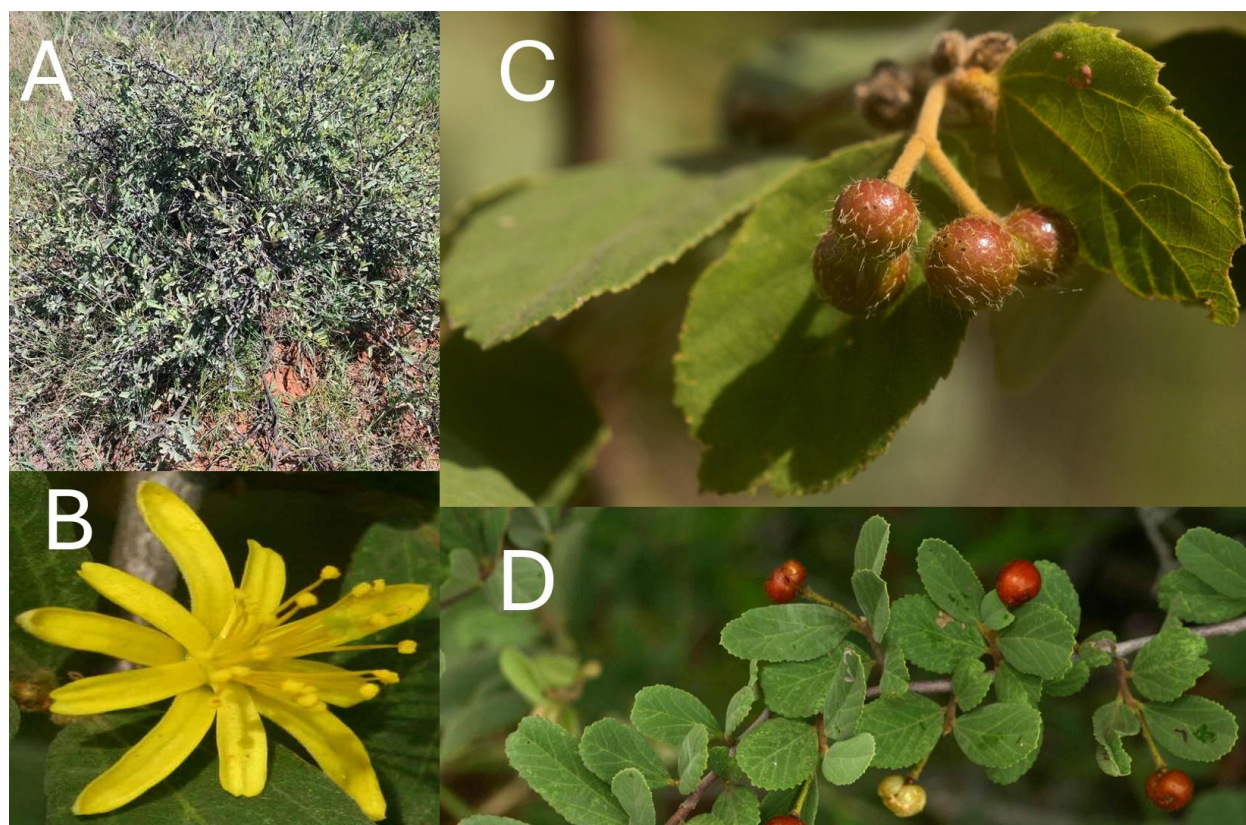


**Figure 1: *Grewia flava*: A: Entire plant, B: flower, C: branch showing leaves and immature hairy fruits, and D: branch showing leaves and mature fruits (photos: A = C Ryan, and B - D = B Wursten)**

*Grewia flava* is a multipurpose species, used as an important source of firewood, timber, construction material, and fodder (Pisto and Lebesse, 2014; Neelo et al., 2015; Semenya and Machete, 2022). Hence, *G. flava* is often cultivated, managed, or tolerated in rural and urban home gardens as an ornamental, food plant, or source of traditional medicines (Molebatsi et al., 2011; Venter and Venter, 2015; Gwedla et al., 2025). The leaves and twigs of *G. flava* are browsed by livestock and game; the wood makes sticks which are used for weapons and tools, and for bows and arrows; the pliable branchlets for baskets; and the bark for cordage and string

(Palmer and Pitman, 1972; Tibe et al., 2013; Van Wyk and Van Wyk, 2013; Ravhuhali et al., 2020). In Botswana, the bark of *G. flava* is used for tanning hides and skins (Koloka and Moreki, 2011). *Grewia flava* is a larval food plant for the butterflies *Caprona pillaana*, *Leucochitonea levubu* and *Abantis tettensis* (Van Wyk and Van Wyk, 2013). In several countries in southern Africa, the frayed ends of small branches of *G. flava* are used as toothbrushes (Palgrave, 2002; Van Wyk and Van Wyk, 2013; Pisto and Lebesse, 2014). Similarly, *G. flava* is an important source of traditional medicines in southern Africa, and its medicinal

applications have been reviewed by several researchers in Botswana (Hedberg and Staugård, 1989), Eswatini (Dlamini, 1981), Namibia (Malan and Owen-Smith, 1974; Rodin, 1985), South Africa (Watt and Breyer-Brandwijk, 1962; Pooley, 1993; Arnold et al., 2002) and Zimbabwe (Tredgold, 1990). It is within this context that the current study was undertaken, aimed at reviewing the nutritional, medicinal and ethnopharmacological properties of *G. flava*.

## Materials and methods

This review critically examined the nutritional, medicinal and ethnopharmacological properties of *G. flava*. Comprehensive data were systematically compiled in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Figure 3). The literature studies documenting nutritional, medicinal and ethnopharmacological properties of *G. flava* were conducted from September 2025 to June 2026 through databases such as ScienceDirect (<https://www.sciencedirect.com/search>), PubMed (<https://pubmed.ncbi.nlm.nih.gov/>), Google Scholar (<https://scholar.google.com/>), Scopus (<http://www.scopus.com/>), Web of Science (<https://www.webofknowledge.com/>), SpringerLink (<https://link.springer.com/>) and SciELO

(<https://search.scielo.org/>). The pre-electronic sources, which included books, book chapters, journal articles, dissertations, and theses obtained from the University library, were also used. The search strategy involved using keywords: “*Grewia flava*”, English common names “brandy bush”, “bushman raisin bush”, “raisinbush”, “raisin tree”, “velvet raisin”, “wild currant”, “wild plum”, and “wild raisin”. An additional search was also conducted using the keywords “nutritional properties of *Grewia flava*”, “biological activities of *Grewia flava*”, “pharmacological properties of *Grewia flava*”, “ethnobotany of *Grewia flava*”, “medicinal uses of *Grewia flava*”, “phytochemistry of *Grewia flava*” and “traditional uses of *Grewia flava*”. The selection process was designed to include a wide range of scientific publications focusing on the nutritional, medicinal uses, and ethnopharmacological properties of *G. flava*. The search covered publications from 1962 to 2026, a long period to capture literature on the nutritional, medicinal, and ethnopharmacological properties of *G. flava*. Literature sources excluded from this review are those articles that are partially accessed, that is, accessed as abstracts only, and also published or unpublished ethnobotanical, nutritional, or ethnopharmacological surveys lacking information on medicinal uses, nutritional and/or ethnopharmacological properties of *G. flava*.

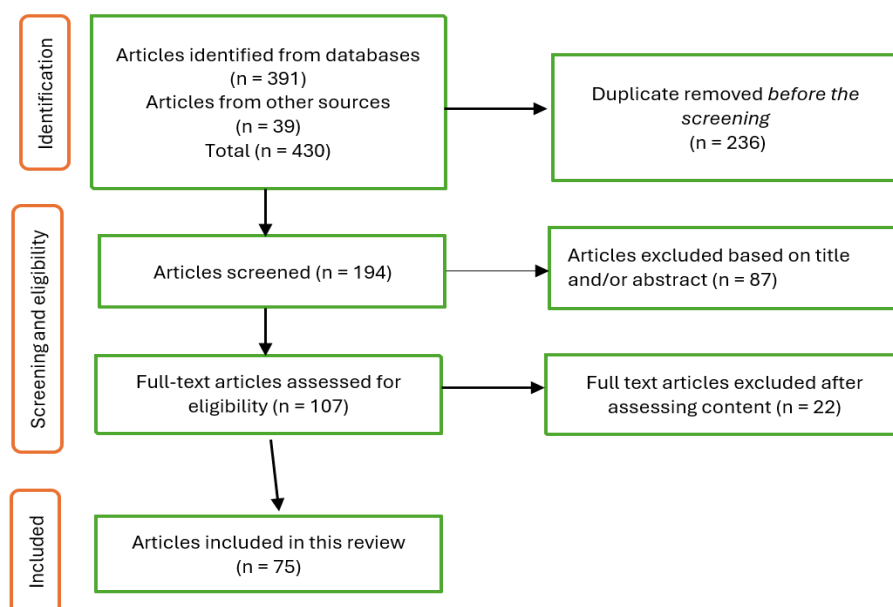


Figure 3: Flow diagram showing identification and screening of articles used in this review

### Taxonomy and description of *Grewia flava*

*Grewia flava* belongs to the Malvaceae family, or the mallows. The genus *Grewia* L. belongs to the Malvaceae family as opposed to its previous association with the Tiliaceae family (Bayer and Kubitzki, 2003; Heywood et al., 2007; APG III, 2009). Evidence from molecular analysis resulted in the expansion of the family Malvaceae to include other traditional families such as Tiliaceae, Sterculiaceae, and Bombacaceae (Bayer and Kubitzki, 2003; Heywood et al., 2007; APG III, 2009). The family Malvaceae consists of about 244 genera and 4225 species, which are mostly herbs or shrubs but also trees and lianas (Simpson, 2010; Christenhusz and Byng, 2016). The genus *Grewia* is pantropical in distribution, recorded in Africa, Asia and Australia (Leistner, 2000). The genus *Grewia* consists of approximately 323 recognized species of trees, shrubs and lianas (Bayer and Kubitzki, 2003; Karimi and Hanes, 2024; POWO, 2026), with 207 species recorded in Africa, with 80 of these species endemic to Madagascar (Karimi and Hanes, 2024; POWO, 2026). The genus name *Grewia* is in honour of Nehemiah Grew (1641 - 1712), an English botanist, physician, author and microscopist, who is considered to be among the founders of plant anatomy as a branch of scientific research (Palmer and Pitman, 1972; Venter and Venter, 2015; Schmidt et al., 2017). The specific name "*flava*" is derived from the Latin word "*flavus*," which means "a bright clear yellow", probably in reference to the flowers of the species (Palmer and Pitman, 1972). Synonyms of *G. flava* include *Grewia cana* Sond. and *G. hermannioides* Harv. (Wild, 1963, 1984; Germishuizen and Meyer, 2003; Retief and Meyer, 2017). English common names of *G. flava* include "brandy bush", "bushman raisin bush", "raisinbush", "raisin tree", "velvet raisin", "wild currant", "wild plum" and "wild raisin" (Palgrave, 2002; Quattrocchi, 2012; Retief and Meyer, 2017; Roberts and Roberts, 2017).

*Grewia flava* is a spreading (Figure 1A), branched, twiggy with an open crown and deciduous shrub or a small bushy tree seldom exceeding four metres in height (Palmer and Pitman, 1972; Van Wyk and Van Wyk, 2007, 2013; Venter and Venter, 2015). It is multi-stemmed with roundish and darker older stems, while the young branchlets are greyish or greyish brown in colour, velvety, hairy, and becoming dark purplish black with age (Palgrave, 2002; Setshogo and

Venter, 2003; Van Wyk and Van Wyk, 2007, 2013). The bark is grey in colour on young branches but dark grey with some longitudinal fissures on older branches and stems (Palgrave, 2002; Venter and Venter, 2015; Schmidt et al., 2017). The leaves of *G. flava* are simple, alternate, held upright, grey to greyish green in colour, finely hairy above, pale green and densely hairy underneath. The leaves are elliptic to oblanceolate in shape with prominently raised venation from the leaf base, margin toothed, apex rounded and base broadly tapering. The flowers are small, occur in branched axillary clusters, sweet-smelling, starry with narrow yellow petals (Figure 1B) that are usually borne singly in the axils of the leaves, and the sepals longer and wider than the petals (Venter and Venter, 2015). The fruits are subglobose, usually two-lobed, sometimes with bristly hairs (Figure 1C), yellow in colour and turning red when ripe (Figure 1D), and are edible (Van Wyk, 2008). *Grewia flava* has been recorded in Botswana, South Africa, Namibia, Eswatini and Zimbabwe (Wild, 1963, 1984; Drummond, 1975; Germishuizen and Meyer, 2003; Setshogo and Venter, 2003; Mapaura and Timberlake, 2004; Setshogo, 2005; Mannheimer and Curtis, 2009; Boon, 2010; Mashungwa et al., 2019; Hyde et al., 2026) (Figure 2) at an altitude ranging from 155 m to 1830 m above sea level (Germishuizen and Meyer, 2003). *Grewia flava* has been recorded in dry, deciduous woodland, savanna, bushveld, grassland and wooded grassland, coarse grey sand, overgrazed loose sand, often in drier areas and on limestone and red Kalahari sands (Wild, 1963, 1984; Palgrave 2002; Van Wyk and Van Wyk, 2013; Retief and Meyer, 2017). *Grewia flava* flowers from October to March, and its fruits are available from December to April (Wild, 1963, 1984; Palgrave, 2002; Mashungwa et al., 2019) in areas with a mean annual rainfall of 300 mm to 350 mm (Mashungwa et al., 2019). In the field, it is difficult to distinguish *G. flava* from *G. bicolor* Juss. (Palgrave, 2002). But the two species are usually distinguished on the basis of leaf base, number of flower stalks on the peduncle, and reticulate venation of the tertiary veins (Wild, 1963, 1984; Palgrave, 2002). While the leaves of *G. flava* are very similar to those of *G. bicolor*, its leaves are held upright and not horizontally or slightly drooping as are those of the latter species. The leaves of *G. flava* are also coarser, with more prominent lateral veins and net-veining, and the base is more or less symmetric, whereas *G. bicolor* may or may not have an asymmetric base (Palgrave, 2002).



**Figure 2: Distribution of *Grewia flava* in southern Africa (drawn by the author using the MapChart programme)**

### Medicinal uses of *Grewia flava*

*Grewia flava* is used as a source of traditional medicines in Botswana, Eswatini, Namibia, and South Africa, that is, 80% of the countries where the species is indigenous (Table 1). The traditional medicines prepared from the bark, fruits, leaves, roots, sap, stem, and stem bark decoction or infusion of *G. flava* are used to treat and manage 31 human and animal diseases and ailments (Table 1). The main ailments and diseases treated by *G. flava* extracts (Figure 4) include its use as charm and ethnoveterinary medicine, and traditional medicine for sexually transmitted infections, burns, cough, diarrhoea, kidney problems, stomach problems, and tuberculosis. Medicinal applications of *G. flava* throughout its distributional range are quite broad, ranging from cultural uses such as charm to treatment of wounds, microbial infections, and other applications like intestinal tumours, back pain, kidney problems, postnatal care, and sprains. The extracts of *G. flava* are used as herbal medicines against some of the major infections causing the highest mortality on the African continent, which include lower respiratory infections, tuberculosis, diarrhoeal

diseases, and cancer (Anaemene, 2018; Barry et al., 2025). Although preliminary ethnopharmacological evaluations such as antibacterial, antifungal, anti-inflammatory, antioxidant, and cytotoxicity evaluations of *G. flava* have been undertaken, there is a need for detailed assessment of mechanisms of action, clinical effectiveness, and proper dosage for the documented ethnomedicinal applications and associated phytochemical and pharmacological properties of the species. There is obviously need to focus on standardized quality, toxicology, evidence-based safety, and regulatory approvals involving *G. flava* extracts and phytochemical compounds isolated from the species. The *in vitro*, *in vivo*, pre-clinical, and clinical studies are the most convincing scientific methods of proving the safety and efficacy of plant-based therapies and natural products involving medicinal plant species such as *G. flava* (Maroyi, 2026). In South Africa, the leaves of *G. flava* are mixed with those of *Barleria coriacea* Oberm. subsp. *dinteri* (Oberm.) I.Darbysh. and *Jatropha lagarinthoides* Sond. as traditional medicine for bacterial infections (Gololo et al., 2017). Similarly, the roots of *G. flava* are mixed with those of *Ziziphus zeyheriana* Sond. as ethnoveterinary medicine for

calf diarrhoea (McGaw et al., 2020; Chakale et al., 2021; Selogatwe et al., 2021; Ndou et al., 2023).

**Table 1: Medicinal uses of *Grewia flava***

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| Medicinal use                             | Part used                                                                                                                                     | Country                   | Reference                                                                                                                                             |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Backbone pain                             | Root decoction taken orally                                                                                                                   | Botswana                  | Hedberg and Staugård, 1989                                                                                                                            |
| Bacterial infection                       | Leaves mixed with those of <i>Barleria coriacea</i> Oberm. subsp. <i>dinteri</i> (Oberm.) I.Darbysh. and <i>Jatropha lagarinthoides</i> Sond. | South Africa              | Gololo et al., 2017                                                                                                                                   |
| Burns                                     | Pounded roots used as plaster                                                                                                                 | Botswana and South Africa | Palmer and Pitman, 1972; Bolten, 1998; Pisto and Lebese, 2014                                                                                         |
| Charm (death rites or ward off lightning) | Bark or wood                                                                                                                                  | Botswana and South Africa | Palmer and Pitman, 1972; Roodt, 1998; Palgrave, 2002; Setshogo and Venter, 2003; Roberts and Roberts, 2017; Schmidt et al., 2017                      |
| Colds                                     | Fruit decoction taken orally                                                                                                                  | South Africa              | Roberts and Roberts, 2017                                                                                                                             |
| Cough                                     | Fruit or root decoction taken orally                                                                                                          | Botswana and South Africa | Neelo et al., 2015; Roberts and Roberts, 2017; Chakale et al., 2025                                                                                   |
| Diarrhoea                                 | Bark, leaf or root decoction taken orally                                                                                                     | Namibia and South Africa  | Chinsembu and Hedimbi, 2010; Mongalo and Makhafola, 2018; Mogale et al., 2019; Matlala et al., 2025                                                   |
| Emetic                                    | Root decoction taken orally                                                                                                                   | Eswatini                  | Quattrocchi, 2012                                                                                                                                     |
| Gastrointestinal problems                 | Root decoction taken orally                                                                                                                   | Botswana                  | Majinda and Motswaledi, 1998                                                                                                                          |
| Germicide                                 | Sap                                                                                                                                           | South Africa              | Palmer and Pitman, 1972                                                                                                                               |
| Insecticide                               | Sap                                                                                                                                           | South Africa              | Palmer and Pitman, 1972                                                                                                                               |
| Intestinal tumours                        | Leaf decoction taken orally                                                                                                                   | South Africa              | Gololo et al., 2016a                                                                                                                                  |
| Kidney problems                           | Leaf, root or stem decoction taken orally                                                                                                     | Botswana and South Africa | Hedberg and Staugård, 1989; Roberts and Roberts, 2017; Mashungwa et al., 2019; Coin et al., 2024                                                      |
| Pearly penile papules                     | Root decoction applied topically                                                                                                              | South Africa              | Asong et al., 2019; Chakale et al., 2024, 2025; Matlala et al., 2025                                                                                  |
| Postnatal                                 | Root decoction taken orally                                                                                                                   | Botswana                  | Hedberg and Staugård, 1989                                                                                                                            |
| Respiratory infections                    | Root decoction taken orally                                                                                                                   | South Africa              | Semenya and Maroyi, 2019a                                                                                                                             |
| Sexually transmitted infections           | Root decoction or infusion taken orally                                                                                                       | South Africa              | Mongalo and Makhafola, 2018; Mogale et al., 2019; Mongalo and Raletsena, 2022; Mongalo et al., 2017, 2022; Chakale et al., 2024; Matlala et al., 2025 |
| <b>Medicinal use</b>                      | <b>Part used</b>                                                                                                                              | <b>Country</b>            | <b>Reference</b>                                                                                                                                      |
| Sprains                                   | Bark decoction applied topically                                                                                                              | South Africa              | Roberts and Roberts, 2017                                                                                                                             |



|                                 |                                                          |                          |                                                                                                                                                                        |
|---------------------------------|----------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stomach problems                | Leaf, root or stem bark decoction taken orally           | South Africa             | Gololo et al., 2016a,b; Mashungwa et al. 2019; Coin et al., 2024                                                                                                       |
| Tuberculosis                    | Root decoction taken orally                              | South Africa             | Semenya and Maroyi, 2019b,c, 2020; Matlala et al., 2025                                                                                                                |
| Wounds                          | Bark decoction applied topically                         | South Africa             | Roberts and Roberts, 2017                                                                                                                                              |
| <b>Ethnoveterinary medicine</b> |                                                          |                          |                                                                                                                                                                        |
| Abortion                        | Leaves                                                   | South Africa             | Mpolokeng et al., 2026a                                                                                                                                                |
| Calf diarrhoea                  | Root mixed with that of <i>Ziziphus zeyheriana</i> Sond. | South Africa             | McGaw et al., 2020; Chakale et al., 2021; Selogatwe et al., 2021; Ndou et al., 2023                                                                                    |
| Constipation                    | Roots                                                    | South Africa             | Mpolokeng et al., 2026a                                                                                                                                                |
| Diarrhoea                       | Roots                                                    | South Africa             | Chakale et al., 2022, 2025; Mpolokeng et al., 2026b                                                                                                                    |
| Dystocia                        | Roots                                                    | South Africa             | Chakale et al., 2022, 2025; Mpolokeng et al., 2026b                                                                                                                    |
| Fertility enhancement           | Roots                                                    | South Africa             | Van der Merwe et al., 2001; McGaw and Eloff, 2008; Khunoana and McGaw, 2020; McGaw et al., 2020; Selogatwe et al., 2021; Chakale et al., 2025; Mpolokeng et al., 2026b |
| Intestinal worms                | Leaves                                                   | South Africa             | Mpolokeng et al., 2026a                                                                                                                                                |
| Pulmonary diseases in cattle    | Roots                                                    | Not specified            | Mashungwa et al., 2019                                                                                                                                                 |
| Retained placenta               | Leaves                                                   | Namibia and South Africa | Malan and Owen-Smith, 1974; Mpolokeng et al., 2026a                                                                                                                    |

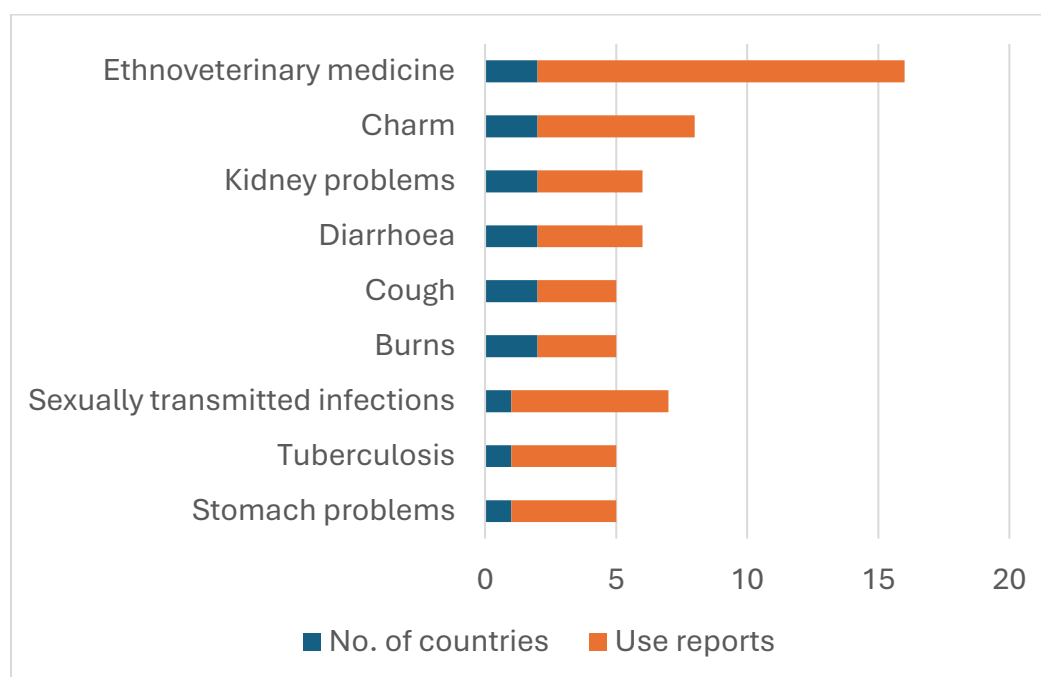


**Figure 4: Main ethnomedicinal uses of *Grewia flava* in southern Africa**

### Nutritional and phytochemistry of *Grewia flava*

Researchers such as Wehmeyer (1986) and Nko et al. (2025) investigated the nutritional properties of *G. flava* (Table 2). Analyses of the nutritional properties of the fruit pulp and skin (Table 2) show that *G. flava* is a good source of energy, classic nutrients, and minerals. Gololo et al. (2016a,b), Mudau et al. (2022) and Coin et al. (2024) identified

alkaloids, flavonoids, phenols, saponins, glycosides, steroids, anthraquinones, terpenoids, tannins, anthraquinones and reducing sugars from *G. flava* leaves, roots and twigs. Major phytochemical compounds identified from the roots and twigs of *G. flava* include fatty acids, fatty acid esters and triterpenoids; see Table 3. Some of these phytochemical compounds may be responsible for the pharmacological activities associated with *G. flava*.

**Table 2: Nutrients of the fruit pulp and skin of *Grewia flava***

| Nutritional or element                | Value        | Reference                        |
|---------------------------------------|--------------|----------------------------------|
| Ash (g/100g)                          | 1.0 – 3.0    | Wehmeyer, 1986                   |
| B-carotene (mg/100g)                  | 1.48         | Nko et al., 2025                 |
| Calcium (mg/100g)                     | 68.1 - 163.0 | Wehmeyer, 1986; Nko et al., 2025 |
| Carbohydrates (g/100g)                | 2 – 6        | Wehmeyer, 1986                   |
| Copper (mg/100g)                      | 0.3          | Wehmeyer, 1986                   |
| Energy (kj/100g)                      | 377-1103     | Wehmeyer, 1986; Nko et al., 2025 |
| Fat (g/100g)                          | 0.1 - 0.3    | Wehmeyer, 1986                   |
| Fibre (g/100g)                        | 2 – 22.1     | Wehmeyer, 1986; Nko et al., 2025 |
| Iron (mg/100g)                        | 1.2 – 140.8  | Wehmeyer, 1986; Nko et al., 2025 |
| Magnesium (mg/100g)                   | 70.5 - 169   | Wehmeyer, 1986                   |
| Moisture (g/100g)                     | 9.6 74.7     | Wehmeyer, 1986                   |
| Nicotinic acid (vitamin B3) (mg/100g) | 0.6 – 1.6    | Wehmeyer, 1986                   |

|                                   |             |                                  |
|-----------------------------------|-------------|----------------------------------|
| Phosphorus (mg/100g)              | 67 – 86.5   | Wehmeyer, 1986                   |
| Potassium (mg/100g)               | 288 - 981   | Wehmeyer, 1986                   |
| Protein (g/100g)                  | 1.6 – 5     | Wehmeyer, 1986; Nko et al., 2025 |
| Riboflavin (vitamin B2) (mg/100g) | 0.03 – 0.2  | Wehmeyer, 1986                   |
| Sodium (mg/100g)                  | 3.1         | Wehmeyer, 1986                   |
| Thiamine (vitamin B1) (mg/100g)   | 0.04 – 0.07 | Wehmeyer, 1986                   |
| Vitamin C (mg/100g)               | 4.39 - 29.4 | Wehmeyer, 1986; Nko et al., 2025 |
| Zinc (mg/100g)                    | 0.6 - 144   | Wehmeyer, 1986; Nko et al., 2025 |

**Table 3: Phytochemical compounds isolated from *Grewia flava***

| Phytochemical compound                                  | Value (%)     | Part            | Reference         |
|---------------------------------------------------------|---------------|-----------------|-------------------|
| 1,1,7,7-Tetramethyl-s-hydrindacene                      | 0.48          | Roots           | Coin et al., 2024 |
| 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester | 0.29          | Twigs           | Coin et al., 2024 |
| 1,4,4,5,7,8-Pentamethyl-6-chromanol                     | 0.58          | Roots           | Coin et al., 2024 |
| 2-(4-Pyridyl)-4-methyl thiazole-5-carboxylic acid       | 2.5           | Roots           | Coin et al., 2024 |
| 2-Pentadecanone, 6,10,14-trimethyl-                     | 0.27          | Twigs           | Coin et al., 2024 |
| 4,5,6,7-Tetramethyl-2H-isoindole                        | 0.81          | Roots           | Coin et al., 2024 |
| 7-Methyl-Z-tetradecen-1-ol acetate                      | 0.53          | Twigs           | Coin et al., 2024 |
| 9,12-Octadecadienoic acid (Z, Z)-                       | 5.84 – 27.19  | Roots and twigs | Coin et al., 2024 |
| 9,12-Octadecadienoic acid (Z, Z)-, methyl ester         | 2.57 - 2.85   | Roots and twigs | Coin et al., 2024 |
| 9,12,15-Octadecatrienoic acid, methyl ester, (Z, Z, Z)- | 1.94          | Twigs           | Coin et al., 2024 |
| 9-Octadecenamide, (Z)-                                  | 0.39 - 7.87   | Roots and twigs | Coin et al., 2024 |
| 11-Octadecenoic acid, methyl ester                      | 3.06          | Roots           | Coin et al., 2024 |
| 12-Methyl-E, E-2,13-octadecadien-1-ol                   | 0.39          | Twigs           | Coin et al., 2024 |
| β-Amyrin                                                | 1.27          | Twigs           | Coin et al., 2024 |
| Betulin                                                 | 0.61          | Roots           | Coin et al., 2024 |
| Campesterol                                             | 0.54          | Twigs           | Coin et al., 2024 |
| Chlorpyrifos                                            | 5.24          | Twigs           | Coin et al., 2024 |
| Diisobutyl phthalate                                    | 2.15          | Roots           | Coin et al., 2024 |
| Diisooctyl phthalate                                    | 0.29 – 1.01   | Roots and twigs | Coin et al., 2024 |
| Eicosanoic acid, methyl ester                           | 0.37          | Twigs           | Coin et al., 2024 |
| Friedelan-3-one                                         | 0.90          | Roots           | Coin et al., 2024 |
| Hentriacontane                                          | 4.01          | Twigs           | Coin et al., 2024 |
| Heptacosane                                             | 0.26          | Roots           | Coin et al., 2024 |
| Hexadecanamide                                          | 4.76          | Roots           | Coin et al., 2024 |
| Hexadecanoic acid, methyl ester                         | 6.99 – 9.75   | Roots and twigs | Coin et al., 2024 |
| n-Hexadecanoic acid                                     | 14.58 – 16.99 | Roots and twigs | Coin et al., 2024 |
| Lupenone                                                | 0.67          | Twigs           | Coin et al., 2024 |

|                                  |              |                 |                                         |
|----------------------------------|--------------|-----------------|-----------------------------------------|
| Lupeol                           | 6.82 – 23.58 | Roots and twigs | Mongalo et al., 2022; Coin et al., 2024 |
| Methyl stearate                  | 0.45 – 0.87  | Roots and twigs | Coin et al., 2024                       |
| Octacosane                       | 9.48         | Twigs           | Coin et al., 2024                       |
| Octadecanamide                   | 4.50         | Roots           | Coin et al., 2024                       |
| Octadecanoic acid                | 1.19 – 3.51  | Roots and twigs | Coin et al., 2024                       |
| Oleic acid                       | 10.14        | Roots           | Coin et al., 2024                       |
| Phytol                           | 0.51         | Twigs           | Coin et al., 2024                       |
| $\gamma$ -Sitosterol             | 0.90 – 5.53  | Roots and twigs | Coin et al., 2024                       |
| Squalene                         | 0.82         | Roots           | Coin et al., 2024                       |
| Stigmasterol                     | 1.37         | Twigs           | Coin et al., 2024                       |
| Taraxerol                        | -            | Roots           | Mongalo et al., 2022                    |
| Tetracosanoic acid, methyl ester | 0.21         | Twigs           | Coin et al., 2024                       |
| Tetradecane, 2,6,10-trimethyl-   | 0.24         | Twigs           | Coin et al., 2024                       |
| Tetradecanoic acid               | 0.63         | Twigs           | Coin et al., 2024                       |
| Tetratetracontane                | 0.37         | Twigs           | Coin et al., 2024                       |

### Antibacterial activities

Pretorius et al. (2003) evaluated the antibacterial activities of crude extracts of *G. flava* leaves at a concentration of 50.0 mg/mL against *Pseudomonas solanacearum* and *Clavibacter michiganensis* pv. *michiganense* using the agar diffusion method with dimethyl dodecyl ammonium chloride as a positive control. The extract inhibited the growth of the pathogens, exhibiting an inhibition zone of 8 mm to 9 mm (Pretorius et al., 2003). Gololo et al. (2017) evaluated the antibacterial activities of acetone, dichloromethane, and hexane extracts of *G. flava* leaves against *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, and *Enterococcus faecalis* using the broth micro-dilution assay with gentamicin as a positive control. The extracts demonstrated activity against the tested pathogens and exhibited minimum inhibitory concentration (MIC) values that ranged from 0.38 mg/ml to 3.0 mg/ml (Gololo et al., 2017). Lamola et al. (2017) evaluated the antibacterial activities of acetone, methanol, ethyl acetate, chloroform, and water extracts of *G. flava* roots, leaves, berries, and bark against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Salmonella typhimurium* using the broth micro-dilution assay with gentamicin as a positive control. The extracts demonstrated activities against the tested pathogens, exhibiting MIC values that ranged from 0.03 mg/ml to >2.5 mg/ml (Lamola et al., 2017). Mongalo et al. (2017) evaluated the antibacterial activities of methanol, ethyl acetate, chloroform, and water extracts of *G. flava* roots and leaves against *Moraxella catarrhalis*,

*Proteus mirabilis*, *Staphylococcus aureus*, *Mycobacterium smegmatis*, and *Mycoplasma hominis* using the broth micro-dilution assay with gentamicin as a positive control. The extracts demonstrated activity against the tested pathogens, exhibiting MIC values that ranged from 0.05 mg/ml to >12.5 mg/ml (Mongalo et al., 2017). Mongalo et al. (2022) evaluated the antibacterial activities of aqueous, methanol-water, carbon tetrachloride, and butanol extracts of *G. flava* roots and the phytochemical compounds lupeol and taraxerol isolated from the species against *Staphylococcus aureus*, *Moraxella catarrhalis*, *Klebsiella pneumoniae*, *Bacillus cereus*, *Mycobacterium smegmatis*, *Mycoplasma hominis*, *Escherichia coli*, and *Pseudomonas aeruginosa* using the microdilution assay with streptomycin and vancomycin as positive controls. The extracts and the phytochemical compounds demonstrated activities against the tested pathogens, exhibiting noteworthy MIC values that ranged from 10  $\mu$ g/ml to 80  $\mu$ g/ml (Mongalo et al., 2022). Coin et al. (2024) evaluated the antibacterial activities of 80% methanol extract of *G. flava* roots and twigs against *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* using the microbroth dilution method with chloramphenicol as a positive control. The extract demonstrated activity against the tested pathogens, exhibiting MIC values that ranged from 0.11 mg/mL to 0.96 mg/mL (Coin et al., 2024).

### Antifungal activities

Mongalo et al. (2017) evaluated the antifungal activities of methanol, ethyl acetate, chloroform, and water extracts of *G. flava* roots and leaves against *Candida albicans* and *Cryptococcus neoformans* using the broth micro-dilution assay with amphotericin B as a positive control. The extracts demonstrated activity against the tested pathogens, exhibiting MIC values that ranged from 0.1 mg/ml to >12.5 mg/ml (Mongalo et al., 2017). Mongalo et al. (2022) evaluated the antifungal activities of aqueous, methanol-water, carbon tetrachloride, and butanol extracts of *G. flava* roots and the phytochemical compounds lupeol and taraxerol isolated from the species against *Candida albicans* and *Cryptococcus neoformans* using the microdilution assay with amphotericin B as a positive control. The extracts and the phytochemical compounds demonstrated activities against the tested pathogens, exhibiting noteworthy MIC values that ranged from 30 µg/ml to 80 µg/ml (Mongalo et al., 2022). Coin et al. (2024) evaluated the antifungal activities of 80% methanol extract of *G. flava* roots and twigs against *Aspergillus niger* and *Rhizopus oryzae* using the microbroth dilution method. The extract demonstrated activity against the tested pathogens, exhibiting MIC values that ranged from 0.17 mg/mL to 0.27 mg/mL (Coin et al., 2024).

### Anti-inflammatory activities

Mongalo et al. (2022) evaluated the anti-inflammatory activities of water-ethanol, butanol, and carbon tetrachloride fractions of *G. flava* roots and the phytochemical compounds lupeol and taraxerol isolated from the species by assessing the inhibition of nitric oxide release from RAW264.7 macrophages and the soybean lipoxygenase (15-LOX) inhibition assay with quercetin as a positive control. The extracts demonstrated noteworthy half-maximal inhibitory concentration (IC<sub>50</sub>) values ranging from 29.31 µg/ml to 41.32 µg/ml against 15-LOX enzyme and RAW264.7 cells, respectively, compared to quercetin, which exhibited 41.44 µg/ml. Both taraxerol and lupeol exhibited better anti-inflammatory activities in both assays compared to quercetin (Mongalo et al., 2022).

### Antioxidant activities

Gololo et al. (2017) evaluated the antioxidant activities of acetone and methanol extracts of *G. flava* leaves using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay with vitamin C as a positive control. The methanol and acetone extracts demonstrated activity and exhibited half-maximal effective concentration (EC<sub>50</sub>)

values of 0.11 mg/ml and 0.22 mg/ml, respectively (Gololo et al., 2017). Lamola et al. (2017) evaluated the antioxidant activities of acetone extract of *G. flava* roots, leaves, berries, and bark using the DPPH free radical scavenging assay with ascorbic acid and Trolox as positive controls. The extracts demonstrated activities exhibiting IC<sub>50</sub> values that ranged from 70.09 µg/ml to 250.53 µg/ml (Lamola et al., 2017). Masisi et al. (2021) evaluated the antioxidant activities of aqueous and ethanol extracts of *G. flava* berries using the DPPH free radical scavenging assay, with gallic acid as a positive control. The extracts demonstrated antioxidant activities (Masisi et al., 2021). Coin et al. (2024) evaluated the antioxidant activities of hexane, acetone, 80% methanol, and water extracts of *G. flava* roots and twigs using the DPPH free radical scavenging, ferric reducing antioxidant power (FRAP), and metal chelation assays with ascorbic acid and ethylenediaminetetraacetic acid (EDTA) as positive controls. The extracts showed moderate to strong dose-dependent antioxidant activities (Coin et al., 2024).

### Anti-parasitic activities

Tibe et al. (2013) evaluated the anti-parasitic activities of purified condensed tannin fraction from *G. flava* leaves using the egg hatch, larval development, and larval migration inhibition assays against gastrointestinal nematode species *Haemonchus contortus*, *Teladorsagia circumcincta*, and *Trichostrongylus colubriformis*. The condensed tannin fraction completely inhibited the development of all parasite species (Tibe et al., 2013).

### Cytotoxicity activities

Mongalo et al. (2022) evaluated the cytotoxicity activities of the butanol fraction of *G. flava* roots against the adult human dermal fibroblast (HDF) and bovine dermis (BD) cell lines using the tetrazolium-based colorimetric (MTT) assay with doxorubicin chloride as a positive control. The butanol fraction showed some degree of toxicity against HDF and BD, yielding IC<sub>50</sub> values of 89.0 µg/ml and 139.2 µg/ml, respectively (Mongalo et al., 2022).

### Conclusion

*Grewia flava* is best known for provision of edible fruits and as a source of traditional medicines. The dual nutritional and medicinal applications of *G. flava* throughout its distributional range have significance in the maintenance and promotion of good nutrition and health of local communities. But it is clear that several medicinal applications of *G. flava* still require ethnopharmacological validation. Such further ethnopharmacological research

should assess mechanisms of action, clinical effectiveness, and proper dosage for the documented ethnomedicinal applications of the species. There is also a need for ethnopharmacological studies examining the combinational effects of *G. flava* with other plant species such as *B. coriacea* subsp. *dinteri*, *J. lagarinthoides* and *Z. zeyheriana*.

### Limitations

The current study is a narrative review which relies on a suite of literature sources. Therefore, the study is characterized by literature selection bias, exclusion of some literature sources, language restrictions, and reliance on the quality of past primary studies. Access and identification of literature sources focusing on nutritional, medicinal uses and ethnopharmacological properties of *G. flava* were a major challenge. Information provided in this study is based on available scientific sources identified through a systematic literature review, which is often susceptible to publication, analysis, and interpretation bias. In order to minimize these forms of bias and subjective decisions, credible literature sources associated with quality ethnobotanical studies and experimental techniques focusing on nutritional, medicinal, and ethnopharmacological evaluations of the species were selected and used in this study.

### Recommendations

The general outlook for *G. flava* is promising, particularly as research continues to validate its food value and ethnomedicinal applications. Its potential contributions to nutritional, pharmaceutical, nutraceutical, and/or functional sectors could be enhanced if these properties are supported by experimental data generated from phytochemical research, standardized quality, toxicology, evidence-based safety, and regulatory approvals involving the species. In ethnopharmacological research, there is a need for *in vitro*, *in vivo*, pre-clinical, and clinical studies, as these are the most convincing scientific methods of proving the safety and efficacy of plant-based therapies and natural products involving *G. flava*.

### Acknowledgments

The author would like to thank the reviewers for their comments and suggestions, which greatly improved the final quality of the manuscript.

### Source of funding

The University of Fort Hare funded this research.

### Author contributions

I am solely responsible for the conception and design of the research work, data collection, analysis, interpretation of the data, and writing of the manuscript.

### Registration and protocol

The review was not registered, and a protocol was not prepared.

### Competing interests

The author declares that there is no conflict of interest associated with this research.

### List of abbreviations

APG III - Angiosperm Phylogeny Group III  
BD - bovine dermis  
DPPH - 2,2-diphenyl-1-picrylhydrazyl  
EC<sub>50</sub> - half-maximal effective concentration  
EDTA - ethylenediaminetetraacetic acid  
FRAP - ferric reducing antioxidant power  
HDF - human dermal fibroblast  
IC<sub>50</sub> - half-maximal inhibitory concentration  
15-LOX - lipoxygenase 15  
MIC - minimum inhibitory concentration  
MTT - tetrazolium-based colorimetric assay  
POWO - Plants of the World Online  
PRISMA - preferred reporting items for systematic reviews and meta-analyses

### Availability of data, code, and other materials

All data generated or analyzed during this study are included in this article.

### Author biography

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Student's Journal of Health Research Africa

e-ISSN: 2709-9997, p-ISSN: 3006-1059

Vol.7 No. 3 (2026): September 2026 Issue

<https://doi.org/10.51168/3c51rb96>

Narrative Review

**Publisher details:**

**Student's Journal of Health Research (SJHR)**

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: [studentsjournal2020@gmail.com](mailto:studentsjournal2020@gmail.com)

WhatsApp: +256 775 434 261

Location: Scholar's Summit Nakigalala, P. O. Box 701432,

Entebbe Uganda, East Africa

