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Taxonomy, Pharmacology and economic importance of *Vachellia farnesiana* (L.) Wight & Arn. (Leguminosae: Mimosoideae): A review

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Abstract
In India a local type of pomade, attar of cassie, is made from *Vachellia farnesiana* flowers. It is growing almost throughout the India and used in the bark and the pods are used for dying and tanning. It has a great number of uses in traditional medicine. It shows Anthelmintic activity, Antibacterial activity, Anti-Inflammatory activity, Antioxidant Activity, Cytotoxicity activity. The present paper deals with the review on taxonomy, bioactives, Pharmacology and economic importance of *Vachellia farnesiana.*

Keywords: *Acacia*, attar, India, phytochemistry, pods, uses

Introduction
The genus *Vachellia* Wight & Arn. belongs to subfamily Mimosoideae of Leguminosae and comprises ca. 163 species, 60 species in the Americas, 73 in Africa, 36 in Asia and seven in Australia (Mabberley 2017) [5]. *Vachellia* is distinguished from other *Acacia* s.l. by the characters like presence of stipular spines, the absence of prickles, the presence of an involucre on the peduncles, bipinnately compound leaves, colporate pollen apertures, pollen columellae, and smooth pollen exine ornamentation (Maslin *et al*. 2003) [6]. Recently Deshpande *et al*. (2019) [2] reported 18 taxa of *Vachellia* of which 12 are indigenous species for the Indian subcontinent.
Vachellia farnesiana (L.) Wight & Arn. is economically important species of the genus native to Tropical & Subtropical America and introduced to Africa, Asia and Australia. It is used as animal food, a medicine, invertebrate food, fuel and has environmental uses (POWO 2025) [7]. *Vachellia farnesiana* has many of uses in traditional medicine. The article presents the review on taxonomy, bioactives, Pharmacology and economic importance of *Vachellia farnesiana.*

Materials and Methods
For this review we searched all papers that mention *Vachellia farnesiana* or *Acacia farnesiana* on Google Scholar (https://scholar.google.dk/), ResearchGate (https://www.researchgate.net/) and PubMed (https://pubmed.ncbi.nlm.nih.gov/). We also searched books and reports about Pharmacology and phytochemistry of *Vachellia farnesiana* in general.

Taxonomy
Classification
- **Class:** Equisetopsida C. Agardh
- **Subclass:** Magnoliidae Novák ex Takht.
- **Superorder:** Rosanae Takht.
- **Order:** Fabales Bromhead
- **Family:** Fabaceae Lindl.
- **Genus:** *Vachellia* Wight & Arn.
- **Species:** *Vachellia farnesiana* (L.) Wight & Arn.

Vachellia farnesiana (L.) Wight & Arn., Prodr. Fl. Ind. Orient. 1: 272 (1834).
Acacia farnesiana (L.) Willd. in Sp. Pl., ed. 4. 4: 1083 (1806)
Mimosa farnesiana L. in Sp. Pl.: 521 (1753)
Poponax farnesiana (L.) Raf. in Sylva Tellur.: 118 (1838)

Vachellia farnesiana f. *typica* Speg. in Bol. Acad. Nac. Ci. Republ. Argent. 26: 298 (1923), not validly publ.

Type: Aldinus. Exactissima description 736 rariorum plantarum Romae, Horto Franesiano 3, 4. 1625, lectotype [icon] designated by Ross (1975) [10]. Figure 1.

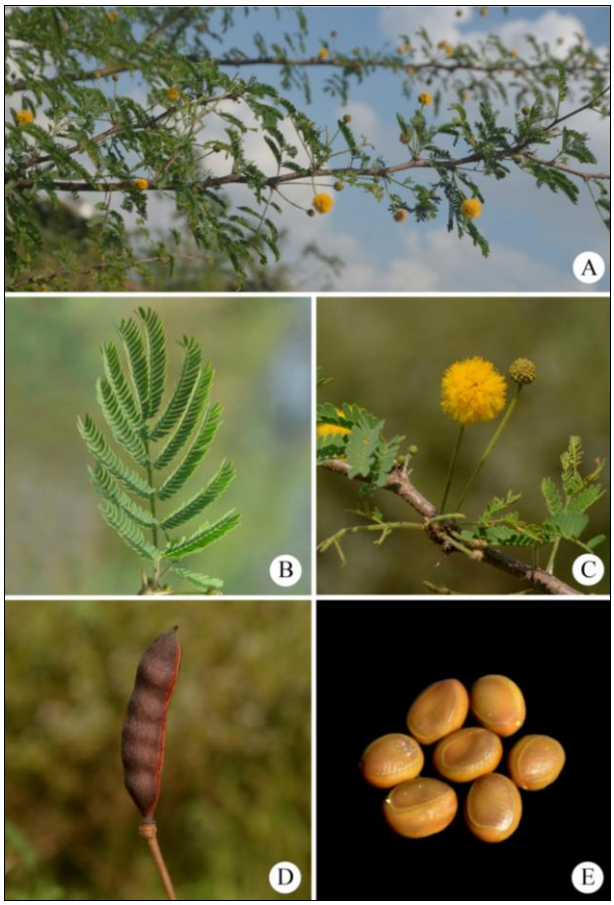

Fig 1: *Vachellia farnesiana* (L.) Wight & Arn., A. Habit; B. Leaf; C. Inflores-cence; D. Fruit; E. Seeds

Large shrub or small trees upto 8 m tall. Bark dark gray to brown, furrowed. Stems dark reddish brown to dark gray, glabrous, branchlets zigzag. Leaves bipinnately compound alternate, Pinnae 4-8 pairs, leaflets 10-20 pairs, 0.4-5 mm long. Stipular spines, terete, straight, stout, 3.0-5.0 cm long. Petiole 0.5-1.7 cm long adaxially grooved, sparsely pubescent, petiolar gland present; petiolar gland solitary, on the petiole. Pinnae 2 to 6 pairs per leaf, 1.2-3.3 cm long, 0.4-1.2 (16) cm between pinna pairs. Leaflets (10) 12 to 19 pairs per pinna, opposite, 0.5-2.0 mm between leaflets, oblong, 3.0-6.3 x 0.5-1.7 mm, glabrous, apex broadly acute to obtuse. Inflorescence globose head with dense flowers, 7-10 mm across, solitary or in clusters of 2 to 5 with short shoots. Peduncles 13-40 mm long. Flowers sessile; calyx 5-lobed, 0.11-0.18 cm long; corolla yellow, 5-lobed, 0.19-0.28 cm long; filaments 3.5-5.5 mm long; ovary glabrous. Pods, dark brown, straight or slightly curved, terete, oblong, 3.0-9.0 x 1.0-1.8 cm, coriaceous, striated, glabrous; apex obtuse to acuminate. Seeds ovoid to ellipsoid, slightly flattened, 4.2-8.0 x 3.5-5.8 mm, smooth.

Flowering and fruiting: November to February.

Distribution: This species is native to Tropical & Subtropical America and introduced into Africa, Australia and South Asia. It is found throughout India (Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, South Andaman, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal).

Bioactives

Vachellia farnesiana contains anisaldehyde, benzoic acid, benzyl alcohol, butyric acid, coumarin, cresol, cuminaldehyde, decyl aldehyde, eicosane, eugenol, farnesol, geraniol, hydroxyacetophenone, methyleugenol, methyl salicylate, nerolidol, palmitic acid, salicylic acid, and terpineol (Duke *et al*. 1981) [1]. Lin *et al*. (2009) [4] reported four new diterpenes, acasiane A, acasiane B, farnesirane A, and farnesirane B, along with three known diterpenes, two triterpenes, and eight flavonoids were isolated from the roots of *Vachellia farnesiana*.

As per studies, the primary constituents of *Vachellia farnesiana*'s essential oil are methyl salicylate, anisaldehyde, geraniol, nonadecane, benzaldehyde, and geranial. The seeds of *Vachellia farnesiana* were also used to isolate a number of non-volatile terpenes, including diterpene glycoside (such as farnesiaside). The mucilage from *Vachellia farnesiana* pods contains polysaccharides like arabinose, xylose, galactose, glucose, and mannose. The pods also contain phenolics, flavonoids, their glycosides, and galloylglycosides, including gallic acid and a number of its derivatives, including ellagic acid, m-digallic acid, and methyl gallate. Flavone diosmetin, sitosterol glucoside, and flavone farnesin, such as 7,3′-dihydroxy-4′-methoxyflavone, have all been found to be present in *Vachellia farnesiana* seeds (Ragavi *et al*., 2023) [9].

Pharmacology

Anthelmintic activity

Zarza-Albarrán *et al*. (2020) [12] extracted Galloyl flavonoids from *Vachellia farnesiana* pods possess potent anthelmintic activity against *Haemonchus contortus* eggs and infective larvae. They used the *V. farnesiana* pods for chemical fractioning using ethyl acetate against *H. contortus* eggs and infective larvae allowed for the identification of naringenin 7-O-(6″-galloylglucoside) (flavonol group) as the compound responsible for the anthelmintic activity against this important parasitic nematode.

Antibacterial activity

Cholera is an infectious diarrheal disease caused by *Vibrio cholerae*, a Gram-negative, curved rod bacteria. The ethanolic extracts of *Vachellia farnesiana* effectively inhibited bacterial growth of *Vibrio cholera.* The study showed minimal bactericidal concentration (MBC) for growth was 4.0-7.0 mg/ml for *Vachellia farnesiana* (García *et al*. 2006) [3].

Anti-Inflammatory

The compounds 8, diosmetin, and 3′,4′,5-trihydroxy- 7-methoxyflavone isolated from the roots of *Vachellia farnesiana* slightly inhibited superoxide anion generation or elastase release by human neutrophils, indicating moderate anti-inflammatory activities (Lin *et al*. 2009) [4].

Antioxidant Activity

The investigation of the antioxidant activity of *Vachellia farnesiana* pods studied by Delgadillo Puga *et al*. (2018) [8] and in this study, Methyl gallate, gallic acid, galloyl glucose isomer 1, galloyl glucose isomer 2, galloyl glucose isomer 3,

digalloyl glucose isomer 1, digalloyl glucose isomer 2, digalloyl glucose isomer 3, digalloyl glucose isomer 4, hydroxytyrosol acetate, quinic acid, and caffeoylmalic acid were identified. Both organic and aqueous extracts displayed antioxidant activity.

Cytotoxicity

Betulinic acid a isolated compound from the roots of *Vachellia farnesiana* displayed moderate cytotoxicity (1.70-5.74 µg/mL) towards five human cancer cell lines and the flavonoids had slight effects. Betulinic acid exhibited moderate cytotoxicity, with IC50 values of 1.87 ± 0.04 (Hep G2), 14.70 ± 0.12 (Hep 3B), 5.38 ± 0.05 (MDA-MB-231), 5.74 ± 0.61 (MCF-7), 1.70 ± 0.04 (A549), and 1.80 ± 0.04 (Ca9 -22) µg/mL (Lin *et al*. 2009) [4].

Economic importance

Vachellia farnesiana is used as animal food, a medicine and invertebrate food, has environmental uses and social uses and it is also used for fuel (POWO 2025). Cassie perfume distilled from the flowers *Vachellia farnesiana*. It is used in preparation of violet bouquets, extensively used in European perfumery. In India, Cassie pomades manufactured in Uttar Pradesh and the Punjab. Pods of *Vachellia farnesiana* contain 23% tannin, a glucoside of ellagic acid, and used for tanning leather. Bark is also used for tanning and dyeing leather along with iron ores and salts. In West Bengal and West Indies pods used for a black leather dye. In Java, the gummy substances from pods are used as cement for broken crockery. Gum exuding from trunk considered better-quality to gum Arabic in arts. Ivory Coast trees used as ingredient in arrow poison in hunting. The wood of *Vachellia farnesiana* is used as timber, which is hard and durable underground, used for wooden plows and for pegs. *Vachellia farnesiana* is often planted as an ornamental (Duke *et al*. 1881) [1].

Decoction of bark of *Vachellia farnesiana* is used against dysentery and stomach disorder. The paste of fresh leaf are used for eye inflammation. Both leaf and bark of this species are crushed, boiled, and inhaled by the patient for malaria. Paste of pods is used for the treatment of ulcer and dental caries. It is used in manage pain and inflammation. The paste of stem bark is applied on swollen neck glands (Subhan *et al*. 2018) [11].

The Bark of *Vachellia farnesiana* is astringent and demulcent, and with leaves and roots is used for medicinal purposes. In India the woody branches aare used as toothbrushes and the gummy roots chewed for sore throat. (Duke *et al* 1981) [1].

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