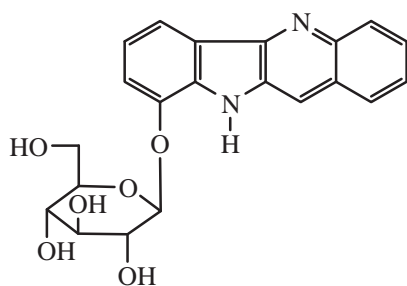
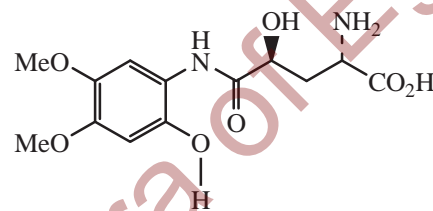


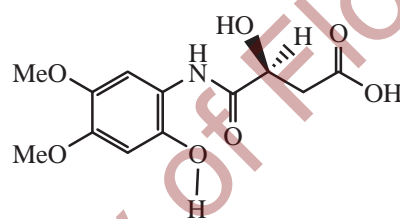
Jusbetonine (**147**) (an indole [3,2-*b*] quinoline alkaloid glycoside), 10-*H*-quinoline, 6-*H*-quinindoline and 5*H*,6*H*-quinindolin-11-one have been isolated from the leaves of *Justicia betonica* (Subbaraju *et al.*, 2004). Chakravarty *et al.* (1982) isolated four simple aromatic amines from the leaves of *Justicia gendarussa* viz. 2-H₂NC₆H₄CH₂OR (I, R=H; II, R=Me) and 2-RCH₂C₆H₄NHCH₂C₆H₄NH₂ (III, R=H; IV, R=Me). Justiciamide (**148**), an amide of L-threo- γ -hydroxyglutamic acid was isolated from *Justicia ghiesbreghtiana* (Lorenz *et al.*, 1999). The leaves of the latter species yielded *N*-(2-hydroxyl-4,5-dimethoxyphenyl)-(*S*)- α -malamic acid (**149**) (Ismail *et al.*, 1998).



147 Jusbetonine



148 Justiciamide



149

Folk Medicine, Pharmacological and Biological Activities

The aerial parts of *Justicia betonica* L. are used in Indian traditional medicine as an anti-diarrhea medicine, as well as anti-inflammatory agent (Kanchanapoom *et al.*, 2004c).

The leaf of *Justicia euosmia* Lindau is made by the Bugu into an ointment with butter for application to pimples and pustules. A decoction of the root of *Justicia matammensis* Oliv. is a Bondei remedy for inflammation of the testicles. The leaf and root of the plant are Shambala remedies for heart diseases (Watt and Breyer-Branjdwijk, 1962).

The roots of *Justicia gendarussa* have been early reported to produce a slight pyresis, and was depressing with an accompanying antipyretic effect in doses of 10-20 gm/kg producing a violent diarrhea and eventually death (Hutchins and Smith, 1937).

The brine shrimp toxicity by *Justicia graciflora* (Gupta *et al.*, 1996b) and the 10*H*-indolo[3,2-*b*] quinoline isolated from *Justicia betonica* (Arunakumari *et al.*, 2007) has been reported. Mruthunjaya and Hukkeri (2007) stated that the leaves of *Justicia gendarussa* Burm. possess antioxidant activity and the flavonoids are responsible for this activity. Prostalidin A, a lignan isolated from *Justicia prostrata* produced mild antidepressant activity in albino mice and rats (Ghosal *et al.*, 1979). The ethanolic extract of *Justicia neesii* Ramamoorthy, exhibited anticancer activity against P388 lymphocytic leukaemia in mice (Aswal *et al.*, 1984).

Justicia gendarussa is useful in bronchitis, inflammations, vaginal discharges, dyspepsia, tympanitis, eye diseases and fevers. The leaves and tender shoots are diaphoretic and are given in chronic rheumatism in the form of decoction. An oil prepared from the leaves when applied locally is said to be useful in eczema, and an infusion of the leaves is given internally

in cephalalgia, hemiplegia and facial paralysis. The Malays employ the plant as a febrifuge. A decoction of the leaf is also used as an emetic and stimulant (Kirtikar and Basu, 1984). *Justicia gendarussa* Burm. is considered as a febrifuge and emetic. It is also used for treatment of lunacy, debility, snake bite (Bachheti *et al.*, 2011) and inflammation diseases such as rheumatoid arthritis (Varma *et al.*, 2011). The ethanolic extract of *Justicia gendarussa* showed significant anti-arthritis activity that was statistically similar to that of aspirin (Jajesh *et al.*, 2009). The plant also possesses antioxidant and hepatoprotective activities (Krishna *et al.*, 2009).

Justicia pectoralis Jacq. is used in Costa Rica for the management of menopausal symptoms and dysmenorrhea (Leal *et al.*, 2000; Locklear *et al.*, 2010). In Brazil, the plant is used in treatment of respiratory tract diseases, such as asthma, cough and bronchitis (Fonseca *et al.*, 2010). On the other hand, in Cuba the tea from the leaves is used as tranquilizer, sedative, anti-inflammatory, antimicrobial and bronchodilator (Venancio *et al.*, 2011). Some studies (e.g. Macrae and Towers, 1984) have shown that *Justicia pectoralis* possesses sedative effects. However, the results obtained by Venancio *et al.* (2011) showed that the aqueous extract of the plant presented an anxiolytic-like effect, disproving sedative effects. Joseph and Sainte-Luce (1992) reported that *Justicia pectoralis* Jacq. can be used for the treatment of circulatory diseases including venous circulation diseases, facial microcirculation disease. *Justicia pectoralis* is also used as anti-inflammatory, antimicrobial and bronchodilator, and its extract exerts an anxiolytic-like activity, disproving sedative effects (Venancio *et al.*, 2011). The extracts of the same species have estrogenic and progestagenic effects (Locklear *et al.*, 2010). The juice of the leaves of *Justicia procumbens* is squeezed into the eye in case of ophthalmia (Kirtikar and Basu, 1984).

The lignans of *Justicia ciliata* viz. ciliatosides A and B have anti-inflammatory activity (Day *et al.*, 2000). Most of the lignans isolated from *Justicia ciliata* (Day *et al.*, 1999) and *Justicia patentiflora* (Susplugos *et al.*, 2005) possess significant cytotoxic activity. Elenoside, a lignan isolated from *Justicia hyssopifolia* was cytotoxic to human cancer cell lines in a range of concentrations from 10^{-5} to 10^{-4} M. It has an LD₅₀, i.p. in mice, of 305 mg/kg and central depressive properties at doses of 25, 50, and 100 mg/kg (Navarro *et al.*, 2001).

The ability of lignans (e.g. justicidin A, procumbenoside A and ciliatosides A and B), isolated from *Justicia ciliata* and *Justicia procumbens* to induce DNA cleavage activity was reported (Lu *et al.*, 2008). The efficacy of the compounds justicidins A-D, G, H and diphyllin (isolated from *Justicia procumbens*) for treatment of osteoporosis has been reported (Tauda *et al.*, 1992). Macrae and Towers (1984) examined the basis for the use of *Justicia pectoralis* var. *stenophylla* as a *Virola* snuff admixture. They found that the extracts lowered locomotor activity in mice but did not affect the hyperactivity induced by 5-methoxy-*N,N*-dimethyltryptamine, the primary psychotropic constituent of *Virola* resin snuff. The antiplatelet effect of some lignans from *Justicia procumbens* (Weng *et al.*, 2004) and *Justicia procumbens* var. *hayati* (Wu *et al.*, 2007) has been reported. Many of the aryl-naphthalene lignans, isolated from *Justicia* species exhibit a diverse biological activities including antitumoral (Mulabagal *et al.*, 2008), antiviral, insecticidal, cardiogenic, antiulcerogenic and anti-inflammatory properties and an ability to inhibit lipid peroxidation. Activities also include platelet activating factor antagonism and central nervous system action. Elenoside has central sedative effects and possible application in anxiety conditions (Navarro *et al.*, 2004), and was found to produce an increase in catharsis index and water percentage of blouses, intestinal transit, and codeine antagonism (Navarro *et al.*, 2006). The hepatoprotective activity of *Justicia simplex* has been reported (Jasemine *et al.*, 2007). The leaf of *Justicia striata* Bullock is used in East Africa by Shambala as a remedy for pimples and by the Haya as a gonorrhoea remedy and as diuretic (Watt and Breyer-Brandwijk, 1962).

Oral administration of the lignan justicidin A, isolated from *Justicia procumbens* suppresses the growth of HT-29 cells transplanted into NOD-SCID mice, suggesting chemotherapeutic potential of the compound on colorectal cancer cells (Lee *et al.*, 2005). Also, justicidin A from *Justicia procumbens* var *leucantha*, to KKAY mice lowered blood leptin, inhibited increases in body weight, blood glucose, plasma triglycerides, plasma free fatty acids, and plasma HDL and LDL/VLDL cholesterol and lowered liver triglycerides (Taketomi, 2010). *Justicia spicigera* is reported in Saudi folk medicine as anti-inflammatory, antidysenteric and stimulant (Ageel *et al.*, 1987). The fresh leaves of *Justicia adhatoda* Nees are used in India to treat scabies and ringworm infection (Singh and Singh, 2009). Sepulveda-Jimenez *et al.* (2009) reported that *Justicia spicigera* is a source of antioxidant and supported its use as an anti-inflammatory for the treatment of uterine cancer and against various free radical-related disorders.

Justicidin B, isolated from *Justicia pectoralis* exhibited antileukemic activity *in vitro* (Joseph *et al.*, 1988a). The lignans, isolated from *Justicia procumbens* showed strong antiviral activity (Asano *et al.*, 1996) and potent cytotoxic effects against a number of cancer cells *in vitro* (Day *et al.*, 2002). The anti-inflammatory, antiulcer (Sanmugapriya *et al.*, 2005a,b), and hepatoprotective (Srivastava and Bhadur, 2006) activities of *Justicia prostrata* have been reported.

The genus *Justicia* is represented in Egypt by 2 species.

- 1.4.1. ***Justicia heterocarpa*** T. Anderson, J. Linn. Soc. London Bot. 7: 41 (1864); Boulos, Fl. Egypt 3: 103 (2002).
subsp. ***heterocarpa***

Heitar, Goraar. هيتار - جَرار

A podophyllotoxin lignin (111), β -sitosterol, stigmasterol, hexahydrofarnesylacetone, farnesylacetone, phytol, 4,8,12-tetramethylheptadecan-4-olide, farnesyl acetate and the fatty acids palmitic, linoleic, oleic and stearic acids were identified from the plant (Al-Juaid and Abdel-Mogib, 2004)

- 1.4.2. ***Justicia ladanoides*** Lam., Tabl. Encycl. 1(1): 42 (1791); Boulos, Fl. Egypt 3:103 (2002).
Syns. *Justicia kotschy* (Hochst.) Dandy in F.W. Andrews, Fl. Pl.Sudan 3: 180 (1956); Täckh., Stud. Fl. Egypt, ed. 2, 503 (1974).

Nothing has been reported about the constituents and/or biological activities of this species.

1.5. **PERISTROPHE** Nees

β -Sitosterol, stigmasterol, *n*-octacosanol, a saturated monocarboxylic acid (Liu *et al.*, 2006), β -ergosterol (Liu *et al.*, 2007), *n*-octadecane, cholest-5-en-3 β -oxyl hexadecanoate, octadecanoic acid, palmitic acid, stigmasterol, stigmasteryl glucoside, β -sitosterol glucoside, lupeol, and allantoin (Wang *et al.*, 1992; Pi *et al.*, 2008) were identified in *Peristrophe japonica*. Pelargonidin-3 β -glucoside (150) was identified from the leaves (Wei *et al.*, 1989)