



## Ethno-Phyto-Pharmacological Overview on *Rauwolfia densiflora* (Wall) Benth.ex Hook.f

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### ABSTRACT

*Rauwolfia densiflora* (wall) Benth. ex Hook.f. (*R. densiflora*) syn. *R. verticillata*. F is an erect herb, known to kanikkars as “Paarisirunila”. Its roots have biologically active compounds including reserpine, densiflorine, ajmaline, sarpagine, rescinnamine, reserpiline, isoreserpiline and reserpinine. These alkaloids show various activities like antimicrobial, anticancer, antihypertensive, antioxidant etc. The present paper is an attempt to explore and compile updated information on ethnobotanical, phyto-chemical and pharmacological investigations of *R.densiflora*. The novelty and applicability of *R.densiflora* are hidden. Such things should be overcome through modern scientific concepts.

**Key Words:** *Rauwolfia densiflora*, Densiflorine, Apocynaceae, Phytochemical, Pharmacological.

### INTRODUCTION

*R. densiflora* (Wall) Benth. ex Hook.f.syn. *R. verticillata*. F. known to the kanikkars as “Paarisirunila / Sirumarapatchilai” belonging to the family Apocynaceae. It is commonly known as Jeyasembagam (Tamil) Kattamalpori (Malyalam) dieng larkei, dieng latyrking, dieng latyrkai, dieng sohbu blang (Assam) Dense-Flowered Snake Root(English) in different languages and regions of India. It is a large shrub 3-6 m. (occasionally 9 m.) high with milky juice and obovate or oblanceolate leaves, rose-red or white flowers, obliquely ellipsoid, brownish or purple drupes and roques, compressed pyrenes pointed at the tip, found in Dajipur, Hassane, Patgaon, Tambyachiwadi, Khandala, Mahabaleshwar, Matheran, Lonavala, Amboli (Maharashtra), the Himalayas, Khasi and Aka hills, and the western and the eastern ghats. *R. densiflora* is an economically important medicinal plant because of the presence of various indole alkaloids in its different parts<sup>1,2,3,4,5,12</sup>. The present paper is an attempt to explore and compile updated information on ethno-botanical, phyto-chemical and pharmacological investigations of *R.densiflora*.

### ETHNOBOTANICAL SIGNIFICANCE

The ethno botanical survey on *R. densiflora* revealed that plant possessed various significant activities and widely used by South Indian tribes.

Malapandaram tribe of Idukki district of Kerala are eaten the fresh leaves to expulse the placenta and the leaf galls to facilitate childbirth, the crushed bark, mixed with coconut, is ingested to induce sterility and as a contraceptive. The sap or bark to facilitate childbirth. Grinded green fruit is mixed

with coconut oil and rubbed onto boils and carbuncles, cuts and sores.

The unripe fruit is used as a medicine for ringworm and psoriasis and an infusion of the sap from a green fruit is taken for asthma and shortness of breath by the *Ulladan* tribe of Waynadu district of Kerala .The leaves are ground and taken with salt for coughs and juice squeezed from a rhizome is used for diabetes, coughs, cold, peptic ulcers, stomach-ache and mouth infections.

During the interaction with the local inhabitants of plant collection area (Wayanadu), it is revealed that the local people used the leaf juice in water as a remedy for fever and root bark are squeezed in salt water and the solution is ingested as a remedy for hypertension. Powdered root or stem bark is used to treat urinary tract infections and the warmed leaves covered with oil are utilized as a poultice for sprains and broken bones. The sap squeezed from the bark is used in treating ringworm and the roots for beriberi, syphilis, and dysentery, and the leaf sap mixed with water is drunk to treat hypotension or anaemia, parts of the plant are utilized to treat cough, tuberculosis, and stings of the sting ray, the stalk of the plant can either be chewed or the healer chews the young leaves and spits them into the patients face to treat headache by the *Kaani* tribe of Wayanadu district of Kerala.

The leaf juice is applied to the ear or a stalk is warmed over fire and the healer spits into the infected ear using the stalk like a straw and latex of leaves is also applied topically to aching ears by the *Kurumba* tribe of Wayanadu district of Kerala. The fresh leaves are rubbed onto painful muscles and rheumatism, and the leaves are also used to treat maternity complications and the fruits are chewed to cure

internal illnesses. Leaf paste is applied topically at the bitten site of snake, beetle and scorpion. Powdered leaf is mixed with cow or goat's milk and taken orally to treat diabetes and as a remedy for snake bites and hypertension<sup>6</sup>.

### PHYTOCHEMICAL STUDIES

A phytochemical investigation of *R. densiflora* has revealed the presence of several alkaloids of which the reserpine, ajmaline and densiflorine are the most important and major alkaloids. The alkaloids are concentrated mostly in the bark of the roots, the quantity being much less in the wood; the bark is reported to yield about 90 per cent of the total alkaloidal content. The various alkaloids isolated from *R. densiflora* are given in Table 1<sup>1,28</sup>.

### PHARMACOLOGICAL ACTIVITIES

#### Antimicrobial, Anticancer, Anti-Inflammatory and Diuretic Activities

Whole plant of *R. densiflora* (wall) Benth .ex. HK. f were collected from karaiyar Agasthiarmalai Biosphere Reserve, Western Ghats, Tamil Nadu. The ethanol extract of the whole plant was analyzed using GC-MS. Seven compounds were identified namely propionic acid anhydride, 1,10-Decanediol, Phytol and 3-Pentanol-2,4-dimethyl. All these compounds showed antimicrobial activity. Phytol was detected in whole plant of *R. densiflora* which also found to be effective at different stages of the arthritis. It was found to give good as well as preventive and therapeutic results against arthritis. The result shows that reactive oxygen species-promoting substances such as phytol constitute a promising novel class of pharmaceuticals for the treatment of rheumatoid arthritis and possibly other chronic inflammatory diseases. Anticancer, antioxidant and diuretic activities are reported for the phytol<sup>7,8</sup>.

#### Antirheumatic Activity

1 gm paste made from equal quantity of leaves and flowers is consumed with honey 2 times a day for four days for rheumatism.

5 gm of leaf mixed with sugar is consumed and drunk 1 liter of water daily in the morning. One km jogging and an exercise are advised for 3 days to cure sprain<sup>9</sup>.

Paste made from an equal quantity of leaves and flowers is consumed twice a day for 5 days to treat rheumatic complaints<sup>10,11</sup>.

#### Antioxidant Activity

Leaves of all reported five species of *Rauwolfia* (*R. beddomei*, *R. densiflora*, *R. micrantha*, *R. serpentina* and *R. tetraphylla*) from Southern Western Ghats were chosen to investigate their antioxidant activities, phytochemicals and nutrient composition. The five species were then screened for their antioxidant potentials using various in-vitro models such as total antioxidant capacity, 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, reducing power and superoxide anion scavenging activity at various concentration *R. densiflora* showed highest level of vitamin C content and metal chelating activity among the five species<sup>12</sup>.

#### Antidiabetic Activity

The molecules ajmaline and isosandwichine, which are enantiomers with the same CAS number, 509-37-5, are found in several *Rauwolfia* species including *R. densiflora*. The *rauwolfia* species containing these molecules are putative antidiabetic extracts. Serpinine isolated from *Rauwolfia* species strongly stimulate glucose utilization.<sup>13,14</sup>

#### Sedative Activity

*R. densiflora* plants were collected from Raltota (Matala district). Sri Lanka. The sedative activity of *R. densiflora* roots and leaves were evaluated using the rat hole board technique. The results indicate that crude extracts of *R. densiflora* has sedative properties as the leaf extract significantly reduced dips and rearing, and the root extracts reduced dips, motor and rearing activities related to exploratory behaviour of rats<sup>15,16</sup>.

#### ACE Inhibiting Activity

Rescinnamine an important alkaloid of *R. densiflora* inhibits angiotensin converting enzyme (ACE) and used to treat hypertension<sup>17</sup>.

#### Antibacterial Activity

*R. densiflora* plants were collected and studied for antibacterial and pharmacological studies these studies revealed that *R. densiflora* root has significant Antibacterial activity<sup>18</sup>.

#### Antipsychotic Activity

Alkaloid of *R. densiflora*, isoreserpiline is having antipsychotic activity<sup>19</sup>.

#### Cardiovascular Activity

*R. densiflora* roots have various biologically active compounds including reserpine, densiflorine, ajmaline, sarpagine, rescinnamine, reserpiline, isoreserpiline and reserpiline. Reserpine is most prominent of these alkaloids and is useful in the treatment of hypertension, cardiovascular diseases, nervous disorders and as a tranquilising agent that is in great demand by modern pharmaceutical industries.<sup>16,20,22</sup>

#### Miscellaneous Activities

*R. densiflora* is used in China to treat snake poisoning, malaria, typhus, hypertension and as a sedative<sup>21</sup>. Ajmaline isolated from *Rauwolfia* species including *R. densiflora* has Antiarrhythmic activity<sup>23,24</sup>. It is also used in Brugada Syndrome which is a condition that affect electrical signaling in the heart and may cause palpitation, dizzy episodes, blackouts and some time has been associated with sudden death. Ajmaline used for ajmaline testing to look for sign of Brugada syndrome<sup>25</sup>. It is also effective in treatment of Wolff-Parkinson-White syndrome<sup>26</sup>.

### CONCLUSION

From the literature survey it is evident that *R. densiflora* is medicinal plant of ethnic use. It is source of many pharmacological and medicinally important phyto-chemicals such as reserpine, ajmaline, densiflorine, rescinnamine, isoreserpiline, reserpiline, reserpiline and sarpagine. The 18-hydroxy-yohimbine, ajmaline and spirobenzylisoquiniline group of alkaloids are the most searched chemical constituents of it. Apart from being used

in the treatment of hypertension popularly its use in traditional system of medicine in the treatment of rheumatism, maternity complications, beri beri, syphilis, dysentery, diabetes, asthma, snake bite, skin diseases and gastrointestinal problems etc. must be critically evaluated and documented. So far little work has been done to bridge

up the vast ethnomedicinal utilization of this plant and its active principle related to treatment of various ailments. It is to be noted that tribal use of plant must be verified by further scientific experimentation which can be used for drug discovery and drug development.



Whole plant

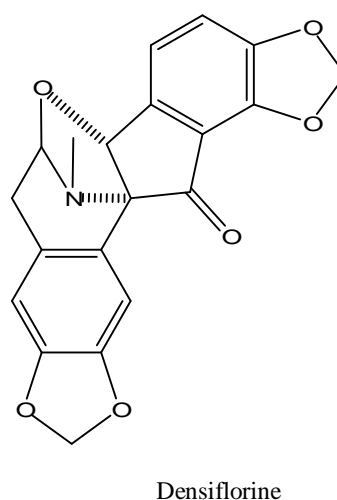
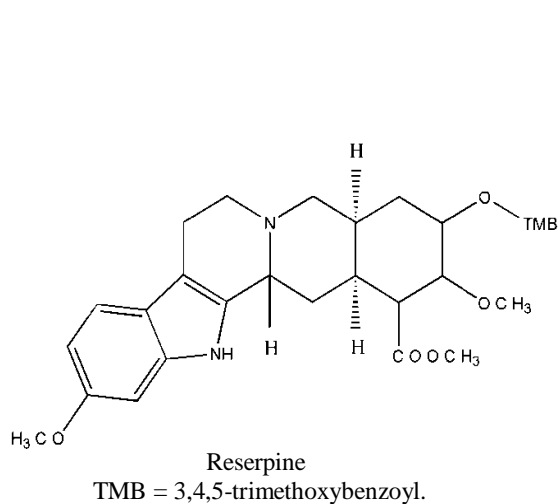


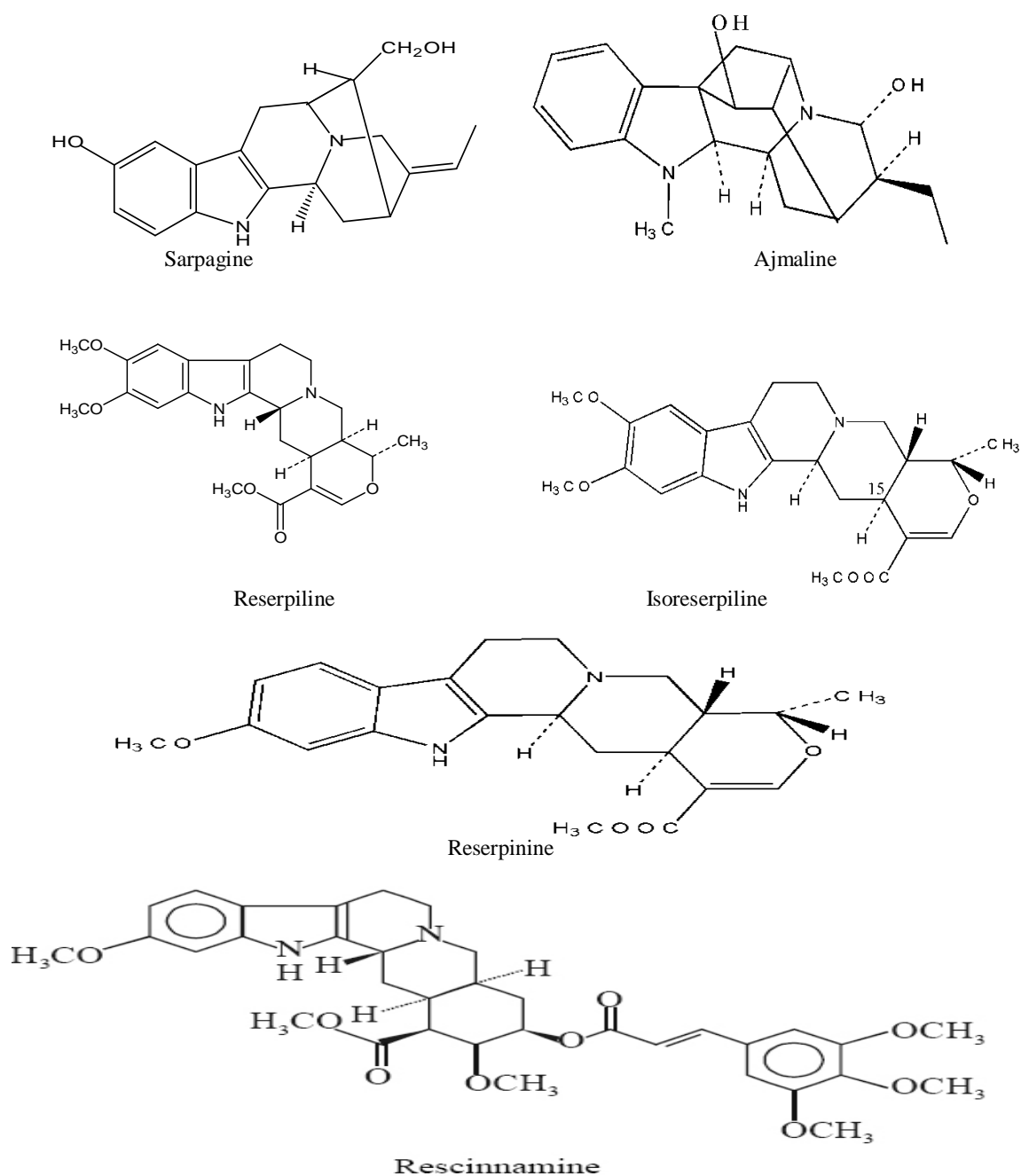
Root



Flowering and Fruiting branches

**Fig.1.** *Rauwolfia densiflora* (wall) Benth. ex Hook.f ( Family Apocynaceae)<sup>21,27</sup>





**Fig.2.** Structures of various alkaloids isolated from *Rauwolfia densiflora* (wall) Benth. ex Hook.f..

**Table 1:** Types of alkaloid found in *Rauwolfia densiflora* (wall) Benth. ex Hook.f.<sup>1,28</sup>.

Sr. No.	Alkaloid type	Alkaloids	Mol. formula	m.p.	[ $\alpha$ ] <sub>D</sub>
1	18-Hydroxy-yohimbine type	Reserpine	C <sub>32</sub> H <sub>40</sub> N <sub>2</sub> O <sub>9</sub>	264-265 <sup>0</sup>	-117 <sup>0</sup>
		Rescinnamine	C <sub>35</sub> H <sub>42</sub> N <sub>2</sub> O <sub>9</sub>	237-238 <sup>0</sup>	-97 <sup>0</sup>
2	Hetero-yohimbine type	Isoreserpiline	C <sub>22</sub> H <sub>26</sub> N <sub>2</sub> O <sub>1</sub>	225-226 <sup>0</sup>	-18 <sup>0</sup>
		Reserpiline	C <sub>23</sub> H <sub>28</sub> N <sub>2</sub> O <sub>3</sub>	*	-12 <sup>0</sup>
		Reserpinine	C <sub>22</sub> H <sub>26</sub> N <sub>2</sub> O <sub>1</sub>	243-244 <sup>0</sup>	-131 <sup>0</sup>
3	Sarpagine type	Sarpagine	C <sub>19</sub> H <sub>22</sub> N <sub>2</sub> O <sub>2</sub>	>350 <sup>0</sup>	+53 <sup>0</sup>
4	Ajmaline type	Ajmaline	C <sub>20</sub> H <sub>26</sub> N <sub>2</sub> O <sub>2</sub>	158-160 <sup>0</sup>	+141 <sup>0</sup>
5	Spirobenzylisoquiniline type	Densiflorine	C <sub>20</sub> H <sub>15</sub> NO <sub>6</sub>	71-73 <sup>0</sup>	*

\* Indicates that value is not reported.

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