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A brief review on *Agauria salicifolia*; A Mediterranean Plant Species

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Abstract

The family Ericaceae is a large cosmopolitan family, represented by 124 genus and 4100 species. She predominates in the temperate regions and tropical mountains of extra South East, Asia and America. The Ericaceae family produces many edible berries that can be grown, but others are violent poisons and ornamental plants. Traditional pharmacopoeias used these plant families to cure many diseases such as anti-diarrheal, anti-inflammatory, urinary astringent and antiseptic activities. The species of *Agauriasalicifolia* belongs to the genus Agauria. *Agauriasalicifolia* is a species of Central Africa, Southern Africa and Madagascar. In Cameroon, this species is especially found in KilumIjim (Oku) and the South West region particularly in the Bamboutos Mountain. *A. salicifolia* are used for the treatment of several diseases such as bites by snakes, skin diseases, on the wounds caused by scarification, rheumatism, sexually transmitted diseases, insecticide, fungal infections, scabies. The leaves and roots are fatally toxic to humans and livestock, even the leaves can cause vomiting, seizures, difficulty breathing and coma. Previous phytochemical investigations on some species of the genus Agauria led to the isolation of triterpenes, diterpenes, steroids and flavonoids.

Keywords: Ericaceae, Agauria, *A. salicifolia*, toxic

1.THE FAMILY ERICACEA

The family *Ericaceae* is a large cosmopolitan family, represented by 124 genera including Arbutus, Calluna, Erica, Rhododendron and about 4100 species [1]. Ericaceae predominate in the temperate regions and tropical mountains of extra South East, Asia and America. It is also present in Himalayas as strong concentration, New Guinea and the Andes. In general, higher density and greater diversity of Ericacea family is found in Mediterranean climates such as Australia and South Africa.The Ericaceae are often mushroom plants that live in symbiosis with some trees preferring the poor and acidic soils [2]. From the perspective of ancient systematic classifications, the family Ericaceae is one of Dicotyledons and belongs to the order Ericales.

1.1. Classifications and botanical aspects of Ericaceae

Although the boundaries of the Ericaceae family are well defined, it is divided into several subfamilies and tribes which were established in 1971 and revised by the Stevens work in 2004 [3]. Thus, the *Ericaceae* family are divided into 8 subfamilies namely *Enkianthoideae*, *Monotropoideae*, *Arbutoideae*, *Cassiopoideae*, *Ericoideae*, *Marrimanelloideae*, *Styphelioideae* and *Vacciniodeae*. The *Ericaceae* plants are shrubs, sometimes very small or subherbacées, trees, rarely lianas or epiphytes. The leaves are alternate. The flowers are small, are actinomorphic and hermaphrodite pentamers. The chalice has 4-5 sepals more or less united at the base; it is sometimes reduced to a ring; it can be persistent and more or less accrescent. The fruit is a small fleshy berry and indehiscent or dry capsule dehiscence loculicidal sometimes locked in a persistent corolla. The seed is very small, often winged fleshy albumen [4-5].

1.2. Medicinal uses of Ericaceae

The Ericaceae family produces many edible berries such as *Vaccinium myrtillus*, *macrocarpum*,*Aiton*, and *vitis-idaea*, Many of the species from the genus Kalmia and Gaultheriaareviolent poisons. The genus *Rhododendron*, *Kalmia* or *Gaultheria* contains grayanotoxins which cause poisoning and fatal [6-8]. The species from the genus such as *Rhododendron*, *Calluna*, *Erica*are grown as ornamental plants and the burls root of *arborea Erica* L. or *E. scoparia* L. are used for the manufacture of pipes [9].

1.3.Ericaceaein traditional medicine

The Ericaceae in traditional pharmacopoeia is used to cure many diseases. Infusions of leaves of Rhododendron sect, *Vaccinium Arctostaphylos* and *Gaultheria procumbens* were an important source of salicylic acid before its production by synthetic method. *Arbutus unedo*, the decotion of its leaves are used as anti-diarrheal and anti-inflammatory properties. *Calluna vulgaris* and *Arctostaphylos Uva-Ursi*, are urinary astringent and antiseptic plants.

2. GENUS AGAURIA

2.1. Botanical aspects of Agauria

The genus belongs to the largest subfamily of Ericaceae. Agauria is a genus of tropical Africa highly represented in Madagascar and the Mascarene Islands. Although many species and subspecies have been described, some authors recognize only one variable species on the African Continent; the great polymorphism is even more marked in Madagascar. The species of the genus Agauria were included in the genus Agarista. Indeed, Agarista, is a genus of about thirty species, is located in tropical regions of the South American continent and particularly in eastern Brazil. Both Agauria and Agarista groups have the same habitat types namely areas of tropical mountains. This may prove that the vast distribution of Agauria on the African continent. On another meeting between *A. polyphylla*, *A.littoralis*, *A. nummularifolia*, *A.bojeri*, *A.mexecana* and *A. salicifolia* or *A.buxiflolia* [10-11]. One can recognize the genus Agauria very easily by its generally whole leaves that are often sea green color on the underside and its inflorescence cluster bearing flowers somewhat fleshy, white to pink or red.

2.2. Importance of Agauria

The leaves of *A. polyphylla* are used against rashes and scabies; They are also used to treat rheumatism and to heal wounds. The plant causes fatalities on livestock that consume the leaves [12]. Wood Agauria genus generally is deemed in poor quality for the construction of houses, they are also used in the manufacture of coal playing a role in the economy.

3. *AGAURIASALICIFOLIA* SPECIES

3.1. Botanical aspects of *Agauriasalicifolia*

Agauria salicifolia is a species of Central Africa, Southern Africa and Madagascar. It is widespread in the forests and meadows of

the highlands (1300 -3000 m) in Cameroon especially in KilumIjim (Oku) and the SouthWest region particularly in the Bamboutos Mountain [13-14]. *A. salicifolia* is a shrub or tree about 10-20 m tall with branched stems and leaf buds of reddish color. The bark is grayish cracked lengthwise. The heart wood is reddish. The leaves are prominent midrib, very dense at the top of twigs, young leaves are reddish. The lamina is elliptic or lanceolate leathery, acuminate at the top, tomentose when young. The leaf margin is bent underneath. The inflorescence is bunch of flowers in cream with red bells, terminal or axillary pluriflores. The fruit capsules are small seeds dispersed by wind [15].

Figure 1: Aspect of leaves of *A. salicifolia*

3.1.2. Traditional uses

In Central Africa, particularly in Cameroon sap from leaves of *A. salicifolia* is applied on the wounds caused by scarification acting analgesic properties, with the aim of relieving rheumatism. The leaves and bark are still steeped in Cameroon and consumed orally for the treatment of sexually transmitted diseases. In East Africa, the plant is also used as an insecticide and as an antidote against the poison arrows .The bark is mixed with fresh water and then drunk by the Massaï in Kenya as an aid to digestion or after excessive meat . The roots and bark of the stem of *A. salicifolia* are used for the treatment of several diseases in Central Africa for example when bites by snakes, skin diseases, added to baitto kill [16-18]. In Madagascar, grilled plant is pulverized and applied to ulcerous wounds. It is also used to treat syphilis and neuralgia. Externally, the leaves are also used for the treatment against scabies. The leaves are fatally toxic to humans and livestock, even the leaves can cause vomiting, seizures, difficulty in breathing and coma. The roots are also toxic [19]. In 2005, Martinet et al. reported the case of poisoning by *A. salicifolia*. A woman who had mistakenly consumed this tea plant was prone to vomiting, hypotension and bradycardia and healed within hours under medical supervision [20]. In Reunion, *A. salicifolia* is usually used in topical application in the treatment of eczema.

The leaves of *A. salicifolia* were used by traditional healers for treatment of fungal infections in Tanzania. Bioassay guided chromatographic separation of a methanolic extract of *A.salicifolia* led to isolation of 3-acetyl moraldehyde (**2**) and aguariasterone(**9**). Insecticidal activity was done for these compounds usingadult *Phaedoncochleariae*. These compounds were found to be active with LD_{50} values of 0.04 and 0.15 µg, respectively [21-22]. Traditional healers in Tanzania use the leaves of *A.salicifolia* for treatment of fungal infections**.**This plant was tested for brine shrimp lethality and the result of LC_{50} gave a value >240 µg/ml.For this preparation it is still topical.

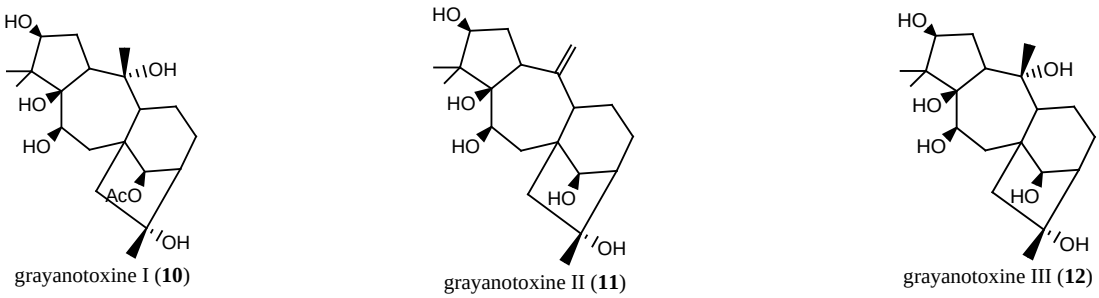
An ethanolic extract of leaves of *A.salicifolia* was tested on voltage-clamped isolated skeletal and cardiac frog muscle cells using the double sucrose-gap (skeletal) and the whole-cell patch-clamp (cardiac) methods, at concentrations ranging from 10^{-8} to 5×10^{-5} g/l. At 10^{-6} g/l a progressive and limited decrease was observed in resting membrane potential (≈ 5 mV). At outgoing for these assays they are concluded the extract acts on the sodium channel regardless of its state (resting, activated and inactivated) on at least two different sites [23].

4. ADVERSE EFFECTS

In spite of a use in traditional medicine most patients presented with showed faintless, bradycardia, hypotension and dizziness, consistent with ingested food containing grayanotoxins (**10-12**) All patients fully recovered with a symptomatic treatment. A survey around the hives where the honey was collected showed the presence of large quantities of *A.salicifolia* (Ericaceae family), an endemic plant in the south-western Indian Ocean and rich in grayanotoxins[24].

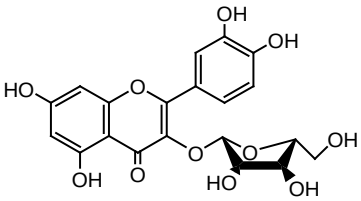
5 PHYTOCONTITUENTS OF *AGAURIA*

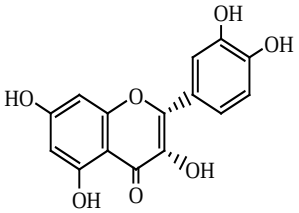
Previous phytochemical investigations on some species of the genus Agauria led to the isolation of triterpenes (Rotenone (**1**),3-acetyl moraldehyde (**2**),acidemorolique (**3**), Taraxerone (**4**), Taraxerol (**5**),3-acétylmoradiol (**6**),Lupeol (**7**), steroids(*β*-sitosterol (**8**), Aguariasterone (**9**) diterpenes mainly the grayanotoxine(**10-12**) and flavonoids (quercetin-3-O-*α*-arabinofuranoside (**13),** (-)-épicatechine (**14**),quercetine-3-O-β-glucuronopyranoside (**15**)) [13].The work of Lhuilier in 2007 showed a comparative study by LC-MS composition of flavonoid fractions of *A. salicifolia* and *A. polyphylla*. This resulted in the identification "on line" say that is to without isolation 8 compounds of type glycosylate flavonols: quercetin-3-O-galactoside (**16**), quercetin-3-O-glucoside (**17**), quercetin-3-O-rhamnoside (**18**), genin quercetin (**20**), kaempferol-3-O-arabinopyranoside (**21**), kaempferol-3-O-arabinofuranoside (**22**), kaempferol-3-O-rhamnoside (**23**) and kaempferol-3-O-glucuronide (**24**) .

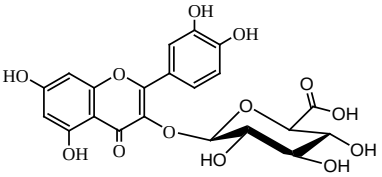


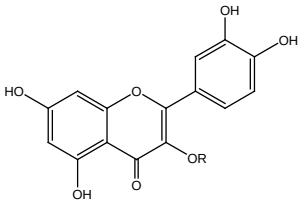
grayanotoxine I (**10**) grayanotoxine II (**11**) grayanotoxine III (**12**)

Figure 3: Diterpenes from leaves of *A. polyphylla* [16-23-26]

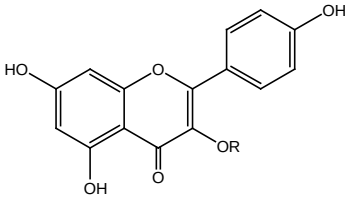

quercetin-3-O-α-arabinofuranoside (**13**)


(-)-épicatechine (**14**)


quercetine-3-O-β-glucuronopyranoside(**15**)



(**16**): quercetin-3-O-galactoside (hyperoside), R= galactose
(**17**): quercetin-3-O-glucoside (isoquercitrin), R= glucose
(**18**): quercetin-3-O-rhamnose (quercitrin), R= rhamnose
(**19**): quercetin-3-O-glucuronide (miquelianin), R= glucuronide
(**20**): géninequercetin,



(**21**): kaempferol-3-O-arabinopyranoside, R= arabinopyranose
(**22**): kaempeérol-3-O-arabinofuranoside, R= arabinofuranose
(**23**): kaempferol-3-O-rhamnoside (afzeline), R= rhamnose
(**24**): le kaempferol-3-O-glucuronide, R= glucuronide

. Figure 4.: Flavonoid compounds isolated from the genus Agauria[13]

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