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A REVIEW ON *SCLEROPYRUM PENTANDRUM* (Dennst.) Mabb

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ABSTRACT

Scleropyrum pentandrum (Dennst.) Mabb, Synonym: *Scleropyrum wallichianum* Arn belongs to the family Santalaceae growing along the margin of evergreen to semi-evergreen forests between 600 and 1600 m. It will flowering in January to March, fruiting in August to October. They are small trees growing up to 7m tall; branches ascending or horizontally to the main trunk. Literatures revealed that, a proper investigation was not done with this plant. It is used by semalai people for its contraceptive activity. The roots are boiled and the decoction is taken as a contraceptive. It is believed that women will become barren after consuming the decoction. Paste of stem bark and leaf is applied externally to treat skin diseases. Screened antibacterial activity of methanol extract of leaves and found inhibitory efficacy was dose dependent. Anticariogenic and cytotoxic activity of methanol extract of *S. pentandrum* leaves were carried out. The extract was found to be having anticariogenic activity. Hence in this current review a list of activities present in the plant *Scleropyrum pentandrum* were screened. It is a beneficial work for researchers to provide many details about the plant *Scleropyrum pentandrum* plant.

KEY WORDS

Anticariogenic, Contraceptive, *Scleropyrum pentandrum* and Anti-bacterial.

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INTRODUCTION

Scleropyrum pentandrum (Dennst.) Mabb is a tree well distributed throughout the world, used traditionally by many people for different ailments, still untouched by the researchers in carrying out a systematic scientific study of the plant. Less than 20% of the plant kingdom was so far studied for their medicinal activity and their phytochemical nature. Many of the plants were destroyed from the nature before recorded anywhere their medicinal activity and their phytochemical identities.

Each species of *Scleropyrum* has its own calendar of events to perform these cyclic developmental changes. A basic understanding of floral structure, phenology and pollination systems is a prerequisite for studies on reproductive biology¹. *Scleropyrum pentandrum* (Dennst.) Mabb (Synonym: *Scleropyrum wallichianum* Arn.) belongs to the family Santalaceae growing along the margin of evergreen to semi-evergreen forests between 600 and 1600 m. *S. Pentandrum* (Malayalam: *Irumulli*; Kannada: *Benduga*, *Naikkuli*) distributed in Cambodia, China (Southern and Hainan island), Thailand (Northern, Eastern, South Eastern, South Western, Peninsular), Sri Lanka and Laos (Attapetu, Khammouane and Louangphrabang provinces). In India, it is distributed in Peninsular India (Western Ghats- South and Central Sahyadris and generally found in disturbed habitats on sandy soil, as well found in semi and dry evergreen forests, in open forest near stream and in lowland Dipterocarps forest, from 500 to 1000 m. flowering in January to March, fruiting in August to October². They are small trees growing up to 7m tall; branches ascending or horizontally to the main trunk. Bole, straight with fascicle of sharp spines on trunk or branches³. Bark deeply cracked while juvenile stem striate, light brown, inner bark light brown-cream; Twigs slightly flattened at leaves insertion and densely pubescent when young, becoming terete and glabrous in mature. Young twigs with spines. Exudate absent; Leaves simple alternate and spiral, 10- 20 x 2.5-9 cm, narrowly to broadly elliptic or ovate, apex acute, shortly acuminate, base attenuate, margin entire, blade leathery to coriaceous, upper surface shining, glabrous, under surface glabrescent along midrib^{4,5}.

Scleropyrum pentandrum (Dennst.) Mabb (Synonym: *Scleropyrum wallichianum* Arn.) belongs to the family Santalaceae and grows along the margin of evergreen to semi-evergreen forests between 600 and 1600 m. *S. Pentandrum* is distributed in Cambodia, China, Thailand, Sri Lanka and Laos. In India, it is distributed in Peninsular India, Western Ghats, South and Central Sahyadris and generally found on sandy soil, as well found in semi and dry evergreen forests, in open forest near

stream and in lowland Dipterocarps forest, from 500 to 1000m. Flowering occurs in January to March, fruiting in August to October⁶. The whole plant parts are applied externally to treat skin irritation in Kani tribal settlement, Agasthiayamalai biosphere reserve, Tirunelveli, South India⁷. It is commonly called Naaikuli in Kasargod, Kerala and is used as a mechanical barrier (fencing) in dried or live condition. The crushed roots are given for curing stomach ailments in Kurichyas tribal community in Kannur district of Kerala. Screened antibacterial activity methanol extract of leaves and found inhibitory efficacy was dose dependent. Extensive literature reviews revealed that much of the bioactivities of this plant remain unexplored. Hence, the present investigation was undertaken to determine mineral content and to screen anticariogenic and cytotoxic activity of methanol extract of *S. pentandrum* leaves. Fruits of *S.pentandrum* are consumed by the paniya tribal community of Wynad district, Kerala.⁸

MORPHOLOGY

Leaves are simple alternate and spiral with 10-20 cm long and 2.5-9 cm width. They are narrowly to broadly elliptic or ovate with acute apex. Leaves are shortly acuminate, margin entire, blade leathery to coriaceous, upper surface shining, glabrous, under surface glabrescent along midrib. Midrib is canaliculated above primary vein single, secondary veins oblique to the midrib, widely parallel and anastomosing at margin, tertiary veins obscure. Petioles are pubescent and exstipulated. Color, dark green on upper surface and light green colour on lower surface; Texture, leathery to coriaceous; odor, slightly aromatic and unpleasant; taste, slightly bitter. The stem is, green with smooth texture⁹ was shown in Figure No.1.

Midrib is canaliculated above. Primary vein single, secondary veins oblique to the midrib, widely parallel and anastomosing at margin, tertiary veins obscure. Petiole pubescent. Stipules absent. Inflorescence axillary spikes; Flowers small, polygamous, red, sessile, grouped in fascicle of catkins, cauliflorous, bisexual, male flower smelling unpleasant, shortly pedicel led while female flower

sessile; Fruit is a drupe with pear shape or ovoid, 1.8-3.5 by 1.3-2.6 cm, stalked, green turning yellow when ripen. Seed(s) 1-3, nearly globose. *Scleropyrum pentandrum* is polygamous and bears male, female and bisexual flowers were shown in Figure No.2. The foliculous fungi inhabiting on the leaves was also recorded by the researchers¹⁰.

Male flowers are small arranged in catkin/fascicle inflorescence and maximum positioned at the trunk of the tree. The actual life span of male flowers is 4-7 days after anthesis. At the time of anthesis, the male flowers emit minute odour to attract pollinators especially the bees, wasps and ants, but they are not prefer these male flowers. There was no accurate anthesis time recorded for male flowers.

Female flowers are comparatively larger than male flowers and arranged in racemes. They are globose in structure, epigynous with tristylous. In some cases, both male and female flowers are positioned at nearest while happening so, the pollen grains transferred to the stigma easier.

Bisexual flowers, both anthers (5) and stigmas are positioned in the same flower but the anthers are inactive and sterile (staminodes). The anthers are in imperfect stage while the stigma comes receptive. Therefore, the receptive stigmas prefer geitonogamous/ xenogamous pollen grains for pollination. At the time of receptivity, the bisexual flowers acts as female. Likewise, the male flower has also a undeveloped gynoecium. The maximum level of pollination by insects takes place in unisexual flowers only due to the perfect development of advertisement and reward of the flower. After compatible pollination subsequent fertilization, the fruits (drupes) development took 20-25 days after pollination. The fruit bears 1-3 seeds¹¹.

BOTANICAL DESCRIPTIONS

Diagnostic characters

Parasitic trees, trunk and branches with spines. Leaves simple, alternate, characteristically yellow-green. Flowers bisexual in catkin-like fascicles. Fruit a drupe.

Habit

Small evergreen tree (parasitic) up to 20 m high, branches ascending or horizontally to the main trunk.

Trunk and bark

Bole straight with fascicle of sharp spines on trunk or branches. Bark deeply fissured while juvenile stem striate, light brown, inner bark light brown-cream.

Branches and branchlets or twigs

Twigs slightly flattened at leaf insertion and densely pubescent when young, becoming terete and glabrous when matures. Young twigs with spines.

Exudates

Exudate absent.

Leaves

Leaves simple alternate and spiral, 10- 20 x 2.5-9 cm, narrowly to broadly elliptic or ovate, apex acute, shortly acuminate, base attenuate, margin entire, blade leathery to coriaceous, upper surface shining, glabrous, under surface glabrescent along midrib. Midrib canaliculated above, primary vein single, secondary veins oblique to the midrib, widely parallel and anastomosing at margin, tertiary veins obscure. Petiole pubescent. Stipules absent was show in Figure No.3.

Inflorescences or flowers

Flowers small, grouped in fascicle of catkins, cauliflorous, unisexual, male flower smelling unpleasant, shortly pedicel led while female flowers sessile¹².

Fruits

Fruit is a drupe with pear shape or ovoid, 1.8-3.5 by 1.3-2.6 cm, stalked, green turning yellow when ripen was show in Figure No.4.

Seeds

Seed(s) 1-3, nearly globose.

Habitat and ecology

Generally found in disturbed habitats on sandy soil, as well found in semi and dry evergreen forests, in open forest near stream and in lowland Dipterocarp forest, from 500 to 1000 m. Flowering in January to March, fruiting in August to October¹³.

QUALITATIVE MICROSCOPY

TS of petiole are somewhat oval in shape with a depression on the upper side. Detailed TS shows an outermost single layered epidermis with cuticle and unicellular trichomes. Inner to the epidermis is a wide zone of thick walled parenchymatous ground tissue with intercellular spaces. The centre is occupied by five vascular bundles arranged in the shape of 'U'. Each bundle composed of numerous xylem elements arranged towards the upper region and a few phloem elements towards the lower side. Outer to the phloem, multi layered sclerenchymatous bundle cap is present. A few sclerenchymatous cells are also embedded in the ground tissue inner to the vascular bundle. Most of the parenchymatous cells of the ground tissue consist of rosette and prism crystals of calcium oxalate which is seen scattered throughout the ground tissue.

Leaf

The leaf passing through the midrib shows dorsiventral nature. Midrib is comparatively large and rounded on the lower side and deep concave towards the upper side. Epidermis is single layered and inner to the epidermis 1 to 2 layers are collenchymatous in the lower side. On the upper side palisade cells extend into the midrib and are in 2 to 3 layers just below the epidermis. The ground tissue is parenchymatous and three vascular bundles are embedded in the ground tissue slightly towards the upper side. Sclerenchymatous bundle sheath is present in each vascular bundle.

In the lamina portion also, both epidermis are single layered with cuticle. Upper epidermis is followed by 2 to 3 layers of compactly arranged palisade cells which are short oval or rectangular and the size is more or less same as that of epidermal cells. Some of the palisade cells consist of prismatic crystals of calcium oxalate. The major portion of the lamina is occupied by spongy mesophyll tissue traversed with vascular strands. Spongy parenchymas cells are tangentially elongated and arranged with large inter cellular spaces. Stomata and trichomes are present only on the lower epidermis. Stomata are of paracytic with two subsidiary cells. Venation pattern of the

leaf shows primary and secondary veins. Secondary veins are oblique to the midrib and reticulate.

Description of *Scleropyrum pentandrum*

When searched for literatures, it revealed that, a proper investigation was not done with this plant. It is used by semalai people for its contraceptive activity. The roots are boiled and the decoction is taken as a contraceptive. It is believed that women will become barren after consuming the decoction. Paste of stem bark and leaf is applied externally to treat skin diseases. Screened antibacterial activity of methanol extract of leaves and found inhibitory efficacy was dose dependent. Extensive literature reviews revealed that much of the bioactivities of this plant remain unexplored. Anticariogenic and cytotoxic activity of methanol extract of *S. pentandrum* leaves were carried out the extract was found to be having anticariogenic activity. Recently, five unprecedented furan-2-carbonyl C-glycosides, and two phenolic diglycosides, were isolated from leaves and twigs of *Scleropyrum pentandrum*. George A. The cyclooxygenase inhibiting, anti malarial and anti TB activities of *Scleropyrum pentandrum*. Fruits and seeds of *Scleropyrum Pentandrum* also called kirindas consumed by Paniya, Kattunaikka and Kuruma tribes of Wynad district, Kerala, India¹⁴.

Antibacterial activity of methanol extract of *Scleropyrum pentandrum*

The antibacterial efficacy of different concentrations of methanol extract was tested by Agar-well-diffusion method against two Gram positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*) and two Gram negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*). Briefly, 24 hours old Nutrient broth (HiMedia, Mumbai) cultures of test bacteria were swabbed uniformly on solidified sterile Nutrient agar (HiMedia, Mumbai) plates using sterile cotton swab. Then, wells of 6mm diameter were bored in the inoculated plates with the help of sterile cork borer and the extract (10, 25, 50 and 100mg/ml of 10% DMSO), Standard (*Chloramphenicol*, 1mg/ml) and Control (10% DMSO) were added separately into respectively labelled wells. The inoculated plates were incubated at 37°C for 24 hours in upright position and the zone

of inhibition formed around the well was measured with a ruler. The experiment was carried in triplicates to get average reading. The inhibitory efficacy could be attributed to the secondary metabolites present in the *Scleropyrum pentandrum* extract¹⁵.

Anticariogenic activity of *Scleropyrum pentandrum* (Dennst.) Mabb

The anticariogenic activity of methanol extract was investigated against 24 oral isolates of *S. Mutans* recovered from plaque and saliva samples of dental caries patients. The result of inhibitory activity of extract. Results were recorded as presence or absence of zones of inhibition around the well. The inhibitory zone around the well indicated the absence of bacterial growth and it as reported as positive and the absence of zone as negative. It was found that the extract caused inhibition of oral bacterial isolates in a dose dependent manner. The diameter of inhibition zone formed was in the range of 1.7 to 2.3cm and 1.3 to 2.0cm at extract concentration of 20mg/ml and 10mg/ml respectively. Inhibition caused by standard antibiotic was higher than that of methanol extract. DMSO did not cause any inhibition of cariogenic isolates. In suitable form, the extract could be used against dental caries and cancer or tumor. Further study is needed to isolate and characterize the bioactive components present in the extract and their anticariogenic and cytotoxic efficacy¹⁶.

***Scleropyrum pentandrum* (Dennst.)Mabb used for skin diseases**

Frequent field surveys were carried out in Tirunelveli hills during different seasons in 2002 and 2003. The ethnobotanical data (local name, mode of preparation, medicinal uses) were collected through interviews and discussions among the tribal practitioners in and around the study area. Data were also collected through questionnaires in their local language. In addition to the vernacular names and medicinal uses, detailed information about mode of preparation (i.e., decoction, paste, powder and juice), form of use such as fresh or dried and mixtures of other plants used as ingredients were also collected. The medicinal plants were identified (local name sample specimens were collected for the preparation of herbarium. *Scleropyrum pentandrum*

(Dennst.)Mabb. (Santalaceae) Local name: Mulkirayan.

Uses: Paste of stem bark and leaf is applied externally to cure skin diseases¹⁷.

***Scleropyrum pentandrum*(Dennst.)Mabb used for stomach ache**

Scleropyrum pentandrum (Dennst.) Mabblerley Crushed roots given for curing stomach ailments¹⁸.

Phytochemical Analysis of *Scleropyrum pentandrum* (Dennst.)

In previous phytochemical investigation, nonpolar compounds such as acetylenic acids, fatty acids and sterol derivatives have been reported^{19, 20}. The present paper²¹ describes the isolation and structure elucidation of 15 polar compounds, including five unprecedented furan-2-carbonyl C-glycosides (Figure No.5, 1-5), two new phenolic glycosides (Figure No.5, 7-8) in addition to five flavone C-glycosides (9–13), a phenolic glycoside (Figure No-5, 6), a nucleoside (14) and an amino acid (15) from the aqueous soluble fraction of leaves and twigs of this plant.

From the twigs of *Scleropyrum wallichianum*, were isolated and characterized using spectroscopic methods²¹, in that found, a new unsaturated carboxylic acid, scleropyric acid (1), two new esters such as b-sitosteryl-3-O-scleropyrate (2) and stigmasteryl-3-O-scleropyrate (3), and two well-known sterols such as b-sitosterol (4) and stigma sterol (5) (Figure No.6).

DISCUSSION

The presence of antibacterial substances, anti-inflammatory, skin diseases, anticariogenic activity and stomach ache of different extract of *Scleropyrum pentandrum* well established. Plant have provided a source of inspiration for novel drug compounds as plants derived medicines have made significant contribution towards human health. Phytomedicine can be used for the treatment of diseases as is done in case of Unani and Ayurvedic system of medicines or it can be the base for the development of a medicine, a natural blueprint for the development of a drug. The isolation of botanical compounds from plant material is largely dependent on the type of solvent used in the

extraction procedure. The traditional healers use primarily water as the solvent but we found in this study the plant extracts by methanol provided more consistent antimicrobial activity. Therefore, given that the literature on tests for the antimicrobial action of plant *Scleropyrum pentandrum* broad,

including an increasing number of publications per year, it is highly difficult to relate the countless reports on the antimicrobial action of these products in this review article about a subject of such a great complexity, which requires a multidisciplinary approach.



Figure No.1: *Scleropyrum pentandrum*



Figure No.3: *Scleropyrum pentandrum* leaf



Figure No.2: *Scleropyrum pentandrum* male and female flowers



Figure No.4: *Scleropyrum pentandrum* fruits

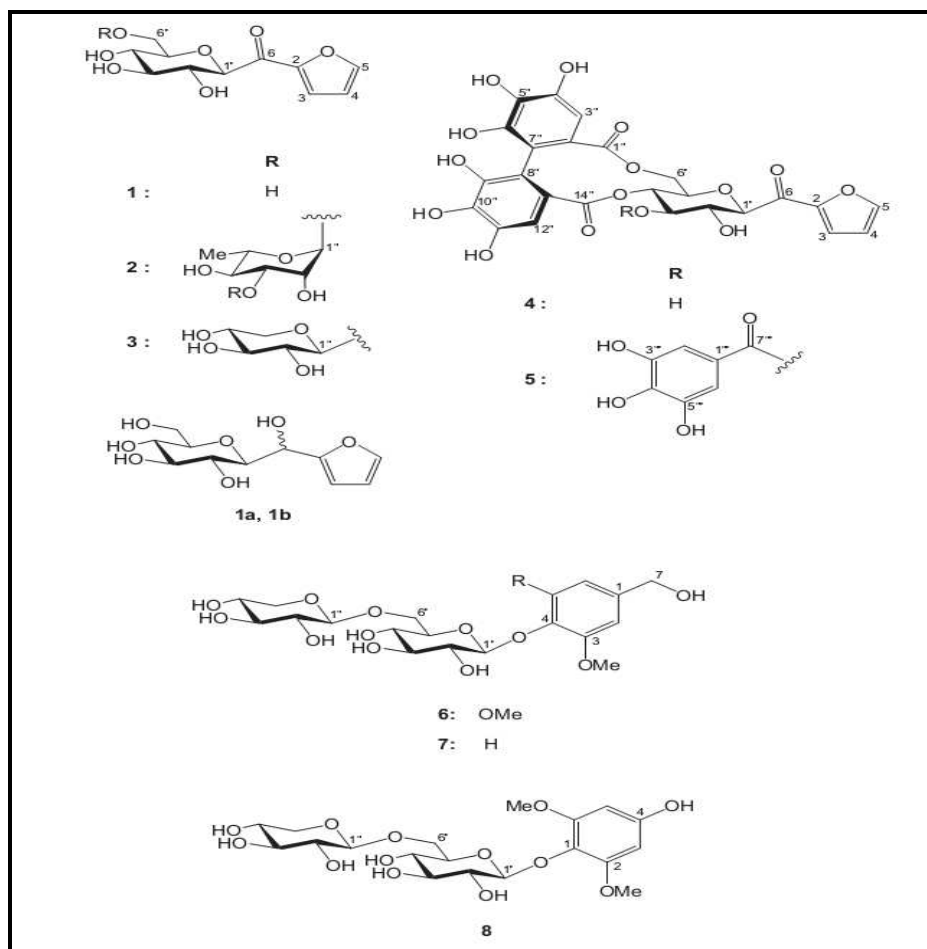


Figure No.5: Structures of isolated compounds from *Scleropyrum pentandrum* (Dennst.)

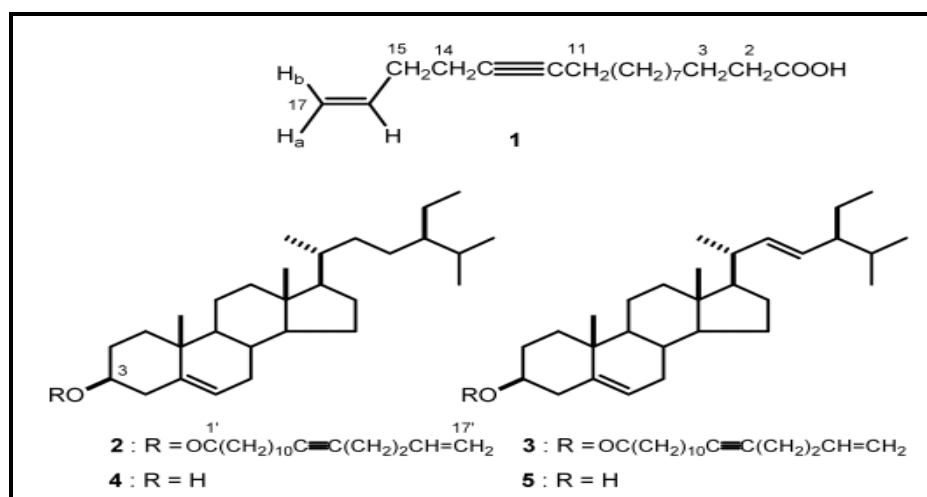


Figure No.6: New unsaturated carboxylic acid, scleropyric acid (1), two new esters such as b-sitosteryl-3-O-scleropyrate (2) and stigmasteryl-3-O-scleropyrate (3), and two well-known sterols such as b-sitosterol (4) and stigma sterol (5)

CONCLUSION

In this study, an appreciable quantity of different activities was detected and hence, the plant could be used as an important source for many treatments such as antibacterial, stomach ache, skin diseases, anti carcinogenic etc. The plant could be used as a source of important elements needed for normal physiology of the body. In suitable form, the extract could be used against such diseases mentioned above. Further study is needed to isolate and characterize the bioactive components present in the extract and their cytotoxic efficacy.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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