IJBPAS, August, 2024, 13(8): 3833-3846

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

POLYSCIAS SCUTELLARIA (SHIELD ARALIA): BOTANICAL, ETHNOBOTANICAL, NUTRITIONAL, PHYTOCHEMICAL, AND PHARMACOLOGICAL REVIEW

EVANGELINE JA, SAKTHIPRIYADARSINI S*, KAMARAJ R

Department of Pharmacognosy, SRM College of Pharmacy, Faculty of Medicine and Health Science, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamil Nadu, India-603203

***Corresponding Author: Dr. Sakthi Priyadarsini Sethuraman: E Mail: sakthips1@srmist.edu.in**

Received 15th May 2023; Revised 18th Aug. 2023; Accepted 4th Nov. 2023; Available online 1st Aug. 2024

https://doi.org/10.31032/IJBPAS/2024/13.8.8239

ABSTRACT

Polyscias scutellaria (Shield Aralia) is an indigenous plant of the Araliaceae family. The Araliaceae family includes a number of beneficial medicinal species as well as ornamental plants for the garden. More than 1,500 plant species present in the Araliaceae family, and this is made up of more than 55 genera and includes species of Aralia, Eleutherococcus, and Panax, are used as traditional Chinese medicines. *Polyscias scutellaria* is found in the islands of the Pacific Ocean, especially New Guinea and its surrounding islands, India, Central America, and Africa. Reports state that the plant has been traditionally used to treat breast discomfort, wounds, urinary tract infections, and body odour. Further, Indonesians have long used the plant to improve breast milk production in lactating mothers. Around 97 chemical compounds from various chemical classes were isolated from Polyscias species, with saponins serving as the primary component and exhibiting anti-inflammatory, anti-toxin, antiviral, anti-dysenteric, anti-neurogenic, anti-rheumatic, and diuretic properties. The phytoconstituents present in *Polyscias scutellaria* include flavonoids, saponins, and glycosides reported with antibacterial, antioxidant, anti-cancer, and antifungal properties and also effective in prolactin secretion and metabolic syndromes. The present review summarizes the botanical, phytochemical, and pharmacological studies reported in *Polyscias scutellaria* and its ethnobotanical and nutritional values.

Keywords: Araliaceae, Ethnobotanical, Mangkokan, *Polyscias scutellaria,* Shield Aralia

1.INTRODUCTION:

Polyscias scutellaria, commonly known as Shield Aralia, is an indigenous plant of the Araliaceae family, prevalent in Indonesia, and has been used to treat various diseases **[1]**. Various indigenous trees and shrubs, primarily from tropical regions of Indo-Malaysia and tropical America, are indeed members of the Araliaceae family. The family consists of several valuable medicinal species as well as decorative plants for home gardens **[2]**. There are over 1,500 plant species in the Araliaceae family, comprised of more than 55 genera, and most of them are utilized as traditional Chinese medicines, including species of *Aralia, Eleutherococcus, and Panax* **[3]**. Over a hundred species have been used for medicinal purposes because of the biological constituents such as triterpenoid saponins, diterpenes, flavones, coumarins, and phenols **[4]**. *Polyscias* (Family Araliaceae) is a plant genus with nearly 116 species frequently employed for cosmetic reasons and its potential therapeutic benefit. *Moreover, Polyscias* species were reported with the isolation of around 97 chemical compounds from different chemical classes, with saponins serving as main ingredients exhibiting anti-inflammatory, anti-toxin, antibacterial, antiviral, anti-dysenteric, anti-neuralgic, anti-rheumatic and diuretic properties **[5]**.

Polyscias scutellaria has been traditionally used to treat breast discomfort, wound healing, urinary tract issues, and body odour. The reported chemical constituents include alkaloids, saponins, tannins, and flavonoids **[6]**. Scientific reports have highlighted the benefits of Shield Aralia leaves as a breast milk enhancer1. Further, *Polyscias scutellaria* has been proven to increase the growth of hair **[7]**. The flavonoids in *Polyscias scutellaria* leaves include flavonols (quercetin, kaempferol, and myricetin), which are thought to have antioxidant action, as well as flavones (luteolin and apigenin) **[8]**. *Polyscias scutellaria* boosts the antioxidant levels in the body, improves blood circulation, and reduces anemic symptoms. *Polyscias scutellaria* has been proven in several trials to decrease blood sugar levels **[9]**. Traditionally, *Polyscias scutellaria* **(Figure 1)** leaves are boiled and eaten as vegetables, and the roots are used as diuretics**[10].** Despite its valuable traditional uses in the literature, a vast lacuna exists in their scientific validation. This article aims to provide an overview of the scientific research on this particular plant, *Polyscias scutellaria*, and review its existing scientific reports. Moreover, our primary objective is to bring

this less explored and therapeutically effective plant to the limelight so that the plant extract or its constituent may turn into a promising pharmaceutical.

Figure 1: ***Polyscias scutellaria (Burm. f.) Fosberg***

2. TAXONOMICAL HIERARCHY [11]

Scientific Name: *Polyscias scutellaria (Burm. f.) Fosberg*

Kingdom: Plantae

Phylum: Anthophyta

Class: Dicotyledoneae

Order: Apiales

Family: Araliaceae

Genus: *Polyscias*

Species: *Scutellaria*

3. COMMON NAMES AND SYNONYMS

Polyscias scutellaria is commonly known as Plum Aralia, Balfour Aralia, in addition to

- Shield aralia in the United States
- Cup leaves in Sri Lanka,
- Mangkokan in Indonesia and
- Phlox rotundum in China **[12]**

The Plant List provides more than 17 synonyms.

- *Aralia cochleata Lam.*
- *Aralia rotunda W.Bull,*
- *Crassula scutellaria Burm.f.*
- *Aralia rotundifolia hort. ex Truff.*
- *Hedera cochleata (Lam.) Sweet.*
- *Hedera latifolia Wight & Arn.*
- *Nothopanax cochleatus (Lam.) Miq.*
- *Nothopanax scutellarius (Burm.f.) Merr.*
- *Nothopanax tricochleatus Miq.*
- *Panax cochleatus (Lam.) DC.*
- *Panax heyneanus Wall. ex G.Don.*
- *Panax rotundatus B.S.Williams.*
- *Panax rumphii Hassk.*
- *Panax scutellarioides Reinw. Ex Blume.*
- *Paratropia latifolia (Wight & Arn.) K.Koch.*
- *Polyscias tricochleata (Miq.) Fosberg.*
- *Polyscias scutellarioides (Reinw. Ex Blume) M.R.Almeida* **[13]**

4. DISTRIBUTION AND HABITATS

Polyscias scutellaria is native to the islands of the Pacific Ocean, especially New Guinea and surrounding islands, India, Central America, and Africa. The Shrub reaches a maximum height of 3 – 4 m (120 to

160 inches) at maturity. Some varieties can even reach up to 6 meters. It grows well in warmer areas and is intolerant to chilly winters.

5. BOTANICAL DESCRIPTION

- **PLANT DESCRIPTION:**
  Treelets are andromonoecious and 2m-7m tall.
- **Leaves:**
  Leaves are enlarged and clasping at base, alate with membranous wings, 1- or 2-pinnate; petiole 35-30 cm, petiolules 1-5 cm; leaflets.
- **Shape:**
  Broadly elliptic to oblate or reniform, occasionally ovate or obovate,
- **Size:** 5-20(-24) × 5-20(-26) cm.
- **Texture:**
  Papery to sub-leathery,
- **Leaf apex:** Rounded
- **Leaf base:** Shallowly cordate or convex,
- **Leaf margin:** Subentire to coarsely crenulate or shallowly serrate, teeth short

5.9. INFLORESCENCE

Terminal inflorescence, erect, a panicle of umbels; primary axis 30-100 cm; secondary axis 15-30, in 2-4 verticils, 15-50 cm; tertiary axis (peduncles) 7-30 per secondary axis, in irregular verticils, 2-18 mm, with a terminal umbel bisexual and lateral umbels of staminate flowers; pedicels 1.5-7 mm. Ovary (2 or)3-5-carpellate; styles free near the base, 0.4-0.6 mm at anthesis, spreading, expanding in fruit to 0.8 mm.

5.10. FRUIT

Subglobose to depressed-globose **[14]**.

6. ETHNOBOTANICAL USES

Polyscias scutellaria is a traditional medicinal plant that has several health benefits like

- Preventing hair loss
- Healing wounds
- Antibacterial
- Boosting blood circulation
- Antioxidant
- Protect skin from sun exposure **[15]**
- Diuretic and lactant actions
- Treat breast inflammation, fever, headaches, and constipation **[16]**

7. NUTRITIONAL VALUE

The chemical composition present in 100g of the leaf of *Polyscias scutellaria* is summarized in **Table 1 [17]**

Table 1: Nutritional composition of *polyscias scutellaria* leaf

S. No.	Nutritional Component	Quantity per gm
1.	Water	82 - 84 g
2.	Protein	3.5 - 3.7 g
3.	Fat	0.3 - 0.4 g
4.	Carbohydrates	11.8 - 13.4 g
5.	Vitamin B1	0.06 mg
6.	Vitamin C	29 - 83 mg
7.	Calcium	474 - 540 mg
8.	Phosphorus	49 - 82 mg
9.	Iron	4.0 - 6.2 mg

8. PHYTOCHEMICAL STUDIES

Around 97 compounds belonging to various phytochemical groups have been isolated from species of *the Polyscias* genus, including lignans, cyanogen derivatives, sterols, phenolic compounds, essential oils, cerebrosides, polyacetylenes, and saponins **[18]**. The chief constituents isolated from *Polyscias scutellaria* genus are tabulated in **Table 2**.

In a study by Budiono et 2023, the total phenolic content was found to be 16.35, 24.49, and 15.37 mg GAE/g and the total flavonoid content was reported as 59.89, 63.66, and 58.42 mg QE/g for the aqueous, 70% ethanolic and ethanolic dry extract, respectively **[19]**.

Additionally, LC-HRMS was used to identify the secondary metabolites. The results revealed the presence of six compounds, including rutin, quercetin-3β-D-glucoside, quercetin, kaempferol, oleanolic acid, and (-)-caryophyllene oxide, followed by nine flavonoid compounds, including seven flavonols, two flavonoid-3-O-glycosides, and two flavonoid-7-O-glycosides and five terpenes, seven phenolic acids, and one lignan. Overall, LC-HRMS reflects that aqueous extract of *Polyscias scutellaria* predominantly contains flavonoids, such as quercetin, rutin, kaempferol, quercitrin, quercetin-3β-D-glucosides, afzelin, hyperoside, quercetin 3-O-rhamnoside-7O-glucoside, and kaempferol-3-O-β-glucopyranosyl-7-O-α-rhamnopyroside.

8.1. FLAVONOIDS

Faridatussaadah S *et al*. reported a bright yellow-colored flavonoid compound from the leaves of *Polyscias scutellaria*. Initial phytochemical studies showed the presence of alkaloids, flavonoids, saponins, triterpenoids, steroids, and phenolic compounds. Maceration using 95% ethanol and fractionation by liquid-liquid extraction using n-hexane, ethyl acetate, and water was carried out. The ethyl acetate fraction was further sub-fractionated by using UV-

Visible chromatography. Further purification was done by preparative TLC using silica gel GF_{254} and n-hexane- ethyl acetate (6:4), which, upon the characterization, yielded flavonoids of the auron category **[17]**.

8.2. TERPENOID SAPONINS

Paphassarang S *et al*. have reported triterpenoid saponins from the leaves of *Polyscias scutellaria.* The leaves were extracted using hot ethanol. Further fractionation with chloroform, ethyl acetate, and n-butanol was performed. The n-butanol fraction was further subjected to column chromatography using chloroform: methanol: H_2O by gradient elution (from 70:2:2 to 70:40:10) yielded Polysciasaponin P_2, Polysciasaponin P_5 and Polysciasaponin P_6 after identification and structure elucidation by TLC with authentic samples, Fab Mass, GC-MS and C_{13} NMR spectroscopy **[20]**.

8.3. TRITERPENIC GLYCOSIDES

In another study by Paphassarang *et al*., 1989b, three triterpenic glycosides from the leaves of *Polyscias scutellaria* were reported. The study revealed that the compounds possessed oleanolic acid as the aglycone moiety, whereas the sugar moiety was found to be glucuronic acid. By ^{13}C NMR interpretation in addition to enzymatic hydrolysis with β-glucuronidase, the chemical structure of saponin A (Calenduloside E), 3-O-β-D-glucurnoicpyranosyl oleanolic acid, saponin B, 3-β-O-[β-D-glucopyranosyl(l → 3)-β-D-glucuronopyranosyl] oleanolic acid and saponin C, 3-β-O-[β-D-glucopy-ranosyl (1→3)-β-D-glucuronopyranosyl] oleanolic acid 28-O-βD-glucopyranoside was established **[21]**.

8.4. OLEANOLIC GLYCOSIDE

Paphassarang *et al*. reported two oleanolic glycosides, Polysciasaponin P_1, and Polysciasaponin P_3, from the leaves of *Polyscias scutellaria.* Hot ethanolic extraction followed by successive fractionation using solvents of increasing polarity yielded chloroform, ethyl acetate, and n-butanol fractions. The n-butanol fraction upon column chromatography by gradient elution yielded 6 fractions, of which fraction 4 and fraction 6 resulted in the oleanolic glycosides P3 and P1, respectively **[22]**.

Table 2: Compounds reported in *Polyscias scutellaria*

Compound name	Isolated compound
Flavanoid	**Auron group flavonoids with o-dihydroxy in ring B [17]**
Triterpenic glycosides	• **Saponin A (3-O-β-D-glucurnoicpyranosyl oleanolic acid)** • **Saponin B (3-β-O-[β-D-glucopyranosyl(l → 3)-β-D-glucuronopyranosyl] oleanolic acid)** • **saponin C (3-β-0-[β-D-glucopy-ranosyl (1→3)-β-D-glucuronopyranosyl] oleanolic acid 28-O-β-D-glucopyranoside) [21]**
Terpenoid saponin	**PolysciasaponinP$_2$, PolysciassaponinP$_5$, Polysciassaponin P$_6$ [22]**
Oleanolic glycoside	**3-O-[β-D-glucopyranosyl (1→4)-β-D-glucopyranosyl(1→2)-β-D-glucuronopymnosyl] oleanolic acid 28-0-β-D-glucopyranoside [22]**

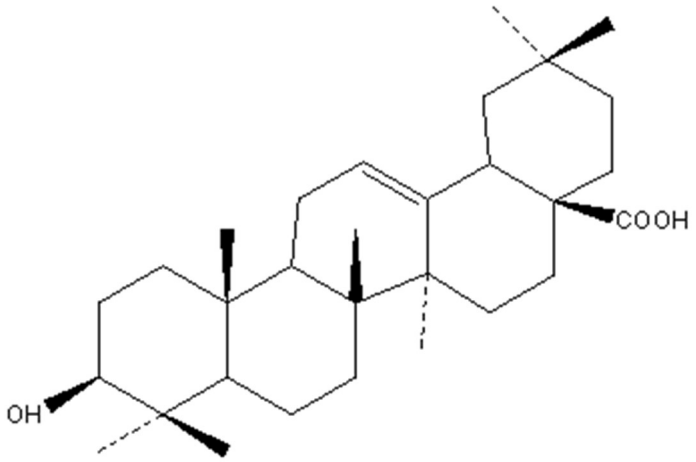

Figure 2 oleanolic acid

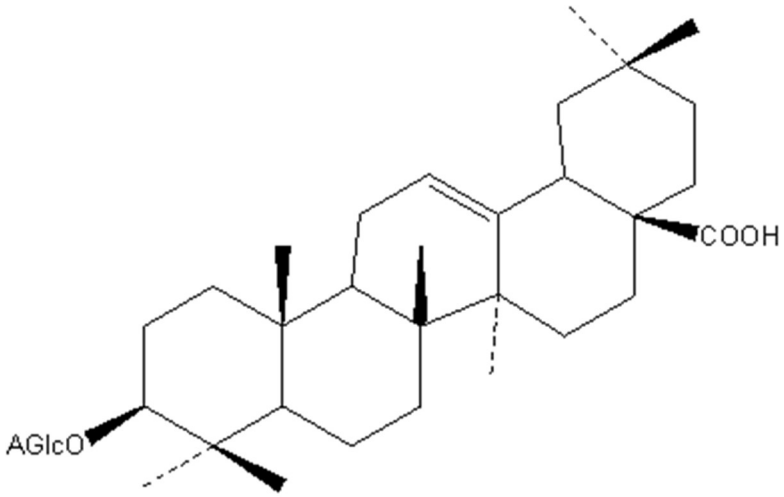

Figure 3 Polysciasaponin A

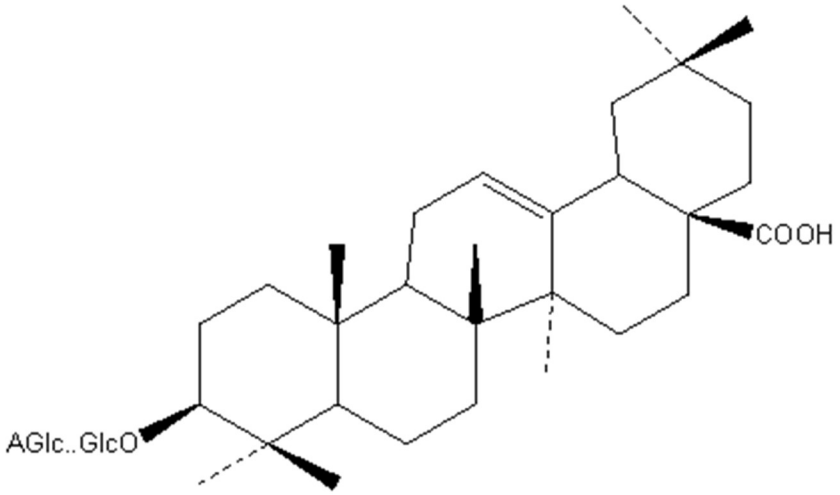

Figure 4 Polysciasaponin B

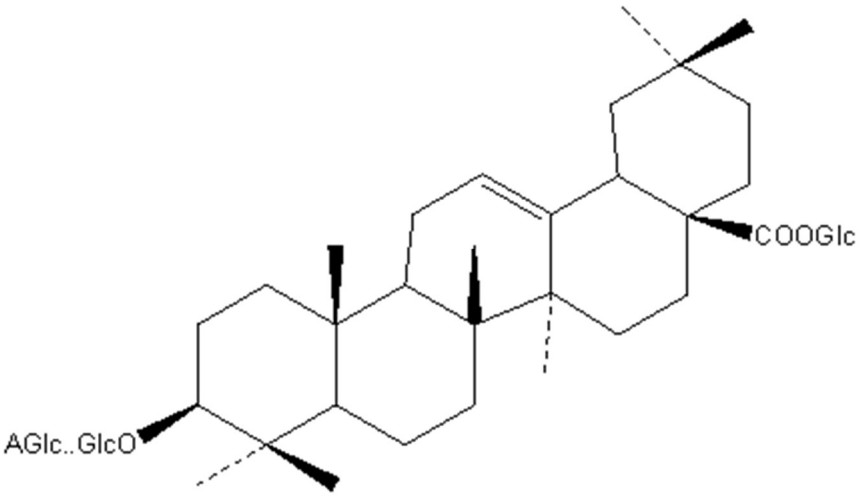

Figure 5 Polysciasaponin C

9. PHARMACOLOGICAL STUDIES

Various biologically active compounds and phytochemicals are present in *Polyscias scutellaria*. Many of these effects can be helpful in various medical treatment and biological effects. A varied pharmacological effect such as prolactin secretion, antibacterial, antioxidant, antifungal, hypolipidemic and anti-cancer activity have been reported in *Polyscias scutellaria*

9.1. PROLACTIN SECRETION

Budiono B *et al*. reported that the plant *Polyscias scutellaria* increases breast milk production. Studies have been done on the potential active compounds of *Polyscias s cutellaria* acting as dopamine D2 receptor (D2R) inhibitors through molecular docking studies. The docking results towards D2R

showed binding energies of −6.9, - 6.1, -6.3, - 6.1, and -7.0 kcal/mol for the ligands risperidone, afzelin, quercetin, quercitrin, and rutin revealing the inhibitory activity on D2R affects increasing the production on the breast milk **[19]**.

9.2. ANTIBACTERIAL ACTIVITY:

Rose *et al*. recorded the antibacterial potential of different extracts of leaves of *Polyscias scutellaria* against *Acinetobacter* species by qualitative diffusion and quantitative colony forming unit (CFU) technique. The extraction was carried out by consecutive maceration using hexane, ethyl acetate, and methanol. The *Acinetobacter* species were isolated from the donor's armpit and performed the molecular identification of rRNA using PCR and GenBank database (BLAST). The hexane fraction exhibited the largest zone diameter of 32.5 mm, at the maximum concentration of 400 mg/ml, in comparison to the standard tetracycline (24.6 mm), followed by ethyl acetate and methanol fraction (24.3 mm and 78 mm, respectively). Furthermore, quantitative analysis by CFU assay showed both hexane and ethyl acetate fraction could decline the bacterial cell population of 6 log cycles at 225 mg/mL and 250 mg/mL, respectively. Sustainable bacterial growth was also observed with methanol fraction, even at 400 mg/mL [**23**].

9.3. ANTIOXIDANT ACTIVITY

Budiono *et al*. have reported the antioxidant activity of leaves of *Polyscias scutellaria*. The leaves were extracted in the study with three different solvents: distilled water, 70% ethanol, and absolute ethanol. The antioxidant activity was studied by the 1-diphenyl-2-picrylhydrazyl (DPPH) assay. The results of the study revealed that among the three extracts, the aqueous extract showed the highest antioxidant activity with an IC_{50} value of 0.67 ± 0.14 mg/mL in comparison to the ethanolic extract (1.71 ± 0.75 mg/mL), followed by 70% ethanol (1.83 ± 0.57 mg/mL) and Vitamin C (1.86 ± 0.54 mg/mL) **[19]**.

9.4. ANTIFUNGAL ACTIVITY

Marcha Putri *et al*. reported the antifungal potential of different concentrations of leaves of *Polyscias scutellaria to* extract against *Candida albicans* by disc diffusion and well dilution method. The extraction was carried out by maceration using ethanol for 24 hours. To inoculate *Candida albicans,* the yeast colony was suspended in NaCl solution, and turbidity was equalized to the standard McFarland. The disc diffusion method was performed by preparing the *Polyscias scutellaria* extract at concentrations 100, 200, 400, 800, 1600, 3200, and 6400 µg/mL. The organism was inoculated in Sabouraud

Dextrose Agar (SDA) medium containing the discs with fluconazole as the standard. At the end of 24 hours of incubation, the appearance of a clear zone diameter of 2.68 ± 0.48 mm at the maximum concentration of 1600 µg/mL indicating the antifungal activity of ethanol extract. Moreover, the study's results also showed that the ethanol extract exhibited a Minimum inhibitory concentration of 6400 µg/mL establishing its antifungal activity, which could be attributed to alkaloids and triterpenoid saponins **[6]**.

9.5. ANTI-CANCER ACTIVITY

Kurniawan *et al*. performed the *in-silico* docking studies on bioactive compounds of *Polyscias scutellaria* viz., kaempferol, myricetin, quercetin, and 3-β-[O-aG55lphaLrhamnopyranosyl-(1-2)-αarabionopyranosyl)oxy]-16- α hydroxyolean12-en-28-oic acid against Bcl-2 protein with the help of Autodock 4.2 software. With 4 bioactive compounds, the standard ligand, topotecan, was selected to evaluate their Gibbs energy. The Gibbs energy of ligands was found to be -6.07, -5.18, -5.43, -6.02, and -6,40 kcal/mol, respectively, which interprets that bioactive compounds of *Polyscias scutellaria* show inhibitory activity against Bcl-2 proteins. The study revealed that out of 4 compounds, 3-β-[O-aG55lphaLrhamnopyranosyl-(1-2)-αarabionopyranosyl)oxy]-16- α hydroxyolean12-en-28-oic acid showed better potential (-6.07 kcal/mol) in inhibiting Bcl-2 protein **[24]**.

9.6. METABOLIC SYNDROME

Rachma *et al*. reported the dietary inclusion of fresh or boiled *Polyscias scutellaria* on body weight and biochemical markers in metabolic syndrome rats. The homogenized leaves were prepared into a semipurified rodent diet and made into pellets. Phytochemical screening was carried out to estimate the total phenolic, flavonoid, chlorophyll, and carotenoid content. An *invivo* study was carried out by high fat and high fructose (HFHFr) induced metabolic syndrome model. The results of the study revealed that the fasting blood glucose (FBG), serum triglycerides, total cholesterol, LDL cholesterol, and malondialdehyde (MDA) were all considerably increased by the HFHFr diet, but HDL cholesterol was significantly decreased. Serum triglycerides, total cholesterol, and LDL cholesterol levels decreased after 29 days on the intervention diet, whereas HDL cholesterol levels rose significantly ($p < 0.05$). It may be inferred from this that consuming *Polyscias scutellaria* in dietary form for 29 days can enhance the fasting blood glucose, serum lipid profile, and malondialdehyde in a manner

comparable to that observed in rats on a control diet **[25]**.

10. FUTURE PROSPECTIVES:

The present review remarks the significant lacuna in the research and development of this ornamental plant, *Polyscias scutellaria.* Besides possessing rich nutritional value and promising traditional uses, the plant has numerous biological research areas that need to be studied and further explored. Even though various phytochemical and pharmacological activities of *Polyscias scutellaria* have been investigated by researchers worldwide, supporting its very few medicinal uses, a complete systematic phytochemical and pharmacological study is yet to be performed. Therefore, our review has enforced its limelight on the scanty research work carried out on this plant owing to further investigation on therapeutic actions, particularly at cellular and molecular levels. Thus, the above review can be an eye-opener in bringing out such hidden and new traditional plants for further phytopharmacological research.

11. REFERENCE

[1] Budiono B, Pertami SB, Arifah SN, Lestari SR. Molecular docking analysis of Polyscias scutellaria active compounds as inhibitor of dopamine D2receptors to increase prolactin secretion. In: AIP Conference Proceedings. American Institute of Physics Inc.; 2021. doi: 10.1063/5.0052655.

[2] Rojas Herrera V. Protocolo para la multiplicación in vitro e inducción de mutaciones en Polyscias scutellaria cv. 'Fabian'. 2015.

[3] Kim K, Nguyen VB, Dong J, Wang Y, Park JY, Lee SC. Evolution of the Araliaceae family inferred from complete chloroplast genomes and 45S nrDNAs of 10 Panax-related species, Sci Rep, 1;7(1), 2017.

[4] Liu Z, Zeng X, Yang D, Chu G, Yuan Z, Chen S. Applying DNA barcodes for identification of plant species in the family Araliaceae, Gene, 499(1), 2012 May, 76–80.

[5] Ashmawy NS, Gad HA, Ashour ML, El-Ahmady SH, Singab AN. The genus Polyscias (Araliaceae): A phytochemical and biological review, Journal of Herbal Medicine, 23:100377. 2020.

[6] Putri NM, Putri JR, Elya B, Adawiyah R. antifungal activity of Polyscias scutellaria Fosberg leaves against Candida albicans, Pharm Sci Res, 7(3), 2020, 7.

[7] Sumiati, Triyani, Roswiem, Anna P, Wardhani, Ayu Kusuma. Potensi Ekstrak Daun Kacang Panjang (Vigna unguiculata (L.) Walp.) dan Daun Mangkokan Polyscias scutellaria (Burm. f.) Fosberg) Serta Kombinasinya terhadap Pertumbuhan Rambut Pada Tikus Jantan Galur Sprague Dawley, Jurnal Katalisator, 7(2), 2022; 204.

[8] Eden, Willy Tirza, Badahdah, Nilam Kencana. Aktivitas ANTIOKSIDAN EKSTRAK METANOL DAUN MANGKOKAN (Polyscias scutellaria (Burn.f.)Fosberg). Media Farmasi Indonesia, 11(2), 2016.

[9] Nurbaya S, Wiratma DY, Sitorus E. Uji aktivitas antibakteri ekstrak etanol daunmangkokan (Polyscias scutellaria) TERHADAP BAKTERI Propionibacterium acnes, Jurnal Farmanesia, 8(2), 2021, 120-5.

[10] Dr. K S Krishnan Marg. The useful plants of India. New Delhi: National institute of science and communication and information resources; 1992. 483 p.

[11] Astragalus jejunus | NatureServe Explorer [Internet]. [cited 2023 Jun 23]. Available from: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.145617/Astragalus_jejunus

[12] USDA N. Polyscias scutellaria (shield aralia). The PLANTS Database (plants.usda.gov) [Internet]. [cited 2023 Jun 21]; Available from: https://plants.sc.egov.usda.gov/home/plantProfile?symbol=POSC10

[13] Polyscias scutellaria (Burm.f.) Fosberg — The Plant List [Internet]. [cited 2023 Jun 21]. Available from: http://www.theplantlist.org/tpl1.1/record/kew-162576

[14] Plunkett GM, Lowry PP, Paraphyly and polyphyly in Polyscias sensu lato: molecular evidence and the case for recircumscribing the 'pinnate genera' of Araliaceae. Plant Divers Evol, 128(1–2):2010, 23–54.

[15] Islami D, Kurnia Utama V, Mayasari D, Hendrika Y, Farmasi F, Kesehatan I. Uji Aktivitas Antibakteri Ekstrak Etanol Daun Mangkokan (Polyscias

scutallarium (Burm.f.) Fosberg) terhadap Bakteri Escherichia coli dan Staphylococcus aureus, Jurnal Proteksi Kesehatan, 10(2), 2021, 101–6.

[16] Sriyanti C, Siregar TN, Mudatsir, Gani. A. Phytochemical and infra-radiation test of Mangkokan leaf (Nothophanax scutellarum merr.). In: IOP Conference Series: Earth and Environmental Science. IOP Publishing Ltd; 2021.

[17] Faridatussadah S. Isolasi dan identifikasi Senyawa Flavonoid dari Daun Mangkokan (Polyscias scutellarium (Burm. f.) Fosb), Jurnal Farmasi, 2(1), 111-123.

[18] Śliwińska A, Figat R, Zgadzaj A, Wileńska B, Misicka A, Nałęcz-Jawecki G, Pietrosiuk A, Sykłowska-Baranek K. Polyscias filicifolia (Araliaceae) hairy roots with antigenotoxic and anti-photogenotoxic activity. Molecules. 2021 Dec 29;27(1):186.

[19] Budiono B, Pertami SB, Arifah SN, Atho'illah MF. Lactogenic effect of Polyscias scutellaria extract to maintain postpartum prolactin and oxytocin in lactating rats, Journal of Ayurveda and Integrative Medicine, 14(2), 2023, 14(2).

[20] Paphassarang S, Raynaud J, Lussignol M, Becchi M. Triterpenoid saponins from Polyscias scutellaria. Journal of natural products, 52(2), 1989, 239-42.

[21] Paphassarang S, Raynaud J, Lussignol M, Becchi M. Triterpenic glycosides from Polyscias scutellaria, Phytochemistry, 28(5), 1989, 1539-41.

[22] Paphassarang S, Raynaud J, Lussignol M, Cabalion P. A new oleanolic glycoside from Polyscias scutellaria, Journal of natural products, Jan;53(1), 1990, 163-6.

[23] Rosa D, Halim Y, Kam N, Sugata M, Samantha A. Antibacterial activity of polyscias scutellaria fosberg against acinetobacter sp, Asian Journal of Pharmaceutical and Clinical Research, 12(1), 2019, 516.

[24] Kurniawan MR, Humaedi A. The potential of active compounds polyscias scutellaria as inhibitors in cervical cancer with virtual

screening approach, Jurnal Kimia dan Kemasan, 43(1), 2021, Apr, 22.

[25] Rachma DE, Murwani R, Juniarto AZ. Dietary fresh and boiled mangkokan leaves (Nothopanax scutellarius) normalized body weight, serum lipid profile and malondialdehyde in metabolic syndrome rats, Current Research in Nutrition and Food Science, 8(3), 2020, 889–902.