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ECOLOGICAL DISTRIBUTION, BOTANICAL CHARACTERISTICS, TRADITIONAL USES, PHYTOCHEMICAL, AND BIOLOGICAL ASPECTS OF *PLOCAMA AUCHERI* FROM FAMILY RUBIACEAE: A SYSTEMATIC REVIEW

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Abstract

Members of the family Rubiaceae are distributed all over the world and are traditionally used. Plocama aucheri genus of Rubiaceae is a perennial shrub, sometimes called as "Tusso" plant having chemical compounds responsive in biological aspects. The collected information is a systematic review on P. aucheri to summarizes all available data. P. aucheri is a spinescent shrub it is native to the arid regions of Mascat (Oman), Iran, Afghanistan, and Pakistan. In Pakistan it is commonly found in Southern and lower Baluchistan. It grows in sandy soil and rocky ridges. Phytochemical studies showed that P. aucheri has a high amount of tannins, alkaloids, quinones, coumarins, flavonoids, saponins, Ascorbic acid, Total soluble proteins, Proline, Glutin, TOS, Glycine betain, Total free amino acid. P. aucheri is reported for its biological activities. Extract of leaves and flowers are used for anti-microbial activities. Whole plant extract were reported for its anti-diabetic and anti-inflammatory activity. The plant can be further utilized in pharmaceutical industries for drug discoveries. Plant is also having importance in livestock and are further investigations will also be benefit for livestock.

Keywords: *Botanical characteristics, Ecological distribution, Plocama aucheri, Rubiaceae*

INTRODUCTION

The Rubiaceae also known as coffee family exhibited the fourth number according to the reported species number of Angiosperms, i.e. approximately 650 genera and 13,000 species worldwide. It is a diverse family, mainly pantropical, some species distributed as extra-tropical while one half found in the Neotropics (1-3).

In Pakistan it is represented by 36 genera and 87 species, included wild, cultivated and ornamental plants. Few imported medicinal important pants of Rubiaceaae are *Rubia cordifolia*, *R. tinctorum*, *Neolamarckia cadamba* and *Mitragyna parvifolia*.

Jubertia is a monotypic genus, *Jubertia aucheri* Guill., *Gaillonia aucheri* (Guill.) Jaub. & Spach, *Neogaillonia aucheri* (Guilt) Puff, are now synonym of *Plocama aucheri* (Guill.) M. Backlund & Thulin (4).

PHYTOCHEMICALS OF RUBIACEAE

Secondary metabolites of the family Rubiaceae are found in diverse forms. Many structurally diverse compounds were identified, which includes important phenols, flavonoids, alkaloids, glycosides, anthraquinones, coumarins, terpenes, triterpenoids, and volatile components Fig. 1. These compounds were known for their pharmacological properties. There known properties incudes antioxidant and anti-inflammatory effects. It is also having antibacterial and antimalarial properties. Plants of rubiaceae are also good as antidiabetic (5, 6). Various species from the Rubiaceae family have proven to be a promising source for the development of new potential metabolites and drug prototypes because of their diversity and pharmacology properties (7, 8).

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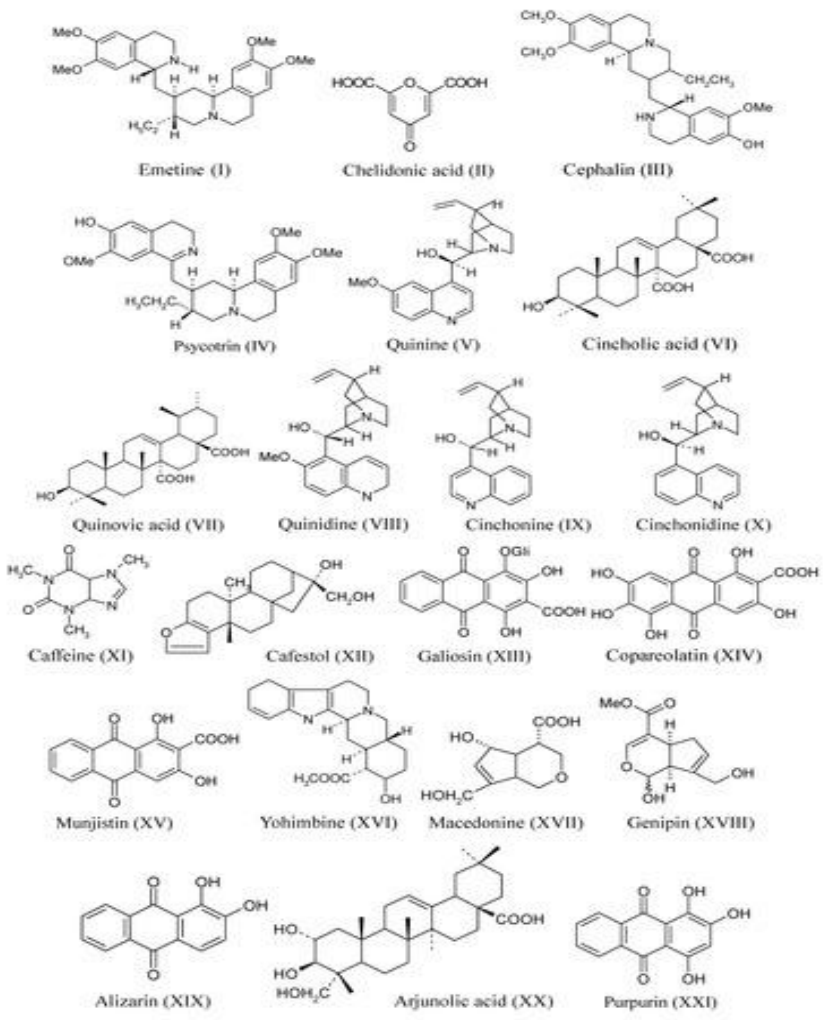

Fig. 1. Different classes of compounds isolated from Rubiaceae (7)

PLOCAMA AUCHERI

Plocama aucheri (Guill) M. Backlund & Thulin (Family Rubiaceae) is a perennial shrub, sometimes called as "Tusso" is an endemic to arid and semi-arid regions of Balochistan, Iran, Afghanistan and Arabian Peninsula. It grows well in sandy soils.

Leaves are said to be medicinal and it has been historically used for the treatment of skin problems, constipation and gum bleeding. The *P. aucheri* is also high preference value for livestock for sheep and goats (9).

PLANT DESCRIPTION AND TAXONOMY

The plant belongs to the kingdom Plantae (plants) and is classified as an angiosperm (flowering plant), falling within the eudicots and asterids clades. It is placed in the order Gentianales and the family Rubiaceae (the madder/bedstraw family), and at the genus level it is classified as Plocama, with the species being *P. aucheri.*

Taxonomic rank	Classification
Kingdom	Plantae (Plants)
Clade	Angiosperms (Flowering plants)
Clade	Eudicots
Clade	Asterids
Order	Gentianales
Family	Rubiaceae (Madder/Bedstraw family)
Genus	*Plocama*
Species	*P. aucheri*

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ECOLOGICAL DISTRIBUTION AND HABIT

Rubiaceae family has a diverse distribution and found all region of the world, except for extreme environments such as the polar region and deserts. The distribution pattern of the family is very similar to the global distribution of plant diversity overall. However, the largest diversity is distinctly concentrated in the humid tropics and subtropics. *P. aucheri* is a spinescent shrub it is native to the arid regions of Mascat (Oman), Iran, Afghanistan, and Pakistan. In Pakistan it is commonly found in Southern and lower Baluchistan. It grows in sandy soil and rocky ridges.

ASSOCIATED COMMUNITIES

The flora of the northern mountains and the foot- hills has close links with the mountain flora of south- west Iran, Afghanistan and Baluchistan (southwest Pakistan) (Ghazanfar, 1991a). Plocama aucheri is associated with species such as *Convolvulus virgatus* Boiss., *Dianthus crinitus* Sm., *Ebenus stellata* Boiss., *Ochradenus aucheri* Boiss., *Physorrhynchus chamaerapistum* (Boiss.) Boiss., *Rubia infundibularis* Hemsl. & Lace and *Teucrium stocksianum* Boiss (cf. Omano-Makranian sub- province, Kuirschner, 1986). On the rocky ridges of the Hajar mountains two species of the Rubiaceae, *Pseudogaillonia hymenostephana* and *P. aucheri* colonize fissures in the limestone and are associated with *Euphorbia larica* (10, 11).

MORPHOLOGICAL CHARACTERS

The plant exhibits a height ranging approximately from 30 to 100 cm, with a whitish, erect, rigid, spinescent, circular, glabrous, and divaricately branched stem. Its leaves, found on dwarf shoots, measure 2–5 x 0.5–1 mm and are sessile, spathulate, oblong-linear, fleshy, unequal, glabrous, entire, and acute. The inflorescence consists of 3 to 7-flowered axillary and terminal cymes, rarely solitary, while the calyx is 2.5 mm long with plumose hairs, a tube of 1–5 mm, and linear plumose-setaceous teeth 0.5–0.75 mm long. The corolla is 4.5–5 mm long, puberulous outside, with a tube 2–3 mm long and five lanceolate, acute lobes measuring 2 x 0.5 mm; the stamens are attached at the mouth of the corolla tube, ± exserted, with short filaments 1 mm long and anthers up to 1.25 mm long, and the style is 3 mm long with a simple stigma, while the mericarps are 3 mm long.

CHEMICAL CHARACTERIZATION

Phytochemical studies showed that *P. aucheri* has a high amount of tannins, alkaloids, quinones, coumarins, flavonoids and saponins (12). Other phytochemical compounds were reported are total phenol content, the total flavonoid, Ascorbic acid, Total soluble proteins, Proline, Glutin, TOS, Glycine betain, Total free amino acid Table I (13).

Table I. Biochemical constituents of *P. aucheri* whole plant powder

Sample	Mean	Standard error of the mean
TPC (uM/g. wt)	35400	±300
TF (Rutin equlients µg/ g wt)	2147.71	±53
AsA (µg/g wt)	535.25	±0.75
TSP (mg/g wt)	424	±4.67
Proline (µg/g wt)	113.05	±1.8
Glycine Betain (ug/g wt)	245.13	±12.31
Total free amino acid (µg/ g .wt)	11.31	±0.06
Glutin (mg/g wt)	250.3	±7
TOS (µM/g. wt)	16450	±2100
TAC (µM/g. wt)	6.51	±0.17

PIGMENT ANALYSIS

Chlorophyll a, b and total chlorophyll content were evaluated of from *P. aucheri.* Lycopene and total carotenoid were also reported in *P. aucheri* Table II (13).

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Table II. Pigment analysis of *P. aucheri* whole plant powder

Sample	Mean	Standard error of the mean
Chl a (µg/g wt)	192.11	±7.87
Chl b (µg/g wt)	156.31	±1.16
Total chl (µg/g wt)	348.42	±6.72
Total car(mg/g wt)	15.67	±0.08
Lyco (mg/g wt)	8.83	±0.06

BIOLOGICAL ACTIVITIES

P. aucheri is reported for its biological activities. Extract of leaves and flowers are used for anti-microbial activities. Whole plant extract were reported for its anti-diabetic and anti-inflammatory activities (13). It also has significant antibacterial and antioxidant potential (14). This plant may serve as a promising natural source for developing pharmaceutical and food products and contribute to sustainable agricult ural practices. Significant inhibition zones were observed against tested bacteria. The extracts of *P. aucheri* have shown antifungal activity against *Aspergillus flavus*, *A. niger* and *A. parasiticus* (Table III) (15, 16). Extract of leaves were control of *Fusarium Wilt* in tomatoes caused by Fusarium oxysporum f. sp. lycopersici (FOL) is one of the principal soil-borne diseases affecting tomato crops worldwide especially in Balochistan, Pakistan (15).

Table III. List of Bacterial and fungal strains tested for *P. aucheri* extract against anti-bacterial and anti-fungal activities

S. no.	Bacterial strain	Fungal strain
1.	*Clostridium spp.*	*Aspergillus flavus*
2.	*Escherichia coli*	*A. niger*
3.	*Klebsiella spp.*	*A. parasiticus*
4.	*Listeria monocytogenes*	
5.	*Salmonella spp.*	
6.	*Shigella spp.*	
7.	*Staphylococcus aureus*	

CONCLUSION

In this review, all authors try to compile all available data on *P. aucheri* belongs to the family Rubiaceae. It was very difficult to identify the genus from other genera *Gallonia* of the family. Leaves, and flowers reported are useful parts so far while no report on root and fruits are found for this plant. The plant is also used as traditional medicine for skin infection. Various chemical components are identified. The antimicrobial activity of plants was proven by various examples, form leaves and flowers extracts. Thus, this property can suggest plant capable in the development of medicines against bacterial strains that become resistant to conventional antibiotics and other preventive medicine.

Conflict of interest:

Authors declared no conflict of interest.

Authors' contribution:

IK Data collection, Drafting the initial text of the review; SS Research supervision and design, Technical guidance, Manuscript review and revision; AA Review and Editing, Managing references, Screening databases and Extracting data from selected studies.

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