Morphology and Phytochemistry of *Solanum xanthocarpum* Schradd. and Wendl. "The yellow berried nightshades".

Prajakta S. Patil*, Anil S. Bhuktar, Nandkishor B. Adhao

Department of Botany

Vivekananda Arts, Sardar Dalipsingh Commerce and Science College.

Aurangabad, Maharashtra.

Abstract

Ayurvedic medicines are widely used due to their effectiveness and there are rarely any side effects of Ayurvedic preparations in humans. *Solanum xanthocarpum* Schradd and Wendl i.e. Kantakari is a very important medicinal plant used in many Ayurvedic medicines. In this investigation we are focusing on the morphological and phytochemical investigation through UV Spectroscopy of *Solanum xanthocarpum* Schradd. and Wendl. This study is necessary for identification of correct medicinal plant through morphological characteristics and phytochemical analysis. This plant is distributed throughout India but mostly found in dry regions of the country. *Solanum xanthocarpum* Schradd. and Wendl. is prickly diffused perennial herb with the presence of ovate leaves with stellate hairs; flowers mostly in axillary and few are in cymes and violet, fruits berries, yellow, seeds glabrous yellowish brown. Phytochemical analysis through UV Spectroscopy shows the presence of alkaloids and flavonoids. Due to its alkaloid content this plant is medicinally very important. Berries of this plant contain alkaloids such as Solasodine, Solamargine etc.

Keywords:- ***Solanum xanthocarpum;*** **Berries; Alkaloids; Flavonoids; UV spectroscopy.**

1. Introduction

Family Solanaceae is a cosmopolitan family distributed throughout the world but is more prevalent in tropics and subtropics. Solanaceae is known for possessing wide range of alkaloids. Scopolamine, Atropine and Hyocyamine are the key alkaloids present in Solanaceae. Solanum is the largest and most complicated genus of the family Solanaceae. Presence of alkaloids make genus Solanum medicinally important. Various plant parts of *Solanum xanthocarpum* Schradd. and Wendl. such as roots, leaves and fruits are useful in pharmaceutical industry. Berries of this plant contain alkaloids such as Solasodine, Solamargine etc. Further study of this plant is required to know its peculiarities and avoid adulteration during drug preparations. Such study is useful in Pharmaceutical Botany. Pharmaceutical Botany is the study of morphology, structure, physiological function, classification, identification, cell tissue culture, resource development and rational utilization of plants with medical and health care function. Medicinal botany is systematic study of botanical knowledge to study the classification, identification of medicinal plants to investigate and ensure the accuracy and efficiency of the use of medicinal herbs [4]. Fruits of *Solanum xanthocarpum* Schradd. and

Wendl. are edible and local people of Manipur (India) use it as folk medicine for treatment of various ailments. Irula tribes of Hasanur Hills (Tamil Nadu, India) have history of consuming the cooked unripe fruits of *S. xanthocarpum* Schradd. and Wendl. as vegetable [1]. In Kerala, the Kattunaikka, Paniya and Kuruma tribes of Wayanad district consume fruits and seeds as food [2]. Fruits are considered as a valuable herbal product for traditional healers in treatment of many common diseases in other parts of India. In Ayurveda, medicinal use of the plant is well documented. Phytoconstituents present in *S. xanthocarpum* are used as anti-fertility, anti-inflammatory, anti-allergic agents and as potential fungicide [3]. This study reports morphological and phytochemical observations of *S. xanthocarpum* Schradd and Wendl.

2. Material and Methods:-

2.1 Collection of the plant material:

The fresh plant material was collected from Aurangabad, Maharashtra (India) during our excursion tour in the month of November 2018.The specimen were brought in the laboratory. The identification of the plant was done with the help of standard floras [5, 6], herbarium were prepared and submitted in the dept. of Botany. The fruits were shade dried, powdered. The prepared powder sample was filtered through muslin cloth and stored in airtight container for the further phytochemical investigation.

3. Morphological observations:-

Scientific name: - *Solanum xanthocarpum* Schradd. and Wendl.

Synonyms: - *Solanum surattense*, *Solanum virginianum*.

Sanskrit: Kantkari. Marathi: Bhuiringani. Hindi: Kateri. Gujarati: Bhoringni, Bhonya-ringani. Tamil: Kantankattiri. Malayalam: Kantkariccunta, Kantakarivalutana, Kantankattiti. Telugu: Callamulaga, Pinnamulaka, Nelamulaka, Vakudu. Kannad: Nelagulle

Morphological characteristics:-

Perennial herb with very prickly diffused bright green plant. Branches are spreading on the ground. Many branches are woody at the base. Younger branches are covered with dense stellate tomentum, prickles compressed, straight, yellow, shining, 1.2 cm long. Leaves 5-10 x 2.5-5.9 cm, ovate, bearing stellate hairs on abaxial and adaxial surface of leaf. Petioles 1.2–2.6 cm long.

Fig 1: *Solanum xanthocarpum* Habit **Fig 2:** *Solanum xanthocarpum* Fruits

Flowers are mostly axillary but some are in cymes, violet in colour, pedicel short, covered with stellate hairs. Calyx is nearly 1.2 cm long, densely hairy and prickly, tube short, globose, lobes 10 mm long, linear lanceolate, acute and prickly outside. Corolla is purple, 2-2.3 cm long, lobes deltoid, acute hairy outside. Filament 1.6 mm long, glabrous, anthers 8 mm long, oblong lanceolate. Ovary ovoid, glabrous, style glabrous. Fruits are berry, 1.2-2.0 cm in diameter yellow with green veins and surrounded by the enlarged calyx. Seeds glabrous, smooth and yellowish brown.

Occurrence: - Distributed throughout Maharashtra state.

Phenology: - June-Jan

Illustr: - Occasionally found on waste lands**,** open spaces.

4. Phytochemical screening through UV Spectroscopy

4.1 Preparation of Test sample

Weigh 4.5799 gm. test sample and Soxhlet it in methanol for 1 hour. Filter the sample using Whatman filter paper and make up to 100 ml with methanol.

4.2 Method for qualitative phytochemical screening

1. Carbohydrate

   Methodology
   Take 1 ml of Sample, Add 1 ml 5 % Phenol and 5 ml concentrated sulphuric acid to it. Interpretation: Red Color development indicates presence of carbohydrate.

2. Phenol/Tannic acid

   Methodology
   Take 1 ml of Sample, Add pinch of Ferric chloride to it.

   Interpretation: Green Color development indicates presence of Phenol.

3. Terpenes/Steroid

   Methodology
   Take 1 ml of Sample, Add 1 ml Glacial Acetic acid to it add 3 ml concentrated sulphuric acid to it.

   Interpretation: Formation of pink ring indicates the presence of terpenes.

4. Protein

Methodology

Take 1 ml of Sample, Add pinch of Ninhydrine reagent. Boil for 5 min.

Interpretation: Purple Color development indicates presence of Protein.

5. Saponin

Methodology

Take 1 ml of Sample, Add 5 µl Anisaldehyde reagent. Incubate for 10 min. Add 50 % Sulphuric acid to it. Incubate the tube at 60 ^{0}C for 10 min.

Interpretation: Reddish-pink color development indicate presence of Saponin.

6. Flavonoids
Methodology
Take 1 ml. of sample. Add 1 ml. of Aluminium Chloride in it. Incubate for 10 min.

Interpretation: Yellow color observed indicate presence of Flavonoids.

7. Alkaloids
Methodology
Take 1 ml of Sample, Add 1 ml Dragandroff Reagent. Incubate for 5 min. Centrifuge the content For 10 min at 5000 RPM.

Interpretation: Orange color pellet observed indicate the presence of Alkaloids.

Sr. No.	Test	Interpretation for Positive result	Observation	Result
1	Carbohydrate	Red color development	Red color observed	Present
2	Phenol/Tannic acid	Green color development	Green color observed	Present
3	Terpenes/Steroid	pink ring should be formed	Pink ring is Observed	Present
4	Protein	Purple Color development	purple color observed	Present
5	Saponin	Reddish-pink color development	Reddish-pink color Observed	Present
6	Flavonoids	Yellow color development	Yellow color Observed	Present
7	Alkaloids	Orange color pellet formation	Orange color pellet observed	Present

Table 1: Results of qualitative analysis of fruit extract of *Solanum Xanthocarpum*

4.3 Method for quantitative test of Total Flavonoids and Total Alkaloids

Test of total Flavonoids:-

Reagent

2 % Aluminium chloride prepared in methanol.

Standard Preparation

Dissolve 9.8 mg Quercetin WS in 25 ml methanol. Further dilute 1 ml in 25 ml methanol (solution A). Further dilute 5 ml of solution A up to 10 ml with methanol.

Test preparation

As per method given above.

Procedure

Take 1 ml sample and standard solution in test tube respectively. To it add 1 ml Aluminium chloride solution. Incubate the tubes at room temperature for 10 min. Measure the absorbance at 430 nm against reagent blank.

Calculation:-

$$\%Total\ Flavonoids = \frac{Test\ Absorbance\ X\ STD\ Conce.\ X\ 100}{STD\ Absorbance\ X\ Test\ Conce.}$$

$$= \frac{0.115\ X\ 9.8\ X\ 1\ X\ 1\ X\ 100\ X\ 100}{0.503\ X\ 25\ X\ 25\ X\ 2\ X\ 4579.9}$$

= 0.0039%

Test of total Alkaloids:-

Reagent

20 % Nitric acid, 1 M Thiourea.

Standard Preparation

Dissolve 10.3 mg Barbloin WS in 10 ml methanol. Further dilute 1 ml in 10 ml methanol.

Test preparation

Weigh 4.5799 gm. test sample and Soxhlet it in methanol for 1 hour. Filter the sample using Whatman filter paper and make up to 100 ml with methanol. Further take 25 ml Add 2 ml 1M hydrochloric acid and 25 ml water. Adjust pH 4.2 with glacial acetic acid. Add 50 ml petroleum ether to it shake well. Collect aqueous layer. Adjust pH 9 with 0.1N sodium chloride. Now extract aqueous layer with chloroform (3 times). Collect the chloroform layer and evaporate it. Resuspend the residue in 5 ml methanol.

Procedure: Take 5 ml sample and standard solution in 15 ml. centrifuge tube, to it add 2 ml. Dragendroff reagent respectively. Centrifuge for 15 min. at 5000 RPM. Resuspend the pellet in 2 ml 20% Nitric acid and 3 ml methanol. Further Take 1 ml and add 5 ml Thiourea (1M). Take absorbance at 435 nm. against reagent blank.

Calculation:

$$\%Total\ Alkaloids = \frac{Test\ Absorbance\ X\ STD\ Conce.X\ 100}{STD\ Absorbance\ X\ Test\ Conce.}$$

$$= \frac{0.193\ X\ 10.3\ X\ 1\ X\ 100\ X\ 100}{0.280\ X\ 10\ X\ 10\ X\ 4579.9\ X\ 25}$$

= 0.0062 %

UV Spectrophotometry and other phytochemical analysis performed on methanol extracts of fruits of *Solanum xanthocarpum* shows the presence of Flavonoids 0.0039% and alkaloids 0.0062%.

Conclusion

Investigation of *Solanum xanthocarpum* Schradd. and Wendl. shows various morphological peculiarities which are important tool in identification of the plant. Phytochemical analysis of fruits of this plant shows the presence of Carbohydrate, Phenol/Tannic acid, Terpenes/Steroid, Protein, Saponin, alkaloid and flavonoids. Quantification of important secondary metabolites alkaloids and flavonoids is useful in further drug preparation. Pharmaceutical botany plays an important role in identification of correct plant species and helps to prevent adulteration of medicinal preparations. Further qualitative and quantitative analysis for chemical profiling through advanced scientific tools will be done to confirm various phytochemicals present in *Solanum Xanthocarpum* Schradd. and Wendl.

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