

# Pharmacognostic Study on *Solanum nigrum* L. Variants Black and Orange Fruits

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## Abstract

The present work deals with pharmacognostic study on *Solanum nigrum* L. black and orange fruits. The two variants of *Solanum nigrum* are used in food as well as medicine one for the other. These two variants have distinctive features both in morphology and anatomy. The results showed important diagnostic characters and differences of fruits and seeds. This study provides scientific validation on anatomical features of fruits of two variants.

**Keywords:** Black Fruit, Orange Fruit, Pharmacognosy *Solanum nigrum*, Solanaceae

**MSC (2010):**

## 1. Introduction

Medicinal plants have been used by human societies throughout history, also across geographical barriers because plant species have the principal ingredients of traditional medicine<sup>1</sup> and their use dates back to the beginning of human civilization<sup>2</sup>. *Solanum nigrum* L. (Black nightshade) is an annual herbaceous plant which belongs to the family Solanaceae. It is widely found in the river bound, wet wood, waste land, old field, road side and in wet cultivated land. It has been found that *Solanum nigrum* contains the substances such as alkaloid, steroid, saponins and glycoprotein, exhibiting anti-tumour activity by Saijo *et al.*, 1982<sup>3</sup>. In Indian traditional medicine, the plant is used as a hepatoprotective agent<sup>4</sup>. The plant has been traditionally used as an antiulcer, anti-diarrhoeal, analgesic, antispasmodic, antiseptic, antinarcotic, emollient, diuretic, tonic, soporific, laxative and anticancer<sup>5–8</sup>. Field observations noted and in earlier work revealed presence of variations among popula-

tions of *Solanum nigrum*. Dhasmana *et al.* observed three variants. (Black, Orange and Yellow fruited)<sup>9</sup>. The black and orange fruited variants are noted both in Tamil Nadu and Pondicherry. Both variants have been used as green and for treating diseases like ulcer (mouth and stomach) under a vernacular name Manathakkali or Milakuthakkali. For both as food and medicine, these two variants have been used one for the other without prejudice. With the above background, the present work has been initiated with a view to establish pharmacognostic study of *Solanum nigrum* L. variant black and orange fruits.

## 2. Materials and Methods

### 2.1 Plant Material

*Solanum nigrum* Linn is a medicinal plant belonging to the family Solanaceae has been selected for the present investigation.

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## 2.2 Collection of Plant Sample

The whole plants of *Solanum nigrum* L. variants black and orange fruited were collected from Thirumalairayan Pattinam (609 606), Karaikal Region, Pondicherry, Union Territory of South India, located at latitude 10° 52'4"N and longitude 79° 49'42"E at 3m MSL during March – April 2016. Both plant samples were collected during same season.

## 2.3 Plant Identification

The plant specimens were confirmed by using the Floras<sup>10-12</sup> and other treatises<sup>13-15</sup>. Identification of the plants was confirmed with the help of type specimens available in the Herbarium of Botanical Survey of India, Southern Circle, TNAU Campus, Coimbatore, Tamil Nadu. The herbarium number in BSI is "BSI/SRC/5/23/2012-13/Tech.1480". The Herbarium specimens were prepared following the method of Jain and Rao<sup>16</sup>.

## 2.4 Macroscopic Characters [Trease and Evans (1983) and Wallis (1985)]<sup>17,18</sup>

The macroscopic features of collected plants were examined using naked eyes and magnifying lens. Measurements of parameters such a habit, leaves, flower, fruit size, colour of the fruit, seed type and size and colour of the seed were recorded.

## 2.5 Microscopical Studies

The fruits of *Solanum nigrum* variants were fixed in FAA (Formalin 5 ml: Acetic acid 5 ml: 70% Ethyl alcohol - 90 ml). The materials were left in FAA for a few days and then they were dehydrated employing Tertiary Butyl Alcohol (TBA) series as per the procedure given by Sass<sup>19</sup>. Paraffin infiltration and embedding in wax blocks were done in the usual method<sup>20</sup>. Serial paraffin sections of 10-12 m thickness were prepared with the help of Spencer Rotary Microtome. These sections were stained with Toluidine blue as per the schedule suggested by O'Brien *et al.*<sup>21</sup>. Toluidine blue stain was found to be quite satisfactory for microscopic observation of cells because of the metachromatic property of the stain. Sections were also stained with fast green.

Microscopic observations were made both under normal and polarized lights. Photomicrographs were also taken with NIKON ALPHA PHOTO- 2 microscopic unit using normal and polarized lights.

## 3. Result and Discussion

Two variants of *Solanum nigrum* L. are identified namely-variant black fruited and orange fruited. Both the variants

of *Solanum nigrum* are called by one Tamil vernacular name 'Manattakkali'. The two variants of *Solanum nigrum* are used in food as well as medicine one for the other. Most of the characters are similar but some differences also seen in the leaves, fruit colour, seed etc., (Figure 1-4). The important distinct features were noted on the fruits and seeds. Large and black coloured fruits are noted in variant black fruited but small orange colour fruits are seen in variant orange fruited. In black fruited, seeds are discoid, minutely pitted and yellow coloured where as in orange fruited it is minutely scaly. Comparative account of morphological characters of the two variants were given in Table 1.



Figure 1. Habit of *Solanum nigrum* L. variant (Black fruited).



Figure 2. Habit of *Solanum nigrum* L. variant (Orange fruited).



**Table 1.** Morphological characters of *Solanum nigrum* L. variants black and orange fruited

S.No.	Characters observed	Black fruited	Orange fruited
1.	Habit	Erect and branched 1.5m tall	Erect and sparsely branched 2-3m tall
2.	Leaves	Broadly ovate – elliptic 6- 12 x 4 -7 cm chartaceous	Deltoid to elliptic ovate 5.5 – 12 x 3.5 – 6.5 cm chartaceous
3.	Flower	Small, Umbel Ca. 7- flowered, extra axillary	Racemes, axillary
4.	Fruit	Berry	Berry
	Fruit size (cm)	1-1.25 cm, Ripening	1.5cm across
	Fruit colour	Black (or) purplish black, globose, smooth, shining	orange when ripe
	Seed per fruit	64 (11-72)	38(9-48)
5.	Seeds	discoid, minutely pitted, 1.5mm diameter, Yellow	Minutely scaly

**Figure 3.** Morphology of fruits of *Solanum nigrum* L. variant (Black).**Figure 4.** Morphology of fruits of *Solanum nigrum* L. variant (orange).**Figure 5.** Fruit of *Solanum nigrum* L. Variant black fruited.

T.S of Seeds possessing embryos.

2. A seed with an embryo.

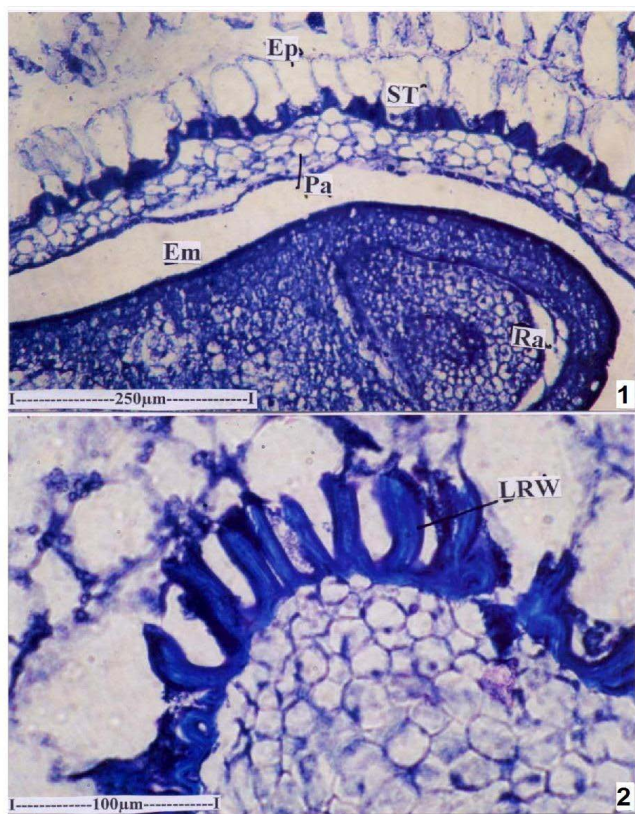
Em – Embryo; Ep – Epidermis; SC – Seed Coat; Ra – Radicle;  
ST – Sarcotesta; PL – Parenchyma Layers.

### 3.1 Anatomy of Variant Black Fruit

The fruit has two carpels, each carpel has one mature embryo. The embryo is enclosed within thick seed coat. In longitudinal sectional view, the embryo appears slip-



per shaped. The radical of the embryo thick (Figure 5). The seed coat thick and it consists of three zones, the outer zone consists of vertically elongate rectangular thin walled parenchyma cells. Innerto the outer epidermal layer the sclerotesta which consists of U-shaped cells. The cells have very thick and lignified walls. The third zone is thick, four layered and parenchymatous (Figure 6).



**Figure 6.** Seed of *Solanum nigrum* L. black fruited.

1. L.S of Seed.

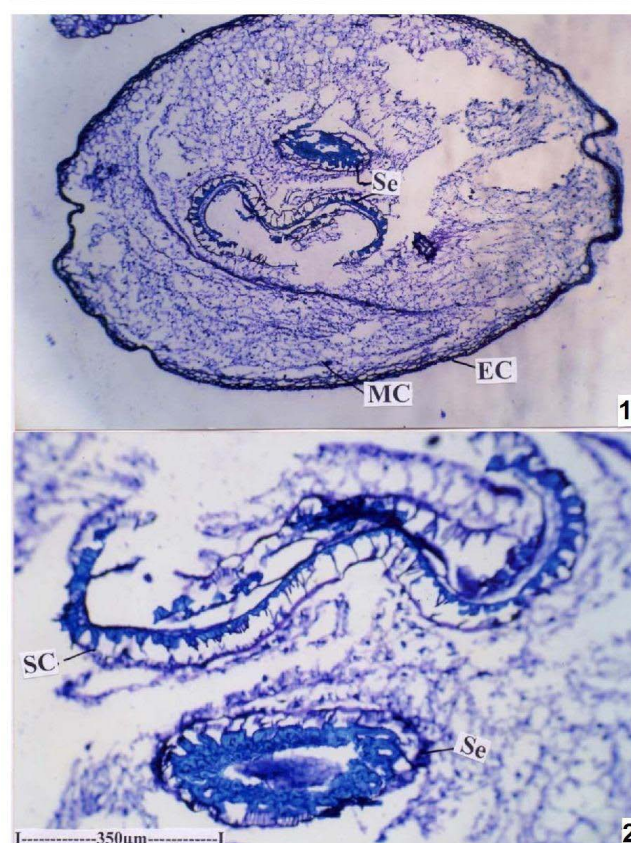
2. Schorotic – Seed Coat with lignified radial walls.

Em – Embryo; Ep – Epidermis; LRW – Lignified Radial Wall; Pa – Parenchyma Layers; Ra – Radicle; St – Sclerotesta

### 3.2 Anatomy of Variant Orange Fruit

The fruit was elliptical in outline. It is 4x5mm in size. It consists of thick semicircular epidermal (epicarp) cells with very thick cuticle. The epidermal cells 20μm thick. The epidermis is followed by two layers of large radially dilated thin walled cells. The mesocarp consists of fragile soft thin walled compact parenchyma cells (Figure 7). The seeds were embedded in the parenchymatous mesocarp. They are bean-shaped with a concavity on mid-lateral side.

The seed coat (testa) thick and consists of U-shaped sclerotesta and two layers of sarcotesta. The sclerotesta 70μm thick. The cells have very thick, lignified radial and inner tangential walls, the outer tangential walls are thin. In surface view, the thick walled epidermal cells appear curled and wavy (Figure 8).



**Figure 7.** Fruit of *Solanum nigrum* L. variant orange fruited.

1. LS of the fruit.

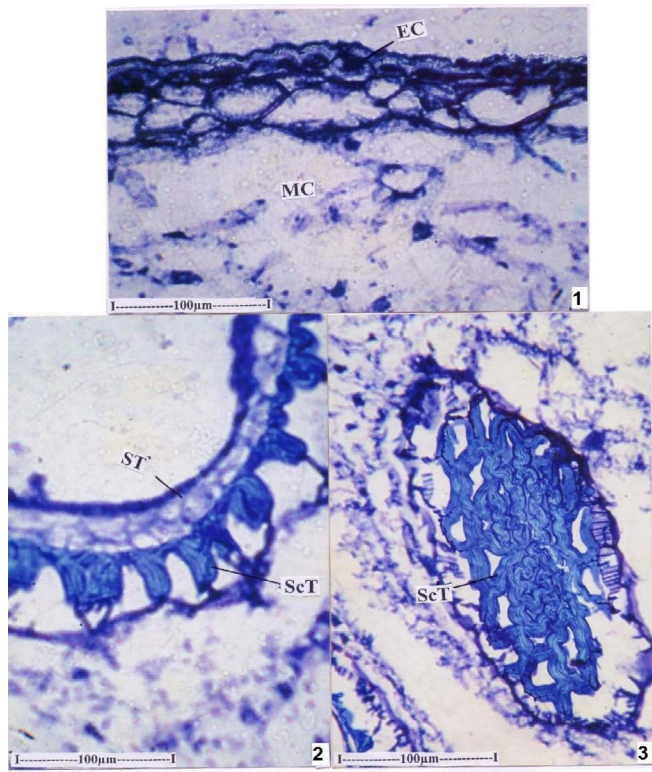
2. Seeds embedded in the fruit.

EC – Epicarp; MC – Mesocarp; SC – Seed Coa

The results of anatomical study provide diagnostic characters of *Solanum nigrum* variants. The similarities in structures showed reasons for the two taxa to be in the same genus while the differences in root anatomical structures showed reasons for them to be as different species<sup>22</sup>. The same observations are also noted in current study.

In the present investigation, the microscopical study has provided for first time for the taxon as per the norms prescribed by WHO<sup>23</sup>. In Morphological characters, the two variants of *Solanum nigrum* could be distinguished by

the size of leaves and colour of the fruits. The similar study was carried out in *Cardiospermum halicacabum* varieties microcarbum and luridum seeds<sup>24</sup>. Anatomical characters could be used as diagnostic key to identify the variants in fragmentary form.



**Figure 8.** Fruit of *Solanum nigrum* L. variant orange fruited. T.S of fruit showing epicarp and mesocarp. Seed coat in sectional view. Seed coat in surface view. EC - Epicarp; MC - Mesocarp; ST - Sarcotesta; ScT - Sclerotesta

## 4. Conclusion

The present pharmacognostic study was carried out on the two variants of *Solanum nigrum* L. variant black and orange fruited. These two variants have distinctive features in morphology and anatomy. The results of the present study would help in formulation of herbal drugs, its purity and adulteration. This study will provide a unique platform to help future researchers on these two variants of *S. nigrum*.

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