

## Pharmacognostical Studies on *Sarcostemma brevistigma*, Wight. & Arn. – An Ethnomedicinal Plant

S M Dhivya<sup>\*</sup>, K.Kalaichelvi, S Sharmila<sup>3</sup>

PG and Research Department of Botany, Vellalar College for Women (Autonomous), Thindal, Erode, Tamil Nadu, India-638012.

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### ABSTRACT

The genus *Sarcostemma* finds a prominent place in different Indian systems of medicine. The different ethnic communities in India have used different species of *Sarcostemma* in the treatment of various human ailments. The plant *Sarcostemma brevistigma* is a perennial leafless, twining trailing shrub, with green cylindrical, fleshy, glabrous, green pendulous stems, exhibiting longitudinal ridges and nodes and exuding milky white latex. Plant shows circular vascular bundles in stem, absence of pith in root and anomocytic type of stomata on stem bark. The powder is fibrous, light greenish brown in colour and bitter in taste. It shows the presence of rosettes of calcium oxalate crystals, fragments of pitted, spiral vessels and laticifers. Laticiferous canals are wide, thick walled and non septate. The macroscopic, microscopic, histological identification and microscopic constants of *Sarcostemma brevistigma* can be used as a rapid, inexpensive and botanical identification technique which would be of immense value in standardization and authentication of this plant.

**Keywords:** *Sarcostemma brevistigma*, pharmacognostic evaluation, macroscopic and microscopic.

### INTRODUCTION

*Sarcostemma brevistigma*, Wight and Arn. belongs to family Asclepiadaceae and commonly known as Kodikalli (Tamil), Soma (Sans), Somvel, Chirodi (Guj), Somlata (Hindi) and Moon Creeper (Eng.). It is found in countries like India, Burma, Baluchistan, Himalayas, arid rocks of Konkan and Kashmir.

This plant has been traditionally used in different areas of India: Roots are used in treating snake bite and taken as an infusion in dog bite cases<sup>1</sup>. Three drops with honey taken orally thrice a day for chronic ulcer in Andra Pradesh Sirumalai Hills<sup>2</sup>. In digestive disorder, scabies, skin disease, poisoning, cardiac disease, fever, cold, thirst mental disorders and dog bite in Karnataka<sup>3</sup>. Used as eye drops in Nallamala forests of Andra Pradesh<sup>4</sup>. Stem juice mixed with water is given in rheumatism, arthritis, and joints pain. Dry powder of the plant is being used in the form of decoction to treat earache in babies. Milky latex is prescribed to the lactating mother in Purulia district of West Bengal<sup>5</sup>. Latex is applied on wounds and cuts in Bidhar district of Karnataka<sup>6</sup>. Stem is used to cure bone fracture in Madhya Pradesh<sup>7</sup>. Water solution of pulpy mesocarp given as nasal drops (externally remedy) in epilepsy by Yanadis community in Cuddapah district, Andra Pradesh<sup>8</sup>.

The pharmacognostical study of *S. brevistigma* has not yet been studied fully. The present study was therefore undertaken to investigate the pharmacognostical characters of the plant.

### MATERIALS AND METHODS

#### Collection of specimens

The plant specimen was collected from Pillur beat (Pillur slope RF and Nellithurai RF), Karamadai Range. Care was taken to select healthy plant and normal organs. The required samples of different organs were cut and removed from the plant and fixed in FAA (Formalin-5ml+ Acetic acid-5ml + 70% Ethyl alcohol-90ml). After 24 hrs of fixing, the specimens were dehydrated with graded series of tertiary –butyl alcohol as per the schedule given by Sass<sup>9</sup>. Infiltration of the specimens was carried by gradual addition of paraffin wax (melting point 58-60°C) until TBA solution attained super saturation. The specimens were cast into paraffin blocks.

#### Sectioning

The paraffin embedded specimens were sectioned with the help of Rotary Microtome. The thickness of the sections was 10-12 µm. Dewaxing of the sections was by customary procedure<sup>10</sup>. The sections were stained with Toluidine blue as per the method published by O'Brien<sup>11</sup>. Since Toluidine blue is a polychromatic stain, the staining results were remarkably good; and some cytochemical reactions were also obtained. The dye rendered pink colour to the cellulose walls, blue to the lignified cells, dark green to suberin, violet to the mucilage, blue to the protein bodies etc. wherever necessary sections were also stained with safranin and fast-green and IKI(for Starch)

For studying the stomatal morphology, venation pattern and trichome distribution, paradermal sections (sections taken parallel to the surface of leaf) as well as clearing of leaf with 5% sodium hydroxide or epidermal peeling by partial maceration employing Jeffrey's maceration fluid<sup>9</sup>



Figure 1: Plant



Figure 2: A portion enlarged with flower.

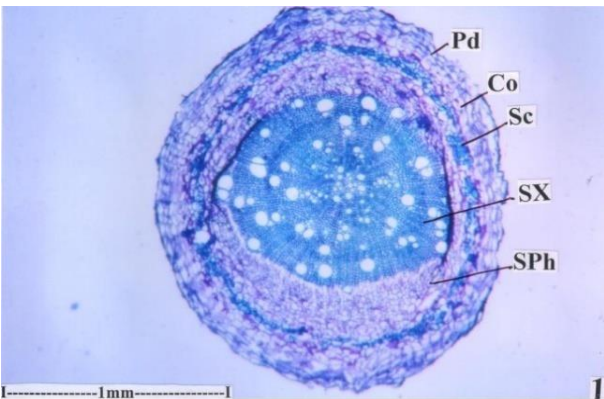


Figure 3: T.S of thick root- entire view.

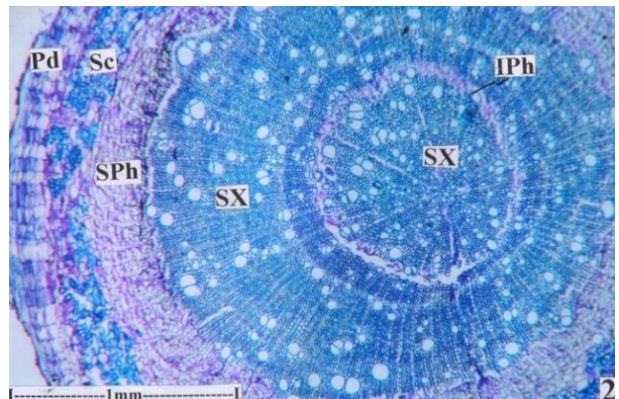


Figure 4: T.S of thick root - portion enlarged.

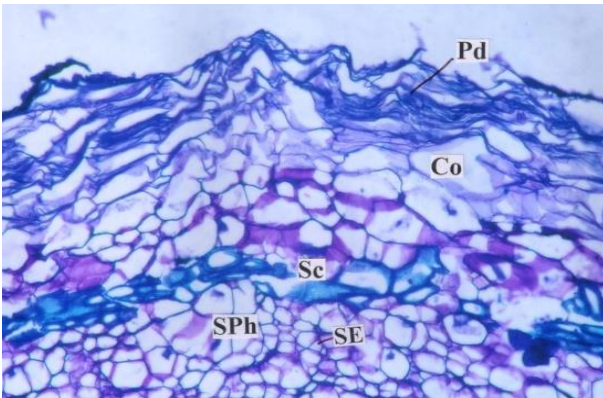


Figure 5: T.S of thick root –a sector enlarged

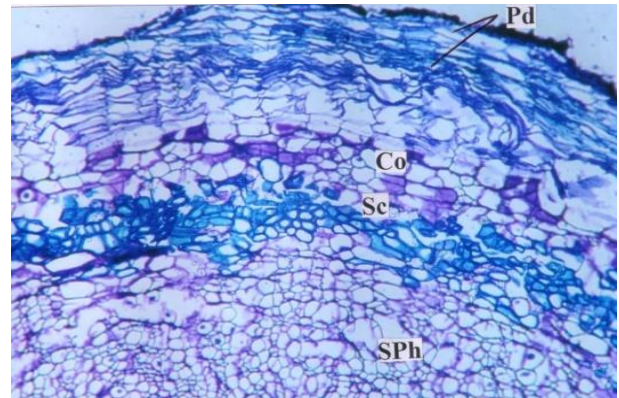


Figure 6: T.S. of thick root showing tissue zones

(CO: Cortex, Pd: Periderm, SPh: Secondary Phloem, SE: Sieve elements, SC: Sclerenchyma cylinder, Ve: Vessels, XF: Xylem Fibres, XR: Xylem Ray, IPh: (Included Phloem) Internal phloem)=

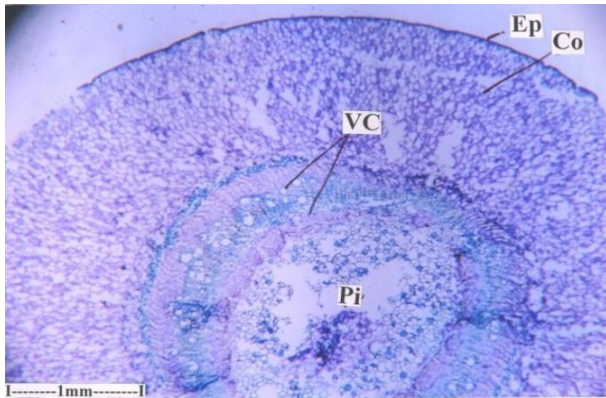


Figure 7: T.S. of stem-enlarged view.

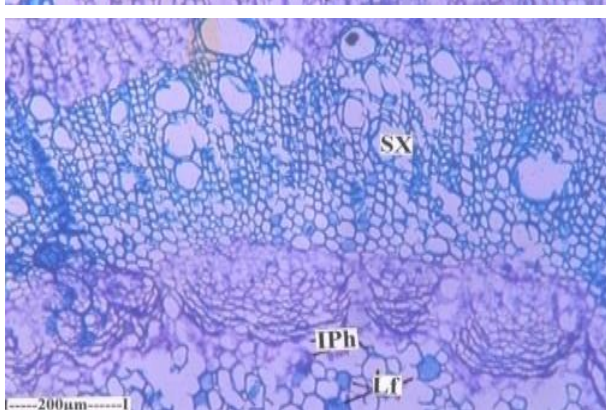
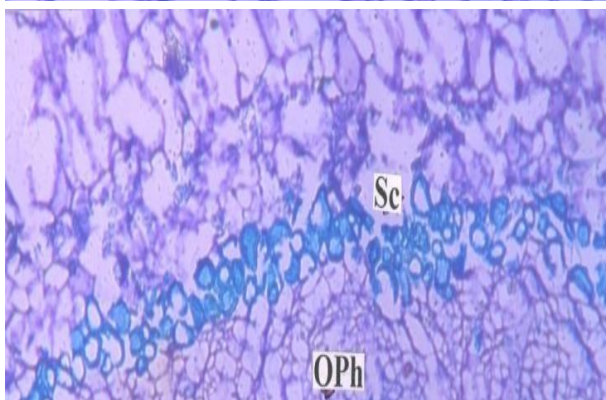
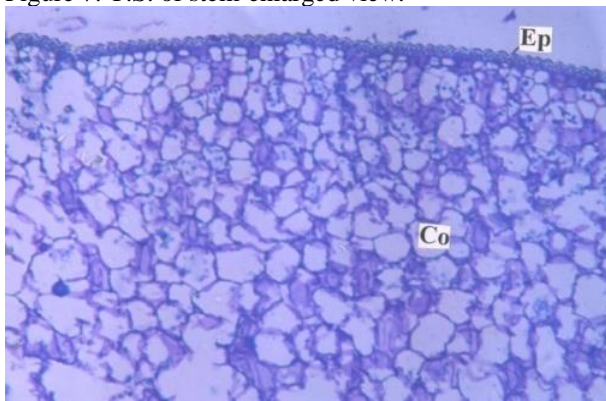


Figure 8: T.S. of stem-A sector enlarged.

were prepared. Glycerine mounted temporary preparations were made for macerated/cleared materials. Powdered materials of different parts were cleared with NaOH and mounted in glycerine medium after staining. Different cell components were studied and measured.

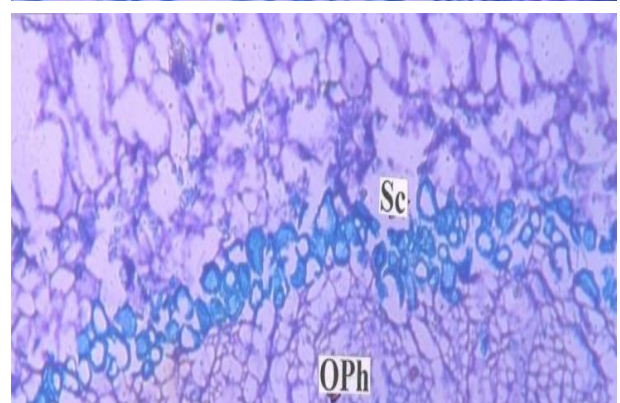
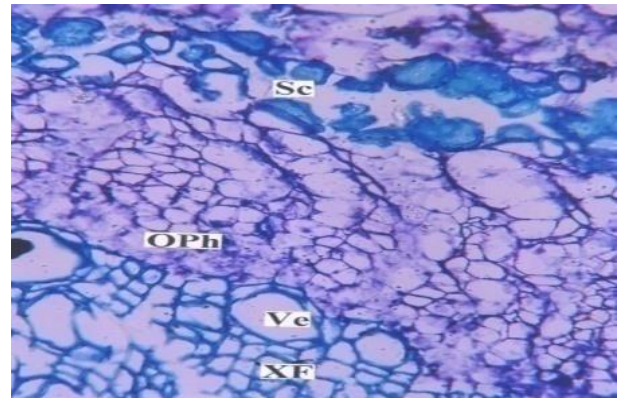


Figure 9: T.S. of stem-Vascular cylinder enlarged.

(Ep: Epidermis, Pi: Pith, VC: Vascular cylinder, CO: Cortex, Ep: Epidermis, IPh: Inner Phloem, Lf: Laticifer, OPh: Outer Phloem, Sc: Sclerenchyma, SX: Secondary Xylem)

#### Photomicrographs

Microscopic descriptions of tissues are supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with Nikon lab photo 2 microscopic Unit. For normal observations bright field was used. For the study of crystals, starch grains and lignified cells, polarized light was employed. Since these structures have birefringent property, under polarized light they appear bright against dark background. Magnifications of the figures are indicated by the scale-bars. Descriptive terms of the anatomical features are as given in the standard Anatomy books<sup>12</sup>.

#### RESULTS AND DISCUSSION

Macroscopical investigation of *S. brevistigma* revealed that the plant is a perennial leafless, twining trailing shrub, with green cylindrical, fleshy, glabrous, green pendulous stems exuding milky white latex, exhibiting longitudinal ridges and nodes. Stem is succulent grows up to 25 in. in diam. Leaves reduced to minute scales. Flowers small, in sessile terminal or lateral umbels, calyx small, 5-partite, glandular or not within. Corolla rotate, deeply lobed; lobes 5, overlapping to the right in bud. Corona double, the outer cupular, membranous, 5-10 lobed or crenate, attached to the base of the stamina column. Stamens adnate to the base of the corolla-tube; filaments forming a column; anthers with membranous inflexed appendages; pollen-masses slender, curved, pendulous, attached by usually short

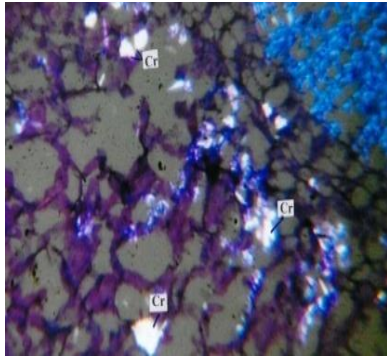


Figure 10: Calcium Crystals.

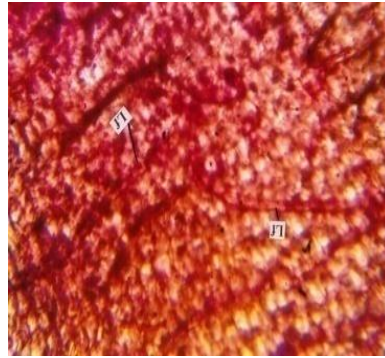


Figure 11a: Laticifer cells- entire view.

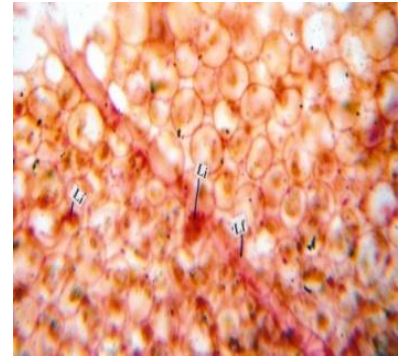


Figure 11b: Laticifer cells- a enlarged view

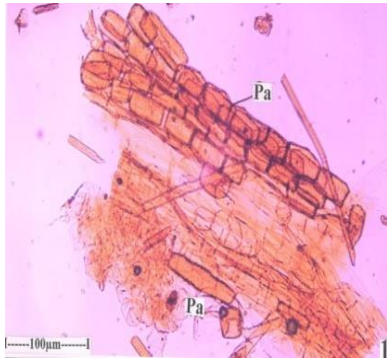


Figure 12a: Bundle of rectangular rows of parenchyma cells

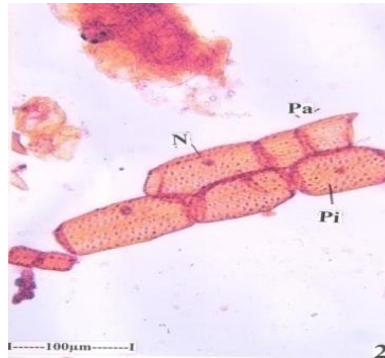


Figure 12b: Isolated group of rectangular parenchyma cell with dense simple pits

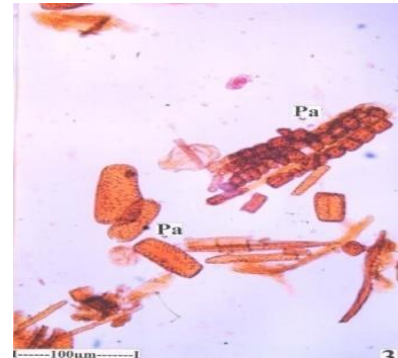


Figure 12c: Vertical small cuticle parenchyma cell

(Lf: Laticifers; Cr: Calcium crystals; N: Nucleus, Pa: Parenchyma cells, Pi: Pits)

caudicles to the hard pollen-carriers. Ovary of 2 carpels; styles slender; style-apex 5-angled, rounded or conical at the top. Fruit of 2 straight smooth follicular mericarps (Fig. 1 & 2).

Anatomically the young root is 1.7mm thick. It consists of broken remnants of the epidermal cells, thin periderm, narrow cortical zone, cortical sclerenchyma layer and secondary phloem with secondary xylem (Fig. 3). In the young (thin) root the periderm is not well differentiated. It includes three or four layers of shrunken and deformed cells (Fig. 5). The cortical zone is intact and includes large, thin walled compact parenchyma cells. The inner boundary of the cortex is marked by a thin continuous layer of sclerenchyma cells (Fig. 4). The vascular cylinder is 1.4mm thick. It includes wide continuous cylinder of secondary phloem and solid, dense cylinder of secondary xylem (Fig. 3). The secondary phloem comprises small, polygonal sieve elements, associate with small companion cells. There are wide thin walled phloem parenchyma cells amidst the companion cells (Fig. 5). Secondary xylem consists of wide and narrow types circular, thin walled vessels. The wide vessels are 70µm in diameter and the narrow vessels are 10µm in diameter. Xylem fibers have thick lignified walls and narrow lumen. They are in straight radial lines. The xylem rays are narrow and run straight. (Fig. 5).

The thick root is 4.2mm in diameter. The root consists of periderm, cortex sclerenchyma cylinder, secondary phloem and secondary xylem (Fig. 4). The periderm is 150µm thick. It consists of several narrow, rectangular,

thin walled and suberised cells (Fig. 6). The cortical zone is narrow and comprises four or five layers of circular compact thin walled cells. Sclerenchyma cylinder occurs as inner boundary of the cortex. The sclerenchyma cylinder consists of about four layers of small angular thick walled cells (Fig.6). Secondary phloem zone is 250 µm thick. It is continuous all around the xylem cylinder. The phloem includes dead collapsed cells in the outer zone and the cells in the inner zone are (Fig. 6). The sieve elements are small, angular and thin walled. Secondary xylem cylinder is 3mm thick. It includes vessels, fibers and rays. The vessels are both wide and narrow type. The vessels are diffuse in distributions. The vessels are up to 50µm in diameter. In the inner portion of the xylem cylinder occurs a thin circular cylinder of phloem elements (Fig. 3,5,6). Similar studies were carried out in *Sarcostemma Secamone*<sup>13</sup> and *Sarcostemma acidum*<sup>14</sup>.

The stem is circular in sectional view with smooth and even surface. It is 5mm in diameter (Fig. 7). Outer most layer of stem was seen as a thick single cell layer. The epidermal cells consist of small semicircular epidermal cells with projecting papillate outer surface walls, the cuticle (Fig. 8). The cortical zone is 1mm thick. It is homogenous and parenchymatous and the cells are wide, thin walled, compact and polygonal, which show the presence of rosettes of calcium oxalate crystals. The cells of the cortex show the presence of non lignified fibres and latex cavities (Fig. 7). The inner border of the cortex is demarcated by a thin continuous layer of sclerenchyma cells.



Figure 13a: Narrow fibers.

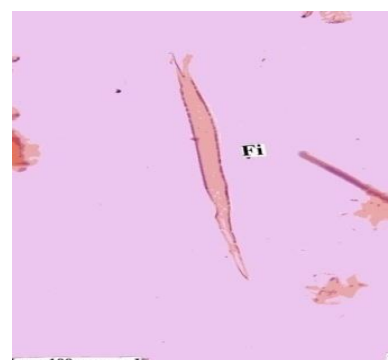
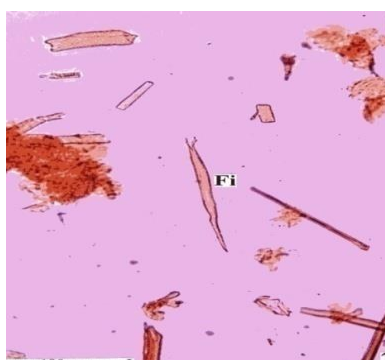


Figure 13b,c: Wide fibers.

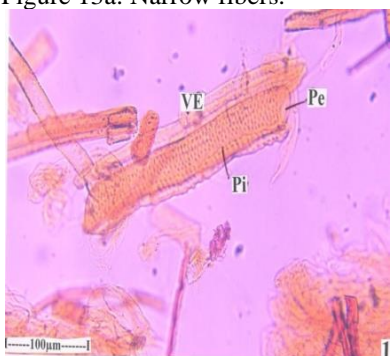


Figure 14: Vessel Elements

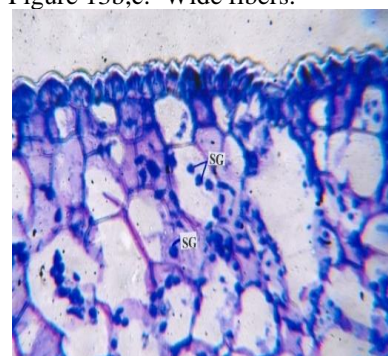
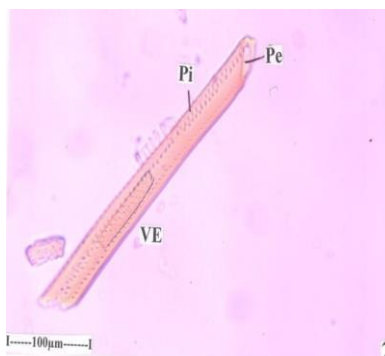


Figure 15: Starch grains.

(Fi: Fibers; Pa: Parenchyma cells; Ve: Vessels, XF: Xylem Fibres, Pe: Perforation, Pi: Pits, VE: Vessel Elements; SG: Starch grains)

The vascular cylinder is bicollateral. There is a central thick cylinder of secondary xylem and secondary phloem occurs both on the outer and inner portion of the xylem. Secondary xylem consists of wide, circular thin walled solitary vessels and narrow xylem fibers with angular, thick walled lignified fibers. The vessels are up to 100µm wide. The outer phloem consists of thin continuous layer of sieve elements which occurs in short radial rows. The inner phloem consists of wide, semi circular masses of sieve elements (Fig.8,9), pith is round and parenchymatous. The microscopic features observed in the specimen were consistent with the descriptions reported by Poornima<sup>15</sup>.

The powder is fibrous, light greenish brown in colour and bitter in taste. It shows the presence of rosettes of calcium oxalate crystals (Fig. 10), fragments of pitted, spiral vessels and laticifers. Laticiferous canals are wide, thick walled and non septate (Fig. 11a and 11b). Franceschi and Horner<sup>16</sup> have thrown light on the crystal morphology and their biosynthesis in plants. The relevance of crystallography in pharmacognostical studies has been well recognized by Wallis and Evans<sup>17,18</sup>. Generally, frequency, distribution and size of crystals are used as diagnostic characters in microscopical and powder studies of herbal drugs<sup>19</sup>.

Parenchyma cells of different shape and size are abundant in the powder. Some of the parenchyma cells are wide, rectangular, thin walled and have dense simple pits with prominent nuclei. The cells are either solitary or in thick bundles (Fig. 12a). They are 120µm long and 50µm wide. Apart from the wide, rectangular parenchyma cells, there are small squaring thick walled, parenchyma cells, which

are in compact rows (Fig. 12b and 12 c). Thus, cells are 20×20µm in size.

#### Portion

Xylem fibres are common in the powder. They are either narrow fibres or wide fibres. Narrow fibres are thick walled with narrow lumen. They are 250µm long and 5µm thick (Fig.-13a). The wide fibres have thin walls and wide lumen. They are 310µm long and 20µm wide (Fig.-13b). Long narrow cylindrical vessel elements are frequently seen in the powder. The vessel elements have dense multiseriate bordered pits and wide, elliptical oblique perforations. The vessel elements are 320µm long and 40µm wide (Fig.-14).

Starch grains were dark in colour. The shape of the grain is characteristic. They are dumb bell shaped (short rod dilated at both ends). The grains are 20 µm long (Fig.-15). Indhumathi and Kalvimoorthi<sup>13</sup> have recorded the presence of laticifers and trichomes in the stem of *Sarcostemma secamone*.

According to World Health Organization (WHO) the macroscopic and microscopic description of a medicinal plant is the first step towards establishing its identity and purity and should be carried out before any tests are undertaken. Quality control of herbal drugs has traditionally been based on appearance and microscopic evaluation, which is indispensable in the initial identification of herbs, as well as in identifying small fragments of crude or powdered herbs, detection of foreign matter, substitutes and adulterants. The Pharmacognostic studies provide useful information for identifying and authenticating the medicinal plants. The present

pharmacognostic details of *Sarcostemma brevistigma* would be helpful for further scientific studies in this plant.

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