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THE CORRECT SCIENTIFIC NAME OF "DUDHI"

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"Dudhi" is an indigenous drug which is used in the diseases of children e.g. worms, bowel complaints, cough, dysentery and colic. In the last two diseases the juice of the plant is given. Decoction of plant is given in bronchial affections and asthma. The latex of the plant is used as application for warts [1, 2]. It has been recommended for hay fever and whooping cough [3]. The drug, which is used for cure of many diseases in the indigenous system of medicine, has unfortunately not been standardized. Two botanical names, *Euphorbia hirta* L. and *Euphorbia hypercifolia* Hk.f, are referred to in the literature under one Unani name "Dudhi" [4, 7]. In order to determine the correct scientific name of the Unani drug "Dudhi" comparative pharmacognostic studies have been taken up. These studies revealed that the correct botanical name of unani drug "Dudhi" is *Euphorbia hirta* L.

INTRODUCTION

In the Indo-Pakistan sub-continent herbal drugs are used widely by the rural population. "Dudhi" is used in the diseases of children e.g. in worms, bowel complaints and cough. While the plant juice is given in dysentery and colic. Decoction of plant is taken in bronchial affections and asthma. Latex of the plant is used as application for warts. It has been recommended for hay fever and whooping cough.

"Dudhi" is a Unani drug which is dispensed in the indigenous system of medicine. Sometimes a wrong plant is selected and it does not show the desired results. One reason for the collection of a wrong plant is that two or more plants are referred to under one Unani name in the literature. For example, *Anthemis nobilis* L., *Corchorus depressus* L., and *Matricaria chamomilla* L., are reported under one Unani name "Babuna" at different places in the literature. The Unani drug "kakrasingi" is also referred to in the literature by two botanical names *Rhus succedanea* L. and *Pistacia integrima* Stew. ex. Brandis. The correct scientific names of the Unani drugs "Babuna" and "Kakrasingi" as *Matricaria chamomilla* L., and *Pistacia integrima* Stew. ex. Brandis. have recently been established [8, 9]. Since "Dudhi" is confused with two plants, viz., *Euphorbia hirta* L. and *Euphorbia hypercifolia* Hk.f., comparative pharmacognostic studies were undertaken in order to determine its correct botanical name.

MATERIAL AND METHODS

The Unani drug "Dudhi" which consists of leaves and stems was procured from drug stores of Akbari Mandi, Lahore and the plant speciments of *Euphorbia hirta* L. and *E. hypercifolia* Hk.f. were obtained from the herbarium of the Peshawar Laboratories. Macroscopy, microscopy with free-hand sectioning, and the microtomy of the plant samples and the drug sample were carried out [10]. Macerated studies were conducted by Jaffery's method [10].

RESULTS AND DISCUSSION

Comparative pharmacognostic studies, i.e. macroscopy, microscopy and microchemical tests of "Dudhi", *Euphorbia hirta* L., and *E. hypercifolia* Hk.f. disclosed the following.

Macroscopic characters.

Comparative macroscopic characters of "Dudhi", *Euphorbia hirta* L., and *E. hypercifolia* Hk.f. as recorded in Table 1 show that "Dudhi" and *Euphorbia hirta* L. resemble one another, whereas the macroscopic characters of *Euphorbia hypercifolia* Hk.f. are different.

Microscopic characters.

Microscopic characters were studied with the help of macerations, free-hand sectioning and microtomy.

Studies on macerated Euphorbia hirta L.

Leaf (Fig. 1): Maceration studies show that the fragments of the epidermal cells consisted of parenchyma and

stomata. The stomata are of the rubiaceous type. The palisade and spongy parenchyma were observed. Ramifying cells, i.e. laticiferous tubes, were also located. The lumina of these cells were found enriched with latex. The xylem parenchyma of varying size were also present. Simple and branched reticulate vessels were oriented. Spiral vessels were also a part of vascular system in *Euphorbia hirta* L. 4-8 celled trichomes were situated in the upper and lower epidermal tissue. Collenchyma was also observed in the macerated tissues.

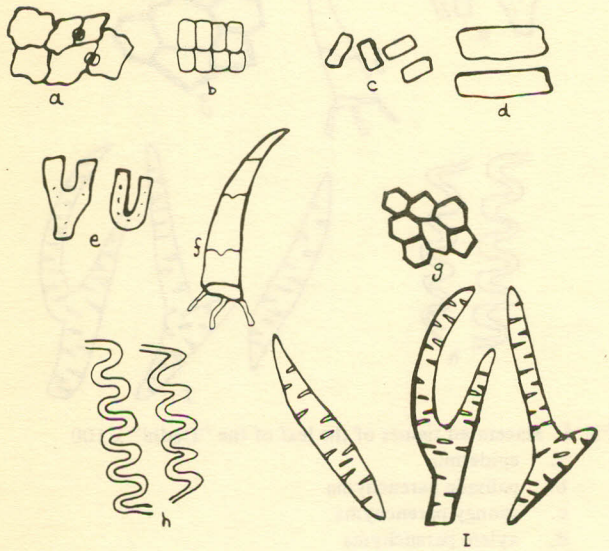

Fig. 1. Macerated tissues of of *Euphorbia hirta* L. leaf x 100

a. epidermal parenchyma
b. palisade parenchyma
c. spongy parenchyma
d. xylem parenchyma
e. laticiferous tubes
f. trichome
g. collenchyma
h. spiral vessels
i. simple & branched reticulate vessels.

Stem (Fig. 2): Epidermal and hypodermal cells were observed. Fibres of sclerenchymatous nature were studied. Spiral and pitted vessels were situated. 2-4 celled trichomes were also studied.

Maceration studies of Euphorbia hypercifolia Hk.f.

Leaf (Fig. 3): Epidermal cells along with rubiaceus type of stomata were observed. Kidney-shaped guard cells encircle the stomatal opening. Palisade parenchyma was pentahexagonal in shape. Reticulate and spiral vessels were studied. 2-5 celled trichomes and fibres were also observed.

Stem (Fig. 4): Maceration studies of the stem of *Euphorbia hypercifolia* Hk.f. show the following features:

Hypodermal cells and xylem parenchyma, scleriform, spiral, reticulate and pitted vessels were observed. Laticiferous cells possessing latex were located. Fibres of different sizes were found.

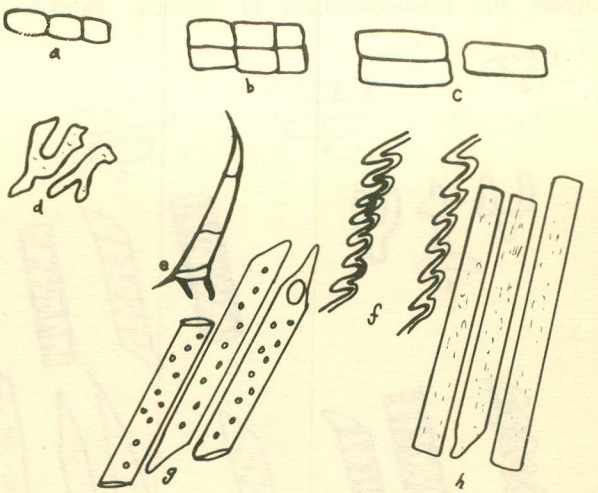

Fig. 2. Macerated tissues of the stem of *Euphorbia hirta* L x 100

a. epidermis parenchyma
b. hypodermal cells
c. xylem parenchyma
d. laticiferous tubes
e. trichomes
f. spiral vessels
g. pitted vessel
h. fibres.

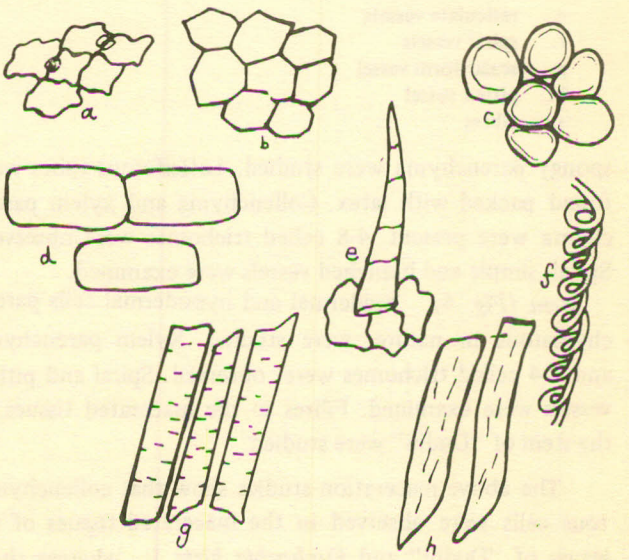

Fig. 3. Macerated tissues of the leaf of *Euphorbia hypercifolia* Hk.f. x 100

a. epidermal parenchyma
b. palisade parenchyma
c. spongy parenchyma
d. xylem parenchyma
e. trichome
f. spiral vessel
g. reticulate vessels
h. fibers

Maceration studies of "Dudhi"

Leaf (Fig. 5): Epidermal tissues consisted of parenchyma and rubiaceous-type of stomata. Palisade and spongy parenchyma were studied. Laticiferous tubes were found packed with latex. Collenchyma and xylem parenchyma were present. 4-8 celled trichomes were observed. Spiral, simple and branched vessels were examined.

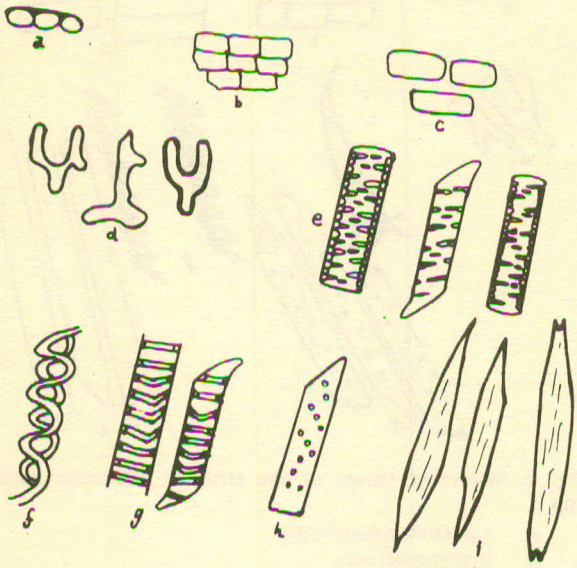

Fig. 4. Macerated tissues of the stem of *Euphorbia hypercifia* Hk.f. x 100

a. epidermis
b. hypodermal cells
c. xylem parenchyma
d. laticiferous tubes
e. reticulate vessels
f. spiral vessels
g. scalariform vessel
h. pitted vessel
i. fibres

Stem (Fig. 6). Epidermal and hypodermal cells parenchymatous in nature, were studied. Xylem parenchyma and 2-4 celled trichomes were observed. Spiral and pitted vessels were examined. Fibres in the macerated tissues of the stem of "Dudhi" were studied.

The above maceration studies show that collenchymatous cells were observed in the macerated tissues of the leaves of "Dudhi" and *Euphorbia hirta* L., whereas these cells were absent in *Euphorbia hypercifolia* Hk.f. Moreover, 4-8 celled trichomes in the macerated tissues of the leaves of "Dudhi" and *Euphorbia hirta* L. were present, while 2-5 celled trichomes in the leaves of *Euphorbia hypercifolia* Hk.f. were observed. Simple and branched reticulate vessels were oriented in the leaves of "Dudhi" and *Euphorbia hirta* L. as compared to only simple reticulate vessels present in *Euphorbia hypercifolia* Hk.f. Fibres were absent in the macerated tissues of the leaves of "Dudhi" and *Euphorbia hirta* L., while these were present in *Euphorbia hypercifolia* Hk.f.

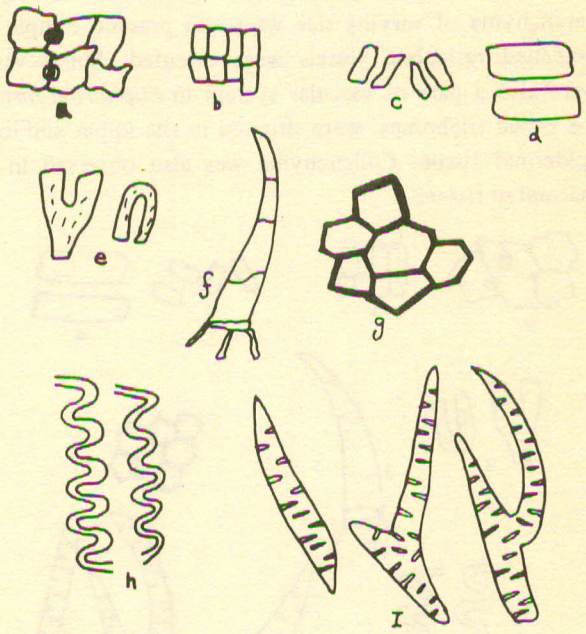

Fig. 5. Macerated tissues of the leaf of the "Dudhi" x 100

a. epidermis
b. palisade parenchyma
c. spongy parenchyma
d. xylem parenchyma
e. laticifierous tubes
f. trichomes
h. spiral vessels
i. simple and branched reticulate vessels

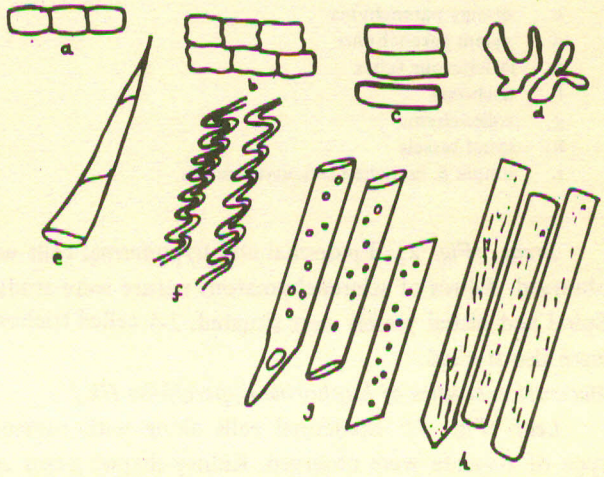

Fig. 6. Macerated tissues of the stem of the "Dudhi" x 100

a. epidermis
b. hypodermal cells
c. xylem parenchyma
d. laticiferous tubes
e. trichome
f. spiral vessels
g. pitted vessels
h. fibres

Reticulate, scleriform, spiral and pitted vessels were present in the macerated tissues of the stem of *Euphorbia hypercifolia* Hk.f. while reticulate and scleriform pitted vessels were absent in "Dudhi" and *Euphorbia hirta* L. 4-6 celled trichomes were observed in the macerated tissues of the stems of *Euphorbia hirta* L., and "Dudhi", whereas the trichomes were absent in the stem of *Euphorbia hypercifolia* Hk.f. Two types of fibres, acicular and rectangular shaped in "Dudhi" and Euphorbia hirta L., were observed, whereas in *Euphorbia hypercifolia* Hk.f. the fibres are pointed or notched at both ends.

The above comparative maceration studies and measurment data in Tables 2-4 reveal that the drug "Dudhi" and *Euphorbia hirta* L. are identical.

Transverse section of leaf of Euphorbia hirta L. (Fig. 7):

Epidermis: The epidermis is encircled by the cuticle. Epidermal cells are modified over veins, leaf margins and trichome scars. The cells of upper epidermis are somewhat curved anticlinally while the cells of lower epidermis are wavy. 4-8 celled trichomes are observed. The trichomes are uniseriate, non-glandular and filiform. Rubiaceous type of stomata are studied. The stomata are encircled by two subsidiary cells.

Table 1. Macroscopic characters of the drug sample, "Dudhi", *Euphorbia hirta* L. and *E. hypercifolia* Hk. f.

Part of sample studied		Unani drug 'Dudhi'	Euphorbia hirta L.	Euphorbia hypercifolia Hk.f.
LEAF	Length	5 – 6 cm	5 – 6 cm	2 – 2.5 cm
	Breadth	2.5 – 3 mm	2.5 – 3 mm	6 – 8 mm
	Lamina	Involucre companulate oblong – lanceolate	Involucre companulate oblong – lanceolate	Oblong
	Margin	Dentate	Dentate	Dentate, but dentation absent at base.
	Hairs	Hairy	Hairy	Bristles observed
	Tip	Pointed	Pointed	Rounded
	Taste	Bitter	Bitter	Tasteless
STEM		Hairy	Hairy	Smooth
	Taste	Bitter	Bitter	Tasteless

Table 2. Maceration studies of 'Dudhi', *Euphorbia hirta* L and *E. hypercifolia* Hk.f.

Part studies	Macerated tissue	'Dudhi"	*Euphorbia hirta* L.	*E. hypercifolia* Hk.f.
LEAF	Collenchyma	Present (+)	Present (+)	–
	Trichomes	4 – 8 celled	4 – 8 celled	2 – 5 celled
	Simple reticulate vessel	+	+	+
	Branched reticulate vessel	+	+	–
	Fibres	–	–	+
	Reticulate and scleriform vessels	–	–	+
Stem Fibres	Trichome	4 – 6 celled	4 – 6 celled	–
	a. Needle shaped	+	+	–
	b. Rectangular	+	+	–
	c. Both ends pointed	–	–	+
	d. Both ends notched	–	–	+

Table 3. Measurements of cells comprising various structural parts of the leaves of crude "Dudhi", *Euphorbia hirta* and *E. hypercifolia*

Type of cells	Dudhi		Euphorbia hirta		Euphorbia hypercifolia	
	Breadth	Length	Breadth	Length	Breadth	Length
Epidermal cells	22-25-30 μ	25-30-38 μ	22-25-30 μ	25-30-38 μ	30-35-42 μ	45-47-50 μ
Palisade parenchyma	12-15-25 μ	37-50-68 μ	12-15-25 μ	37-50-68 μ	17-25-37 μ	40-45-50 μ
Spongy parenchyma	15-17-22 μ	23-25-28 μ	15-17-22 μ	23-25-28 μ	17-22-25 μ	27-30-37 μ
Collenchyma	13-20-25 μ	30-35-40 μ	13-20-25 μ	30-35-40 μ	...	...
Xylem parenchyma	13-17-20 μ	60-90-175 μ	13-17-20 μ	60-90-175 μ	22-25-35 μ	62-100-150 μ
Trichomes	20-25-30 μ	375-390-435 μ	20-25-30 μ	375-390-435 μ	25-27-35 μ	300-315-1500 μ
Spiral vessels	5-17-13 μ	60-125-625 μ	5-7-13 μ	60-125-625 μ	12-15-17 μ	150-420-1250 μ
Reticulate vessels	12-15-35 μ	150-200-900 μ	12-15-35 μ	150-200-900 μ	25-30-50 μ	300-350-1000 μ
Branched reticulate vessels:						
Limb a-b	8-10-13 μ	400-450-675 μ	8-10-13 μ	400-450-675 μ	–	–
Limb a-c	5-7-13 μ	200-250-450 μ	5- 7-13 μ	200-250-450 μ	–	–

Mesophyll: It is comprised of two parts: (a) palisade and (b) spongy parenchyma.

(a) Palisade: Thin walled compact cells arranged somewhat in vertical rows constituting the palisade.

(b) Spongy parenchyma: Spongy parenchyma oriented over the vascular bundles, cells somewhat rectangular in structure.

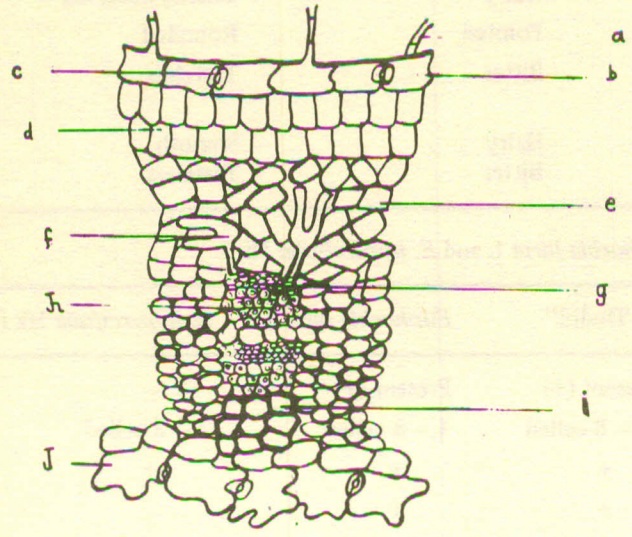

Fig. 7. T.S. of leaf of *Euphoriba hirta* L. x 100
a. trichome scars
b. upper epidermis
c. stomata
d. palisade parenchyma
e. spongy parenchyma
f. laticiferous tubes
g. phloem vessels
h. xylem vessels
i. collenchyma
j. lower epidermis

Vascular bundles: Xylem oriented towards adaxial side. Collenchymatous patches present in transverse sections of the leaf which possess veins. Laticiferous tubes arise from the phloem and enter the mesophyll.

Transverse section of leaf of "Dudhi" (Fig. 8).

Epidermis: The epidermis is located beneath a thin layered cuticle. The cells of the upper epidermis are curved anticlinally and those of the lower epidermis are wavy. The trichomes of 4-8 celled, non-glandular, uniseriate and filiform have been studied. Stomata are of rubiaceous type.

Mesophyll: It is comprised of two parts: (a) palisade and (b) spongy parenchyma.

(a) Palisade: Thin walled compact cells arranged in vertical rows.

(b) Spongy parenchyma: Cells of spongy parenchyma rectangular and located above the vascular bundles.

Vascular bundles: Xylem oriented towards adaxial side. Collendrymatous patches present in transverse section of the leaf having veins. Laticiferous tubes arise from phloem and enter the mesophyll.

Transverse section of the stem of Euphorbia hirta L. (Fig. 9)

Epidermis: Wavy, single-layered epidermis having the scars of trichomes. 4-6 layered hypodermis beneath the epidermis.

Cortex: Thin walled cortical parenchyma larger in size than the hypodermal cells.

Endodermis: Endodermis dissolved and not clearly seen.

Pericycle: The pericycle oriented over the vascular bundles. Cells of pericycle furnished with laticiferous tubes. Laticiferous tubes packed with latex. Sclerenchyma cells present in pericycle.

Vascular bundles: Collateral vascular bundles with interfasicular cambium.

Pith: Occupying the central portion of stem. ¾th part of the pith distintegrated. Remaining cells of the pith loosely arranged and parenchymatous in origin.

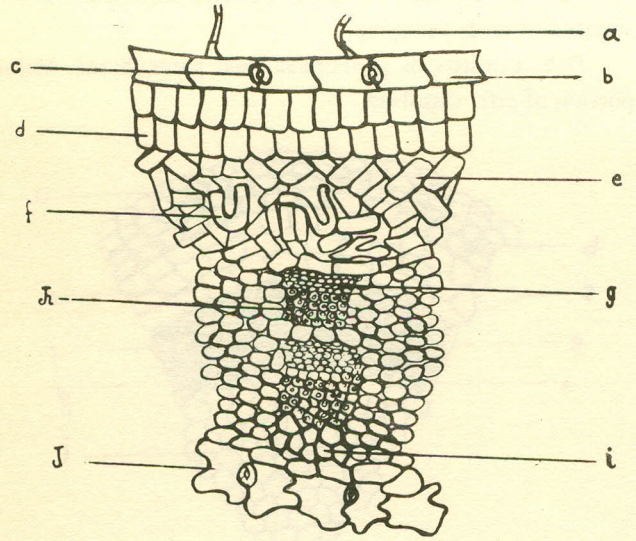

Fig. 8. T.S. of the leaf of "Dudhi" x 100
- a. trichome scar
- b. upper epidermis
- c. stomata
- d. palisade parenchyma
- e. spongy parenchyma
- f. laticiferous tubes
- g. phloem vessels
- h. xylem vessel
- i. collenchyma
- j. lower epidermis

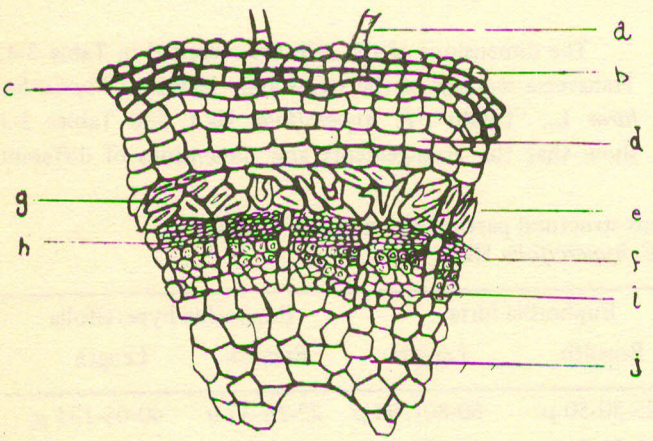

Fig. 9. T.S. of the stem of *Euphorbia hirta* L x 100
- a. trichome scar
- b. epidermis
- c. hypodermis
- d. cortex
- e. pericycle
- f. laticiferous tubes
- g. sclerenchyma
- h. phloem
- i. xylem
- j. pith

Transverse section of the stem of "Dudhi" (Fig. 10).

Epidermis: Wavy, single layered epidermis having scars of trichomes. 4-6 layered hypodermis present beneath the epidermis.

Cortex: Thin walled parenchymatous cells observed.

Endodermis: Endodermis dissolved.

Pericycle: Pericycle situated above vascular bundles. Cells of paricycle furnished with laticiferous tubes. Tubes are packed with latex. Sclerenchyma cells present.

Vascular bundles: Bundles collateral; interfasicular cambium present.

Pith: Pith present in the centre of the stem. Majority of cells disintegrated. Cells parenchymatous in origin.

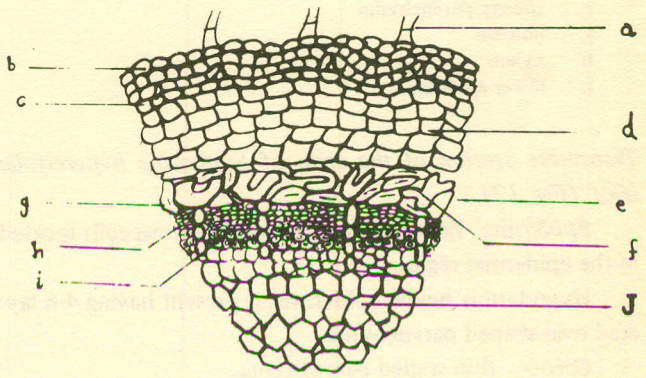

Fig. 10. T.S. of the stem of "Dudhi" x 100
- a. trichome scars
- b. epidermis
- c. hypodermis
- d. cortex
- e. pericycle
- f. laticifierous tubes
- g. sclerenchyma
- h. phioem
- i. xylem
- j. pith

Transverse section of the leaf of Euphorbia hypercifolia Hk.f. (Fig. 11).

Epidermis: Cuticle encircling epidermal cells. Leaf having dorsi-ventral structure. Epidermal cells somewhat wavy. Stomata rubiaceous. 2-5 celled trichomes present.

Mesophyll: It is divided into two parts:

(a) Palisade and (b) Spongy parenhcyma.

(a) *Palisade:* Two-three layered penta-hexagonal

parenchyma studied in palisade.

(b) *Spongy parenchyma:* Palisade followed by a few-layered spongy parenchyma with intercellular spaces.

Vascular bundles: Vascular bundles collateral.

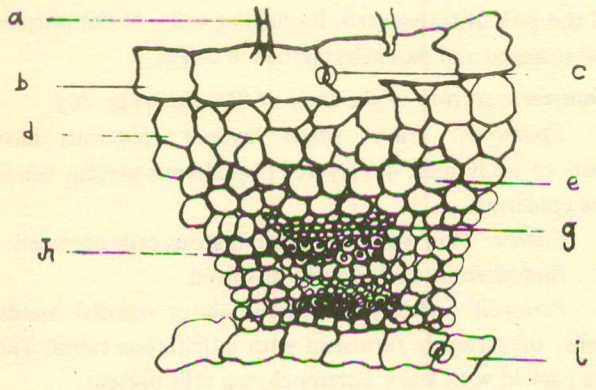

Fig. 11. T.S. of the leaf of *Euphorbia hypercifolia* Hk.f. x 100
- a. trichome scar
- b. upper epidermis
- c. stomata
- d. palisade parenchyma
- e. spongy parenchyma
- g. phloem
- h. xylem
- i. lower epidermis.

Transverse section of the stem of Euphorbia hypercifolia Hk.f. (Fig. 12).

Epidermis: Barrel shaped parenchymatous cells located in the epidermal region.

Hypodermis below epidermis, is present having 4-6 layered oval shaped parenchyma.

Cortex: thin walled parenchyma.

Endodermis: Endodermal cells not present.

Pericycle: Oriented over vascular bundles. Laticiferous tubes lodged in the cells of pericycle. The lumen of the tubes filled with latex. Sclerenchymatous cells also observed.

Vascular bundles: Vascular bundles collateral. Xylem situated towards pericycle.

Pith: Consists of penta-hexagonal parenchyma. Major portion of pith dissolved.

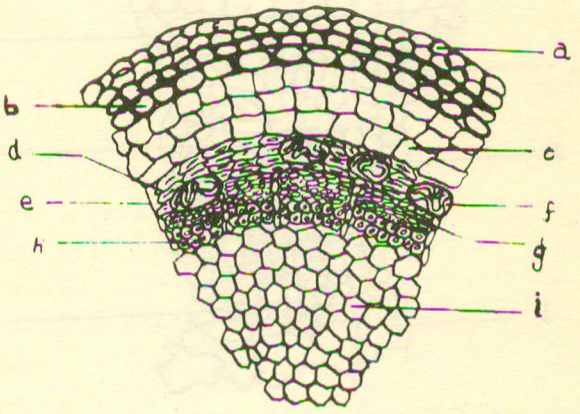

Fig. 12. T.S. of the stem of *Euphorbia hypercifolia* Hk.f. x 100
- a. epidermis
- b. hypodermis
- c. cortex
- d. sclerenchyma
- e. pericycle
- f. laticifierous tubes
- g. phloem
- h. xylem
- i. pith

The dimensions of the cells are recorded in Table 3-4. Transverse sections of the stems and leaves of *Euphorbia hirta* L., "Dudhi", *E. hypercifolia* Hk.f. and Tables 3-4 show that the arrangements and dimensions of different

Table 4. Measurements of cells comprising various structural parts of the stems of "Dudhi", *Euphorbia hirta* L. and *E. hypercifolia* Hk.f.

Type of cells	Unani Drug Dudhi		Euphorbia hirta		Euphorbia hypercifolia	
	Breadth	Length	Breadth	Length	Breadth	Length
Parenchymatous cells	25-30-50 μ	60-80-100 μ	25-30-50 μ	60-80-100 μ	22-28-35 μ	40-65-135 μ
Xylem parenchyma	20-30-50 μ	125-200-500 μ	20-30-50 μ	125-200-500 μ	25-35-50 μ	30-60-130 μ
Trichomes	20-25-30 μ	180-250-500 μ	20-25-30 μ	180-250-500 μ	absent	absent
Spiral vessels	20-25-35 μ	170-260-480 μ	20-25-35 μ	170-260-480 μ	12-27-35 μ	130-180-350 μ
Pitted vessels	13-20-40 μ	425-550-625 μ	13-20-40 μ	425-550-625 μ	25-30-40 μ	250-260-280 μ
Reticulate vessels	Absent	Absent	Absent	Absent	25-30-50 μ	235-300-875 μ
Scalariform vessels	Absent	Absent	Absent	Absent	12-17-27 μ	112-125-800 μ
Fibres	10-17-32 μ	265-525-700 μ	10-17-32 μ	265-525-700 μ	12-14-20 μ	400-525-750 μ

kinds of cells are similar in 'Dudhi" and *E. Hirta* . Moreover, trichome scars are present in the transverse section of stems of "Dudhi" and *E. hirta* L., while they are the absent in the stem of *E. hypercifolia* Hk.f. Collenchyma is present in the transverse section of leaves of *"Dudhi"* and *E. hirta* L., while these tissues are absent in the leaf of *E. hypercifolia* Hk.f.

Microchemical Tests: Samples of "Dudhi", *E. hirta* L., and *E. hypercifolia* Hk.f. were powdered and subjected to different tests in ordinary and UV light [11]. "Dudhi" and *E. hirta* L. behave similarly against these tests but *E. hypercifolia* Hk.f. showed different results under these conditions (Tables 4, 5 and 7).

Microchemical tests show that "Dudhi" and *E. hirta* L., behave similarly while *E. hypercifolia* Hk.f. behaves differently.

Macroscopy, microscopy and microchemical tests reveal that "Dudhi" and *E. hirta* L. are one and the same *E. hypercifolia* Hk.f., though referred to in the literature under the Unani name "Dudhi" is different from "Dudhi". Thus according to the comparative pharmacognostic studies the correct scientific name of "Dudhi" is *Euphorbia hirta* L.

Table 5. Powdered tests of "Dudhi" with different reagents and UV light

Treatment	Colour in ordinary light	Flouresence with UV light
Drug powder + water	No change	Light brown
Drug powder + iodine	Reddish brown	Yellowish green
Drug powder + $FeCl_3$	Black	Black
Drug powder + acetic acid	Light green	Light brown
Drug powder + picric acid	No change	No change
Drug powder + HCl	Dark brown	Green
Drug powder + HNO_3	Light brown	Light brown
Drug powder + H_2SO_4	No change	Sky-blue
Drug powder + NaOH	Light brown	Light green
Drug powder + NH_3	Light brown	Whitish green

Table 6. *Euphorbia hirta* L.: Powdered tests with different reagents and UV light

Treatment	Colour in ordinary light	Flouresence with UV light
Drug powder + water	No change	Light brown
Drug powder + iodine	Reddish brown	Yellowish green
Drug powder + $FeCl_3$	Black	Black
Drug powder + acetic acid	Light green	Light brown
Drug powder + picric acid	No change	No change
Drug powder + HCl	Dark brown	Green
Drug powder + HNO_3	Light brown	Light brown
Drug powder + H_2SO_4	No change	Sky blue
Drug powder + NaOH	Light brown	Light green
Drug powder + NH_3	Light brown	Whitish green

Table 7. *Euphorbia hypercifolia* HK.f.: powdered tests with different reagents and UV light

Treatment	Colour in ordinary light	Flouresence under UV light
Drug powder + water	No change	Light green
Drug powder + iodine	Light brown	Light green
Drug powder + $FeCl_3$	Black	Dark green
Drug powder + acetic acid	Light brown	Colourless
Drug powder + picric acid	Light brown	Yellowish green
Drug powder + HCl	Light brown	Yellowish green
Drug powder + HNO_3	No change	Light green
Drug powder + H_2SO_4	Dark brown	Light green
Drug powder + NaOH	Reddish brown	Pinkish green
Drug powder + NH_3	Light brown	Light green

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