PHARMACOGNOSTIC STUDIES ON THE STEM AND ROOT OF EUPHORBIA HELIOSCOPIA LINN.

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Introduction

Euphorbia helioscopia Linn. (Euphorbiaceae), which is known locally as "gunda buti", is used in the indigenous system of medicine for its cathartic and anthelmintic properties and considered to be useful in cholera and prolonged fevers.[1] The fresh herb contains a non-haemolytic substance,[2] and the seeds contain sufficient fatty oil, the physiological action of which is due to the powerful purgative principle.[3] It is reported that the application of the poultice made from the bruished plant results in ulcerations. *Euphorbia helioscopia* Linn. is a very common spring weed in the plains of Pakistan ascending to 7000 ft. in the outer Himalayas. In view of the fact that it is easily available for adulteration with other medicinal plants growing in the same region, pharmacognostic studies on its stem and root were undertaken.

Botanical Description

Euphorbia helioscopia Linn. (Fig. 1) is a small erect, glabrous, annual; stem, 15-45 cm. high with dichotomous or umbellate branches, cylindrical, usually 2-6 mm. diameter; leaves, 1.25-5 cm. long, spathulate to obovate, alternate, sometimes more or less opposite in the upper part of the stem, finely serrate on the margins, base cuneate; bracts similar, stipules absent; inflorescence five-rayed, compact, the primary branches somewhat longer than their substending bracts; flowers, 3-4 mm. diameter, yellowish green; involacral glands, ovate, entire, pale green; capsule subglobose, smooth, glabrous; seeds about 3×2 mm. ovoid, glabrous, bony, combed, black.

Material and Methods

The material used for the present study was collected from Peshawar. The pieces of stem and root were directly fixed in F.A.A. for for microtome sectioning. After 12 hours, the material was taken out from the fixative and dehydrated by normal butyl and ethyl alcohol.

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Fig. 1.—*Euphorbia helioscopia* Linn.

Later on, paraffin wax embedding was done according to Zirkle's method.[4] The transverse sections were properly stained with safranin and fast green. Some hand sections were also taken for various microchemical tests. To get a clear conception and measurement of the cells, maceration was prepared according to Jaffrey's method.[5] The material was crushed into powder. The powdered material was sifted through a 60 mesh sieve and studied after clearing in 50% chloral hydrate. Cell measurement were taken with the help of an eye piece micrometer.

Description of the Stem

Macroscopic Characters.—The stem is little hard, green, round, measuring about 2-6 mm. diameter. In the transvers section of a mature plant, the xylem covers approximately half the area of the whole stem. The colour is light green. The taste is not distinctive.

Microscopic Characters.—The transvers section of the stem is round, enclosed by a single thick layer of epidermis. The epidermal cells are cuticularised, rectangular in shape and measure about 57-76 (-100) μ in length and 21-33 (-43)μ in breadth (Fig. 2). Below the epidermis, the cortex is composed of seven layers of thin parenchymatous and amyliferous cells. The cortical cells are thin-walled and light green, when stained. They measure about 29-51(-64)μ in length and 29-43

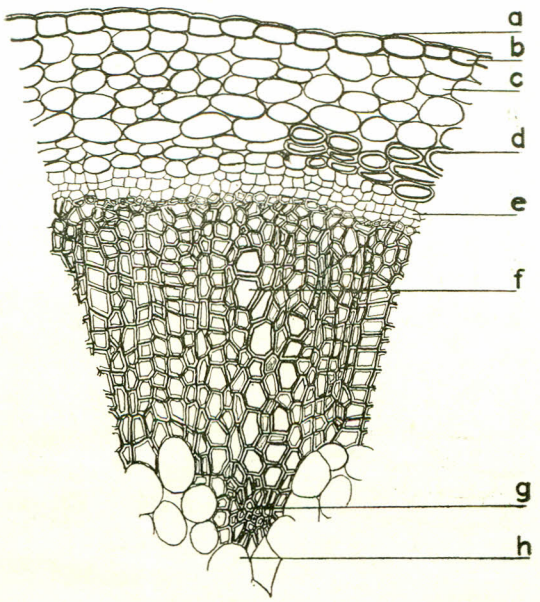

Fig. 2.—T.S. of Stem *Euphorpia helioscopia* L. Mag. (x125).

(-57)μ in breadth. Only a few of these cells contain starch grains. Groups of laticiferous cells are found scattered in the lower cortex. The phloem is composed of sieve tubes, companion cells, phloem parenchyma and phloem fibres. The sieve tubes measure about 57-64(-71.5)μ in length and 21-25(-30)μ in breadth. The phloem is usually 3-4 layers at the time of maturity.

Xylem possesses a normal secondary growth and occupies about half of the central area in the transvers section. The xylem is made up of sclerenchymatous cells, vessels, tracheids, fibres, and xylem parenchyma. The xylem vessels are differentiated into metaxylem, peripheral to the pith region and protoxylem, adjacent to it. The fibres are long, thick - walled, tappering at both ends and measuring 143-572(-1000)μ in length and 14-17(-21) in breadth. The fibers are longitudinally pitted (Fig. 3). The vessels are 243-312(-357)μ in length and 29-50(-71.5)μ in breadth, with annular and pitted thikenings. The tracheids vary in shape and thickenings. They have scalariform and spiral thikenings, measuring 114-297(-443)μ in length and 14-26(-43)μ in breadth. The xylem parenchyma cells are pitted and measure about 71.5-97(-114)μ in length and 29-30(-36)μ in breadth. The thin walled, oval, pith cells measure about 114-136(-157)μ in diameter.

Powdered Stem.—The powder of the dried stem is light green with non-distinctive odour. The

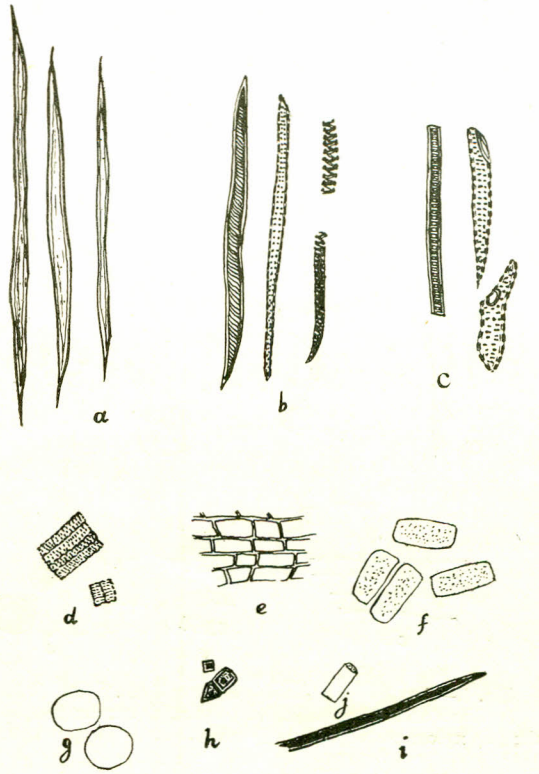

Fig. 3.—Macerate of *Euphorbia helioscopia* L. Stem. (x125). (a) fibres; (b) tracheids; (c) vessels; (d) xylem parenchyma; (e) Epidermis; (f) cortex; (g) pith cells; (h) cortical secretary cells; (i) laticefer; (j) sieve tube.

epidermis, cortex, fibers, tracheids, xylem parenchyma, rounded cells of latcifers are visible under-microscope (Fig. 4).

Description of the Root

Macroscopic Characters.—The root of *Euphorbia heliscopia* Linn. is smooth, pale white, tappering and much branched. The length and the diameter of the root is 70.5-150 mm. and 2-3 mm. respectively.

Microscopic Characters.—In the transvers section, the epidermis is a single layer of rectangular large cells, measuring about 36-100(-200)μ in length and 36-47(-57)μ in breadth (Fig. 5). Below the epidermis are 4-6 layers of parenchymatous cells forming cortex, measuring 71-100(-143)μ long and 43-71(-86)μ broad. Starch grains have been found in some of the cortical cells. Laticiferous cells were few, scattered in the cortex; only 4-5 of them were observed. The xylem occupies three-fouth of the total section area, and the cells are transversed by uniserriate to biserriate thin-walled, parenchymatous medullary rays. The

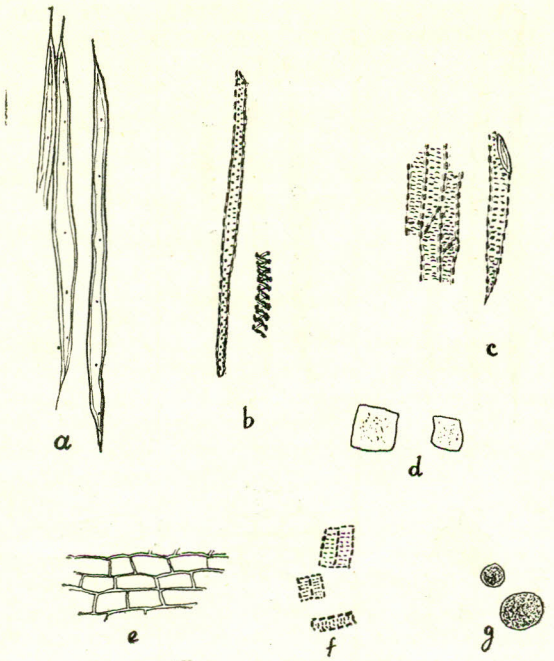

Fig. 4.—Powder of *Euphorbia helioscophia* L. Stem. (x 125); (a) fibres and (b) tracheids; (c) vessels; (d) cortex; (e) epidermis; (f) xylem parenchyma; (g) latifer.

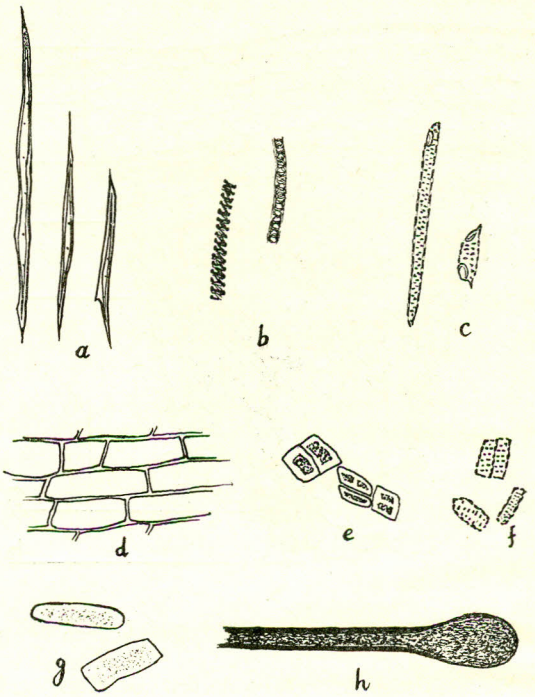

Fig. 6.—Macerate of *Euphorbia helioscopia* L. Root. (x 125). (a) fibres; (b) tracheids;(c) vessels; (d) epidermis; (e) cortex with starch, (f) xylem; (g) cortex without starch; (h) laticifer.

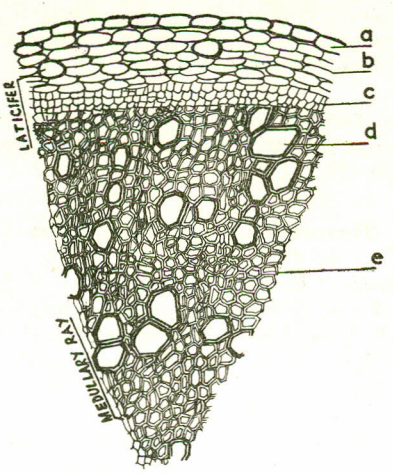

Fig. 5.—T.S. of Root *Euphorbia helioscopia* L. (Mag. x125.)

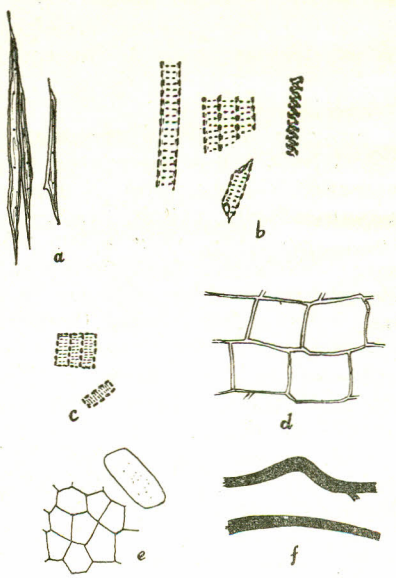

Fig. 7.—Powdered root of *Euphorbia heliescophia* L. (x 125). (a) Fibres; (b) vessels and tracheids; (c) xylem parenchyma; (d) epederims; (e) cortex; (f) laticifer.

xylem is made up of thick-walled sclerendchymatous cells, xylem parenchyma, fibres, tracheids and vessels (Fig. 6). The fibres are long thick-walled, tappering at both ends. They measure 500-580 (-658)μ in length and 14-33(-67)μ in breadth. The tracheids have annular and spiral thickenings. They measure 150-429(-858)μ long and 14-21(-29)μ broad. The vessels are cylindrical, thick walled and oppositely pitted, measuring

about 129-345(-500)μ in length and 29-37(-43)μ in breadth. The xylem parenchyma cells are pitted, measuring about 86-104(-121)μ in length and 14-23(-29)μ in breadth.

Powdered Root.—The powder of the dried root is pale white in colour without distinct odour and taste. After clearing the powder in chloral-hydrate, the following structures are seen(:a) fibres, (b) broken and non-broken pieces of vessels and tracheids, (c) xylem parenchyma, (d) epidermis, (e) cortical cells, (f) broken pieces of branched non-articulated laticifers.

Microchemical Tests.—Microchemical tests of stem and root were undertaken. The presence of brownish starch grains was examined in some of the cortical cells. Proteins, saponins and chitin were also abundantly indicated. Alkaloids and calcium exalate gave negative tests.

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EUPELMUS TACHARDIAE AND ITS INDUCED PARASITICISM OF THE LAC INSECT

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Introduction

While studying the Ceylonese lac insect, *Laksha dia* (*Tachardia*) *albizziae*, several green bred chalcids were identified by L.O. Howard, one of them being named *Eupelmus tachardiae*, How. The designation incorporating the former generic name of the lac insects, suggested that the chalcid was parasitic on the lac insect. This was merely implied for the first observations on the living insect which were reported from Bangalore in 1925 when Mahdihassan[1] found a pupa on the attacked body of an *Eublemma amabilis* caterpillar. This is a predacious enemy of the lac insects and Eupelmus being parasitic on it, became a hyperparasite of lac. At the same time it was found that the numbers of lac insects of their parasitic moth *Eublemma amabilis*, and of the hyperparasitic chalcid, *Eupelmus tachardiae*, existed in descending order. This is expected if each parasite is to be sure of its food. Accordingly at Bangalore the Eublemma moths were always reared in larger numbers than Eupelmus chalcids, an observation of some significance here.

In 1934 Glover[2] and coworkers from Ranchi claimed that Eupelmus was directly parasitic on the lac insect. The photographic evidence they offered was either poor to begin with or was not reproduced properly and consequently it led to a prolonged controversy The Ranchi workers moreover, could only offer pictures of lac insects containing larvae of a large chalcid. When challenged to offer similar photographs with pupae of Eupelmus within the bodies of lac insects nothing was forthcoming. The absence of lac insects harbouring pupal stages of Eupelmus was a strong point against this chalcid being a direct parasite of lac. Moreover, already in 1927, Clausen[3] in ignorance of the findings reported from Bangalore in 1925, remarked that "in Ceylon, *Eupelmus tachardiae*, was reported as parasitic upon the lac insect, *Tachardia albizziae*, but in view of our knowledge of the habits of the genus this record must at present be considered questionable". Even earlier in 1915 Imms and Chatterjee[4] suggested that Eupelmus appeared to be a hyper-parasite attacking the predacious Caterpillar either of *Eublemma amabilis* or of *Holcocera pulvera.*

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Lastly Ferriere[5] has also cast a vote in 1935, against accepting Eupelmus as a parasite of lac. He remarked that "Glover in 1930 had observed that *Eupelmus tachardiae* could be a primary parasite of *Tachardiae lacca* like several hosts and might not be specially related to lac insects". Thus the critical observations by Imms and Chatterjee, of Clausen and of Ferriere all go to support the finding that *Eupelmus tachardiae* is a parasite of Eublemma caterpillars and not that of the lac insects.

Imms and Chatterjee had tried to find lac insects relatively immune to Eublemma, the most dangerous enemy of lac. Whereas the most susceptible species could be mentioned as *Lakshadia communis* on *Ficus mysorensis* at Bangalore the least susceptible is still an open question. While rearing parasites from Sind lac growing on *Acacia arabica* at Karachi, it was found that Eublemma moths were rare and in comparison Eupelmus was not so. The ratio Eublemma: Eupelmus was in favour of the latter, quite unlike the case at Bangalore with lac belonging to *Lakshadia mysorensis* on *Shorea talura*. The Eublemma: Eupelmus ratio in Sind approached equality and even inclined to be in favour of the parasite. This raised the suspicion of Eupelmus having other hosts than Eublemma caterpillars.

Meanwhile an intensive study was being undertaken with the Sind lac collected from all over Karachi and from Hyderabad Sind. This also included a study of parasites of lac.

Among others it was found that some lac insects contained chalcid larvae which were large enough to be specifically those of Eupelmus tachardiae. This at once reminded us of the illustrations offered by the Ranchi workers. Nothing similar was met with Mysore lac. Fig. 1 shows *Lakshadia sindica* with a chalcid larva which is large enough to be considered as that of *Eupelmus tachardiae*. No other chalcid reared from Sind lac has a larva as large as the one seen in Fig. 1. In Fig. 2 the chalcid larva occupies almost three-fourths of the body of the adult female lac insect while that in Fig. 3 almost half since the larva is not full-grown.

In Fig. 3 other darker bodies seem to represent the internal tissues of the lac insect. A larva of Eupelmus teased out of a lac insect is shown in Fig. 4. Specimens from which Figs. 1 to 4 have been made were dead insects.

Once Sind lac insects were found to harbour larvae of Eupelmus search was made for the same containing pupae. No pupa was over found which was also the case with the material studied at Ranchi The conclusion has therefore, to be provisionally drawn that *Eupelmus tachardiae* normally attacks *Eublemma amabilis* caterpillars but when these are scarce lac insects go to feed the chalcid upto the pupal stage which however, never occurs within the bodies of the lac insect. This explains how lac insects may be attacked by the larva of Eupelmus but can never contain its pupa. Such cases of induced parasiticism are

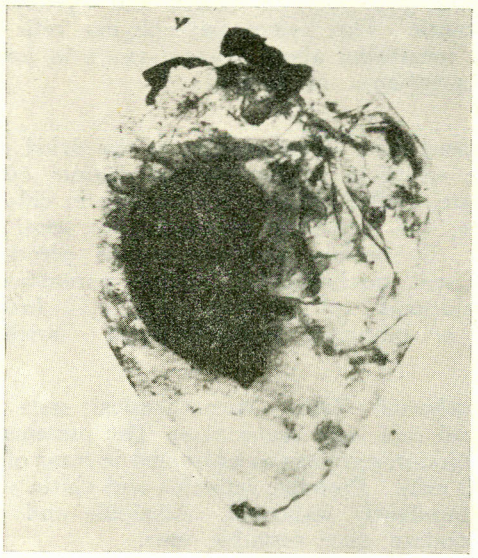

Fig. 1.—*Lakshadia sindica*, on *Z. jujuba*, Karachi with a large chalcid larva. The original was dried material.

Fig. 2.—L. sindica on *Z. jujuba*, Karachi, with a chalcid larva large enough to be that of *Eupelmus tacardiae*. From dried material.

Fig. 3.—*L. sindica*, on *Z. jujuba*, Karachi with a large chalcid larva which can only be that of *E. tachardiae*. Remains of host tissues also visible. From dried material.

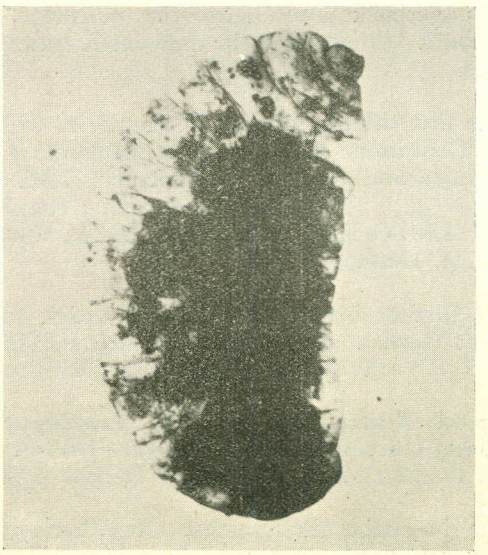

Fig. 4.—Larva of *E. tachardiae* from an attacked Sind lac insect. From dried material.

confined to material which is relatively free from the attack of Eublemma caterpillars when the chalcid is forced to attack lac insects instead. We have not been able to find in Sind lac any pupa of Eupelmus living or dead the same as has been in the case at Ranchi.

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