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# EPIDERMAL FEATURES OF *Lindsaea cultrata*

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## ABSTRACT

**The occurrence of *Lindsaea cultrata* (willd)Swartz species belonging to the family Lindsaeaceae is reported from Darjeeling, West Bengal, India. The present paper deals with the anatomical details like structure of pinnae, structure of stomata, guard cells, other epidermal cells etc. Although several workers has reported about the pteridophytic plants from Darjeeling but it is the first time to work about the epidermal details of Darjeeling fern.**

**KEYWORDS :** Stomata, Epidermal details, Frequency, Scales

Pteridophyta is a small but most interesting group of vascular plants which attract all classes of people from careless rural persons to professional scientists. Pteridophytes are spore bearing plants and they can be distinguished from other cryptogams by the possession of vascular tissues. Modern pteridophytes are widely distributed throughout the world especially in the tropical forests (Kaur, 1989) and play a role in maintaining the ecological balance of the area (Wang De-Qum, 1988; Punetha, 1989). Presently about 13000 species and about 410 genera of pteridophytes are reported out of which approximetly 191 genera and 1000 species are reported to occur in India.

Lindsaea plants are terrestrial. Rhizome well developed, short creeping, densely covered with hair like brown paleae. Fronds unipinnate, glabrous or finely pubescent. Stipe shiny and brown. Pinnae oblique, lower margin nearly straight and entire, upper margin lobed. Veins dichotomously forked, free. Sori marginal, often forming coenosori, connected with two or more veinlets. Sorous indusiate. Sporangia with slender, elongated stalks which are 3- celled thick, Annulus 12-13 cells long. Spores monolete, perineless and with granulose sclerine.

## MATERIALS AND METHODS

The present material of Lindsea cultrata are collected from Darjeeling, West Bengal, India. For the epidermal studies , pieces of young as well as mature pinnae were fixed in farmer's fluid (ethyl alcohol and acetic acid 3:1) and subsequently stored in the 70% ethyl alcohol . Epidermal peels were taken out by macerating pieces of pinnae in Schulz's fluid, using concentrated nitric acid and potassium chlorate and subsequently washing and treating with a dilute solution of ammonia (about 1%). Epidermal peels thus obtained were stained with saffranin and dehydrated through usual ethyl alcohol series and subsequently mounted in euparol. Venation and general orientation of stomata and epidermal cells were investigated in transparencies made by Foster's Technique (Foster, 1966). The pinnae were cleared in 2.5% aqueous sodium hydroxide solution followed by concentrated chloral hydrate, dehydrated in the usually alcohol series and stained in 1% solution of safranin in equal parts of xylene and absolute alcohol. Then mounted in euparol. Petiolar epidermis was studied in epidermal peels which were taken out often light maceration of petiolar pieces in conc. Nitric acid and potassium chlorate and subsequently treating with dilute aqueous ammonia solution. Epidermal peels thus obtained were also dehydrated in usual alcohol series and stained with 1% safranin in equal parts of xylene and absolute alcohol. Then mounted in euparol.

For spore studies, the procedure described by Nayar (1970) was followed. Observations were made under transmitted light microscope. Spore size was observed on the basis of the mean average calculated from a minimum twenty five readings in each plane of spores and was exclusive of the perine.

The nature of various depositions and cell substances was detected by special histochemical tests performed. Presence of lignin was confirmed by occurrence of red colour after treating the lignified portions with phloroglucinal followed by a drop of 25% hydrochloric

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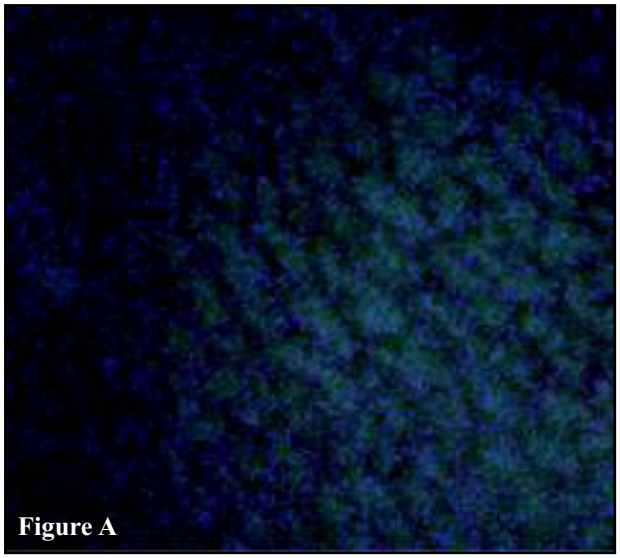
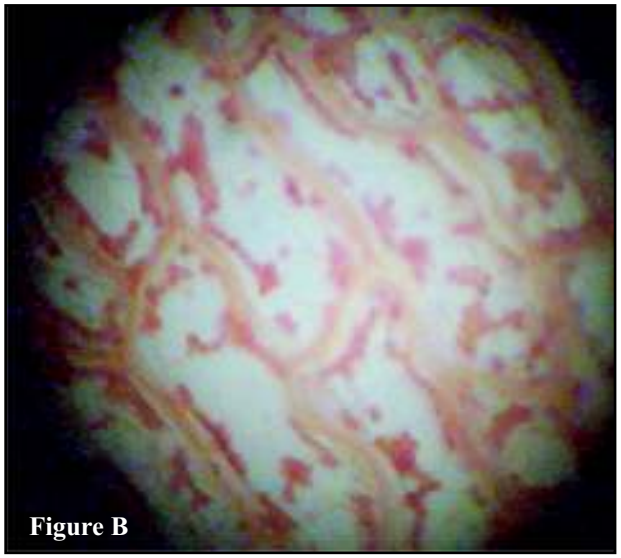


Figure A



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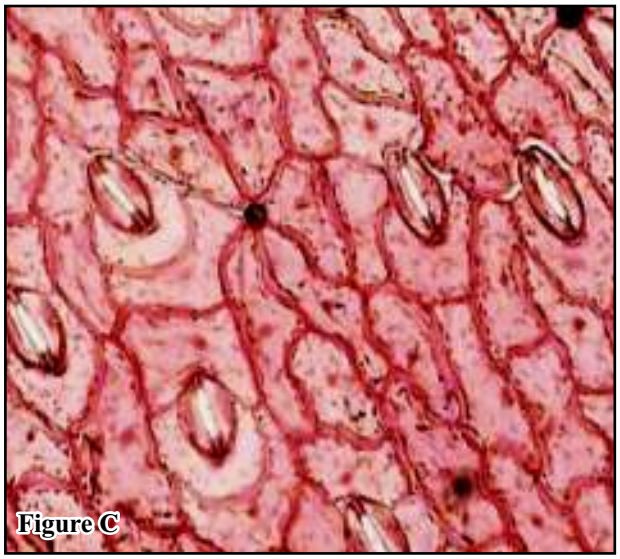

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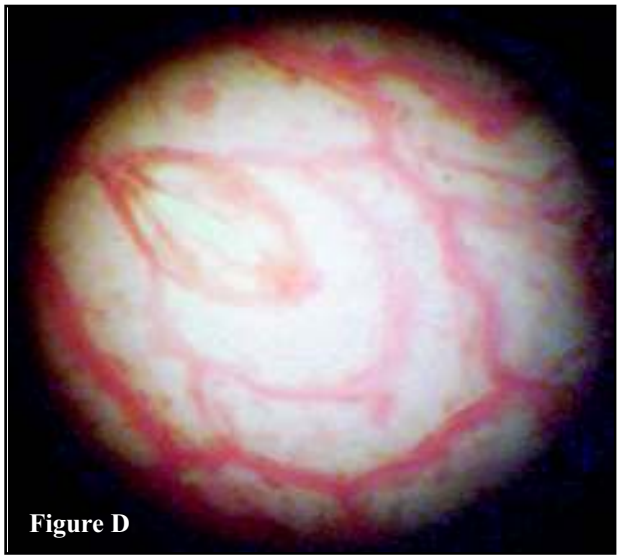

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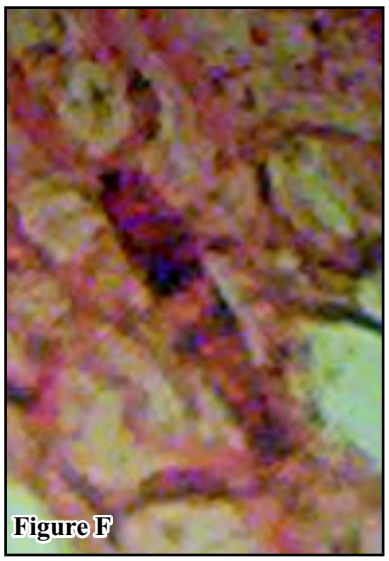

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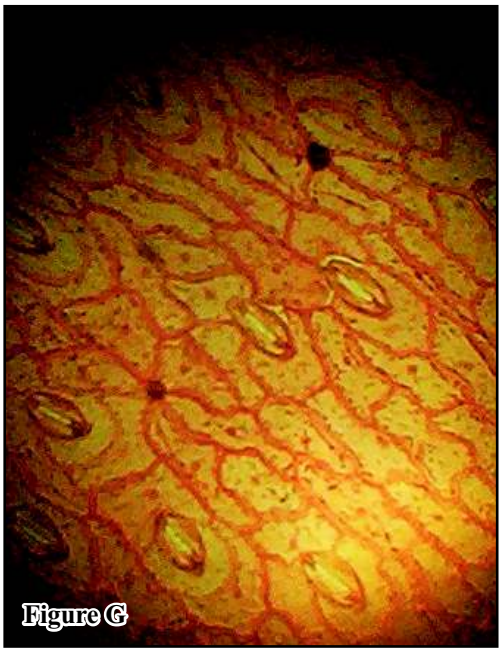
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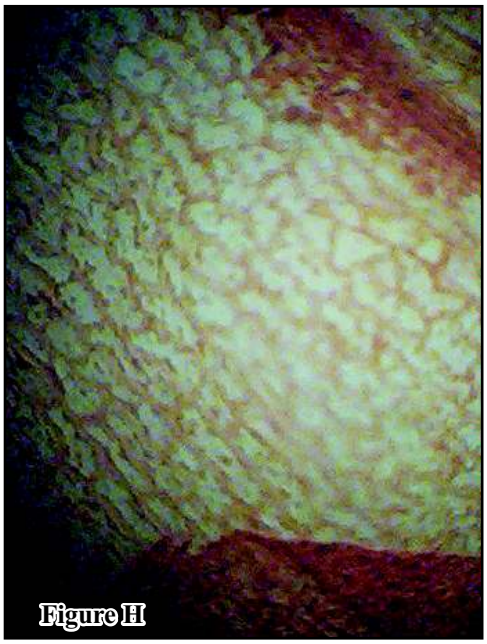
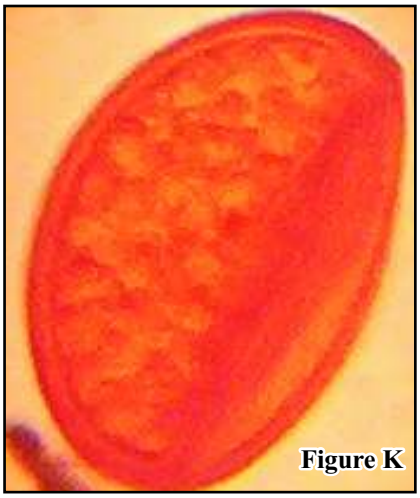


Figure H


Figure I


Figure J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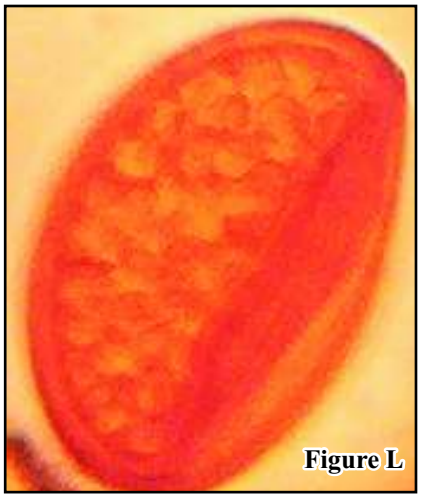
Figure L

acid. Phloroglucinal solution was made by dissolving 1 gm phloroglucinol in 100 ml of 94% ethanol. The contents of phlobaphene was detected by their natural brown colour.

## RESULTS AND DISCUSSION

Rhizome hairy, creeping, furnished with linear scales. Scales 2-3 cells broad, dark brown in colour. Stipe hard slender, shining brown, glabrous. Fronds glabrous or sometimes finely pubescent. Pinnae oblique, membranous, minutely gland dotted, lower edge entire and straight, upper edge 3-7 lobed, each lobe again clefted at apex. Veins prominent, sending on dichotomy to each lobe. Sori terminal on each veinlets, continuous. Indusium with curete base, opens outwards, margin toothed. Spores bean shaped with a longitudinal dark slit, exine slightly grooved.

**Epidermal features**

**Pinnae**

Pinnae have open dichotomizing venation pattern. Uniseriate , multicelled, thin walled, blunt ended trichomes are present on lower surface of pinnae. Epidermal cells on both faces of pinnae are sinuous walled. Sinuosity is not very prominent and the walls are very thick therefore epidermal cells appear wavy only. Cells of lower face are irregularly arranged and broader than the cells of upper face while the cells of upper surface are arranged in rows (Figure - A,B,C,D,E,F,G,H). The epidermal cells at the margin towards distal end of the pinnae are smaller and their surface walls are bulging outwards. Stomata are confined to the lower surface only and oriented parallel to the lateral veins. Guard cells are flush with the epidermal cells. Stomata appear diacytic or monocytic being surrounded by 2-4 neighbouring cells. Development of stomata is mesoperigenous pteris type (Pant et al., 1980).

The size of epidermal cells ranges 65- 237 µm x 34-65 µm in length and breath respectively and their frequency ranges from 154-224 and 140-196 per mm² on the upper and lower surface of pinnule respectively. The frequency of stomata varies from 14-42 per mm² with an average of 28 stomata per mm². The size of guard cells ranges from 65-99 µm in length and 17-22 µm in breadth. Stomatal index is 14.3.

**Petiole**

Petiole cylindrical, hard and shining brown in colour. Petiole bases are covered with scales whose marginal cells are sometimes provided with small projections. In addition to scales uniseriate, thin walled projections. In addition to scales uniseriate, thin walled hairs with tapering ends are also found on the surface of petiole. A groove arises from the base of petiole in adaxial side which remain prominent throughout. In surface view , epidermal cells appear narrow, elongated with pointed ends and thick anticlinal walls. Simple anomocytic stomata surrounded with four to five ordinary cells are occasionally present in the stomatiferous region where the epidermal cells are comparatively short and thin walled.

Transverse section of petiole shows that the epidermal cells throughout their length appear small , thick walled and covered by a smooth cuticular membrane. Except for few layers of inner cells which are parenchymatous and thin walled, cells of epidermis and outer ground tissue are thick walled and lignified. Petiole receives two widely separated vascular strands from the rhizome and remains unchanged throughout the petiole. The shape of vascular strand is oval with an arch shaped xylem surrounded by phloem (Shankar and Khare, 1994).

**Spores**

Spores monolete, bilateral, bean shaped with a longitudinal dark slit, exine slightly grooved. Spore size is 30 x 50 µm (Figure-J,K,L).

**Distribution**

Very common in distribution on western side of Tamil Nadu, higher altitude in the Central India. Eastern (Darjeeling, Sikkim) and Western (Nainital, Mussoorie, Shimla, Dalhousie etc) Himalayas. Also found in Nepal, Myanmar, Ceylon, Australia, Formosa, Japan, Malay Islands and East African Islands. Present collection is from Darjeeling, Western Himalayas.

Plants terrestrial, growing in humus rich soil in shaded and damp places along stremlets with herbaceous pinnae spreading horizontally. Very common along moist roadside and cut slopes.

## ACKNOWLEDGEMENT

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