Coniferous Foliage Shoots From South Rewa Gondwana Basin, India

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Morphological and cuticular details of *Buriadia heterophylla* Seward & Sahni and *Paranocladus sahnii* sp. nov. are described from the coal-bearing horizons of Anuppur and Birsinghpur Pali areas of South Rewa Gondwana Basin, India. Previous records of Indian Lower Gondwana conifers are reviewed and nomenclatural anomalies of the species of *Buriadia* Seward & Sahni, *Paranocladus* Florin, *Walkomiella* Florin and *Searsolia* Pant & Bhatnagar are discussed.

Key-words–Conifers, Early Permian, South Rewa Basin, India.

INTRODUCTION

CONIFERS are extremely rare finds in the Lower Gondwana Flora of India. They are mostly confined to the lower horizons of the Permian Period i.e., Talchir, Karharbari and Barakar formations and their occurrence is also very localised.

The genus *Paranocladus* is known by only fragmentary sterile foliage of *P.? indica* Surange & Lele, 1956 from the Talchir beds of South Rewa Gondwana Basin. *Walkomiella indica* Surange & Singh, 1951 having sterile foliage and female cone is known from the Barakar Formation of West Bokaro Coalfield. Three species of *Buriadia, B. heterophylla* Seward & Sahni, *B. florinii* Maithy and *B. fragilis* Maithy are known from the Giridih Coalfield. *B. heterophylla* is also known from Chirimiri and Jharia Coalfields (Ganguly 1959, Banerjee 1973). Pant and Bhatnagar (1975) instituted a genus *Searsolia* from Raniganj beds of India but Pant (1977) later on doubted its coniferalean affininty. Pant *et al.* (1995) have instituted two new genera on very minor differences *Birsinghia* and *Paliandrolepis* from Birsinghpur Pali area of South Rewa Gondwana Basin. *Birsinghia* differs from *Buriadia* in having seeds with forked or unforked horns whereas *Paliandrolepis* is only a detached microsporophyll.

The specimens collected from the Bakan Nala Section, about 1 km southwest of Son River confluence in Anuppur area and Johilla River Section, about 0.5 km west of Mangthar Village (for geological details and locations see Chandra & Srivastava 1986) yielded rich coniferous plant fossils alongwith leaves of *Noeggerathiopsis, Gangamopteris* and *Glossopteris*. All the specimens are preserved in the form of compressions which yielded well preserved cuticles. The cuticles show stomatiferous and non-stomatiferous epidermal surfaces after proper maceration of cellulose acetate pulls following Schulz method. The type and figured specimens are housed in the museum of Birbal Sahni Institute of Palaeobotany, Lucknow.

Nomenclature

While instituting new species, *Walkomiella indica* Surange & Singh, 1951 and *Paranocladus ? indica* Surange & Lele 1956, the authors did not designate holotype specimens for their newly designated species therefore, in order to validate the species, a lectotype for each species is selected here as per requirements of ICBN.

The genus *Buriadia* was instituted by Seward and Sahni (1920) for the forms earlier described under *Voltzia heterophylla* Brongniart and *Albertia* sp. by Feistmantel (1879) from the Karharbari (now Giridih) Coalfield, however, they (Seward & Sahni 1920 and Sahni 1928) also retained *V. heterophylla* for the forms recorded by Feistmantel (1881) from the Raniganj Formation. Banerjee (1973) reported that except for one fragmentary specimen (No. 5360

of GSI Museum, Calcutta) all other specimens described under *V. heterophylla* are lost.

Curiously Sahni (1928) transferred *B. heterophylla* to a new species, *B. sewardii,* since *B. heterophylla* was validly published species. Florin (1940a) maintained and typified the species with type specimen (GSI Museum No. 5045; vide Feistmantel 1879; pl.23, fig.4) along with diagnosis and description of the species. In 1967 Pant and Nautiyal studied the external and internal morphology of the genus *Buriadia* and emended the diagnosis of the genus but they retained the name for Feistmantel's specimen as *B. heterophylla* (Feistmantel) Seward & Sahni, 1920 and selected a lectotype (GSI Museum No. 5043 vide Feistmantel 1879; pl.23, fig. 2) other than Florin's specimen. This is against the established practice of ICBN, therefore the type specimen of Florin (1940a) is redesignated here as the lectotype for *Buriadia heterophylla* Seward & Sahni, 1920.

SYSTEMATIC DESCRIPTION

***Genus- Walkomiella* Florin, 1940**

Type species - W. australis (Feistmantel) Florin, 1940

***Walkomiella indica* Surange & Singh, 1951**

Diagnosis : As per Surange and Singh, 1951

Lectotype: B.S.I.P. Museum Slide No. 194

Locality & Formation : Pindra Seam, West Bokaro Coalfield; Barakar Formation, Lower Permian.

***Genus - Paranocladus* Florin, 1940**

Type species - P. dusenii Florin, 1940

***Paranocladus ? indica* Surange & Lele, 1956**

Diagnosis : As per Surange and Lele, 1956

Lectotype : B.S.I.P. Museum Specimen No. 5237

Locality & Formation : Johilla River Section, near Goraia Village, South Rewa Gondwana Basin, Talchir Formation, Early Permian.

***Paranocladus sahnii* sp. nov.**

Pl.1, figs 1-5; Text-fig. 1

Diagnosis : Branched or unbranched foliage shoots; leaves homomorphic, spirally arranged, cuneate-lanceolate, bifacial or trifacial, non-stomatiferous cuticle layer bears longitudinally elongated cells without papillae, stomatiferous surface possesses polygonal cells and single papilla; stomata irregularly distributed, haplocheilic, monocylic, subsidiary cells papillate, stomatal pore longitudinally or obliquely oriented.

Holotype : BSIP Museum Specimen No. 36712

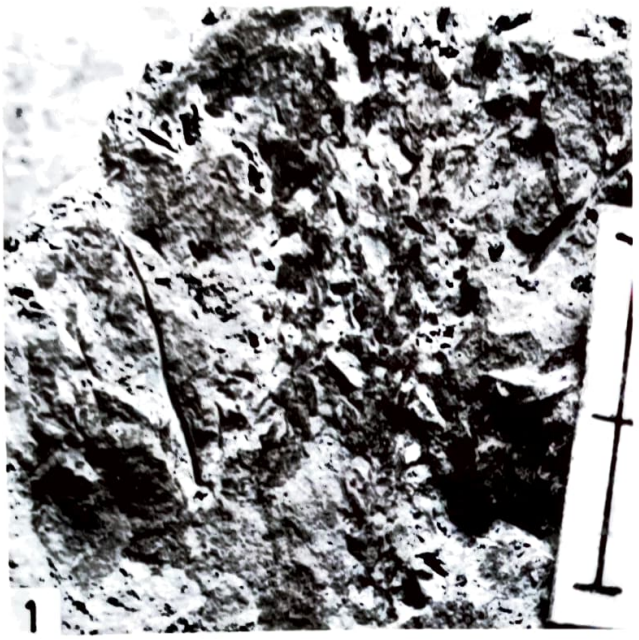
Locality & Formation : Johilla River Section, 0.5 km west of Mangthar Village, Karharbari Formation, Lower Permian.

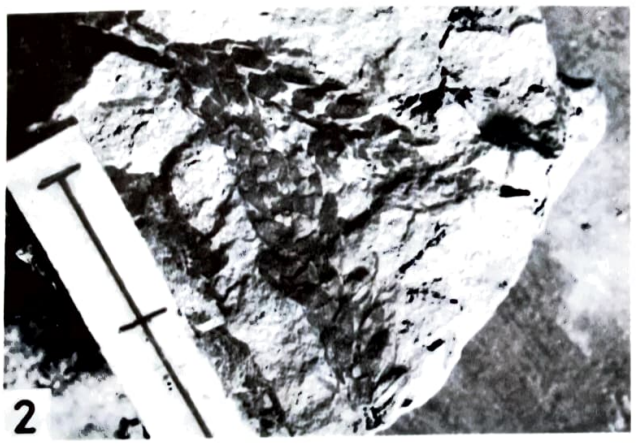
Description : Foliage shoots measure 6-8 cm in length, branched or without branch, monopodial branching system and branches are alternate but apical portion shows opposite branching. Stem axis is 3-7 mm wide showing fine longitudinal striations, the ultimate or penultimate branches bear crowded or spirally disposed leaves. Leaves are homomorphic, slightly spreading and are spirally arranged on the axis by its entire base. Most of the leaves are cuneate-lanceolate in shape, however, linear-ovate to lanceolate leaves are also recorded in the assemblage. Leaves are 0.5-1.5 cm in length and 1-2.5 mm in breadth. Seeds or any other fertile organs are absent.

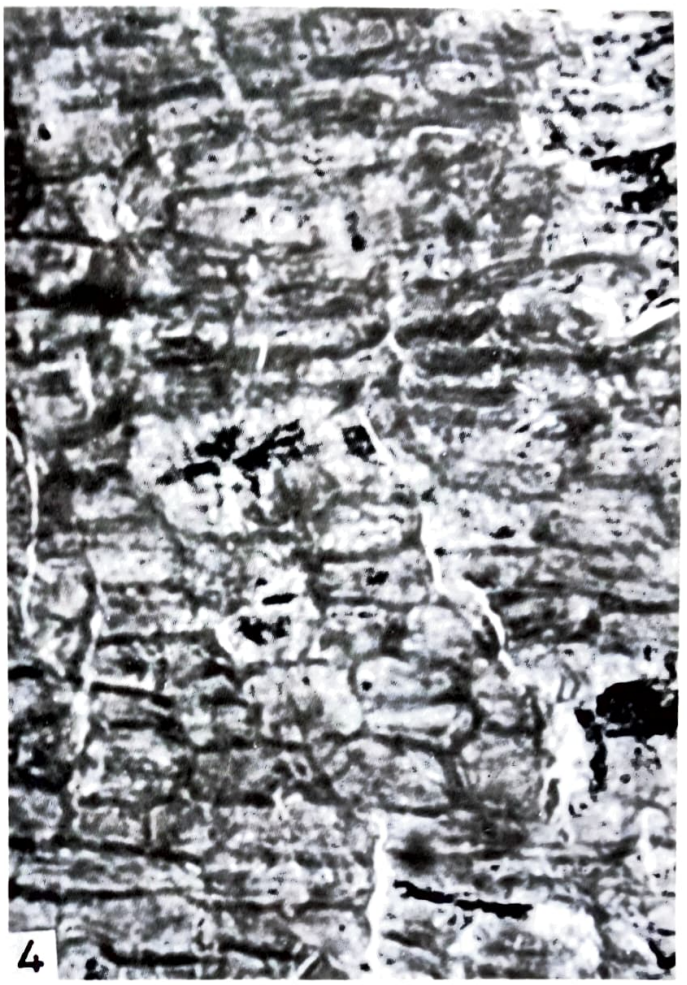
The stomatiferous and non-stomatiferous cuticular layers are recognisable in bifacial and trifacial leaves. Non-stomatiferous surface shows longitudinally elongated cells of 80-160 μm length and

PLATE - 1 ⟶

***Paranocladus sahnii* sp. nov.** Figure 1. Holotype, two unbranched foliage axes showing homomorphic, spirally arranged leaves x 2. B.S.I.P. Specimen No. 36712; Figure 2. Specimen showing foliage shoots and cuneate-lanceolate shape of leaves x 2. B.S.I.P. Specimen No. 36713; Figure 3. Another specimen of *P. sahnii* x 2. B.S.I.P. Specimen No. 36716. Figure 4. Non-stomatiferous upper cuticle having elongated non-papillate cells x 300. B.S.I.P. Slide No. 36712-I; Figure 5. Stomatiferous lower cuticle showing polygonal papillate cells and monocyclic stomata with overarching papillate cells x 500. B.S.I.P. Slide no. 36712-I.







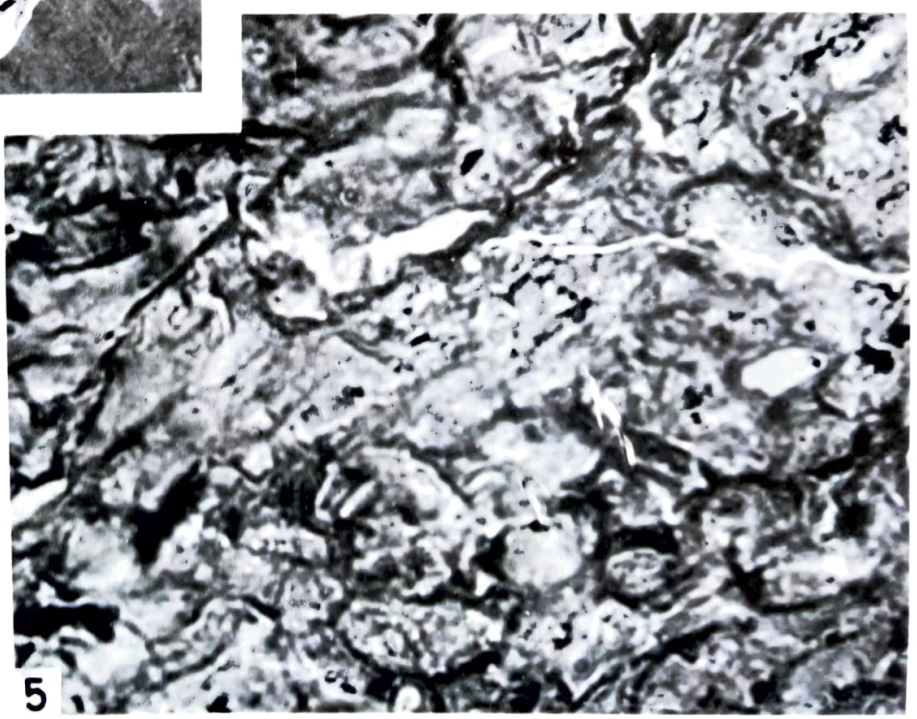
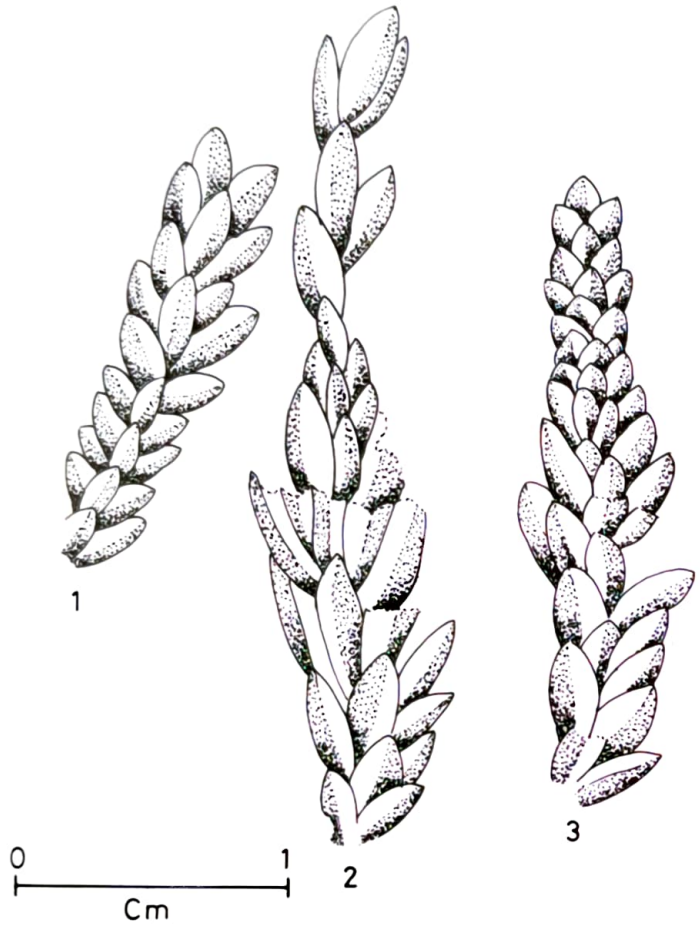


PLATE 1



Text - fig. 1. *Paranocladus sahnii* sp. nov., showing three unbranched foliage shoots having homomorphic, spirally arranged cuneate-lanceolate leaves. x 4.

20-30 µm breadth, they are arranged in linear rows and their walls are straight to slightly undulated. The cell surface is without papillae. Marginal hairs are absent. The remaining two layers have a stomatiferous band in the middle, flanked by strips of rectangular cells but the difference between these two exists in the width of the stomatiferous band in the third layer. The cells of the stomatiferous band in both the layers are polygonal in shape and bear papilla. Mostly markings or remnants of papillae are present. Stomata are few in second layer but their number increase significantly in the third layer. They are haplocheilic, monocyclic, incompletely amphicyclic in nature. Subsidiary cells are 5-7 in number, smaller than the ordinary epidermal cells, bear single papilla in the centre and surface shows thicker cuticle marked by cutin ridges radiating round the stomatal pore. The guard cells are sunken in a shallow pit, surrounded by the overarching subsidiaries. The stomatal pore is longitudinally or obliquely oriented.

Comparison and discussion : Homomorphic, spirally arranged slightly spreading leaves are comparable with the genus, *Paranocladus*. The type species, *P. dusenii* is distinguishable in having papillae on both the layers and linear arrangement of the stomata. Since *P. ? indica* is known by only external morphological characters it is not possible to compare with *P. sahnii* sp. nov.

Derivation of name : The species is named after Late Prof. Birbal Sahni for his valuable contributions in Gondwana Palaeobotany.

***Genus - Buriadia* Seward & Sahni, 1920**

Type species- B. heterophylla Seward & Sahni, 1920

***Buriadia heterophylla* Seward & Sahni, 1920**

Diagnosis: As per Florin, 1940a

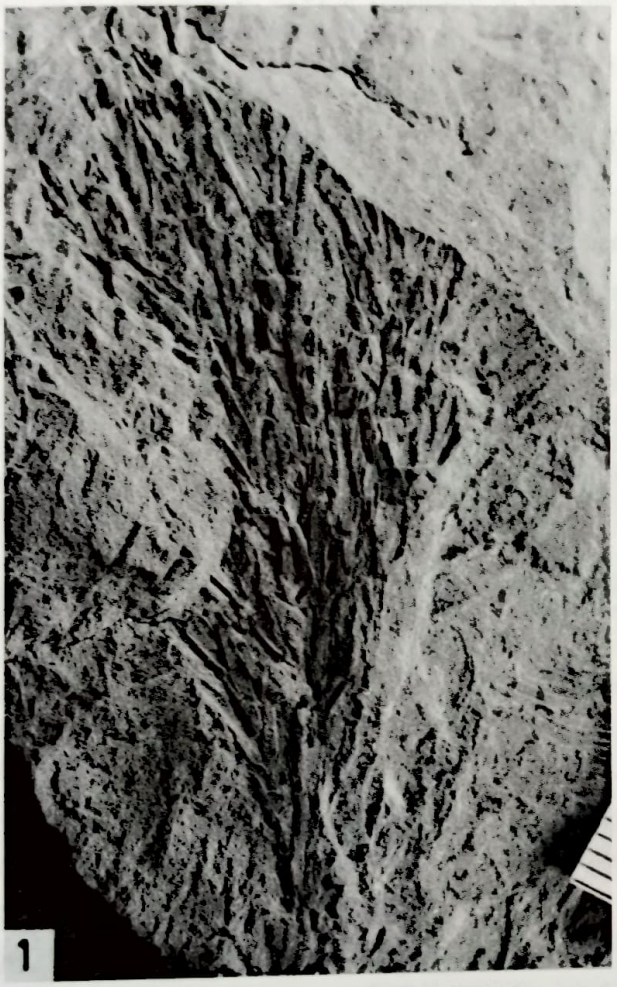
Lectotype :GSI Museum Specimen No. 5045, Calcutta

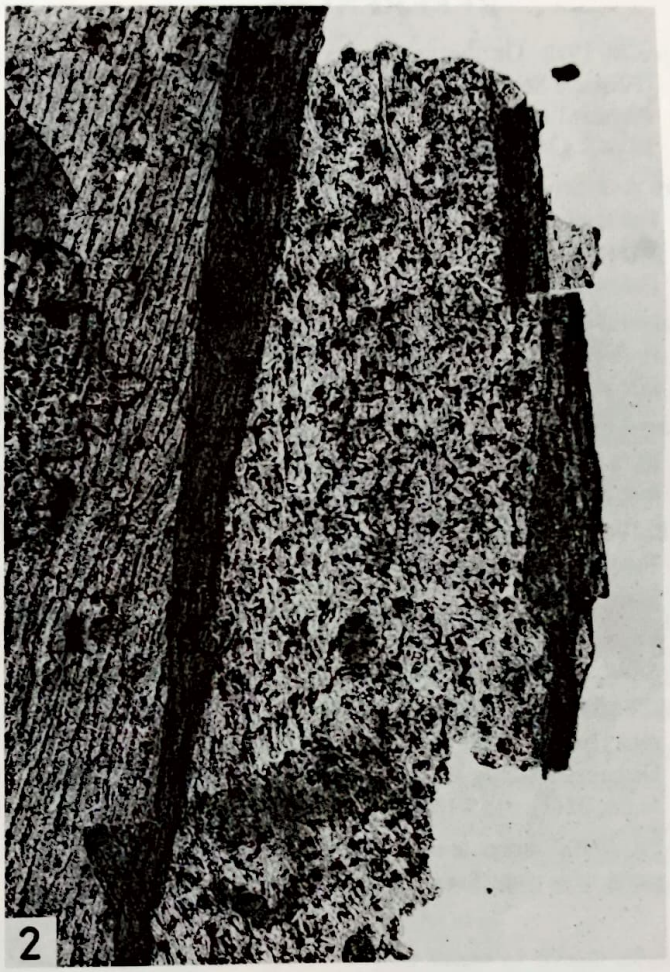
Locality & Formation : Buriadih, Giridih Coalfield, Karharbari Formation, Lower Permian.

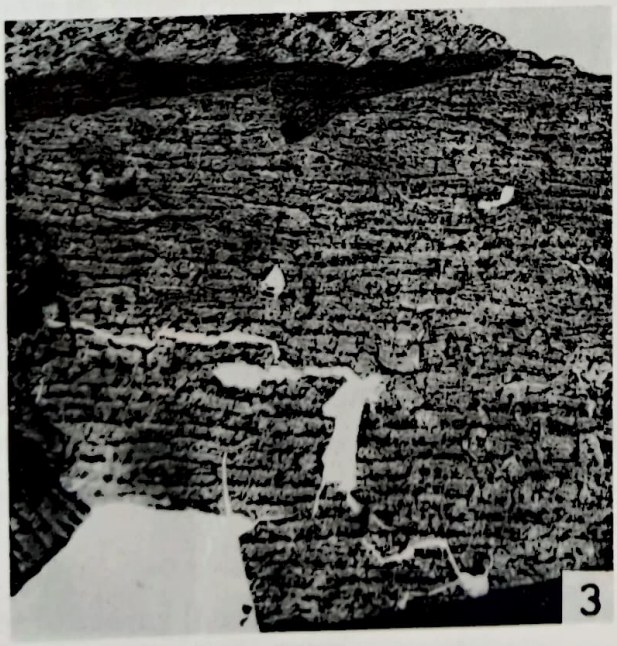
Remarks : The present specimens are mostly sterile foliage shoots, however, in one of the specimens we are able to observe a seed in between the leaves. The external morphological features and cuticular details (Pl. 2, figs.1-4) are closely similar with the specimens described by Pant and Nautiyal

PLATE- 2 →

***Buriadia heterophylla* Seward & Sahni, 1920** Figure 1. Sterile branched foliage shoots with spirally arranged linear leaves. x 2. B.S.I.P. specimen No. 36714; Figure 2. Cuticle of a trifacial leaf, showing all the three faces, first non-papillate non-stomatiferous face on left side, second stomatiferous papillate face partially overlapping and third stomatiferous non-papillate face. x 100. B.S.I.P. slide No. 36714-I; Figure 3, Non-stomatiferous face of the leaf showing outlines of cells in unilateral incident light. x100. B.S.I.P. slide No. 36714 - I; Figure 4. Stomata from the stomatiferous face showing papillate subsidiary cells overarching guard cells. x 500. B.S.I.P. slide No 36714-II.







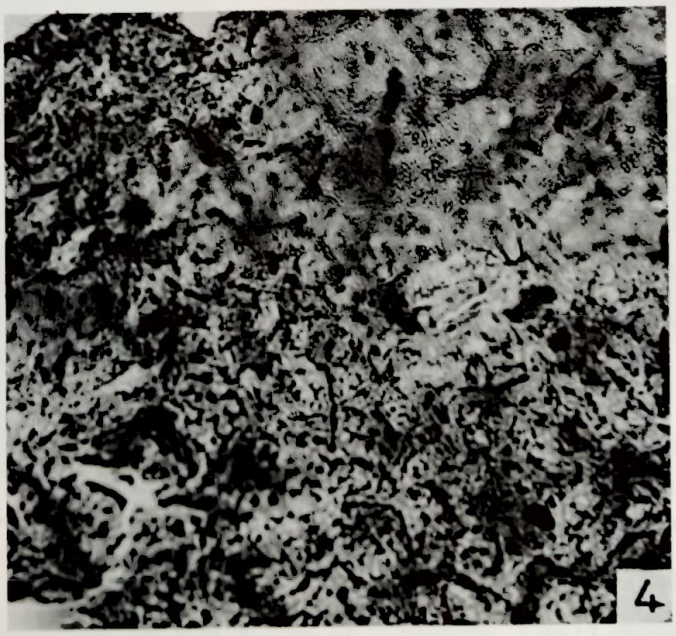


PLATE 2

(1967) but we did not observe marginal hairs in our cuticular preparations.

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