POLIBOTÁNICA Núm. 6:1-18 1997.

TAXONOMIC SIGNIFICANCE OF FOLIAR DERMOTYPES AND FLORAL TRICHOMES IN SOME CUBAN TAXA OF *Indigofera* L. (*Fabaceae-Faboideae*)

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ABSTRACT

A study of the foliar epidermis and floral trichomes in seven Cuban taxa of *Indigofera* L. was performed. Epidermal cell shape and anticlinal wall patterns are variable from taxon to taxon and even within the same taxon. Stomata are mostly anisocytic and all taxa have amphistomatic leaflets. Two bifacial stomatal patterns are reported for the first time for Fabaceae. Four multicellular uniseriate and multiseriate trichome types were found on leaflets of the genus while on floral parts nine trichome types were observed and classified here as unicellular trichome, and multicellular "uni", "bi", and multiseriate trichomes. Six distribution patterns on the standard petal were identified and two of them are reported for the first time. Although the analyzed foliar dermotypes have taxonomic value, they tend to be stable at the generic level. Essentially, trichomes are more useful characters at the species level. On the basis of foliar dermotypes and floral trichome types studied a key to aid identification is provided.

Key words: foliar epidermis, floral trichomes, *Indigofera*, taxonomy, Cuba.

RESUMEN

Se realizó un estudio de la epidermis foliar y de los tricomas florales en siete taxa cubanos de *Indigofera* L. La forma de las células epidérmicas y los patrones en las paredes anticlinales varian de un taxon a otro y aun dentro de un mismo taxon. Los estomas son predominantemente anisocíticos y todos los taxa tienen foliolos anfistomáticos. Se reportan por primera vez para Fabaceae dos patrones estomáticos bifaciales. Se encontraron cuatro tipos de tricomas multicelulares, uniseriados y multiseriados, en los foliolos del género; mientras que en las partes florales se observaron nueve tipos, clasificados como unicelular y multicelular "uni", "bi" y multiseriados. Se identificaron seis patrones de distribución en el pétalo del estandarte y dos de ellos se reportan por primera vez. Aunque los dermotipos foliares tienen valor taxonómico ellos tienden a ser estables a nivel genérico. Esencialmente los tricomas son los caracteres más útiles a nivel de especie. Sobre la base de los dermotipos foliares y los tipos de tricomas estudiados se ofrece una clave para la identificación de los taxa.

Palabras clave: epidermis foliar, tricomas florales, *Indigofera*, taxonomía, Cuba.

INTRODUCTION AND METHODS

It has been demonstrated that the study of foliar and floral epidermal characters in relation to taxonomy within Fabaceae has a great value since, through the analyses of foliar dermotypes and the epidermis of the different floral parts, the delimitation of taxa can be accomplished (Leelavathi *et al*.,1980; Prabhakar *et al*., 1985; Vijay & Ramaya, 1987 and Vijay, 1988).

Although leaf epidermal characters of Fabaceae have been investigated by numerous authors, relatively few have focussed on *Indigofera*. At the begining, Solereder (1908) and Metcalfe & Chalk (1950) made some contributions and more recently Vijay & Ramayya (1987) and Vijay (1988) working with taxa from India, found that the characters analyzed by them had a taxonomic significance, especially the trichomes whose structure, classification, and organographic distribution are important in their recognition (Vijay, 1988).

On the other hand, Prabhakar *et al*. (1985) studied the trichome types on the standard petal which together with their distribution are useful in the delimitation of species.

No detailed foliar epidermal study or analysis of the floral epidermis has been undertaken in the Cuban taxa of *Indigofera*. The objective of this paper is to delimit characters to recognize taxa at the species level.

Samples of leaves and floral parts of seven Cuban taxa of *Indigofera* deposited in HAC were studied. (Tables 1 and 2). In addition, samples of flowers of *Indigofera suffruticosa* were collected by the author.

Epidermal peels were obtained using Johansen's method (1940).

All flower samples were placed in a 3 % potassium hydroxide solution until they were transparent.

The average values of stomatal dimensions were obtained by measuring the length and width of the stomata and the length of the pore of ten stomata in ten fields, selected from a minimum of six leaf samples.

Wall cell patterns and stomata types were described according to Dilcher (1974), and Wilkinson (1979), while trichome types from leaves and floral parts were classified according to Vijay (1988).

The samples were observed under an OLYMPUS BH-2 microscope and the drawings were made using a CARL ZEISS-camera lucida.

RESULTS

Leaf

I. Epidermal cell complex

The intercostal epidermal cells are polygonal, predominantly isodiametric on both surfaces in *I. lespedezioides*, *I. microcarpa* and *I. tinctoria*; on the adaxial surface of *I. hirsuta* and the abaxial surface of *I. suffruticosa* and *I. trita* ssp. *scabra*, but mainly rectangular in both surfaces of *I. cubensis*, abaxial of *I. hirsuta* and adaxial of *I.suffruticosa* and *I. trita* ssp. *scabra*; papillate on abaxial surface only in *I. suffruticosa*. Walls mostly curved and straight and occasionally wavy with U-shaped waves (Table 1).

The epidermal costal cells are mainly tetragonal-isodiametric in the adaxial (sunk and occasionally with wavy walls in the midvein of *I. lespedeziodes*) with one to a few series, and tetragonal-rectangular, linear with many series in the abaxial surface; walls mostly straight,

some wavy either adaxial or abaxial surface. Distinctly differentiated on adaxial and abaxial midvein in *I. cubensis*, *I. lespedezioides*, *I. microcarpa*, *I. suffruticosa* and *I. tinctoria*; and on midvein and primary lateral veins in *I. hirsuta* and *I. trita* ssp. *scabra* (Figs. 1-14; Table 1).

II. Stomatal complex

The stomata are predominantly anisocytic in all taxa, occasionally anomocytic and tetracytic (staurocytic and anomotetracytic). Additionaly, although rare, paracytic, hemiparacytic, brachyparacytic, actinocytic, ciclocytic a diacytic stomata were observed (Table 1). In all taxa the leaflets are amphistomatic (Figs. 1-14; Table 1) and according to the distribution of stomata in both surfaces four unifacial patterns: I. stomata all over the surface, II. stomata all over the surface except on midvein, III. stomata all over the surface except on midvein and primary lateral veins, and IV. stomata all over the surface except on primary lateral veins; and four bifacial patterns: 1. unifacial pattern I on adaxial surface and abaxial surface, 2. unifacial pattern II on adaxial surface and I on abaxial surface, 3. pattern III on adaxial surface and IV on abaxial surface, and 4. pattern IV on adaxial surface and III on abaxial surface could be recognized (Table 1). The stomata are irregularly arranged and variably oriented (Figs. 1-14).

The stomatal measurements analyzed show that stomata are longer than broad in both surfaces. Their shape is elliptic, varying from narrow to broadly elliptic (Figs. 1-14; Table 1).
On the intercostal areas five types of stomatal abnormalities were found: juxtaposed stomata, common in all taxa; adjacent stomata with a common subsidiary cell in *I. cubensis*, *I. hirsuta*, *I. lespedeziodes*, *I.microcarpa* and *I. suffruticosa*; stomata with only one guard cell on *I. microcarpa*, *I. suffruticosa*, *I. tinctoria* and *I. trita* ssp. *scabra*; superposed stomata in *I. cubensis*, *I. hirsuta* and *I. microcarpa*, and giant stomata in *I. lespedeziodes*.

III. Trichome complex

In all taxa four multicellular trichome types could be recognized: uniseriate macroform two-armed trichome, uniseriate macroform plough-shaped trichome, multiseriate clavate trichome and multiseriate hollow-discoid trichome. Their distribution varies from taxon to taxon and also on the same taxon (Figs. 15-35; Table 1). Trichome types are described below:

A. Uniseriate macroform two-armed trichome. Foot: usually composed of only one cell, seldom two, circular to oval, with a thickened wall; encircled by epidermal cells which may differ or not from the remaining ordinary epidermal cells, contents present. Stalk: generally present with only one cell broader than long, contents absent. Head: unicellular with two arms equal or nearly so, mostly T-shaped but also U and V-shaped; ends pointed, occasionally curved as hooks, and pointed at one end but rounded at the other one or both ends rounded, contents absent, surface tuberculate (Figs. 15-22). Distribution: in both foliar surfaces including margin in *I. cubensis*, *I. lespedezioides*, *I. microcarpa*, *I. suffruticosa* and *I. trita* ssp. *scabra* (Figs. 29, 31-33 and 35; Table 1) and only in abaxial, including margin in *I. tinctoria* (Fig. 34; Table 1). Orientation: oblique to midvein in both surfaces in most of the taxa but oriented nearly parallel to midvein on leaflet abaxial in *I. cubensis* (Fig. 29) and sometimes in the same surface in *I. trita* ssp. *scabra*.

B. Uniseriate macroform plough-shaped trichome: similar to the above but with arms of the head cell very unequal, plough-shaped (Figs. 23-26). Distribution: in both foliar surfaces,

including margin in *I. cubensis*, *I. hirsuta*, *I. microcarpa* and *I. trita* ssp. *scabra* (Figs. 29, 30, 32 and 35; Table 1) but only in abaxial surface including margin in *I. tinctoria* (Fig. 34; Table 1). Orientation: oblique to midvein (Figs. 29, 30, 32, 34 and 35).

C. Multiseriate clavate trichome. Foot: it is mostly composed of one cell, occasionally by two to four cells, circular to oval, walls thin, contents absent. Stalk: absent. Body: clavate, multiseriate with six cells in length and three cells wide (Fig. 27). Distribution: All over foliar abaxial surface, except adaxial surface and margin in *I. cubensis* (Fig. 29; Table 1). Orientation: parallel to midvein (Fig.29).

D. Multiseriate hollow-discoid trichome. Foot and Stalk: not observed in paradermal section, the last one being absent, according to Vijay (1988). Body: shield-like, multiseriate, circular to oval in shape, walls thin, surface smooth (Fig. 28). Distribution: All over foliar abaxial surface, except adaxial surface and margin in *I. microcarpa* (Fig. 32; Table 1). Orientation: irregular (Fig. 32).

Flower

In all taxa the following trichome types could be identified: unicellular conical, unicellular cylindrical, unicellular cylindric-clavate, uniseriate conical, uniseriate cylindric-clavate, uniseriate two-armed, uniseriate plough-shaped, biseriate cylindric-clavate and multiseriate hollow-discoid (Figs. 36-48; Table 2).
Of these, uniseriate two-armed and uniseriate plough-shaped trichomes are the most common in almost all floral parts, mainly on the pedicel, sepals, standard petal and the gynoecium; while on the wing and keell petals, and on the androecium they are more sparse and sometimes are completely lacking (Table 2).

Most of the trichomes are distributed on the abaxial surface and margin of the sepals and petals, and only three of them are restricted to the sepals: uniseriate cylindric-clavate, biseriate cylindric-clavate and multiseriate hollow-discoid (Table 2). The largest variation regarding the distribution of the trichomes was observed on the standard petal, where six distribution patterns on the abaxial surface could be identified:

I. Trichomes on and near the margin of the petal except at the base: unicellular conical, unicellular cylindrical and unicellular cylindric-clavate in *I. suffruticosa* and *I. tinctoria* (Figs. 49, 50; Table 2).

II. Trichomes confined only to midvein zone of the petal except at the base: uniseriate two-armed and uniseriate plough-shaped in *I. trita* ssp. *scabra* (Fig. 51; Table 2).

III. Trichomes confined only over the petal except on the margin, base and basilateral sides: unicellular conical, uniseriate two-armed and uniseriate plough-shaped in *I. cubensis* and *I. lespedezioides* (Figs. 52, 53; Table 2).

IV. Trichomes all over the petal including the margin, except at the base and basilateral sides: unicellular conical trichome in *I. hirsuta*, unicellular conical trichome, unicellular cylindrical trichome and uniseriate conical trichomes in *I. trita* ssp. *scabra* (Figs. 54, 55; Table 2).

V. Trichomes all over the petal except on the margin and base petal: uniseriate two-armed trichome in *I. microcarpa*, uniseriate two-armed trichome and uniseriate plough-shaped trichomes in *I. suffruticosa* and *I. tinctoria* (Figs. 56 and 57; Table 2).

VI. Trichomes all over the petal including the margin, except at the base: unicellular conical

trichome and uniseriate plough-shaped trichomes in *I. microcarpa* (Fig. 58; Table 2).

DISCUSSION

The patterns of intercostal epidermal cells on both surfaces are variable not only from taxon to taxon but also in the same taxon. In general there is a predominance of isodiametric cells with straight and curved walls. Vijay & Ramayya (1987) found mainly polygonal-anisodiametric cells, and although the anticlinal wall patterns were mentioned by them, they did not point out the predominant pattern. The occurrence of papillatae in the abaxial surface of *Indigofera* has been pointed out by Metcalfe and Chalk (1950). Of all taxa analyzed, *I. suffruticosa* is the only one bearing this condition. Vijay & Ramayya (1987) found that costal cells are mostly polygonal-linear, with straight to faintly curved walls. In the taxa here analyzed those cells are predominantly tetragonal-isodiametric on adaxial surface and tetragonal-rectangular on abaxial surface, chiefly linear abaxially with straight walls and some curved; nevertheless there are many series of costal cells on abaxial surface and one to few of them on adaxial surface as Vijay & Ramayya (1987) pointed out. In relation to expression of costal cells two unifacial patterns: I. Costal cells distinct only on the midvein and II. Costal cells distinct only on the midvein and primary lateral veins; and two bifacial patterns: 1. Unifacial pattern I on adaxial surface and abaxial surface and 2. Unifacial pattern II on adaxial and abaxial could be distinguished. These represent the bifacial pattern 5 and 6 recognized by Leelavathi *et al*. (1981). The bifacial pattern I/I is common in most taxa, while the II/II pattern is restricted to *I. hirsuta* and *I. trita* ssp. *scabra* respectively (Table 1). These patterns were also observed in the taxa of *Indigofera* from India (Vijay & Ramayya, 1987) although they are not the predominant patterns in them.

The diversity of stomata even on the same foliar surface has been reported for Fabaceae (Metcalfe & Chalk, 1950; Shah & Gopal, 1968, 1969, 1969 a). In the taxa analyzed ten different types of stomata could be identified which confirms the idea given above by these authors. Although Vijay & Ramayya (1987) found anisocytic stomata as prevalent stomatal complex, few anomocytic and tetracytic, and seldom paracytic stomata the remaining stomata here observed are not mentionated by them, so these other types of stomata are then considered as new reports for *Indigofera*. On the other hand, the amphistomatic condition has been recognized by Metcalfe & Chalk (1950) and Vijay & Ramayya (1987). It seems to be a characteristic pertaining to this genus, as all the taxa have stomata adaxial and abaxially.

Leelavathi *et al*. (1980) found 15 unifacial and 25 bifacial stomatal patterns and showed their taxonomic value in Fabaceae. Based on stomatal characters alone, unifacial patterns II, III, IV and VI (I, II, III and IV mentioned in the text) and bifacial patterns 5 and 13 (1 and 4 in the text) could be identified; while bifacial patterns III/II (II/I in the text) belong to *I. cubensis* and *I. microcarpa* and pattern IV/VI (III/IV in the text) which is restricted to *I. hirsuta* have not been reported for this family.

Although there are not great differences in relation to length and width of the stomata, as well as the length of the pore, some groups of species can be distinguished from the last one like: *I. cubensis*, *I. suffruticosa* and *I. trita* ssp. *scabra* which can be separated from *I. hirsuta*, *I. microcarpa* and *I. tinctoria* and these, at the same time, from *I. lespedezioides* (Table 1).

Structurally, the trichomes observed can be divided into two groups: uniseriate trichomes which are typical of most taxa (Figs. 15-26) and multiseriate trichomes seen only in two of them

(Figs. 27 and 28). The foot was observed generally single in uniseriate and multiseriate clavate trichomes, while the body is divided into two parts (stalk and head) in uniseriate macroform two-armed trichome and plough-shaped trichomes but it is entire in multiseriate clavate trichome and hollow-discoid trichomes. These characteristics are in accordance with observations from Vijay & Ramayya (1987). Of all trichomes observed the commonest types were uniseriate macroform two-armed trichome and plough-shaped trichomes. This has already been pointed out by some authors (Solereder, 1908; Sabins, 1920; Metcalfe & Chalk, 1950; Guillet, 1958; Hutchinson, 1964) demonstrating their taxonomic value at the generic level. Nevertheless some taxa can be recognized by an additional trichome type. Thus, *I. cubensis* has multiseriate clavate trichome which is not reported by Vijay (1988) for leaflets and *I. microcarpa*, multiseriate hollow-discoid trichome. On the other hand, *I. lespedeziodes* and *I. suffruticosa* have only uniseriate macroform two-armed trichomes, while the uniseriate macroform plough-shaped trichome is the only type present in *I. hirsuta*. Vijay (1988) also observed only this type in leaflets of the last taxon.

Furthermore, on the base of types and distribution of trichomes, three patterns could be identified:

I. Trichomes on the adaxial surface, abaxial surface and margin: uniseriate macroform two-armed trichome in *I. lespedeziodes* and *I. suffruticosa* (Figs. 31 and 33); uniseriate macroform two-armed trichome and plough-shaped trichomes in *I. cubensis*, *I. microcarpa*, *I. trita* ssp. *scabra* (Figs. 29, 32 and 35), and uniseriate macroform plough-shaped trichome in *I. hirsuta* (Fig. 30).

II. Trichomes on the abaxial surface and margin: uniseriate macroform two-armed trichome and plough-shaped trichomes in *I. tinctoria* (Fig. 34).

III. Trichomes on abaxial surface: multiseriate clavate trichome in *I. cubensis* and multiseriate hollow-discoid trichome in *I. microcarpa* (Figs. 29, 32).

These distribution patterns were observed by Vijay (1988) being the first pattern the most common in almost all taxa. The second one is restricted to *I. tinctoria* while the third pattern is common to *I. cubensis* and *I. microcarpa* but they have different trichome types. Although the uniseriate macroform two-armed trichome and plough-shaped trichomes are distributed all over the leaflet surface of *I. cubensis*, *I. microcarpa* and *I. suffruticosa* it is necessary to point out that in the first taxon those trichomes were not observed on the midvein, while in the two last species their occurrence on the midvein is occasional or rare. On the other hand, Vijay (1988) stated that *I. tinctoria* has trichomes on adaxial, abaxial and margin, nevertheless all samples analyzed are totally glabrous adaxially (Fig. 34; Table 1).

Regarding floral trichome types, of the sixteen types of trichomes known so far in the genus, nine of them were found in the taxa studied. Vijay (1988) pointed out that different trichome types could be classified, according to their structure, in unicellular and multicellular trichomes and the last ones, at the same time, in uni, bi, and multiseriate trichomes. The trichomes observed have these characteristics, being the uniseriate multicellular trichomes the most predominant types.

Vijay (1988) studied 28 taxa of *Indigofera* from India including *I. hirsuta* and *I tinctoria*. From the first species he could only observed of the floral parts, biseriate cylindrical trichome and uniseriate plough-shaped trichomes on the pedicel; seeing also the latter ones on the

gynoecium. In the samples analyzed were found on the pedicel, in addition, unicellular conical trichomes and uniseriate two-armed trichomes, although rare, while the biseriate cylindrical trichomes were not observed. Furthermore, trichomes of the remaining floral parts have not been reported. Most of all trichomes found in the second species were also observed by this author, and although the presence of multiseriate cylindrical trichome, uniseriate conical trichome and uniseriate plough-shaped trichomes on the sepals, standard petal and the gynoecium respectively were pointed out, these were not observed in the present study. On the other hand, uniseriate two-armed trichomes, although rare, on the androecium where the existence of no trichome type is reported, were not poited out, either.

The distribution of trichome types on the petals varies mostly from taxon to taxon although this can be repeated in another one. For example, *I. cubensis* and *I. lespedezioides* have the pattern III in common while *I. suffruticosa* and *I. tinctoria* have both the pattern I and V respectively. *I. hirsuta* and *I. trita* ssp. *scabra* have the pattern IV but the latter taxon has additionally the pattern II which does not exist in any other. The same happens with *I. microcarpa* which shares the pattern V with *I. suffruticosa* and *I. tinctoria* but it, in addition, has the pattern VI, not observed in the remaining taxa.

Prabhakar *et al*. (1985) found seven distribution patterns on the abaxial surface of the standard petal in eight species of this genus. Of these, the patterns I, III, V and VI were reported by them while the patterns II and IV were not known in *Indigofera*.

Although uniseriate two-armed trichomes and uniseriate plough-shaped trichomes were not mentioned in the margin of the standard petal of *I. suffruticosa* and *I. tinctoria*, it is necessary to point out that these were observed with that distribution, but very rarely. Therefore, it is not desirable to include them within the pattern VI. On the other hand, the types and distribution of trichomes on the standard petal of these two species are equal and there are only some differences on the sepals, wing petals, and the gynoecium that permit their discrimination. Likewise, *I. cubensis* and *I. lespedeziodes* have a similar situation but these can be distinguished from one another because the unicellular conical trichome is present on the keell petals of *I. cubensis* and not on the keell petals of *I. lespedezioides*. The same trichome appears on the wing petals of the latter taxon and not in the former. Besides, on the sepals of *I. cubensis* were observed, although rare, unicellular cylindric-clavate trichome and uniseriate cylindric-clavate trichomes, not seen in *I. lespedezioides*.

The foliar epidermal characters analyzed show that most of these are very stable in the genus, although there are some differences at specific level that permit the delimitation of the taxa, being the type and distribution of trichomes the main way for their recognition. On the other hand, the trichome types and their distribution on the different floral parts have also diagnostic value at specific level. On this basis, a key for the identification of Cuban taxa of *Indigofera* is provided.

1. Differentiated epidermal costal cells on the midvein and primary lateral veins.

2. Both uniseriate macroform two-armed trichomes and plough-shaped trichomes present on the leaflet surface. Unicellular conical trichomes and other trichome types present on the standard petal, uniseriate two-armed trichomes and plough-shaped trichomes restricted to midvein zone ….*I. trita* ssp. *scabra*

2. Only uniseriate macroform plough-shaped trichomes and unicellular conical trichomes present on the leaflet and standard petal respectively …… *I. hirsuta*

1. Differentiated epidermal costal cells only on the midvein.

3. Stomata on the midvein adaxially absent, but abaxially present (bifacial pattern 2 in the text). Uniseriate and multiseriate trichomes both present.

4. Multiseriate clavate trichome abaxially present oriented parallel to midvein. Trichomes present on the standard petal margin ……. *.I. cubensis*

4. Multiseriate hollow-discoid trichome abaxially present, irregularly oriented. Trichomes present on the standard petal margin……..……*I. microcarpa*

3. Stomata all over the foliar surface including midvein in both surfaces (Bifacial pattern I in the text). Only uniseriate trichomes present.

5. Trichomes absent on the adaxial surface ..... ……..*I. tinctoria*

5. Trichomes present in both surfaces, not as above.

6. Sides of epidermal intercostal cells mostly curved, sometimes straight, never ondulated. Papillatae absent. Trichomes all over the petal except on the margin, base and basilateral sides ..... ……*I. lespedezioides*

6. Sides of epidermal intercostal cells curved-ondulated, occasionally straight. Papillatae present on abaxial surface. Trichomes on and near the margin of the petal, except at the base*I. suffruticosa*

ACKNOWLEDGEMENTS

I wish to thanks Lina Bravo, who helped me to process data, Prof. Angel Rodríguez for his collaboration in the revision of the English version and Lic. Pedro Herrera from HAC for his encouragement.

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Table 1. Main foliar epidermal characteristics of taxa of ***Indigofera*** L. studied. s = straight; c = curved; w = wavy; A = Uniseriate macroform two-armed trichome; B = Uniseriate macroform plough-shaped trichome; C = Multiseriate clavate trichome; D = Multiseriate hallow-discoid trichome; Anisoc. = anisocytic stoma; Anomot. = anomotetracytic stoma; Anomoc. = anomocytic stoma; Stauroc. = staurocytic stoma; Parac. = paracytic stoma; Brachyparac. = bracyparacytic stoma; Hemiparac. = hemiparacytic. stoma; Actinoc. = actinocytic stoma; Cicloc. = cielocytic stoma; Diac. = diacytic stoma; (-) = Trichome absent or not observed; (*) = structure rare in thath surface; L = long; B = broad; LP = length of pore. Adax. = adaxial surface; Abax. = abaxial surface.

Taxon	Costal cell bifacial distribution pattern	Anticlinal pattern of intercostal epidermal cells		Trichomes types		Stomata types		Stomatal bifacial distribution pattern	Average value of stomatal dimensions (_m)
		Adax.	Abax.	Adax.	Abax.	Adax.	Abax.		L B LP
Indigofera cubensis Urb.	I/I	C, S	C, S	A, B* C*	A, B,	Anisoc. Anomot. Stauroc. Anomoc. Parac. *	Anisoc. Anomot. Stauroc. Anomoc. Parac.* Actinoc.*	II/I	11 10.1 10.2 17.0 9.4 10.4
Indigofera hirsuta L.	II/II	S, C	S, C	B	B	Anisoc. Anomoc. Actinoc.*	Anisoc. Anomoc. Actinoc.* Hemi-parac.* Anomot.	III/IV	11 10.2 9.0 15.8 10.2 9.5
Indigofera lespedezioides Kunth	I/I	C, S	C, S	A	A	Anisos. Anomoc. Anomot. Parac.* Actinoc.*	Anisoc. Anomoc. Anomot. Parac.* Actinoc.* Cicloc.	I/I	11 1 2 . 4 7.8 15.6 12.3 7.8

Indigofera microcarpa Desv.	I/I	S,C,W S,C	A.B* A,B*,D	Anisoc. Anisoc. Anomoc. Anomoc. Parac.* Parac.* Stauroc.* Anomot. Diac. * Actinoc.*	II/I	11 12.1 9.4 15.4 11.1 9.1
Indigofera suffruticosa Mill.	I/I	C, W, S C, W, S	A A	Anisoc. Anisoc. Anomoc. Anomoc. Brachy- Brachy- parc.* parac.* Stauroc. Stauroc. Hemi- Hemi- parac. parac. Actinoc.*	II/I	11 13.9 10.7 18.0 12.5 10.3
Indigofera tinctoria L.	I/I	S, C, W S, C, W	- A, B*	Anisoc. Anisoc. Anomoc. Anomoc. Parac* Parac.* Anomot. Anomot. Stauroc. Actinoc.*	I/I	11 12.4 9.9 17.3 12.1 9.9
Indigofera trita L. f. ssp. *scabra* (Roth) De Kort & Thijsse	II/II	S, W, C C, W, S	A, B A, B	Anisoc. Anisoc. Anomoc. Anomoc.	IV/III	11 11. 9 10.8 18.3 12.7 10.1

Table 2. Trichome types and their distribution on the floral parts of taxa of *Indigofera* L. studied.
A = Unicellular conical trichome; B = Unicellular cylindrical trichome; C = Unicellular cylindric-clavate trichome; D = Uniseriate conical trichome; E = Uniseriate cylindric-clavate trichome; F = Uniseriate two armed-trichome; Uniseriate plough-shaped trichome; H = Biseriate cylindric-clavate trichome; I = Multiseriate hollow-discoid trichome; 1 = trichomes present on abaxial surface and margin; 2 = tricomes present on the margin; 3 = trichomes present on abaxial surface; (*) = trichome rare.

Taxon	Pedicel	Sepal	Standard petal	Wing petal	Keell petal	Androe-cium	Gynoe-cium
Indigofera cubensis Urb.	F, G	3 C * ; 1E*,	3A*, F, G	1F	1 A ; 3F*	F	F
		F, G, H					
Indigofera hirsuta L.	A, F*, G	1F, G; 2H	1A	1A	1A	G*	G
Indigofera lespedezio-des Kunth	A*, F	1F, G; 2H	3 A*, F, G	3A, F*	3F, G*	F*	F
Indigofera microcarpa Desv.	F, G	1 A *, F, G, I	1 A, 3F; 1G	1A	1 , 1G	F *	F, G
Indigofera suffruticosa Mill.	F, G	1A, B, F, G; 2H	1A, B; 2C; 3F, G	1A, B, C	1 A , B*, F, G	F*	A*, B, F, G
Indigofera tinctoria L.	A*, F, G	1A*, F, G; 2H	1A, B; 2C; 3F, G	1A; 2B; 3F, G	1A, F, G	F*	F
Indigofera trita L. f. ssp. ***scabra*** (Roth) de Kort & Thijsse	F, G	2A*; 1F, G; 2H	1A, B*; 3D; 3F, G	1A; 2B*	1A; 3F	F*	A, F, G

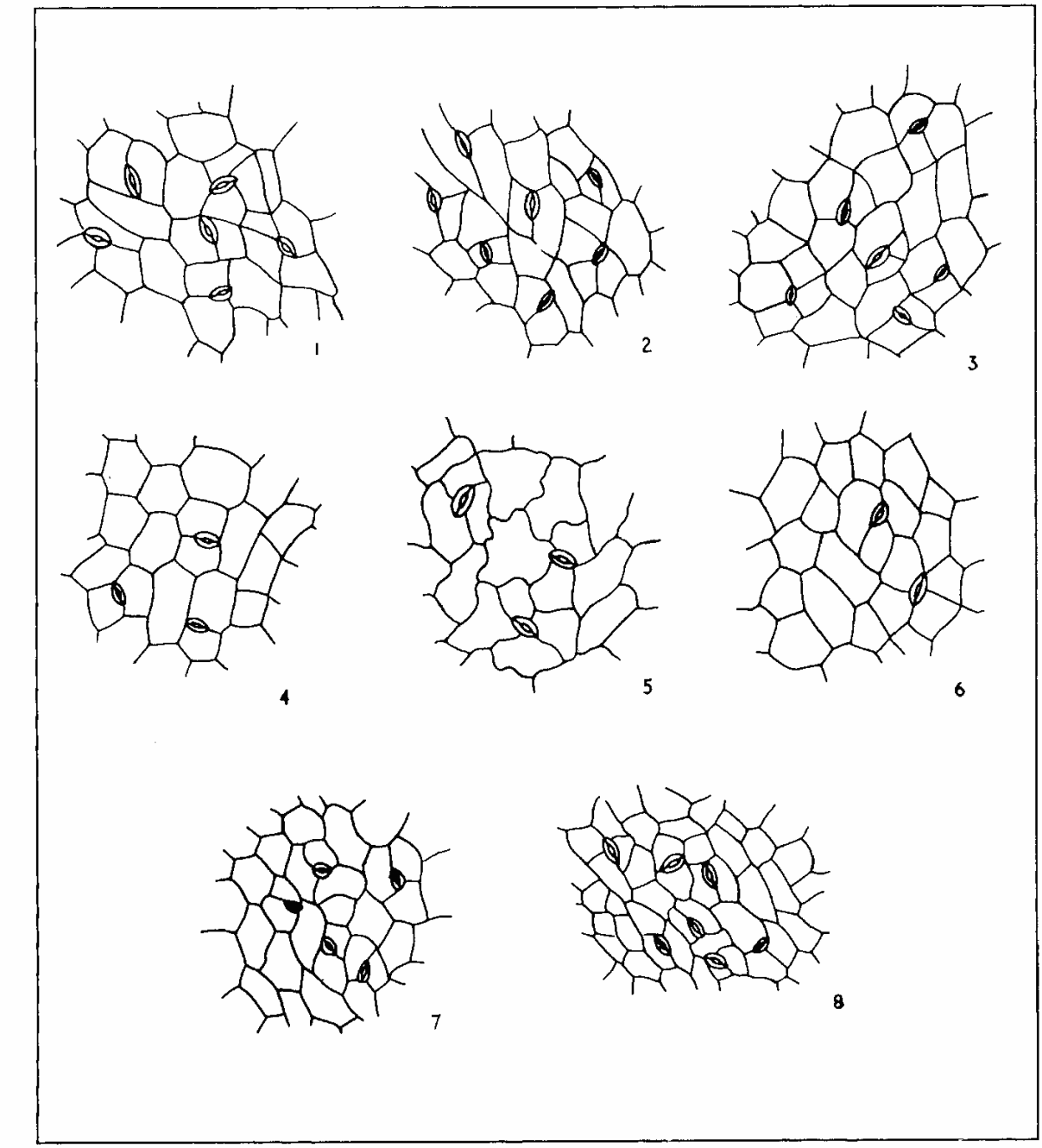


Fig. 1-8 Foliar dermotypes of *Indigofera* L. 1,2 adaxial and abaxial surface of *I. cubensis*; 3,4 *I. hirsuta*; 5,6 *I. lespedezioides*; 7,8. *I. microcarpa*.

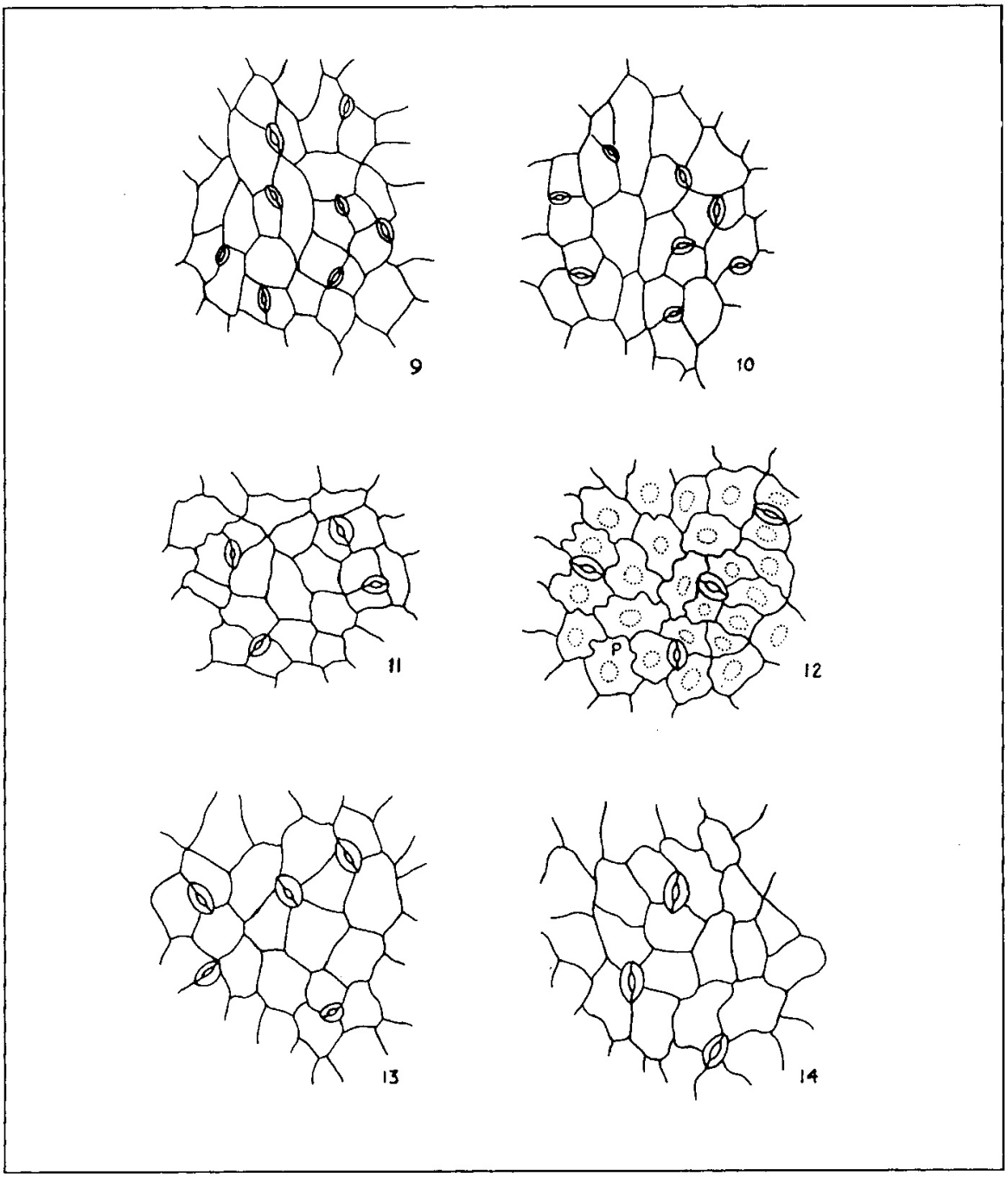


Fig. 9-14 Foliar dermotypes of *Indigofera* L. 9,10 *I. suffruticosa*; 11,12 *I. tinctoria*; 13,14 *I. trita* ssp. *scabra*.

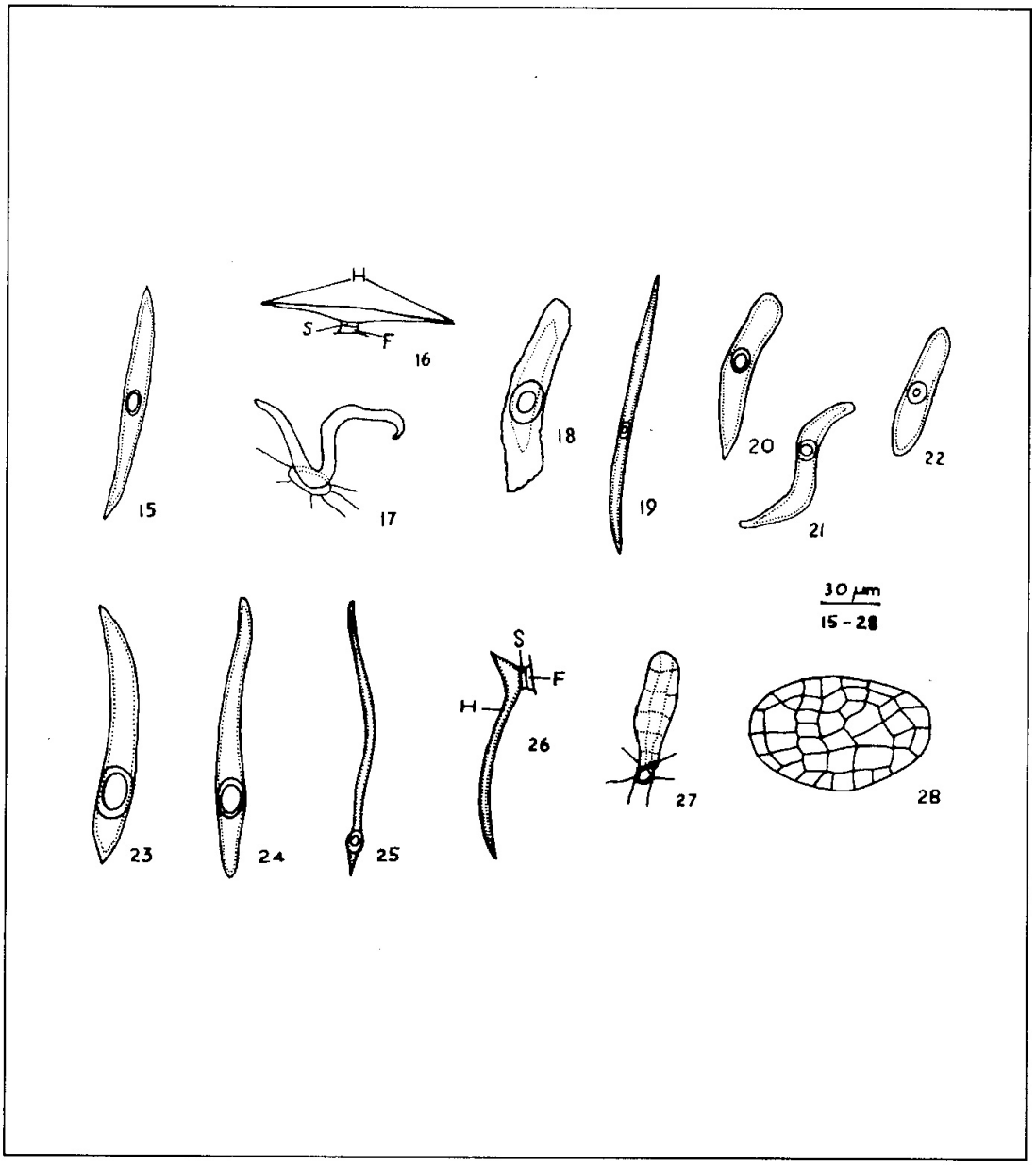
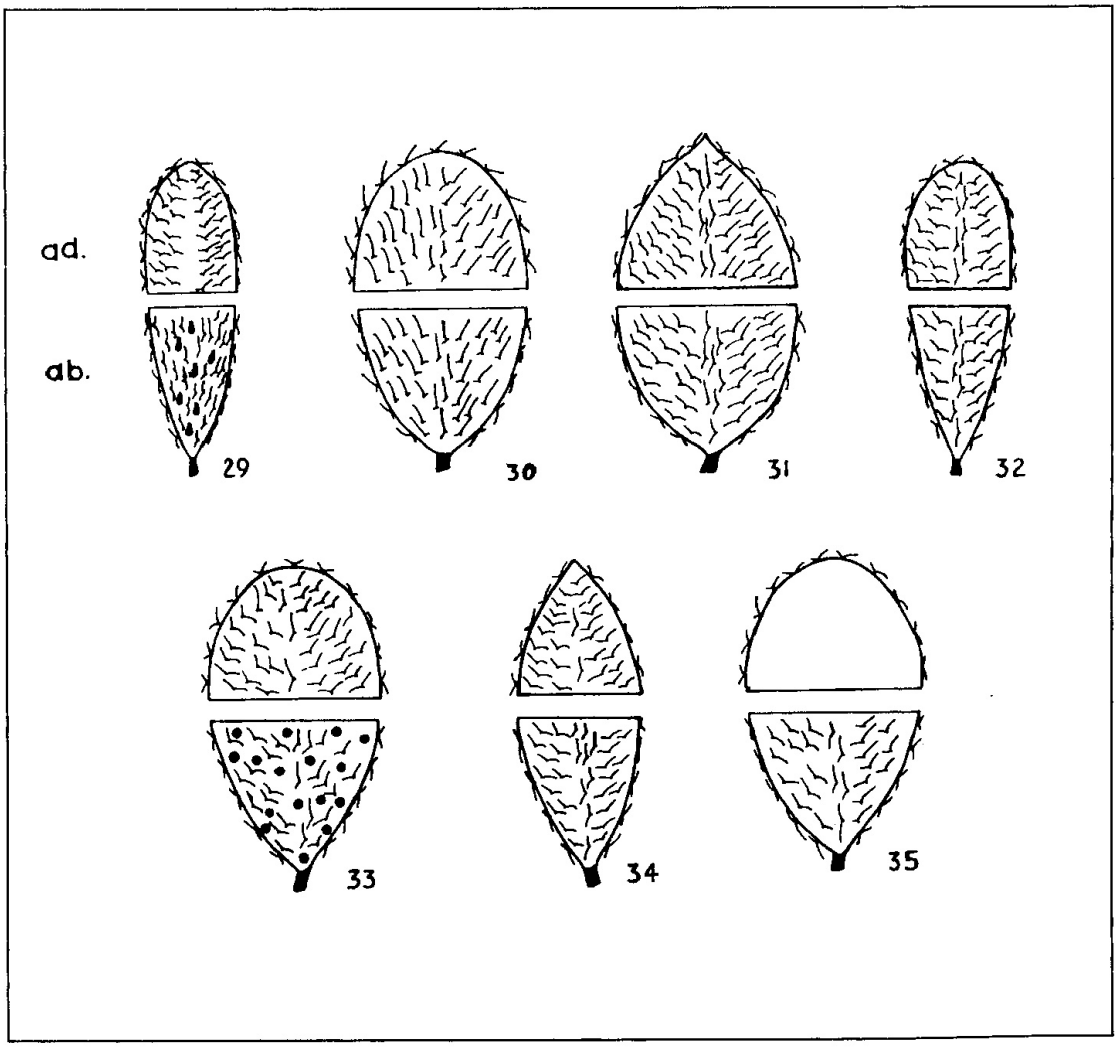
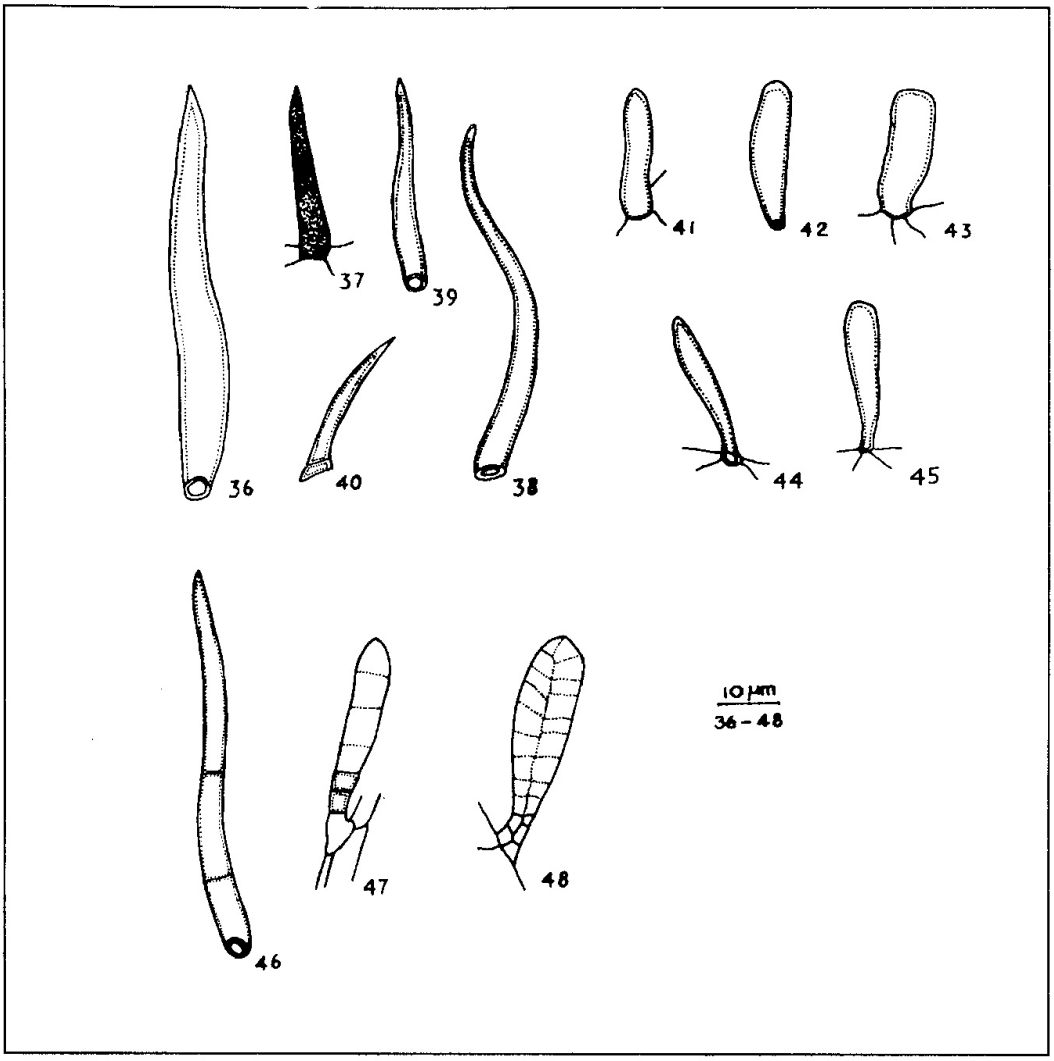


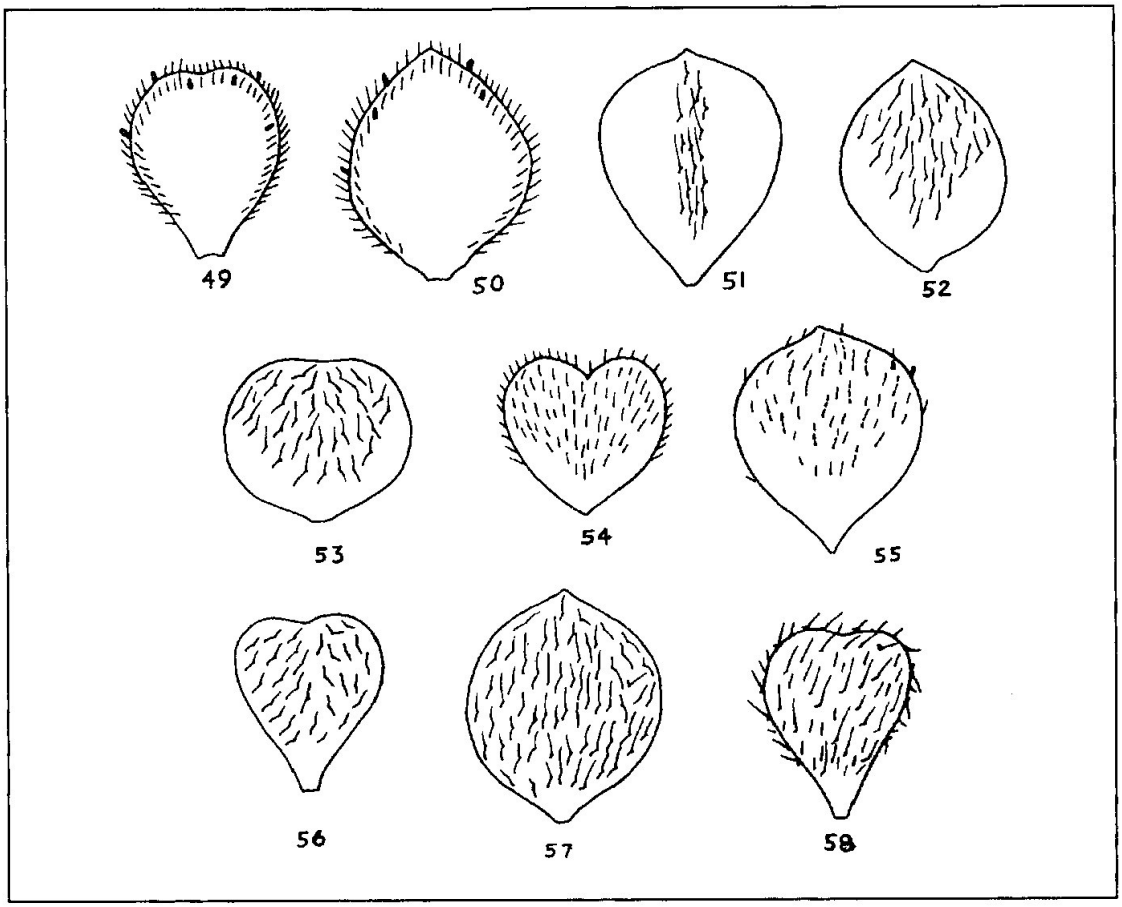
Fig. 15-28 Foliar dermotypes of *Indigofera* L. 15-22 Uniseriate macroform two-armed trichomes; 15,16 paradermal and transversal sections respectively of *I. suffruticosa*; 17 *I. microcarpa*; 18,19 *I. lespedezioides*; 20-22 *I. tinctoria*; 23-26 Uniseriate macroform plough-shaped trichomes; 23 *I. cubensis*; 24 *I. microcarpa*; 25,26 paradermal and transversal sections respectively of *I. hirsuta*; 27 and 28 Multiseriate trichomes; 27 Multiseriate clavate trichome of *I. cubensis;* 28 Multiseriate hollow-discoid trichome of *I. microcarpa*; H= head; F= foot; P= papilla.



Figs. 29-35 Ilustrative diagram of trichome types and their distribution in both foliar surfaces of *Indigofera* L. 29 *I. cubensis*; 30 *I. hirsuta*; 31 *I. lespedezioides*; 32 *I. microcarpa* 33 *I. suffruticosa*; 34 *I. tinctoria*; 35 *I. trita ssp. scabra*; (✓) = Uniseriate macroform two-armed trichomae; (✓) = Uniseriate macroform plough-shaped tricome; (●) = Multiseriate clavate trichome; (●) = Multiseriate hollow-discoid trichome; ad. = adaxial surface; ab. = abaxial surface.



Figs. 36-48. Some floral trichomes of taxa of *Indigofera* L. studied, 36-40 Unicellular conical trichomes; 36 *I. trita ssp. scabra*; 37 trichome near the margin and 38 of internal part of the standar petal of *I. microcarpa*; 39 *I. hirsuta*; 40 *I. tinctoria*, 41-43 Unicellular cylindric trichomes; 41 *I. suffructicosa*; 42 *I. trita* ssp. *scabra*; 43 *I. tinctoria*; 44 and 45 unicellular cylindric-clavate trichomes of *I. suffruticosa* and *I. tinctoria* respectively, 46 Uniseriate conical trichome of *I. trita* ssp. *scabra*; 47 Uniseriate cylindric-clavate trichome from the margin of the sepals of *I. cubensis*; 48 Biseriate cylindric-clavate trichome from the margin of the sepals of *I. tinctoria*.



Figs. 49-58 Ilustrative diagram of trichome types and their distribution on the standar petals. 49 *I. suffruticosa*; 50 *I. tinctoria*; 51 *I. trita* ssp. *scabra*; 52 *I. cubensis*; 53 *I. lespedezioides*; 54 *I. hirsuta*; 55 *I. trita* ssp. *scabra*; 56 *I. microcarpa*; 57 *I. tinctoria*; *I. microcarpa*. (✓) = Unicellular conical trichome; (▮) = Unicellular cylindrical trichome; (▮) = Unicelular cylindric-clavate trichome; (✓) = Uniseriate conical trichome; (✓) = Uniseriate two-armed trichome; (✓) = Uniseriate plough-shaped trichome.