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A Study of Epidermal Patterns of the Leaf Blades of Evergreen Plants on Cheju Island

by

Oh, Yong Cha

(Sung Shin Women's Teachers College, Dept. of Biology)

제주도산 상록수 식물의 잎의 표피형에 대한 연구

오 용 자

(성신여자사범대학 생물과)

Abstract

Epidermal patterns of leaf blades seem to be very important taxonomic characteristics for some taxa of vascular plants at the species level.

The results of the present study show that the elements of leaf epidermis subsidal cells, cell walls of fundamental cells, cushion hairs, oil glands and arrangements of the cell elements are considered to be significant characteristics for the identification and classification of plants.

Introduction

Various documentary works on plant anatomy of dicotyledons and monocotyledons have been done by Metcalfe and others (1950,1960). They found the anatomical characteristics of leaves and twigs very important for plant identification and classification.

Research by the author has resulted in the finding that the leaf blades of Korean sedges are a very useful characteristic for sedge taxonomy.

The present study of leaf epidermis concerns 17 species of evergreen woody plants found on the island of Cheju.

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Materials and Methods

The widest portions of the leaf blades, collected fresh on Cheju, were used.

The epidermises of the leaves were peeled with a razor blade and observation was made under an

Olympus microscope of 200X magnification.

The material evergreen woody plants species are as follows;

Moraceae

Ficus erecta Thunberg.....천선과

Lauraceae

Cinnamomum japonicum Sieb.생달나무 or 센달나무

Litsea japonica (Thunb.) Juss.가마귀쪽나무

Pittosporaceae

Pittosporum tobira (Thunb.) Aiton.....돈나무

Hamamelidaceae

Distylium racemosum Sieb. et Zucc.조록나무

Euphorbiaceae

Daphniphyllum macropodum Miquel.....굴거리나무

Aquifoliaceae

Ilex crenata Thunb. var. *microphylla* (Maxim.).....광평나무

Celastraceae

Euonymus japonica Nakai.....사철나무

Elaeocarpaceae

Elaeocarpus sylvestris (Lour.) Poir var. *ellipticus* (Thunb.) Hara.....담팔수

Theaceae

Camellia japonica Linne.....동백나무

Eurya japonica Thunb.사스레피나무

Ternstroemia gymnathera (Wight et Arn.) Sprague.....후피향나무

Ericaceae

Vaccinium bracteatum Thunberg.모새나무

Oleaceae

Ligustrum japonicum Thunberg.....광나무

Apocynaceae

Nerium indicum Mill.협죽도

Trachelospermum asiaticum (Sieb. et Zucc.) Nakai var. *intermedius* Nakai.....마삭줄

Rubiaceae

Gardenia jasminoides Ellis.치자나무

Observations

Moraceae

Ficus erecta Thunberg.....천선과

Long cushion hairs are present on the adaxial surface. Stomata are 17-24-29 μ m long and 14-18-23 μ m wide.

Well-developed oil bodies, 34 μ m across, present on abaxial surface.

Lauraceae

Cinnamomum japonicum Sieb.: 생달나무 or 센달나무

Stomata are 18-25-29 μ m long and 24-31-37 μ m wide. Cell wall is lobed and very thick. Oil glands are present.

Litsea japonica (Thunberg) Juss.: 가마귀쪽나무

Numerous hairs are present on abaxial surface. Stomata are 17-24-32 μ m long and 17-23-32 μ m wide. Cell walls of adaxial surface are not undulate and very thick.

Pittosporaceae

Pittosporum tobira (Thunb.) Aiton: 돈나무

Stomata are 29-30-35 μ m long and 28-28-29 μ m wide. Subsidiary cells well developed and surround the stomata. Cell walls are thick and not undulate.

Hamamelidaceae

Distylium racemosum Sieb. et Zucc.: 조록나무

Cuticle layer of epidermis thick. Stomata 23-27-29 μ m long and 17-21-23 μ m wide. Subsidiary cells are present on both sides of pores. Small fundamental cells arranged irregularly. Cell walls are thick and not undulate. Oil glands are abundant.

Euphorbiaceae

Daphniphyllum macropodum Miquel: 줄거리나무

Stomata are 23-26-29 μ m long and 17-21-26 μ m wide. Oil bodies are present on both surfaces of epidermis. Fundamental cell walls are not undulate and thick. Subsidiary cells are prominent but small.

Aquifoliaceae

Ilex crenata Thunb. var. *microphylla* (Maxim.): 팽팽나무

Numerous stomata are present with developed subsidiary cells, 26-32-40 μ m long and 23-25-29 μ m wide. Cell walls of adaxial surface are deeply undulate. Large fundamental cells with oil glands are present on the abaxial surface.

Celastraceae

Euonymus japonica Nakai: 사철나무

Stomata, 32-35-40 μ m long and 26-29-37 μ m wide, are surrounded by subsidiary cells. Cell walls are thick and not undulate. Fundamental cells are very small.

Elaeocarpaceae

Elaeocarpus sylvestria (Lour.) Poir var. *ellipticus* (Thunb.) Hara: 담팔수

Stomata, 23-25-29 μ m long and 17-22-23 μ m wide, are surrounded by subsidiary cells. Cell wall is thick and not undulate. Oil glands are present.

Theaceae

Camellia japonica Linne: 동백나무

Subsidiary cells are present. Stomata, 23-28-35 μ m long and 29-32-40 μ m wide. Fundamental cells are present and very small. Cell wall is thick and not undulate. Numerous oil bodies are present on both surfaces.

Eurya japonica Thunberg: 사스레피나무

Stomata, 23-24-29 μ m long and 14-18-23 μ m wide. Fundamental cell walls are shallowly undulate

and thick. Oil glands are abundantly present on abaxial surface.

Ternstroemia gymnathera (Wight et Arn.) Sprague: 후피향나무

Stomata are 32-25-46 μm long and 23-26-35 μm wide. Epidermal cell walls of abaxial surface are deeply undulate. Oil glands are present on both surfaces of epidermis

Ericaceae

Vaccinium bracteatum Thunberg: 모새나무

Cuticle of epidermis is thick. Stomata are deeply sunken in epidermis, 23-27-29 μm long and 14-20-26 μm wide. Fundamental cell walls are not undulate but very thick.

Oleaceae

Ligustrum japonicum Thunberg: 광나무

Stomata are 29-35-37 μm long and 23-28-32 μm wide. Fundamental cell walls are not undulate and very thick. Oil bodies are 39 μm across, present on abaxial surface.

Apocynaceae

Nerium indicum Mill.: 협죽도

Stomata are present in sunken epidermis and they are surrounded by numerous hairs. Fundamental cells are arranged irregularly and their walls shallowly undulate. Oil glands are present on both surfaces.

Trachelospermum asiaticum (Sieb. et Zucc.) Nakai var. *intermedius* Nakai: 마삭줄

Stomata, 20-23-26 μm long 20-25-29 μm wide. Fundamental cells are very small, and numerous oil bodies are on both surfaces of cells. Cell wall is not undulate.

Rubiaceae

Gardenia jasminoides Ellis: 치자나무

Numerous stomata are 20-22-23 μm long and 17-17-18 μm wide, present on abaxial surface, and surrounded by the well developed subsidal cells. Cell wall is thick but not undulate.

Key based on epidermis of leaf blades on plants observed.

A. Subsidiary cells present

B. Oil glands are present on abaxial surface

C. Cell walls undulate *Ilex crenata* Thunb. var. *microphylla* (Maximowicz)

C. Cell walls not undulate

D. Subsidiary cells surround stomata; cuticle layer thin..... *Elaeocarpus sylvestris* (Lour.) Poir. var. *ellipticus* (Thunb.) Hara

D. Subsidiary cells do not surround stomata: cuticle layer thick..... *Distylium racemosum* Sieb. et Zucc.

B. Oil glands are absent on abaxial surface

C. Subsidiary cell well developed: stomata are 20-22-23 to 29-30-35 μm long and 17-17-18 to 28-28-29 μm wide

D. Stomata are 29-30-35 μm long and 28-28-29 μm wide..... *Pittosporum tobira* (Thunb.) Aiton

D. Stomata are 20-22-23 μm long and 17-17-18 μm wide..... *Gardenia jasminoides* Ellis.

C. Subsidiary cells do not well developed: stomata are 32-35-40 μm long and 26-29-37 μm wide..... *Euonymus japonica* Nakai

A. Subsidiary cells absent

B. Oil glands are present on abaxial surface

- C. Oil glands well developed; cushion hairs are present on adaxial surface
 - D. Cushion hairs are present on adaxial surface *Ficus erecta* Thunb.
 - D. Cushion hairs are absent on adaxial surface..... *Ligustrum japonicum* Thunb.
- C. Oil glands do not well developed, and cushion hairs absent on the adaxial surface
 - D. Cell walls are shallowly waved or lobed
 - E. Cell walls shallowly waved *Eurya japonica* Thunb.
 - E. Cell walls lobed waved..... *Cinnamomum japonicum* Sieb.
 - D. Cell wall not waved
 - E. Oil glands are present on both surfaces
 - F. Fundamental cells and subsidal cells small
 - G. Stomata 23-28-35 μ m long and 29-32-40 μ m wide..... *Camellia japonica* Linne
 - G. Stomata 20-23-26 μ m long and 20-25-29 μ m wide
 Trachelospermum asiaticum (Sieb. et Zucc.) Nakai var. *intermedius* Nakai
 - F. Fundamental cells are not small and subsidal cells prominent... *Daphniphyllum macropodum* Miquel
 - E. Oil glands are absent on the both surfaces and numerous hairs present on the abaxial surface.....
 Litsea japonica Juss.
- B. Oil glands are absent on the abaxial surface
 - C. Stomata are present on the sunken epidermis surrounded by numerous hairs..... *Nerium indicum* Mill.
 - C. Stomata are present but not undulate as above
 - D. Cell walls are very undulate on adaxial surface ... *Ternstroemia gymnathera* (Wight et Arn.) Sprague
 - D. Cell walls are not undulate on adaxial surface *Vaccinium bracteatum* Thunberg

Conclusion and Discussion

The present study is a comparison of epidermal patterns of leaf blades of 17 species of evergreen woody plants. There are many distinguishing characteristics in the epidermis elements of leaves: subsidal cell, cell walls of fundamental cells, cushion hairs and oil glands.

The cell walls of the fundamental epidermis are very thick and variously undulate or some not undulate at all. Stomata size varies considerably among the species.

Stomata are large on the leaves of *Cinnamomum japonicum* Sieb., *Camellia japonica* Linné, *Ligustrum japonicum* Thunb., *Ternstroemia gymnathera* (Wight et Arn.) Sprague and *Euonymus japonica* Nakai while they are small on *Ficus erecta* Thunb. and *Gardenia jasminoides* Ellis. Oil glands are present on the leaves of *Ilex crenata* Thunb. var. *microphylla* (Maxim.), *Elaeocarpus sylvestris* (Lour.) Poir var. *ellipticus* (Thunb.) Hara, *Distylium racemosum* Sieb. et Zucc., *Ficus erecta* Thunb., *Ligustrum japonicum* Thunb., *Eurya japonica* Thunb.

Stomata of *Nerium indicum* Mill. are present on the sunken epidermis surrounded by numerous hairs

Cushion hairs are present on the adaxial surface of *Ficus erecta* Thunberg

In this study the author confirms that the leaf epidermis of dicotyledons is a distinguishing characteristics whereas it does not seem to be significant in the case of monocotyledons, particularly taxa in *Gramineae* and *Cyperaceae*.

요 약

우리나라 제주도산 상록수식물의 잎의 표피형에 대한 조사로써 사용한 재료는 17종의 표피형을 조사하였다. 표피형의 구성요소인 표피기본세포(Fundamental cell), 기공(Stomata), 이모세포(Cushions hairs), 유세포(Oil glands)등의 배열상태와 모양을 조사하였다. 표피형 구성세포의 특징이 종류에 따라서 차이가 있어 식물의 감별 및 분류에 쓸수 있는 좋은 형질이 될 수가 있다고 사료되는 바이다.

관찰한 표피형에 대하여 사진, 기재와 검색표를 밝히는 바이다.

Bibliography Cited

- Ahuja A., 1962. Studies on the Epidermis of some *Cyperaceae*, Curr. Sci., 31;213-214
- Chung T., 1965. Illus. Encycl. Fau. Fl., Samwha, Korea 5;1-1824
- Kitamura, S., Mura, G. & T., Koyama 1964. Coloured Illus. of Herb. Pl. of Japan, Hoikusha, Japan, 1-464
- Lee, Yong No & Yong Cha Oh, 1968. Taxonomic Study on the Genera of *Cyperaceae* in Kore, J.K.R.I.B.L., 1-101-121
- _____, 1969. A Study of Epidermal Patterns of the Leaf Blades on Korean *Sedges* (1), J.K.R.I.B.L., 2;147-159
- _____, 1971. A Study of Epidermal Patterns of the Leaf Blades on Korean *Sedges* (2), J.K.R.I.B.L., 7;41-53
- _____, 1972. A Study of Epidermal Patterns of the Leaf Blades on Korean *Sedges* (3), Genus *Carex*, J.K.R.I.B.L., 9;151-165
- Metcalf and Clalk, 1950. Anatomy of the Dicotyledons, Oxford Press, Vol. 1:1-724
- _____, 1950. Anatomy of the Dicotyledons, Oxford Press, Vol. 2:725-15004
- Nakai, T., 1952. A Synoptical Sketch of Korean Flora Bull. Nat. Sci. Mus., 31 Tokyo, Japan, 129-135
- Oh, Yong Cha, 1973. A Study of Epidermal Patterns of the Leaf Blades on Korean *Sedges* (4), Genus *Cyperus*, J.K.R.I.B.L., 11:117-125
- _____, 1974(a), A Study of Epidermal Patterns of the Leaf Blades on Korean *Sedges* (5) Genus *Fimbristylis*, J.K.R.I.B.L., 13:35-43
- _____, 1974(b), A Study of Epidermal Patterns of the Leaf Blades on Korean *Sedges*, *Eriophorum*, *Fuirena*, *Kobresia*, *Rhynchospora* and *Scirpus* (6), Kor. Jour. Bot., 17, 2:99-165
- Owhi, J., 1953. Flora of Japan, Shibundo, Tokyo, Japan, 1-1338
- Park, M., 1946, An Enumeration of Korea Plants, Seoul, Korea, 1-340

Plate 1. Epidermal patterns of Leaf Blades (X250)

1. *Ficus erecta* Thunb. (abaxial surface)
2. *F. erecta* Thunb. (adaxial surface)
3. *Litsea japonica* (Thunb.) Juss. (ab.)
4. *Pittosporum tobira* (Thunb.) Aiton (ab.)
5. *Distylium racemosum* Sieb. et Zucc. (ab.)
6. *Daphniphyllum macropodum* Miquel (ab.)

Plate 2. Epidermal patterns of Leaf Blades (X250)

7. *Ilex crenata* Thunb. var. *microphylla* (Maxim.) (ab.)
8. *I. crenata* Thunb. var. *microphylla* (Maxim.) (ad.)
9. *Euonymus japonica* Nakai (ab.)
10. *Elaeocarpus sylvestris* (Lour.) Poir. var. *ellipticus* (Thunb.) Hara (ab.)
11. *Camellia japonica* Linne (ab.)
12. *Eurya japonica* Thunb. (ab)

Plate 3. Epidermal patterns of Leaf Blades (X250)

13. *Ternstroemia gymnathera* (Wight et Arn.) Sprague (ab.)
14. *Ligustrum japonica* Thunb. (ab.)
15. *Vaccinium bracteatum* Thunb. (ab.)
16. *V. bracteatum* Thunb. (ad.)
17. *Nerium indicum* Mill. (ab.)
18. *N. indicum* Mill. (ad.)