

The Correlation of Morphology and Geographical Distribution in *Lycopodium saururus*

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The leaves of *Lycopodium saururus* Lam. exhibit several features that vary in relation to certain environmental factors. The wide geographical distribution of this species led de la Sota (1972) to suggest that possibly a complex was involved. The present analysis is part of an attempt to solve the systematic problems of *L. saururus* and to elucidate its relationships with allied species, with which it shares the following characters. The plants are terrestrial or saxicolous and grow in tropical or subtropical regions, especially at medium to high elevations in mountains; their stems are columnar, finger-like, erect or ascending, and can be succulent or herbaceous, but generally are stiff or sometimes very rigid, with radial symmetry and dichotomous branching; their microphylls are isomorphic; distinct fertile areas or well-defined strobili are never produced.

Lycopodium saururus is included in series *Eusaurura* Herter of section *Crassistachys* Herter (Herter, 1949, p. 72). In Herter's sense, series *Eusaurura* does not include all the species I believe are allied to *L. saururus*. Section *Crassistachys*, even if it may prove to be natural, was based on insufficient morphological analysis. Nomenclatural details concerning *L. saururus* will be presented in a forthcoming paper.

MATERIAL STUDIED

CENTRAL AMERICA: Costa Rica: PCIA. CARTAGO: Among rocks in the páramo of Cerro de la Muerte, Cordillera de Talamanca, *Williams 20025* (US); Paramillo on Cerro de La Muerte, Cordillera de Talamanca, along Panamerican Highway, *Williams et al. 28833* (US); Páramo de Cerro de La Muerte, Cordillera de Talamanca, *Williams 16087* (US); Cerro de La Muerte, Panamerican Highway, *Carpenter 299* (US). PCIA. S. JOSÉ: Cerro de Las Vueltas, *Standley & Valerio 44004, 44006, 43611* (all US); Cerro de La Muerte, La Virgen de Los Angeles páramo, *Brown 88* (US); 0.55 km towards Cartago from San Isidro del General, *McKee 11203* (US); Páramo Buena Vista, 1-3 km S of the Interamerican Highway, *Lellinger 869, 870* (both US); Páramo Buena Vista, 1-3 km S of the Interamerican Highway, *Mickel 2117, 2118* (both US); Páramo Buena Vista, *de la Sota 5047* (LP, US); Pseudopáramo on Buena Vista Massive, 33 mi NW of San Isidro del General, 5 km NW of La Georgina, *Woodruff* (US 2551951). **PANAMA:** PCIA. CHIRIQUÍ: Loma Larga to summit, Volcán de Chiriquí, *Woodson & Siebert 1079* (US).

SOUTH AMERICA: Venezuela: EDO. TACHIRA: Páramo de El Colorado, continuación de El Zumbador, cumbre del páramo, *Cuatrecasas et al. 28282, 28283* (both US). EDO MERIDA: Laguna Coromoto-Laguna Verde, *Aristeguieta 2625a* (VEN). **Peru:** DEPTO. CUZCO: Acanacu, *Vargas 355* (GH). DEPTO. JUNÍN: Pcia. Huancayo, Laguna Huacracocho, *Soukup 3744* (US); Nevado Sallcantay, *Buës 744* (US); Cerro Huaytapallana, *Tryon & Tryon 5469* (US); San José, *Macbride & Featherstone 1111* (US). DEPTO. LA LIBERTAD: Pcia. Santiago de Chuco, Jalca de Quesquenda, *Sagastegui 4542* (GH); Jalca de Quiruvilca, *Sagastegui 2874* (GH). **Bolivia:** DEPTO. COCHABAMBA: Chapare, *Steinbach 9750* (GH); San Benito (Chapare), *Steinbach 9799* (NY); Choro, Aparcita, above the Cocapata River, ca. 100 mi from Cochabamba, across the Tunari Range, *Brooks 6095* (NY); Cordillera Real, Alaska Mine, *Tate 52* (NY); La Fabulosa, tin mine at the head of Challana valley, *Brooks 6347* (NY). DEPTO. LA PAZ: Yungas, Unduavi, *Rusby 453a* (NY). **Argen-**

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tina: PCIA. JUJUY: Volcán, Loma del Tambo, *Schreiter 2559, 4111* (both LIL); Volcán, Mula Muerta, *Castillon 218* (LIL); Tumbaya, Filo del Vallecito, Cerro Horqueta, *Cabrera et al. 16978* (LP); Tumbaya, Abra del Cerro Morado, *Fabris et al. 6325* (LP, US); Tilcara, Falda Grande, Cerro Huaira-Huasi, *Cabrera & Hernandez 14003* (LP); Valle Grande, Cerro Hermoso, *Fabris et al. 5827, 5921* (both LP); Santa Barbara, Cerro El Centinela, *de la Sota 2884* (LP); Capital, Abra Delgada, entre León y Nevado de Chani, *Fabris et al. 4188* (LP). PCIA. SALTA: Oran, Cerro Questo Asentado, *Peirotti 1036* (LIL); Santa Victoria, camino a Santa Victoria, *de la Sota 4118* (LP, US); Santa Victoria, entre Lizoite y Rodeo Pampa, *Meyer* (LIL, US 1564924); Pampa Grande, *Spegazzini* (SI 21251); Candelaria, Cerro Chorrillos, *Venturi 3844* (SI); Caldera, subida al Nevado del Castillo por El Mal Paso, *Sleumer & Verveorst 2910* (LIL, US). PCIA. CATAMARCA: Ambato, El Creston,

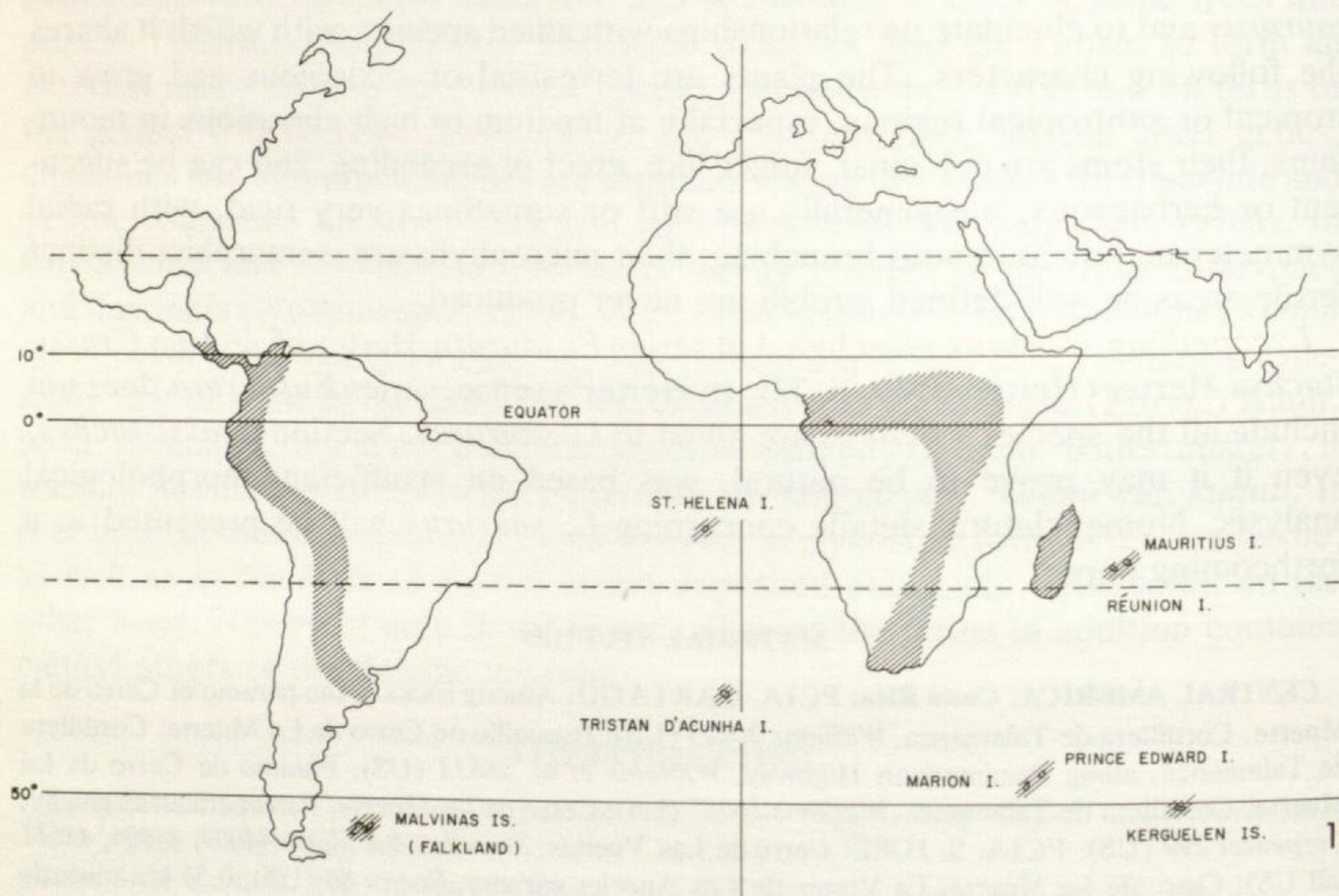


FIG. 1. Geographical distribution of *Lycopodium saururus*.

Castillon 11542 (LIL), *92290* (US 2084230); Andagalá, *Jörgensen 106* (SI); Capallan, Los Angeles, *Peyrano* (GH). PCIA. TUCUMÁN: Tafi, La Quenoa, *Parodi 18773* (GH); Tafi, Río Blanco, *Castillon* (LIL 92362); Tafi, Cumbre NE de La Ciénaga, *Schreiter 1031* (LIL); Tafi, Cumbre de Mala Mala, *Lillo 2720* (LIL); Tafi, Tafi del Valle, *Sparre 5724* (LIL); Tafi, Valle de San José, La Banderita, *Sparre 5904* (LIL); Tafi, La Hoyada, *Venturi 2848* (SI), *Castellanos 14616* (LIL); Tafi, Quebrada Honda, *Sparre 9274* (LIL); Tafi, Carapunco, Infiernillo, *Lamb 5389* (LIL); Río Chico, Escaba, *Monetti 1906* (LIL); Trancas, Las Burras, *Chavez* (LIL 442298); Chicligasta, La Pavas, *Castillon?* 3038 (GH, SI, US). PCIA. CÓRDOBA: Sierras de Córdoba, *Lorentz 1783* (US); Sierra de Achala, *Hieronymus* (US 1431706), *Hieronymus* (US 594600); Pampa de Achala, *Hunziker 1426* (US), *6477* (LP, US), *Rentzell* (SI, US).

ISLAS MALVINAS (FALKLAND ISLANDS): 1839-43 *Antarctic Expedition* (GH).

AFRICA: Ethiopia: East slopes of Mt. Delo, Amaro Mountains, southern Ethiopia, *Gillet 15048* (US). **Democratic Republic of the Congo:** Volcan Karisimbi, au NE du Lac Kivu, *Humbert 8567* (US); Mt. Kahuvi, W. of Lake Kivu, *Cambridge 1959 Congo Exped. 465* (US). **Kenya:** Aberdare Range, Mt. Aberdare, sul Kinangop, *Balbo 405* (US); Maibey Swamp, Cherangani Hills, *Tweedie 3400* (US) West slopes of Mt. Kenia, along the trail from West Kenia Forest Station to summit, *Mearns 1463, 1498, 1457* (all US).

MADAGASCAR: Iratsy, Massif de l'Andringitra, vallées de La Riambava et de l'Antsifotra, *Humbert 3925a, 3925b* (both US).

RÉUNION: "Pelousse altimontaine du Plateau Kerveguen," 2200 m alt, *Badré 936* (US).

KERGUELEN ISLAND: *Eaton* (GH).

PRINCE EDWARD ISLANDS: Marion Island, Challenger Exped., *Moseley* (GH).

GEOGRAPHICAL AND ALTITUDINAL DISTRIBUTION

Lycopodium saururus is confined almost exclusively to the southern hemisphere (*Fig. 1*). Its distribution is as follows.

In the New World, it grows from 10°N to 35°S Lat. in Costa Rica, Panama, and in the western Andean region of South America from Venezuela to northwestern Argentina, where it spreads eastward to the Sierras Subandinas and the Sierras Pampeanas of northwestern and central Argentina and the Sierras Australes (Ventania system) of Buenos Aires province. The connections between these ranges seem to be more or less clearly established (Frenguelli, 1950) and afford adequate geographic and ecologic continuity to the dispersal of this typically montane species.

TABLE 1. ALTITUDINAL RANGE OF *Lycopodium saururus* THROUGHOUT ITS GEOGRAPHICAL RANGE.

Region	Altitudinal range (m)
Central America	2500-3500
South America	
Andes	3000-5000
Sierras Subandinas	2000-4000
Sierras Pampeanas	1500-2500
Sierras Australes	1000-1200
Africa	2500-5000
Madagascar	2000-3500
Réunion	2200

In Africa it grows from 8°N to 36°S Lat. on the high mountains of the tropical and subtropical region, from southern Ethiopia (Aberdare Range) through Kenya, the Congo, Uganda, Zambia, Tanzania, and Rhodesia to South Africa (Cape Town, Natal).

Among the islands of the south Atlantic Ocean, it is known from 15°S to 37°S Lat. on St. Helena and Tristan d'Acunha. It occurs from 15°S to 50°S Lat. on the Indian Ocean islands of Réunion, Mauritius, Madagascar, Kerguelen, and Marion.

Lycopodium saururus inhabits exclusively medium- to high-elevation mountains, and has a wider range of elevation in continental areas than on islands (*Table 1*). The elevation range in America is wider than in Africa, although it is uncommon below 2000 m on both continents. The ecological continuity provided by the peripampasic arch (Frenguelli, 1950) or "arco serrano" (de la Sota, 1967) favors its appearance at greater latitudes and lower heights, down to the Sierra de la Ventana in Buenos Aires province.

ECOLOGY

Lycopodium saururus grows on permanently or densely clouded slopes or on those with a considerable seasonal rainfall. Occasionally it is found in more exposed areas with less humidity and higher radiation, but in this case the colonies are smaller, with lower density, and contain smaller plants.

Soil seems to be an important factor. *Lycopodium saururus* lives on acid, peaty soils rich in organic materials and which have abundant soil moisture, including swampy or periodically inundated places. Low temperatures do not seem to be a limiting factor, and plants can be found at high altitudes, although below the permanent snow line.

In Costa Rica and Panama *L. saururus* grows on high mountains and volcanos, on humid slopes protected by other plants or stones. In Costa Rica it grows on the "páramos without *Espeletia*" (Cuatrecasas, 1968), or pseudopáramos, marshes, or high swamps, associated with *Sphagnum*, or on open, grassy areas with species of *Chusquea*, *Senecio*, *Hypericum*, etc.

In Venezuela, Colombia, and Peru it grows in subpáramo, in the páramo proper,¹ and in superpáramo (Cuatrecasas, 1968), associated with the flora characteristic of each. It is more abundant in the páramo proper, where climatic, edaphic, and thermic conditions seem to be most favorable for its development.

In Peru, Bolivia, and Argentina it grows in humid puna and high mountain communities, generally on the eastern slopes of the Andes. On cloud-covered mountains in Peru and Bolivia it is associated with a rich flora of hepatics, pteridophytes, and angiosperms.

In northwestern Argentina it occurs in moorlands ("vegas de altura"), grassy swamp areas, or protected by stones near streambanks. In the Sierras Pampeanas and Australes, it occurs in similar situations, in grasslands, low woods, and in general near streams protected by other plants or rocks.

MORPHOLOGY AND DISTRIBUTION

Previous studies on the group (Rolleri, 1970, 1972, 1974, 1975, in press; de la Sota & Rolleri, 1972) have led to two main lines of analysis: the study of leaf morphology, especially the epidermis, stomata, and epidermic modifications, and the study of sporangium morphology, especially its epidermis. The former has been very useful in solving systematic problems because of specific and intra-specific variation of a certain number of characters useful in separating the species, subspecies, and varieties. Although studies of the latter kind are rare and mostly quite recent (Englert, 1925; Rolleri, 1972, 1974, 1975, in press; Øllgaard, 1975), these investigations are important because characters of the sporangium vary at the specific and infraspecific levels. It is also possible to determine the degree of maturity of the plant by knowing the stage of development of the

¹ In northern Peru, the term "jalca" is equivalent to what is termed páramo in central and southern Ecuador. Because the former is a vernacular term, I have adopted the latter, which has been scientifically defined.

sporangium wall (Rolleri, in press), which allows one to determine plants with incipient fertility or to recognize juvenile forms that resemble adult specimens (and so avoid these in taking measurements). The different stages of sporangium wall development can be correlated with definite stages of sporogenesis.

Both kinds of morphological studies are the basis for the present comparative study, which was carried out on *L. saururus* specimens from different parts of its distribution. Measurements were taken from 25 leaves from the median portion of each adult stem. Basal and terminal leaves were avoided to eliminate taking measurements from aged, modified, or juvenile leaves. Twenty-five stomata were measured on each of 25 leaves (625 stomata per branch) for diameters and density. The total of measured plants was 58 for America, ten for Africa and Madagascar, and one each for Réunion, Kerguelen, and the Prince Edward Islands. But on specimens borrowed from the Gray Herbarium (three for Venezuela and one each for Bolivia, the Malvinas, Kerguelen, and Prince Edward Islands), only the dimensions of the leaves were measured due to the impossibility of processing leaves for clearing.

The leaves of *L. saururus* are lanceolate and isomorphic (the sterile and fertile are alike), with straight to inflexed, acute apices. They are thick or nearly so, slightly succulent, and have a smooth, glossy surface and papillose margins. The leaves are smooth and convex on both faces, not keeled, erect and stiff but not rigid. They become papyraceous and break easily, when dry, and so differ from those of other allied species (e.g., *L. crassum* Humb. & Bonpl. ex Willd.), which are always coriaceous and very rigid, even when dry.

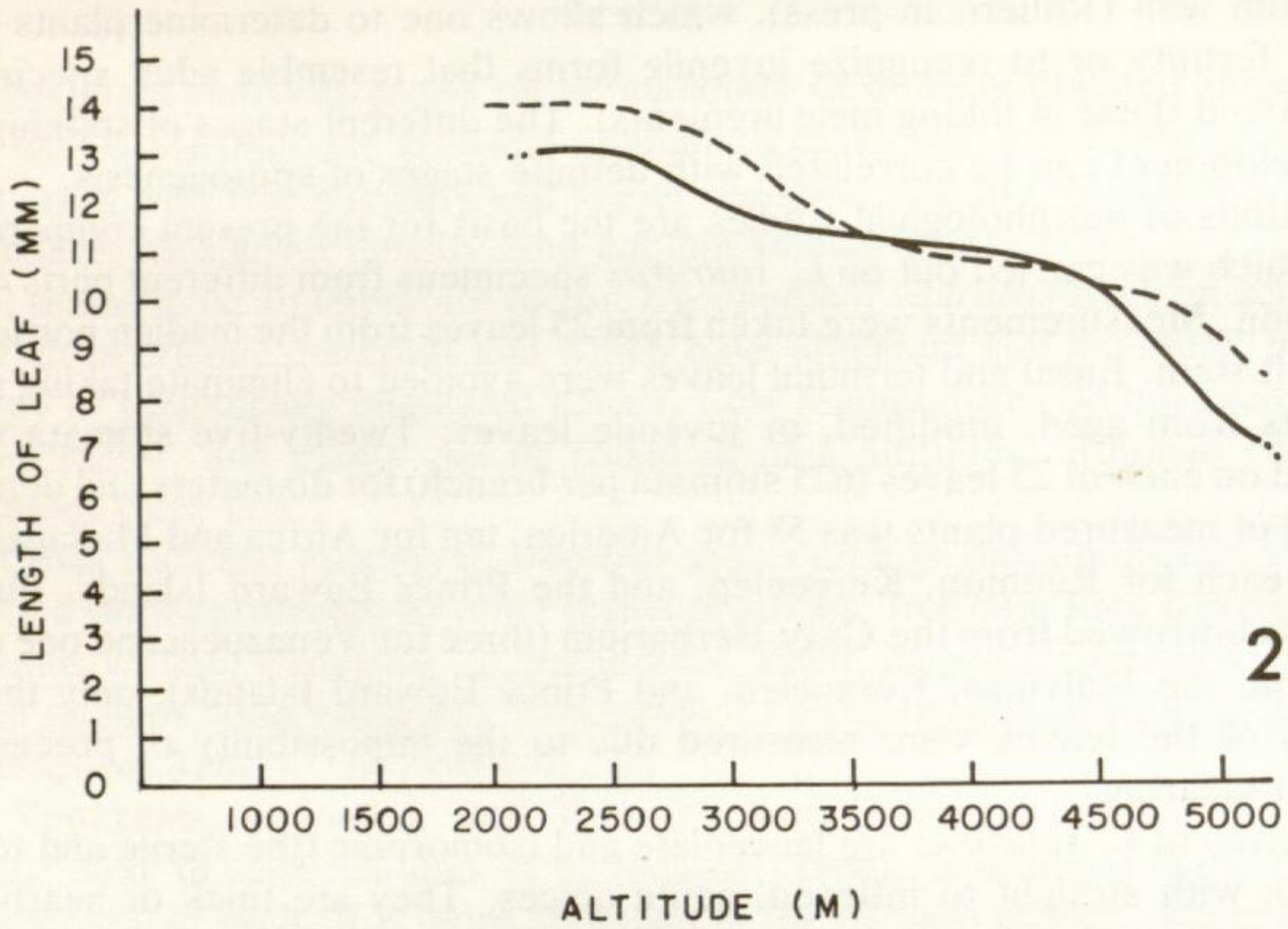
No noticeable modifications of shape are observed; this character, as well as the phyllotaxis, seems to be quite stable. Leaf length, on the other hand, varies in relation to elevation, both in America and in Africa and Madagascar (*Fig. 2*).

Similarly, plant height seems to diminish with elevation. *Figure 3* shows this in African populations. The lack of reliable data from American specimens makes a generalization impossible.

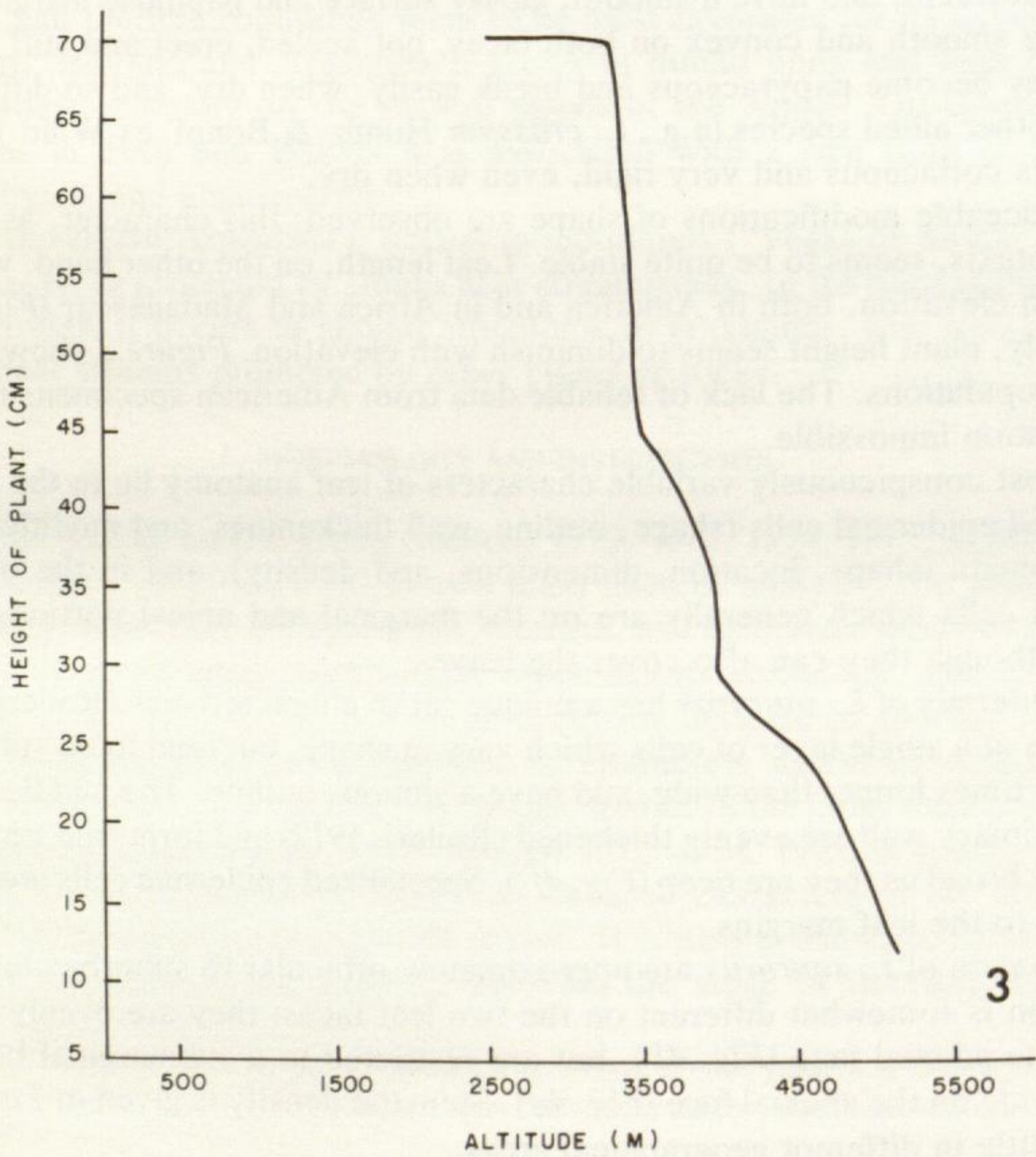
The most conspicuously variable characters of leaf anatomy lie in the typical, unmodified epidermal cells (shape, outline, wall thickenings, and modifications), in the stomata (shape, location, dimensions, and density), and in the modified epidermal cells which generally are on the marginal and apical portions of the leaves, although they can also cover the leaves.

The epidermis of *L. saururus* has a unique set of characteristics (Rolleri, 1972). It consists of a single layer of cells which vary in shape, but tend to be subrectangular, 2-3 times longer than wide, and have a sinuous outline. The middle lamella and the primary wall are evenly thickened (Rolleri, 1972) and form true sinuosities that are as broad as they are deep (*Fig. 4f*). Specialized epidermic cells always are restricted to the leaf margins.

The stomata of *L. saururus* are approximately orbicular to suborbicular. Their distribution is somewhat different on the two leaf faces: they are evenly distributed on the adaxial face (*Fig. 4b*), but are restricted to a submarginal band 3-5 stomata wide on the abaxial face (*Fig. 4a*). Stomatal density is given in *Table 2*; it varied a little in different geographical areas.



2



3

The width of the stomatic band on the abaxial face is given in *Table 2*. The larger numbers are found at the leaf base. Stomatic dimensions (longer \times shorter diameter) are also given in *Table 2*. In American specimens, the stomata are relatively narrower than they are in specimens from other areas.

The most remarkable character of the leaves of *L. saururus* is the peculiar morphology of the margins (*Fig. 5*). The mechanical marginal cells are quite different from the adjacent cells. They protrude, have very thick walls, are fusiform, tracheiform, or resemble blunt papillae, and project laterally or upwards. Their cell walls have large pits and sometimes are rugulose or have wrinkled surfaces. Several rows of these cells are clearly observable on both faces of the leaf.

TABLE 2. RELATIONSHIP OF STOMATAL DENSITY, ABAXIAL STOMATAL BAND WIDTH, AND STOMATE SIZE OF *Lycopodium saururus* THROUGHOUT ITS GEOGRAPHICAL RANGE.

Region	Density on adaxial face ¹	Density on abaxial face ¹	Width of band ²	Size on adaxial face ³	Size on abaxial face ³
America	(7)13(15)	(5)7(9)	3-5(7)	(62)72(74) \times (43)48(52)	(63)67(72) \times (45)49(51)
Africa & Madagascar	(9)13(16)	(5)8(9)	2-5(7)	(65)72(74) \times (48)54(58)	(62)67(72) \times (48)55(58)
Réunion	(9)12(15)	(5)9(10)	3-5(8)	(64)68(70) \times (50)53(56)	(62)66(70) \times (50)54(56)

¹Number per 0.25 mm² based on 25 counts on each of 25 leaves; extreme and mean values are given.

²Number of stomates across width of band based on 25 counts on each of 25 leaves; usual and extreme values given.

³Length and width in μ m based on 25 stomates on each of 25 leaves; extreme and mean values given.

The combination of epidermal pattern and papillose margin identifies the leaves of *L. saururus* and clearly differentiates them from those of related species, which have a smooth and glossy epidermis. Both character states are stable, and no modifications have been observed with variations in elevation, latitude, or geographic area.

In sect. *Crassistachys*, epidermal modifications are frequent along the margin and rare on the surface. In certain cases, armored margins appear combined with superficial mechanical reinforcements composed of groups of fusiform cells located on the abaxial face. The cells of these groups are morphologically similar to the marginal ones and project above the general level of the epidermis. Such an epidermic modification of the abaxial face gives the texture and coriaceous consistency to *L. crassum* leaves.

The sporangium wall probably will prove to be an important character in the morphology and systematics of sect. *Crassistachys*. In *L. saururus* the most

FIG. 2. Relationship of altitude and leaf length in *Lycopodium saururus* from the Americas (broken line) and from Africa and Madagascar (solid line). FIG. 3. Relationship of altitude and plant height in *L. saururus* from Africa.

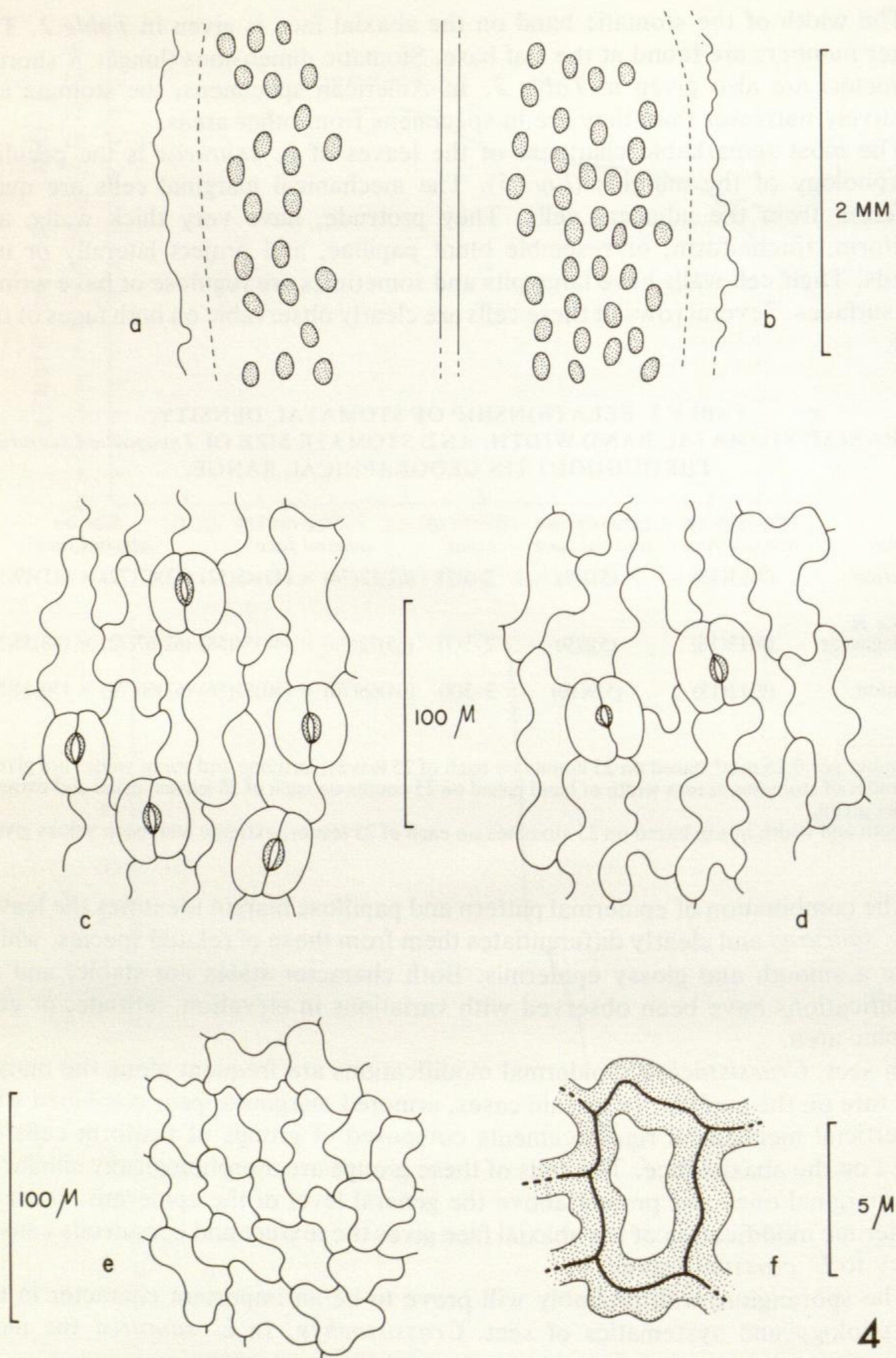


FIG. 4. Stomates and epidermal cells of *Lycopodium saururus*. FIG. 4a. Distribution of stomates on the abaxial leaf face. FIG. 4b. Same, adaxial leaf face. FIG. 4c. Abaxial epidermis. FIG. 4d. Adaxial epidermis. FIG. 4e. Sporangium epidermis. FIG. 4f. Detail of sporangium epidermal cell.

prominent traits of the sporangium wall are subrectangular cells 1-2 times longer than wide, with sinuous and remarkably thickened cell walls (thickenings 3-6 μm wide). The sinuosities are uniformly thick, shallow, and rather irregular (Figs. 4e, f).

Although the saxicolous species and some of the epiphytic ones share a similar sporangium wall morphology, a detailed analysis of the epiphytic species shows variations at the species level in cell outline and shape, sinuosities, and wall thickenings. In the specimens of *L. saururus* analyzed, no observable variation was found in the sporangium wall; the basic morphological characters of cell shape, outline (sinuosities), and wall thickening (width and uniformity) do not seem to be affected appreciably by the ecological variables.

CONCLUSIONS

Certain foliar characters of *L. saururus* are independent with respect to environmental variables. These include leaf shape, texture, phyllotaxis, stomate size, and epidermal and marginal cell structure.

Other characters, such as leaf length and, in certain cases, plant size, show variation that seems to correlate with elevation (Figs. 2 and 3). Plants growing at 4,000-5,000 m elevation have shorter leaves than those growing at lower elevations. The change in leaf length with respect to altitude is less in plants growing below 4,000 m elevation. Above that height, leaf length diminishes quickly with increasing elevation. Plant size is smaller with increasing elevation (Fig. 3). These conclusions coincide with those of Schelpe (1951) for plant communities for Mt. Kenya. He reported a marked diminution in *L. saururus*, from 60-70 cm for those growing in the upper level of the forest (2,500 m elev) to 10-12 cm for those living at the top "moorlands" (5,100 m elev). A similar situation seems to occur in American material of this species, but the scarcity of reliable data (many herbarium specimens have only fragments of branches) does not permit comparisons to be made.

Soil is a factor that seems to be important. Together with elevation, it defines the ecological trends of this species and its affinity for mountainous environments, in continental as well as in insular environments. Schelpe (1951) mentioned the general diminution of plant size where the plants or the soil they have been growing on has been affected by fire.

Lycopodium saururus is typically a montane plant and has a wide range of elevational tolerance, as shown in the relative stability of the aforementioned characters between elevations of 1,000 and 3,800 m.

This species has rather marked edaphic preferences with respect to nutrients, acidity, and regularity of soil moisture. Communities or specimens from loose and poor soils are reduced and dwarfed, and so are comparable to those growing at higher elevations.

Except for the aforementioned characters, the morphological variation of *L. saururus* is not very great, considering its wide distribution. Latitude does not alter the general proportions as elevation does, probably because the plants are

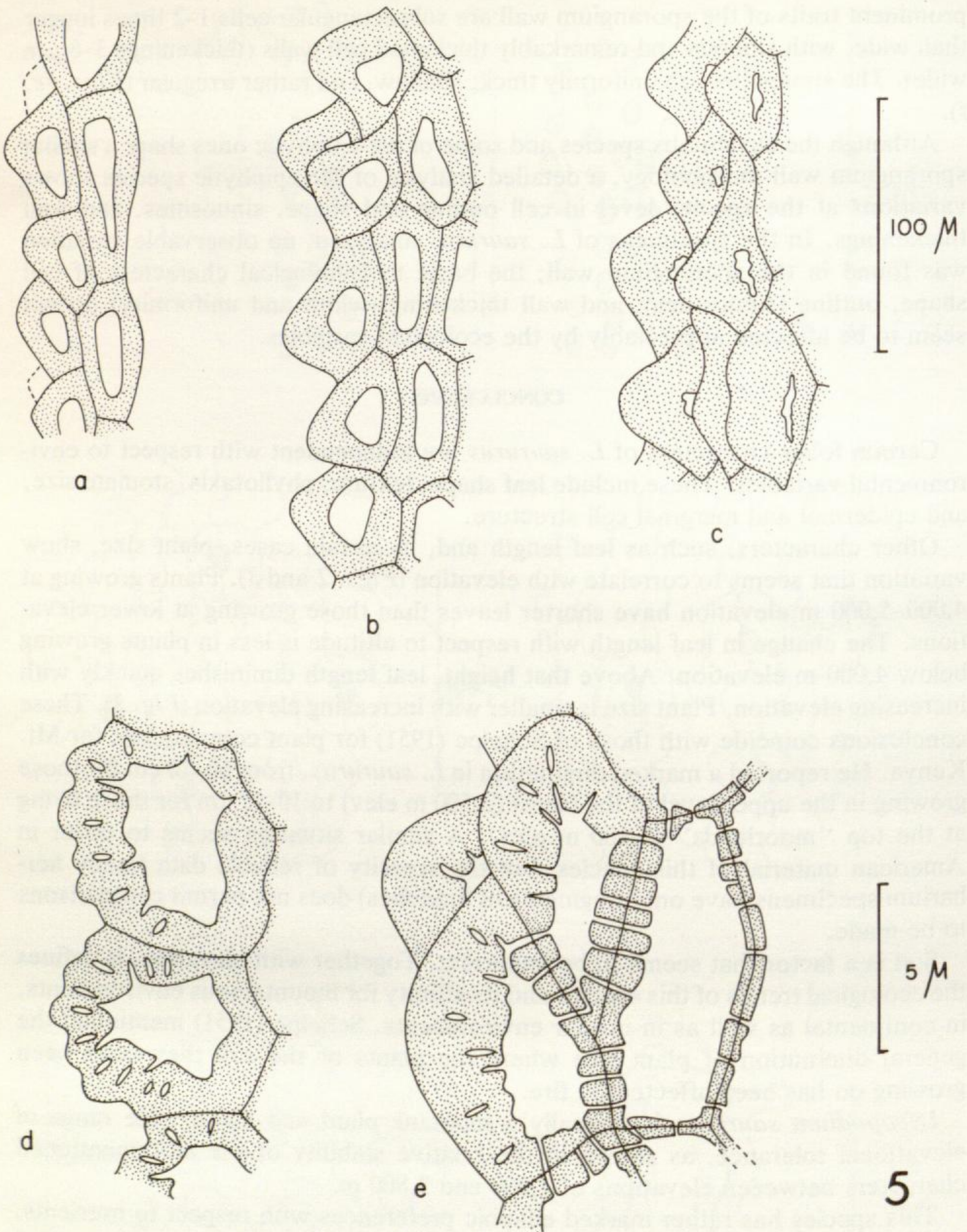


FIG. 5. Leaf margins in *Lycopodium saururus*. FIG. 5a. Near leaf apex. FIG. 5b. In median portion. FIG. 5c. Near leaf base. FIG. 5d. Detail of marginal cells in the apical and median portions. FIG. 5e. Detail of marginal cells near the leaf base.

confined to a single habitat which occurs as a geographical continuity, thus creating a migratory route of ample latitudinal range.

The variable morphological characters are not markedly modified with changes in environment or geographic area, and the morphological variation is statistically very low, considering the enormous distribution of this species. Given such variation, the strong disjunction, and the morphological correlations, the consideration of *L. saururus* as a species complex or the introduction of infraspecific categories is not justifiable. According to the preliminary morphological evidence, *L. saururus* is a homogeneous, relatively stable species with marked ecological preferences and a peculiar geographical distribution.

ACKNOWLEDGEMENTS

The research in this paper was carried out during 1975-76 at the U.S. National Herbarium, National Museum of Natural History, Smithsonian Institution, where I was a post-doctoral fellow and where I also had a grant from the Council for International Exchange of Scholars, Fulbright Commission. I wish to thank the curators of the following herbaria for lending specimens: Gray Herbarium (GH), Instituto y Fundación "Miguel Lillo" (LIL), Museo de La Plata (LP), New York Botanical Garden (NY), Instituto de Botánica "Darwinion" (SI), and Herbario Nacional de Venezuela (VEN). I am grateful to Bernardo Dougherty, who made the first translation of this manuscript into English, and to Betty Meggers and Clifford Evans, Dept. of Anthropology, Smithsonian Institution, who reviewed it and offered helpful comments. Thanks are also due to Dr. Elías R. de la Sota, Museo de La Plata, and to Dr. José Cuatrecasas, Dept. of Botany, Smithsonian Institution, for their important suggestions. George Robert Lewis, Dept. of Anthropology, Smithsonian Institution, did the careful inking of the original drawings and graphs.

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Motozi Tagawa (1908-1977)

Dr. Motozi Tagawa was born in Osaka, Japan on April 11, 1908. During his high school years he developed an interest in fern taxonomy, and entered Kyoto University to learn plant taxonomy under Dr. G. Koidzumi. In the 1930's, when he started his botanical career, Japanese ferns were known quite insufficiently. He had to collect and identify the ferns even around Kyoto, and he described a number of new species that were based on specimens he collected in or near Kyoto. Naturally, his work was extended to include the ferns from every part of Japan, and he made a field trip to Yakushima Island in 1933 and to Taiwan three times between 1934 and 1940. Based on his own collections, as well as those sent to him from various parts of Japan, he developed greatly our knowledge of Japanese ferns. In 1959 he published a comprehensive "Coloured Illustrations of the Japanese Pteridophyta," which is a monumental work on the taxonomy of Japanese ferns and fern allies, although the text is in Japanese.

In 1965 Dr. Tagawa started to lead a project on the study of southeastern Asian flora. He made field trips to Thailand three times during 1965-1967 and published various papers on the ferns from Southeast Asia, making a great contribution to the flora of that area.

He took a part in the foundation of the Phytogeographical Society in 1932 and served as a member of the editorial board for "Acta Phytotaxonomica et Geobotanica" for about 45 years. The Japanese Pteridological Society was founded in 1957. It was proposed by Dr. H. Ito, the late Dr. S. Momose, and Dr. M. Tagawa, who served as its secretary for the first ten years. Dr. Tagawa belonged to the faculty of Kyoto University throughout his botanical life, and retired from the professorship of botany in 1972.

Dr. Tagawa died rather suddenly on July 19, 1977, of heart disease. By his death we will miss his knowledge of Asiatic pteridophytes very much. He prepared a great number of fine specimens which were distributed to various herbaria throughout the world. The life and work of Dr. Tagawa will be published in more detail in volume 29 of "Acta Phytotaxonomica et Geobotanica," along with a list of his main publications.—K. Iwatsuki, Department of Botany, Faculty of Science, Kyoto University, Kyoto 606, Japan.