LEAF CUTICULAR DYNAMICS IN DISJUNCT POPULATIONS OF *PASSIFLORA INCARNATA* L.

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ABSTRACT—Leaf cuticular features of two disjunct populations of *Passiflora incarnata* L. were studied to determine the constancy of cuticular features in the species. Plastic imprints of the cuticle were prepared according to the method of Williams. Microscopic analysis of the abaxial leaf surface cuticular feature data of the two plant populations revealed that stomatal frequency, stomatal length and width, trichome length, and epidermal cell undulation were inconsistent. However, trichome type and subsidiary cell complex were consistent in the two disjunct plant populations of this taxon.

Passiflora incarnata L. is an attractive flowering vine. The flowers are showy and fragrant. The fruit is edible (Steyermark, 1996). The plant is widely distributed in many parts of the world. The present study was conducted to determine the constancy of cuticular features in two isolated disjunct populations of passion flower (*Passiflora incarnata* L.). Cuticular features are regarded as important taxonomic tools. Stebbins and Khush (1961) emphasized the taxonomic usefulness of cuticular features at generic and familial levels. Stace (1965) indicated their application in taxonomic research and phylogenetic interpretations. Furthermore, their significance in taxonomic and pharmacological investigations has been studied for years (Fritsch, 1903; Sharma, 1972, 1983; Sharma and Lewis, 1987; Sinclair and Sharma, 1971; Timmerman, 1927; Watson, 1962). Recently, Paoletti and Gellini (1993) discussed the stomatal density variation in beech and holm oak leaves. Sharma and Jones (2002) studied the cuticular features of disjunct populations of white clover.

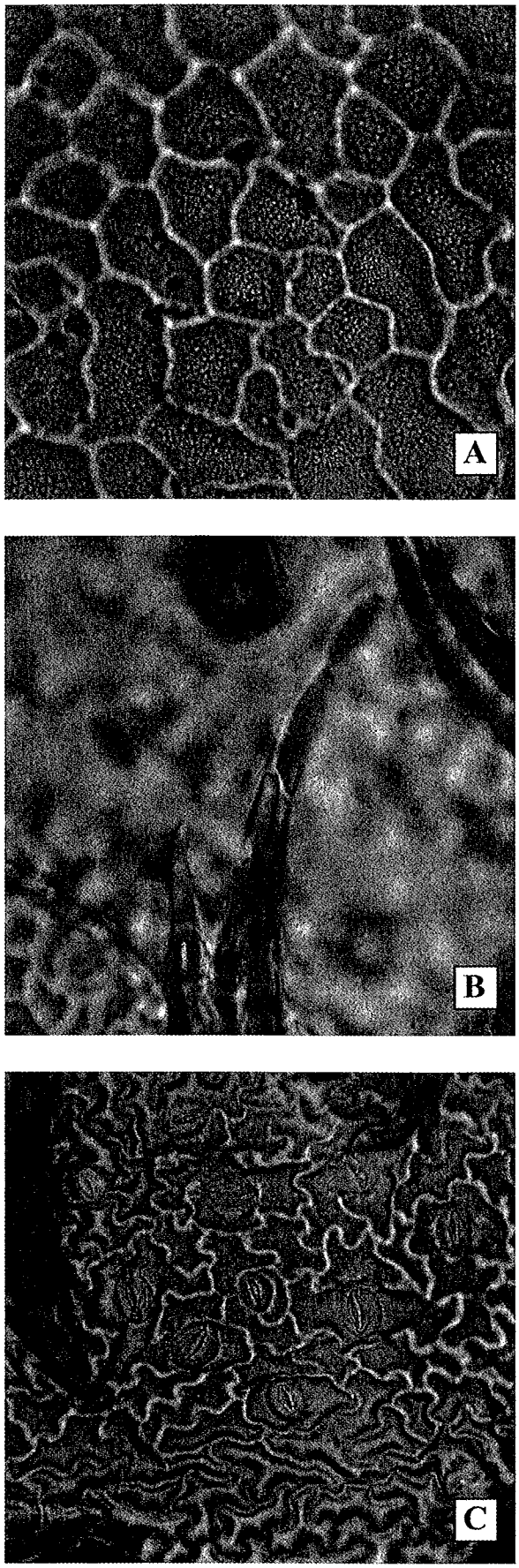
MATERIALS AND METHODS

Five plants of passion flower vine were sampled for each population. Population A was growing in a pristine habitat in Ladakh in the central Himalayas at 31°55′ N longitude and 77°41′ E latitude. Population B was sampled from a rural habitat in Martin, Tennessee (36°21′ N longitude and 88°51′ W latitude). The two disjunct populations represented a great diversity in both microhabitat and macrohabitat conditions. Five mature leaves were selected from each plant population for preparing leaf cu-

TABLE 1. Distribution of abaxial leaf cuticular features[a] of populations of *Passiflora incarnata* L.

Trait/Population	A Himalayas, Ladakh	B Martin, Tennessee, USA
Stomatal frequency[b]	35.6 ± 3.0	44.4 ± 8.1
Stomatal length (μm)		
Largest stoma	48.5 ± 4.2	25.5 ± 1.7
Smallest stoma	27.8 ± 4.2	16.5 ± 2.3
Stomatal width (μm)		
Largest stoma	27.2 ± 3.0	18.1 ± 2.2
Smallest stoma	17.5 ± 3.2	13.3 ± 1.4
Trichome length (μm)		
Longest trichome	100.2 ± 42.2	215.5 ± 61.4
Shortest trichome	66.2 ± 11.4	79.2 ± 23.5
Trichome type	Unicellular, multicellular	Unicellular, multicellular
Epidermal cell undulations (number)	6.4 ± 0.6	4.5 ± 0.6
Subsidiary cell complex (cells)	3	3

[a] Values are means ± *SD*, $n = 20$.
[b] Mean stomatal frequency = stomata of the leaf surface observed through a 40× objective and 10× oculars (field area = 0.152 mm²).



ticular slides. The leaves were washed with distilled water and mild detergent. Upon air-drying, a few drops of Duco cement were applied to the abaxial leaf surfaces. The air-dried strips of Duco cement showing the cuticular impressions were removed (Williams, 1973). A small portion of the strip showing the central portion of the leaves was used to make slides for cuticular analysis. Stomatal frequency, stomatal length and width, trichome length, trichome type, epidermal cell undulation, and subsidiary cell complex were studied by randomly selecting 20 fields (n = 20) from microscope slides with a 40× objective and 10× oculars (field area = 0.152 mm^2). It should be noted that all counts were made in the intercoastal areas since stomata are usually absent over the veins. Photomicrographs of the cuticular imprints were taken (Fig. 1), and the data are shown in Table 1.

RESULTS

Analysis of the cuticular data (Table 1) shows that the stomatal frequency values from the abaxial leaf surfaces of the two populations ranged from 35.6 per unit area; 0.152 mm^2 in population A to 44.4 in population B from Martin, Tennessee. Stomatal length of the largest stoma ranged from 25.5μ in population B to 48.5μ in population A from the Himalayas. Similarly, the length of the smallest stoma ranged from 16.5μ in population B to 27.8μ in population A. Stomatal width values for the largest stoma were 18.1μ and 27.2μ in populations B and A respectively. Width of the smallest stoma was 13.3μ in population B from Martin, while population A from the Himalayas had a value of 17.5μ. Stomatal length and width values for both the largest and the smallest stoma are higher in population A from the Himalayas than population B from Martin, Tennessee. The leaves were fairly glabrous, although a few unicellular and multicellular trichomes were found in both the plant populations (Fig. 1B). However, the length of the shortest trichome ranged from 66.2μ in population A from the Himalayas to 79.2μ in population B. Similarly, the length of the longest trichome was 100.2μ in population A, while population B from Martin, Tennessee had a value of 215.5μ for the same feature. Again, the trichome types were unicellular and multicellular in both the populations. The epidermal cell undulations exhibited variation in the two populations. Population B had fewer (4.5) undulations (Fig. 1A), while population A from the Himalayas had more (6.4) epidermal cell undulations (Fig. 1C). Three small cells remaining beside a stoma may be interpreted as a subsidiary cell complex (Fig. 1C). The relationship in terms of proximity is basically the same as that of the cells consistently acknowledged to be subsidiary cells. It remained the same in both the populations of passion flower.

DISCUSSION

This investigation indicated several cuticular variations exhibited by two disjunct populations of passion flower growing in two widely separated regions characterized by diverse environmental conditions. These environmental-induced variations,

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FIG. 1. Abaxial leaf surface of *Passiflora incarnata* L. All photographs are the same magnification (267×). (A) Epidermal cell undulations. (B) Unicellular and multicellular trichomes. (C) Subsidiary cell complex.

therefore, suggest ecotypic and evolutionary significance. However, the consistency of trichome types and subsidiary cell complex in the two populations of passion flower suggests that these cuticular features are reliable taxonomic characters in this taxon. Additional taxa are under investigation to determine the significance of leaf cuticular dynamics in taxonomic investigations.

LITERATURE CITED

FRITSCH, F. B. 1903. The use of anatomical characters for systematic purposes. New Phytol., 2:177–178.

PAOLETTI, E., AND R. GELLINI. 1993. Stomatal density variation in beech and holm oak leaves collected over the last 200 years. Acta Oecologica, 14:173–178.

SHARMA, G. K. 1972. Environmental modifications of leaf epidermal and morphological features in *Verbena canadensis*. Southwestern Naturalist, 17:221–225.

SHARMA, G. K. 1983. Cuticular differentiation in *Lamium amplexicaule* L. and *Lamium purpureum* L. J. Tennessee Acad. Sci., 58:43–45.

SHARMA, G. K., AND P. B. LEWIS, 1987. Cuticular differentiation in *Kalanchoe fedschenkoi* and *Kalanchoe daigremontiana* (Crassulaceae). J. Tennessee Acad. Sci., 62:97–98.

SHARMA, G. K., AND C. JONES. 2002. Leaf cuticular dynamics in disjunct populations of *Trifolium repens* L. J. Tennessee Acad. Sci., 77:61–63.

SINCLAIR, C. B., AND G. K. SHARMA. 1971. Epidermal and cuticular studies in leaves. J. Tennessee Acad. Sci., 46:2–11.

STACE, C. B. 1965. Cuticular studies as an aid to plant taxonomy. Bull. British Mus. Nat. Hist. Series E, 3:1–78.

STEBBINS, G. L., AND G. S. KHUSH. 1961. Variation in the organization of stomatal complex in the leaf epidermis of monocotyledons and its bearing on their phylogeny. Amer. J. Bot., 48:51–60.

STEYERMARK, J. A. 1996. Flora of Missouri. Iowa State Univ. Press, Ames, Iowa.

TIMMERMAN, T. A. 1927. Stomatal numbers: their value for distinguishing species. Pharm. J. Pharmacist, 118:241–243.

WATSON, K. 1962. The taxonomic significance of stomatal distribution and morphology in Epacridaceae. New Phytol., 61: 36–40.

WILLIAMS, J. A. 1973. A considerably improved method for preparing plastic epidermal imprints. Bot. Gaz., 134:87–91.

JOURNAL OF THE TENNESSEE ACADEMY OF SCIENCE 78(4):122–123 OCTOBER 2003

THE ACADEMY'S LOST SECTION

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ABSTRACT—The Psychology Section of the Tennessee Academy of Science formed in 1948. In 1950 some section members helped organize the Tennessee Psychological Association and then left the Academy. They requested that the Executive Committee disband the section and make the Tennessee Psychological Association an affiliated society. The Committee granted affiliate status but declined termination. In 1951 and 1952 new leaders offered successful psychology programs but the Section's long-term prospects seemed limited. In 1953 the Executive Committee recognized that the Section no longer existed. Psychology is the Academy's only abandoned disciplinary section.

In 1913 the editor of the Tennessee Academy of Science issued a serial publication, *Science Record* (Corgan, 1985). It had disciplinary editors, including one for psychology. In the early decades of the Academy's *Journal,* there were articles on psychology (Peterson, 1932). By the early 1920s, academies in other states had psychology or social science sections (Self, 1981) but the Tennessee Academy did not. In 1920, the Tennessee Academy began regional sections centered in large cities (Corgan, 2002). In 1926 a new constitution made disciplinary sections possible but for many years there was no effort to establish a psychology section. Today, psychology papers continue in Collegiate Division sessions. Thus psychology has always been part of Academy programs. Although a Psychology Section is no longer a routine component of annual meetings, the Academy once had a vigorous Psychology Section.

In the early 1940s, the Academy's infrastructure expanded, establishing sections for Chemistry (Corgan, 1987*a*), Mathematics (Corgan, 1987*b*), and Zoology (Butler and Corgan, 1987). This trend continued in March of 1947 when James H. Elder, a psychologist from the University of Tennessee, met with the Executive Committee to propose a Psychology Section. The history of this section is recorded in the Academy's archives, housed in the Tennessee State Archives in Nashville. History also is recorded in the Academy's published proceedings for 1947–1953 (Quarterman, 1953; Rusk, 1949, 1950; Smith, 1951, 1952; Tipton, 1954; Wall, 1948). All sources were examined in preparing the present text.

In 1948 Elder presented the Executive Committee with a formal petition for the creation of a Psychology Section. It was approved by the Committee and by a business meeting prior to the 1948 session. The Section's initial program was successful (Fig. 1). Prospects seemed bright, especially since Elder joined the Executive Committee to lead the Academy's recruitment efforts.

LATER DEVELOPMENTS

In August 1949, Elder left the Academy. Stanford C. Erickson, of Vanderbilt University, became chairman of the section, continuing into the next year. In 1950 Erickson also chaired a newly formed Tennessee Psychological Association (TPA). Some psychologists left the Academy following the creation of TPA. This erosion of membership was the reason Psychology did not have a program in 1950 (Fig. 1).

Many psychologists felt Tennessee needed a society exclusively for psychologists. Some who held this view also wanted to disband the Academy's Psychology Section. In 1950 Erickson approached the Executive Committee with a request for formal termination of the section. He also wanted to have TPA recognized as an independent society that was an affiliate of the Academy. His requests were made, at least in part, because TPA wished to join the American Psychological Association. Apparently the American Psychological Association wanted member societies to be autonomous rather then sections within other organizations. The Tennessee Psychological Association met the requirement for independence, and its leaders hoped to make it the only clear voice for psychologists in Tennessee.

Initially the Executive Committee approved affiliate status for TPA but was unwilling to disband a successful section. In 1951 and 1952, they tried to rebuild the section (Fig 1). Programs were successful. Still, long-term prospects seemed dim. When the Executive Committee discussed this matter in 1953 they concluded that the Psychology Section had ceased to exist. The Committee reaffirmed the affiliate status of TPA. Executive Committee interest in a Psychology Section languished until the late 1980s. Then, the present author guided a sustained Executive Committee effort to establish new sections, including a Psychology Section (Nelson, 1989; 1990). For Psychology, the effort failed, apparently because TPA met the needs of Tennessee psychologists. This Association continues as an affiliate that is rooted in the membership of the Academy.

ACKNOWLEDGMENT

I am indebted to the editor of this journal and to two anonymous readers for aid. This text is part of a general study of Academy history supported by the Academy (Nelson, 1984). A first-draft manuscript was ready for the 75th anniversary in 1987. Publication was not possible. Three papers appeared (Corgan, 1988; 1998; 2002). A report by Butler and Corgan (1987) is

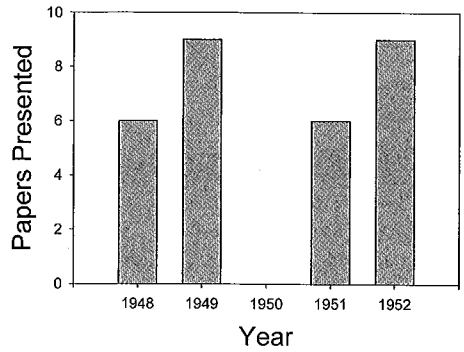

FIG. 1. Activity of the Psychology Section at annual meetings, based on Academy proceedings cited in this paper. In 1949 the Section had one formal talk and two roundtables with eight major participants. This program seems equivalent to nine talks.

typical of nineteen talks on Academy history that were presented at sectional meetings and published in abstract form.

LITERATURE CITED

BUTLER, J. L., AND J. X. CORGAN. 1987. History of the Zoology Section, 1944–1986. J. Tennessee Acad. Sci., 62:42. [Abstract.]

CORGAN, J. X. 1985. The Academy's First Publication: The Science Record. J. Tennessee Acad. Sci., 60:38. [Abstract.]

———. 1987*a*. A History of the Chemistry Section, 1940–1986. J. Tennessee Acad. Sci., 62:33. [Abstract.].

———. 1987*b*. The Academy's Mathematicians, 1940–1986. J. Tennessee Acad. Sci., 62:37. [Abstract.]

———. 1988. Fifty years of the Geology and Geography Section, 1937–1986. J. Tennessee Acad. Sci., 63:73–76.

———. 1998. Tennessee Academy of Science P. 918–919 *in* Encyclopedia of Tennessee History and Culture. (Carroll Van West, ed.), Nashville.

———. 2002. Leaders of the Tennessee Academy of Science, 1912–1936: An overview and bibliography. J. Tennessee Acad. Sci., 76:85–90.

NELSON, D. R. 1984. Proceedings of the Tennessee Academy of Science 1983. J. Tennessee Acad. Sci., 59:2–14.

———. 1989. Proceedings of the Tennessee Academy of Science 1988. J. Tennessee Acad. Sci., 64:30–35.

———. 1990. Proceedings of the Tennessee Academy of Science 1989. J. Tennessee Acad. Sci., 65:30–37.

PETERSON, J. 1932. The Training and Research Activities of Teachers of Psychology in the United States. J. Tennessee Acad. Sci., 7:120–121.

QUARTERMAN, E. 1953. Proceedings of the Tennessee Academy of Science for 1952. J. Tennessee Acad. Sci., 28:124–145.

RUSK, W. R. 1949. Proceedings of the Tennessee Academy of Science for 1948. J. Tennessee Acad. Sci., 24:94–113.

———. 1950. Proceedings of the Tennessee Academy of Science for 1949. J. Tennessee Acad. Sci., 25:258–274.

SELF, J. T. 1981. The Oklahoma Academy of Science: A History. Proceed. Oklahoma Acad. Sci., 61:90–102.

SMITH, A. I. 1951. Proceedings of the Tennessee Academy of Science for 1950. J. Tennessee Acad. Sci., 26:135–155.

———. 1952. Proceedings of the Tennessee Academy of Science for 1951. J. Tennessee Acad. Sci., 27:109–125.

TIPTON, I. H. 1954. Proceedings of the Tennessee Academy of Science for 1953. J. Tennessee Acad. Sci., 29:126–147.

WALL, J. G. 1948. Proceedings of the Tennessee Academy of Science for 1947. J. Tennessee Acad. Sci., 23:156–168.