ENVIRONMENTAL EFFECT ON LEAVES OF *DIPLANTHERA* DU PETIT-THOUARS[1]

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ABSTRACT

Diplanthera was collected from three tidal zones from various Florida locations. Three growth conditions were found which corresponded to these tidal zones. The first, found in areas exposed at both neap and spring low tides, consisted of dwarf-sized plants. The second, found in areas exposed only at spring low tides, were intermediate in size between the first and third classifications. The third condition, found in areas never exposed, displayed plants of luxuriant size. Leaf length, leaf width, rhizome thickness, and rhizome internode length were found to be affected by the environment. The two vegetative characters of leaf apex and internal cellular anatomy were considered by Sauvageau (1890) and later substantiated by Feldmann (1938) as valid for the separation of the two species of *Diplanthera, D. uninervis* and *D. wrightii*. The author found that these factors were variable in *D. wrightii*, according to the tidal zone in which the plants were found. It is concluded that these two characters are not valid for distinguishing the two species.

INTRODUCTION

The two described species of *Diplanthera (D. uninervis* (Forsk.) Aschers. and *D. wrightii* Aschers.) closely resemble each other. Feldmann (1938) stated that it was very difficult to distinguish between the two species in the sterile condition. Sauvageau (1890), however, found that the leaves differ in two ways. At the apex of mature leaves of *D. uninervis,* three points were found (Fig. 1a). These points represent the extension of the three leaf vascular bundles beyond the regular leaf tissue. In *D. wrightii* the midvein in the center of the leaf did not project out. The leaf apex is thus V-shaped (Fig. 1b). Only in very young leaves of *D. wrightii* is a small round point found terminating the midvein. These later decay and fall off, according to Sauvageau *(op. cit.).* Feldmann *(op. cit.)* found that mature leaves of *D. wrightii* from Mauritius and Guadeloupe lacked the projection in the center of the leaf apex. The other difference was observed by taking a transverse section of a mature leaf immediately above the ensheathing portion. Sauvageau *(op. cit.)* found intercellular spaces between the cells situated above and below the median vascular bundle in mature leaves of *D. uninervis* (Fig. 3). In *D. wrightii* these spaces became well defined lacunae (Fig. 2). Feldmann *(op. cit.)* found this latter structure in

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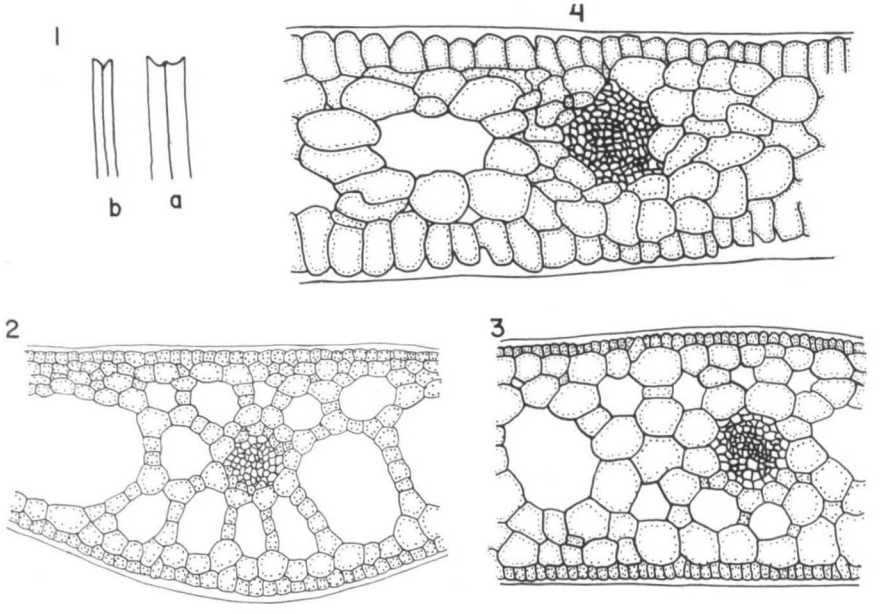


FIGURE 1. Leaf apices of *Diplanthera* (after Sauvageau, 1890). a. Apex of *D. uninervis* leaf, 6X. b. Apex of *D. wrightii* leaf, 6X.
FIGURES 2-3. X-section of *Diplanthera* leaves at base, just above the ensheathing portion. (after Sauvageau, 1890). 500X. Fig. 2. *D. wrightii*. Note large, conspicuous lacunae surrounding midvein. Fig. 3. *D. uninervis*. Note absence of large conspicuous lacunae.
FIGURE 4. X-section of *D. wrightii* leaves at base, just above the ensheathing portions. From zone exposed to air at all low tides, Beach Drive, SE, St. Petersburg, Tampa Bay, October 17, 1958. 640X.

plants collected at Mauritius and Guadeloupe. This zone of intercellular spaces and lacunae around the midvein, according to Sauvageau *(op. cit.)*, was narrow. At a level slightly above the ensheathing portion of the leaf the structure of each species became identical. This condition persisted all the way to the leaf apex. The structure at the apex, a genus characteristic, consisted of two internal layers of cells, in contact with and opposite each other, between the upper and lower epidermal cell layers.

DISCUSSION

In the course of research on Florida seagrasses, *Diplanthera* was collected from many locations. It is generally accepted that *Diplanthera wrightii* is the correct name for the species found in Florida and

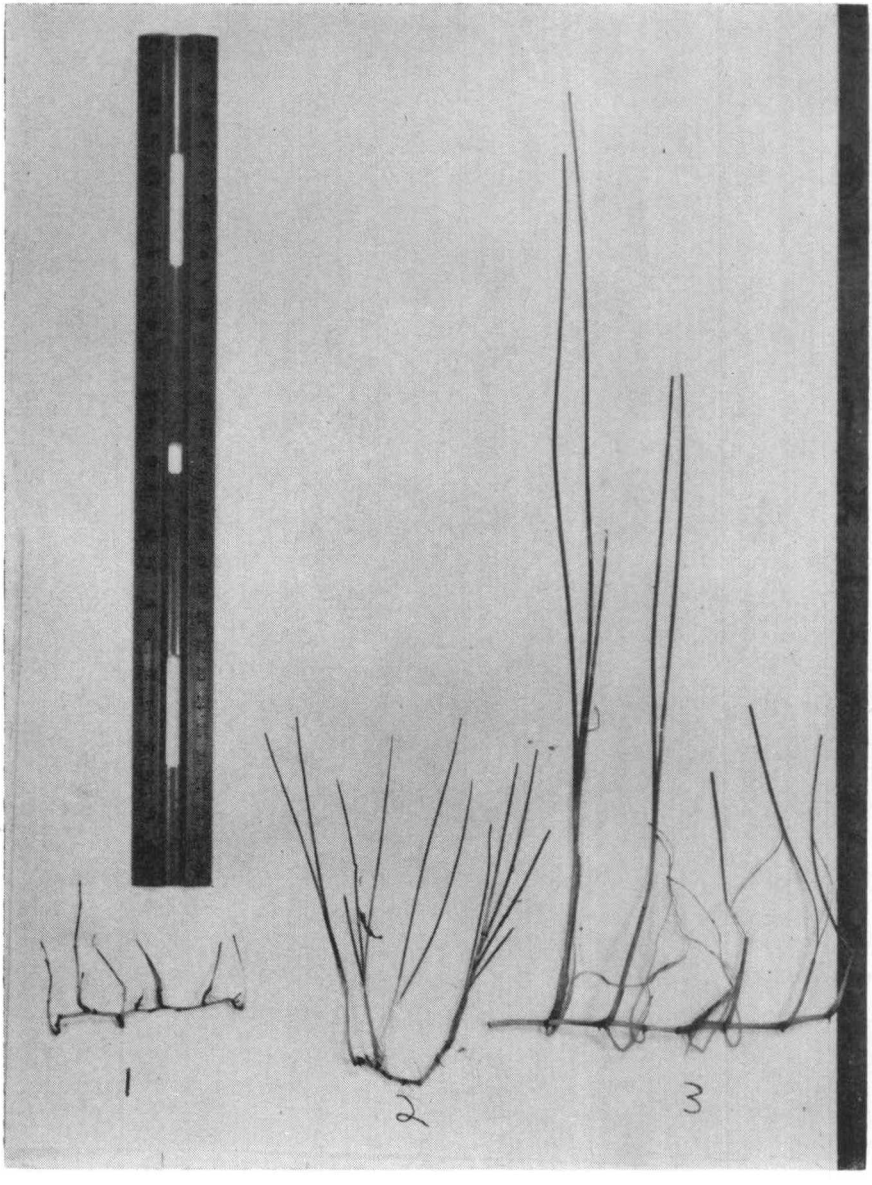


FIGURE 5. *D. wrightii* from Cats Point Bank, Boca Ciega Bay, September 19, 1958. 1. Plants found in zone exposed to air at all low tides. 2. Plants found in zone exposed to air only at spring low tides. 3. Plants found in zone never exposed to air.

throughout the Caribbean area. *Diplanthera uninervis* has been reported from the Red Sea, to the Indian Ocean, and on to the coasts of Australia in the Pacific Ocean.

The author has observed that in very shallow water plants of *Diplanthera* differ in size and habit, according to the tidal zone in which they are found (Fig. 5). All collections were made before winter leaf kill modified conclusions. Observations listed below are specific for a location, but in all instances were confirmed by observations from other areas.

Three growth conditions of *Diplanthera* were found. The first, found in areas which were left exposed to the air at all low tides, consisted of dwarfed plants. The second, intermediate in size between the first and third classifications, were found in areas left exposed only at the spring slack low tides. The third growth condition which displayed long and luxurious leaves was found in areas never uncovered by low tides. Plants found in one foot or ten feet of water at the spring slack low tide appeared to have identical leaf length and plant vigor.

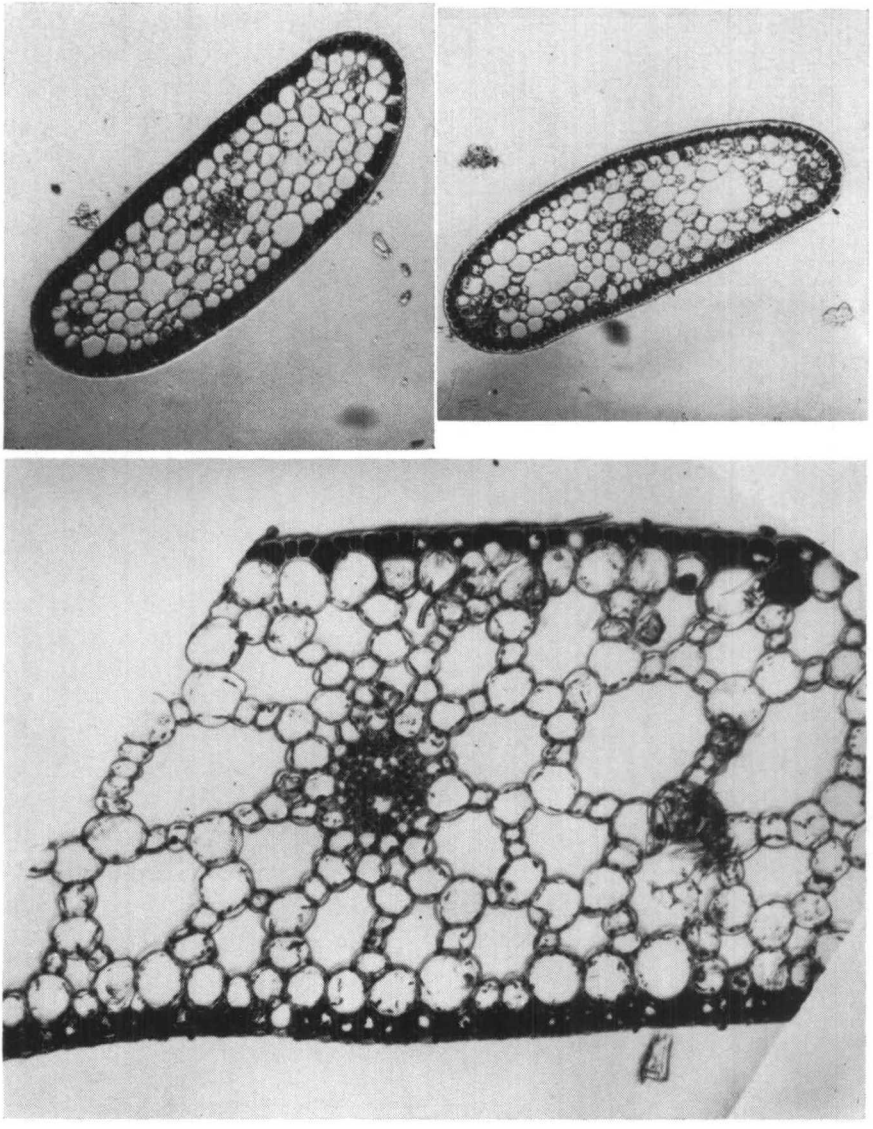
Measurements were made of plants taken from these three zones on Cats Point Bank in Boca Ciega Bay, Pinellas County, on 19 September 1958. It was discovered that not only leaf length but also rhizome thickness and rhizome internode length varied according to the tidal zone in which the plants were found. The plants growing in the zone experiencing exposure on both neap and spring low tides displayed the shortest and narrowest leaves, most narrow rhizomes, and shortest internodes. All increased in size as the tidal zone changed to one of less air exposure. These measurements were: Plants exposed at all low tides: mature leaves—48-58 mm long, mature leaves—½-⅜ mm wide, rhizome thickness—⅞ mm, internode length—0.4-1.2 cm—variable.

Plants only exposed at spring low tides: mature leaves—128-148 mm long, mature leaves—1 mm wide, rhizome thickness—1.5 mm, internode length—0.3-0.5 cm—constant.

Plants never exposed: mature leaves — 134-362 mm long, mature leaves — 1.5 mm wide, rhizome thickness — 1 1/3 mm, internode length—1-2 cm—variable.

These measurements are applicable to plants occurring in these zones in all areas observed.

An investigation was made of the leaf cellular and apical form structure of plants in the three tidal zones. A cross-section of the basal



FIGURES 6-8. X-section of *D. wrightii* leaves at base, just above the ensheathing portions. Fig. 6. From zone exposed to air at all low tides, Longboat Key, Sarasota Bay, October 23, 1958. Note compactness of cells around midvein. 400X. Fig. 7. From zone only exposed to air on spring low tides, Longboat Key, Sarasota Bay, October 23, 1958. Note lacunae becoming evident. Seemingly an intermediate condition between leaves in Figs. 4-5 and Fig. 8. 290X. Fig. 8. From zone never exposed at any low tides, Tarpon Springs, September 30, 1958. Note large conspicuous lacunae surrounding midvein. 255X.

portion of leaves occurring in the zone which is exposed at all low tides is shown in Figure 6. This is almost identical to the structure of leaves of *D. uninervis*. From a cross-section of leaves from the zone exposed only at the spring low tide it is seen the lacunae around the midvein are slightly more evident, a condition clearly intermediate between the leaves from the first and third zone (Fig. 7). The structure of the basal portion of leaves from the zone never exposed is typical of that given by Sauvageau *(op. cit.)* for *D. wrightii* (Fig. 8).

Occasionally variation in this sequence is observed. On 19 September 1958 at Cats Point Bank leaves collected from the zone exposed at all low tides and the zone never exposed displayed the compact arrangement around the midvein which is typical of *D. uninervis*. The structure of the leaves from the zone exposed only at the spring slack low tides at this station was conspicuously typical for that described for *D. wrightii*. The tissue around the midvein of leaves from one station in Tampa Bay in an area exposed at all low tides was so compact that no intercellular spaces were present around the midvein (Fig. 4).

In considering the form of the leaf apex it is concluded that the number of projections is highly variable. Only mature leaves were studied. Plants collected in the zone exposed at all low tides were seen both with and without three points at the leaf apex. Leaves from this zone at Tarpon Springs on 30 September 1958 were found with three points at the apex and with no lacunae around the midvein. This was also seen on plants collected from Longboat Key in Sarasota Bay, 23 October 1958. Both these factors are typical of *D. uninervis*. Leaves collected from this zone at Clearwater Beach on 13 November 1957 were observed to have only two marginal points at the leaf apex, and no conspicuous lacunae were present around the midvein.

In leaves occurring in the zone exposed only at the spring low tide, collected from Longboat Key in Sarasota Bay on 23 October 1958, three points were seen on the leaf apices, and lacunae were just beginning to become evident. These leaves, therefore, incorporate one characteristic of each species.

Leaves collected at Tarpon Springs on 30 September 1958 from an area never exposed presented only two points at the apex, and had large conspicuous lacunae around the midvein. These characteristics are typical of *D. wrightii*.

Isotype material of *D. wrightii* was lent for study by the New York

Botanical Garden through the kindness of Dr. B. Maguire, Curator and Coordinator of Tropical Research. This material was collected by C. Wright from Cuba in 1862. The name on the herbarium label was *Halodule? wrightii* Asch. No leaf sectioning was done on this isotypic material. Two of the growth forms, described above, were present on the sheet, probably representing collection from two tidal zones. The first consisted of dwarf-sized plants, which, if the previous observations may be applied here, were collected in an area exposed at all low tides. The leaf lengths and widths were almost exactly those of dwarf-sized plants previously measured from stations in Florida. Most of the mature leaves in this size class had only two marginal projections present at the leaf apex which is typical of *D. wrightii;* however, occasionally mature leaves were found with three projections.

The other size classification in the isotypic material was the intermediate size probably found in the zone exposed only at spring low tides. Leaf lengths and widths also closely approximated those recorded from Florida stations in the same zone. Because most of the leaves in this size class did not have the original apex present, no remarks may be made concerning the number of projections at the apex. Several of the younger leaves had the original tip present; however, these would tend to be more variable on this aspect, according to the earlier observations of Sauvageau *(op. cit.).*

It is concluded that the habitat affects the growth of *Diplanthera.* According to my observations the two characters given by Sauvageau *(op. cit.)* are not adequate for distinguishing sterile specimens of *D. uninervis* and *D. wrightii.*

Ascherson and Graebner (1907) listed only one character which could be used for comparing differences in the flowers of the two species. The anthers of *D. uninervis* were recorded as being three millimeters long, while those of *D. wrightii* were six millimeters long. If anther length varies with the habitat as has been shown here for leaf and rhizome internode length, it is possible that *D. uninervis* and *D. wrightii* are the same species. However, until a detailed study is made of the inflorescences of the two species and a tidal zone study of *D. uninervis,* the question of the status of these two species names cannot be settled.

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