

STUDIES ON COLOMBIA CRYPTOGRAMS. I. VARIATION OF CHARACTERS IN SOUTH AMERICAN SPECIES OF *CAMPYLOPUS*

P. A. FLORSCHÜTZ and J. FLORSCHÜTZ-DE WAARD¹

This paper is a preliminary account of investigations on species of *Campylopus*, mainly from the high Andes of Colombia and from adjacent regions. The studies are based on herbarium specimens, field studies and cultural experiments.

The genus *Campylopus* was founded by Bridel (1819) on the basis of a curved seta only and included, therefore, species of *Grimmia* and other genera. Later he modified his earlier circumscription (Bridel 1826) so that the genus then contained (except for one uncertain species) only species of *Campylopus* as known today. A subdivision of the genus was made by Limpricht (1886) based on the structure of the costa as seen in cross section:

Pseudocampylopus

Costa without stereids, ventral layer of large cells, other cells containing chlorophyll with moderately thickened walls.

Campylopus

Costa with dorsal stereid groups.

Palinocraspis

Costa with dorsal and ventral groups of stereids.

Later, probably for the first time, Brotherus (1924) changed the circumscription of the subgenus *Pseudocampylopus*, and the presence of substereidal cells was added. Unfortunately the term substereid has never been defined and one is completely at a loss as to the differences between moderately thickened cells, substereidal cells and stereids. Even the latter term is difficult to interpret accurately. To quote Eames and MacDaniels (1925): "The term stereid is obsolete" (for stone cells). Moreover Thériot (1939) who studied *Campylopus* for a long time, introduced another term: pseudostereid, which he probably intended as a replacement for the term substereid. This new term, however, does not clarify the differences either. This difficulty has been mentioned by several authors. Thériot (l.c.) also drew attention to the fact that there is variation in structure of the costa from base to apex in the leaves of several species. He mentioned species with a costal structure more or less intermediate between *Pseudocampylopus* and *Campylopus* [for which Herzog (1916) had erected the subgenus *Leucocampylopus*] but retained these species in a special unnamed group of the subgenus *Pseudocampylopus*. He did not say, as Robinson (1967) suggests, that the costal differences between the subgenera *Campylopus* and *Pseudocampylopus* are almost meaningless. According to Robinson (l.c.) "every possible intergradation of stereid and pseudostereid development seems to exist in the genus, and some species

¹ Botanical Museum & Herbarium, University of Utrecht, Uithof, Utrecht, The Netherlands.

with different costal structure are almost certainly closely related." This is indeed the fact. Some examples are shown in the photomicrographs (Figs. 1-4). Figure 1 shows a cross section through the costa of a specimen (Florschütz 4261) which would key out (Robinson 1967) to *C. leucognodes*. It matches the type material (Germain s.n., Bolivia, NY) closely in all characters. However, the cross section of figure 2,

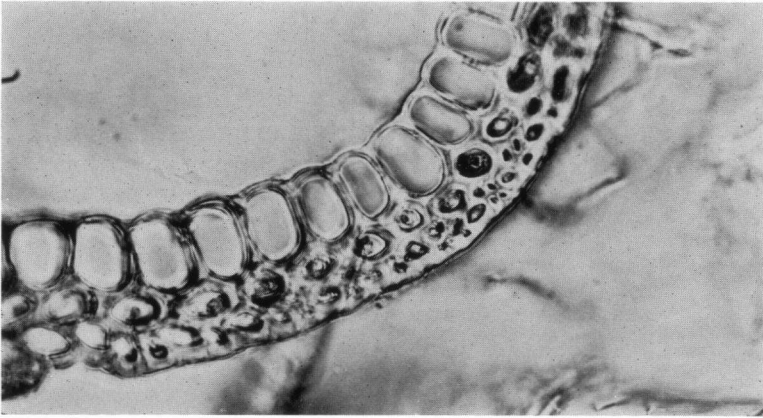


FIG. 1. Cross section through part of costa of a specimen of *Campylopus* (Florschütz 4261), showing several clusters of stereids.

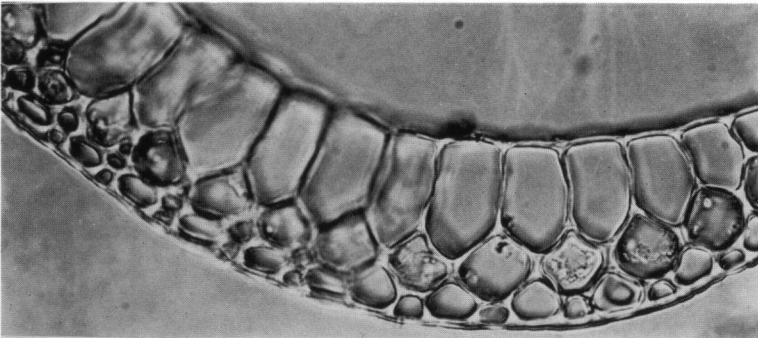


FIG. 2. Cross section through part of costa of a specimen of *Campylopus* (Florschütz 4261); no stereids are present.

from the same specimen does not show any stereids at all and the specimen would thus key out to *C. subconcolor*. Cross sections of the latter species are shown in figures 3 and 4. Figure 3 shows the more common pattern of the cross section (Florschütz 4184) but in the same specimen cross sections with stereidal cells can be found, as shown in figure 4. All sections were made in the lower half of the leaf. Even in a single cross section a change from a very regular pattern with thin walled cells to a more or less irregular arrangement of cells with thicker walls is often observed (fig. 2). We cannot therefore agree with Robinson's statement: "for purposes of making a key

to any large number of species, no other basic subdivision is possible now." A certain specimen would belong to two different species with a key based on these characters.

From our studies we became suspicious that ecological variation could be responsible for the differences. We, thus, began a series of cultural studies, growing

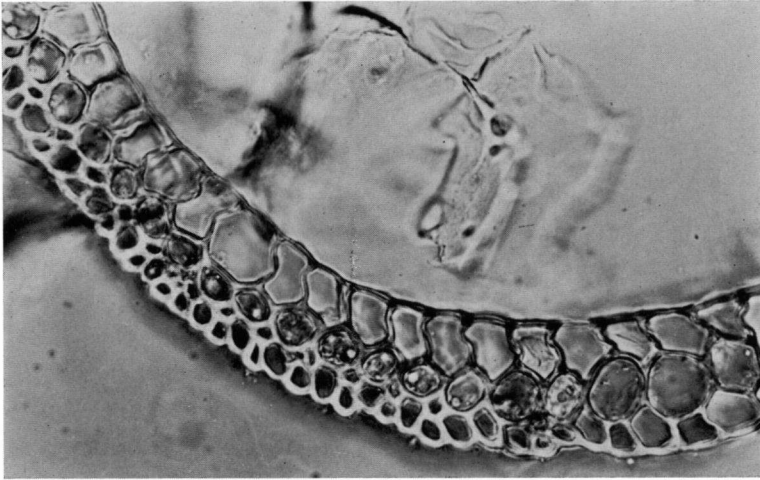


FIG. 3. Cross section through part of costa of a specimen of *Campylopus* (Florschütz 4184); no stereids are present.

material according to the method of Schelpe (1953). Fresh material of 43 collections possibly belonging to 8–10 different taxa and collected by the senior author in the Colombian Andes was cultured on coarse sand to which diluted Knop-solution had been added. Only young stem tips started growing. Although the cultures are still rather young we can say that in cultures grown under the similar conditions (in a cool greenhouse) no changes in costal structure have been observed up to now. These structures, however variable they may be, do not seem to be influenced by ecological conditions. This does not affect our opinion however that the costal structure of *Campylopus* is a variable character and should not form the basis for a subdivision of this genus.

Other characters

Another character often used in distinguishing between species of *Campylopus* is the presence or absence of auricles. To our great surprise most of the specimens that did not show auricles when collected produced very distinct ones in cultivation! As these specimens seem to have the genetic capability of producing auricles under certain conditions we think this character is unreliable as a major diagnostic feature.

In the field we had earlier observed that the production of microphyllous branches (by which *C. trichophorus* Herz. is characterized) also occurs in several other species

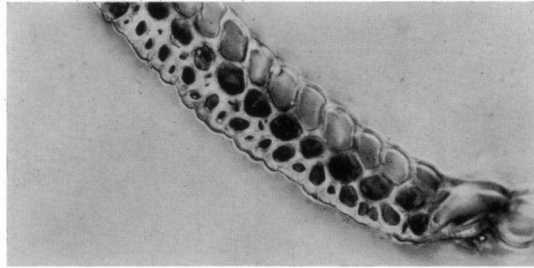


FIG. 4. Cross section through part of costa of a specimen of *Campylopus* (Florschütz 4184); several stereids are visible.

belonging even to other subgenera. This character also seems unfit for diagnostic use.

Sizes of stems and leaves are not reliable at all. Within the same population very short and very long stems may occur and the same holds for the length of the leaves. Also, considerable differences may be found between sterile and fertile plants of a single taxon, as we propose to show in a future paper.

We also have doubts about the reliability of the presence or absence of cilia on the calyptra. This problem, however, needs further investigation.

At this moment, still with a large number of collections to be studied it seems somewhat premature to reach a final conclusion. We dare say, however, that several characters on which species of *Campylopus* have been based in the past are at least doubtful. We need more reliable characters for the delimitation of the species of Andean *Campylopus*.

ACKNOWLEDGEMENTS

The authors wish to thank the Netherlands Foundation for the Advancement of Tropical Research (WOTRO) for a grant which enabled the senior author to carry out field work in the Colombian Andes. Thanks are also due to Mrs. and Mr. A. M. Cleef for help and guidance during the field work.

LITERATURE CITED

- Bridel, S. E. 1819. *Mantissa Muscorum* (Methodus nova muscorum): 71–78. Gotha.
 ———. 1826. *Bryologia Universa* I: 468–479. Leipzig.
 Brotherus, V. F. 1924. In Engler & Prantl, *Die natürlichen Pflanzenfamilien* 10: 183–188. Leipzig.
 Eames, A. J. and MacDaniels, L. H. 1925. *An Introduction to Plant Anatomy*: 57. New York & London.
 Herzog, Th. 1916. *Die Bryophyten meiner zweiten Reise durch Bolivia*. *Bibliotheca Botanica* 87: 1–347.
 Limpricht, K. G. 1886. *Die Laubmoose Deutschlands, Oesterreichs und der Schweiz* 1: 379–401. Leipzig.
 Robinson, H. 1967. Preliminary studies on the bryophytes of Colombia. *The Bryologist* 70: 1–61.
 Schelpe, E.A.C.L.E. 1953. Techniques for the experimental culture of bryophytes. *Trans. British Bryol. Soc.* 2: 216–219.
 Thériot, I. 1939. Complément à la flore bryologique de la Bolivie et de la Colombie. *Rev. Bryol. N.S.* 11: 40–66 (“1938”).