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Various Thoughts on Characters in Moss Taxonomy

by

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For a recent international congress, Koponen (1978) reviewed at length modern taxonomic methods in muscology. I have decided to introduce the topics to be considered by preparing a list of questions.

1) Do we know much about the adaptive value of moss character states?

Although traits used as taxonomic characters do not need to have any obvious function or inferable adaptive value to be important in classification, bryologists are woefully ignorant of the exact functions of many morphological traits. For example, Watson (1913) gave a long list of morphological features of mosses that he inferred to be adaptations to periodic drying of the habitat. But Patterson (1964), in a review of experimental studies, concluded that physiological responses were far more important than morphological traits in determining resistance to desiccation, suggesting, in fact, that Watson's list of traits lacked any actual basis. However, Anderson (1974) in a review of experimental physiology, suggested that the morphology of mosses is probably of some importance in determining their ability to live in dry habitats.

2) Are there any ecogeographical generalizations — such as, in mammology, Gologer's Rule for pigmentation, Bergmann's Rule for body size, or Allen's Rule for appendage measurements — that might make some sense of morphological variation in bryophyte species?

Every good taxonomist has some rules-of-thumb derived from observation of well-studied taxa that he or she follows in deciding the limits of species variation in other taxa, or in assigning names to unusual specimens. For example it is commonly acknowledged that: (a) species characteristic of very wet or of unusually harsh habitats are often polymorphic; (b) species at the edge of ranges may grow on unusual substrates; (c) plants are distributed in phytogeographically circumscribed areas or at least in areas of similar environmental parameters (not according to political boundaries); and (d) "major" characters considered evolutionarily conservative in one group may be variable in another or may be completely missing, such as when a peristome is absent.

I recognize in the Pottiaceae (Zander, 1972, 1977, 1978) the following additional trends: In polymorphic species, character state combinations typical of small plants often change through various permutations in middle-sized plants into combinations typical of large plants, though seldom doing so in the same clump. I call this clinal dimorphism of extremes a "stature gradient." In species that rarely produce propagula, collections of very small plants are more apt to have propagula. Small plants lose characters and phenocopy other species. For instance, those with two stereid bands in the costa may have only one or none in small plants. Populations in montane regions may be of unusually small or large size. Leaf cell walls are often unusually incrassate in island or montane populations.

3) Are patterns of variation good taxonomic characters?

Patterns of variation are often good characters in that they may be distinctive for a taxon and, once known from revisionary studies, they define the expected combinations of character states needed for identification and help in the disposition of extreme morphological variants. Although Vavilov (1951) showed that related species of cultivated plants have similar patterns of variation, it is not appropriate to use this assumption in bryophyte taxonomy without extreme caution. For example, certain taxa of Pottiaceae characteristically show great variation in the shape of the leaf apex but some related taxa are not polymorphic in this respect (Zander, 1977). Also the position and size of propagula in some species is more stable than in other, related, species (Zander, 1979). On the other hand some workers have described parallel patterns of variation between infraspecific taxa in certain species, e.g. G. Raeymaekers (pers. comm.) in *Philonotis* species, During (1977) in *Garovaglia* species, and Karczmarz (1971) in *Calliergon* species.

4) Can evaluation of the variation in characters in one species that is well represented in herbaria be used to judge the taxonomic distinctiveness of related, but poorly represented, species?

This is, in fact, done all the time. But it may be that a different pattern of variation distinguishes the specimens of a separate taxon, or that different patterns may exist in different regions of the world in populations of the same species. For example, *Leptodontium viticulosoides* (P. Beauv.) Wijk & Marg. is stenomorphic in the disjunctive, isolated populations of the southern Appalachian mountains of North America, but polymorphic throughout its tropical and subtropical range (Zander, 1972) while *Barbula indica* (Hook.) Spreng. and *B. convoluta* Hedw. have entirely different patterns of variation in propagula position (Zander, 1979).

5) In view of very short (leptokurtic) sperm-flow distances in bryophytes (Anderson & Lemmon, 1974; Clayton-Greene et al., 1977; Longton 1976), is "restricted gene flow due to differing chromosome numbers" a good argument for recognizing cytotypes as distinct taxa?

If gene flow is really greatly restricted by microgeographic isolation, would the additional isolation of cytotypy make much of a difference? The converse seems at least occasionally true. Mechanisms facilitating outbreeding have been described for mosses, including dichogamy (Bauer, 1963; Longton, 1976, Steere, 1940, p. 101; but see Grimme, 1903) and small antheridiophore/archegoniophore number and size ratios (Anderson & Lemmon, 1974; Lemmon, 1968; Lewis, 1961; Newton, 1978; but see Wyatt, 1977), which indicate that heterozygosity is of some adaptive importance in some taxa. In some groups, morphological traits are correlated with cytological variation, but in others there is no correlation. For such latter groups, I think the fact of chromosome variation should be treated taxonomically as a one-character difference between populations.

6) Are there any chemical reactions that might be used to help in the routine identification of bryophytes?

There is, for example, the chemical test of sodium bicarbonate/water solution used in the taxonomy of red-pigmented sections of *Sphagnum* that was cited recently by Lane (1978).

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