STATISTICAL STUDIES ON FESTUCA SPECIES

(Preliminary Publication)

by

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Considerable difficulty arises in the determination of certain *Festuca* species owing to the fact that the characteristics of the species are greatly variable. Thus, occasionally one comes across species which, on the basis of a single characteristic, could be classified in two species. The determination of such plants is possible only on the basis of additional characteristics.

This type of difficulty arises some times in the case of the *Festuca sulcata*, *valesiaca* and *pseudovina* found in Hungary. Their anatomical peculiarieties manifest themselves chiefly as differences in size. (1) Although it is usually possible to effect the determination of a given specimen on the basis of several characteristics, the accuracy of the determination often remains an open question.

In earlier literature, these species were classified differently, depending on the individual author. Modern taxonomy regards them as species, noting that although they are closely related types with many transition forms in between, nevertheless there are striking plant sociological and ecological differences between them and therefore it is more practicable to consider them distinct species. (3)

The difficulties in determination have posed the question whether we are really dealing with distinct species or with transition forms. This problem is answered in a general way by the present study.

The apparently most practicable characteristic — the length of the lemmas — was taken as a criterion. Measurements were taken on 20 samples from the herbarium. Ten lemmas were measured for every sample; thus 200 figures were obtained. The specimens from the herbarium were selected so that all three species should be represented.

In order to investigate whether the variability of the length of the lemmas provide a reliable index, statistical methods had to be applied.

The first question to be examined was whether the lengths of the lemmas were homogenous for the entire group of 20. This was determined statistically by the analysis of variance. (4)

The calculations indicated that the group was not homogenous. Therefore further comparisons were made by the so called D u n c a n test. (4) The results of this test are shown by the diagram on figure 1. The pairs of samples which belong together according to the corresponding vertical and horizontal lines differ form each other above the boldfaced line in the size of their lemmas, and do not differ from each other in this respect below the heavy line. The figure shows quite clearly the division of the samples into three groups.

The next problem is whether the specimens classified according to the sizes of their lemmas show the same division if we make a different characteristic the basis of our determination.

To investigate this question, I considered three additional characteristics : thickness of leaves, number of flowers in a spikelet, and the length of panicles (one leaf, 10 spikelets and 3 panicles for every specimen).

If we wish to separate two groups (species) on the basis of several characteristics, we are aided by the statistical method of discriminance analysis.

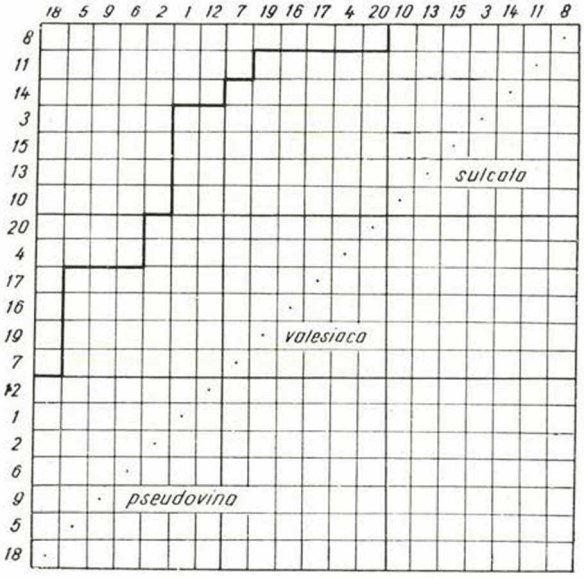

Fig. 1.

In the calculations we take the values measured (length of lemmas, thickness of leaves, number of flowers, etc.) and then derive certain values from these. From the discriminance function we can decide whether the groups are really separable.

I carried out the analysis by the Penrose method (2, 4) in three groupings. I compared 1. the specimens with the longest and shortest lemmas *(sulcata* and *pseudovina)*, 2. those with medium and long lemmas *(valesiaca* and *sulcata)* and 3. those with medium and short lemmas *(valesiaca* and *pseudovina)*.

This method furnished us with values which express the proportion and weight of the occurrence of all four characteristics in every case. In the final analysis we get for every specimen a pair of values ("a" = shape and "p"=size) which can then be shown in a coordinate system.

From the diagram of this coordinate system (figure 2), we can read off how the three groups depart from each other. The clear differentiation of the three groups (species) indicates that the distinction of the three species on the basis of characteristics other than the length of the lemmas corresponds to their separation according to the characteristic (length of lemmas) soriginally taken as the basis of our investigation.

The above investigations were of a preliminary nature, but their results evidence that the categories (taxons) which sometimes do not seem clearly distinct, are in fact separable.

It will be the object of further studies to determine which of the characteristics considered show more and which less departure, and what is the distribution of the different characteristics. When we will be able to give the mean value and the variance for each one of the characteristics, the species can be determined with greater precision.

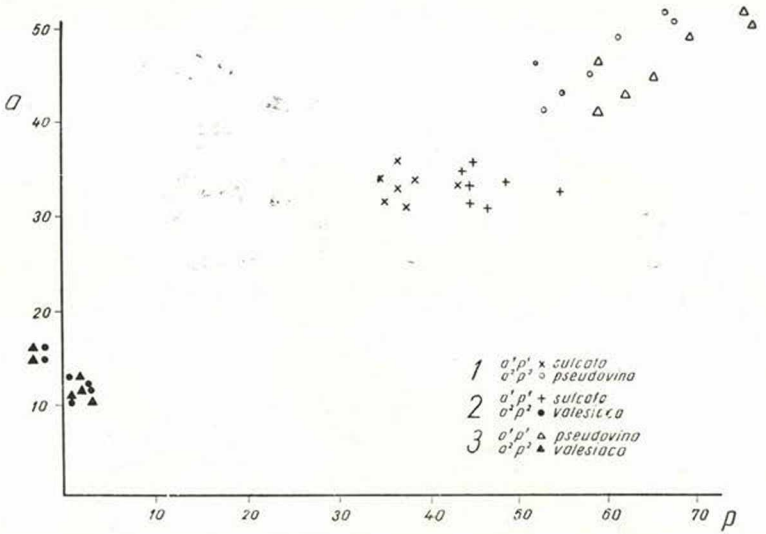

Fig. 2.

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РЕЗЮМЕ

Математические систематические исследования ориентировочного характера освещают систематическое отношение между видами **Festuca sulcata valesiaca** и и pseudovina с принятием во внимание у двадцати гербарных экземпляров длины остьи, толщину листа, длины метелки, и числа цветов. Траф. 1 показывает результат пробы Duncan, граф. 2-графическое изображение полученных из анализа дискриминанции данных «а» и «р».