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A TECHNIQUE FOR MORPHOLOGICAL ANALYSIS IN POPULATION STUDIES

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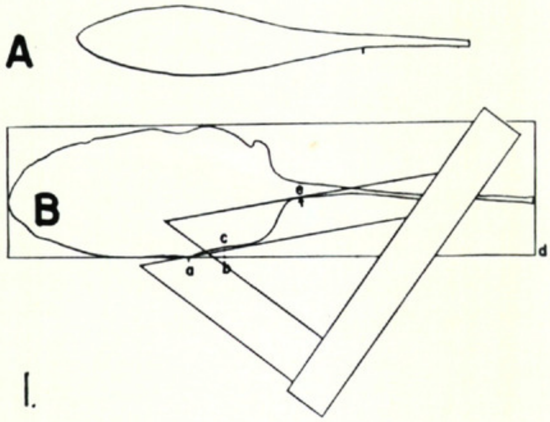
IN the analysis of a population, the taxonomist is generally concerned with the determination of whether the population contains two or more segregates or only one variable (Davidson, 1947). In such analysis whether the results are shown by graphs, curves, or polygonal projection, the "keying" characteristics are used. In most infraspecific categories the number of such keying characteristics is not often reduced to less than the minimum of three required for polygonal graphing which is considered to be the best type of graph for portrayal of results of such analysis.

In some specific and subspecific taxa there are two distinct leaf shapes and two distinct habitats. Leaf shape may be environmentally induced or genetically fixed (ecotype or ecospecies). Complete biosystematic methods of study are necessary for this determination and subsequent settlement of taxonomic status. If the morphology of the plant is environmentally controlled the two plants have a common morphology when both are grown under uniform culture conditions. This is well established by the researches of Turesson (1922) and by Clausen, Keck, and Hiesey (1940). The main factor for the change in leaf shape may be determined by ecological study. Often light is the factor. In some studies traced outlines of leaves have been presented as evidence of morphological change without an outline of what the leaf looked like to start with or statement of whether it was a mature leaf or an immature one.

A method of determining the degree of morphological change is suggested which eliminates more of the subjective interpretation of the degree of leaf shape change than to compare the outlines. Measurements may be obtained which could be used for polygonal graphing or straight numerical comparisons. Examples of measurements that could be used are blade length/petiole length, blade length/blade width, the angle at which the blade contracts to the petiole, and scape length/leaf length. Many measurements should be made from random samples obtained in mass collection within the population for determination of the variation within the population. Usually floral characters will be used, but in some taxa the vegetative characters are more useful. Only older and mature leaves should be used as it has been reported (Brown, 1944) that greater variation in shape is to be found in immature leaves. Where it is desired to show the amount of morphological change with changed habitat conditions, the plants should be cloned, or, if this is impossible, the leaves should be measured as the individuals are planted and preserved on herbarium sheets when vegetative growth is complete. After a season, or two seasons, of growth the leaves can be compared with those of the same order at the start of the experiment.

In a leaf that tapers to join the petiole (Fig. 1. A), it is difficult to determine just where the blade ends and the petiole begins. This determination is not so difficult in leaf B, fig. 1, because of the abruptly contracted blade at the juncture of blade and petiole. To eliminate subjective impressions of such a point the curve made by the taper or contraction of the blade to the petiole is used in the following manner. Ten per cent of the distance *a–d* is marked at *c* (Fig. 1). A right triangle is laid so that the edge passes through the point *a–c*. By laying a ruler or straight edge along the right hand margin of the triangle and sliding the triangle upward the top edge of the triangle strikes a tangent to the curve at point *e*. Point *e* is considered the lowermost extent of the blade. This method has been adapted from the plant sociological method of determining an adequate sample known as the species-area curve (Cain, 1938). The ten per cent values are those which Cain states in his experience give the best results.

The worth of the method, regardless of using the ten per cent value or another arbitrarily selected, is in making the analysis more objective. As an added criterion of change in leaf shape the angle of contraction of blade to the petiole may be measured (angle *a–e*) with a protractor.



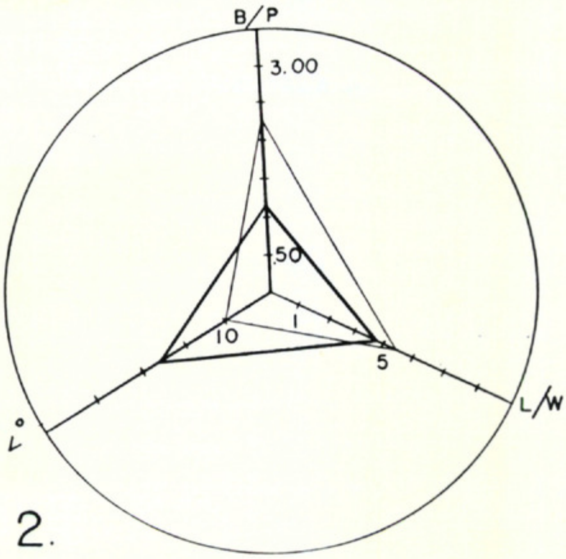


Fig. 1. (top) Leaves of a species (A), and a leaf from one of its infraspecific taxa (B). The method of determining blade length of leaves which have blades tapering to the petiole is shown. Ten per cent of the distance *a–d* is marked at *b*, and ten per cent of one-half the width of the leaf (the approximate height of the curve *a–c–e*) is marked at the point *c*. A right triangle is laid across the points *a–c*, and by sliding the triangle along a straight edge held at the right, the triangle strikes a tangent to the curve at point *e*. This point is considered to be the lowermost extent of the blade.

Fig. 2. (bottom) A polygonal graph showing the blade-petiole index (B/P), the angle of contraction of the blade to the petiole ($<$) and the length / width ratio (L/W) for leaf A (light line) and for leaf B (heavy line). Leaves A and B referred to are from Fig. 1, and are tracings of actual leaves. The angle of contraction of the blade to the petiole for each has been figured by the method shown and described by Fig. 1.

A polygonal graph for simultaneous portrayal of three variables found in the two leaves (Fig. 1 A & B) is given in Fig. 2. Where the lines cross each other more than once, there is an indication of more remote relation than where the lines are chiefly parallel (Davidson, 1947). When plants are reciprocally transplanted or where the plants of the taxa are grown in the same environment and are graphed and there is a high degree of parallelism to the lines, then the change may be safely assumed to have been environmentally induced. Straight numerical measurement comparisons would also be objective.—Dept. of Botany, Southern Illinois University.

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CONTRIBUTIONS TO THE FLORA OF NOVA SCOTIA

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Northern Cape Breton Island has been noted by various botanists to contain a relatively rich "isolated flora." Few recent discoveries have been made there due, no doubt, to the relatively inaccessible nature of the interior of the northern plateau. The following lists of plants collected mainly in this area add a number of arctic-montane species to the provincial flora and indicate the desirability of an extended study of this element in Nova Scotia. With this in mind, various phytogeographical comments have been omitted from the present paper.

The annotated lists below are mainly the result of exploration in Cape Breton Island during the summer of 1951. This exploration was carried out as part of a detailed ecological survey of the forests of the area, a survey sponsored by the Nova Scotia Research Foundation. Some of the taxonomic results of earlier surveys for the Foundation have been reported by D. S. Erskine (1951).

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