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A method of studying growth in lichens

Metoda badania wzrostu porostów

Метод исследования разрастания лишайников

What science knows at present about the growth of lichens is quite superficial. In general it is known that they grow extremely slowly and live a great many years. Investigations on this matter were very scarce and in most cases the data were based upon occasional observations and not upon long continued, systematic studies. In Poland the growth of lichens was not dealt with at all. The author attributes this state of things, on the one hand to the subject itself which is poorly attractive on account of the long waiting for results, on the other hand -- to the lack of a suitable method. Nevertheless, the rate of growth in lichens is worth to be given particular attention, because on its ground may be elucidated many problems in lichen biology, which is at present a mysterious field. Moreover, studies in this direction will enable to go much deeper into the knowledge of some biologic problems of general meaning, e. g. the dynamism of such processes as metabolism food uptake, parasitism, symbiosis, struggle for existence and the like.

All these reasons create the need of extensive studies dealing with the growth of various lichen species, in different localities and under different ecological conditions.

In 1953, the author chose for object of his researches a few species of crustose lichens growing on trees and started investigations at Białowieża in the National Parc, at Puławy and since 1954, also at Lublin. Already after 2 years of studies, the method he adopted gave positive results (Fig. 1). For this reason, and that of arguments quoted

above, the author hopes his method may be of interest for other workers in botany, who could simultaneously conduct analogous researches on the growth of various lichen species in various localities, prior to the publishing of results of the present, unavoidably limited study, which can be completed no sooner than after several years.

The method in question is as follows:

1. A rectangular or square, sheet of adequate size of colourless, transparent cellophane is fixed with four pins to the chosen, possibly even surface of the trunk. Then, with a fountain pen one draws the external contours of every lichen thallus enclosed within the area of the sheet. If the pen writes sufficiently thin lines one can take into account even the smallest bends of thallus borders, using for this procedure a magnifying glass (5 — 8 x).

2. When this is done, the successive number of the „growth surface chart” and the date of the performance are written down on the sheet of cellophane.

3. The same number and date are recorded in a copy — book which contains particulars about the tree and its situation in the given area, viz. the species of the tree, its distance from other stable points, species of neighbouring trees, etc. These data should be as accurate as possible for the tree to be found easily, without a loss of time, even after several years.

4. Every thallus has also its number written down on the cellophane within the respective contour. In the copy — book, below this figure are noted the name of the lichen species and all observations as made, i. e. colour of the thallus, fructification, splits on the bark, etc. If, for instance, apotheciums are not very numerous it is recommendable to indicate their position on the chart by means of dots.

5. Distinct dots of red or white varnish, applied with a small stick to the bark at the corners of the cellophane, indicate for the tree the position of the chart.

6. Below the surface thus determined one paints in the same way the numerical designation for the chart.

7. After the removal of the cellophane sheet one measures the circumference of the trunk on the median line of the chart and also the distance to the earth from one of the lower dots. With a compass the position of the chart in relation to the four cardinal points is determined.

8. The drawings are kept in a dry place, between paper sheets and under a small presser.

9. Of every chart is made a copy on cellophane which will serve for comparison in the next period of studies. When the copy is applied to the respective surface on the tree and for no thallus any growth increase is found, we simply record this result and restrain our inspection to measurements of trunk circumference and distance to the earth. If instead, the surface of the lichen cover has increased we make a drawing of the entire area on a new sheet of cellophane which has the same number as the former one and the actual date. All present changes are described in the copy—book. The same procedure is observed in the following years.

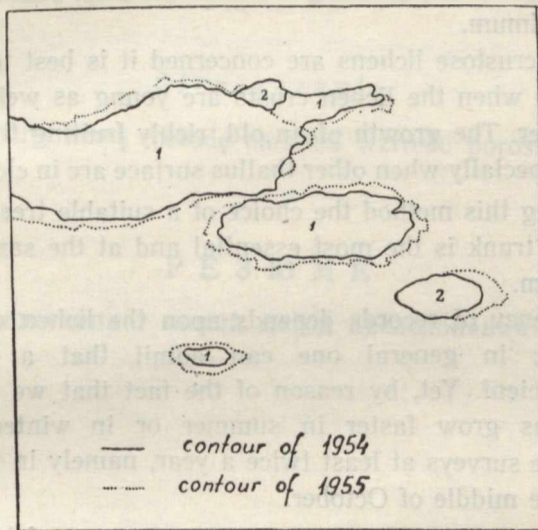


Fig. 1; Two third of the actual size.

10. The surface increase for a thallus is estimated as follows: one applies the first drawing to a millimetre paper and counts the area of each thallus separately; then in the same way the increased surface is computed. The difference between the two sums determines in mm^2 the growth increase in the given period. Out of these data can be determined for each thallus its growth increase per surface unit and time unit. Of course, measurements of the surface can be made with adequate instruments.

The greater the number of cover measurements for a given species living under similar ecological conditions, the more the average results allow to draw general conclusions. Large numbers of data with reference to various lichen species lead to a full synthesis of the dynamism of growth in lichens. Moreover, studies conducted under different ecological conditions might perhaps reveal noteworthy differences in the degree of lichen growth rates which would depend upon these conditions.

General remarks

In view of the necessity of long lasting studies it is greatly important to choose both area and particular trees that owing to a right choice the danger of a tree being felled or the bark damaged could be reduced to minimum.

As far as crustose lichens are concerned it is best to study them on young trees when the lichen crusts are young as well and do not join one another. The growth of an old, richly fruiting thallus is very slow, if any, especially when other thallus surface are in close proximity.

In adapting this method the choice of a suitable tree and suitable surface on the trunk is the most essential and at the same time most difficult problem.

The frequency of records depends upon the lichen species which is under test; in general one can admit that a record once a year is sufficient. Yet, by reason of the fact that we do not know whether lichens grow faster in summer or in winter, it is preferable to make surveys at least twice a year, namely in the middle of May and in the middle of October.

The author gives here a very detailed account of his method in order to warn possible investigators that any inaccuracy can result in the loss of one — year or even several—year studies. Thus the choice of a proper stand and of the boundary and diversity of observations must be made with particular thoughtfulness. It may happen for instance, that in the environment of tested habitat phytosociological lists can be required.

The present method suits especially growth rate investigations on crustose lichens which live both on trees and rocks and have their thallus sufficiently uniform. Further, in this way can be studied foliose lichens provided the patches are well adherent to the substratum and are

not too small. The method is not suitable for fruticose lichens or pulveraceous species with indefinite contours; no more for ascending species and those which form small patches.

As cellophane gets wrinkled with humidity, it is advised to choose a dry weather for observations.

The afore described method of delineation is very accurate, simple, excluding errors, easy to be verified, inexpensive and not time consuming. With proper organization even technical workers may apply it instead of scientists. A wide use of this method, not by lichenologists merely, would provide, after several years, a sufficiently rich material for elucidating the growth rate in many lichen species.

Streszczenie

Autor opisuje nową metodę badania wzrostu porostów.

РЕЗЮМЕ

Автор представляет новый метод исследования разрастания лишайников.

The first described method of education is *Inductive*. It consists in leading the student to the truth by a series of questions and answers. The teacher asks questions which lead the student to the truth. The method is not suitable for subjects which require a large amount of facts to be learned. It is suitable for subjects which require a deep understanding of the principles involved. It is suitable for subjects which require a high degree of reasoning and judgment. It is suitable for subjects which require a high degree of originality and independence of thought.

The second described method of education is *Deductive*. It consists in leading the student to the truth by a series of statements and proofs. The teacher states the truth and then proves it. The method is not suitable for subjects which require a large amount of facts to be learned. It is suitable for subjects which require a deep understanding of the principles involved. It is suitable for subjects which require a high degree of reasoning and judgment. It is suitable for subjects which require a high degree of originality and independence of thought.

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The third described method of education is *Inductive-Deductive*. It consists in leading the student to the truth by a series of questions and answers, followed by a series of statements and proofs. The teacher asks questions which lead the student to the truth, and then states the truth and proves it. The method is not suitable for subjects which require a large amount of facts to be learned. It is suitable for subjects which require a deep understanding of the principles involved. It is suitable for subjects which require a high degree of reasoning and judgment. It is suitable for subjects which require a high degree of originality and independence of thought.

The fourth described method of education is *Deductive-Inductive*. It consists in leading the student to the truth by a series of statements and proofs, followed by a series of questions and answers. The teacher states the truth and proves it, and then asks questions which lead the student to the truth. The method is not suitable for subjects which require a large amount of facts to be learned. It is suitable for subjects which require a deep understanding of the principles involved. It is suitable for subjects which require a high degree of reasoning and judgment. It is suitable for subjects which require a high degree of originality and independence of thought.

The fifth described method of education is *Inductive-Deductive-Inductive*. It consists in leading the student to the truth by a series of questions and answers, followed by a series of statements and proofs, followed by a series of questions and answers. The teacher asks questions which lead the student to the truth, states the truth and proves it, and then asks questions which lead the student to the truth. The method is not suitable for subjects which require a large amount of facts to be learned. It is suitable for subjects which require a deep understanding of the principles involved. It is suitable for subjects which require a high degree of reasoning and judgment. It is suitable for subjects which require a high degree of originality and independence of thought.