A new object for investigation on the phototactic chloroplast movements

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It has been known for a long time that the capacity for phototactic chloroplast movements very common in water plants can also be observed in higher land plants (S t a h l 1880, H a b e r l a n d t 1888, S e n n 1908). So far however among the plants of the latter kind no object convenient for observations was found. As a rule very thin leaves with one or at most several cell layers of mosses, ferns and some higher water plants were used besides algae for experiments on phototactic chloroplast movements. The difficulties in observing phototactic movements in land plants are caused by 1) the bad visibility inside the leaf cells which can only partially be improved by infiltration, and 2) the complicated light conditions resulting from the many reflections and refractions on the inner leaf surfaces. In almost all earlier investigations on phototactic movements in land plants the chloroplast arrangements were observed on cross sections of leaves previously submitted to the action of light. Such results supply no data on the movement dynamism which can be studied only by continuous observation of the course of chloroplast movements while the movements take place in the cell.

It was found that an excellent object for such observations are the leaves of *Arabis arenosa* and it is best to collect the leaves from shadowed places. In the leaves of this plant it is easy to separate the spongy parenchyma from the palisade tissue without inflicting much damage to the cells. For making the preparation a leaf is placed in a hypotonic sucrose solution (0.3 m solutions were used when the osmotic value of leaves was 0.45—0.50 m) with the upper surface downwards, then using a scalpel or a needle the epidermis from the under surface of the leaf is removed together with the spongy parenchyma. When the leaf is prepared in such a manner the cells of the palisade tissue and the chloroplasts inside them can readily be observed through the epidermis of the upper leaf surface. Though some cells are damaged during the operation and in these the chloroplasts do not move. In a great majority of cells the chloroplast movements are quite normal.

Preparations can also be made by separating the palisade parenchyma from the spongy tissue, however, the number of damaged cells in the spongy parenchyma is far greater. By applying this method of preparation the object for observation is composed of two cell layers, the inner tissue and the epidermis. Owing to this and also because of the partial infiltration of the sucrose solution into the inter cell space the visibility of the microscope image is very good. The photographs in Fig. 1 illustrate the same cells with chloroplast arrangements corresponding to weak light (epistrophe) and strong light (parastrophe).

Fig. 1. *Arabis arenosa*. Flat and profil position of chloroplasts in the same cells of palisade parenchyma.

A drawback of the method here described is that the leaves must be treated rather roughly for preparation and that the cells are observed in conditions which deviate from normal. However this is the only method yet which makes possible an investigation on the dynamics of phototactic movements in cells of land plants. It may be that besides the leaves of *Arabis arenosa* the leaves of some other plants will prove to be adequate for preparation with this method and for observation.

S U M M A R Y

The leaves of the land plant *Arabis arenosa* proved to be convenient for investigations on phototactic chloroplast movements. In these leaves the palisade tissue can be separated from the spongy one without much damage to the cells. The method of preparation was described in detail. It seems that the leaves of *A. arenosa* are as yet the only material in which the course of chloroplast movements may be observed while the phototactic reactions take place.

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S T R E S Z C Z E N I E

Materiałem odpowiednim do obserwacji ruchów fototaktycznych chloroplastów okazały się liście rośliny lądowej *Arabis arenosa*, w których można oddzielić bez większego uszkodzenia miękisz palisadowy od gąbczastego. Sposób sporządzania preparatu został szczegółowo opisany. Wymieniony materiał jest jak dotąd jedynym obiektem wśród wyższych roślin lądowych, na którym można studiować ruchy chloroplastów w trakcie przebiegu reakcji fototaktycznych.

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