BIOLOGIA PLANTARUM (PRAHA)

13 (5—6) : 408—410, 1971

BRIEF COMMUNICATION

Absorption and Translocation of Lipidic Substances by Plants

S. Prát and S. A. Ahmed

Department of Plant Physiology and Soil Biology Faculty
of Natural Science Charles University, Praha*

Received March 12, 1971

Abstract. Young seedlings of *Zea mays* L. and *Cucurbita pepo* L. were grown in water culture with a layer of oil (linum or olive oil) or liquid paraffin. The seedlings transport oil and parafin into the top and in the young root. *Cucurbita* seedlings proved to be very sensitive and died within few days. *Zea* proved to be resistant. In *Zea* this transport of oil was found to be related to the age of the seedlings and the zone of the root in contact with oil. The oil was localised in the cell walls of different tissues of root and top, in the intercellular spaces of cortex and pith and in the xylem vessels.

In the years about 1930 S. Prát (unpubl.) in the investigations on transpiration and ions uptake used a thin layer of oil or liquid paraffin on the surface of the nutrient solution to prevent the evaporation of water. During these experiments a remarkable result was observed: the young plants of *Zea mays* (roots and leaves) appeared translucent, the intercellular spaces being filled with oil.

Seeds of *Zea mays* and *Cucurbita pepo* were germinated in Benson's solution in Petri dishes at about 25° C for about 66—72 h. Young seedlings were grown in Benson's solution in test tubes (or culture tubes). The seedlings were planted in culture tubes through cork pieces about 2—3 mm in thickness with a hole in the centre. Olive oil or liquid paraffin was introduced in the culture tubes at the surface of Benson's solution by means of a medicinal syringe with hypodermic needle so that about 3—5 mm portion of young root (or hypocotyl) was bathed in oil or liquid paraffin while the rest was in nutrient solution. The roots were in the dark while the tops were exposed to light. The boxes were placed in a cultivation room with controlled conditions.

It was seen that the oil as well as liquid paraffin were absorbed and transported by the seedlings of *Zea* and *Cucurbita*. Growth was very much retarded. Roots were more sensitive to the presence of oil than the tops.

Some lipophilic dyes like Sudan red, Sudan black and Ceres black were used to follow the movement of oil or liquid paraffin in the young seedlings

* *Address*: Viničná 5, Praha 2, Czechoslovakia.

of *Zea* and *Cucurbita*. It was seen that the dye (and consequently oil) first appeared in the top and later on started appearing in the young roots. The whole of the top as well as root except a few millimetres near root tip was coloured. In some cases a small drop of coloured oil was observed on the top of the coleoptile.

Cucurbita proved to be very sensitive to the presence of oil or liquid paraffin. Almost all the plants died by the 3rd or 4th day. The rate of mortality in *Zea* seedlings was only small. Some of the seedlings lived even for a month. But apparently there was no difference in the transport of oil and liquid paraffin by *Zea* or *Cucurbita* seedlings.

Young seedlings of *Zea* died earlier. Old seedlings were more resistant to the presence of oil and remained alive for a longer time. While still older seedlings did not transport oil at all.

The zone of the root which is in contact with the oil is also a very important factor in determining the transport of oil. Only when the oil is placed within about 1 cm—1·5 cm of the "basal" part of young root (or hypocotyl) it is transported. No transport of oil was possible if it was placed at the middle or at the part of the root near to the tip (apex).

Different methods were tried to demonstrate the presence of oil in the plant tissues. In the last a mixture of OsO_4 and CrO_3 was used to fix small segments of root and top of *Zea* seedlings grown with a layer of linseed oil. This method proved to be quite successful due to the following reasons:

1. Linseed oil was oxidized and consequently became immobile (and hard). The problem of disturbance and dislocation of oil was overcome.

2. Osmium gave a dark black colour to the linseed oil wherever it was present in the tissues.

The material was sectioned by a freezing microtome. The sections mounted in commercially available "Klovatina" (gum arabic) were dried and photographed.

It was seen in the transverse section of root and coleoptile that the cell walls of rhizodermis and epidermis, collenchyma, parenchyma, endodermis and pericycle were coloured black. Intercellular spaces of cortex and pith were also full of oil. Some of the vessels in the coleoptile also had oil. In the "basal" part of the root the vessels also contained oil.

The results are to be evaluated with reference:

1. To the theories of permeability and transport of lipidic substances in the plant.

2. To the use of herbicide sprays mixed with oils and oils used to impede transmission of viruses (see KÜLPS 1968, BRČÁK 1971).

3. To the practice of coating seeds and of oil treatment of fertilizers as to the increasing danger of pollution of water and soil with "mineral oils".

References

BRČÁK, J.: Vztahy rostlinných virů k přenašečům. [Plant viruses-vectors relations.] 318 pp. Academia, Praha 1971.

KÜLPS, G.: Untersuchungen zur Schutzwirkung von Ölen bei der Virusübertragung durch Blattläuse. — Z. f. Pflanzenkrank. (Pflanzenpathol.) und Pflanzenschutz 75 : 213—217, 1968.

S. Prát, S. A. Ahmed, Katedra fysiologie rostlin a půdní biologie přírodovědecké fakulty University Karlovy, Praha: **Resorpce a transport lipiduích substancí v rostlině.** — Biol. Plant. **13** : 408—410, 1971.

Z vrstvičky lněného oleje nebo tekutého parafinu, pokrývající hladinu živného roztoku, se tyto látky šíří akropetálně i basipetálně do rostliny, patrně buněčnými blanami a cévami a vyplňují mezibuněčné prostory.

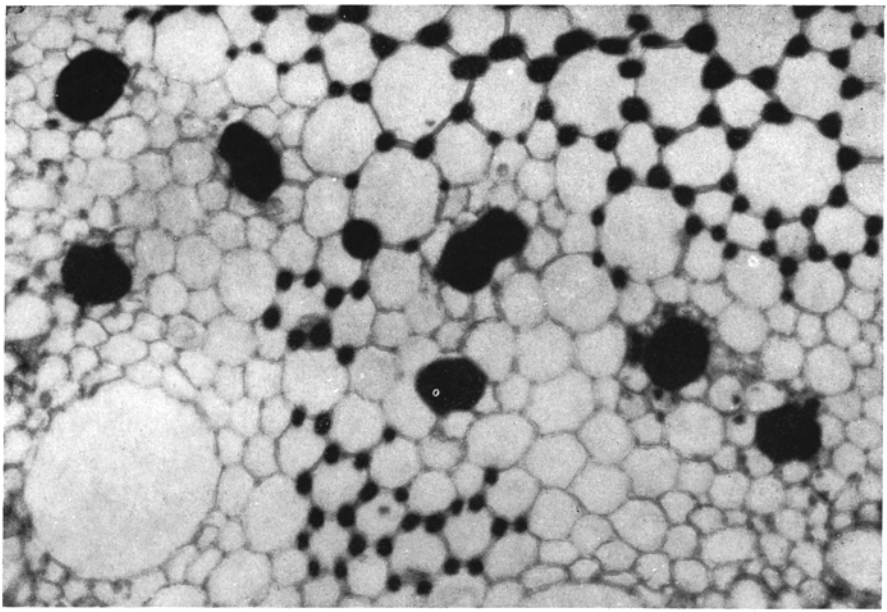

Fig. 1. Transverse section of six days old *Zea mays* coleoptile (lower part). The seedling was grown with a layer of linseed oil. The material was fixed in a mixture of OsO_4 and CrO_3. The oil is visible in the intercellular spaces and some of the vessels.

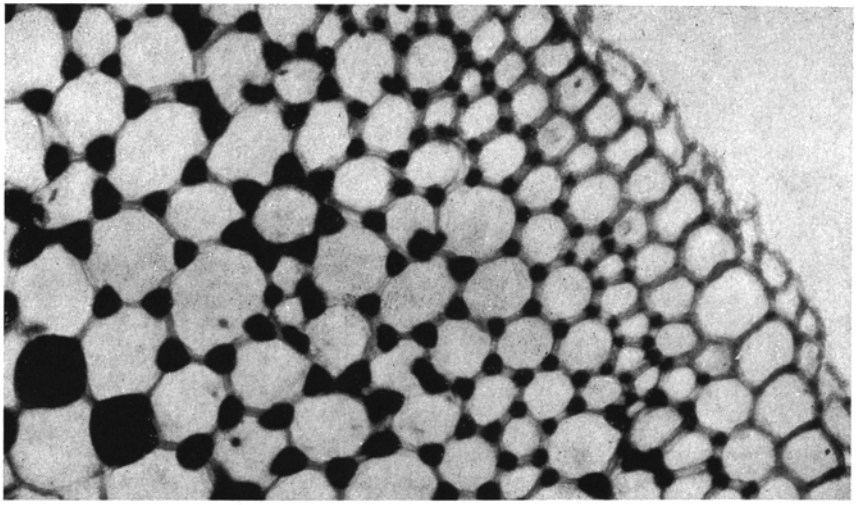

Fig. 2. Transverse section of six days old *Zea mays* root ("basal" part — the part which was bathed in oil) grown with a layer of linseed oil. The material was fixed in a mixture of OsO_4 and CrO_3. The walls of rhizodermis, collenchyma and parenchyma are black indicating the presence of oil.

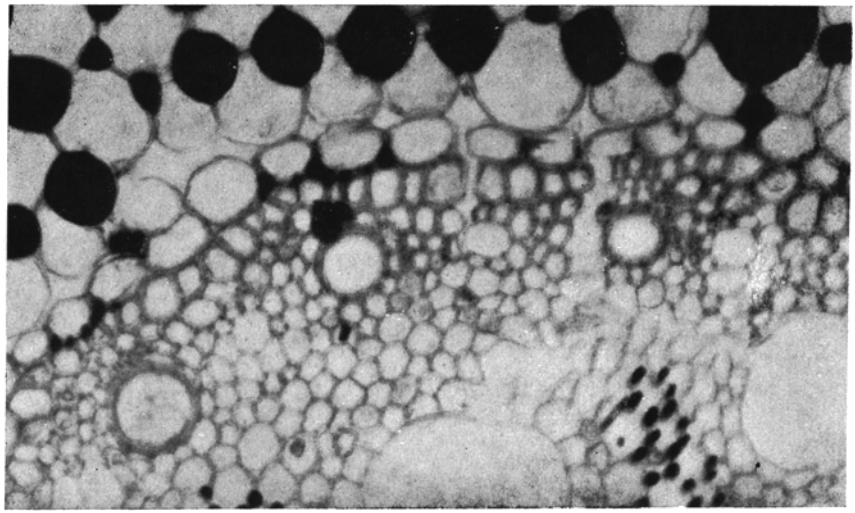

Fig. 3. Same as in No. 2. The oil is seen in the intercellular spaces of lower cortex and the intercellular spaces near the pith. Oil is also seen in some of the small vessels and in the spaces between the cells of endodermis and pericycle.