

## TRANSLOCATION OF ASSIMILATES IN FRITILLARIA IMPERIALIS L. II. DOWNWARD MOVEMENT OF $^{14}\text{C}$ -LABELLED PHOTO- SYNTHATES INTO THE DEVELOPING BULB AND THEIR SUBSEQUENT DISTRIBUTION AMONG THE SCALE PARTS

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### SUMMARY

$^{14}\text{CO}_2$  was supplied to single leaves of the vegetative shoot part of *F. imperialis* plants under conditions of photosynthesis. Three days later the bulbs were harvested, cut into slices, and freeze-dried. Autoradiograms showed the  $^{14}\text{C}$  to be localized in a 1/5 sector of the transverse sections of the bulbs.

The phyllotactic arrangement on the vegetative shoot part of the plants used was 2/5, thus 5 rows of leaves (orthostichies) could be distinguished.

The bulb scales, however, are arranged in a 1/2 phyllotactic configuration. Nevertheless, each row of leaves of the vegetative shoot supplies a 1/5 sector of the bulb with photosynthates, irrespective of the arrangement of the bulb scales.

### I. INTRODUCTION

As regards dicotyledonous plants several studies have appeared on the relation between tracer distribution and phyllotaxis (e.g. CALDWELL 1930; PROKOFIEV *et al.* 1957; LEVI 1967; HO & PEEL 1969). Similar studies on bulbous monocotyledons – with their quite different vascular pattern (FALKENBERG 1876), however, have never been made as far as we are aware.

In a previous study it was found that the supply of  $^{14}\text{CO}_2$  to a single leaf of *F. imperialis* invariably led to a movement of labelled photosynthates to the inflorescence as well as to the developing bulb (VAN DIE *et al.* 1970). In all experiments the part of the  $^{14}\text{C}$ -assimilates that was translocated towards the inflorescence mainly moved into the one flower that was situated in the orthostichy above the treated leaf, although the distance between the flower and leaf could be as large as 90 cm.

As the vegetative shoot part of the *F. imperialis* plants used in the experiments exhibited a 2/5 phyllotactic configuration, 5 orthostichies could be distinguished, reflecting 5 groups of vascular bundles. Each of these connects a particular row of leaves with a 1/5 sector of the flower-bearing shoot part. As the plants used in the experiments usually carried one whorl of 5 flowers, each flower was connected to 1/5 sector of the inflorescence and consequently received the photosynthates produced in the leaves of its own orthostichy, but not those produced in the others.

The question arose whether the  $^{14}\text{C}$ -photosynthates produced in a particular

leaf also moved into one fifth sector of the developing bulb. An abstract of preliminary work on these problems has been published elsewhere (VAN DIE & TIETEMA 1971). The experiments described in the present paper allow to answer this question in the affirmative. They also show that this distribution pattern is not influenced by the  $1/2$  phyllotactic pattern of the bulb scales.

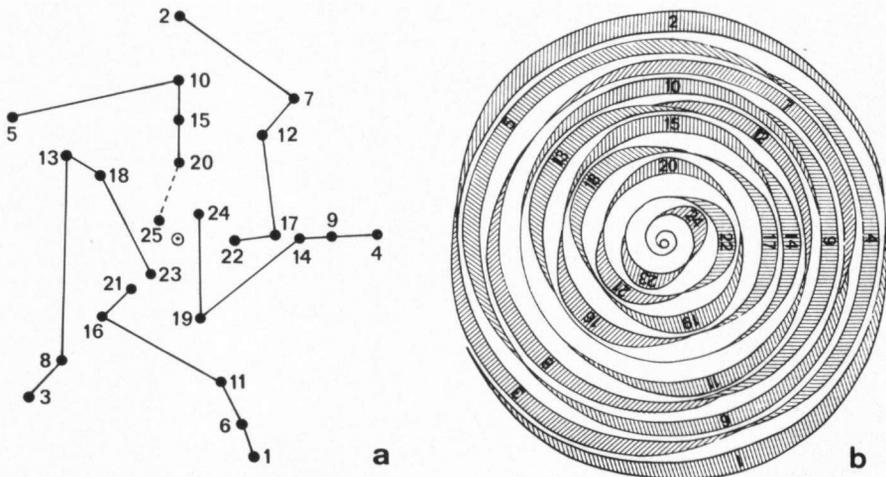
## 2. MATERIAL AND METHODS

Details on the plants and on most of the techniques used in the present work have been described in a previous paper (VAN DIE *et al.* 1970).  $^{14}\text{CO}_2$  was supplied to one of the bottom leaves of the vegetative part of the shoot of *F. imperialis* plants just after termination of flowering. After three days the bulbs were cut into a number of slices. In order to remove as much of the radioactive solutes that were set free from the damaged cells at the surface of the slices the cutting was carried out under running tap water. The slices were rapidly blotted with filter paper and freeze-dried at  $-20^\circ\text{C}$ . They were subsequently fixed onto card board and covered with X-ray film (Kodak "no-screen"). The time of exposure of the films was 4 weeks.

## 3. RESULTS AND DISCUSSION

*Fig. 1* shows the phyllotactic pattern of the vegetative shoot part of a plant, together with the assumed course of the orthostichies. In contrast to this  $2/5$  spiral pattern the bulb scales exhibit a  $1/2$  phyllotactic configuration (*fig. 2*). In the bulb depicted it can also be observed that the scales of the two new bulbs are turned  $90^\circ$  with respect to those of the present year.

*Fig. 1.* Diagram demonstrating the  $2/5$  phyllotactic arrangement in the vegetative shoot part of *F. imperialis* and the assumed course of the orthostichies.



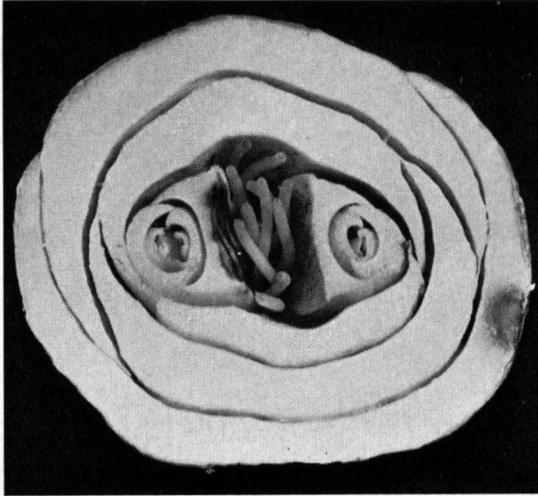


Fig. 2. Cross section through a bulb, demonstrating the 1/2 phyllotactic configuration of the scales.

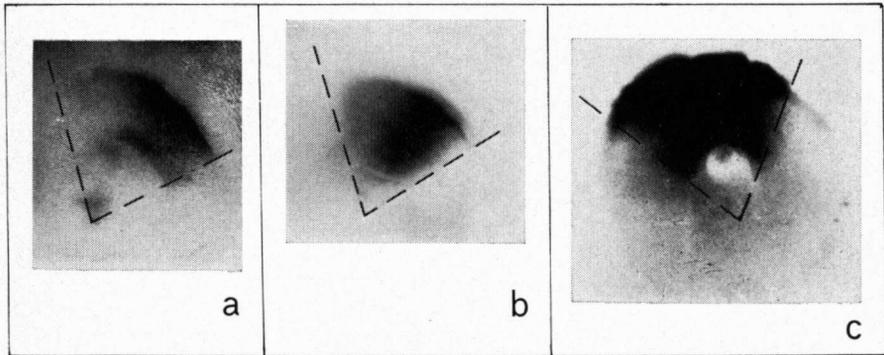
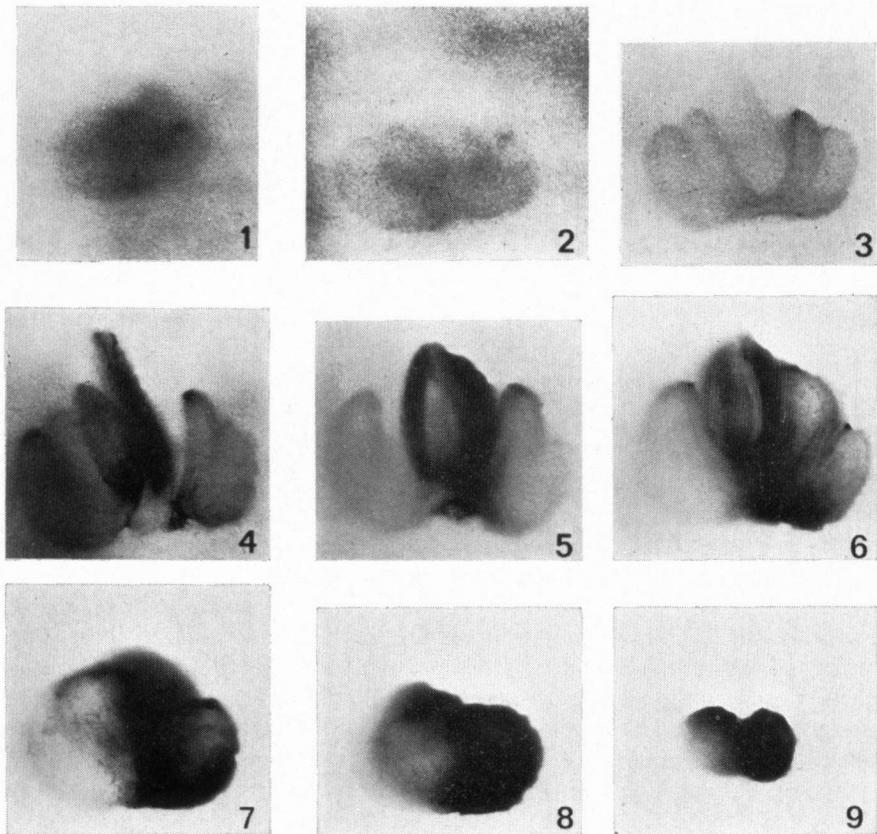


Fig. 3. Autoradiograms of transverse sections of three bulbs, each made after one of the bottom leaves of the vegetative stem part had received  $^{14}\text{C}\text{CO}_2$ . Note the clear, non-radioactive, circular cross section of the shoot stem near the centre of the bulb in fig. 3c, and within it the radioactive bundles which connected the treated leaf with the active bulb sector. In fig. 3a the black dots visible are radioactive bundles which are transversely cut. The back sectors in these three figures all approximate an angle of  $72^\circ$ .

A considerable number of experiments was performed to investigate the distribution of  $^{14}\text{C}$ -labelled compounds formed in a particular leaf among the growing bulb scales. *Figs. 3 and 4* demonstrate the results of some of them. They clearly show that the radioactivity exported from the leaf to the growing bulb parts was distributed in a way closely resembling the earlier observed distribution pattern of  $^{14}\text{C}$  in the inflorescence. Each row of leaves in *F. imperialis* supplies a 1/5 sector of both the inflorescence and the developing bulb with photosynthates, quite independent of the phyllotactic arrangement of the bulb scales on the axis. Only a 1/5 sector of the bulb became labelled, apparently by import

of assimilates translocated along one of the five groups of vascular bundles, which reflect the five orthostichies of the shoot. *Fig. 3c* beautifully exhibits the topographical relation between the active bundles in the shoot cross-section and the active bulb sector. In the same way as was observed for the inflorescence, also in the bulb there is little or no tangential movement of the assimilates out of the bundles, or out of the bulb sector in which the assimilates are accumulated. Whether the faint black fog on the assumed non-active parts of the bulb autoradiograms means that these parts are actually weakly labelled, or only demonstrates a contamination as the result of the cutting, remains an open question.

**Fig. 4.** Autoradiograms of a sequence of nine lengthwise-cut slices of a bulb made three days after a bottom leaf of the plant had received  $^{14}\text{CO}_2$ .



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