CCLIV. A NOTE ON THE RELATIVE DISTRIBUTION OF PHOSPHORUS AND PHOSPHATASE ACTIVITY IN THE FLORAL PARTS OF *NICOTIANA AFFINIS*, *PETUNIA*, *SALPIGLOSSIS* AND *GLADIOLUS*.

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THE activity of phosphatase in the bean, potato, radish and wheat at different stages of their life histories was reported in a previous paper [Ignatieff & Wasteneys, 1936]. The small amounts of material available however made the investigation of the distribution of the enzyme in the various parts of the flower impossible. Such data are needed to complete our knowledge of the distribution of the activity of phosphatase in the higher plants.

EXPERIMENTAL.

The method used for the estimation of the enzymic activity was the same as that described in the previous paper.

The first determinations were made on *Nicotiana affinis*, *Salpiglossis* and *Petunia* (Table I). The flowers were divided into petals, sepals and sex organs, and it is clear that in *Salpiglossis* and *Nicotiana affinis* the sex organs have a higher phosphatase activity than the other floral parts or the leaves. In *Petunia*

Table I. *Phosphatase activity in the leaves and in the flowers of Nicotiana affinis, Petunia and Salpiglossis.*

Parts of the plant	mg. of inorganic phosphorus released from 2% sodium β -glycerophosphate solution by 1g. of dry tissue in 1 min.		
	<i>N. affinis</i>	<i>Petunia</i>	<i>Salpiglossis</i>
Leaves	0.95	2.93	0.47
Spathes	0.65	2.91	0.51
Petals	0.61	1.71	1.14
Sex organs	1.39	2.97	4.52

there was no greater phosphatase activity in the sex organs than in the leaves and sepals. If the relatively high phosphatase activity in the sex organs is related to their functions, such a relationship should exist in all higher flowering plants. On the other hand it should be borne in mind that there is a great variation in the relative size of the different parts of the sex organs of the different species of flowering plants. It is possible also that there are differences in the concentrations of phosphatase present in the various sex organs, and therefore the activity of the enzyme in these organs when tested collectively will depend not only on the actual concentration of phosphatase present but also on their relative size. More accurate information on the distribution of phosphatase

in the floral parts of the plants is obtained, if the activity of the enzyme determined in anthers, filaments, styles and ovaries separately. *Gladiolus* was selected for such determinations because it possesses large sex organs.

Three different groups of flowering spikes, designated respectively A, B and C, were obtained. The flowers were removed from their spikes and were separated into their component parts as soon as possible, but as this process could not be completed in 1 day the material was kept overnight in a cold room at about 38° F. At this temperature the metabolic activity and the transpiration in the plants are very low, so that no significant changes could have occurred. The flowers were divided into petals, spathes, filaments, anthers, styles and ovaries. Samples of the leaves were also taken. After the flowers had been removed from the spikes, the latter were placed in water to allow the rest of the flower buds to blossom. In this manner two or three crops of flowers were collected from the same group of spikes, each crop being designated by a number placed after the letter which established the identity of the group.

The results of the experiments on *Gladiolus* are reported in Table II. From these results it is clear that the anthers show the greatest and the leaves the lowest enzymic activity. The leaves, however, towards the end of the life cycle

Table II. *Phosphatase activity in the leaves, spathes, petals and individual sex organs of Gladiolus.*

mg. of inorganic phosphorus released from 2% sodium β -glycero-phosphate solution by 1 g. of dry tissue in 1 min.						
Parts of the plant	Group A			Group B	Group C	
	Crop 1	Crop 2	Crop 3		Crop 1	Crop 2
Leaves	—	0.13	0.18	0.22	0.13	—
Spathes	0.15	0.17	0.18	0.24	0.25	0.23
Petals, white	0.20	—	—	0.30	0.44	—
Petals, coloured	0.16	0.35	0.65	0.24	0.36	0.59
Ovary	0.43	0.51	—	0.41	0.48	0.46
Style and stigma	0.28	0.60	0.60	0.49	0.57	0.71
Filaments	0.48	0.59	0.54	0.67	0.40	0.42
Anthers	1.19	1.48	1.41	1.15	1.19	1.18

Table III. *Phosphorus distribution in the leaves, spathes, petals and individual sex organs of Gladiolus.*

Parts of the plant	Total phosphorus in mg. per g. of dry matter	
	Group B	Group C ₁
Leaves	1.68	1.79
Spathes	1.97	2.07
Petals	2.43	2.45
Ovary	4.65	—
Style and stigma	3.00	3.42
Filaments	3.63	3.74
Anthers	6.70	6.99

of the plant contain large quantities of less vitalized fibrous material which may account for their low phosphatase activity. The activity was almost as low in the spathes and, indeed, there is no significant difference in the activities of the phosphatase in these two parts. The enzymic activity of the petals of the first crop of flowers removed from the spikes was also low, being equal to that of the spathes, but there was an increased activity in the petals of the flowers which

bloomed while the spikes were standing in water. On several occasions phosphatase activities in white and coloured petals were separately determined but no significant differences were found. The enzymic activity in the filaments, styles and ovaries was, in general, higher than in the petals.

Total phosphorus determinations were made on different parts of the flowers of groups B and C₁, according to Cockefair's method [Cockefair, 1931]. The results are presented in Table III and show that the phosphorus concentration in the sex organs is higher than in the petals, spathes or leaves and is greater in the anthers than in any of the other sex organs.

The variation in size of the floral parts is clearly shown by the results of total dry weight determinations shown in Table IV.

Table IV. *Dry weight (g.) of different parts of Gladiolus flower.*

Spathes ...	...	...	...	0.058
Corolla ...	...	...	...	0.139
Ovary ...	...	...	...	0.013
Style and stigma ...	...	...	...	0.005
Filaments ...	...	...	...	0.006
Anthers ...	...	...	...	0.010

DISCUSSION.

In the previous paper [Ignatieff & Wasteneys, 1936] it was stated that the phosphatase activity in the flowers was approximately the same as in the leaves at maturity of the plant. Whilst the results here reported appear to be at variance with this, the explanation for the difference is provided by the determinations of enzymic activity in the floral components of *Gladiolus* (Table II), which show that whilst the phosphatase activity is greater in the sex organs as a whole than in other parts of the flowers or in the leaves, it is only the anthers which have markedly higher phosphatase activity, and these, as Table IV shows, constitute only one-twentieth of the total dry weight of the flowers. Moreover, in *Gladiolus* and in *Salpiglossis* the leaves at the time of flowering contain, as compared with those of the other plants whose phosphatase activity is reported, a high proportion of inert fibre which explains the more marked difference between flowers and leaves in these two plants.

The very high phosphatase activity in the anthers of the *Gladiolus* is of special interest in view of the very high concentration of total phosphorus in these organs.

At present it is unwise to generalize but since in *Gladiolus* the sex organs have greater phosphatase activity, as well as a greater phosphorus concentration, than the spathes and petals, it may perhaps be suggested that in the flower the sex organs and especially the anthers are the site of the most active phosphorus metabolism. This hypothesis finds further support in Cockefair's work [Cockefair, 1931].

Unfortunately it was impossible to study the phosphatase activity throughout the life histories of the flowering plants investigated, and therefore no comparisons can be made between the enzymic activity of the floral parts and that of the other portions of the plant at an active stage of growth. Such a study would be of great interest. It was shown in the previous paper [Ignatieff & Wasteneys, 1936] that young leaves have a very high concentration of the enzyme.

SUMMARY.

Phosphatase activity of the floral parts of *Nicotiana affinis*, *Salpiglossis*, *Petunia* and *Gladiolus* was determined. It was found to be higher in the sex organs as a whole than in other floral parts. In the case of *Gladiolus* it is the anthers which especially are responsible for this higher activity.

Total phosphorus estimations which were made on the floral parts of *Gladiolus* showed the phosphorus concentration of sex organs to be higher than that of spathes and petals, and again it is the anthers which have the highest content of phosphorus.

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