The Influence of Pollination on the Respiratory Activity of the Gynaecium.

BY

JEAN WHITE, M.Sc.,

Melbourne University.

THE fact has now been known for some time that injuries and also small doses of poisonous substances produce a kind of feverish reaction on the part of the plant, resulting in a resumption or increased rapidity of growth, accompanied by an increase in the respiratory activity and in the production of heat¹. The two latter phenomena necessarily go together, but an increase in the rate of growth need not always be accompanied by a rise in the relative respiratory activity, as, for instance, when a stem seems to grow more rapidly simply because the apical internodes retain the power of elongating for a longer time than usual. Conversely, in the case of an injured potato or onion, as shown by Richards², the amount of growth is altogether disproportionate to the rise in the respiratory activity, and, in fact, in the case of the onion, little or no growth takes place after injury.

It is evident, therefore, that when a gynaecium begins its second period of growth, as the result of pollination, the respiratory activity might either remain unaltered, rise, or even conceivably fall as the result of more active production of adult, feebly respiring cells. The latter ultimately takes place as the period of complete ripeness is reached, and this fall is slowly continued until the fruit and seed become decayed or completely dried. No exact comparative determinations appear ever to have been made of the relative respiratory activities of pollinated and unpollinated gynaeciums in as young a condition as possible, so that a reasonable comparison can be made. Naturally, if the flower is one of short duration, and the experiments are delayed, the unpollinated gynaecium could only be expected to exhibit a lower respiratory activity, but, in the following investigation, care was taken to carry out the experiments while the flowers were quite young, and to determine the activity of respiration while the unpollinated gynaecium was still active and receptive.

¹ The literature up to 1902-1906 is given in Pfeffer's *Physiology of Plants*, the English translation.

² *Annals of Botany*, vol. x, No. XL, December, 1896.

Flowers were used from as widely separated orders as possible, so as to test the range of variation. Owing to the difficulty of preventing the pollination of the native Australian types growing in the open bush under their natural conditions, it was not possible to do much work with them.

The apparatus used throughout the experiments was Aubert's improved form of that of MM. G. Bonnier and L. Mangin for gas analysis. This apparatus has been described in full by Richards in his paper mentioned before.

I found that, after becoming accustomed to this instrument by trying a few preliminary experiments, it worked with perfect satisfaction, provided that the mercury was pure and clean, and that the sodium hydrate and pyrogallol were used in the proper concentration. The complaints from certain quarters as to the lack of accuracy of the apparatus are due to inattention to these precautions.

METHOD OF EXPERIMENTING.

The anthers were removed from some of the flower buds while quite young and undehiscent, and while the pistil was quite immature.

In many cases this had to be done in extremely young buds, owing to the flowers being strongly protandrous, the anthers depositing their pollen on the still immature stigma, which pollen adhered, and would have served for autogamous fertilization even if access of pollen from other sources were cut off.

The flowers from which the anthers had been removed were tied up securely in loose muslin bags, while other buds, generally on the same plant, of similar age were marked.

These latter were watched, and directly the stigma was seen to be receptive were pollinated with the pollen from other flowers, either on the same or adjacent plants. These flowers were then left for a period extending over a day and a half to six days, the length of the period depending on such conditions as temperature, atmospheric moisture, and the length of the style in those particular flowers.

At the end of this period a certain number of the pollinated and unpollinated flowers were removed, and their respiratory activity tested. Usually they were tested at once, in other cases they were kept with their stems in water for several hours before they were used. The peduncle, sepals, petals, and stamens or filaments were removed very carefully in order to prevent, as much as possible, any stimulating effect on the respiratory activity which might be caused by injury. Since the experiments usually were completed during the latent period of the wound-reaction, and since the gynaeciums were similarly treated in both cases, the disturbing action of this factor can be reasonably neglected.

As a rule the complete gynaecium was used, but in the case of flowers

having inferior ovaries, such as the *Fuchsia*, it was impossible to retain the style and stigma throughout the experiment, so that the ovaries alone were taken.

The gynaeceums or ovaries were then weighed, the experiments being performed in pairs, pollinated and unpollinated alternately, the weights of material employed in each pair of experiments being as nearly equal as possible.

The gynaeceums were put into a glass tube graduated into cubic centimetres over mercury, and an almost imperceptible quantity of water was passed up to the air space containing the gynaeceums, to avoid any deleterious effects which might be produced by the mercury vapour.

The tubes were placed upright with their open ends immersed in a dish of mercury and left for a certain time, during which they were covered with black cloth to prevent any complications due to carbon-dioxide assimilation. The gynaeceums were necessarily placed in a small volume of air in order to obtain sufficient carbon-dioxide for analysis in a short time, the general time during which they were left in the tubes being two hours.

The detailed results of the experiments are given below in tabulated form. In every case the weight of carbon-dioxide produced was calculated from the volume after correction to normal pressure and temperature.

GYNAECEUMS OF *EUCALYPTUS CALOPHYLLA*, R. BROWN

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{OC_2}{O_2}$ volume.
625	7/3/07	Pollinated flowers opened 4 days	19.3° C.	5 c.c.	14.1	2.5	2 hours	.62
625	7/3/07	Unpollinated flowers opened 4 days	19.3° C.	5 c.c.	17.5	1.6	2 hours	.33
675	7/3/07	Pollinated flowers opened 4 days	19.3° C.	5 c.c.	16.5	2.4	2 hours	.52
705	7/3/07	Unpollinated flowers opened 4 days	19.3° C.	5 c.c.	13.2	1.6	2 hours	.37
775	8/3/07	Pollinated flowers opened 5 days	18.2° C.	5 c.c.	13.4	1.8	2 hours	.38
665	8/3/07	Unpollinated flowers opened 5 days	18.2° C.	5 c.c.	9.0	1.0	2 hours	.39

The high percentage of oxygen absorbed by the pistils of *Eucalyptus*

calophylla is an interesting phenomenon, in all cases the percentage of oxygen absorbed being greatly in excess of the carbon-dioxide produced. This is probably due to the oily nature of the ovary, some of the oxygen combining with the hydrogen of the hydrocarbon to form water, and only that which combines with the carbon appearing as an equal volume of gaseous carbon-dioxide.

The ratios between the respiratory activities of the pollinated and unpollinated gynaeceums average respectively sixty-seven and forty-two, whilst the respiratory quotient is higher in the pollinated material four days after pollination, but appears to fall to about the same level on the fifth, although the difference in the respiratory activities is as pronounced as on the fourth day.

GYNAECEUMS OF *FUCHSIA SERRATIFOLIA*, RUIZ ET PAVON

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient CO ₂ volume. O ₂
300	19/11/06	Pollinated flowers opened 4 days	18° C.	5 c.c.	3.4	2.4	2.3 hours	.53
250	19/11/06	Unpollinated flowers opened 4 days	18° C.	5 c.c.	1.7	1.5	1.8 hours	.43
270	21/11/06	Pollinated flowers opened 5 days	19° C.	5 c.c.	3.6	4.0	2 hours	.69
290	21/11/06	Unpollinated flowers opened 5 days	19° C.	5 c.c.	3.1	2.2	2 hours	.45
480	26/11/06	Pollinated flowers opened 5 days	17.5° C.	5 c.c.	4.0	2.1	2 hours	.57
400	26/11/06	Unpollinated flowers opened 5 days	17.5° C.	5 c.c.	3.6	1.6	2 hours	.39
455	1/12/06	Pollinated flowers opened 4 days	18.5° C.	5 c.c.	1.9	2.7	2.3 hours	.79
265	1/12/06	Unpollinated flowers opened 4 days	18.5° C.	5 c.c.	3.9	1.6	2 hours	.50

In *Fuchsia* the weight of carbon-dioxide expired per 10 grms. of material was fairly constant, except in one pair of experiments which were performed on a different day from the other pairs. For no apparent reason the weight of carbon-dioxide given off in both the pollinated and unpollinated material was nearly double the amount evolved on the preceding and subsequent days. In many instances, throughout the experiments,

similar irregularities occurred, due in all probability to local variations or to nutritional factors. The position of the flower on the plant, whether it is terminal or lateral at the base or apex, and whether it is shaded or exposed, are all factors which influence the vigour of flowers, and hence also their respiratory activities.

The average ratios for the respiratory activity of the pollinated and unpollinated material are in this case as 112 : 69. The respiratory quotient is less than unity, and is throughout higher in the pollinated than in the unpollinated gynaeciums, the average difference being practically the same on both the fourth and fifth days.

GYNAECEUMS OF *PELARGONIUM ZONALE*, L'HÉRIT.

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{\text{CO}_2 \text{ volume}}{\text{O}_2}$
30	25/3/07	Pollinated flowers opened 5 days	18° C.	3 c.c.	2.7	38.0	2 hours	.92
25	25/3/07	Unpollinated flowers opened 5 days	18° C.	3 c.c.	2.0	4.9	2 hours	.75
40	3/4/07	Pollinated flowers opened 6 days	17° C.	3.5 c.c.	1.6	22.0	2 hours	1.2
20	3/4/07	Unpollinated flowers opened 6 days	17° C.	3.5 c.c.	1.9	4.6	2 hours	.1
30	3/4/07	Pollinated flowers opened 6 days	17° C.	3.5 c.c.	2.9	35.0	2 hours	1.2
20	3/4/07	Unpollinated flowers opened 6 days	17° C.	3.5 c.c.	2.4	6.8	2 hours	.28

Conspicuous irregularities are noticeable in the respiratory quotient of *Pelargonium zonale*. These were caused mainly by the extremely large differences between the CO₂ production in the pollinated and unpollinated material, the differences between the O₂ absorption being less pronounced.

The average relative respiratory activities were:—pollinated, 950; unpollinated, 163; the difference being more pronounced on the fifth day than on the sixth day. The respiratory quotient on the fifth day was nearly the same in both lots of material, but on the sixth day rose above unity in the case of the pollinated, and fell to quite a small fraction in the case of the unpollinated material. Possibly the stimulus of pollination hastens or induces the passage of a certain amount of oily food material to the gynaecium.

GYNAECEUMS OF *DIGITALIS PURPUREA*, L.

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{\text{CO}_2 \text{ volume}}{\text{O}_2}$
295	5/12/06	Pollinated flowers opened 5 days	17° C.	5 c.c.	6.7	6.9	2 hours	.65
290	5/12/06	Unpollinated flowers opened 5 days	17° C.	5 c.c.	5.0	3.2	2.2 hours	.44
295	10/12/06	Pollinated flowers opened 5 days	20° C.	5 c.c.	11.2	15.0	2 hours	.87
255	10/12/06	Unpollinated flowers opened 5 days	20° C.	5 c.c.	9.9	10.9	2 hours	.61
260	12/12/06	Pollinated flowers opened 5 days	17.5° C.	5 c.c.	4.3	8.8	2 hours	.74
265	12/12/06	Unpollinated flowers opened 5 days	17.5° C.	5 c.c.	3.9	5.5	2 hours	.56

As in previous cases, if the production of CO₂ is taken as representing the respiratory activity, the pollinated material produces 307 grams of CO₂ in the same time as a similar weight of unpollinated material produces 196 grams. There is, however, a wide range between the means of successive pairs of experiments. The respiratory quotients for the pollinated material average 0.75, and for the unpollinated 0.54, showing less fluctuation and a smaller average difference than in any previous case.

GYNAECEUMS OF *BEGONIA SEMPERFLORENS*, LINK

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{\text{CO}_2 \text{ volume}}{\text{O}_2}$
300	11/4/07	Pollinated flowers opened 4 days	15° C.	5 c.c.	1.9	2.1	2 hours	.73
380	11/4/07	Unpollinated flowers opened 4 days	15° C.	5 c.c.	2.7	.4	2 hours	.29
265	12/4/07	Pollinated flowers opened 5 days	16° C.	5 c.c.	1.9	2.4	2.1 hours	.73
325	12/4/07	Unpollinated flowers opened 5 days	16° C.	5 c.c.	1.6	.7	2.2 hours	.32

In the case of *Begonia semperflorens* 45 milligrams of carbon-dioxide were produced by the pollinated gynaeciums, as compared with 11 milligrams obtained from an equal weight of the unpollinated.

The average respiratory quotients of the pollinated specimens and unpollinated specimens, respectively, are as .73 : .31.

GYNAECEUMS OF *TECOMA CAPENSIS*, R. BROWN

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of Experiment.	Resp. quotient $\frac{CO_2 \text{ volume.}}{O_2}$
50	27/3/07	Pollinated flowers opened 5 days	12.5° C.	6 c.c.	3.0	30.0	2 hours	.53
60	27/3/07	Unpollinated flowers opened 5 days	12.5° C.	6 c.c.	2.9	15.0	2 hours	.34
60	27/3/07	Pollinated flowers opened 5 days	12.5° C.	5 c.c.	1.9	7.0	2 hours	.36
60	27/3/07	Unpollinated flowers opened 5 days	12.5° C.	4 c.c.	1.9	3.1	2 hours	.11
60	4/4/07	Pollinated flowers opened 5 days	16.5° C.	5 c.c.	1.3	4.6	2 hours	.35
65	4/4/07	Unpollinated flowers opened 5 days	16.5° C.	5 c.c.	1.0	2.8	2 hours	.28

In *Tecoma capensis*, out of two pairs of experiments performed on the same day there was a pronounced difference in the carbon-dioxide production between the first and second pair. The fall in the oxygen absorption was not so marked, but it is evident that the respiratory activity rapidly decreased in the flowers cut and kept with their cut ends under water. Whether this was due to a closure of stomata, or to the consumption of the presumably limited supply of food material available, is difficult to say. In any case the respiratory activities of the pollinated and unpollinated gynaeciums are as 416 : 209, and the average respiratory quotients as 0.41 : 0.24.

GYNAECEUMS OF *TROPAEOLUM MAYUS*, L.

<i>Weight of material in milligrams.</i>	<i>Date.</i>	<i>Condition of material.</i>	<i>Temperature.</i>	<i>Vol. of air enclosed.</i>	<i>Vol. per cent. of O₂ absorbed by material.</i>	<i>Milligrams of CO₂ produced by 10 grms. of material per hour.</i>	<i>Duration of experiment.</i>	<i>Resp. quotient $\frac{\text{CO}_2}{\text{O}_2}$ volume.</i>
40	3/12/06	Pollinated flowers opened about 6 days	16° C.	2 c.c.	3.6	11.7	2 hours	.66
30	3/12/06	Unpollinated flowers opened 6 days	16° C.	2 c.c.	3.5	10.1	2.2 hours	.51
45	8/12/06	Pollinated flowers opened 6 days	20° C.	2 c.c.	4.5	12.0	2 hours	.68
35	8/12/06	Unpollinated flowers opened 6 days	20° C.	2 c.c.	2.8	4.4	2 hours	.30
45	8/12/06	Pollinated flowers opened 6 days	20° C.	2 c.c.	3.3	11.0	2 hours	.75
35	8/12/06	Unpollinated flowers opened 6 days	20° C.	2 c.c.	3.9	8.8	2 hours	.43

Comparing the pollinated with the unpollinated material as before, 100 grams of the former were found to produce 347 milligrams of carbon-dioxide, while that produced by 100 grams of the latter was 233 milligrams. The respiratory quotients of the pollinated material are fairly constant, as are also those of the unpollinated, the average quotient in the first case being 0.69, and in the second case being 0.41.

GYNAECEUMS OF *CHEIRANTHUS CHEIRI*, L.

<i>Weight of material in milligrams.</i>	<i>Date.</i>	<i>Condition of material.</i>	<i>Temperature.</i>	<i>Vol. of air enclosed.</i>	<i>Vol. per cent. of O₂ absorbed by material.</i>	<i>Milligrams of CO₂ produced by 10 grms. of material per hour.</i>	<i>Duration of experiment.</i>	<i>Resp. quotient $\frac{\text{CO}_2}{\text{O}_2}$ volume.</i>
100	11/10/06	Pollinated flowers opened 5 days	11° C.	5 c.c.	4.6	15.0	2 hours	.69
100	11/10/06	Unpollinated flowers opened 5 days	11° C.	5 c.c.	2.6	5.3	2 hours	.46
100	24/10/06	Pollinated flowers opened 4 days	12° C.	5 c.c.	4.5	16.0	2.3 hours	.53
100	24/10/06	Unpollinated flowers opened 4 days	12° C.	5 c.c.	4.0	10.0	2 hours	.57

Irregularities manifest themselves in the previous set of experiments, though the data show a higher degree of respiratory activity in the pollinated specimens than in the unpollinated, as represented by the weight of carbon-dioxide evolved. The difference between the specimens which had been pollinated for five days was twenty, whilst in those which had been pollinated four days it was five.

All through the experiments it was a practically universal rule that the respiratory quotient was higher in the pollinated gynaeceums, but here an exception is observed in the second pair of experiments.

GYNAECEUMS OF *ANTIRRHINUM MAJUS*, L.

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{\text{CO}_2 \text{ volume}}{\text{O}_2}$
48	7/12/06	Pollinated, corolla just falling off, opened 5 days	21° C.	4 c.c.	3.4	9.5	2.5 hours	.56
48	7/12/06	Unpollinated flowers opened the same time as above	21° C.	4 c.c.	1.3	4.5	2.5 hours	.69
135	8/4/07	Pollinated flowers opened 5 days	17.5° C.	5 c.c.	3.0	7.5	2 hours	.73
120	8/4/07	Unpollinated flowers opened 5 days	17.5° C.	5 c.c.	2.2	1.5	2 hours	.18
120	8/4/07	Pollinated flowers opened 5 days	17.5° C.	5 c.c.	4.0	12.0	2.3 hours	.95
120	8/4/07	Unpollinated flowers opened 5 days	17.5° C.	5 c.c.	3.0	5.0	2.3 hours	.50

The carbon-dioxide production in the pollinated material bears a ratio to the production in the unpollinated material of 290 : 110.

Also the average respiratory quotients were as 0.75 : 0.46.

GYNAECEUMS OF *ANEMONE JAPONICA* VAR. *ALBA*,
SIEB. ET ZUCC.

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{CO_2}{O_2}$ volume.
650	5/4/07	Pollinated flowers opened 5 days	18.5° C.	5 c.c.	5.2	.28	2 hours	.69
480	5/4/07	Unpollinated flowers opened 5 days	18.5° C.	5 c.c.	6.1	.28	2 hours	.49
380	8/4/07	Pollinated flowers opened 5 days	18.5° C.	5 c.c.	5.2	.51	2 hours	.82
390	8/4/07	Unpollinated flowers opened 5 days	18.5° C.	5 c.c.	6.4	.51	2 hours	.68

Practically the same results were obtained from the pollinated and unpollinated specimens of *Anemone japonica*.

As no trace of fruit formation could be found in any one flower out of an extremely large number which were examined and watched, it was evident that the pollen was infertile, and that all the specimens used were really unpollinated. The experiments serve to show, however, that in similar pairs of gynaeciums the production of carbon-dioxide is very constant, although the respiratory quotient fluctuates quite appreciably. From the variation in the respiratory quotient it can be concluded that the variations shown in the case of *Cheiranthus Cheiri* are also independent of pollination.

GYNAECEUMS OF *LILIUM CANDIDUM*, L.

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient $\frac{CO_2}{O_2}$ volume.
340	12/12/06	Pollinated flowers opened 5 days	16.5° C.	15 c.c.	5.4	2.0	16 hours	.68
515	12/12/06	Unpollinated flowers opened 5 days	16.5° C.	15 c.c.	6.1	1.2	16 hours	.60

In experimenting with Monocotyledons, irregularities in both CO₂ production and O₂ absorption were found to be of more frequent occurrence than in Dicotyledons.

Also the respiratory activity of the gynaeceum was in each case much feebler than in the Dicotyledons.

From the data given for the experiments on *Lilium candidum* it will be seen that it was necessary to leave the material enclosed in the tube for many hours before any appreciable change in the enclosed air was observed.

GYNAECEUMS OF *CANNA INDICA*, L.

Weight of material in milligrams.	Date.	Condition of material.	Temperature.	Vol. of air enclosed.	Vol. per cent. of O ₂ absorbed by material.	Milligrams of CO ₂ produced by 10 grms. of material per hour.	Duration of experiment.	Resp. quotient CO ₂ volume. O ₂
290	13/3/07	Pollinated flowers opened 7 days	19.6° C.	5 c.c.	1.9	2.0	1.7 hours	.57
205	13/3/07	Unpollinated flowers opened 7 days	19.6° C.	5 c.c.	3.2	.5	1.7 hours	.62
270	20/3/07	Pollinated flowers opened 5 days	16.5° C.	5 c.c.	2.7	1.6	2 hours	.36
320	20/3/07	Unpollinated flowers opened 5 days	16.5° C.	5 c.c.	3.0	.1	2 hours	.03
240	20/3/07	Pollinated flowers opened 5 days	16.5° C.	5 c.c.	3.2	3.9	2.2 hours	.72
300	20/3/07	Unpollinated flowers opened 5 days	16.5° C.	5 c.c.	2.4	.6	2.2 hours	.20

The principal fact noted here was that the carbon-dioxide given off was markedly less than in the experiments previously given on other flowers.

The ratio of the carbon-dioxide evolved by the pollinated to that evolved by the unpollinated specimens was $\frac{75}{12}$.

The respiratory quotient of the former was to that of the latter as 0.55 is to 0.28.

GYNAECEUMS OF *AGAPANTHUS UMBELLATUS*
VAR. *ALBIFLORUS*, L'HÉRIT.

<i>Weight of material in milligrams.</i>	<i>Date.</i>	<i>Condition of material.</i>	<i>Temperature.</i>	<i>Vol. of air enclosed.</i>	<i>Vol. per cent. of O₂ absorbed by material.</i>	<i>Milligrams of CO₂ produced by 10 grms. of material per hour.</i>	<i>Duration of experiment.</i>	<i>Resp. quotient CO₂ volume. O₂</i>
200	16/3/07	Pollinated flowers opened 6 days	19.6° C.	5 c.c.	1.9	2.5	2 hours	.57
190	16/3/07	Unpollinated flowers opened 6 days	19.6° C.	5 c.c.	1.7	2.3	2 hours	.59
235	16/3/07	Pollinated flowers opened 6 days	19.6° C.	5 c.c.	3.3	2.3	2 hours	.36
220	16/3/07	Unpollinated flowers opened 6 days	19.6° C.	5 c.c.	2.7	1.6	2 hours	.29
240	22/3/07	Pollinated flowers opened 7 days	18° C.	5 c.c.	3.1	1.5	2 hours	.17
240	22/3/07	Unpollinated flowers opened 7 days	18° C.	5 c.c.	3.3	.19	2 hours	.63

Except in one pair of experiments in *Agapanthus*, in which the weight of carbon-dioxide evolved per gram of material was the same for the unpollinated as for the pollinated specimens, every result which has been obtained shows a distinctly marked rise in the evolution of carbon-dioxide in the pollinated gynaeceums, as compared with the unpollinated.

The most strongly marked results were manifested in *Pelargonium zonale*, the amount of carbon-dioxide produced by the pollinated material being 5.8 times greater than the amount produced by the unpollinated. Pronounced differences were also observed, though to a less degree in *Cheiranthus Cheiri*, the pollinated specimens producing 2.0 times as much as the unpollinated, and in *Antirrhinum majus* the pollinated material evolved 2.6 times as much by weight of carbon-dioxide as the unpollinated.

Throughout the series of experiments, with a few rare exceptions, the respiratory quotient in the pollinated gynaeceums exceeded that in the unpollinated, the principal exceptions occurring as isolated cases among the Monocotyledons. These irregular fluctuations, however, appeared to be independent of pollination, and, when they did occur, in no case did the respiratory quotient in the unpollinated specimens exceed that in the pollinated specimens to any great extent; the most notable instance being found in the *Canna*, where the respiratory quotient in the unpollinated specimens in one pair of experiments was in excess of that in the pollinated

specimens of the same pair by 0.05. The respiratory quotient in both kinds of material was somewhere below unity, except in *Pelargonium zonale*, in the pollinated gynaeceums of which it rose above unity, its maximum being 1.2, while in the unpollinated gynaeceums it fell well below unity.

Slight environmental changes, such as temperature and moisture in the atmosphere, or changes in the material itself, such, for instance, as would probably occur owing to the length of time which elapsed between the cutting of the flower and experimenting upon it, appeared to affect the oxygen absorption in a more marked degree than the amount of carbon-dioxide evolved by the material.

The net result of the whole work is to show that pollination not only produces a rapid rise of the respiratory activity, but also affects the respiratory quotient of the gynaeceum.

The foregoing work was carried out in the Botanical Laboratory at the Melbourne University. I wish to record my indebtedness to Professor Ewart for the interest he has taken, and for the advice he has given me.

White, Jean. 1907. "The influence of pollination on the respiratory activity of the Gynaecium." *Annals of botany* 21, 487–499.

<https://doi.org/10.1093/oxfordjournals.aob.a089149>.

View This Item Online: <https://www.biodiversitylibrary.org/item/235747>

DOI: <https://doi.org/10.1093/oxfordjournals.aob.a089149>

Permalink: <https://www.biodiversitylibrary.org/partpdf/318888>

Holding Institution

Smithsonian Libraries

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: Not in copyright. The BHL knows of no copyright restrictions on this item.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.