

The Influence of Stimulating Doses of 6-Benzylaminopurine on Awakening Apple Buds and on their Consumption of Oxygen

L. CHVOJKA, M. TRÁVNÍČEK, M. ZAKOUŘILOVÁ

Institute of Experimental Botany of the Czechoslovak Academy of Sciences

Received October 2, 1961

Vliv stimulačních dávek 6-benzylaminopurinu na probouzející se pupeny jabloně a na jejich spotřebu kyslíku.

Byl sledován vliv 6-benzylaminopurinu na dýchání pupenů jabloně odrůdy Boskooské v průběhu 5 dnů po podání kininu. Bylo zjištěno, že spotřeba kyslíku stanovená přímou metodou Warburgovou je vyšší již prvního dne po podání 6-benzylaminopurinu a stoupá stále výrazněji až do pátého dne, kdy je spotřeba kyslíku u pupenů stimulovaných o 75 % vyšší, než u pupenů kontrolních.

Summary

The influence of 6-benzylaminopurine on the respiration of apple buds of the Boskoop variety for 5 days after application of kinine was observed.

It was discovered that the consumption of oxygen determined by the direct method of Warburg is higher from the first day after application of 6-benzylaminopurine and the increase is continually more marked up to the fifth day, when the consumption of oxygen in stimulated buds is 75 per cent higher than in the control buds.

Introduction

6-Furfurylaminopurine and 6-benzylaminopurine in small doses, causes the expansion of apple buds and in larger doses, opening of the buds. A dose of 10—30 μg . 6-benzylaminopurine causes expansion while higher doses (50—200 μg .) bring about sprouting of the buds (CHVOJKA, VEBEŠ,

* *Address:* Čejetice u Mladé Boleslavi, pokusná základna ČSAV

KOZEL 1961). These morphological changes can usually be observed 5 to 10 days after the application of kinine.

In studying the mechanism of the effect of kinine, however, it is especially interesting to observe the period from the application of kinine up to the time when visible, morphological changes can be noted in the stimulated buds. We expected that an increase in the synthetic process in the stimulated buds would be reflected during this period in changes of their metabolism, particularly respiration. Because activation of the synthetic process is closely connected with respiration, the aim of this work was to determine the consumption of oxygen in the controls and in the stimulated buds, in a time dependence, during the first five days after the application of 6-benzylaminopurine.

Material and Methods

The experiment was carried out in August 1961, on 5-year-old apple trees of the Boskoop variety growing on M I stocks. The 6-benzylaminopurine was applied to buds on the middle parts of one-year shoots on these trees. Five buds were used from each shoot.

6-Benzylaminopurine in 50 μg . amounts dissolved in 1 ml. to one bud, was introduced into the experimental buds and 1 ml. of distilled water into the control buds.

6-Benzylaminopurine was added to 5 ml. test tubes into which the given amount of fluid had been pipetted: One end of a thin rubber tube 20 to 30 cm. long was inserted right to the bottom of each test tube, and the solution was drawn up through a pipette fixed to the other end of the rubber tube until the whole tube was full. The end of the tube was then closed hermetically between the fingers, the pipette taken away and the end of the rubber tube pulled on to the end of the stem of the shoot which remained after cutting of the leaf blade. The end of the rubber tube which was in the solution in the test tube was about 2–3 cm. higher than the stem, into which the solution then flowed automatically. It is necessary to take great care when removing the tube from the stem, so as not to pull the stem off.

Preparation of the 6-benzylaminopurine solution: The weighed amount of 6-benzylaminopurine is dissolved in 5 ml. of distilled water acidified with HCl to $\text{pH} = 2$, by heating on a boiling water bath. The solution is then diluted with water to a final volume of 80–90% and again heated so that the granules dissolve completely. Finally, the pH of the solution is adjusted to 5.5 and the solution is made up to the final volume.

The consumption of oxygen by the stimulated and control buds was determined by the direct Warburg method. The buds were collected at daily intervals from the first to the fifth day after the application of 6-benzylaminopurine. For each determination, 32 stimulated buds from seven shoots were taken and 32 control buds also from seven shoots.

Contents of the Warburg flasks: Eight buds were placed freely on the bottom of the Warburg flasks, 1 ml. of distilled water was pipetted into the side-arm and into the adsorption dish, 0.2 ml. of 20% KOH.

Measuring was always carried out one hour after removal of the buds. The changes in pressure were subtracted at 15 minute intervals for a period of 90 minutes at 26° C. When measuring was completed, the dry weight of the buds was determined. The results of measuring are expressed in μl . of consumed oxygen per 100 μg . of dried bud weight during 90 minutes, both in tables and graphs. Each experiment was repeated four times.

Results and Discussion

Five experiments with two variations were carried out on the buds of a Boskoop apple tree. The buds were stimulated with kinine in the experi-

mental variants while plain solvent was added to the control variants. The consumption of oxygen in the controls and in the stimulated buds was determined daily up to the fifth day after the application of kinine.

The control variants in all experiments showed practically the same value of consumed oxygen referred to dry weight. On the contrary, in all experimental variants a greater consumption of oxygen was observed, compared with the controls, from the first day after the application of kinine. It is interesting that this increase in the consumption of oxygen rises with time. While the increase in oxygen consumption on the first day after the application of kinine was 8.3%, on the fifth day it had reached 75% in the stimulated buds as compared with the controls. (See tab. 1 and Fig. 1.)

On the basis of given results it can be concluded that 6-benzylaminopurine increases respiration in stimulated apple tree buds. Only 24 hours after application, the consumption of oxygen in stimulated buds is higher than that of control buds, and in the course of the first five days after the application of 6-benzylaminopurine the increase is increasingly more marked. From the sixth day after the application of 6-benzylaminopurine there was no purpose in measuring oxygen consumption because, beginning on this day, the stimulated buds began to have a markedly different morphological appearance from that of the control buds.

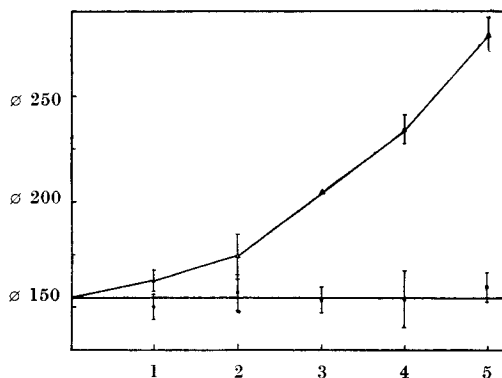


Fig. 1. Oxygen consumption of control and stimulated (6-benzylaminopurine) buds of apple tree. Abscissa: days. Ordinate: $\mu\text{l. O}_2$.

Tab. 1. Differences in the consumption of oxygen in buds stimulated with 6-benzylamidopurine compared with controls

No. of days after stimul.	Consumption of O ₂ in μl		Difference in percent
	Control	Experiment	
1	150.2	162.7	8.3
2	157.2	174.0	10.7
3	153.7	207.5*	35.0
4	153.9	234.5	55.4
5	159.3	278.8	75.0

* Because of a technical fault in measuring the value as the average of two parallel determinations is given only (faulty hermetic ring fittings in two manometers).

References

Хвойка, Л., Вереш, К., Козел, Я.: Влияние кининов на рост почек яблони и на включение P^{32} . [The effect of kinins on the growth of apple tree buds and on the incorporation of P^{32} .] Biol. Plant. 3 : 140—147, 1961. Translated into English: Commonwealth Bureau of Horticulture and Plantation crops, East Malling Research Station, Kent, England. Query No. 4025. Sept. 1961.

Л. Хвойка (Институт экспериментальной ботаники, ЧСАН, Прага)

Влияние стимулирующих доз 6-бензиламинопурина на пробуждение почек яблони и на потребление кислорода этими почками

В течение 5 дней после введения 6-бензиламинопурина было изучено его влияние на дыхание почек яблони. Авторы определяли потребление кислорода методом Варбурга. Было найдено, что потребление кислорода почками увеличивается с первого дня после введения 6-бензиламинопурина и на пятый день превышает на 75% потребление кислорода контрольными почками.