The Stimulatory Effect of Uracil and 5-Bromouracil on the Seed Set in *Papaver somniferum* L.

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Abstract. A study was made concerning the effect of the analogues of nucleic acid components upon the seed set in *Papaver somniferum* L. For the experiments flowers one day after anthesis were used, as the pollination taking place at this flower age had previously been found to be most efficient for the seed set. The solutions of analogues in a 10 per cent sucrose were applied by injecting them into the ovaries three hours prior to pollination. Damage to the ovary by the injection reduces the seed set by about two thirds.

In comparison with control flowers, into which only a sucrose solution was injected, 5-bromouracil at a concentration of $5.2 \times 10^{-4}$ M increases the seed set by about 70 per cent. Uracil brings about the same degree of promotion. The same concentration of 5-bromodeoxyuridine has no significant effect on the seed set. When applied simultaneously with uracil it suppresses its stimulating effect completely. The equimolar mixture of uracil and bromouracil did not cause any significant increase in the number of seeds in the capsules, either.

The analogues of nucleic acid components are generally considered as compounds inhibiting physiological processes by affecting the RNA synthesis unfavourably. A few cases of their stimulatory effects were revealed in higher plants (e.g. Šormová et al. 1960, Woodstock and Brown 1963, Mathur and Sharma 1968); however, the biochemical basis of such an action has not been elucidated so far. Some unnatural pyrimidine and purine derivatives exhibit an especially striking stimulatory effect upon the growth of pollen tubes (Tupy et al. 1965).

The mutagenic effects of analogues are well known in lower organisms (Freese 1963). With higher plants, negative results are reported in this respect (e.g. Müller 1965, Jacobs 1967), apart from the experiments in which the induction of gene mutations by analogues was achieved (Hirono and Smith 1969). It seems that in plant material the mutagenic effect of analogues is greatly dependent upon the technique of their application. This may consist in the different metabolic activity in different plant parts and on the different levels of their development, in relation to the metab-

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oolism of analogues, as well as to the processes connected with the growth depression of genetically abnormal cells, and to the repair itself of induced changes in DNA structure.

The experiments described in this paper were aimed at finding out the effect of analogues on the process of fertilization and seed formation, and at developing, on the basis of the method of intraovarian pollination (Kanta et al. 1962), the procedure of their application to germ cells for the purpose of genetical investigation. It was this aspect of our work which determined the choice of BU and BUdR for the experiments.

Material and Methods

Two cultivars of Papaver somniferum L. were employed for the experiments, namely cv. Hanácký medrosemenný (HM), and cv. Dětenický bélozrný (DB), both grown under field conditions.

All experimental flowers were emasculated. The castration was carried out with the buds one day prior to anthesis, and moreover in the early morning, because at about noon of the same day the dehiscence of the anthers was over.

Pollen was obtained from the anthers which were collected from the buds also one day prior to anthesis and kept overnight at room temperature. It was used for pollination only on the day of collection, owing to the fact that when stored, its germinating capacity decreases rapidly.

The flowers were isolated using paper bags, which were taken away 7 days after pollination. After their removal the stigmas were at once smeared with petroleum jelly, in order to prevent any undesirable pollination.

The compounds to be tested by being injected into the ovaries were dissolved in a 10 per cent sucrose solution containing 10^{-3} per cent H_2BO_3. The ovarian cavity was completely filled up with the solution injected.

The differences in the number of fully developed seeds in mature capsules were evaluated using the Student’s t-test. As neither of the two experimental cultivars differed significantly in this respect (the t-test values fluctuating between 0.31 and 1.86), the results of both cultivars were grouped together for the final evaluation. On the whole, a relatively high variability was revealed among the capsules in the number of developed seeds. In the tables it is represented by the values of the coefficient of variability (v).

Results and Discussion

The Dependence of the Seed Set upon the Age of Pollinated Flowers

In view of our previous findings concerning the dependence of the seed set on the age of the experimental flowers of tobacco (Balatková and Tupý 1972), the solution of this problem with the opium poppy was considered to be the first task. In the given experiment flowers of four different age groups were pollinated simultaneously: in the first group anthesis was due the following day, in the second it was due on the same day, in the third and fourth it had already taken place one or two days before, respectively. Seeds were formed in all four groups, but their numbers differed markedly (Tab. 1). The lowest number resulted from flowers pollinated one day before anthesis. This was contrary to expectations, considering that in nature, flowers of the same developmental levels shed pollen only 4h later on the very same day, and kleistogamic pollination occurs. According to our experiments

Abbreviations used: HS = highly significant (P < 0.01), NS = non-significant (P < 0.05); BU = 5-bromouracil, BUdR = 5-bromodeoxyuridine; HM = cultivar Hanácký medrosemenný, DB = cultivar Dětenický bélozrný.