Bergapten in *Dictamnus albus* L.

Among the plants with known photosensitizing action on the human skin, *Dictamnus albus* (*D. fraxinella*, gasplant) is a well-known example. Contact of the plant juice with the skin, and the subsequent irradiation with ultraviolet light (366 nm), produces an obligatory phototoxic inflammatory reaction. Clinically, the condition is known as phytophotodermatitis. Plants causing this phenomenon chiefly belong to the families Umbelliferae and Rutaceae, and it has been known for some time that the responsible agents are linear (6, 7-)furocoumarins (psoralen and derivatives)[1].

Although phytophotodermatitis due to the contact with *D. albus* has been recognized by clinicians[2,3], the presence of furocoumarins in extracts of this plant has so far not been demonstrated. In a study of the photosensitizing potency of a number of plants[4], we identified bergapten as the major furocoumarin in *D. albus*.

Dried whole plants (obtained from The Cantonspark, Baarn, Holland) were extracted with a mixture of ethanol-water (1:2) at 70°C for 1 h, the extract was filtered while hot and allowed to cool. The pH was brought down from pH 6.5 to pH 1 with 4 *n* H_2SO_4, the solution heated for 90 min on a steam bath, allowed to cool, and extracted three times with petrolether (40–60). The organic layer was washed with 0.5% aq. $NaHCO_3$ and water, and dried over anh. Na_2SO_4; it was then taken to dryness *in vacuo*, the residue dissolved in excess absolute ethanol and filtered. The ethanol was removed from the filtrate *in vacuo*, the residue dissolved in $CHCl_3$:petrolether (1:4), and brought on a column of Al_2O_3 (Brockmann) in the same solvent mixture. After percolation of $CHCl_3$:petrolether (1:4) to remove inactive material, the column was eluted with $CHCl_3$:petrolether (1:1). The colourless eluate was finally taken to dryness and the residue recrystallized several times from petrolether to give white needles, $C_{12}H_8O_4$, m.p. 189° (uncorr.), identified as bergapten by UV-absorption spectrum, paper chromatography and its photosensitizing potency in skin tests. Available evidence indicates that at least part of this furocoumarin in the original extract exists as the glycoside of the corresponding furocoumarinic acid.

Zusammenfassung. Die Isolierung von Bergapten (5-Methoxy-Psoralen) aus *Dictamnus albus* L. wird beschrieben. Die photosensibilisierende Wirkung der Inhaltsstoffe dieser Pflanze nach UV-Bestrahlung auf die menschliche Haut ist hauptsächlich auf dieses Furocoumarin zurückzuführen.

L. Berrens and E. van Dijk

Academic Hospital, Department of Dermatology, Utrecht (The Netherlands), August 3, 1964.

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Ovule Development in the Carpelloid Stamens of *Solanum tuberosum* L.

The carpelloidy of stamens has so far been recorded only in *Nicotiana* hybrids[1,2]. The present note records the occurrence of the fasciated carpelloid stamens in an intervarietal hybrid (D.7409) of *Solanum tuberosum* L. (Up-to-Date × E96) and endeavours to present the morphological and anatomical study of this abnormality.

Morphological observations. The normal potato flower consists of a five gamosepalous calyx, five gamopetalous rotate corolla, five basifixed anthers and a bicarpellary syncarpous superior ovary.

In the present case, the calyx and corolla of the flower were normal. The anthers were five in number but irregular in size and two or three of them showed fasciation (Figure 1). From the base of the anther filaments arose club-shaped filiform staminal appendages projecting slightly beyond the anthers (Figure 1). In most of these cases the anthers were made up of only spongy tissues. But in some flowers anthers were light yellow in colour and contained empty and shrivelled pollen grains. In many of the flowers the styles were thickened. In some it looked as if two or more styles had fused together (Figures 1 and 2). The stigmatic surfaces in these cases were broader and spongy compared with the normal ones.

Anatomical observations. Anatomical studies showed that: (1) The development and differentiation of female and male parts proceeded simultaneously, suggesting that the factors responsible for the differentiation and growth of both of these organs act simultaneously.

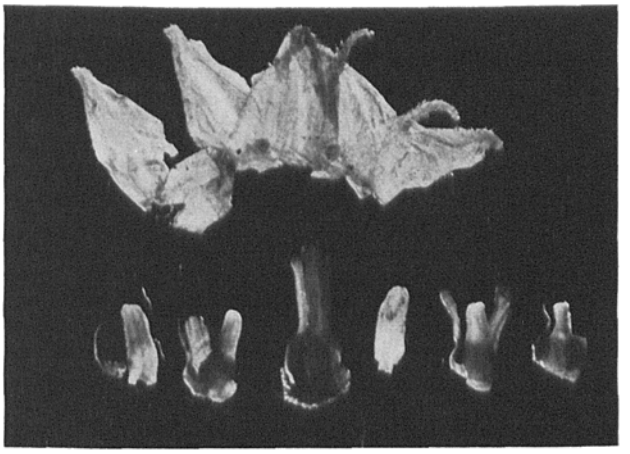

Fig. 1. Morphological variation in floral parts of a carpelloid flower (× 10).

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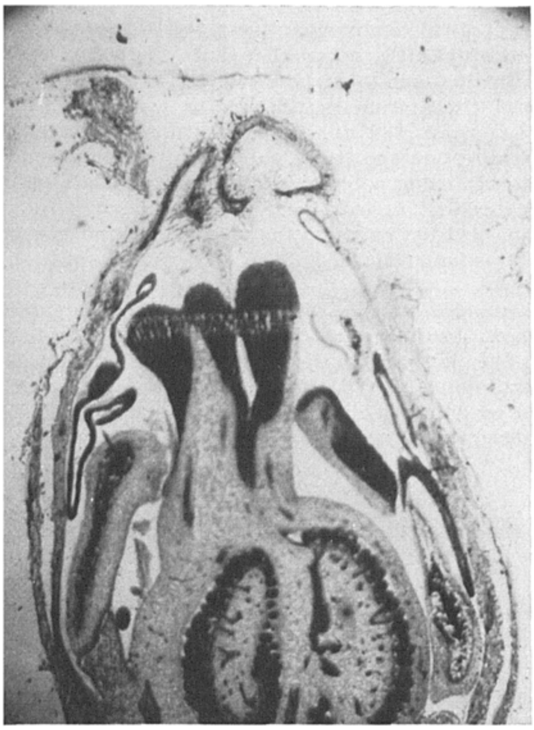

Fig. 2. L.S. of a carpelloid flower showing anther sacs and splitting of the style and stigma (× 20).

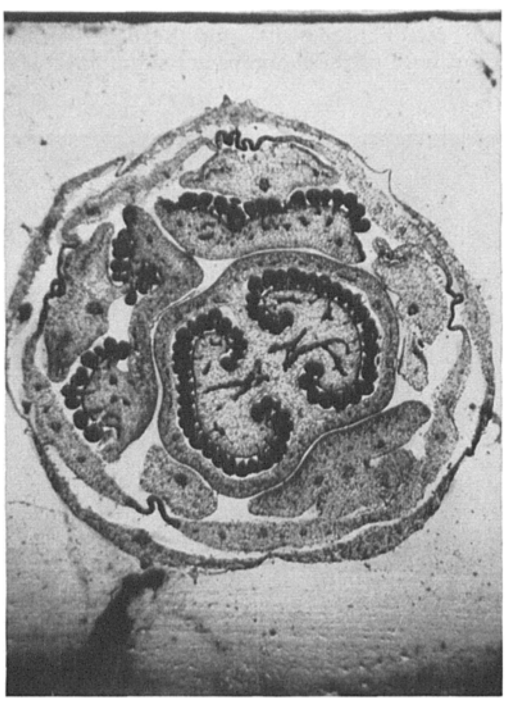

Fig. 3. T.S. of a carpelloid flower showing the ovules and the placentation on the carpelloid stamens (× 20).

(2) The development of anthers took place only up to the formation of tapetal cells. The sporogenous tissue was absent in most of the anthers, leaving an empty cavity in its place. In some of the anther sacs, empty shrivelled sterile pollen grains were present.

(3) The fasciation of the anthers started after a certain period of growth. As stated earlier, two of the stamens showed malformation in most cases. Sometimes they became fused together at the sides to form one fasciated, thick, club-shaped staminal appendage. The three remaining stamens were reduced in size, usually became non-functional and consisted of only an undifferentiated parenchymatous mass of tissue giving them a spongy nature. The club-shaped malformed stamens developed papilate cells on the tips, similar to those seen on the normal stigmatic surface (Figure 2).

(4) In the case of fasciated anthers, naked ovules were seen to develop on the 'false placenta' in place of pollen grains. Sometimes such ovules were also found in pouches between the parenchymatous tissues of the modified androecium. In these cases the ovules were marginally attached as in parietal placentation (Figure 3). The ovules seemed to have developed on the tissues formed by the fusion of the anther filaments and staminal appendages.

(5) The structure of ovules found on the modified stamens was almost identical to that of the normal ovules of the true ovary.

The modified flowers described here did not form mature seeds under open pollinated conditions or on selfing. However, a few seeds were obtained when they were crossed with a normal male-fertile *S. tuberosum*.

The present case is an instance of sex modification in a hermaphrodite plant species. Modified sex expression in flowering plants can be either genetic or due to various physiological and environmental factors, such as nutrition, light, temperature, mutilation, grafting and hormonal effects[3]. The modification reported here appears to be genetic, because it was observed only in one plant of a large F_1 population. The exact nature of the gene action is under investigation.

The above is another teratological case similar to those reported earlier[3,4] in support of the view that carpels and stamens are homologous structures[5,6].

Résumé. On présente un rapport sur l'occurrence de stamens carpelloides dans une variété *Solanum tuberosum* L. Au lieu du pollen, les stamens développèrent des ovules nues sur une placenta fausse. L'expression sexuelle modifiée qu'on vient d'observer paraît d'être d'origine génétique.

S. S. SIROHI, HARI KISHORE, and M. L. KHANNA

Central Potato Research Institute, Simla (India),
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