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SOME ASPECTS OF THE POLLINATION MECHANISM OF VIOLA TRICOLOR L. AND VIOLA × WITTROCKIANA GAMS

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SUMMARY

Pollination experiments on garden pansies (*V.* × *wittrockiana* Gams) and *V. tricolor* L. have shown that the assumption of earlier investigators that the stigmatic cavity is closed, is incorrect. The flower morphology is described especially in relation to the way pollination takes place and to the question which parts of the stigma are receptive to pollen.

1. INTRODUCTION

Although flower biological observations on *Viola tricolor* L. and the garden pansies (*V.* × *wittrockiana* Gams) bred from them, have already been made since the end of last century (KNUTH 1898), it is not yet quite clear how the pollination proceeds. Notably there appears to be a difference of opinion which stigmatic parts are receptive to pollen and what the function of the stigmatic lip is.

At the Institute for Horticultural Plant Breeding experience was gained for a number of years with the breeding of pansies (KROON 1972) in which the pollination mechanism was extensively studied and the above problems critically reviewed.

2. FLOWER STRUCTURE

The flower of the pansy is so constituted that selfing is made difficult or entirely prevented *(fig. 1)*.

The five stamina have only very short filaments and form together a tube enclosing the ovary and part of the style. This is further accentuated by an outgrowth of the connective at the tip of the stamen. The pollen liberated on the inner side of the staminal tube falls into a hairy groove of the lowermost petal and is retained there. This groove leads to the spur of this petal containing the nectar. The two nectaries are appendages of the two lowermost stamina. Rather ingenious is the structure of style and stigma: the style is very elastic and has a knee-shaped joint so that the whole is highly flexible. The stigma has the shape of a cup with the opening at the front and a lip below it *(fig. 2)*.

3. POLLINATION

A visiting insect pushes its proboscis through the hairy groove into the nectar containing spur and presses against the stigma, which, thanks to the elasticity

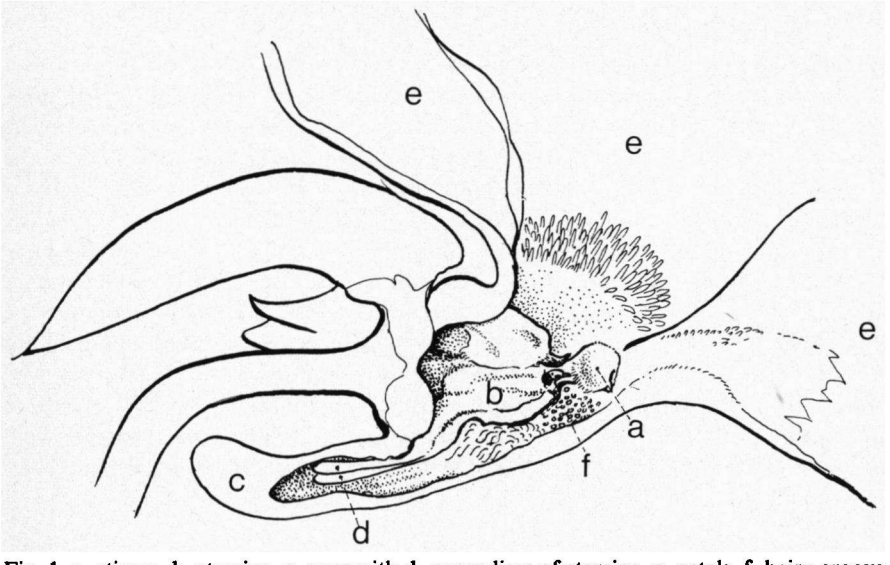

Fig. 1. a. stigma, b. stamina, c. spur with d. appendices of stamina, e. petals, f. hairy groove with pollen.

of the style, bends with its opening downwards. Thus the pollen which the insect carries on its head and thorax is deposited in the stigmatic cavity and on the front of the stigmatic lip. At the same time the ripe pollen of the flower being visited falls on the pollinating insect and into the hairy groove of the lowermost petal. After collecting the nectar from the spur the insect leaves the flower. As a result the whole stigma is pushed upwards so that selfing is prevented.

Carefully executed hand pollination has shown that the lip is only receptive to pollen on the upper side which is covered with papillae. The interior of the stigmatic cavity as well as the edges around it also appeared to be receptive. The globular stigma is provided with lateral outgrowths which are covered with hairs, while hairs are also borne on the top of the stigma so that selfing is prevented.

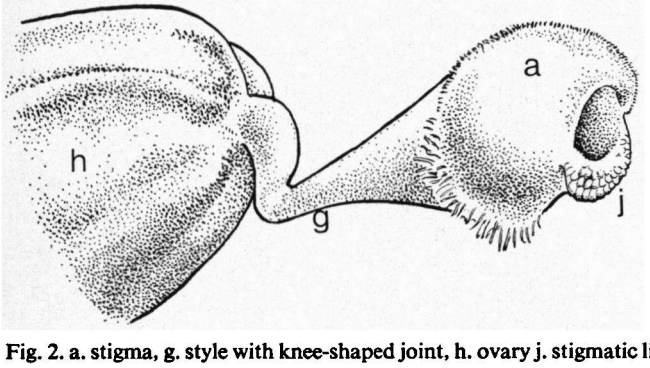

Fig. 2. a. stigma, g. style with knee-shaped joint, h. ovary j. stigmatic lip.

4. DISCUSSION

VEERMAN & VAN ZON (1965) mention in their study on insect pollination of *Viola* how cross-pollination is promoted and selfing is prevented, at the same time the morphology of the flower is described. Like some earlier authors (KNUTH 1898) they assume that the withdrawal of the proboscis results in the forward hinging of the stigmatic lip, owing to which the stigmatic cavity is closed and selfing thereby prevented. Our observations have shown, however, that the opening in the stigma is not closed by this lip, which is firmly fixed to the stigma and hardly hinges. Moreover in most cases the lip is not large enough to cover the whole opening. WITTROCK (1895, 1897) already stated that the stigmatic lip is composed of epidermis cells which are covered with papillae and that it is not sufficiently flexible. Therefore the function of the lip should not be sought in the prevention of selfing by closing the stimatic cavity but mainly in promoting cross-pollination by scraping the pollen off the visiting insect, while at the same time the above-mentioned groove on the lowermost petal is partially closed at the front.

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