THE SELFCOMPATIBILITY IN *IMPATIENS BALSAMINA* (A LONG-DAY VARIETY)

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ABSTRACT

Pollination and seed-setting in *Impatiens balsamina* (a long-day variety, originated from the Frankfurt Botanical Garden) were studied. Flowers were isolated from insect pollinators, or were openly pollinated. Plants of both groups set seeds, but open pollinated had 10% more seeds. Microscopic analysis showed that flowers could be selfpollinated before anthesis. The pollen tubes grew to the ovary and fertilized the ovules. After selfing, the normal endosperm and embryo developed. The viability of seeds was similar to that after crosspollination.

KEY WORDS: *Impatiens balsamina*, selfcompatibility, pollination, fertilization, pollen tube.

INTRODUCTION

Impatiens balsamina is an ornamental plant originated from India and China. Many species of the genus *Impatiens* have a different pollination biology (Masuda & Yahara 1994, McCall et al. 1994, Schoen et al. 1994). New cultivars are bred mainly by intersexual crossing of species or varieties. The knowledge of the biology of flowering and seed-setting is necessary to obtain good breeding results.

Impatiens balsamina pollination was tested. Isolated plants were able to set seeds but it was not clear whether the seeds were of sexual or apomictic origin. Both possibilities should be considered.

MATERIALS AND METHODS

Impatiens balsamina L. (*Balsaminaceae*) plants originating from seeds received from the Botanical Garden in Frankfurt were grown in greenhouses and plots in the Botanical Garden in Lublin during 1994 and 1995. Whole plants were isolated by special plastic bags from pollinating insects, unisolated plants served as control. Buds and flowers of each plant were collected at different stages of development and fixed in AA 3:1 mixture or 3% glutaraldehyde. Pistils were prepared for anatomical examination by routine paraffin wax method, stained with PAS or hematoxylin. Resin embedded semithin sections were stained with toluidine blue. Some pistils were macerated in 1N NaOH and after rinsing stained with aniline blue for detecting callose under the fluorescence microscope.

OBSERVATIONS

Impatiens balsamina plants grew and flowered similarly under an isolating cover or without it. The flowering rate was slightly slower in isolated plants. Flowers in both groups of plants were similar. Before anthesis a stigma is covered by a ring of joined anthers. After several hours the anthers withered and fell out. The stigma was of wet type with a relatively small receptive surface.

Unisolated flowers were visited by bees and bumble bees, but pollen brought could only be deposited on the stigma when the anthers fell out. Pollen grains could germinate in the anthers and on the stigma (Fig. 1). Pollen germination commenced two days before anthesis when anthers were partially open. Sometimes two pollen tubes emerged from two pores of tetraporate pollen grain. The pollen tubes grew on the stigma (Fig. 2), down the style, into the ovary, there they penetrated into the micropyle (Fig. 3). Fertilized ovules were found at the anthesis and a few hours later in flowers with a stigma covered by surrounding anthers. The similar selfpollination and fertilization also took place in the buds of isolated and unisolated plants.

Anatomical sections of ovules showed that the embryo sac was already mature in the buds. The egg apparatus was situated in the micropylar part of the ovule. The central cell and antipods were in the wider part near the chalaza. At the anthesis early proembryos surrounded by cellular endosperm were in ovules. Later heart and torpedo shaped embryos occurred in ovules from flowers with stigmas covered by anthers. Ovules from withering flowers contained embryos in developed endosperm with chalazal haustorial cells (Fig. 4).

Figs 1-5. Pollen tube growth and seed-setting in the isolated flowers of *Impatiens balsamina* L.

1. Pollen grains germinating on the stigma (x 400)
2. Pollen tube on stigmatic lobes (x 250)
3. Pollen tube growing toward the micropyle (x 250)
4. Embryo surrounded by cellular endosperm (x 400)
5. Young fruit with developing seeds (x 25)

The isolated plants developed fruits (Fig. 5) but with 10% less seeds, than in the openly pollinated plants.

DISCUSSION

The genus *Impatiens balsamina* has been described as crosspollinating. Selfpollination was observed only in species which develop cleistogamic flowers and occasionally in plants with chasmogamic flowers (Grey-Wilson 1980). Only Korohoda (1972) mentioned selfpollination in buds in *Impatiens balsamina*. On the other hand, the attractive and colourful chasmogamic flowers of many varieties of *Impatiens balsamina* are often visited by insects.

Impatiens balsamina L. plants set fruits and seeds after self-pollination and crosspollination. The number of seeds was slightly higher but statistically significant in crosspollinating plants. This can indicate that selfpollination was sufficient for the reproduction process, however, apomictic development can not be excluded.

The pollination and pollen tube growth in close flower buds leads to the selfing process in isolated and unisolated flowers. It seems that anthers in freshly open flowers are a barrier for foreign pollen deposition. After cleistogamous pollination the pollen tube growth is leading effectively to fertilization. In selfpollinated flowers the embryo development was apparently normal and similar to that in crosspollinated flowers. Seeds were viable. No signs of selfincompatibility barriers were found. These facts seem to contradict the

existing idea that *Impatiens* flowers can be only crosspollinating (Davis 1966, Grey-Wilson 1980, McCall et al. 1994, Nettancourt 1977).

Our investigations support the observation of *Impatiens balsamina* selfpollination (Korohoda 1972). We assume the crosspollination by insects is an additional process which enables fertilization of the youngest ovules in the ovary.

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SAMOGODNOŚĆ U *IMPATIENS BALSAMINA* L. (ODMIANA DŁUGIEGO DNIA)

STRESZCZENIE

Biologia zapylenia i rozwój nasion *Impatiens balsamina* L., odmiany długiego dnia, pochodzącej z Ogrodu Botanicznego we Frankfurcie, została szczegółowo przebadana do celów hodowlanych. Rośliny hodowano w Ogrodzie Botanicznym UMCS w Lublinie. Część roślin okryto izolatorami aby uniemożliwić zapylenie przez owady, pozostałe rośliny pozostawiono w warunkach naturalnych. Obie grupy roślin kwitły podobnie i wiązały nasiona. Aby ustalić pochodzenie nasion u roślin izolowanych przeprowadzono badania metodami mikroskopii świetlnej i fluorescencyjnej. Stwierdzono występowanie zapylenia własnym pyłkiem w pąku oraz w kwiatach, których znamię było okryte własnymi pyłkami. Łagiewki pyłkowe rosły przez znamię, szyjkę słupka do zalążni podobnie po samo- jak i krzyżowym zapyleniu. Łagiewki dorastały do mikropyle zalążków i zapładniały woreczek zalążkowy. Rozwijało się bielmo komórkowe i zarodek. Nie stwierdzono występowania barier samoniezgodności. Rośliny nieizolowane wiązały ok. 10% nasion więcej, można więc przypuszczać, że zapylenie przez owady jest dodatkowym procesem uzupełniającym samozapylenie.

SŁOWA KLUCZOWE: *Impatiens balsamina*, samozgodność, zapylenie, zapłodnienie, łagiewka pyłkowa.