Genotypic and environmental variation in production of 2n-gametes of Oriental x Asiatic lily hybrids

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Introduction
Introgression breeding between Oriental (O) and Asiatic (A) hybrid lilies is hampered by the (male) sterility of OA F1 hybrids. This crossing barrier can be overcome by means of polyploidisation. Meiotic polyploidisation (using unreduced gametes) is an attractive approach for this purpose because it allows homoeologous recombination between the Oriental and Asiatic chromosomes. The number of 2n gamete producing genotypes among OA-hybrids is naturally very low. A careful screening method was used to detect 2n pollen producing genotypes in a large collection of OA F1 hybrids. Furthermore an attempt was made to induce the production of 2n pollen in sterile OA-hybrids using heat shock treatment.

Materials & Methods
The collection of OA F1 hybrid genotypes were grown in both heated (causing an environment with a more or less stable temperature) and unheated greenhouses (creating an environment with temperature fluctuation due to the daily changes in outside temperature). Additionally plants of four normally sterile genotypes were grown in a fytotron for 6 weeks and exposed daily to an extreme temperature fluctuation regime: 4 alternating periods of 10 °C and 30 °C each day. Upon flowering all genotypes were screened for 2n pollen production using a pollen germination test: Pollen was cultured on artificial bacteriological agar medium (100 g sucrose, 5 g bacteriological agar, 20 mg boric acid and 200 mg calcium nitrate per litre) over night at 25 °C. After 24 hours the pollen germination (i.e. viable 2n pollen) percentage was scored. Four of these twelve genotypes had already been identified as 2n pollen producers in previous years. The other eight were all detected in the unheated greenhouse. Up until then they had always been grown in heated greenhouses and had always been tested sterile.

Results
In total 12 genotypes were found to produce 2n pollen in notable frequencies. Considerable variation in germination percentages was observed. Not only variation between the different genotypes but also variation between clones of the same genotype growing in different environments. There was even considerable variation among different clones of one genotype within one environment and even among the different flowers of one clone.

Discussion & Conclusion
These results suggests that the variation in 2n pollen production is of both environmental and genetic origin. Temperature fluctuation both natural (the unheated greenhouse) and artificial (the fytotron) might be an agent that stimulates the production of 2n gametes. But not all results corroborate with this assumption: some genotypes showed higher pollen germination percentages in the heated greenhouse. Because of the large variation in 2n pollen frequencies and the inconsistent nature of this variation it is advisable to repeat screening and screen under different environments. It is also demonstrated that heat shock treatment can be used successfully to induce 2n pollen production for breeding proposes.