

An interspecific cross between *Allium roylei* Stearn and *Allium cepa* L., and its backcross to *A. cepa*

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Summary

A cross between *Allium roylei* Stearn and *A. cepa* L. and a backcross of the probable interspecific hybrid to *Allium cepa* L. were realized in a simple and practical way, possibly opening up perspectives for introgression of downy mildew resistance and other characters from this wild relative into the onion germplasm.

Introduction

One of the possibilities of essentially broadening the narrow genetic basis of the onion crop is introgression of characters from wild relatives of *A. cepa*. Until recently for this purpose most attention was paid to the closely related and cross compatible species *A. fistulosum* L., but so far progress has been limited mainly owing to sterility of the interspecific hybrid (van der Meer, 1984; Cryder, 1988; Currah & Ockendon, 1988).

Inspired by i) a certain morphological resemblance between *A. roylei* and *A. cepa*, ii) complete field resistance of *A. roylei* to downy mildew caused by *Peronospora destructor* (Berk.) Casp. under Dutch growing conditions (Anon., 1986) which was verified under controlled conditions (Kofaet, 1988), and iii) successful reciprocal crosses between *A. roylei* and *A. fistulosum* achieved by McCollum (1982), utilization of *A. roylei* as an introgression partner for *A. cepa* was attempted, notwithstanding that previous attempts to cross *A.*

roylei and *A. cepa* failed (Saini & Davis, 1967). In this report some important preliminary observations concerning the cross between *A. roylei* and *A. cepa*, as well as the backcross of the probable interspecific hybrid to *A. cepa* are presented.

Materials and methods

Plants of *A. roylei*, received in 1979 from G.D. McCOLLUM, B.A.R.C. Beltsville, U.S.A. (PI 243009; McCOLLUM, 1982), and *A. cepa* 'Jumbo' (Zaadunie, Enkhuizen, the Netherlands) were grown in 1984, and flowered together in a greenhouse-isolation room at IVT, Wageningen, during the summer of 1985 using fish flies for pollination.

Several grams of seed harvested separately from *A. roylei* and *A. cepa* were sown in the open in 1986. In the offspring derived from the *A. cepa* parent all plants showed the typical phenotype of onion. Seeds harvested from the *A. roylei* parent gave rise to an offspring containing plants pheno-

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typically similar to *A. roylei* except for one individual. Several morphological characteristics of this plant were clearly intermediate between those of the parental species. Therefore, this plant was identified as most probably being an interspecific hybrid resulting from the cross *A. roylei* × *A. cepa*.

It was separated into two parts which developed into new plants. Under isolation, one flowered in 1987 together with three cytoplasmic male sterile F₁ hybrid onion plants ('Hylight', Bejo Zaden, Noord-Scharwoude, the Netherlands), and the other one with three male fertile onions ('Jumbo'). Again fish flies were used for pollination. Seedlings obtained from these experiments were grown in 1988, after having sown all available seeds.

Results

When flowering in 1987 the pollen production of the plant which was identified as a probable interspecific hybrid between *A. roylei* and *A. cepa*, was reduced compared to both parents, but pollen could still be easily observed by the naked eye.

In Table 1 the numbers of seedlings obtained after flowering of the putative interspecific hybrid in combination with the onion cultivars 'Jumbo' and 'Hylight' are presented, accompanied by a remark in relation to their morphology.

Discussion

High levels of male and female sterility are commonly found with *Allium* interspecific hybrids. For instance in hybrids between *A. fistulosum* and *A.*

cepa anthers are often poorly developed or may lack completely, whereas hardly any seeds are produced even after abundant pollination by either of the parents. Occasionally, however, pollen production can be observed. The pollen formed by the suspected interspecific hybrid between *A. roylei* and *A. cepa*, although not abundantly produced, appeared to be functional. This is concluded from the emergence of seedlings after combined isolated flowering with the male sterile plants of 'Hylight' (Table 1). The total of six seedlings obtained from the suspected hybrid in both combinations with *A. cepa* indicates a certain level of female fertility as well.

All offspring harvested from the 'Jumbo' individuals uniformly displayed the phenotype of the seed parent (Table 1), indicating that they originated from fertilization with pollen of 'Jumbo'. In contrast, a considerable variation in many traits, such as leaf habit, bulbing and downy mildew resistance was found among the backcross offspring obtained from 'Hylight'.

The results presented here are rather surprising as in the cross and backcross two not very closely related *Allium* species are involved. The morphological variation generated in the backcross offspring seems indicative for a break-through towards a large scale introgression of *A. roylei* characters into *A. cepa*, resistance to downy mildew caused by *Peronospora destructor* (Berk.) Casp. probably being one of the most promising for the time being.

Succeeding reports concerning ploidy, meiotic events and segregational behaviour for a number of characters, provide conclusive evidence for the true interspecific hybrid nature of the morpholog-

Table 1. Numbers of surviving seedlings and their morphological variation resulting from combined flowering of the probable interspecific hybrid between *A. roylei* and *A. cepa* with 'Jumbo' and 'Hylight', respectively. All available seeds were sown

Flowering in combination	Seed parent	Surviving seedlings	Offspring morphology
with <i>A. cepa</i> 'Jumbo'	Intersp. hybr.	3	n.d.
with <i>A. cepa</i> 'Jumbo'	<i>A. cepa</i> 'Jumbo'	> 200	like 'Jumbo'
with <i>A. cepa</i> 'Hylight'	Intersp. hybr.	3	n.d.
with <i>A. cepa</i> 'Hylight'	<i>A. cepa</i> 'Hylight'	149	variable

n.d. = not determined.

ically deviant plant found among the *A. roylei* offspring in 1986, and for introgression of *A. roylei* characters into onion (de Vries et al., in prep.; Kofoet et al., in press).

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