1. Restoration of pollen and spikelet fertility in Swarna x *O. nivara* backcross derivatives

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Wild species constitute a significant proportion of the rice germplasm collection. They serve as an important source for the improvement of both simple and complex traits. Recently, the use of wild species to improve yield is of increasing interest in rice research. *O. nivara* (2n=24, AA) is the closest wild progenitor of *O. sativa*. Accession 101508 was the only source of resistance to grassy stunt virus. This annual species grows around rice fields and thus is important for studies on gene flow to assess the risk of transgenic rice (Chen et al. 2004). Pollen sterility, low seed set and poor seed germination are the major problems that limit the utilization of even closely related wild species in breeding programs (Sarla and Swamy, 2005). *O. nivara* accession IRGC81848 from Uttar Pradesh in India was selected as the donor parent for mapping novel yield enhancing alleles. This accession was genetically distant from the recipient parent Swarna, a popular rainfed lowland rice variety grown over a large area in India. Swarna was used as female parent and *O. nivara* was used as male parent. Crosses were made using 30 different plants during Rabi (dry season) in 2003 and Kharif (wet season) in 2004. Seeds were set in only six plants during Rabi 2003 and in all the 30 plants during Kharif in 2004. In all, only 1.32 to 12.5% of the pollinated spikelets per plant set seed. The F_1 seed germination varied from 40 to 100%. The F_1 plants were confirmed for hybridity using polymorphic markers RM16 and RM19. However, in F_1 plants obtained during Kharif season male parent specific bands were also amplified indicating their true hybrid nature. All the true F_1 plants were completely pollen sterile based on a pollen stainability test using 1.5% I_2KI solution. These plants were backcrossed using Swarna pollen. Seeds were obtained from only 1.3 to 16% of the pollinated spikelets on F_1. This indicates that the F_1 plants have sterile megagametophytes in addition to sterile pollen. The germination of BC_1F_1 seed ranged from 15 to 73%. Pollen fertility in the BC_1F_1 plants varied from 40 to 60%. Only 0.66 to 25.4% pollinated spikelets of BC_1F_1 set seed. The germination of the BC_2F_1 seeds varied from 5 to 100%. Pollen fertility in BC_2F_1 plants ranged from 65 to 100%. Thus, there was distinct plant - to -plant variation in pollen fertility and also seed set in Swarna x *O. nivara* interspecific hybrids and their derivatives. It helps to use different plants for crossing in each accession of the wild species *O. nivara* to maximize the chances of obtaining fertile hybrids. In addition, it is important to note that there is also a seasonal variation for both pollen fertility and seed set. Wet season (Kharif) was better than dry season (Rabi) for obtaining good seed set. We obtained similar results when we used another *O. nivara* accession IRGC81832. Advanced backcross-QTL method has been used extensively to introgress and map the yield component and related QTLs from wild species in different crops. Yield enhancing QTLs have been mapped from BC_2F_2 crosses involving *O. rufipogon*, *O. glumaepatula* and *O. grandiglumis*. But there are no reports of yield QTLs from *O. nivara*. We developed two mapping populations to map yield-enhancing QTLs from *O. nivara*. The parental polymorphism survey showed that 120 out of 150 SSR markers from all chromosomes were polymorphic between the parents *O. nivara* (IRGC81848) and Swarna. When another accession of *O. nivara* (IRGC81832) was used, only 108 SSRs were polymorphic. Thus our study clearly demonstrates that pollen fertility and seed set in *O. nivara* x *O. sativa* crosses are fully

restored in only two backcrosses to the recurrent elite parent. Also, plant-to-plant variability exists for these two traits within an accession of the wild species. Therefore, it is desirable to use a large number of plants initially in the crossing programs to maximize the seed set in later generations. DNA polymorphism with Swarna also varied when two different accessions of *O. nivara* were used to develop a mapping population. Introgression lines of Swarna derived from both *O. nivara* accessions are being evaluated for yield, grain quality, and growth in aerobic and low P conditions in the field.

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