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**Estimation of Outcrossing Rate in *Hordeum spontaneum* and
Barley Landraces from Jordan**

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Abstract

Previous studies conducted at the University of Hohenheim and ICARDA indicated that yielding ability and stability of barley could be improved in environments with drought stress by increasing the level of heterozygosity. This could be accomplished by developing synthetic varieties composed of germplasm with a high outcrossing rate. As a first step, we characterized the genetic structure of barley landraces and *H. spontaneum* populations collected from various semi-arid localities in Jordan to obtain reliable estimates of the amount and variation of outcrossing in this germplasm.

Natural outcrossing was estimated in 13 populations of *H. spontaneum* and 12 barley landraces from collection sites that covered high-low rainfall and altitude transects to detect possible environmental effects on outcrossing rate. Four Microsatellite markers were used to estimate outcrossing rate based on maximum likelihood methods and mixed mating models.

Low outcrossing rates were found in cultivated barley and its wild relative *H. spontaneum* ranging among populations from 0–1.8% with a mean of 0.32%. Somewhat higher, though not significant, outcrossing rates were observed in *H. spontaneum* than in *H. vulgare* populations under high rainfall conditions. A significant positive correlation was detected between outcrossing rate and average annual precipitation. However, a negative correlation occurred between outcrossing rate and monthly average temperature during flowering. Results suggest that high precipitations and cool temperatures during flowering may enhance outcrossing in cultivated and wild barley populations.

The rather low levels of outcrossing indicate that increased vigor due to heterozygosity has not been a major force in the evolution and domestication of *H. spontaneum* and *H. vulgare*, respectively. Stable seed production to secure survival under extreme heat and drought stress may be more important. Cleistogamy may be considered as an effective mechanism to warrant pollination even in drought-stunted plants with non-dehiscent spikes and to prolong pollen viability. Yet ICARDA's gene bank contains a number of drought-adapted accessions showing various degrees of open-pollination. This material is presently being evaluated for its outcrossing behavior. It is considered a valuable genetic resource for increasing the level of heterozygosity in actual barley gene pools and thus combining high yielding potential with superior drought tolerance.

Keywords: Barley, landrace, microsatellites, outcrossing rate, plant genetic resources, *Hordeum spontaneum*