Heritability of seed weight in an inbred population of large-seeded *Lathyrus sativus*

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Introduction

The grass pea (*Lathyrus sativus* L.) cultivated in Chile has a large, mostly clear white, grain. It is valued by European communities as the basis for the preparation of traditional dishes. Small Chilean farmers are exporting grass pea to these markets, which pay higher prices for larger seed. However, the size of the grain currently being produced is quite heterogeneous, and the export grain is produced after severe sorting of the harvested grain. A short-term project is underway [(4)], which aims to improve crop management and grain quality, particularly seed diameter. This preliminary work provides an estimate on how much of the observed variation for seed weight in a local grass pea population has a genetic basis. Seed mass appears to be a reasonably good estimator of seed diameter [(4)].

Material and Methods

A composite of 1640 seeds was assembled by combining grass pea samples of equal size from 41 farmers of Lumaco, an area located ~150 km NW of Temuco, southern Chile. The composite was planted in the winter (August) of 1999 in a sparse stand (6 plants.m^{-2}) and 1385 plants were harvested individually during the summer (January) of 2000. The grain produced by each single plant was cleaned, counted and weighed, and mean seed weight was calculated.

Ten randomly chosen seeds from each plant were planted in hills 0.7 m apart in August 2000, and 1384 families were harvested in February 2001. The grain produced by each family was cleaned and weighed, and mean seed weight was calculated from 200 random grains per family.

Heritability was estimated by the standard unit method [(1)], which uses regression on data coded in standard deviation units to eliminate the environmental effect expected when parents are measured in one season and their offspring in another. This is equivalent to calculating the correlation coefficient. Heritability estimates were also obtained by using parent-offspring regression [(3)].

Results and Discussion

The 1385 plants harvested in 2000 had a seed weight range of 114-455 mg.seed^{-1} on a single plant basis, with a mean of 270 mg.seed^{-1} and a standard deviation of 48.6. Seeds per plant ranged from 10 to 233 with a mean of 61 and standard deviation of 30.9. For the 1384 families harvested in 2001, seed weight ranged 130-442 mg.seed^{-1}, with mean of 279 mg.seed^{-1} and standard deviation of 37.8.

Heritability based on the parent-offspring correlation coefficient calculated from 1384 paired data was 0.58, a value that predicts a good response to selection for seed size (seed mass basis). The correlation coefficient, b', was highly significant ($P<0.0001$).

The linear regression coefficient, b, was 0.45, estimate significant at $P<0.0001$. Heritability values for an inbred population of a self-pollinated species based directly on the linear regression coefficient ($b=h^2$) are largely overestimated, and the correct estimator is $b/2r_{xy}=h^2$, r_{xy} being a measure of the degree of genetic relationship between the parent and its offspring [(5)]. Therefore, considering for this case a genetic relationship of unity between the homozygous parent and its self-pollinated offspring, $h^2=½b$, and narrow sense heritability estimate becomes 0.23.

Previous estimates on the heritability of seed weight are scarce. Broad sense heritability values from 0.26 to 0.31 were reported for seed weight in segregating populations of *Lathyrus sativus* derived from crosses between a medium-size (132 mg.seed^{-1}) line originating from France and two small-seeded lines from Bangladesh and India [(7)].

According to the data generated from the evaluation of our families in the 2000-01 cropping season, seed weight and seed yield were positively though weakly correlated, with phenotypic correlation coefficient $r_{ph} = 0.27^{***}$. This value agrees with previous findings [(7)] and it is higher than $r_{ph} = 0.15^{ns}$ reported [(2)] between seed weight and yield per plant in small-seeded grass peas.

The mean seed weights for both seasons are higher than the 176 mg.seed^{-1} observed among Chilean grass pea accessions collected in the central-south zone [6]. Part of the difference may be due to the higher annual rainfall of the southern zone as compared to the central-south, which would provide conditions more favourable for seed filling.

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