

Spatio-temporal demographic variation and reproductive strategy in rare endemic *Oncoclycus irises* (Iridaceae) of Lebanon

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Introduction An initial step of the development of recovery programs for rare and endangered species requires knowledge of breeding system as well as demography. Identifying the relative importance of factors contributing to the decline or restriction of threatened plant species is critical if restoration and conservation attempts are to succeed. Detailed demographic studies can reveal critical stages of the life cycle and allow predictions about the future development of populations.

Objectives The aim of this study was to characterize the spatio-temporal variation of demographic and reproductive parameters of Lebanese endemic *Oncoclycus irises*, which are rare and threatened plants, in order to draw implications for their conservation. More specifically this study focused on 1) their mating system, 2) the variation of stage structure and reproductive success among populations of different sizes and 3) the within populations variation of the reproductive success and seed dynamics.

Mating system Are *Oncoclycus irises* strictly self-incompatible?

5 pollination treatments were applied in order to test for self incompatibility

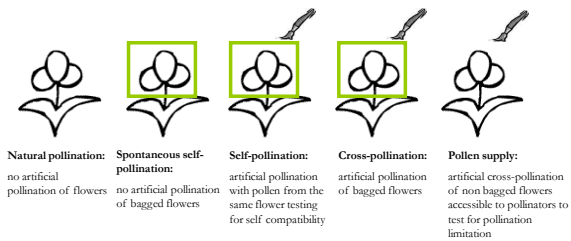


Table 1: Percentage fruit set and mean (+/- SE) seed set, fertilisation rate and seed/ovule ratio in the five pollination treatments performed in the C. population.

Treatment	Fruit set (%)	Seed set	Fertilization rate	Seed:ovule ratio
Natural pollination	100	57.5 +/- 12.1	0.34	0.33
Spontaneous self-pollination	0	0	0	-
Self-pollination	0	0	0	-
Cross-pollination	100	51.5 +/- 15.8	0.61	0.46
Pollen supply	83.5	38.8 +/- 33.2	0.34	0.32

The two selfing treatments gave no fruiting while fruit set was high following allogamous pollen supply (table 1). Subsequent fertilization rates and seed:ovule ratios were not significantly different.

Lebanese *Oncoclycus irises* are strictly self incompatible

Seed bank Do seeds remain viable in the soil?

Soil samples (10x10x10 cm) were taken after seed dispersal along transects within two large populations (C and L) and nearby ants nests.

Table 2: Mean number of seeds per m² (+/- SE) found in the seed bank compared to the estimated seed rain in 2003 in two *Oncoclycus irises* populations, L and C.

Population	Sampling	Seed bank	Estimated seed rain
C	Transect 1	27 (+/- 13)	30.35
	Transect 2	40 (+/- 12)	35.50
	Ant's nest	557 (+/- 350)	-
L	Transect 1	40 (+/- 15)	4.40
	Transect 2	147 (+/- 48)	70.98
	Ant's nest	540 (+/- 141)	-

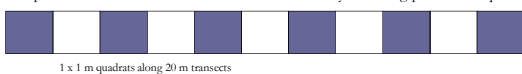
The density of viable seeds in the soil is 13.0 seed/m² for C and 54.9 seed/m² for L. The mean number of seeds/m² in the seed bank was of the same order of magnitude than the previous annual seed rain except in the transect 1 of the L population.

Soil seed bank is not permanent

Demography What is the stage structure of populations?

Are there spatial variations? Are there temporal variations?
What is the reproductive success of populations?

Populations were monitored over two consecutive years using permanent quadrats



Recorded stages/m²:
-Number of flowers
-Number of vegetative adults
-Number of juveniles

Comparative stage structure

The density and proportion of ramets in the different stage classes were very similar among the large studied populations. Juveniles represented 15% of the individuals, which indicated a good regeneration of populations. Small populations displayed a different demographic structure with a much lower proportion of flowering ramets (Fig. 1).

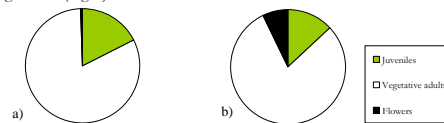


Figure 1: Proportional stage structure in small (a) and large (b) populations.

Within large populations, the density and proportion of ramets in the different stage classes varied little between years within the same population but was significantly different between populations each year (Table 3).

Table 3: Means (+/- SE) of the total number of individuals/m², number of individuals in the different life stages and percentage fruit set in two *Oncoclycus irises* populations, C and L, monitored over two consecutive years (2002-2003).

	Nramet	%juv	Nveg	Nflor	%flor	%fruit
C-2002	22.95 (3.91)	17.70 (0.05)	16.20 (2.69)	3.55 (0.93)	12.82 (0.02)	61.88 (0.07)
	C-2003	24.68 (4.5)	16.18 (0.02)	18.10 (3.48)	2.75 (0.71)	11.51 (2.30)
C- Year comparison						
L-2002	80.13 (9.72)	13.19 (0.02)	64.03 (7.82)	5.77 (0.93)	7.86 (0.01)	57.85 (0.06)
L-2003	94.37 (13.32)	15.99 (0.02)	76.37 (11.07)	5.60 (1.67)	4.76 (0.01)	18.81 (0.06)
L- Year comparison						
2002 - Pop comparisons	***	NS	***	**	NS	NS
2003 - Pop comparisons	***	NS	***	NS	NS	**

Reproductive success

No fruiting was recorded on small populations, which could imperil their long term regeneration. Herbivory reaching up to 70% was recorded on these populations.

Within large populations, a significant relationship was found between floral display and fruit set (Fig.2). Fruit set reached up to 60% of the flowering plants in some populations.

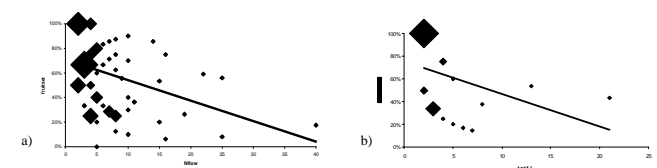
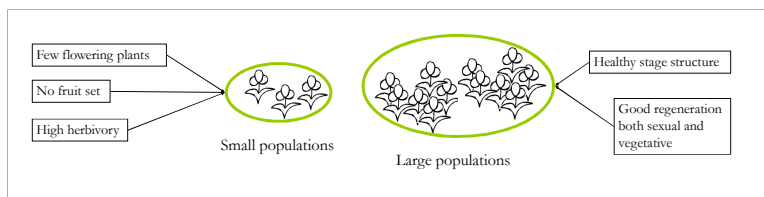


Figure 2: Fruit set according to a) the number of flowers/m² in demographic transects (data pooled over years and populations) and b) the number of co-flowering ramets in the C population in 2003. Size of the symbol is proportional to the number of observations.

Stage structure and reproductive success are variable according to population size
Spatial and temporal variability was also shown within populations



Our results suggest that the species distribution is not limited by a general failure of reproductive success or regeneration. Population size could play an important role in the long term survival of populations and should be taken into account when designing conservation strategies for these threatened plants.