

**In situ conservation of *Phaseolus lunatus* L. in the Central Valley of Costa Rica: first results from studies on demography and phenology**

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In order to devise *in situ* conservation strategies for the wild Lima bean populations in the Central Valley of Costa Rica, studies on demography and phenology have been initiated in the frame of a collaborative project between the Faculty of Gembloux and the University of Costa Rica, sponsored by IPGRI (Roma, Italy). The investigations are based on the inventory of the populations and their ecological mapping made by the Costa Rican partners. Accumulated data on demography and phenology concern only the first year of the study.

**Material and methods**

For the demography study, the material is made of six wild populations representative of the ecological sites of the Valley : table 1 indicates the location, the shape and the surrounding vegetation for the six populations. For each population, data are recorded on air moisture, air temperature and precipitation and 1 m<sup>2</sup> quadrats are established throughout the areas of investigation to observe relevant demographical traits.

Table 1: Wild *P. lunatus* populations studied.

<u>Population</u> N°	<u>Coordinates</u>	<u>Vegetation type</u>	<u>Type</u>	<u>Number</u> <u>quadrats</u>
E 25	9°53'N-84°07'W	woody / coffee	bi-dimensional	15
E 37	9°52'N-84°14'W	woody zone	bi-dimensional	6
E 50	9°52'N-84°06'W	woody zone	bi-dimensional	11
E 88	9°59'N-84°09'W	trail / coffee	linear	12
J 87	9°49'N-84°04'W	woody / coffee	bi-dimensional	6
54 TR	9°54'N-83°54'W	trail	linear	8

Since November 1994, monthly measurements are made in each quadrat to determine the vital rates of individuals (fecundity, survival, growth and mortality). The soil seed bank and the possible dormancy of the seeds collected from different depths in the soil are also evaluated in each population. Plastic made dishes containing coloured seeds are also placed in the six sites to assess the seed bank dynamics by reporting the annual germination rate. Such data will allow to establish the life cycle graphs (HUBBEL & WERNER, 1979) and to analyze demography by matrix calculation (CASWELL, 1989, VAN GROENENDAEL *et al.*, 1988) related to the wild populations under study.

For the phenology, monthly observations are taken from 100 populations situated along 6 ways covering all the ecological areas of the Valley. The phenological state of each plant of the selected populations is defined from the vegetative to the ripening stages, including floral buds, flowers, green and dry pods, disseminated seeds. These data will show both the intra- and inter-population variabilities in the timing of succession stages of the Lima bean and the time evolution of the number of individuals per population. Such behaviour will also be related with available ecological data.

## Results

From 2000 individuals labelled at the end of the first year, it appears that the mortality rate is particularly high during the dry season (from mid-November till mid-April), reaching 90 % for some populations. Single plant death occurs at 1 or 2 months age, when stem diameters reach about 1 to 2 mm. Only the lignous plants are able to survive during the dry season. The time between emergence and lignification varies from 3 to 4 months according to edaphic and climatic factors. Death may also occur sometimes following an important pod production or may be due to waterlogging during the wet season, causing rotting of the plants.

The occurrence of a persistent seed bank for the wild populations has been demonstrated : seeds are found in the soil at least one year after their dissemination. The seeds number per square meter showed a high inter- and intra-population variability, the number of seeds per m<sup>2</sup> varying between 0 to more than 180 according to the populations and quadrats studied.

The germination tests with seeds directly collected from the plants in the studied populations did not show any innate dormancy. Nevertheless a dormancy induced by very high temperature and dryness during the period the seeds remain at the soil surface cannot be discarded : this dormancy could be explained by a mechanical obstruction of the micropyle, preventing water imbibition by the seeds.

Phenological observations indicate a great decrease in the number of individuals occurring during the dry season and this is due to the high mortality of plants showing basal vegetative stem. Some populations constituted only of such green plants totally disappear above the soil level at the end of the dry season and only reappear at the beginning of the rains thanks to the seeds buried in the soil. It also appears clearly that vegetative plants grow regularly during the wet season and begin usually to carry their first buds in September.

## First conclusions

The high fecundity and high mortality rates, the quick lignification of adult plants, the importance of the soil seed bank and the occurrence of an induced dormancy are all factors influencing considerably the minimum population size needed to maintain *in situ* the genetic variability of the wild Lima bean populations in the Central Valley. Other experiments will be conducted to determine the mechanisms inducing dormancy and to evaluate the seeds migration in the soil. Regular observations on phenology and demography during the following years will allow us to forecast the population dynamics and to suggest *in situ* conservation strategies.

## References

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