Growing halophytes in China for agronomic and ecological purposes: a case study for flowering deserts - 'Biodosimetry'- BL/10/C34-BL/16/C35

(Geographic) study area : China / Najing - Dalian

Data used: /

Context and objectives

The development of menkind has reached the point that a variety of new resources need to be trapped in order to fill our basic needs for food, feed and energy. Each year, an important portion of agricultural utilized areas is lost as a consequence of desertification and salinization problems. The use of xero-halophyte (drought- and salt resistant plants) species may contribute to use desertic lands where no other plants are able to grow and to save good quality water for human consumption. Halophytes may be used in land that has not been forested or farmed and afford beneficial side effects since they can aid in revegetating arid regions, restore ecological biodiversity and improve mesoscale climatic parameters. However, their rational use is greatly hampered by: 1) Our insufficient knowledge about the specificity of physiological and biochemical mechanisms which allow halophyte species to cope with environmental constraint, 2) The important intra-specific biodiversity of most halophytes species.

The aim of the project is to determine the putative interests of a halophyte species (***Koztleletskya virginica*) present in China for alternative agricultural production and for revegetation of salt-affected desertic lands**.

Methodology

- The project is based on a set of integrated tasks that consider physiological responses of K. virginica to stress, mode of reproduction and seed set in agronomic conditions, and genetic diversity of the species in the context of agronomic selection,
- Physiology: kinetic of growth in semi natural environment; ion accumulation, water and osmotic potential, organic compound analysis, photosynthesis activity evaluated in experimental environment in lretaion to stress intensity. Analysis of physico-chemical properties of mucus.
- Reproduction: capacity of self-pollination, seed production in relation to pollinators activities in field, experimental comparisons of reproduction modalities.
- Genetic diversity: development of SSR markers to evaluate genetic diversity of introduced populations.

Results

The physiological response of stressed plants confirmed the results of Blits and Gallagher (1990) in terms of number of leaves produced, biomass, and water content. Gaz exchanges, cation exchanges and chlorophylle fluorescence were also characterized. An increase of Na+ coupled with a decrease in K+ was associated with the saline stress in all plant organs. The quantity of mucilage increased throughout the plant with saline stress. This mucilage has an important role in plant water transport and as stomatic plug, as weel as potential use in industry.

Preliminary studies on oil extraction (24.5% produced) and quality did not allow to draw conclusions on its use as biodiesel and should be pursued. K. virginica presents an autonomous self-pollination system. The species is able to set seed in the absence of pollinators, a characteristic favourable to its use in pollinators limited conditions of its introduced range.

In addition, seed of K. virginica present interesting properties for their valorisation in bio-fuel.

SSR markers have been developed from probes used in Cotton.

Products and services

Chengjiang RUAN, Lijun ZHOU, Fangyu ZENG, Ruiming Han, Qei Qin, Stanley Lutts' Layla Saad, and Gregory Mahy, (submitted). Contribution of delayed autonomous selfing to reproductive success in Kosteletzkya virginica. Submitted to Belgian Journal of Botany.

Lenoir C. Physiological response of K. virginica to salinity. Master thesis. UCL, 2007. Paper in preparation.

Execution

Period: 01 may 2005 – 31 June 2007

Laboratory/network:
S. LUTTS - Unité de Biologie végétale, Université catholique de Louvain

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Discipline

Agriculture Environment
Desertification
Biodiverstity

Perspective

Due to the need of China for additional agronomic production and energy concomitant to soil salinization and desertification, selection of Xero-halophytes species for biomass production will be a key topic in the future. This will be linked in the same time to additional pressure on ecosystems and need to restore ecological diversity. Nevertheless, considering the potential detrimental effect of introducing exotic species demonstrated in numerous world wide situations, further researches on this topic should focus on the valorisation of indigenous species.
In addition to biomass production for shelter or energy, more attention should be paid to species that produce secondary products, such as mucilage, with potential high added value. More attention should also be paid to quantifying the positive impact of desert restoration on biodiversity and to develop environment-friend agronomic methods to produce those plants.