



REPORT

Francisco José do Nascimento Carrapiço, Prof. of the Faculty of Sciences of the University of Lisbon, Portugal (FCUL) / Department of Plant Biology (DBV) and Researcher of the Centre of Environmental Biology (CBA) and International Scientific Consultant of Proj. A-A, has visited the Escuela Superior Politecnica del Litoral (ESPOL) in Guayaquil, Ecuador, from January 11th to the 19th 2003, as I was invited by the Coordinator of the Project "Aplicacion de la simbiosis diazotrófica entre *Azolla* y *Anabaena* como abono verde para el cultivo del arroz en Litoral Ecuatoriano", Eng. Mariano Montaña Armijos. During my stay it was possible to have contact with the reality and aims of the project, thus developing several theoretical as well lab workshops for researchers and representatives of public and private institutions studying the applicability of *Azolla-Anabaena*-bacteria symbiotic system. These workshops were namely focused on *Azolla* biology, on lab and field culture management and the use of this fern in rice culture. Likewise, other areas of applicability were developed, namely phytoremediation, in particular the domestic and industrial wastewater treatment.

As a scientific consultant, I was able to observe and assert the well structured and committed management of the project, both at a technical-scientific level, and at human resources level. The

Azolla-Anabaena system was adopted as the main object of study as a biological alternative or complement to the use of chemical fertilizers in rice culture. A problem associated with the use of chemical fertilizers is the adverse effects on long term soil fertility, soil productivity and environmental safety. A new strategy for increasing rice production, particular in developing countries should be taken into account for programmes to use the biofertilizers which will not only increase the rice productivity, but also improve the long term soil fertility. We must draw your attention to the fact that the *Azolla-Anabaena* system is the only fern-cyanobacteria association which presents agricultural interest for the nitrogen input that this plant can introduce in the fields and for this reason it has been used in several tropical and subtropical countries in different continents.

Ecuador presents adequate ecological and climatic conditions for the development of the genus *Azolla*. In the country four species are described:

1. *Azolla caroliniana* Willd.
2. *Azolla filiculoides* Lam.
3. *Azolla mexicana* C. Presl
4. *Azolla microphylla* Kaulf.

The species chosen by the Project team was *Azolla caroliniana* Willd., and confirmed by our lab, which is native of the Guayaquil region. This option was the correct one since it is the best species for local farmers to use and also to avoid stress environmental conditions. In conclusion, *Azolla* is a good option as a green fertilizer, namely in South-American countries that present a low cost of labour force. In industrial countries or regions, the potential of *Azolla* as a symbiotic nitrogen-fixing system should continue to be exploited for a more

developing environmentally-friendly agricultural system, namely, in particular segments of this important economical activity. Other uses of the *Azolla-Anabaena* system are now in progress, such as the control of aquatic weeds, the use as animal feed and the concentration of mineral elements, namely its use as biofilter in industrial and domestical effluents.

At last but not least, *Azolla* must be considered as an important natural resource and included in the sustainable Ecuador agricultural and industrial development strategies for the country in this century. To develop and implement this strategy we must reinforce the scientific knowledge on this symbiotic system and integrate it in the *curricula* of the Universities and Polytechnic Schools allowing the development and establishment of human and technical resources that are the main base for Ecuador's development in this area.

Lisbon, 14 December 2003

A handwritten signature in black ink that reads "Francisco Carrapico". The signature is written in a cursive style with a long, sweeping underline.

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Photos

