

Instituto de Biología Agrícola de Mendoza (IBAM). The tenth birthday of a research envision with international impact but strongly involved with the territory

At the beginning of the 2000' a small group of researchers belonging to the Facultad de Ciencias Agrarias (FCA), began meeting regularly with colleagues from other institutions in a sort of "scientific club" then called Centro de Biología Vegetal de Mendoza (CEBIVEM). The aim of this group was to carry on seminars to discuss the advances either of the CEBIVEM members and/or the state of arts in some specific subjects related to plant biology and associated organisms. From the beginning, the holistic vision of plants and their environment was clear.

Nonetheless, the gathering led to a more ambitious scope, and so the project of a research institute was proposed. The idea was, at first, advancing with timidity, but with the support of the local Universidad Nacional de Cuyo (UNCuyo) authorities and the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), representatives in Mendoza, the proposal strengthened. Eventually, on November 5th 2009, the Institute of Agricultural Biology of Mendoza, Instituto de Biología Agrícola de Mendoza (IBAM), was formally inaugurated.

The foundational objectives declared were: i) to promote basic and applied research in the field of agro-biotechnology, taking in consideration the hypothesis of the disciplines and sub-disciplines related with the agronomical sciences, plant biology and biotechnology; ii) to contribute to the field of the Institute's expertise in generating knowledge for the development of technologies, primarily having in mind the regional demand, as well as projects of national relevance; iii) to train qualified personnel in high education, in number and quality, according to the necessities of the region and the country; iv) to collaborate with the productive sector related with agribusiness, in projects of technical assistance and technological transfer, aiming to a tied interrelationship with the local community.

From the beginning the IBAM's scope was of course to develop knowledge at the best scientific level, on condition that the generated information should be linked and transferred to the society that support the activities, especially regarding plant productivity and their applications. It was in this way that a collaborative process started with local firms even before the creation of the institute. The collaboration between the academy and the private industry was gaining momentum as time went by. Today, after 10 years, more than 90% of the research developed at IBAM is in collaborative association with different companies, mainly from the viticulture and winemaking area, although production of vegetables of local importance like tomato, olive, garlic, onion and potato is also included. As well, the search of knowledge has been carried out in collaboration among the different scientific groups of the institute, other scholars of FCA, UNCuyo, other Argentinean institutions and scientists from all over the world. More precise data on the matter are provided by an article in this issue.

The Institute was a collective construction. Those that opposed and/or presented hard criticisms were a valuable contribution for mending pathways or simply reinforcing the will to go forward with the enterprise. But people that contributed positively were many more, starting with the political willingness of authorities in charge, both from CONICET as well as from UNCuyo, but mainly with administrative, technicians, doctoral students and researchers. Citing names will exceed the possibilities of this letter, aside the fact of unavoidable (and unpardonable) forgetfulness.

Now, what and how is IBAM after 10 years from its formal creation? As it is quite common in the Argentinean scientific environment, the institute has double dependence from both, the university (UNCuyo in this case) and CONICET. Roughly speaking, the first provides the building infrastructure and utilities, while the council supplies doctoral scholarships and salaries, while both contribute to the regular budget. This budget is complemented with extramural grants obtained from Scientific Agencies (both national and international) and,



in the case of IBAM, especially with contributions from the local agribusiness industry. In the latter case, such contributions are not provided as money but mainly supplied as productive infrastructure and consumables, as well as doctoral scholarships that have been and still are co-financed. In return, the IBAM members, apart their academic positions (in some cases) at UNCuyo, are strongly involved in teaching at both, undergraduate and postgraduate levels.

After 10 years of work the main scientific achievements may be resumed as follows:

Extensive research has been explored and results published regarding the plant's responses to environmental clues, which are light quality, water restriction and soil microflora. Most noticeably, the role of UV-B radiation in the grapes for red winemaking characteristics (especially of the cultivar Malbec, emblematic for Argentina's winemaking industry) has been appraised. Therefore, explaining the reason why "wines of altitude" (grapevines grown at more than 1300 m a.s.l.) show superior quality as compared to their low altitude counterparts. Such effects have been interacted with water restriction and plant hormones applications, so generating valuable tools for winegrowing industry. Analytical and tasting combined studies are currently under development in order to characterize different "terroir" for the cultivar Malbec. In addition, the influence of light spectra inside the grape canopy is also being analyzed, concerning the grapevine management system. Finally, several beneficial bacteria have been isolated and characterized their effects on grapevines (and the wine product) have been established. Soil characterization in vineyards of high value is in progress, both from the physic-chemical as well as the biological standpoints.

The importance of interspecific hybridization and polyploidy in the generation of genetic and epigenetic variability in *Solanum* species have been established. These mechanisms are key aspects for the improvement of potato breeding, since they allow the introduction of genes of interest from wild species to commercial cultivars. The investigations demonstrated that both mentioned mechanisms generated genetic and epigenetic changes, which may explain the yield increases of polyploidy hybrids (heterosis). As well, it has been found that, in wild populations, hybridization generates new epigenetic patterns that explain the adaptation to new environments. Recently, there has been advances in understanding how the epigenetic variability may explain phenotypic changes of plants in response to environmental clues, either in hybrids of wild and cultivated potato, and also in grapevines.

Another valuable contribution has been on the understanding of molecular mechanisms and horizontal transfer of genes in plants. Such observations are implied in the maintaining or potential expansion of genes introduced by genetic engineering (transgenic plants). Furthermore, it has been established that the molecular mechanisms for acquisition of foreign genes by mitochondria through genomic recombination, is related with quimera genes that cause cytoplasmic male sterility. A review article on this topic can be found in this issue.

Genomic studies involving selection and adaptation of the Malbec grape cultivar were also performed. Starting with the genomic sequencing of 4 grapevine clones (two of Malbec, two of Cot) the genotyping of more than 220 different Malbec clones has been accomplished. In addition, advances on the understanding of the genetic regulation of Resveratrol and Anthocyanins (important in grape and wine quality and as anti-oxidants) were achieved. Transcription factors elicited by the plant hormone jasmonic (JA) acid were identified, and the biosynthesis of Resveratrol and Anthocyanin increased in the red varieties Malbec, Bonarda, Syrah, Cabernet Sauvignon and Pinot Noir cultured in different regions (cold and warm) through application of abscisic acid (ABA) and JA. It has been found that the detrimental effect of high temperatures on Anthocyanin content in berries may be counteracted by combining ABA and salicylic acid (SA) with water stress in the varieties Malbec and Bonarda.

With respect to plant pathogenesis, several *Phylloxera* genotypes present in Argentinean grapevines and not found in other regions of the world were identified, in ecological associations with the plague in different Argentinean vineyards. Eventhough different levels of susceptibility of *Vitis Vinifera* cultivars and rootstocks were assessed for tolerance,

no correlation was found between the pathogen harmfulness and the plant's watering management. Another important research lines include the biology of new plagues for grapevines, like *Lobesia botrana*.

Pioneering studies with Eutectic Natural Solvents have been endeavored, as solvents in Green Chemistry and their functional role in cells and organisms.

The analytical profile of different foods, noticeably grapes, wine, olives and byproducts of the winemaking and olive industries, have been evaluated by using physic-chemical. Methods to improve their scrutiny have also been developed. Likewise, the bioactivity of extracts from such foods and byproducts (including wastes) were tested in biological systems, seeking applications in human health and as nutraceutic supplements. Another pursued goal has been the use of extracts from autochthonous species and from agribusiness byproducts in the control of different pathogenesis.

The reproduction of the native grass *Thricloris crinita* has been established as sexual, autogamous and tetraploid. Molecular markers have been developed for different cultivars of the species, and the stress tolerance, productivity and forage quality established for different genotypes. This will permit a better use of this Gramineae in order to restore degraded areas and/or as forage.

It is worth to mention that, along the process of generating knowledge that produced more than 200 scientific indexed articles, numerous human resources were trained in research and development (36 doctoral thesis defended to this day). Many of the former graduated students are now investigators at IBAM, other CONICET institutes, scholars at UNCuyo and other universities, or incorporated to Instituto Nacional de Tecnología Agropecuaria (INTA) and the agribusiness sector.

Considering, altogether, the scientific production, human resources formation and collaborative work with the productive sector, IBAM has given fresh impetus to the idea that investigations with international impact but strongly involved with the territory are possible. This has established the paradigm that academia and industry may invest associatively in research as a way to optimize resources.

Finally, even though the initial envision seems to be fulfilled, it is quite clear, for the IBAM's members, that the story just begins.

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