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*Profile*

# Pilar Catalán

## What inspired your interest in plant science?

I spent my early childhood and a large part of my youth in the countryside; since then I have been fascinated with all aspects of nature and especially with plants, first in my native Spanish Aragonaise region and later elsewhere. I delighted in contemplating how much plant diversity was growing in the Prepyrenees and Pyrenees, along the seasons and at different ecosystems and altitudinal belts when I hiked in the mountains. I wanted to know more about those fantastic herbs, shrubs and trees that I found on my excursions – how and why they were there. I also had a strong scientific tradition in the family; my father and my uncle were scientists. My uncle was a physicist who discovered the atomic structure of the multiplets in manganese. His discoveries, and my enthusiast mother – who was a pharmacist – greatly stimulated my interest in science, but I decided to study botany as the way to decipher the many intriguing questions on diversity, speciation and evolution posed by plants.

## Why did you decide to pursue a career in research?

I wanted to learn more about plant systematics and evolution, and also to provide new discoveries to the community. During my Biology degree thesis and first years of my PhD, I worked on taxonomy as an immediate approach to know the plants more intimately. It was a pleasure to acquire knowledge on the highly diverse floras, their biogeographical distributions and ecological interactions. I then fell in love with grasses, those 'herbs' without apparent flowers that were so amazingly beautiful and had such a complex history of hybridizations and polyploidizations. I decided to investigate in depth some groups of temperate grasses that were poorly known at that time using newly developed tools such as fine-scale morphoanatomy, cytogenetics, molecular phylogenetics and, more recently, comparative genomics and phylogenomics. I was also interested in searching the intraspecific variation of some grass species and their adaptation to different ecological conditions and ventured into population genetics, phylogeography and ecological niche modelling. One of these wild pooid groups (*Brachypodium*) was later selected as a model system for monocots, and it was a great satisfaction to realize that my work could contribute to improving our knowledge of these grasses and – by extension – of other plants.

## What motivates you on a day-to-day basis?

My principal motivation is the fact that after any new finding there are still many scientific questions and problems to be solved about the evolution and speciation processes of plants and other interesting biological mechanisms that could be investigated with our focal plants, and I would like to participate in

### Box 1

Photograph courtesy of Antonio Díaz-Pérez

Pilar Catalán graduated in Biology from the University of Navarra (Spain) in 1980 and obtained her PhD in 1987 under Prof. Pedro Montserrat-Recoder's direction at the Aranzadi Natural Sciences Institute – Pyrenean Institute of Ecology (CSIC) – Basque Country University (Spain). From 1989 to 1991 Pilar joined Prof. Clive A. Stace's laboratory at Leicester University (UK) for her first postdoctoral training, and from 1993 to 1994 at Dr Richard Olmstead's and Dr Elizabeth Kellogg's laboratories at Colorado and Harvard Universities (USA), respectively, for further postdoctoral collaboration. Since 1998 Pilar has been head of her research team, Bioflora, at the University of Zaragoza in Huesca (Spain). She obtained a Professorship in Botany at the University of Zaragoza in 2008 and a visiting Professorship at Tomsk State University (Russia) in 2014. In addition, Pilar was a member of the Spanish National Board for Biodiversity from 2006 to 2010 and has led scientific networks with Venezuelan, Argentinian and Ecuadorian institutions since 2000. In 2010 Pilar joined the US–EU scientific consortium funded by the Joint Genome Institute (JGI) for the study of the model monocot genus *Brachypodium*. She was awarded Corresponding member of the Botanical Society of America in 2017. Pilar is interested in grass diversity and evolution and polyploid speciation using biological, genomic and evolutionary approaches.

Pilar is a coordinator of the *Brachypodium* feature in this issue of *New Phytologist*.

For more information on Pilar visit: https://www.bifi.es/bioflora/new-page.html and https://www.bifi.es/bioflora/research-team/profile1.html

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this. During the last decade, and thanks to the advances of the genomic analyses and the collaboration with colleagues of the International Brachypodium Initiative, I have been involved in deeper functional genomic and phylogenomic analyses of our model species. Our joint contributions to dissect the main constituent parts of diploid, derived polyploid and orphan genomes, their expression levels and regulatory networks under different developmental and stress conditions, and the time-course comparative analysis of re-created synthetic allopolyploid plants and their recurrently originated wild counterparts have opened new exciting ways for making discoveries on the origins of these species. It is a challenge, but also an exciting motivation, to pursue the new promising research avenues that can keep you active and researching for the rest of your life.

## Is there anyone that you consider to be a role model?

My supervisors have been a direct source of inspiration for me. My PhD advisor Prof. Pedro Montserrat-Recoder transmitted to me not only his broad knowledge and passion for plants, but also his integrated vision of the Pyrenean ecological landscape. My postdoctoral mentors moved me to carry on deeper science. Prof. Clive A. Stace enlarged my plant systematic formation; he introduced me to artificial crossing and hybrid fertility as a Mayrean approach to establish taxonomic boundaries and species relationships. I learnt about plant molecular phylogenetics with Prof. Richard Olmstead; the development of phylogenetic reconstruction methods and their application to the incipient phylogenies of grasses were most stimulating. This, together with the wonderful hiking to the Rockies and the familiarization with its rich flora was one the greatest experiences I have ever had. Prof. Elizabeth (Toby) Kellogg taught me about grass evolution; she pushed ahead the evo-devo studies in the grass family. I was – and still am – fascinated with the thorough studies Toby has conducted on gene expression and regulation at different floral developmental states in several grass groups, deciphering in some cases the variations observed in the grass spikelet. From a historical perspective, I admire Barbara McClintock (transposons) and Rosalynd Franklin (DNA and TMV X-ray structures), for their outstanding scientific discoveries, tenacity and wisdom, and my uncle (structure of complex atoms that granted him Miguel Catalan's craters on the moon: 45°42′S 87°18′W) who, apart from being a great scientist, also loved teaching and mountaineering.

## What are your favourite *New Phytologist* papers of recent years, and why?

I like the Tansley reviews and Tansley insights, which inform about the most recent advances on different scientific aspects of plants. My favourite articles are those that deal with plant speciation processes and especially with hybridization and polyploidization, two common evolutionary phenomena in grasses and other angiosperms. Among the extraordinary papers produced on genome dominance, gene behaviour and their phenotypic and evolutionary consequences on hybrid polyploids

**Fig. 1** Spikelets of *Brachypodium distachyon*, the model plant for temperate cereals and biofuel grasses.

by, among others, the laboratories of Pamela and Douglas Soltis, Jonathan Wendel, Jeff Doyle and Aaron Liston, I enjoyed two relatively recent response letters published in *New Phytologist*. The publication by Soltis *et al.* (2014) 'Are polyploids really evolutionary dead-ends (again)?' admirably refutes the hypothesis of the fate of polyploids; using philosophical, analytical, and broad sampling approaches, they reject the idea that stabilized polyploids undergo higher extinction rates than diploids. The article by Doyle & Sherman-Broyles (2017) 'Double trouble: taxonomy and definition of polyploidy' soundly discusses main conceptual topics on plant polyploids using *Glycine* as a case study (e.g. infraspecific unnamed cytotypes are different species, genomic analyses differentiate allo(from auto)polyploids, genetic and taxonomic classification may differ, multiple allopolyploid origins may lead to the same speciation outcome but could also end in multiple separate polyploid species).

## What is your favourite plant, and why?

I like grasses in general though my favourite plants are fescues and 'brachys' (*Brachypodium*) (Fig. 1), probably because I have studied them more intensively. Though some people say that all grasses look the same, they are very different; each species has its own particular traits. They also show amazing dispersal structures, have adapted to very different ecological conditions and make beautiful grassland landscapes. Some fescues and Brachypodiums have fascinating histories of coevolution with their fungal endophytes acquiring defence alkaloids against herbivores from them; also, the origin of some heteroploid symbionts is linked to that of their allopolyploid grass hosts. Some fescues and close relatives are the best forage, pasture and lawn grasses. The small size and low repetitive DNA content genomes of most *Brachypodium* species have allowed us to investigate, more straightforwardly, different aspects of genome evolution and speciation of plants. In addition, the *Festuca* and *Brachypodium* species are present in almost all continents and habitats, and sampling them in the field is a good

way to know also about other plants and accompanying organisms.

## References

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