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Editorial

Advances in Legume Systematics 13

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The Advances in Legume Systematics (ALS) series has provided the venues for publishing outputs from the series of seven International Legume Conferences (ILC) held over the last four decades. The first two editions arising from the first ILC in 1978 at the Royal Botanic Gardens, Kew, were published in 1981. The first ten parts of ALS were published as a coherent series by the Royal Botanic Gardens, Kew Publishing, whereas more recent editions have been published as Special Issues of botanical journals – Part 11 in *Australian Systematic Botany* in 2003, and Part 12 in the *South African Journal of Botany* in 2013. This, the 13th edition of the ALS series, is here published as a Special Issue of *Australian Systematic Botany*, and includes papers arising from the 7th ILC held in Sendai, Japan, in September 2018. The ALS13 Special Issue includes a *potpourri* of papers spanning the full spectrum of topics and research activities in current legume systematics, namely fossils, morphology, classification and taxonomy, ethnobotany, genomics and informatics. When referring to the Special Issue as a whole it should be cited as Hughes, Egan, Murphy and Kajita, ALS13; however, individual papers should be cited where relevant.

Legumes have a rich fossil record spanning the last 60 million years and this record is further enhanced here by Herrera *et al*. (2019) who return to the Cerrejón and Bogotá mid- to late-Paleocene formations and fossil assemblages in Colombia where the earliest definitive legume fossils were first documented by Wing *et al*. (2009). They describe a large set of interesting legume fossils comprising more than 500 specimens representing 6 putative leaf and 8 fruit fossil morphotypes. This spectacular set of fossils confirms that legumes were abundant at both these sites in the Paleocene rainforests of northern South America 60–58 million years ago, and that the family was already diverse at that time, with probably at least three of the six legume subfamilies represented.

Extrafloral nectaries (EFNs) involving ecologically important ant–plant protection mutualisms are very frequent in legumes. Marazzi *et al*. (2019) present a major review of the phylogenetic distribution, morphological diversity and evolution of extrafloral nectaries (EFNs) across the legume family. This review brings together a large body of new data on the occurrence of EFNs in legumes assembled since the last synthesis by McKey (1989). Marazzi *et al*. (2019) present the first comprehensively curated list of legume genera with EFNs, increasing the number of genera known to have EFNs to 153, or ~20% of legume genera. A revised classification of legume EFNs is presented and the different EFN categories are mapped onto a time-calibrated version of the Legume Phylogeny Working Group (2017) legume phylogeny showing the different EFN types had independent evolutionary trajectories.

High throughput sequencing is revolutionising all aspects of plant biology and legumes have been at the forefront of this revolution with early genome sequencing of a suite of crop and model legume species. All of the initially sequenced legume genomes are in subfamily Papilionoideae, but legume genomics is now rapidly expanding across the other legume subfamilies. This rising tsunami of genomic data is opening up massive new opportunities in legume biology across disparate fields from phylogenomics to legume crop breeding, and from legume diversity assessment to conservation of legume genetic resources. Some of the most exciting developments are associated with understanding the genetic basis and evolution of key legume functional traits, such as nodulation (e.g. Griesmann *et al*. 2018), ushering in a new era of comparative legume genomics. This legume genomics revolution is thoroughly reviewed here by Egan and Vatanparast (2019) who present a detailed synthesis of these burgeoning new data and what they mean for both pure and more applied aspects of legume biology.

Plastid genome sequences are rapidly proliferating across legumes (with now several 100 published plastid genomes) and there is a rapidly growing number of nuclear genomes (currently ~37 – see Egan and Vatanparast 2019) now at

various stages of assembly. However, sequencing and assembly of plant mitochondrial genomes has lagged behind. Here, Zhang *et al*. (2019) present the mitochondrial genome of *Castanospermum australe*, bringing the total number of legume mitochondrial genomes to 33 (see Egan and Vatanparast 2019). They also compare this newly sequenced genome to ten other legume mitochondrial genomes, detect genes, and present a phylogenetic analysis, suggesting that the mitochondrial genome can be phylogenetically informative even at deep levels within legumes.

It makes sense that legumes, as one of the largest and most economically and ecologically important plant families, were the focus of some of the earliest pioneering work to develop online species databases and information systems from the 1980s onwards, notably through the International Legume Database & Information System (ILDIS). However, despite this early prominence of legumes in biodiversity informatics, in recent years it has become increasingly clear that a new and more modern database and species information system for legumes is required. In a paper produced under the umbrella of the Legume Phylogeny Working Group (Bruneau *et al*. 2019) the history of legume databasing and ILDIS is reviewed, the value of taxon-centric information systems is discussed in relation to wider global biodiversity databasing initiatives, and exemplar species information systems for other taxonomic groups are surveyed. This survey provides the foundations and a road-map for a much-needed new online species information system for legumes. We very much encourage this new initiative to reinstate legumes at the forefront of species informatics; we endorse the on-going value of taxon-centric information systems and encourage the development of a system that can interface efficiently with key global taxonomic, specimen and trait databases; we look forward to a state-of-the-art new legume species information system.

This proposed new legume information system will be useful for myriad sub-disciplines in science, with trait details of various sorts compiled into a searchable and expandable database, including information on economic uses and ethnobotany of legumes. Here, van Wyk (2019) presents a review of economic and ethnobotanical uses of legumes in South Africa. Regression analyses inform on the relative distribution of endemic taxa across the family and also suggest that tribes Phaseoleae and Millettieae have been favoured in the selection of useful plants.

ALS Part 13 continues the strong tradition of the ALS series in supporting taxonomic initiatives and discoveries, and includes three such taxonomic papers. Lewis *et al*. (2019) describe two new species of *Poecilanthe* from Brazil and Bolivia, and present a summary of the current generic circumscription of the papilionoid legume tribe Brongniartieae (Benth.) Hutch., to which *Poecilanthe* belongs. De Queiroz *et al*. (2019) describe a new species in *Tephrosia* and present a key to the South American species of this large pantropical genus, update synonymy, and present several new lectotypes. Finally, de la Estrella *et al*. (2019) tackle generic delimitation issues in the *Englerodendron–Anthonotha* clade using a new and as yet only partially published backbone phylogeny of subfamily Detarioideae based on hybrid capture of nuclear gene sequences (Ojeda *et al*. 2019). They demonstrate the non-monophyly of the genera *Englerodendron*, *Isomacrolobium* and *Pseudomacrolobium*, consigning the latter two genera to synonymy under an expanded *Englerodendron*, and presenting a key for the identification of the now 17 species assigned to that genus. This paper exemplifies the on-going efforts to align legume genera to robustly supported monophyletic groups, efforts which lie very much at the heart of current legume systematics

Conflicts of interest

Colin Hughes and Ashley Egan are ALS13 Associate Editors; Daniel Murphy is the *Australian Systematic Botany* Editor-in-Chief; and Tadashi Kajita is the principal organiser of the 7th International Legume Conference, ILC7.

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