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editorial

Seasonal cheer

With the year drawing to a close, what hope is there for a 'golden' future for plant sciences in 2017 and beyond?

This issue of *Nature Plants* is the last of 2016, and it is fair to say that this year has not been an unending procession of good news. However, with end-of-year festivities fast approaching, it is cheering to look back at some of the plant science from the year with a seasonal flavour.

First of the plants and plant products associated with the rituals and mythologies of Christmas time is mistletoe. It has been associated with the winter solstice since long before Christian times, being tied up with both Iron Age Druidic and Norse culture. Mistletoe is not a well-defined species, or even genus, but a catch-all term for a number of plants that share the obligate hemiparasitic lifestyle of European mistletoe, *Viscum album*.

Mistletoes are popular nesting sites for many bird species, especially those that value concealment. However, we learnt this year that for the Grey Go-away-bird of Southern Africa (*Corythaixoides concolor*), this is not a successful tactic; survival rates in mistletoe-located nests are less than 25%, in comparison to around 90% in other locations[1].

We also found out that mistletoes mimic another charismatic parasite, the cuckoo. Similar to cuckoos, a mistletoe native to Mexico, *Psittacanthus calyculatus*, shows individual preferences for hosts of particular species[2]. The mistletoes were far more successful on native than non-native trees. In addition, seeds that were the result of pollination by individuals growing on the same species of tree were more successful at growing on their 'paternal' tree than were seeds produced by random cross-pollinations.

Another plant frequently associated with Christmas is holly (*Ilex* spp.). Holly appears to enjoy urban living; an English citizen-science project coordinated by the Open Air Laboratories programme and involving close to 3,000 volunteers found that holly was almost twice as prevalent in urban hedges as in rural ones[3]. Holly was also the focus of detailed molecular work including the sequencing of mitochondrial genomes from seven *Ilex* species, which contributed to the elucidation of a detailed phylogeny for this genus and the order Aquifoliales as a whole[4].

As far as I could discover, there have been no advances in our knowledge of the interactions between pear trees and ground-living game birds (aside from a randomized trial of a healthy eating regimen that had an emphasis on vegetable and fruit consumption, presumably including pears, authored by Stephanie Partridge and colleagues at the University of Sydney[5]). Chestnuts have not been the focus of much scrutiny either, although it was shown that roasting is a superior cooking method than boiling[6], and that they formed a major part of the diet of Stone Age residents of what is now Finland[7].

Two of the three traditional presents of Christmas are products of plant secondary metabolism. Myrrh for example, is an aromatic resin produced by a number of bushes of the genus *Commiphora*. It is used in traditional medicine as an antiseptic and antimicrobial, but there is some debate as to whether what we now call myrrh is the same as the myrrh of biblical times. Such doubt is perhaps unsurprising as the *Commiphora* have a wide global distribution within relatively dry tropical forests. A quarter of the known species are native to Madagascar. A new phylogeny of the genus, using nuclear and chloroplast gene sequencing, shows that these Malagasy species are only distantly related, and suggests that their ancestors colonized the island on as many as four separate occasions[8].

Genetics was also the focus of work on frankincense by Rene Smulders and colleagues from Wageningen University. Rather than the phylogenetic relations between species, they looked at the population structure within a single species[9,10]. As with myrrh, frankincense is a plant resin, in this case extracted from the bark of *Boswellia* trees. Smulders and colleagues were particularly interested in *B. papyrifera*, a native of Ethiopia where it is threatened by human activity, existing only in small isolated patches throughout the country. Nevertheless, microsatellite analysis of the various populations shows a high level of genetic variation in the population, maintained by a predominance of outcrossing as the reproductive strategy.

Which brings us to gold.

In this issue of *Nature Plants*, there is a Feature discussing initiatives to increase the nutritional value of various fruit varieties[11]. However, there is a long way between the development of a biofortified crop and its agricultural production, as the progress of the 'Golden Rice' illustrates. The original form of Golden Rice was developed by Professors Ingo Potrykus and Peter Beyer in the 1990s, to tackle problems of dietary vitamin A deficiency[12]. They used daffodil and bacterial genes to create a transgenic plant that produced β-carotene (pro-vitamin A), which is essentially absent from conventional rice varieties. This was followed by an improved version using genes from maize instead of daffodils[13].

Despite a study as long ago as 2009 showing that even quite modest consumption of Golden Rice could supply half the recommended daily allowance of vitamin A[14], and the support of the International Rice Research Institute, the Bill and Melinda Gates Foundation and Syngenta, it has not yet been cleared for agricultural use anywhere in the world.

However, 2016 may prove to be a year of good news for Golden Rice. This September, at the 4th Annual South Asia Biosafety Meeting in Hydrebad, India, Partha Biswas of the Bangladesh Rice Research Institute presented the results of a contained field trial of a golden version of Bangladesh's best-performing rice variety, dhan29 (ref. 15). Even after two months of storage, rice grains contained 10 $\mu g\ g^{-1}$ of β-carotene, from plants whose weediness, disease and pest susceptibility were essentially the same as ordinary dhan29.

The way is therefore clear for multilocation trials of Golden dhan29, which could lead to a commercial release of seeds in 2018. Let us hope that this step to alleviating, or even abolishing, vitamin A deficiency will prove to be the most significant and memorable event of 2016. ❐

References

1. Ndagurwa, H. G. T., Nyawo, E. & Muvengwi, J. *African J. Ecol.* **54,** 336–341 (2016).
2. Pérez-Crespo, M. J., Lara, C. & Ornelas, J. F. *Evol. Ecol.* **30,** 1061–1080 (2016).
3. Gosling, L., Sparks, T. H., Araya, Y., Harvey, M. & Ansine, J. *BMC Ecol.* **16,** 15 (2016).
4. Yao, X. *et al. Sci. Rep.* **6,** 28559 (2016).
5. Partridge, S., McGeechan, K., Bauman, A., Phongsavan, P. & Allman-Farinelli, M. *Int. J. Behav. Nutr. Phys. Act.* **13,** 44 (2016).
6. Kan, L. *et al. Carbohydr. Polym.* **151,** 614–623 (2016).
7. Vanhanen, S. & Pesonen, P. *Quat. Int.* **404,** 43–55 (2016).
8. Gostel, M. R., Phillipson, P. B. & Weeks, A. *Syst. Bot.* **41,** 67–81 (2016).
9. Addisalem, A. B., Bongers, F., Kassahun, T. & Smulders, M. J. M. *Forest Ecol. Manag.* **360,** 253–260 (2016).
10. Addisalem, A. B., Duminil, J., Wouters, D., Bongers, F. & Smulders, M. J. M. *Tree Genet. Genom.* **12,** 86 (2016).
11. Gruber, K. *Nat. Plants* **2,** 16191 (2016).
12. Ye, X. *et al. Science* **287,** 303–305 (2000).
13. Paine, J. A. *et al. Nat. Biotechnol.* **23,** 482–487 (2005).
14. Tang, G., Qin, J., Dolnikowski, G. G., Russell, R. M. & Grusak, M. A. *Am. J. Clin. Nutr.* **89,** 1776–1789 (2009).
15. Biswas, P. *Recent Advances in Breeding Golden Rice in Bangladesh* (2016); http://doi.org/btcx

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