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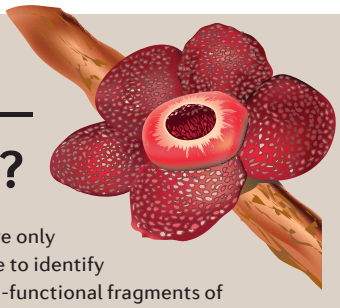
PLANT GENETICS

Plastid genomes — lost in translation?



Macmillan New Zealand

> “evidence for plastid genome loss in distinct non-photosynthetic green plants”

Many eukaryotic lineages have lost the ability to photosynthesize but have retained plastids — membrane-bound organelles that typically contain a small DNA genome — that continue to carry out metabolic functions. Researchers have previously suggested that the plastid genome is essential because it has been widely preserved. However, two separate studies now provide evidence for plastid genome loss in distinct non-photosynthetic green plants. Jeanmaire Molina and colleagues focused on the parasitic flowering plant genus *Rafflesia*, and the other study by David Roy Smith and Robert Lee focused on the free-living non-photosynthetic green algae *Polytomella*.

Both teams used next-generation sequencing of the entire DNA content of the plants to look for plastid DNA. Molina and colleagues were only able to identify non-functional fragments of plastid genes, and phylogenetic analyses led the authors to suggest that these fragments might have integrated into the nuclear DNA through horizontal gene transfer from the host plant *Tetrastigma*. “It’s always a problem trying to prove a negative,” says Michael Purugganan, a senior author of the Molina study, “but we made sure we used multiple computational techniques to try to find a plastid genome, and we also performed several experimental controls.”

Similarly, despite being able to identify sequencing reads from the *Polytomella* nuclear and mitochondrial genomes, Smith and Lee were unable to identify any *Polytomella* sequencing reads of an obvious plastid genome origin. In addition, Smith and Lee carried out transcriptome sequencing of *Polytomella parva* to see whether they could identify any transcripts of nuclear-encoded, plastid-targeted proteins. “Importantly, we were unable to identify any nuclear genes associated with the expression, replication or repair of plastid DNA,” explains Smith.

The plastid genomes of non-photosynthetic plants are usually smaller than those of photosynthetic plants; although many genes are often lost, most plastids contain several genes that are considered essential. “These results are surprising because even among plants that don’t do photosynthesis, a plastid genome had always been seen,” says Purugganan. Both teams plan on confirming and expanding this work in the future.

Bryony Jones

ORIGINAL RESEARCH PAPERS Smith, D. R. & Lee, R. W. A plastid without a genome: evidence from the nonphotosynthetic green alga Polytomella. *Plant Physiol.* http://dx.doi.org/10.1104/pp.113.233718 (2014) | Molina, J. *et al.* Possible loss of the chloroplast genome in the parasitic flowering plant *Rafflesia lagascae* (Rafflesiaceae). *Mol. Biol. Evol.* http://dx.doi.org/10.1093/molbev/msu051 (2014)