Biogeosciences Discuss.,
doi:10.5194/bg-2016-386-RC6, 2016

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Sedimentary ancient DNA and pollen reveal the composition of plant organic matter in Late Quaternary permafrost sediments of the Buor Khaya Peninsula (north-astern Siberia)" *by* Heike Hildegard Zimmermann et al.

Anonymous Referee #3

Received and published: 24 October 2016

Absolutely correct. Until recently in the literature we thought that that was the case. However we have now understood that pollen must contain both organelles after maturation (cp and mt) that are necessary, regardless of the type of inheritance, for pollen maturation and for creating the pollen tube during fertilisation. The total amount however will vary extensively depending on inheritance (see text below).

As an example, mtDNA as been amplified in spruce pollen (conifer: maternally inherited) > Parducci et al 2012 and viceversa cpDNA has been amplified in birch pollen

Printer-friendly version

Discussion paper

(angiosperm: maternally inherited)> Paffetti et al 2007.

I attach below a paragraph of a manuscript that will be soon published by my group that explain why we know now that pollen contain all three types of DNA (but in different amounts).

Below also a list of references.

Inside the pollen, after maturation, there are 2-3 cells (a large vegetative cell and 1-2 generative cells) that comprise the male gametophyte. The vegetative cell comprises the cytoplasm, and numerous plastids and mitochondria, which are responsible for the development of the pollen tube and delivery of the generative cells to the embryo sac together with the nuclear haploid DNA. Generative cells of pollen from the majority of plant species contain multiple organelles, including several copies of organelle DNA [chloroplast (cpDNA) and mtDNA], regardless of the type of inheritance of these genomes (maternal or paternal). Some nuclear repetitive regions, like ITS ribosomal repeats, are also present in multiple copies in the nucleus of both cell types. During pollen maturation however, there is a selective increase or decrease in the amount of organelle DNA in the generative cells (not in the vegetative) depending on the inheritance pattern (Nagata et al., 1999; Zhang & Liu, 2003). For example, mature pollen from species with paternal cpDNA inheritance (the majority of conifers), contains a regular amount of mtDNA and cpDNA in the vegetative cell and an increased amount of cpDNA in the generative cell/s. On the other hand, pollen from species with maternal inheritance of cpDNA and mtDNA (most of the angiosperms) contains at maturation a regular amount of both genomes in the vegetative cell and a decreased amount in the generative cell/s.

References

Nagata N, Saito C, Sakai A, Kuroiwa H, Kuroiwa T. 1999. The selective increase or decrease of organellar DNA in generative cells just after pollen mitosis one controls cytoplasmic inheritance. Planta 209: 53–65.

Parducci L, Jørgensen T, Tollefsrud MM, Elverland E, Alm T, Fontana SL, Bennett KD, Haile J, Matetovici I, Suyama Y, et al. 2012. Glacial survival of boreal trees in northern Scandinavia. Science 335: 1083–1086.

Zhang AB, Muster C, Liang HB, Zhu CD, Crozier R, Wan P, Feng J, Ward RD. 2011. A fuzzy-set-theory-based approach to analyse species membership in DNA barcoding. Molecular Ecology 21: 1848–1863.

Paffetti D, Vettori C, Caramelli D, Vernesi C, Lari M, Paganelli A, Paule L, Giannini R. 2007. Unexpected presence of Fagus orientalis complex in Italy as inferred from 45,000-year-old DNA pollen samples from Venice lagoon. BMC Evolutionary Biology 7: S6.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-386, 2016.

Printer-friendly version

Discussion paper