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Interactive comment on “The root economics spectrum: divergence of absorptive root strategies with root diameter” by D. Kong et al.

Anonymous Referee #1

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General comments The aims of the paper were to evaluate (1) the influence of root diameter on the root economics spectrum (RES) and (2) that the root chemical traits (C, N) vary across branch orders. Recently it has been argued that roots should be categorized based on their function or order with the architecture more than that based on a diameter cutoff, typically 2 mm (see McCormack et al 2015). The distal roots, called absorptive, could be considered as a main group because of their position in the root system. The authors would like to demonstrate this is not the case and that absorptive roots could follow different patterns. The authors consider that a RES exists in plants in general, but it has not been yet demonstrated at large scales (see debates given by Mommer & Weenstra 2012, Reich 2014 or Bardgett et al 2015). Defining a RES needs to observe similar traits syndromes related to resource acquisition and conservation in a large number of species. In the present study only a limited number of

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traits (mainly chemical and anatomy) for 7 species were measured. For these reasons the title gives a false message of the paper and RES should be removed from the title. Additional traits related to resource acquisition (SRL, SRA) in order to confirm the separation between thin and thick roots are expected. In addition the size of cortex (root EC) seems to be a promising trait more than diameter itself, as it drives values of root tissue density (RTD), C and N. But this trait has not been enough underlined in the hypotheses. Similarly for mycorrhiza colonization as it seems to contrast thin and thick absorptive roots.

I consider this paper addresses relevant scientific questions within the scope of BG and presents novel data on absorptive roots by considering separation of thin and thick based on diameter. However the attractive title does not reflect the data shown. The conclusions should take into account this point of view.

Specific comments Choice of the measured root traits. It is surprising that for absorptive roots (distal part of root system including apices) the authors did not measure specific root length or root surface area, nor mycorrhiza colonization, traits considered to be linked with resource acquisition whereas the chosen traits (anatomy, chemical) are more related to transport or construction cost. How can you estimate acquisition strategy with such traits? Root tissue density is more related to construction cost of tissue (mainly stele, see Wahl & Ryser 2000) and not to resource acquisition.

Root diameter in driving root trait spectra. Comments on two sentences given page 13044, line 21-22: "Traits syndrome for thicker absorptive roots would differ from the predictions of faster acquisition and shorter lifespan"; and page 13044, line 23-24: "This highlights the importance of discriminating the thicker for the thinner absorptive roots when exploring root strategies". I agree but this is because in case of your species thick roots have higher proportion of cortex than thin roots while for other species including monocots this is the opposite. What is then important is the proportion of cortex in the surface area, more than the diameter per se. Thus the link between diameter and lifespan is not applicable. Furthermore, the presence of mycorrhiza in thick roots

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changes also the capacity of the roots to uptake nutrients, independently of their morphology. Thus defining a RES with/without mycorrhiza should be explored.

Page 13044, line 24-25: Contrary to the sentence, the effect of root diameter in driving root traits spectra has been tested in monocots (see Drouet et al 2005. European Journal of Agronomy, 22:185–193 ; Picon-Cochard et al 2012. Plant and Soil, 353:47–57; and see Zobel. 2003. New Phytologist, 160:276–279).

Methods. Page 13046, line 6-12: precise if all species hold mycorrhiza Page 13047, line 1-2: Precise if the roots collected in plastic bags were washed or not before or after freezing. This is important for chemical analyses. Page 13047, line 7: The type and company of the stereomicroscope should be given Page 13048, line 1-2: determination of absorptive roots should be developed a bit even always described earlier. Page 13048, line 25: “root EC”: why there is no link with hypotheses? Page 13049, line 9: 247 μm for root EC: have you tested the normal distribution of fig S1a, because it seems there are 2 groups, 250-300 μm being in the middle. Page 13049, line 16: Moving average analyses should be more described as there are different methods Page 13049, line 17: a point is missing between fit and No.

Results. thin vs thick absorptive roots: thick roots do not follow the same pattern as thin one: in conclusion can you consider that thick roots are still absorptive roots? The use of RES is not correct in your work (see comments above) Fig S3: different symbols between thin and thick should be shown

Discussion. Page 13052, line 8-10: fig S1 shows distribution of root EC thickness for your species and previous work, but the two distributions seem to be different not similar. The comparison of your dataset with previous studies (supplementary material) raises more questions than answers. For example, fig S1: the two distributions seem different

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