

Response to Reviewer 3 Comments

Firstly, I would like to express our sincere thanks to the reviewers for the constructive and positive comments.

Point 1: In the introduction the authors present the plant and the importance of the produced pigments. However, are the authors sure of the species *Hylocereus polyrhizus*? *H. polyrhizus* and *H. undatus*, another species, have the same red fruit skin color at mature stage but different flesh colors, red and white respectively. In the same way the cultivar "Zihonglong" is often described in literature as a cultivar from *H. undatus*.

Response 1: Thank you for your good suggestion. Indeed, Zihonglong was previously regarded as belonging to *Hylocereus undatus* (such as article written by Nie et al. Gene, 2015, <https://doi.org/10.1016/j.gene.2015.03.007>), however, international literatures classifies pitaya type with red flesh as *Hylocereus polyrhizus*. Therefore, the accurate Latin name of 'Zihonglong' should be *Hylocereus polyrhizus*, and we use this presentation herein.

Point 2: In the part Results and discussion, figures 5 and 6 must be improved. It is very difficult to read the axes.

Response 2: We pasted images directly into the submitted manuscript and resulted in the blurry of image. As for this problem, we amplified the image axis title font size and make them bold. If revision is acceptable, we will upload TIFF images with 600 dpi to the editorial department.

Point 3: The authors report the presence of citramalic acid as a metabolite contributing to the formation of betalains. Can the authors present a putative biosynthetic way for the formation of this metabolite and from this metabolite to the betalains.

Response 3: Information regarding the physiological function of citramalic acids in plants has been limited until now. We have made some efforts to fulfill the putative biosynthetic way between citramalic acid and betalain but failed to establish the putative biosynthetic way. We only supplemented limited physiological functions of citramalic acid in plants (The revised details can be found in Line 344-348, page 10-11.) , Nevertheless your advice is very important and provide inspiration for us, we

have found the shortcomings in current work and would follow your advice to improve my scientific research level.

Point 4: lines 101 and 111, the authors report that the color changing is due to a degradation of chlorophyll. Can the authors explain this degradation? What is the biosynthetic way between chlorophyll and betalains. Did the authors analyse the different chlorophyll a and b, but also xanthophylls.

Response 4: Peel color changed from pale green to reddish due to the decreased content in chlorophyll during pitaya fruit developing (Phebe et al, 2009, <http://psasir.upm.edu.my/id/eprint/6716>; Nerd and Mizrahi, 1997, <http://doi:10.1002/9780470650608.ch7>). About your suggestion, we supplemented the column chart of chlorophyll and carotenoid content (chart 1) of pitaya fruit during developmental stages (Firstly, freeze-dried samples were ground into powder, and then extracted with 80% methanol for 24h, next the absorption value was determined by ultraviolet spectrophotometer and the corresponding content was calculated). Compared with peel, the content of chlorophyll and carotenoid are trace in pulp, and the chlorophyll content in peel decreased significantly at 29DPA, which was consistent with the change trend of b* value in this paper. Indeed, Chlorophyll degradation and betalain formation were spatially successive in peel, and resulted in the color changing from green to red. However, there is yet no direct causal relationship between chlorophyll degradation and betalain synthesis, hence, the chart was not cited in paper. Thanks to your kind reminder, we have further verified the description in this paper to avoid mistakes.

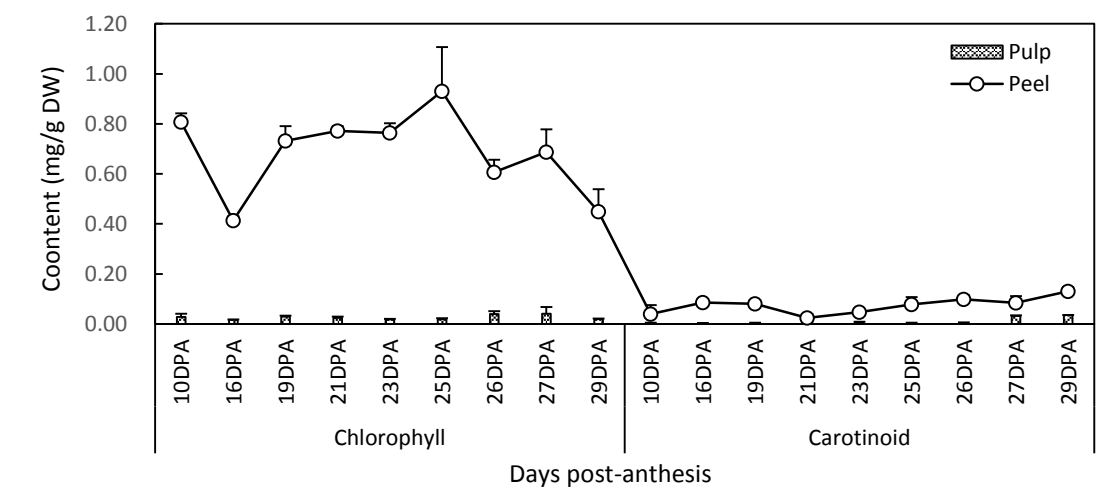


Chart 1 The content of chlorophyll and carotenoid in pitaya fruit

Thank you for your suggestions, which are instructive to our thesis writing and scientific research work, and we learn more knowledge from your valuable comments.

With best wishes,

Yours sincerely,

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