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Letter to Editor

Criterion is a touchstone in study of early angiosperms

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Abstract

Herendeen et al. set up a criterion identifying fossil angiosperms while they named five examples of fossil angiosperms in the same paper. Their normal-appearing operation, however, is fundamentally flawed: their exemplar fossil angiosperms did not honor their own criterion. This operation confused their proponents as well as other botanical researchers, hindering healthy progress in study on the origin of angiosperms. Herendeen et al. are obligated to give a plausible explanation for their perplexing operation.

*Nature Plants has been informed of the problem in Herendeen et al. (2017). Nature Plants has refused to fix the problem due to reasons, according to the communication with Dr. Chris Surridge, an editor of Nature Plants.

Background

Early angiosperms have been a focus of controversy in botany mainly because different scholars adopt different undeclared self-accepted criteria identifying fossil angiosperms [1-23]. The situation started to improve as scholars started to set up criteria for fossil angiosperms. Wang [13] designated ovules enclosed before pollination as a criterion for fossil angiosperms, while Herendeen et al. [23] proposed another criterion including several different features for fossil angiosperms. Although different opinions are acceptable in science as long as the authors are self-consistent, Herendeen et al. [23] have gone beyond the tolerance scope of science: they failed to remain self-consistent.

A Criterion for fossil angiosperms

Herendeen et al. [23] assumed that fossil angiosperms in their terms can be inferred to have "unique angiosperm features" including "tetrasporangiate dithecate stamens with four pollen sacs arranged in two pairs, pollen grains with multiple apertures in a radially symmetrical or global arrangement, and carpels enclosing one or several bitegmic ovules with two integuments". If this criterion were accepted and applied in palaeobotany properly, it would definitely help to reduce controversy on the origin of angiosperms.

Exemplar fossil angiosperms

Herendeen et al. set up the following fossil taxa as good examples of fossil angiosperms, namely, *Monetianthus*, *Canrightiopsis*, *Archaeanthus*, *Mauldinia*, and *Kajanthus* [23]. It is noteworthy that all of these taxa were published by one or more members of Herendeen et al. These examples, if accepted and used properly, definitely would be helpful for study on early angiosperms, too.

A wrangling between the criterion and examples

Although, ideally, the above criterion and examples, both

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set up by the same group of authors in the same paper at the same time [23], should be coherent, the cruel reality, as shown in Table 1, is beyond everyone's imagination and tolerance: None of *Monetianthus*, *Canrightiopsis*, *Archaeanthus*, *Mauldinia*, and *Kajanthus* has all the features enumerated in the criterion proposed by Herendeen et al. [23].

In addition to the above self-contradiction, the criterion proposed by Herendeen et al. [23] appears to have been deserted by various later independent researchers [14,24-27] (including some of Herendeen et al. themselves [28,29]). Now it appears as if that Herendeen alone was the only single person who insists on the criterion proposed by Herendeen et al. [23] among all botanical researchers.

Although controversy is a routine and healthy existence in science, the self-inconsistency of Herendeen et al. [23] is astonishingly beyond the tolerance of anyone (probably including themselves, this explains why Friis et al. (part of Herendeen et al.) [28] have discarded the criterion).

No wrangling between the criterion and examples?

An explanation less embarrassing for Herendeen et al. is that they simply meant that their exemplar fossils "can be inferred with high confidence to have possessed all of the diagnostic features". To test whether this is true, Herendeen et al.'s own exemplar angiosperms constitute ideal testing samples. According to Herendeen et al. [23], *Monetianthus*, one of Herendeen et al.'s exemplar angiosperms, "can be inferred with high confidence to have possessed all of the diagnostic features". Friis et al. [30] did claim the existence of "two integuments" in *Monetianthus*. This echoing each other between Herendeen et al. [23] and Friis et al. [30] appears perfect in science and logics. However, anyone would be petrified when he puts Figure 5f of Friis et al. [30] and Figure 2h (standard ovule with two integuments) of Herendeen et al. [23] side by side: Do they mean 1 = 2 in botany? Such anti-science operation is not conceivable unless some errors or dishonesty occurred. It becomes obvious that the so-called "high confidence" of Herendeen et al. [23] is "zero confidence" in the reality.

Conclusion

Setting up both a criterion and examples that conflict each other at the same time by the same authors in the same paper is apparently unacceptable and absurd in science. It seems necessary for Herendeen et al. to give a plausible explanation for their treatment. Otherwise this may become a permanent man-made abominable mystery in the history of science.

Table 1: None of their exemplar fossil angiosperms has all features enumerated in the criterion advanced by Herendeen et al.

	Monetianthus	*Canrightiopsis*	*Archaeanthus*	*Mauldinia*	*Kajanthus*
Tetrasporangiate stamen	No	No	No	No	Yes
Radial multiaperturate pollen grains	No	No	No	No	Yes, tricolpate
Enclosed ovules	?	Yes	Yes	Yes	Yes
Ovule with two integuments	No	Yes	?	No	No
References	[30]	[31,32]	[5]	[33]	[34]

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