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The trap of *Utricularia multifida* is not a link between that of *Genlisea* and the other ~240 *Utricularia* species

Introduction/Background

From an evolutionary point of view, the total absence of and the lack of proof for the postulated enormously long series of thousands of transitional links¹ between the three clearly delineated genera *Pinguicula*, *Genlisea* and *Utricularia*² of the carnivorous plant family Lentibulariaceae – most notably the disturbing void³ between their completely different trap types – has been felt so keenly that several attempts and great efforts have been made to fill these glaring gaps by at least some intermediate⁴ links, not least to bridge the strong disparity between the traps of *Genlisea* and *Utricularia*.

In 2006, Reifenrath et al. first proposed the trap of *Utricularia multifida* to be something akin to a link to the *Genlisea* traps stating (p. 603): “We suggest regarding these traps as channel traps with a permanent open door, resembling the traps of related genus *Genlisea*”. The special anatomy of *U. multifida* “might be an indication for a primordial (non-suction) trapping mechanism [...] similar to that of the eel traps of the closely related genus *Genlisea*” (p. 597)⁵.

I have analyzed this hypothesis in detail in my exposition of 2008: ***Utricularia multifida* (previously *Polypompholyx multifida*) has suction traps like all the other *Utricularia* species (Lloyd 1942)**.⁶

¹ Darwin had provided the basic idea of continuous evolution – still dominating the *Modern Synthesis* today – more than 150 years ago by postulating “*innumerable* slight variations”, “*extremely* slight variations” and “*infinitesimally* small inherited variations” (he also spoke of “infinitesimally small changes”, “infinitesimally slight variations” and “slow degrees”) and hence imagined “steps not greater than those separating fine varieties”, “insensibly fine steps” and “insensibly fine gradations”, “for natural selection can act only by taking advantage of slight successive variations; **she can never take a leap**, but must advance by the shortest and slowest steps” or “the transition [between species] could, according to my theory, be effected only by *numberless small gradations*” (emphasis added, see <http://darwin-online.org.uk/>). Virtually the same today: “**Countless successive small microevolutionary steps** have led to large changes in the body forms of organisms over the course of millions of years (**macroevolution, concept of additive typogenesis**)” – Kutschera 2006, p. 204/2015, p. 256: **Evolutionbiologie**; Eugen Ulmer). For a further documentation of this very basic/fundamental idea of the contemporary modern evolutionary theory, see <http://www.weloennig.de/PlantGalls.pdf> (especially pp. 20-22).

² Within these genera, however, there is a wealth of forms and species (*Utricularia* about 240 species, *Genlisea* ca. 30, and *Pinguicula* more than 80).

³ As for the diction ‘disturbing void’, see also Butterfield on the Cambrian explosion (2011, p. 1655): “Ever since Darwin there has been a disturbing void, both paleontological and psychological, at the base of the Phanerozoic eon.” <http://science.sciencemag.org/content/334/6063/1655>

⁴ Please keep in mind the difference between the adjectives “transitional” and “intermediate”.

⁵ Reifenrath, K., Theisen, I., Schnitzler, J., Porembski, S. & Barthlott, W. Trap architecture in carnivorous *Utricularia* (Lentibulariaceae). *Flora* **201**, 597-605 (2006).

⁶ <http://www.weloennig.de/Polypompholyx.pdf>

Now, in a paper of 2017, Westermeier et al. seem to corroborate the assumption of Reifenrath et al., by strongly affirming that “*U. multifida* (*U. sect. Polypompholyx*) **most probably** possesses an exceptional passive trap type. According to our observations, the traps do not capture prey by suction but work in a passive manner similar to closely related *Genlisea* corkscrew plants (eel- or lobster-traps)” (p. 11)⁷.

A careful analysis of the paper by Westermeier et al. implying that *U. multifida* may be something akin to an intermediate link to *Genlisea*, reveals that this hypothesis remains not only more than doubtful but has now also been falsified by further scientific research.

Analysis of the passive *Utricularia multifida* trap hypothesis of Westermeier et al. (2017)

Although appreciating the sophisticated study by Westermeier et al. (2017) *Trap diversity and character evolution in carnivorous bladderworts (Utricularia, Lentibulariaceae)*⁸ for its extensive and thorough experimental work providing abundant and substantial information on the topic, I wonder, nevertheless, whether their distinction/proposal of a “passive trap in *U. multifida* vs. active suction traps” in all the other some 240 species of *Utricularia* is, in fact, really warranted.

In the ensuing points I’m going to enumerate several theoretical (as well as empirically substantiated) reasons for skepticism that *U. multifida* “most probably possesses an exceptional passive trap type”:

1. In 1932 the great **Francis E. Lloyd**, perhaps ‘the Einstein of carnivorous plant research’, initially also described *U. multifida* to possess a passive trap type, suggesting “that in *Polypompholyx* the door acts as a simple valve and is incapable of contributing to the sustention of a low pressure of water within the trap”⁹ (material *in spiritus*). However, studying live specimen in Australia, he **corrected his earlier view** in a paper of 1936¹⁰, summing up his further erudite analyses in his classic *Carnivorous Plants* (1942, p. 257)¹¹, emphasizing that “it was difficult to study **the trap in action**, and especially to photograph it. Nevertheless, **the attempt succeeded.**” And he provided the details graphically in 8 figures on Plate 36 and a photograph in Plate 24, Fig. 8 of his book.

⁷ Westermeier, A. S., Fleischmann, A., Müller, K., Schäferhoff, B., Rubach, C., Speck, T. & Poppinga, S. Trap diversity and character evolution in carnivorous bladder bladderworts (*Utricularia*, Lentibulariaceae). *Scientific Reports*. Sep 21;7(1):12052. DOI: 10.1038/s41598-017-12324-4 (2017) <https://www.nature.com/articles/s41598-017-12324-4>

⁸ (See again) *Scientific Reports*. Sep 21;7(1):12052. DOI: 10.1038/s41598-017-12324-4

⁹ Lloyd, F. E. The range of structural and functional variety in the traps of *Utricularia* and *Polypompholyx*. *Flora* **126**, 303–328 (1932).

¹⁰ Lloyd, F. E. Notes on *Utricularia*. With special reference to Australia, with descriptions of four new species. *The Victorian Naturalist* **53**, 91–112 (1936).

¹¹ Lloyd, F. E. *The Carnivorous Plants*. Chronica Botanica, Waltham (1942).

2. Though Lloyd is surely not exempt from the old Latin adage *errare humanum est*, a correction of an earlier mistake by further painful studies and meticulous analyses by an extraordinarily qualified scientist and successful expert in the field might be of special weight and particular importance, so that it should not lightly be dismissed. Thus, avoiding *chronological snobbery* (C. S. Lewis), if there are no reasons to assume that Lloyd was a victim of an *illusion d'optique*, **he had really watched *U. multifida* traps in action.**
3. Westermeier et al. state that they “did not observe any trap action in *U. multifida* of *U. sect. Polypompholyx* [...] and hence, no trapdoor movement type can be assigned. Therefore, we propose establishing the passive *U. multifida* trap type.” Yet, against the background of the research of Lloyd and obviously some further authors¹², this seems to be just **negative evidence**. In the case of *U. menziesii*, Westermeier et al. observed SF (Spontaneous Firings) “only once” – see Table 1). Missing such a phenomenon in perhaps less extensive investigations in this species, other researchers could have wrongly concluded that *U. menziesii* would be fully incapable of spontaneous firings. In this context, it could also be noted that even live *U. vulgaris* and *U. australis* plants sometimes produce anatomically and functionally reduced traps (“*Utricularia vulgaris* f. *platyloba* GLÜCK: ...mostly without traps or rudimentary traps”, similarly also in *U. australis* f. *platyloba*¹³).
4. In **case of real absence of active suction traps** in perhaps some lines or ecotypes of *U. multifida*, the possibility of **rudimentation** (degeneration) of some features should be considered and further be investigated (see also some hints by Reifenrath et al. 2006¹⁴ for a “rudimentary threshold” and “rudimentary appendages”¹⁵ in some *Utricularia* species). Losses of even essential functions likewise appear to have happened in some other carnivorous plant families (“Interestingly carnivory was lost secondarily in Dioncophyllaceae (except *Triphyophyllum*) and Ancistrocladaceae”¹⁶). Moreover, from an evolutionary perspective, most authors believe that active water pumping came first¹⁷. Also, *U. multifida* seems to be distinctly

¹² Lönnig, W.-E. *Die Evolution der karnivoren Pflanzen: Was die Selektion nicht leisten kann – das Beispiel Utricularia (Wasserschlauch)*. MV-Wissenschaft. Verlagshaus Monsenstein und Vannerdat OHG, Münster, 3. Auflage (2012). (See especially pp. 204-206.) Cf. also the second edition, same pages at <http://www.weloennig.de/Utricularia2011Buch.pdf>

¹³ Casper, S. J. & Krausch, H. D. Pteridophyta und Anthophyta, Teil 1 – In: Ettl, H., Gerloff, J. & Heynig, H. *Süßwasserflora von Mitteleuropa*, Bd. 23 und 24. G. Fischer Verlag, Stuttgart, New York (1980).

¹⁴ Reifenrath, K., Theisen, I., Schnitzler, J., Porembski, S. & Barthlott, W. Trap architecture in carnivorous *Utricularia* (Lentibulariaceae). *Flora* **201**, 597-605 (2006).

¹⁵ Further investigations on this question would not be inappropriate.

¹⁶ Porembski, S. & Barthlott, W. Advances in carnivorous plants research (editorial). *Plant Biology* **8**, 737-739 (2006). (Quotation according to Heubl et al. 2006.)

¹⁷ Jobson, R. W., Nielsen, R., Laakkonen, L., Wikström, M. & Albert, V.A. Adaptive evolution of cytochrome c oxidase: infrastructure for a carnivorous plant radiation. *Proceedings of the National Academy of Sciences USA* **101**, 18064–18068 (2004).

younger than many other *Utricularia* species – not to speak about the divergence date for the *Utricularia* crown group (see below) – **with undeniably active suction traps**. Divergence dates for subgenus, crown group and later *U. multifida*:

Jobson et al. (2017, p. 267): “Divergence of subgenus *Polypompholyx* from sister subgenus *Utricularia* + *Bivalvaria* was calibrated to **31 million years ago**, indicating that the lineage may have occurred in Australia for c. **15 million years, before divergence of the two major clades** (Figs 2–4).”

(P. 270) “Recent molecular divergence dating estimated that the split between subgenus *Polypompholyx* and subgenus *Utricularia* + *Bivalvaria* may have occurred **c. 31 million years ago** (21.3–42.2 million years ago, 95% HPD; Ibarra-Laclette et al., 2013) in the early Oligocene...”¹⁸

Silva et al. (2017, p. 262) “According to our results (also suggested by Jobson et al., 2003 and Fleischmann et al., 2011), the last common ancestor of *Genlisea-Utricularia* clade was possibly a South American lineage, that arose 39 mya (36 mya estimated by Ibarra-Laclette et al., 2013) (Figs. 6–8). *Utricularia* diverged from its sister genus **30 mya (31 mya** according to Ibarra-Laclette et al., 2013) and dispersed to Australia with the lineage represented by subgenus *Polypompholyx* (**17 mya** by our estimate and **15** by Ibarra-Laclette et al., 2013) and possibly to Africa afterwards (16 mya; 21 mya by Ibarra-Laclette et al., 2013).”

“The dispersal [of *Utricularia*] to North America possibly occurred from South America, between **11 mya** (Ibarra Laclette et al., 2013) **and 12 mya** (this study; Figs. 6–8), in the middle of Miocene...”¹⁹

Ibarra-Laclette et al. (2013, p. 37): “The divergence date for the ***Utricularia* crown group** [“the group consisting of all the living species of a clade together with their latest common ancestor and any of its extinct descendants”²⁰] was about **28.5 mya** (14.4 – 43.8 mya).”²¹

Without considering the reasons for contradictory time proposals – in one point all the authors nevertheless entirely agree: the divergence date for the “twig” leading to ***Utricularia multifida* is definitely much younger than that for the *Utricularia* crown group displaying active suction traps**, just **4.87 mya** (split between *U. westonii* and *U. tenella/multifida* and between the latter two species **2.54 mya**²²). Thus, if one does not want to postulate something like highly improbable multiple independent (convergent) origins of the sophisticated *fully functioning active suction traps*, their start/beginning/origin must have happened long before that time. Based on these data, loss of function of an originally/primordially active trap in a line leading to an ecotype with putatively passive traps in *U. multifida* would be the only option.

¹⁸ Jobson, R. W., Baleeiro, P. C. & Reut, M. S. Molecular phylogeny of subgenus *Polypompholyx* (*Utricularia*; Lentibulariaceae) based on three plastid markers: diversification and proposal of a new section. Australian Systematic Botany **30**, 259-278 (2017). <http://www.publish.csiro.au/SB/pdf/SB17003>

¹⁹ Silva, S. R., Gibson, R., Adamec, L., Domínguez, Y., & Miranda, V. F. O. Molecular phylogeny of bladderworts: A wide approach of *Utricularia* (Lentibulariaceae) species relationships based on six plastidial and nuclear DNA sequences. *Molecular Phylogenetics and Evolution* **118**, 244-264 (2017).

²⁰ https://en.oxforddictionaries.com/definition/crown_group (26 November 2017)

²¹ Ibarra-Laclette, E., Lyons, E., Hernández-Guzmán, G., Pérez-Torres, C.A., Carretero-Paulet, L., Chang, T.-H., Lan, T., Welch, A.J., Juárez, M.J.A., Simpson, J., Fernández-Cortés, A., Arteaga-Vázquez, M., Góngora-Castillo, E., Acevedo-Hernández, G., Schuster, S.C., Himmelbauer, H., Minoche, A.E., Xu, S., Lynch, M., Oropeza-Aburto, A., Cervantes-Pérez, S.A., de Jesús Ortega-Estrada, M., Cervantes-Luevano, J.I., Michael, T.P., Mockler, T., Bryant, D., Herrera-Estrella, A., Albert, V.A. & Herrera-Estrella, L., 2013. Architecture and evolution of a minute plant genome. *Nature* **498**, 94–98 (2013). Quotation from the *Supplementary Information* by the authors.

²² See again Jobson, R. W., Baleeiro, P. C. & Reut, M. S. Molecular phylogeny of subgenus *Polypompholyx* (*Utricularia*; Lentibulariaceae) based on three plastid markers: diversification and proposal of a new section. Australian Systematic Botany **30**, 259-278 (2017) (especially Figure 3, p. 264).

A biologist got to the heart of the issue, commenting the situation of the allegedly passive *U. multifida* trap as follows:

“The strongest evidence against a close evolutionary link between traps of *multifida/tenella* plus the rest of *Utricularia*, with *Genlisea*, is presented in Jobson et al 2017. The sister position of *U. westonii* (i. e., sect. *Tridentaria-Polypompholyx/Pleiochasia* – subg. *Utricularia-Bivalvaria*) makes any loss of function in the former spp. a reversal i.e., nothing to do with the passive nature of *Genlisea* traps – an independent acquisition.”²³

5. As mentioned by Westermeier et al., traps are very rarely developed in the rheophyte *U. nettioides* “and often these plants are entirely devoid of traps” (pp. 17/18). Nevertheless, the authors give reasons to assume that the few traps these plants may produce, seem to belong to the active suction traps in harmony with Lloyd’s findings.
6. In my experimental work on mutations in *Misopates orontium* (the lesser snapdragon; 335,000 plants, 10,800 M₂-families), I noted that some features can be reproduced only under **special environmental conditions**²⁴. For example, a red flowering mutant isolated in a white flowering Coimbra line, proved to be entirely UV dependent to display its new flower colour²⁵.
7. Lloyd described a **velum** in *U. multifida*, Westermeier et al. did not (“Velum: none” – cf. again Table 1). Normally a velum belongs to the characters of an active suction trap that helps keep it watertight. In the best case, genetic variation could be involved in the differences described. One may raise the question of the **functional necessity** of a multiple component system as found in an allegedly passive *U. multifida* trap consisting of **almost all the decisive features usually characterizing active suction traps in nearly all the other some 240 species of *Utricularia***: tight trap door²⁶, threshold, internal two-armed and four-armed glands (bifids and quadrifids) as well as external globe-shaped secretory organs (all glands thought to be involved in the generation of a strong negative hydrostatic pressure²⁷), “system of trap vascularization” also delineating the subgenus *Polypompholyx* from *Genlisea* (see below) with vascular bundles “highly functional” (xylem and phloem)²⁸, dorsal and ventral wall thickness being

²³ Mail 20 November 2017. Anonymous.

²⁴ This has also been detected in several other plant species, for example, in *Antirrhinum majus* (especially temperature sensitivity) and *Physalis pubescens*. <http://www.weloennig.de/evolution/PhysalisOriginalPaper.pdf> (2010) Well known are the pH dependent colour changes in *Hydrangea*.

²⁵ Lönnig, W.-E., Stüber, K., Saedler, H. & J. H. Kim. Biodiversity and Dollo’s Law: to what extent can the phenotypic differences between *Antirrhinum majus* and *Misopates orontium* be bridged by mutagenesis? *Bioremediation, Biodiversity and Bioavailability* **1**, 1-30 (2007) <http://www.weloennig.de/Dollo-1a.pdf>

²⁶ See also figures by Slack, A. *Carnivorous Plants*. Marston House, Yeovil, UK (2000, reprinted 2001, p. 180) as well as Pietropaolo, J & P. *Carnivorous Plants of the World*. Fig. 6-8, p. 137 *Polypompholyx* trap and longitudinal section through trap. Timber Press, Portland, Oregon (2001).

²⁷ Fineran, B. A. Glandular trichomes in *Utricularia*: a review of their structure and function. *Israel Journal of Botany* **34**, 295-330 (1985). For a recent review, see Poppinga et. al. Fastest predators in plant kingdom: Functional morphology and biomechanics of suction traps found in the largest genus of carnivorous plants. *AoB Plants* (2015).

²⁸ Płachno, B. J., Kamińskab, I., Adamecc, L. & Świątek, P. Vascular tissue in traps of Australian carnivorous bladderworts (*Utricularia*) of the subgenus *Polypompholyx*. *Aquatic Botany* **142**, 25-31 (2014).

well within the range of many other *Utricularia* species (see Table 1 in Płachno et al. 2014), in spite of being three or four-layered (“traps in some clones of *U. dichotoma* (a species evolutionarily more advanced than *U. volubilis*) also possess trap walls which are three cell layers thick” Płachno et al. 2014, p. 295). The most probably active suction traps of *U. westonii* (non-funneled entranceways and highly developed trigger hairs²⁹) display 4 layers on the dorsal *and* ventral trap sides (*U. multifida* only 3 on the dorsal side).

8. According to Fig 12 (E) the posterior part of the bladder of *U. multifida* was “filled with caught **copepods**”. Also found inside the trap were small nematodes that “could be considered as potentially being too weak to pull open the trapdoor but are perfectly built to squeeze through the tightest trap entrances” (Westermaier et al. p. 13). But how, then, did all the much larger copepods enter the trap? And what about the “**big nematodes**, which are often larger than the longitudinal diameter of the bladder” as well as “the **leftovers of insect larvae**” detected by Lang in *U. multifida* traps³⁰? Did all these animals – as Darwin hypothesized for his investigations on *U. neglecta* – really “enter the bladders by bending inwards the posterior free edge of the valve, which from being highly elastic shuts again instantly”? Or, as he further suggested, “that animals enter merely by forcing their way through the slit-like orifice; their heads serving as a wedge”³¹. In the case of *U. neglecta* this proposal proved to be false, and it appears to be **doubtful also in *U. multifida*** (so far Westermaier et al. obviously did not observe any such temporally elongated and stretched out trapping events).
9. In contrast to *Utricularia*, in the passive *Genlisea* traps the slit-like entrances are open (larger trap mouth in the fork, numerous smaller slits in the twisted arms³², but no trap door, no threshold, no velum, no negative hydrostatic pressure, etc.) – something like a door would probably be counterproductive for carnivory in this genus. For a list of differences between the two genera cf. Lönnig 2012, pp. 43-45³³, see also same author 2016³⁴. To be added is that, although the structure of vascular bundles was similar, “the **system of trap vascularization** in the members of the subgenus *Polypompholyx* was **different from that found in the traps of**

²⁹ Reut, M. S. & Jobson, R. W. A phylogenetic study of subgenus *Polypompholyx*: a parallel radiation of *Utricularia* (Lentibulariaceae) throughout Australasia. *Australian Systematic Botany* **23**, 152-161 (2010).

³⁰ Lang, F. X. Untersuchungen über Morphologie, Anatomie und Samenentwicklung von *Polypompholyx* und *Byblis*. *Flora* **88**: 149-206 (1901).

³¹ Darwin, C. R. *Insectivorous Plants*. John Murray, London (1875).

³² Fleischmann, A. *Monograph of the Genus Genlisea*. Redfern Natural History Productions. Poole, Dorset, England (2012).

³³ See again Lönnig, W.-E. Die Evolution der karnivoren Pflanzen: Was die Selektion nicht leisten kann – das Beispiel *Utricularia* (Wasserschlauch). MV-Wissenschaft. Verlagshaus Monsenstein und Vannerdat OHG, Münster, 3. Auflage (2012). Cf. second edition, same pages <http://www.weloennig.de/Utricularia2011Buch.pdf>

³⁴ Lönnig, W.-E. Carnivorous Plants. *The Encyclopedia of Life Sciences (ELS)*, 1-8 (2016). <http://www.els.net/WileyCDA/ElsArticle/refId-a0003818.html>

*Genlisea*³⁵. It was also different from that of *U. vulgaris*. Due to its particular anatomical features (*inter alia* large intracellular space in stalk approaching trap, broad ciliate wings, triangular shape of the bladder), the trap of *U. multifida* is, perhaps, one of the most peculiar and queerest of all the trap variations in the genus *Utricularia*, yet it is neither something akin to a link or intermediate form between *Genlisea* and the other *Utricularia* species, nor – due to its many heterobathmies (*chevauchements de specialization*) – a model for an ancestor of the latter (see also Fleischmann 2012, p. 237).

10. Referring to Rutishauser³⁶, the authors favour **saltational evolution** for the origin of suction: “Possible key innovations (e.g., suction) may have resulted in novel phenotypes facilitating the establishment of new habitats and thus amplified the morphological diversity in *Utricularia*. Such saltational evolutionary innovations have been proposed to play a crucial role regarding the vegetative morphology in Lentibulariaceae” (Westermeier et al. p. 19). Well, could such saltational innovations mean that simultaneously in a passive trap (as assumed for *U. multifida*), for instance: (1) The door rather suddenly became watertight? (2) The door quickly obtained fully functional antennae (or other trigger mechanisms)? (3) The middle cells of the digestive-absorptive hairs of passive traps all at once produced a “highly developed wall labyrinth”, which is “associated with rapid water transport during removal of water from the *Utricularia* bladders”³⁷? (4) The different glands (inside and outside) the trap abruptly produced the necessary negative hydrostatic pressure? (5) The trap walls swiftly obtained the indispensable flexibility to accurately function correspondingly? Hardly probable, neither by just one ‘macromutation’ nor by several simultaneously occurring mutations with smaller but additive effects on the phenotype³⁸. Hence, the **synorganization (coadaptation)** problem for the origin of active suction traps most probably **cannot be solved by saltational evolution**, not even on the basis of **an already rather complex but passive bladderlike trap**.

11. Although Westermaier et al. concede in their discussion that their conclusion concerning the passive trap “has to be considered as

³⁵ Plachno, B. J., Kamińskab, I., Adamecc, L. & Świątekd, P. Vascular tissue in traps of Australian carnivorous bladderworts (*Utricularia*) of the subgenus *Polypompholyx*. *Aquatic Botany* **142**, 25-31 (2017).

³⁶ Rutishauser, R. Evolution of unusual morphologies in Lentibulariaceae (bladderworts and allies) and Podostemaceae (river-weeds): a pictorial report at the interface of developmental biology and morphological diversification. *Annals of Botany* **117**, 811–832

³⁷ Plachno, B. J., Kozieradzka-Kiszkurno, M. & P. Swiatek. Functional ultrastructure of *Genlisea* (Lentibulariaceae) digestive hairs. *Annals of Botany* **100**, 195-203 (2007).

³⁸ For the probabilities *cf.*, for example, Lönnig, W.-E. Auge widerlegt Zufall-Evolution. Naturwissenschaftlicher Verlag Köln, Köln (1989); Montañez, G., Marks II, R.J., Fernandez, J. & Sanford, J. C. Multiple overlapping genetic codes profoundly reduce the probability of beneficial mutation. Chapter 1.2.3., 139-167 in *Information – New Perspectives* (Eds. Sanford, J. C., Marks, R.J. Behe, M.J. & Dembski, W. A.). World Scientific, London (2013). Sanford, J., Brewer, W., Smith, F. & Baumgardner, J. The waiting time problem in a model hominin population. *Theoretical Biology and Medical Modeling*. <https://doi.org/10.1186/s12976-015-0016-z> (2015).

preliminary”, the **overall impression** gained by science communicators in particular and correspondingly in the public eye in general, has been explicitly stated in the paper’s abstract: “Our investigations **show** the existence of two functional trap principles (passive trap in *U. multifida* vs. active suction trap).” Hence, here the hypothesis has been presented as an **unquestionable/undeniable fact**.

12. In my view, further careful **investigations**, especially **considering the original Australian locations and environmental conditions** of *U. multifida*, as well as – in carnivorous plants – the sometimes neglected, but veritably *important topic of genetic variation* within the species (perhaps even leading to losses of essential functions in some lines/ecotypes of *U. multifida*³⁹) would be advisable.

Since “the traps are of various sizes, the largest measuring **4 mm. in length**” (Lloyd), the studies could, perhaps, **focus especially on such larger traps**, being four times longer (and proportionately wider in the transversal plane) than that shown by Westermeier et al. in their paper. Incidentally, there seems to be what has been called “a deep swamp dwelling form of *multifida*” with probably larger traps – a thorough investigation of such ecotypes appears to be worthwhile to eventually solve the problem.

Concerning the recent explosive increase of meticulous research and correspondingly valuable papers on *Utricularia*, not least that of Westermeier et al., let me sum up that **I strongly welcome and appreciate these endeavours**. Some premature inferences and questionable presuppositions hopefully can be discussed and be corrected for possibly an improved comprehension of the botanical world we live in.

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³⁹ Nelson, C. W. & Sanford, J. C. Computational evolution experiments reveal a net loss of genetic information despite selection. Chapter 2.6, 338-368 in: *Biological Information – New Perspectives* (Eds. Sanford, J. C., Marks, R.J. Behe, M.J. & Dembski, W. A.). World Scientific, London (2013).