Pinguicula lusitanica and *P. crystallina* subsp. *hirtiflora* traps

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Keywords: *Pinguicula lusitanica*, *Pinguicula crystallina* subsp. *hirtiflora*, active traps
Received: 13 January 2024
https://doi.org/10.55360/cpn532.ms113

Butterworts from the relatives around *Pinguicula vulgaris* (creating hibernacula) have a well-known characteristic – the ability to roll edges of their leaves after catching larger prey. The fact that they react in a slightly different way than the leaves of sundews was already described in CPN years ago (Studnička 2001).

Motile leaves are not reported in any of the American tropical homophyllous species. As far as I can see, the leaf margins do not roll in *P. albida*, *P. jackii* (Cuba), *P. ionantha*, *P. primuliflora*, or *P. planifolia* (USA). Transforming leaf shape into a roll is a modern adaptation. It is therefore not logical to assume a margin roll in *P. lusitanica* L., which has archaic characters: It is tropically homophyllous, has isolobate corollas, and its seedlings have two cotyledons (compared to the single cotyledon of the mentioned modern butterworts).

However, Darwin (1875) recognized that the pale butterwort was a particularly interesting European species and experimented with it as well (Darwin 1875: 392). He described his attempt as follows:

> "A moderately sized and angular bit of albumen was placed on one side of a leaf, halfway between the midrib and the naturally involuted margin. In 2 hrs. 15 m. the glands poured forth much secretion, and this side became more infolded than the opposite one. The inflection increased, and in 3 hrs. 30 m. extended up almost to the apex. After 24 hrs. the margin was rolled into a cylinder, the outer surface of which touched the blade of the leaf and reached to within the 1/20 of an inch of the midrib. After 48 hrs. it began to unfold, and in 72 hrs. was completely unfolded. The cube was rounded and greatly reduced in size; the remainder being in a semi-liquefied state."

As written by Terentius BC, "*duo cum faciunt idem, saepe non est idem*" (when two do the same thing, it is often not the same thing), and so I imitated Darwin's previous experiment just to be sure.

Methods

I placed a frozen (and then thawed) daphnia on *P. lusitanica* leaves and watched the movement response. I placed a live housefly on a leaf of the more robust *P. crystallina* subsp. *hirtiflora* (Ten.) Strid and again watched the movement response. Both plants were cultivated. The first experiment was inspired by Darwin's research (Darwin 1875). The second attempt is, I believe, new for this experimental object.

Results

On a leaf of *P. lusitanica*, I placed the frozen macerated daphnia so that the digestible substances work immediately. It took less than a day for the leaf to form into a "carnivorous roll". Compared to *P. grandiflora* or *P. vulgaris*, there was a noticeable difference here: The roll does not arise from one or the other edge of the leaf, but the entire leaf is transformed into a roll by bringing the edges together. After 4.5 days, digestion had apparently ended, as the younger, more active leaf had already begun to return to its original shape (Fig. 1).

But how is it with *P. crystallina* subsp. *hirtiflora*, the other homophyllous species native to Europe? I have not been able to find in the literature any report on whether it also has movable leaves that roll their edges. So, I subjected it to the same experiment.

Due to the larger size of the leaf, I used a live fly as food. Within an hour it was clear that the leaf worked the same way as *P. lusitanica*. The situation 6 hours after the placement of food was interesting in that the live fly got out of its original place by its own doing. In 24 hours from the start of the experiment, the leaf began to open, and after another 5 hours it was already quite obvious. The leaf returned to its original shape finally (Fig. 2).

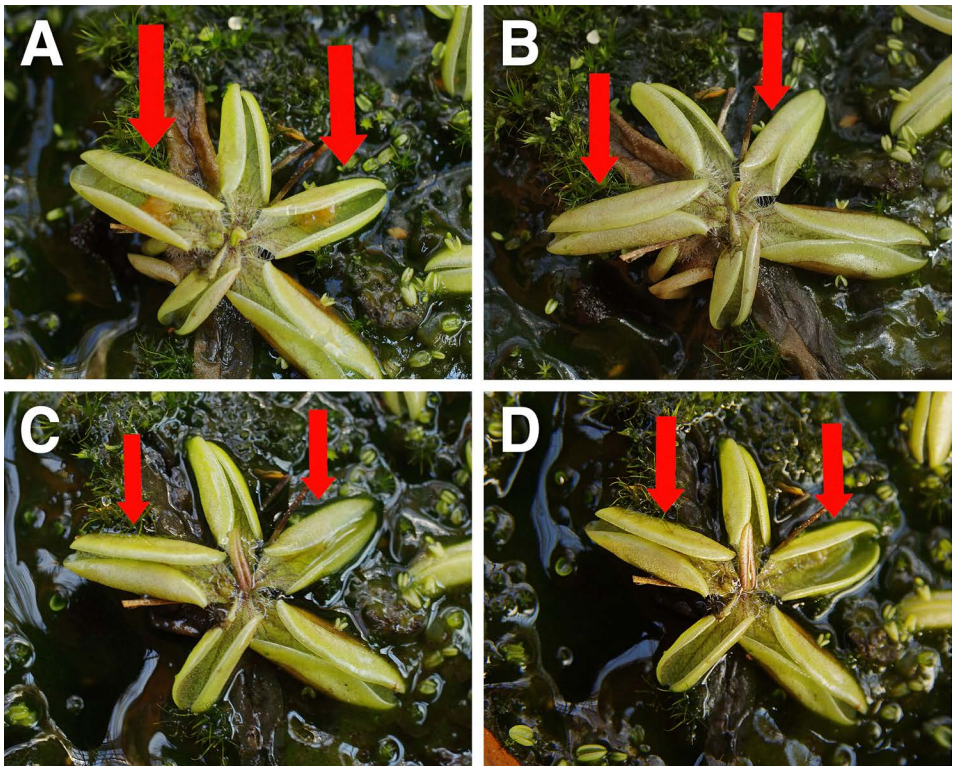

Figure 1: *Pinguicula lusitanica*: (A) Time 0, food was placed. (B) Time 19 hours, by joining the edges of the leaf, a carnivorous roll was created. (C) Time 113 hours, end of digestion, the edges of the leaves started to move away. (D) Time 128 hours, the right leaf has already opened.

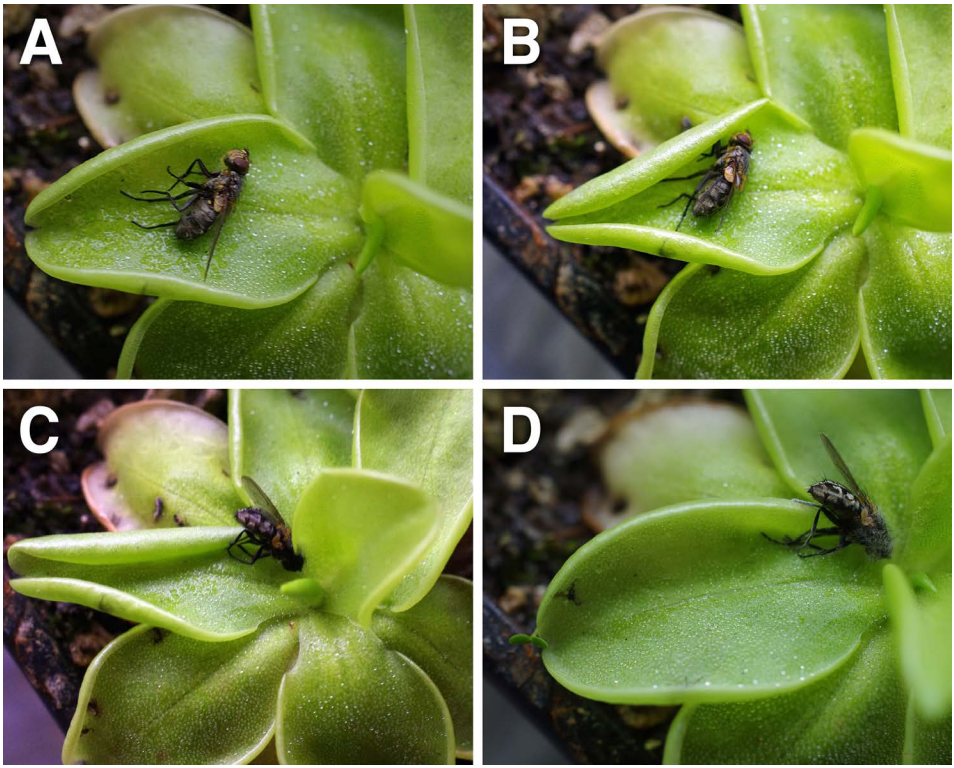

Figure 2: *Pinguicula crystallina* subsp. *hirtiflora*: (A) Time 0, food was placed. (B) Time 1 hour, leaf scrolling is obvious. (C) Time 6 hours, by joining the edges of the leaf, a carnivorous roll was created. After 24 hours the leaf began to open. (D) Time 29 hours, the leaf had returned to its original shape.

Conclusion

Both tropically homophyllous species native to Europe have movable leaf margins. They work by making their upturned leaf edges bend more and come closer together. This appears to be an adaptation to increase the absorption surface of the trap. The object of the documented endeavor is the liquid product of digestion.

The entire digestion time was 4.5 days for *P. lusitanica*, while only 1 day for *P. crystallina* subsp. *hirtiflora*. But it cannot be said that one works faster than the other. Digestion is affected by the size of the prey, its digestibility, and certainly also the condition of the plant.

References

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