The action phenomenon of *Drosera scorpioides* Planch

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Abstract: Photographs are used to document the observed reactions of marginal and interzonal tentacles of *Drosera scorpioides*. The leaf of this sundew was irritated both mechanically and chemically, using inanimate organic prey. Although the marginal tentacle in movement, acting as the main "pass on" device, can commonly be seen in various species of sundews when irritated, *D. scorpioides* behaves differently. In it, after both mechanical and chemical irritation, only the interzonal tentacles are the first to bend, so they are the "labourer" instead of the marginal tentacles, which is unusual. In the observed cases, the marginal tentacles remained rigid in a straight position, even after their direct mechanical irritation, after which the trap began to react by moving the interzonal tentacles. However, the marginal tentacles are able to bend subsequently (delayed after the interzonal tentacles), but only when they are repeatedly and very strongly mechanically stimulated.

The tentacles of sundews are divided into three types, differing in morphology, length and function: marginal, interzonal and discal (Pietropaolo & Pietropaolo 1986) or snap, peripheral and short-tentacles (Ivesic *et al*. 2022). In *Drosera scorpioides* the marginal tentacles are conspicuously long. Their appearance is described in CPN by Hartmeyer and Hartmeyer (2010). The interzonal tentacles are only slightly shorter than the marginal ones. The discal tentacles are on the surface of the blade and are short and straight. They are mainly assigned for the digestion and absorption process itself.

Marginal tentacles in sundews are generally particularly sensitive to mechanical irritation caused by the movement of prey. They always react to this stimulus in the same way, namely by bending towards the center of the leaf. The movement of the other tentacles follows, but is adapted to the position of the prey. The first type of movement, always in the same direction, is called nastia. The second type of movement, oriented differently according to the position of the prey, is called tropism. *Drosera scorpioides* belongs to species that also bend the entire blade.

Everything looks quite ordinary in *D. scorpioides* and I expected that the action of the tentacles is the same or very similar to *D. rotundifolia* or *D. capensis* (Studnička 1984: figs. 32–35). On the middle of a long leaf of *D. capensis*, a live syrphid fly was placed and stuck in a position obliquely across the longitudinal axis of the leaf. After 30 minutes, all the marginal tentacles along the entire length of the fly's body were fully bent, attached to it, and moved it longitudinally with the axis of the leaf. The interzonal tentacles, differing only in length, participated synchronously and in the same manner. After 26 hours the blade looped like a noose over the prey. Thus, a "temporary stomach" was formed, as described by Darwin in *D. rotundifolia*. Such a function of the sundew trap can be considered the most common and normal.

The long marginal tentacles of *D. scorpioides* really look like a catching device ensuring the placement of the prey on the blade so that it can be digested on the surface of the blade, or even

wrapped in a leaf (temporary stomach according to Darwin 1875). The present report comments on and documents observations that contradict this assumption. The event was so unexpected that I had to repeat the experiments several times on different leaves to believe it!

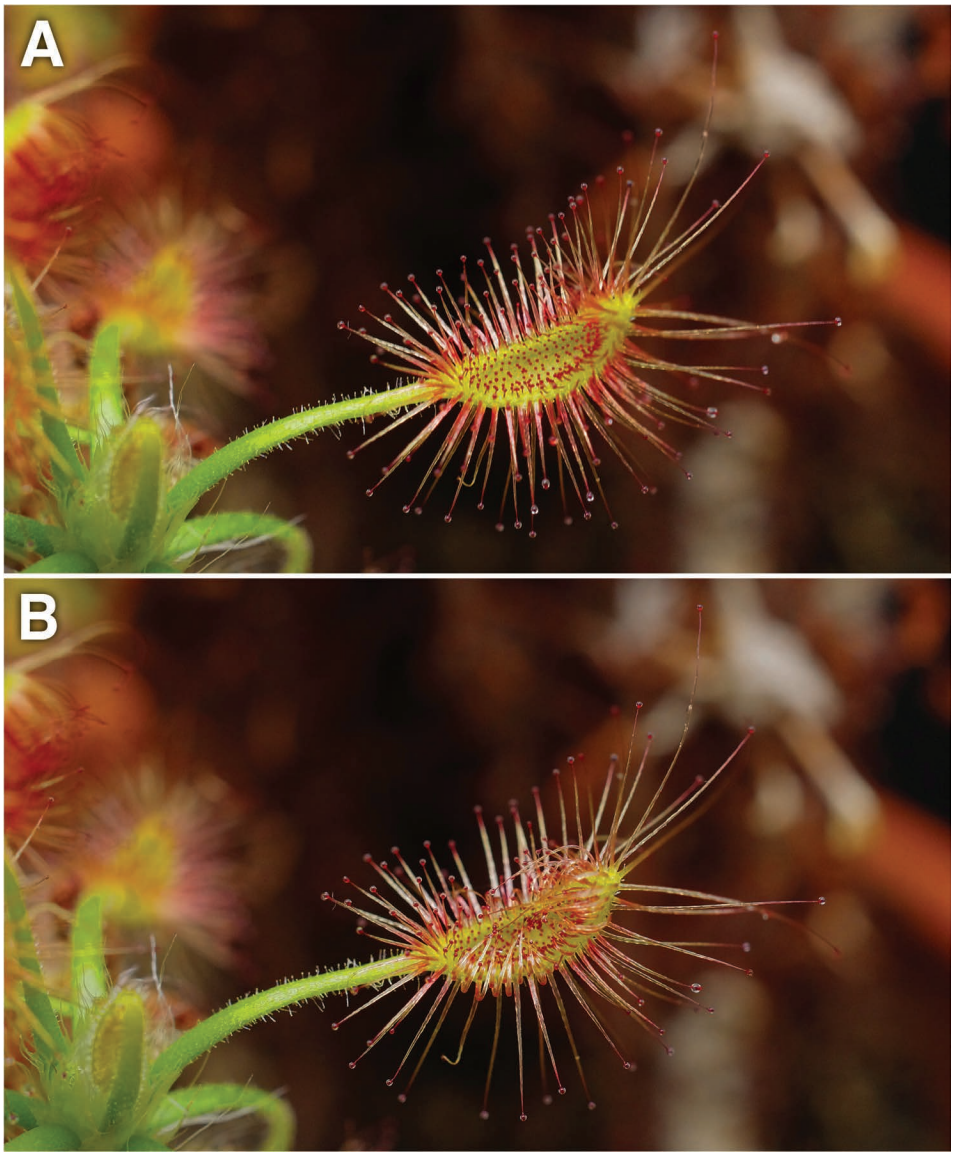


Figure 1: (A) *Drosera scorpioides* leaf 2 minutes after mechanical irritation of the marginal tentacles; (B) leaf 3 minutes after mechanical irritation of the marginal tentacles. The interzonal tentacles bent, while the marginal tentacles remained straight.

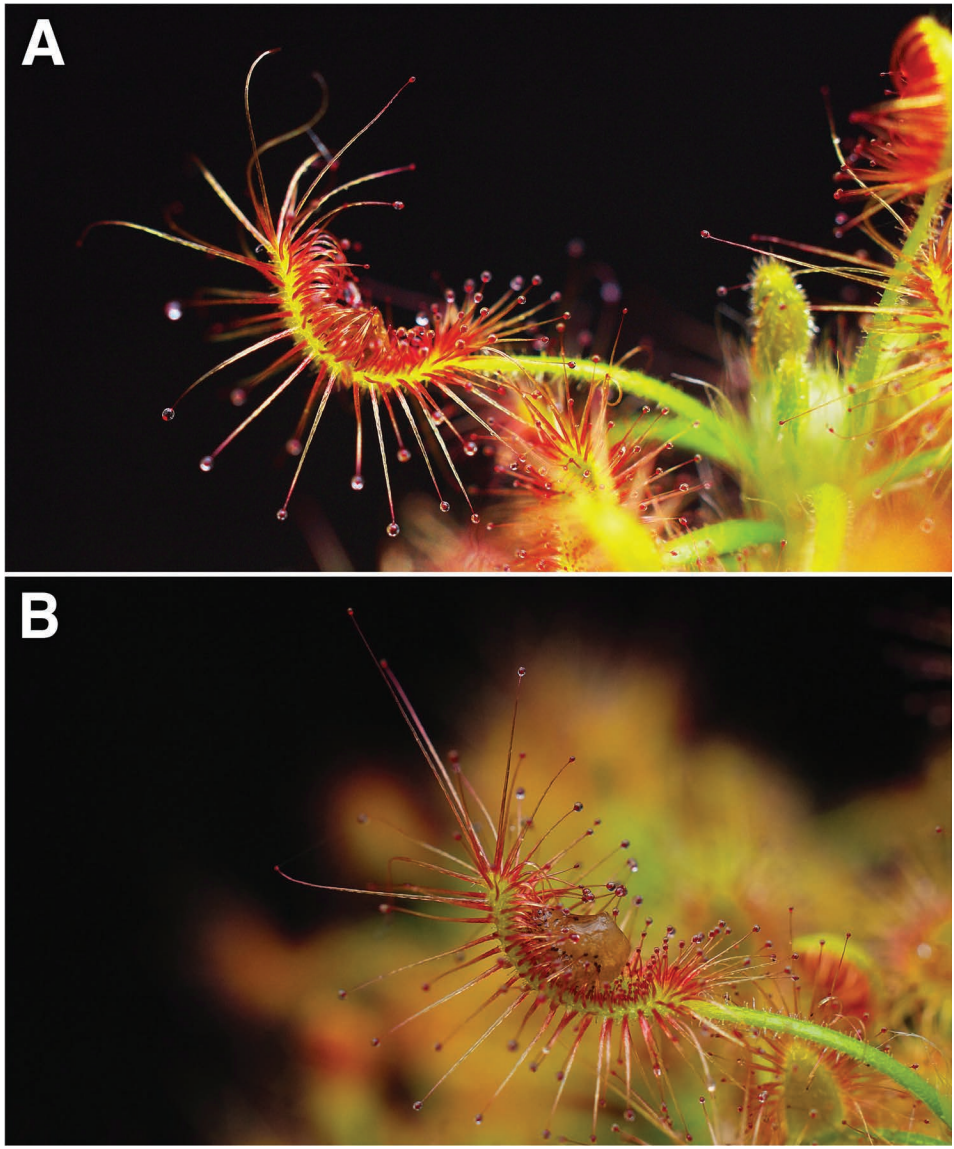


Figure 2: (A) *Drosera scorpioides* leaf 12 minutes after placing prey on the blade. The interzonal tentacles bent, while the marginal tentacles remained straight; (B) leaf the second day after presenting the prey. The blade curved into a distinctly concave shape. The marginal tentacles remained straight.

Methods

Observations were made on plants grown in a greenhouse. At the currently prevailing temperature of 19°C, the movement of the tentacles and possibly also the change in the shape of the blade after irritation were investigated in two different ways:

a) The first stimulus to move was only mechanical, in a way imitating the movement of the prey trying to detach from the marginal tentacles. Using a needle, a group of marginal tentacles, one side of the oval blade and the longest tentacles at the end of the leaf, were irritated several times in rapid succession. No food was served to the sundew.
b) The second movement stimulus, carried out on other leaves, was only chemical. It was induced by carefully placing a lump of defrosted daphnia (aquarium fish food) on the discal tentacles on the blade surface. Neither the marginal nor the interzonal tentacles were directly irritated.

Important tentacle positions and blade shape were photographed with the lens smc PENTAX-DA 35 mm Macro. The time each photograph was taken was recorded as metadata.

Results

The mechanically irritated group of marginal tentacles, on one side of the oval blade and at the end of the leaf, did not move appreciably. Two minutes after this mechanical stimulus, however, the interzonal tentacles began to flex *en masse*, but were not mechanically affected. In just another minute, they were fully bent to the longitudinal axis of the blade. This movement was nastia because no food was served to the sundew that would attract the movement of the tentacles. However, the marginal tentacles, the source of excitement, remained permanently in their original shape and did not bend (Fig. 1). However, they are not completely immobile feelers. If the mechanical stimulus is particularly strong and persistently repeated, they also bend, but second only to the interzonal tentacles. Then they move at a speed visible to the eye.

The leaf irritated by placing daphnia on the surface reacted even faster than with the mechanical method of irritation. Within a minute, the first movement of the interzonal tentacles was visible. In this case, the entire movement of all involved tentacles was completed in 12 minutes (Fig. 2).

The long marginal tentacles did not bend this time either, not even until the second day. By the second day, the oblong, bowl-shaped blade had bent to the shape of the letter C in a lying position, to a distinctly concave shape, by a slight growth movement. However, the prey was not wrapped by the blade.

Conclusions

Marginal tentacles functioning only as touch-sensitive tentacles without inflection are quite different from the marginal tentacles of other sundews. The phenomenon, when they advance the task of ensuring the placement of the prey on the blade with interzonal tentacles, actually delegate their authority, I call here the "action phenomenon of *Drosera scorpioides*". This phenomenon clearly demonstrates that the hitherto generally accepted opinion that the interzonal tentacles are a kind of functionally undefined transitional structure between discal and marginal tentacles, mixing the properties of both, does not apply everywhere. At least in *D. scorpioides*, they are a peculiar specialized device, participating in their own way in the activity of the trapping system.

Drosera scorpioides may not be unique, as it belongs to a group of 40 closely related Australian Pygmy *Drosera* species. However, according to Hartmeyer, the marginal tentacles of caulescent and acaulescent species are different. The latter have (unlike *D. scorpioides*) mucus-free snap-tentacles (Hartmeyer & Hartmeyer 2015). I focused my research on *D. scorpioides* because it is the largest and was the most watchable example of the group.

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