Genlisea Traps—A New Piece of Knowledge

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Introduction

The subterranean traps of *Genlisea* have been described in detail by various authors such as Lloyd (1942), Fromm-Trinta (1979), Slack (1979), and others, but while these workers examined the details of plant morphology, anatomy and function, they did not answer an important question: What attracts prey organisms into *Genlisea* traps? Slack (1979) speculated on this topic, "It is not clear whether the trap has any particular power to attract its prey, however. The outer parts are scattered with stalkless (sessile) glands which secrete mucilage, but it is not known whether this is of an alluring nature." Meanwhile, recent authors speculated that *Genlisea* traps could function via suction, by expelling water from the trap interiors (Juniper, Robins and Joel, 1989: 87; Meyers-Rice, 1994), but see Studnicka (1996). Recent studies by Barthlott *et al.* (1998) indicate that microfauna such as protozoans may be attracted to *Genlisea* traps. Still, the question remains—what is the attracting agent?

I would like to present a novel explanation that might explain how *Genlisea* traps attract prey to their interiors.

The Trap as a False Soil Interspace

Observing subterranean organs of *Genlisea* we find only a portion of the system of traps in the aerated upper soil layer. A conspicuous number of traps, which are sometimes rather different from the first, are positively geotropic and reach lower parts of the soil profile (Figure 1). In wetlands these parts of the soil can be anaerobic—such conditions are inhospitable to oxygen-dependent microfauna. Oxygen transfer through the body surface becomes inefficient for such organisms in anaerobic conditions (Rusek, 1998). This limitation is especially true at higher temperatures, because of the very low oxygen content in warm water.

Since oxygen availability is a limiting factor for soil microfauna, they are attracted to the tiny air cavities found between soil particles (Rusek, 2000). It is in these oxygen-starved regions that the descending type of *Genlisea* traps are found. If there is an air space within the traps, they should be the best and universal lure for prey in anaerobic conditions. *Genlisea* may be attracting prey by providing an oxygen-rich, false soil interspace.

An Experiment

If *Genlisea* traps were to act as false soil interspaces, we would expect that the neck of the trap might not merely be a tube filled with water. Rather, we would expect the tube to be a more complicated structure in which air cavities would occur—indeed, the trap interior is complex, and adorned with many bristles and cavities.

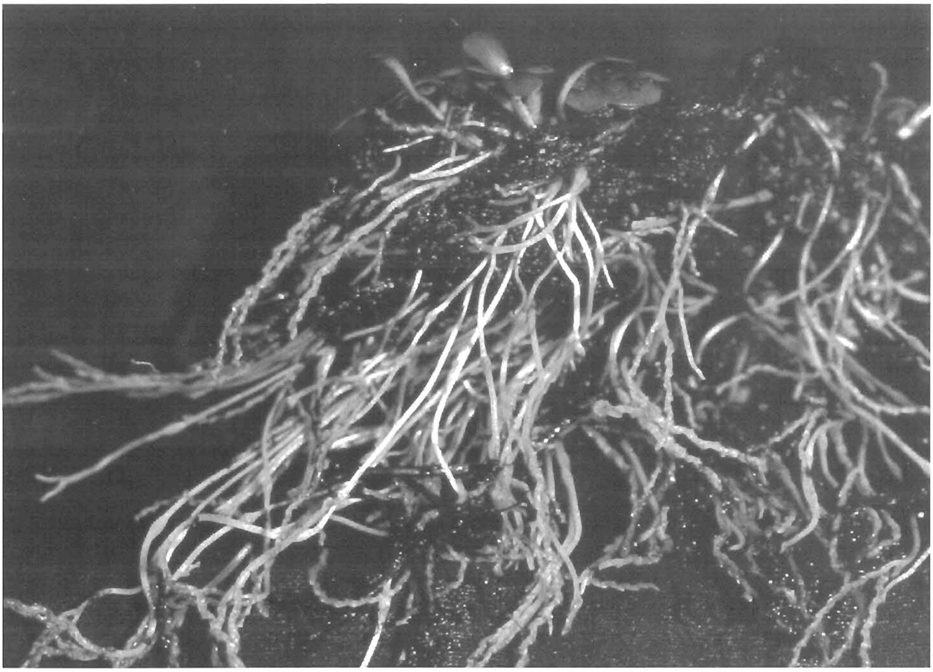

Figure 1: The traps of *Genlisea hispidula* reach to anaerobic soil space, because the pot was nearly completely immersed in water.

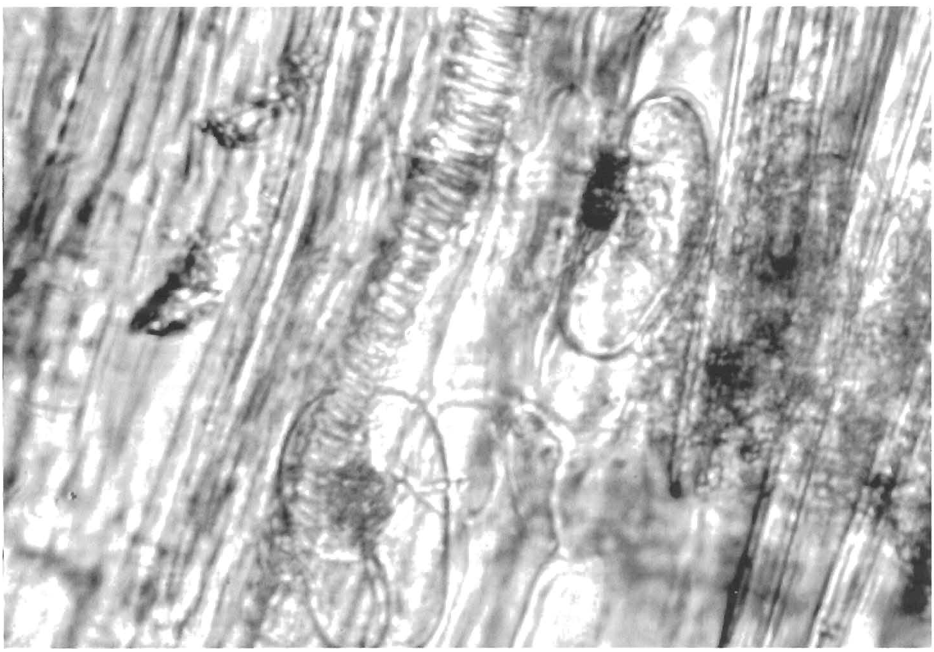

Figure 2: Inner glands in the neck of a *Genlisea* trap (seen from above and in profile). The 2-celled gland head (looking much like a coffee grain) is sitting on the eccentric endodermal cell.

Figure 3: A portion of the interior of a *Utricularia reniformis* trap, near the trap entrance. The 2-celled glands could be analogous to the glands seen in the Figure 2.

To investigate the nature of *Genlisea* traps, a complete trap of *Genlisea hispidula* was transferred from its soil medium to clean water. The forked portion of the trap was removed and discarded. Holding the trap with needle-tipped forceps near the utricle, a second set of forceps was used to squeeze the contents out of the trap-tube (like toothpaste out of a tube). Even though the trap was held underwater for this entire procedure, air bubbles were clearly observed being forced out of the trap.

I also confirmed that the tissues of the *Genlisea* trap are well aerated by lysigenous intercellulars (so called aerenchyma), as reported by Lloyd (1942). Aeration of such underground organs in amphibious plants is a common phenomenon (Votrubová & Soukup, 1999).

Discussion

I conclude that both air and water exist inside *Genlisea* traps. The air cavities are possibly maintained separate from the water by the rows of bristles in the trap neck. This is analogous to the trichomes in *Salvinia* leaves.

We can go back to the question regarding whether *Genlisea* traps are passive or active. The conjectures of Juniper *et al.* (1989) and also Meyers-Rice (1994) may be true in the following special sense! The 2-celled glands in the trap necks (see Figure 2; also see Lloyd, 1942; Fromm-Trinta, 1979) should be compared to the bifid glands in *Utricularia* traps (Figure 3). Inside *Utricularia* bladders, near the trap mouth, there is an area covered by bifid glands which is probably important in exhausting water from the bladders (Sydenham & Findlay, 1975). Perhaps the glands in the neck of *Genlisea* traps, situated between the trap wall and the inner layers of bristles (being covered by bristles) also pump water out of the neck. It would be helpful for air to pass through the plant aerenchyma into the neck.

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