Aerobiology meets Ecology: Development of Low-Cost Passive Gravitational Samplers

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Rationale

Access to proper and reliable research equipment is crucial in all natural science disciplines. This is especially true in biological research, since experiments and observations require equipment with consistency. Our research focus is sampling pollen and other bioaerosols from the air[1]. When sampling particles from locations without electricity, the type of devices we can use limits us. This has led us to create samplers that do not require any electrical power; by using passive sampling[2]. We have created passive samplers of the Sigma-2 design using low-cost materials.

Use and Analysis

The sampler is fastened to either a post or other structure to ensure accurate inlet height. The Sigma-2 design works by using double walls and apertures with offset placement to deflect the wind, and particles it carries, which then fall into the sampler[3]. A collection receptacle (e.g. microscopy slides or petri dishes) is placed within the bottom to capture bioaerosols and allow for later classification. It is recommended to apply adhesives to the collection receptacle before sampling. Analysis methods include microscopy[4] or bio-chemical methods[5] depending on purpose.

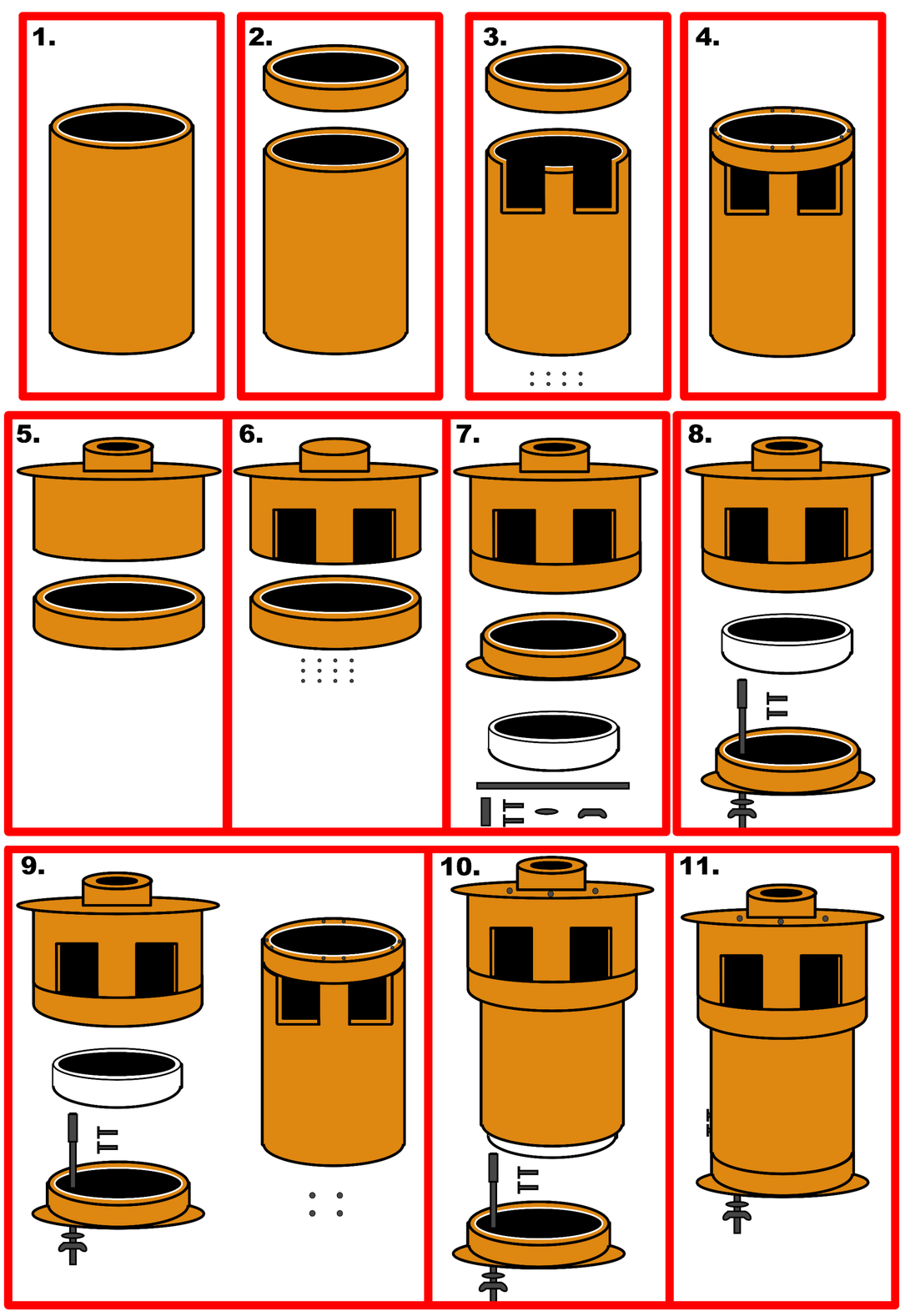

Fig. 1. Illustrative[Z] schematics of the creation of the passive gravitational samplers. The complete sampler is about 40cm tall.

[Z] Not all parts are to scale due to the illustrative nature shown above.

Construction

1. Cut small PVC tube to correct size, abrade cut edges. Always abrade until smooth. **2.** Cut off a smaller section, abrade the cut edges. **3.** Cut four radial slots with equal distance (only 2 slots shown), abrade all edges. **4.** Drill holes and attach the separated section with screws. **5.** Cut large PVC tube to correct size, and prepare top. **6.** Cut four radial slots with equal distance in top (only 2 slots shown), abrade all edges. **7.** Drill holes in top and attach PVC section with screws. Cut smaller white tube to correct size and prepare other parts. **8.** Drill hole in bottom and attach opening mechanism. **9.** Prepare all parts for mounting. **10.** Turn main piece 45 degrees (so that inlets does not overlap), drill holes in both top and main piece and attach top to main piece with screws, prepare other parts. **11.** Drill holes in side of the main piece and attach the opening mechanism with bolts. **Sampler complete. (Fig. 1.)**

Quality Control

To ensure that our sampler is representing reality and comparable with other air-samplers we performed 3 5-day tests using an active Burkard Volumetric Spore Sampler[6] as reference. The tests were conducted during mid-spring, when yew, hazel and alder pollen were airborne[7]. The tests show that relative abundances of pollen are comparative, with around 51 % yew, 11% hazel and 38% alder **(Fig. 2.)**. Absolute abundances was overall lower (1/12th total abundance) for the Sigma-2 sampler (results not shown).

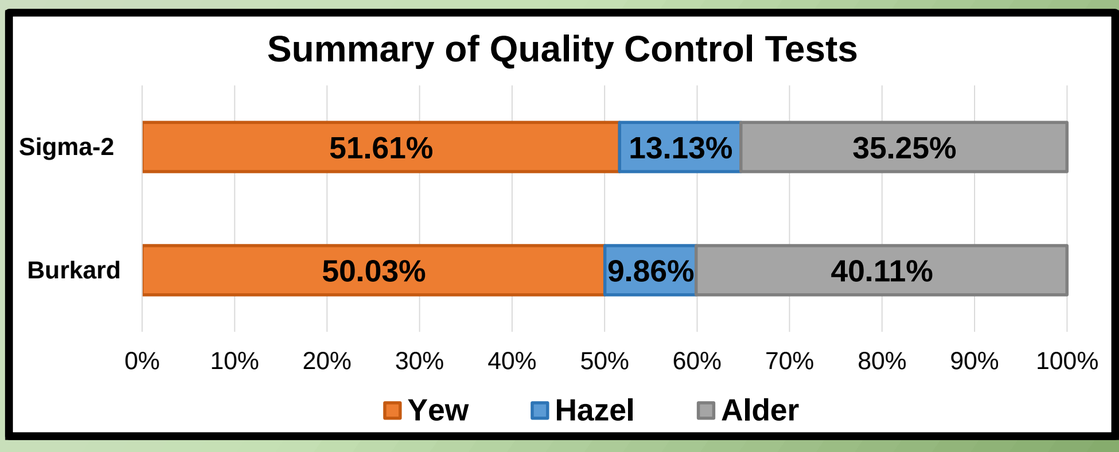

Fig. 2. Relative abundance of pollen between the Sigma-2 and the Burkard sampler during the 3 5-day quality control tests.

Conclusion

The low-cost construction of Sigma-2 samplers demonstrate that it is possible to conduct passive sampling in remote regions for a fraction of the price. The quality control illustrates that the relative abundance of pollen is comparable with the standard pollen monitoring method using Burkard traps. By using low-cost materials aerobiological research becomes cheaper, and promotes the potential for more extensive projects.

References

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