

# how to make a good impression with horsetails

## **making an imprint**

Eighteen years ago I made my first photograph of the the ridges of a horsetail. On slide film, with poor equipment, and in full sunlight. Needless to say that little detail was visible in the resulting picture. It wasn't until several years later that we came to realize the importance of the shape of the various lumps and bumps on the ridges. Subsequently, I screwed ever more extension rings on my camera, but ignorant of diffraction and without any understanding of the light, the results, albeit larger now, remained poor. Then I learnt about avoiding specular highlights (parts of the photo where the light is reflected straight into the lens that show al featureless white spots). The silica on *Equisetum* is essentially glass: transparent and shiny. A subject rather hard to photograph, especially when during the process the camera is moving to take a stack of photos. The highlights go everywhere and change colour, reminiscent of a 1980's discotheque. The solution seemed to be to make the silica opaque. I have tried to paint it over with everything I could think of: spray paint, felt markers, flour, graphite powder, xerox toner, nail varnish, whatever. Either they were too transparent and had little effect, or the grain was too coarse, thus obscuring the fine detail. Finally, about ten years ago, I found that blackening the stems over an oil lamp emitting soot works rather well, at least in capturing the form and shape of the surface.

That might have finalized the project. I mean, ten years studying horsetails intensively is rewarding, but it's not like models appearing every spring fair. But then I saw some very detailed micro photos made by an Austrian nicknamed "seemann" of grape vine leaves<sup>1</sup>. He had used nail varnish to make an imprint of the leaf's surface.

I was much amazed to see such excellent results, for I had tried this method too in my experimenting years, and had rejected it. If I remember well, hardly any fine detail was captured and it was hard to make photos of the negative imprint. Perhaps seemann's wife uses a better quality of nail varnish than I had acquired for this purpose. Anyway, I had disposed of the clotting bottles a year ago and not being welcome in the shops in these times of covid, I tried superglue. And was perplexed by the first results (FIGURE 1).

The method is all too simple: draw a line of glue on a microscope slide, flatten out a fresh stem section in it, clamp it for an hour or so, and then gently pull away the stem (FIGURE 2). With very thin stems it helps to cut the section longitudinally to one side and carefully scratch away the central cylinder in order to allow a wider surface to lie flat.

Often a perfect impression remains. Of course, it's appropriately called superglue, so it won't always let go of the stem. My success rate is a little over two out of three. Once the mailman had delivered a fresh bottle of transparent nail varnish I could try alternative ways for sticky cases. Pure nail varnish still didn't dry well and once again it only showed the coarsest of details, as if half molten. Diluted with roughly the same

amount of acetone it dries much better, but doesn't come loose since the affinity for horsetail stems is stronger than for microscope slides. What works quite well is painting the stem with diluted nail varnish and letting it dry. Then glue the varnished stem to the slide and once the glue is hard, gently pry the stem loose in such a way that both the varnish and glue remain on the slide. The softer skinned Great horsetail yields better results this way while the scouring rushes do well in the former fashion.

I am not certain as to why the results were so much better this time. Factors that seem important are the better control of the hardening, transparent instead of opaque nail varnish, and a much better microscope.

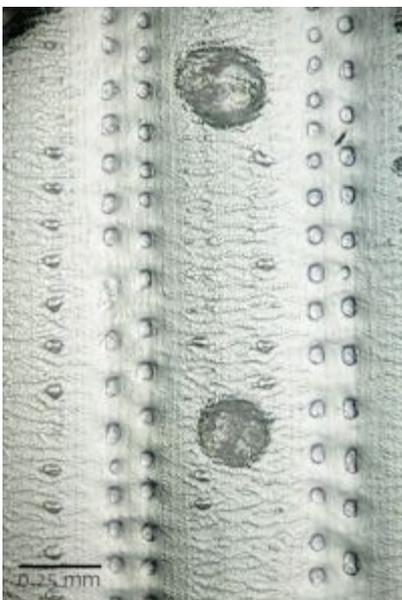
### photogrammetry

Microscopes have extremely shallow depths of field. In order to obtain full depth of focus, a stack of photographs taken over a range of depths have to be combined. From each single take only the sharpest pixels are kept for the final image. A choice of software is available to assist with focus stacking. I always use *Zerene Stacker*<sup>2</sup>. This software combines the stack of shallow focus photographs into a single deep focus photo, but also remembers for each pixel in the result, which photo in the stack it has come from. With this information it can create a depth map. A depth map is like any topographical map where colours distinguish altitudes in the terrain (FIGURE 3). From this depth map a 3-dimensional model of the surface can be reconstructed (FIGURE 4 & 5). The plug-in *Interactive 3D surface plot* of the free software package *ImageJ* does exactly that<sup>3 4</sup>. To add more realism to the model, it can even paint the stacked image over the surface of the model. Additionally, without skin and viewed straight on, the model rendering may be used in Photoshop as a shade layer to add a sense of depth to the stacked image (FIGURE 1)

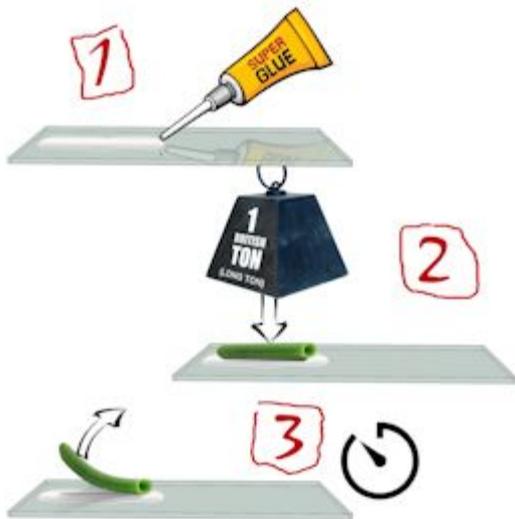
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### FIGURES

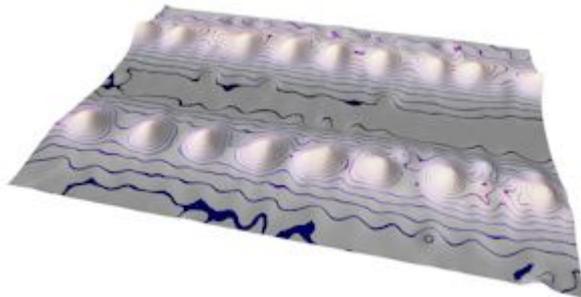
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--- figure 1: Cyanoacrylate impressions of *Equisetum hyemale* ssp. *hyemale* (left) and *E. hyemale* subsp. *affine* (right).



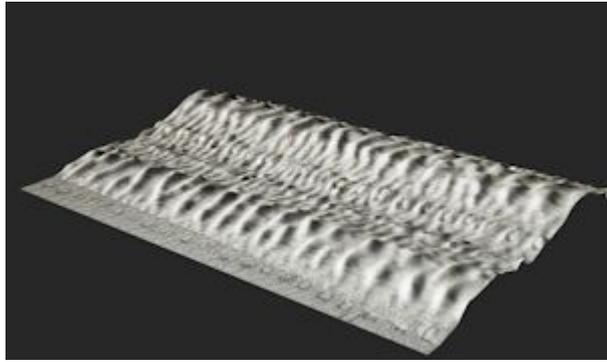
--- figure 2: Draw a line of glue on a microscope slide, flatten out a fresh stem section in it, clamp it for an hour or so, and then gently pull away the stem



--- figure 3: depth map constructed from the photo stack



--- figure 4: photogrammetrically reconstructed 3D-model of *E. hyemale* ssp. *affine*



--- figure 5: photogrammetrically reconstructed 3D-model of *E. ramosissimum*

1 <https://www.photomacrography.net/forum/viewtopic.php?p=268904#p268904>

2 <http://zerenesystems.com/cms/stacker>

3 <https://imagej.nih.gov/ij/>

4 <https://imagej.nih.gov/ij/plugins/surface-plot-3d.html>