Actinosphaerium eichhornii var. *viride*

Penard, 1902

Most likely ID: n.a.

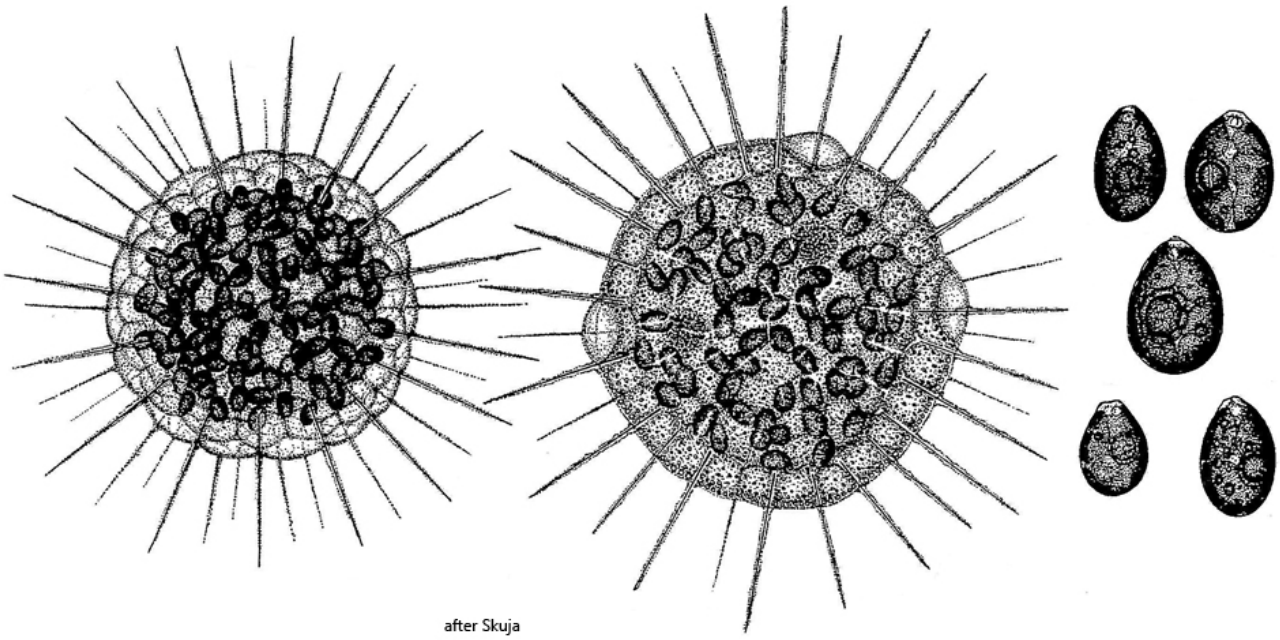
Synonym: n.a.

Sampling location: Spechtensee (Austria), Schwemm Moor (Austria), Pillersee Moor (Austria)

Phylogenetic tree: n.a.

Diagnosis:

- body spherical, transparent, cytoplasm vacuolated
- diameter 125–200 µm
- endo- and ectoplasm clearly separated
- endoplasm green due to symbiotic algae
- about 20 nuclei scattered in the endoplasm
- about 40 axopodia
- axiopodia thick, with granules, distally tapered
- axonemes of the axiopodia orginate near the nuclei



Actinosphaerium eichhornii var. viride

Actinosphaerium eichhornii var. *viride* was first described by Penard (1902) as a subspecies of the parent form *Actinosphaerium eichhornii*. I have found *Actinosphaerium eichhornii* var. *viride* several times, but only in acidic bog waters in Austria. The first time I have found *Actinosphaerium eichhornii* var. *viride* was in May 1999 in the Spechtensee. Then in June 2004 in the Schwemm near Walchsee and finally in July 2017 and June 2024 in the Pillersee Moor. In my opinion, the species differs significantly from the parent form *Actinosphaerium eichhornii* in terms of habitat, size and symbiotic algae and would deserve to be considered a separate species.

Due to the findings mentioned above, I was able to examine a total of about 20 specimens. All specimens were always smaller than 200 µm (mostly 170 µm), which fits well with Penard's description, which states a diameter of 125 µm to a maximum of 200 µm. There are very few food vacuoles in the cell, which makes the plasma look very "clean". The ectoplasm is highly vacuolated and forms a foam-like structure. According to Penard, there should be about 20 nuclei in the endoplasm, which are located at the points of contact of the honeycomb-like vacuoles. However, I was only able to find 8-10 nuclei per specimen, although I may not have discovered all of them.

The symbiotic algae of *Actinosphaerium eichhorni* var. *viride* are highly interesting because they are not of the widespread *Chlorella* type, especially as they have two distinct contractile vacuoles in the apical region (s. fig. 6). These symbionts were named by Penard as the chlorococcal alga *Sphaerocystis schroeteri*. He did not describe the two contractile vacuoles, which may be why he sought the origin of the symbionts in the chlorococcal algae. The true nature of the symbiotic algae of *Actinosphaerium eichhornii* var. *viride* was only

recognized in 1964 by Skuja, who meticulously examined and described the symbiotic algae. He saw the origin of the algae in the chlamydomonads and defined them as a separate species *Chlamydomonas actinosphaerii*, as their characteristics differ significantly from free-living species. Apart from the two typical contractile vacuoles, the genus *Chlamydomonas* is characterized by the possession of a transparent papilla at the anterior end, the possession of a pyrenoid, a bell-shaped chloroplast and an eyespot. Regarding the eyespot, Skuja writes that it is absent in most cells of *Chlamydomonas actinosphaerii* and can only be recognized as a tiny orange dot. I have examined about 100 cells (in bright field and DIC), but could not find such an eyespot. However, the refraction of crystals and starch grains often results in orange reflections, which can simulate an eyespot. In my opinion, such an eyespot is not present, which can be interpreted as an adaptation to the symbiotic lifestyle of *Chlamydomonas actinosphaerii*. In addition, *Chlamydomonas actinosphaerii* no longer has flagella and the cell wall is very thin. In my population, the cells were oval or ovoid, as Skuja drew them (s. drawings, above) and 12–14 µm long. Skuja gives a length of 12–19 µm.

About 20–40 axopodia radiate from the cell body. These are usually no longer than the cell diameter. The axopodia are covered by a thin, granular layer of cytoplasm and have a central axis of bundled microtubules, the axionem. The axioneme extends through the ectoplasm and always ends at or near a nucleus. This is the typical structure of actinophyrids. In the second large group of heliozoans, the centrohelids, the axionemes always end at the centroplasts, the organizer for the structure of the microtubules. The axiopodia of *Actiniosphaerium eichhorni* var. *viride* are soft and flexible, which can be observed under the coverslip during a flow.

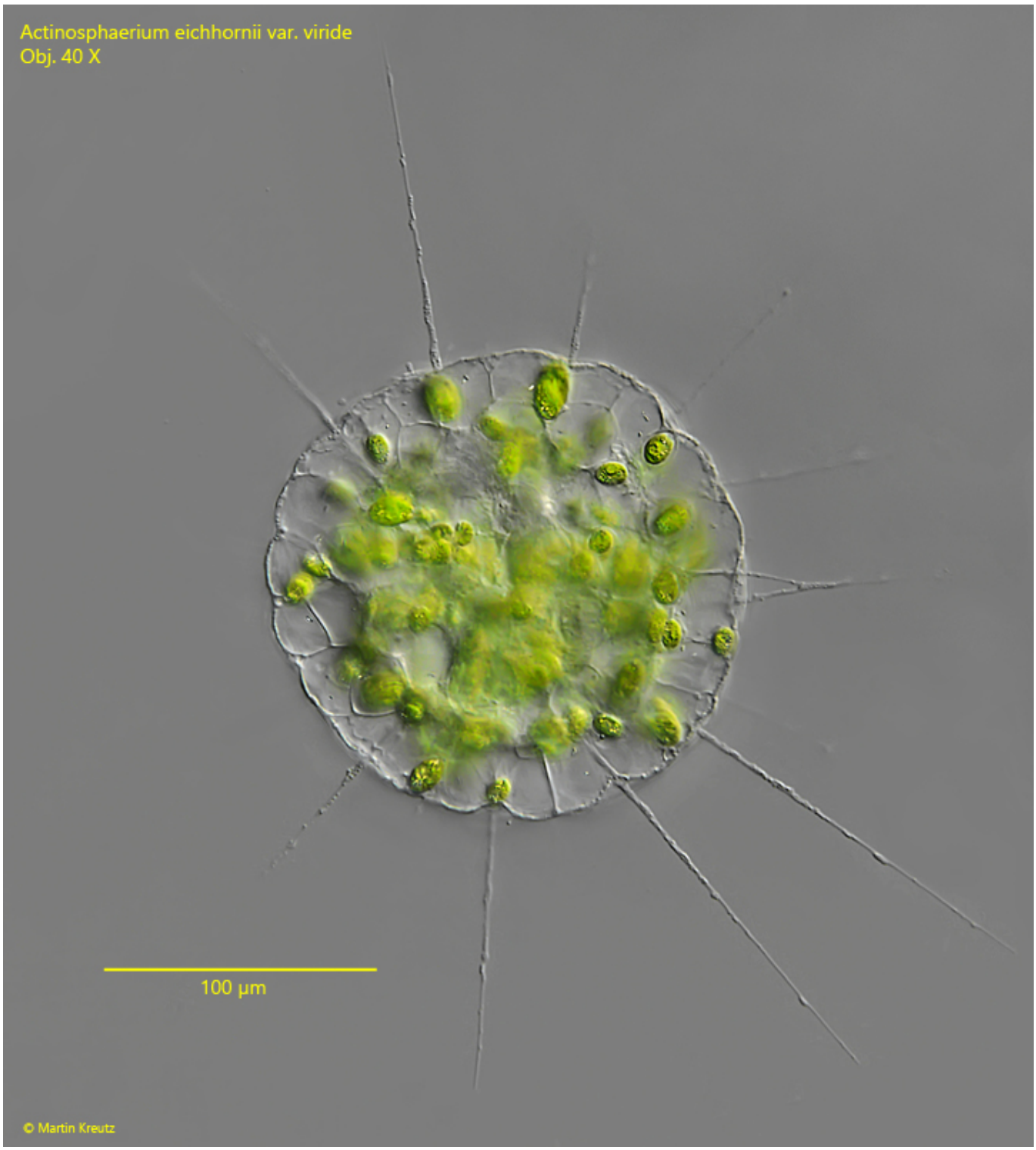


Fig. 1: *Actinosphaerium eichhornii* var. *viride*. D = 171 µm. A specimen with fully extended axopodia. Obj. 40 X.

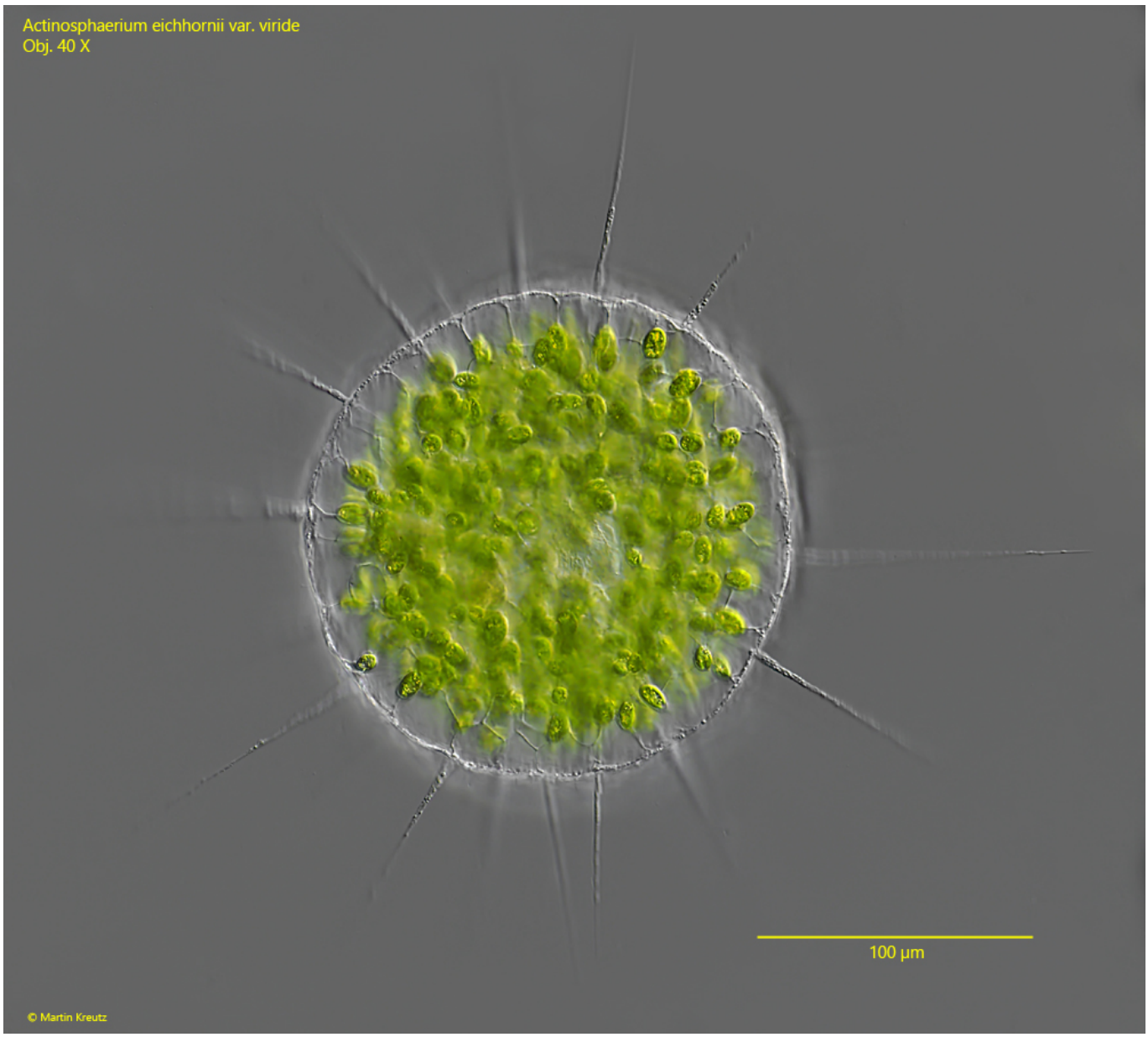


Fig. 2: *Actinosphaerium eichhornii* var. *viride*. D = 175 µm. A second, slightly squashed specimen. Obj. 40 X.

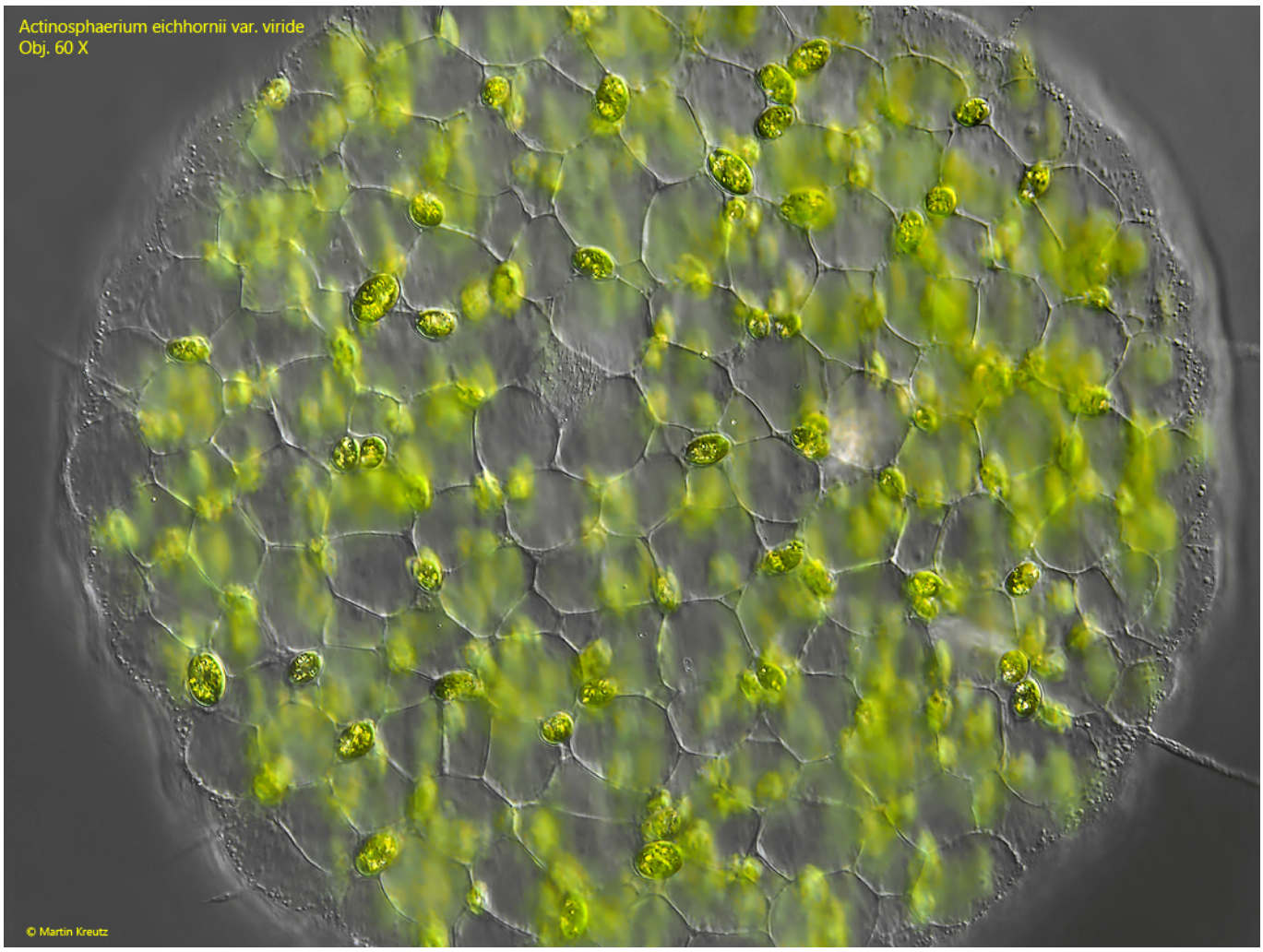


Fig. 3: *Actinosphaerium eichhornii* var. *viride*. The ectoplasm is highly vacuolized and has a honeycomb-like structure. Obj. 60 X.

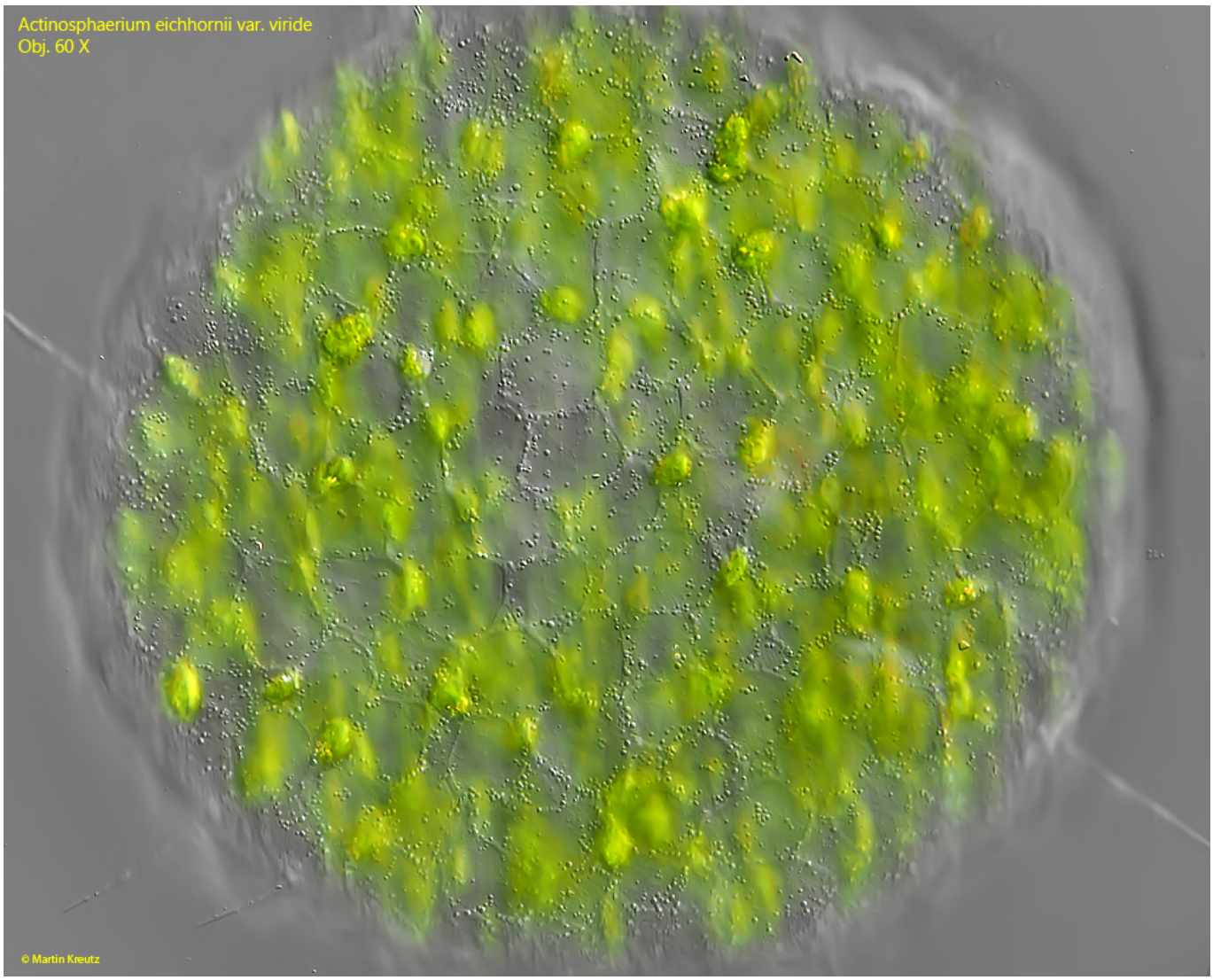


Fig. 4: *Actinosphaerium eichhornii* var. *viride*. The cell surface is covered with oily droplets mainly arranged beween the large vacuoles. Obj. 60 X.

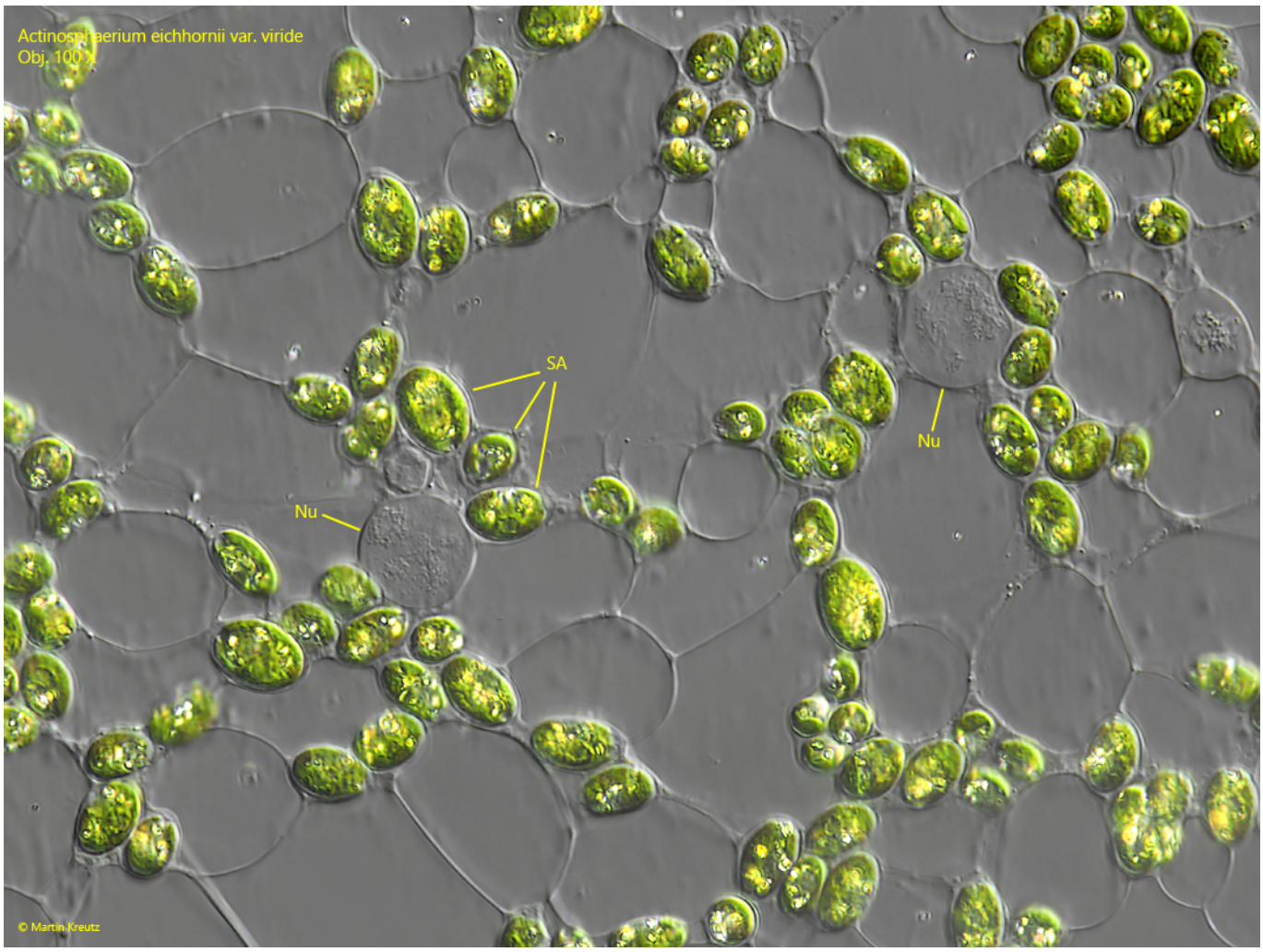


Fig. 5: *Actinosphaerium eichhornii* var. *viride*. In a squashed specimen the nuclei (Nu) become visible and the symbiotic algae (SA). Obj. 100 X.

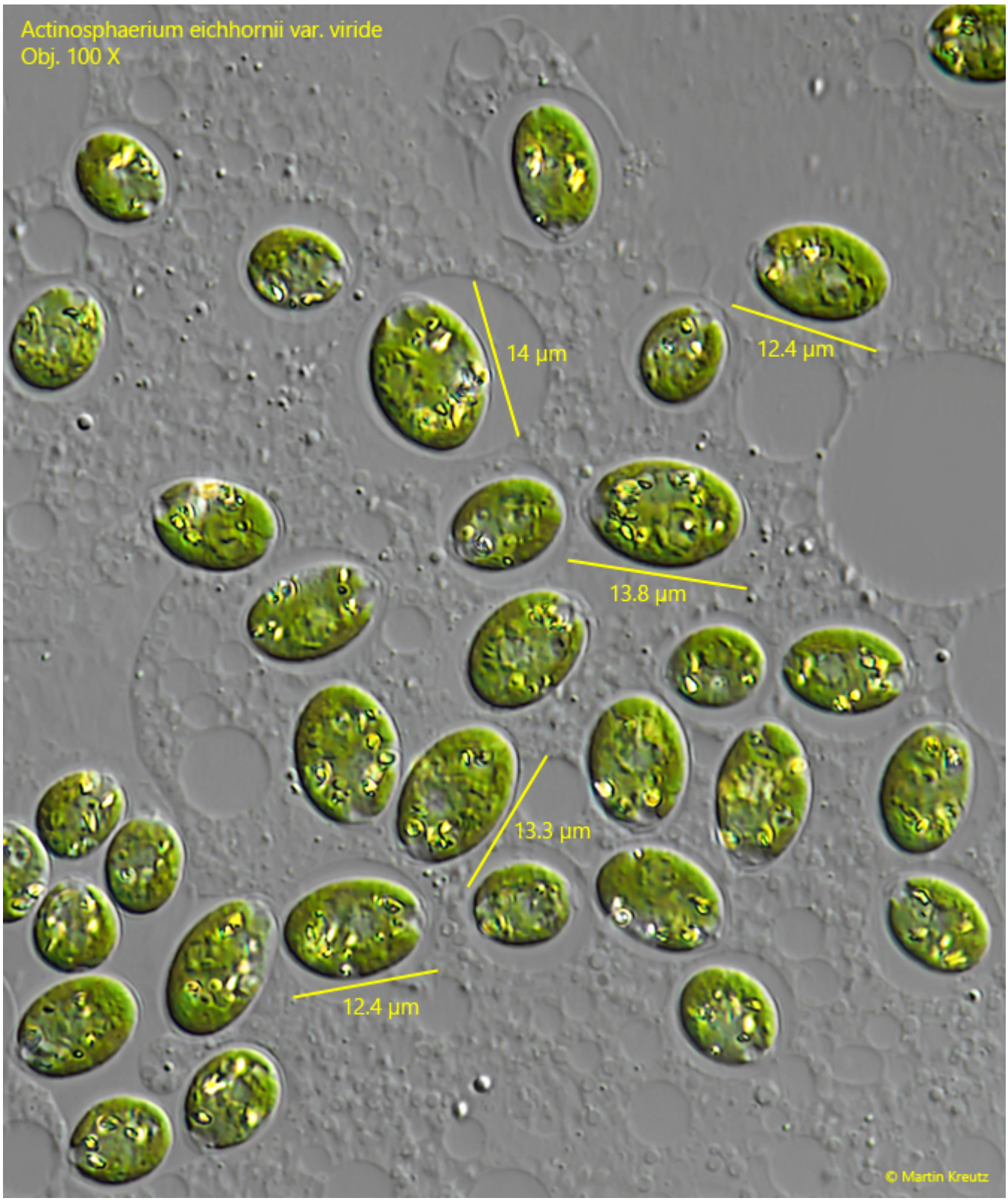


Fig. 6: *Actinosphaerium eichhornii* var. *viride*. The symbiotic algae are *Chlamydomonas actinosphaerii*. The shape ist oval or ovoid and they have a length of 12–14 µm. Obj. 100 X.

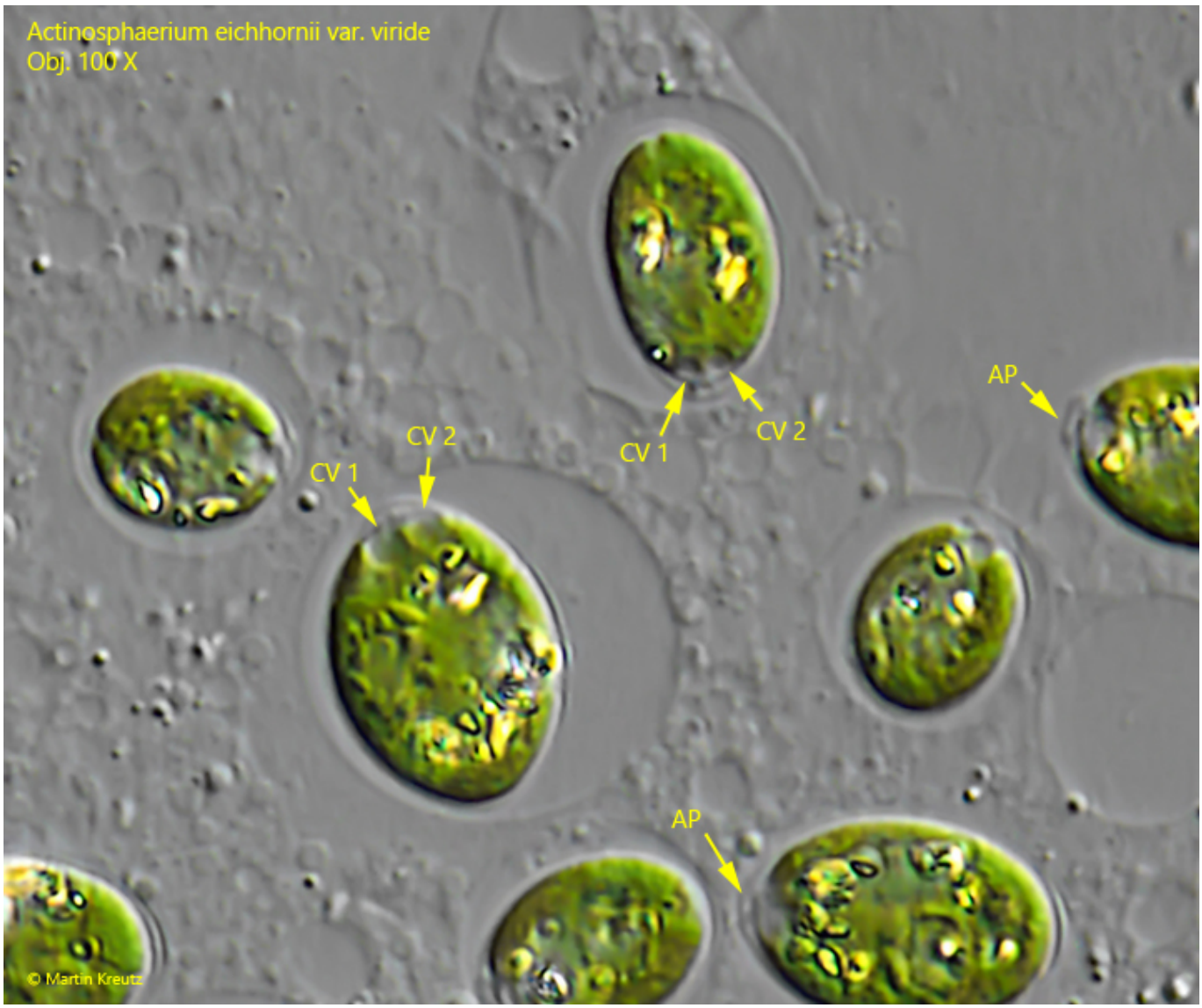


Fig. 7: *Actinosphaerium eichhornii* var. *viride*. The cells of *Chlamydomonas actinosphaerii* in detail. The two apical contractile vacuoles (CV 1, CV 2) are visible as well the apical papillae (AP). Obj. 100 X.

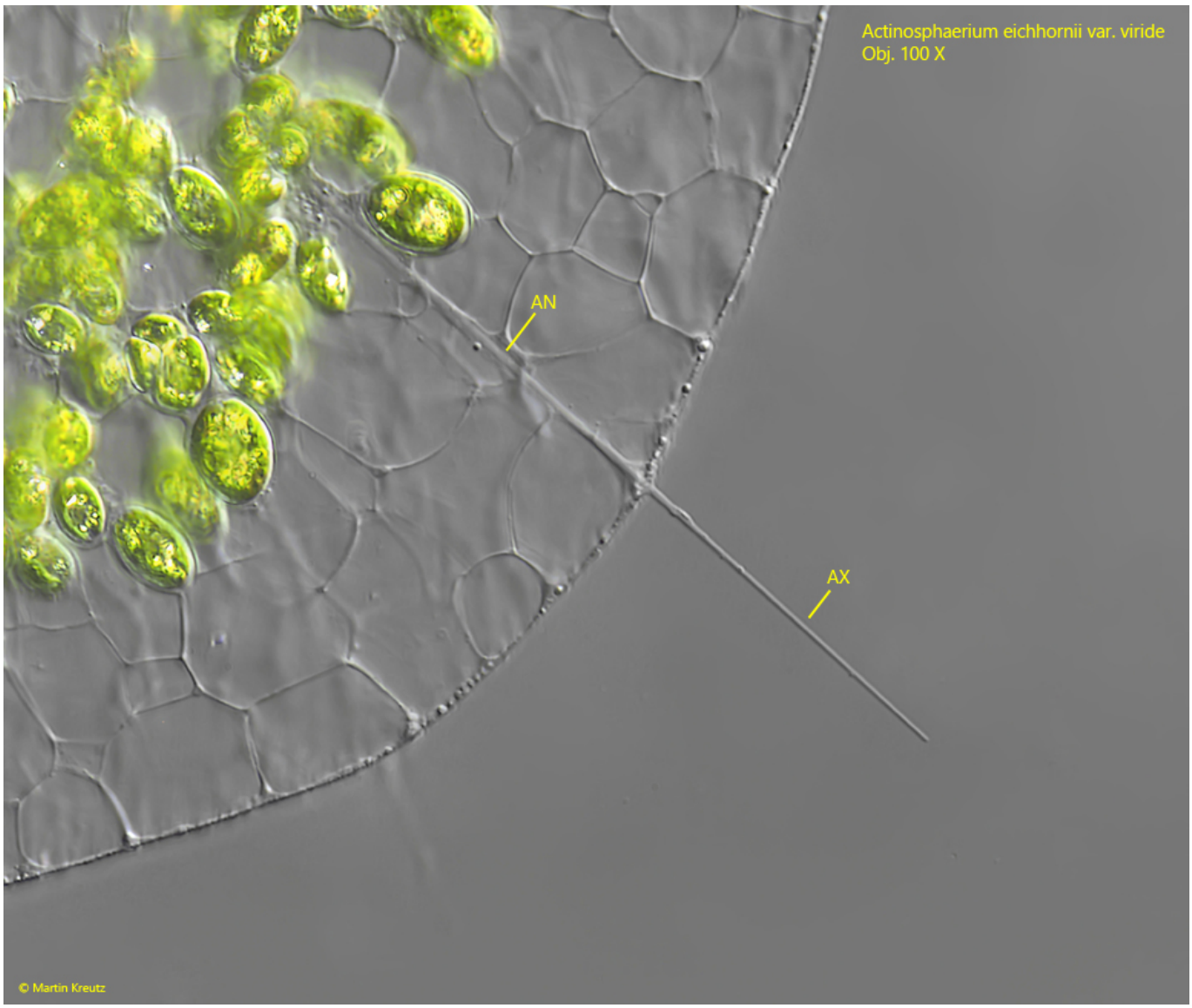


Fig. 8: *Actinosphaerium eichhornii* var. *viride*. The axopodia (AX) have a central axis of microtubules (AN = axionema), which extend into the endoplasm and end at a cell nucleus. Obj. 100 X.