Some Photos to Help Identify Soil, Compost & Compost Tea Organisms

Part 1; Bacteria, [Protozoa] = Flagellates, Amoebae, Ciliates and Fungal Hyphae

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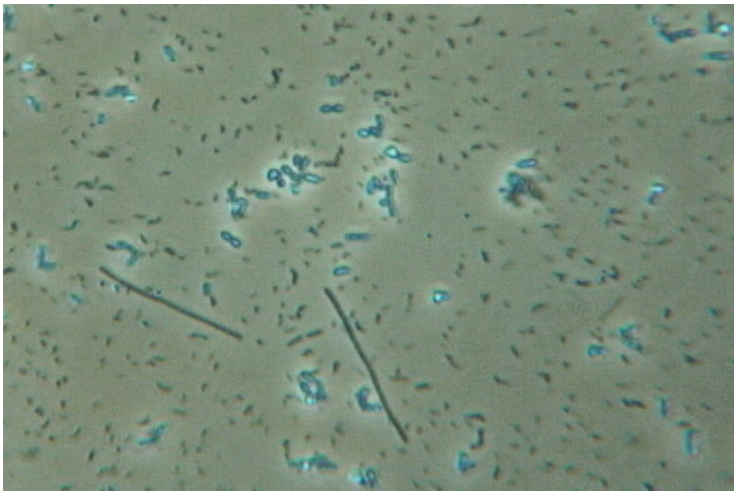
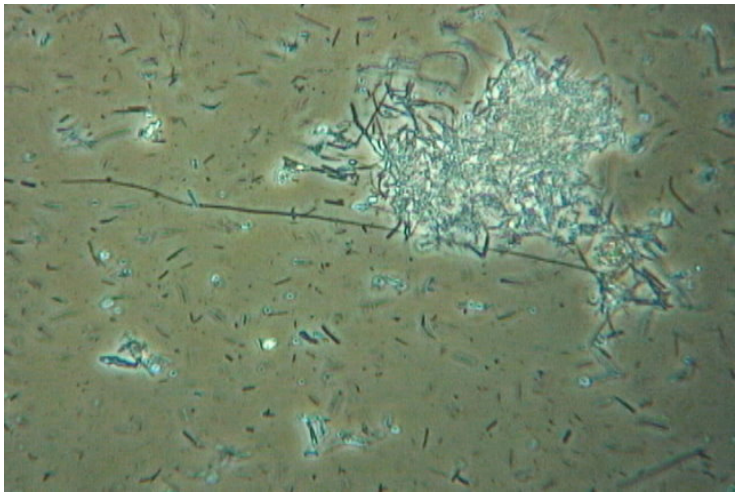
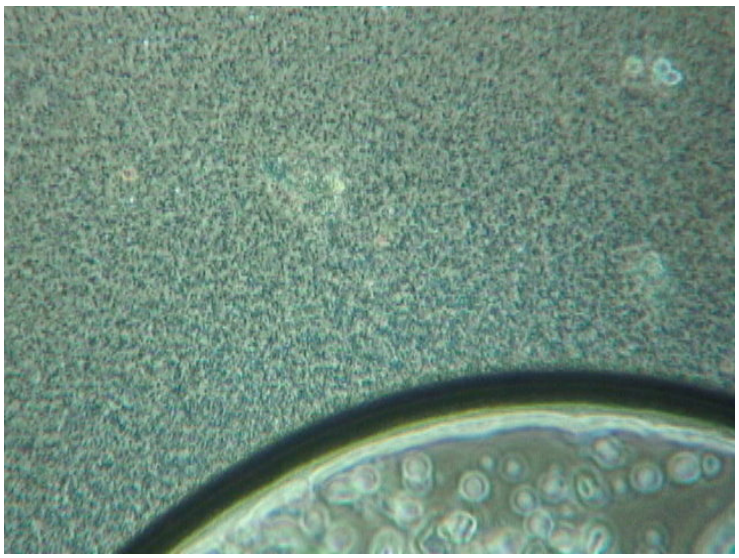
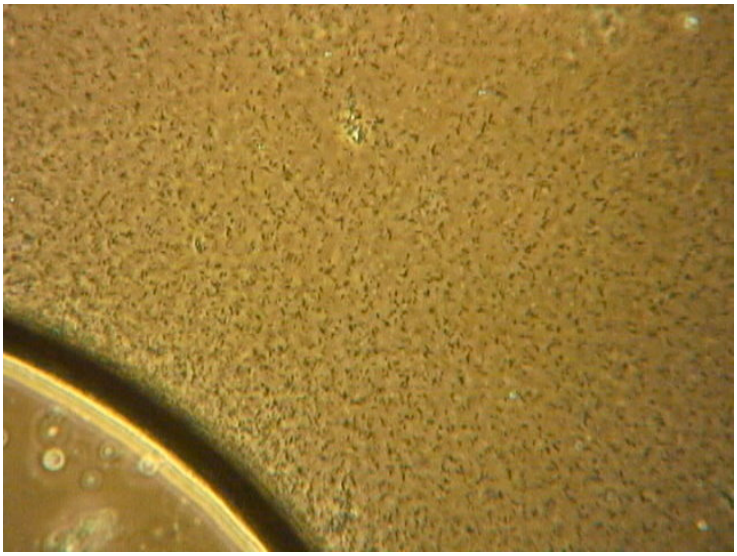
Bacteria:



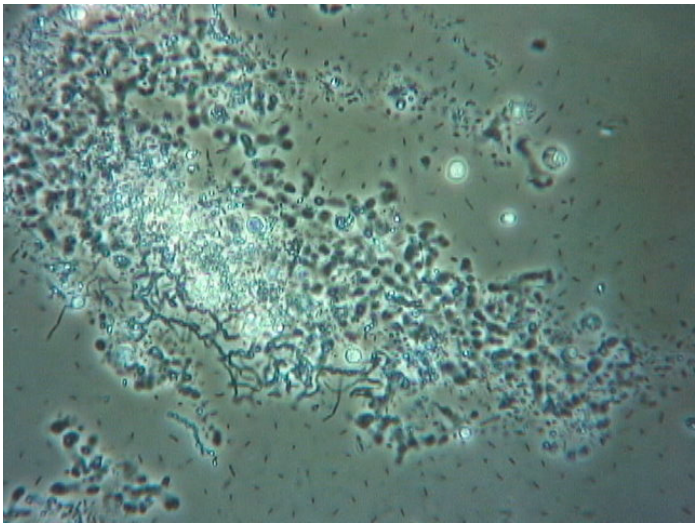


Undoubtedly if you have a good bacterial content in compost tea you will see mobile bacteria in addition to non-mobile. In the photos above the long rod shaped bacteria are mobile as well as the shorter rod shaped bacteria. You will also see smaller round or dot shaped bacteria moving. Sometimes the bacteria form non-mobile structures often in the presence of a food source creating a large biomass. In the photo on the right bacteria are beginning to congregate around/on the organic matter. These photos are zoomed in at 250X magnification so represent about 1/10th of a field of view using 200X magnification. It appears there are at least 100 bacteria in the view so extrapolating 1000 is probably a good minimum amount to see in compost tea.



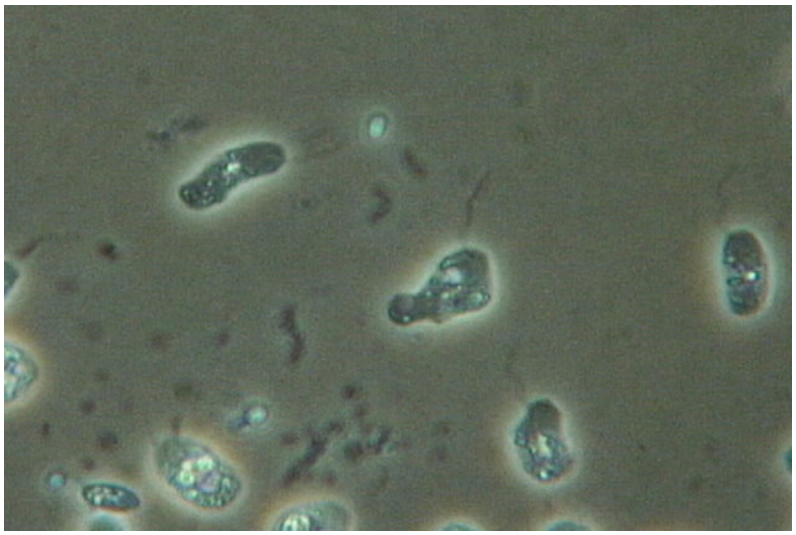


Just to see how dense bacteria can be in compost tea, everyone of the dots in the photo on the left is a moving bacteria and that is only one level in less than 1/10th of a field of view. The photo on the right shows denser bacteria close to the air bubble possibly an indication of being aerobes.

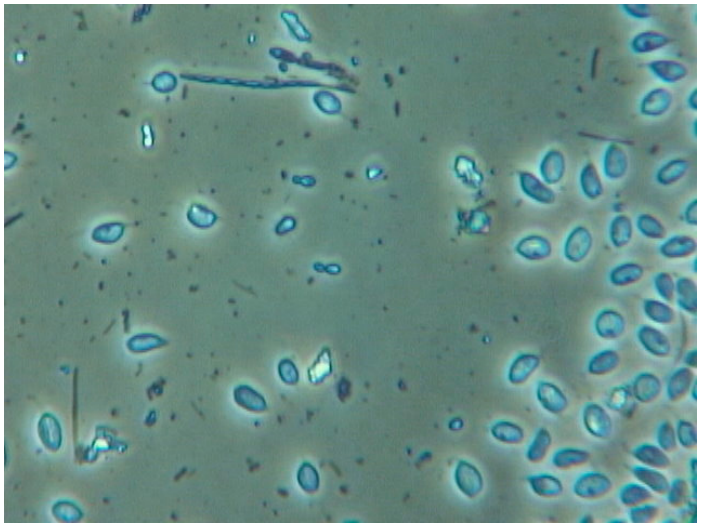
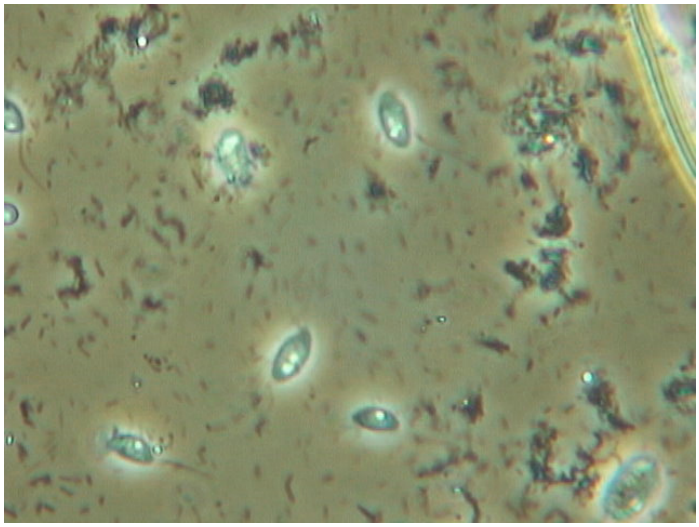


Bacteria can also form some intricate and beautiful structures.

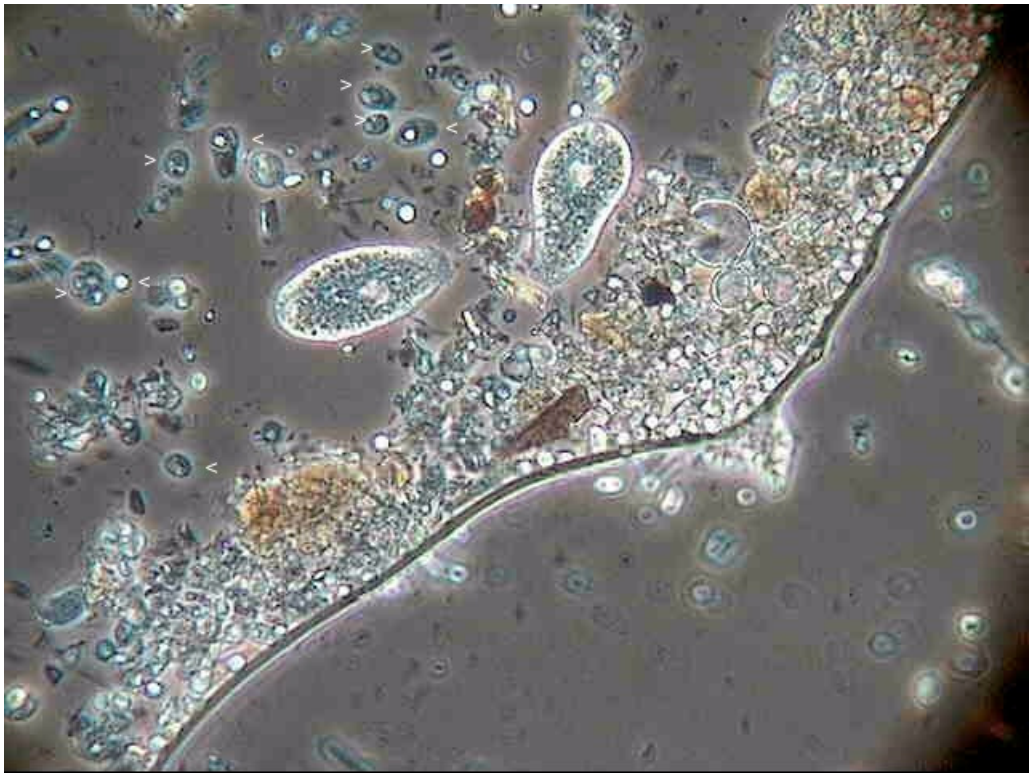
Protozoa consists of flagellates, amoebae & ciliates.
Flagellates:



As you can see in these zoomed in photos, flagellates come in a wide variety of shapes and sizes.

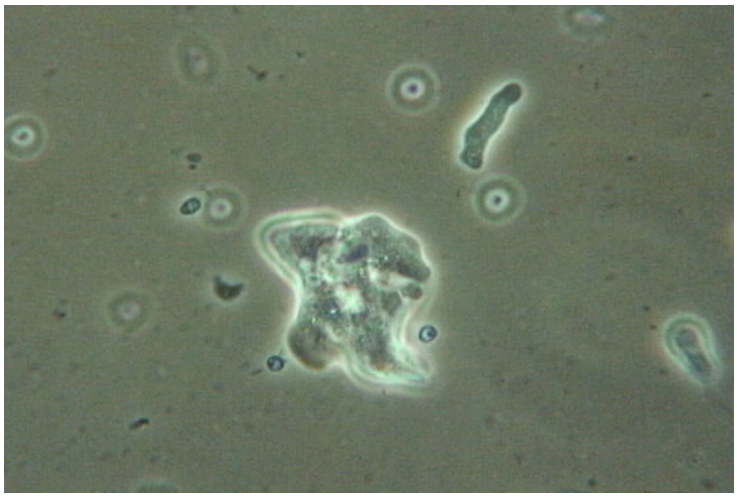



The left photo shows a very high number of flagellates in a compost tea and in the right photo there are several flagellates among some bacteria and small bacterial structures (sorry not very clear). In a compost tea you are going to want to see a minimum number of 2 flagellates or naked amoebae in every 200X field of view (this equates to SFI test results of about 13,000 /ml/gram) I prefer to see a number ranging from 5 to 20 as long as you also have good bacterial numbers.

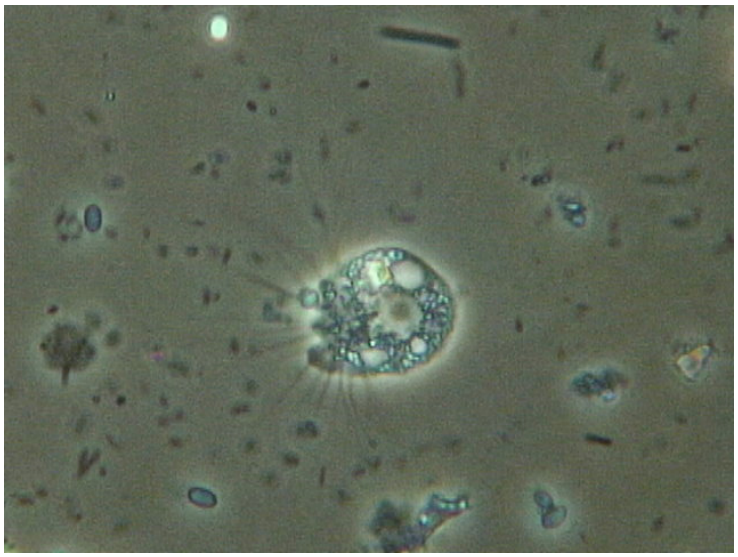


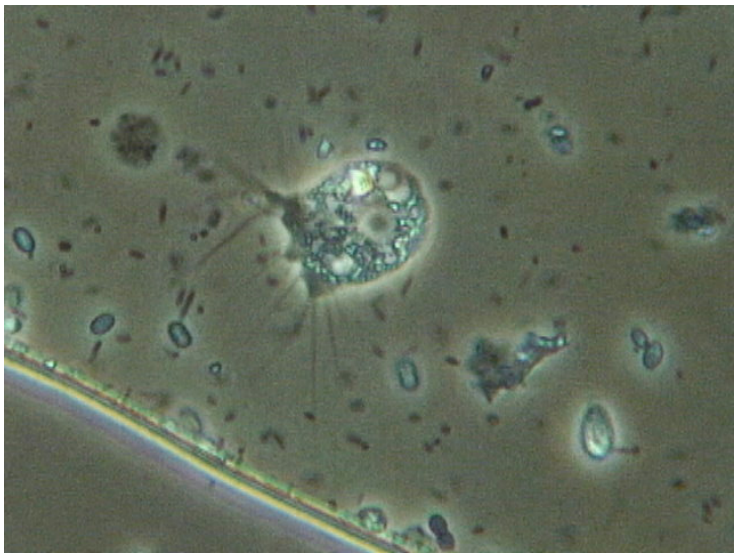
Here is a photo with 2 ciliates and a bunch of flagellates. I have placed little arrows pointing at some of the flagellates.

Amoebae:

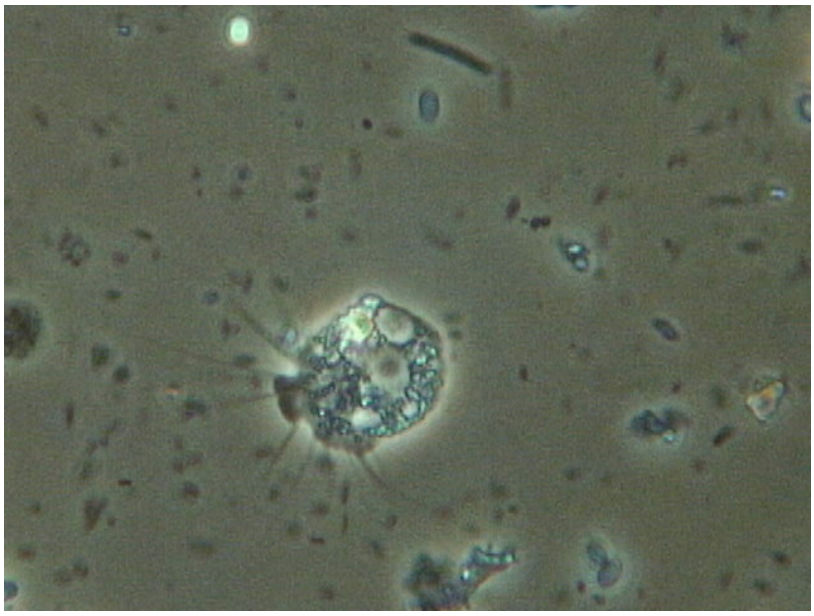


Naked amoebae come very large and very small. The photo on the right shows my efforts to focus on three different sized (types) at one time. They are easily recognized by their very slow oozing motion as they flow using pseudopods. They are excellent to have in compost tea in about the same numbers or greater than those suggested for flagellates.



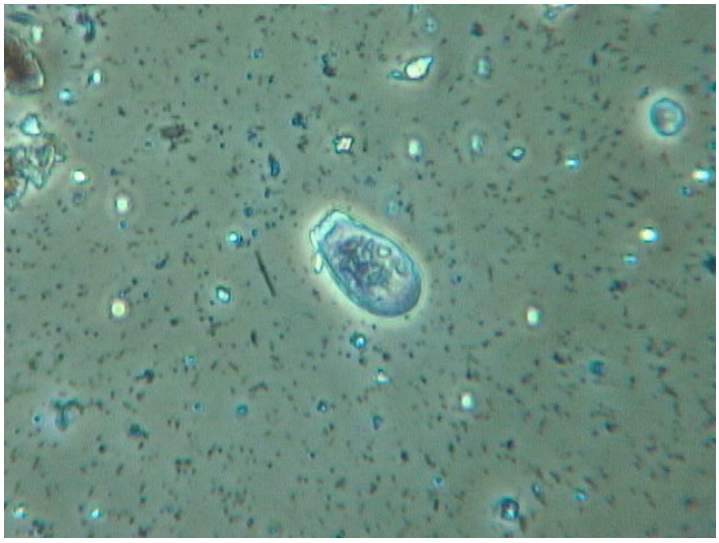


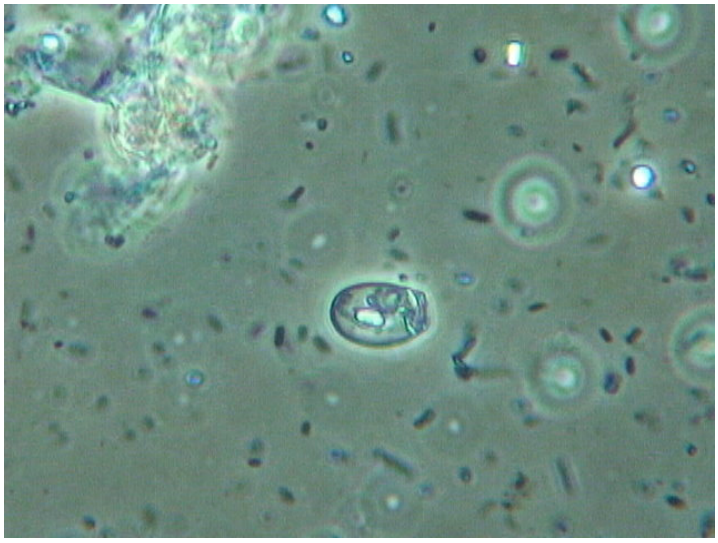
An amoeba with long spine-like pseudopods. Although it looks a little like a testate amoeba it is a naked amoeba.



Okay, one more shot because he's so beautiful!

Testate Amoebae:

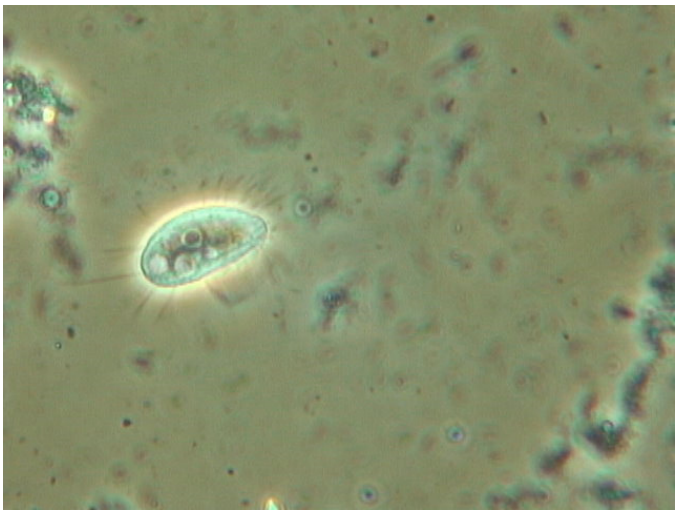




Here are Testate Amoebae that live out their lives in shells from which they protrude their psuedopods for mobility and feeding.

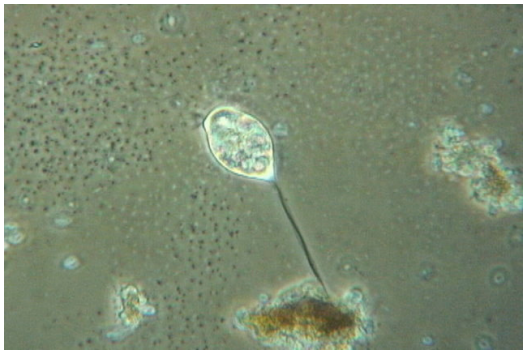
Ciliates:

Normally you don't wish to see more than a ciliate every 4th or 5th field of view in tea unless there is also a really high number of flagellates and/or naked amoebae.

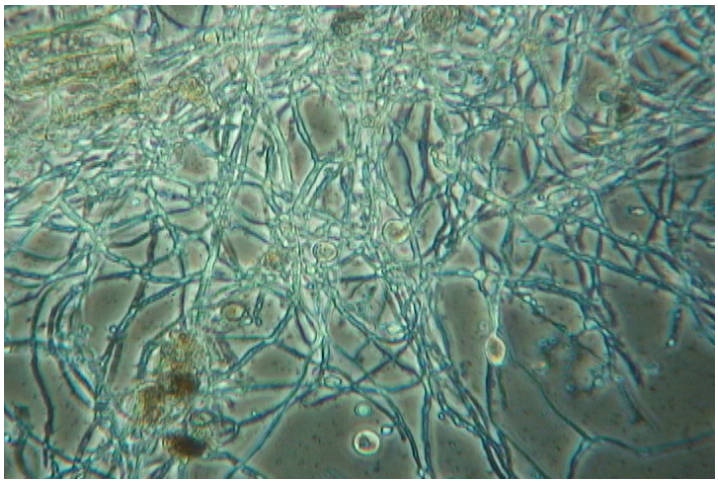


Ciliates are beautiful varied complex creatures. It is very difficult to believe they are single celled. The photo on the left shows a large ciliate to the left with some tiny ciliates and a rotifer. The right hand photo depicts a ciliate with some longer cilia.

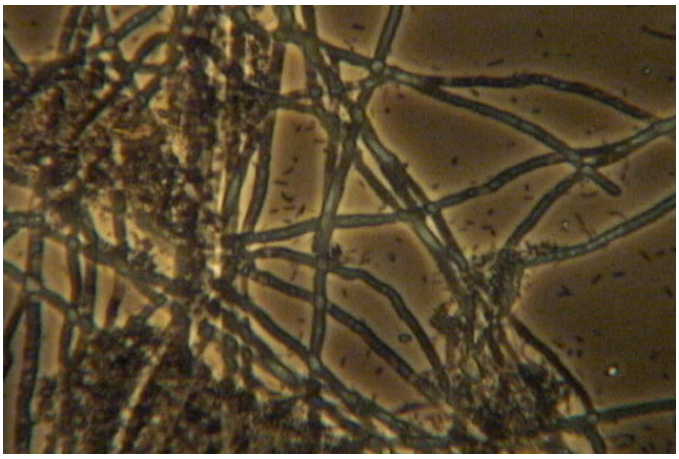
Two rod shaped bacteria swim by the ciliate in the right-hand photo. In a sample ciliates normally move faster and more fluidly than flagellates. Flagellates usually move or feed with a little jerking or vibration motion but a few species move very similar to ciliates and it takes some careful examination to discern. You cannot always see the fast moving cilia or flagella. Following is a stem anchored Vorticella another type of ciliate.



Fungal Hyphae:



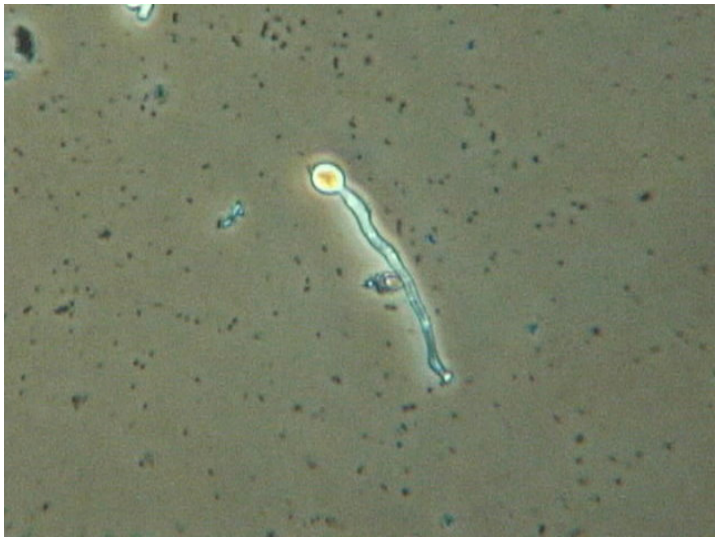
Fungal hyphae is unmistakable. In the photo on the left you can see two thick fungal strands contrasted with thinner bacterial strands trailing off to the bottom right. In a very good quality compost tea you should see some hyphae every fourth to sixth field of view on average but some hyphal complexes like the right-hand photo may fill several fields of view.

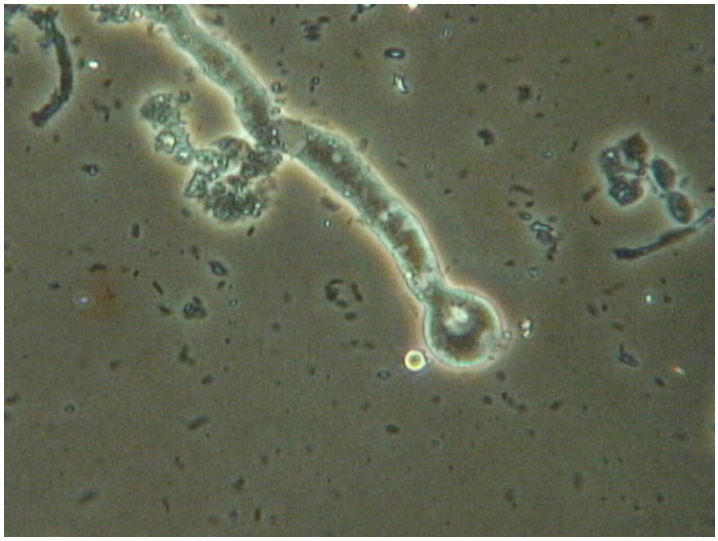


4X magnification brightfield

I like to see hyphae which is over 5 microns in diameter to be sure of beneficial fungi in samples of compost and tea but it is great if it is 6 to 10 microns.

Following are examples of sprouted fungal spores.





As a review, in my opinion, a decent compost tea should have at least 1000 bacteria and 2 flagellates and/or naked amoebae in a 200X field of view but better to have higher numbers for a good nutrient cycling consortia (protozoa eating bacteria to release nutrients). I'm really happy if I see 10,000+ bacteria and 10+ flagellates/amoebae Additionally, if you have fungi in the compost or vermicompost used it is good to see hyphae every 4th to 6th field of view but you may see much more or somewhat less so don't sweat it; the tea will still be effective.

Archaea: Please note that there is some credence to applying this term in place of the word bacteria, since recent research has shown that archaea exist in large numbers in soil and they cannot be differentiated visually from bacteria.