

Aquaponics

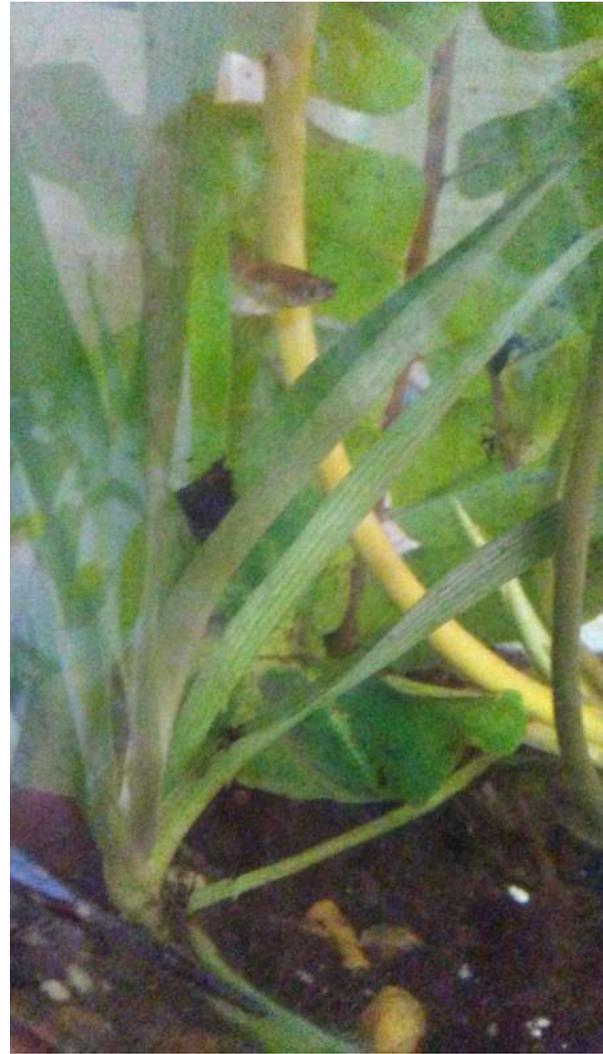
Plants on 1/9/18	<a href="http://identify.plantnet-project.org/">http://identify.plantnet-project.org/</a>
 A photograph of a small plant specimen with several dark green, heart-shaped leaves and a few reddish-brown stems, lying on a white surface.	American Evergreen ( <i>Syngonium podophyllum</i> Schott)
 A photograph of a single, long, pinnate leaf with many small, lanceolate leaflets, lying on a white surface.	<i>Averrhoa bilimbi</i> L. Oxalidaceae
 A photograph of a single, broad, ovate leaf with a mottled pattern of green and yellow, lying on a white surface.	<i>Aglaonema commutatum</i> Schott Araceae Philippine evergreen
 A photograph of a small plant specimen with several long, narrow, lanceolate leaves and a few reddish-brown stems, lying on a white surface.	<i>Helicodiceros muscivorus</i> (L.f.) Engl. Araceae

Fish on 1/15/18

Female



Male



Initial Aquarium Set-up:

1/9/18 12:05 pm



The aquarium has a small layer of dirt and rocks on the bottom. I put approximately 102 ounces of cold tap water in the container. Some of the dirt has floated to the top. The container is currently placed on the window ledge in our dorm (Vollmer).

Date/Time	Picture	Description
1/10/18 12:23 pm		<p>Some of the floating dirt has settled back down to the bottom of the container; the water is clearer. There is still some dirt particles floating at the top in a layer. The plants are looking good and green at the moment; no roots can be seen yet.</p> <p><u>3:20 pm</u></p> <p>I moved the container to the top of my dresser due to concerns that the water is too cold for the plants, and eventually the fish. My roommate and I will leave the blinds open to provide sunlight to the container in its new location.</p>
1/11/18 11:16 am		<p>There is more outside light coming in and shining on the container in its new location than expected. I believe there may be tiny roots growing from the <i>Helicodiceros muscivorus</i> (L.f.) Engl. I will continue to watch for any new root production. The water level has dropped approximately an 1/8th of an inch</p>
1/12/18 12:40 pm		<p>The water continues to look clearer and clearer-- the more we turn the jar to look inside, the more dirt floats back to the bottom. The plants look about the same; I am continuing to watch for root buds on the bottom of <i>Helicodiceros muscivorus</i> (L.f.) Engl. The water is colder than expected and I am slightly nervous at how this factor may treat the coming fish</p>

1/13/18 12:31 pm



Today the shine shone right on the plant, so I think moving it was the right decision. The water feels more like room temperature-- when testing the water with my pinky I did not realize I actually had submerged my finger as the temperature was so similar. The water level has gone down a 1/4 of an inch. The root buds on *Helicodiceros muscivorus* (L.f.) Engl have gotten longer, and there are now three of them.

1/14/18 10:42 am



No new root activity can be seen. Water continues to look clear. Plants are still green & do not seem to show signs of dying yet. It is cold in the room.

1/15/18 2:54 pm



There are fish! There is a larger orangish female and a smaller darker male. They seem to be inseparable, but not mating. There is some definite plant decay on the bottom right side. The end of the stem is turning black and hollow.

1/16/18 11:46 am



My plants are looking relatively good aside from the noted decay described yesterday. The female fish moves around more than the male. The male is hard to find in the container due to his small shape. There is a lot of fish poop already noticeable in the bottom of the container floating over the dirt. Both fish move around slowly.

1/17/18 7:53 am



The male fish seems to be in the same place he was last night when I last looked at him, but he is still breathing so that is good. The female moves around quite a bit. The male looks lighter in color than he was when he first was put into the container, but I do not know why. The plants have not changed much. I am considering getting fish food just to put a pinch in every few weeks to make sure they are able to eat even if the plants begin to die. The water is about as clear as it has been.

Note: The female can be seen in the white circle.

1/18/18 12:08 pm



The plant leaves are changing colors. The *Averrhoa bilimbi* L. leaves look almost water logged as the tips are darker than before. The fish are swimming around more than before & are hard to find due to the plants. Water levels have decreased an eighth of an inch since adding the fish. The room is warmer than it has been.

Note: The male fish swam by while I was taking this photo and can be seen in the circle.

1/19/18 12:15 pm



Female can be seen in middle of tank. *Aglaonema commutatum* Schott looks yellow & dying. When we move the tank around to find the fish, lots of poop can be seen floating around. Roots have continued to grow on *Helicodicerus muscivorus* (L.f.) Engl.

1/20/18 8:33 am



Plants seem to have been moved around somehow. A skinny, light green sprout is coming out of the *Syngonium podophyllum* Schott. Water levels have gone down a quarter of an inch. Fish are moving around quite a bit today. Water is looking slightly yellow.

1/21/18 9:29 am



*Aglaonema commutatum* Schott is very yellow now and definitely dying. The fish are both active today & seem to be nibbling on something. Water levels continue to go down. I believe the previously noted yellow water is contributed to the yellowing plant, not a change in water color.

1/22/18 12:21 pm



Each plant is now showing signs of dying. However, a green sprout is still growing on the *Syngonium podophyllum* Schott. Another BI 131 student ponders if my female is pregnant- I do not know whether this is true or not but I will watch her either way. Water levels decrease each day. Current levels are .5 an inch lower than original.

1/23/18 3:10 pm

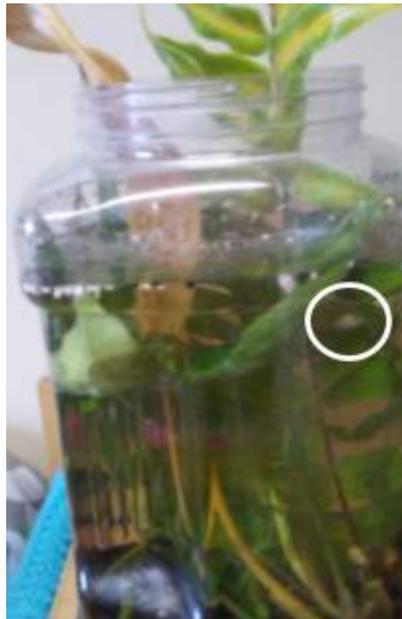


None of the plants seem to be thriving at this point. The stem on the *Syngonium podophyllum* Schott has split open & is rotting. The *Averrhoa bilimbi* L. is turning yellow & curling up as if dying. The fish seem to be changing color.

Note:

Female can be seen in upper right corner. Water level has gone down a noticeable amount.

1/24/18 12:18 pm



Water is down an inch- but if plants are dying is it all evaporating? Fish seem very anxious & swimming quickly. I need to get new plants as I don't want the fish to starve if all the plants die.

1/25/18 11:37 am



The female fish is swimming all over the container. The male fish tends to swim close to the bottom. They both currently have poop coming out of them. The sprout continues to grow out of the American Evergreen.

1/26/18 1:16 pm



Roots are still growing on the *Helicodieros muscivorus* (L.f.) Engl. & the sprout on the *Syngonium podophyllum* Schott is still doing well, however, the other plants are all dying. The female fish still has a spot on her belly which makes us wonder if she may be pregnant. Water should be added soon.

1/27/18 11:56 am



Water has officially gone down over an inch. For my upcoming change (1st change due this Tuesday) I'm going to go & buy fish food today. Today, the male fish is swimming around the perimeter of the container more than the female. In the upcoming days I plan to remove the dead plants & see how the fish react.

1/28/18 10:46 am



The *Averrhoa bilimbi* L. has since shedded all of its leaves that were above water. The fish are using the fallen leaves to hide in & behind. Water is down an inch & an eighth & continues to get murkier & murkier.

1/29/18 12:17 pm



Because several of the *Averrhoa bilimbi* L. leaves have fallen into the water & are floating, the fish have taken to hiding under them. The 2 main living plants are the *Helicodiceros muscivorus* (L.f.) Engl. & *Syngonium podophyllum* Schott. The male fish seems to have gotten longer. Tomorrow I will make my first change to the habitat. I believe I am simply going to remove the dead plants & see how the fish react. I am tempted to hold off on adding fish food for my next change.

1/30/18 12:01 pm



I took out the *Aglaonema commutatum* Schott as it was becoming brown, black, & slightly moldy. As this was one of the main plants for my fish, it will be interesting to see how they react. I removed a few of the dead floating *Averrhoa bilimbi* L. leaves that the fish had been hiding under. I know this wasn't a huge change, but as they hid under them, I am curious to see if they will proceed to hide under the remaining leaves or find a new hiding place.

1/31/18 12:29 pm



The female fish can be seen on the top left & the male fish not far below. So far, the fish continue to prefer to hide under the remaining leaves & appear to be eating something as well. 3 more root developments are protruding on the *Syngonium podophyllum* Schott. Water levels are down almost a full 1.5 inches & should be added to this weekend.

2/1/18 7:10 am



Water continues to go down & get dirtier & dirtier. Female fish was observed today swimming into a leaf, backing up, & repeating this motion over & over. The remaining plants seem to be doing okay, however, they look dirtier than before (change in color).

2/2/18 12:35 pm



Water has noticeably gone down. More leaves have died from the *Averrhoa bilimbi* L. since I removed some on Tuesday. Fish are hiding behind some leaves that are stuck on the side of the container.

2/3/18 11:22 am



The female fish is eating something floating at the top of the container. The two fish are with each other a lot today. I removed another floating dead leaf today. Several newer root systems can be seen on the remaining plants. I will be adding water later today- I have a glass of 8oz of water sitting on my dresser to adapt to room temperature before I pour it in the container as to not shock the fish.

2/4/18 1:01 pm



The female fish can be seen in the upper left corner. I added 2 cups (16oz) of water yesterday afternoon that had adjusted to room temperature. No new plant growth can be seen, but due to the addition of water, the leaves are all covered in water so hopefully they will not die as quick.

2/5/18 12:40 pm



Both fish can be seen in the upper right corner: the male is uppermost & the female is right below. The water has turned noticeably yellow & has not gone down since I have refilled it. The American Evergreen seems to be doing exceedingly well.

2/6/18 2:55 pm



The water is darker than the day before, but less yellow. There is a lot of poop floating in the bottom. The plants are looking greener than the past few days. The fish are acting nervous.

2/7/18 2:37 pm



The female fish seems to be even more skitterish than normal. Anytime I went to take a picture, she will freak out & dive behind the remaining plants. Each plant is now coated in fish poop that has been floating Around. Water levels have decreased almost .5 an inch.

2/8/18 12:29 pm



The female fish is pooping at the time of this recording- when the container is moved around, poop is spun all over. The female fish is also eating something from the top. The male fish is also pooping now & seems to look more silver than before. The water is quite yellow, but the plants seem to be green & relatively healthy.

2/9/18 4:35 pm



One of the water saturated *Averrhoa bilimbi* L. leaves is becoming practically transparent- there are clear "holes" in the middle of the green leaf. The female fish has a black streak on her body before her tail fin. The male fish looks quite small anymore. The water levels have stayed constant since last notation.

2/10/18 3:55 pm



The male fish is on the left & the female is on the right. The thin, clearing leaves can be seen on the left as well. The *Helicodicerus muscivorus* (L.f.) Engl. roots have really grown. The water has gone down slightly & is still changing color to a brown-yellow color.

2/11/18 11:40 am



The *Averrhoa bilimbi* L. leaf is still intact, but the green is gone. another student hypothesizes that the fish are eating them. Water levels have gone down half an inch. The female fish is still quite skittish.

2/12/18 12:45 pm



The sprouts from the *Syngonium podophyllum* Schott have taken off & has turned into a leaf which is starting to uncurl. Water levels have decreased. The male fish is eating part of a leaf. The female fish is swimming into the wall.

2/13/18 11:50 am



The plant decay can be seen in the bottom of this picture. The female has black lines completely outlining her right side. The male fish is following close behind the female today. Both fish have generally lost their initial scare without the leaves for protection, but they still attempt to hide behind the fading leaves. Water is down over half an inch.

2/14/18 12:20 pm



The plant decay of the *Averrhoa bilimbi* L. is more evident than ever before- much of the leaf is gone & the stem remains. The water is darker than yesterday & I wonder if some of the plants cause the water to darken. The male fish is quite active today.

2/15/18 11:43 am



The male fish eating something that was floating at the top of the container. We still wonder if the female is pregnant or not. The water is down an inch. The leaves of the *Averrhoa bilimbi* L. continue to turn clear.

2/16/18 12:33 pm



The water has become a brown tinge that makes it harder to identify the location of the fish. I will definitely need to add water soon. the next big change is scheduled for this coming Monday I think I'm going to start using fish food. The male fish is swimming near the top now & is currently pooping. The *Syngonium podophyllum* Schott is changing to a different shade of green but is still living.

2/17/18 4:07 pm



Today I spent some time observing the various plants in my container. Only the *Averrhoa bilimbi* L. has shown any huge change & since I've cut it back, it has been growing well. I can only find the female at the moment & she is acting like she did before the leaves were removed. I will be adding water this weekend.

2/18/18 10:59 am



There are half an inch roots on the *Helicodicerus muscivorus* (L.f.) Engl. Almost all the *Averrhoa bilimbi* L. leaves are completely dissolved. I need to add water. The fish are swimming around together.

2/19/18 12:34 pm



Today I will be doing my 2nd change. I am filling a glass with 16oz of water & letting it sit to adjust to room temperature. For my change, I will feed the fish a pinch of food each Monday starting today. The female has some dark coloring on her sides again. Plants look well.

2/20/18 12:25 pm



I added 12oz of water & a pinch of food last night. The food is all gone. My plants are doing well & staying green. The fish are very active today.

2/21/18 12:26 pm



The entire *Averrhoa bilimbi* L is gone now- either the fish ate it or it simply dissolved? My *Syngonium podophyllum* Schott is still doing well & the fish are swimming together. The water level is back to normal.

2/22/18 11:55 am



The fish are together again. The plants are looking stable. Water has seemingly gone down some already.

2/23/18 12:33 pm



The male fish is in the middle of the container & the female is on the top right. anyone who comes & looks at my fish immediately comments on the fact of how dark my water is from the fish poop. Each plant has at least one leaf that is above water & all seem to be doing well.

2/24/18 12:05 pm



The *Helicodiceros muscivorus* (L.f.) Engl & the *Syngonium podophyllum* Schott are still thriving relatively well. The *Averrhoa bilimbi* L. is completely dismantled now. The leaves are all gone & the stem is the only thing left. The water has gone down almost half an inch. The fish are swimming around happily.

2/25/18 5:51 am



Because it is so early in the morning, the fish are not moving Around much yet as it has been dark for them. The *Helicodiceros muscivorus* (L.f.) Engl. looks very green today & has good root growth. Water levels seem constant from yesterday.

2/26/18 12:22 pm



One of the *Syngonium podophyllum* Schott leaves has fallen off & is now on the bottom of the container. Both fish are swimming around today. The water has gone down slightly. I will be giving them a pinch of food today to continue my 2nd change.

2/27/18 12:19 pm



The female fish can be seen on the upper right. The male is going crazy swimming everywhere. Water is down .75 inches. The plants are living well.

2/28/18 12:26 pm



The female fish can easily be seen in the middle left as well as the impressive root structure of the *Helicodiceros muscivorus* (L.f.) Engl. There is a curved leaf coming from the *Helicodiceros muscivorus* (L.f.) Engl as well. Water levels are down one inch.

3/1/18 12:00 pm



The male is currently digging in the poop on the bottom. The remaining plants are fine. I will be adding 2 cups of water this evening once the water adjusts to Room temperature.

3/2/18 7:31 am



I added 16oz of water last night. Both fish continue to dig in the poop and dirt on the bottom of the container. Break begins tomorrow so today will be my last observation until March 11. I am giving the fish an extra pinch of food before I go.

3/3/18-3/10/18: Winter Break

3/11/18 4:05 pm



Since being gone, the middle leaf of the *Helicodiceros muscivorus* (L.f.) Engl. has begun to rot though the root growth still looks fine. The water has gone down around .5 inch. Both fish are still alive, but both also have very noticeable black lines tracing their sides. Both are currently eating something from the mix of poop & dirt.

3/12/18 12:23 pm



The *Aglaonema commutatum* Schott is definitely rotting but I plan to leave the rest of the plant in the container due to the good root structure. Both fish are swimming well & currently pooping. I will need to add water at some point.

3/13/18 11:54 am



The female is in the upper right corner. Each plant is beginning to look worse for wear. Water will be added soon.

3/14/18 12:23 pm



In comparison to a classmates' container, my fish & water look very dirty. 16oz of water will need to be added. The *Syngonium podophyllum* Schott is my only plant still living its best life.

3/15/18 11:31 am



This picture shows that the *Helicodiceros muscivorus* (L.f.) Engl is still growing at certain leaves; its root structure is still looking well. Water will be added this weekend. Both fish appear to be doing well.

3/16/18 5:34 pm



The male fish is in the bottom right corner. Both fish are currently on the bottom eating something from the dirt. There is a new, uncurled *Syngonium podophyllum* Schott leaf. I am measuring out water tonight to adjust to room temperature to pour in tomorrow.

3/17/18 1:34 pm



Both fish can be seen in the bottom middle (female over male). I added 16 oz of room temperature water to the container this morning. Some of the tips of the *Helicodiceros muscivorus* (L.f.) Engl. have begun to wilt under the water.

3/18/18 4:37 pm



The *Syngonium podophyllum* Schott is definitely thriving & looking green. The *Helicodiceros muscivorus* (L.f.) Engl. is getting furry, so it may be mold. The female fish is swimming into the *Syngonium podophyllum* Schott. I added 16 oz of water yesterday.

3/19/18 12:25 pm



The female can be seen in the bottom right corner. I will be giving the fish a pinch of food today. Water levels are constant from yesterday; water looks less mucky but still yellow. The mentioned leaf of *Helicodiceros muscivorus* (L.f.) Engl. from the other day is falling over from having appeared to have been bitten.

3/20/18 12:13 pm



The remaining leaf on the *Helicodiceros muscivorus* (L.f.) Engl. has begun to decompose & has developed a circular pattern. The fish are on the bottom of the container eating poop. Water levels have remained constant since the other day.

3/21/18 12:27 pm



Only the female fish can be seen at the moment. Extreme root growth can be seen on the *Syngonium podophyllum* Schott. Water has gone down an eighth of an inch.

3/22/18 11:32 am



Water has not gone down since last report. Both fish are quite active today. The water is more yellow than before, & all the plants seem to be falling apart.

3/23/18 6:33 pm



The female fish is in the bottom right corner & the male fish is not far behind her; they are both eating from the dirt. The male seems to be turning a darker color than originally. The roots on the *Helicodiceros muscivorus* (L.f.) Engl. are no longer white & seem to be dying. For my third & final change, I will remove the *Helicodiceros muscivorus* (L.f.) Engl. as it is decomposing. I'm interested to see if the fish can still successfully survive without the plant with the main root source.

3/24/18 5:31 pm



The *Syngonium podophyllum* Schott is the only plant left; it does have some noticeable root structure. The female fish is swimming in very sudden movements. The water has gone down a .25 in.

3/25/18 6:17 pm



The fish are swimming together. Fun fact: earlier, there was a fake Christmas tree sitting outside the container & the fish kept swimming into the side as if they thought they could get to it. Water levels have decreased slightly. The cut of the Syngonium podophyllum Schott is dark brown but the rest of the plant looks healthy.

3/26/18 2:41 pm



The fish will be given a pinch of fish food today. Water has gone down slightly since last documented. The Syngonium podophyllum Schott looks generally okay, it just has slightly rolled leaves.

3/27/18 12:12 pm



The fish are eating fish food from the top. Water seems constant from yesterday. The green pigment from the top of the leaves are looking lighter.

3/28/18 7:46 am



The female fish is in the top center. Both fish tend to move slower in the morning & eat from the top or bottom depending when food was last given. Water is now down just under .75 of an inch from what was poured in. One of the curled leaves has begun to unfold & has good root growth.

3/29/18 12:09 pm



The female fish can be clearly seen in the middle right. The uncurling leaf has continued to make progress; there are approximately 9 roots coming from the cut of the plant. Water will need to be added upon my returning from break on April 2nd.

3/30/18-4/1/18 Easter Break

4/2/18 4:54 pm



Both fish are still alive after break. They were just fed. The remaining plant looks fine. water is down over an inch- I will set some out to adjust to room temperature & add it tomorrow.

4/3/18 3:19 pm



16oz of water was just added, so dirt has been disturbed. both fish are rapidly finding food that has emerged from the dirt. The uncurling leaf has transitioned to pointing upwards.

4/4/18 12:29 pm



Both fish can be seen on the lower left. Water levels are back to normal. Each leaf is pointed upward.

4/5/18 11:51 am



The female fish can be seen on the lower left side. Both fish seem happy. The plant has one leaf pointing out the top of the water & is beginning to yellow. Water levels have stayed constant.

4/6/18 2:44 pm



The female fish is on the bottom left & the male the lower right. The cut of the plant is turning colors. The water is still constant.

4/7/18 10:55 am



The fish seem to be chill today & are swimming calmly all over the container. Water levels have dropped approximately a tenth of an inch. The part of the plant sticking up above the container is beginning to brown & shrivel, but there is a very good root structure developing on the remaining plant.

4/8/18 7:56 am



Today is the final day of observation for this aquaponics system. Only one plant, the *Syngonium podophyllum* Schott, remains, two guppies, & approximately 100oz of water are in the container. The water has consistently become darker & dirtier throughout this experiment. The guppies' behavior can be adapted by adding water, removing plants, and by moving the container.



# Aquaponics

*1/9/18 to 4/8/18*

BI 131: Biology of Ordinary Things  
**Wartburg College Class of 2020**