Table of Content

1. Lit Review……pg 2
   - Introduction……..…..pg 2
   - About the Ketapang leave……..…pg 3
   - About the Fishes……....pg 6
   - Experiment Plans…….…...pg 11
   - Reflections……..…pg 13
2. Interviews..……..…….……pg 14
   - Interviews……...…pg 14
   - Interview Reflections…….……pg 18
3. Survey…….……..pg 19
   - Introduction……....pg 19
   - Survey Questions……...…pg 20
   - Survey Results……..……..pg 21
   - Survey Results Analysis……...….pg 41
4. Experiment……..…….pg 45
   - Apparatus……...pg 45
   - Budget……....pg 49
   - Variables……pg 50
   - Hypothesis……..pg 51
   - Experiment on the Betta Splenden…..…….……pg 52
   - Experiment on the Serpae Tetra……..……...pg 58
   - Experiment on the Apistogramma Agassizi……...pg 63
   - Experiment on Swordtails……..pg 72
   - Overall Conclusion……pg 80
5. Problems faced…….……pg 81
6. How we could have improved…….…pg 82
7. Our Personal Reflections……..pg 83
8. Acknowledgements……..pg 88

introduction

Singapore has an increasing number of fish hobbyists nowadays. It is a common sight in our homes. Be it young or old, Singaporeans have different reasons to breed fish.

People keep fish is that they have taken it up as a hobby, just like many teenagers have developed strong liking towards sports like basketball and soccer.

Some believe that keeping pets will help to relieve stress at school or work, which is very logical. By doing something that you enjoy, you will naturally lift pressure off your back.

Rich residents buy expensive and beautiful fish to brighten up their homes; superstitious people keep them in belief that it will bring them luck; old folks like to watch fish to help pass time.

As a group, all of us have also developed interests in fish and have become avid fish hobbyists. It has proven to be an addictive hobby and helps us to de-stress. Once you begin keeping fish, you will have a desire to keep more, as there is a wide variety of fish in the world. It is also a learning journey for hobbyists as we take opportunities to learn from mistakes.

For example, a common error for hobbyists is to neglect their fish when they are too caught up with their work. This may result in an epidemic breaking out within the tank, and not just do one or two fishes die, but many, and perhaps all of them. This teaches a lesson in life that we must be serious in whatever we do, and we must pursue to achieve or we will end up with nothing in the end.

If you are an experienced fish hobbyist, you woud surely come across South East Asia fishes, like Betta and the Dragon fish. One would surely have heard advice from experts to use Ketapang leaves to provide better conditions in your aquarium for these fishes. Many hobbyists heed this advice blindly, but not actually knowing what benefits the leaves bring them.

Therefore, as curious and learning students, we decide to pursue in an investigation to find out the effects of Ketapang leaves on freshwater fish. We have decided to test the effects on several commonly kept fish, namely the livebearer, betta, tetra and cichlid ‘families’. More specifically, we will be using the swordtail, betta splenden, serpae tetra and apistogramma agassizi.

Through this project, we hope to find out how these fascinating Ketapang leaves really improve conditions for freshwater fish.

about the ketapang leaf

Ketapang leaves are basically also known as the Indian Almond Leaf (Terminalla Catappa) The following are what we have came across on a site. However, we made special effort not to plagiarise.

The Effects of the Indian Almond Leaf on Bettas:

Firstly, the water in the tank would turn from yellow to brown. The changed water helps the Bettas heal wounds and ward off illnesses. Be careful, because it also makes the male more aggressive at breeding time.

On the other hand, it also helps the female recover from any wounds she receives during the breeding process. It is a source of energy for the fighting Betta and also, the acidity solution of these can help these fighters build up a thick coat of slim fast. This coating prevents the fish from toxic as well as from some parasite and bacteria in water.

Furthermore, it also helps to prevent Bettas from getting wounded when attacked by other Bettas.

Although experiments have already been carried out on the Betta, we will also experiment on it to see if we get the same results.

Disadvantages of the Indian Almond Leaf:

The Indian almond leaves are supposed to be in dry form; however, these leaves are not dried completely sometimes and thus, could contain bacteria and green moss.

When placed in water, a biological process turns bacteria into nitrate and the nitrate turns into poison. Some leaves may have also come from places with biological and chemical wastes and thus the leaf may be contaminated.

History of the Indian Almond Leaf:

Indian Almond leaves – the so-called Asian Breeding Secret Recipe which creates a natural environment and induces spawning. It is also known as ketapang leaf.

Most of the tropical fishes that live in rivers and lakes also live in black water which is their natural environment. Black water has a distinctive brownish tea-like colour and contains many dissolved organic materials. It was first noticed that fishes living around the water where the ketapang/Indian Almond trees grew were much more colourful and vibrant. Thus, people put the leave in the water to achieve the same results.

The ketapang/Indian Almond tree is a big 'pagoda-shaped' tree with distinctly tiered branching. The origin of the tree is in Malaysia and Thailand. A noted peculiarity of this species is the tendency for its leaves to turn bright red and fall - a rarity in the tropics where most trees remain evergreen throughout the year. The bark, fruit and leaves of the tree have traditionally been used to treat various ailments.

Science behind the Indian Almond Leaf:

The Ketapang/Indian Almond tree is known to produce a poison in its leaves and sap to defend against insect parasites. When the dried leaves falls into the river, a strong brown dye is given off. The dye is full of organic acids like humic and tannin. Thus, the dried Ketapang/Indian Almond leaves actually release organic acids like humic and tannins which lower the pH of the water, absorbs harmful chemicals and help create a soothing and calm environment for the fish.

What is Humic Acid?

Is it a mixture of several organic acids? Humic acids are a complex mixture of partially "decomposed" and otherwise transformed organic materials. The freshwater humic acids can come from a variety of sources, most of which are on land (decomposing terrestrial vegetation.) These substances wash into lakes and rivers, undergoing further transformations along the way, and ultimately into the ocean.

Humic acid contains Sulfur, Nitrogen and Phosphorus in varying amounts. It also contains metals such as Ca, Mg, Cu and Zn etc. Humic acid can be broken down into two

groups based on the polarity and size of the individual 'compounds'.

The smaller, more polar fraction is generally termed fulvic acid and the larger, more non-polar fraction is generally termed humic acid. Humic acids are the end product of microbial degradation of plant and animal debris and are one of the most important constituents of fertile soils.

Tannins, lignins and fulvic acids are sub classes of humic acids. They all tint the water yellow. Tannic and humic acids may be useful for inhibiting many types of bacteria including cyano-bacteria and are fairly benign for your fish.

Another paradoxical effect of humic acids is the detoxification of heavy metals. Humic material and detritus in the aquarium also rapidly absorb and detoxify many chemicals including zinc, aluminum and copper! One might expect them to be made more, not less toxic by humic acids, but the studies seem to indicate a detoxifying effect.

Also important to know: The harder the water the more ineffective the humic acids – more exactly: the dissolved lime in the water produces indissoluble calcium humates. So, the higher the water hardness, the higher must be the supply of humates in order to achieve an acidifying effect. The softer the water, the less humates are needed and the better the effect. It creates a natural environment similar to that of the lakes in the tropical rainforest and some area of the Amazon River. It also induces spawning for most soft water and acid loving fishes. Too much of the ketapang/Indian Almond leaves may result in too low a pH in the water and this may result in the killing of your fishes.

Sources (APA citation):

- (n.d.). retrieved Mar 03, 2004, from www.warriorbetta.com.

- yew, C. (n.d.). The gallery. retrieved Mar 03, 2004, from www.siamsbestbettas.com/gallery.html Web site: www.siamsbestbettas.com.

- c. (n.d.). Ketapang leaves and Black Water Extract. retrieved Mar 10, 2004, from Bettas Onli Web site: http://www.bettasonli.netfirms.com/article7.html.

about the Fishes

Below, we will be providing some information about the fishes that we will be using.

Swordtails

- Common name: Swordtail
- Scientific name: *Xiphophorous helleri*
- Found in: South America, South Mexico, Guatemala
- Size:
  - females can grow up to 4.5" (12cm)
  - males can grow up to 4" (10cm)

- Sexual Differences:
  - Males have a sword-like extension on the bottom of their tails
  - Males have gonopodiums (male fish copulatory organ)
  - Females do not have the sword-like exntension on the bottom of their tales
  - Females have rounder bodies
  - Females will have a spawning patch during the breeding period
- Feeding: This comes from personal experience. These fish are omnivorous, and eat both fresh and flake food.
- Water Chemistry:
  - Hardness: 1-30°dGH (moderately hard)
  - Acidity: pH 7.0-8.3 (fairly high)
  - Temperature: 64-82°F (18-28°C)
- Breeding: These fish, unlike many others, give birth to their youngs alive. Having a well-planted tank will result in more offsprings. From our observations, these plants help the baby fish to hide from their parents, which tend to eat their young.
- Others: Live in perfect harmony with each other and other types of fishes.

Serpae tetras

- Common name: Serpae tetra
- Scientific name: *Hyphessobrycon serpae*
- Also known as: Red Minor tetra
- Found in: Amazon river, Madeira and Guapore regions, upper Paraguay
- Size: can grow up to 1.75" (4cm)
- Sexual Differences:
  - Females are generally plumper than males (from general knowledge)

- Feeding: From personal experience again, these fish are omnivorous, and eat both fresh and flake food.
- Water Chemistry:
  - Hardness: 8-12°dGH (fairly hard)
  - Acidity: pH 6.5-7.0 (fairly high)
  - Temperature: 72-82°F (26-28°C)
- Breeding: Like many other tetras, the serpae tetra likes to lay its eggs in plants, especially those that are fine-leaved. It is typical of their specie to sometimes eat their eggs.
- Others: Are known as 'fin-nippers', but are not too aggressive in behaviour. Seem to be like 'friendly' nipping.

Apistogramma

- Common name: Apisto
- Scientific name: *Apistogramma agassizi*
- Found in: South America, Middle Amazon region
- Size:
  - Can grow up to 3" (7.5cm)
- Sexual Differences:
  - Males are distinctly more colourful
  - Males have a fin near its head that is longer than the females'
  - Females have rounder bodies
  - Females will have a yellow marking on her stomach during the breeding period
- Feeding: From our knowledge, this fish is carnivorous. Live food is best suited for it.
- Water Chemistry:
  - Hardness: 1-3°dGH (very soft)
  - Acidity: pH 6.5 to 7.0 (soft)
  - Temperature: 64-82°F (18-28°C)
- Breeding: These fish is a fish that take cares of its young by moving them in their mouth, they are therefore classified as mouth brooders. Having many caves in the tank will result in the fish having more choices of a breeding site.
- Others: Peaceful except for several periods, such as mating and spawning. Need more space to roam because cichlids are generally territorial fish.

Betta Splendens

- Common name: Fighting fish
- Scientific name: *Betta Splenden*
- Found in: South East Asia

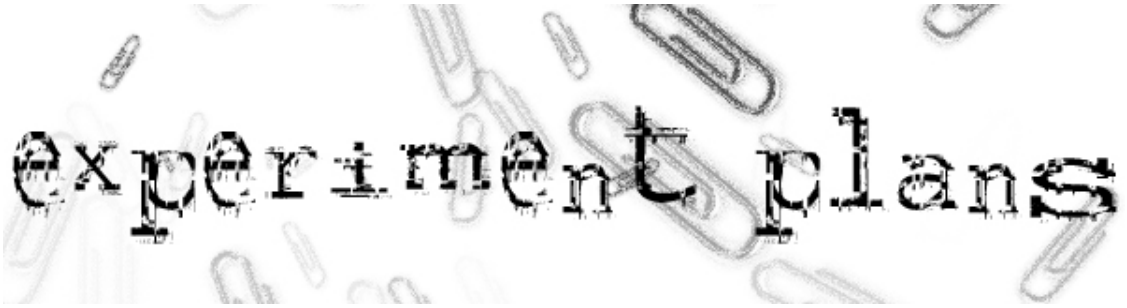
- Size:
  - females can grow up to 4” (10cm)
  - males can grow up to 3” (7.5cm)
- Sexual Differences:
  - Males are distinctly more colourful
  - Males generally have longer fins.
  - Females have rounder bodies
  - Females are less aggressive
- Feeding: This comes from personal experience. These fish are mainly carnivorous, live food is the best.
- Water Chemistry:
  - Hardness: 6-11°dGH (hard)
  - Acidity: pH 6.5 to 7.0 (relatively acidic)
  - Temperature: 22-30°C
- Breeding: This fish is very aggressive and will not tolerant another male. The male will build a bubble nest when he is ready. It will attach it to a floating plant or something else. The female will show plumpness when ready, showing that she is full of eggs. Most people put the female in a transparent container in the tank first as they need to familiarness so that sparring will be shortened. The male will embrace the female who releases a few eggs, the male will collect the eggs and blow them up into his nest. This act is repeated for a few hundred times, until the female is depleted of eggs. At this time it's best to remove the female and leave the male to take care of the eggs. He will replace any eggs that fall from the nest and guard the eggs from any threats.

Sources (APA citation):

- (n.d.). Apistogramma agassizi. retrieved Mar 11, 2004, from Tropical Aquariums: The home to tropical aquaria on the net Web site: http://homepages.tesco.net/~davyreynolds/fishindex/fish/A/apistogramma_agassizi.htm.

- (n.d.). animal-world.com. retrieved Mar 11, 2004, from Freshwater Fishes of the World Web site: http://animal-world.com/encyclo/fresh/characins/serpae.php, http://animal-world.com/encyclo/fresh/livebearers/swordtails.php.

- (n.d.). petfish.net. retrieved Mar 11, 2004, from Betta Basics Web site: http://www.petfish.net/bettabasics.htm.



Basically, we will be doing on 4 species, each being the best representative from their genres. We will be doing on Tetras, Livebearers, Bettas and Cichlids which are the common fishes that people see. We will have 3 set up for each species. One will be the control; one will be the one with the Indian almond leaves; and the last one with the tea leaves.

Basically, what we plan to do for each fish is to have three set-ups for the experiment. The first two set will have a group of the fish, ready to breed with an equal number of males and females (perhaps except for the Betta splenden, which its males will fight to death) with one Ketapang/Indian almond leaf inside and any other necessary items. The control will then have all the similar conditions and items, also with a pair of ready-to-breed fish but without the Ketapang/Indian almond leaf.

The need for two sets of the experiment and one control is essential since we want to be as accurate as possible. We would then observe the fishes daily and write up a logbook including the water conditions etc. Over a long period of time, we will continue the logbook and finally collate all the information into the final conclusion of the effects of the leaf. This would be the end of the experiment stage. The Scientific Method will be applied and throughout the experiment.

Each tank (one and a half feet, size may differ) will have:

1. A sponge filter powered by air
2. A thin layer of substrates
3. Some plants (plants may differ, or may be plastic plants)
4. Other (equipments differ from setup to setup due to each fishes' different breeding habits.)

Tetras: We will be doing on Serpae tetra which is easy to breed and is very common, it comes from acidic water and so we deduced that it will do well in tanks with Ketapang leaves. We will test to find out whether the leaves will have a positive effect on it, or be a safe, cheap alternative to commercial produce black water extract.

Setup: It will be the same as the above but with plants that are bushy. A group of the fish has to be kept together and fed live food before they pair up. The pair that is most healthy will be chosen and kept in the breeding tank for the experiment. It will be conditioned with live food and provided with rain water (it is pure and has no contamination), a drop in water level and temperature will be done to stimulate breeding.

Betta: We will be doing on Betta Splenden, the common fighting fish. This fish is easy to breed and represent the family well. It comes also from acidic water and so we hypothesise that it does well in water with Ketapang leaves.

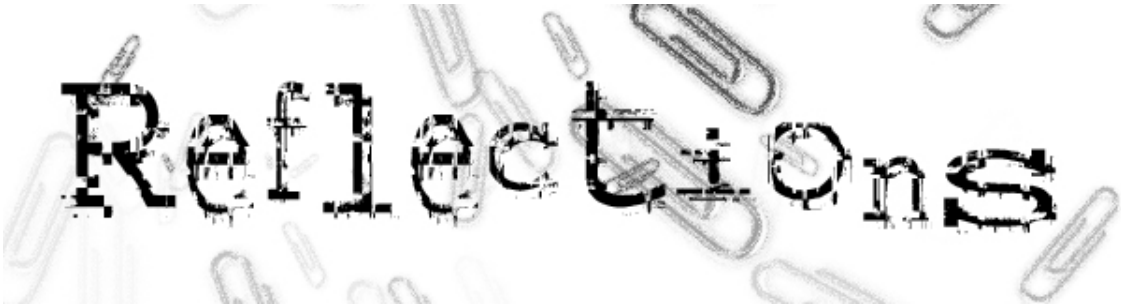
Setup: It will be the same as above but with extra floating plants to help the bubble nest be built. The filter will be operated at the lowest possible power or not runned at all as the fish require quiet water with no agitation. The pair will be kept together in the same tank but separated at first as the male need to be used to her. We will condition them till they show signs of interest in each others.

Cichlid: We will be doing on Apistogramma Agassizi. This species is the fish most beginners get. It comes from the South America, the Amazon which is famous for its acidic water. The fish may not come from South East Asia but we believed that the Ketapang leaves will benefit it, as from background information that we gathered, we found out that the leaves produce the same chemical that the river has, and those that stimulate breeding.

Setup: The tank will be slightly bigger than the rest as this fish is aggressive and require a large space. We will keep a pair in a one feet cube tank. We will feed them with live food to condition them. Broken small pots, wood and small length of pipe will be put into the tank as this fish form their next in such holes. The fish will be bought at mature size as they take quite a long time to mature.

Livebearer: The Swordtail will be used under this category. This fish is undoubtly one of the world's easiest and most common fish to keep. They usually do better in hard water, but we will be trying out whether the Ketapang leaves still benefit it or harm it.

Setup: The setup for the swordtail will be the simplest. We will follow the general setup for each tank. We will feed it with live food everyday.



As a group, we all fully agree that this topic was very well chosen since we all have excellent background and firsthand knowledge of how to rear fishes. We are all very interested in this topic and have thus chosen it to explore deeper and find the true effects of the leaf. Many people strangely call the Ketapang/Indian almond leaf the ‘magic leaf’. Thus, we embarked on this investigation to find out the true effects of it and what exactly is this “magic” that it produces.

Through this project, we will learn more about each other, how to work with others, and more importantly, more about ourselves. Although there will surely be some conflicts within the group, they are really opportunities for us to improve on ourselves.

We know that this project will prove to be a successful and interesting one and we hope that everyone will agree when they see the final product.

Interviews

***The following interviews were conducted through use of high technology, mainly computerised communication over an internet broadband system at Kennedy's house. The first interviewee was Mr. Ronnie, expert tropical fish hobbyist and breeder.**
Below are the conversations which took place.

Kennedy: Hi there Ronnie, we are of course here to ask you some questions regarding your expertise with the use of ketapang/Indian almond leaves. Tell us, How did you get to know about the ketapang leaves?

Ronnie: First time I heard of it was when I kept some bettas. That was when it was said to help prevent fungus in killie eggs, I decided to give it a try.

Kennedy: I see… When did you start using it?

Ronnie: With bettas, it was about 2 years ago. 1 year with killies.

Elton: Well… So far, do you think it has positive effects on fish? Please give some examples.

Ronnie: The tannin released seems to calm skittish fishes, probably because it cuts down the light level. The other might be a lower pH... their colors seem to be slightly more intense. Over-usage can drive pH to as low as 4.5!

Group: Wow …that's pretty awesome.

Xuan Lang: On what occasions do you use ketapang leaves?

Ronnie: Mostly with freshly collected eggs or to trigger some fishes to spawn (those that like it dark with low pH).

Aaron: Can you briefly explain to us how it affects the overall condition of your tank with regard to the water condition etc.?

Ronnie: Turns the tank dark! Water condition =turns tannic, low pH as said before.

Aaron: Can you also elaborate on any examples of which using ketapang leaves can be a disadvantage?

Ronnie: Okay… it's good for acidic loving fishes, bad for brackish species. Definitely not for mollies, platies, etc., or the swordtails you use.

Elton: If so, are there any ways to prevent these disadvantages?

Ronnie: Not sure but perhaps lengthy acclimatization can overcome lower pH?

Xuan Lang: We have heard of extracting the essence out of ketapang leaves. Do you mind sharing your views and opinions of it with us? Do you think it solves some of the problem of using ketapang leaves?

Ronnie: Well…I've only boiled and bottled the ketapang leaf 'brew' for later use. Not sure if that's what you mean by 'essence'. Solution can only meet half of what I require. As for anti-bacterial and anti-fungus properties, I can't say it works 100%. Will need to get to root of problem.

Elton: That marks the end of our interview with Mr. Ronnie. Thank you for taking your time off your busy schedule to complete this interview with us.

Kennedy, Aaron and Xuan Lang: Yes, Thank you very much.

Ronnie: You're welcomed and good luck with your project.

***The next interviewee was Mr. Zulkifli, moderator of online fish hobbyist forum, Aquatic Quotient, and expert tropical fish hobbyist and breeder.**

Kennedy: Hi Zulkifli, we are of course here to ask you a few questions regarding your expertise and experience with ketapang leaves. So… How did you get to know about the ketapang leaves?

Zulkifli: Through the fish forums such as arofanatics.com, aquaticquotient.com

Aaron: and when did you start to use it?

Zulkifli: About 1 month back…

Elton: So far, do you think it has positive effects on fish? Please give some examples.

Zulkifli: Erm… it helps to calm the fishes down and also helps in their spawning. E.g. for the species Aphyosemion australe - the lowering down of the pH by the ketapang leaves helps to boost the egg production. For water incubating of eggs - helps to prevent fungus of the eggs.

Xuan Lang: On what occasion do you use ketapang leaves?

Zulkifli: Only for breeding purposes – and only for those species whose biotope is slightly acidic. Also use it in water when incubating the eggs of certain killifish species.

Kennedy: Can you briefly explain to us how it affects the overall condition of your tank with regard to the water condition etc.?

Zulkifli: It gives water a yellowish/brownish tinge, which effectively dims the tank. The

pH is also reduced which is good for certain species of fishes.

Aaron: Are there any examples of which using ketapang leaves can be a disadvantage?

Zulkifli: With regards to fishes, not sure. But leaving the leaves inside the tank causes the leaves to rot. At the same time, can be difficult to control the pH.

Xuan Lang: Are there any ways to prevent these disadvantages?

Zulkifli: Yes, brewing the leaves can do it.

Elton: We have heard of extracting the essence out of ketapang leaves. Do you mind sharing your views and opinions of it with us? Will it solve the problems of using ketapang leaves?

Zulkifli: Yes, by brewing them, it helps to solve the problem of the leaves rotting inside the tank, which can be difficult to remove. Yes, it helps to solve the problem as mentioned before.

Xuan Lang: And now we come to the end of the interview. Thank you for taking your time off your busy schedule to complete this interview with us.

Our Reflections for Interview:

Before our interviews were conducted, we all understood the importance of an interview. It was to basically understand the different perspectives that experts had and to get their opinions. We also knew that with that one or two extra information, it would open new doors for us to explore and understand.

We would like to comment that the interviews went rather smooth. The interviewees shared their expertise with us and were open with their answers. There was not a hint of disruption throughout the processes.

After the interviews were carried out, everyone in the group felt that we had learnt much more. The interviewees were extremely helpful and understand, providing us with knowledge in this area of their expertise. We were really grateful toward them and overall, we actually enjoyed the time corresponding with the interviewees.

Survey

Introduction:

After deciding on the survey questions, we gained the permission of the moderators of 2 online forums for fish breeders, aquaticquotient.com and killies.com, and posted the survey on the websites on 21-4-04. We figured out that to survey experienced fish hobbyists would be better towards our finding of this project, rather than the opinions of people who have not heard of the leaf at all, and cannot offer us any useful information.

After 4 days, we had collected 16 responses in all, 5 from aquaticquotient and 11 from killies. However, from thereafter, we hardly got any more replies to the posts.

Hence, we decided to look for more forums to post them on, ending up with two more, namely petfrd.com and bettaclub.org.sg. From 27-4-04 to 5-5-04, we collected 20 more responses altogether, 9 from petfrd.com and 11 from bettaclub.org.sg. By that date, we had already received a total of 36 replies to the four posts.

Overall, we felt everything went quite smooth except for the fact that some of the website servers were down occasionally. Everyone who participated was extremely helpful, and many wished us good luck with our project. By the end of this project we plan to thank them all for helping us out.

Here are the URLs to the forums:

- Killies.com - http://www.killies.com/forum/viewtopic.php?t=786
- Aquaticquotient.com - http://www.aquaticquotient.com/phpBB2/viewtopic.php?t=17791
- Petfrd.com - http://www.aquaticquotient.com/phpBB2/viewtopic.php?t=17791
- Bettaclub.org.sg - http://www.bettaclub.org.sg/forum/topic.asp?TOPIC_ID=2410

[By the way, the surveys were posted under Kennedy's name because we used his accounts to log in to the forums.]

Survey Questions

Hi everyone, I am Kennedy Ng from Raffles Institution. We are doing an experimental project and we hope sincerely that you would take some time off your busy schedule to complete this survey. Thank you very much. Moderators, I hope you would allow this, but if you don't then please don't hesitate to remove it.

Survey target: For users and people who have heard of the Ketapang/Indian Almond Leaf only

Hi, we are Teo Xuan Lang, Elton Yeo, Kennedy Ng and Aaron Teoh from class 2H of Raffles Institution and we are doing a project on the 'Effect of Ketapang leaves on Freshwater Fishes'. We are now conducting a survey for users of the Ketapang/Indian Almond leaf or people who have heard of it. We really hope that you'll participate.

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes/No

2. Have you used the Ketapang/Indian Almond leaf before?
Yes/No

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
Yes/No

4. How much do you know about it?
a) To a large extent
b) Average
c) To a small extent

5. Do you know the scientific reason behind its effectiveness?
Yes/No

6. Do you think the leaf has good effects on the following fishes?
a) Livebearers (we are using swordtails in our experiment) Yes/No/Don't know
b) Betta Splendens Yes/No/Don't know
c) Apistogramma agassizi 'super red' Yes/No/Don't know
d) Tetra (we are using the serpae tetra) Yes/No/Don't know

Thank you for participating in our survey!
If there are any inquiries, please contact us at kennedy_ng29@hotmail.com.

Survey Results

Results from Aquatic Quotient:

(URL: http://www.aquaticquotient.com/phpBB2/viewtopic.php?t=17791)

1:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Maybe

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Yes

2:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) Yes
b) Yes
c) Don't know
d) Yes

3:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
No

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Don't know

4:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
Yes

4. How much do you know about it?
Average

5. Do you know the scientific reason behind its effectiveness?
Probably

6. Do you think the leaf has good effects on the following fishes?
a) No, at least not for swordtails
b) Yes
c) Yes
d) Yes

5:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
VERY EFFECTIVE

4. How much do you know about it?
a) To a large extent

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Don't know
d) Yes

Results from Killies.com:

(URL: http://www.killies.com/forum/viewtopic.php?t=786)

1:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes, I've heard of the *ketapang* leaf before.

2. Have you used the Ketapang/Indian Almond leaf before?
Yes, I've used it before.

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
My question to you would be, *effective* in what sense? *Ketapang* leaves don't work for ALL freshwater fishes.. (think African Rift Lake cichlids.. get it?)

4. How much do you know about it?
a) To a large extent.

5. Do you know the scientific reason behind its effectiveness?
Yes, I do know the reason.

6. Do you think the leaf has good effects on the following fishes?
a) No.
b) Yes.
c) Yes.
d) Yes.

2:

1. Have you heard of the Ketapang/Indian Almond leaf before?
yes

2. Have you used the Ketapang/Indian Almond leaf before?
yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
No, some fish just don't like what ketapang do to the water (like the Betta simplex from lime stone stream.)

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) no
b) yes
c) yes
d) yes

3:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
No because the environments which fish live in differs from species to species.

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
I think it is because the Ketapang Leaves acidify the water. Also, it makes the water murkier which simulate the natural habitats of certain fish.

6. Do you think the leaf has good effects on the following fishes?
a) No
b) Yes
c) Don't know
d) No

4:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes (and also in combination with Peat tea)

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
Yes (but guppies and mollies don't seem to like it. Could be that water became too acidic)

4. How much do you know about it?
c) To a small extent

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) No
b) Yes
c) Don't know
d) Yes

5:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
I don't know how the Ketapang affect the water but I will use it when my fishes are uncomfortable after a change of water.

4. How much do you know about it?
c) To a small extent

5. Do you know the scientific reason behind its effectiveness?
No, but I guess ketapang leave are used to bring down the ph level in the water.

6. Do you think the leaf has good effects on the following fishes?
a) don't know
b) don't know
c) don't know
d) don't know

6:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
No

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
No, the freshwater fishes varies from softwater fishes to hardwater fishes. The effect of the ketapang leaves is to soften the water.

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) No
b) Yes
c) Yes
d) Yes

7:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on freshwater fishes?
No - same as others

4. How much do you know about it?
b) Average (organic acid + some doubtful herbal effect...)

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Yes

8:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
No. It creates a soft acidic condition prevalent in rainforest streams, also known as blackwater streams (not really black but brown, and it is clear not murky). Some fishes lives in alkaline condition e.g. water fed from limestone formation and these do not like soft acidic conditions.

4. How much do you know about it?
a) To a large extent

5. Do you know the scientific reason behind its effectiveness?
Yes (to be verified scientifically), the humic acid and other "natural goodness" simulates the natural water conditions found in streams that are covered by rainforest canopies, which has a thick leaf litter from the canopy above.

6. Do you think the leaf has good effects on the following fishes?
a) No (but swordtails are bred on farms and may not be a good experimental subject as they are conditioned to farm water)
b) Yes
c) Yes - I think so
d) Yes - most tetra comes from South American blackwater systems

9:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
This I am not so sure because ketapang leaves not only used to soften the water but it's also use as medicinal purposes. I have not use them on all freshwater fishes since all of the fish I rear are acidic based. Perhaps an experiment could be done if it were to be used on alkaline based fishes not to soften the water but as a medicinal remedy for sick or diseased sticken fishes.

4. How much do you know about it?
a) To a large extent

5. Do you know the scientific reason behind its effectiveness?
Yes. My answer will be the same as others.

6. Do you think the leaf has good effects on the following fishes?
a) yes
b) yes
c) yes
d) yes
(ketapang leaves to me is used as medicinal purposes.)

10:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Not really. (I wonder any scientist did a research on it?)

6. Do you think the leaf has good effects on the following fishes?
a) Yes
b) Yes
c) Yes
d) Yes

11:
1. Have you heard of the Ketapang/Indian Almond leaf before?
yes

2. Have you used the Ketapang/Indian Almond leaf before?
yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
no, some fish do not like the acid in the leaves.

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
yes

6. Do you think the leaf has good effects on the following fishes?
a) no (if you have very soft water)
b) don't know
c) don't know
d) yes (the tetras that I have black shirt,neon,bleeding heart,serpae...)

Results from Petfrd.com:

(URL: http://www.petfrd.com/forum/showthread.php?s=&threadid=7412)

1:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
No

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
No... I've only heard of it being used for bettas (fighting fish)

4. How much do you know about it?
c) To a small extent

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Don't know
d) Don't know

2:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Yes

3:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes. If no, why does it not affect all freshwater fishes and only a specific group.
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Don't know
d) Don't know

4:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes. If no, why does it not affect all freshwater fishes and only a specific group.
No. I assume some cichlids don't like acidic water

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Don't know

5:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Don't know

6:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
No

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Of course, everything has an effect on everything, perhaps you should ask is it beneficial for all freshwater fishes, which I think it's not beneficial for all freshwater fishes. Because it release humid acids which drops ph, and some freshwater fishes; for instance African rift lake cichlids, prefers higher ph conditions.

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) No (Depends on which type of livebearers and the type of water they live in, there are livebearing killifishes from the acidic waters of the Amazon, and there are livebearing killifishes from alkaline waters of lake Malawi. In this case it isn't good for swordtails, cause swordtails prefer waters with higher ph.)
b) Yes
c) Yes
d) Yes

7:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Not all. Some fishes prefers more alkaline water.

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Don't know
d) Don't know

8:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
No, some fish may not have evolved with much fallen leaves in its waters.

4. How much do you know about it?
c) To a small extent

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Don't know
c) Don't know
d) Don't know

9:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?

4. How much do you know about it?
Average

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) No
b) Yes
c) Yes
d) Yes

Results from Bettaclub.org.sg:

(URL: http://www.bettaclub.org.sg/forum/topic.asp?TOPIC_ID=2410)

1:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think its effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average
5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Yes
d) Yes

2:

1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
No

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) don't know
b) yes
c) yes
d) don't know

3:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think its effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
yes

6. Do you think the leaf has good effects on the following fishes?
a) don't know
b) yes
c) don't know
d) don't know

4:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it’s effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) don’t know
b) yes
c) don’t know
d) don’t know

5:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think its effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
No

6. Do you think the leaf has good effects on the following fishes?
a) don't know
b) yes
c) don't know
d) don't know

6:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes
2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Don't know
d) Don't know

7:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think its effective on all freshwater fishes?
Don't know

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
no

6. Do you think the leaf has good effects on the following fishes?
a) Don't know
b) Yes
c) Don't know
d) Don't know

8:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
no

6. Do you think the leaf has good effects on the following fishes?
a)Don't know
b)yes
c)Don't know
d)Don't know

9:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes
2. Have you used the Ketapang/Indian Almond leaf before?
No

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Don't know.

4. How much do you know about it?
c) To a small extent

5. Do you know the scientific reason behind its effectiveness?
Yes (assuming it is effective)

6. Do you think the leaf has good effects on the following fishes?
a) don't know
b) don't know
c) don't know
d) don't know

10:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
Yes

4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
Yes

6. Do you think the leaf has good effects on the following fishes?
a)Don't know
b) Yes
c) Don't know
d) Don't know

11:
1. Have you heard of the Ketapang/Indian Almond leaf before?
Yes

2. Have you used the Ketapang/Indian Almond leaf before?
Yes

3. Even if you have or have not used it, do you think it's effective on all freshwater fishes?
not really effective on all freshwater fishes. not all fishes are accustomed to low acidity levels caused by the release of acids from the brown pigment of ketapang. in addition, effectiveness also depends on the ketapang dosage.

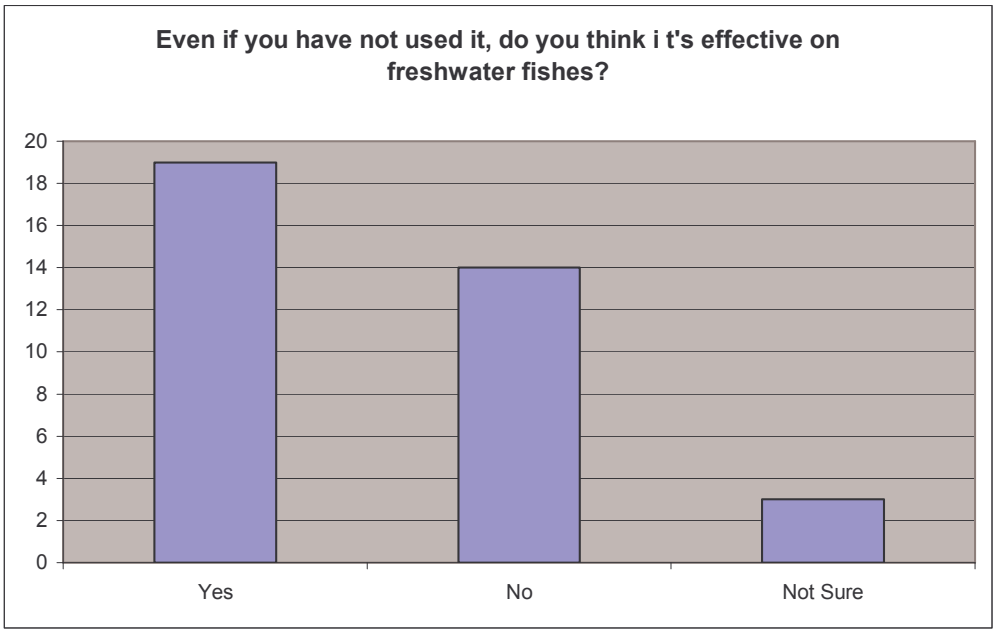
4. How much do you know about it?
b) Average

5. Do you know the scientific reason behind its effectiveness?
yes

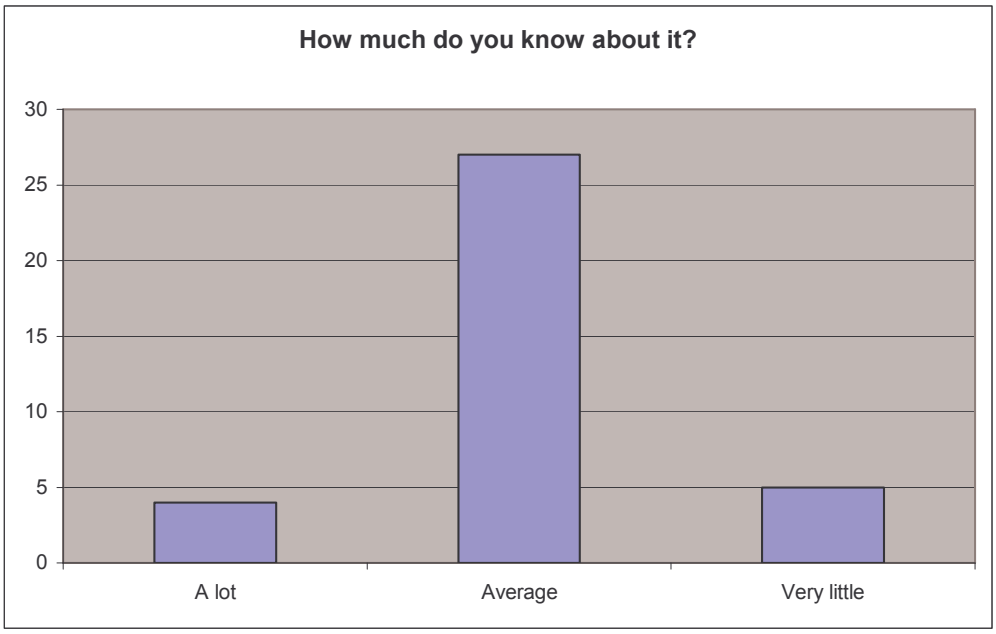
6. Do you think the leaf has good effects on the following fishes?
a) yes
b) yes
c) don't know
d) don't know

Survey Results Analysis:

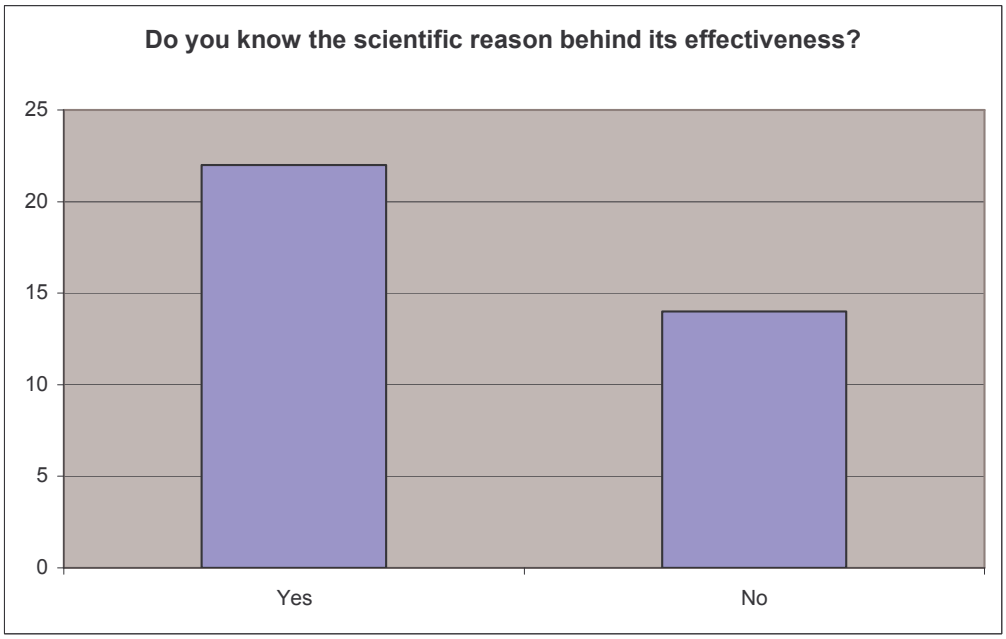
Q1. 100% of the people surveyed have heard of the ketapang leaf. We expected this result as the forums we had posted the survey on were patronized by experienced fish hobbyists.



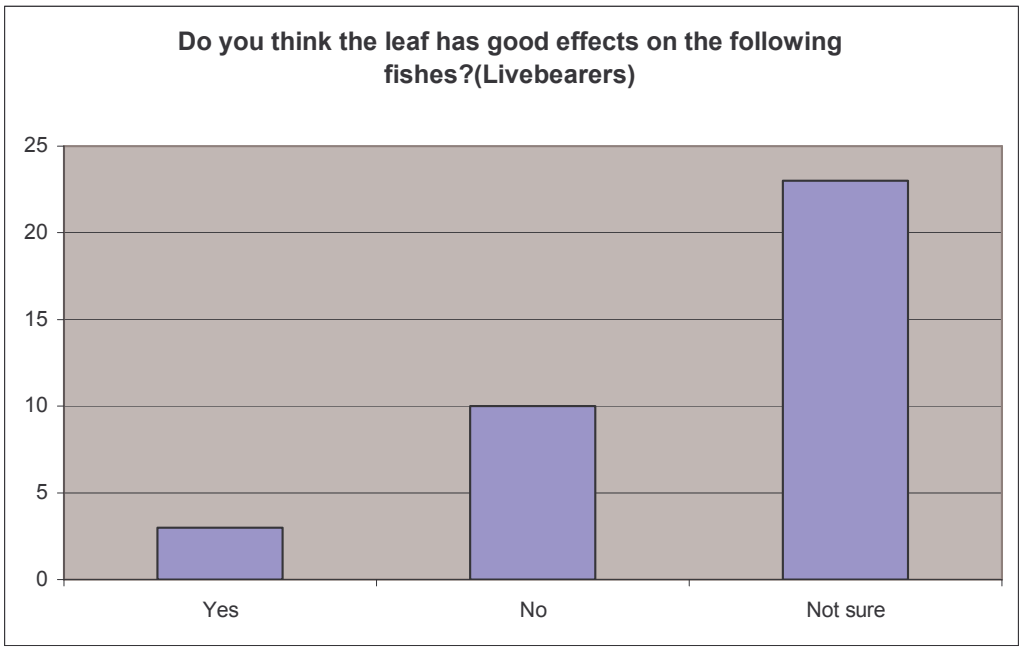
Q2. The results show more than half of the people feeling that ketapang leaves are useful to all tropical fishes. The people who said 'no' stated that some fishes are sensitive to the leaves and may not get use to it, but from our results we have shown that those fishes which are supposed to react badly to the leaves actually reacted better.



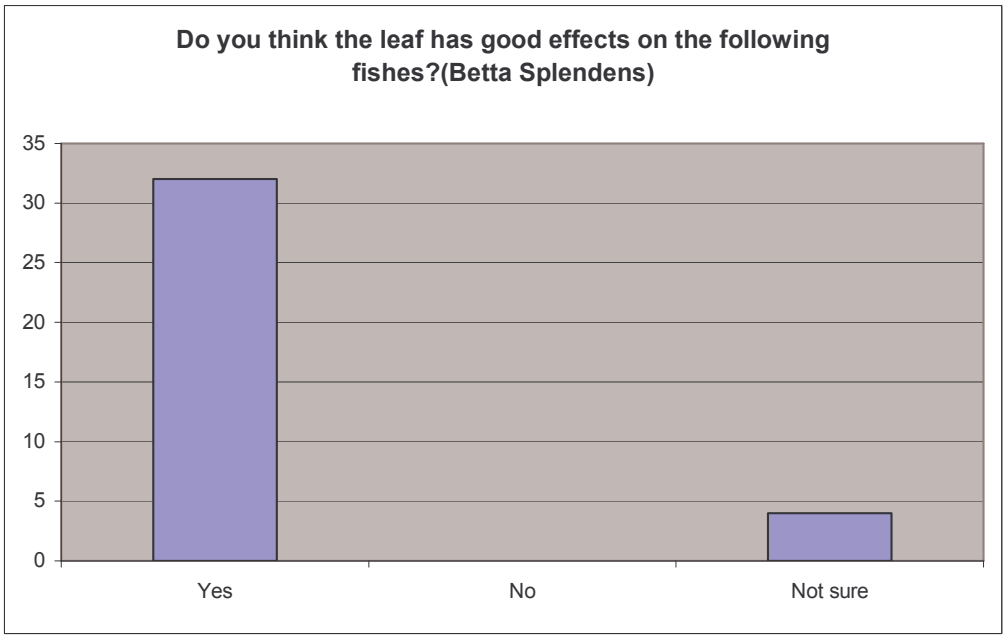
Q3. One of our reasons for conducting this experiment is that we felt that many people use ketapang leaves but do not know a lot about it, and that is why we wanted to gather results to show the community. From the above graph, we can tell that most people only know average amount of information about the leaves. Information like how it would strain the water and so on.



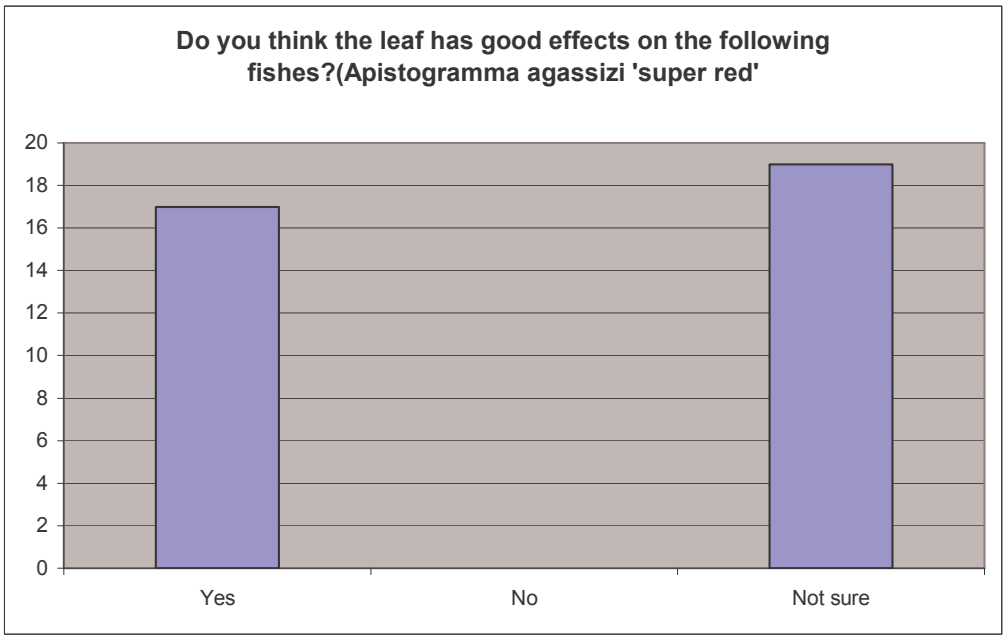
Q5. More than half knows about the scientific reasons, but almost half of the people are also not sure about able the scientific reasons. This shows the need for us to show the community the reasons.



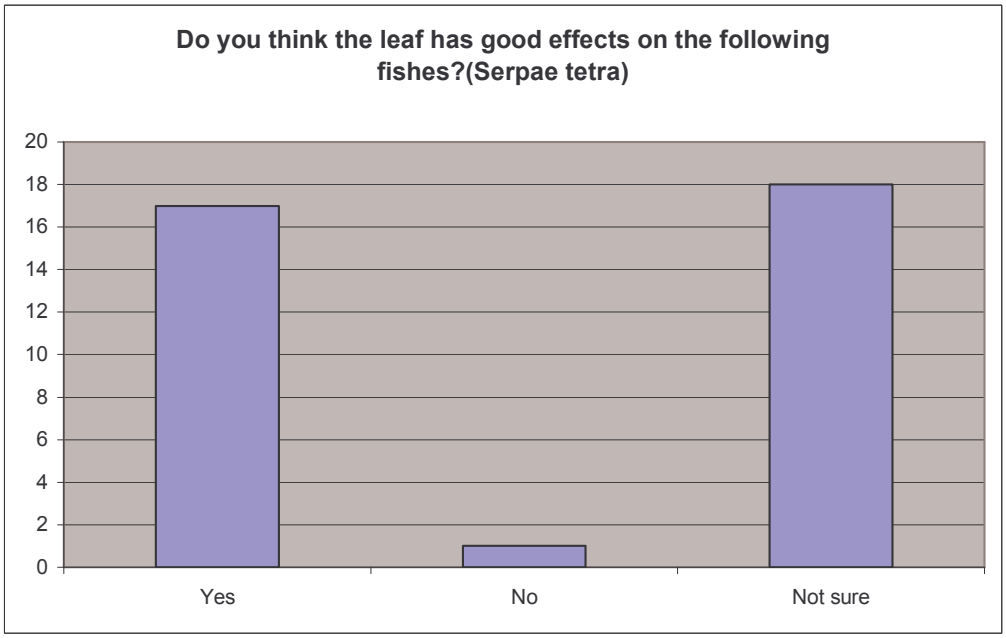
Q6a. Nearly ¾ of the people are not sure of whether it is useful. This proved our statement that many are not sure some of its properties. The outcome of the experiment will be shared presented in a different part of the report, but contrary to those who said 'no', the outcome is good.



Q6b. Ketapang leaves had always been the one of the most essential thing that all betta keeper need. It provides the most natural and soothing condition for the fish. It is not surprising that most people chose 'yes'.



Q6c. Apistogramma requires a slightly acidic condition to thrive in. the ketapang leaves is able to provide that, so about half of the people chose ‘yes’. But more than half of the people, chose ‘not sure’, this proves that there is a need for this experiment.



Q6d. Serpae tetra is found from the Amazon River. The amazon river pH varies from very low (3) to slightly acidic of (6.5). Therefore, Serpae tetra will do well in an acidic condition. The ketapang leaves will lower the pH. As with the previous graph many are not sure, and thus show the need of the experiment.

Experiment

Apparatus (equipment/items used):

Air pump:

The air pump we use is known as the 'Mouse M-104'. In usage of the air pump, it has to be placed on a shelf or other support system above the aquarium water level. It is not to be oiled at any time, and the plug is to be disconnected immediately should the pump fall into the water in case of electrocution. Air tube has to be cleaned or replaced regularly to obtain maximum air outlet and longer life.

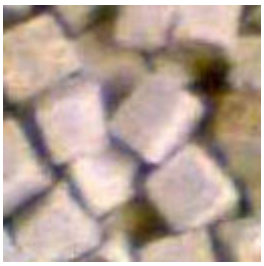
Filter:

The filter we used is known as the 'Ocean Free Mini Star Filter'. Before use, it is to be rinsed under runny water. Then, a rubber hose is to be attached from the air pump to the filter. Next, the filter is placed at a corner of a tank, and the air pump has to be above water level before switching on the power point. The filter consists of 5 parts:

1. Top cover
2. Filter wool
3. Suction inlet bay
4. Gravel weight
5. Bottom cover

Food:

The swordtail, serpae tetra and betta splenden were fed a tablet of dried shrimp meat (as shown in the picture) once a day.



As for the apistogramma agassizi, we fed it frozen tubifex worms, as this specie of carnivorous fish prefers to eat live food.

Tank:

The tanks used for the experiments measured 58cm (length) by 24cm (breadth) by 30cm (height). There was 13920cm³ of water in each tank, which is one-third of the total capacity of the tank. White Styrofoam was placed under the tanks so that colour changes can be observed more clearly. Each experiment would have either 2 tanks (1 containing leaves and the other not) or 3 tanks (2 containing leaves and the last not).

The tanks for the swordfish, due to the fact that they were outdoors, were covered up by plastic sheets so that sunlight would not enter and promote the growth of algae.

Two leaves of similar sizes were picked out and a pair would be put into each of the 3 tanks.

Java moss was introduced to the tank. It is an extremely easy to keep plant which can provide shelter for the fish's offsprings.

Immediate observations:

As soon as the leaf was added to the tank, the water was clear and there was no change in colour as yet.

After 3 hours, the water turned yellow.

Making observations:

We used the pH kit to measure the pH value of the water. This, shown in the picture, is the pH tester. It is a yellow substance which changes upon coming in contact with either acidic or alkaline solutions.

The other component of the pH kit is this container. It is used to contain the solution which we are going to test. In this case, we put water up to the 5cm mark before testing it.

The container has a hole in its cap such that the pH testing liquid can be dripped into it.

When the cap of pH tester is removed, it reveals a dropper which allows the liquid to drip out carefully.

Each tank also had an aquarium thermometer. Basically, these thermometers were stuck to the wall of the fish tank using a rubber suction pad (as seen in the picture). The thermometer has a temperature range of 10ºc to 40ºc. The temperature of the water of each tank is taken during feeding time unless otherwise stated.

Budget

1. Fish (all 4 species) -$29
2. Air Pump (x1) -$6
3. Air tube (3 meters) -$1
4. Partition (x1) -$4
5. Pots (x4) -$10
6. Java moss -$2
7. Filters (x4) -$10
8. Sand (1 bag) -$7
9. 3 Test kits -$21
10. Food -$5
11. Thermometers (x4) -$10

Total: $105
Average for each of the 4 members: $26.25 ($26.50 if rounded off to the nearest $0.50)

Conclusion:

In this experiment, one of the major factors we had to overcome is the cost. We knew that the tanks and equipment would not be cheap. We had to try and get the cost down as much as possible. We tried to use old equipment and of course getting discount from shops. Luckily, some of us have been in the hobby for a long time and we know the shop owner quite well. We used tanks that were not in use that saved considerable amount, as they was quite expensive. We got the pumps, tubes, sand and filter at one of our classmates' uncle shop. The shop owner was nice, and said that since we were doing a project, he would give us some discount. We got the moss from an aquatic plant farm. Although it was very far, the stuff were dirt cheap and we profited from this. The pH kit was gotten from the shop near Kennedy's house.

$26.50 per member is a rather reasonable cost. After all, a field trip to anywhere would probably have cost us just as much. This project will take us on an educational journey in pursuit of new knowledge. Money does not matter much to us, its our passion for this project, although of course we try to minimize the cost. If you must argue that money *does* matter, well, in this case it is put to good use as we will reap the fruits of our hard work and sacrifices from what we put in.

Variables

In an experiment, only the necessary variables are to be changed. What is a variable? It is a factor that is likely to vary; something that is subject to variation. The rest are to be kept constant, so that the results will be as accurate as possible. We had made careful considerations before carrying out the experiment as to which factors were to be changed and which kept constant.

Basically, the following variables were kept constant:

- Location of fish tanks
- Amount of sunlight each tank is exposed to
- Type of water (tap water) used
- Amount of water in each tank
- Temperature of water used
- Type of plants used
- Amount of plants in each tank
- Type of gravel (used in the Apistogramma agassizi tanks)
- Amount of gravel in each tank
- Number of fishes in each tank
- Condition of fishes (at the start of the experiment)
- Type of food fed
- Amount of food fed
- Time of feeding
- Number of Ketapang leaves (in each of the tanks which are supposed to contain it)
- Condition of Ketapang leaves (at the start of the experiment)
- Size of Ketapang leaves

As for the variables that have been changed, there is only one, which is the presence of Ketapang leaves in the tanks. In an experiment, it is necessary to have a control set-up. The control acts as a standard against which other conditions can be compared in a scientific experiment. Therefore, this control set-up does not contain the ketapang leaves.

Hypothesis:

A hypothesis, broken down into simpler words, would be a tentative theory. In the Scientific Process, the first step for us to take would be to hypothesize before carrying out our experiments. Therefore, we can then prove if we have made a correct statement or a wrong one.

Firstly, we hypothesize that the Betta Splenden, or normally known as the common fighting fish, would benefit from the use of Ketapang leaves. We base this hypothesis on our knowledge that the Betta Splenden originates from places with acidic water. Ketapang leaves, as we have heard, causes water to become more acidic. Therefore, the fish would then do well in the water with the leaves.

Secondly, we hypothesize that the Ketapang leaves will also help the Serpae tetra. From contextual knowledge, the Serpae tetra comes from soft, acidic water. Therefore, with the presence of the leaves, the fish will grow healthier.

Thirdly, we hypothesize that the Ketapang leaves will once again do the Apistogramma Agassizi good. (The Apistogramma Agassizi is a breed of cichlids.) It comes from the Amazon, which is widely known for its acidic water. Therefore, once more, these fish will also benefit from the effect of the leaves.

Lastly, we hypothesize the the Ketapang leaves will not affect the Swordtails much. These fish usually do better in hard water; hence there may not be many effects of the leaves on them. However, we do not believe that the leaves will have negative effects on the fish.

In conclusion, we believe that the Ketapang leaves will benefit the Betta Splenden, the Serpae tetra and the Apistogramma Agassizi, but not the Swordtails.

Experiment on the Betta Splenden:

Day	Feeding time	*Acidity (pH)	Temperature (°c)	Brief Comments:
1st May	3:45pm & 9pm	Same for Both Tanks (pH of 7)	27 – taken at 3:45pm	Overall condition of fishes well.
2nd May	4:05pm & 9pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	28 – taken at 4:05pm	There is an obvious change in pH value.
3rd May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	25.5 – taken at 6:30pm	The leaf is starting to show full characteristics. Slight tinge of brown in water.
4th May	4:30pm & 10:00pm	Tanks with leaf: 6 Tank w/o leaf: 7	25 – taken at 4:30pm	Colour change more obvious in tank with leaf now.
5th May	3:30pm & 10:00pm	Tanks with leaf: 6.5 Tank w/o leaf: 7.5	26 – taken at 3:30pm	Colour in tank is darker brown. Fishes are doing well.
6th May	3:45pm & 9pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	26 – taken at 3:45pm	Have taken out the leaf as prolonged usage would lead to rotting.
7th May	6:00 am & 6:30pm	Tanks with leaf: 6.5 Tank w/o leaf: 7.5	25.5 – taken at 6:30pm	Male Betta has built bubble nest for tank with leaf. Seems that it is ready for action!
8th May	4:30pm & 10:00pm	Tanks with leaf: 6 Tank w/o leaf: 7	25 – taken at 4:30pm	The male in tank without leaf has started its bubble nest.
9th May	5:30pm & 10:00pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	25 – taken at 5:30pm	The females are reacting well to the enticement of the males.
10th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26 – taken at 6:00pm	Signs of sexual arousement. May breed in following week.
11th May	3:30pm & 10:00pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	27 – taken at 3:30pm	Fish in tanks with leaf seems to be growing better, active behaviour.
12th May	6:00 am & 6:30pm	Tanks with leaf: 6.5 Tank w/o leaf: 7	26 – taken at 6:00pm	I have taken out the dividing plate. Fishes can begin process of breeding.
13th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	25 – taken at 6:00pm	I can now see the definite difference in the tanks with and without the leaf.

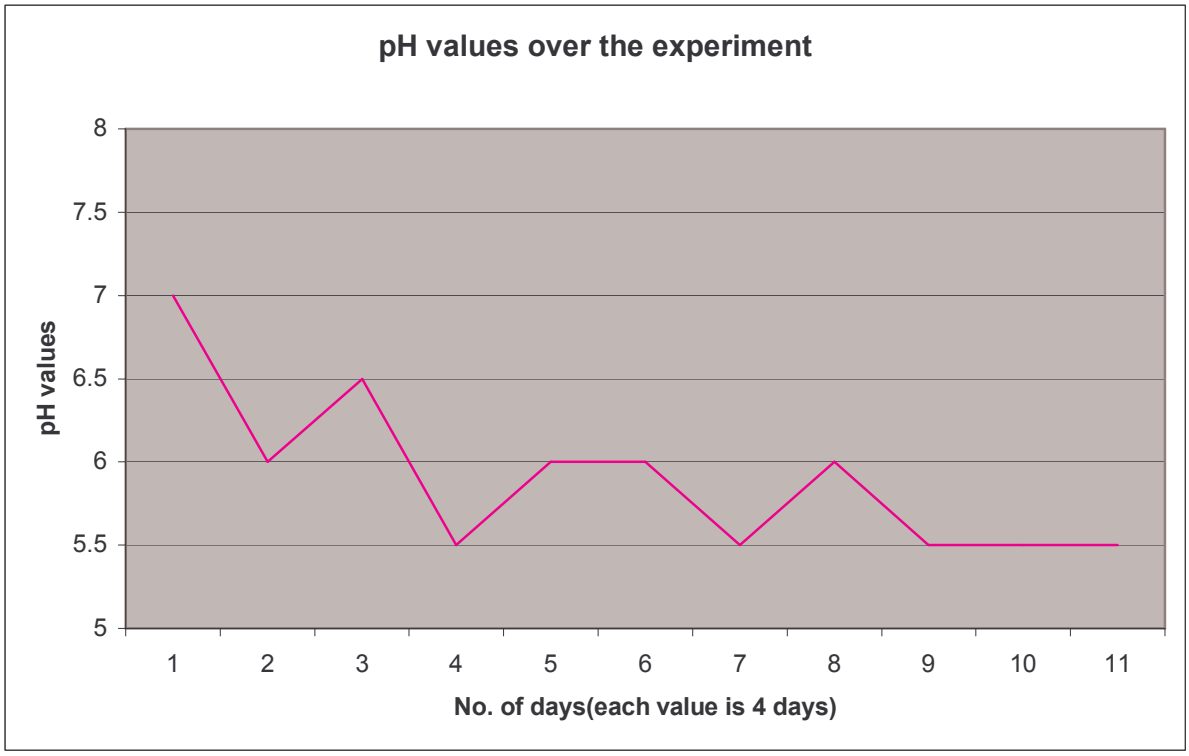
14th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26 – taken at 6:00pm	The Fishes in both tanks have bred if I am not wrong. The females are badly worn out and they have been transferred out. The male will take care of the eggs.
15th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	26 – taken at 6:00pm	*I made an additional change for the females, some were put in a tank with leaves while the others in normal water. I would like to observe the change.
16th May	6:00 am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	25.5 – taken at 6:00pm	The males are vigilant in their care. *Females in tank with leaves are recovering faster.
17th	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26 – taken at 6:00pm	I have made preparation for new fishes. Not much change. *Females in tank with leaves are doing better.
18th May	3:30pm & 10:00pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	27 – taken at 3:30pm	Not much change.
19th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26.5 – taken at 6:00pm	The male in the tank with leaves seems to be having problems. However, I believe it had nothing to do with the leaves whatsoever and is an external case.
20th May	6:00 am & 6:30pm	Tanks with leaf: 6.5 Tank w/o leaf: 7.5	25.5 – taken at 6:00pm	The males are fine. Development going well. *Females near normal conditions.
21st May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26 – taken at 6:00pm	Not much change.
22nd May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	25.5 – taken at 6:00pm	Eggs have hatched.
23rd May	6:00 am & 6:30pm	Tanks with leaf: 6.5 Tank w/o leaf: 7.5	25.5 – taken at 6:30pm	Hatchlings are free swimming, am feeding them infusoria.
24th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	25.5 – taken at 6:00pm	I am conducting very slight water changes to not harm the fishes. The fishes are doing well.

25th May	6:00 am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	27 – taken at 6:30pm	Male in tank with leaf is already more active.
26th May	6:00 am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	28 – taken at 6:30pm	Change in temp. due to heat.
27th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	28 – taken at 6:30pm	Have taken out male. Fries are doing well on raw egg yolk too, said to be nutritious.
28th May	6:00 am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	27 – taken at 6:30pm	I am a bit inexperienced in taking care of betta fries. Some have died in the tanks.
29th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26 – taken at 6:30pm	I am more accustomed to the features and needs of the fries. Soon, we will be able to tell the difference.
30th May	6:00 am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	24 – taken at 6:30pm	There is now a slight distinction between the male fries and female fries. The males are more aggressive. The fries in tank with leaves are really progressing faster.
1st June	3:30pm & 10:00pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	25 – taken at 6:30pm	I have placed the males into separate tanks with leaves and without leaves to further prove the effects of the leaf.
2nd June	3:30pm & 10:00pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	25.5 – taken at 10:00pm	The males in both tanks have surprisingly recovered after one day. Did not see which appeared better first.
3rd June	10:00am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7.5	26 – taken at 6:30pm	The fries are doing well and I am following a guide to help me out.
4th June	11:30am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	25.5 – taken at 6:30pm	The fries are showing colour. There is indeed a difference in the growth rate with most of the fries in the tank with a leaf being bigger than the others.
5th June	11:30am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	26 – taken at 6:30pm	Not much change.
6th June	11:30am & 8:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	27 – taken at 8:30pm	The fries are now fed brine shrimps.

7th June	1:00pm & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	26 – taken at 6:30pm	I have separated the males into different jars. There are not much left. However, it is not the amount of fishes, rather it is the effects which I have observed that are important.
8th June	11:30am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	28 – taken at 6:30pm	The fries are doing well.
9th June	11:30am & 6:30pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	26 – taken at 6:30pm	Not much change.
10th June	11:30am & 7:30pm	Tanks with leaf: 6 Tank w/o leaf: 7.5	26.5 – taken at 6:30pm	The fries are growing much bigger now. Reaching a few centimeters.
11th June	11:30am & 7:30pm	Tanks with leaf: 6.5 Tank w/o leaf: 7.5	27 – taken at 7:30pm	Fries in tanks with leaves have a more distinct colour and are growing exceptionally well.
12th June	9:30am & 8:00pm	Tanks with leaf: 5.5 Tank w/o leaf: 7	28 – taken at 8:00pm	No change.
13th June	9:30am & 8:00pm	Tanks with leaf: 6 Tank w/o leaf: 7	26.5 – taken at 8:00pm	Fishes are doing well now.
14th June	11:30am & 6:30pm	Tanks with leaf: 6.5 Tank w/o leaf: 7.5	26 – taken at 6:30pm	Fishes are doing well now.
15th June	11:30am & 6:30pm	Tanks with leaf: 6 Tank w/o leaf: 7	25.5 – taken at 6:30pm	End of experiment. It is a success.

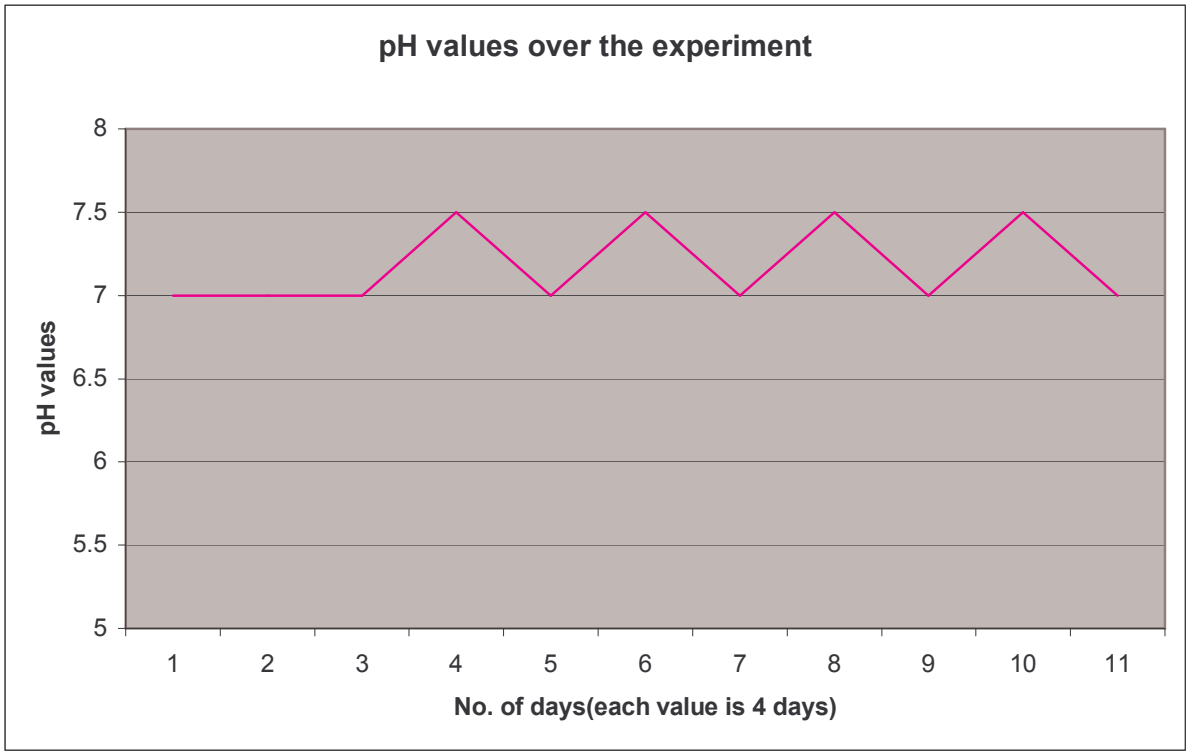
*I rounded off my pH values to the nearest 0.5.

With Ketapang leaves



My pH values were noted down and rounded off to the nearest 0.5, hence explaining the zig-zag trend. However, on the overall, we can tell that the pH value gradually falls. With inference to the pH values of the water in the tank without the Ketapang leaves, we can conclude that the Ketapang leaves lower the pH of water.

Without Ketapang leaves



In the first few days, the pH of the water remained at 7. After that, it changed slightly, ranging between pH 7.5 and 7.

Personal Conclusion for Betta Species

After observing the above results, I can thus conclude that the ketapang leaves are very effective on the betta species. I can tell that from the fact that there was/were:

- Faster growth in fries.
- Faster recovery for injured fishes.
- Faster and easier breeding with fishes.
- Healthier and more active fishes.

I can also see that it acts as a stimulant during courtship for the fishes. It seems to induce spawning behavior and also enhance the coloration of the courting pair. I personally feel that it is a wonderful natural product which assists fish hobbyists all over the world. Our hypothesis has been proven correct.

Experiment on the Serpae Tetra

Day	Feeding time	Acidity (pH)	Temperature (ºc)	Comments
1st May	6:30am and 5:30pm	Tank with leaves: 7.6 W/o leaves: 7.7	27ºc 28ºc	Tank newly set up.
2nd May	6:30am and 5:30pm	Tank with leaves: 7.4 W/o leaves: 7.6	27.5ºc 28ºc	Water still cloudy. The fishes showing signs of stress
3rd May	6:30am and 5:30pm	Tank with leaves: 7.1 W/o leaves: 7.6	28ºc 28ºc	The water cleared up. The water in Tank A is starting to turn brown.
4th May	6:30am and 6:30pm	Tank with leaves: 6.7 W/o leaves: 7.6	27ºc 28ºc	The fishes are starting to be not so stressed. They are eating well.
5th May	6:30am and 5:30pm	Tank with leaves: 6.6 W/o leaves: 7.7	26ºc 28ºc	The fishes in Tank A have better colour than those that are in Tank B. They seemed to be adapting quickly.
6th May	3:30am and 9:30pm	Tank with leaves: 6.5 W/o leaves: 7.7	27ºc 27ºc	The fishes are eating well.
7th May	6:30am and 10:00pm	Tank with leaves: 6.4 W/o leaves: 7.6	27.5ºc 28ºc	The fishes are doing well.
8th May	6:30am and 6:30pm	Tank with leaves: 6.3 W/o leaves: 7.6	28.5ºc 28ºc	The fishes in Tank A are showing signs of breeding. The male is starting to chase the female around.
9th May	6:30am and 6:30pm	Tank with leaves: 6.2	27ºc	The fishes are doing well.

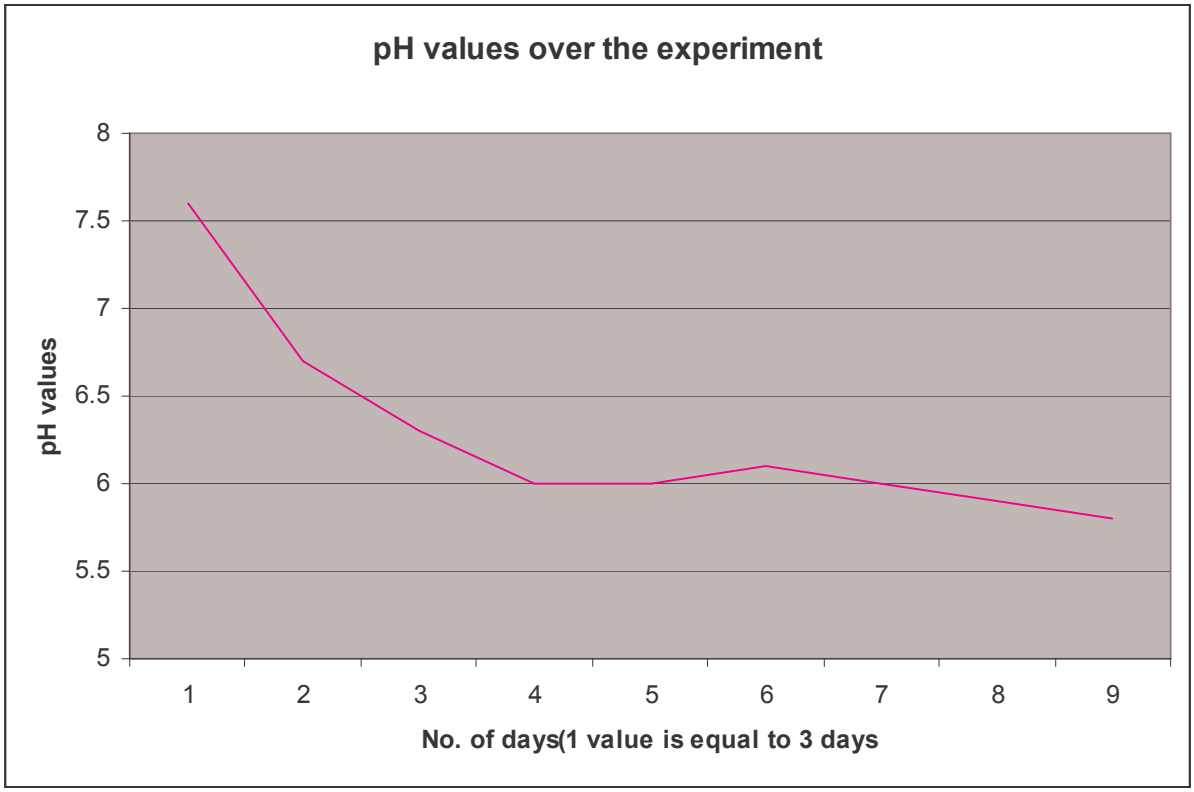
		W/o leaves: 7.5	28ºc	
10th May	6:30am and 10:00pm	Tank with leaves: 6.2 W/o leaves: 7.5	26ºc 28ºc	The fishes are not frightened anymore when someone approaches the tank. They seemed to have gotten used to the tank
11th May	6:30am and 6:30pm	Tank with leaves: 6.1 W/o leaves: 7.6	26.5ºc 28ºc	The fishes in both tanks are now showing signs of breeding.
12th May	3:30am and 9:30pm	Tank with leaves: 6.1 W/o leaves: 7.6	27ºc 28ºc	The females are round with eggs, but we are not sure when will it be laid.
13th May	6:30am and 10:00pm	Tank with leaves: 6.1 W/o leaves: 7.5	27.5ºc 28ºc	No new changes observed.
14th May	6:30am and 10:00pm	Tank with leaves: 6.0 W/o leaves: 7.6	27ºc 28ºc	No new changes observed.
15th May	3:30am and 9:30pm	Tank with leaves: 6.0 W/o leaves: 7.7	28ºc 28ºc	No new changes observed.
16th May	6:30am and 5:30pm	Tank with leaves: 6.0 W/o leaves: 7.7	29ºc 28ºc	The female in Tank A seemed to have laid the eggs, but we didn't see any eggs. We suspect the fishes ate them up.
17th May	6:30am and 10:00pm	Tank with leaves: 6.1 W/o leaves: 7.6	28.5ºc 28ºc	The same thing happen in Tank B, but we saw a couple of eggs.
18th May	4:00pm and 9:00pm	Tank with leaves: 6.1	27ºc	No new changes observed.

		W/o leaves: 7.6	28ºc	
19th May	6:30am and 5:30pm	Tank with leaves: 6.0 W/o leaves: 7.6	28ºc 28ºc	The females fishes seemed to be getting round again.
20th May	4:00pm and 9:30pm	Tank with leaves: 6.0 W/o leaves: 7.6	27ºc 28ºc	The females have some torn fins.
21st May	3:30am and 9:30pm	Tank with leaves: 5.9 W/o leaves: 7.6	27.5ºc 28ºc	The female in Tank A seemed to heal faster than the one in Tank B.
22nd May	4:00pm and 9:00pm	Tank with leaves: 5.9 W/o leaves: 7.6	26.5ºc 28ºc	The female in Tank A had completely healed, but the one in Tank B did not.
23rd May	3:30am and 9:30pm	Tank with leaves: 5.9 W/o leaves: 7.7	28ºc 28ºc	No new changes observed.
24th May	6:30am and 5:30pm	Tank with leaves: 6.0 W/o leaves: 7.5	27ºc 28ºc	The females seemed to be ready to breed again.
25th May	6:30am and 5:30pm	Tank with leaves: 6.0 W/o leaves: 7.5	28.5ºc 28ºc	The males are chasing the females again.
26th May		Tank with leaves: 6.0 W/o leaves: 7.6	29ºc 28ºc	The female in Tank A laid the eggs. This time we added a mop and they laid some of the eggs there. We collected some of the eggs.
27th	3:30am and	Tank with leaves:	27ºc	The fries hatched.

May	9:30pm	5.9 W/o leaves: 7.7	 28ºc	
28th May	6:30am and 6:30pm	Tank with leaves: 5.8 Tank with leaves: 7.6	27ºc 28ºc	End of experiment

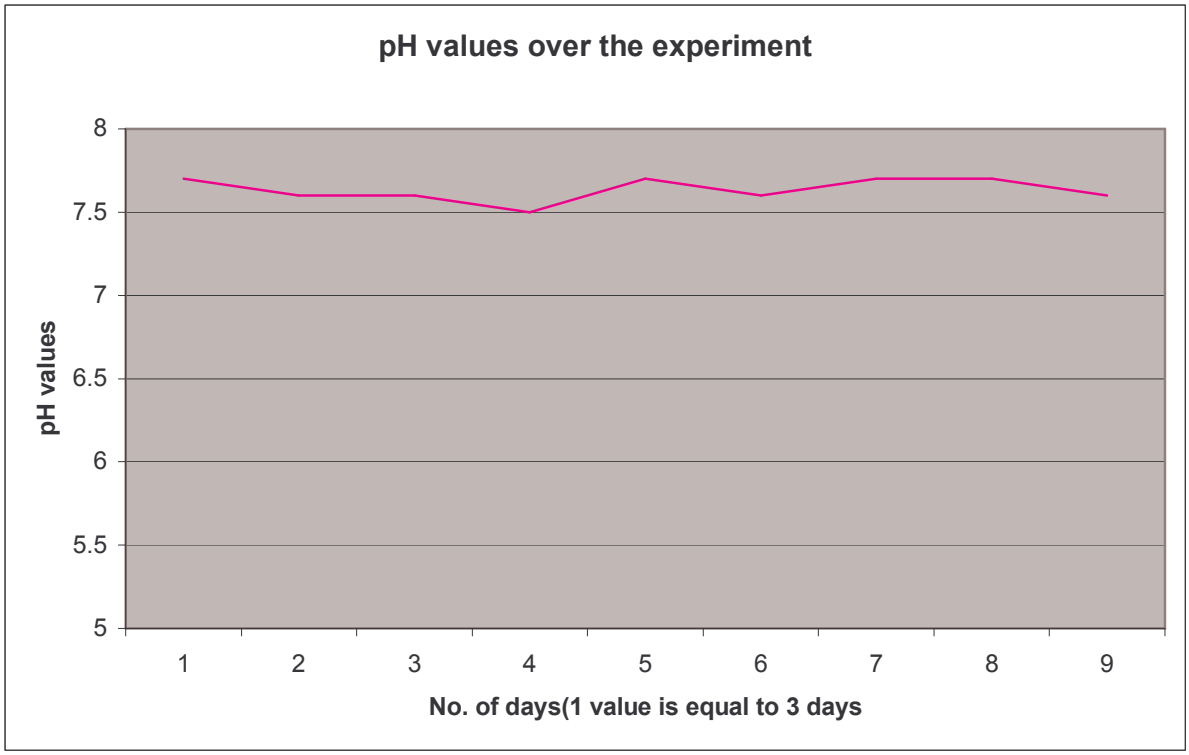
Tank A= Ketapang leaves
Tank B= No Ketapang leaves

With Ketapang leaves



As we can read from the graph, there is a sharp drop of the water's pH at the beginning of the experiment. I believe this applies to all the of the tanks containing Ketapang leaves.

Without Ketapang leaves



The pH of the water in the tank not containing Ketapang leaves lingered between the pH 8 and pH 7.5 mark. Most of it is towards the pH 7.5 mark.

Personal Conclusion for Serpae Tetra

After observing the above results, I can thus conclude that the ketapang leaves are effective on the Serpae Tetra. Effects observed are:

- Fishes are more calm
- Fishes have better colour.
- It helps them adapt to changes
- Helps fishes breed better

Experiment on the Apistogramma Agassizi:

Day	Feeding time	Acidity (pH)	Temperature (°c) (taken at feeding time)	Comments
1st May	Nil	Tank with leaves: 7.2 W/o leaves: 7.1	27 28	The tank was just newly set up. Water is cloudy due to the layer of gravel. The fish colours are not very nice and they showed signs of stress. Ketapang leaves were added already for one tank
2nd May	6pm (fed very little)	Tank with leaves: 7.0 W/o leaves: 7.1	27 28	The tank water is still cloudy, but it had clear up a little. The Apisto are eating sparingly. The fish colours are still not very nice and they are still showing signs of stress. The colour of the water is slightly brownish for the tank with Ketapang leaves
3rd May	5.30pm (fed very little)	Tank with leaves: 6.7 W/o leaves: 7.1	27 28	The water as cleared up significantly. The fish colours are starting to show up for the ones with Ketapang leaves and showing less signs of stress. The colour of the water is even more brownish.
4th May	6pm (fed very little)	Tank with leaves: 6.6 W/o leaves: 7.2	26 27	The water had cleared up. The fish colours are showing up more in the tank with Ketapang leaves. The colour of the water is even more brownish. The fishes ate very greedily for both tanks.

5th May	6pm	Tank with leaves: 6.6 W/o leaves: 7.2	27 28	The water is clear and the fish colours are improving with each passing day---Although the ones with Ketapang leaves were more intense. The colour of the water is very brown by now. The fishes ate greedily for both tanks
6th May	5pm	Tank with leaves: 6.5 W/o leaves: 7.1	26 28	The water is clear for both tanks. The fish colours improved for both tanks especially the one in the Ketapang leaves tank. The male had started flaring towards the female, showing signs of breeding. The colour of the water is very brown.
7th May	4 pm	Tank with leaves: 6.5 W/o leaves: 7.1	28 27	The water is clear for both tank(If I do not mention cloudy water, it means there is clear water) The water is brown for the tank with Ketapang leaves(I will not mention this anymore) The males started flaring at each other, and the females are showing yellow bellies, which means they are going to breed. The fish with Ketapang leaves have more intense colour.
8th May	4.30pm	Tank with leaves: 6.4 W/o leaves: 7.1	28 27	The fishes bred. I went to buy brine shrimps to prepare for the arrival for the fries.
9th May	4.30pm	Tank with leaves: 6.3 W/o leaves: 7.2	27 27	The Ketapang leaves started to rot. I kept it in there to see how would it affect the fishes.

10th May	3pm	Tank with leaves: 6.3 W/o leaves: 7.2	27 27	The Ketapang leaves had started to disintegrate. The fishes in the tank with Ketapang leaves bred. There were some eggs spotted
11th May	3pm	Tank with leaves: 6.4 W/o leaves: 7.2	28 26	The frys had hatched but due to disturbance by me, some of the frys were eaten up. The pair in the non-Ketapang tank is doing well.
12th May	3.30pm	Tank with leaves: 6.2 W/o leaves: 7.3	26 26	The surviving hatchlings are free swimming; I am feeding them infusoria. The females in both tanks have suffered some fin injuries.
13th May	3.30pm	Tank with leaves: 6.2 W/o leaves: 7.3	26 27	The female in the tank with Ketapang leaves seems to already start healing. The pair in the non-Ketapang leaves bred.
14th May	3pm	Tank with leaves: 6.1 W/o leaves: 7.3	26 27	The female in the tank with Ketapang leaves seemed to be almost healed of her fin injury, while the other female recovery is not as fast. Some eggs were noticed to have fungus going on it in the other tank(There was no fungus growing on the eggs with Ketapang leaves)
15th May	3pm	Tank with leaves: 6.1 W/o leaves: 7.3	25 26	The female in the tank with Ketapang leaves had recovered. The other one has almost healed. Those eggs with fungus were noticed to disappear. From our research, the parents would eat those eggs.

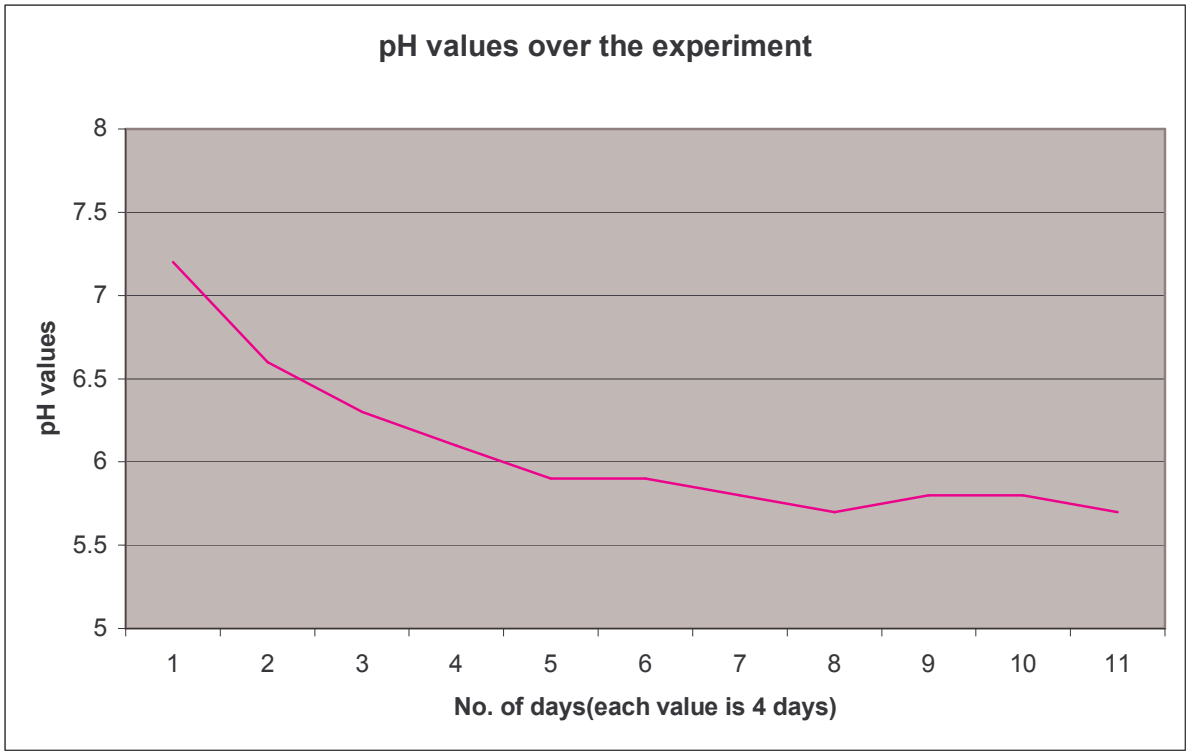
16th May	3.30pm	Tank with leaves: 6.0 W/o leaves: 7.3	25 26	The eggs have hatched. The previous batch of frys has grown bigger, with some death. I have begun feeding them with brine shrimp.
17th May	3.30pm	Tank with leaves: 6.0 W/o leaves: 7.2	26 25	No significant changes was observed
18th May	4pm	Tank with leaves: 6.0 W/o leaves: 7.2	27 25	I have begun to feed the latest batch of frys with brine shrimp.
19th May	5pm	Tank with leaves: 5.9 W/o leaves 7.2	27 26	The previous batch of frys have grown to about 2 cm already, while the other batch have grown to about 1 cm. The parents are doing well.
20th May	4p	Tank with leaves: 5.9 W/o leaves 7.2	27 26	The frys are going well and so are their parents. The Ketapang leaves have rotted till only the stem remains.
21st May	4pm	Tank with leaves: 5.9 W/o leaves: 7.1	27 26	Due to my inexperience of handling frys, a few died today.
22nd May	3pm	Tank with leaves: 5.8 W/o leaves 7.2	25 26	All the fishes are doing well.
23rd June	5pm	Tank with leaves: 5.9 W/o leaves 7.1	26 26	No significant change is observed.

24th June	4pm	Tank with leaves: 5.9 W/o leaves 7.0	27 26	The pair in the tank with Ketapang leaves seems to be ready to breed again.
25th June	5pm	Tank with leaves: 5.9 W/o leaves 7.0	26 26	The frys from the previous batch had grown about 5cm, while the other batch have grown to a size of 2cm. The first batch is starting to show some colours.
26th June	3.30pm	Tank with leaves: 5.8 W/o leaves: 7.1	26 25	There is difference in growth rate between the frys. The ones with the leaves grow faster than the other batch.
27th June	7pm	Tank with leaves: 5.8 W/o leaves: 7.1	27 26	The fishes are doing well.
28th June	7pm	Tank with leaves: 5.7 W/o leaves: 7.2	28 27	The pair in the tank with Ketapang leaves has bred again.
29th June	6pm	Tank with leaves: 5.7	26 27	Strangely, all the eggs seemed to be disappeared. I guessed the pair had eaten them up
30th June	7.30pm	Tank with leaves: 5.7 W/o leaves: 7.2	27 27	I can already began to tell the difference in sex between some of the bigger frys.
31st June	7pm	Tank with leaves: 5.7 W/o leaves: 7.2	26 28	No significance changes noted.

1st June	7pm	Tank with leaves: 5.8 W/o leaves: 7.2	28 27	No significance changes noted.
2nd June	6pm	Tank with leaves: 5.8 W/o leaves: 7.1	26 26	No significance changes noted.
3rd June	5.30pm	Tank with leaves: 5.8 W/o leaves: 7.1	25 26	All of the frys in the first batch sex could be noticed.
4th June	5pm	Tank with leaves: 5.7 W/o leaves: 7.2	26 26	Fries in tanks with leaves have a more distinct colour and are growing exceptionally well.
5th June	5.45pm	Tank with leaves: 5.7 W/o leaves: 7.2	26 25	The fishes are growing well.
6th June	6pm	Tank with leaves: 5.8 W/o leaves: 7.1	24 27	The fishes are growing well.
7th June	5pm	Tank with leaves: 5.8 W/o leaves: 7.2	25 26	The leaves have rot till there is not any trace of it left.
8th June	5pm	Tank with leaves: 5.8 W/o leaves: 7.2	25 26	Some frys in the younger batch went missing. Reason maybe because the older frys ate the younger ones up.

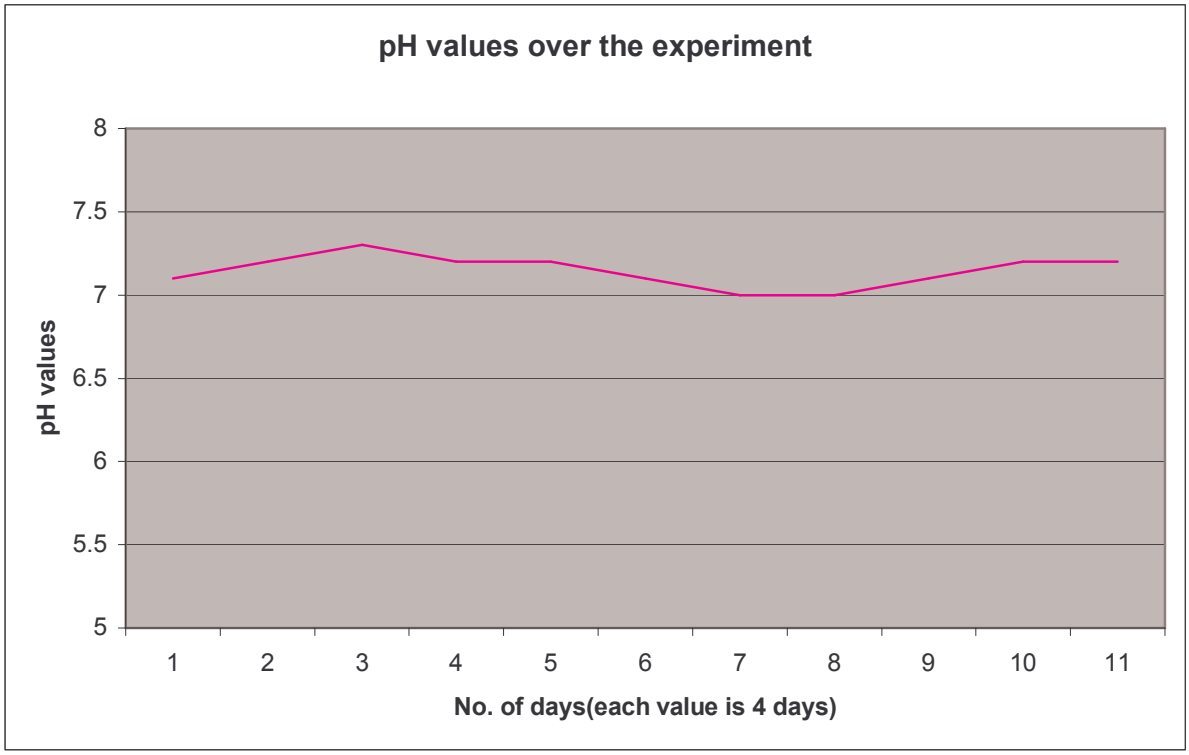
9th June	5.25pm	Tank with leaves: 5.7 W/o leaves: 7.2	25 27	The fishes are growing well.
10th June	5.45pm	Tank with leaves: 5.7 W/o leaves: 7.2	26 27	The fishes are growing well.
11th June	5pm	Tank with leaves: 5.8 W/o leaves: 7.2	26 26	The frys from the previous batch had grown about 6.5cm, while the other batch had grown to a size of 3cm.
12th June	6pm	Tank with leaves: 5.7 W/o leaves: 7.2	25 27	For the older batch, I can tell clearly the sex.
13th June	6.15pm	Tank with leaves: 5.7 W/o leaves: 7.2	25 26	For the younger batch, I can tell some of the older frys sex.
14th June	5pm	Tank with leaves: 5.8 W/o leaves: 7.2	25 26	No new changes observed.
15th June	5pm	Tank with leaves: 5.8 W/o leaves: 7.2	26 26	End of experiment.

With Ketapang leaves:



As we can notice the steepest drop in pH was at the beginning. That was when the Ketapang leaves released the most tanic acid. Slowly, it began to give out lesser. In the end, the ketapang leaves rot and therefore the pH stabilized.

Without Ketapang leaves:



The value was relatively constant, as there was no other media to affect the pH. The minor changes could be due to change in carbon dioxide level and so on. (Carbon dioxide level in water affect the pH)

Personal Conclusion for Apistogramma Species

After observing the above results, I can thus conclude that the ketapang leaves are effective on the Apistogramma species. Effects observed are:

- Fishes are more calm
- Fishes have better colours.
- They eat much better
- It helps them adapt to changes
- Act as a prevention of diseases, seemed to inhabit the growth of fungus
- Acts as a stimulant to breed.
- Provide a natural environment.

Experiment on Swordtails:

Day	Feeding time	Acidity (pH)	Temperature (°c)	Comments
1st May	5:00pm	Tank with leaves: 7.6 W/o leaves: 7.7	27 28	The fish appear to be slightly stressed and are not used to the environment. Do not eat the food fed.
2nd May	5:00pm	Tank with leaves: 7.5 W/o leaves: 7.6	27 28	The food fed yesterday has been eaten up. The fish in the tanks with Ketapang leaves settle down more quickly than those without. They hide under these leaves, whereas the fish without the leaves hide either under the java moss or huddled in a corner. They still refuse to in the presence of anyone. The colour of the water turns to a distinct brown.
3rd May	5:00pm	Tank with leaves: 7.4 W/o leaves: 7.6	26 27	Same as the previous observation, but the fish in the tanks with Ketapang leaves are warming up to seeing me. The fish in the tanks without the leaves still show signs of stress.
4th May	5:00pm	Tank with leaves: 6.9 W/o leaves: 7.6	26 26	The females in one of the tank (now named tank A) containing Ketapang leaves show signs of pregnancy. (large belly)
5th May	5:00pm	Tank with leaves: 6.8 W/o leaves: 7.7	26 26	Signs of pregnancy are observed in the other two tanks. (Tank B will be the one with Ketapang leaves and tank C the one without.) The fish in the tanks with Ketapang leaves are not very afraid of me any more, but are startled by sudden movements. The fish without Ketapang leaves somehow seem to hide behind the filter frequently.

6th May	5:00pm	Tank with leaves: 6.7 W/o leaves: 7.7	27 26	The fish in tanks A and B are growing more active. Meanwhile, those in C dwell at the bottom of the tank while they huddle together in fear when they notice me. Overall, they are less active.
7th May	5:00pm	Tank with leaves: 6.7 W/o leaves: 7.6	27 26	Nothing new observed.
8th May	5:00pm	Tank with leaves: 6.7 W/o leaves: 7.6	27 26	As observed from feeding, the fish in C are less frightened than before.
9th May	5:00pm	Tank with leaves: 6.6 W/o leaves: 7.5	28 26	Fish in tanks A and B have seemingly better appetite. Hardly any food remains are left behind, while small food remains can be seen left behind in C.
10th May	5:00pm	Tank with leaves: 6.6 W/o leaves: 7.5	27 27	Nothing new observed.
11th May	5:00pm	Tank with leaves: 6.5 W/o leaves: 7.6	28 27	Nothing new observed.
12th May	5:00pm	Tank with leaves: 6.6 W/o leaves: 7.6	28 28	Nothing new observed.
13th May	5:00pm	Tank with leaves: 6.5 W/o leaves: 7.5	27 28	So far so good, the fish are doing well.

14th May	5:00pm	Tank with leaves: 6.5 W/o leaves: 7.6	28 27	The bottoms of tanks A and B are littered with fish droppings. It appears that the fish have been feeding on the Ketapang leaves as well. Tiny holes have been observed on the leaves.
15th May	5:00pm	Tank with leaves: 6.5 W/o leaves: 7.7	27 27	The leaves seem to be thinning.
16th May	5:00pm	Tank with leaves: 6.4 W/o leaves: 7.7	27 27	Nothing new observed.
17th May	5:00pm	Tank with leaves: 6.4 W/o leaves: 7.6	26 27	Nothing new observed.
18th May	5:00pm	Tank with leaves: 6.5 W/o leaves: 7.6	26 27	Nothing new observed.
19th May	5:00pm	Tank with leaves: 6.4 W/o leaves: 7.6	26 27	Nothing new observed.
20th May	5:00pm	Tank with leaves: 6.4 W/o leaves: 7.6	26 26	Apparently the leaves are beginning to decompose, but very slowly.
21st May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.6	25 26	The colour of the leaves seems to have faded, though almost unnoticeable.

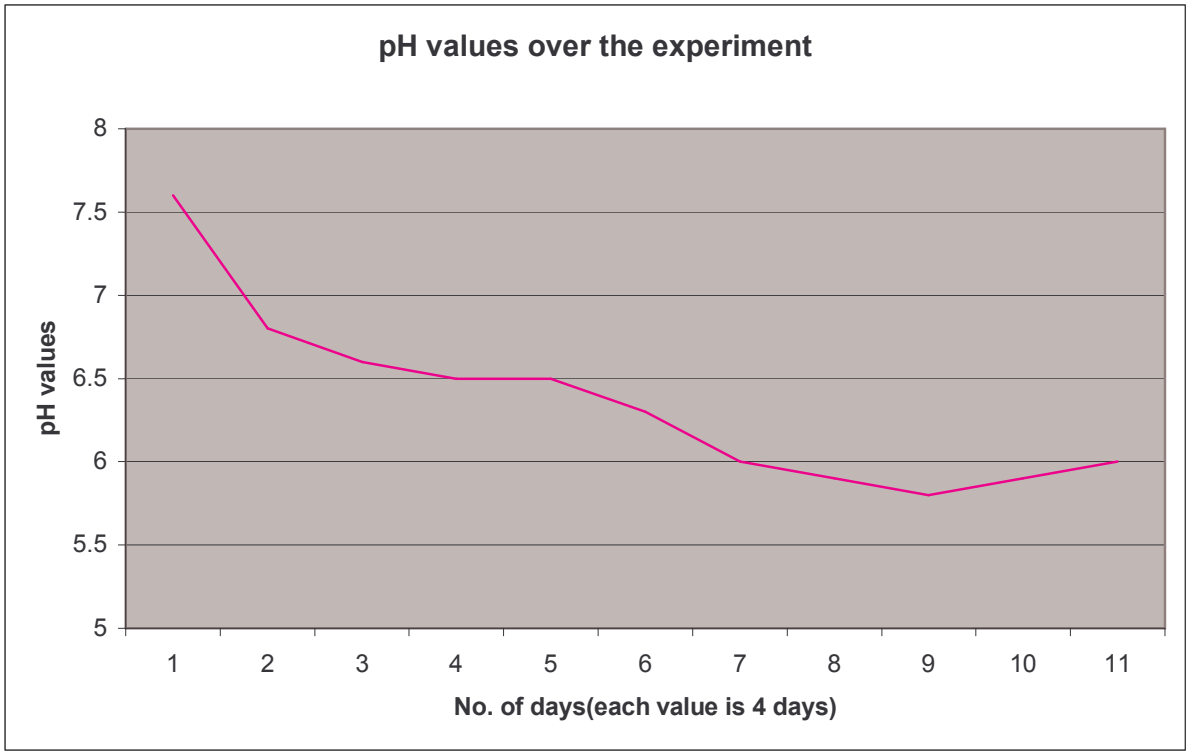
22nd May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.6	26 26	The colour of the leaves is almost the same as yesterday.
23rd May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.7	26 26	The leaves start to have dots of white patches on them. They are starting to lose their brown colour.
24th May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.5	25 26	The leaves continue to decompose slowly.
25th May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.5	26 26	The white patches on the leaves are growing larger, and the leaves start to disintegrate. The droppings at the bottoms of tanks A and B are still increasing, though not as quickly as before, but still faster than that of tank C.
26th May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.6	27 26	The fish are doing well.
27th May	5:00pm	Tank with leaves: 6.3 W/o leaves: 7.7	26 26	The tank conditions are fine.
28th May	5:00pm	Tank with leaves: 6.2 W/o leaves: 7.6	27 27	Nothing new observed.
29th May	5:00pm	Tank with leaves: 6.2 W/o leaves: 7.6	27 27	The leaves have disintegrated into almost nothing. Only the leaf stalk is left.

30th May	5:00pm	Tank with leaves: 6.2 W/o leaves: 7.6	28 27	The fish hardly seem affected although the leaves are gone.
31st May	5:00pm	Tank with leaves: 6.1 W/o leaves: 7.6	27 27	Nothing new observed.
1st June	5:00pm	Tank with leaves: 6.1 W/o leaves: 7.5	28 28	Nothing new observed.
2nd June	5:00pm	Tank with leaves: 6.1 W/o leaves: 7.6	28 28	Nothing new observed.
3rd June	5:00pm	Tank with leaves: 6.0 W/o leaves: 7.5	27 28	On the long term, the fish still have not responded much to the absence of the leaves, except that they now hide more frequently under the java moss.
4th June	5:00pm	Tank with leaves: 6.0 W/o leaves: 7.6	28 28	The water remains brown although the leaves are gone.
5th June	5:00pm	Tank with leaves: 5.9 W/o leaves: 7.6	28 28	Nothing new observed.
6th June	5:00pm	Tank with leaves: 5.9 W/o leaves: 7.7	27 28	Nothing new observed.

7th June	5:00pm	Tank with leaves: 5.9 W/o leaves: 7.7	27 27	Nothing new observed.
8th June	5:00pm	Tank with leaves: 5.8 W/o leaves: 7.7	27 27	So far so good, the fish are still doing pretty fine and the tank conditions are good.
9th June	5:00pm	Tank with leaves: 5.8 W/o leaves: 7.7	28 27	Nothing new observed.
10th June	5:00pm	Tank with leaves: 5.9 W/o leaves: 7.6	27 28	Nothing new observed.
11th June	5:00pm	Tank with leaves: 5.9 W/o leaves: 7.6	28 28	Nothing new observed.
12th June	5:00pm	Tank with leaves: 5.9 W/o leaves: 7.7	27 28	The fishes in tank A and tank C have given birth and they are noticeably slimmer. However, the youngs of the fish are not visible. I believe that their parents have eaten them up. This is the habit of the swordtail.
13th June	5:00pm	Tank with leaves: 6.0 W/o leaves: 7.6	27 28	The fish in tank B still have not given birth yet.
14th June	5:00pm	Tank with leaves: 6.0 W/o leaves: 7.6	27 28	The fishes in tank B have also given birth as we can infer from the females' body sizes. Unfortunately, they have been consumed as well.

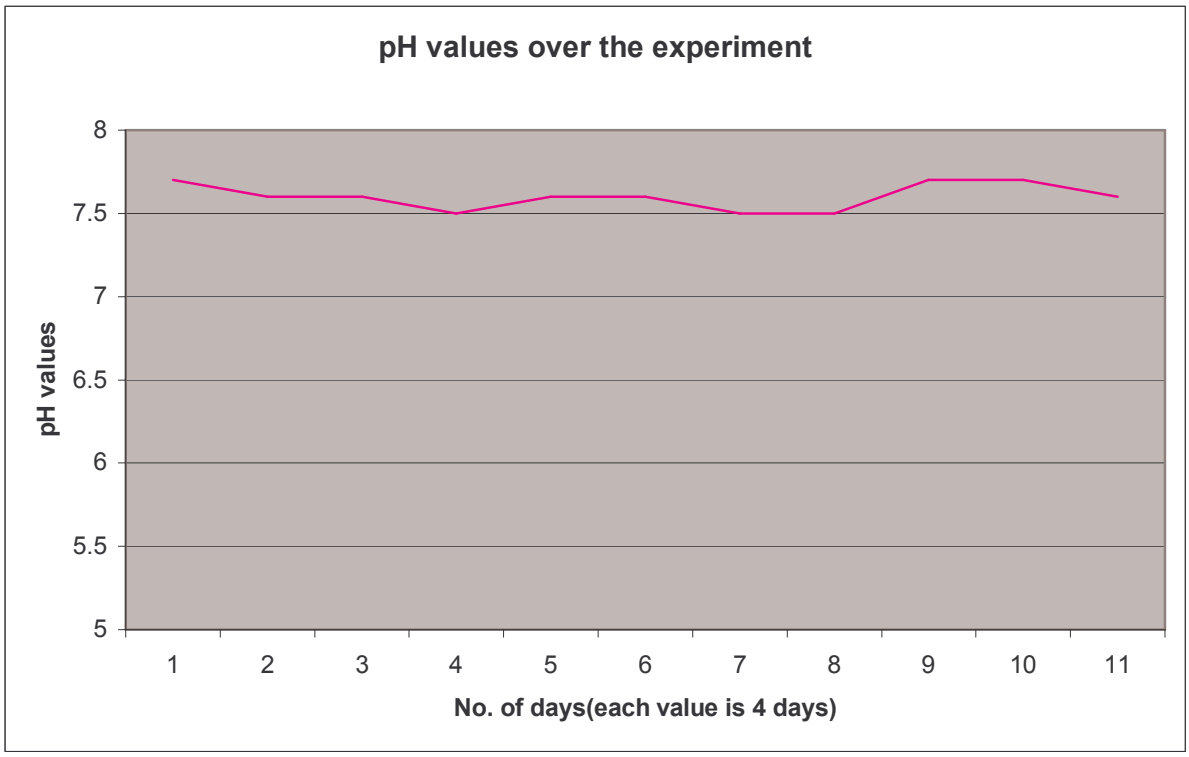
15th June	5:00pm	Tank with leaves: 6.0 W/o leaves: 7.6	28 27	The last day of the experiment. The fish are all well and the tank conditions are good.

Ketapang leaves



At the start of the experiment, the pH value of the water shows a sudden drop. This is due to the Ketapang leaves releasing the most amount of acid around this period. However, as the experiment wore on, the pH gradually settled down to around pH 6.

Without Ketapang leaves



The pH value of the water not containing Ketapang leaves stays at around pH 7.5. There is an obvious difference between the pH values of this tank and the tank containing Ketapang leaves. From this, we can conclude that the Ketapang leaves release acid to lower the pH of water. The pH value of the water as shown above is not always constant due to the ever-changing amount of carbon dioxide in the water, which will affect pH.

Personal Conclusion for Swordtail

From the results above, we can conclude that the Swordtails have not benefited from the Ketapang leaves in terms of breeding. It also does not help to improve the health of these fishes nor beautify and deepen the colours of their skins.

However, from observations, we can tell that the leaves help the Swordtails adapt better to the aquarium. They provide an alternate source of food and also shelter for these fishes.

Overall Conclusion:

At the end of our experiments, we can proudly say that they have been a success.

First of all, our hypothesis that the Betta Splenden would benefit from the use of Ketapang leaves has been proven to be correct. It has been shown that these leaves help in the breeding, recovery, growth and beautification of the Bettas.

Secondly, our hypothesis that the Ketapang leaves will help the Serpae tetra is also correct. Our experiment with the tetras have proven that the leaves help the fishes develop better colour, keeps them calm, helps them adapt to new environment and also helps breeding.

Thirdly, our hypothesis that the Ketapang leaves will do the Apistogramma Agassizi good has once again been proven to be right. In fact, the leaves seem to have benefited these fishes the most. They help keep the fishes calm, give them better colours and better appetites, helps them adapt well to changes in the aquarium, helps prevent certain diseases and also provides them with a natural environment.

Our last hypothesis about the Ketapang leaves not affecting the Swordtails much is again correct. Due to the fact that these fish are suppose to live in hard water, the acid released by the Ketapang leaves most certainly do not help them. However, they are useful in a sense that they provide an alternate source of food and also some shelter for these little fishes.

To conclude, our hypothesis on the four species of fishes have all been proven to be correct.

Problems faced

At the beginning of year, as soon as we had assembled this RE group, we faced the challenge of choosing a topic. We were too ambitious at first, and our topics ranged from environmental issues to social issues. However, we decided that we would do a project on our common interest, which was keeping fishes. Eventually, we settled on the topic of how Ketapang leaves would affect freshwater fish. However, that was only the start of our problems.

Firstly, our budget caused some trouble. With so many required apparatus and so little money in our hands, how are we going to get them?

Being patrons of certain fish shops, we have become regular customers and hence also friends of these fish shop owners. They gave us discounts on the fishes, plants, filters, air pumps and so on. As for our fish tanks, we used old ones which we have kept at home.

The second problem faced would be our hunt for the Ketapang leaves. These leaves were not easily found around town. Fortunately, through contacts, we managed to pluck them off a tree along Serangoon Road.

Thirdly but most definitely not least, would be the conflicts among the team. In self-defense of one's own ideas, we were overly protective of our own opinions and refuted any others coming from teammates. However, we got together and decided on solving the problem. We developed a structured way of discussion in a sense that we would contribute ideas one at a time, and no one was to put down or refuse another's opinion. The idea of this was that every thought counts towards the big picture.

Overall, we'd like to say that although we faced many difficulties, we overcame them as a group. Eventually, we emerged with a superb final product and we feel that we deserve our credit, not as individuals but as a well-bonded team.

How we could have improved

Firstly, if we had more time to do the experiments, our results would be more accurate. Homework and assignments had probably also played a part in making our lives more stressful and hence, resulting in a little less time on our experiments.

Next, if we had not spent so much time quarrelling at the beginning of the project, we could have saved time and gotten things done earlier. That way, we would have more time to carry out our experiments.

Also, there were some meetings that were called upon at the last minute. We could do away with this if we had better organization skills. If we had prepared beforehand, then we would be informed of meetings earlier and can make necessary arrangements on our timetables.

Other then these very few points, we feel that we have done a rather good job. If we had improved on these little mistakes, I'm sure we would have done great.

Our Personal Reflections

At the beginning of 2004, I knew that there once again would be a MDP (Multi Disciplinary Project), now of course known as RE (Research Education). When my form teacher informed us of the start of it, the first issues that came to my mind were suitable partners and a suitable topic. Being an avid fish hobbyist, I then decided to team up with Kennedy, Xuan Lang and Aaron who were as enthusiastic as I was about fishes. We immediately met up to discuss a topic and eventually decided upon: The Effects of Ketapang Leaves on Freshwater Fishes. I was joyful to find partners who had a similar interest and we then commenced on our experiment.

I feel that throughout the process of the project, we definitely met with many difficulties and obstacles. One, of course, was our budget. We realised that equipment for our experiments would not come cheap and were worried. However, we managed to pool our resources together to finally overcome this problem. Through the help of our close contacts, we managed to find a fish shop which gave us much discount for our equipment. We also salvaged some old equipment to at last ensure that we could begin our experiment.

Another obstacle was the lack of our main ingredient: The Ketapang Leaf. It is not common in Singapore and thus we had much difficulty locating it. After much searching, we found one of the trees in Serangoon and heaved a sigh of relief.

However, that cannot be said to be the end of our problems. We had many disagreements on the type of fishes we should use etc. but, I am very proud to say that we managed to resolve all of it to the final result of the experiment which proved successful.

This project work with my fellow classmates had taught me a lot of valuable lessons. My group and I went through thick and thin together and all in all, still stood by each other to reach our destination. I learnt how to deal with the many misunderstandings that came our way and have learnt how to work harmoniously with others. The hammer of our teamwork knocked down these difficulties and I grew closely to my teammates as friends. We learnt how to cope with disagreements and problems, and at the same time, bonded a strong friendship. The project needed us to meet many deadlines and sometimes, we would be stuck in an assignment not completed. Everyone then came together to help out and that is why we never had problem with punctuality too.

Most of all, I must not forget our teacher-mentor, Mdm. Chiang who guided us the whole way and gave us uncontinuous support in our quest for knowledge. She helped us along the way and it meant a great deal to us. I feel that I owe this enlightening experience to the all the above mentioned and I hope that next year's RE (Research Education) would be just as fulfilling.

-Elton Yeo

I felt that our experiment was a success, but of course there is still room for improvement. Firstly, I would like to point out what are our strong points, which are commendable. Our group showed much teamwork throughout the experiment, but much more towards the end of it. I felt that we have learned much from our squabbles. Our team is made up of ethusiatics novice and advanced fish hobbyist. The more experienced hobbyists were always giving advises to the beginners. This allowed us to share our experiences, increasing our learning. Also, our team was quite good in planning the things well and we did most of task before our targeted date. We organized the experiment very well, and it was not messy.

We have many places, which we need to improve. We quarreled quite often in the beginning, as some of us tend to disregard the others' suggestion. As time passes, we felt that continuing to quarrel will only waste more time. We decided that just stopping each other from quarreling will only result in more quarrels as the root problem was not solved. We sat down and pour out our feelings and thoughts. Quickly we understood each other so much better, knowing how he felt and so on. We are more concerned about each other feeling than our own. In my opinion, we are also lacking in terms of getting a task done without prompting. All of us required occasional prompting to get our task done. We have improved and now we would complete our task without much reminders. Another problem we have is that some of us tend to forget the priority of the project. Other stuff would distract us, but luckily we have each other and when one of us is drifting, we would put him back on the right track.

One very major problem that I believed most groups have also is that we start comparing amount of work each of us do. This is not encourage as it would lead to argument in the group but we managed to resolve this problem

I feel that the project had been a learning journey for all of us and all of us have grown more mature. We have learned more about fishes and even more about treating others and understanding each other. It was very meaningful and I do not regret choosing to join this group of friends.

-Kennedy Ng

The start of 2004 signified that we, being Rafflesian students, were to embark on yet another learning journey, or rather, the Research Education project. As a somewhat new but rather enthusiastic fish hobbyist, I went around looking for classmates with the same interest, and eventually ended up with Elton, Kennedy and Aaron.

As passionate and spirited about the project as we were, we did not have a topic to start off with. We brainstormed for nearly a week, and after much consideration, finally settled for the topic "The Effect of Ketapang Leaves on Freshwater Fishes".

Our objective of this project is simple: to find out if the effectiveness of the leaf is true as we have heard, or but a myth. This would help us attain more knowledge in keeping fish and it would also benefit others to share the results of our experiments.

As the project wore on, we faced many difficulties and setback. For one, money was not exactly on our hands. However, thanks to the retailers from whom we had bought our required equipment from, we managed to solve the problem. Another would be our search for the Ketapang leaves itself, the locations to buy the fish and so on. We were looking for healthy, strong fish which we could use in our experiments instead of unhealthy fish.

A more interesting problem would be that somehow, when we went on our outings, the weather did not seem to favour us. Put in other words, we were, somehow, always caught in the rain whenever we had planned to purchase our plants, fish etc.

However, I feel the most major obstacles would be us ourselves. We had to overcome ourselves, our rebuttal of each other's idea, our inability to accept other opinions, and our rashness and obstinance. It is only human nature to be selfish, to protect one's possessions, and in this case, our own ideas.

This may sound cliché, but I sincerely feel that this project has taught me things out of the books, things which one have to experience to really know what it is like. For one, I have learnt how to work better with others. In this project, I have chosen to work with other people rather than the usual, old friends of mine. As my mentors (including my parents and teachers) have said, it is better to start working with others whom are out of your little circle of friends and relatives, because as we grow up into the society, we have to learn to "familiarize ourselves with the unfamiliar". This makes sense to me: you cannot expect to grow up with your classmates and work with them in the same office. The world is a humongous.

Another thing which I have learnt would be to be more patient, though not entirely. Through organized discussions, I have learnt to take turns and give others a chance to express themselves. Of course, this then leads again to my learning of accepting others and their views. I am not the only person in the group, why should everything be done as I wish? And afterall, others' ideas may be equally, if not more, valuable than mine. Every thought contributes to the success of the project.

Last but most definitely not least, I have shrugged off my occasional bad habit of procrastinating. To work in a group where everyone is giving their best, it would not be fair to just slacken off on my part of the work and bury my teammates in someone else's burden.

I daresay that this project has been the most fun and exciting project I have ventured into. I'd like to thank Mdm. Chiang in particular for her support of our experiments and her understanding and care for us. My teammates are not to be left out too. Elton, Kennedy and Aaron have done a great job in their parts, and have made this quest a most memorable one. Hopefully we will get to work together again soon, and good luck to you guys in overcoming obstacles in the future!

Cheers!

-Teo Xuan Lang

To begin with, I would like to thank our teacher-mentor, Mdm. Chiang, for her guidance and support for our group, and for being always there for us when we needed help for our demanding project. Next, I would like to thank my teammates, for staying united as one despite the many difficulties and setbacks we encountered in, as I had said, our demanding project. And lastly, of course, I would like to thank the cooperative and helpful individuals who participated in our surveys and interviews and those who might have helped in our project in one way or another.

We wouldn't have gone so far without the help of all these people. Our group embarked on a rather adventurous project and decided to do an experiment on top of the usual surveys and interviews done by the other groups. I described our project as adventurous as we were doing the experiment in the circumstances that we were not in those specialized groups doing experiments who had the help of teachers specialized in the subject that they were researching on. Furthermore, we had included surveys and interviews in the project and had only a short time frame to complete the project on top of the many events and happenings during that period. We knew from the start that this was not as easy as what we had done last year and tried to get ourselves mentally prepared for what was to come.

No matter how prepared we were, there were problems that we could not foresee in the beginning. First of all, if we had gotten the livestock we wanted from fish shops, the cost would have gone too high. Furthermore, most fish shops did not have the fishes we wanted. So, finally, we decided to approach fish farms to get our supplies, which normally sold the fishes at much lower prices than fish shops and had a larger variety of fish. This brings us to the second problem. Fish farms are situated far from the city and therefore little transport reached there. If we took the bus there, it would not be easy to transport the bought items back home and if we took the taxi, it would be too expensive. MRT was out because the nearest station is too far from the farm, out of walking distance. We were left with asking our parents for help. Due to our parents tight schedule, by the time one of our parents were free to fetch us to and fro our houses and the farms, we were left with two months to carry out the experiment. In these two months, we had to do the interview, the survey, and the experiment. Being in secondary 2 means having more commitments and lesser free time. And due to our differences in opinion in different issues, some sparks flew but after awhile, we would reconcile together as a team again. And it is our strong bond of friendship and teamwork that tide us through the difficult times and brought us thus far.

Overall, I feel that what makes our group stand out is our enthusiasm and determination. What drove us was the interest for the subject and not the marks. We were certainly more determined than some others to do the project in a proper manner rather than rush to finish it, as we had to wait until we had two months left to get better quality and better priced apparatus and equipment for the experiment. We put our heart into the project and certainly tried our best. I am satisfied with what our group has done though there were a few areas for improvement given the circumstances we were put in. Good job everybody! Keep up the teamwork and determination!

-Aaron Teoh

Acknowledgements

We would like to express our thanks to the following people:

- Mdm. Chiang – our teacher mentor, for her undying support and guidance
- Our parents – for their support and understanding towards our project
- The people who took our survey – we could not do without their valued opinions
- The moderators of the website's forums as mentioned below – thanks for the permission granted for allowing us to post our surveys on the forums:
    - Aquaticquotient.com
    - Killies.com
    - Petfrd.com
    - Bettaclub.org.sg
- Mr. Ronnie – for taking precious time off his hands to let us interview him
- Mr. Zulkifli – same goes to him
- Nature Aquarium's shop owner – for giving us good deals on the apparatus and fish required
- The cichlid farm owner in Lim Chu Kang – for the advice on breeding cichlid
- The nameless fish farm (where we got the tetras from) – for providing information on the experiment regarding tetras
- Teoh's Plant Farm owner – for the great discounts on the fish and plants we purchased