

THE EFFECT OF BAYATI (*Anamirta*
cocculus L.) ON DAMSELFI~~S~~H
(*Pomacentrus coelestis* L.)

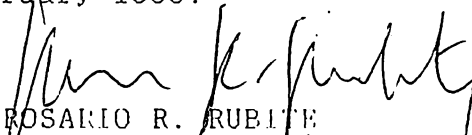
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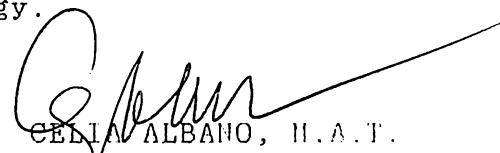
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for the Degree of Bachelor
of Science in Biology

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This is to certify that this undergraduate thesis entitled, "The effect of Bayati (*Anamirta cocculus* Linn.) on Damselfish (*Pomacentrus coelestis* Linn.) and submitted by Michael Cirineo San Felipe to fulfill part of the requirements for the degree of Bachelor of Science in Biology was approved and accepted in February 1989.


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This undergraduate thesis is hereby officially accepted as partial fulfillment of the requirements for the degree of Bachelor of Science in Biology.

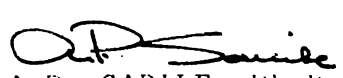

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ABSTRACT

For many decades, the people of Pagsanjan Laguna have used the bayati fruit in catching fishes from the Pagsanjan River. Ripe fruits of the plant were dried, crushed, mixed with earthworms and thrown into the river. This paper aims to study the action and effect of this fruit on a fish living in the marine biome, particularly, damselfish. After mixing traditionally prepared bayati fruit powder with dried ground shrimps and making it into a paste, this was fed to the fishes. It was observed that the fishes showed great distress and disorientation before dying shortly afterwards. This was mainly due to the picrotoxin content of the bayati fruit. Picrotoxin is occasionally used as a drug depressant among humans, an overdose of which is lethal.

I. INTRODUCTION

It has been an acquired tradition to use bayati for fishing. This kind of practice has been performed by the people of Laguna since time immemorial. This study aims to provide scientific basis of such practice. *Anamirta cocculus*, a typical wild vine growing in different parts of the country is of great commercial value. It is also significant to both science and society.

Bayati (*Anamirta cocculus*) is a well known fish poison because of its picrotoxin content. Its fruits are dried and roasted, then crushed into powder and mixed with fish food. It is said that the odor of roasted bayati fruits attract the fishes. Although this method has long been employed in

catching fish in the Pagsanjan River, little is known on how it takes its effects on the fish. Moreover, this method has not been tried in catching fish from the sea since it is believed that salt water lessens the odor of the bayati. For these reasons, this study provides the possible effects of bayati on damselfish (*Pomacentrus coelestis*), a species of tropical salt water fish native of the Atlantic Ocean.

This study also aims to provide a complete description of the characteristics of bayati and its nature with regards to its effect on the fish. Furthermore, to show the potentials of bayati as a cheap source of lethal chemicals which can be used in the manufacture of pesticides and insecticides. No preliminary studies has been done on this topic, specifically, with bayati's use in the marine biome. Likewise, physiological and histological studies regarding the effects of bayati shall not be determined.

This study aims to answer the following questions:

- a.) Do the fishes respond to bayati?
- b.) How do the fishes respond to bayati?
- c.) How long does bayati take its effect on the fishes?
- d.) What is the significance of bayati in the fields of science and medicine?

Definition of terms

1. Analeptic. In medicine, it is the ability to restore or to recover.
2. Anuria. It is the failure to urinate due to lack of urine formation.
3. Barbiturates. Group of drugs used as sedative or hypnotic.
4. Chorea. It refers to the convulsive motions of the limbs.
5. Coma. It refers to the state of prolonged unconsciousness, usually due to disease and injury from which it is difficult to rouse a person.
6. Depressants. A group of drugs which reduces vital functions of an organisms.
7. Edema. It is the swelling due to excessive accumulation of fluid in the connective tissues.
8. Emetic. It is the tendency to produce vomiting.
9. Epilepsy. It refers to the chronic nervous disease characterized by brief convulsive seizures.
10. Hyperthermia. It refers to an abnormally high temperature.

11. Gynoecium. A term for collective pistils.
12. Phthisis. It refers to the continuous destruction of the tissues.

II. REVIEW OF RELATED LITERATURE

Anamirta cocculus, also known as ligtang, lictang, bayati, balasing, Coca de Levante, arai, suma, taua, and uplig in different parts of the country. It is considered as part of the Berberidaceae, Magnoliaceae, and Anonaceae families. Most contemporary authors have treated it as of close affinity to the Berberidaceae family and the Lardisabalaceae. It has about 700 genera, 400 species and it is largely distributed throughout the paleotropic regions. The species of a few genera extend into the eastern Mediterranean region and eastern Asia. Here in the Philippines, it is found from Northern Luzon to Southern Mindanao in scattered thickets.

The plant is a large, woody vine with corky, gray bark and white wood. It is dioecious. The stem is sometimes ten centimeters thick, longitudinally wadded, porous and with stout branches. The leaves are ovate to ovatechordate, ten to twenty centimeters long, with pointed or tapering and rounded or nearly heart-shaped base, smooth above and hairy on the axils. The leaves are arranged on an alternate

manner and the venation is netted. The flowers are yellowish, sweet-scented, six to seven millimeters across, crowded on three to four and one half centimeters long, pendulous panicles and double whorl of sepals. It has a unisexual flower wherein the calyx and usually the corolla are present. the staminate flower has usually six stamens. The anthers are four-celled or falsely so, dehiscing longitudinally. The pistillate flower has a gynoecium of usually three to six distinct sessile or stipitate pistils. The ovary is superior and one loculed with parietal placentation. It has one carpel. It has a terminal stigma. It may have a a very short style or none at all. The fruit is a drupe, nearly spherical, about one centimeter in diameter when dry, smooth and hard. The fruit is green when young and becomes yellowish when ripe. The seeds are curved. It may or may not have a fleshy endosperm (Laurence, 1951).

Bayati is known more as a fiber plant and as a fish poison than a medicinal plant. It is sometimes used as a parasiticide and among the Indo-malayans as a fish poison for an easy fishing in the rivers, stagnant water and the ditches. The bark is made into a rope and is used for tying animals and hauling. There were experiments performed with regards to the effect of heating so as to justify the common

practice, stated that the toxic particles are not in anyway altered by roasting (Kabayao, 1922).

Medicinally, the plant is not very well known. In the Philippines, it has been reported that the seeds are used externally to kill lice in the hair (Quisumbing, 1978). Also, it is useful as an ingredient in ointment for the destruction of the peduncle in the hair (Nelson, 1951). The pericarp is also said to be emetic (Nelson, 1951). Likewise, the juice of the fresh fruits are applied externally to foul ulcers and scabies (Quisumbing, 1978).

Damselfish or damoiselle is one of about 250 species of small, primarily tropical marine fishes of the family Pomacentridae (Order Perciformes) found in the Atlantic and Indo-Pacific oceans. Damselfishes are deep bodies and usually have forked tails. They resemble the related cichlids. Many of the species are brightly-colored, often in shades of red, orange, yellow or blue. Most do not exceed the length of about fifteen centimeters.

Damselfishes are lively and quick and are usually strongly territorial and aggressive. Some feed mainly on plant matter or animals suspended in the water; others are omnivorous. Most damselfishes live along reefs but certain species, the anemone fishes, are noted for living in the stinging tentacles of the sea anemone.

Picrotoxin is the bitter principle occurring in the fruit of bayaki. It appears that it is made up of picrotoxinin and picrotin. Picrotoxin is a flexible, shining, prismatic crystals with a molecular formula $C_{10}H_{10}O_4$ (Quisumbing, 1978).

30 34 13

Picrotoxin powerfully stimulates the central nervous system. At first, higher cortical centers are affected, and also the midbrain and the medulla. Larger concentrations stimulate the spinal cord (Gennaro, 1985).

It is used as a drug in depressed human patients particularly those under the influence of barbiturates. Picrotoxin increases the rate and depth of respiration. The Analeptic effect may be pronounced and is utilized in the treatment of poisoning by central nervous system depressant. Although it is to counteract the depression resulting from overdosage of depressant drugs, it is not considered to be as effective as it is with barbiturates. The drug was officially recognized for its use in the treatment of epilepsy and chorea (Osol, 1960).

The toxicity of picrotoxin has been recorded. It is an irritant poison causing vomiting, surging, giddiness, faintness and dimness in vision, followed by delirium and epileptiform convulsions and loss of voluntary power (Dreisbach, 1971).

Picrotoxin crystals are soluble in benzene, ethyl alcohol, methyl alcohol, glacial acetic acid, acetone and hot water. It is slightly soluble in ether, chloroform, and cold water. The compound has a bitter taste and it reduces a solution of alkaline copper sulfate. Although it has a bitter taste, aqueous solution of the substance is neutral to litmus paper (Feliciano, 1947).

III. METHODOLOGY

A fifteen gallon aquarium was used in the experiment which was filled with salt water from the sea. Oxygen pump for aeration was provided and at the same time, lighting was installed. The container where the fishes were placed when they were bought was allowed to float. This was done to allow the temperature of the water inside the aquarium to be the same as that of the water inside the container. This would prevent shock in the fishes due to the sudden change in temperature which may eventually lead to death. The fishes were conditioned in this environment for several days to allow proper adaptation. They were fed regularly with three pinches of pounded dried shrimps.

FISH FOOD-BAYATI MIXTURE AND ADMINISTRATION

About 250 grams of dried berries were roasted. The method of roasting was made similar to that of roasting coffee beans. The berries were then pulverized and the powder were mixed the regular fish food in a 1:1 ratio by reducing the amount of powdered shrimp and replacing with the powdered bayati to equal the normal food consumption. The bayati and dried shrimps were made into a paste by the addition of a small amount of water. It was air dried and administered to the fishes. Observations were accurately recorded.

IV. RESULTS

After the fish food-bayati mixture was fed to the fishes, the following observations were obtained and gathered:

1. The fishes swam awkwardly:
 - a. Some fishes swam in an upside down position with their ventral side-up.
 - b. Some fishes swam on the lateral side of their body.
 - c. Some fishes swam vertically upward and/or downward.
 - d. There was a disorientation in swimming by rapidly moving in no definite direction.

- e. The fishes bumped into the walls of the aquarium.
 - f. The fishes jumped in and out of the water.
 - g. The body of the fishes were rolling on its axis.
 - h. The rate of swimming was faster.
2. The fishes were continuously gasping for air:
- a. The fishes went near the source of aeration.
 - b. Others stayed near the surface where the amount of dissolved oxygen is the greatest.
 - c. There was rapid movement of the opercula and the mouth.
3. Other observations:
- a. The dorsal and caudal fins were erect.
 - b. The color of the fishes changed from luminous blue to indigo.
 - c. The scales were erect.

V. DISCUSSION

The preparation of the fish poison made use of the traditional methods being observed. The ripe berries were sun-dried and turned brown, then it was roasted, producing an odor similar to that of coffee beans. This, according to the people of Pagsanjan, is the potent factor in attracting

the fishes. The seeds were pulverized small enough to be eaten by the fishes and was mixed to the fish food. This mixture was fed to the fishes after which they started to die.

Bayati has been used for catching freshwater fishes. In this experiment, however, it was administered to a saltwater fish, the damselfish, to be able to determine its effectiveness in a different aquatic environment. Damselfish was chosen because of its easy availability.

The fishes were obtained from one of the pet shops in Pasay City. They were first placed in an oxygenated plastic bag prior to their release in to the aquarium. The plastic bags were allowed to set afloat on the aquarium with saltwater so as to ensure that the temperature of the water in the plastic bag was similar to that of the aquarium. A sudden release of the fishes into the aquarium would result to shock and ultimately, death. Thus, acclimatization was a priority.

After the set-up was prepared, ten fishes were conditioned for five days prior to the performance of the experiment to allow them to adapt to the environment. This was done to ensure that the fishes would not die due to factors aside from the effect of bayati.

Powdered dried shrimps was used in feeding the fishes

since it was a fact that marine fishes feed on brine shrimps for food. They were fed every twelve hours with three pinches of food each feeding time.

After the conditioning period, the fishes were then fed with bayati. The powdered shrimps and the pulverized bayati were mixed in a 1:1 ratio. This was done by reducing the amount of fish food by 50% and replacing this with bayati. Water was added to the mixture and was made into a paste to ensure that bayati would adhere to the shrimp food. This was given to the fishes and as the food was descending, the fishes swam toward it and started to feed.

This was done three times. After an average of ten minutes, the fishes started to show unnatural movements which were assumed to be the symptoms of the effect of bayati. These unnatural movements were observed and obtained as previously stated.

The seeds of bayati contain picrotoxin which can be absorbed and ingested. The seeds, when administered, stimulate all the motor and inhibitory centers in the medulla, especially the respiratory and vagus centers. As a result of the stimulation of the motor centers in the medulla and cerebrum, the fishes exhibited the awkward and increased rate of respiration. Due to this stimulation, there was an increase in their metabolic activities. As a result, this

led to increased expenditure of energy, consequently leading to an increased need for oxygen. This explains why the opercula and the mouth were constantly moving as they constantly swim towards the source of air to compensate for the loss of oxygen due to increased utilization of energy. The said effects on the motor centers account for the abnormal responses of the fishes.

The fishes reacted differently with bayati due to several reasons. One, the fishes did not ingest the same amount of bayati. Secondly, the fishes did not ingest bayati at the same time. Third, the sizes of the fishes, though uniform, still vary to some extent, thus affecting the rate of metabolism. And lastly, the ages of the fishes cannot be determined since younger fishes are affected faster.

Though the author wanted to determine the lethal dosage of bayati to an individual damselfish, this was not accomplished. The fishes cannot be isolated individually because they are sociable and can survive only with fishes of the same species. Likewise, the amount of ingested bayati by an individual fish cannot be established since not all of the bayati particles were taken in by the fish. Confidence cannot also be established that all of the bayati were digested and absorbed, some may have been egested by

the fishes. Thus, further physiological and histological studies are highly recommended so that more facts can be attained with regards to the lethal dosage and other scientific aspects.

VI. SUMMARY AND CONCLUSIONS

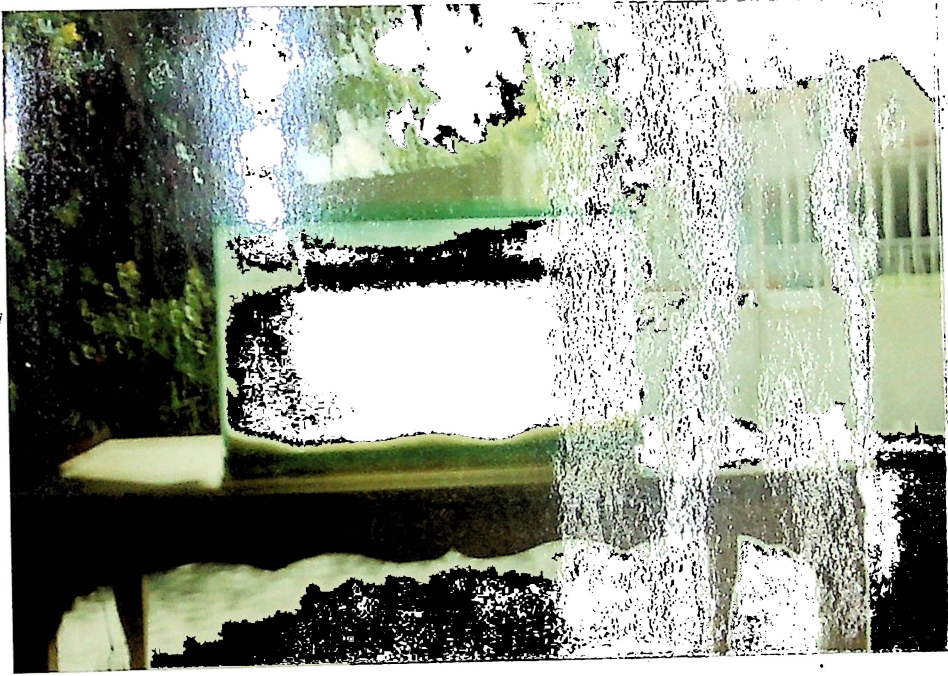
Based on the results of this study, it can be concluded that bayati has an effect on demselfish, a saltwater fish. The fishes are affected after an average of ten minutes after feeding which depends on the size of the fish and the amount of bayati particles ingested. The duration of its effects approximately lasts for eleven minutes then eventually the fishes die. This is attributed to the presence of picrotoxin present in the bayati fruit. It greatly stimulates the higher centers of the brain and results in increased metabolic activity and respiratory rate. It is also a fact that picrotoxin is used as a stimulant among human beings, an overdose of which is lethal. However, nothing much has been known about this substance since no further has been conducted to further investigate its true nature.

VII. RECOMMENDATIONS

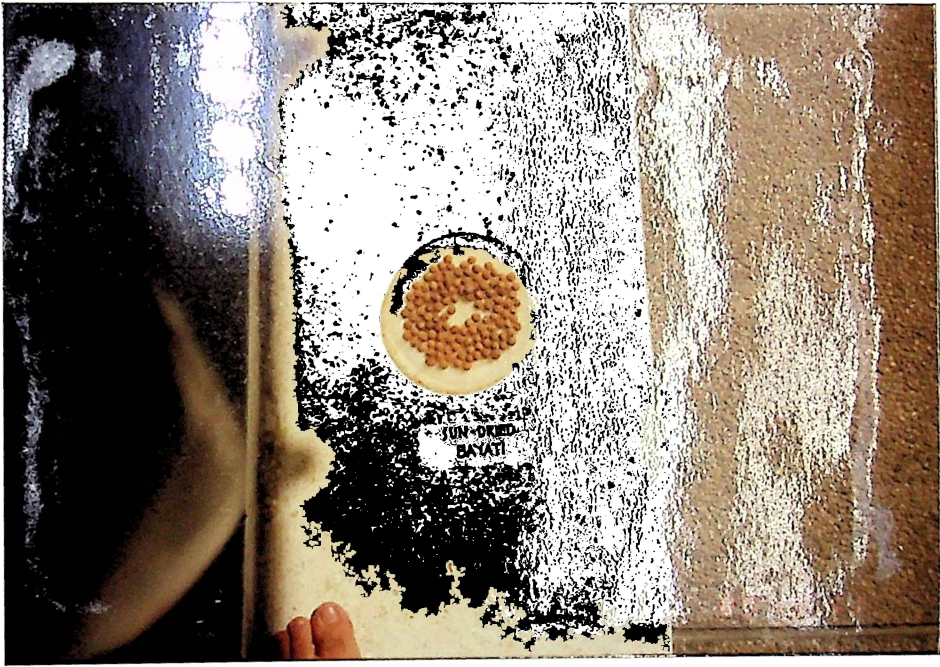
The author highly recommends the following for further

studies and investigations:

- a. Determining the possible effect of bayati on its consumers for a possible occurrence of biological magnification.
- b. Conducting experiments for the administration of bayati to other forms of animals especially those considered pests.
- c. Studying the possible use of picrotoxin as pesticide.
- d. Establishing the importance of picrotoxin to other fields of science and medicine.



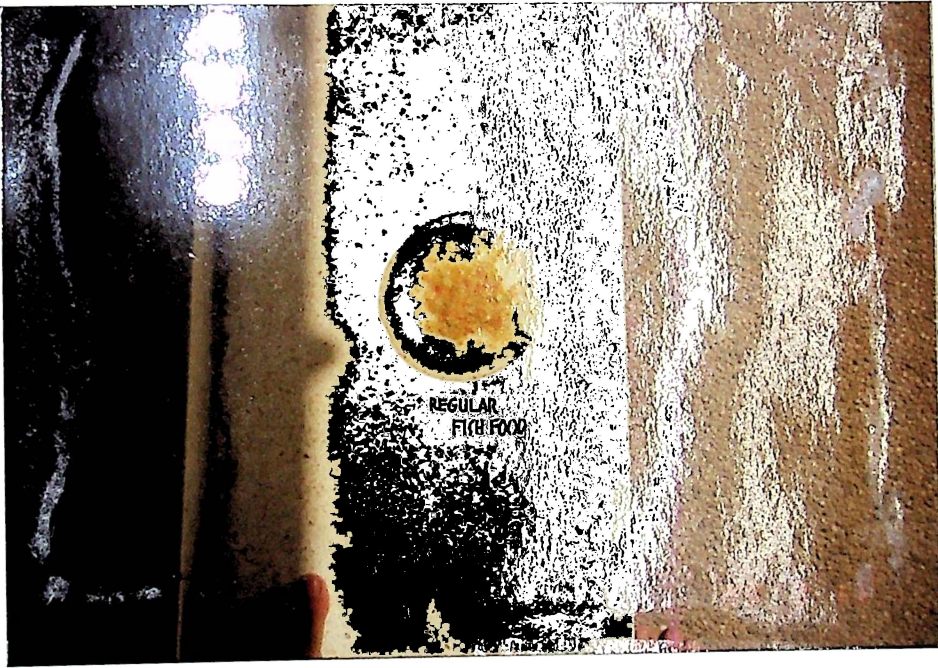
EXPERIMENTAL SET-UP



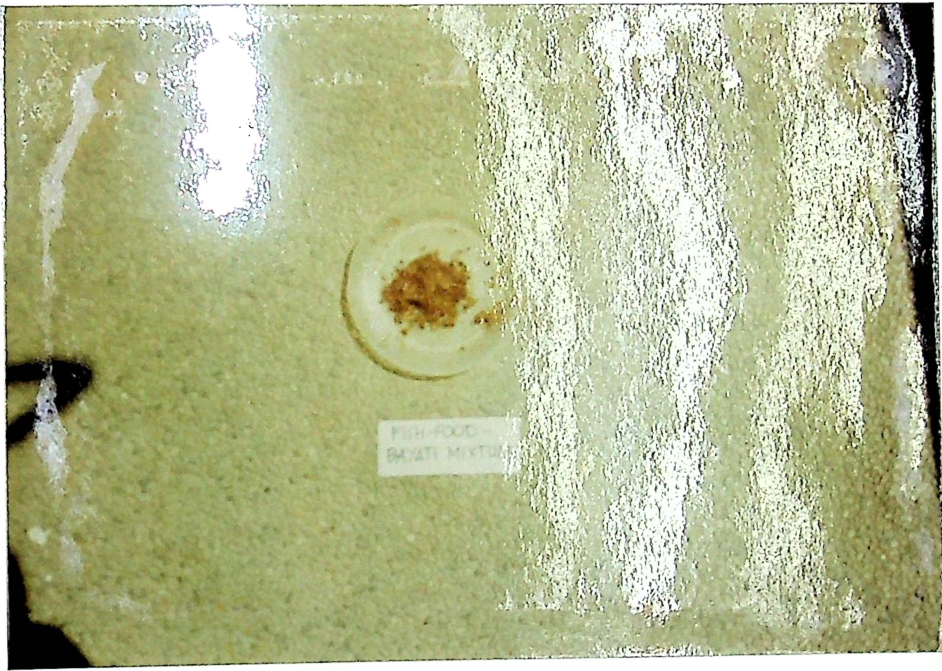
SUN-DRIED BAYATI



ROASTED -BAYATI



REGULAR FISH FOOD



FISH-FOOD BAYATI MIXTURE

THE EFFECTS OF BAYATI



DAMSELFISH WITH ERECT SCALES AT BODY
AND HEADPARTS (LIGHT SPOTS ON THE FISH)



THE FISHES NEAR SOURCE OF AERATION.



DAMSELFISH AT SURFACE ~~OF~~ DUE TO HIGHER
OXYGEN CONTENT



DAMSELFISH AT SURFACE WHERE OXYGEN CONTENT IS HIGH.
LOWER LEFT FISH IS ALREADY DEAD. UPPER RIGHT FISH
ALSO EXHIBITS UPWARD-DOWNWARD SWIMMING MOTION.



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