Organoleptic Properties of *Macarangatanarius Linn.* (Parasol Leaf Tree) Vinegar and Experiences of Fishers in Toughening Fish Nets

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Abstract –*The researcher investigated the uses of Macarangatanarius (Parasol Leaf Tree) because it is believed to be medicinal and has other uses to improve life. This study determined the phytochemicals present in the Parasol leaves . It tested the fermenting properties of the plant in the production of vinegar .The acidity and aroma of the products (leaves and stems) were compared with the two brands of commercial vinegar. It also determined the effectiveness of the leaf, stem and bark extracts to toughen fishing nets and ropes. It utilized the mixed methods approach. In the experimental research design, there were five phases: Preparation of Extract, Phytochemical Screening, Vinegar Making, Acidity and Aroma Test. Interview was used to gather data from the six fishers who were the only ones using parasol. Ethical protocols were implemented. Mean and standard deviation, ranks, Test of Homogeneity of Variances and Post hoc test using the Tukey's Honestly Significant Difference (HSD), Kruskal–Wallis Test and Post hoc test using the Tukey's Honestly Significant Difference (HSD) were used. Results showed that the parasol leaves contain phytochemicals such as sterols, flavonoids, saponins, glycosides and tannins. The parasol stem vinegar had the most desirable aroma compared to the three treatments. First commercial vinegar was the most acidic. Fishers confirmed the effectiveness of the parasol extracts to toughen fishing nets and ropes. The parasol vinegar can be an alternative to commercial vinegar. The extracts are recommended to be used by fishers to strengthen fishing nets. Everyone is encouraged to plant Parasol Leaf Tree.*

Keywords –*acidity, fishers, mixed methods approach*

INTRODUCTION

The earth is called a green planet because of its vast plants on it. Without the trees, weeds, herbs, vines, and grasses, the humankind and animal life so with the environment on earth cannot exist. Their presence is inevitable for clean air, medicine, food, additives, shelter, source of rubber, biofuels, natural insecticides and water in this world. Plants are hugely interlinked with climate and environment. Plants influence the weather condition of a certain place. Tree cutting imbalances the environment which indirectly affects animal and human life. Peoples of the world rely on plant products for their income and livelihood, hence these plants contribute to economic growth and development of a country.

Drugs originate from varied sources, incidental observations on natural products, unforeseen clinical findings on distinguished compounds, prime biochemical or physiological investigations or even test tube experimentations have led to huge therapeutic findings.

In this modern world, most of the newly discovered drugs are known by systematic screening procedures. The processes are designed to distinguish useful drug materials from the non-useful ones as comprehensively, inexpensively and as rapidly as possible.

The Macaranga genus is known to have 250 species of which many are growing in Asia and are used as medicines by folks [1].The Parasol Leaf Tree is one of the species .Native to Southeastern Asia, through Australia and the Western Pacific Islands, the tree is an average-sized plant that is located in the typical areas throughout the globe for versatile uses, including therapeutic products, timber, firewood, and shade. Several uses for reforestation and landscaping too. In the Hawaiian Islands, given its strength for fast colonization and its capacity to create dense

stands, it is considered either implicitly or invasive cultivated plant threatening endangered species .

Parasol leaf tree is a dioecian medium plant, flourishing from four to seven meters. It has an oblong -heart leaf shape. The female flower is usually located in ordinary panicled spikes. Male flower is characterized with small slender -branched peduncles and leaves are bigger. Capsules are 20 to 24 mm. in radius, of two or three cocci, enveloped with pale waxy glands and with scattered, mushy and long spine-like appearance. This plant is common in other countries like Indonesia, Philippines and Malaysia, planted for different uses like healing, shading and landscaping. Several uses of Parasol Leaf Tree are mentioned too in World Agroforestry Center. This tree can be found in village groves and brushwood, beach vegetation and thickets. Parasol leaf tree grows in varied types of soil including clay, loam and in the lowlands [2].

In the Philippines this Parasol Leaf Tree is found in forests at medium and low altitudes. It has a relatively wide span of distribution in different countries from Malay Peninsula to Andaman Islands, Southern part of China, then from Formosa southward to northeastern part of Australia.

The aforementioned plant was found out to have hyperglycemic properties. It revealed a potential inhibitory activity. Five ellagitannins were observed and isolated successfully. Structure determination manifested that the constituents were corilagin, mallotinic and chebulagic acids and two compounds, namely macatannins A and B. These can cure diabetic patients [3].

A phytochemical analysis of this parasol leaf tree revealed that metabolites screened solely from the leaf of varied kinds unveiled that the isolated compounds seen were tannins, stilbenes, terpenoids, coumarins, flavonoids etc. The extracts and isolated chemical compounds when studied further revealed to heal inflammation, cancer, and microbial infections [4].

A similar study on analysis of antioxidant prenyl flavonoids in parasol leaf tree, found that varied plant parts contained antioxidant prenyl flavonoids. Specifically,not only the parts of glandular trichome but also the leaves contained prenyl flavonoids which indicated that the plant may be utilized as a versatile tree, due to its being easily located and gathered[5].

Another study of the plant on pharmacological analysis of the leaves showed that the Parasol Leaf tree contain hepatoprotective and antihyperlipidemic properties when applied to the rats. It showed too that there is no toxicity effect of the leaf extracts when tested to the animal models [6].

In the Philippines and Indonesia the bark sap is utilized as a glue, especially for putting together musical instrument parts. The bark of the plant in Sumatra is also used in making food containers.

Leaves and Barks of Parasol in the Philippines can be made into wine known as "basi" made from sugar cane. In Sumatra, macaranga fruits are mixed to Arecaceae juice when boiled to improve the taste of the formed sugar .The timber is not used on a huge scale, however in Sumatra it is used to make ladders for pepper picking while in the Philippines wooden shoes are designed out of it. In addition, Malaysians use the timber to build their dwellings. The therapeutic uses are numerous. In the Philippines, the powdered root heals febrile, and boiling of the root is used against haemoptysis. In Papua, New Guinea and Indonesia, the leaf extracts have been used to treat dysentery internally and as an abortifacient. In Malaysia, grinded leaves are applied to bruises and wounds, and an infusion of the root internally is used to treat febrile [7].

To the Ilocano people, parasol leaf is an agent in making delicious vinegar. Vinegar has been an ancient food preservative ,it is very important for its various culinary uses at home and in the food industry. It is needed to promote safety of food and wellness uniwide as an essential part of food products [8].

The current investigation was limited to screening of the chemical constituents of the leaf using ethyl alcohol as solvent. The identification of the substances was limited to qualitative analysis. The researcher did not look into the percentage of specific phytochemicals seen in the leaf. In the vinegar making, only the leaves and stems were subjected to study, the barks, roots and fruits were excluded. As to the effectiveness of the Macaranga stem and bark extracts to strengthen fishing nets, only six fishers were interviewed because they were the only ones who used those in the selected coastal sites.

OBJECTIVES OF THE STUDY

This study on parasol leaf tree specifically attempted to: identify the phytochemicals located in the leaves; produce homemade vinegar out of the leaves and stems, determine the significant difference between/among the experimental vinegar in terms of acidity and aroma compared to that of the Commercial Vinegar 1 and 2.

Second part of this research aimed to confirm the effectiveness of the Macarangatanarius leaf, stem and bark extracts to toughen fishing nets through interview of the local fishers.

METHODS

The researcher utilized the mixed methods approach which includes the experimental research design in actual laboratory set-up and interview, observation and field notes as data collection tools. The author followed the procedure of the study on *Cyperusrotundus* phytochemical analysis[9]. The plant identification was validated by the Botany experts at the Bureau of Plant Industry, Malate, Manila, Philippines.

There were five steps performed: I –Leaf Extract Preparation - the gathering of fresh leaves of Parasol , air drying and extraction processes; II - Screening of Phytochemicals- to identify the presence or absence of alkaloids, sterols, tannins, triterpenes, glycosides, flavonoids and saponins in the leaves; and, III – Vinegar Making using Parasol leaves and stems. IV Acidity Test and V. Aroma Test.

Figure 1. Parasol Leaf Tree

Leaf Extract Preparation

The researcher gathered fresh leaves of "parasol leaf tree" in Manangat, Caoayan and Sto Domingo, Ilocos Sur. Leaves were thoroughly washed and air dried for a week then was finely cut, 500 gms of the cut leaves were put inside an Erlenmeyer flask after which subjected for weighing in a platform balance. The material was soaked with 95 percent ethyl alcohol and covered for a day and filtered using a laboratory funnel.

The researcher subjected the leaves for extraction in a water bath apparatus. The filtrates were concentrated in a vacuo to about 60 ml. The researcher measured the volumes of the concentrated leaf extracts. Then stored the tightly stoppered leaf extracts in a refrigerator ready for the phytochemical screening. Air drying of the leaves and the extraction procedures were done at the University of Northern Philippines College of Teacher Education Laboratory Room.

Screening of the Phytochemicals

The screening of the Parasol phytochemicals was performed at the Department of Science and Technology (DOST), Taguig, Metro Manila (MM). This screening identified the presence or absence of alkaloids, glycosides, tannins, saponins, flavonoids, triterpenes and sterols in the leaves of "parasol leaf tree" (*Macarangatanarius*). The researcher based the methods and procedures available at the Chemistry and Pharmacological Division, DOST, Taguig, MM.

Alkaloidal test using the leaves

The researcher boiled 12 ml of the leaf extract to a syrup consistency on an evaporating dish using a water bath apparatus. To the concentrated extract, five ml of hydrogen chloride/ hydrochloric acid (HCL) solution was added while heating. Then stirred the solution to about six minutes while going down to 25 degrees Celsius. About 0.6 gm of sodium chloride (NaCl) powder was added to this. While stirring, the researcher added sufficient HCL to wash and bring the filtrate to a volume of three ml. The researcher added drops of Mayer's reagent to one ml of liquid. (The appearance of precipitates when adding the Mayer's reagent implies alkaloidal constituents present in the leaf extract).

Fehling's Test for Glycosides.

The researcher dissolved 12 ml of leaf extracts in hot water and filtered, then used the filtrate for the test. Two (2) ml each sample was placed in two test tubes. To sample 1, one ml diluted HCL was added. To sample 2, nothing was added. Then the two test tubes were placed in a boiling water bath apparatus for 5minutes. The test tubes were cooled. Both were neutralized with anhydrous sodium carbonate until no more effervescence was produced. Fehling's solution was added to the two test tubes which were heated over a water bath for two minutes. (An increase in the amount of brick red precipitates in the hydrolyzed sample as compared to the other sample implies the presence of glycosides).

Gelatin Test for Tannins.

Twelve ml. of the parasol leaf extract was evaporated to dryness over a water bath then cooled. The residue was extracted with 21ml of hot distilled water, chilled, then to it, five drops of 10 percent

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NACL solution was added to remove the undesirable parts, then the researcher filtered the residue. The filtrates were placed equally in test tubes 1 and 2. Test tube 1 was considered the control. To test tube 2 (experimental), three drops of one percent gelatin solution was mixed. (The formation of precipitates suggests tannins in the Parasol leaves)

Froth Test for Saponins

Twelve (12) ml of the parasol leaf extract was dissolved in boiling water. The extract was shaken thoroughly in about 30 seconds and was observed in 30 minutes. (The honeycomb froth formation at a height of about 3 cms is suggestive of the presence of saponins in the parasol leaf.)

Color Test for Flavonoids.

Three (3) ml of the parasol extract was tested with three (3) ml, 10 percent Hydrogen Chloride (HCL) and magnesium (Mg) turnings. (Appearance of reddish color implies a positive result.)

Libermann-Burchard Test for Sterols and Triterpenes

Three (3) ml of leaf extracts were dissolved in acetic anhydride. The soluble portion was decanted and to this, 2-3 drops of HCL acid were added. (A pinkish to redish color implies the presence of triterpenes, while a pinkish to bluish color implies the presence of sterols.)

"Parasol leaf tree" Vinegar Making.

The leaves and stems were tested separately in producing vinegar. Vinegar was produced using the following steps a) thoroughly wash the Parasol leaves and stems separately to be free from dirt; b) cut into fine pieces; c) measure eight cups of small pieces of the materials and put carefully in a glass jar; vinegar should be placed in a glass jar; a glass container allows visual and easy monitoring of the process but does not impart any flavor to the vinegar; d) add eight cups of water and two cups of brown sugar; e) cover its mouth with white cheesecloth and tighten with a rubber band; Put the jar in a very dark, warmer place from 15 to 27 degrees centigrade . Fermentation is observed faster in a warmer temperature. (f) stir everyday for almost a month; g) after a month squeeze the plant parts; drain with cloth; and h) boil for an hour to remove the residual alcohol and microorganisms.

Phase IV. Acidity Test

Figure 2. Acidity Test

The researcher used the ph meter in determining the acidity of the four treatments namely, Parasol Leaf Vinegar, Parasol Stem Vinegar, Commercial Vinegar 1 and Commercial Vinegar 2. There were four trials and four replicates for the acidity test.

pH Value of the Experimental and Commercial Vinegars

In measuring the pH value of the vinegars, the researcher used the pH strip. The colors indicate the acidity and basicity of the vinegar. The 7 pH is considered neutral, below it is acidic and above 7 is basic.

Phase V.Aroma Test

Figure 3. Aroma Testing.

The researcher performed the Aroma test in Manangat Caoayan, Ilocos Sur. The respondents were blindfolded and smelled the four treatments and they ranked which one has the most desirable smell among the vinegars up to the least. There were four trials and four replicates for the aroma test. After which they also tasted the four treatments, after each taste they have to gargle with water to remove the vinegar thoroughly.

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Part II. Interviewing the fishers on the effectiveness of Macarangatanarius stems and barks to toughen the fishing nets.

Basic Interview guide method was used to ensure that the same pattern of information are gathered from each interviewee; this provided better focus than the conversational technique, but still allows a degree of freedom and adaptability in getting the information from the interviewee. The researcher used open-ended questionnaires and validated by three experts .A week before the interview, the researcher asked permission to conduct the study from the authorities in the sites and letters to the respondents were delivered. Together with three research assistants they surveyed first who among all the fishers in the study sites used the parasol extracts. Six fishers who used the bark and stems to toughen their fishing nets were the interviewees. Research sites were along the coastal areas of Caoayan and Vigan, Ilocos Sur particularly, Manangat &Fuerte, Caoayan, and San Pedro Vigan, City. They were the only ones who used the Parasol Leaf Tree. The interview lasted for 30 minutes.

Ethical Considerations. The interviewees received verbal instructions and written information about the objectives, significance, procedure, and benefits of the current research. Full consent was obtained from the interviewees a week before the data gathering of the study. Respondents were not subjected to any kind of harm whatsoever. The researcher prioritized respecting the dignity of research interviewees. Privacy protection of research interviewees was ensured. The researcher considered and treated the gathered data in utmost confidentiality. The names of the interviewees and commercial vinegar studied were coded, only the researcher had the hands on them. There was no misleading statement regarding the objectives and purpose of the current investigation.

The researcher used the following statistical treatments: mean and standard deviation, ranks, Test of Homogeneity of Variances in acidity of the samples and Post hoc test using the Tukey's Honestly Significant Difference (HSD); Kruskal–Wallis Test and Post hoc test using the Tukey's Honestly Significant Difference (HSD) for the aroma test.

This study also underwent the Harmonized Gender and Development Guidelines **(**HGDG) screening of the university.

RESULTS AND DISCUSSION

Phytochemical Tests. The chemical components present in Macarangatanarius leaves are presented in Table 1. Sterols are moderately present in the parasol leaves. The presence was shown by the appearance of blue color with the Liebermann-Burchard reagent. Sterols are derivatives of the steroid nucleus.

The leaves subjected for Liebermann-Burchard test to determine the presence of triterpenes gave a negative result. It shows that Vitamin A cannot be found in the parasol leaf. Traces of flavonoids were observed in the leaves as seen in the coming out of red precipitates in the color test. This implies that the plant has the potential to prevent the physical body from free radicals associated with atherosclerosis and cancer [10].

The result of the current study was confirmed by Ricardo and Nerona [11] in their screening of Parasol leaves ,they claimed these have flavonoids, saponins, sterols, triterpenes, tannins and glycosides. Only alkaloids cannot be found in the leaf. It is similar to the present study except for triterpenes which are positive in their study but negative in the present study.

Table 1. Phytochemical Constituents of Macarangatanarius leaves.

Chemical Substances	Chemical Tests	Results
Triterpenes	Liebermann Burchard Test	**Negative**
Sterols	Liebermann Burchard Test	**Moderate amounts**
Flavonoids	Color Test	**Traces**
Alkaloids	Mayer's Test	**Negative**
Saponins	Froth Test	**Traces**
Glycosides	Fehling's Test	**Moderate amounts**
Tannins	**Gelatin Test**	**Abundant**

Acidity

Table 2. Acidity Test of the Four Treatments

Acidity	N	Mean	Std. Deviation
A Parasol Leaf	4	5.900	.0816
B. Parasol Stem	4	5.825	.0500
C. Commercial Vinegar 1 (CV1)	4	5.625	.0500
D. Commercial Vinegar 2 (CV2)	4	6.075	.0957
Total	16	5.856	.1788

It could be gleaned from table 2 that Commercial Vinegar 1 has the lowest mean which indicates that this is the most acidic among the vinegars followed by Parasol Stem, Parasol leaf and Commercial Vinegar 2. This confirmed the testimonies of all the respondents who tasted the four treatments, when interviewed, to them the most sour is Commercial Vinegar 1 followed by Parasol stem, Parasol leaf and the least sour is Commercial Vinegar 2.

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Table 3. Test of Homogeneity of Variances in acidity of the samples

acidity	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.417	3	.139	26.680	.000
Within Groups	.063	12	.005		
Total	.479	15			

The F prob value is less than 0.01, it means that at least one pair of acidity values are significantly different from one another. In determining which of the treatments differ as to acidity, the means are subjected to post hoc test using Tukey's Honestly Significant Difference (HSD), results are given below.

Table 4. Post hoc test using the Tukey's Honestly Significant Difference (HSD)

Dependent Variable: acidity				
(I) Treatments	(J) Treatments	Mean Difference (I-J)	Std. Error	Sig.
	C .CV1	.2750*	.0510	.001
	D CV2	-.1750*	.0510	.022
B Stems	C CV1	.2000*	.0510	.010
	D CV2	-.2500*	.0510	.002
C DatuPuti	D	-.4500*	.0510	.000

*Significant at the 0.05 level.

Table 4 reveals that Parasol leaves when compared with Parasol stems showed no significant difference, it means that the Parasol leaves and stem vinegar have the same acidity level. The leaves and Commercial Vinegar 1 have significant difference at .05 level. It means that CV1 is more acidic than the leaves. There is a significant difference between leaves and CV2.It implies that the leaves are more acidic than CV2. The stems and CV1 are significantly different. CV1 is more acidic than stem vinegar. The stem vinegar is more acidic than CV2. There is a high significant difference between CV1 and CV2. Commercial Vinegar 1 is far acidic than Commercial Vinegar 2.

Table 5. Summary of Kruskal Wallis Test Ranks for Aroma

Plant Part	N	Mean Rank
Leaves	16	26.50 -2
Stem	16	11.50-1
CV1	16	54.50-4
CV2	16	37.50-3
Total	64	

The Parasol stem vinegar ranked first in the aroma test with a mean rank of 11.5 described as most desirable followed by leaves (26.50), CV2 (37.50) and CV1 (54.50) the least desirable among the four treatments.

Table 6. Kruskal–Wallis Test

Test Statistics[a,b]	
	Ranks
Chi-Square	48.530
Df	3
Asymp. Sig.	.000
a. Kruskal Wallis Test	
b. Grouping Variable: Plant Part	

The results of a Kruskal–Wallis test were significant (H=48.530, df=3, p<0.01); the mean ranks of smell are significantly different among the four treatments.

Table 7. Aroma Pairwise Comparisons of the Four Treatments

Dependent Variable: Ranks smell				
(I) Group	(J) Group	Mean Rank Difference (I-J)	Mann-Whitney U	Sig.
Leaves	Stem	121.44	28.50	0.000
	CV1	-15.62	3.000	0.000
	CV2	-8.82	57.50	0.004
Stem	CV1	-15.88	1.000	0.000
	CV2	-13.68	18.50	0.000
DatuPuti	CV2	12.50	28.00	0.000

**The mean rank is significant at 0.01 level.

The above table revealed comparisons of the aroma of the 4 types of vinegar , there is a significant difference between the parasol leaf &stem vinegar; the stem vinegar has a more desirable smell than leaf vinegar; CV1 and CV2 are less desirable than the parasol leaf vinegar; the stem is more desirable than CV1 and CV2. CV2 has a more desirable smell than CV1.

Results on the interview of the six fishers are exhibited in Table 8. All the six respondents that represented the fishers in the coastal areas in Caoayan and Vigan, Ilocos Sur using Macarangatanarius mentioned that the leaf, stem and bark extracts are effective to toughen their fishing nets. This result is confirmed in the study on the investigation of parasol leaf tree in vitro propagation which found out that the plant with tannin constituents were used to strengthen fish nets as well as an agent for dyeing [12]. The respondents all mentioned that there is a need to plant the parasol leaf tree so they may continue what their forefathers had taught them regarding toughening of fish nets through the submersion in macaranga extracts.

Table 8. Interview with the Caoayan (Manangat) and Vigan (San Pedro) Fisherfolks

Fisherman	Number of years fishing	Age	Answers during the interview
A	**28**	**54**	"Yes I had been using *Macarangatanarius leaf*, stem and bark extracts for 5 years, to strengthen our fishing nets and ropes. I put half water in our big pot then boil the leaves and barks. Then I let it cool and later I soak the nets and ropes in a big basin. The plant has properties to toughen the fishing materials. I learned this from my grandfather who used this species when he was still alive. The nets are durable and truly last long. However at this time I do not use anymore because of the lack of trees, there is a need to plant Parasol Leaf Tree again"
B	**20**	**58**	"I used the parasol leaf ,bark and stem extracts for about 7 years and all I can say is, the parasol made the fishing net strong and lasted for years unlike if you do not soak the net in the parasol leaf,stem and bark extracts , the rope is easily destroyed. This is more economical, you just need to be patient in soaking the nets. I learned this from my great grandparents because they were fishers."
C	**32**	**57**	"Been using the leaf, bark and stem extracts to soak for four years and I find it good. The parasol can strengthen the fishing nets and makes it last longer. Like if you soak it twice a week for about 4 hours. The net lasts for 3 years or even more depending on how you take care of it. I learned this from my grandfather who was a fisher. However, because of no more available plants I stopped using already"
D	**33**	**60**	"Yes I had been using Parasol leaf, bark and stem through decoction to strengthen my fish nets. This really helped me especially so I do not have enough money to buy new fishing nets .I soak all my nets and for years the materials proved that the plant could toughen the nets and I even use these ropes and they last. I learned this from my father who had been using Macaranga leaf and bark extracts for about 8 years."
E	**32**	**58**	"Because life is too hard, I patiently boil the leaf, stem and barks of *Macarangatanarius* and I submerge my fishing nets and ropes in the extracts and I really find it very helpful .It saved me from buying new ones. I had been doing this since I started fishing. I learned this from my grandfather who was a fisher. That is why there was a need for me to plant more Parasol.
F	**29**	**67**	I had been using it for a decade but not frequent, it depends on the abundance of the leaves, stems and barks This practice was handed to me by my father who is also a fisherman. We used the leaves, stems and barks of *binunga*, boil together in water and when it cools we soak our fishing nets and ropes to provide strength. I had observed that those ropes became tougher and lasted for years. We really had to do this and we even plant because life is hard, we cannot just buy new ones because we have children to feed and many things to buy."

CONCLUSIONS AND RECOMMENDATIONS

The Macarangatanarius leaves contain chemical constituents such as sterols, flavonoids, saponins, glycosides and tannins. However, Triterpenes and alkaloids are not present. The Macarangatanarius leaves and stems can be made into vinegar. This is economical and is possible for commercial purposes. As to the aroma and acidity of the parasol leaf tree, stem vinegar is the most desirable and "Commercial Vinegar 1" is the most sour. The stems and barks of the plant can be used as strengthening agents to fishing nets and ropes as revealed by the fishers and due to tannins present in the plant.

A follow-up study should be performed on the phytochemical screening of the other parts of the "parasol leaf tree" like stems, roots, fruits and flowers. Types of saponins, glycosides, tannins, sterols and flavonoids present in the plant parts may be quantified, isolated and identified.

The plant is recommended for pharmacological, microbiological and other screenings. The parasol is recommended in tanning leathers, coloring foods and other materials. It is also recommended as an alternative for commercial vinegar.

It is highly recommended that everyone especially fishers will plant parasol leaf tree in their yards .The government should provide seedlings of this tree. The leaves, stems and barks should be used for strengthening fishing nets and ropes to save money.

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