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ISSN: 2354-5844(Print)
ISSN: 2477-5223 (Online)

The Potential of Organic Vegetable from Peat Swamp Land in Central Kalimantan as Fungicide and Bactericide

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ABSTRACT

The research was to determine the potential of various species of organic vegetable from bamboo, taro, rattan and eggplant group from Central Kalimantan as fungicide and bactericide. In vitro testing of botanical pesticides used two types of fungi, namely *Colletotrichum capsici* and *Sclerotium roflsii*), and one pathogenic bacteria, namely *Xanthomonas campestris*. The results showed that several organic vegetable extracts from taro and rattan could control *C. capsici, S. roflsii* and *X. campestris*. It was proven that extract plant from immature fruit of *Solanum ferox*, mature fruit of *S. lasiocarpum*, leaf of *S. torvum*, tuber of *Xanthosoma sagittifolium*, leaf and midrib of *Colocasia esculenta*, *C. esculenta* and *C. esculenta*, fresh leaf of *Dendrocalamus asper*, stem inside of rattan *Calamus trachycoleus* and *Daemonorops fissa* against growth of *S. rolfsii*. It was also found that four type of plant extracts could control *C. capsici* (that is fresh leaf of *S. lasiocarpum* and *S. torvum*, tuber of *C. esculenta*, leaf and midrib of *X. sagittifolium*). This study was the first to report that plant extracts from fresh leaf and mature fruit of *S. ferox*, mature fruit of *S. melongena*, leaf and midrib of *C. esculenta*, fresh leaf and stem of *D. asper*, stem of *B. vulgaris* var *striata*, skin and stem inside of *C. trachycoleus* and skin of *D. fissa* can inhibit growth of *X. campestris bacteria*. Hance, non-vegetable and organic vegetables from Central Kalimantan had potential as botanical pesticides.

Key words: bactericide, fungicide, organic vegetable, peat swamp

INTRODUCTION

Organic farming is increasingly in demand along with public awareness to reduce the use of chemical pesticides by increasing the use of botanical pesticides. The potential use of botanical pesticides using organic local of vegetables in Central Kalimantan is still a few. Septian (2016) has researched various plant extracts from Central Kalimantan as fungicides and found that taro (*Colocasia esculenta*) extract and rattan (*Daemonorops fissa*) peel have potential to control fungal pathogen of *Sclerotium rolfsii*.

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Several studies have reported that the extract from terong asam (*Solanum ferox* in Bahasa Indonesia or rimbang in Dayak Ngaju language) has the potential as a bactericidal, fungicide, insecticide and is useful for increasing immunity in fish. *S. ferox* has various bioactive compounds that are antifungal in *Aspergillus niger* (Rahman *et al*., 2008), antirheumatic, antiasthmatic, antiviral, and anticancer (Kumar & Borah, 2012). *S. ferox* extract (leaves, stems, twigs and branches) inhibited 71% of *Mycobacterium tuberculosis* H37Rv (Mtb) (Kumar & Borah, 2012). Fruit, leaf and stem extracts as botanical pesticides control red flour beetle (*Tribolium casteneum*) (Abdullah *et al*., 2012), and useful as fish feed pellets. Meanwhile, pellet from *S. ferox* extract and probiotic *Lactobacillus casei* in catfish can increase growth, and increase the immune system against the pathogens

ISSN: 2354-5844(Print)
ISSN: 2477-5223 (Online)

Aeromonas hydrophila and *Pseudomonas fluorescens* (Hardi *et al*., 2022).

Xanthosoma undipes contain tannins with oxalic acid, namely the yields of 3448.20 mg/kg and 8361.52 mg/kg, hence this can be used as a biopesticide (Fatmawaty et al., 2019). The liquid and starch contents of taro has the potential as an insecticide. Abaza et al (2015) have isolated the content of taro leaves (*Colocasia esculenta*) containing 2 phytosterols (β-sitosterol and stigmasterol), where this taro leaf extract is capable of being toxic and anti-feeding for *Spodoptera littoralis* larvae. It was reported that taro leaf powder suppressed *Acanthoscelides obtectus* larvae in mung bean plants (Nta *et al*., 2015).

Bamboo (*Dendrocalamus asper*) leaves have potential as a herbicide to control *Cyperus rotundus* (Hidayatulah et al., 2019) and are reported to have antifungal activity (Shen, 2014). Moso bamboo leaf extract showed antifungal activity against *Phytophthora capsici, Fusarium graminearum, Valsa mali, Botryosphaeria dothidea, Venturia nashicola*, and *Botrytis cinerea* Pers, with inhibition of 100.00%, 75.12%, 60.66%, 57.24% , 44.62%, and 30.16%, respectively (Liao *et al.*, 2021).

There are few reports in the potential of plant extracts from local vegetables of Central Kalimantan which have multifold properties as fungicides and bactericidal. The availability of local vegetables from the bamboo, taro, rattan and eggplant groups is abundant in Central Kalimantan and only a few are used as biopesticides. The purpose of this study was to determine the potential of various types of plant groups from bamboo, taro, rattan and *S. ferox* as fungicide and bactericide.

MATERIAL AND METHODS

The botanical pesticide materials used in this study were the eggplant (5 species, Figure 1), taro (11 species, Figure 2), bamboo (5 species, Figure 3), and rattan (2 species, Figure 4). The parts extracted from these plants are leaves, tubers, stems and fruit. Specifically for various types of rattan and eggplant plants, they were purchased at the Pasar Besar and Kahayan markets in Palangka Raya city, while other types of plants were sought in the people's yards or gardens.

Preparation of Botanical Pesticide

The extraction method used in this research is simple extraction using water as described by Zhang et al., 2018. The method of extracting botanical pesticides is described briefly as follows. Materials were taken from different organs, namely leaves and stems taken separately from bamboo; the midrib leaves and tubers of taro are taken separately; the skin and stems of rattan were taken separately, and leaves, stems and fruit of eggplant were taken separately. The raw organs of the plant were weighed and crushed with a blender, or cut into small pieces. The materials were mixed with water in a ratio of 1:2 and 1:10. The mixtures were soak for two days prior to filtration. The pH of the extract was measured to determine the acid-base value of all the extracts and not adjusted to a specific pH value.

In Vitro Test Antifungal and Antibacterial Potential of Plant Extract

In vitro tests were employed to evaluate the antifungal potency of plant extracts against *Colletotrichum capsici* and *Sclerotium roflsii* besed on method described by Kursa *et al*.,

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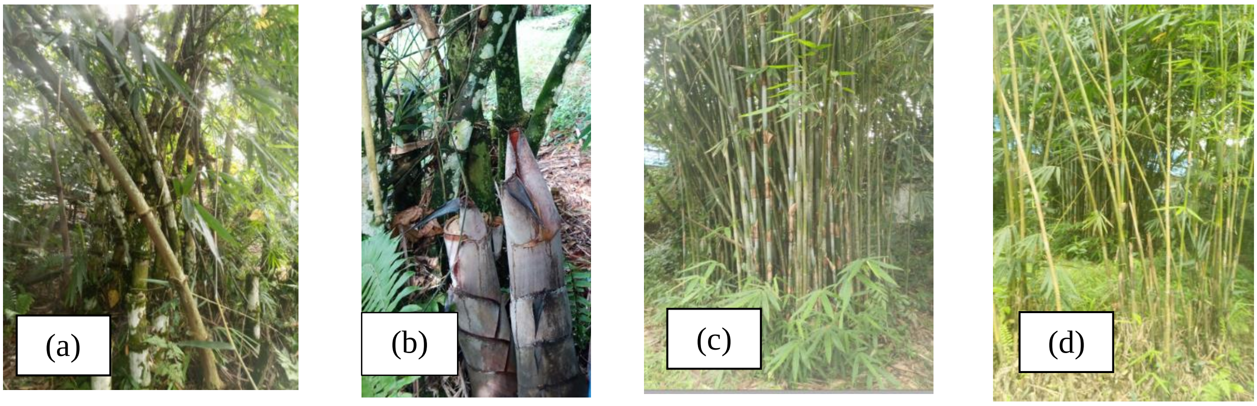
(2022) and antibacterial test against *Xanthomonas campestris* bacteria by agar disc diffusion method as described by Balouiri *et al*. (2016).

This study used a factorial Completely Randomized Design (CRD one factor (namely botanical pesticide) with 3 repetitions. Data were analyzed using analysis of variance and Tukey's HSD (honestly significant difference) test at the 5% confidence level (only at last day observation).



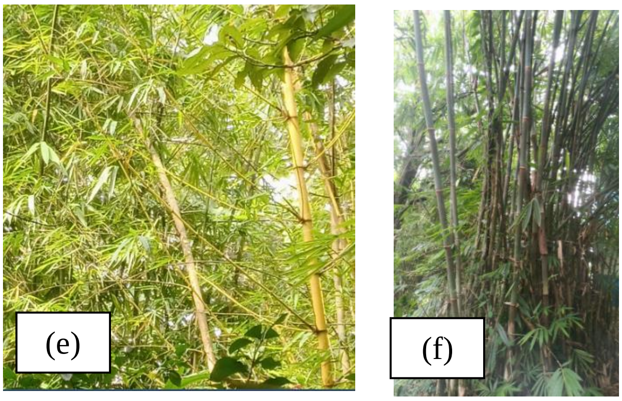


Fig. 1. Bamboo from yard
(a) *Dendrocalamus asper*-tree,
(b). *D. asper*-bamboo shoots
(c). *Schizostachyum brachycladum*
(d). Phyllostachys bambusoides,
(e). *Bambusa vulgaris* var *striata*,
(f). *B. vulgaris* var *vulgaris*

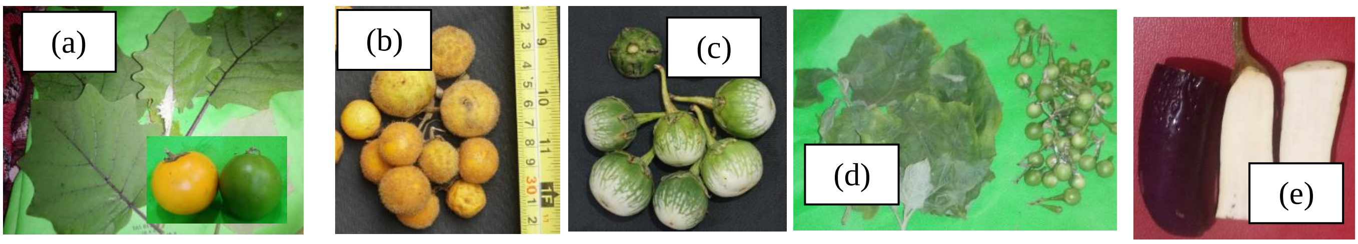


Fig. 2. Eggplant group. (a) fruit and leaf of *S. ferox*, (b). fruit of *S. lasiocaprum*, (c). fruit of *S. melongena*-round egg plant, (d). fruit and leaf of *S. torvum*, (e). Fruit of *S. melongena*-purple fruit.

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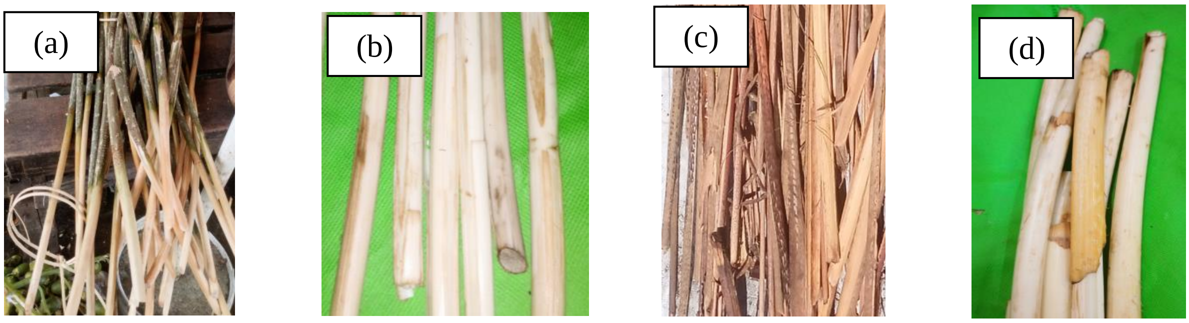

Fig. 3. Rattan from market (a) skin of uwei irit (*C. trachycoleus* Beccari), (b). stem inside of uwei irit, (c). skin of uwei bajungan (*D. fissa* Blume) (d). stem inside of uwei bajungan (*D. fissa* Blume)

RESULTS AND DISCUSSION

The research results show that the vegetable group of the eggplant type has a wider spectrum of inhibition because it can inhibit fungal and bacterial pathogens. Most antifungal compounds were found in the eggplant group, taro group, followed by rattan and the least in the bamboo group, conversely the most antibacterials were found in the eggplant, followed by rattan, bamboo and the least in the taro group in this order (Table 1).

The results also showed that some inedible and edible vegetable extracts can suppress one type of pathogen or two types of pathogens and even three types of pathogens. There are four types of plant extracts that inhibited the fungus *S. rolfsii* and the bacteria *X. campestris*, and there were two types of plant extracts that inhibited both fungi of *S. rolfsii* and *C. capsici*. Besides that, there were six types of plant extracts that only inhibited one type of fungus either *S. rolfsii* or *C. capsici* (Table 1).

Different parts of plant organs from the same plant showed different powers of inhibition against pathogens of bacteria and fungi. In the case of fungal inhibition, extracts from eggplant fruit organs were better than leaves, taro tuber organs were better than leaf midribs, and extracts from rattan stem inside were better than rattan skin. On the other hand, in the case of bacterial inhibition, bamboo stems were better than leaves, rattan skin was better than the stems inside, but for eggplant, fruit organs and leaves both showed good inhibition.

The novelty of this research is that several organic vegetable extracts from taro and rattan can control fungal and bacterial pathogens. Extract plant from immature fruit of *Solanum ferox*, mature fruit of *S. lasiocarpum*, leaf of *S. torvum*, tuber of *Xanthosoma sagittifolium*, leaf and midrib of *Colocasia esculenta*-kujang biha, *C. esculenta*-kujang lais and *C. esculenta*-kujang lilin, fresh leaf of *Dendrocalamus asper*, stem inside of rattan *Calamus trachycoleus* and *Daemonorops fissa* found the first report against growth of *S. rolfsii* also found that four types of plant extracts that can control *C. capsici* that is fresh leaf of *S. lasiocarpum* and *S. torvum*, tuber of *C. esculenta*-kujang lais, leaf and midrib of *X. sagittifolium* (Table 1, Fig. 5).

This study is the first to report that plant extracts from fresh leaf and mature fruit of *S. ferox*, mature fruit of *S. melongena*-purple egplant, leaf and midrib of *C. esculenta*-, fresh leaf and stem of *D. asper*, stem of *B. vulgaris* var *striata*, skin and stem inside of *C. trachycoleus* and skin of *D. fissa* can inhibit growth of *X. campestris bacteria* (Fig. 6, Table 1).

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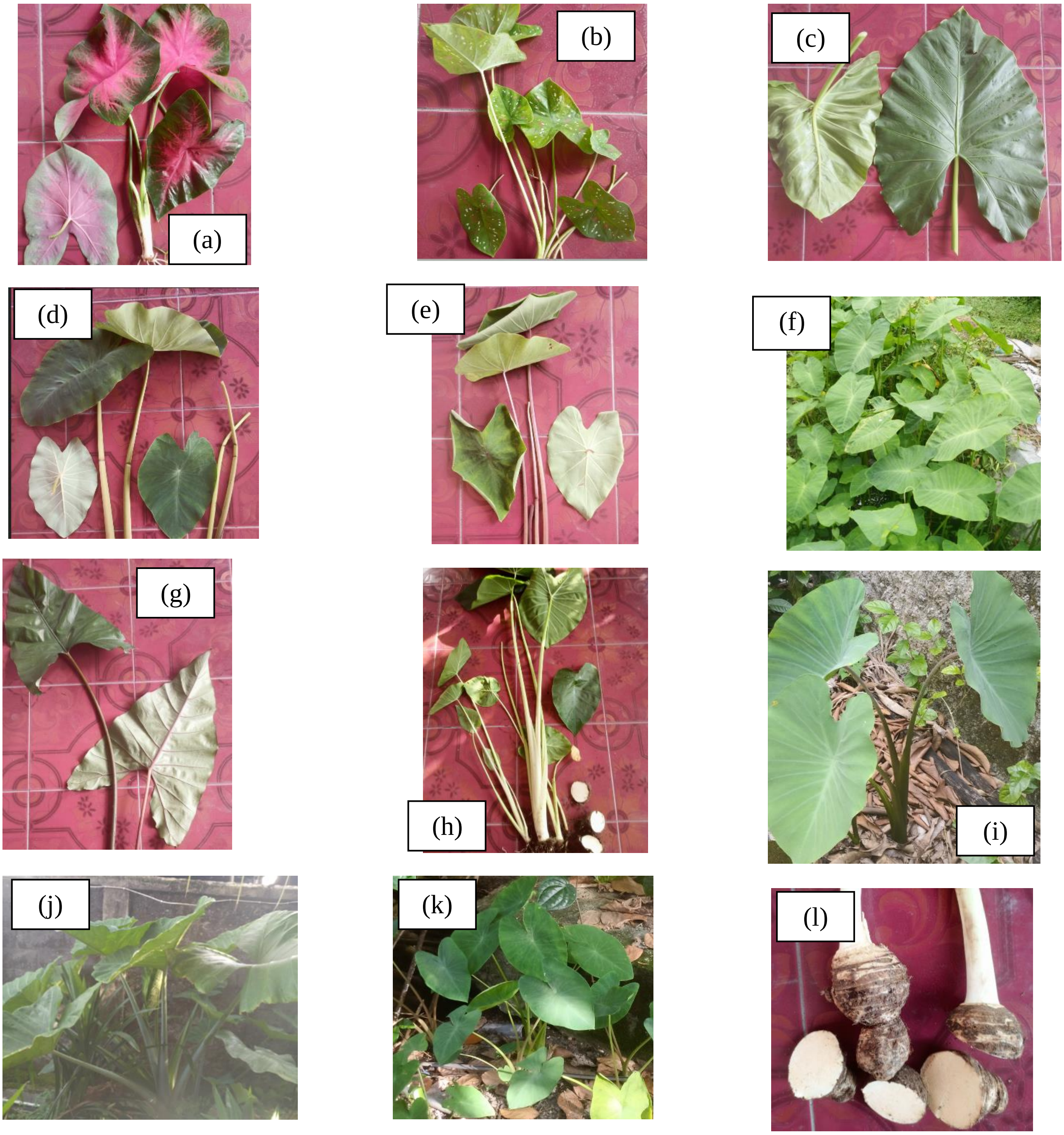

Fig. 4. Inedible and edible taro. (a). *Caladium redflash*, (b). *C. tricolor*, (c). *Alocasia macrorrhizos*, (d). *Colocasia esculenta*-kujang burung*, (e). *C. esculenta*-kujang lilin*, (f). *C. esculenta*-kujang hijau*, (g). *Alocasia* sp-kujang biha*, (h). *C. esculenta*-kujang lais*, (i). *C. esculenta*-kujang pandan* (j). *Xanthosoma sagittifolium*, (k). *C. esculenta*-kujang enyuh* (l).tuber of *C. esculenta*-kujang enyuh*; note: * is Dayak Ngaju language

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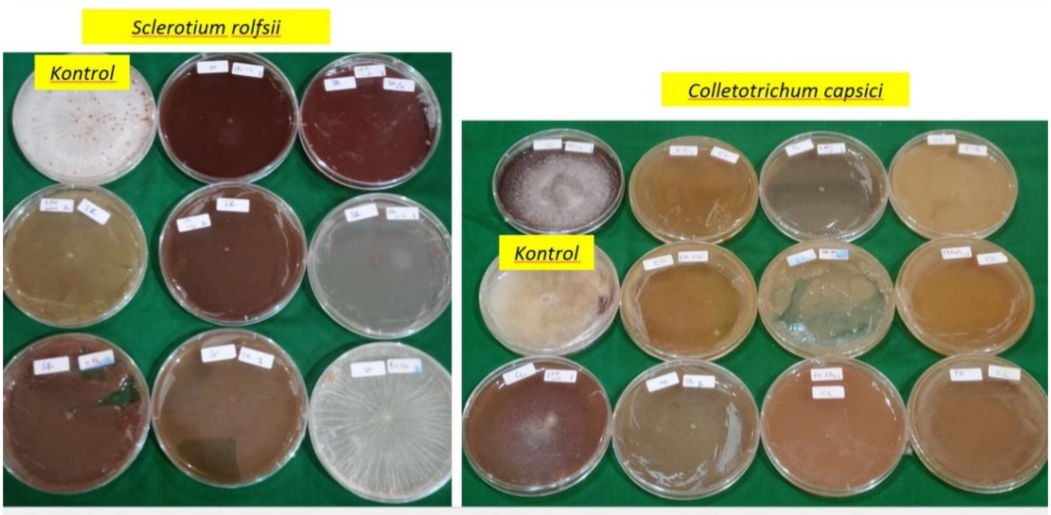

Fig 5. Antifungal test activity used vegetable extract that against growth of *S. rolfsii* and *C. capsici.*

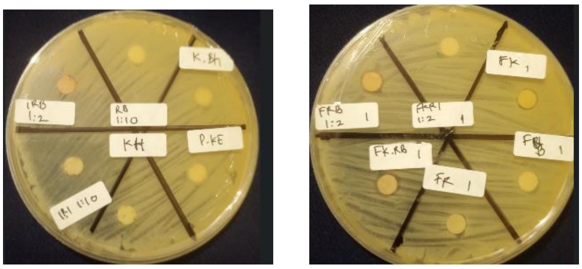

Fig 6. Antibacterial test activity used vegetable extract that against growth of *X. campestris*

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Table 1. The potential inhibition of botanical pesticide on the growth of pathogenic fungi *S. rolfsii* and *C. capsici*, and pathogenic bacteria *X. campestris.*

Water extraction method	pH of botanical pesticide	Diameter (cm) of *Sclerotium rolfsii* days to					Diameter (cm) of *Colletotrichum capsici* days to						Diameter (mm) of lysis zone on *Xanthomonas campestris*
		3	4	5	6	7**	3	4	5	6	7	8**	
Control		4.65	7.00	9.00	9.00	9.00^{f}	3.70	5.75	6.60	7.05	7.75	8.90^{mn}	(-)
Eggplant													
Solanum ferox -rimbang*-ripe fruit (1:2)	3.78	0.50	0.50	0.50	0.50	0.50^{a}	3.70	5.75	6.6	7.05	7.75	8.90^{mn}	(+) 0.20
S. ferox -rimbang*-ripe fruit (1:10)	6.23	3.00	4.75	6.10	7.25	9.00^{f}	1.90	2.15	2.45	3.20	4.25	4.50^{e}	(+) 0.50
S. ferox -rimbang*-unripe fruit (1:2)	3.79	0.50	0.50	0.50	0.50	0.50^{a}	1.65	2.90	3.75	4.50	5.60	6.15^{hij}	(-)
S. ferox -rimbang*-leaf (1:2)	5.98	1.25	2.20	3.25	4.1	5.25^{bcdef}	3.00	3.65	4.20	4.75	5.20	5.75^{fgh}	(+) 0.50
S. lasiocarpum -rimbang bulu*-ripe fruit (1:2)	4.60	0.50	0.50	0.50	0.50	0.50^{a}	0.50	0.50	0.50	0.50	0.50	0.50^{a}	(-)
S. melongena -round eggplant-ripe fruit (1:2)	3.78	3.50	6.00	7.50	8.00	9.00^{f}	0.75	1.25	2.35	3.25	4.2	4.80^{e}	(-)
S. melongena -purple-ripe fruit (1:2)	3.81	2.25	3.30	4.40	5.25	6.65	1.15	1.55	2.00	2.40	2.50	2.90^{cd}	(+) 0.50
S. torvum -unripe fruit (1:2)	4.55	0.95	1.25	2.25	3.50	4.75^{bcde}	1.90	2.25	2.75	3.90	4.9	6.00^{ghij}	(-)
S. torvum -leaf (1:2)	4.11	0.50	0.50	0.50	0.50	0.50^{a}	0.50	0.50	0.50	0.50	0.50	0.50^{a}	(+) 0.20
Taro													
Colocasia esculenta -kujang enyuh*-leaf, midrib (1:2)	3.28	3.00	4.00	5.75	7.00	9.00^{f}	1.50	2.35	2.75	3.75	5.40	9.00^{n}	(-)
C. esculenta -kujang enyuh*-tuber(1:2)	3.98	5.25	6.5	8.00	9.00	9.00^{f}	0.50	0.50	1.10	1.90	2.25	2.75^{c}	(-)
Xanthosoma sagittifolium -kujang malahoi*-leaf, midrib (1:2)	3.31	4.00	6.75	7.00	9.00	9.00^{f}	0.50	1.00	1.50	2.50	3.90	5.00^{ef}	(-)
X. sagittifolium -kujang malahoi*-tuber (1:2)	3.49	0.50	0.50	0.50	0.50	0.50^{a}	0.50	0.50	0.50	0.50	0.75	1.00^{b}	(-)
C. esculent a-kujang hijau*-leaf, midrib (1:2)	4.16	2.75	5.50	7.00	8.00	9.00^{f}	2.90	3.40	4.25	5.00	5.75	6.25^{hij}	(-)
Alocasia sp-kujang biha*-leaf, midrib (1:2)	3.66	0.50	0.50	0.50	0.50	0.50^{a}	0.50	1.00	2.20	2.90	3.35	4.40^{e}	(+) 0.10
C. esculenta- kujang burung*-leaf, midrib (1:2)	3.28	0.50	1.10	1.75	2.25	3.00^{abc}	0.75	2.00	2.50	2.50	8.10	9.00^{n}	(-)
C. esculenta- kujang lais*-leaf, midrib (1:2)	3.31	0.50	1.50	3.50	6.15	9.00^{f}	2.40	2.40	2.40	2.40	2.90	3.10^{cd}	(-)
C. esculenta- kujang lais*-tuber (1:2)	3.91	0.50	0.50	0.50	0.50	0.50^{a}	0.50	0.50	0.50	0.50	0.50	0.50^{a}	(-)
C. esculenta- kujang lilin*-leaf, midrib (1:2)	4.06	4.65	6.50	9.00	9.00	9.00^{f}	2.75	3.65	4.00	5.00	6.00	6.90^{jk}	(-)
C. esculenta- kujang pandan*-leaf, midrib (1:2)	3.48	0.50	0.50	0.50	0.50	0.50^{a}	0.8	1.00	1.65	2.50	4.50	5.50^{efgh}	(-)
Caladium redflash -leaf, midrib (1:2)	3.11	0.50	1.00	2.25	4.50	6.00^{cdef}	2.00	2.50	3.50	4.50	5.50	6.75^{ij}	(-)
C. tricolor- leaf, midrib (1:2)	3.46	1.90	3.50	4.75	5.25	6.00^{cdef}	0.75	0.75	1.00	2.00	2.75	3.25^{d}	(-)
Alocasia macrorrhizos -leaf, midrib (1:2)	3.26	5.00	6.75	7.10	7.25	8.00^{def}	0.50	0.50	0.50	0.50	0.50	0.50^{a}	(-)
A. macrorrhizos -tuber (1:2)	3.34	5.50	7.25	7.75	9.00	9.00^{f}	1.25	1.50	2.00	2.00	2.00	2.85^{cd}	(-)
Bamboo													
Dendrocalamus asper- fresh leaf (1:2)	5.13	0.50	0.50	0.50	0.50	0.50^{a}	2.75	3.90	4.90	5.90	6.50	7.00^{jkl}	(+) 0.20
D. asper- fallen leaf (1:2)	5.85	4.00	5.50	8.00	9.00	9.00^{f}	1.75	2.65	4.00	5.25	7.50	9.00^{n}	(-)
D. asper- stem (1:2)	5.25	4.40	6.25	7.00	8.00	9.00^{f}	2.15	3.10	4.25	6.25	7.90	9.00^{n}	(+) 0.50
D. asper- stem (1:10)	3.99	1.00	3.00	4.50	6.50	8.75^{ef}	2.65	3.00	4.00	6.00	7.25	9.00^{n}	(-)
Bambusa vulgaris var *striata* -fresh leaf (1:2)	4.51	2.50	3.75	4.75	4.75	4.75^{bcde}	3.60	4.35	5.25	6.10	7.25	8.20^{mn}	(-)
B. vulgaris var *striata*- stem (1:2)	4.53	0.50	0.50	0.75	1.25	1.75^{ab}	2.75	4.00	5.50	6.25	7.00	7.80^{kl}	(+) 1
B. vulgaris var vulgaris-fresh leaf (1:2)	4.70	7.40	9.00	9.00	9.00	9.00^{f}	2.75	3.50	4.40	5.50	7.40	9.00^{n}	(-)
Phyllostachys bambusoides -fresh leaf (1:2)	7.75	3.75	4.90	5.20	7.00	8.00^{def}	4.50	5.25	6.25	8.00	9.00	9.00^{n}	(-)
Schizostachyum brachycladum -fresh leaf (1:2)	5.23	5.00	6.50	8.00	9.00	9.00^{f}	3.00	4.00	4.50	6.00	7.10	8.00^{lm}	(-)
Rattan													
Calamus trachycoleus- uwei irit*-skin (1:2)	7.25	0.50	1.65	1.9	2.90	4.25^{abcd}	3.70	4.20	5.65	6.25	7.75	9.00^{n}	(+) 1
C. trachycoleus- uwei irit*-skin (1:10)	7.19	2.50	3.3	4.25	6.00	9.00^{f}	2.45	3.65	5.30	6.40	7.40	9.00^{n}	(-)
C. trachycoleus- uwei irit*-stem inside (1:2)	5.93	0.50	0.50	0.50	0.50	0.50^{a}	3.00	3.85	4.65	5.10	6.25	6.65^{ij}	(+) 0.20
C. trachycoleus- uwei irit*-stem inside (1:10)	6.00	0.50	0.50	0.50	0.50	0.50^{a}	2.90	3.50	4.15	4.65	5.10	5.45^{efg}	(-)
Daemonorops fissa -uwei bajungan*-skin (1:2)	7.02	1.40	2.15	3.25	4.10	4.75^{bcde}	1.65	2.50	3.25	4.95	5.90	9.00^{n}	(+) 0.20
D. fissa -uwei bajungan*-skin (1:10)	5.23	1.00	1.9	3.65	4.65	5.25^{bcdef}	1.50	1.75	2.30	2.75	3.60	4.50^{e}	(+) 0.20
D. fissa -uwei bajungan*-stem inside (1:2)	5.66	0.50	0.50	0.50	0.50	0.50^{a}	2.65	3.10	4.20	4.75	5.30	6.00^{ghij}	(-)
D. fissa -uwei bajungan*-stem inside (1:10)	5.83	0.50	0.50	0.50	0.50	0.50^{a}	2.90	3.90	4.65	5.25	5.60	6.65^{ij}	(-)

*Note: * Dayak Ngaju language; a ratio fresh of plant and water of 1:2 and 1:10; (-)=haven't antibacteria, (+)=have antibacteria*

***Data were analyzed using analysis of variance and Tukey's HSD (honestly significant difference) test at the 5% confidence level (only at last day observation); the same letter are not significantly different*

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It is known that bacterial growth is positively related to pH (pH 4.0–8.3) while fungal growth increases with decreasing pH (Rousk et al., 2011). When viewed from the pH data of plant extracts, it turns out that the pH that can inhibit fungal growth ranges from 3.48 to 5.93 and can inhibit bacterial growth ranges from 3.68 to 7.02 (Table 1). However, not always a low pH could suppress the growth of fungi or not always a high pH could suppress the growth of bacteria. This suggested that the effect of pH on suppressing microbial growth was not significant in this study, meaning that the chemical compounds contained in the plant extracts played a greater role in suppressing microbial growth.

The research showed that organic vegetables from the eggplant group especially from *S. torvum* show a lot of inhibition against bacterial and fungal pathogens (Table 1). This is in accordance with the results of Bari et al. (2011) who reported that extracts from the leaves, stems, roots and flowers of *S. torvum* can suppress on fifteen (six Gram positive and nine Gram negative) human pathogenic bacteria and on eight pathogenic fungi. The toxicity of the extracts is as follows, the best comes from the roots, followed by the stems, after that from the flowers and the least effect from the leaves. *S. torvum* can be an attractive material for the development of environmentally friendly biopesticides.

In generally eggplant produces secondary metabolites, including glycoalkaloids, antioxidant compounds such as phenolic, phenolic acid and flavonoid that there is a potentially used for against pathogen (Sharma and Khausik, 2021). However *S. torvum* have bioactivity as chemical components, namely phenolic, flavonoid and alkaloids compounds. Phenolic compounds have been used as anti-inflammatory and antioxidants. Anti-inflammatory activity was measured by testing for edema in the feet of rats induced by carrageenan and treated with indomethacin, while the antioxidant activity of *S. torvum* fruit contains alkaloids, flavonoids, saponins and tannins that can inhibit or prevent cell damage due to free radical oxidation (Ningsih *et al.*, 2010).

Liao *et al.* (2021) reported that bamboo leaf extract shows antifungal activity but in this study none of plant extract from several bamboo type showed antifungal activity. The different antifungal activity is thought to be due to the use of different extraction methods. This study used the water extraction method while in reference used 95% of aqueous ethanol at room temperature. This is in accordance with what was explained by Kuncoroe (2015) said that the extraction method is one of the factors that affect the extraction results.

Even though the extraction from bamboo plants did not show antifungal activity when using the water extraction method, it did show antibacterial activity, where the organ extracts from the stems showed a higher lysis zone than that from the leaves. Several studies reported that *D. asper* leaf extract was the most effective for inhibiting all tested *Escherichia coli* strains. Fatty acids, along with esters, long chain alcohols, and aldehydes are the main compounds in the ethanol extract of *D. asper* leaves (Mulyono *et al.*, 2012). Sap of *D. asper* shoot contained quinine, quercetin and saponin, which were supposed to have antibacterial activity against *Klebsiella pneumoniae* and

ISSN: 2354-5844(Print)
ISSN: 2477-5223 (Online)

Pseudomonas aeruginosa (Artanti and Mujahidah, 2021).

What is also interesting to discuss was the taro plant, which was the opposite of the bamboo plant, where various types of taro show more antifungal activity than antibacterial. The method used in this study was water extraction so that compounds that inhibit bacterial activity are thought to be produced less than compounds that inhibit fungi. Several references reported that the phytochemical compounds contained in *C. esculenta* contain alkaloids, terpenoids, glycosides, resins, saponins, tannins, flavonoids, phenols, and amino acids. Taro leaf extract has been shown to suppress bacterial isolates such as *Staphylococcus aureus, E. coli, P. aeruginosa* and *Klebsiella* sp. and single fungus *Candida albicans* isolates (Al-Kaf *et al*., 2019).

From this study, it can be seen that only one type of taro can control bacteria, namely taro type *Alocasia* sp which in the Dayak Ngaju language is called Kujang Biha. This plant extract has been shown to suppress the growth of *S. rolfsii* and *X. campestris* bacteria. Based on local wisdom in Central Kalimantan, the liquid from the stem of Kujang Biha is often used to treat lung infections. Kari *et al.* (2015) reported that extract of *Alocasia indica* in vitro showed antibacterial and antifungal activity against Gram positive and Gram negative bacteria and pathogenic fungi. Leaf and stem extracts were found to have antibacterial activity against *S. aureus, Bacillus subtilis, E. coli* and *K. pneumoniae* also showed antifungal activity against *Aspergillus niger, C. albicans* and *Saccharomyces cerevisiae.*

This research is the first finding which states that extracts from rattan skin and stems inside can inhibit the growth of fungi and bacteria. Stem inside of *C. trachycoleus* (*uwei irit*) and inhibit growth of *S. rolfsii*, and the other hand skin of *C. trachycoleus* and *D. fissa* (*uwei bajungan*) showed antibacterial activity of *X. campetris*. Only stem inside of *C. trachycoleus* against both of fungal and bacterial growth such as *S. rolfsii* and *X. campestris*. Edible rattan (*C. tenuis* Roxb) contain in saponins and steroids whereas, ethyl acetate extract recorded presence of steroids only. However, methanolic extract containing carbohydrates, saponins, flavonoids, steroids, tannins and glycosides accounted for significant cytotoxic activity (Thakur *et al.*, 2016). Fruit of *C. ornatus* known to inhibit growth of *E. coli* was found in the pericarp and the seed, while antibacterial activity against *S. mutans* was found in the pericarp and the flesh (Salusu *et al*., 2019).

The abundant availability of non-vegetables and organic vegetables from peat swamp areas such as bamboo, taro, rattan and eggplant grooup are abundant in Central Kalimantan as potential ingredients for botanical pesticides. The further research is needed to determine the effect of this plant extract in the field whether it is stable or not has an inhibitory effect. The advantages of botanical pesticides are that they have specific targets, do not leave residues on food and feed based on their biodegradability, look economical and are environmentally friendly so that they are expected to provide cleaner and safer ecosystems. However, the drawbacks are limited availability of raw materials for biopesticides, variation in potency, standardization of extraction methods, quality control, shelf life and improvement of bio-efficacy (Mendki and Maheswari, 2001). Indeed a lot of works must be done to get an effective botanical pesticide.

CONCLUSSIONS

It could be concluded that organic vegetables and non-vegetables from peat swamp of Central Kalimantan have the potential to inhibit microbial growth. Plant extracts that could control *S. rolfsii* is derived from *Solanum ferox*,

ISSN: 2354-5844(Print)
ISSN: 2477-5223 (Online)

S. lasiocarpum, *S. torvum*, *X. sagittifolium*, *C. esculenta*-kujang biha, *C. esculenta*-kujang lais and *C. esculenta*-kujang lilin, *D. asper*, *C. trachycoleus* and *D. fissa*. Botanical pesticides from *S. lasiocarpum* , *S. torvum*, *C. esculenta*-kujang lais, and *X. sagittifolium* against growth *of C. capsici*.Bactericide found on *S. ferox*, *S. melongena*-purple egplant, *C. esculenta*-kujang biha, *D. asper*, *B. vulgaris* var *striata*, *C. trachycoleus* and *D. fissa*. The results of the study also showed that the extract form leaf of *S. torvum* that suppressed fungi and bacteria pathogen such as *S. rolfsii*, *C. capsici* and *X. campestris.*

ACKNOWLEGEMENT

The researchers would like to deeply thank the University of Palangka Raya for funding this research from the PNBP DIPA of the University of Palangka Raya, Innovative Applied Research, for the fiscal year 2022, with contract No. 749/UN24.13/AL.04/2022. Deep appreciation should go to Dolvin, Nesa Cristia, Yarni Hulu, Novia Arnia Saragih and Saiful who assisted the whole period of research activities.

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