



# Article Evaluation of Allelopathic Potentials from Medicinal Plant Species in Phnom Kulen National Park, Cambodia by the Sandwich Method

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**Abstract**: Phnom Kulen National Park, in north-western Cambodia, has huge richness in biodiversity and medicinal value. One hundred and ninety-five (195) medicinal plant species were collected from the national park to examine allelopathic potentials by using the sandwich method, a specific bioassay for the evaluation of leachates from plants. The study found 58 out of 195 medicinal plant species showed significant inhibitory effects on lettuce radicle elongation as evaluated by standard deviation variance based on the normal distribution. Three species including *Iris pallida* (4% of control), *Parabarium micranthum* (7.5% of control), and *Peliosanthes teta* (8.2% of control) showed strong inhibition of lettuce radicle elongation less than 10% of the control. The results presented could present as a benchmark for isolation and identification of allelochemicals among medicinal plants used in Cambodia.

Keywords: allelopathy; allelochemicals; leachates; sandwich method

## 1. Introduction

Plant species in the natural diversity have been used by humans to treat numerous diseases worldwide. The various modes of medicinal plant use associated with traditional knowledge were found in different ways in different regions [1]. Hundreds of species have been used for curing various diseases such as fever, malaria, cough, flu, asthma, colds, chest diseases, skin itch, acne, headache, jaundice, nausea, ulcer, tumours, typhus, stomach pain, heart attack, chills, inflammation, herpes, hepatitis, swelling, and among others. [2]. Over the last three decades, no less than 80% of people worldwide relied on medicinal plants for primary healthcare and other factors [3]. Medicinal plants are a significant source of bioactive substances in the development of most drugs [4,5]. In the natural ecology, bioactive phytochemical constituents include alkaloids, tannins, flavonoids and some other phenolic compounds present in medicinal plants that produce a definite physiological action effect either on humans, animals, and other plants [6]. Interestingly, a wide range of these secondary metabolites was reported to have strong relativity in allelopathic activity [7]. Some bioactive compounds contained in medicinal plants including ferulic, coumaric, vanillic, caffeic and chlorogenic acids in medicinal plants were found to possess plant growth inhibitory effect [8,9]. The term allelopathy was introduced by Molisch in 1937, referring to a phenomenon observed in many plants that influence the physiological process of neighbouring plants and or organisms, interacting through secondary



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**Copyright:** © 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/). metabolites [10,11]. In this process, chemicals—called allelochemicals—are released from plants that impose allelopathic influences (stimulatory or inhibition) into the environment through volatilization, leaching, root exudation and decomposition of plant residues in soil [12]. Allelopathic substances from either specialized or varying amounts of different plant organs are consisted in a vast array of seemingly disconnected structures and possess different modes of action which are mostly interpreted in ecology as a defence against other plants, pests, or diseases [13,14]. Allelochemicals can also stimulate or inhibit the germination, growth, and development of plants [15,16]. The incorporation of allelopathic substances released from plant residues was introduced to reduce the use of synthetic herbicides which were reported to harmful to human health and to cause environmental deterioration [17–19]. Consequently, allelopathic potentials of medicinal plant species were suggested as a practical option for sustainable weed management [20–22]. A previous study linked the allelopathic potential of medicinal plants to the medicinal values (relative frequency of citation, fidelity level, and use values) of plants [23]. Research have focused much attention on the search for novel natural plant products to promote sustainable agriculture. This study, therefore, focused on medicinal plants in Phnom Kulen National Park, a region known for its cultural and medicinal value, in north-western Cambodia. The national park named from a lychee tree species (*Litchi chinensis*), elevated up to 500 m and covering 37,373 ha, was expected to have around 1500 plant species. However, only 500 species were currently recorded in taxonomy among 775 known plant species [24]. It is also believed that the medicinal value from this area is likely different from other regions in Cambodia, and it is home to 389 medicinal plant species associated with traditional knowledge that has been elucidated by the School for Field Studies in 2017 [25,26]. One hundred and ninety-five medicinal plant species belonging to 81 different families were collected from the national park to evaluate allelopathic potentials by using the sandwich method.

#### 2. Materials and Methods

### 2.1. Material

The parts used of the medicinal plant species were collected and dried up (oven oven-dried at 60 °C for 3 hours) at the target area before being transferred for testing at the Laboratory of Department of International Environment and Agriculture, Tokyo University of Agriculture and Technology, Japan. The various plant parts collected for this study were leaves, stems, barks, bulbs, rhizomes, tubers, roots, flowers and fruits. Lettuce (*Lactuca sativa L.*) was selected as a test plant material in the bioassay due to its reliability in germination and its susceptibility to inhibitory and stimulatory chemicals [27].

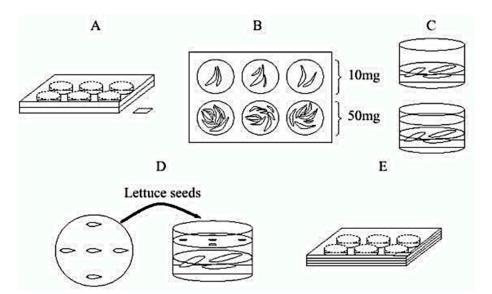
### 2.2. Sandwich Method

The sandwich method was introduced as a very useful tool for large scale allelopathic activity screening of plant leachates [28]. Multi-dish plastic plates were used as shown in Figure 1. Agar without plant material was set up as the untreated control. After lettuce seeding in each well, the multi-dish plastic plates were sealed with plastic tape, marked with a corresponding label and kept in an incubator (NTS Model MI-25S) at 25°C for three days. With three replication treatments, the germination percentage of the lettuce seedlings were measured and recorded including the mean of radicle and hypocotyl growth.

#### 2.3. Statistical Analysis

The treatment tested was arranged in a complete randomized design with three replicates. Statistical analysis of the experimental data was conducted with Microsoft Excel 2010. And the means, standard deviation (SD), and SD variance (SDV) were also evaluated.

 $Elongation = \frac{(Average \ length \ of \ treatment \ radicle / hypocotyl)}{(Average \ length \ of \ control \ radicle / hypocotyl)} \times \ 100$ 



**Figure 1.** Sandwich method: (**A**) six-well multi-dish plastic plate; (**B**) 10 or 50 mg dried leaves placed in each well of the multi-dish plate; (**C**) addition of 5 mL plus 5 mL agar in two layers on the dried leaves; (**D**) five lettuce seeds vertically placed; (**E**) covered with plastic tape and appropriately labelled the multi-dish for incubation in dark conditions.

## 3. Results

The elongation percentages of radicle and hypocotyl of lettuce seedlings were affected by leachates from 195 medicinal plant species in the sandwich bioassay (Table 1). In this study, the radicle elongation percentages of lettuce seedlings were in the range of 4.0%to 132.5% and 3.1% to 119.7% for 10 mg and 50 mg, respectively. In both the 10 mg and 50 mg treatments, the lettuce radicle elongations were inhibited more than hypocotyl elongations. Concerning the 10 mg oven oven-dried treatment, we observed that only 58 species showed significant inhibition on lettuce radicle growth as evaluated by using standard deviation variance (SDV). The radicle growth elongation of >90% occurred in 64 species, 70–90% in 61 species, 50–70% in 36 species, 30–50% in 25 species, and 4–30% in 9 species. The six families with highest species number in all examined medicinal plants were Rubiaceae (13 species), Fabaceae (12 species), Euphorbiaceae (12 species), Apocynaceae (10 species), Moraceae (7 species) and Zingiberaceae (7 species). Our study found that 34 species from different plant families showed less than 50% of radicle elongation percentage. However, only three species from different families such as Iridaceae, Apocynaceae and Asparagaceae had lettuce radicle elongation growth less than 10%. The species with the strongest inhibition on lettuce radicle elongation was Iris pallida (4% of control), followed by Parabarium micranthum (7.5% of control), Peliosanthes teta (8.2% of control), Crinum latifolium (21.3% of control), Suregada multiflora (21.3% of control), Ervatamia microphylla (22.4% of control), Allophyllus serrulatus (23.3% of control) and Eupatorium odoratum (24.1% of control). Nonetheless, the phytochemicals that linked to phytotoxicity and the inhibitory activities of these top inhibiting medicinal plants might contain compounds or some unknown chemical constituents.

**Table 1.** The radicle and hypocotyl elongation percentages of lettuce seedlings grown containing oven-dried plant materials tested using the sandwich method.

Scientific Name	Plant Families	Part Used	10 mg		50 mg		– Criteria
			R	Н	R	Н	- Criteria
Iris pallida Lam	Iridaceae	Rhizome	4.0	7.1	3.1	0	****
Parabarium micranthum (A.DC.) Pierre	Apocynaceae	Leaf	7.5	16.8	5.9	3.2	****
Peliosanthes teta Andrew	Asparagaceae	Leaf	8.2	38.9	7.20	19.7	****
Crinum latifolium L	Amaryllidaceae	Bulb	21.3	65.5	5.50	13.0	****
Suregada multiflora Baill	Euphorbiaceae	Stem	21.3	57.7	12.4	35.5	****
Ervatamia microphylla Kerr	Apocynaceae	Leaf	22.4	104	10.3	46.6	****
Allophyllus serrulatus Radlk	Sapindaceae	Leaf	23.3	22.5	12.8	17.5	****
Eupatorium odoratum (L.) R.M.King & H.Rob	Asteraceae	Leaf	24.1	77.5	11.5	35.0	****
Stephania rotunda Linn	Menispermaceae	Tuber	28.7	46.2	10.0	24.6	***
Cyclea barbata Miers	Menispermaceae	Leaf	31.4	94.1	14.4	44.7	***
Jasminum nobile C.B.Clarke	Oleaceae	Stem	31.7	83.2	24.4	89.1	***
<i>Kaempferia galanga</i> Linn	Zingiberaceae	Bulb	32.1	59.3	21.6	34.1	***
Holarrhena curtisii King & Gamble	Apocynaceae	Leaf	32.7	95.1	27.6	85.4	***
Mimosa pudica Linn	Fabaceae	Leaf	32.8	91.9	21.1	76.4	***
Eleutherine bulbosa (Mill.) Urb	Iridaceae	Flower	34.5	56.9	19.1	28.5	***
Cleistanthus tomentosus Hance	Euphorbiaceae	Stem	36.3	90.5	10.3	30.5	***
Sindora siamensis Teysm	Fabaceae	Bark	37.5	70.0	12.2	27.0	***
Cassia siamea Lam	Fabaceae	Leaf	38.0	90.0	29.0	86.0	**
Phyllanthus amarus Schum.ct Thonn	Phyllanthaceae	Stem	38.6	115	13.2	56.0	**
Spirolobium cambodianum Baill	Apocynaceae	Stem	38.8	88.5	25.2	64.2	**
, <i>Terminalia corticosa</i> Pierre	Combretaceae	Bark	39.4	69.5	14.1	71.9	**
Adina cordifolia Hok. F	Rubiaceae	Stem	39.7	68.0	9.40	35.5	**
Croton oblongifolius Roxb	Euphorbiaceae	Leaf	41.0	107	21.6	44.3	**
<i>Carallia brachiata</i> (Lour.) Merr	Rhizophoraceae	Bark	42.6	76.9	26.5	72.3	**
Euphorbia hirta Linn	Euphorbiaceae	Leaf	43.3	104	21.2	83.8	**
Brucea javanica (Linn) Merr	Simaroubaceae	Stem	43.8	68.6	10.8	21.8	**
Couroupia guianensis Aubert	Lecythidaceae	Flower	43.9	83.8	19.6	45.3	**
Dialium cochinchinense Pierre	Fabaceae	Bark	43.9	101	14.2	67.2	**
Cyperus rotundus Linn	Cyperaceae	Leaf	44.8	115	22.8	106	**
Dracaena angustifolia Roxb	Asparagaceae	Leaf	45.0	106	31.7	95.3	**
Hymenocardia punctata Wall. ex Lindl	Euphorbiaceae	Stem	46.4	69.6	31.3	58.9	**
Melaleuca leucadendra L	Myrtaceae	Leaf	46.6	91.0	22.3	74.5	**
Diospyros decandra Lour	Ebenaceae	Bark	47.3	96.9	31.2	77.7	**
Dillenia pentagyna Roxb	Dilleniaceae	Stem	49.5	91.1	13.1	58.1	**
Ficus pumila L	Moraceae	Leaf	50.2	110	18.1	69.9	**
Diospyros nitida Merr	Ebenaceae	Stem	50.3	95.5	15.6	39.1	**
Rhodomyrtus tomentosa (Ait) Hassk	Myrtaceae	Leaf	50.4	79.3	24.2	80.2	**
Streptocaulon juventas Merr	Apocynaceae	Stem	50.7	97.0	27.8	84.4	*
Kaempferia parviflora Wall. ex Baker	Zingiberaceae	Bulb	50.8	120	33.6	108	*
Acacia harmandiana (Pierre) Gagnep	Fabaceae	Bark	51.6	84.5	31.6	70.9	*
Derris scandens (Roxb.) Benth	Fabaceae	Stem	51.6	80.8	20.1	36.9	*
Peltophorum dasyrhachis (Miq.) Kurz	Caesalpinioideae	Bark	52.3	77.8	24.7	85.2	*
Tetracera scendens (L.) Merr	Dilleniaceae	Leaf	52.7	114	46.1	111	*
Harrisonia perforata Merr	Rutaceae	Bark	53.4	91.5	36.2	87.9	*
Spatholobus parviflorous Kuntz	Fabaceae	Stem	54.2	111	69.3	93.2	*
Lagerstroemia floribunda Jack	Lythraceae	Bark	57.3	109	8.60	47.7	*
Scoparia dulcis L	Plantaginaceae	Stem	57.6	95.0	92.2	107	*
Ampelocissus matinii Planch	Vitaceae	Stem	58.8	118	16.7	59.5	*
Macaranga triloba (Blume) Muell.Arg	Euphorbiaceae	Stem	59.2	107	39.5	72.1	*
Acalypha boehmerioides Miq	Euphorbiaceae	Leaf	60.0	149	41.5	106	*
Pteridium aquilinum (L) Kuhm	Dennstaedtiaceae	Leaf	60.0	149	41.5 17.0	71.7	*
Coptosapelta flavescens Korth	Rubiaceae	Stem	60.3 60.7	73.9	64.2	125	*
Nepenthes kampotiana Lecomte	Nepenthaceae	Flower	60.9	120	43.9	125	*
		Stem	60.9 61.0	120 130	43.9 26.1	114	*
Plumbago zeylanica L Macua farraa I	Plumbaginaceae	Leaf					*
Mesua ferrea L	Calophyllaceae		61.1 61.1	95.5 80.7	22.3	69.8 70.3	*
Scindapsus officinalis (Roxb.) Schott	Araceae	Stem	61.1	80.7	8.60	70.3	<b>n</b> .

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Scientific Name	Plant Families	Part Used	10 mg		50 mg		
			R	Н	R	Н	- Criteria
<i>Moringa oleifera</i> Lamk	Moringaceae	Bark	62.5	112	13.9	61.9	*
Pandanus tectorius Parkinson ex Du Roi	Pandanaceae	Leaf	63.0	122	28.3	87.1	*
Dillenia ovata Wall. ex Hook.f	Dilleniaceae	Bark	63.3	100	35.6	90.6	
Alpinia conchigera Grulf	Zingiberaceae	Leaf	63.7	117	45.3	117	
Oroxylum indicum (Linn.) Kurz	Bignoniaceae	Bark	64.7	120	41.4	132	
Careya sphaerica Roxb	Lecythidaceae	Bark	65.3	119	41.1	136	
Blumea balsamifera DC	Asteraceae	Leaf	65.9	110	42.3	102	
Croton lachnocarpus Benth.	Euphorbiaceae	Leaf	66.3	112	31.9	96.9	
<i>Eleusine indica</i> (L) Gaertn	Poaceae	Leaf	67.4	138	35.1	129	
Aquilaria crassna Pierr	Thymeleaceae	Root	67.5	134	60.4	127	
Drynaria quercifolia (L.) J Sm	Polypodiaceae	Leaf	68.7	120	49.8	129	
Lagerstroemia calyculata Kurz	Lythraceae	Bark	68.7	108	53.7	61.9	
Erythroxylum cambodianum Pierre	Erythroxylaceae	Stem	69.7	84.7	67.3	113	
Cnestis palala (Lour.) Merr	Connaraceae	Leaf	69.8	103	44.9	103	
Capparis micracantha DC	Capparaceae	Stem	70.6	98.2	42.2	93.1	
<i>Glycosmis pentaphylla</i> (Retz) Correa	Rutaceae	Stem	70.7	137	44.4	113	
Ventilago cristata Pierre	Rhamnaceae	Stem	70.7	124	32.8	102	
Dioscorea hispida Dennst	Dioscoreaceae	Tuber	71.0	104	39.0	114	
Solanum torvum Swartz	Solanaceae	Stem	71.4	104	65.4	113	
Hoya diversifolia Blume	Asclepiadaceae	Leaf	72.1	116	46.8	105	
Bauhinia bassacensis Pierre	Fabaceae	Stem	72.6	118	46.9	110	
Garcinia villersiana Pierre	Clusiaceae	Stem	72.6	101	44.5	86.9	
Polyalthia evecta (Pierre) Finet et Gagnep	Annonaceae	Stem	72.9	125	24.9	72.3	
Gardenia philastrei Pierre-ex-Pit	Rubiaceae	Stem	73.6	125	24.3	92.6	
Schleicheria oleosa (Lour.) Oken	Sapindaceae	Stem	74.0	103	31.5	94.2	
Entada phaseoloides Merr	Fabaceae	Fruit	75.0	103	46.9	80.2	
Calamus rudentum Lour	Arecaceae	Stem	75.2	124	53.5	102	
Tiliacora triandra Diels	Menispermaceae	Stem	75.2	114	28.1	75.0	
Alstonia scholaris R-Br	Apocynaceae	Bark	76.2	93.2	84.1	110	
Congea tomentosa Roxb	Lamiaceae	Stem	76.3	120	43.0	90.5	
Gnetum montanum Markgr	Gnetaceae	Stem	76.5	118	24.1	64.1	
Andrographis paniculata (Burm.f.)	Acanthaceae	Leaf	77.1	136	44.9	75.2	
Anacardium occidentale Linn	Anacardiaceae	Bark	77.8	99	14.8	55.0	
Imperata cylindrica Beauv	Poaceae	Leaf	78.2	91.9	69.1	99.1	
Sterculia lychnophora Hance	Sterculiaceae	Stem	78.8	125	49.4	93.7	
Melodorum fruticosum Lour	Annonaceae	Stem	79.1	131	52.9	109	
Physalis angulata L	Solanaceae	Root	79.2	126	55.3	115	
Afzelia xylocarpa (Kurz) Craib	Fabaceae	Bark	79.3	141	82.6	125	
Licuala spinosa Wurmb	Arecaceae	Root	79.4	129	60.6	147	
Diospyros venosa Wall	Ebenaceae	Stem	79.6	126	44.2	109	
Illigera rhodantha Hance	Hernandiaceae	Stem	80.2	131	43.9	99.2	
Asplenium nidus L	Aspleniaceae	Leaf	80.8	120	64.6	106	
Shorea roxburgii G Don	Dipterocarpaceae	Bark	81.4	93.2	39.4	81.0	
Mallotus paniculatus (Lam.) Mull.Arg	Euphorbiaceae	Stem	81.7	120	22.2	64.4	
Gomphrena celosioides Mart	Amaranthaceae	Flower	82.0	135	45.8	122	
Litchi chinensis Sonn	Sapindaceae	Bark	82.1	103	14.8	78.8	
Elaeocarpus stipularis Blume	Elaeocarpaceae	Stem	83.0	120	37.1	92.1	
Leea rubra Bl	Vitaceae	Stem	83.8	118	32.0	109	
Streblus asper Lour	Moraceae	Stem	83.9	149	52.1	126	
Kalanchoe Integra Kuntze	Crassulaceae	Stem	84.0	186	49.8	166	
Anthocephalus chinensis (Lam.)	Rubiaceae	Bark	84.2	95.2	92.8	118	
Microcos paniculata L	Malvaceae	Stem	84.4	103	43.2	95.8	
Manilkara hexandra (Roxb.) Dubard	Sapotaceae	Leaf	85.1	105	58.9	98.1	
Uvaria rufa Blume	Annonaceae	Stem	86.1	120	56.2	84.5	
Prismatomeris tetrandra (Roxb.) K.Schum	Rubiaceae	Stem	86.3	110	73.2	112	
Memecylon laevigalum Blume	Melastomataceae	Stem	86.4	123	56.3	112	
Amomum xanthioides Wall.	Zingiberaceae	Stem	87.0	161	58.1	139	
	Lingiscruccuc	0.0111	07.0	101	20.1	107	

 Table 1. Cont.

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Scientific NamePant familiesPant familiesPant familiesPant familiesCriteriaCriteriaTimespor crisps (Linn) Miers ex HookMenispermaccaeStem87.0134450.0112Morindu tomentos RothRubiaccaeStem87.410180.1117Cassis altat LLeguninosaeStem87.513569.2117Parmerio korights (Uss.)MoldenkeApocynaccaeBark87.712380.281.7Albia to korightsApocynaccaeBark87.712380.422.284.3Liggelatin conforme C. ChrLygoliaccaeLug88.011066.394.6Zingber purpurean.RosceZingberaccaeStem88.611650.2116Broussented parytine for functioninal JackRubiaccaeStem88.611650.2116Broussented parytine for functioninal JackArubiaccaeStem89.811780.3117Typhoniam tribulation SchottAraccaeStem89.811780.3110109Sterula forthif ULARKLucscueStem89.811080.5100100Colona atriculat properties (Linn) MarkAruccaeStem90.3110101115109Sterula forthif ULARKLucscueStem90.311010313394.4133Typhoniam tribulation SchottAraccaeStem90.311010414494.8 <th></th> <th></th> <th>D ( II 1</th> <th>10 1</th> <th>ng</th> <th>50</th> <th>mg</th> <th></th>			D ( II 1	10 1	ng	50	mg	
Morinde ionentiese RothRubineaceStem $87.1$ 119 $50.6$ $73.0$ Ficus agritu VahlMoraceaeIcan $87.4$ $101$ $80.1$ $117$ Casis alataLLeguminosaStem $87.4$ $101$ $80.1$ $117$ Lindernia crustaros (L) FMuellLinderniaceaeStem $87.5$ $133$ $60.2$ $117$ Parameria heroigata (tuss) MoldenkeManosaceaeStem $87.7$ $123$ $88.0$ $102$ Albiai (chek (L) BenthMirosaceaeStem $87.7$ $128.4$ $43.5$ Liggeling runpureum, RoscoeLingebrasceeTuber $88.4$ $97.6$ $48.1$ $53.7$ Inglinnthine conforme (C) ChLipgodiaceaeTuber $88.4$ $97.6$ $48.1$ $53.7$ Inglinnthine moliticatLipcodiaceaeTuber $88.4$ $97.6$ $48.1$ $53.7$ Inglinnthine moliticatLipcodiaceaeStem $88.6$ $112$ $38.7$ $88.7$ Inglinnthine moliticatLipcodiaceaeStem $88.6$ $112$ $38.7$ $88.7$ $113.7$ $78.8$ Scienia terrestris (L) TassettCyperaceaeStem $88.6$ $112$ $38.7$ $88.7$ $117.7$ $78.6$ $128.7$ $88.6$ $112.7$ $88.6$ $112.7$ $88.6$ $112.7$ $88.6$ $112.7$ $88.6$ $112.7$ $88.6$ $112.7$ $88.6$ $112.7$ $88.6$ $113.7$ $78.6$ $12.7$ $88.7$ $117.7$ $78.6$ $117.7$ $78.6$	Scientific Name	Plant Families	Part Used	R	Н	R	Н	- Criteria
Fich as agricult VahlMoraccaeLeaf $87.4$ $150$ $87.4$ $150$ Peydrix preproditis (Guota) RidsdaRubiaccaeStem $87.5$ $123$ $84.4$ $95.7$ Lindernic curstace (L) FMuelLindernicaceStem $87.5$ $123$ $85.4$ $95.7$ Albia lenkeApocynaecaeBark $87.7$ $123$ $55.0$ $127$ Albia lenkeApocynaecaeBark $87.7$ $123$ $55.0$ $127$ Albia lenkeApocynaecaeBark $87.7$ $123$ $55.6$ $43.1$ Iggolianc onforme C. ChrIrgoliaceaeLeaf $88.0$ $109$ $66.3$ $94.6$ Zangbrug margurum. RoscoZingiberacceTuber $88.4$ $97.6$ $48.1$ $53.7$ Figlianthus embiralEurophrinicoceStem $88.6$ $126.5$ $87.6$ $88.1$ $76.6$ $128.5$ Schrin terrestric (L) FassetCyperaccaeLaaf $89.0$ $166.5$ $90.5$ $117.5$ $76.5$ $123.5$ Browssoretin graphirm (L) Lift der ex VentTraccaeStem $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$ $112.5$ $89.6$	<i>Tinospora crispa</i> (Linn) Miers ex Hook	Menispermaceae	Stem	87.0	134	45.0	112	
Pspdrax pergracific (Bourd.) Ridsdale         Rubiaceae         Stem         87.4         101         80.1         117           Cassia data I.         Lindernia crustros (L.) FMuell         Nonsoccae         Bark         87.7         133         88.0         127           Alticia lefted (L.) Benth         Mirosaccae         Est         87.9         108         42.2         84.3           Liggotian conforme C. Chr         Lygotiaceae         Tuber         88.4         97.6         48.1         53.7           Thyliphophylam formicarium lack         Rubiaceae         Tuber         88.4         97.6         123         84.5         114         55.8         130           Hyliphophylam formicarium lack         Rubiaceae         Stem         89.2         114         55.8         137         60.2         161           Broussonella payrifern (L.) Lifter, ex Ven         Urticaccae         Stem         89.6         112         35.7         57.7           Globan antriculatin (Dexi), Craib         Tiliaccae         Stem         89.8         127         44.8         123           Madinco during fostaim (Dux)         Traia </td <td>Morinda tomentosa Roth</td> <td>Rubiaceae</td> <td>Stem</td> <td>87.1</td> <td>119</td> <td>50.6</td> <td>73.0</td> <td></td>	Morinda tomentosa Roth	Rubiaceae	Stem	87.1	119	50.6	73.0	
Casesia adual L.         Leguminosae         Stem         87.5         123         84.4         95.7           Dimourcia incritacia (L) EMuell         Linderniaccae         Stem         87.7         123         58.0         117           Ambria incristati (L) EMuell         Minnostaccae         Stark         87.7         123         58.0         127           Ambria incristati (L)         Bordh         Minnostaccae         Stark         87.7         123         58.0         127           Ambria incristati         Device         Stem         88.4         97.6         48.3         130           Augusti incristati         Device         Stem         88.4         97.6         48.3         130           Hydrophydum formicarium Jack         Rubiaccae         Stem         88.8         118         77.6         128           Soleria terrestris (L) Flasett         Colora auriculati (Device) Crab         Tatak         Rutaccae         Stem         89.8         117         80.3         117           Tydowini rrilobitinum (Miners) Kurz         Araceae         Stem         89.8         124         44.8         123           Madhuco bulyroperperimoles A.Chev         Sapotaccae         Bark         90.0         110         22.0	<i>Ficus sagitta</i> Vahl	Moraceae	Leaf	87.4	159	74.9	150	
Lindernia crustace (L.) EMuell         Linderniaceae         Stem         87.5         135         69.2         117           Parameria langitat (L.) Borth         Mirosaceae         Stem         87.7         108         82.2         84.3           Lygedium conforme C. Ch         Lygediaceae         Leaf         88.0         109         66.3         94.6           Zinglber purpressin. Roscie         Zinglberaceae         Tuber         88.4         97.6         48.1         30.7           Hydroplatum formicinium Jack         Rubiaceae         Tuber         88.4         97.6         48.1         30.7           Bruassoncia appriferi (L.) Fler ex Vett         Urticaceae         Stem         89.2         114         55.8         123           Colona auriculata (Desv). Craib         Hiliaceae         Stem         89.8         127         44.8         123           Maditaca butropsermides A.Chev         Sapotaceae         Bark         90.0         110         29.0         86.0           Cananga latifolia Finet et Gaspen         Anonaceae         Stem         90.3         130         74.4         91.3         120           Stroulin forbuit (Mires) Kurz         Tacaceae         Ster         90.3         133         74.4         9			Stem			80.1		
Parameria laceignia (jusic.) Moldenke         Appcynaceae         Bark         #7.7         123         58.0         127           Albricia lebba (L)         Borth         Timgboraceae         State         87.9         108         42.2         84.3           Ligodium conforme C. Chr         Lygodiaceae         Luch         88.0         109         66.3         94.6           Zingiber purpursum. Roscoe         Tuber         88.4         126         59.8         130           Hightophytum formitarium Jack         Rubiaceae         Stem         89.6         126         35.8         121           Birnussonetia papyriferi (L) L'Har. ex Vent         Uriticaceae         Stem         89.8         112         38.7         96.7           Midromelum falcitum (Lour) Tanak         Rutaceae         Stem         89.8         112         38.7         96.7           Taylonium ritolatium (Shott         Araceae         Stem         90.3         110         71.5         109           Connagu tiffui First et Gagnep         Annonaceae         Stem         90.3         110         71.5         109           Sterculiaceae         Sterculiaceae         Stem         90.5         138         74.4         94.8           Connagu ti		Leguminosae	Stem		123	48.4		
Albizin lebics (L) Benth         Minrosaccae         Stem         \$7.9         108         42.2         84.3           Jugodinu conforme C. Chr         Lygodiaceae         Luder         88.6         126         59.8         130           Hydrophytum formicarium Jack         Rubiaceae         Tuber         88.6         126         59.8         130           Hydrophytum formicarium Jack         Rubiaceae         Tuber         88.6         114         55.8         123           Scient terrestris (L) Fassett         Cyperaceae         Laaf         89.0         117         80.3         117           Typhonium trificatum (Lour) Tanak         Rutaceae         Stem         89.8         127         44.8         123           Malinea butyospermicides A.Chev         Sapotaceae         Bark         90.0         110         29.0         86.0           Gonocarupun lobianum (Miesis Kurz         Laccinaceae         Stem         90.3         113         79.4         113           Wrightin termitos Rome-Schult         Apocynaceae         Stem         90.3         110         71.5         109           Strenulia fordia Linn         Sterculia caceae         Stem         90.3         130         74.4         120           Go	Lindernia crustacea (L.) F.Muell	Linderniaceae	Stem		135			
Iggodiam conforme C. Chr $Iggodiaccae$ $Leaf$ 88.010066.394.6 $ZinglberzeeaTuber88.497.648.153.7Hyllanthum fornicarium JackRubiaccaeSterm88.612659.8130Hydnophytum fornicarium JackRubiaccaeSterm88.811877.6128Scient intrastrik (I). Ther. ex VentUriticaccaeSterm89.211455.8123Colona uriculati (Dex.) CraibTitalcacaeSterm89.811780.3117Typhonium tribolatum SchottAraccaeSterm89.811780.3117Typhonium tribolatum SchottAraccaeSterm90.311029.086.0Canarag Idifila Fine Le GapepAnnonaccaeSterm90.311359.4133Goncargan Inbinum (Micer) KurzIcacinaccaeSterm90.313159.4133Zanthoxylum heta DC.KutaccaeSterm90.513874.3120Zanthoxylum heta DC.KutaccaeSterm91.312959.8119StrychosalicaeatisStern91.010474.494.8Parinari anauensis HanceChrysobalanaceaeStern93.613674.3120Suthax Chine LSuthax ChineAraccaceaStem93.614671.2122Domax grandis KidleyPaccaceaStem93.614774.494.8Parinari anauensis Hance$	Parameria laevigata (Juss.) Moldenke	Apocynaceae	Bark	87.7	123	58.0		
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Albizia lebbek (L.) Benth	Mimosaceae	Stem	87.9	108	42.2	84.3	
	Lygodium conforme C. Chr	Lygodiaceae	Leaf	88.0	109	66.3		
Hydnophytum formicarium JackŘubiaceaeTuber88.811877.6128Seleria terrestris (L) EssettCyperaceaeLeaf89.016650.2161Broussonctia papyrifera (L) L'Hér. ex VentUrticaceaeStem89.211455.8123Colona auricultat (Dexy, CraibTiliaceaeStem89.811780.3117Typhonium trilobatum SchottAraceaeStem89.811780.3117Maticone butyrosperniosités A.ChevSapotaceaeBark90.011022.086.0Cananga latifolia Finet et GagnepAnnonaceaeStem90.311071.5109Genecaryum bibinum (Miers) KurzIaciaceaeStem90.313159.4133Wrightin tomentosa Roem-SchultApocynaceaeStem90.313674.3120Zanthoxylam thetsa DC.RutaceaeStem91.312974.494.8Barriar anamesis HaceChrysobalanaceaeStem93.110074.494.8Barriar anamesis HaceChrysobalanaceaeStem93.613671.3124Donax grandis RidleyPoaceaeStem93.613671.3124Larva chimesis LamRutiaceaeStem94.311887.2110Vitex pubescens VahlLamiaceaeStem94.313362.8112Donax grandis RidleyPoaceaeStem95.411371.4105Ba					97.6			
$\hat{S}cleina$ lerresity Broussonetia papyrifora (L.) UHér. ex Vent UtricaceaeLeaf89.016650.2161 $Broussonetia papyrifora (L.) UHér. ex VentUtricaceaeStem89.611238.796.7Micromelum fielatum (Lour) TanakTuphoinun trilobatum SchottRutaceaeStem89.811780.3117Micromelum fielatum (SchottAraceaeStem89.811238.796.7Madhuca butyrospermoides A.ChevSapotaceaeBark90.011029.086.0Camaga dipiloli Fince tel GagnepAnnonaceaeStem90.313159.4133Goncoarpum bolinum (Miers) KurzLacinaceaeStem90.313874.3120Zanthoxylum rhetsa DC.RutaceaeStem90.010474.494.8Parinari anamensis HanceChrysobalanaceaeStem91.010474.494.8Parinari anamensis HanceChrysobalanaceaeStem93.110010474.4Strychnos valichiana tseud. Ex DCLoganiaceaeStem93.613279.0132Danax granidis RidleyPoaceaeStem93.613362.8130Danax granidis RidleyPoaceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeStem95.614975.6126Costus spectosus VahlLamiac$	Fhyllanthus emblica L	Euphorbiaceae	Stem		126	59.8	130	
Broussonetia papprifera (L.) L'Hér. ex Vent         Úritcaceae         Stem         89.2         114         55.8         123           Coloma anviculati (Desv) Craib         Tiliaceae         Stem         89.6         112         35.7         96.7           Micromelum falcatum (Lour.) Tanak         Rutaceae         Stem         89.8         117         80.3         117           Typhonium tribubatum Schott         Araccae         Stem         89.8         110         7.15         109           Cananga latifolia Finet et Gagnep         Annonaccae         Stem         90.3         110         7.15         109           Genocaryum lobinium (Miers) Kurz         Laccinaccae         Stem         90.3         110         7.15         109           Sterculia foetida Linn         Sterculiaceae         Stem         90.3         131         59.4         132           Zanthoxylum rietsa DC.         Rutaceae         Bark         91.3         129         59.8         119           Strychnos tvalitchina Steud. Ex DC         Loganiaceae         Stem         93.1         100         54.7         90.5           Borinsis flabelifferm Linn         Arcecaea         Stem         93.6         133         62.8         130			Tuber	88.8	118	77.6	128	
	Scleria terrestris (L.) Fassett	Cyperaceae	Leaf		166			
Micromelum factum (Lour) Imaak         Rutaceae         Stem         89.8         117         80.3         117           Typhonium trilobatum Schott         Araceae         Stem         89.8         127         44.8         123           Maldiuca butyrospermoides A.Chev         Sapotaceae         Stem         90.3         110         29.0         86.0           Cananga latifolia Finet et Gagnep         Annonaceae         Stem         90.3         110         71.5         109           Genocaryum lobinum (Miers) Kurz         Icacinaceae         Stem         90.5         138         74.3         120           Zanthoxylum rhetsi DC.         Rutaceae         Bark         91.0         104         74.4         94.8           Barrain anamensis Hance         Chrysobalanaceae         Stem         91.0         104         74.4         94.8           Strychnos valichinan Steud, Ex DC         Loganiaceae         Stem         93.1         100         54.7         90.5           Barassing fabelliftor Linn         Areaceae         Stem         93.6         136         71.3         124           Lovar chinensis Lam         Rubiaceae         Laf         93.6         147         83.8         130           Othan integerri	Broussonetia papyrifera (L.) L'Hér. ex Vent	Urticaceae	Stem	89.2	114	55.8		
Typhonium tribolatium Schott         Araceae         Stem         89.8         127         44.8         123           Madhuca butyraspermoides A.Chev         Sapotaceae         Bark         90.0         110         29.0         86.0           Cannarga latifolia Finet et Gagnep         Annonaceae         Stem         90.3         126         54.8         90.5           Gonocaryum lobintum (Miers) Kurz         Icacinaceae         Stem         90.3         131         59.4         133           Wrightia tomentosa Roem-Schult         Apocynaceae         Stem         90.5         138         74.3         120           Zanthoxylum rhetsa DC.         Rutaceae         Bark         91.0         104         74.4         94.8           Parinari anamensis Hance         Chrysobalanaceae         Stem         93.1         100         54.7         90.5           Borassus flabellifera Linn         Arecaceae         Root         93.2         122         79.0         132           Dotax grandis Kidley         Poaceae         Stem         93.6         147         83.8         110           Vitze pubsectors Vahl         Lamiaceae         Stem         94.3         118         87.2         104           Artocarpus rigidus Blu	Colona auriculata (Desv.) Craib	Tiliaceae	Stem	89.6	112	38.7	96.7	
Mail         Mail         Sapotaceae         Bark         90.0         110         29.0         86.0           Cananga latifolia Finet et Gagnep         Annonaceae         Stem         90.3         126         54.8         90.5           Gonocaryum lobianum (Miers) Kurz         Icacinaceae         Stem         90.3         110         71.5         109           Sterculia fetida Linn         Sterculiaceae         Stem         90.5         138         74.3         120           Wrightia tomentosa Roem-Schul         Apocypraceae         Stem         90.7         162         65.5         130           Structura Anamensis Hance         Chrysobalanaceae         Bark         91.0         104         74.4         94.8           Parinari anamensis Hance         Chrysobalanaceae         Bark         91.3         129         59.8         119           Strychnos walitchiana Steud. Ex DC         Loganiaceae         Stem         93.6         136         71.3         124           Lorar chimensis Lam         Ruciaceae         Stem         93.6         137         82.8         130           Ochna integerrina (Lour) Merr         Ochnaceae         Stem         94.3         133         62.8         112           V	Micromelum falcatum (Lour.) Tanak	Rutaceae	Stem	89.8	117	80.3	117	
$  \begin{array}{c} Canange latificilie Fince et Gagnep Annonaceae Stem 90.3 126 54.8 90.5 \\                                   $	Typhonium trilobatum Schott	Araceae	Stem	89.8	127	44.8		
Goncariyum lobianum (Miers)         Kurz         Icacinaceae         Ster         90.3         110         71.5         109           Sterculia foetida Linn         Sterculiaceae         Stem         90.3         131         59.4         133           Wrightia tomentiosa Roem-Schult         Apocynaceae         Stem         90.5         138         74.3         120           Zanthoxyluen rhetsa DC.         Rutaceae         Bark         90.7         162         65.5         130           Strychno swalitchiana         Sterculiaceae         Ster         91.3         129         59.8         119           Strychnos walitchiana         Sterculiaceae         Ster         93.6         136         71.3         124           Loran chinensis Lann         Rubiaceae         Leaf         93.6         137         82.8         131           Ochna integerrina (Lour)         Merr         Ochnaceae         Stem         94.3         133         62.8         112           Vitex pubescens Vahl         Lamiaceae         Ster         94.3         118         87.2         104           Artocarpus rigidus Blume         Moraceae         Bark         95.0         149         78.6         147           Phyllanthus	Madhuca butyrospermoides A.Chev	Sapotaceae	Bark	90.0	110	29.0	86.0	
	<i>Cananga latifolia</i> Finet et Gagnep	Annonaceae	Stem	90.3	126	54.8	90.5	
Wrightia tomentosa Roem-SchultApocynaceaeStem90.513874.3120Zanthoxylum rhetsa DC.RutaceaeBark90.716265.5130Smilax china LSmilax china LSmilax china L10074.494.8Parinari anamensis HanceChrysobalanaceaeBark91.312959.8119Strychnos wallichiana Steud. Ex DCLoganiaceaeStem93.110054.790.5Borassus flabellifra LinnArecaceaeRot93.212279.0132Donax grandis RidleyPoaceaeStem93.613671.3124Lxora chinensis LamRubiaceaeLeaf93.613672.3124Atoraptus rigidus BlumeMoraceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeBark95.011687.5126Costus speciosus (Koenig) J.E.SmithCostaceaeRoot95.014978.6147Phyllanthus reticulatus PoirEuphorbiaceaeStem95.610268.0107Derris elliptica (Wall) BenthFabaceaeStem96.611855.194.8Lephantopus scaber LAsteraceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromati	Gonocaryum lobianum (Miers) Kurz	Icacinaceae	Stem	90.3	110	71.5	109	
Zamthoxylum rhetsa DC.       Rufaceae       Bark       90.7       162 $65.5$ 130         Smilac china L       Smilacaceae       Stem       91.0       104       74.4       94.8         Parinari anamensis Hance       Chrysobalanaceae       Bark       91.3       129       59.8       119         Strychnos callichiana Steud. Ex DC       Loganiaceae       Stem       93.1       100       54.7       90.5         Borassus flabellifera Linn       Arecaceae       Stem       93.6       136       71.3       124         Lxora chimensis Lam       Rubiaceae       Leaf       93.6       147       83.8       130         Ochna integerrina (Lour) Merr       Ochnaceae       Stem       94.3       133       62.8       112         Vitex pubescens Vahl       Lamiaceae       Stem       94.3       118       87.2       104         Artocarpus rigidus Blume       Moraceae       Bark       95.0       116       87.5       126         Costus speciosus (Koenig) J.E.Smith       Costaceae       Root       95.6       102       68.0       107         Derris elliptica (Wall.) Benth       Fabaceae       Stem       95.6       102       65.5       109 <t< td=""><td>Sterculia foetida Linn</td><td>Sterculiaceae</td><td>Stem</td><td>90.3</td><td>131</td><td>59.4</td><td>133</td><td></td></t<>	Sterculia foetida Linn	Sterculiaceae	Stem	90.3	131	59.4	133	
Smilax china L         Smilacaceae         Stem         91.0         104         74.4         94.8           Parinari anamensis Hance         Chrysobalanaceae         Bark         91.3         129         59.8         119           Strychnos valichinan Steud. Ex DC         Loganiaccae         Stem         93.2         122         79.0         132           Donax grandis Ridley         Poaceae         Stem         93.6         136         71.3         124           Lxora chinensis Lam         Rubiaceae         Leaf         93.6         136         71.3         124           Ochna integerina (Lour) Merr         Ochnaceae         Stem         94.3         133         62.8         112           Vitex pubescens Vahl         Lamiaceae         Stem         95.0         148         87.5         126           Costus speciosus (Koenig) J.E.Smith         Costaceae         Rot         95.6         102         68.0         107           Derris elliptica (Wall.) Benth         Fabaceae         Stem         95.6         102         68.0         107           Derris elliptica (Wall.) Benth         Fabaceae         Stem         96.8         110         64.6         114           Stad nombifolia L         Malvace	Wrightia tomentosa Roem-Schult	Apocynaceae	Stem	90.5	138	74.3	120	
Parinari anamensis Hance         Chrysobalanaceae         Bark         91.3         129         59.8         119           Strychnos vallichiana Steud. Ex DC         Loganiaceae         Stem         93.1         100         54.7         90.5           Borassus fabellifera Linn         Arecaceae         Rot         93.2         122         79.0         132           Donax grandis Ridley         Poaceae         Stem         93.6         136         71.3         124           Lxora chimensis Lam         Rubiaceae         Leaf         93.6         136         71.3         124           Ochna integerina (Lour) Merr         Ochnaceae         Stem         94.3         118         87.2         104           Artocarpus rigidus Blume         Moraceae         Stem         95.0         116         87.5         126           Costus speciosus (Koenig) J.E.Smith         Costaceae         Stem         95.6         102         68.0         107           Derris elliptica (Wall) Benth         Fabaceae         Stem         96.8         115         67.5         109           Knema globularia Warb         Myristicaceae         Reaf         97.2         150         79.9         154           Ancistrocladus tectorius (Lour.) M	Zanthoxylum rhetsa DC.	Rutaceae	Bark	90.7	162	65.5	130	
Strychnos wallichiana Steud. Ex DCLoganiaceaeStem $93.1$ $100$ $54.7$ $90.5$ Borassis flabellifera LinnArecaceaeRoot $93.2$ $122$ $79.0$ $132$ Donax grandis RidleyPoaceaeStem $93.6$ $136$ $71.3$ $124$ Lxora chinensis LamRubiaceaeLeaf $93.6$ $147$ $83.8$ $130$ Ochna integerrina (Lour) MerrOchnaceaeStem $94.3$ $118$ $87.2$ $104$ Artocarpus rigidus BlumeMoraceaeStem $94.3$ $118$ $87.2$ $104$ Artocarpus rigidus BlumeMoraceaeStem $95.0$ $149$ $78.6$ $147$ Phyllanthus reticulatus PoirEuphorbiaceaeStem $95.6$ $102$ $68.0$ $107$ Derris elliptica (Wall.) BenthFabaceaeStem $95.6$ $102$ $68.0$ $107$ Derris elliptica (Wall.) BenthFabaceaeStem $96.6$ $118$ $55.1$ $94.8$ Elephantopus scaber LAsteraceaeLeaf $96.8$ $110$ $64.6$ $114$ Sida rhombifola LMalvaceaeRoot $96.8$ $115$ $75.8$ $162$ Heliotropium indicum LBoraginaceaeLeaf $97.6$ $115$ $27.5$ $69.0$ Curcuma aromatica Salisb.ZingiberaceaeLeaf $97.6$ $115$ $27.5$ $69.0$ Curcuma aromatica Salisb.ZingiberaceaeLeaf $97.6$ $115$ $27.5$ $69.0$ Curuma aromatica Salisb.	Smilax china L	Smilacaceae	Stem	91.0	104	74.4	94.8	
Borassus flabellifera LinnArecaceaeRoot $93.2$ $122$ $79.0$ $132$ Donax grandis RidleyPoaceaeStem $93.6$ $136$ $71.3$ $124$ Lxora chinensis LamRubiaceaeLeaf $93.6$ $147$ $83.8$ $130$ Ochna integerrima (Lour) MerrOchnaceaeStem $94.3$ $133$ $62.8$ $112$ Vitex pubsecens VahlLamiaceaeStem $94.3$ $118$ $87.2$ $104$ Artocarpus rigidus BlumeMoraceaeBark $95.0$ $116$ $87.5$ $126$ Costus speciosus (Koenig) J.E.SmithCostaceaeRoot $95.0$ $149$ $78.6$ $147$ Phyllanthus reticulatus PoirEuphorbiaceaeStem $95.6$ $102$ $68.0$ $107$ Derris elliptica (Wall.) BenthFabaceaeStem $96.6$ $118$ $55.1$ $94.8$ Elephantopus scaber LAsteraceaeLeaf $96.8$ $155$ $67.5$ $109$ Knema glohularia WarbMyristicaceaeStem $96.6$ $118$ $55.7$ $109$ Knema glohularia WarbMaristicaceaeStem $96.6$ $115$ $57.5$ $109$ Knema glohularia WarbMaristicaceaeStem $96.6$ $115$ $57.5$ $109$ Knema glohularia WarbMaristicaceaeStem $96.6$ $115$ $57.5$ $109$ Knema glohularia WarbMaristicaceaeStem $97.6$ $115$ $27.5$ $69.0$ Curcuma aromatica Salisb.Zingiberac	Parinari anamensis Hance	Chrysobalanaceae	Bark	91.3	129	59.8	119	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Strychnos wallichiana Steud. Ex DC	Loganiaceae	Stem	93.1	100	54.7	90.5	
Lxora chinensis LamRubiaceaeLeaf93.614783.8130Oclma integerrina (Lour) MerrOchnaceaeStem94.313362.8112Vitex pubescens VahlLamiaceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeBark95.011687.5126Costus speciosus (Koenig) J.E.SmithCostaceaeRoot95.014978.6147Phyllanthus reticulatus PoirEuphorbiaceaeStem95.411371.4105Melastoma mormale (Kuntze) MerrMelastomataceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.910669.3102Lygodium flexuosum (L) SWLygodiaceaeLeaf98.915461.0124Zizuphus oeniplia MillRhamaceaeStem99.211261.8129Fagraea fragrams RoxbLoganiaceaeStem99.212242.996.0Cymbidium a	Borassus flabellifera Linn	Arecaceae	Root	93.2	122	79.0	132	
Ochna integerrina (Lour) MerrOchnaceaeStem94.313362.8112Vitex pubsecens VahlLamiaceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeBark95.011687.5126Costus speciosus (Koenig) J.E.SmithCostaceaeRoot95.014978.6147Phyllanthus reticulatus PoirEuphorbiaceaeStem95.610268.0107Derris elliptica (Wall.) BenthFabacceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeStem96.611557.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.611527.569.0Cymbidium flexuosum (L.) SWLygodiaceaeLeaf98.915461.0124Zizyphus omiplic MillRhamaceaeStem98.915461.0124Ligodium flexuosum (L.) SWLoganiaceaeStem99.292.2107110Heiotropium indicumKanaceaeStem99.312977.0132Mussaen	Donax grandis Ridley	Poaceae	Stem	93.6	136	71.3	124	
Vitex pubescens VahlLamiaceaeStem94.311887.2104Artocarpus rigidus BlumeMoraceaeBark95.011687.5126Costus speciosus (Koenig) J.E.SmithCostaceaeRoot95.011978.6147Phyllanthus reticulatus PoirEuphorbiaceaeStem95.610268.0107Derris elliptica (Wall.) BenthFabaceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosun (L.) SWLygodiaceaeLeaf99.2154101124Zizyphus oeniplia MillRhamnaceaeStem99.212242.996.0Cymbidium alojfolium (Roxb) wRubiaceaeLeaf99.211261.8129Fagraaa fragrans RoxbLoganiaceaeStem99.614082.6125Smilax ovalif	<i>Lxora chinensis</i> Lam	Rubiaceae	Leaf	93.6	147	83.8	130	
Artocarpus rigidus BlumeMoraceaeBark95.011687.5126Costus speciosus (Koenig) J.E.SmithCostaceaeRoot95.014978.6147Phyllanthus reticulatus PoirEuphorbiaceaeStem95.411371.4105Melastoma mormale (Kuntze) MerrMelastomataceaeStem95.611855.194.8Derris elliptica (Wall.) BenthFabaceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.811064.6114Sida rhombifolia LMalvaceaeRoot96.811575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodiaum flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus ceriplia MillRhamaceaeStem99.2107110Hymodicityon excelsum (Roxb) wRubiaceaeStem99.2107110Heilotropilai ma olipfolia (Ming)MoraceaeStem99.614082.6125S	Ochna integerrima (Lour) Merr	Ochnaceae	Stem	94.3	133	62.8	112	
Costus speciosus (Koenig) J.E.SmithCostaceaeRoot95.014978.6147Phyllanthus reticulatus PoirEuphorbiaceaeStem95.411371.4105Melastoma mormale (Kuntze) MerrMelastomataceaeStem95.610268.0107Derris elliptica (Wall.) BenthFabaceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.811567.5109Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.811575.8162Heliotropium indicum LBoraginaceaeLeaf97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.611527.569.0Lygodium flexuosum (L.) SWLygodiaceaeLeaf97.811981.3121Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.614176.5116Scheffera elliptaca (Rous on KL.) SWLygodiaceaeLeaf99.312242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeStem99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.614082.6125Smilax coaligina RoxbSmilacaceaeStem99.614082.6125	Vitex pubescens Vahl	Lamiaceae	Stem	94.3	118	87.2	104	
Phyllanthus reticulatus PoirEuphorbiaceaeStem95.411371.4105Melastoma mormale (Kuntze) MerrMelastomataceaeStem95.610268.0107Derris elliptica (Wall.) BenthFabaceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamaceaeStem99.212242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.312977.0132Mussaenda cambodiana Pirrl ex PitRubiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeStem10012553.7 </td <td>Artocarpus rigidus Blume</td> <td>Moraceae</td> <td>Bark</td> <td>95.0</td> <td>116</td> <td>87.5</td> <td>126</td> <td></td>	Artocarpus rigidus Blume	Moraceae	Bark	95.0	116	87.5	126	
Melastoma mormale (Kuntze) MerrMelastomataceaeStem95.610268.0107Derris elliptica (Wall.) BenthFabaceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeRoot96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.611527.569.0Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.614082.6125Smilac coalifolia RoxbSmilacaceaeStem10012553.7101Hymenodicityon excelsum (Roxb) wRubiaceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10014175.5127 <td>Costus speciosus (Koenig) J.E.Smith</td> <td>Costaceae</td> <td>Root</td> <td>95.0</td> <td>149</td> <td>78.6</td> <td>147</td> <td></td>	Costus speciosus (Koenig) J.E.Smith	Costaceae	Root	95.0	149	78.6	147	
Derris elliptica (Wall.) BenthFabaceaeStem96.611855.194.8Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.915461.0124Zizyphus oeniplia MillRhamnaceaeStem98.915461.0124Jinghus actificitum (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.614082.6125Smilac acambodiana Pirrl ex PitRubiaceaeStem99.614082.6125Smilac caceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10113097.613221226.6132Clerodendrum schmiditi	Phyllanthus reticulatus Poir	Euphorbiaceae	Stem	95.4		71.4		
Elephantopus scaber LAsteraceaeLeaf96.815567.5109Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamnaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeLeaf99.312977.0132Mussaenda cambodiana Pirrl ex PitRubiaceaeStem10012553.7101Ficus hirta Vahl var roxburghii (Miq)MoraceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10113097.6132 <td>Melastoma mormale (Kuntze) Merr</td> <td></td> <td></td> <td>95.6</td> <td>102</td> <td>68.0</td> <td>107</td> <td></td>	Melastoma mormale (Kuntze) Merr			95.6	102	68.0	107	
Knema globularia WarbMyristicaceaeStem96.811064.6114Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.614776.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamnaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeStem99.614082.6125Smilax ovalifolia RoxbSmilacaeaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10113097.6132Zizyphus cambodiana PierreRhamnaceaeStem10213091.1140Pouzolzia zeylanica (L) BennUrticaceaeStem10213091.1140Pouzolzia z	Derris elliptica (Wall.) Benth	Fabaceae	Stem	96.6	118	55.1		
Sida rhombifolia LMalvaceaeRoot96.815575.8162Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamnaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeLeaf99.312977.0132Mussaenda cambodiana Pirrl ex PitRubiaceaeStem99.614082.6125Smilax ovalifolia RoxbSmilacaceaeStem10012553.7101Ficus hirta Vahl var roxburghii (Miq)MoraceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10113097.6132Zizyphus cambodiana PierreRhamnaceaeStem10113097.6132<		Asteraceae	Leaf			67.5	109	
Heliotropium indicum LBoraginaceaeLeaf97.215079.9154Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeLeaf99.312977.0132Mussaenda cambodiana Pirrl ex PitRubiaceaeStem10012553.7101Ficus hirta Vahl var roxburghii (Miq)MoraceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10113097.6132Zizyphus cambodiana PierreRhamaceaeStem10113091.1140Pouzolzia zeylanica (L) BennUrticaceaeStem10213091.1140Pouzolzia zeylanica (L) BennUrticaceaeStem10211494.1<		Myristicaceae	Stem	96.8	110	64.6	114	
Ancistrocladus tectorius (Lour.) MerrAncistrocladaceaeStem97.611527.569.0Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamnaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeLeaf99.312977.0132Mussaenda cambodiana Pirrl ex PitRubiaceaeStem99.614082.6125Smilax ovalifolia RoxbSmilacaceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeBark10191.810687.0Clerodendrum schmidtii C.B.ClarkeLamiaceaeStem10213091.1140Pouzolzia zeylanica (L) BennUrticaceaeStem10213091.1140Pouzolzia zeylanica (L) BennUrticaceaeStem10211494.1116			Root		155	75.8		
Curcuma aromatica Salisb.ZingiberaceaeLeaf97.811981.3121Salacia chinensis LinnCelastraceaeStem97.910669.3102Lygodium flexuosum (L.) SWLygodiaceaeLeaf98.614176.5116Scheffera elliptaca (Blume) Harms.AraliaceaeStem98.915461.0124Zizyphus oeniplia MillRhamnaceaeStem98.912242.996.0Cymbidium aloifolium (Linn) SwartzOrchidaceaeLeaf99.211261.8129Fagraea fragrans RoxbLoganiaceaeStem99.298.2107110Hymenodictyon excelsum (Roxb) wRubiaceaeLeaf99.312977.0132Mussaenda cambodiana Pirrl ex PitRubiaceaeStem99.614082.6125Smilax ovalifolia RoxbSmilacaceaeStem10014175.5127Caesalpinia sappan LinnFabaceaeStem10113097.6132Clerodendrum schmidtii C.B.ClarkeLamiaceaeStem10113097.6132Zizyphus cambodiana PierreRhamnaceaeStem10213091.1140Pouzolzia zeylanica (L) BennUrticaceaeStem10212076.6132Aganosma marginata G. DonApocynaceaeStem10211494.1116			Leaf		150			
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<i>Eurycoma longifolia</i> Jack Simaroubaceae Bark 102 91.7 54.9 53.9								
	Eurycoma longifolia Jack	Simaroubaceae	Bark	102	91.7	54.9	53.9	

Table 1. Cont.

Scientific Name	Plant Families	Part Used	10 mg		50 mg		<u> </u>
			R	Н	R	Н	– Criteria
Gnetum latifolium Blume	Gnetaceae	Stem	102	116	73.0	125	
Homonoia riparia Lour	Euphorbiaceae	Bark	103	138	59.0	104	
Syzygium polyanthum (Wight) Walp	Myrtaceae	Bark	103	116	14.2	57.2	
Rauwenhoffia siamensis Scheff	Annonaceae	Stem	103	122	100	135	
Mangnifera duperreana Pierre	Anacardiaceae	Bark	105	137	64.2	118	
Randia tomentosa Bl	Rubiaceae	Stem	107	114	83.5	112	
Bombax ceiba L	Malvaceae	Bark	107	142	98.8	159	
Ficus benjamina L	Moraceae	Stem	107	136	62.6	121	
Ficus hispida L	Moraceae	Stem	107	143	77.6	110	
Dipterocarpus tuberculatus Roxb	Dipterocarpaceae	Stem	108	142	31.3	90.7	
Millingtonia hortensis Linn	Bignoniaceae	Stem	110	138	74.3	112	
Irvingia malayana Olive. Ex Benn	Irvingiaceae	Bark	110	129	19.1	125	
Dipterocarpus obtusifolius Teijsmex-Miq	Dipterocarpaceae	Stem	111	128	55.1	95.5	
Neonauclea sessilifolia (Roxb.)Merr	Rubiaceae	Bark	112	137	48.5	86.5	
Dracaena lourieri (Gagnep.)	Asparagaceae	Bark	112	104	97.5	127	
Alocasia macrorrhiza (L.) G.Don	Araceae	Bulb	114	140	51.9	104	
<i>Terminalia triptera</i> Stap f	Combretaceae	Stem	114	130	19.1	53.2	
Pseuderanthemum latifolium (Vahl) B. Hansen	Acanthaceae	Leaf	114	149	89.0	142	
Willughbeia edulis Roxb	Apocynaceae	Stem	115	119	43.2	84.4	
Dioscorea bulbifera L	Discoreaceae	Tuber	115	150	103	145	
Walsura villosa Wall. Ex Hiern	Meliaceae	Bark	116	121	184	141	
Pandanus capusii. Marc	Pandanaceae	Root	117	138	79.0	142	
Melastoma villosum L	Melastomataceae	Stem	119	137	92.2	120	
Zingiber ottensii Valeton	Zingiberaceae	Tuber	133	97.4	120	71.1	

Table 1. Cont.

Note: Criteria indicates stronger inhibitory activity of test sample on the radicle elongation of lettuce by standard deviation variance (SDV) where: \* = M-0.5(SD), \*\* = M-1.0(SD), \*\*\* = M-1.5(SD), and \*\*\*\* = M-2.5(SD). Species with more \* indicates increasing inhibitory activity. M: mean of radicle elongation, SD: standard deviation of radicle length. R: radicle, H: hypocotyl, %: percentage of control growth. Values close to 0% indicate strong inhibitory activity in that plant species.

## 4. Discussion

We observed that Iris pallida showed higher plant growth inhibitory activity (4% of control) than *Eleutherine bulbosa* (34% of control) on lettuce radicle elongation among the Iridaceae family. Irises contain up to 80 genera and 300 species that are distributed worldwide, but abundant and diversified in Southern Africa and Asia. Many of them are common ornamental plants [29]. The Iris species are rich sources of isoflavonoids and flavonoids [30]; and they are primarily used in traditional medicine [31–33]. Sweet iris (Iris Pallida) is a perennial herb native to the Dalmatian coast, Croatia [34]. Iridals (tritepenoids) from sweet iris were reported to prevent cancer formation and act as antiplasmodial [35,36]. The content of irones extracted from iris rhizomes contain aromatic principles which mostly responsible for the characteristic scent, and also commercialize in many industries [37,38]. Additionally, many compounds were also reported from the leaf and rhizome of iris essential oil. The major compounds were fatty acids, alkanes, aromatic compounds, sesquiterpenes, and triterpenes [14]; however, its allelochemicals were yet to be reported. On the other hand, *Eleutherine bulbosa*, known as an exotic ornamental and medicinal plant, is native to South America. The underground bulbous part was reported to with a wide range of pharmacognostical and physicochemical properties [39]. Some bioactive compounds contained in ethyl acetate extract of bulbs *Eleutherine bulbosa* including phenolic compounds, flavonoids, quinones and saponins were also reported [40].

The extract of the bulbs of *Eleutherine bulbosa* was reported to have strong activity in the direct bio-autography assay with phytopathogenic fungus *Cladosporium sphaerospermum* [41]. Four compounds were isolated from fungitoxic components including eleutherinone [8-methoxy-1-methyl-1,3dihydro-naphtho(2,3-c)furan-4,9-dione]; eleutherin [9-methoxy1(R),3(S)-dimethyl-3,4-dihydro-1H-benzo(g) isochromene-5,10-dione]; isoeleutherin [9-methoxy-1(R),3(R)-dimethyl-3,4-dihydro-1H-benzo(g) isochromene-5,10-dione] and eleutherol [4-hy droxy-5-methoxy-3(R)-methyl-3H-naphtho (2,3-c)furan-1-one].

*Parabarium micranthum* showed the strongest inhibition activity (7.5% of control) among the other ten medicinal plants in Apocynaceae family. *Parabarium micranthum* known as a climbing shrub is native to China but widespread across in East and Southeast Asia and Himalayas. The branches of *P. micranthum* have inconspicuous lenticels and its leave-ovate elliptics are 5–8 cm long and 1.5–3 cm wide. Some part like bark and roots are used for the treatment of infantile paralysis, rheumatalgia, injury, and fractures [42]. Two phytochemical compounds were also identified including 2,2-dime thoxybutane and 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one. The containing of catechol and quinic acid in this plant was contributed to extract in anti-aging activities [43].

Another interesting medicinal plant is *Peliosanthes teta* from Asparagaceae family. This plant also showed strong inhibitory activity (8.2% of control) in leachates treatment. *Peliosanthes teta* is a perennial herb with thick roots, short stem and blade-linear leaves. The solitary flower and bursting seed of this plant were shown during the early stage [43]. Although a monotypic genus of *Peliosanthes teta* ranging from India to China, it is well distributed in southeast Asia, particularly in wet evergreen forest [44]. The medicinal values such as earache treatment, energy tonic, circulation and postpartum care were also reported [45,46]. However, its allelochemicals have not yet been exploited.

## 5. Conclusions

This is the first comprehensive screening of medicinal plants used in Cambodia to evaluate their allelopathic effects. The results presented could serve as a benchmark to elucidate chemical involvement in allelopathy phenomenon. Such information could help researchers to develop new and potent bioactive compounds from natural products to enhance sustainable agriculture and effective use of biological functions. We hereby presented *Iris pallida* for the next study in the isolation and identification of allelochemicals.

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Conflicts of Interest: The authors declare no conflict of interest.

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