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Morphological and anatomical property, phytochemical screening and antibacterial activity of "Green" wild taro (*Colocasia esculenta* (L.) schott)

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Abstract
Wild taro, a natural type of taro that thrives in many countries, has been used as food for humans and animals, and in traditional medicine since ancient times, but with little research. The aims of the study were to investigate of morphological and anatomical vegetative characteristics, determinate chromosome number, preliminary determinate chemical composition, and assess antibacteria activity against *E. coli* and *B. subtilis* of "green" morphotype wild taro (*Colocasia esculenta* (L.) Schott.) at CanTho city, Viet Nam. The transverse sections of leaf and tuber were double-stained with carmine alum laque–iodin green dye to investigate anatomical properties. The root tips were pretreated by hypo-osmotic shock and double-dyed with aceto-carmine to estimate chromosome number. Phytochemical compositions and antibacterial activity against *Escherichia coli* and *Bacillus subtilis* were detected on leaf and tuber extraction by reagents and well difusion method. The results showed morphological and anatomical characters of fresh leaf blade, petiole, root, and corm of "green" wild taro. The chromosome number at root tip was 2n = 28. "Green" wild taro *C. esculenta* contained organic compounds such as steroids, flavonoids, alkaloids, saponins, tannins, coumarines, and glycosides. Both leaf and tuber extracts showed antibacterial activity against the tested bacteria. This wild taro was indicated to be more effective against gram-negative bacteria than gram-positive bacteria.

Keywords: "green" morphotype wild taro, *Colocasia esculenta* (L.) Schott, morphology and anatomy, phytochemical, antibacteria

Introduction

The traditional medicine has been successful to cure diseases for the past thousands of years (Kala *et al*., 2006; Sridharan and Sivaramakrishnan, 2018) [13, 36]. Approximately 88% (170 countries) of all Member States across all WHO regions acknowledged the use of traditional and complementary medicines in 2018 (WHO, 2019) [43]. These medicinal plants have provided an important source of herbal remedies since ancient times and have been preserved to the present day.

Phytochemicals, chemicals derived from primary or secondary metabolism of plants, are considered as a rich source of various drugs (Kala *et al*., 2006) [13]. Several phytochemicals have therapeutic properties for various diseases and disorders (Rajkumar *et al*., 2018) [30] as cardiovascular protection, anti-cancer activity, anti-nociceptive activity and anti-inflammatory effects (Mohammed *et al*., 2014) [18]. Therefore, medicinal-property plants are determined as an indigenous source of new compounds in drug development (Vines, 2004; Newman *et al*., 2020) [22]. The bioactive phytochemicals are recognized as alkaloids, phenolics, tannins, terpenes, steroids, flavonoids and glycosides (Rajkumar *et al*., 2018) [30].

Colocasia esculenta (L.) Schott or taro is a tropical plant belonging to the family Araceae and has its origin from South-East Asia. Taro is rich in carbohydrates, proteins and micronutrients (Temesgen & Retta, 2015; Rashmi *et al.*, 2018) [39, 31]. Taro has various potential for investigating its medicinal and pharmaceutical properties (Dutta *et al*., 2017; Sharma *et al*., 2019; Nayak *et al*., 2019) [21, 6, 33]. Taro has been shown to have anti-tumor, antibacterial (antibacterial and antifungal), antidiabetic, antitoxic and anticancer biological activities (Sharma *et al*., 2020).

Wild taro, a natural type of *Colocasia esculenta* (L.) Schott, has little studied and is poorly known (Matthews *et al*., 2012). Wild taro has been valued as a source of traditional medicine and food for human and animals in many countries. The leaf juice of wild taro is useful in treatment of internal haemorrhages, otalgia, otorrhoea, adenitis and buboes and the corm juice is used to treat somatalgia, alopecia areata, haemorrhoids and congestion of the portal system (Namrata *et al*., 2011) [34]. Chakraborty *et al*. (2015) [4] confirms the presence of alkaloids, flavonoids, carbohydrates, tannins, terpenoids in methanol extract of both tuber and leaves extract. According to Ivancic and Lebot (1999), wild taro is separated into three distinct morphotypes: "purple", "green", and "green with purple vein junction on lamina". "Green" morphotype is the tallest height (mean 141,52 cm), the largest leaves (mean 81.32 cm), cylindrical sucks (3-10 cm long and thick 1.7-2.5 cm in diameter) stolons. Each inflorescence of "green" morphotype wild taro is made up of peduncle, spathe and spadix.

The objectives of this study were to investigate of morphologically and anatomically vegetative characteristics, determinate chromosome number, preliminary determinate chemical composition, and assess antibacteria activity against *E. coli* and *B. subtilis* of "green" morphotype wild taro *Colocasia esculenta* (L.) Schott.

Materials and Methods

Collection of Plant Material

"Green" morphotype *Colocasia esculenta* (L.) Schott was collected at Cantho province, Mekong Delta, VietNam.

Morphogical and Anatomical Study

Vegetative organs were keep intact to investigate morphological and anatomical features. Leaves (including lamina and petiole) and tubers (including root and stem) were sliced horizontally (Vo, 2019). The slices were soaked in sodium hypochlorite, rinsed with distilled water, soaked in 5% acetic acid, double-stained with carmine alum laque-iodin blue dye, and washed again with distilled water. The specimens were observed under light microscope.

Estimation of Chromosome Number

Root tips were treated hypo-osmotic shock by sodium citrate dihydrate 0.1% for 45 minutes, fixed in Carnoy'solution (3 ethanol: 1 acid acetic) for 4 hours, and stainned by aceto-carmine 1% for 50 - 60 minutes. Chromosome numbers of meristem of root tip at pro-metaphase plate were counted and estimated. P value <0.05 was considered statistically significant different (Vo, 2019).

Moisture Content

Each 5g fresh tuber/leaf was cut into small parts, and place the samples in a hot air oven at 50ºC until the dry weight of the samples become constant. Sample moisture content was determined as the percentage moisture: Moisture (%) = (Fresh weight – Dry weight)/Fresh weight (Krishnapriya and Suganth, 2007).

Qualitative analysis of the phytochemicals

Preparation for powder sample

Leaf/ tuber were cut into small pieces and dried in hot air oven at 55^0C until the dry weight of the samples become constant. Grind samples to a fine powder for phytochemical analysis.

Phytochemical screenning

Second metabolic production of leaf/tuber powder of "green" morphotype wild taro were carried out according to the procedures proposed by of Parekh and Chanda (2007), Okafor and Ezejindu (2014), Osibemhe and Onoagbe (2015), and Akintola *et al*. (2020) with some modifications. Alkaloids*:* 5 g leaf/tuber powder were gently boiled with H_2SO_4 1% in hour, and filtered. To 1 ml filtrate, add drops of 1 ml reagents of Dragendorff's reagent ($KBiI_4$)/ Wagner's reagent (I_2 in Kali iodua (KI)/ Bouchardat (2,5g I_2 + 5g KI + 10 ml distilled water). Orange to red precipitate/ Brown precipitate/ Brown or dark yellow precipitate respectively indicated the presence of alkaloids. Coumarines: Circulating boil 1 g of leaf/ tuber powder with 10 ml ethanol (96^0) in 10 minutes.

- Lactone ring opening: Boiling on water bath 2 ml extraction + 0.5 ml NaOH 10% + 4 ml H_2O. Solution became clear. Acidify with a few drops of HCl. Solution became cloudy or precipitate indicates the presence of coumarines.
- Diazotization reaction: Boiling 1 ml extract with 2 ml NaOH 10%. Let cooler. Each drops of Diazo's reagent (0.9 g sulfanilic acid in 9 ml concentrated HCl). The solution turned yellow/ orange/ pink/ red indicated coumarines.

Flavonoids*:* 5 g leaf/tuber powder were gently boiled with 50 ml ethanol 95 % in 30 minutes, and filtered.

- **Shinoda test:** To 1 ml filtrate, add few drops of conc. HCl and magnesium ribbon and shaked. Each drop of alcol isoamylic. Pink, orange or purple indicated the presence of flavonoids.
- **$Pb(CH_3COO)_2$:** To 1 ml filtrate, add each drops of 1 ml $Pb(CH_3COO)_2$. White precipitate is a positive test.
- **$FeCl_3$ 1%**: To 1 ml filtrate, add $FeCl_3$ 1% reagent drop by drop. Blue-black precipitate indicated the presence of flavonoid.

Glycosides*:* Circulating boil 10 g of leaf/ tuber powder into 10% HCl in 50% methanol (50 ml). Remove methanol. Extract with ethyl acetate. Make anhydrous with Na_2SO_4. Add Na_2CO_3 and filtered.

- **Tollens:** To 1 ml filtrate, add Tollens reagents ($AgNO_3$ 10% (1 ml) + NaOH 10% (1 ml) + NH_4OH 25% drop wise) drop by drop. Presence of silver precipitate is a positive sign.
- **Fehling's:** To 1 ml filtrate, add 1 ml Fehling A and B. Boil test tube for 1 minute. The appearance of a brick red precipitate is positive.

Saponins: 1 g leaf/tuber powder were gently boiled with 20 ml distilled water in 10 minutes, and filtered.

- **Foam test:** To 1 ml extraction, add distilled water to make 10 ml. Shake the tube vertically for 15 seconds. Let stand for 15 minutes. The foam column in the test tubes is less than 1 cm indicated the absence of saponins.
- **Libermen-Burchard test ($(CH_3CO)_2O$ + conc. H_2SO_4):** Make dry residue. Mix the sample with 1ml $(CH_3CO)_2O$, slowly add conc. H_2SO_4 (0.3 ml - 0.5 ml).

Steroids: 1 g leaf/tuber powder were soaked with 20 ml chloroform in 2 hours, and filtered.

- **Salkowski test (Conc. H_2SO_4):** To 1 ml filtrate, add each drop of Conc. H_2SO_4 from the sides of the test tube. Red/ orange colour appears at the lower layer a positive test.
- **Libermann-Buchard test ($(CH_3CO)_2O$ (20 ml) + conc. H_2SO_4 (1ml)):** To 1 ml extract, add each drop of Libermann-Buchard from the side of test tube. Observe a brown/ green ring at the junction of two layers shows the presence of steroids.

Tannins: 1 g leaf/tuber powder were gently boiled with 20 ml distilled water in 10 minutes, and filtered. Add reagent $(CH3COO)_2Pb$/ $FeCl_3$ 1% drop wise to 1 ml of the filtrate. Slightly yellow precipitate/ Blue-black or dark green precipitate indicated tannin's presence.

Antibacterial screening

Ethanol extraction

The 30 g sample powder (leaf/ tuber) were extracted with 450 ml ethanol by maceration method in 48 hours. The solvent was remove by evaporating under reduced pressure by using

rotary evaporator. The crude extracts were dissolved in DMSO to a concentration of 200 µg/ml, 400 µg/ml, 800 µg/ml.

Antimicrobial assay

Antibacterial activity of wild taro extractions were detected by the agar well diffusion method. *Escherichia coli* and *Bacillus subtilis* were cultured in LB agar at 37ºC in 24 hours and adjusted to 10^6 cfu/ml (compared to 0.5 McFarland turbidity standards). Each 100 µl of prepared bacterial suspension were spread on one LB Agar petri dish and inoculated for 24h. At every dish, 100 µl of leaf/ tuber extraction of three different concentrations (200 µg/ml, 400 µg/ml, 800 µg/ml), and negative control DMSO were added into 6 mm diameter wells. After incubating at 37ºC for 24hrs, all petri dishes were taken out to measure the diameter of the inhibition zone in mm. The experiments were repeated 3 times. Statistical analysis of the data was done by using One-way ANOVA, and p value < 0.05 was considered statistically significant.

Results

Morphological Characteristics

"Green" morphotype wild taro (*Colocasia esculenta* (L.) Schott.) was a herbaceous, underground stem that developed into corms. The height of the tree were up to 1.2 m - 1.4 m. The false stem grew above where the petiole were arranged around.

Leaves consisted of green leaf blade (lamina) and green petiole without purple vein junction on lamina. Leaf blade was simple, broad, heart-shaped, up to 75 cm long and 65 cm wide with prominent veins. The main venation had a "Y" shape that run along the length of the blade leaf and reached 2 sides of lobes. Along the main venation were 8 to10 pairs of sub-venations. Petiole was oblong. Closer to the leaf blade, the petiole was rounder and smaller. Tuber consisted of corm and roots. Corms were bulb-like, grow underground and inedible. The lower part of corm was rhizomes with different shapes and sizes. One or few yellow inflorescences with yellow spathe grew in one bush. Spadix consisted of four portions: female portion (lowest), a sterile region, a male portion, and an appendix. Fruit was watery, spherical-liked shape, and turned from green to orange or red as mature. Fruits contained many yellow-brown seeds (Figure 1). Vo (2020) described further anatomical characterictics of "green" morphotype wild taro's reproductive organs.

Fig 1: "Green" morphotype wild taro (*Colocasia esculenta* (L.) Schott.)

Anatomical Property

Root: Transverse section of "green" wild taro root showed three structural parts, epiblema, cortex, and stele. Epiblema, the outermost single layer, was made from compactly arranged parenchyma cells without intercellular space. At root hair zone, some epiblema cells prolong to form unicellular root hairs. In transverse section of lateral root, there is a trace of root hair. Cortex consisted of 15 - 18 layers of oval parenchymal cells with intercellular spaces varying in size and shape The intercellular spaces contained air for gaseous exchanges. Exodermis of cortex was 2 - 3 layers of suberisation cells to protect the internal tissues. Endodermis, the inner most layer of the cortex, included a single layer of barrel-shaped parenchymal cells. Inside the endodermis was the stele that included pericycle, vascular system, and pith. Pericycle, uni-seriate layer of thinner-walled parenchyma cells, was located next to endodermis. Vascular tissues consisted of 10 - 12 bundles of xylem and phloem arranged radially within stele. Phloem bundles were in shape of circle or oval clusters. Round or oval xylem bundles with different size were located next to phloem bundles. Protoxylem lied towards pericycle and metaxylem was toward center. Some small parenchyma cells were arranged between xylem and phloem bundles. The central part of the stele was pith that consisted of thin-walled parenchyma cells with intercellular spaces. Free needle-liked crystals (not seen at low magnification), druses, and raphide bundles were scattered in root. Emerging or lateral roots were also revealed (Figure 2A, B).

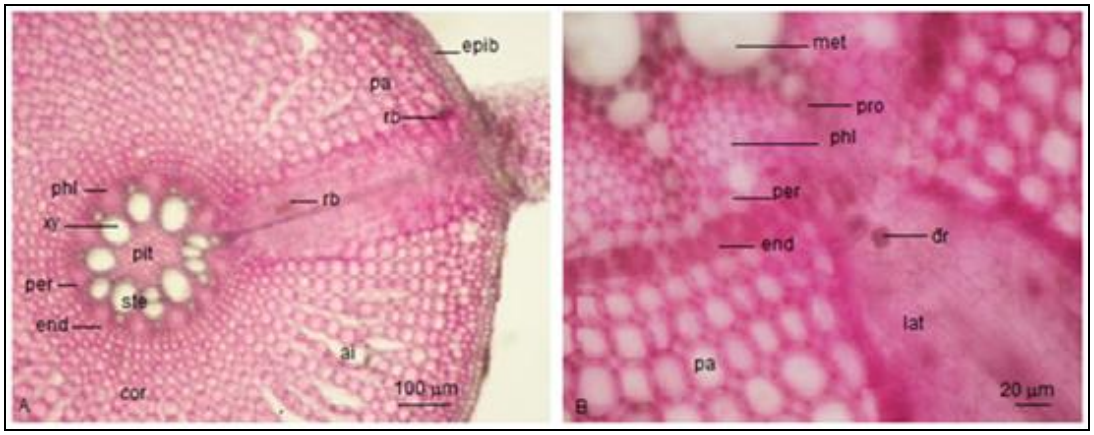

Fig 2: Transverse section of root at 4x (A) and 10X (B) Abbreviations: phl –phloem, xy - xylem, per - pericycle, end - endodermis, cor - cortex, ste – stele, pit - pith, epib - epiblema, pa - parenchyma cell, rb - raphide bundle, ai - air space, dr – druse, met – metaxylem, pro – protophloem, lat - lateral root

Corm: Transverse section of corm's starchy flesh showed polygon-spaped parenchyma cells. The size of these parenchyma cells were smaller than that of root. Fibers were also detected in corm. Calcium oxalate crystals were revealed in forms of free needle-liked crystals, druses and raphide bundles. Biforine or biforine-liked cells, another type of raphide bundle, were observed in corm (Figure 3 A, B).

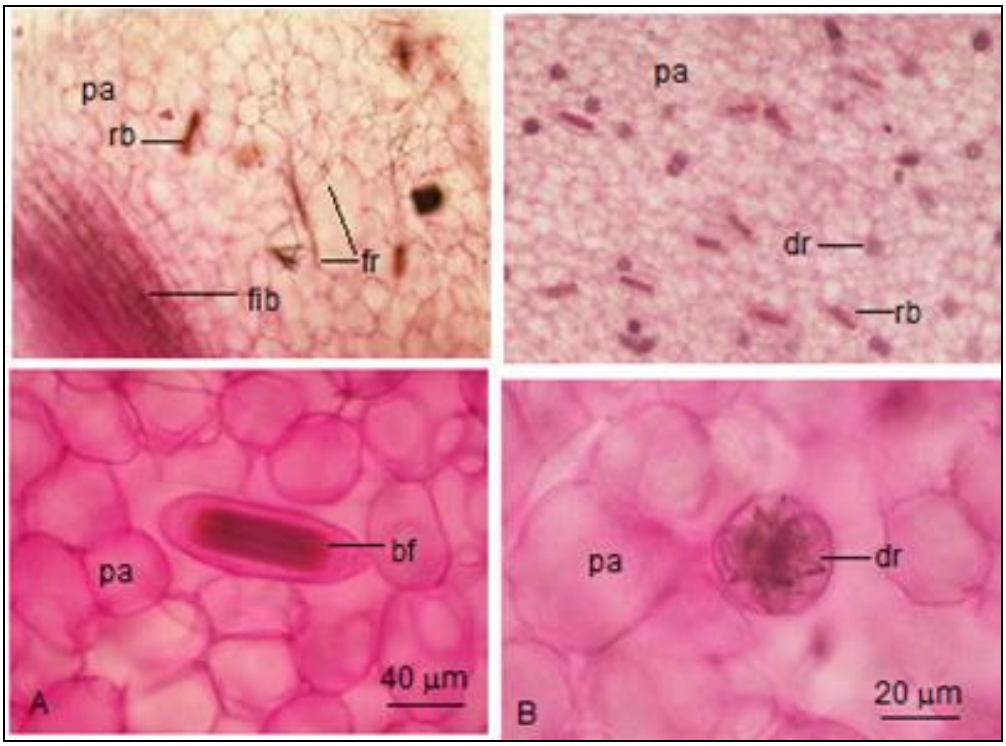

Fig 3: Transverse section of starchy flesh Abbreviations: fr – free needle-liked crystal, bf – biforine or biforine liked cell, others as in Figure 2

Blade leaf: Epidermis, the outermost layer, was present on the upper and lower surfaces of the vein and lamina of leaf blade. Both upper and lower epidermic layers were composed of contiguous, jar-shaped cells. Cuticle layer was revealed on both epidemic layers, but the lower layer were impregnated with a thicker cuticle. Under the upper epidermis was 2 - 3 layers of rectangular-shaped palisade mesophyll cells that were embeded many calcium oxalate crystals. Free needle-liked crystals, druses, and raphide bundles (included biforine or biforine liked cells) were investigated on leaf blade. Druse crystals on the upper surface of the leaf blade were more densely distributed than on the lower surface. Spongy mesophyll cells were varied in size and shape, and separated by intercellular spaces. Sclerenchyma fibers were arranged circumferentially in the leaf veins. Vascular bundles with various size were scattered in both leaf venation and lamina (Figure 4A, B).

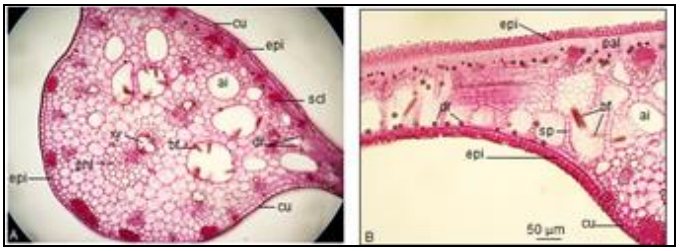

Fig 4: Transverse section of leaf blade A. Leaf venation, B. Lamina Abbreviations: epi – epidermis, cu – cuticle, sc – sclerenchyma pal – palisade mesophyll cell, sp – spongy mesophyll cell, dr –druse; others as in Figure 2

Petiole: Epidermis contained cells laced cuticle. Beneath the epidermis was hypodermal paenchyma that was 2 - 3 layers of small, angular collenchymal cells. The sclerenchyma fibres were formed phloem caps, and arranged circularly below epidermis. Parenchyma layers were thin-walled cells with various size and polygonal shape. Dozens of vascular bundles were arranged radially throughout the ground tissue, with the phloem bundles facing the epidermis and the xylem bundles slightly toward the center. Air spaces were revealed with different sizes and shapes, and distributed throughout the petiole (Figure 5 A, B)

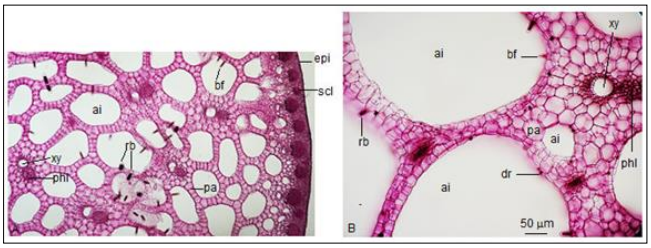

Fig 5: Transverse section of petiole. *Abbreviations: as in Figure 2.*

Many researches have been studied morphlogical and anatomical properties of taro (*C. esculenta*). Stein *et al*. (2015) [35] were described a multi-layered palisade, air-filled spongy mesophyll, vascular strand, collenchyma bundle, raphide bundle, stomata, etc. of leaf of taro. Pitoyo *et al*. (2018) [27] were investigated morphological measurements and anatomical characters of 20 taro accessions, and suggested that stomatal data, epidermis thickness, adaxial epidermis thickness, mesophyll thickness, and palisade thickness could be employed to distinguish these varieties. Ezebra *et al*. (2015a, b) compared anatomical features of leaf, root, and petiole of five taro cultivars, and found that morphological and anatomical characters (such as stomata data, CaOx crystals, airspace, thickness of epidermis, mesophyll, and palisade, etc.) were an additional parameter in taro identification. Compared with the above studies, the vegetative organs of "green" wild taro showed common histological and anatomical features of Colocasia. However, the stomata and stomatal chambers were rarely revealed in horizontally sectional studies. This study revealed three types of CaOx crystals such as free needle-liked crystals, druses and raphide bundles compared to druses, raphide bundles, prims and sand crystals found in the above studies on taro. Therefore, more studies are needed to compare the three morphotypes of wild taro or between wild taro and cultivated taro. Many methods have been applied to study the anatomical and histological features with good results. In this study, double staining with carmine alum laque-iodin blue dye on the vegetative organs helped to clearly identify and distinguish the anatomical characteristics of the investigated plants.

Estimation Of Chromosome Number

Chromosome number of "green" morphotype wild taro was estimated 2n = 28, 1 ± 1.125 ($p > 0.05$) (Figure 6). Ivancic and Lebot (1999) [12] reported that all three wild taro morphotypes were diploids (2n = 2x = 28). However, in China, chromosome number of Colocasia species were found as 2n = 26, 28, 38, 42, and 56 (Wang *et al*.,2017) [45]. Das *et al*. (2015) revealed ten Indian cultivars of *Colocasia esculenta* to be possessed from (2n = 2x = 28) to (3n = 3x = 42).

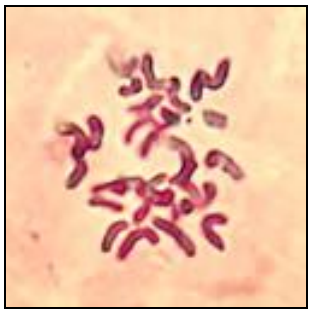

Fig 6: Chromosome number

Water Content and Yield Extract Of "Green" Morphotype Wild Taro

Water content of "green" morphotype wild taro was 94.1 ± 0,91 % at leaf and 90,3 ± 0,58 % at tuber. For taro, its moisture content were 73,1% at tuber and 82,7% at leaf (Gopalan *et al*., 1989). Water content of taro tuber was 56.8% - 57% (Krishnapriya and Suganth, 2017; Nayak *et al*., 2019) [21]. The moisture content of taro ranges from 60 - 83% (Huang and Tanudjaja, 1992) [11]. Moisture content of taro varied depending on their variety, growth condition and harvest time. The extract yield of "green" morphotype wild taro was 12, 33 % at leaf and 10,03 % at tuber. Dutta and Aich (2017) [6] was provided the yield extract of leaf taro was 9.12%.

Qualitative Phytochemical Screening

Based on precipitation, colour reaction, crystallization reaction, foaming index, lactone ring opening reaction, diazotization reaction to determine the presence of phytochemical compounds. The results showed on Table 2. Alkaloids, tannins, glycosides and coumarines were found to be positive for all organic reagents tested. Steroids and saponins were indicated positive for Libermann-Burchard reagent but negative for Salkowsky reagent or foam test. Specially, flavonoids at leaf/tuber extracts were proved positive to all reagents tested but negative for Shinoda at tuber extract. In summary, both leaf and tuber extract of "green" wild taro were indicated the presence of steroids, flavonoids, alkaloids, tannins, glycosides, coumarines, and saponins.

Table 1: Phytochemicals in leaf and tuber extract of "green" morphotype wild taro

Phytochemicals	Reagents	Leaf	Tuber
Alkaloids	Dragendorff	+	+
	Bouchardat	+	+
	Wagner	+	+
Flavonoids	Shinoda	+	-
	$FeCl_3$	+	+
	$(CH_3COO)_2Pb$	+	+
Coumarines	Diazotization reaction	+	+
	Lactone ring opening	+	+
Glycosides	Fehling	+	+
	Tollens	+	+
Saponins	Foam	-	-
	Libermen - Burchard	+	+
Steroids	Libermann-Burchard	+	+
	Salkowsky	-	-
Tannins	$(CH_3COO)_2Pb$	+	+
	$FeCl_3$	+	+

+:Positive-: Negative

In Indonesia, local wild taro leaf, named Beneng taro, was negatively assigned for alkaloids, flavonoids, and saponins, but positively for tannins (Fatmawaty *et al*., 2019) [9], and leaf stalks of wild taro, named Hideung Cultivar, was showed the presence of flavonoid, tannin, saponin, alkaloid, and calcium oxalate (Widhyastini *et al*., 2019) [44]. Tuber extraction of wild taro at Garhwal Himalaya (India) was indicated the presence of glycosides, flavonoids, phenols, resin and tannins (Subhash *et al*., 2012) [38]. Keshav *et al*. (2019) [15] reported that alkaloids, glycosides, flavonoids, terpenoids, saponins, oxalates and phenols in *C. esculenta* could have lot of medicinal benefits such as reducing headache, treatment of congestive heart failure, prevent oxidative cell damage.

Antibacterial Activity of ethanol Extraction of "Green" Wild Taro Again *E. coli* and *B. subtilis*

Both leaf and tuber extraction of "green" wild taro inhibited the growth of gram-negative and gram-positive bacteria. For *E. coli*, the diameter of inhibition zone were varied from 9.33 mm to 19.00 mm at the concentration of 200 µg/ml, 400 µg/ml and 800 µg/ml. For *B. subtilis*, the diameters of inhibition zone were varied from 5.67 mm to 19.00 mm at the concentration of 400 µg/ml and 800 µg/ml, and no inhibition zone was observed at 200 µg/ml.

Table 2: Diameter of inhibition zones again *E. coli* and *B. subtilis*

	Concentration (µg/ml)	Diameter of inhibition zones (mm)	
		E.coli	***B. subtilis***
Leaf	800	19.00 ± 0.57^{ad}	13.00 ± 1.52^{a}
	400	15.33 ± 1.20^{ad}	9.00 ± 1.13^{a}
	200	10.33 ± 1.20^{b}	-
Tuber	800	18.67 ± 1.30^{ad}	6.33 ± 1.48^{a}
	400	12.33 ± 0.88^{ad}	5.67 ± 2.84^{a}
	200	9.33 ± 0.33^{b}	-

Values are expressed as mean ± SE and analyzed by ANOVA ($p < 0.05$).

a, b: $p < 0.05$ when compared between different concentrations against E. coli or B. subtilis

d: $p < 0.05$ when compared between E. coli to B. subtilis at the same concentration of leaf and tuber extraction.

At both leaf and tuber extraction, the diameter of inhibition zones against *E. coli* and *B. subtilis* was not statistically different between 800 µg/ml and 400 µg/ml ($p > 0.05$). For *E. coli*, the diameter of inhibition zones of both tuber and leaf extraction at the concentration of 800 µg/ml and 400 µg/ml were statistically different at 200 µg/ml ($p < 0.05$). The study also found that at both leaf and tuber extraction, the diameter of inhibition zones against *E. coli* were statistically different from that of *B. subtilis.*

Aqueous leaf extract of wild taro "Arbi" in Northern India showed antibacterial activity against *Streptococcus mutans*, *B. subtilis*, *Pseudomonas fragi*, *and E. coli* (Singh *et al*., 2011). Ethanol leaf extraction of wild taro at Western region India showed antibacterial activity against *Salmonella typhi*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, and *B. subtilis* but non-effective on *Salmonella paratyphi*, *Staphylococcus aureus*, *Proteus vulgaris*, and *E. coli* (Nakade *et al*., 2013). Leaf extraction of wild taro "keladi" in Malaysia, was against *Staphylococcus aureus* and *Vibrio parahaemolyticus* (Padzil *et al*., 2021). Antibacterial activity of wild taro suggests the potential of medicinal plant to treat typhoid, pneumonia, otitis media, urinary tract infections and diarrhea (Nakade *et al*., 2013) [9].

Second metabolic productions of plants play an important role as anti-inflammatory (Mohammed *et al*., 2014) [18] and antibacterial agents (Compean and Ynalvez, 2014). Alkaloids are used for reducing fever and headache Krishnapriya and Suganthi (2017). Flavonoids were recorded their antifungal, antiviral and antibacterial activity (Panche *et al*., 2016) [25]. Glycosides are used in treatment of congestive heart failure. Coumarin activities range from antimicrobial and antiviral to anticoagulant and anticancer (Stringlis *et al.,* 2019) [37]. Glycosides isolated from plants demonstrated potent cytotoxic effects against various cancer cell lines (Khan *et al*., 2019). Terpenoids showed defence activity against environmental stress and help to heal injuries (Prakash, 2017) [28]. Saponins showed anti-inflammatory activity in mice and rats inflammation models (Mohammed, 2014) [18]. Saponins exhibit a medicinal properties such as anti-inflammatory, antibacterial, antifungal, antiviral, insecticidal, anticancer and cholesterol-lowering action in animals and human (Aziz *et al*., 2019). Steroids possess pharmacological properties such as antidiabetic, analgesic, anti-inflammatory and anthelmintic activities (Rahman *et al*., 2017) [29]. These biological properties in plants are expressed through organic compounds, which can belong to many different phytochemical structures. Traditional medicine has used wild taro as a medicinal ingredient and its antibacterial properties may be related to the presence of qualitative organic substances.

Conclusion

Anatomical and morphological characteristics of tuber and leaf of "green" morphotype wild taro (*C. esculenta)* were discribed on this research. Chromosome numbers of investigated species were estimated as 2n = 28. Leaf and tuber of "green" wild taro were indicated the presence of phytochemicals such as steroids, flavonoids, alkaloids, saponins, tannins, coumarine and glycosides. The leaf and tuber ethanol extract of wild taro were resistant to both strains

of *E. coli* and *B. subtilis*. Preliminary results showed that the effect of ethanol extract is stronger against gram-negative bacteria than gram-positive. Therefore, this plant has great potential to be used for further study on phytochemical components and their correlation with pharmacological effects.

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