ecies Diversity of Zingiberaceae in the Central Java's Main Producer of Medicinal Plants

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ABSTRACT

information on accuracy of species identification, population stock, species distribution and estimation and abundance is needed for conservation. The objective of this study is to determine the species f Zingiberaceae in the Central Java's main producer of medicinal plants, i.e., Semarang City, Semarang Boyolali, Sukoharjo, Karanganyar and Wonogiri. The research had been carried out in April until August survey and quadrate/plot method. All founded species was counted into total individual in each 5x5 m² parameters used in this study are density, frequency, relative dominance, importance value, and dex. The result shows that there are 17 species of Zingiberaceae, i.e., Alpinia galanga, Amomum um, Curcuma aeruginosa, Curcuma longa, Curcuma heyneana, Curcuma mangga, Curcuma petiolata, soloensis, Curcuma xanthorrhiza, Costus speciosus, Kaempferia galanga, Kaempferia pandurata, rotunda, Zingiber americans, Zingiber aromaticum, Zingiber cassumunar. Curcuma domestica has the portance value in Sukoharjo, then follows by Semarang Regency and Wonogiri. The highest diversity found in Semarang City.

: Species diversity, Zingiberaceae, medicinal plant, Central Java.

DUCTION

has so many species of medicinal plant and traditional knowledge, among hundreds ethnic living in the cosystem which are very potential to support the environment. Approximately 95 species of medicinal ving in the wild and being exploited enourmously for providing the traditional medicine material for Indonesia. [1].

t demand for the medicine made of medicinal plant is closely related to the increasing consumption of dicine itself. The high consumption rate for herbal medicine has two correlative dimensions. They are spect that is in relation with wide broad usage of herbal medicine all over the world, and economics t is in relation with additional value and the development of economics in the society. [2]

kinds of medicinal plant, there are only 13 species of those medicinal plant which are cultivated. Those engkuas, kencur, kunyit, lempuyang, temulawak, temu ireng, keji beling, dringo, kapolaga, temukunci, and sambiloto. Indonesia has several medical herbs plantation centres that are located in over 15 Indonesia. Those centres are located in North Sumatra, Riau, Jambi, DKI Jakarta, West Java, Central ah Istimewa Yogyakarta, East Java, Banten, Bali, West Kalimantan, East Kalimantan, North Sulawesi, awesi, and Gorontalo [3]. West Java, Central Java, and East Java are the major provinces producing medical herb plants, with average production around 70 – 90 % from all the national products [4]

d for medicinal plant material will be increasing because : (1) the higher population, (2) the higher price medicine, (3) the higher number of traditional medicine industries and factories in society, and (4) people ange their habit, from modern habit and back to nature. These situations become the major causes of the some medicinal plants permanently, and will cause death and prevent the growth of regenerations or ons of those plants, so that they will threaten the existence of some medicinal plants.

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ABSTRACT

An information on accuracy of species identification, population stock, species distribution and estimation of scarcity and abundance is needed for conservation. The objective of this study is to determine the species diversity of Zingiberaceae in the Central Java's main producer of medicinal plants, i.e., Semarang City, Semarang Regency, Boyolali, Sukoharjo, Karanganyar and Wonogiri. The research had been carried out in April until August 2010 using survey and quadrate/plot method. All founded species was counted into total individual in each $5 \times 5 \, m^2$ plots. The parameters used in this study are density, frequency, relative dominance, importance value, and diversity index. The result shows that there are 17 species of Zingiberaceae, i.e., Alpinia galanga, Amomum cardamomum, Curcuma aeruginosa, Curcuma longa, Curcuma heyneana, Curcuma mangga, Curcuma petiolata, Curcuma soloensis, Curcuma xanthorrhiza, Costus speciosus, Kaempferia galanga, Kaempferia pandurata, Kaempferia rotunda, Zingiber amaricans, Zingiber aromaticum, Zingiber cassumunar. Curcuma domestica has the highest importance value in Sukoharjo, then follows by Semarang Regency and Wonogiri. The highest diversity index was found in Semarang City.

Keywords : Species diversity, Zingiberaceae, medicinal plant, Central Java.

INTRODUCTION

Indonesia has so many species of medicinal plant and traditional knowledge, among hundreds ethnic living in the different ecosystem which are very potential to support the environment. Approximately 95 species of medicinal plant are living in the wild and being exploited enourmously for providing the traditional medicine material for industry in Indonesia. [1].

The market demand for the medicine made of medicinal plant is closely related to the increasing consumption of herbal medicine itself. The high consumption rate for herbal medicine has two correlative dimensions. They are medical aspect that is in relation with wide broad usage of herbal medicine all over the world, and economics aspect that is in relation with additional value and the development of economics in the society. [2]

Out of 283 kinds of medicinal plant, there are only 13 species of those medicinal plant which are cultivated. Those are ahe, lengkuas, kencur, kunyit, lempuyang, temulawak, temu ireng, keji beling, dringo, kapolaga, temukunci, mengkudu and sambiloto. Indonesia has several medical herbs plantation centres that are located in over 15 provinces in Indonesia. Those centres are located in North Sumatra, Riau, Jambi, DKI Jakarta, West Java, Central Java, Daerah Istimewa Yogyakarta, East Java, Banten, Bali, West Kalimantan, East Kalimantan, North Sulawesi, South Sulawesi, and Gorontalo [3]. West Java, Central Java, and East Java are the major provinces producing plantation medical herb plants, with average production around 70 – 90 % from all the national products [4]

The demand for medicinal plant material will be increasing because : (1) the higher population, (2) the higher price of modern medicine, (3) the higher number of traditional medicine industries and factories in society, and (4) people tend to change their habit, from modern habit and back to nature. These situations become the major causes of the extinction of some medicinal plants permanently, and will cause death and prevent the growth of regenerations or reproductions of those plants, so that they will threaten the existence of some medicinal plants.

tral Java, there are a lot of macro and micro traditional medicine companies or factories. It shows that
al Java has a great potential to make use the medical herb plantations and to produce a large quantity of
nal medicine too. The Central Java Government gave a conductive response for its germplasm of medicinal
by establishing six central herbs plantations in order to preserve the existence of herb plants in Central Java.
ogram is conducted by Dinas Perkebunan in Central Java. Those six central herbs plantation are located in
ang City, Semarang Regency, Boyolali, Sukoharjo, Karanganyar, and Wonogiri. Each centre has different
gical environments [5]

eraceae is one of the herbs plants whose roots are mostly used by people to make traditional medicine to
healthy. Based on the information gathered from Etnobotany shows that many people use these herb plants
e some traditional medicine.

es of Zingiberacea has similarities in morphological. Identification based on morphological characters is often
t, especially if flower are absent. The morphological character, shape, and the texture of the leaves are alike
another. People try to identify them by the shapes, smell, and the color of the roots. Those can help to
fication of each species.

species sometimes have the same local names. in fact,they actually belong to different species. For
nce, *Kaemferia rotunda*, *Curcuma mangga* and *Curcuma zeodaria* have the same local names that is kunir
(Temu Putih). *Curcuma petiolata* and *Kaemferia rotunda* also have the same local names called Temu Putri
[6]. That causes a confusion when people sell them in the market using those same trade names,but actually
re different.

observation for the diversity of Zingiberaceae is very crucial to be done in order to analyze the changes every
Those changes are caused by land conversion in several areas whether in town or in village. These
ersions are the results of rapidly growing population in the society. Human beings need plants to live but,on
ther hand, the plant ecosystem are changed and destroyed.

purpose of the research is to explore the diversity of Zingiberaceae in main medicinal plants centre in Central
, which are located in Semarang City, Semarang Regency, Boyolali, Sukoharjo, Karanganyar, and Wonogiri.

ATERIALS AND METHODS

researches are done in six Regency where some herbal plantation centres are located around Central Java.
se are Semarang City, Semarang Regency, Boyolali, Sukoharjo, Karanganyar, and Wonogiri. For every
ncy, there are 3 subRegencys (6x3= 18 subRegencys).

data of plants are gathered by doing several vegetation analysis. The method used is quadrate method with 5
metres in size. Based on this quadrate method, the parameters include species and number of individuals. The
arch identifies and descriptions every species including (local name, scientific name, brief description, habitant,
cal uses). Several interviews have been done to the inhabitants nearby in order to identify and to recoqnize
names of every species, and the medical uses of those plants as well. The identifications are also done
ually by using literatures. The identifications refer to [7], [6] , [8], [9] & [10].

very centre of observations, we determine the coordinate using GPS. We also take some data about the
ronmental factors including the altitude, weather temperature, the soil pH, light intensity, humidity.

vegetation data gathered are analyzed to find out the relative density, relative domination, and relative
uency and Importance Value Index. The diversity of the species are counted using the Diversity index by
nnon and Wiener, Evennes index (E) by Barbour and friends.

RESULTS AND DISCUSSIONS.

ed on the identifications toward some specimen, the researches got 17 species from Zingiberaceae which are
ibuted in main medicinal plants plantation centres in six Regency in Central Java. Those species are *Alpinia*
anga, *Amomum cardamomum*, *Curcuma aeruginosa*, *Curcuma longa*, *Curcuma heyneana*, *Curcuma mangga*,
cuma petiolata, *Curcuma soloensis*, *Curcuma xanthorrhiza*, *Costus speciosus*, *Kaempferia galanga*,
mpferia pandurata, *Kaemferia rotunda*, *Zingiber amaricans*, *Zingiber. Aromaticum*, *Zingiber cassumuna* (Table

species of Zingiberacea which are found in main medicinal plants plantation centres in six Regency in Central ... are still a few, because there are actually around 53 genus and 1200 species which are distributed in all over ... areas, especially in Indo–Malaya and India. The species of Zingiberacea which have been found are ... used to fulfil the materials needed to make several traditional medicine.

Table 01. Species diversity of Zingiberaceae in the Central Java's Main Producer of Medicinal Plants

No.	Local Name	Scientific Name
1	Lengkuas	Alpinia galanga, Linn.,Willd.
2	Kapulogo	Amomum cardamomum.
3	Temu Ireng	Curcuma aeruginosa Roxb.
4	Kunyit/Kunir	Curcuma domestica Val.
5	Temu Giring	Curcuma heyneana Val. & V
6	Temu Mangga	Curcuma mangga Val. et Zip
7	Temu Badur	Curcuma petiolata Roxb
8	Temu Glenyeh	Curcuma soloensis Val.
9	Temu Lawak	Curcuma xanthorrhiza L.
10	Kostus/Pacing	Costus speciosus
11	Kencur	Kaempferia galanga L
12	Kunci	Kaempferia pandurata Roxb
13	Kunir Putih	Kaemferia rotunda L.
14	Lempuyang	Zingiber amaricans Bl.
15	Lempuyang Wangi	Zingiber. aromaticum Vahl
16	Bengle	Zingiber cassumunar Roxb.
17	Jahe	Zingitemukan di ber officinale

The scientists have recorded around 70 species of Curcuma whether live in wilderness or in plantations over Indo – ... areas, China, and North Australia [11]

Table. 02. Relatife density value (%) of Spesies

No	Species	Semarang City	Semarang Regency	Boyolali Regency	Sukoharjo Regency	Wonogiri Regency	Karang Anyar Regency
		1	2	3	4	5	6
1	Alpinia galanga	2,180	1,549	2,177	2,079	13,087	3,436
2	Amomum cardamomum.	7,709	1,084	-	-	-	-
3	Curcuma aeruginosa.	1,010	2,246	5,268	1,701	13,861	11,798
4	Curcuma domestica.	23,179	48,799	26,594	62,760	40,095	25,086
5	Curcuma heyneana	10,367	-	-	-	-	
6	Curcuma mangga	4,785	-	-	1,134	0,833	
7	Curcuma petiolata	-	2,401	-	-	-	-
8	Curcuma soloensis	-	-	0,467	6,049	1,011	
9	Curcuma xanthorrhiza	26,901	2,789	2,955	2,457	0,297	12,371
10	Costus speciosus	0,372	0,232	1,711	-	-	-
11	Kaempferia galanga	7,443	-	17,263	-	7,852	16,037
12	Kaempferia pandurata	0,372	0,775	2,644	7,183	3,510	
13	Kaemferia rotunda	0,020				2,022	0,573
14	Zingiber amaricans	-	-	-	-	0,458	
15	Zingiber. aromaticum	1,967	0,930	2,333	16,635	2,201	0,344
16	Zingiber cassumunar	1,701	0,387	1,400	-	2,617	10,080
17	Zingiber officinale	3,987	38,575	34,059	-	12,612	19,817

are some scarce plants obtained in Indonesia. Namely are *Curcuma petiolata* called Temu putri [12] and *...ma soloensis* called Temu glenyeh whose distributions are relatively limited [13]. Both species of plants are *...ma petiolata* which are found in Semarang Regency and *Curcuma soloensis* that can be found in Boyolali *...cy,* Sukaharjo Regency, and Wonogiri.

...sults of some vegetation analysis are available from Table 02 to 05. The data in Table 02 shows that *C.* *...stica* in Sukoharjo Regency has relatively the highest relatife density value, that is around 62.76%. if it is ...red with other plants, *C. domestica* has the highest density level of all the research areas, except in Boyolali ...cy. The species which has relatively the highest relatife density level in Boyolali Regency is *Z. officinale.* the ...ensity level shows adaptation pattern for this species to the environmental factors. it is supported by the ...of *C. domestica* to reprouce or regenerate easily and this species doesn't need special treatment to grow ...oreover, *C domestica* has so plenty of functions, as the ingriedients and as traditional medicine so that many ...e are willing to plant it in their neighbourhood.

...a Island, many inhabitants make use of curcuma as the traditional medical drink called Jamu. The effects are ...g, cleaning, drying, relieving itches, and relieving numb. The major functions of curcuma plants are : the ...l for traditional medicine, the material for traditional drink factory and cosmetics, ingredients, farming, etc. ...hile, the rhizomes of curcuma plants are also very useful to reduce inflammation, as anti oxidan, anti ...a, cancer prevention, anti tumor, and reduce fat level in blood, colestherol, and also as blood cleaners [12].

Table 03. Frequency value (%) of Spesies

No	Species	Semarang City	Semarang Regency	Boyolali Regency	Sukoharjo Regency	Wonogiri Regency	Karang Anyar Regency
		1	2	3	4	5	6
1	Alpinia galanga	9,091	6,452	3,571	7,143	10,526	8,000
2	Amomum cardamomum.	2,273	-	-	-	-	-
3	Curcuma aerugincsa.	4,545	6,452	7,143		15,789	12,000
4	Curcuma domestica	15,909	32,258	21,429	42,857	21,053	28,000
5	Curcuma heyneana	6,818	-	-	-	-	-
6	Curcuma mangga	2,273	-	-	7,143	-	-
7	Curcuma petiolata	-	3,226	-	-	-	-
8	Curcuma soloensis	-	-	-	7,143	-	-
9	Curcuma xanthorrhiza	15,909	6,452	3,571		5,263	12,000
10	Costus speciosus	9,091	3,226	10,714	-	-	-
11	Kaempferia galanga	2,273	-	7,143	-	5,263	4,000
12	Kaempferia pandurata	2,273	6,452	10,714	21,429	10,526	-
13	Kaemferia rotunda	6,818		7,143		5,263	4,000
14	Zingiber amaricans	13,636	9,677	17,857	14,286	10,526	4,000
15	Zingiber. aromaticum	-	-	-	-	-	4,000
16	Zingiber cassumunar	6,818	6,452	3,571	-	5,263	4,000
17	Zingiber officinale	2,273	16,129	7,143	-	10,526	20,000

...bserve the distribution patterns of these plants which is usually called frequency, *C domestica* in Sukoharjo ...cy has the highest frequency value that is 42.857% and followed by Semarang Regency as big as 32.258% ...rang Anyar Regency with 28%. In Karang Anyar Regency, *Zingiber officinale* has quite enormous frequency ...20.00% and then it is followed by both Semarag Regency and Boyolali Regency for as much as 10.526%.

...ing to habitant dominate pattern which is called Domination, apparently *C domestica* in Wonogiri Regency ...atively the highest domination that is 51.102%. Meanwhile, in Karang Anyar Regency, *C aeruginosa* has ...ely the highest domination which is 43.571%. This kind of domination implemented that *C domestica* has the ...opulation if it is compared with the other species of *Zingiberaceae* and the second largest population is *C.* ...osa.

...ing to table 05, Semarang City tends to present the highest index of Diversity if it is compared with ...ang Regency, Boyolali, Wonogiri, as well as Karang Anyar. The index of Diversity of species gives

planation about the relationship among the population of the species and the population of the individuals that compound community. It is closely related to the population of some species which are found in each location or area, the higher the population of the species is, the higher the species varieties index is. Semarang city has the most population of the species. So we can conclude that the environment situations and conditions in Semarang fully support the growth of Zingiberaceae plants. In general, the species diversity level in one certain ecosystem is closely related to the indicator of the stability from the ecosystem. The higher the species diversity level in one ecosystem is, the higher the stability level in that ecosystem will be.

Table. 04. Relatife *Dominancy* value (%) of Spesies

No	Species	Semarang City	Semarang Regency	Boyolali Regency	Sukoharjo Regency	Wonogiri Regency	Karang Anyar Regency
		1	2	3	4	5	6
1	Alpinia galanga	3,314	3,228	0,748	2,722	2,350	0,847
2	Amomum cardamomum.	5,207	9,945	-	-	-	-
3	Curcuma aeruginosa.	1,546	1,359	10,019	3,407	35,089	43,571
4	Curcuma domestica .	22,005	34,758	42,737	26,920	51,102	19,655
5	Curcuma heyneana	18,517	-	-	-	-	-
6	Curcuma mangga	7,693	14,034		2,012	0,117	-
7	Curcuma petiolata	-	2,331	-	-	-	-
8	Curcuma soloensis	-	-	0,642	15,017	0,163	-
9	Curcuma xanthorrhiza	32,985	5,344	3,239	6,626	0,448	14,856
10	Costus speciosus	0,213	0,126	5,821	-	-	-
11	Kaempferia galanga	0,263	-	1,242	-	0,484	0,912
12	Kaempferia pandurata	0,104	0,144	4,357	5,601	1,859	-
13	Kaemferia rotunda	2,351		1,537	-	-	0,393
14	Zingiber amaricans	2,544	2,895	7,401	37,695	1,651	0,110
15	Zingiber. aromaticum	-	-	-	-	-	0,049
16	Zingiber cassumunar	0,864	0,279	2,065	-	2,219	12,293
17	Zingiber officinale	2,394	25,486	20,192	-	4,517	7,314

Table. 05. Index of *Important Value* (%)

No	Species	Semarang City	Semarang Regency	Boyolali Regency	Sukoharjo Regency	Wonogiri Regency	Karang Anyar Regency
		1	2	3	4	5	6
1	Alpinia galanga	14,585	11,229	6,497	11,945	25,963	12,283
2	Amomum cardamomum.	15,188	11,029				
3	Curcuma aeruginosa	7,102	10,057	22,450	5,109	64,740	67,369
4	Curcuma domestica	61,093	115,816	90,760	132,537	112,250	72,741
5	Curcuma heyneana	35,702	-	-	-	-	-
6	Curcuma mangga	14,750	14,034	-	10,289	0.949	-
7	Curcuma petiolata	-	7,958	-	-	-	-
8	Curcuma soloensis	-	-	1,108	28,209	1,174	-
9	Curcuma xanthorrhiza	75,795	14,584	9,765	9,083	6,009	39,227
10	Costus speciosus	9,463	3,264	18,292	-		
11	Kaempferia galanga	9,716	-	25,737	-	13,749	20,948
12	Kaempferia pandurata	2,645	6,985	17,755	35,149	15,967	-
13	Kaemferia rotunda	14,846	-	11,815		7,324	4,966
14	Zingiber amaricans	18,463	12,943	27,650	73,541	14,425	4,453
15	Zingiber. aromaticum	-	-	-	-	-	4,507
16	Zingiber cassumunar	8,519	6,731	7,056	-	10,155	26,374
17	Zingiber officinale	8,654	80,190	61,394	-	27,654	47,131

The results of the calculation toward species distribution index in every research area are around 0.513 % until 822 %. Semarang city has the highest species distribution index. The parameters for the number of species and

species distribution will bring several benefits for determining the varieties of the species in one ecosystem. Whenever certain ecosystems have the number of individuals with a great deal of species numbers, those ecosystems will surely have higher diversities of species if they are compared with some ecosytems which have the same number of individuals, unfortunately they are only a few varieties of species.

Based on the data on table 06, we can see that *Curcuma domestica* has the highest Index of Important Value in almost every researsh location., it is around 61.1% until 132.5%. This situation is fully understood because *C. domestica* or it is called turmeric, is very famous. This plant is enourmously used by people as the materials for making traditional medicine and also as the ingredients. *Curcuma xanthorrhiza* also has the same highest Index of important Value in Semarang City for 75.8%.

Table 06. Sum of Species (S),Diversity Index (H1) dan Evenees Index (E)

Location	H'	E	S
Semarang City	2,112	0,800	14
Semarang Regency	1,229	0,513	11
Boyolali Regency	1,811	0,729	12
Sukoharjo Regency	1,241	0,597	8
Wonogiri Regency	1,847	0,743	12
Karang Anyar Regency	1,893	0,822	10

The results of the calculation to the parameter in the environment in some research areas (table 07) explains that the research areas have the altitude around 111 – 1019 above the sea level and the soil pH ranges from 5.8 – 7.2. While the light intensity is around 200 – 1820bLux, and the weather humidity is 30 – 100 %. And for the air temperature is between 24 – 32 °C. According to the results of those calculation towards some environmental factors, we can say that the research areas are mostly excellent areas that can support . the growth of the Zingiberaceae.

Table. 07. Environment Factor

Location	Altitude (m.dpl.)	pH Soil	Light Intensity	Air Temperature (°C)	Humidity (%)
Semarang City	188 - 367	5,2 - 7,2	471 - 1820	29 - 30	56 - 64
Semarang Regency	140 - 1019	7	400 -1500	32	48
Boyolali Regency	209 - 867	6	200 -1300	24 - 26	60 - 77.5
Sukoharjo Regency	111 - 258	5 - 7	560 - 847	30	55 - 57
Wonogiri Regency	149 - 258	5 - 6,7	640 - 847	30 - 30,5	30 - 50,5
Karang Anyar Regency	183 - 309	4,9	417 -1369	26 - 28	62 - 100

CONCLUSION

The researches have gathered 17 species from Zingiberaceae which are distributed in main medicinal plants centres in six Regency in Central Java. There are some rare plants in Indonesia, these are *Curcuma zedolata* called Temu putri and *Curcuma soloensis* called Temu glenyeh. Turmeric (*Curcuma domestica*) has the highest importance value in Sukoharjo, then follows by Semarang Regency and Wonogiri. The highest diversity index was found in Semarang city.

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