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## THE RELATIONSHIP OF PIPERACEAE BASED ON MORPHOLOGICAL CHARACTER OF VEGETATIVE ORGAN IN MERU BETIRI NATIONAL PARK JEMBER EAST JAVA

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### Abstract

The family of Piperaceae in Meru Betiri National Park Jember East Java is represented by ten species: *Peperomia pellucida*, *P. Sarmentosum*, *P. aduncum*, *P. auriculatum*, *P. retrofractum*, *P. nigrum*, *P. canicum*, *Piper Sp 1*, *P. betle* and *Piper Sp 2*. Taxonomic studies were performed to determine the relationship between each species based on morphological characters. By using hierarchical cluster analysis, the relationships between species were illustrated in a dendrogram. The results show that from 10 species collected can be grouped into 7 clusters as follow: (*P. aduncum* + (*Peperomia pellucida*) + (*P. retrofractum*) + (*P. canicum*) + (*P. betle*) + (*P. sarmentosum*) + (*P. auriculatum* + *Piper Sp. 2* + *P. nigrum* + *Piper Sp.1*)). The closest relationship was obtained between species of SP 4 (*P. auriculatum*) and SP 10 (*Piper Sp. 2*) with 0.7% similarity level and 24.307 of the coefficient value. The farthest relationship was obtained between SP 1 (*Peperomia pellucida*) and SP 3 (*P. Aduncum*) with 25% similarity level and a coefficient value of 387.415.

**Keywords:** relationship, *Piperaceae*, morphology, taxonomic characters.

### 1. Introduction

Piperaceae is an aromatic herbs, shrubs or small trees there are often [rhizomatous](#), and can be [terrestrial](#) or [epiphytic](#). The stems can be either simple or branched. Leaves are simple with entire margins, and are positioned at the base of the plant or along the stem, and can be alternate, opposite, or whorled in arrangement [1]. Piperaceae contains most of the species in the order, with *Peperomia* and *Piper* as the largest genera (approximately 1600 and 2000 species respectively), but also including the smaller genera *Verhuellia*, *Manekia* and *Zippelia* [2,3].

*Piper* species occur in the understory of tropical forests as herbs, trees, tree lets and climbers. All species of the genus are easy to recognize in the field by their thickened nodes. Due to the rather uniform floral morphology and the number of species in the genus, classification is complicated, as well as distinction of species based on morphological characters [4]. In contrast to

*Piper*, *Peperomia* shows a larger morphological variation. While *Piper* occurs mostly as trees and shrubs, life forms of *Peperomia* are herbs, geophytes, succulents, epiphytes and more. Not only interspecific variation is remarkably large, it is even observed within species. Processes like hybridization and rapid speciation could lead to this variation, but little is known about this in *Peperomia* [3].

*Piper* and *Peperomia* are the largest genera of Piperaceae and have wide geographical distribution, among them in Meru Betiri National Park (TNMB). The members of *piper* and *Peperomia* shows the diversity of species and variations of morphology between the both. Diversity of species with variations of morphology in *piper* and *peperomia* can be accurately studied with morphometry, in order to know the relationship between types of the species.

### 2. Materials and Methods



The materials used in this research were GPS Garmin e-Trex 10, ruler, slide, knife, scissor, glove, labels, raffia rope, Munsell Color Charts for Plant tissues book, used newspaper, stationary and camera. The raw materials were vegetative organ (root, stem and leaf) of family Piperaceae and alcohol 70% for preservation.

The sample had been taken by roaming forest in left side of the main road of Andongrejo-Bandealit resort. The location where the Piperaceae specimens found is marked by the position of the coordinate point using GPS.

The observed parameters were qualitative and quantitative parameters of vegetative organ, qualitative parameter were scored in order to quantified. Data obtained from each observation parameter had been analyzed using descriptive statistical analysis and then followed by group analysis (Cluster Analysis) SPSS 16.0. Then, the result is dendrogram which depicting the relationship of the existing species [5-7].

### 3. Results and Discussion

Results of the research was represented by ten species of family Piperaceae in Meru Betiri National Park Jember Jawa Timur: *Peperomia pellucida*, *Piper Sarmentosum*, *Piper aduncum*, *Piper auriculatum*, *Piper retrofractum*, *Piper nigrum*, *Piper canicum*, *Piper Sp 1*, *Piper betle* and *Piper. Sp 2*.

Based on qualitative and quantitative measurement and descriptive statistical analysis in SPSS 16.0, the highest result of general measurement was *Piper aduncum* which is the only type of tree habitus Piperaceae found in the research area. Its highest result was on PIT parameter (Length of Center Petiol). Otherwise, the lowest results of measurement were *P. sarmentosum*, *P. retrofractum* and *Piper sp. 1* with 0,00 on RPD PIT (Length of Leaf and Length of Center Petiol Ratio) which indicated uniformity between the two parameters as shown in Table 1.

**Table 1.** Measurement Average of Qualitative and Quantitative Parameters

No	Jenis	P.P	P.S	P.A	P.AU	P.R	P.N	P.C	P.1	P.B	P.2
1.	PB (cm)	2.15	6.33	14	3.347	8	4.043	6.357	2.43	6.857	4.23
2.	DB (mm)	0.61	0.4	0.67	0.147	0.245	0.267	0.235	0.269	0.336	0.14
3.	RPDB (cm)	1.43	5.91	10.16	3.17	7.754	3.77	6.12	2.164	6.52	4.09
4.	PHD (cm)	1.56	10.53	16.52	6.72	13.37	8.52	7.79	7.07	9.97	7.22
5.	LHD (cm)	1.64	7.79	7.5	4.53	5.37	5.023	3.93	6.8	5.7	6.37
6.	RPLHD(cm)	-0.09	2.68	9.03	2.19	8	3.5	3.857	0.27	4.31	0.85
7.	PIT (cm)	1.56	10.53	16.52	6.7	13.37	8.49	7.7	7.07	9.9	7.2
8.	PBM (cm)	0.78	3.82	3.97	2.43	2.73	2.39	2.03	3.43	2.9	3.13
9.	DTD (cm)	0.107	0.15	11.81	0.151	0.18	0.202	0.2	0.22	0.165	0.12
10.	PTD (cm)	0.88	3.58	1.3	2.19	1.653	2.243	1.97	3.3	2.57	1.57
11.	RPDPIT(cm)	0.01	0	0.01	0.023	0	0.03	0.123	0	0.077	0.02
12.	RPDPTD(cm)	0.68	6.96	15.27	4.53	11.713	9.09	5.83	3.73	7.143	5.65
13.	KHD (cm)	0.023	0.03	0.15	0.01	0.03	0.029	0.02	0.03	0.021	0.02
14.	RPTDDTD(cm)	0.77	3.454	-10.47	2.053	1.473	2.201	1.77	3.113	2.4	1.45
15.	RLHDPBM(cm)	0.87	3.97	3.53	2.1	2.63	2.63	1.9	3.37	2.77	3.2
16.	RPITPTD (cm)	0.69	6.957	15.19	4.5	11.71	6.147	5.7	3.73	7.33	5.63
17.	RLHDKHD (cm)	1.621	7.759	7.48	4.523	5.337	4.993	3.913	6.77	5.645	6.35
18.	AA	2	1	2	1	1	1	1	1	1	1
19.	BB	1	1	1	1	1	1	1	1	1	1
20.	ATB	1	4	1	3	3	3	3	3	3	3
21.	SPB	1	3	3	4	3	3	1	3	3	4
22.	WB	4	4	1	3	3	4	2	4	4	3
23.	BD	3	3	4	3	4	3	3	3	3	3
24.	PD	4	4	1	4	1	4	4	4	4	4
25.	UD	2	2	1	2	2	2	2	2	1	2
26.	TD	1	1	1	1	1	1	1	1	1	1

27.	BPD	2	3	1	2	1	2	1	2	2	2
28.	SPAD	1	1	3	2	1	1	4	1	1	2
29.	SPBD	1	3	3	2	3	3	3	3	1	2
30.	WPAD	2	4	4	2	4	4	2	4	4	2
31.	WPBD	4	4	4	3	4	3	3	3	4	3
32.	TID	1	1	2	1	1	1	1	1	1	1
33.	AD	1	2	2	2	2	2	2	2	2	2

Note: P.P (*Peperomia pellucida*), P.S (*Piper sarmentosum*), P.A (*Piper aduncum*), P.AU (*Piper auriculatum*), P.R (*Piper retrofractum*), P.N (*Piper nigrum*), P.C (*Piper canicum*), P.1 (*Piper Sp.1*), P.B (*Piper betle*), P.2 (*Piper Sp.2*), PB (Length of stem),DB (Stem Diameter),RPDB (Length of stem and Stem Diameter Ratio), PHD (Length of Lamina), LHD (Lamina Wide), RPLHD (Length and wide of Lamina Ratio),PIT (Length of Center nervatio),PBM (Basal-Marginal Length of leaf), DTD (Petiol Diameter),PTD (Lenght of Petiol), RPDPTD(Length of Leaf and Length of center nervatio Ratio), RPDPTD(Length of Leaf and Length of center Petiol Ratio), KHD (Lamina Thickness), RPTDDTD (Length of center Petiol and Petiol Diameter Ratio), RLHDPBM (Lamina Wide and Basal-Marginal Length of leaf Ratio), RPITPTD (Length of Center nervatio and Lenght of Petiol Ratio), RLHDKHD (Lamina Wide and Lamina Thickness Ratio), AA (Adventious Root),BB (Stem Shape),ATB (Growing Direction Stem),SPB (Structure Surface of stem), WB (Color of stem), BD (Leaf Shape), PD (Length of Leaf),UD (end of leaf), TD (Leaf edge), BPD (Nervatio Shape of Leaf), SPAD (Upper surface structure of Leaf), SPBD (Bottom surface structure of Leaf), WPAD(Upper surface Color of Leaf), WPBD(Upper surface Color of Leaf), TID (Leaf Type), AD (Leaf Aromatic).

Table 2. Showed on the highest deviation standard was in the RPDPTD parameter (Length of Leaf and Length of center Petiol Ratio) with the amount 4.42665, it indicated that this parameter has the greatest variation or diversity. The lowest deviation standard

was in the parameter BB (Stem Form) and TD (leaf edges) with the amount 0.0000 which means it has a very small variation, it can be seen from the stem form and leaf edges which is almost the same of the obtained ten species of Piperaceae.

**Table 2.** Deviation Standard of Qualitative and Quantitative Parameters Measurement

No Parameter	Jenis	PP	PS	P.A	P.AU	P.R	P.N	P.C	P.1	P.B	P.2
1.	PB	30089	1.84218	3.96863	91686	3.86264	.53631	1.71949	.60277	2.04246	20817
2.	DB	.79674	1.2166	24007	.01155	.01528	.06110	.05033	18.502	.06110	.01155
3.	RPDB	44185	1.81997	5.94172	88794	3.87145	.59702	1.69193	.78341	1.99369	21166
4.	PHD	.09815	2.30290	3.92895	1.35596	.37859	1.21173	2.69115	1.40119	1.38298	31177
5.	LHD	24826	2.62246	1.00000	1.73183	.89629	.04041	.60277	2.49900	1.01160	11547
6.	RPLHD	15588	.48952	3.22542	1.60758	1.15326	1.23406	2.08869	1.49778	88.504	27301
7.	PIT	12503	2.30290	3.90636	1.35277	.37859	1.23988	2.51661	1.40119	1.30610	34641
8.	PBM	16523	1.39366	.45092	.68069	.57735	.10149	.30551	1.40119	.43589	11547
9.	DTD	.00577	.02517	.61587	.07810	.01732	.12166	.00000	.01732	.01155	.01155
10.	PTD	.21362	1.01717	.57735	1.98023	.06807	.64694	.30551	1.89297	.65744	.05774
11.	RPDPIT	.01732	.00000	.01732	.04041	.00000	.03512	.21362	.00000	.08083	.03464
12.	RPDPTD	1.6623	2.15073	3.65559	2.20303	4.3317	3.63831	3.00888	1.53731	1.98888	25403
13.	KHD	.00577	.00000	11358	.00000	.00000	.00577	.00000	.00000	.00000	.00000
14.	RPTDDTD	21656	1.02510	1.19274	1.92516	.05568	.83345	.30551	1.91014	.64532	.04619
15.	RLHDPBM	.09074	1.22882	.55076	1.07000	.32146	.06506	.30000	1.09697	.57735	1.7321
16.	RPITPTD	18520	2.15073	3.76116	2.25167	4.3317	1.94104	2.82135	1.53731	1.91709	28968
17.	RLHDKHD	25120	2.62041	1.00000	1.72653	.89629	.03464	.60277	2.49900	1.00898	11547
18.	AA	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
19.	BB	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
20.	ATB	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
21.	SPB	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
22.	WB	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
23.	BD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
24.	PD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
25.	UD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
26.	TD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
27.	BPD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
28.	SPAD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
29.	SPBD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

30.	WPAD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
31.	WPBD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
32.	TID	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
33.	AD	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

Note: P.P (*Peperomia pellucida*), P.S (*Piper sarmentosum*), P.A (*Piper aduncum*), P.AU (*Piper auriculatum*), P.R (*Piper retrofractum*), P.N (*Piper nigrum*), P.C (*Piper canicum*), P.1 (*Piper Sp.1*), P.B (*Piper betle*), P.2 (*Piper Sp.2*), PB (Length of stem),DB (Stem Diameter),RPDB (Length of stem and Stem Diameter Ratio), PHD (Length of Lamina), LHD (Lamina Wide), RPLHD (Length and wide of Lamina Ratio),PIT (Length of Center nervatio),PBM (Basal-Marginal Length of leaf), DTD (Petiol Diameter),PTD (Length of Petiol), RPDPTD(Length of Leaf and Length of center nervatio Ratio), RPDPTD(Length of Leaf and Length of center Petiol Ratio), KHD (Lamina Thickness), RPTDDTD (Length of center Petiol and Petiol Diameter Ratio), RLHDPBM (Lamina Wide and Basal-Marginal Length of leaf Ratio), RPITPTD (Length of Center nervatio and Lenght of Petiol Ratio), RLHDKHD (Lamina Wide and Lamina Thickness Ratio), AA (Adventious Root),BB (Stem Shape),ATB (Growing Direction Stem),SPB (Structure Surface of stem), WB (Color of stem), BD (Leaf Shape), PD (Length of Leaf),UD (end of leaf), TD (Leaf edge), BPD (Nervatio Shape of Leaf), SPAD (Upper surface structure of Leaf), SPBD (Bottom surface structure of Leaf), WPAD(Upper surface Color of Leaf), WPBD(Upper surface Color of Leaf), TID (Leaf Type), AD (Leaf Aromatic).

From the ten types of cluster analysis based on morphological characters of vegetative organs can be grouped into 7 clusters as follow: (*P. aduncum* + *Peperomia pellucida*) + (*P. retrofractum* + *P. canicum*) + (*P. betle*) + (*P. sarmentosum*) + (*P. auriculatum* + *Piper Sp. 2* + *P. nigrum* + *Piper Sp.1* ).

The closest relationship was obtained between species of SP 4 (*P. auriculatum*) and SP 10 (*Piper Sp. 2*) with 0.7% similarity level and 24.307 of the coefficient value. The farthest relationship was obtained between SP 1 (*Peperomia pellucida*) and SP 3 (*P. Aduncum*) with 25% similarity level and a coefficient value of 387.415 as shown in Figure 1.

### Average Linkage (Between Groups)

**Agglomeration Schedule**

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	4	10	24.307	0	0	3
2	6	8	42.537	0	0	3
3	4	6	57.591	1	2	4
4	2	4	88.832	0	3	5
5	2	9	103.859	4	0	6
6	2	7	125.691	5	0	7
7	2	5	141.476	6	0	8
8	1	2	245.869	0	7	9
9	1	3	387.415	8	0	0

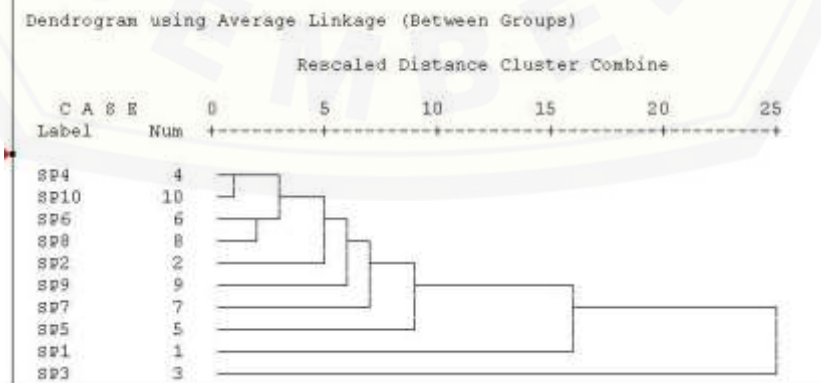


Figure 1. Dendrogram The result of 10 Species Piperaceae Relationship

#### 4. Conclusion

The results show that from 10 species collected can be grouped into 7 clusters, the closest relationship was obtained between species of SP 4 (*P. auriculatum*) and SP 10 (*Piper* Sp. 2) with 0.7% similarity level and 24.307 of the coefficient value. The farthest relationship was obtained between SP 1 (*Peperomia pellucida*) and SP 3 (*P. Aduncum*) with 25% similarity level and a coefficient value of 387.415.

#### REFERENCES

- [1] Cronquist, A. 1981. *An Integrated System of Classification of Flowering Plants*. New York: Columbia University Press. Hal.36-38.
- [2] Wanke, S., M.S. Samain, L. Vanderschaeve, G. Mathieu, P. Goetghebeur and C. Neinhuis.2006. *Phylogeny of the genus Peperomia (Piperaceae) inferred from the trnK/matK region (cpDNA)*. Plant Biology 8:93-102.
- [3] Samain, M.S., L. Vanderschaeve, P. Chaerle, P. Goetghebeur, C. Neinhuis, and S. Wanke. 2009. Is morphology telling the truth about the evolution of the species rich genus *Peperomia* (Piperaceae)? Plant Systematics and Evolution 278:1-21.
- [4] Jaramillo MA, R Callejas, C Davidson, JF Smith, AC Stevens, EJ Tepe. 2008. *A Phylogeny of the tropical genus Piper using ITS and the Chloroplast intron psbJ-petA*. Systematic Botany 33 (4), 647-660.
- [5] Mattjik, AA., m. Sumertajaya, H. Wijayanto, A. Kurnia dan B. Satono. 2002. *Aplikasi Analisis Peubah Ganda*. Bogor: Jurusan Statistik Fakultas Matematika dan IPA Pertanian Bogor.
- [6] Purnamasari, W.W. 2013. *Kekerabatan Lengkek (Dimocarpus Longan Lour.) Berdasarkan Morfometri Daun, Buah dan Biji*. Skripsi. Jember: FMIPA. Universitas Jember.
- [7] Santoso. S. 2002. *Buku Latihan SPSS Statistik Multivariat*. Jakarta: Elex Media Komputindo