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The Study of Spermatophyta Diversity Based on Taxonomy in Univet Bantara Sukoharjo

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***Abstract*— This study aimed to determine the diversity of seed plants (Spermatophyta) based on taxonomy in Univet Bantara Sukoharjo campus. This study type was an explorative descriptive. The study was carried out in 2017 at the Univet Bantara Sukoharjo campus. The method used was to census all spermatophyta plants in the campus environment. Data collection was done by observation, identification and documentation techniques. Data in the form of plant list were then identified in the laboratory to determine their taxonomy and grouped by divisions, subdivisions, class, subclass and family. The results showed that the number of plant species obtained showed a high diversity even though there were few families whose members were few. The number of spermatophyta species found was 106 species. Distribution of plants found were 2 plants of gymnosperms, 104 plants of angiosperms. Angiosperms amounted to 104 plants distributed into 39 plants monocotyledoneae class and 65 plants dicotyledoneae class (apetalae / monoclamidae as many as 18 plants, dialypetalae as many as 29 plants, sympetalae as many as 18 plants).**

***Keywords*— Diversity, Spermatophyta, Taxonomy**

I. INTRODUCTION

The largest biodiversity center in the world is in Indonesia, so Indonesia is called a megabiodiversity country which has a lot of genetic uniqueness, high diversity of species, ecosystems and endemies [1]. In addition, Indonesia is a vast and varied archipelagic country that lives in a variety of flora, fauna and microbes. Based on the biogeographic area profile, Indonesia has an important and strategic position in terms of the richness and diversity of plant species and its ecosystem [2]. Species diversity includes all species found on earth. Diversity is characterized by the many species that make up a community, the more the number of species, the higher the diversity [3]. The diversity of flowering plants in Indonesia constitutes 10% of the species of flowering plants in the world [4] or was the seventh largest country with species reaching 38,000 species, 55% are endemic or native to Indonesia [5]. High diversity and level of endemism make Indonesia a unique natural laboratory for tropical plants with various phenomena.

Whereas in terms of taxonomic diversity, the plant family that has the most species of number is the orchidaceae which was about 4,000 species. For woody plants, the dipterocarpaceae family has 386 species, 500 members of the myrtaceae family (eugenia) and moraceae (ficus) and 737 species of ericaceae family, including 287 rhododendrom species and 239 naccinium species [6]. Indonesia is also referred to as the Vavilov center, which was the center of the distribution of genetic diversity of cultivation / agricultural plants such as banana plants (*Musa spp*.) Nutmeg (Myristica fragrans), cloves (*Syzygium aromaticum*), durian (*Durio spp*.) and *Nephelium spp* [7].

Based on the results of the process of forming the land area of Indonesia as well as the results of Wallace and Weber's research, geologically, the distribution of flora (as well as fauna) in Indonesia is divided into 3 regions, namely Sundanese plain flora which includes Java, Sumatera, Kalimantan and Bali; Sahul plain flora which includes Papua and the surrounding small islands; the transitional flora (wallace area) which includes Sulawesi, Maluku, and Nusa Tenggara. Specifically for the Javanese flora, the characteristics of the plant are similar to the flora characteristics of the Asian continent, so it is often called the Asiatic flora. Flora in Java is dominated by plants with tree species from the Dipterocarpaceae tribe.

This diversity of resources has been partially utilized but human attention to its existence was still limited [8]. Only a small number of plant species that have known genetic resources information, especially for species that have been developed commercially. One group of high-level plants that live in Indonesia is spermatophyta. Spermatophyta (seed plants) is a plant with the characteristic of having an organ in the form of seeds. Seed plants can be divided into two divisions: gymnosperms (open seed plants) and angiosperms (closed seed plants). In addition, spermatophyta is a true cormus plant. Moringa plants are plants whose bodies can be clearly distinguished between true roots, stems and leaves.

University of Veteran Bangun Nusantara Sukoharjo is a college campus located in Sukoharjo Regency, Central Java. Various high-level plants grow around the campus, thus making the campus cooler and more beautiful. Some of these plants are intentionally planted as ornamental plants and there are wild plants. However, the number of species that live in the campus environment is not yet known in detail. In an effort to add information about plants that live in the campus environment, research on the diversity of spermatophyta (seed plants) has been carried out based on their taxonomy. Plants identification is an activity to reveal and establish the identity or identity of plants, more specifically, to determine the correct name of the plant and its proper place in the classification system. Classification is a way of sorting and classifying living things into certain groups or units. Identification and classification begins by observing morphological characteristics or characteristics of roots, tubers, rhizomes, stems, leaves, and other parts of plants in the species. The characters that appear can be used for the identification process. The plants identified are

possible to be unknown to the world of science, so the determination of a new name, or level of taxon follows the rules of the KITT (International Code of Plant Nomenclature). Plants that have been identified can be identified using plant experts, herbaria, specimens, reference books, or keys to determination [9]. The purpose of this study was to determine the diversity of spermatophyta in the Univet Bantara Sukoharjo environment. Spermatophyta that grows on campus, were identified to determine the classification and then grouped according to taxonomy. The results of the research in the form of spermatophyta diversity based on taxonomy within the Veteran Bangun Nusantara University were used as one of the material materials in the module of high plant systematics for students of biological education [10].

II. MATERIALS AND METHODS

This type of research was descriptive qualitative. Qualitative descriptive research was carried out with the aim of describing, interpreting and describing the results of research that has been carried out systematically, factually, and accurately regarding the truth, facts and nature of seed plants (Spermathophyta). The study was conducted in April-May 2017 at the Veteran Bangun Nusantara University (Univet Bantara) Sukoharjo which was located at Jalan Letjend Sujono Humardani Number 1, Jombor, Bendosari, Sukoharjo. Research begans with data collection by means of literature review. After that a survey was conducted to find out the general description and determine the location observed. This study included all seed plants (spermatophyta) that live in the Univet Bantara Sukoharjo environment. The research used was census / chopping method for all types of spermatophyta plants that live in the Univet Bantara Sukoharjo environment. Data collection was carried out with exploration techniques, identification, literature review and documentation [11]. 1) exploration was carried out directly on site. Data collected in the form of plants complete with morphological and habitat data. These data were used to facilitate vegetation identification of plants so that clear data was obtained regarding the diversity of Spermatophyta plants in Univet Bantara Sukoharjo.

Observation and identification of plants was carried out directly on site. Several plant species that cannot be identified directly on site, were identified in a biological laboratory with the help of references and botanists (lecturers). Identification was carried out to determine the classification of the plant. Data collection was carried out with exploration techniques, identification, literature review and documentation [11]. 1) exploration was carried out directly on site. Data collected in the form of plants complete with morphological and habitat data. These data were used to facilitate vegetation identification of plants so that clear data is obtained regarding the diversity of Spermatophyta plants in Univet Bantara Sukoharjo. Data was analyzed using qualitative description that describes the results of identification in the form of various types of spermatophyta in terms of taxonomy.

III. RESULTS AND DISCUSSION

Univet Bantara Sukoharjo has an area of about 34,500 m2 (3.45 hectares) with an altitude of 100-110 MDPL. The Univet Bantara Sukoharjo campus environment consists of several buildings and surrounding areas overgrown with many plants. Plants that live in the campus environment have a natural life and some are intentionally planted. Plants intentionally planted affect the distribution of species and the number of individuals in the area. Distribution and number of individuals depends on the conditions, area, and area needs [12]. On campus, there are several plant species whose distribution is uneven and there are plants that dominate and spread in various areas. Various kinds of plants that grow mostly come from spermatophyta (seed plants). The results of identification of spermatophyta growing showed that there were 106 species of spermatophyta. Following are the results of research on the diversity of Spermatophyta plants (seed plants) on the campus environment.

TABLE 1. SPERMATOPHYTA DIVERSITY IN THE UNIVET BANTARA SUKOHARJO.

No	Name of Plants	Gymnospermae	Angiospermae			
			Monokotiledoneae	Dikotilidoneae		
				Apetalae (monoclamidae)	Dialypetalae	Sympetalae
1	*Anthurium plowmanii*		Araceae			
2	*Rhoeo discolor*		Commelinaceae			
3	*Syzgium oelana*				Myrtaceae	
4	*Ageratum conyzoides*					Asteraceae
5	*Arachis pintoi*					papilionaceae
6	*Mimosa pudica*					Mimosaseae
7	*Jasminum sambac*					Oleaceae
8	*Juniperu srigida*	coniferales				
9	*Kalanchoe pinnata*				Crassulaceae	
10	*Apium graveolens*				Zingiberaceae	
11	*Kaemteria galanga*				Zingiberaceae	
12	*Cupressus sempervirens*	coniferales				
13	*Carica papaya*				Caricaceae	
14	*Salacca zalacca*		Arecaceae			
15	*Mangifera indica*				Anacardiaceae	
16	*Polianthus tuberosa*			Cactaceae		
17	*Leucanea leucocephala*					mimosaceae
18	*Cajuput oil*				Myrtaceae	
19	*Musa paradisiaca*		Musaceae			
20	*Ceiba pentandra*				Bombacaceae	

No	Name of Plants	Gymnospermae	Angiospermae			
			Monokotiledoneae	Dikotilidoneae		
				Apetalae (monoclamidae)	Dialypetalae	Sympetalae
21	*Casuarina equisentifolia*			Casuarinaceae		
22	*Livistonachinensis*		Arecacea			
23	*Cordyline frukticosa*		Agavaceae			
24	*Codiaeum variegatum*			Euphorbiaceae		
25	*Cordiaeum sp.*			Euphorbiaceae		
26	*Thyponium flagelliforme*		Aracaceae			
27	*Terminalia cattapa*				Combretaceae	
28	*Brassica orelacea var. italica*				Brasicaceae	
29	*Euphorbia milli*			Euphorbiacae		
30	*Syzygium aqueum*				Myrtaceae	
31	*Archraszapota*					Sapotaceae
32	*Zingibe rOfficinale*		Zingiberaceae			
33	*Ocimumbasilicum*					Lamiaceae
34	*Aloe vera*		Xanthorrhoeaceae			
35	*Cymbopogon citratus*		Poaceae			
36	*Capsicum frustescens*					Solanaceae
37	*Sansevieria trifasciata Prain*		Agavaceae			
38	*Chrysalidocarpus lutescens*		Arecaceae			
39	*Ptychosperma macarthurii*		Arecaceae			
40	*Saraca indica*				Caesalpiniaceae	
41	*Bougenvillea*			Nictaginaceae		
42	*Zamiaculcas zamifolia*			Moraceae		
43	*Adenium obesum*					Apocynaceae
44	*Ipomea cairica*					Apocynaceae
45	*Ficus benjamina*			Moraceae		
46	*Cymbidium sp.*		Orchidaceae			
47	*Filicium sp.*				Sapindaceae	
48	*Dhryophloeus beguinii*		Arecaceae			
49	*Dimocarpus longanum*				Sapindaceae	
50	*Axonopus compressus*		Poaceae			
51	*Euphorbia hirta*				Euphorbiaceae	
52	*Zoysia japonica*		Poaceae			
53	*Chloris barbata*		Poaceae			
54	*Talinum paniculatum*				Portuacaceae	
55	*Veitchia merillii*		Arecaceae			
56	*Plumeria acuminata*					Apocynaceae
57	*Chamaedorea seifrizli*		Arecaceae			
58	*Phyllanthus reticulatus*			Euphorbiaceae		
59	*Cyperus rotundus*		Cyperaceae			
60	*Schefflera grandiflora*				Araliaceae	
61	*Citrus sinensis*				Rutaceae	
62	*Pterocarpus indicus*					Papilionaceae
63	*Dendrobium phalaenopsis*		Orchidaceae			
64	*Eragrotis amabilis*		Poaceae			
65	*Dactyloctenium aegyptium*		Poaceae			
66	*Sporobolus poiretii*		Poaceae			
67	*Polyalthia longifalia*				Annonaceae	
68	*Portulaca oleracea*			Portulacaceae		
69	*Dendrocnide moroides*				Urticaceae	
70	*Clorophytum comosum*		Antericaceae			
71	*Bidens pilosa*					Asteraceae
72	*Terminalia mantaly*				Combretaceae	
73	*Dracaena fragrans*		Asparagaceae			
74	*Citrus hystrix*				Rutaceae	
75	*Clitoria ternatea*					Papilionaceae
76	*Samanea saman*					Mimosaceae
77	*Muntingia calabura*				Muntingiaceae	
78	*Manihot glaziovii*			Euphorbiaceae		
79	*Axonopus compressus*		Poaceae			
80	*Rosa sp*				*Rosaceae*	
81	*Sesbania grandiflra*			Papilionaceae		
82	*Arachnis flos aeris*		Orchidaceae			
83	*Nephellium lappaceum*			Sapindaceae		
84	*Psidium guajava*		Myrtaceae			
85	*Colocasia*		Araceae			
86	*Canna indica*		Canaceae			
87	*Averrhoa carambola*				Oxalidaceae	
88	*Tectona grandis*				Laminaceae	
89	*Nerium oleander*				Veregnaceae	
90	*Peperomia pellucida*			Piperaceae		
91	*Glyune max*			Papilionaceae		
92	*Eclipta prostrata*					Asteraceae

No	Name of Plants	Gymnospermae	Angiospermae			
			Monokotiledoneae	Dikotilidoneae		
				Apetalae (monoclamidae)	Dialypetalae	Sympetalae
93	*Phylantus nururi*			Euporbiaceae		
94	*Cynodon dactylon*		Poaceae			
95	*Amaranthus spinosus*			Amarantaceae		
96	*Dieffenbachia ambena*		Araceae			
97	*Aglonema cmutatum*				Araceae	
98	*Alternanthera brasilliana*			Amaranthaceae		
99	*Hedyotis crymbosa*		Poaceae			
100	*Eleusine indica*		Poaceae			
101	*Chentotheca lappacea*		Commelinaceae			
102	*Casuaring junghulni*		Casuarinaceae			
103	*Solanum ningrum*					Solanaceae
104	*Vernnia cinerea*					Asteraceae
105	*Isora sp*				Rubiaceae	
106	*Dracaena reflexa*		Agavaceae			
	Total	2	39	18	29	18

Data on the diversity of spermatophyta plants in the Univet Bantara Sukoharjo campus showed that the number of plant species obtained showed a high diversity even though there were few families whose members were few. In detail the plants found included 104 species of angiospermae with details of dicotyledoneae (magnoliopsida) had the highest number of 65 species, while monocotyledoneae were 39 species. The gymnosspermae group was 2 species. Plants need certain conditions to grow and develop properly. The existence of plants especially angiosperms is strongly influenced by abiotic factors. Abiotic factors in this study are air temperature and soil pH. The temperature in the campus environment ranges from 25^0-30^0 C. The temperature is included in the warm category. High plants including angiosperms can grow optimally at temperatures of 10-38^{o}C. Generally plants do not grow at temperatures below 0^{o}C and above 45^{o}C. The optimal temperature causes the photosynthetic process of angiosperm to take place smoothly. Air temperature is a component of microclimate that affects growth and creates optimal environmental conditions for plants. Growth increases if temperature increases and humidity decreases [13]. Soil temperature was influenced by air temperature, the intensity of sunlight entering the soil, and water in the soil [14]. Plants have an important role in controlling environmental temperature. Plants control environmental temperature through physiological processes, namely transpiration. Diverse plants, the plant canopy system will stimulate an increase in the rate of transpiration (especially to maintain plant temperature stability). The existence of plants is also able to absorb solar radiation, especially the role of tree shoots. Solar radiation is absorbed by the leaves of the canopy compiler as an energy source for photosynthesis [12]. The diversity of species that constitute plant communities in one place was also influenced by climate [15]. The Univet Bantara Sukoharjo campus is in a tropical climate, in the tropics has a more stable climate and has a higher diversity of species than in temperate and polar regions. In addition abiotic measurements are also carried out on soil pH. Soil pH in the campus environment ranges from 5-7. This shows that the soil tends to be neutral towards the acid. The effect of pH on nutrient uptake and growth includes the effects of toxic substances and nutrient moisture [16].

Plant diversity is not only based on the number of species found but also the distribution of their families. The number of families found in the Bantara Sukoharjo Univet amounted to 48 among others poaceae, euphorbiacae, arecaceae, araceae, papilionaceae, myrtaceae, asteraceae, zingiberaceae, agavaceae, apocynaceae, orchidaceae, sapindaceae, mimosaceae, lamiaceae, solanaceae, moraceae, portuacaceae, rutaceae, amarantaceae, commelinaceae, casuarinaceae, combretaceae, brasicaceae, sapotaceae, xanthorrhoeaceae, caesalpiniaceae, nictaginaceae, cyperaceae, araliaceae, annonaceae, urticaceae, antericaceae, combretaceae, asparagaceae, muntingiaceae, rosaceae, canaceae, oxalidaceae, veregnaceae, piperaceae, rubiaceae, oleaceae, crassulaceae, caricaceae, anacardiaceae, cactaceae, musaceae, and bombacaceae. Here is a diagram of the distribution of families from the angiosperms found in Univet Bantara Sukoharjo.

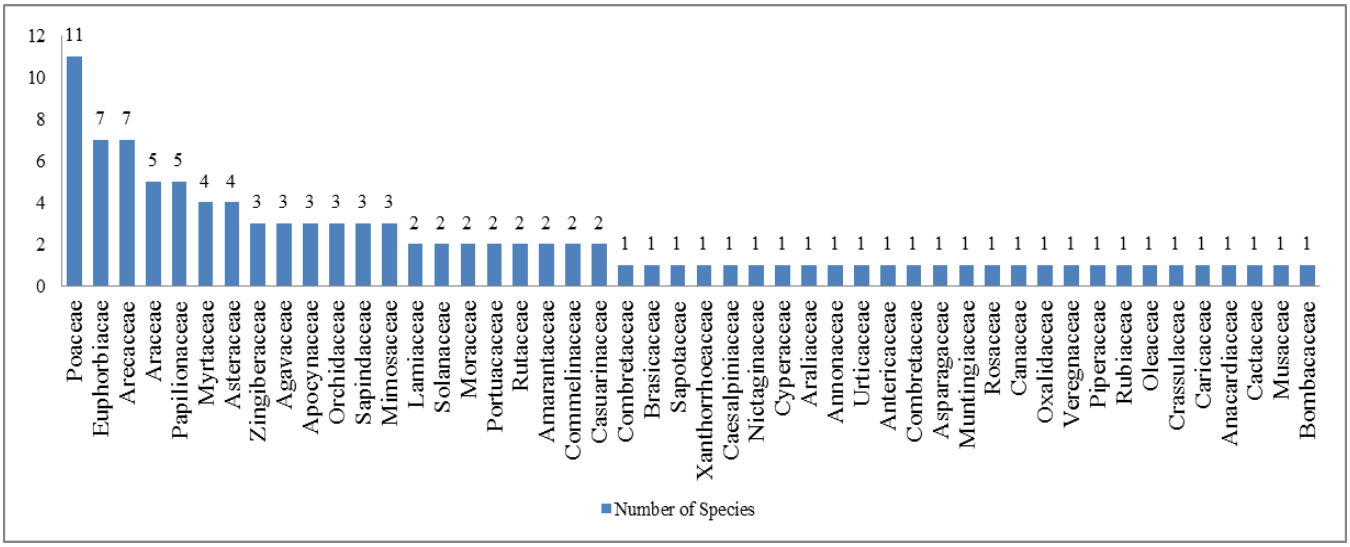

Figure 1. Family Distribution in Angiosperms

Most families are poaceae / graminae (grasses) with 11 species. These families were found on campus because the Poaceae family has microscopic sized seeds that were easily carried by the wind, have high adaptability, very wide distribution, and were able to grow both on dry and flooded land [17]. The existence of a plant is also affected by minerals. If the minerals needed support this type will be superior and more widely found [18]. Grass plants have a role to play in maintaining the balance of the ecosystem, strengthening the structure of the soil, helping to withstand falling water directly, and inhibiting or preventing erosion that takes place quickly. Grass plants can also prevent the fall of rainwater directly and encourage the development of soil biota that can improve the physical and chemical properties of the soil and play a role in increasing soil organic matter. The gymnospermae group only found 1 order with a total of 2 species, namely Juniperu srigida and Cupressus sempervirens. Gymnosperms were rarely found in low-lying areas and most plants in the highlands with low temperatures. Gymnosperms that grow on campus are plants that are intentionally planted as ornamental plants.

IV. CONCLUSION

The study of spermatophyta diversity based on taxonomy in the Univet Bantara Sukoharjo campus environment showed that the number of plant species obtained shows a high diversity even though there were few families whose members are few. The number of spermatophyta species found was 106 species. Plants of the angiosperm group as many as 104 species with details of dicotyledoneae (magnoliopsida) had the highest number of 65 species, while the monocotyledoneae group were 39 species. The gymnossperma group was 2 species.

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