Life-form of Vascular Plants and the Climatic Conditions of the Micronesian Islands[1)]

Takahide Hosokawa

Department of Biology, Kyushu University, Fukuoka, Japan

It is certain that the life-form of vascular plants characterizes the physiognomy of an island ecosystem. Plant life-form may be a reflection of climatic conditions and/or edaphic factors in ecological character in a given ecosystem, and it may sometimes be considered as a climatic indicator of the ecosystem. To the Micronesian region the writer made explorations 7 times from 1933 to 1941. As one of the results of vegetation studies the writer would illustrate the relation of life-form of vascular plants to the climatic conditions of Micronesian Islands.

1. *Phytogeographical consideration.* From the air temperature of macroclimatic condition of Micronesian Islands, the islands are situated certainly in the tropics. In the tropical Pacific, from the view point of climatic conditions, we can recognize four major zones from the north to the south; NE Trade-Wind Zone, Equatorial Humid Zone, Equatorial Arid Zone, and SE Trade-Wind Zone. The second zone is to the north of the equator, and in the third zone the equator runs east-west. Considering the average monthly and annual rainfall in the Micronesian Islands, the Marianne Islands [NE Trade-Wind Zone] are indicated to be in Köppen's *Amwi* climatic type; Palau and the Caroline Islands and the Marshall Islands, [all in Equatorial Humid Zone] are in *Afi*, and those islands of the Equatorial Arid Zone may be in *BSwi* or *Awi* (Tables 1 and 2). In Table 2, Raunkiaer's life-form spectra and Epiphyte-Quotient (Ep-Q) (Hosokawa 1950) of several islands of those zones are compared with each other. One can see the predominant influence of rainfall upon the vegetation or life-form spectrum of these islands.

On raised coral limestone covered with even the thin soil of Terra Rossa or without any soil, e.g. in Saipan and Palau, and on lateritic soil, e.g. in Ponape, Kusaie, Yap and Palau, there are developed climax tropical rainforests. Nevertheless, in the Marianne Islands, the Palau and Caroline islands, grassland vegetation is developed to some extent everywhere as a substitute for climax rainforest, for example, the grassland vegetation in Yap, in most parts of Babeldaob island in Palau, everywhere in Truk, in the Palkier area in Ponape, and in most parts of the Marianne Islands, especially in the northern Marianne Islands.

The Mariannes are volcanic in origin and may have appeared in the Quaternary, and in the Northern volcanic areas (Pagan, etc.) the vegetation

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Table 1. Rainfall Averages in Micronesia.

Zone		NE Trade-Wind Zone							Equatorial Humid Zone											Eq. Mod. Zone		Eq. Arid. Zone	
			Marianne Islands						Caroline Islands											Gilbert			
						Saipan			Palau		Yap	Truk		Ponape		Kusaie							
Station	Bonin Isls. Titi Is. (Chichi)	Midway	Guam (Sumay)	Rota	Tinian	Gara-pan		Ujelang Marshall Is.	Kor-ror				Eten	Colo-nia	Nipit	Lela-hafen	Mis-sion	Jaluit (Marshall Is.)	Fanning	Nauru	Banaba	Malden	Christmas
Elevation (m)	4.3	6	19	<10	<10	10	207	9	<10	32	35	32		<10	450	<10	±100	3	3	5	28	8	<3
Precipitation (mm)																							
Years (Total)	1907–1940 (34)	1921–1930 (10)	1906–1922 (17)	1926–1934 (9)	1926–1934 (9)	1901–1913 (13)	1927–1929 (3)	1894–1912 (9)	1905–1913 (9)	1924–1929 (6)	1900–1930 (31)	(3)	(8)	1901–1913 (13)	1934–1940 (7)	1904–1931 (10)	(5)	1892–1913 (22)	1903–1930 (28)	1894–1913 (20)	1904–1930 (27)	1890–1925 (36)	1916–1919 (4)
Jan	*89*	110	*61*	132	112	*51*	104	*53*	**219**	**400**	**177**	160	**178**	**281**	**414**	**391**	**483**	**244**	**257**	**301**	**300**	*86*	**176**
Feb	*82*	*97*	*80*	135	*62*	*93*	147	*56*	**196**	**210**	**173**	102	**232**	**223**	**314**	**340**	**380**	**224**	**278**	**239**	**234**	*54*	136
Mar	108	*85*	*81*	*68*	*69*	102	*96*	*65*	**196**	**172**	124	*66*	**241**	**359**	**494**	**403**	**692**	**362**	**268**	**175**	**190**	114	127
Apr	138	111	*57*	*49*	*47*	*73*	*94*	157	**177**	**294**	131	161	**297**	**496**	**613**	**489**	**542**	**417**	**349**	143	154	117	117
May	**204**	*79*	102	135	125	*76*	168	160	**293**	**438**	**245**	**263**	**340**	**507**	**724**	**452**	**730**	**407**	**313**	160	113	107	141
Jun	149	*58*	145	139	120	143	146	**189**	**310**	**332**	**273**	**352**	**260**	**348**	**530**	**433**	**573**	**381**	**260**	112	115	*54*	*48*
Jul	*92*	103	**357**	**297**	**302**	**224**	**402**	**215**	**456**	**619**	**420**	**254**	**333**	**419**	**511**	**313**	**608**	**385**	**213**	**246**	159	*49*	*68*
Aug	153	*92*	**393**	**267**	**254**	**352**	**252**	**222**	**387**	**388**	**413**	**223**	**339**	**408**	**504**	**312**	**513**	**298**	114	**191**	118	*39*	*30*
Sept	150	132	**415**	**308**	**331**	**328**	**454**	**274**	**285**	**328**	**339**	**173**	**339**	**391**	**376**	**332**	**632**	**340**	*82*	140	110	*21*	*27*
Oct	159	*64*	**315**	**297**	**294**	**303**	**361**	**257**	**244**	**388**	**298**	157	**261**	**393**	**464**	**267**	**395**	**302**	*92*	133	109	*24*	*14*
Nov	150	*67*	**186**	**204**	141	**211**	127	**277**	**338**	**253**	**258**	**232**	**290**	**419**	**587**	**364**	**492**	**306**	*80*	107	150	*19*	*8*
Dec	140	*72*	120	145	134	141	135	125	**382**	**347**	**227**	126	**261**	**407**	**669**	**339**	**424**	**334**	**212**	**243**	**229**	*21*	*57*
Year	1614	*1070*	**2312**	**2176**	1990	**2103**	**2486**	**2050**	**3433**	**4078**	**3080**	**2270**	**3371**	**4651**	**6200**	**4495**	**6472**	**4000**	**2518**	**2200**	1981	*705*	*949*
Ep.-Q			8.1	10.4	4.7	7.8			9.0		5.1	9.2		16.0		15.2		6.7	3.1			0	0
Climatic formula	Cfah	Awa	Amwi	Amwi	Amwi	Amwi	Afwi	Amwi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	Afi	BSwi	Awi

Italic: less than 100 mm/month and less than 1200 mm/year.
Gothic: more than 170 mm/month and more than 2000 mm/year.

Table 2. Life-form Spectra.

Zone	Island	No. spp	S	E	MM	M	N	Ch	H	G	HH	Th	Ep. Q	Climatic formula
Normal biological Spectrum		1000	2	3	8	18	15	9	26	4	2	13		
NE Trade-Wind Zone	Saipan	245	4	3	7	**29**	**22**	**16**	10	4	3	1	7.8	Amwi
	Guam	358	2	8	6	**22**	**21**	**16**	14	3	7	3	8.1	Amwi
Equatorial Humid Zone	Palau	770	1	**9**	7	**28**	16	**16**	14	4	4	1	9.0	Afi
	Fanning*	32		3	6	9	9	**31**	22	3		15	3.1	Afi
	Washington*	37		**11**	8	5	11	13	22	14	3	14	11.1	
	Palmyra*	21		**10**	5	**24**	5	**38**	5	5		10	13.3	
	Ponape	406	1	**17**	10	**25**	13	**16**	12	3	3	1	16.0	Afi
Equatorial Arid Zone	Christmas*	23		4**	4	9	**26**	**30**	13	9		4	0	Awi
	Jarvis*	8					**25**	**25**	25	13		13	0	
	Howland*	6				17		**17**	**50**	17			0	
	Barker*	15					13	**33**	33	7		14	0	

* Christophersen 1927.

** Parasite (Cassytha filiformis L.); it is not a true epiphyte.

Table 3. Vascular epiphytes with minute disseminules.

	Orchid species % within Angiospermae	Pteridophyte species % within vascular plants
Marianne Isls. (Hosokawa 1934)	4.6	11.8
Yap (Hosokawa's field note 1938)	4.8	11.7
Palau (Hosokawa's field note 1941)	11.7	14.9
Truk (Hosokawa 1937)	3.5	15.0
Ponape (Glassman 1952)	11.6	22.7
Kusaie (Hosokawa's field note 1938)	6.2	21.8

remains in earlier stages of ecological succession. Some of those grassland vegetations of Yap, Palau and Ponape are in seral stages derived from natural alteration of vegetation, but most of them are developed to be grassland vegetation which seems as if it were in stabilization outside the normal seral course. However some of them are also in earlier seral stages of succession, because of unfavourable conditions of soil after the destruction of natural vegetation owing to human disturbance. Judging from the climatic condition, such a grassy vegetation is not climax. The climatic climax in those islands is naturally the tropical rainforests. Accordingly, an ecological approach to the life-form of plants of the Micronesian major island ecosystems in relation to the climatic conditions should be shown by the tropical rainforests and not by grassy vegetation.

In the oceanic islands of Micronesia, as compared with continental islands, there are small numbers of plant species per genus. Because oceanic islands are under the condition of tropical rainforest climate, there is many a plant species which has minute seeds or spores (e.g. orchids, ferns) capable of effective dispersal by wind. Especially, there we have numerous species of vascular epiphytes having such minute disseminules (Table 3).

Table 4. Life-form spectrum of major islands of Micronesia.

	Numb. of species	S	E	MM	M	N	Ch	H	G	HH	Th	Climatic formula
Normal biological spectrum	1000	2	3	8	18	15	9	26	4	2	13	—
Jaluit	90	3	7	7	**28**	**23**	**18**	12	3		2	Afi
Kusaie	269	2	**15**	9	**27**	14	17	12	2	3	1	Afi
Ponape	406	1	**17**	10	**25**	13	16	12	3	3	1	Afi
Truk	282	3	**10**	10	**30**	14	14	13	4	5	1	Afi
Palau	770	1	**9**	7	**28**	16	16	14	4	4	1	Afi
Yap	359	1	5	6	**25**	17	**18**	18	5	6	2	Afi
Guam	358	2	8	6	**22**	**21**	16	14	3	7	3	Amwi
Rota	230	2	**11**	8	**32**	**21**	12	11	4		2	Amwi
Tinian	169	4	5	8	**28**	**23**	**19**	11	3	2	2	Amwi
Saipan	245	4	3	7	**29**	**22**	16	10	4	3	1	Amwi
Alamagan	46		4	2	**32**	**23**	**23**	10			2	Amwi
Pagan	81		6	2	**26**	**24**	**18**	6	1		2	Amwi

The stature of phanerophytes growing in Micronesian Islands is generally low, and as compared with Raunkiaer's normal biological spectrum the life-form spectra of major islands of Micronesia are different significantly from it; viz. in Palau, Yap, Truk, Ponape and Kusaie vegetation being all under the condition of Köppen's Afi type of climate, species number in percentage of MM is rather small in the spectrum, even though there are developed tropical rainforests. The species percentage number of E and M is great enough, but that of H is as about one half that of the normal biological spectrum, and Th is much smaller in percentage number (Table 4).

2. *Synecological considerations.*

a) Altitudinal differentiation of life-form spectrum.

On the characteristic relation of the life-form spectrum to the climatic conditions of every forest type in altitudinal range of some islands, e.g. Ponape and Kusaie, consideration is given for the purpose of explaining the physiognomical characteristic of each island ecosystem. For example, in Ponape, with rising of altitudes, there is observed the trend that the stature of trees becomes lower even in the same species and their leaf areas become smaller (Imanishi and Kira 1944) (Table 5). Such phenomena may partly be ascribed to the adaptation of trees to thin soil, on which plants grow, to rising of evapotranspiration rates, and to being greatly exposed to wind. In Ponape, as shown in Table 6, with rising altitudes the percentage value of MM becomes lower, those of N and E higher. Such a trend is also seen in Kusaie (Table 7). The cause of increasing E value, becoming more than 50%, in both islands Ponape and Kusaie is because of the highland which is covered nearly always with rainy clouds, so that the environmental conditions of epiphytes are characterized by moist atmosphere favourable to them. In mangrove forest communities, the reason why the percentage value of E is rather high, more than 50%, as compared with that of woody species, MM, M or N, will supposedly be attributed to that the woody species which grow in such condition are to be confined to those adaptable to such a severe life of muddy shallow sea while the environmental condition of

Table 5. Leaf area of Ponape plants related to altitude.

Life-form	Name of major species	Relative value of leaf area: Gynotroches consoc. (600—780 m)	Campno.-Pandan. assoc. (30—600 m)
MM	Bentinckiopsis ponapensis Becc.	100	100
M	Alsophila ponapeana Hosokawa	100	None
M	Gynotroches axillaris Bl.	32—46	100
M	Syzygium carolinense Hosokawa	21—53	100
M	Astronidium ponapense Mgf.	37—79	100
M	Pandanus patina Martelli	100	None
M	Ilex volkensiana Kaneh. & Hatus.	28—30	100
M	Aglaia ponapensis Kanehira	23—36	100
M	Timonius ledermannii Val.	100	100
M	Glochidion ponapense Hosokawa	100	100
M	Garcinia ponapense Lauterb.	12—27	100
M	Maesa carolinensis Mez	50—52	100
M	Elaeocarpus kerstingiana Schltr.	40—70	100
M	Lepinia ponapensis Hosokawa	100	None
M	Glochidion marianum Muell.-Arg.	100	100
M	Campnosperma brevipetiolata Volkens	100	100
M	Cinnamomum sessilifolium Kanehira	21—24	100
N	Eurya ponapensis Hosokawa	32—33	100
N	Jambosa stelechantha Diels	25—36	100
N	Rapanea carolinensis Mez	48—49	100
N	Melicope ponapensis Lauterb.	15—21	100
N	Amaracarpus carolinensis Val.	100	100
N	Psychotria merrillii Kanehira	51—58	100
N	Pandanus cominsii Hemsl.	100	100
N	Cyrtandra ponapensis Kanehira	100	100
H	Thoracostachyum pacificum Hosokawa	100	None

Table 6. Proportions of life-forms in Ponape.

Ponape		Life-form of vascular plants: S	E	MM	M	N	Ch	H	G	HH	Th	Species number
Alsophila ponapeana-Pandanus patina assoc. (600—780 m)	Garcinia-Astronidium consoc.		16			**84**						19
	Pandanus patina consoc.		25		17	**50**	8					12
	Gynotroches axillaris consoc.		**53**	2	**32**	8	3	3				66
Campnosperma-Pandanus cominsii assoc. (30—680 m)	Bentinckiopsis ponapensis consoc. (110 m—680 m)		**43**	20	16	5	6	8	2			145
	Campnosperma brevipetiolata consoc. (30 m—340 m)		**40**	**28**	14	6	5	6	1	1		123
Barringtonia racemosa assoc. (Lowland swamp forest)			**41**	7	**30**	15				7		27
Mangrove forest			**52**	12	**32**					4		25

Table 7. Proportions of life-forms in Kusaie.

Kusaie		Life-form of vascular plants										Species number
		S	E	MM	M	N	Ch	H	G	HH	Th	
Alsophila ponapeana assoc. (mossy, 480—654 m)			**55**		10	**19**	9	7				58
Campnosperma-Ponapea kusaiensis assoc. (80—500 m)			**35**	19	12	9	12	11			1	93
Horsfieldia nunu-Cyclosorus heterocarpus assoc. (0—260 m)	Horsfieldia nunu consoc. (0—260 m)		26	**35**	12	3	10	12		2		86
	Terminalia carolinensis consoc. (Swampy forest) (0—10 m)		20	**38**	11	4	12	13		2		84
Hibiscus tiliaceus assoc. (Swamp and inland forest)			9	9	**26**	**26**	9	20	3			35
Barringtonia racemosa assoc. (Swamp forest) (±0 m)			**52**	13	17	4	4			9		23
Mangrove forest			**65**	10	**20**					5		20

vascular epiphytes on mangrove trees is not so different in general from that of the lowland rainforest adjacent to mangrove area (Hosokawa 1957–a).

It is certainly a noteworthy character of mangrove forest community that from the viewpoint of the life-forms of vascular epiphytes (Hosokawa 1943, 1949, 1955), the Fi type prevalent in lowland rainforests, especially growing thick on the lower parts of tree-trunks, disappears not only from the lower parts of trunks but also from most parts of trunks of mangrove forest trees (Table 8 and 9). Most parts of tree-trunks of mangrove forest are immersed at high tide, and in the mangrove area epiphytes cannot grow on the lower parts of trunks.

Mossy forest, which is characterized by the luxuriant thick growth of corticolous and epiphyllous bryophytes, is usually developed in the warm and damp areas of warm temperate and tropical montane regions. In tropical humid countries mossy forest is developed generally in the highlands at more than 1,000 m altitude. In Micronesia, islands which are situated in the Equatorial Humid Zone of the Pacific, e.g. Ponape and Kusaie, have mossy forests which are developed at much lower altitudes, ranging from about 450 m to the summit of the islands (Hosokawa 1952–a). Occurrence of such mossy forest at extremely low altitudes in Micronesia would clearly seem to result from the climatic conditions of the islands, which are situated in the midst of the ocean. Altitudes of about 450 m may be the lowest in the world among the altitudes in which mossy forests are developed (Hosokawa 1952–a).

b) Local or exposal differentiation of life-form spectrum.

The islands of the Southeast Pacific, which are situated in the Southeast Trade-Wind Zone, e.g. Marquesas Isls., have quite different types of vegetation in different directions in the islands under the influence of trade-winds (F.B.H. Brown 1931, 1935). According to Brown, the direction of the trade-wind is almost constant throughout the year, and the arborescent vegetation is developed on the windward side of the islands, while on the leeward side grassland vegetation is predominantly developed. Most of the Caroline Islands are situated in

Table 8. Proportions of life-forms in Ponape, summarized.

Ponape		Life-form of vascular epiphytes													Species number
		D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	
Gynotroches axillaris consoc. (600—780 m) (Alsophila ponapeana-Pandanus patina assoc.) (Mossy forest)					29	3	9	**31**		11	(11)	3	3		35
Campno-sperma-Pondanus cominsii assoc. (Inland rain forest)	Bentinckiopsis ponapensis consoc. (600—780 m)		2	2	14	6	16	22	2	16	(10)	6	8	6	63
	Campno-sperma consoc. (30—340 m)		2	2	16	8	20	16		12	(8)	8	6	8	49
Mangrove forest	(±0 m)		3	3	**54**	8	15	**8**			(2)	8	8		13

Table 9. Proportions of life-forms in Kusaie, summarized.

Kusaie	Life-form of vascular epiphytes													Species number
	D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	
Alsophila ponapeana assoc. (mossy, 480—654 m)		3	6	19	9	16	16		**19**	(19)				32
Campnosperma-Ponapea kusaiensis assoc. (80—500 m)		9	3	21	9	12	24		18	(15)		3		33
Horsfieldia nunu-Cyclosorus hetrocarpus (Swampy) assoc. (0—260 m)		9	5	18	9	18	23		9	(9)	9			22
Mangrove forest (±0 m)		8	8	**23**	8	**23**	**23**			(15)	8			13

the Equatorial Humid Zone, and the wind blows in every direction in the year, consequently the vegetation is not so different according to wind directions.

In the Equatorial Humid Zone, the life-form spectra of the several types of rainforests and those of vascular epiphyte societies as well, are developed in the lowlands at almost similar altitudes and similar microclimatic conditions, allowing me to offer an explanation based on my work in Palau. In Palau, among the inland tropical rainforests of the *Campnosperma brevipetiolata-Pandanus aimiriikensis* association and the *Planchonella obovata* association, and the swamp rainforests of the *Horsfieldia amklaal-Donax canniformis* association, the percentage values of E, MM, M, and N in the life-form spectra are scarcely different from each other. Because of the latter association being under the condition of swampy places those of Ch, H and G are almost the same as null values, while the value of HH amounts to 7%, a situation that is not found in the nonswampy forests (Table 10). In the mangrove forest communities, there are found almost similar values of most life-forms [E excepted] as in swamp forests (Hosokawa 1952-b). The comparatively high value of E in mangrove forest is considered to result from the small number of woody species, which is confined to those growing in muddy shallow sea. Consequently, there is not found any fundamental difference

Fig. 1. Inside view of the *Gynotroches* mossy forest in Ponape (Phot. by T. Hosokawa).

Fig. 2. Numerous epiphytes and climbing *Freycinetia* growing on the trunks of *Terminalia carolinensis* in the swamp forest of Kusaie (Phot. by T. Hosokawa).

Table 10. Palau: Life-form spectrum of vascular plants.

Forest community \ Life-form	S	E	MM	M	N	Ch	H	G	HH	Th	Numb. of species
Campnosperma-Pandanus aimiriikensis assoc. (<150 m)		41	12	26	10	5	4	3			190
Planchonella obovata assoc. (<150 m)		38	16	22	6	9	8	2			129
Horsfieldia amklaal-Donax canniformis assoc. (±10 m)		42	12	32	6	1			**7**		118
Mangrove forest (±0 m)		**59**	9	25	4				3		55

Table 11. Life-form spectrum of vascular epiphytes.

Forest community \ Life-form	D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	Numb. of species
Campnosperma-Pandanus aimiriikensis assoc. (<150 m)		9	2	20	8	22	17		9	(24)	6	5	3	71
Planchonella obovata assoc. (<150 m)		6	2	30	12	18	18		8	(28)	2	2		49
Horsfieldia amklaal-Donax canniformis assoc. (±10 m)		8	2	22	10	22	18		**14**	(23)	2	2		50
Mangrove forest (±0 m)		7	2	27	12	24	**10**		**2**	(27)	2	5	7	41

between the life-form spectra of epiphyte societies in four different kinds of forests (Table 11). Nevertheless, the low values of F and Fi in mangrove forest, and contrary to it, the high value of Fi in swamp forest, may be the result of the influence of water-level as an important edaphic factor in mangrove and swamp forest areas.

c) Spatial differentiation of life-form spectrum of the vascular epiphyte society in forest.

The effect of microclimatic conditions in forest on plant life-form, has been studied. The relationship of microclimatic conditions in the forests of major islands of Micronesia to the life-form of their vascular epiphytes was analyzed. Investigations were made in the *Gynotroches axillaris* consociation of mossy forest in Ponape (Hosokawa 1952–a) (Table 12), and in several kinds of *Campnosperma brevipetiolata* forests (Hosokawa 1954–a, 1954–b, 1954–c, 1957) which are identified with typical inland tropical rainforest covering extensive areas of major islands (Yap, Palau, Ponape and Kusaie) in Micronesia (Tables 13 and 14), and moreover in the *Terminalia carolinensis* consociation of Kusaie and the *Horsfieldia amklaal-Donax canniformis* association of Palau, the latter two identified with peat forest, a kind of swamp forest (Table 15). In any case, among the ecologically important microclimatic factors in forest, the light intensity and the conditions of atmospheric humidity and evaporation stand out. According to the writer's investigation on the spatial distribution of the life-forms of vascular epiphytes on trees within the forests, we can group those life-forms into four ecological types, viz. the sun type of direct sunshine (Rr and C), the stem and/or leaf succulent xerophilous type (Se), the shade tolerant type of diffused light (Rd and F), and the hygrophilous

Table 12. Effect of microclimatic conditions on life-form.

Mossy forest			Life-form spectrum of vascular epiphytes													Species number
Island	Forest community	Level in forest	D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	
Ponape	Gynotroches axillaris consoc. (Alsophila ponapeana-Pandanus patina assoc.) (600—780 m)	Crown		9		**32**	9	**14**	32			(14)	5			22
		Crown-base			4	**35**	9	9	35		4	**(17)**	4			23
		Trunk			4	25	4	7	**39**		14	(7)	4	4		28
		Trunk-base				23			**38**		**31**	(8)		8		13

Table 13. Effect of microclimatic conditions on life-form in *Campnosperma* forests (Inland Rainforest).

Island	Forest communities	Level in forest	Life-form spectrum of vascular epiphytes													Sepcies number
			D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	
Kusaie	Campnosperma-Ponapea kusaiensis association	Crown		13	4	**29**	13	**17**	25			**(21)**				24
		Trunk			4	17	13	13	30		13	(7)	9			23
		Trunk-base			4	4	**8**		**35**		**38**	(15)	8	4		13
Ponape	Campnosperma-Pandanus cominsii association	Cr		4	2	**20**	8	**24**	31			**(14)**	8		2	49
		T			3	13	10	13	28	3	23	(13)	3		5	39
		T-b				10			18	2	**30**	(5)		25	15	21
Yap	Semecarpus venenosa-Pandanus japensis association	Cr		13		**27**	13	**20**	20			**(33)**	7			15
		T				25	**25**		38			(25)	13			8
		T-b					**25**		**50**		**25**	(25)				4
Palau	Campnosperma-Pandanus aimiriikensis association	Cr		13	2	**23**	10	**27**	14		3	**(32)**	4	3	2	51
		T		8	2	21	8	20	17		9	(22)	7	6	2	53
		T-b		4		16	11	13	**20**		**19**	(16)	7	7	3	43

Table 14. Quantitative spectrum of life-forms in an Inland Rainforest in Palau.

Palau (Inland Rainforest)			Life-form spectrum of vascular epiphytes													Species number
			D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	
Campnosperma brevipetiolata-Pandanus aimiriikensis association (<150 m)	Crown	A		11		**56**		**33**				**(44)**				9
		P		11		**56**		**33**				**(33)**				9
	Crown-base	A		8		50		25			8	(25)	8			12
		P		6		47	12	18	6		6	(29)	6			17
	Trunk	A				29	**29**	14	14		14	(29)				7
		P		7		33	**27**	7	**20**		7	(13)				15
	Trunk-base	A					20				**80**					5
		P					14		**29**		**57**					7

"A" indicates in percentage the number of species having the average value of abundance higher than 1 within the range 1–5.
"P" is that of the presence degree higher than 4 within the range 1–5.

Table 15. Epiphyte life-form spectrum of swampforest in Kusaie and Palau.

Swamp forest			Life-form spectrum of vascular epiphytes													Species number
Island	Forest community	Level in forest	D	Mc	SV	Rr	Rd	C	F	Rt	Fi	(Se)	He	O	Eph	
Kusaie	Terminalia carolinensis consoc.	Crown		17		**33**	8	**25**	17			**(17)**				12
		Trunk			10	30	10	10	30			(10)	10			10
		Trunk-base			12		12		**38**		**25**	(12)	12			8
Palau	Horsfieldia amklaal-Donax canniformis assoc.	Crown		9	2	**24**	11	**24**	18		7	**(29)**	2	2		45
		Trunk		6	3	22	13	19	22		13	(22)		3		32
		Trunk-base					**18**		**27**		**55**					11

type (Fi and Rt), deduced from the growing condition and the percentage values of every life-form in the spectra of epiphyte societies which were investigated on different levels on trees. Accordingly, there is recognized an adaptation of every life-form of epiphyte to the microclimatic conditions in the forests.

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