

## APPENDIX II

THE ALLOCATION OF POLLEN AND SPORE TAXA TO  
ECOLOGICAL GROUPS

This appendix is comprised of two sections. Table II.1 represents a collation of available information concerning the habit, ecology, and altitudinal and geographical distribution of plant taxa probably represented by the identified pollen and spore taxa. Table II.2 shows all pollen and spore taxa actually included in each of the groups plotted on the pollen diagrams in Chapters 7 and 8.

With the exception of observations by the author on predominantly swamp and non-forest taxa, the data in Table II.1 are based on secondary sources. These fall into three main categories: results of ecological studies in the Markham Valley and environs, botanical collections from this area, and ecological and botanical information either of a more general or regional nature, or pertaining to locations outside the present study area.

The only systematic ecological sampling work from the area is that of Johns (unpubl. a) for seventeen forest plots within the Oomsis-Gabensis region, and of Gillison (1970) who investigated the composition of the forest-grassland transition along transects at three localities near Oomsis. In addition, Holloway *et al.* (1973) have described and mapped the major vegetation alliances of the Markham Valley floor, as far east as the Erap River.

Extensive botanical collections have been made in the Oomsis-Gabensis area, and along the Wampit and lower Markham valleys. Johns (unpubl. b,c.) presents preliminary check-lists of plant collections relating to the Herzog Ranges and adjacent areas. Lane-Poole (1925) lists some of the major tree species found in the forest of the valley floor at Yalu. Other collections noted in the records

of the Herbarium of the Botany Division, Lae, include a great many by staff of the Division and also comprehensive series by L.J. Brass and T.G. Hartley.

No Flora of Papua New Guinea yet exists although some of the more common forest tree species are briefly described in publications of the Botany Division (van Royen, 1964, Coode, 1969, and Foreman 1971) and of the Forestry College (Johns, 1975). A large quantity of plant ecological data from Papua New Guinea has also been gathered by the CSIRO Division of Land Use Research, and much of this is summarised by Paijmans (1975, 1976).

The *Flora Malesiana* provides information on the known distribution and ecology of many New Guinean representatives of families so far revised for the series, as do the *Flora of Java* (Backer and Backhuisen van der Brink, 1963-1968) and the *Tree Flora of Malaya* (Whitmore, 1972, 1973).

The data presented in Table II.1 have thus been gleaned from a variety of sources of differing emphasis and accuracy, ranging from individual botanists' field descriptions through forestry manuals, to detailed scientific, but primarily taxonomic, works. Much of the information derives from observations made outside the study area, and the extent of its applicability to the Markham region is largely unknown. However, in many cases this represents the only data available on which to base an interpretation of the plant's ecology.

The uncertainty both in the identification of some pollen and spore taxa, and in the ecological affinities of these and other taxa is reflected in Table II.2. Many of the palynomorph taxa may therefore be placed in more than one ecological group, depending on the criteria used for the construction of each category.

TABLE II.1. The ecology of plants contributing to the pollen and spore taxa.

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
1	TYPHA 1-1-	<i>Typha</i>	Swamp herbs	<i>T. angustifolia</i> is a tall erect herb of swamp and shallow fresh or brackish water situations found particularly where the substrate is predominantly inorganic. Not recorded from the Markham area.
2	PANDA 2-1-6	<i>Pandanus radula</i> T.	Small trees 'pandans'	<i>Pandanus</i> spp. are common in swamp and swamp forest vegetation; also in wet grassland areas and around lake shores, particularly at Lake Wanum. A frequent understorey component of lowland forest.
3	SPARG 3-1-2	<i>Sparganium antipodum</i> T.	Swamp or aquatic herb	Erect herb of swamp or shallow water. Not recorded from the Markham area.
4	GRAM1 11-	Gramineae 1	Swamp grass	<i>Leersia hexandra</i> grows in swamp margin situations, and as an almost monospecific stand on some floating root-mats.
5	GRAM2 11-	Gramineae 2	Grasses	Represents predominantly swamp grasses, <i>Leersia</i> , <i>Sacciolepis</i> , and <i>Phragmites</i> .
6	GRAM3 11-	Gramineae 3	Grasses	Genera from swamp, wet grassland, and dry grassland situations.
7	GRAM4 11-	Gramineae 4	Grasses	This taxon includes a proportion of swamp genera, and a majority of the grains of <i>Imperata cylindrica</i> and <i>Ischaemum barbatum</i> .
8	GRAM5 11-	Gramineae 5	Grasses	Small proportion of swamp genera, large proportion of land grasses, including <i>Themeda australis</i> , and <i>Miscanthus floridulus</i> .
9	CYPAL 12-	Cyperaceae A1	Swamp herbs	Mainly representative of swamp and floating root-mat taxa.
10	CYPA2 12-	Cyperaceae A2	Erect herbs	Includes swamp and wet grassland taxa.
11	CYPB1 12-	Cyperaceae B1	Erect herbs	Includes swamp and wet grassland taxa.
12	CYPB2 12-	Cyperaceae B2	Erect herbs	Includes swamp and wet grassland taxa.
13	CYPCI 12-	Cyperaceae C	Erect herbs	Includes swamp and wet grassland taxa.
14	HYPOL 12-19-2	<i>Hypolytrum nemorum</i> T.	Swamp herb	<i>H. nemorum</i> is the dominant taxon in much of the herbaceous swamp vegetation at Lake Wanum and Redhill Swamp. It occurs rooted in the substrate in up to 1.5 m of water, and forms part of the floating root-mat vegetation in areas of greater water depth.
15	PALMA 13-	?Palmae	Understorey trees or vines	Many genera of Palmae are found in lowland forests as sub-canopy or understorey trees, and vines. Some are also cultivated in gardens.
16	METRO 13-	? <i>Metroxylon sagu</i>	Swamp palm	<i>Metroxylon</i> is very common in open swamp, swamp forest and alluvium forest in the lower Markham Valley, and also occurs around Yanamugi lake.
17	CALAM 13-3-	<i>Calamus</i>	Vines	Abundant in lowland forests.
18	NORMA 13-27-	? <i>Normanbya</i> T.	Trees	Probably occur in the subcanopy component of lowland forest.
19	ARENG 13-48	cf. <i>Arenga</i>	Small trees	Occur as understorey in lowland forest and also in swamp forest. Some species are cultivated.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
20 COLOC	15-6-1	cf. <i>Colocasia</i>	Fleshy herbs	Species of <i>Colocasia</i> occur in swamp margin and floating root-mat vegetation at Lake Wanum. The cultivated <i>C. esculenta</i> (taro) is commonly grown in gardens fringing the lake.
21 FLAGE	17-1-	<i>Flagellaria</i>	Vines	<i>F. indica</i> is abundant in forests of seasonally drier areas but is also widespread in lowland forest up to 1 500 m, and in coastal scrub.
22 LILIA	32-	cf. Liliaceae	Shrubs, herbs, and vines	Widespread in lowland forest; some genera occur in regrowth or swamp vegetation.
23 CASUA	45-1-	<i>Casuarina</i>	Small trees	Generally restricted, in the Markham area, to village and garden sites.
24 ENGEL	55-4-	cf. <i>Engelhardtia</i>	Canopy trees	More common in ridge-top and lower montane forest between c. 1 000-2 000 m, although also present in the lowlands particularly along watercourses. Not found on limestone.
25 NOTHO	59-3-	<i>Nothofagus</i>	Canopy trees	Known to occur between 750-3 100 m on the New Guinea mainland but could be present at slightly lower altitudes. Assumes dominance in many areas between 1 500-3 000 m.
26 CASTA	59-4-1	<i>Castanopsis</i> T.	Canopy trees	Alt. range of <i>Castanopsis/Lithocarpus</i> spp. descends to sea-level. The genera become dominant in many ridge-top and lower montane forests between c. 1 000-1 500 m. <i>Castanopsis</i> is not found on limestone soils.
27 CELTI	60-1-	<i>Celtis</i>	Tall canopy trees	Common in primary and secondary lowland and lower montane forests, particularly below c. 1 100 m altitude.
28 TREMA	60-2-	<i>Trema</i>	Trees	Common and abundant in secondary regrowth.
29 APHAN	60-4-	cf. <i>Aphananthe</i>	Trees or shrubs	-
30 URMO2	61-/62-	Urticaceae/ Moraceae (diporate)	1. Herbs, shrubs or trees (Urticaceae) 2. Shrubs or trees (Moraceae)	Widespread; herbs in wetter grassland, shrubs and trees in forest and regrowth communities.
31 URMO3	61-/62-	Urticaceae/ Moraceae (triporate)	as above	as above
32 STREB	61-4-	<i>Streblus</i> T.	Trees or shrubs	<i>Streblus</i> is altitudinally widespread. <i>Antiaris toxicaria</i> is a large tree of 'alluvium' forest below c. 600 m.
33 PILEA	62-2-	<i>Pilea</i> T.	Herbs	Ground cover in forest and secondary vegetation.
34 HELIC	63-15-	<i>Helicia</i>	Sub-canopy trees and shrubs	The many species of <i>Helicia</i> occupy a wide altitudinal range, although representatives of the genus are more common above c. 500 m. <i>H. latifolia</i> is recorded from the Gabensis area.
35 RUMEX	75-1-3	cf. <i>Rumex brownii</i>	Herb	-
36 MUEHL	75-11-	cf. <i>Muehlenbeckia</i>	Scandent shrubs or vines	-

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
37 NELUM	85-6-1	<i>Nelumbo nucifera</i>	Aquatic herb	Occurs at Lake Wanum in wet swamp and open water less than 4 m in depth. Dominant in open water shallower than 2 m, particularly where the substrate is predominantly inorganic.
38 STEPJ	92-2-2	<i>Stephania japonica</i> T.	Vine	In lowland forest. Collected from the Oomsis area.
39 HYPSE	92-4-	<i>Hypserpa</i>	Vines	<i>H. polyandra</i> has been recorded from Lake Wanum.
40 TINOS	92-6-	<i>Tinospora</i>	Woody vines	Fairly common especially in seasonally drier areas.
41 CANAN	96-1-1	cf. <i>Cananga odorata</i>	Canopy tree	Common in lowlands, particularly in secondary 'alluvium' and swamp forests.
42 TRIME	100-5-	cf. <i>Trimenia</i>	Trees or shrubs	-
43 NEPEN	110-1-	<i>Nepenthes</i>	Herbaceous creepers	<i>N. mirabilis</i> occurs commonly in wet grassland or swamp margin communities, and also occasionally in well developed floating root-mat vegetation.
44 QUINT	117-3-	<i>Quintinia</i>	Canopy trees	More common in montane forest than at lower altitudes.
45 POLYO	117-7-	<i>Polyosoma</i>	Canopy or sub-canopy trees	More common in montane forest, but recorded from lower altitudes in the Oomsis Creek area.
46 WEINM	120-3-	<i>Weinmannia</i> T.	Canopy or sub-canopy trees	Occur in lowland and montane forest communities especially along the forest margin.
47 SPIRA	120-15-	<i>Spiraeopsis</i> T.	Canopy and sub-canopy trees	Lowland and montane forests
48 ACAEN	127-4-	<i>Acaena</i>	Herbs	More common in alpine and sub-alpine non-forest communities, although may be present at lower altitudes.
49 PARIN	127-16-	? <i>Parinari</i>	Canopy or sub-canopy trees	In lowland and lower montane forests, particularly in areas of lower rainfall.
50 LEGPB	129-	?Leguminosae (Papilionatae) B	Trees, shrubs, herbs, climbing herbs, or vines	Widespread in lowland forest and non-forest vegetation.
51 LEGPD	129-	?Leguminosae (Papilionatae) D	as above	as above
52 VANDA	129-1-	<i>Vandasia</i> T.	1. Climbing herbs or shrubs 2. large trees ( <i>Pterocarpus</i> )	1. Found in non-forest vegetation 2. <i>Pterocarpus indicus</i> occurs in lowland forest below 700 m altitude.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
53	CROTA 129-23-	cf. <i>Crotalaria</i> T.	Herbs or small shrubs	Commonly found in non-forest vegetation particularly on disturbed or cultivated ground.
54	RUTAR 139-/231-	Rutaceae/ Araliaceae T.	Trees	Mostly canopy or sub-canopy forest trees.
55	EVODI 139-9-	<i>Evodia</i> T.	Canopy or sub-canopy trees	In primary forest, but more common in secondary regrowth communities. Some species occur in swamp forest.
56	EUPHT 149-	cf. Euphorbiaceae	Herbs, shrubs or small trees	More commonly genera of non-forest or secondary forest vegetation rather than rainforest.
57	EUPHO 149-	?Euphorbiaceae	as above	as above
58	EUPHA 149-1-	cf. <i>Euphorbia</i>	1. Herbs or small shrubs 2. Small trees or shrubs ( <i>Sapium</i> )	<i>Euphorbia</i> spp. are common in grassland, and in the early stages of regrowth after cultivation. <i>S. indicum</i> is found in 'alluvium' forest.
59	EUPHI 149-1-41	<i>Euphorbia hirta</i> T.	Herb	Common in grassland and early stages of regrowth.
60	MALLO 149-3-	<i>Mallotus</i> T.	Small trees	Sub-canopy trees in lowland forest, particularly at margins. Also fairly common in disturbed forest and post-cultivation regrowth associations.
61	MACMA 149-3/-19	<i>Macaranga</i> / <i>Mallotus</i>	Small trees	In forest, regrowth, or grassland.
62	CLAOX 149-7-	<i>Claoxylon</i>	Small trees or shrubs	Present in the sub-canopy of the forest, or in secondary vegetation communities.
63	PHYLA 149-8-18	<i>Phyllanthus</i> cf. <i>urinaria</i>	Herbs, shrubs or small trees	<i>P. urinaria</i> is a widespread erect herb of open ground. Other <i>Phyllanthus</i> spp. also occur in disturbed areas and grassland.
64	ACALY 149-9-	<i>Acalypha</i>	Herbs, shrubs or small trees	In shrubby grassland and regrowth communities; sometimes in the forest understorey.
65	GLOCH 149-17-	<i>Glochidion</i> T.	sub-canopy tree or shrub	Fairly common sub-canopy tree in open forest, particularly where disturbed. Also occur as isolated small trees or shrubs in grassland.
66	MACAR 149-19-	<i>Macaranga</i>	Trees or shrubs	Very common in regrowth communities in areas of disturbed vegetation. <i>Macaranga</i> spp. frequently occur as solitary trees in grassland, and in the forest understorey.
67	MACOV 149-19-17	<i>Macaranga ovatifolia</i> T.	small tree	-
68	ANTID 149-36-	<i>Antidesma</i>	Small trees or shrubs	Fire-tolerant trees of <i>A. ghaesembilla</i> occur frequently in grassland areas. <i>Antidesma</i> spp. are also found as sub-canopy trees in 'alluvium' forest.
69	APORO 149-61-	<i>Aporosa</i>	Sub-canopy trees	Small trees occurring commonly in lowland and lower montane forests.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
70	MELAN 149-73-	<i>Melanolepis</i>	Small trees or shrubs	<i>Melanolepis</i> is found in the understorey of secondary forest; <i>Bridelia</i> is a sub-canopy forest tree.
71	BISCH 149-79-	cf. <i>Bischofia</i>	Large canopy trees	Widespread and common in 'alluvium' forest and secondary forest with soils of high moisture content. Also occur in lower montane forest.
72	ENDOS 149-42-	<i>Endospermum</i>	Emergent forest tree	Some species occur as emergent trees in lowland rainforest and 'alluvium' forest. The genus is also common in long-established secondary forest. Characteristically a fast-growing opportunist tree.
73	CLEID 149-83-	<i>Cleidion</i> T.	Small trees or shrubs	Reported from lowland forest and limestone areas in Malaya. Probably not common.
74	ANACA 155-	Anacardiaceae	Forest trees	<i>Euroschinus</i> and <i>Semecarpus</i> are commonly found in swamp and 'alluvium' forest, but also occur in lowland and hill forest, and in secondary forest.
75	RHUST 155-1-	<i>Rhus</i> T.	Small trees	<i>R. taitensis</i> is very common in many lowland secondary forests.
76	ILEXA 159-1-	<i>Ilex</i>	Small trees	<i>I. arnhemensis</i> is common in wet scrub-grassland around Redhill Swamp. Other species occur as canopy or sub-canopy trees in lowland and montane forest.
77	SPHEN 159-2-1	<i>Sphenostemon</i> cf. <i>papuanum</i>	Forest tree or shrub	Probably more common in montane forest than at lower altitudes.
78	POLYP 165-4-1	<i>Polyporandra scandens</i>	Woody vine or scandent shrub	Present in lowland forest up to c. 700 m altitude.
79	STEMO 165-15-	<i>Stemonurus</i>	Canopy tree	The only representative of the genus in New Guinea is <i>S. monticolus</i> which occurs in lowland forest on slopes, up to c. 750 m altitude. Locally common.
80	PLATE 165-16-1	<i>Platea excelsa</i>	Canopy or sub-canopy tree	Found in lowland and montane forests.
81	DODON 168-5-	<i>Dodonaea</i>	Shrub or small tree	<i>D. viscosa</i> is a pioneer plant of disturbed ground over a wide altitudinal range.
82	GANOP 168-18-1	<i>Ganophyllum falcatum</i>	Canopy or sub-canopy tree	Restricted to lowland forest, frequently on the better drained soils.
83	TRIST 168-22-	<i>Tristiropsis</i> T.	Tall canopy trees	Lowland forest, especially in valleys, and 'alluvium' or swamp forest.
84	RHAMN 172-	Rhamnaceae	Shrubs or trees	<i>Gouania</i> and <i>Ventilago</i> are climbing shrubs; <i>Alphitonia</i> and <i>Zizyphus</i> are trees of lowland rainforest.
85	ELAEO 174-1-	<i>Elaeocarpus</i> T.	Canopy trees	Widespread in lowland and lower montane forests.
86	MICRO 177-4-	<i>Microcos</i> T.	Trees or shrubs	Occur commonly as understorey in lowland hill forest and 'alluvium' forest.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
87	TRICO 177-9-	<i>Trichospermum</i>	Trees	May be locally common along river banks and similar localities.
88	BRACH 180-1-	<i>Brachychiton</i> T.	Trees	<i>B. carruthersii</i> is a deciduous species occurring in lowland forest, particularly 'alluvium' forest, below c. 550 m. However, it is not common in New Guinea and has not been reported from the Markham area. <i>Agyrodendron</i> is also rare. <i>Pterocymbium</i> is a common lowland tree, sometimes deciduous, often found on alluvial or swampy soils, and on ridges. Many <i>Sterculia</i> spp. are also common in lowland forests.
89	KLEIN 180-6-1	<i>Kleinhovia hospita</i>	Understorey tree	Common in lowland forest regrowth, especially in areas of seasonal rainfall, and in 'alluvium' forest particularly in the early stages of colonisation of river margins.
90	STERC 180-11-4	cf. <i>Sterculia</i>	Small trees or shrubs	Many species occur in New Guinea. Widespread in lowland and lower montane forests, particularly in secondary forest. Sometimes deciduous.
91	STERE 180-11-7	cf. <i>Sterculia edelfeltii</i>	Small tree	Recorded from hill forest in the Oomsis area.
92	TETRA 182-5-	<i>Tetracera</i> T.	Vines or scandent shrubs	Particularly in lowland forest-margin situations.
93	ANISO 190-1-	<i>Anisoptera</i> T.	Tall canopy trees	<i>A. polyandra</i> is a common species of ridge crest and hill forest in the Oomsis area. The species is frequently deciduous. <i>Vatica</i> is a common tree, particularly in parts of Papua, growing both in swamp and hill forest situations. It has not been recorded from the Markham area.
94	DRIMY 198-1	<i>Drimys</i> T.	Shrubs or understorey trees	<i>Drimys</i> is a widely distributed component of upper-montane or sub-alpine forest, although it has also been reported growing as low as 1 600 m. <i>Bubbia</i> has been collected in the Morobe Province at Mt. Kiandi, and Gurakor (640 m).
95	TRICA 200-7-1	<i>Trichadenia philippinensis</i>	Canopy trees	Widespread, but not common, lowland tree of primary or secondary rainforest (up to c. 500 m altitude). Never in periodically inundated localities.
96	OCTOM 208-1-1	<i>Octomeles sumatrana</i>	Tall canopy tree	Massive tree up to 75 m in height. Common near rivers and in 'alluvium' forest, often in almost uniform stands. Fast growing pioneer species on abandoned river channels and levees.
97	SONNE 218-1-1	<i>Sonneratia caseolaris</i>	Shrub or tree	A pioneer species of the coastal mangrove vegetation, although generally growing in areas less saline than those occupied by <i>S. alba</i> .
98	BARRI 220-1-	<i>Barringtonia</i> T.	Canopy or sub-canopy trees	<i>Barringtonia</i> spp. occur in coastal forest, 'alluvium' forest and some swamp forest. <i>Planchonia</i> is also found in littoral and 'alluvium' forest.



TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
99 RHIZO	221-1-	<i>Rhizophora apiculata</i> T.	Tree	<i>R. apiculata</i> is widespread and common mangrove species, although it is more tolerant of freshwater conditions than the two other New Guinean members of the genus.
100 COMEL	224-/226-	Combretaceae/ Melastomataceae	1.Canopy trees or shrubs (Combretaceae) 2.Herbs or shrubs (Melastomataceae)	1. The many species of <i>Terminalia</i> occupy a wide range of habitats. The genus is common in lowland 'alluvium' forest although may occur up to c. 2 000 m altitude. Most are deciduous. <i>Combretum</i> is an understorey shrub or vine. 2. <i>Melastoma affine</i> is a small shrub found in established tall grassland. <i>Osbeckia</i> is an erect herb which often grows on bare ground within grassland.
101 MYRTA	225-1-	Myrtaceae	Canopy or sub-canopy trees or shrubs	Main representatives are probably the many <i>Syzygium</i> spp. These occur in a wide variety of forest habitats including littoral forest and swamp forest. The genus is also common as an understorey component of lowland hill forest.
102 POIKI	226-1-	<i>Poikilogyne</i> T.	Herbs and scandent shrubs	-
103 HALOR	228-2-	<i>Haloragis</i>	1.Herb ( <i>H. chinensis</i> ) 2.Shrub ( <i>H. halconensis</i> )	1. On open ground in grassland, especially on poor soils or river banks. Recorded growing close to the Markham River. 2. More common in montane forest, or as a garden weed in the highlands. Also possibly occurs in drier swamp situations.
104 BOERL	231-9-	<i>Boerlagiodendron</i>	Tree or erect shrub	Occurs in swamp forest at Oomsis.
105 EPACR	238-	Epacridaceae	Shrubs	The many genera occupy a wide altitudinal range, although are more common in montane forest and sub-alpine vegetation.
106 RAPAN	241-1-7	<i>Rapanea</i> cf. <i>achradaefolia</i> T.	Small tree or shrub	More common in montane forest than at lower altitudes.
107 MYRSI	241-4-	cf. <i>Myrsine</i> T.	Small tree or shrubs	-
108 PLANC	244-2-	<i>Planchonella</i> T.	Canopy tree	<i>Planchonella</i> is widespread in lowland and lower montane forest, and 'alluvium' forests. <i>Pouteria</i> and <i>Chrysophyllum</i> tend to occur on well drained ridge sites.
109 PALAQ	244-7-	cf. <i>Palaquium</i>	Tall canopy tree	Lowland rainforest, coastal or swamp forests.
110 DIOSP	245-1-4	<i>Diospyros</i> cf. <i>ferrea</i>	Sub-canopy tree	Found in 'alluvium' and swamp forests, and lowland hill forest. Occurs at Yanamugi in forest bordering the lake.
111 SYMPL	246-1-	<i>Symplocos</i>	Small sub-canopy tree	Commonly occurs as an understorey genus in montane forest, but also recorded from the Oomsis Creek area.
112 OLEAS	248-3-	<i>Olea</i>	Canopy trees	-
113 NYMPH	250-2-	<i>Nymphoides</i>	Aquatic herb	<i>N. indica</i> is a common species at both Lake Wanum and Yanamugi, occurring in open water up to c. 4 m in depth.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen taxon	Habit	Ecology and distribution of plants probably included in the pollen taxon
114 ALYXI	251-2-	<i>Alyxia</i>	Vines or shrubs	In lowland forest, or swamp marginal vegetation.
115 EVOLV	254-9-	? <i>Evolvulus</i>	Herbs or shrubs	-
116 ECHIP	257-1-1	<i>Echium</i> cf. <i>plantagineum</i>	Herb	An exotic European weed, not recorded from New Guinea, but naturalised in southern Australia.
117 VERBI	258-/263-	cf. Verbenaceae/ Bignoniaceae	Herbs and vines	Predominantly genera of forest or secondary vegetation.
118 VITEX	258-14-1	cf. <i>Vitex acuminata</i>	Canopy tree	Some <i>Vitex</i> spp. are found in lowland 'alluvium' and swamp forest.
119 DYSOP	259-7-	<i>Dysophylla</i> T.	Swamp herb	<i>D. verticillata</i> is an erect herb common in swamp margin situations. It may be found growing in up to c. 15 cm of water, and is particularly predominant at Redhill Swamp.
120 PLANT	271-1-	<i>Plantago</i>	Herbs	Several <i>Plantago</i> spp. are found in sub-alpine herb-fields. Exotic species have become introduced to the Eastern Highlands Province, although there is no record of these from the Markham area.
121 TIMON	275-7-	<i>Timonius</i> T.	Small tree	<i>T. timon</i> is a bushy fire tolerant tree often found in shrubby grassland. It is particularly common around the margin of Redhill Swamp. Other species occur in 'alluvium' or swamp forest.
122 GARDE	275-11-	<i>Gardenia</i>	Understorey tree	In lowland forest, especially along the forest margin.
123 MORIN	275-20-	<i>Morinda</i>	Shrubs or vines	<i>M. citrifolia</i> and <i>M. hirtella</i> are large shrubs occurring fairly commonly in forest-margin situations. <i>Morinda</i> is present around the lake at Yanamugi, and has been collected from many locations in the Markham Valley and Oomsis areas.
124 NAUCL	275-35-	<i>Nauclea</i> T.	Trees or shrubs	Some <i>Nauclea</i> spp. are found in swampy grassland or mixed swamp forest. <i>N. orientalis</i> is a common tree in the 'savanna' grassland areas of the Markham Valley. It is fire tolerant, yet also thrives in water-logged or swampy soils, occurring at the water's edge around Lake Wanum. It is also a common and vigorous pioneer on the steep piedmont fans of the northern side of the valley. <i>Anthocephalus</i> is a tree or shrub of 'alluvium' or swamp forest and possesses exceptional capacity for regeneration in such situations. Many <i>Neonauclea</i> spp. are shrubs or small trees found in 'alluvium' forest or along watercourses, although others are trees of montane forest up to 2 000 m in altitude.
125 UNCAR	275-78-	<i>Uncaria</i> T.	Herbaceous creeper or climber	<i>U. gambir</i> is found in the dense herbaceous swamp vegetation at Lake Wanum.
126 COMPT	286-	Compositae (Tubuliflorae)	Erect herbs	Many genera represented. Composites commonly occur on disturbed ground, in short grassland, and as weeds in cultivated gardens.
127 PODOC	305-1-	<i>Podocarpus</i>	Canopy trees	A dominant genus of much montane forest above c. 2 400 m, although <i>P. amarus</i> may be found as low as 600 m altitude.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen or Spore taxon	Habit	Ecology and distribution of plants probably included in the pollen or spore taxon
128 PHYLO	305-4-	<i>Phyllocladus</i>	Canopy tree	More common in upper-montane forest, although has been recorded as low as 900 m altitude.
129 DACRY	305-7-	<i>Dacrycarpus</i> T.	Canopy tree	Generally restricted to montane vegetation above c. 2 600 m.
130 GNETU	311-1-	cf. <i>Gnetum</i>	Trees, shrubs or woody vines	<i>G. gnemon</i> is a common understorey tree of hill forest. It is often cultivated, and is present on old garden sites around the shores of L. Wanum. Other species may occur as vines in lowland forest.
167 LYCOC	401-1-17	<i>Lycopodium cernuum</i> T.	Ground creeper	Commonly found on areas of disturbed ground, especially on landslips and in gullies.
168 LYCOV	401-1-18	<i>Lycopodium</i> cf. <i>volubile</i> T.	Ground creeper	Found in wet grassland
169 LYCOS	401-1-19	<i>Lycopodium squarrosum</i> T.	Epiphyte	In lowland forest.
170 LYGOD	407-1-1-3	<i>Lygodium microphyllum</i> T.	Scandent fern	Grows on trees particularly at the forest margin of secondary communities. In areas with a pronounced dry season the species may also occur in swamp communities. Other species are ground creepers of grassland, or old garden sites. Restricted to lowlands below c. 1 300 m altitude.
171 ANEMI	407-1-2-1	cf. <i>Anemia hirsuta</i>	Ground fern or vine	-
172 PTERI	407-2-1-	<i>Pteris</i>	Fern	-
173 ADIAN	407-8-1-6	cf. <i>Adiantum diaphanum</i> T.	Fern	-
174 HISTI	407-11-3-1	<i>Histiopteris incisa</i> T.	Fern	-
175 DAVAL	407-13-1-	<i>Davallia</i> T.	Epiphytic ferns	-
176 NEPHR	407-14-1-	<i>Nephrolepis</i>	Swamp ferns, ground ferns and epiphytes	<i>N. hirsutula</i> is a very common species in the floating root-mat vegetation at Lake Wanum <i>N. biserrata</i> is a ground fern, occurring particularly along creeks.
177 ARTHR	407-14-2-	? <i>Arthropteris</i> cf. <i>tenella</i>	fern	-
178 CYAT1	407-18-	Cyatheaaceae 1 (psilate)	tree ferns	In forest, especially near creeks. All lowland <i>Cyathea</i> spp. are more or less shade-demanding and are not found in grassland.
179 CYAT2	407-18-	Cyatheaaceae 2 (patterned perisporium)	Tree ferns	as above
180 CYCLA	407-20-1-5	cf. <i>Cyclosorus archboldiana</i> T.	Ground ferns	<i>Cyclosorus</i> spp. are common in the ground cover of swamp forest. At least one species occurs in the floating root-mat vegetation at Lake Wanum, but is not common.

TABLE II.1 (Cont.)

Computer Identifier	ANU Ref. Collection No.	Pollen or Spore taxon	Habit	Ecology and distribution of plants probably included in the pollen or spore taxon
181 CYCLO	407-20-1-11	<i>Cyclosorus</i> T.	Ground fern	as above
182 CYCLT	407-20-1-12	<i>Cyclosorus truncatus</i> T.	Ground fern	as above
183 ASPLE	407-21-1-	<i>Asplenium</i> T.	Epiphytic or ground ferns	In forest
184 TECTA	407-23-9-	cf. <i>Tectaria</i>	Fern	-
185 STENA	407-25-3-	cf. <i>Stenochlaena areolaris</i>	Scandent epiphytic fern	Occurs in New Guinea growing often on <i>Pandanus</i> .
186 STENL	407-25-3-1	<i>Stenochlaena laurifolia</i>	Fern	In 'alluvium' forest
187 STENO	407-25-3-2	<i>Stenochlaena palustris</i>	Scandent swamp fern	Abundant in open swamp forest and lake marginal vegetation, and as a component of floating root-mat vegetation.
188 MICSO	407-29-2	<i>Microsorium</i> T.	Swamp or ground ferns	One <i>Microsorium</i> sp. is fairly common in established floating root-mat vegetation at Lake Wanum. Others occur in lowland forest.

TABLE II.2. *Identified pollen and spore taxa included in ecological groups*

## HERBACEOUS SWAMP

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
1	TYPHA	20	COLOC
3	SPARG	37	NELUM
4	GRAM1	43	NEPEN
5	GRAM2	113	NYMPH
9	CYPAL	119	DYSOP
10	CYPA2	125	UNCAR
11	CYPB1	176	NEPHR
12	CYPB2	187	STENO
13	CYPCI	188	MICSO
14	HYPOL		

## DRY LAND, NON-FOREST

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
6	GRAM3	66	MACAR
7	GRAM4	68	ANTID
8	GRAM5	73	CLEID
23	CASUA	76	ILEXA
28	TREMA	81	DODON
42	TRIME	102	POIKI
53	CROTA	114	ALYXI
56	EUPHT	115	EVOLV
57	EUPHO	117	VERBI
58	EUPHA	120	PLANT
59	EUPHI	121	TIMON
60	MALLO	123	MORIN
61	MACMA	124	NAUCL
62	CLAOX	126	COMPT
63	PHYLA	167	LYCOC
64	ACALY	168	LYCOV
65	GLOCH		

## FOREST TREES

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
27	CELTI	79	STEMO
46	WEINM	80	PLATE
47	SPIRA	82	GANOP
49	PARIN	83	TRIST
54	RUTAR	84	RHAMN
67	MACOV	91	STERE
69	APORO	95	TRICA
74	ANACA	112	OLEAS
75	RHUST	122	GARDE

TABLE II.2. (Cont.)

## FOREST, NON-CANOPY

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
15	PALMA	40	TINOS
17	CALAM	70	MELAN
18	NORMA	78	POLYP
21	FLAGE	92	TETRA
34	HELIC	101	MYRTA
38	STEPJ	111	SYMPL
39	HYPSE	130	GNETU

## FOREST FERNS

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
169	LYCOS	183	ASPLE
178	CYAT1	186	STENL
179	CYAT2		

## 'ALLUVIUM' FOREST

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
16	METRO	96	OCTOM
41	CANAN	97	SONNE
71	BISCH	98	BARRI
72	ENDOS	99	RHIZO
86	MICRO	104	BOERL
87	TRICO	110	DIOSP
89	KLEIN	118	VITEX

## 'MONTANE' FOREST

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
24	ENGEL	93	ANISO
25	NOTHO	94	DRIMY
26	CASTA	105	EPACR
44	QUINT	106	RAPAN
45	POLYO	127	PODOC
48	ACAEN	128	PHYLO
77	SPHEN	129	DACRY
85	ELAEO		

TABLE II.2. (Cont.)

## UBIQUITOUS ANGIOSPERMS

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
2	PANDA	51	LEGPD
19	ARENG	52	VANDA
22	LILIA	55	EVODI
29	APHAN	88	BRACH
30	URMO2	90	STERC
31	URMO3	100	COMEL
32	STREB	103	HALOR
33	PILEA	107	MYRSI
35	RUMEX	108	PLANC
36	MUEHL	109	PALAQ
50	LEGPB	116	ECHIP

## UBIQUITOUS PTERIDOPHYTES

Taxon No.	Taxon Identifier	Taxon No.	Taxon Identifier
170	LYGOD	180	CYCLA
171	ANEMI	181	CYCLO
172	PTERI	182	CYCLT
173	ADIAN	184	TECTA
174	HISTI	185	STENA
175	DAVAL	189	MONLS
177	ARTHUR	190	MONLL