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New and Noteworthy Plant Records from Palau: An Annotated Checklist

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Abstract—A total of 37 new or notable records of vascular plants are listed here for Palau. Most of these have not been included in previous checklists and/or floras of Palau. If so the names have been revised or new information is presented here. The majority were discovered through herbarium and database inventory and are records that have been overlooked. A few of them have been collected or published more recently which would account for their absence from any checklist. Additionally, five records are listed as doubtfully recorded or likely mistakes. Approximately 12 (32%) of the records are introduced species, or suspected to be so. The remaining 68%, approximately 25, are likely to be native species. Two of these are endemic to Palau or suspected to be so. Many of these are entirely new records for Palau. These are mostly flowering plants but also include two ferns and even one new cycad record. Some of the records require further revisions and/or collections. All known data of these records is presented to assist in this effort. Although most of the annotated specimens contain descriptive information about the habitat they were collected in, distribution data for the majority of records is not well known. Some of these new native records are likely to be uncommon or rare. Clearly this new information demonstrates the need for further floristic work and taxonomic revision in Micronesia.

Introduction

Work on the flora of Micronesia began during the Japanese era. Kanehirae (1933) was the first to attempt compiling an actual flora of Micronesia, although it was not until the Micronesian islands came under American political influence that the greatest progress was made towards a flora. The most cited floristic accounts of the region today are of Raymond Fosberg and his collaborators, Sachet and Oliver. Their most significant floristic contribution to the region was their geographical checklist (Fosberg et al. 1979, 1982, 1987) published in three separate volumes. This work was carried out simultaneously with the gradual publication of the Flora of Micronesia (Fosberg & Sachet 1975a, 1975b, 1977, 1980; Fosberg et al. 1993). Though Fosberg and his colleagues only had time to get a start on the publication of the Flora, covering only a portion of the total

flora before Fosberg's death in 1993, their checklist series laid a foundation for all subsequent floristic research in the region, and has proved an invaluable resource for Pacific biologists.

Subsequent work and updates to Fosberg et al.'s checklists have mostly been unpublished lists and databases. Lorence & Flynn (2001) produced a draft checklist of the vascular plants of Palau. Tarita Holm and colleagues, with the Palau Conservation Society, constructed an Access database of Palau's vascular plants. This was a consolidation of the checklists of Fosberg et al. (1980) and Raulerson et al. (1997), and is known as the Palau Vascular Plant Database (PVPD 2006). It is an unpublished working database maintained by the Belau National Museum. Warren L. Wagner, Darrell R. Herbst, and David H. Lorence are currently working on an updated database of the Micronesian flora, based on the Fosberg and Sachet records as well as additional records from recent literature. This is intended to be published as a web-based Internet resource at some point in the future.

Recent research has turned up 37 taxa that are not in any of the mentioned published lists or databases and are therefore considered new records, even though many were collected decades ago. The following list has been compiled simultaneously and collaboratively with the Provisional Checklist of the Plants of Palau (Kitalong et al. 2008), which is intended to be the basis for a complete Annotated Checklist of the Plants of Palau. Many of the records presented here will also be included in the Provisional Checklist that is currently in progress. Future work towards the completion of Palau's vascular plant checklist must take these records into account. As misidentification of herbarium material is common, researchers inclined to question or reject any of these records for inclusion in Palau's flora are welcomed, but are requested to address the specimen material cited here.

Methods

All of the records presented here that reference a specimen are based on collections made in Palau. The Belau National Museum Herbarium (BNM) holds a small collection of mostly Palau specimens. All of these holdings were seen by the author. Some of the new records here are based on the BNM collection. The other records are primarily from holdings at the Bishop Museum Herbarium Pacificum (BISH) in Honolulu and the National Tropical Botanic Garden Herbarium in Kauai (PTBG), Hawaii. A few were observed at the Royal Botanic Gardens Kew (K). One was collected by the author during the Babeldaob Forest Survey 2006. Additional specimens have been cited from other herbaria not visited by the author; Cornell University (BH) the Arnold Arboretum, Harvard University (A), and the University of Guam (GUAM). Data regarding these specimens was shared by correspondence with other researchers.

In addition, all specimens collected from Palau that were databased as of April 2007 at the Bishop Museum Herbarium (BISH) and the Smithsonian Herbarium (US), were inventoried. A few new records were obtained from

simply going through these databases. In all cases scanned photos of these records were requested. A few were unable to be retrieved from the collections by the curators, likely due to loans or misplacement in the collections. For any questionable records, photos of specimens were sent to experts in the particular taxon for verification. A list of these collaborators is provided in the acknowledgements.

The format for the checklist is as follows. The records listed are presented in four traditional taxonomic groups; Pteridophyta, Gymnospermae, Monocots, and Dicots. They are then listed in alphabetical order by family, then genus. The material cited for each species is listed following standard format for taxonomic publications. The collector's name is italicized followed by the collection number, then the herbarium code where the specimen is held. An "!" follows the herbarium code, (US!), if the specimen was seen by the author. The specimens are listed in no particular order. Localities are given in exactly or nearly exactly the same format as they appeared on the herbarium labels. If GPS coordinates were present they are included here in decimal form. Habitat information is taken from the specimen labels. A 'Notes' section has been included to summarize ecological information included in the labels or other important information such as native status, if it is known. If the record is believed to have been determined in error, the specimen is listed under "Doubtfully Recorded Specimens" in alphabetical order by family and genus. The notes category in this section is used to explain why they are considered doubtful records.

Results

Out of the 37 records listed, many are reported for the first time here. A few of these records are based on specimens that have been collected more recently, which would account for their absence in any checklists. One was collected by the author during the Babeldaob forest survey (Costion & Kitalong 2006) and a few are recently described species. There are an additional five records that are considered to be doubtfully recorded or likely mistakes.

Out of the 37 new or notable records, 12 (32%) are introduced species, or suspected to be introduced. These are mostly weedy herbs, including three grasses and four legumes. At least six of these introduced species, are considered invasive in Palau (US Forest Service PIER 2007). A total of eight of the introduced species listed here have already been recorded online as introductions to Palau (US Forest Service PIER 2007) or cited in previous reports on invasive species. Technically, these species may not be considered new records for Palau. This checklist however, provides documentation of the species occurrence on the island by referencing specimens, which is a valuable contribution to the ongoing effort of completing Palau's vascular plant checklist.

The remaining 68% of the new records, approximately 25, are likely to be native species. Two of these are endemic to Palau, including one *Pandanus* species restricted to the Limestone Rock Islands, and two of the orchids listed are

endemic to the Caroline Islands. One of these orchids is only known from the Western Caroline Islands. Two ferns and two cycads are listed; the remaining records are angiosperms. Many of the specimens listed have habitat data, which was obtained from the specimen labels. However, since most of the species listed here are represented by only a few (often only one or two) collections in Palau, there is currently not enough information available to determine each plant's distribution and degree of abundance in Palau. Some specimens were noted (by the collector) to be "rare," but often this is all the information given. It is reasonable to suggest that some of the new records listed here that are native, are potentially uncommon or rare and deserve further study.

In any case, it is clear that there is need for more botanical collections and floristic research in Palau. This topic is explored in further depth in Costion (2007). Maps showing the collection history for Palau were produced which show areas that were more heavily collected and highlight large areas of unbroken forest where no known collections have been made. The entire central interior of Palau's largest island, Babeldaob, has no collection records from it, and uncollected patches of forest on the island make up a total of roughly 20-25% of the island's area. This is clearly a result of the lack of roads going into these areas which has biased collection efforts. Although surprising to some people perhaps, that on such a small island significant areas of land remain unexplored, is not uncommon in the Pacific or in the tropics in general.

Collection efforts in this corner of the globe have come in waves historically followed by substantial periods of inactivity. The remoteness and sheer cost of travel to the islands has limited intensive floristic research to a handful of keen taxonomists. Thus it is no surprise that some of the records here have gone unnoticed. Current research initiatives are facilitating collaboration between island residents and American botanists. These are increasing the number of collections and hold the promise of for sustained floristic research for the region. However, many data gaps remain, as is evident from the following checklist. A number of the taxa listed remain inconclusive records since in some cases they are only known from a few collections, and for others time and funding simply did not permit further research or travel to resolve the question. In compiling and documenting all the known information regarding these records, it is hoped that this list will serve as a resource for future collection efforts and taxonomic treatments in the region and perhaps inspire others to follow up on some of the unresolved records.

Annotated Checklist of New Records

PTERIDOPHYTA
SCHIZAEACEAE

Lygodium japonicum (Thunb.) Sw.

Malakal Is., road bank near sea on way out to quarry, 19 Feb 1996, *Rinehart LR26237* (BISH!)

Distribution: Japonia, China, Asia, Australian tropics (IPNI 2004)

Notes: This specimen was more recently collected and determined in 1997, which is why it has not been included in previous checklists. It has previously been confused with *Lygodium salicifolium* Presl.

GYMNOSPERMAE

CYCADACEAE

There has been much confusion regarding the identity of cycad species in Micronesia historically and recently. The taxonomy is still not fully resolved but there are now two species acknowledged as occurring in Palau. Previously only one species was acknowledged. The accepted name for this species has changed between *Cycas rumphii* Miq., *Cycas circinalis* L., and *Cycas micronesica* K. D. Hill. There has also been confusion with the range of *Cycas silvestris* K.D. Hill extending way beyond its original circumscription into Palau (De Laubenfels & Adema 1998). *Cycas circinalis* L. is now accepted as endemic and restricted to Southern India (Hill, 2007). *Cycas rumphii* Miq. is now understood to occur from Borneo and Java across the Moluccas into Papua New Guinea (Hill 2004). *Cycas silvestris* K.D. Hill is an Australian endemic only known from a few populations on the Cape York Peninsula of Queensland (Hill 1992 & 2004), and is listed as Vulnerable (Hill 2003 & DEWHA 2007). *Cycas micronesica* was first recognized as endemic to the Marianas (Hill 1994), then later also recognized in the Western Carolines (Hill 2004). A new species *Cycas truncata* has recently been proposed (De Laubenfels 2007). It should also be noted however that though a species complex in the Western Carolines and Philippines has been acknowledged (Hill 2004) there is not always agreement among cycad taxonomists. Further more, ongoing molecular studies may yet again render another revision of names. In any case, two species are now documented in the literature as occurring in Palau. They can be distinguished by the following characters: *Cycas micronesica* has a spongy layer in the seed, a distinct crest on the seed, relatively short acumens on the male and female sporophylls, and rather few thorns on the petioles. *Cycas truncata* does not have a spongy layer or a crest, has long acumens, and lots of thorns.

Cycas truncata de Laub.

Cycas silvestris auct. non Hill: de Laub. & Adema (1998)

Ngatkip Airai, 26 Mar 1950, *Fosberg 32376* (US!)

Distribution: Viet Nam coast to the Philippines and Palau, south to eastern Sumatra, and east to the Lesser Sundas (de Laubenfels 2007).

Cycas micronesica K. D. Hill

Palau, *Fosberg 46237* (US); Yap *Kanehira 3743* (A); Yap, *Takamatsu 1849* (BH)

Distribution: Marianas and Western Caroline Islands (Hill 2004)

Notes: This name has gradually made its way into environmental reports for Palau since its description (Hill 1994) but has not been included in formal checklists. It has also been confused with the former species, *Cycas truncata* under the name of *Cycas circinalis* L.. It occurs commonly on coral limestone or sand and occasionally on islands with volcanic soils where the former substrates occur (Hill 1994).

MONOCOTS

CYPERACEAE

Eleocharis pellucida C. Presl

Mt. Luisualumonogui, 16 Sept 1933, *Hosokawa 6856* (BISH!)

Distribution: Russian Far East, China, to Tropical & Subtropical Asia (Kew World Checklist of Selected Plant Families 2007)

Notes: Specimen determined by T. Koyama, 1959.

ORCHIDACEAE

Liparis condylobulbon Rchb.f.

Aulupse'el Is., Ngerebe'ed Beach, 23 Aug 1965, *M. Evan 593* (BISH!)

Distribution: Taiwan, Indo-China to SW. Pacific (Kew World Checklist of Selected Plant Families 2007)

Notes: Growing on limestone cliffs. Determination confirmed by P. Cribb.

Liparis elegans Lindl.

South Central Babeldaob Island, SW of Mt. Yekigaroto, 2 Sep 1965, *Fosberg 47682* (BISH)

Distribution: Thailand, Malesia, New Guinea, Philippines, New Caledonia, Fiji, Tonga (Hassler et al. 2001)

Notes: Locally common, epiphytic in rather scrubby forest on deeply weathered volcanic rock. This record, from the collections database (BISH), could not be physically located for verification.

Moerenhoutia leucantha Schltr.

Aimiliki, Hosokawa 7222, 25 Sep 1933, (BISH); Mt. Galasumao-Unkasyu, 22 Sep 1933, *Hosokawa, T. 7142* (BISH); Road to Ngchesar, N-facing slope near bench mark 4.1947, 19 Jul 1991, *Herbst 9441* (BISH!)

Distribution: This species is recorded as being restricted to Pohnpei (Kew World Checklist of Selected Families 2007) & (Fosberg et al. 1979). These three records from Palau may prove a wider distribution.

Notes: Upland forest association. Additional fertile collections and floral dissection is necessary to confirm.

Oberonia equitans (G.Forster) Mutel
Synonym: Oberonia glandulosa Lindl.

Aimeliik, Imelsubech, Skillangs paddock, 4 May 1982, *Timberlake 3168* (BNM!)

Distribution: Native to Madagascar, Mascarenes, Borneo, New Caledonia, New Guinea, Solomon Is. to S. Pacific (Hassler et al. 2001).

Notes: This specimen was originally determined by Fosberg as *Oberonia* cf. *glandulosa* Lindl., then as listed here by P. Cribb.

Peristylus setifer Tuyama
Habenaria setifera (Tuyama) Fosb. & Sachet

Ngchesar, along upper tributary to Ngardok river, Babeldaob Forest Survey 2005 Transect, Ngchesar 3, station 2, 15 Dec 2005, *Costion 800* (BNM!)

Distribution: Previously recorded as endemic to Yap (Fosberg et al. 1987)

Notes: Very rare, only observed once in entire Babeldaob Forest Survey 2005. Found growing as terrestrial in wet volcanic clay, adjacent stream. Duplicates were sent to University of Guam (GUAM) and the Royal Botanic Gardens Kew (K).

Phreatia micrantha (A.Rich.) Lindl.
Rhynchophreatia micrantha (A.Rich.) Hallé.

Swamp forest along road to Ibobang, 0.5 km SSE of Gnat, 18 Jul 1991, *Herbst 9425* (BISH!)

Distribution: Papuasia to W. Pacific (Kew World Checklist of Selected Plant Families, 2007), in Micronesia, previously only recorded from Saipan, Rota, and Guam (Fosberg et al. 1987). Occurrence in the Pacific is noted as "widespread" (Hassler et al 2001).

Notes: This species has recently been transferred to the genus *Phreatia* based on floral morphology (Cribb & Wood pers. comm. 2007)

PANDANACEAE

Pandanus lorencei Huynh.

Koror State, limestone rock island in vicinity of Omekang, W. of Bablomekang Island, 7° 08' 32"N, 134° 19' 02"E, 17 Feb. 1998, *Lorence et al. 8310* (PTBG)

Distribution: Palau endemic

Notes: This new species was recently described (Huynh 1999). It is common on limestone cliffs of the Rock Islands and distinct from the other *Pandanus* spp. in Palau, by its smaller syncarp, with fewer-celled drupes and smaller leaves (Huynh 1999).

POACEAE

Capillipedium assimile (Steud.) A. Camus.

Ngatpang, forest savanna edge, 3 April 1996, *Y. Singeo LR26620* (BISH!)

Distribution: India, Burma, Southeast Asia, China, Taiwan, Malesia: Java, (Flora Taiwan Website 2007)

Notes: Fosberg & Sachet (1979) treated specimens determined as *Capillipedium* in Micronesia as *Dichnathium* however, the determination of this specimen, by D. R. Herbst, was made in 2004 and the name *Capillipedium assimile* (Steud.) A. Camus is accepted (Tropicos 2007). Clayton (1997) reports this taxon as occurring in the Pacific in his checklist of grasses of the Pacific.

Dichanthium annulatum (Forssk.) Stapf

Aimeliik, Nekken Forest Station, 2 Nov 1982, *Timberlake 3160* (BNM!)

Distribution: Northern Africa through the Middle East, India, Southeast Asia, Malesia and Papaua New Guinea (US Forest Service PIER 2007). Clayton (1997) lists it as occurring in the Pacific with no specification.

Notes: The specimen was determined by Fosberg. This species is considered introduced and invasive on other Pacific islands (US Forest Service PIER 2007) and is potentially a new or overlooked invasive threat in Palau.

Eragrostis cilianensis (All.) Vignolo ex Janch.

Eragrostis major Host

Ngatpang to Ngeremlengui, 2 April 1996, *Raulerson 26601* (BISH!)

Distribution: Native to old world tropics and temperate regions, now widely introduced (US Forest Service PIER 2007). It is listed as occurring in the Pacific with no specification on island (Clayton 1997).

Notes: Found in wet areas. Considered introduced and invasive on other Pacific islands (US Forest Service PIER 2007). This is potentially a new or overlooked invasive threat in Palau.

Imperata cylindrica (L.) P. Beauv.

Northern end of international airport, 7.3666 N 134.55 E, 1999, *Falanruw 11002* (BISH)

Distribution: Native to Old World (US Forest Service PIER 2007).

Notes: Introduced invasive weed reported on Babeldaob and other islands in Micronesia (US Forest Service PIER 2007).

Ischaemum ciliare Retz.

Polytrias indica (Houtt.) Veldkamp

Ischaemum indicum (Houttuyn) Merr.

Koror, along roads, gardens, empty lots, 22 Aug 1977, *Otobed PW-10091* (BISH!); Arumonogui-sogan, near Arumaten, 15 Sept 1933, *Hosokawa 6779* (BISH!)

Distribution: Mesoamerica, South America, Sri Lanka to Pacific (Tropicos 2007)

Notes: Recorded as native for Yap, Truk, and Pohnpei for Micronesia (Fosberg et al. 1987). This specimen was originally determined as *Ischaemum intermedium* Brong. in 1935 by Hosokawa and later determined by W. D. Clayton as *I. indicum*.

Sorghum nitidum (Vahl) Pers.

Koror, on roadsides, 1 April 1950, *Fosberg 32483* (BISH!)

Distribution: China, Japan, Taiwan, Korea, India, Myanmar, Thailand, Indochina, Indonesia, New Guinea, Philippines, Queensland (USDA GRIN 2007)

Notes: This specimen was originally determined as *Sorghum halepense* (L.) Pers. by the collector, Fosberg. Later, in 1994, W. D. Clayton, determined it as presented here.

DICOTS

ACANTHACEAE

Ruellia repens L.

Ngeruikl, disturbed, forest margins, 7.483888 N 134.616388 E, 12 Dec. 2002, *Waterhouse BMW6562* (BISH!)

Notes: Introduced, previously only recorded as an introduction to Pohnpei (Fosberg et al. 1979).

AMARANTHACEAE

Alternanthera tenella Colla.

Melekeok, 8 Apr 1936, *Takamatsu 1389* (BISH!)

Distribution: Native to tropical Americas, now widespread (McCormack 2007)

Notes: Introduced

APOCYNACEAE

Hoya sp. (formerly in Asclepiadaceae)

Ngeruktabel Island, 3.5 km NNE of Ngkesiil Island, On steep west facing slope along mangrove channel, Rock Island forest association. 27 Jul 1991, *Herbst 542* (BISH)

Notes: Two species recorded for Micronesia: *Hoya schneei* Schltr. (Pohnpei) *Hoya trukensis* Hosok. (Truk) but not previously for Palau (Fosberg, Sachet, & Oliver 1979). Further collections with fertile material are required to identify to species.

BORAGINACEAE

Heliotropium procumbens Mill.

Peleliu, airstrip, roads and woods, 6.9941666 N 134.2288 E 30 Dec 1991, *Raulerson 22670* (BISH)

Distribution: Native to Southern United States, Central and South America, West Indies (Wagner et al. 1999)

Notes: Considered invasive on Peleliu and has been recorded on Babeldoab (US Forest Service PIER 2007).

CONVOLVULACEAE

Operculina polynesica~ventricosa

Peleliu, 26 Jan 1978, *Stemmermann 3391* (BISH); central part, on sterile coral rock, 26 Jul 1946, *Fosberg 25878,* 25982 (BISH); Flat west of Bloodynose Ridge; Sept 1950, *Fosberg 32004, 32005* (BISH); Malakal, 11 Mar 1974, *Otobed s.n.* (BISH); Ngerebe'ed beach, east end of Aulupse'el Island, 23 Aug 1965, *Fosberg 47471* (BISH); Old seaplane base on west side of island, 23 Mar 1950, *Fosberg 32277*, (BISH);

Notes: Common in dense thickets, second growth scrub, and cultivated areas on all types of soil. The "~" implies an intermediate form between *O. polynesica* Staples and *O. ventricosa* (Bert.) Peter that has not been placed yet. It is suspected that these may represent a hybrid species but this is currently unresolved until further study (Staples 2007).

CUCURBITACEAE

Zehneria mucronata (Blume) Miq.

Oropusyakaru, 28 Aug 1937, *Hosokawa 9104* (BISH)

Distribution: Native to China in the Guangdong, Yunnan, and Taiwan Provinces (Tropicos 2007), across Melanesia in New Guinea, the Northern Australian Coast and Australian Oceanic Islands, Norfolk Island (Australian Plant Name Index 2007 & Flora Base 2007), and Pohnpei (Fosberg et al. 1979).

Notes: The specimen (BISH) could not be located for verification. The record is in their database and may be on loan or misplaced. The known native distribution across Melanesia to Pohnpei suggests this record is valid.

EBENACEAE

Diospyros aff. **elliptica** (J.R. & G.Forst.) P.S.Green.

Ngeruktabel Island, Kisaol point, 2.0 km SE of Kekereibl Toi Channel, 26 Jul 1991, *Herbst 9535* (BISH!); Rock Islands, 20 Oct 1933, A. W. Herre (BISH!)

Distribution: Southwestern Pacific: Fiji; Tonga, Wallis and Futuna Islands (USDA GRIN 2007)

Notes: Both specimens found growing on limestone cliff vegetation. Fosberg et al. (1979) have a *Diospyros* sp. listed for Palau in Koror state. An additional one of his specimens collected from Yap was also observed. It was determined as "*Diospyros* cf. *elliptica*?" The specimens annotated here very closely resemble *D. ferrea* var. *palauensis* (Kaneh.) Fosb., but it is difficult to be certain from these two specimens. Further collection of *Diospyros* from Palau's Rock Islands are clearly needed to verify which species occurs there.

EUPHORBIACEAE

Claoxylon aff. **fallax** Müll.Arg.

Urukthapel Island, 17-19 March 1950, *Fosberg 32193* (BISH! & K!)

Distribution: Fiji, Tonga (Kew World Checklist of Selected Families 2007)

Notes: Occurring on limestone Rock Islands. Fosberg and Sachet (1979) included *C. fallax* with a "?" on their checklist. They indeed had reason to do this. This specimen was observed and compared with material of *C. fallax* from other Pacific islands at Kew Gardens with Euphorbiaceae specialist Petra Hoffmann. It appears to be distinct. However, flowering material was inadequate to verify this. Its occurrence on limestone karst is also suggestive of a potential new record or new taxon. Further collections with sufficient fertile material are required to verify what species it is.

FABACEAE

Chamaecrista nictitans (L.) Moench

Airai state, road to Aimeliik, 29 Jul 1991, *Herbst, Stemmermann, & Canfield 9572* (US); Nekken forest station Aimeliik, 13 Mar 1981, *J. Timberlake & Johannes 3001* (US); Koror Is., 28 Feb 1977, *D. Otobed Pw-10020* (US); Koror Is., 19 Oct 1949, E. Holt 54 (US); Former Japanese Communication Station area, on roadsides, 3 Apr 1996, *Rinehart LR 26618* (BISH); Ngerebeched. S weather station, with coarse, high grass and other legumes, 27 Mar 1949, *Hill 15* (BISH)

Distribution: Native to neotropics, now widely naturalized (US Forest Service PIER 2007)

Notes: Introduced.

Senna alata (L.) Roxb.

Koror, Topside, 29 Dec 1967, *Emmons 44* (BISH)

Distribution: Native to Mexico (US Forest Service PIER 2007)

Notes: Introduced and considered invasive (Space et al. 2003) but is valued and used throughout the Pacific as a medicinal plant (US Forest Service PIER 2007).

Senna siamea (Lam.) H.S. Irwin & Barneby

Ngerkebesang Is., 28 Dec 1967, *Emmons 40* (BISH); 28 Mar 1959, *Fosberg 22377* (GUAM); 2 July 1970, *Salsedo 427* (GUAM)

Distribution: Native to India, Sri Lanka and Malaysia (US Forest Service PIER 2007)

Notes: Introduced.

Stylosanthes guianensis (Aubl.) Sw.

Aimeliik, Nekken Forestry Station, 27 Mar 1981, *Timberlake & Johannes 3022* (BNM!); Aimeliik, Nekken Forestry Station, river paddocks, 23 Sep 1981, *Timberlake 3102* (BNM!)

Distribution: Native to Central and South America, now widely introduced (ILDIS 2007).

Notes: Introduced, previously only recorded for Micronesia in Nauru Island (Fosberg et al. 1979). The first known collection record for Palau was determined by Fosberg in 1981. It is now considered an invasive plant on Babeldaob (US Forest Service PIER 2007).

FLACOURTIACEAE

Only one *Casearia* has been included on previous checklists for Palau, *C. hirtella* Hosok. There are however specimens from Palau that may represent a species complex. A short study was done by Sue Zmarzty (2007) on all *Casearia* material at Kew from Palau. The results were inconclusive regarding the two additional names listed here. However, overall the results suggested that there may be more than one species that occurs in Palau. Most interesting were Zmarzty's (2007) comments on the material of *C. hirtella* and *C. cauliflora*. For *C. hirtella* they suggested that the three specimens available, though incomplete for certain identification, may not be of the same taxon. For *C. cauliflora* they suggested that neither of the two specimens available matched up to the protolouges of either *C. cauliflora* or *C. hirtella* [the only two possibilities listed for the Western Carolines (Fosberg et al. 1979)]. It should be noted however, that even experts on this genus stress the difficulty in identifying them to species level. Zmarzty (2007) noted in her study that there was insufficient material for verification of the specimens studied. What is clear is that further collections and study are needed for this genus in the Western Caroline Islands.

Casearia raymundii Gilg

Coral Is., July 1929, *Kanehirae 362* (BISH!); Ngatpang, 27 April 1936, *Takamatsu 1294* (BISH! & K!); Garudokku, in field, rare, 7 April 1936 *Takamatsu 1239* (K!)

Notes: This name is not recognized by IPNI, and is not in any checklist. The protologue could not be found. Study of the specimens at Kew suggested that it may be *C. hirtella* but the material was insufficient to be conclusive.

Casearia cauliflora Volk.

Olopsachal, on coral rocks of mountain, 6 May 1936, *Takamatsu 1468* (K!); Palau, August, 1932, *Kanehira 2006* (K!)

Distribution: Only known from Yap (Fosberg et al. 1979)

Notes: These two records from Palau were studied and were not able to be determined with certainty. They do not agree with the protologues of either *C. cauliflora* or *C. hirtella*.

MALVACEAE

Corchorus torresianus Gaudich.

Omekang area, west side of Bablomekang Island, small unnamed rock Island of about 10 m, 7.148333 N 134.31777 E, 17 Feb 1998, *T. Flynn 6441* (BISH!)

Notes: "On sheer limestone face of Island"

Distribution: Micronesia, New Caledonia, Tuamotus (McCormack 2007)

Grewia sp.

Lake, over water, 23 Jun 1982, *R. W. Hobdy 1521* (BISH!)

Notes: This is likely to be *Grewia crenata* (Forst.) Schinz & Guill. which is recorded for the Marianas (Fosberg et al. 1979). This specimen was confirmed as a *Grewia* species by Dr. Richard Chung, who has recently written a revision of *Grewia* for Malaysia and Borneo (Chung 2006). Additional collections with more fertile material are necessary to identify this to species.

PLANTAGINACEAE

Limnophila palauensis T.Yamaz. (formerly in Scrophulariaceae)

Babeldaob, adjacent to giant taro crop, 14 Dec 2002, *Waterhouse BMW6570,* (BISH!); Melekeok, taro patch, 17 Jan 1978, paratype, *Stemmermann 3300* (BISH!)

Notes: This is probably endemic to Palau. Yamazaki (1993) stated that this new species "is probably the same with *L. indica* (L.) Merr. var. *raymundii* Schltr. (Bot. Jahrb. Syst. 56: 571 1921)." This may be the case however, the author did not confirm this by comparing it to the type of *L. indica* (L.) Merr. var. *raymundii* Schltr. Further more, Yamazaki (1993) stated that the description of *Limnophila indica* (L.) Druce in the Flora of Guam (Stone 1970) resembles that of his new species *Limnophila palauensis* T.Yamaz.. This cannot be true considering the type of *L. indica* var. *raymundii* was distinguished from *Limnophila indica* by lacking heterophyllous and divided leaves (Schlechter

1921). Stone (1970) clearly reports a *Limnophila indica* in Guam with divided and heterophyllous leaves. Yamazaki does not stress this distinction, though his material of *Limnophila palauensis* (paratype cited above) does not appear heterophyllous. It is not described as such in the protologue. This suggests a synonymy with *L. indica* var. *raymundii*. However, since Yamazaki did not compare the two types and he has confused his new species with the records of *Limnophila indica* in Guam, further collection and study including comparison of the types of *L. indica* var. *raymundii* and *L. palauensis* and additional material from both Palau and Guam is needed.

TURNERACEAE

Turnera ulmifolia L.

Just west of the mangroves from the Airai road airport road intersection, 18 Feb 1996, *Herbst LR26198* (BISH)

Distribution: Native to Florida, the West Indies and Tropical America, widely planted as an ornamental and naturalized in the tropics (US Forest Service PIER 2007)

Notes: Introduced, cultivated. (US Forest Service PIER 2007)

VERBENACEAE

Duranta erecta L.

Koror, 4 July 1990, L. *Nairaibai, H. Adelbai, D. Otobed P-10 187* (BNM!)

Distribution: Native to tropical America, widely cultivated and naturalized in the tropics, cultivated in Palau (US Forest Service PIER 2007)

Notes: Introduced, cultivated (Space et al. 2003).

Species Doubtfully Recorded

ORCHIDACEAE

Dendrobium pachystele Schltr.

Ngeruktabel, along east coast, in cove, growing over the water 26 Jun 1982, *Hobdy 1553* (BISH!)

Notes: This determination was falsely applied as a synonym to *D. brachyanthum* Schltr. which is an accepted name. Dissection of the flowers will be necessary to determine this specimen with certainty.

Dendrobium scopa Lindl.

Malakal hill, rock outcrop on slope, 25 Aug. 1965, *Fosberg 47515* (BISH!)

Notes: This specimen does not resemble *D. scopa* which is only known to Rota, Guam, and Pohnpei in Micronesia (Fosberg et al. 1987). Dissection of flowers is necessary for determining this specimen with certainty.

FABACEAE

Tephrosia cf. **vestita** Vog.

Airai, old Japanese farming area, 20 Jan 1982, *Timberlake 33155* (BNM!)

Distribution: Native to China, Southeast Asia, Malaysia, Indonesia, PNG Philippines (ILDIS 2007)

Notes: There are three introduced *Tephroisa* species and only one native species for Micronesia (Fosberg et al. 1979). The specimen was inadequate for accurate identification.

Uraria lagopodioides DC.

Aimeliik State, Tulau, Imelsubech village, 30 Nov 1982, *Timberlake 3196* (BNM!); S.W. coast, Gakip (Gakkip), in field, 20 Apr 1936, *Takamatsu 1185*, (BISH!)

Distribution: Native to India, China, Taiwan, Southeast Asia (ILDIS 2007), New Guinea, Samoa, and Fiji (US Forest Service PIER 2007). Considered an aboriginal introduction to western Polynesia (Whistler 1988).

Notes: These specimens have been confidently doubted by Gwilym Lewis (Kew Gardens) to even be in the genus *Uraria* and have been re-determined as *Desmodium* sensu lato.

Vigna hosei (Craib) Baker

Aimeliik, Nekken Forestry Station, *Timberlake 3061, 3100, 3042* (BNM!)

Distribution: Native to India and Borneo

Notes: Introduced. Recorded as an introduction to Yap and Pohnpei (Fosberg et al. 1979) and probably introduced to New Guinea (ILDIS 2007). This specimen was originally determined by Fosberg as *Teramnus labialis* (L. f.) Spreng then re-determined it as listed here. The specimen is infertile and cannot be listed as a new record with any confidence.

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