

IX. TYPHOON EFFECTS ON INDIVIDUAL SPECIES OF PLANTS

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Observations were made on the effects of the typhoon on many individual species and their recovery. These are indicated in the following systematic list of species. The list includes all plants which were known or thought to be present on the atoll in 1946 or thereafter. Various species reported earlier but of which there are no recent records are omitted. Information has been supplied by Prof. Harold St. John and by Boyd Mackenzie, as well as taken from records gathered by the writer on a visit in 1946 and in the present survey. Names have been adjusted to correspond with those considered correct at the present time.

Asplenium nidus--Very frequent locally, terrestrial and epiphytic.

Reduced in numbers as trees on which it was growing were swept away or as ground was covered by gravel, but still very common except where islets were seriously swept by waves.

Nephrolepis acutifolia--Common locally, epiphytic, especially in and around mangrove depressions. Reduced in numbers where trees on which it was growing were swept away and individual clumps killed or seriously injured by salt or wind, but generally recovering, still common in protected places.

Nephrolepis hirsutula--Common locally. No injury noted but doubtless reduced or eliminated where islets were seriously swept by salt water.

Polypodium scolopendria--Generally very common, terrestrial and on bases and trunks of trees; still so except where islets were swept by waves. Buried by gravel in places, but otherwise no injury noted; doubtless reduced in numbers where host trees were swept away.

Pteris tripartita--Occasional and very local in protected places; terrestrial. No injury noted but doubtless reduced in numbers by destruction of habitats.

Vittaria elongata--Rare, epiphytic. No injury noted except that some clumps may have suffered from exposure to sun or salt.

Cycas circinalis--Planted in Jabor only, rare. Leaves seriously battered, one plant, at least, uprooted.

Pandanus tectorius--One of the commonest trees generally, forming part of the vegetation on the seaward margins of plantations and the principal component of the understory. Trees generally very seriously battered, some uprooted, many more broken off between stilt roots and first branches, or with most of the branches broken off. Branches either broken in leafless part or torn from trunk. Sometimes a few tufts of frayed green leaves left

on trees, especially on those in more sheltered places. Even the trees otherwise in fair condition in least affected areas had leaves broken. No sprouting seen where breaks occurred below the leafy portions of branches or in trunks. The few sprouts noted were from the soft leafy parts of branches. Apparently the lower parts of branches, trunks, or roots have no capacity for sprouting. Young plants below 1.5 m. tall on the areas not swept by waves not particularly injured.

Thalassia hemprichii--In elongate patches on lagoon bottom in about 1 m. of water. No effects noted.

Cenchrus echinatus--Common locally. Absent from many places swept bare by salt water in situation where it would be expected to be abundant.

Cynodon dactylon--Scarcely seen, not known if it was common or not before typhoon; no obvious effects seen.

Digitaria pruriens var. microbachne--Widely distributed but local, not abundant. No effects noted, but some habitats undoubtedly rendered less favorable by removal of soil and flooding by salt water.

Echinochloa crus-galli--This species seen only in taro pits, where it forms large masses. No effect noted.

Eleusine indica--Very common. No obvious effects; but doubtless some habitats made less favorable and others more favorable, resulting in elimination where soil was removed or buried and greater abundance where trees were thinned and soil only moderately disturbed.

Eragrostis amabilis--Very common. No effects noted that might not have resulted from mere dry weather.

Lepturus repens--Very general, locally abundant. In places undoubtedly buried by gravel sheets; in many places removed by wave erosion; otherwise no effects noted. New open habitats will doubtless result in increase of this species in the near future.

Paspalum conjugatum--Only seen on Pinlep Islet, where it was very common. No effects noted, but thinning out of coconuts may well encourage this species, which was luxuriant in areas on Pinlep where many trees were knocked down.

Paspalum distichum--Found in brackish depressions. No effects noted, but scour pits may become habitats for this species.

Sorghum bicolor--Very rare, on Jabor only. No effects noted, plant very rarely persisting.

Thuarea involuta--Abundant, generally distributed. Undoubtedly buried in large areas covered by gravel sheet and removed in seriously eroded areas. Otherwise no effects noted except some browning of leaves, possibly by salt water.

Cyperus compressus--Local, in Jabor only. Inundated; no effects noted. These plants possibly grew from seeds since the typhoon.

Cyperus javanicus--Local, in low or wet places. No effects noted, but possibly some habitats buried by gravel or eroded away. Scour pits and channels may eventually become new habitats for this species.

Cyperus kyllingia--Occasional, only seen on Jabor. No effects noted except some browning of leaves and dwarfing of plants in areas flooded by salt water.

Cyperus odoratus--Seen only in taro pits. No effects noted.

Cyperus rotundus--Local, in Jabor village only. No effects noted except that only young shoots were seen. The tubers undoubtedly survived the inundation by salt water.

Eleocharis geniculata--Seen only on mud in taro pits. No effects noted.

Fimbristylis cymosa--Very general, especially in open places, locally abundant. Some stands of this species doubtless buried by gravel sheets, others eroded away by waves; gravel sheets doubtless will afford extensive new habitats. No effects noted in areas not affected by waves.

Cocos nucifera--Planted over entire atoll (Pl. IV-a, -b, -c). These trees showed the most conspicuous damage of all, because of their size and abundance. Thousands of trees were either uprooted or snapped off part way up the trunk (Pls II-c, -d, V-d, VI-a, -b, -c, VII, VIII-a, IX-c, -d, X-a). On the islets along the east reef of the atoll the majority of coconut trees are down; on some islets almost all. On the south reef, west reef, and at the northern end many are down, but there are still a majority standing in most places. The nuts, of course, are stripped from most of those left standing. However, on the less damaged islets there are occasional trees with nuts in drinking condition and some trees are flowering. A surprising thing was the extent to which young palms, with scarcely any trunk, were flattened out, especially where hit by waves; here more were down than standing. Ripe nuts lying on ground are germinating in great abundance wherever they have not been picked up.

Elais guineensis--Planted on Jabor. The only tree was destroyed, apparently by waves.

Pritchardia pacifica--Planted on Jabor. The only tree was destroyed, apparently by waves.

Alocasia macrorrhiza--This was common generally on larger islets; seems not to have been much affected, even where inundated.

Colocasia esculenta--Very rarely noted; seems not to have been much planted by the Marshallese. No effects noted; not inundated.

- Cyrtosperma chamissonis--Abundant in taro pits on Pinlep Islet (Pl. IX-b).
The leaves were apparently destroyed by the storm but were sprouting up again. Leaves at time of survey up to 4-5 dm. high; not inundated.
- Epipremnum pinnatum--Was common in experiment station grounds. Occasional plants survived inundation and are growing again.
- Scindapsus aureus--Was common in experiment station grounds. Many plants survived inundation and are growing again.
- Xanthosoma sagittifolia--Was occasionally planted around villages. Some plants, at least, survived inundation.
- Rhoeo spathacea--Common on Jabor. Inundated but no effects noted.
- Agave sisalana--Seen only in one place on Jabor, young plants only. Large ones may have been swept away, if there were any.
- Cordyline terminalis--Planted on Jabor; battered by storm and inundation but recovering.
- Sansevieria roxburghiana?--Planted on Jabor; no effects noted.
- Crinum asiaticum?--Common around villages and home sites; survived inundation; large plants apparently mostly destroyed, smaller ones not flowering but appear healthy.
- Hippeastrum puniceum--Rarely planted about dwellings; no effects noted.
- Zephyranthes rosea--Commonly planted; no effects noted; survived complete inundation by salt water.
- Tacca leontopetaloides--Generally distributed; doubtless some plants too deeply buried for recovery and others removed by erosion, but those in most situations apparently unaffected, even where inundated by salt water.
- Dioscorea sp.--Seen by St. John in 1946 on Imroj but not found in 1958.
- Musa nana--Not seen with certainty on this survey.
- Musa sapientum--Generally planted; shoots destroyed by storm but rhizomes apparently unaffected, even by inundation by salt water, as healthy shoots, up to half mature size, were very common at time of survey.
- Canna indica?--Occasionally planted; shoots apparently destroyed but tubers unaffected and new shoots appearing.
- Peperomia pellucida--Weed on Jabor; plants seen were probably ones that had grown from seed after typhoon.

Peperomia ponapensis--After typhoon seen only on Majurirek in protected area on western end where there was no inundation; no effects noted, but seen on Imroj in 1946 and not after typhoon.

Casuarina equisetifolia--Planted on Jabor, trees reaching 10 m. height, a few trees uprooted, most of those standing had lost most of their branches and had been pretty well stripped of photosynthetic branchlets, but were vigorously sprouting new branchlets from trunk and remaining limbs, apparently unaffected by inundation.

Artocarpus altilis--(Impractical to distinguish A. mariannensis in dead condition but many of living trees were this.) Breadfruit was a common and important tree on all inhabited islets (Pl.IV-b). It was very badly damaged by the storm (Pls.VI-a,VIII-a,-b). On the eastern islets that were inundated most trees were uprooted and some that were still standing were dead probably from the effect of salt water on the roots. Most of the branches were torn off the trees left standing in all areas examined. In very few places were trees of over 3 dm. diameter at breast height left standing and these were mostly dead. On the non-inundated islets the trunks and few remaining branches were sprouting leafy branchlets. On Majurirek and Pinlep several partly uprooted trees were observed which had many partly grown fruits in good condition. It is probable that most of the standing trees on the south and west islets will make a rather prompt recovery. Seedlings were noted on many areas which had not been inundated and a few on lightly inundated areas. Breadfruit trunks were generally not broken. Either the entire tree was uprooted or branches were split off, mostly at their bases, and small branches torn off of larger branches that remained.

Ficus elastica--Several large trees were growing in Jabor. They survived the inundation and remain standing, but with most of the branches torn off and most of leaves damaged.

Ficus tinctoria--One tree seen on Jabor, uprooted but sprouting from trunk.

Fleurya ruderalis--Common generally in rocky or open places. Doubtless mostly destroyed by typhoon in all places where there was flooding by salt water or exposure to strong wind; but plants have since come up from seeds in most appropriate habitats.

Pilea microphylla--Naturalized from cultivation. Doubtless destroyed by typhoon, but on Jabor and Pinlep has come up abundantly from seed.

Pipturus argenteus--Common in some areas, especially somewhat protected places. Doubtless many plants destroyed by typhoon but some sprouting from battered plants and much seedling reproduction.

Procris pedunculata--Known only from one restricted area on west end of Majurirek Islet where there was no inundation by salt water. Common there but not flowering. No effects observed which could easily be ascribed to typhoon.

Boerhavia tetrandra--Known only from restricted area on east end of Majurirek Islet. No effects observed.

Bougainvillea sp.--Planted around villages and in experiment station, but apparently destroyed by storm except on Kinajon, where two somewhat defoliated plants remain.

Mirabilis jalapa--Planted around villages. No effects noted, but probably present plants have grown from seed since typhoon.

Pisonia grandis--Common, but only small plants seen in most places. On Mejatto one small tree still standing. On Ribon and Lijeron this is the most prominent species. Here some large trees have been uprooted, others are still standing but with many branches blown off and much defoliation (Pl.X-d). Almost all fallen trees and all standing ones sprouting vigorously.

Amaranthus viridis--Common weed, seen only on Jabor and Kinajon, where it is abundant locally, probably grown from seed since the typhoon.

Celosia argentea--Seen on Imroj in 1946, not found on present survey.

Gomphrena globosa--Planted commonly around dwellings even in inundated areas probably grown from seed since the typhoon.

Portulaca oleracea--Generally common. In areas inundated by salt water probably growing from seed since typhoon.

Cassytha filiformis--Common locally, parasitic on other plants. No effects noted.

Hernandia sonora--Occasional fair sized trees, mostly uprooted but continuing to grow, leaves on these trees in inundated areas reduced in size.

Nasturtium sarmentosum--Rare weed on Jabor; no effects noted, but may have come up from seed after inundation.

Kalanchoe pinnata--Local on Imroj and Kinajon, no effects noted but doubtless reduced in numbers on Imroj by burying and erosion.

Albizia lebbek--Planted on Jabor but did not survive inundation by salt water.

Canavalia microcarpa--Common on less disturbed islets, seedlings seen on some eroded areas and deposition areas; no effects noted.

Caesalpinia pulcherrima--Seen planted on Imroj in 1946 but not found during present survey.

Cassia occidentalis--Very local on Jabor, destroyed by storm but seedlings growing in some places.

Crotalaria incana--Dominant plant on many open areas on Jabor, plants grown from seed since inundation are flowering and fruiting abundantly. Deliberately introduced and spread long before typhoon.

Delonix regia--Several large trees planted on Jabor; uprooted by typhoon but still alive, flowering.

Erythrina variegata var. orientalis--One or two large trees planted on Jabor; inundated, uprooted by typhoon but still alive.

Inocarpus fagiferus--Several trees planted on Jabor; inundated, badly battered and defoliated by typhoon but still alive, sprouting from trunk.

Intsia bijuga--Seen on several islands but always blown down by typhoon and sprouting, even in inundated areas.

Leucaena glauca--Abundant on Jabor; survived inundation by salt water, defoliated and upper parts killed by typhoon, now sprouting abundantly from roots and lower parts.

Sophora tomentosa--Seen on Mejatto in 1946, not found on this survey.

Vigna marina--Common on all islets; large numbers undoubtedly buried by gravel and removed by erosion, but in less disturbed places very abundant, probably greatly increased by opening up of shady plantations by fall of trees. Seedlings common on newly deposited gravel.

Citrus aurantifolia--Occasionally planted; in areas inundated by salt water the trees look half-dead but sprouting from trunk, in other areas merely somewhat defoliated.

Citrus maxima--Planted on Jabor but did not survive typhoon.

Citrus sinensis--Planted on Jabor, some plants said to have survived typhoon, not seen.

Citrus reticulata--Planted on Jabor but did not survive typhoon.

Acalypha wilkesiana--Planted on Jabor and Pinlep; no effects noted.

Codiaeum variegatum--Planted on Majurirek Islet; no effects noted.

Euphorbia chamissonis--Common on lagoon ridges on Majurirek and Pinlep Islets; no effects noted.

Euphorbia glomerifera--Common weed on Jabor; no effects noted.

Euphorbia hirta--Very common in waste places on some inhabited islets; no effects noted but plants seen could have grown from seed after typhoon.

Euphorbia prostrata--Local around dwellings; no effects noted.

Euphorbia pulcherrima--Planted on Jabor but did not survive typhoon.

Phyllanthus amarus--Abundant weed on Jabor, Kinajon and Pinlep; no effects noted, but on Jabor could have grown from seed since inundation by salt water.

Ricinus communis--Planted on Jabor but did not survive typhoon.

Allophylus timorensis--Common on Kinajon, Majurirek and Pinlep; seen also on Imroj, Jabor and Mejatto in 1946, not in 1958. Larger trees on Kinajon uprooted but sprouting; others badly battered but growing and flowering; not definitely known to have survived inundation.

Triumfetta procumbens--Common generally, especially in open places, but not seen on Jabor; no effects noted but doubtless many plants buried and eroded away; seedlings common.

Hibiscus esculentus--Planted in garden of imported volcanic soil on Jabor; still growing and fruiting, in spite of inundation by typhoon and periodic inundation of this garden by highest tides.

Hibiscus mutabilis--Planted in Jabor but apparently did not survive typhoon.

Hibiscus tiliaceus--Occasional on inhabited islets. One or two trees knocked over but sprouting; seen on Imroj in 1946 but not in 1958. Abundant in some mangrove depressions but tops usually dead; apparently survived some inundation on Pinlep.

Sida fallax--Seen planted on Mejatto in 1946 but not found in 1958.

Thespesia populnea--Planted on Jabor but apparently did not survive the typhoon.

Ceiba pentandra--One tree planted on Jabor, uprooted and still alive, but doubtful if it will survive; seen on Imroj in 1946 but not in 1958.

Calophyllum inophyllum--Large and conspicuous tree on most islets, especially on lagoon ridges, badly battered by typhoon, more trees uprooted or partly so than not; some blown completely into lagoon. Generally sprouting if some roots still in ground even where inundated. Not seen on two smaller islets except for one seedling on Lijeron.

Passiflora laurifolia--Said to have been planted on Jabor but not found.

Carica papaya--On most islets, but large trees all eliminated by typhoon. Seedlings and partly grown, not very healthy, trees are occasional to common.

Citrullus vulgaris--Planted on Jabor but not seen after typhoon.

Cucumis sativus--Planted on Jabor but not seen after typhoon.

Cucurbita maxima--Commonly planted around habitations, no effects noted but small plants only and very scarce on areas inundated by salt water.

Cucurbita pepo--Planted on Jabor but not seen after typhoon.

Pemphis acidula--Common, especially on most exposed areas, on bare rocks; usually badly beaten and completely defoliated by typhoon (Pl.III-a), but seldom uprooted. Often broken off a few dm. above ground, small branches usually killed (Pl.IX-a). Sprouting abundantly from root crowns and trunks (Pl.VIII-c).

Sonneratia alba--Seen near Sydney Pier in 1946, not found in 1958.

Bruguiera gymnorhiza--Dominant tree in most mangrove depressions; larger trees often dead or with tops dead (Pls.IV-d,V-c), smaller ones, especially seedlings 1 m. tall or less, not much affected by typhoon.

Terminalia catappa--Planted around villages, especially on Jabor, mostly uprooted by typhoon but still alive and sprouting.

Terminalia samoensis--Common, especially on shore ridges and in brushy areas; generally not much injured by typhoon, but some larger plants uprooted though still sprouting.

Barringtonia asiatica--Small groves of several large and many small trees on Mejatto and Imroj islets; most of trees uprooted or large ones with branches torn off; sprouting abundantly from roots, stumps, trunks and large branches, as well as abundant seedlings. These groves were so situated that they got the full force of both wind and waves.

Miconia sp.?--Something identified as this genus was planted on Jabor but not found after the typhoon.

Brassaia actinophylla--Large tree planted on Jabor, badly battered by storm but sprouting from trunk and larger branches.

Polyscias fruticosa--Planted on Jabor but apparently did not survive typhoon.

Polyscias guilfoylei--Seen on Jabor in 1946 but not found in 1958.

Polyscias scutellaria--A few plants in village on Majurirek; no effects noted.

Centella asiatica--Common on several islets, mostly in places not inundated by salt water; no effects noted but plant probably was more common before typhoon, especially on inundated islets.

Jasminum sambac--Planted on Majurirek; no effects noted.

Catharanthus roseus--Planted on Pinlep; no effects noted, but was probably found on other islets before typhoon.

Cerbera manghas--Planted on Jabor; larger trees uprooted but sprouting, saplings locally very common.

Nerium spp.--N. indicum and N. oleander both known from atoll in 1946; plants seen on Majurirek Islet in 1958 not flowering and hence unidentified; no effects noted except lack of flowering.

Ochrosia oppositifolia--Seen only on the seaward side of the west end of Imroj Islet, where there were several fair sized trees. Most of these had been knocked down and the places where they were growing covered by a thick gravel deposit. Two, almost at the extreme end of the seaward side, were still standing, badly battered but with some green leaves.

Plumeria rubra--A few shrubs or small trees planted around dwellings and graves. Those on Mejatto, Majurirek and Pinlep showed no signs of damage, but one on Kinajon was partly uprooted. That on Mejatto was on a small section that was not touched by waves. That on Kinajon was not inundated either, except possibly by lagoon waves.

Ipomoea batatas--Seen planted on Imroj in 1946 but not found in 1958.

Ipomoea littoralis--Occasional locally on Jabor and Pinlep; seen on Imroj in 1946 but not in 1958; no effects noted but on Jabor probably much reduced by inundation and on Imroj probably eliminated.

Ipomoea pes-caprae ssp. brasiliensis--Seen only on Jabor, except for a single seedling on Ribon. In 1946 this was one of the most abundant plants on the narrow strip south of Jabor and around Sydney Pier. Now there is little of it to be seen, as might be expected, since this was where inundation and stripping of loose material were most severe.

Ipomoea tuba--Seen only on Kinajon and around large banked oil tank at Sydney Pier. No effects noted, but it would have been expected to be more abundant.

Cordia subcordata--Common generally, especially around periphery of most islets; few trees actually uprooted but several somewhat tipped over, some dead or at least leafless above, but with vigorous lower branches flowering even where there was severe inundation; seedlings common on deposited material.

Tournefortia argentea--Seen on all islets visited, on most of them common around periphery; variously battered by typhoon, uprooted or branches broken off, usually sprouting vigorously; seedlings abundant on newly deposited or disturbed ground.

Clerodendrum inerme--Occasional, locally common; defoliated but not badly hurt by typhoon, recovering even where inundated by salt water.

Lantana camara--Said to have been planted on Jabor but apparently did not survive typhoon.

Premna obtusifolia--Nowhere common; most plants severely battered, those seen on Mejatto were only stumps with sprouts, but perhaps cut before typhoon; plants on Majurirek less damaged than others.

Stachytarpheta urticifolia--Common weed on Jabor, probably all plants seen grew from seeds after typhoon.

Ocimum sanctum--Planted on Pinlep; seen on Imroj in 1946, not in 1958; no effects noted but probably eliminated from Imroj.

Nicotiana tabacum--Growing on Jabor in 1946, not seen in 1958.

Physalis angulata--Abundant weed on most larger islets; probably grew from seed since typhoon.

Solanum nigrum--Common weed on Jabor and Pinlep, probably grown from seed since typhoon.

Jacaranda filicifolia--Planted on Jabor but apparently did not survive typhoon.

Beloperone guttata--Planted on Jabor but not found after typhoon.

Blechnum brownei--Abundant weed locally on Jabor, probably grown from seed since typhoon.

Hemigraphis reptans--Rare, only seen on lagoon side of Pinlep; no effects noted.

Pseuderanthemum carruthersii--and its variety atropurpureum. Planted very generally around habitations; suffered rather little damage even from inundation, except where bent down and partly buried by gravel sheets, even here flowering freely.

Dentella repens--Locally common on Jabor; said to have appeared rather recently in field of bananas brought from Kusaie and Ponape; no effects noted, plants probably from seed after typhoon.

Guettarda speciosa--Common on most islets; most trees either badly broken or uprooted, some of them sprouting, seedlings common.

Hedyotis biflora--Occasional on Imroj, Mejatto and Jabor in protected places; no effects noted, but probably much less common than before typhoon.

Ixora casei--On Imroj before the typhoon, not seen after, apparently did not survive typhoon.

Ixora fraseri--Planted on Jabor but did not survive typhoon.

Morinda citrifolia--Common on most islets, plants mostly bent down or broken off by typhoon but sprouting vigorously, several very large plants uprooted; seedlings occasional.

Hippobroma longiflora--Weed in Jabor, one plant seen, in flower, during survey.

Scaevola sericea--One of most common plants on most islets; doubtless greatly reduced in numbers by erosion of seaward ridges, many plants battered but sending out leaves; seedlings common.

Adenostemma lavenia--Seen on Imroj in 1946, not found in 1958 except one plant seen on Kinajon Islet.

Ageratum conyzoides--Known on Jaluit and reported by Germans and Japanese, but not found in 1946 or subsequently, until one small plant was collected just above lagoon beach on Jabor.

Cichorium endivium--Said to have been planted in garden on Jabor, not found.

Spilanthes iabadicensis--Said to have been a weed on Jabor, not found.

Synedrella nodiflora--Weed, common to occasional on Jabor, Kinajon, and Pinlep; no effects noted, probably grown from seed after typhoon.

Tagetes sp.--A few plants seen in garden on Majurirek, no effects noted but may have been planted after typhoon.

Vernonia cinerea--Common weed on most inhabited islets; no effects noted, but plants could have come from seed after typhoon; not seen on Imroj where it was found in 1946.

Wedelia biflora--Common on all islets visited except Lijeron. Abundant on parts of wider ones; no effects noted, but doubtless greatly reduced in places eroded by waves and where much gravel was deposited; probably much more abundant than formerly in places where coconuts were knocked down but which were not inundated by salt water (Pl.VIII-b).