DISTRIBUTION AND HABITAT FEATURES OF THE SEDGE *KYLLINGA NEMORALIS* ON THE POLYNESIAN ISLAND OF MO'OREA

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Abstract. This study focuses on the current distribution and habitat preferences of the sedge *Kyllinga nemoralis.* It is a weed on Mo'orea, but an invasive to other islands of the Pacific. Annual precipitation, temperature, water availability, soil moisture, soil type, canopy cover and elevation are shown to influence the distribution of this species. A minor transplant study affirms its preference of full sun locations to those with low light due to canopy cover.

Key words: Sedge; Cyperaceae; Kyllinga nemoralis; rangelands; roadsides; Mo'orea, French Polynesia

INTRODUCTION

Invasive plant species are problematic to native plant populations worldwide (Vitousek et al. 1996). A plant becomes invasive when, after dispersal to a new range, its progeny reproduces, thrives and persists (Elton 1958). Invasives enter a population by filling seasonally or habitually empty niches, then out-competing their native counterparts (Davis 2000). *Kyllinga nemoralis* (Forst.) exhibits characteristics common to the success of an invasive species such as asexual spreading, positive reaction to human-caused disturbance (Mack 2000), early and consistent reproduction, and small seed mass (Rejmanek 1996). Several species of Cyperaceae are listed as highly invasive worldwide (Muyasa et al. 2001). Sedges of the genus *Kyllinga* are recognized for their invasive tendencies within tropical climates (Space 2002). This trend is exemplified by a related sedge, *Kyllinga polyphylla.* Whether due to later introduction rate or a reduced ability to spread due to differing environmental conditions, *Kyllinga* species exhibit a less aggressive distribution on Mo'orea. *Kyllinga nemoralis* (Forst.) is native to the Old World Tropics. It is a listed invasive introduction, and moderate invader to Hawaii (Whister 1994, SREP 2000), an invasive weed in Samoa (Whistler 2002) and is considered a benign "mauvaise herbe," or weed, in Mo'orea (Welsh 1984, Whistler 1995).

The first step in managing an invasive species is understanding its distribution (Chornesky 2003). In this study, I assess the distribution of *K. nemoralis* in Mo'orea. Its distribution on Tahiti and other Pacific islands extends to 800 meters in elevations and is found along roadsides and in close proximity to human habitations (Whistler 1995). At first glance, *K. nemoralis* is not as extensively established on Mo'orea as it is in its neighboring island, Tahiti. I hypothesize that *K. nemoralis* has a preferred habitat type that includes zero or low canopy cover and ready moisture availability. I also propose that average annual precipitation, temperature, water availability, soil moisture, soil type, elevation, and proximity to human interaction contribute to the presence of *K. nemoralis*.

METHODS

Study organism

K. nemoralis is a rhizome-spreading perennial sedge with angular stems, a brown to purple leaf sheath, and a globose terminal head (Whister 1995). With its three to four long, distinct bracts and fluffy white

inflorescence, this sedge is easily identified from surrounding vegetation. Other names for *K. nemoralis* include *K. cephalotes* (Jacq.) *K. monocephala* (Rottb.), and *Cyperus kyllingia* (Endl.). *K. nemoralis*, known as Mo'u upoo in Tahitian (Petard 1986). Samoans called this herb Tuisē (Whistler 2001) and mo'u upo'o (PIER). In Hawaiian, it is known as mau'u mokae, and to the Maori of the Cook Islands it is called maku 'ōniāni. While this species has been a trusted remedy to illness such as rheumatism (Petard 1986), today it appears as a common weed. It grows in full sun in lawns beside houses (Petard 1986), and pastures. It is also found alongside roads in ditches, thriving on the moist habitats formed by storm drainage.

Terms

The culm is the above-ground shoot, from which leaves and inflorescence diverge. The culm extends from the rhizome to the base of the inflorescence.

Distribution

Initial distribution study was conducted by way of planned habitat searches. Three searches were conducted of five minutes each for each of 34 localities. Localities searched included variation in elevation, average annual temperature, average annual precipitation, canopy cover, and soil type. Choice of localities was made by overlaying multiple map layers using ArcMap. Layers were produced by taking digital photographs of soil type, temperature, precipitation, and vegetation maps from OSTRAM's *Atlas de la Polynesie Francaise*, georeferencing them using ArcMap, georeferencing them, and layering them with a topographical map of Mo'orea, obtained from Berkeley's GIIS website. Noted and obtained from each locality was a GPS point, a 3cm x 1cm cylindrical soil core, average canopy coverage, presence or absence of *K. nemoralis*, and a list of present Cyperaceae. GPS point data was later used to infer the presence of *K. nemoralis* throughout the island (Image 8). Soil core samples extended only 3cm into the soil to correspond with average depth of root mass. Canopy cover percentages were collected to show the variation in canopy cover habitat preference.

Habitat Preference

Habitat preference was inferred from statistical analysis of presence/absence data of *K. nemoralis* within each habitat variable. Variables included: elevation, average annual temperature, average precipitation, water availability, canopy cover, vegetation type, soil moisture, and soil type. A transplant study then was used to confirm the hypothesis: while *K. nemoralis* prefers environments where moisture is readily available, it does not perform well in moist, densely shaded environments.

Transplant

One hundred rhizomes of *K. nemoralis* were taken from a thriving roadside population and placed in two habitat types where *K. nemoralis* was never found to be naturalized during the initial distribution study: within the *Inocarpus fagifer* and *Hibsicus tiliaceous* forests, under 60% - 100% canopy cover, within iron-rich, high-moisture content soils. Within the transplant sites, 10 plots measuring 15cm x 7cm x 7cm deep were formed every 5 meters along two 25 meter transects: one set of 10 plots in *Inocarpus fagifer* forest, the other set of 10 plots in *Hibsicus tiliaceous* forest. Each transplant site contained 50 total rhizomes. Transects ran perpendicular to a stream's edge. 10 healthy rhizomes were measured, labeled, and planted in each plot. Upon planting, soil from host site was rinsed off each rhizome to show bare roots, and measurements were taken of each rhizome's length in cm, with one measurement of a culm length for each

rhizome. Culm lengths were only taken at a distinct stage of flowering, to avoid discrepancies inherent in different stages of development. Within the host population, 20 culm lengths were measured and labeled at the time of transplant specimen removal. Upon completion of 20 days in each environment, rhizome and culm measurements were again taken of transplant specimens, and culm measurements alone for host population. Growth rate of shade-grown versus full-sun host population *K. nemoralis* was then shown through rhizome growth and culm growth.

Associated Species

Ten locations were chosen from the 20 located in the initial distribution study that showed presence of *K. nemoralis*. Sites were visited to gather additional data on associated species. Transects of 25 meters ran in a pre-determined randomized ordinal direction. Four 25cm^2 quadrats were taken at 7, 12, 19, and 25 meter marks. *K. nemoralis* was consistently found within 3 meters of the transect line, if not along the transect line.

Statistical Tests

The following tests were performed using the JMP 7 statistical analysis program: Oneway Analysis of Culm Difference By Transplant Location, principal components analysis was also performed of transplant factors including distance from water source, percent canopy, soil moisture, and average light per location.

RESULTS

Distribution

K. nemoralis occurs on Mo'orea in moist (fig. 1), sunny (fig. 2), low-elevation (fig. 3) locations. These areas also exhibit low-range precipitation levels (fig. 4) and close proximity to roads. While distribution is limited to moist areas near human habitation, low average water availability levels are common among distributions of *K. nemoralis.*

Habitat Preference

The transplant study showed that culm and rhizome growth are not correlated. Growth rates between full-shade sites were not significant (fig. 5). *K. nemoralis* preferred full-sun to both dense-canopy environments (fig. 6). Intense soil moisture levels did not encourage growth of *K. nemoralis* in the absence of full-sun. Growth rates were often negative in full-shade plots, and positive in full-sun. Soil type and soil moisture were correlated., and *K. nemoralis* was more likely to occur in soil types 2, 5, 6, 8, and 9 than in type 11. It is not likely to occur in soils 12 and 7 (fig. 7). GIS projection of habitat preference on Mo'orea is shown in figure 8.

DISCUSSION

The current distribution of *K. nemoralis* on Mo'orea is influenced by temperature, soil type,

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APPENDIX A

RESULTS OF STATISTICAL ANALYSIS

Oneway Analysis of Culm Difference By Transplant Location

Oneway Anova
Summary of Fit

Rsquare	0.055084
Adj Rsquare	0.038932
Root Mean Square Error	18.31929
Mean of Response	-3.57242
Observations (or Sum Wgts)	120

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Transplant Location	2	2288.952	1144.48	3.4103	0.0363
Error	117	39264.788	335.60		
C. Total	119	41553.740			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
CJ7 roadside ditch	20	6.0630	4.0963	-2.05	14.18
Hibiscuss forest	50	-4.7200	2.5907	-9.85	0.41
Inocarpus forest	50	-6.2790	2.5907	-11.41	-1.15

Std Error uses a pooled estimate of error variance

Oneway Analysis of Rhizome Difference By Transplant Location

Oneway Anova
Summary of Fit

Rsquare	0.000134
Adj Rsquare	-0.01007
Root Mean Square Error	3.361285
Mean of Response	-0.3915
Observations (or Sum Wgts)	100

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Transplant Location	1	0.1482	0.1482	0.0131	0.9090
Error	98	1107.2271	11.2982		
C. Total	99	1107.3753			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
CJ7 roadside ditch	0	.	.	.	.
Hibiscuss forest	50	-0.43000	0.47536	-1.373	0.51333
Inocarpus forest	50	-0.35300	0.47536	-1.296	0.59033

Std Error uses a pooled estimate of error variance

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Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
CJ7 roadside ditch	20	6.0630	5.7129	1.2774	3.39	8.737
Hibiscuss forest	50	-4.7200	18.8237	2.6621	-10.07	0.630
Inocarpus forest	50	-6.2790	20.8407	2.9473	-12.20	-0.356

Oneway Analysis of Rhizome Difference By Transplant Location

Oneway Anova
Summary of Fit

Rsquare	0.000134
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Transplant Location	1	0.1482	0.1482	0.0131	0.9090
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Std Error uses a pooled estimate of error variance

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
CJ7 roadside ditch	0	.	.	.	.	.
Hibiscuss forest	50	-0.43000	1.67262	0.23654	-0.905	0.04535
Inocarpus forest	50	-0.35300	4.44959	0.62927	-1.618	0.91156

Bivariate Fit of K.nemoralis (y/n) By SOIL MOISTURE

Linear Fit
K.nemoralis (y/n) = 0.9652918 - 0.1610492*SOIL MOISTURE

Summary of Fit

RSquare	0.110694
RSquare Adj	0.098512
Root Mean Square Error	0.440757
Mean of Response	0.693333
Observations (or Sum Wgts)	75

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.765207	1.76521	9.0865
Error	73	14.181460	0.19427	**Prob > F**
C. Total	74	15.946667		0.0035

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.9652918	0.103585	9.32	<.0001
SOIL MOISTURE	-0.161049	0.053427	-3.01	0.0035

Bivariate Fit of K.nemoralis (y/n) By % CANOPY

Linear Fit

K.nemoralis (y/n) = 0.7727088 - 0.0078749*% CANOPY

Summary of Fit

RSquare	0.273191
RSquare Adj	0.264218
Root Mean Square Error	0.408027
Mean of Response	0.662651
Observations (or Sum Wgts)	83

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	5.068846	5.06885	30.4461
Error	81	13.485371	0.16649	**Prob > F**
C. Total	82	18.554217		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.7727088	0.049028	15.76	<.0001
% CANOPY	-0.007875	0.001427	-5.52	<.0001

Bivariate Fit of K.nemoralis (y/n) By ALTITUDE (ft)

Linear Fit

K.nemoralis (y/n) = 0.7616211 - 0.00034*ALTITUDE (ft)

Summary of Fit

RSquare	0.203911
RSquare Adj	0.194082
Root Mean Square Error	0.427031

Mean of Response	0.662651
Observations (or Sum Wgts)	83

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3.783402	3.78340	20.7474
Error	81	14.770815	0.18236	**Prob > F**
C. Total	82	18.554217		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.7616211	0.051664	14.74	<.0001
ALTITUDE (ft)	-0.00034	7.463e-5	-4.55	<.0001

Bivariate Fit of K.nemoralis (y/n) By HYDRO (m)

Linear Fit

K.nemoralis (y/n) = 0.7602717 - 0.000594*HYDRO (m)

Summary of Fit

RSquare	0.172839
RSquare Adj	0.162627
Root Mean Square Error	0.435285
Mean of Response	0.662651
Observations (or Sum Wgts)	83

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3.206895	3.20690	16.9253
Error	81	15.347322	0.18947	**Prob > F**
C. Total	82	18.554217		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.7602717	0.053347	14.25	<.0001
HYDRO (m)	-0.000594	0.000144	-4.11	<.0001

Bivariate Fit of K.nemoralis (y/n) By PRECIP

Linear Fit

K.nemoralis (y/n) = 1.2501546 - 0.0002097*PRECIP

Summary of Fit

RSquare	0.135996
RSquare Adj	0.125329
Root Mean Square Error	0.444874
Mean of Response	0.662651
Observations (or Sum Wgts)	83

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2.523302	2.52330	12.7496
Error	81	16.030915	0.19791	**Prob > F**
C. Total	82	18.554217		0.0006

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.2501546	0.17163	7.28	<.0001
PRECIP	-0.00021	5.874e-5	-3.57	0.0006

Oneway Analysis of Soil Moisture By Soil Type

Oneway Anova
Summary of Fit

Rsquare	0.415494
Adj Rsquare	0.353967
Root Mean Square Error	0.521467
Mean of Response	1.316279
Observations (or Sum Wgts)	43

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Soil Type	4	7.345347	1.83634	6.7530	0.0003
Error	38	10.333258	0.27193		
C. Total	42	17.678605			

Means for Oneway Anova

Level	Number	Mean	Std Error	Lower 95%	Upper 95%
4	12	1.36667	0.15053	1.0619	1.6714
5	8	1.18750	0.18437	0.8143	1.5607
6	8	0.71250	0.18437	0.3393	1.0857
8	11	1.90909	0.15723	1.5908	2.2274
9	4	1.00000	0.26073	0.4722	1.5278

Std Error uses a pooled estimate of error variance

APPENDIX B

Cyperaceae of French Polynesia		
Genus species	**Locality**	**Description**
Carex tahitensis	Tahiti (Fosberg)	Plants tufted perrenials, (20) 60-80 cm tall, the culms sharply 3-angled, the angles spinulose-serrulate; lowermost leaves bladeless, the blades elongated upward, finally to 60 cm long or more and much overtopping the inflorescences; inflorescence 10-20cm long, subteneded by foliose bracts to 25cm long, spikes pedunculate, 3-6 (or more), 1.5-3 cm long, 6-12mm thick, androgynous; peduncles 1-7cm long, the basal one the longest; lemma of staminate floret ca. 3mm long; lemma of pistillate floret ca 2.5mm long; perigynia 3-4mm long or more, irregularly biconvex, many-veined, the apex acute, the mith minutely bidentate, achene dull yellow to brownish, ca 1.7mm long. Socitey islands ; tahiti, Orofena, Mt. Marau, endemic. (Welsh)
Cladium jamaicense	Tahiti, Tetiaroa, Huahine, Tahaa, Maupiti, Tupai (Fosberg) Tahiti, Tupae, Huahine, Feie, Raietea, Tahaa, New World, Many pacific Islands, Asia. (Welsh)	Perenials from thick, spreading rhizomes; culm solitary, ca. 1.5-2.5 m tall, terete, often with extra-vaginal shoots at lower nodes; leaves cauline, the blades thick, coriaceous, serrulate-scabrous, the apex caudate; sheathes loose, shorter umbellate corymbs, these terminal and lateral, nearly as wide as the peduncle and rays flattened; bracts leafy, sheathing, much longer than their subtending corymb; congested in globose heads of 4-12, each one ovoid-ellipsoid; glumes broadly ovate, contracted to the obtuse or ovoid-globose, 1.8-2mm long, apiculate,

		rounded basally. Society Islands; Tahiti; Tupae; Huahine, Feie, wetland margin of lagoon; Raiatea, Tahaa; widely distributed in the New World, many Pacific Islands, Asia. (Welsh)
Cyperus alternifolius/ flabelliformis	Tahiti, Raiatea (Fosberg) Society Islands; Tahiti, low, swampy land near Outo-maroro, Punaauia; introduced, cultivated and escaped; originally described from sw. Asia and adjacent Africa; Raiatea. A portion of this has been called C. papyrus. (Welsh)	Perennial, from short, woody rhizome; culms tufted, 5-15dm tall, trigonous to subterete, scabrous below the corymb; basal leaves reduced to bladeless sheathes; basal leaves reduced to bladeless sheaths; basal sheaths 10-20cm long, the lower ones yellowish brown; corymbs large, dense, decompound, 15-30cm in diameter, primary rays numerous, slender, 7-10cm long, each with 4-10 secondary rays, 1-1.5cm long, the lower ones yellowish brown; corymbs large, dense, decompound, 15-30cm in diameter, primary rays numerous, slender, 7-10cm long; involucral bracts numerous (12-20), stiff, flat, subequal, ca twice as long as the corymb, 2-12mm wide, the apex abruptly acute; spikelets clustered at apices of secondary rays, densely 6-to30-flowered, lanceolate-oblong to elliptic, flattened, 3-9mm long, 1.7-3 mm wide, the rachilla not winged; glumes pale green and variegated with rusty brown, membranous, ovate, 1.5-2mm long, 3-or 5-nerved, the keel prominent, acute apically; style subequal to length of achene;

		stigmas 3, elongate; achenes brown, trigonous, less than half as long as the glume; 2n=30,32. (Welsh)
Cyperus compressus	Tahiti, Maupiti (Fosberg) All main island groups (Whistler) Society Islands; Tahiti, Arue, introduced, pantropical, originally described from North America, Paea District; Mehetia; Meetia; Raiatea; Marquesas; cosmopolitan weedy species. (Welsh)	(Chlorocyperus c.) Tufted annual sedge with fibrous roots, culms erect, 3-sided, leaves basal, shorter than culm, spikelets 3-12 o up to 5 rays subtended by leaf-like bracts, fruit a 3-sided achene (Murdock's checkllist) Tufted annual sedge with fibrous roots, Culms erect, 4-60cm in height, 3-sided, glabrous. Leaves few, basal, blade linear, flat 1-3mm in diameter, shorter than the culms; leaf sheath membranous, pale brown, striate. Inflorescence umblliform with 3-12 spikelets on 2-5 rays up to 8 cm long, or sessile in dense clusters, subtended by 2-4 unequal, leaf like bracts 4-20cm long. Spikelets 3-12 per axis, lanceolate to oblong, 0.5-3.5m lolng, 15-40 flowered, laterally compressed, imbricate, green turning yellow. Glumes ovate, 3-3.5mm long, strongly folded with an acute keel, acute at the apex with a short mucro. stamens 3. Ovary superior, style 3-lobed. Fruit a broadly obovate, 3-

		sided achene 1-1.3mm long, shiny dark brown. (Whistler) Tufted annuals, with fibrous roots; culms spreading, 8-30dm tall, trigonous, smooth;leaves few per culm, basal, with blades pale green, linear, flat, shorter than the culm, 1-3mm wide; sheaths membranous, pale brown, striate; inflorescences umbelliform or congested, 2-10cm long and wide, rays (when present) 2-5, spreading, 0.8-5cm long, slightly compressed, the spikes with 3-10 spikelets on a shortened axis; involucral bracts 2-4, foliaceous, unequal, the longest 2-3times as long as the inflorescence; spikelets oblong-lanceolate, 10-25mm long, 2.5-3 mm wide, compressed, rachilla not winged; glumes herbaceous or thin and coriaceous, ovate or broadly so, 3-3.5mm long, strongly folded, the keel green, acute, 3-nerved on both sides, apex acute with a straight mucro ca 0.8mm long; style elongate; stamens 3; stigmas 3; achenes dark brown, siny, broadly obovoid, trigonous, 1-1.3mm long; 2n=96. (Welsh)

Cyperus elegans	Raiatea (Fosberg) Society Islands; Raiatea. Probably introduced (Welsh)	Rhizome short; stems many, caespitose, 30-60cm tall, rigid, obscurely trigonous; leaves equaling the stem, canaliculate-convolute, often viscosus, transversely septatenodose, with margins remotely dentate, the sheaths pale but reddish at base; bracts 3, foliaceous, finally spreading; inflorescence lax, 5- to 9-rayed, the rays spreading, unequal, to 10cm long, the raylets divaricate, to 2cm long, with short setaceous bracteoles; spikes 3, foliaceous, finally spreading, inflorescence lax, 5- to 9-rayed, the rays spreading, unequal, to 10cm long, the raylets divaricate, to 2cm long, with short setacous bracteoles; spikes 3-12 in a congested, radiate head, ovate-oblong or lanceolate-oblong 5-8mm long, 3mm wide, turgidly subcompressed, obtusish 8- to 12-flowered; rachilla rigid, elevated; glumes rather densely imbricated, chartaceous, 2 mm long, broadly obate, on the broad back green, acutely carinate, mucronate, the margins stramineous and often suffused purplish, obsoletely 7- to 9-nerved, cellular-reticulate; stamens 3; style long, deeply trifid, the three stigmas slender, exserted. (Welsh)

Cyperus iria	Tahiti (Fosberg) Tahiti, on the flanks of Pinai towards 800m; Raiatea, Faaroa Valley, Tepua Valley, Africa and Asia to Malaysia and Australia, USA, West Indies, and S. America. (Welsh)	Annual, with fibrous roots; culms solitary or tufted and few to several, erect, mainly 1-6dm tall, slender, trigonous, smooth; leaves 2 or 3 per culm, much shorter than the culm; blades linear, 2-5mm broad, weakly folded; sheaths reddish or purplish brown; corymbs mainly compound, 5-15 cm long, 3-10cm broad, with 3-7 unequal rays, these 2-12 cm long, each bearing 5-10 spikes; spikes often more or less inclined, 1-4cm long, bearing 4-20 spikelets; leafy bracts 4 or 5, the lowest 2 or 3 surpassing the corymb; spikelets rather loosely disposed, erect-spreading, linear-oblong or elliptic to lanceolate, 4-9 (11)mm long, 1.7-2mm wide, flattened, 6-to 22-flowered; rachilla conspicuously flexuous, hardly winged, the glumes somewhat loosely disposed, obovate-orbicular, 1-1.5mm long, truncate to shallowly retuse, the apex usually mucronulate, yellow or straw-colored, pale on hyaline upper margin, 3- or 5- nerved, convex; achenes obovate, trigonous, less than half as long as the achene; stigmas 3, stamens 4. (Welsh)

Cyperus papyrus	Tahiti (Fosberg) Society Islands; Tahiti; cultivated aquatic ornamental and botanical curiosity; noted in Papeete and Faa; native to Africa and adjacent areas. (Welsh)	Tall perennial herbs, from a short thick rhizome; culms tufted along the rhizome, mostly 1-2.5m tall, 1-3cm thick near the base, obtusely trigonous, naked or with bladeless sheaths at base, the basal sheaths coriaceous, brown, obliquely truncate at orifice, the sterile shoots sometimes bearing short-bladed leaves; corymb ample; bracts 4-10, narrowly lanceolate, much shorter than the corymb rays, these numerous, 1-3dm long, subequal in length, slender, a prophyll at base of rays 3cm long; secondary corymbs bearing 3-5 slender raylets and 3-5 bracteoles; spikes cylindric, 1-2cm long, 6-9mm broad, bearing many spikelets, these linear, 6-12mm long, ca 1mm wide, with 6-20 flowers; rachilla winged with lanceolate base of glumes; body of glumes ovate-elliptic or elliptic, winged, pale brownish and green on midvein; stamens 3; achenes oblong, trigonous, obtuse apically, maturing brownish; style 3-lobed; 2n= ca. 102. (Welsh)
Cyperus rotundus	Tahiti, Raiatea, Maupiti, Tahaa (Fosberg)	Perrenial sedge with long stoloniferous rhizomes arising from scaly tubers, leaves few, basal, inflorescence a loose cluster of up to 8 unequal rays subtended by 2-3 bracts, fruit a 3-sided achene. (Murdock's checklist) Perennial, with long, slender stoloniferous rhizome terminated by a globose-ovoid tuber; culms solitary or few, bearing a cormlike enlargement at base, erect, 1-4 (6) dm tall, slender, triquetrous, smooth, with leaves at base; leaves few, much shorter than culm; blade linear, 2-5mm broad, folded; sheaths light brownish, eventually breaking into brown fibers; corymbs simple to compound,

		loose, with 2-10 slender rays of unequal length... (Welsh)
Fimbristylis dichotoma	Mo'orea (digital flora project)	(F. annua, F. diphylla, F. polymorpha, Scirpus dichotomus, Scirpus diphyllus) Perennial sedge from short rhizome, culms thin, tufted, glabrous, inflorescence variously compound subtended by up to 5 bracts, 1 or 2 leaf-like, fruit a pitted achene. (Murdock's checklist) (more description and photo in Whistler)
Gahnia schoenoides	Tahiti, Aorai, Mo'orea; Raiatea.(Welsh) Mo'orea (digital flora project)	Rhizome thick, fibrous; culms clumb-forming, becomng large, 8-12dm tall; leaves cauline along much of the stem, the sheaths cylindric, scabrous through the upper part, the floral bracts of the same form, much surpassing the inflorescence; panicle 5-30cm long, slender, the spikes erect, ca 3-7cm long, slender, the spikes erect, ca 3-7cm long; glumes chestnut-brown to blackish, the body ovate, to ca 1cm long, with a long-aristate, scabrous awn-tip surpassing the body in length; stamens 4; style hispid at the base; achenes brown, shiny or somewhat punctate. (Welsh)

Kyllinga nemoralis		(Cyperus k., K. cephalotes, K. monocephala, Thyrocephaoln m.) Perennial, creeping via rhizomes, culms basally leafy, up to 50cm tall, though generally much shorter, inflorescence a white terminal globose head subtended by 3 or 4 spreading bracts, fruit an achene.(Murdock's checklist) (more description and photo in Whistler) It is a small, vivacious herb that is very abundant, found in the vicinity of human habitation. It has globose inflorescences that are 1cm in diameter. It is called mo'u upoo nui in Tahitian (Cyperaceae with a big head). The entire plant is used medicinally to treat a number of uses, including vaginal discharge, hemorrhoids, rheumatism, etc... (Translated from Petard p. 115)
Kyllinga polyphylla	Samoa, Tahiti, Fiji (Whistler)	Creeping perennial sedge up t 75cm in height. Culms 3-angled, glabrous, congested on the knotty, purple-scaled rhizome to form dense clumps. Leaves basal 2-4, linear and shorter than the culms, 2-4mm wide; lower leaf sheaths leafless, surrounding the culm base. Inflorescence a green, globose head 8-15mm in diameter, formed form 1-3 confluent spikes and subtended by 5-8 drooping, unequal, leaf-like bracts up to 15cm long and wider than the leaves. Spikelets green, densely packed on the head, 1-2 flowered, laterally compressed, narrowly elliptic, 2.5-3.5mm long. Glumes several, lanceolate to ovate, tip slightly curved. Stamens 3. Ovary superior, style elongated, 2-lobed. Fruit a dark, oblong to ovate, biconvex achene 1.5-2mm long. The 4-8 leaf-like bracts are wider than the leaves. Native to tropical

		Africa. Similar to Kyllinga brevifolia, but much more robust and has wider bracts. (Whistler)
Kyllinga spp.		TUISE (Samoan) Two sedges, one of ancient introduction, the other modern, common in disturbed spaces. The stems are used to clean out the ears. The name also applied to other sedges similarly used, which would otherwise remain nameless. (Whistler, 2001)
Mariscus cyperinus	Mo'orea (digital flora project)	Perennial; rhizomes short, woody, clothed with brown fibers; culms solitary or few, erect 2-7dm tall, trigonous, smooth, thickened at base; leaves several, basal, the blades linear, shorter than the culm, 5-7mm wide, flat, plicate; sheaths green, tinged purplish or pink; inflorescences umblliform, simple, open or sometimes almost headlike, solitary on each ray, cylindrical, narrowed at the base, 1.5-3cm long, 8-12mm wide, densely bearing numerous spikelets.... (Welsh)
Mariscus javanicus	Mo'orea (digital flora project)	Coarse tufted perennial, the rhizome short; culms robust, 4-11dm tall, 3-5mm thick, obtusely trigonous; leaves many, mostly surpassing culms; blades linear, 8-12mm wide, plicate below the

		middle, septate-nodulose, prominently cylindric, septate-nodulose; corymbs compound to decompound, 10-15cm long... (Welsh)
Pycreus polystachyos	all of the main island groups (Whistler)	Annual or perennial herb. Culms tufted, erect 16-100cm in height, 3-angled, smooth. Leaves few, shorter than the culms, blade linear, 1.5-3mm wide, stiff; leaf sheath reddish brown. Inflorescence a loose corymb with 2-6 rays up to 7 cm long, or condensed in to head-like clusters. 1.5-5cm across, subtended by 4-8 leafy, unequal bracts 1-30cm long, the lowest usually longer than the corymb. Spikelets digitately arranged, linear to linear-lanceolate, 7-12mm long, acute at the apex, flattened, 9-15 flowered... Uncertain origin. First recorded in Hawaii in 1888, listed as native to Hawaii.Synonym: Cyperus polystachyos. (Whistler)