

ORIGIN AND DISTRIBUTION OF ADVENTIVE ALIEN FLOWERING PLANTS IN HAWAI'I

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ABSTRACT

Hawai'i has more than 800 known species of alien plants that are reproducing without direct human assistance. During this century, new plant species have been arriving at the rate of about five per year. Patterns of plant collecting in time and space suggest that other species await discovery and that data on the ranges of known species are far from satisfactory. The New and Old World tropics have supplied most of the adventive alien plants in Hawai'i, although other places, particularly those with which Hawai'i has close economic and cultural ties, have contributed significant numbers in recent years.

INTRODUCTION

The nature and derivation of native floras have long attracted the attention of biologists, but the rearrangement and wholesale homogenization of the world's biota caused by humans in the last 10,000 years has aroused comparatively little interest until recently. Contributing reasons for this are that alien plant invasions are generally short-lived, and that populations depend upon continued disturbance, are unstable, and are determined to a large extent on chance dispersal. Furthermore, there is a built-in preference for what is natural and rare and a prejudice against the commonplace and alien among biologists, except perhaps where economic factors are involved.

To protect natural ecosystems, agriculture, and even urban areas from undesirable invasion from alien plants, reliable data about the alien species present are needed. Information about how plants were introduced is helpful to plan means to limit further additions to the alien flora. Understanding generalized patterns of establishment and spread is also useful in managing problems that already exist.

DEFINITIONS AND DATA SOURCES

Considerable confusion exists about terminology applied to introduced plants and weeds (Frenkel 1984; Smith 1985), so it is important from the outset to define, in exact terms, the subject of this study. The focus of the work here will be plants introduced to Hawai'i that have shown the ability to reproduce themselves, either sexually or vegetatively, and to spread without direct human assistance. Excluded, therefore, are the introduced plants cultivated as crops or ornamentals, although it must be recognized that new recruits for the naturalized alien flora often come from the plants cultivated intentionally by humans.

Weeds may be categorized according to the degree of human disturbance they require for survival (Harlan and de Wet 1965; Hart 1976). Slight disturbance, such as a small opening in the canopy of a forest, may be sufficient to ensure the establishment of some species. However, ruderals, the plants of waste places, or the weeds of crops depend upon continual disturbance. Some species may depend for their survival on humans to supply water, to act as local dispersal agents, to set or extinguish fires, or to eliminate competitors by mowing, trampling, or spraying. All alien plants that are reproducing and actively spreading, or that have done so in the past, were considered in this survey. The degree of direct or indirect dependence on humans for the survival of the populations was not taken into account. Excluded, however, were plants confined to cultivation or persisting without showing any tendency to spread after abandonment. Opinions as to whether species are disliked, welcomed as valued additions to the flora, or simply tolerated were not taken into consideration.

There is no infallible way to determine whether a plant is indigenous or alien by its external characteristics. However, if a plant was not recorded in early botanical surveys, has no closely related indigenous relatives, seems incapable of dispersing over great stretches of open ocean without human assistance, and favors disturbed habitats created by humans, it seems reasonably safe to assume the species is an alien. There is substantial agreement of opinion about the provenance of most species in Hawai'i; however, there is some disagreement about a small number of species that might be indigenous, Polynesian introductions, or very early European introductions. Because many of these species have spread well beyond cultivation, this question must be addressed in more detail.

Exact and reliable information on the time and circumstances of an introduction is rarely available. Furthermore, many adventive aliens were first introduced as crop or ornamental species and only later did they escape from cultivation. It is rare for escapes to be recorded. In fact, a plant may spread for many years and build up a large population before it is noticed. For example, *Oxyspora paniculata* was observed growing as a planted species in a forest reserve in 1958 when a collector commented, "this plant does not spread, does not seem to be a pest" (B.P. Bishop Museum herbarium specimen 58128). Only in 1984 was a serious infestation found in the same area (Obata 1985). In the course of the present study, the earliest record of each alien species was sought, regardless of the situation where it was first found. Sources for this information included

published floras, checklists, other written accounts, accession records of arboreta or botanical gardens, and botanical specimens. The majority of first records (72%) are from herbarium specimens. The B.P. Bishop Museum herbarium was the most important source. However, other herbaria containing the collections of 19th century botanists were also searched for plants believed to be early introductions to Hawai'i. The collections consulted were U.S. National Herbarium, Gray Herbarium of Harvard University, British Museum of Natural History, Royal Botanical Gardens at Kew, Museum National d'Histoire Naturelle, Paris, Universitatis Florentinae, Instituto Botanico, Academy of Sciences of the U.S.S.R. in Leningrad, Harold L. Lyon Arboretum at University of Hawaii, and Department of Botany, University of Hawaii.

EARLY ALIEN INTRODUCTIONS

Most of the main food and fiber crops used by the Hawaiians lack mechanisms of dispersal that would enable them to reach Hawai'i by natural processes. Handy and Handy (1972) believed that only 14 species were actually introduced by the Polynesians (Table 1), whereas St. John (1973, 1978) and Nagata (1985) have a rather longer list of candidates. Included are weedy species, which may have been introduced accidentally, and strand trees of widespread distribution in the Indo-Pacific (Merrill 1946). The status of several other plants, conventionally considered aliens introduced by Europeans, must be reconsidered in the light of the rediscovery of collections made by the first botanists to visit Hawai'i. As there is considerable controversy surrounding these species, each will be discussed separately.

'Ahu'awa, (*Mariscus javanicus*)

The first record of 'ahu'awa in Hawai'i comes from the collection by Lay and Collie, botanists on the Beechey voyage, in 1827 (Hooker and Arnott 1965). The plant is commonly found on sandy beaches, in taro (*Colocasia esculenta*) patches, and in marshes and may be one of the indigenous, pan-tropical wetland species whose seeds were widely dispersed by waterbirds; or it could have been carried as an accidental passenger on taro corms.

Kili'o'opu (*Kyllinga nemoralis*)

Mann (1866) was apparently the first botanist to collect kili'o'opu, which was regarded as indigenous by Hillebrand (1965) and "long established" by St. John (1973). It was reported in Tahiti in 1769 by Banks and Solander (Merrill 1954) and, like *Mariscus javanicus*, may either be indigenous or one of those species spread accidentally by the Polynesians.

Kūkaepua'a (*Digitaria setigera*)

The botanist David Nelson, who accompanied Cook to Hawai'i, was the first to collect botanical specimens of this plant in 1779 (St. John 1978). Since it is frequently found growing around pig pens and its Hawaiian name, *kūkaepua'a*, implies an association with pigs, it may have been carried along accidentally when the Polynesians brought the pig to Hawai'i (Degener 1962).

Table 1. Plants associated with Hawaiian culture and land use.

	Handy & Handy 1972	St. John 1973	St. John 1978	Nagata 1985
MAIN ECONOMIC PLANTS				
<i>Aleurites moluccana</i>		*		*
<i>Alocasia macrorrhiza</i>		*		*
<i>Artocarpus altilis</i>	*	*		*
<i>Broussonetia papyrifera</i>	*	*		*
<i>Cocos nucifera</i>	*	?		*
<i>Colocasia esculenta</i>	*	*		*
<i>Cordyline fruticosa</i>	*	*		*
<i>Curcuma longa</i>	*	*		*
<i>Dioscorea alata</i>	*	*		*
<i>Dioscorea bulbifera</i>		*		*
<i>Dioscorea pentaphylla</i>		*		*
<i>Ipomoea batatas</i>	*	*		*
<i>Lagenaria siceraria</i>	*	*		*
<i>Musa</i> spp.	*			*
<i>Nasturtium sarmentosum</i>		*		*
<i>Piper methysticum</i>	*	*		*
<i>Saccharum officinarum</i>	*	*		*
<i>Schizostachyum glaucifolium</i>	*	*		*
<i>Syzygium malaccense</i>		*		*
<i>Tacca leontopetaloides</i>	*	*		*
<i>Tephrosia purpurea</i>		*		*
<i>Zingiber zerumbet</i>		*		*
STRAND TREES AND SHRUBS				
<i>Calophyllum inophyllum</i>		*		*
<i>Cordia subcordata</i>		*		*
<i>Morinda citrifolia</i>		*		*
<i>Thespesia populnea</i>		*		*
ACCIDENTAL INTRODUCTIONS				
<i>Digitaria setigera</i>			*	
<i>Indigofera suffruticosa</i>			*	*
<i>Ludwigia octovalvis</i>			*	*
<i>Merremia aegyptia</i>			*	*
<i>Oxalis corniculata</i>			*	*
<i>Urena lobata</i>			*	*
<i>Waltheria indica</i>			*	
OTHER POSSIBLE POLYNESIAN INTRODUCTIONS				
<i>Kyllinga nemoralis</i>				
<i>Lycopersicon pimpinellifolium</i>				
<i>Lythrum maritimum</i>				
<i>Mariscus javanicus</i>				
<i>Solanum americanum</i>				
<i>Vigna adenantha</i>				

‘Inikō (*Indigofera suffruticosa*)

Hillebrand (1965) noted that ‘inikō was one of the most common weeds in the Islands but believed that it had been introduced in 1836 for the production of indigo. Nelson, the botanist with Cook, listed "*Indigofera*, Indigo" in a report, which Beaglehole's informant assumed was *Indigofera suffruticosa* (St. John 1978; Beaglehole 1967). No herbarium specimen has been found to substantiate this observation. No record of the use of the plant by Hawaiians has been found, and it is hard to imagine that such a useful dye plant would have escaped their attention had it been present in prehistoric times. It therefore seems likely that the plant was not a Polynesian introduction and that Nelson was mistaken in including it on his list.

Vigna adenantha

This plant is probably a native of South America but was reported by early botanists in many Polynesian islands as well as in eastern Australia. Plant specimens from Hawai'i bearing this name, including those collected by Menzies in 1794 (British Museum of Natural History), Macrae in 1825 (British Museum of Natural History), Nuttall in 1835 (British Museum of Natural History), and Rémy sometime between 1851 and 1855 (Gray Herbarium), can be found in a number of herbaria. Mann (1866) believed the species to be a Polynesian introduction, and Hillebrand (1965) reported that the Wilkes Expedition, which visited Hawai'i in 1840, found it on "Diamond Hill." A search for this specimen in the U.S. National Herbarium, where the collections from the expedition are said to be preserved, did not locate it. No more recent reports based on voucher specimens have been found, so the extant specimens should perhaps be reexamined to ensure that the earlier botanists did not confuse this species with other taxa.

Yellow wood sorrel (*Oxalis corniculata*)

Yellow wood sorrel or 'ihi'ai is a pantropical weed collected by Banks and Solander in Tahiti and was observed but not collected by Nelson in Hawai'i in 1779 (St. John 1978). The fact that seeds have been found in prehistoric archaeological sites makes it clear that the plant was not introduced by Europeans (Kirch 1985) but was either indigenous or an introduction, probably accidental, by the Polynesians.

Hau (*Hibiscus tiliaceus*)

Hau was a valuable plant for the Hawaiians and was widely cultivated. For this reason, it has been considered a likely Polynesian introduction (Krauss 1974). However, it is a widespread strand species whose seeds are adapted to long-distance dispersal over the ocean (Merrill 1946). The plant is common along sheltered coasts and in wet upland gulches in Hawai'i today. It is quite likely that it reached Hawai'i without human assistance.

Milo (*Thespesia populnea*)

The Polynesians held this tree in high regard as a shade tree and also used it for tannin, dye, medicines, and wood (Krauss 1974). It was widely planted around houses and may be found persisting and occasionally establishing along the coast today. As a plant of the coastal strand, it

is adapted to transoceanic dispersal and hence may be indigenous, although St. John (1973) and Nagata (1985) judge it to be a Polynesian introduction.

Aramina (*Urena lobata*)

Nelson observed "*Urena*, Indian Mallow" in Hawai'i in 1779 but did not take a specimen of the plant. This was assumed to be the native *ōpuhe*, *Urera sandwicensis*, in the family Urticaceae; however St. John (1978) argued that Nelson, a competent botanist, would not have confused plants in such distinctively different families. Merrill (1954) stated that Banks and Solander found *Urena* in Tahiti. Seeds of this plant could have been carried by birds to Hawai'i, or it might have been a Polynesian introduction.

Kamani (*Calophyllum inophyllum*)

This tree was cultivated by Hawaiians and had many uses. It is not found naturalized to any great extent in Hawai'i today but may have been so in the past. It is generally regarded as a Polynesian introduction, but since its natural habitat is the coastal strand and its seeds are adapted to ocean dispersal, the possibility that it is indigenous should not be entirely discounted.

Carrot (*Daucus pusillus*)

Hillebrand (1965) believed the American carrot was undoubtedly in the Islands before European discovery. A collection made by Menzies (British Museum of Natural History) provides support for this conclusion. It might possibly have been brought to the Islands by migrating birds and thus be an indigenous species.

‘Uhaloa (*Waltheria indica*)

‘Uhaloa has weedy properties and is considered by most to be indigenous. It was collected by Nelson (St. John 1978) and has small seeds that might adhere to birds; it may have been transported to Hawai'i by this means.

Pūkāmole (*Lythrum maritimum*)

Today pūkāmole has been generally regarded as a European introduction in Hawai'i. It was collected by many of the early botanists, including Menzies in 1794. This would suggest that it is probably an indigenous species.

Primrose willow or Kāmole (*Ludwigia octovalvis*)

Nelson observed kāmole in Hawai'i in 1779, and Menzies collected it in 1794 (St. John 1978). It is most abundant in wetland habitats, and its small seeds may have been transported to Hawai'i by waterbirds; or, as it is a frequent weed in taro patches, it might possibly have been introduced accidentally by the Polynesians with taro.

Kou (*Cordia subcordata*)

The wood of the tree kou was one of the most prized by the Hawaiians and was used in prehistoric times (Krauss 1974). It is a plant of the littoral zone, and its seeds are dispersed on the ocean, so it may be an indigenous plant. However, it is not found in the wild in Hawai'i, possibly

indicating either that it was brought and cultivated by the Polynesians or that its original habitat has been destroyed.

Hairy merremia or Kuahulu (*Merremia aegyptia*)

Most botanists regarded kuahulu as a weed introduced in the 19th century until it was realized that Nelson had collected it in Hawai'i in 1779 (St. John 1978; British Museum of Natural History). Thus, it may be regarded as indigenous or introduced.

Currant tomato (*Lycopersicon pimpinellifolium*)

The tomato is found as a volunteer in waste places and has been regarded as an alien introduced by Europeans. The fact that there is a specimen labelled as a collection by Menzies from Hawai'i (British Museum of Natural History) now casts doubt on this conclusion. It is conceivable that seeds might have been transported to Hawai'i stuck to migrating birds; but, if it were indigenous, it is surprising that Hawaiians did not make more conspicuous use of it. Furthermore, the fact that the plant was not collected or mentioned by other botanists until Hillebrand suggests that the Menzies specimen may have been collected elsewhere and is mislabeled. This is believed to have occurred with some other Menzies specimens.

Glossy nightshade or Pōpolo (*Solanum americanum*)

Although pōpolo was not recorded in Hawai'i until Nuttall made a collection of it in 1835 (British Museum of Natural History), it was one of the most important medicinal plants for the Hawaiians (Gutmanis 1979). Furthermore, its Hawaiian name, *pōpolo*, comes from a proto-Polynesian root word that is widely applied, with small variations, to the same plant throughout Polynesia (Biggs 1979). It would appear that it is either indigenous or was introduced, perhaps on purpose, by Polynesians.

Noni (*Morinda citrifolia*)

The noni was cultivated by Hawaiians in prehistoric times and was a valuable medicinal and dye plant. It has a very wide distribution in the tropical Pacific, and its buoyant seeds disperse by flotation. Although generally regarded as a Polynesian introduction it may have reached Hawai'i by means of natural dispersal.

The status of the above species as indigenes or aliens could be a subject of endless debate. However, it is unlikely that any of the disputes can be satisfactorily solved unless pollen or microfossil evidence is found in sediments that unmistakably date from a period before human settlement.

ALIEN INTRODUCTIONS AFTER EUROPEAN CONTACT

Rate of Introduction

In the last 200 years, 813 species of alien plants have naturalized in Hawai'i (Appendix). (The nomenclature used in this study follows that of the *Manual of the Flowering Plants of Hawai'i* (Wagner *et al.* 1990) except in a few cases, where taxa used by earlier authorities are retained

in order to minimize information loss in the present analysis. Instances of retained older nomenclature are noted in the Appendix.) The rate of introduction increased by the end of the 19th century to the present average rate of about five species per year (Fig. 1). A similar pattern was observed by Healy (1947) in New Zealand, where, in the hundred years prior to 1946, alien plants arrived at a more or less constant rate of 10 per year.

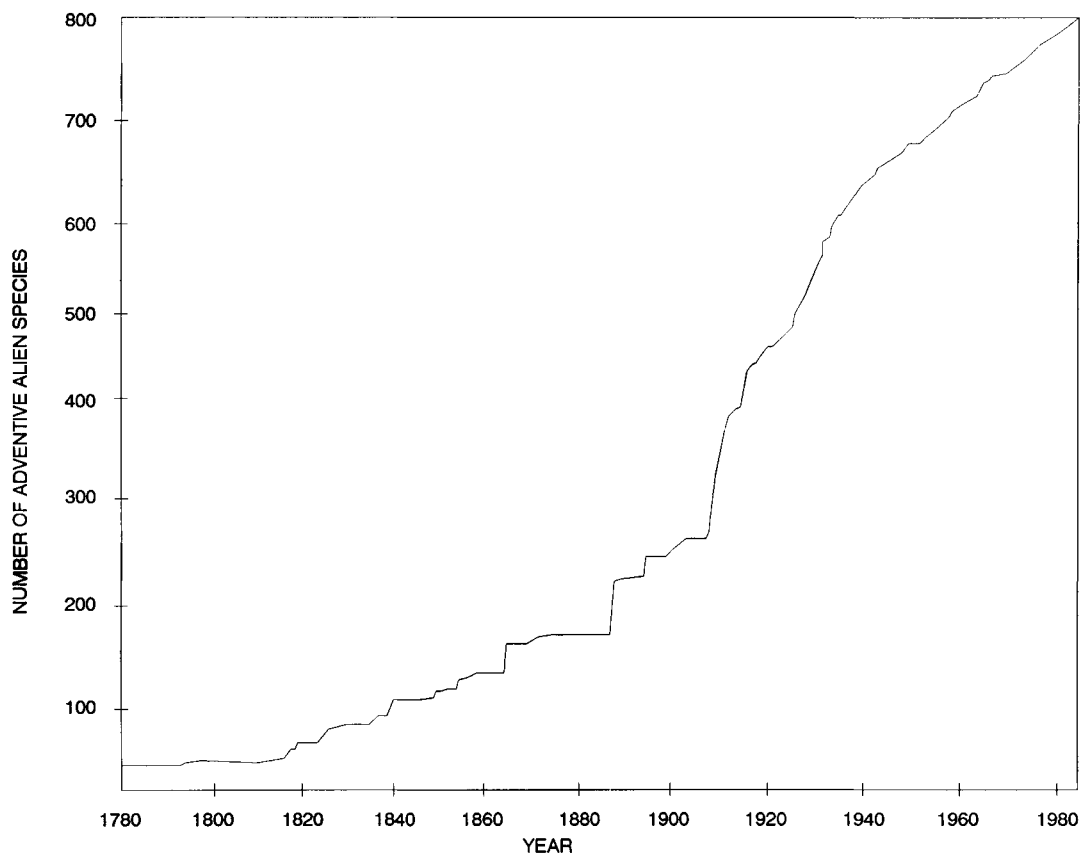


Figure 1. Accumulated number of adventive alien plant species in Hawai'i.

Bias in Herbarium Collections

Herbarium specimens may be an important source of information to establish the time of arrival of aliens in Hawai'i; thus, it is worthwhile to consider in detail the nature of the information preserved in collections. This approach is useful in interpreting the establishment and spread of colonizing alien plants and may also provide information useful in managing alien invasions. Extensive use has been made of herbarium material for mapping the ranges of taxa (Hastings *et al.* 1972) and for

phenology (Holland 1975), as well as for reconstructing the introduction and colonization of species (Strother and Smith 1970). However, it is widely recognized that many biases exist in herbarium collections (Stearns 1951; Davis and Heywood 1965). For example, cultivated plants, as well as those difficult to preserve or store, tend to be poorly represented in collections. Furthermore, collecting activity tends to be concentrated in certain geographical areas and at certain times. This has special implications for alien species and will be discussed in more detail.

Temporal Biases. Sudden increases in accumulated species in Hawai'i herbaria during the 20th century reflect the intermittent nature of botanical surveys. In the 20th century, survey and systematic collecting of the flora were more frequent after the B.P. Bishop Museum and the University of Hawaii were founded and individuals with botanical training were employed permanently by private organizations or government agencies. As a result, newly introduced species were probably noticed and recorded on a more regular basis. Fluctuations in numbers of species accumulated in herbaria can be noted, for example, in the 1930s. This might be interpreted as a wave of invasion caused by the conscious attempt to revegetate degraded watershed with introduced plants. However, the historical records used to compile these data are not free from biases, and the observed fluctuations may well be the result of these instead.

The dates of collection of a randomized sample of approximately 2,000 sheets from the B.P. Bishop Museum herbarium reveal three main periods of intensive collecting activity in the 20th century (Fig. 2):

- a. 1908-1920: This was the period soon after the founding of the B.P. Bishop Museum, when C.N. Forbes and others were building a representative collection.
- b. 1930-1940: During this time several enthusiastic collectors worked in Hawai'i, including O. Degener, F.E. Egler, F.R. Fosberg, and H. St. John.
- c. 1968-present: The last 18 years have been a period a renewed interest in ecological and taxonomic research.

Significant increases in the number of "first records" of alien plants correspond closely with these periods of intense collecting activity. Therefore, small fluctuations in the curve of accumulated numbers of species (Fig. 1) should not be given much significance. However, it is reasonable to assume that still more searching would reveal additional species, even though the period from 1968 to the present has been one of intensive collecting activity, because new aliens continue to colonize.

Geographic Biases. Considerable difference in intensity of botanical reconnaissance from place to place is obvious when examining the herbarium specimens preserved in the B.P. Bishop Museum herbarium. A randomized sample collected from O'ahu shows that many specimens were obtained from only a few favored areas such as the highest peaks of the Ko'olau and Wai'anae ranges, offshore islands, and in and around Honolulu (Fig. 3).

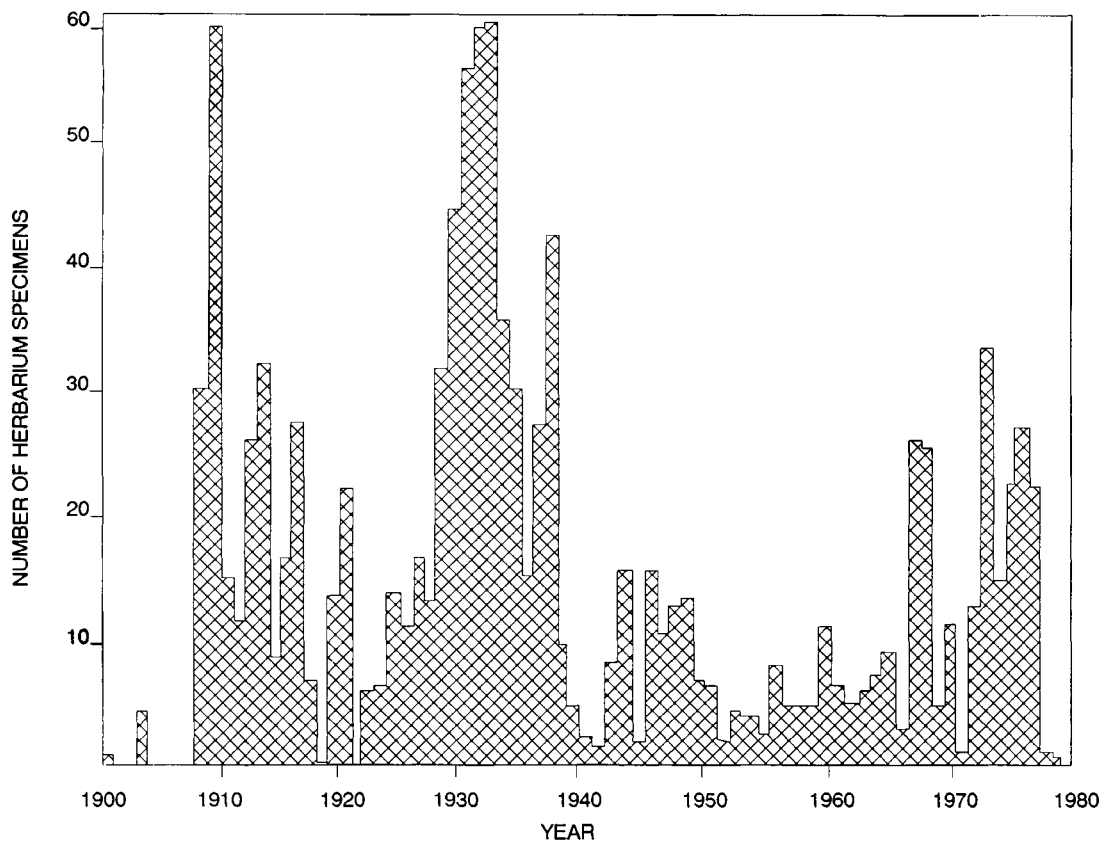


Figure 2. Number of herbarium specimens collected in Hawai'i that are preserved in the B.P. Bishop Museum herbarium.

The University of Hawaii campus at Mānoa and the B.P. Bishop Museum themselves figure prominently as sites of intense collecting activity. However, on the whole, most collecting, and presumably other botanical surveying, is concentrated in essentially natural areas where aliens are least common, not in the disturbed habitats where newly introduced plants are most likely to become established first. This is unfortunate because control or eradication of aliens is simplest when plants are recognized as soon as possible after arrival in an area, when populations are small and geographically confined.

If a policy of early detection and eradication were to be seriously adopted as a management technique, searches should be directed to sites other than those typically surveyed in the course of botanical research. For example, we might expect newly introduced aliens to establish near ports of entry such as airports, or perhaps more likely, near harbors where used automobiles are unloaded, as Wace (1979) demonstrated that cars carry a very large number of weed propagules. On the other hand, if many adventive plants in Hawai'i were first introduced as ornamental or crop

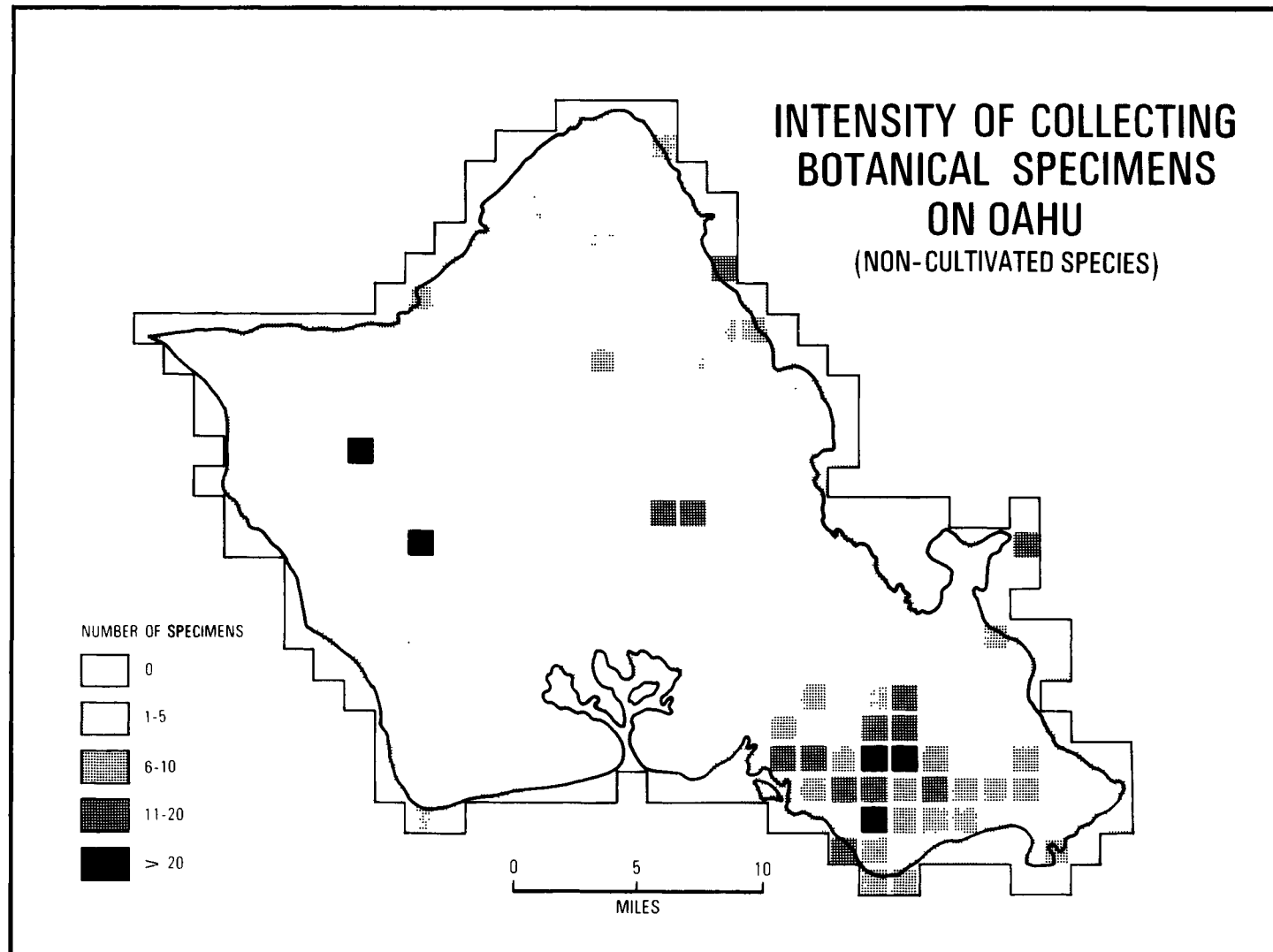


Figure 3. Number of herbarium specimens collected on O'ahu in the B.P. Bishop Museum Herbarium.

species, they may have first appeared in or near arboreta, botanical gardens, nurseries, or experimental plantings. In point of fact, many first records do come from these sites. Ornamental plants are also introduced and grown by hobbyists. Those that spread aggressively may colonize from these foci or be removed and dumped at official refuse sites, along roads, or in wasteland. Areas such as these should be searched for potential new invaders.

Roadsides not only provide a disturbed substrate for many alien species, but also provide corridors for dispersal through undisturbed landscapes otherwise inhospitable to aliens (Smith 1982; Wester and Juvik 1983). Roads allow aliens to achieve wide distribution rapidly.

Further sampling of B.P. Bishop Museum herbarium specimen sheets was done to determine relative numbers of collections from each island. The results show that the largest number of specimens come from O'ahu; with the exception of Ni'ihau, the small islands are represented by a large number of specimens in proportion to their area (Table 2). On the other hand, fewer specimens have been taken from Hawai'i Island than from O'ahu, which is only one-eighth its size.

A high correlation exists between the number of herbarium specimens taken from each island and the number of species known from that island, higher in fact than with other factors, which are often taken to determine the richness of an island flora (Table 3). It has been similarly noted in the Galapagos Archipelago that the number of botanical collecting trips to each of the islands is a better predictor of numbers of species than area, elevation, or isolation (Conner and Simberloff 1978). Hence, it seems likely that our knowledge of the ranges of alien plants in the Hawaiian Islands, based on herbarium material, is inadequate; efforts can be most profitably be spent to correct this by concentrating on Hawai'i, Maui, Kaua'i, and Ni'ihau.

EXTINCTION OF ALIEN SPECIES

Invading species owe part of their success to an ability to increase populations rapidly. However, they are also subject to population crashes caused by environmental factors, such as drought or hurricanes, or to competition from other species. They often inbreed, forming homozygous populations vulnerable to attack by pests. As Baker (1965) pointed out, weeds are well adapted to rapid colonization and spread, but they have a limited future because they are often poorly equipped genetically to adjust to inevitable ecological and environmental changes. Although this does not seem to be the case in benign and isolated tropical areas, it is therefore of interest to consider whether abundant new arrivals are at least partly balanced by extinctions.

It is not possible to prove that a species has become extinct, but species once reported as aliens in Hawai'i that have not been collected at least since 1959 are listed in Table 4. The recent period of intensive collecting activity occurred after 1959, and it might usually be that a

Table 2. Alien species per unit area (mi²) on major islands.

	Number of alien species	Area (mi ²)	Number of species per mi ²	Number of specimens per mi ²
NW Hawn. Ids.	76	5	14.62	20.77
Lānaʻi	217	139	1.56	1.25
Kahoʻolawe	65	45	1.44	1.56
Niʻihau	77	73	1.05	0.62
Oʻahu	571	608	0.94	2.60
Molokaʻi	232	261	0.89	0.73
Kauaʻi	345	553	0.62	0.58
Maui	379	729	0.52	0.45
Hawaiʻi	566	4,038	0.14	0.27
TOTAL	813	6,451	0.126	0.60

Table 3. Factors likely to influence the number of known adventive alien plant species on each island.

	Area (mi ²)	Maximum Elevation (feet)	Island Age (m. years)	Number of Alien Species	Number of Herbarium Specimens
Hawaiʻi	4,038	13,796	0.50	566	1,082
Maui	729	10,023	1.63	379	327
Oʻahu	608	4,020	3.80	571	1,578
Kauaʻi	553	5,243	5.72	345	319
Molokaʻi	261	4,970	1.84	232	190
Lānaʻi	139	3,370	1.46	217	174
Niʻihau	73	1,281	n.a.	77	45
Kahoʻolawe	45	1,477	1.03	65	70
NW Hawn. Ids.	5	874	11.30	76	108
Correlation coefficient	0.685*	0.757*	-0.312		0.888**

*p < 0.05

**p < 0.01

Table 4. Alien species not collected or observed since 1959.*

Species	Date of First Record	Date of Last Record	Number of Herbarium Specimens
<i>Bidens laevis</i>	1855	1912	2
<i>Blumea laciniata</i>	1923	1937	7
<i>Blumea sessiliflora</i>	1920	1937	1
<i>Bothriochloa intermedia</i>	1916	1940	2
<i>Digitaria longiflora</i> **	1916	1938	5
<i>Echinochloa phyllopogon</i> ***	1928	1930	2
<i>Geranium dissectum</i>	1910	1948	4
<i>Laportea interrupta</i>	1819	1959	1
<i>Potamogeton nodosus</i>	1825	1920	5
<i>Potamogeton pectinatus</i>	1947	1949	2
<i>Spergula arvensis</i>	1888	1958	5
<i>Stachytarpheta x intercedens</i>	1939	1940	2
<i>Stachytarpheta x trimeni</i>	1928	1951	2
<i>Typha domingensis</i> [#]	1939	1942	2

*Nomenclature according to herbarium labels; a number of commonly cultivated species and those observed as naturalized at only one location on one occasion have not been included in this list.

**Not listed in Wagner *et al.* 1990; listed in St. John 1973.

***Not listed in Wagner *et al.* 1990 or St. John 1973.

[#]Springly naturalized, according to Wagner *et al.* 1990.

species would be collected if populations persisted. Among the species not collected and possibly extinct are a number that once had populations established on several islands and that were collected in considerable numbers. This would suggest that aliens may be suppressed, or possibly exterminated, without purposeful eradication programs, and that large populations do not always survive. The present regression of many koa haole (*Leucaena leucocephala*) populations in the Hawaiian Islands and elsewhere is a vivid illustration of the fact that, once introduced, alien plant populations may undergo dramatic fluctuation without direct human interference. This observation should not be a surprise: most aliens are opportunist species with general ecological roles. Their strategy for survival is effective dispersal and rapid population increase, rather than specialized adaptation to local environments. Successful competition against all other plants over an extended period of time is not favored by the generalist strategy. Disturbance, however, does favor such generalists.

The number of species that seem to disappear from herbarium records has steadily increased during the 20th century; during the decade of the 1950s, this disappearance occurred at an average rate of less than one per year. Preliminary evidence thus suggests that turnover in the weed flora may occur, but the number of arrivals of new alien species is far greater than the number being exterminated.

Place of Origin

The immediate origin of a new alien is usually not known because the colonizing propagule may not come directly from its native home. However, except in a few cases of pantropical species, it is possible to determine the provenance of aliens. It appears that the New World supplied a large proportion of aliens in the early European period of contact (Fig. 4). This is not surprising, since sailing ships coming to Hawai'i typically stopped in South America and hence had the opportunity to pick up tropical plants, on purpose or by accident, suited to the Hawaiian environment. In later times, the Old World made a larger contribution to the Hawaiian alien flora, perhaps as contacts with Asia became more frequent and as the circumtropical weed flora became more homogenized. A significant number of species arrived from North America in the 20th century, and these introductions reflect the close cultural and economic ties with that region.

Mode of Introduction

Direct evidence of the means of introduction of alien plants can only be found for a small proportion of the species. These are mostly plants purposefully introduced as crops, reforestation species, or ornamentals and observed to establish from the original plantings. If we assume that introduction was purposeful for species that are commonly crop or ornamental species, and that introduction was accidental for species with no redeeming social value, it appears that about half the introductions were on purpose and the other half accidental (Table 5).

CONCLUSIONS

The native flora of the Hawaiian Islands has been known in more detail, and for a longer period of time, than that of most other oceanic islands. However, the alien flora is not nearly so well known despite the fact that it represents a large component of the present-day flora; additionally, many aliens are now ecological dominants over much of the land area of Hawai'i. A clearer knowledge of the nature and development of the alien flora is desirable so that further introductions can be minimized and the spread of aliens already present can be monitored and controlled to a greater extent. Competition that aliens exert on the diminishing native ecosystems can thus be reduced.

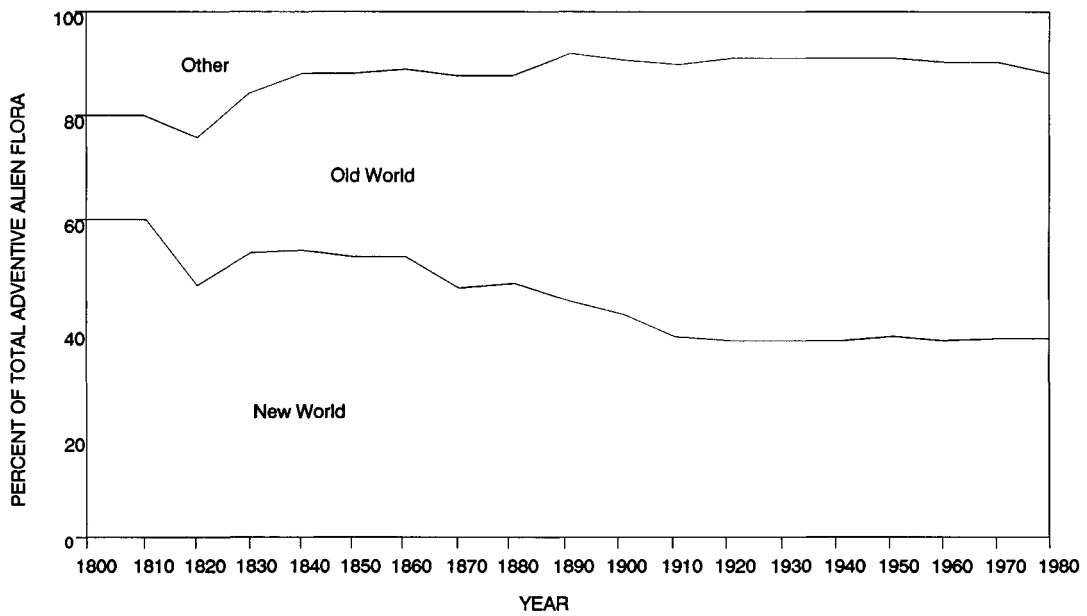


Figure 4. Region of origin of adventive alien plants in Hawai'i.

Table 5. Mode of introduction of alien species.

Mode of Introduction	Number of Species	Percent of Species
Purposeful		
Crop	199	21.8
Ornamental	121	35.9
Accidental	236	42.4

Appendix. A Preliminary List of Alien Adventive Seed Plants in the Hawaiian Islands.

The following abbreviations are used in this list:

<u>Life form</u>	<u>Origin (Place of Origin)</u>
B - tuber, bulb	AA - Asia, Australia
H - herb	AF - Africa
S - shrub	AS - Asia
T - tree	ASP - Asia, Pacific
U - succulent	AUP- Australia, Pacific
V - vine	AUS- Australia
	COS- cosmopolitan
	DIS - disjunct
	EAS - Eurasia
	EUR- Europe
	HOR- horticulture
	MED- Mediterranean
	NAM- North America
	NH - Northern Hemisphere
	NW - New World
	OW - Old World
	P - Pacific
	SAM- South America
	TAM- Tropical America
	TOW- Tropical Old World
	USM- United States Mainland

Mode of Introduction

A - accidental

C - crop

O - ornamental

Record (date of reports of species in the Hawaiian Islands)

first - earliest report

recent - most recent record

Info. Source (information source for earliest report of species in Hawai'i)

P - published reference

H - herbarium specimen

No. spms. (Number of herbarium specimens of species collected in Hawai'i and preserved in B.P. Bishop Museum Herbarium)

Island (Name of island where presence of species can be verified by an herbarium specimen.
Note: many species occur more widely than indicated here.)

Hi - Hawai'i

Ma - Maui

Mo - Moloka'i

Ln - Lāna'i

Kh - Kaho'olawe

Oh - O'ahu

Ka - Kaua'i

Ni - Ni'ihau

NW - Northwest Hawaiian Islands

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island															
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW							
DIOSCOREACEAE (Yam family)																							
<i>Dioscorea bulbifera</i>	B	AS	C	1000	1984	P	40	+	+	+			+	+									
<i>Dioscorea pentaphylla</i>	B	ASP	C	1000	1984	P	26			+			+	+									
HYDROCHARITACEAE (Frog's-bits family)																							
<i>Egeria densa</i>	H	SAM	O	1937	1971	H	4	+						+									
IRIDACEAE (Iris family)																							
<i>Belamcanda chinensis</i>	B	AS	O	1888	1976	P	7							+									
<i>Crocasmia x crocosmiiflora</i>	B	AF	O	1932	1985	H	9	+						+	+								
<i>Sisyrinchium rosulatum</i>	H	TAM	A	1944	1945	H	4	+															
<i>Sisyrinchium strictum</i>	H	USM	A	1938	1938	H	1	+															
<i>Trimezia martinicensis</i>	H	TAM	O	1943	1984	H	2							+									
JUNCACEAE (Rush family)																							
<i>Juncus acuminatus</i>	H	NAM	A	1935	1935	H	1	+															
<i>Juncus bufonius</i>	H	COS	A	1910	1971	H	17	+	+	+													
<i>Juncus effusus</i>	H	COS	A	1900	1975	P	10	+		+				+									
<i>Juncus ensifolius</i>	H	--	A	1911	1980	H	4	+															
<i>Juncus planifolius</i>	H	AUP	A	1930	1984	H	14	+		+						+							
<i>Juncus polyanthemos</i>	H	AUS	A	1953	1967	H	2	+	+														
<i>Juncus tenuis</i>	H	NH	A	1915	1974	H	8	+		+													
LEMNACEAE (Duckweed family)																							
<i>Lemna perpusilla</i>	H	COS	O	1895	1961	H	10			+	+			+	+								
<i>Spirodela polyrhiza</i>	H	COS	O	1918	1976	H	5									+							
LILIACEAE (Lily family)																							
<i>Hippeastrum puniceum</i>	B	TAM	O	1928	1986	P	3							+	+								
LIMNOCHARITACEAE**																							
** <i>Hydrocleys nymphoides</i>	H	SAM	O	1939	1986	H	4							+									

Taxon	Life		Mode of Intro.	<u>Record in Hi.</u>		Info. Source	No. Spms.	<u>Island</u>							
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
MUSACEAE (Banana family)															
<i>Musa troglodytarum</i>	H	P	C	1960	1960	H	3							+	
<i>Musa x paradisiaca</i>	H	ASP	C	1000	1957	P	4			+				+	
ORCHIDACEAE (Orchid family)															
<i>Arundina graminifolia</i>	H	AS	O	1950	1983	H	22	+	+				+	+	
<i>Epidendrum x obrianianum</i>	H	TAM	O	1940	1984	H	5						+	+	
<i>Phaius tankarvilleae</i>	H	ASP	O	1931	1985	H	17	+					+	+	
<i>Spathoglottis plicata</i>	H	AS	O	1929	1975	H	34	+	+		+		+	+	
POACEAE (Grass family)															
<i>Agrostis avenacea</i>	H	AUP	A	1888	1982	H	63	+	+	+	+		+	+	
<i>Agrostis semiverticillata</i>	H	EUR	C	1864	1972	P	11	+						+	
<i>Agrostis stolonifera</i>	H	EUR	C	1912	1969	H	13	+	+	+			+	+	
<i>Aira caryophylla</i>	H	EUR	A	1916	1985	H	10	+	+	+					
<i>Ammophila arenaria</i>	H	EUR	A	1913	1962	P	2							+	
<i>Andropogon virginicus</i>	H	USM	C	1924	1973	H	32	+					+		
<i>Anthoxanthum odoratum</i>	H	EUR	C	1907	1984	H	33	+		+					
<i>Arthraxon hispidus</i>	H	AS	-	1972	1972	H	1	+							
<i>Avena barbata</i>	H	EUR	A	1916	1961	P	4				+		+		
<i>Avena fatua</i>	H	EUR	C	1888	1943	P	5	+					+	+	
<i>Axonopus fissifolius</i>	H	USM	C	1912	1984	P	16	+	+		+		+	+	
<i>Bothriochloa barbinodis</i>	H	TAM	C	1910	1967	H	9		+	+			+		
<i>Bothriochloa intermedia</i>	H	AUS	C	1916	1940	H	2			+			+		
<i>Bothriochloa pertusa</i>	H	TOW	C	1916	1980	P	17	+	+	+	+		+	+	
<i>Brachiaria mutica</i>	H	AF	C	1902	1984	P	27	+	+		+		+	+	
<i>Briza maxima</i>	H	EUR	C	1917	1984	H	7	+	+				+		
<i>Briza minor</i>	H	EUR	C	1840	1984	P	30	+	+	+	+		+	+	

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Bromus mollis</i>	H	EUR	C	1909	1978	H	10	+	+					+	+		
<i>Bromus rigidus</i>	H	EUR	C	1910	1984	H	19	+	+							+	
<i>Bromus rubens</i>	H	EUR	C	1920	1967	P	3	+		+							
<i>Bromus tectorum</i>	H	EUR	C	1888	1969	P	3		+	+							
<i>Bromus willdenowii</i>	H	-	-	1909	1982	H	30	+	+	+				+			+
<i>Cenchrus ciliaris</i>	H	AF	C	1932	1982	H	7	+			+			+			
<i>Cenchrus echinatus</i>	H	TAM	A	1867	1984	P	51	+	+	+			+	+	+	+	+
<i>Chloris barbata</i>	H	TAM	A	1902	1984	H	70	+	+	+	+		+	+	+	+	+
<i>Chloris divaricata</i>	H	AUS	C	1924	1980	H	12		+				+	+		+	
<i>Chloris gayana</i>	H	AF	C	1913	1985	H	19	+	+		+			+		+	
<i>Chloris petraea</i>	H	TAM	-	1968	1980	H	2										+
<i>Chloris radiata</i>	H	TAM	C	1851	1976	P	30	+	+		+			+	+		
<i>Chloris truncata</i>	H	AUS	C	1915	1980	P	2						+				
<i>Chloris virgata</i>	H	TAM	C	1903	1982	H	28		+	+	+		+	+	+		+
<i>Chrysopogon aciculatus</i>	H	TAM	A	1865	1972	H	34	+		+	+			+	+		
<i>Coix lachryma-jobi</i>	H	AS	C	1895	1984	P	25	+	+	+				+	+		
<i>Cymbopogon refractus</i>	H	AUS	A	1929	1982	H	10	+		+				+	+		
<i>Cynodon dactylon</i>	H	OW	C	1888	1984	H	93	+	+		+		+	+	+		+
<i>Dactylis glomerata</i>	H	EUR	C	1911	1984	H	51	+	+	+				+	+		
<i>Dactyloctenium aegyptium</i>	H	TOW	A	1909	1983	H	33	+	+	+			+	+			
<i>Danthonia pilosa</i>	H	AUS	C	1910	1985	P	6	+	+								
<i>Danthonia semiannularis</i>	H	AUS	C	1903	1975	P	2	+	+								
<i>Dichanthium annulatum</i>	H	AS	-	1927	1963	P	3	+						+			
<i>Dichanthium aristatum</i>	H	AS	-	1911	1976	H	18		+		+			+			+
<i>Dichanthium sericeum</i>	H	AUS	-	1912	1980	P	11	+			+			+			+
<i>Digitaria ciliaris</i>	H	-	C	1912	1982	H	44	+	+	+	+		+	+	+	+	+

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
<i>Digitaria fuscescens</i>	H	SAM	C	1852	1969	H	38	+	+	+	+		+	+	+
<i>Digitaria insularis</i>	H	COS	-	1948	1957	H	2				+		+		
* <i>Digitaria longiflora</i>	H	AS	C	1916	1938	H	5	+					+		
<i>Digitaria pentzii</i>	H	AF	C	1950	1978	P	2	+				+			
<i>Digitaria sanguinalis</i>	H	EUR	A	1864	1984	P	75	+	+	+	+	+	+	+	+
<i>Digitaria setigera</i>	H	AS	A	1826	1983	P	64	+	+	+	+		+	+	+
<i>Digitaria violascens</i>	H	AS	A	1916	1985	H	10	+	+				+		
<i>Echinochloa colona</i>	H	AS	A	1864	1982	P	54	+	+	+	+	+	+	+	+
<i>Echinochloa crus-galli</i>	H	AS	C	1846	1983	H	62	+	+	+	+		+	+	
* <i>Echinochloa cruspavonis</i>	H	SAM	C	1916	1966	H	2	+					+		
<i>Echinochloa glabrescens</i>	H	AS	-	1895	1966	H	13	+	+		+		+		
** <i>Echinochloa phyllopogon</i>	H	-	-	1928	1930	H	2						+		
<i>Ehrharta stipoides</i>	H	AUP	A	1916	1983	H	16	+	+				+		
<i>Eleusine indica</i>	H	AS	A	1940	1984	P	62	+	+	+	+		+	+	+
<i>Eragrostis brownei</i>	H	AUS	C	1916	1973	H	11	+	+	+					
<i>Eragrostis cilianensis</i>	H	EUR	C	1864	1985	P	36	+		+		+	+	+	
<i>Eragrostis ciliaris</i>	H	COS	-	1976	1976	H	1						+		
<i>Eragrostis elongata</i>	H	AS	C	1949	1983	P	4	+						+	
<i>Eragrostis pectinacea</i>	H	NAM	C	1916	1977	H	16	+	+				+		
<i>Eragrostis pilosa</i>	H	EUR	C	1913	1983	P	1							+	
<i>Eragrostis tenella</i>	H	TOW	A	1895	1984	H	40	+	+			+	+		+
<i>Eragrostis unioides</i>	H	AS	C	1958	1958	H	1	+							
<i>Eustachys petraea</i>	H	TAM	-	1978	1978	H	1								+
<i>Festuca rubra</i>	H	EUR	C	1912	1982	P	5	+	+						
<i>Garnotia acutigluma</i>	H	-	-	1888	1972	H	9	+	+	+					
<i>Gastridium ventricosum</i>	H	EUR	C	1909	1982	H	13	+	+					+	

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Holcus lanatus</i>	H	EUR	A	1909	1985	H	35	+	+	+			+	+		
<i>Hordeum leporinum</i>	H	MED	-	1909	1938	H	12	+	+		+					+
<i>Hordeum vulgare</i>	H	OW	C	1935	1984	H	6	+	+				+	+		
<i>Hyparrhenia hirta</i>	H	OW	C	1962	1981	H	4		+		+					
<i>Hyparrhenia rufa</i>	H	TOW	C	1933	1982	P	16	+	+	+	+		+	+		
<i>Lolium multiflorum</i>	H	EUR	C	1910	1980	H	18	+	+	+			+	+		
<i>Melinis minutiflora</i>	H	EUR	C	1913	1983	P	35	+	+	+	+	+	+	+		
<i>Muhlenbergia microsperma</i>	H	NW	C	1930	1974	H	11							+		
<i>Oplismenus compositus</i>	H	AS	C	1966	1966	H	1							+		
<i>Oplismenus hirtellus</i>	H	TAM	A	1841	1983	P	84	+	+	+	+		+	+		
<i>Panicum maximum</i>	H	AF	C	1888	1984	H	14	+					+	+	+	
<i>Panicum miliaceum</i>	H	EAS	C	1923	1981	P	7	+	+							
<i>Panicum repens</i>	H	OW	C	1916	1979	H	12	+	+		+					
* <i>Paspalidium radiatum</i>	H	AUS	C	1939	1939	H	1									+
<i>Paspalum conjugatum</i>	H	TAM	A	1840	1983	P	55	+	+	+	+		+	+	+	
<i>Paspalum dilatatum</i>	H	SAM	C	1911	1984	H	41	+	+	+	+		+	+		
<i>Paspalum distichum</i>	H	TAM	C	1916	1978	P	3						+	+		
<i>Paspalum fimbriatum</i>	H	TAM	C	1916	1983	P	21						+	+		+
<i>Paspalum paniculatum</i>	H	TAM	C	1980	1980	H	1	+								
<i>Paspalum scrobiculatum</i>	H	NW	-	1852	1982	H	49	+	+	+			+	+		
<i>Paspalum urvillei</i>	H	SAM	C	1914	1984	H	26	+	+	+	+		+	+		
<i>Paspalum vaginatum</i>	H	TAM	C	1936	1974	H	8	+					+	+		
<i>Pennisetum clandestinum</i>	H	AF	C	1924	1984	H	8	+	+		+		+			
<i>Pennisetum macrostachyum</i>	H	AS	C	1916	1967	P	8	+					+	+		
<i>Pennisetum polystachion</i>	H	TOW	-	1929	1985	H	30	+	+	+	+	+	+	+		
<i>Pennisetum purpureum</i>	H	AF	C	1912	1976	P	18	+	+	+	+		+	+		

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
<i>Pennisetum setaceum</i>	H	AF	C	1914	1983	H	27	+			+	+	+		
<i>Poa annua</i>	H	EUR	C	1841	1983	P	35	+	+		+	+	+		+
<i>Poa pratensis</i>	H	EUR	C	1911	1978	H	16	+	+			+			
<i>Polypogon interruptus</i>	H	SAM	C	1871	1970	P	14	+	+			+	+		
<i>Polypogon monspeliensis</i>	H	EUR	C	1909	1967	H	25	+	+			+			+
<i>Rhynchelytrum repens</i>	H	AF	C	1895	1984	P	63	+	+	+	+	+	+	+	+
<i>Sacciolepis indica</i>	H	AS	C	1908	1984	H	43	+	+	+		+	+		
<i>Schizachyrium condensatum</i>	H	NAM	C	1961	1974	H	15	+							
<i>Schizostachyum glaucifolium</i>	H	P	C	1000	1980	P	37	+	+	+		+	+		
<i>Setaria glauca</i>	H	OW	C	1910	1983	P	16	+			+	+	+		
<i>Setaria gracilis</i>	H	TAM	C	1855	1984	H	45	+	+	+	+	+	+		
<i>Setaria palmifolia</i>	H	OW	C	1903	1983	H	30	+	+		+	+			
<i>Setaria verticillata</i>	H	OW	A	1895	1984	H	97	+	+	+	+	+	+	+	+
<i>Sorghum halpense</i>	H	MED	C	1909	1983	H	24	+	+			+	+		
* <i>Sorghum sudanense</i>	H	AF	C	1914	1929	H	4				+	+			
<i>Sporobolus africanus</i>	H	AS	C	1911	1984	H	11	+	+	+	+	+	+		+
<i>Sporobolus diander</i>	H	AF	C	1911	1983	H	39	+				+			
<i>Sporobolus elongatus</i>	H	AUS	C	1909	1936	H	17	+	+		+	+			
<i>Sporobolus indicus</i>	H	TAM	C	1912	1983	P	15	+	+	+	+	+			
<i>Sporobolus pyramidatus</i>	H	TAM	-	1978	1979	H	4					+			+
<i>Stenotaphrum secundatum</i>	H	USM	C	1840	1984	P	36	+		+	+	+	+		+
<i>Stipa cernua</i>	H	USM	C	1957	1982	H	8	+							
<i>Themeda villosa</i>	H	AS	C	1924	1979	H	11	+				+	+		
<i>Tragus berteronianus</i>	H	OW	A	1935	1984	P	8		+	+		+			
# <i>Tricachne insularis</i>	H	TAM	C	1913	1984	H	43	+	+	+	+	+	+		+

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
<i>Vulpia bromoides</i>	H	EUR	-	1901	1976	P	39	+	+	+	+	+	+		
<i>Vulpia myuros</i>	H	EUR	-	1911	1985	H	53	+	+		+		+	+	+
* <i>Vulpia octoflora</i>	H	USM	-	1966	1966	H	2	+							
PONTEDERIACEAE (Pickerel weed family)															
<i>Eichhornia crassipes</i>	H	TAM	O	1900	1976	P	5	+	+				+		
<i>Monochoria vaginalis</i>	H	AS	A	1935	1946	H	4							+	
POTAMOGETONACEAE (Pondweed family)															
<i>Potamogeton foliosus</i>	H	NAM	A	1817	1984	H	15	+	+				+	+	
<i>Potamogeton nodosus</i>	H	COS	A	1825	1920	H	5		+						
<i>Potamogeton pectinatus</i>	H	COS	A	1947	1949	H	2							+	+
TACCACEAE (Tacca family)															
<i>Tacca leontopetaloides</i>	B	AS	C	1000	1977	P	40	+	+	+			+	+	
TYPHACEAE (Cattail family)															
<i>Typha domingensis</i>	H	OW	O	1939	1942	H	2							+	
<i>Typha latifolia</i>	H	COS	A	1977	1981	P	3							+	
XYRIDACEAE (Yellow-eyed grass family)															
<i>Xyris complanata</i>	H	AUS	A	1973	1985	P	2	+							
<i>Xyris platylepis</i>	H	USM	A	1951	1962	H	6	+							
ZINGIBERACEAE (Ginger family)															
<i>Alpinia purpurata</i>	B	P	O	1925	1979	H	16	+		+				+	
<i>Alpinia zerumbet</i>	B	AS	O	1888	1976	P	12	+						+	
<i>Hedychium coronarium</i>	B	AS	O	1888	1986	P	12	+	+	+	+			+	
<i>Hedychium flavescens</i>	B	AS	O	1913	1972	H	16	+	+	+	+			+	+
<i>Hedychium gardnerianum</i>	B	AS	O	1954	1975	H	3	+						+	
<i>Zingiber zerumbet</i>	B	AS	C	1000	1983	P	35			+	+	+		+	+

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Amaranthus lividus</i>	H	COS	A	1971	1985	H	3	+					+				
<i>Amaranthus spinosus</i>	H	TAM	A	1911	1984	P	12	+	+	+		+	+	+			+
<i>Amaranthus viridis</i>	H	COS	A	1819	1984	P	25	+	+		+	+	+				+
<i>Gomphrena globosa</i>	H	TAM	O	1929	1948	H	4							+			
ANACARDIACEAE (Mango family)																	
<i>Anacardium occidentale</i>	T	TAM	C	1915	1983	H	9							+			
<i>Schinus terebinthifolius</i>	T	SAM	O	1909	1972	H	23	+	+	+	+		+				+
ANNONACEAE*																	
* <i>Annona cherimola</i>	T	SAM	C	1791	1975	P	7	+			+						
APIACEAE (Parsley family)																	
<i>Anethum graveolens</i>	H	EAS	O	1888	1953	P	3							+			
<i>Centella asiatica</i>	H	AS	A	1888	1972	P	23	+		+			+	+			
<i>Ciclospermum leptophyllum</i>	H	NW	A	1909	1983	H	26	+		+	+		+	+	+		
<i>Coriandrum sativum</i>	H	EAS	C	1926	1952	H	5	+					+				
<i>Cryptotaenia canadensis</i>	H	NAM	C	1925	1979	H	22	+					+	+			
<i>Daucus pusillus</i>	H	NAM	A	1794	1981	H	14	+		+	+		+				
<i>Eryngium foetidum</i>	H	TAM	A	1944	1976	H	2						+	+			
<i>Foeniculum vulgare</i>	H	EUR	C	1865	1984	P	15	+	+		+		+	+			
<i>Hydrocotyle bowlesioides</i>	H	-	A	1931	1984	H	6	+									
<i>Hydrocotyle sibthorpioides</i>	H	AS	A	1932	1983	H	5	+	+				+				
<i>Hydrocotyle verticillata</i>	H	OW	A	1817	1966	H	31	+	+	+			+	+	+		
<i>Petroselinum crispum</i>	H	MED	C	1910	1984	H	8	+	+				+				
<i>Torilis nodosa</i>	H	OW	A	1855	1911	H	3	+									
APOCYNACEAE (Dogbane family)																	
<i>Catharanthus roseus</i>	H	TAM	O	1865	1983	H	22	+	+	+			+				+

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
AQUIFOLIACEAE (Holly family)															
<i>Ilex cassine</i>	T	USM	O	1949	1985	H	15	+						+	
<i>Ilex paraguariensis</i>	T	SAM	C	1934	1984	H	7							+	
ARALIACEAE (Ginseng family)															
<i>Schefflera actinophylla</i>	T	AUS	O	1900	1976	P	6								+
ASCLEPIADACEAE (Milkweed family)															
<i>Asclepias curassavica</i>	H	TAM	O	1850	1976	P	44	+		+	+	+	+	+	+
<i>Asclepias physocarpa</i>	H	AF	O	1919	1974	H	22	+	+		+			+	
<i>Stapelia gigantea</i>	H	AF	O	1942	1984	H	5							+	
ASTERACEAE (Sunflower family)															
<i>Acanthospermum australe</i>	H	TAM	A	1840	1974	P	28	+		+	+	+	+	+	+
<i>Acanthospermum hispidum</i>	H	TAM	A	1951	1966	H	2			+					
<i>Achillea millefolium</i>	H	NH	A	1911	1975	H	10	+						+	
<i>Ageratina adenophora</i>	H	TAM	A	1909	1967	H	63	+	+	+	+			+	+
<i>Ageratina riparia</i>	H	TAM	A	1925	1976	P	13	+						+	
<i>Ageratum conyzoides</i>	H	TAM	O	1825	1974	P	52	+	+	+	+			+	+
<i>Ageratum houstonianum</i>	H	TAM	O	1909	1977	H	15	+						+	+
<i>Ambrosia artemisiifolia</i>	H	NAM	A	1840	1984	H	40	+	+	+	+			+	
<i>Anthemis cotula</i>	H	EUR	A	1909	1976	H	14	+			+			+	
<i>Arctium lappa</i>	H	EAS	O	1910	1960	H	7	+			+			+	
<i>Artemisia pontica</i>	S	EUR	A	1959	1959	H	1							+	
<i>Artemisia vulgaris</i>	H	EUR	A	1909	1959	H	14	+						+	+
<i>Aster subulatus</i>	H	TAM	O	1826	1977	H	10	+	+	+				+	+
<i>Baltimora recta</i>	H	TAM	A	1984	1984	P	0							+	
<i>Bidens alba</i>	H	-	A	1958	1983	H	5	+					+	+	+
<i>Bidens cynapiifolia</i>	H	TAM	A	1929	1976	H	20	+			+			+	

Appendix, continued.

Appendix, continued.

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Bidens gárdneri</i>	H	-	A	1983	1984	H	1			+							
<i>Bidens laevis</i>	H	NW	A	1855	1912	P	2				+			+			
## <i>Bidens lanceolata</i>	H	-	A	1963	1963	H	1	+									
<i>Bidens pilosa</i>	H	TAM	A	1819	1975	H	56	+	+			+		+			
<i>Blumea laciniata</i>	H	AS	A	1923	1937	H	7										+
<i>Blumea sessiliflora</i>	H	AS	A	1920	1937	H	1			+							
<i>Calypocarpus vialis</i>	H	TAM	A	1971	1985	H	11			+	+	+		+	+		
<i>Centaurea maculosa</i>	H	EUR	A	1965	1965	H	1	+									
<i>Centaurea melitensis</i>	H	EUR	A	1855	1976	H	31	+	+	+	+			+	+	+	
<i>Chrysanthemum leucanthemum</i>	H	EAS	A	1911	1975	H	4	+	+								
* <i>Chrysanthemum maximum</i>	H	EUR	O	1917	1959	H	4	+									
<i>Cirsium vulgare</i>	H	EUR	A	1909	1983	H	19	+	+	+	+	+	+	+	+		
<i>Conyza bonariensis</i>	H	SAM	A	1888	1985	P	53	+	+	+	+	+	+	+			
<i>Conyza canadensis</i> var. <i>canadensis</i>	H	NW	A	1911	1984	H	6	+	+								
<i>Conyza canadensis</i> var. <i>pusilla</i>	H	NW	A	1817	1984	H	57	+	+	+	+			+	+	+	
<i>Coreopsis lanceolata</i>	H	USM	O	1938	1946	H	4	+						+	+		
<i>Cosmos caudatus</i>	H	TAM	O	1865	1953	H	4	+						+			
<i>Cotula australis</i>	H	AUP	A	1943	1983	H	3	+	+					+			
<i>Crassocephalum crepidioides</i>	H	AF	A	1929	1984	H	16							+	+		
<i>Crepis capillaris</i>	H	EUR	A	1934	1975	H	8	+						+	+		
<i>Eclipta alba</i>	H	COS	A	1865	1974	P	16	+						+			+
<i>Elephantopus mollis</i>	H	TAM	A	1926	1974	H	16			+	+					+	+
<i>Elephantopus spicatus</i>	H	TAM	A	1935	1975	H	6	+						+	+		
<i>Emilia coccinea</i>	H	AS	A	1909	1963	H	11					+		+			

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Emilia fosbergii</i>	H	-	A	1920	1984	H	92	+	+	+	+	+	+	+	+	+	+
<i>Emilia sonchifolia</i> var. <i>javanicus</i>	H	AS	A	1927	1976	H	4							+	+		
<i>Emilia sonchifolia</i> var. <i>sonchifolia</i>	H	AS	A	1931	1983	H	9							+	+		
<i>Encelia farinosa</i>	H	USM	A	1909	1983	H	10		+								
<i>Erechtites hieracifolia</i>	H	NW	A	1909	1984	H	15	+		+	+			+	+		
<i>Erechtites valerianifolia</i>	H	TAM	A	1916	1984	H	34	+	+	+	+			+			
<i>Erigeron annuus</i>	H	COS	A	1936	1936	H	1	+									
<i>Erigeron bellioides</i>	H	TAM	A	1984	1985	H	3							+			
<i>Erigeron karvinskianus</i>	H	TAM	O	1911	1983	H	17	+	+					+	+		
<i>Filago gallica</i>	H	EUR	A	1966	1967	H	3	+									
<i>Flaveria trinervia</i>	H	NAM	A	1937	1978	H	8							+			
<i>Gaillardia pulchella</i>	H	USM	O	1908	1984	H	12							+			+
<i>Galinsoga parviflora</i>	H	TAM	A	1908	1976	H	27	+						+	+		
<i>Galinsoga quadriradiata</i>	H	TAM	A	1964	1976	H	4	+		+				+			
<i>Gnaphalium japonicum</i>	H	AS	A	1909	1981	H	35	+	+	+	+			+			
<i>Gnaphalium purpureum</i>	H	NAM	A	1888	1984	P	69	+	+	+			+	+	+		
<i>Helichrysum foetidum</i>	H	NW	O	1949	1982	H	9	+									
<i>Heterotheca grandiflora</i>	H	USM	A	1909	1975	H	33	+	+		+	+	+	+	+		
<i>Hypochoeris glabra</i>	H	EUR	A	1909	1974	H	11	+			+			+			
<i>Hypochoeris radicata</i>	H	MED	A	1895	1975	P	39	+	+	+	+					+	
** <i>Kalimeris pinnatifida</i>	H	-	A	1983	1983	H	1									+	
<i>Lactuca serriola</i>	H	EUR	A	1928	1985	H	6	+	+								
<i>Lapsana communis</i>	H	EUR	A	1909	1984	H	24	+	+								
<i>Madia sativa</i>	H	SAM	A	1927	1937	H	4			+							

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island										
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW		
<i>Matricaria chamomilla</i>	H	EAS	A	1909	1948	H	4	+										
<i>Montanoa hibiscifolia</i>	S	TAM	O	1919	1975	P	18	+	+		+		+	+				
<i>Osteospermum calendulaceum</i>	H	-	A	1983	1983	H	1	+										
<i>Palafoxia callosa</i>	H	USM	A	1971	1971	H	1				+							
<i>Parthenium hysterophorus</i>	H	USM	A	1960	1985	H	7	+	+	+					+			
<i>Picris hieracioides</i>	H	EAS	A	1930	1974	H	9	+			+							
<i>Pluchea indica</i>	S	AS	A	1909	1972	H	41		+					+	+	+		
<i>Pluchea symphytifolia</i>	S	TAM	A	1931	1974	H	44	+	+	+	+			+	+	+		
<i>Pluchea x fosbergii</i>	S	-	A	1934	1980	H	21		+	+				+	+			+
<i>Reichardia picroides</i>	H	OW	A	1909	1955	H	42	+						+				
<i>Rudbeckia laciniata</i>	H	NAM	O	1958	1958	H	1							+				
<i>Senecio mikanioides</i>	V	AF	O	1909	1975	H	14	+										
<i>Senecio sylvaticus</i>	H	EUR	A	1910	1985	H	24	+	+	+				+				
<i>Senecio vulgaris</i>	H	EUR	A	1932	1982	H	4	+	+									
<i>Sigesbeckia orientalis</i>	H	OW	A	1888	1976	P	16	+	+					+	+			
<i>Solidago canadensis</i>	H	USM	O	1926	1977	P	3	+						+	+			
<i>Sonchus asper</i>	H	COS	A	1975	1980	H	2	+										
<i>Sonchus oleraceus</i>	H	EUR	A	1817	1972	H	38	+	+		+			+	+	+		
<i>Synedrella nodifolia</i>	H	TAM	A	1926	1983	H	14	+	+	+			+	+	+			
<i>Tagetes minuta</i>	H	SAM	A	1932	1974	H	14	+						+				
<i>Tanacetum vulgare</i>	H	EUR	A	1959	1959	H	1							+				
<i>Taraxacum laevigatum</i>	H	-	A	1981	1981	H	1							+				
<i>Taraxacum officinale</i>	H	EUR	A	1909	1976	H	18	+	+		+			+				
<i>Tithonia diversifolia</i>	S	TAM	O	1917	1975	H	11	+	+					+	+			
<i>Tragopogon porrifolius</i>	H	EUR	O	1938	1982	H	3	+										
<i>Tridax procumbens</i>	H	TAM	A	1922	1976	H	26	+	+	+	+	+	+	+				

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Verbesina encelioides</i>	H	NAM	A	1888	1976	H	26		+	+	+	+	+	+		
<i>Vernonia cinerea</i>	H	TOW	A	1870	1967	P	30	+			+		+	+	+	
<i>Wedelia trilobata</i>	H	TAM	O	1965	1975	P	13	+	+					+	+	
<i>Xanthium strumarium</i>	H	NAM	A	1840	1983	P	42	+	+	+	+	+	+	+	+	+
<i>Youngia japonica</i>	H	AS	A	1865	1976	H	44	+	+	+	+			+	+	
<i>Zinnia palmeri</i>	H	TAM	O	1980	1980	H	1							+		
<i>Zinnia peruviana</i>	H	TAM	O	1909	1983	H	25		+	+	+	+				
BALSAMINACEAE (Touch-me-not family)																
<i>Impatiens oliveri</i>	H	AF	O	1956	1968	H	2									+
<i>Impatiens wallerana</i>	H	-	O	1939	1984	H	10	+						+		
BASELLACEAE (Basella family)																
<i>Anredera cordifolia</i>	V	SAM	O	1940	1973	H	8	+						+		
<i>Basella alba</i>	V	OW	C	1865	1945	H	3							+		
BATACEAE (Saltwort family)																
<i>Batis maritima</i>	H	TAM	A	1859	1985	P	47	+	+	+	+			+	+	+
BEGONIACEAE (Begonia family)																
<i>Begonia foliosa v. miniata</i>	H	SAM	O	1917	1937	H	3	+								
<i>Begonia hirtella</i>	H	SAM	O	1952	1984	H	6	+						+		
<i>Begonia reniformis</i>	H	-	O	1976	1985	H	2	+								
BIGNONIACEAE (Bignonia family)																
<i>Spathodea campanulata</i>	T	AF	O	1890	1986	H	22		+					+	+	
BIXACEAE (Arnotto family)																
<i>Bixa orellana</i>	T	TAM	C	1830	1986	P	29	+	+	+				+	+	
BORAGINACEAE (Borage family)																
<i>Amsinckia intermedia</i>	H	USM	A	1944	1944	H	1	+								
<i>Bothriospermum tenellum</i>	H	AS	A	1854	1975	H	7	+						+		

Appendix, continued.

Appendix, continued.

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Cordia subcordata</i>	T	TOW	C	1000	1973	P	31	+	+	+	+	+	+	+		
<i>Cynoglossum amabile</i>	H	AS	O	1930	1976	H	11	+					+			
<i>Heliotropium amplexicaule</i>	H	SAM	O	1871	1983	P	20	+	+	+			+			
<i>Heliotropium procumbens</i>	H	TAM	A	1975	1983	H	10		+				+		+	
<i>Mytosis discolor</i>	H	-	-	1981	1981	H	1	+								
<i>Tournefortia argentea</i>	T	AS	O	1888	1974	P	21		+		+		+	+	+	
BRASSICACEAE (Mustard family)																
<i>Brassica campestris</i>	H	EUR	A	1909	1980	H	13	+		+	+		+	+		
<i>Brassica juncea</i>	H	AS	C	1942	1970	H	4	+					+			
<i>Brassica nigra</i>	H	EUR	A	1888	1982	P	8	+	+				+			
<i>Capsella rubella</i>	H	EUR	A	1909	1985	H	20	+	+		+		+			
<i>Cardamine flexuosa</i>	H	EUR	A	1840	1984	H	43	+	+				+			
<i>Cardamine hirsuta</i>	H	EUR	C	1840	1979	H	3	+						+		
<i>Coronopus didymus</i>	H	OW	A	1840	1976	H	44	+	+	+	+		+	+	+	
<i>Lepidium bonariense</i>	H	SAM	A	1975	1975	H	1	+								
<i>Lepidium densiflorum</i>	H	NAM	A	1935	1935	H	1	+								
<i>Lepidium hyssopifolium</i>	H	-	A	1975	1975	H	1	+								
<i>Lepidium oblongum</i>	H	-	A	1914	1980	H	14			+	+	+	+		+	
<i>Lepidium virginicum</i>	H	NAM	A	1872	1985	H	37	+	+	+			+		+	
<i>Lobularia maritima</i>	H	MED	O	1939	1980	H	15	+	+				+		+	
<i>Nasturtium microphyllum</i>	H	EUR	C	1888	1932	P	7	+	+				+	+		
<i>Nasturtium sarmentosum</i>	H	P	C	1912	1984	H	20	+	+				+	+		
<i>Raphanus raphanistrum</i>	H	EUR	C	1963	1984	H	5	+					+	+		
<i>Raphanus sativus</i>	H	EUR	C	1888	1980	P	9	+		+			+	+	+	
<i>Sisymbrium altissimum</i>	H	EAS	A	1927	1981	H	7	+	+			+		+		
<i>Sisymbrium irio</i>	H	EUR	C	1963	1982	H	4	+								
<i>Sisymbrium officinale</i>	H	OW	A	1909	1984	H	25	+	+	+	+			+		

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island															
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW							
BUDDLEIACEAE (Butterfly bush family)																							
<i>Buddleja asiatica</i>	S	AS	O	1908	1984	H	58	+		+			+										
<i>Buddleja madagascariensis</i>	S	AF	O	1931	1984	H	7	+	+				+										
CACTACEAE (Cactus family)																							
<i>Cereus uruguayanus</i>	U	SAM	O	1930	1959	H	4							+		+							
<i>Harrisia martinii</i>	U	SAM	O	1959	1959	P	0																
<i>Hylocereus undatus</i>	U	TAM	O	1830	1985	P	9												+				
<i>Opuntia cochenillifera</i>	U	TAM	O	1888	1985	P	1												+				
<i>Opuntia ficus-indica</i>	U	NW	O	1985	1985	H	4		+										+				
<i>Opuntia vulgaris</i>	U	SAM	O	1932	1944	P	1												+				
CAMPANULACEAE (Bellflower family)																							
<i>Hippobroma longiflora</i>	H	TAM	A	1865	1983	H	24		+										+	+			
<i>Lobelia erinus</i>	H	AF	O	1931	1931	H	1		+														
<i>Triodanis biflora</i>	H	NW	A	1945	1945	H	2		+														
<i>Wahlenbergia gracilis</i>	H	COS	O	1928	1985	H	12		+		+												
CAPPARACEAE (Caper family)																							
<i>Cleome gynandra</i>	H	AF	A	1857	1984	P	38		+	+	+	+							+	+			
CAPRIFOLIACEAE (Honeysuckle family)																							
<i>Lonicera japonica</i>	V	AS	O	1882	1965	P	11		+										+				
<i>Sambucus mexicana</i>	T	TAM	O	1909	1974	P	12		+										+	+			
CARICACEAE (Papaya family)																							
<i>Carica papaya</i>	T	SAM	C	1823	1984	P	13		+										+				
CARYOPHYLLACEAE (Pink family)																							
<i>Arenaria serpyllifolia</i>	H	EUR	A	1935	1983	H	9		+	+													
<i>Cerastium fontanum</i>	H	EUR	A	1865	1985	P	32		+	+	+	+							+	+			
<i>Dianthus armeria</i>	H	EUR	A	1964	1982	H	2		+														

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Drymaria cordata</i>	H	COS	A	1895	1984	H	35	+	+	+	+		+	+		
<i>Petrorhagia velutina</i>	H	MED	A	1938	1962	H	5	+								
<i>Polycarpon tetraphyllum</i>	H	EUR	A	1909	1982	H	22	+	+	+	+	+				
<i>Sagina decumbens</i>	H	USM	A	1865	1974	H	3	+		+						
<i>Sagina japonica</i>	H	AS	A	1985	1985	H	1							+		
<i>Silene gallica</i>	H	EUR	A	1865	1984	H	55	+	+	+	+		+	+		
<i>Spergula arvensis</i>	H	EUR	A	1888	1958	P	5	+					+			
<i>Spergularia marina</i>	H	NH	A	1909	1980	H	35		+	+			+	+		+
<i>Stellaria media</i>	H	EAS	A	1930	1982	H	17	+	+		+		+	+		
CASUARINACEAE (She-oak family)																
<i>Casuarina equisetifolia</i>	T	ASP	C	1895	1985	H	59	+	+		+	+	+	+		
<i>Casuarina glauca</i>	T	AUS	C	1916	1985	H	27			+	+	+	+	+		
CECROPIACEAE (Cecropia family)																
<i>Cecropia obtusifolia</i>	T	TAM	C	1926	1976	H	14	+					+	+		
CERATOPHYLLACEAE (Hornwort family)																
<i>Ceratophyllum demersum</i>	H	COS	O	1934	1985	H	2						+			
CHENOPODIACEAE (Goosefoot family)																
<i>Atriplex eardleyae</i>	H	AUS	A	1984	1984	H	1	+								
<i>Atriplex lentiformis</i>	S	USM	C	1915	1974	H	10			+						
<i>Atriplex semibaccata</i>	S	AUS	C	1895	1977	P	34	+	+	+	+	+	+	+		
<i>Atriplex suberecta</i>	H	AUS	C	1923	1984	H	41	+	+	+			+			+
<i>Bassia hyssopifolia</i>	H	EAS	A	1983	1983	H	1		+							
<i>Chenopodium ambrosioides</i>	H	NAM	A	1858	1975	H	35	+	+		+		+			
<i>Chenopodium carinatum</i>	H	AUS	A	1922	1984	H	24	+	+	+	+	+				
<i>Chenopodium murale</i>	H	EUR	A	1865	1984	H	43	+	+	+		+	+	+	+	+
** <i>Euchylaena tomentosa</i>	S	-	-	1985	1985	H	1		+							

Appendix, continued.

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island										
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW		
<i>Ipomoea violacea</i>	V	-	A	1910	1984	H	9	+	+	+				+				
* <i>Merremia peltata</i>	V	AS	O	1911	1911	H	2											+
<i>Merremia tuberosa</i>	V	TAM	O	1932	1976	H	10	+						+	+			
<i>Merremia umbellata</i>	V	TAM	O	1911	1985	H	10	+						+				
<i>Stictocardia tiliifolia</i>	V	AS	O	1837	1955	H	24	+	+	+				+	+			
CORYNOCARPACEAE (Karakanut family)																		
<i>Corynocarpus laevigatus</i>	T	P	C	1891	1976	P	27				+			+	+			
CRASSULACEAE (Orpine family)																		
<i>Kalanchoe pinnata</i>	H	AF	O	1888	1984	P	18	+	+	+	+			+	+			
<i>Kalanchoe tubiflora</i>	H	AF	O	1930	1983	P	6	+	+		+			+				
CUCURBITACEAE (Gourd family)																		
<i>Coccinia grandis</i>	V	OW	O	1969	1986	P	2							+				
<i>Cucumis dipsaceus</i>	V	AS	C	1903	1984	H	39	+	+		+			+	+	+		
<i>Lagenaria siceraria</i>	V	TOW	C	1000	1986	P	6	+						+				
<i>Momordica charantia</i>	V	OW	C	1909	1986	H	36	+	+	+	+			+	+	+		
<i>Sechium edule</i>	V	TAM	C	1965	1986	P	4							+	+			
CUSCUTACEAE (Dodder family)																		
<i>Cuscuta campestris</i>	H	NAM	A	1955	1955	H	1	+										
ELAEAGNACEAE (Oleaster family)																		
<i>Elaeagnus umbellata</i>	S	AS	O	1963	1984	H	5	+										
EUPHORBIACEAE (Spurge family)																		
<i>Acalypha indica</i>	S	AS	O	1888	1888	P	0											
<i>Aleurites moluccana</i>	T	ASP	C	1000	1973	P	0											
<i>Chamaesyce albomarginata</i>	H	NAM	A	1947	1984	H	3							+	+			
<i>Chamaesyce hirta</i>	H	COS	A	1817	1983	H	53	+	+	+	+	+	+	+	+	+	+	+
<i>Chamaesyce hypericifolia</i>	H	TAM	A	1913	1983	H	16				+			+	+			+

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Chamaesyce hyssopifolia</i>	H	NW	A	1959	1983	H	11	+					+	+		
<i>Chamaesyce maculata</i>	H	COS	A	1980	1980	H	1									+
<i>Chamaesyce prostrata</i>	H	NW	A	1909	1983	H	18						+			+
<i>Chamaesyce thymifolia</i>	H	OW	A	1888	1978	P	5	+					+			
* <i>Euphorbia cotinifolia</i>	S	TAM	O	1959	1985	H	3	+					+			
<i>Euphorbia cyathophora</i>	H	NW	O	1917	1980	H	13		+	+			+	+		+
<i>Euphorbia graminea</i>	H	-	A	1978	1978	H	1						+			
<i>Euphorbia heterophylla</i>	H	TAM	O	1895	1984	H	41	+	+		+		+	+	+	+
<i>Euphorbia pepus</i>	H	EAS	A	1855	1984	H	18	+	+				+			
<i>Jatropha curcas</i>	T	TAM	O	1937	1963	H	12	+	+				+			+
<i>Jatropha gossypifolia</i>	S	TAM	O	1950	1958	H	4						+			
<i>Macaranga mappa</i>	T	AS	C	1927	1971	H	10	+					+			
<i>Phyllanthus debilis</i>	H	AS	A	1865	1978	P	19	+					+	+		
<i>Phyllanthus tenellus</i>	H	AF	A	1963	1983	H	6						+	+		
<i>Ricinis communis</i>	S	AF	C	1819	1974	P	20	+	+		+	+	+	+	+	+
FABACEAE (Pea family)																
<i>Abrus precatorius</i>	V	AS	O	1888	1986	P	8	+	+	+			+	+	+	
<i>Acacia confusa</i>	T	AS	C	1915	1986	P	29	+	+	+	+	+	+	+		
<i>Acacia farnesiana</i>	S	TAM	C	1865	1976	H	21		+	+		+	+			+
<i>Acacia mearnsii</i>	T	-	C	1911	1985	P	13	+	+		+		+	+		
<i>Albizia lebbek</i>	T	AS	C	1865	1983	H	17									+
<i>Alysicarpus vaginalis</i>	H	AS	C	1909	1985	H	18		+				+	+		
<i>Caesalpinia bonduc</i>	S	COS	O	1794	1972	H	37	+	+				+	+	+	
<i>Caesalpinia decapetala</i>	S	AS	O	1888	1984	P	19	+		+			+	+		
<i>Caesalpinia major</i>	S	COS	A	1865	1960	H	24	+		+	+		+			+
* <i>Caesalpinia pulcherrima</i>	S	TAM	O	1828	1985	P	20						+			

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Cajanus cajan</i>	S	AS	C	1865	1986	H	15	+		+			+	+		
<i>Canavalia cathartica</i>	V	OW	O	1908	1972	H	54		+	+			+	+		
<i>Canavalia sericea</i>	V	P	O	1930	1985	H	12		+					+		
<i>Chamaecrista nictitans</i>	S	COS	A	1870	1976	P	105	+	+	+	+	+	+	+	+	+
<i>Clitoria ternata</i>	S	COS	O	1865	1945	H	7							+		
<i>Crotalaria assamica</i>	H	AS	C	1865	1974	H	13	+						+		
<i>Crotalaria berteroa</i>	H	AS	C	1895	1985	H	3		+					+		
<i>Crotalaria incana</i>	H	TAM	C	1895	1976	H	29	+	+		+		+	+		
<i>Crotalaria longirostrata</i>	H	TAM	C	1865	1985	P	6		+					+		
<i>Crotalaria micans</i>	H	SAM	O	1911	1983	H	9	+						+		
<i>Crotalaria pallida</i>	H	OW	C	1965	1983	H	35	+	+		+		+			
<i>Crotalaria retusa</i>	H	AS	A	1931	1975	H	3							+		
<i>Crotalaria spectabilis</i>	S	AS	A	1865	1961	P	8				+			+		
* <i>Crotalaria verrucosa</i>	H	AA	O	1926	1944	H	3				+			+		
* <i>Cytisus monspessulanus</i>	S	MED	O	1956	1956	H	2									+
<i>Cytisus palmensis</i>	S	AF	O	1927	1985	H	9		+							
<i>Cytisus scoparius</i>	S	EAS	O	1909	1909	H	3	+								
<i>Desmanthus virgatus</i>	S	NAM	A	1900	1980	P	22	+	+			+	+	+	+	+
<i>Desmodium cajanifolium</i>	S	TAM	C	1933	1984	H	7	+						+		
<i>Desmodium heterocarpon</i>	H	AS	C	1916	1917	H	3							+		
<i>Desmodium incanum</i>	H	TAM	C	1916	1983	H	32	+	+					+	+	
<i>Desmodium intortum</i>	H	TAM	C	1938	1982	H	3	+	+					+		
<i>Desmodium sandwicense</i>	H	-	-	1847	1986	H	62	+	+		+	+	+	+	+	+
<i>Desmodium tortuosum</i>	H	TAM	A	1913	1986	H	18	+	+				+	+	+	
<i>Desmodium triflorum</i>	H	OW	A	1855	1985	P	34	+	+	+	+	+	+	+	+	
<i>Dioclea wilsonii</i>	V	TAM	O	1825	1974	H	10	+								+

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
* <i>Flemingia strobilifera</i>	S	ASP	O	1910	1979	H	4		+					+			
<i>Haematoxylum campechianum</i>	T	TAM	C	1917	1962	H	7							+			
<i>Indigofera spicata</i>	H	TOW	C	1977	1977	H	1							+			
<i>Indigofera suffruticosa</i>	H	TAM	C	1836	1986	P	48	+	+		+	+	+	+			
<i>Lablab purpureus</i>	V	AS	O	1840	1971	P	25	+		+				+		+	
<i>Lathyrus latifolius</i>	H	EUR	O	1985	1985	H	1		+								
<i>Lathyrus tingitanus</i>	H	-	O	1985	1985	H	1		+								
<i>Leucaena leucocephala</i>	S	TAM	C	1837	1985	H	24				+	+	+	+			
<i>Lotus subbiflorus</i>	H	OW	O	1937	1983	H	4	+	+								
<i>Macrotidium lathyroides</i>	H	TAM	C	1865	1985	H	44	+	+		+	+	+	+	+	+	+
* <i>Medicago intertexta</i>	H	EUR	C	1895	1979	P	6		+		+						
<i>Medicago lupulina</i>	H	OW	C	1888	1984	P	19	+	+								
<i>Medicago polymorpha</i>	H	OW	C	1882	1984	P	30	+	+		+		+	+			
<i>Medicago sativa</i>	H	EAS	C	1929	1982	H	11	+			+		+	+			+
<i>Melilotus indica</i>	H	EAS	C	1909	1985	H	8	+	+			+	+	+			+
<i>Melilotus officinalis</i>	H	EAS	C	1920	1984	P	10	+	+				+				+
<i>Mimosa pudica</i>	S	SAM	A	1855	1985	P	20	+			+		+	+			
<i>Mucuna urens</i>	V	SAM	O	1819	1961	H	8		+				+				
<i>Paraserianthes falcataria</i>	T	AS	C	1930	1976	H	11	+	+				+	+			
<i>Parkinsonia aculeata</i>	T	NW	O	1975	1976	H	2		+				+				
<i>Pithecellobium dulce</i>	T	TAM	O	1870	1985	P	20	+					+	+			
<i>Prosopis pallida</i>	T	SAM	C	1828	1974	P	29	+	+	+	+						
<i>Rhynchosia minima</i>	V	TAM	O	1965	1965	H	1										+
<i>Samanea saman</i>	T	TAM	C	1919	1985	H	15	+					+				
<i>Senna didymobotrya</i>	S	AF	C	1930	1986	H	13		+		+		+	+			
<i>Senna obtusifolia</i>	S	-	A	1945	1960	H	3	+					+				

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
<i>Senna occidentalis</i>	S	TAM	O	1836	1983	H	26	+	+				+	+	+
<i>Senna pendula</i> var. <i>advena</i>	S	-	O	1908	1979	H	20	+	+		+		+		
<i>Senna septemtrionalis</i>	S	-	O	1913	1984	H	20	+	+		+		+		
<i>Senna surattensis</i>	S	AA	O	1888	1985	P	24		+	+			+	+	
<i>Sesbania sesban</i>	S	TOW	C	1909	1982	H	15						+	+	
<i>Spartium junceum</i>	S	EUR	O	1956	1972	H	2							+	
* <i>Tamarindus indica</i>	T	TOW	C	1797	1985	P	16	+	+	+			+	+	
<i>Tephrosia purpurea</i>	H	ASP	C	1000	1984	P	66	+	+	+	+	+	+	+	+
<i>Trifolium arvense</i>	H	EUR	C	1932	1984	H	14	+	+						
<i>Trifolium dubium</i>	H	EUR	C	1985	1985	H	1		+						
<i>Trifolium pratense</i>	H	EUR	C	1932	1982	H	4	+	+						
<i>Trifolium procumbens</i>	H	EUR	C	1966	1966	H	1	+							
<i>Trifolium repens</i>	H	EAS	C	1909	1984	H	9	+	+					+	
<i>Ulex europaeus</i>	S	EUR	C	1915	1983	H	10	+	+						
<i>Vicia angustifolia</i>	H	-	-	1909	1985	H	13	+	+						
FRANKENIACEAE (Frankenia family)															
<i>Frankenia salina</i>	H	USM	A	1968	1968	H	1								+
GENTIANACEAE (Gentian family)															
<i>Centaurium erythraea</i>	H	OW	A	1909	1984	H	75	+	+	+	+		+		+
GERANIACEAE (Geranium family)															
<i>Erodium cicutarium</i>	H	MED	A	1888	1975	P	15	+	+	+	+		+		
<i>Geranium dissectum</i>	H	AA	A	1910	1948	H	4	+	+						
<i>Geranium homeanum</i>	H	-	A	1909	1984	H	25	+	+					+	
<i>Geranium pusillum</i>	H	EUR	A	1909	1909	H	1	+							
<i>Geranium retrorsum</i>	H	-	A	1888	1980	H	8	+	+		+				
<i>Pelargonium zonale</i>	S	AF	O	1888	1940	P	1							+	

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW

HALORAGACEAE (Water milfoil family)																
<i>Gonocarpus chinensis</i>	H	-	-	1966	1983	H	2	+								
<i>Myriophyllum aquaticum</i>	H	SAM	O	1919	1982	H	7	+							+	
LAMIACEAE (Mint family)																
<i>Hyptis pectinata</i>	H	TAM	A	1930	1983	P	15	+	+						+	
<i>Leonotis leonurus</i>	H	AF	O	1929	1929	H	1						+			
<i>Leonotis nepetifolia</i>	H	AF	O	1938	1985	H	13	+							+	+
<i>Leonurus sibiricus</i>	H	AS	O	1909	1971	H	19	+	+						+	+
<i>Marrubium vulgare</i>	H	EAS	C	1913	1978	H	8	+				+				
<i>Mentha pulegium</i>	H	OW	C	1920	1948	H	2	+	+							
<i>Mentha spicata</i>	H	EUR	C	1936	1959	H	2	+								
<i>Mentha x villosa</i>	H	-	C	1953	1959	H	3	+							+	
<i>Ocimum basilicum</i>	H	TOW	C	1912	1984	H	11	+	+	+					+	+
<i>Ocimum gratissimum</i>	H	TOW	C	1924	1984	H	22	+	+	+					+	+
<i>Plectranthus scutellarioides</i>	H	-	O	1890	1972	P	13	+	+						+	
<i>Prunella vulgaris</i>	H	EAS	A	1909	1975	H	15	+	+	+					+	
<i>Salvia coccinea</i>	H	USM	O	1888	1975	P	31	+	+	+	+				+	
<i>Salvia occidentalis</i>	H	TAM	O	1835	1976	H	43	+	+		+				+	+
<i>Stachys arvensis</i>	H	EUR	A	1865	1976	H	40	+	+	+	+				+	+
LAURACEAE (Laurel family)																
<i>Cinnamomum burmannii</i>	T	AS	C	1934	1984	H	18								+	
<i>Persea americana</i>	T	TAM	C	1825	1954	P	7		+						+	
LINACEAE (Flax family)																
<i>Linum bienne</i>	H	-	-	1982	1982	H	1				+					
<i>Linum trigynum</i>	H	EUR	A	1912	1985	H	3								+	

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
LYTHRACEAE (Loosestrife family)																
<i>Ammannia auriculata</i>	H	-	A	1936	1974	H	3		+				+			
<i>Ammannia coccinea</i>	H	-	-	1977	1977	H	1									+
<i>Cuphea carthagenensis</i>	H	TAM	A	1855	1975	H	41	+	+	+			+	+		
<i>Cuphea hyssopifolia</i>	S	NAM	A	1909	1982	H	8	+					+			
<i>Cuphea ignea</i>	S	NAM	O	1915	1933	H	5	+					+			
<i>Lythrum maritimum</i>	S	SAM	A	1794	1975	H	58	+	+	+	+		+	+		
MALVACEAE (Mallow family)																
<i>Abelmoschus moschatus</i>	H	AS	C	1895	1941	H	2							+	+	
<i>Abutilon grandifolium</i>	S	COS	A	1903	1985	H	61	+	+	+	+	+	+	+	+	+
<i>Gossypium barbadense</i>	S	TAM	C	1817	1985	P	20	+			+		+			+
<i>Gossypium hirsutum</i>	S	TAM	C	1914	1916	H	2				+		+			
<i>Hibiscus macrophyllus</i>	T	AS	O	1917	1936	P	7							+		
<i>Malachra alceifolia</i>	H	TAM	A	1940	1971	H	7							+	+	
<i>Malva parviflora</i>	H	EUR	A	1825	1982	P	32	+	+		+	+	+	+	+	+
<i>Malvastrum coromandelianum</i>	H	TAM	A	1840	1984	H	51	+	+	+	+	+	+	+	+	+
<i>Modiola caroliniana</i>	H	NW	A	1911	1985	H	30	+	+							
<i>Sida acuta</i>	S	TAM	A	1985	1985	H	10	+		+			+			
<i>Sida rhombifolia</i>	S	COS	A	1837	1985	H	43	+		+	+		+	+		
<i>Sida spinosa</i>	S	TAM	A	1888	1981	H	8	+					+			
<i>Thespesia populnea</i>	T	AS	C	1000	1984	P	26	+		+			+			+
MELASTOMATACEAE (Melastome family)																
<i>Arthrostema ciliatum</i>	S	SAM	O	1939	1985	H	10	+						+		
<i>Clidemia hirta</i>	S	TAM	A	1941	1978	P	17							+		
<i>Dissotis rotundifolia</i>	H	TAM	O	1958	1975	H	4							+		
<i>Heterocentron subtripplinervium</i>	S	TAM	O	1926	1973	P	20	+	+					+	+	

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Medinilla venosa</i>	S	-	O	1957	1973	H	2		+								
<i>Melastoma candidum</i>	S	-	O	1916	1982	P	22	+									+
<i>Melastoma sanguineum</i>	S	-	O	1957	1979	H	2	+									+
<i>Miconia calvescens</i>	T	-	O	1985	1985	P	0										
<i>Oxyspora paniculata</i>	S	AS	O	1954	1974	H	5										+
<i>Pterolepis glomerata</i>	S	TAM	A	1949	1983	H	14										+
<i>Tetrazygia bicolor</i>	S	TAM	O	1932	1985	H	6	+									+
<i>Tibouchina herbacea</i>	S	-	O	1979	1979	H	4	+		+							
<i>Tibouchina urvilleana</i>	S	SAM	O	1910	1983	P	29	+	+								+
<i>Trembleya phylogiformis</i>	H	-	O	1947	1947	H	1										+
MELIACEAE (Mahogany family)																	
<i>Melia azedarach</i>	T	AS	O	1839	1985	P	30	+	+		+						+
<i>Toona ciliata</i>	T	AA	C	1929	1983	H	19	+	+		+						+
MOLLUGINACEAE (Carpetweed family)																	
<i>Mollugo cerviana</i>	H	-	A	1975	1982	H	3	+									
MORACEAE (Mulberry family)																	
<i>Artocarpus altilis</i>	T	P	C	1000	1976	H	16			+	+						+
<i>Broussonetia papyrifera</i>	T	AS	C	1000	1984	P	71	+	+	+	+						+
<i>Ficus microcarpa</i>	T	AS	O	1943	1976	H	4			+							+
<i>Morus alba</i>	T	AS	C	1920	1984	H	13	+	+								+
MYRICACEAE (Bayberry family)																	
<i>Myrica faya</i>	T	EUR	C	1900	1976	P	38	+	+		+						+
MYRSINACEAE (Myrsine family)																	
<i>Ardisia crenata</i>	S	AS	O	1930	1985	H	16	+									+
<i>Ardisia elliptica</i>	S	AS	O	1888	1986	P	30	+	+								+

Appendix, continued.

Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
MYRTACEAE (Myrtle family)															
<i>Eugenia uniflora</i>	T	TAM	C	1888	1986	P	15	+		+			+	+	+
<i>Leptospermum flavescens</i>	S	AUS	C	1927	1983	H	8	+					+		
<i>Leptospermum laevigatum</i>	S	AUS	C	1930	1985	P	1				+				
<i>Leptospermum scoparium</i>	S	AUP	C	1927	1986	H	44				+		+	+	
<i>Melaleuca quinquenervia</i>	T	AUP	C	1920	1985	P	31	+	+	+			+	+	
<i>Psidium cattleianum</i>	T	TAM	C	1908	1983	H	49	+	+	+	+		+	+	
<i>Psidium guajava</i>	T	TAM	C	1825	1986	P	42	+	+	+	+		+	+	
<i>Rhodomyrtus tomentosa</i>	S	AS	O	1920	1986	P	19	+			+		+	+	
<i>Syzygium cumini</i>	T	AS	C	1888	1978	P	27	+	+	+			+	+	
<i>Syzygium jambos</i>	T	AS	C	1825	1972	P	16	+	+		+		+	+	
<i>Syzygium malaccense</i>	T	ASP	C	1000	1986	P	40	+	+	+			+	+	
NYCTAGINACEAE (Four-o'clock family)															
<i>Boerhavia coccinea</i>	H	-	A	1974	1985	H	10	+	+				+	+	
<i>Mirabilis jalapa</i>	H	TAM	O	1888	1985	P	18	+	+		+		+	+	+
OLEACEAE (Olive family)															
* <i>Chionanthus ligustrina</i>	T	TAM	A	1973	1973	P	1								
<i>Fraxinus uhdei</i>	T	NAM	C	1926	1985	H	14	+			+		+		
<i>Olea europaea</i>															
subsp. <i>africana</i>	T	AF	C	1932	1973	H	7	+					+		
<i>Olea europaea</i>															
subsp. <i>europaea</i>	T	MED	C	1910	1982	H	5	+					+		
ONAGRACEAE (Evening primrose family)															
<i>Epilobium billardierianum</i>	S	ASP	A	1909	1984	H	37	+	+						
<i>Epilobium ciliatum</i>	H	NAM	A	1929	1967	P	2	+							
<i>Fuchsia magellanica</i>	S	SAM	O	1922	1983	H	10	+	+				+		

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Fuchsia paniculata</i>	S	TAM	O	1933	1980	H	3	+									
<i>Ludwigia octovalvis</i>	H	OW	A	1000	1975	P	40	+	+	+	+		+	+			
<i>Ludwigia palustris</i>	H	EUR	A	1934	1982	H	6	+						+	+		
<i>Oenothera affinis</i>	H	SAM	O	1915	1961	H	4	+									
<i>Oenothera laciniata</i>	H	NAM	O	1933	1982	H	14	+	+								+
<i>Oenothera stricta</i>	H	SAM	O	1911	1984	H	20	+	+								
OXALIDACEAE (Wood sorrel family)																	
<i>Oxalis corniculata</i>	H	EUR	A	1000	1976	P	45	+	+	+	+	+	+	+	+	+	+
<i>Oxalis corymbosa</i>	H	SAM	O	1840	1985	P	15	+			+		+	+			
PAPAVERACEAE (Poppy family)																	
<i>Argemone mexicana</i>	H	TAM	O	1934	1984	H	7		+					+	+		
<i>Bocconia frutescens</i>	S	TAM	O	1920	1983	H	16	+	+								
<i>Hunnemannia fumariifolia</i>	H	TAM	O	1920	1983	P	9		+					+			
PASSIFLORACEAE (Passion flower family)																	
<i>Passiflora x caerulea</i>	V	SAM	O	1865	1960	H	6							+	+		
<i>Passiflora edulis</i>	V	SAM	C	1888	1985	P	35	+	+		+			+			
<i>Passiflora foetida</i>	V	SAM	O	1888	1984	P	59	+	+					+	+	+	
<i>Passiflora laurifolia</i>	V	TAM	C	1888	1985	P	14	+		+				+	+		
<i>Passiflora ligularis</i>	V	TAM	C	1910	1977	H	21	+			+			+	+		
<i>Passiflora mollissima</i>	V	TAM	O	1926	1983	H	14	+							+		
<i>Passiflora pulchella</i>	V	TAM	O	1924	1985	H	6	+						+			
<i>Passiflora quadrangularis</i>	V	TAM	C	1888	1945	P	4	+						+			
<i>Passiflora suberosa</i>	V	TAM	O	1888	1986	P	39	+	+					+			
<i>Passiflora subpeltata</i>	V	SAM	C	1914	1986	H	24		+					+	+		
PHYTOLACCACEAE (Pokeweed family)																	
<i>Phytolacca octandra</i>	H	TAM	C	1910	1986	H	52				+	+		+	+		

Appendix, continued.

Appendix, continued.

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island								
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Rivina humilis</i>	H	TAM	C	1888	1985	P	15	+						+	+	
PIPERACEAE (Pepper family)																
<i>Peperomia pellucida</i>	H	TAM	O	1918	1986	P	3								+	
<i>Piper methysticum</i>	S	P	C	1000	1984	P	48	+	+	+				+	+	
PITTIOSPORACEAE (Pittosporum family)																
<i>Pittosporum undulatum</i>		T	AUS	O	1875	1982	P	11		+				+		
<i>Pittosporum viridiflorum</i>	T	AF	C	1954	1978	H	5	+			+			+		
PLANTAGINACEAE (Plantain family)																
<i>Plantago aristata</i>	H	NAM	A	1941	1985	H	3	+								
<i>Plantago australis</i>	H	-	A	1908	1985	H	24	+	+							
<i>Plantago debilis</i>	H	-	A	1934	1985	H	9							+		
<i>Plantago lanceolata</i>	H	EAS	A	1895	1985	H	58	+	+	+	+			+	+	+
<i>Plantago major</i>	H	EAS	A	1850	1985	H	45	+	+	+	+			+	+	+
POLEMONIACEAE (Phlox family)																
<i>Gilia capitata</i>	H	NAM	O	1929	1982	H	5		+							
POLYGALACEAE (Milkwort family)																
<i>Polygala paniculata</i>	H	SAM	A	1974	1984	H	6	+	+							
POLYGONACEAE (Buckwheat family)																
<i>Antigonon leptopus</i>	V	NAM	O	1909	1967	H	14					+		+		
<i>Emex spinosa</i>	H	MED	A	1928	1983	H	17	+	+	+				+		
* <i>Fagopyrum esculentum</i>	H	EAS	C	1925	1925	H	2					+				
<i>Muehlenbeckia axillaris</i>	S	P	A	1937	1963	H	3	+								
<i>Polygonum argyrocoleon</i>	H	AS	A	1937	1937	H	1		+							
<i>Polygonum aviculare</i>	H	EUR	A	1932	1982	H	2	+	+							
<i>Polygonum capitatum</i>	H	AS	A	1960	1983	H	15	+	+					+		
<i>Polygonum chinense</i>	H	AS	C	1966	1983	P	3	+								

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Polygonum convolvulus</i>	H	COS	A	1981	1981	H	1		+								
<i>Polygonum glabrum</i>	H	AS	A	1819	1981	H	43	+	+	+			+	+			
<i>Polygonum punctatum</i>	H	NW	A	1909	1983	H	10	+			+						
<i>Rumex acetosella</i>	H	EAS	A	1895	1975	H	28	+	+							+	
<i>Rumex brownei</i>	H	AUS	A	1958	1978	H	2	+									
<i>Rumex crispus</i>	H	EAS	A	1910	1978	H	16	+	+		+		+	+			
<i>Rumex obtusifolius</i>	H	OW	A	1917	1984	H	16	+									+
PORTULACACEAE (Purslane family)																	
<i>Portulaca oleracea</i>	H	COS	A	1817	1985	H	104	+	+	+	+		+	+	+	+	+
<i>Talinum paniculatum</i>	H	NW	O	1931	1984	H	10	+					+				
<i>Talinum triangulare</i>	H	TAM	O	1979	1979	H	1	+									
PRIMULACEAE (Primrose family)																	
<i>Anagallis arvensis</i>	H	EUR	A	1895	1985	P	61	+	+	+	+	+	+	+	+		+
PROTEACEAE (Protea family)																	
<i>Grevillea banksii</i>	T	AUS	C	1909	1982	H	16	+	+				+	+	+		
<i>Grevillea robusta</i>	T	AUS	C	1909	1984	H	16	+					+	+	+		
RANUNCULACEAE (Buttercup family)																	
<i>Anenome hupehensis</i>	H	AS	O	1942	1983	H	8	+									
<i>Ranunculus muricatus</i>	H	EUR	A	1939	1943	H	2	+									
<i>Ranunculus parviflorus</i>	H	MED	A	1911	1932	H	3	+									
<i>Ranunculus plebius</i>	H	AUS	A	1949	1970	P	0	+									
<i>Ranunculus repens</i>	H	EUR	A	1922	1951	P	4	+									
RHIZOPHORACEAE (Mangrove family)																	
<i>Bruguiera gymnorrhiza</i>	T	AS	C	1922	1946	P	10										+
<i>Rhizophora mangle</i>	T	TAM	C	1902	1984	P	41	+		+	+			+			
ROSACEAE (Rose family)																	
<i>Eriobotrya japonica</i>	T	AS	C	1915	1967	H	6	+									+

Appendix, continued.

Appendix, continued.

Taxon	Life		Mode of Intro.	<u>Record in Hi.</u>		Info. Source	No. Spms.	<u>Island</u>								
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW
<i>Fragaria vesca</i>	H	EUR	C	1829	1983	P	20	+							+	
* <i>Prunus x cerasifera</i>	T	AF	C	1933	1975	P	6	+	+						+	
<i>Pyracantha angustifolia</i>	S	AS	O	1937	1983	H	7	+						+	+	
* <i>Pyracantha crenati-serrata</i>	S	AS	O	1945	1984	H	4	+			+			+		
<i>Rosa</i> sp.	S	-	O	1910	1983	H	24	+	+	+	+					
<i>Rubus argutus</i>	S	USM	C	1894	1983	P	53	+	+					+	+	
<i>Rubus discolor</i>	S	-	C	1983	1983	H	2		+					+		
<i>Rubus ellipticus</i>	S	AS	C	1961	1984	H	5	+								
<i>Rubus niveus</i>	S	-	C	1965	1965	H	1	+								
<i>Rubus rosifolius</i>	S	AS	C	1880	1967	P	44	+	+					+		
<i>Rubus sieboldii</i>	S	ASP	C	1971	1976	H	3								+	
RUBIACEAE (Coffee family)																
<i>Coffea arabica</i>	S	AF	C	1823	1985	P	27	+	+	+	+			+	+	
<i>Galium divaricatum</i>	H	-	A	1981	1981	H	1		+							
<i>Hedyotis corymbosa</i>	H	SAM	A	1965	1986	H	8	+	+					+		
<i>Mitracarpus hirtus</i>	H	TAM	A	1982	1982	H	1	+								
<i>Morinda citrifolia</i>	S	ASP	C	1000	1985	P	60	+	+	+	+			+	+	+
<i>Paederia scandens</i>	V	AS	A	1854	1985	P	39	+						+	+	
<i>Richardia brasiliensis</i>	H	TAM	A	1855	1983	P	36	+	+		+			+		
<i>Sherardia arvensis</i>	H	EUR	A	1909	1984	H	19	+	+							
<i>Spermacoce assurgens</i>	H	AS	A	1929	1986	H	23	+						+	+	
<i>Spermacoce mauritiana</i>	H	-	A	1973	1983	H	4	+								
SAPINDACEAE (Soapberry family)																
<i>Cardiospermum grandiflorum</i>	V	COS	O	1951	1985	H	5							+		
<i>Cardiospermum halicacabum</i>	V	COS	O	1817	1984	H	27	+	+	+				+	+	+
SCROPHULARIACEAE (Figwort family)																
<i>Antirrhinum orontium</i>	H	MED	O	1950	1960	H	4							+		

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Castilleja arvensis</i>	H	TAM	A	1968	1983	H	6	+	+								
<i>Dopatrium junceum</i>	H	-	A	1977	1977	H	1										+
<i>Linaria canadensis</i> var. <i>texana</i>	H	NW	A	1904	1979	P	15	+									+
<i>Lindernia crustacea</i>	H	TOW	A	1954	1984	P	7	+									
<i>Lophospermum erubescens</i>	H	NAM	O	1917	1982	H	14	+									+
<i>Maurandya antirrhiniflora</i>	H	NAM	O	1943	1943	H	1										+
<i>Orthocarpus purpurascens</i>	H	USM	A	1945	1945	H	1	+									
<i>Parentucellia viscosa</i>	H	EUR	-	1971	1971	H	1	+									
<i>Torenia asiatica</i>	H	AS	O	1975	1983	H	4	+									
<i>Verbascum blattaria</i>	H	EAS	A	1955	1955	H	1	+									
<i>Verbascum thapsus</i>	H	EAS	A	1932	1975	H	14	+									
<i>Verbascum virgatum</i>	H	EAS	A	1943	1982	H	2	+									
<i>Veronica arvensis</i>	H	EUR	A	1943	1985	H	10	+	+	+							+
<i>Veronica plebeia</i>	H	AUS	A	1911	1974	H	31	+									
<i>Veronica serpyllifolia</i>	H	NH	A	1926	1983	H	20	+									+
SOLANACEAE (Nightshade family)																	
<i>Brugmansia candida</i>	S	TAM	O	1890	1976	H	23	+	+								+
<i>Capsicum annuum</i>	H	TAM	C	1815	1985	P	16		+								+
<i>Cestrum diurnum</i>	S	TAM	O	1888	1984	P	20				+						+
<i>Cestrum nocturnum</i>	S	TAM	O	1927	1985	H	18	+				+					+
<i>Datura stramonium</i>	H	AS	A	1837	1985	H	20	+	+	+							+
<i>Lycopersicon esculentum</i>	H	SAM	C	1888	1983	P	1										+
<i>Lycopersicon</i> pimpinellifolium	H	SAM	C	1895	1986	H	40	+	+		+						+
<i>Nicandra physalodes</i>	H	SAM	O	1850	1985	P	24	+	+	+							+

Appendix, continued.

Appendix, continued.

Taxon	Life		Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island									
	Form	Origin		First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW	
<i>Nicotiana glauca</i>	S	SAM	A	1865	1982	H	31		+		+	+	+				
<i>Nicotiana tabacum</i>	H	SAM	C	1812	1986	P	42	+	+	+	+		+	+	+	+	+
<i>Physalis angulata</i>	H	TAM	-	1976	1983	H	2										+
<i>Physalis peruviana</i>	H	SAM	O	1825	1985	P	61	+	+	+	+		+	+			
* <i>Salpichroa rhomboidea</i>	H	SAM	O	1931	1985	H	4							+	+		
<i>Solanum aviculare</i>	S	OW	A	1955	1964	H	5				+						
<i>Solanum capsicoides</i>	S	TAM	A	1837	1985	H	34	+	+	+	+		+	+			
<i>Solanum elaeagnifolium</i>	H	USM	A	1958	1979	P	3			+			+				
<i>Solanum linnaeanum</i>	H	MED	A	1895	1983	H	33	+	+	+	+	+	+	+	+		
<i>Solanum mauritianum</i>	H	SAM	O	1909	1985	H	29							+			
<i>Solanum pseudocapsicum</i>	S	OW	O	1888	1986	P	24	+	+	+				+			
<i>Solanum robustum</i>	S	-	A	1977	1977	H	1		+								
<i>Solanum seaforthianum</i>	V	TAM	O	1916	1985	H	14		+	+				+	+		
<i>Solanum torvum</i>	S	-	-	1954	1965	H	3		+								
<i>Solanum tuberosum</i>	B	SAM	C	1811	1919	P	2		+								
<i>Solanum viride</i>	H	-	-	1937	1937	H	1										+
* <i>Streptosolen jamesoni</i>	H	TAM	O	1932	1974	H	7	+	+					+	+		
STERCULIACEAE (Cacao family)																	
<i>Melochia umbellata</i>	T	AS	C	1929	1984	H	15	+	+		+			+			
THEACEAE (Tea family)																	
<i>Camellia sinensis</i>	S	AS	O	1932	1977	H	5							+			
TILIACEAE (Linden family)																	
<i>Heliocarpus popayanensis</i>	T	TAM	O	1941	1968	P	6	+						+			
<i>Triumfetta rhomboidea</i>	H	AF	A	1888	1976	H	27	+		+				+			
<i>Triumfetta semitriloba</i>	H	COS	A	1910	1983	H	20	+	+					+	+		

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island															
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni	NW							
TROPAEOLACEAE (Nasturtium family)																							
<i>Tropaeolum majus</i>	V	SAM	O	1840	1975	P	4	+	+	+													
TURNERACEAE (Turnera family)																							
<i>Turnera ulmifolia</i>	S	TAM	C	1888	1984	P	10			+			+	+									
ULMACEAE (Elm family)																							
<i>Trema orientalis</i>	T	AS	C	1870	1986	H	50	+	+	+			+	+									
URTICACEAE (Nettle family)																							
<i>Boehmeria nivea</i>	H	AS	O	1928	1976	H	12	+	+				+										
<i>Laportea interrupta</i>	H	ASP	A	1819	1959	P	1	+					+										
<i>Pilea microphylla</i>	H	TAM	O	1926	1985	H	2						+										
<i>Urtica urens</i>	H	OW	A	1909	1975	H	8	+															
VALERIANACEAE (Valerian family)																							
<i>Centranthus ruber</i>	H	EAS	O	1965	1982	P	1			+													
VERBENACEAE (Verbena family)																							
<i>Citharexylum caudatum</i>	T	TAM	O	1929	1983	P	17							+									
<i>Citharexylum spinosum</i>	T	TAM	O	1937	1985	H	8							+									
<i>Clerodendrum philippinum</i>	S	AS	O	1839	1978	H	17	+	+	+	+		+	+									
<i>Lantana camara</i>	S	TAM	O	1858	1976	P	50	+			+		+	+	+	+							
<i>Stachytarpheta dichotoma</i>	H	TAM	A	1910	1978	H	46	+	+		+		+	+									
<i>Stachytarpheta jamaicensis</i>	H	TAM	A	1895	1983	H	23	+	+		+		+					+					
<i>Stachytarpheta mutabilis</i>	H	TAM	O	1888	1980	P	7	+					+	+									
<i>Stachytarpheta urticifolia</i>	H	COS	A	1895	1973	H	19	+	+	+			+	+									
<i>Stachytarpheta x intercedens</i>	H	AS	A	1939	1940	H	2							+									
<i>Stachytarpheta x trimeni</i>	H	HOR	A	1928	1951	H	2											+					
<i>Verbena bonariensis</i>	H	SAM	A	1914	1918	H	4						+										

Appendix, continued.

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Appendix, continued.

Taxon	Life Form	Origin	Mode of Intro.	Record in Hi.		Info. Source	No. Spms.	Island							
				First	Recent			Hi	Ma	Mo	Ln	Kh	Oh	Ka	Ni
<i>Verbena litoralis</i>	H	TAM	A	1835	1975	H	61	+	+	+	+		+	+	+
<i>Verbena rigida</i>	H	SAM	O	1932	1938	H	3	+							
VITACEAE (Grape family)															
<i>Cissus nodosa</i>	V	AS	O	1975	1975	H	1	+							
ZYGOPHYLLACEAE (Creosote bush family)															
<i>Tribulus terrestris</i>	V	OW	A	1947	1984	H	5	+							+

* Taxon is not discussed in Wagner *et al.* 1990.

** Taxon is not discussed in Wagner *et al.* 1990 or St. John 1973.

Tricachne insularis = *Digitaria insularis*; taxon is retained to avoid loss of data.

Bidens lanceolata = *Coreopsis lanceolata*; taxon is retained to avoid loss of data.

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