Wedelia - Daisy invader of Melanesia: The worst weed in the Pacific?

Can a pretty daisy be compared with the likes of the *Anopheles* mosquito, the dreaded malaria vector; the brown tree snake that has brought the birds and lizards of Guam to virtual extinction; or the fire ants that threaten endemic lizards and cause blindness in dogs in New Caledonia? I think so. Words by **Randy Thaman**

WEDELIA, creeping oxeye, or the trailing daisy, a deceptively beautiful, bright emerald-green creeper with bright yellow daisy-like flowers, is one of the world's most aggressive weeds and is listed among these other destructive organisms as one of the worlds 1000 worst invasive alien species. It is now firmly established in Melanesia and throughout the Pacific Islands. It is suggested that it should be immediately declared a serious noxious weed, should be restricted from introduction into new islands and habitats, and, where possible, eradicated from islands, habitats and places where it is yet to gain a firm foothold. If action is taken NOW, islands and communities throughout Melanesia, and elsewhere in the Pacific, can prevent the spread of *Wedelia* BEFORE it replaces extensive areas of indigenous vegetation, particularly along streams, drainage ditches, coastlines, swampland, mangroves and swampland, on offshore islands and in plantations, grazing lands and towns and villages where it out-competes plants of considerable ecological and cultural importance. This conclusion is based on my studies of *Wedelia* over the past 30 years in most of the countries and territories of the Pacific.

Wedelia (*Sphagneticola trilobata*)

Wedelia, now known officially by the scientific name, *Sphagneticola trilobata* (L.) Pruski (USDA-GRIN 2008), is still widely known by its previously accepted name, *Wedelia trilobata* (L.) Hitch.), is a member of the family Asteraceae (formerly Compositae), the sunflower or daisy family. The most widely used common name in the Pacific is "*Wedelia*" (after its former genus), although in Australia it is known as "Singapore daisy", in spite of its tropical American origin. Other common names include trailing or creeping daisy, water zinnia, rabbit's paw and creeping or Bay Biscayne oxeye (after Biscayne Bay near the southeast tip of Florida, where it grows profusely and is considered a noxious weed).

Wedelia is native to, and wide ranging throughout tropical America, where it is found from Mexico to Panama in Central America, in western and northern South America (Peru, Ecuador, Bolivia, Columbia, Venezuela, the Guianas and Brazil), throughout the Caribbean (USDA GRIN 2008), and possibly Florida (Macoboy 1986). It is now cultivated throughout much of the tropics and subtropics as an ornamental groundcover. It is closely related to the widespread tropical strand plant or beach daisy, *Wollastonia biflora* (formerly known as *Wedelia biflora*), a very important medicinal plant found throughout the Pacific. Interestingly, the Hawaiian endemic genus *Lipochaeta* is scarcely distinct from *Wedelia* genetically, and two sections of *Lipochaeta* appear to have been independently derived from *Wedelia*-like ancestors (Wagner et al. 1990, Rabakonadrianina and Carr 1981).

It is a creeping, mat-forming perennial herb with fast-growing, rounded stems up to 40 cm long or longer that root at the nodes and grow upwards (ascend) when flowering. The attractive, bright shiny emerald-green, somewhat fleshy, leaves are regularly toothed on the margins, commonly with three shallow lobes (hence the name *trilobata*). The single attractive bright-yellow daisy-like flowers are borne on the end of terminal and axillary stalks. The fruit, which is rarely seen in the Pacific, is a 2- to 4-angled achene, with short, narrow pappus scales on the top (Whistler 1995). Although seedlings have been observed in Hawai'i, cultivated plants seem to develop few flower heads with mature fertile seeds. Wagner et al. (1990) suggest that: "If a fertile strain develops this species could become a serious pest."

It already is!! And, as suggested above, it has been listed in the French Fondation TOTAL-funded Global Invasive Species Database's "One Hundred of the World's Worst Invasive Species", alongside some of the world's most notorious invasive organisms, which include: the *Anopheles* mosquito, the dreaded malaria vector found in Vanuatu, Solomon Islands and Papua New Guinea; the brown tree snake (*Boiga irregularis*), which, since accidental introduction into Guam from Solomon Islands near the end of World War II, has brought to extinction most of the indigenous and endemic birds and devastated the gecko and skink populatons of Guam; miconia, the "green cancer" (*Miconia calvescens*), the small tree that has invaded and devastated native forests in Tahiti; African tulip tree (*Spathodea campanulata*), which has invaded croplands and secondary forests in Fiji; goats, cats, rats, mongoose, pigs, deer, macaque monkeys and the bushtail possum, all of which have caused havoc on islands throughout the world; the Dutch elm disease fungus (*Ceraticystis ulmi*), which has wiped out the totemic elm tree in North America; the Indian mynah bird (*Acridotheres tristis*), which has spread so widely and is such a nuisance in the Pacific; the rosy wolf snail (*Euglandina rosea*), a carnivorous snail responsible for the extinction of endemic land snails in French Polynesia and Hawai'i; banana bunch-top virus, which crippled export banana production in the Pacific; and avian malaria (*Plasmodium relictum*), the micro-organism widely held responsible for the extinction of endemic birds in Hawai'i (ISSG 2008). Yes, this pretty little ground-hugging daisy is among these monsters of the invasive world!

The Introduction of *Wedelia* into the Pacific Islands

The introduction of *Wedelia* into the tropical Pacific Islands, where it is now widely cultivated as a groundcover and ornamental, seems to be a relatively recent phenomenon. Whistler (1995) suggests that it was first recorded from the Pacific Islands in Hawai'i sometime before 1965. It is described in Neal's *In gardens of Hawaii* (1965), although no information is given regarding its date of introduction or status as a naturalized species. It is not listed in *Stone's Flora of Guam* (1970), Moore and McMakin's *Plants of Guam* (1979), Smith's *Flora Vitiensis nova* (1990), Parham's *Plants of the Fiji Islands* (1972), or Merlin et al.'s 1992 study of the *Plants of Pohnpei*, despite the fact that it is now widely naturalized and invasive in all these islands. Similarly, it is not listed as present in Tonga in *Yuncker's Plants of Tonga* (1959), where it seems to be naturalized and spreading, and in Sykes' *Contributions to the flora of Niue* (1970), where it seems to have only been introduced in the past few years, but is now the focus of a very expensive, apparently unsuccessful, control program.

It was listed as present in Guam, on Yap in the Federated States of Micronesia, and on Kwajalein and Enewetak Atolls in the Marshall Islands by Fosberg et al. (1979), by Lambertson (1982) in her study of the plants of Eniwetak, and by Thaman et al. (1994) in their *Flora of Nauru*. Fosberg et al. (1979) report that by the end of the 1970s it was present in Palau where it had come to be known by the name **ngesil ra ngebard** ("the foreign *Wollastonia biflora*"). Guerin (1982) in his "The flora of the atolls of French Polynesia" reported that it was successfully established in the Tuamotus by the early 1980. On South Tarawa atoll, it was not recorded present by the author on four visits between 1984 and 1991, and only first seen present 1993.

This evidence clearly indicates that *Wedelia* first arrived in most of Micronesia and Polynesia and parts of Melanesia, sometime in the 1970s, and even later in some places like Niue, Kiribati, Tuvalu and Solomon Islands. It is possible that it was introduced via Hawai'i or from tropical or subtropical Australia via Brisbane in Queensland, either by individual flower gardeners, local horticulturalists or landscape architects contracted to landscape new tourist resorts and other developments that were built then. Interestingly, *Wedelia* is not even mentioned in Macoboy's first edition of his well-known best-seller, *What flower is that?*, published in Australia in 1969 and reprinted many times up until at least 1980, despite the fact that it was deliberately planted in Queensland as a roadside and railway embankment stabilizer, and heavily promoted by nurseries in the mid-1970s (Australian Weeds Committee 2008). It is mentioned, and its characteristics described in reasonable detail in the revised 1986 edition.

In Fiji, well-known horticulturist and owner of "Flower Power Nursery" and landscaping company, Maureen Southwick, believes it was first planted as an ornamental groundcover at Suva Point in the mid-1970s by a Mrs. Murray. Interestingly, when Mrs. Murray generously gave her some cuttings to plant in her well-known show garden, the long-time Fijian gardener looked at the cuttings and quickly and firmly remarked that this was a weed that should not be planted, and quickly destroyed the intended gift as a potential invader!!

Current Status in the Pacific Islands

Wedelia has been successfully introduced into most Pacific Island countries and territories and is now widely cultivated as an easy-to-maintain attractive, vigorously growing groundcover. It is commonly planted in extensive plots and planting boxes at tourist resorts, as landscaping around airports, golf courses, cemeteries, government buildings, schools and universities, office blocks and other buildings in towns, on road cuts and river embankments to control surface erosion and as landscaping, along road verges and in central dividers along roads and highways, around trees in parks and lawns, in houseyard gardens, and occasionally as a pot plant. Whistler (2000) in his *Tropical Ornamentals* says that it is preferred as a groundcover "since it is able to crowd out nearly all other herbaceous species" and "does well in coastal situations and large planters, and can be grown in elevated containers so that its flowering stems hang down in yellow cascades."

Owing to its vigorous vegetative reproduction and wide environmental tolerance, the frequent pruning and disposal of its cuttings, and its ability to float and withstand saltwater, *Wedelia* has escaped from cultivation and become naturalized and invasive in most Pacific Island countries and territories, including continental islands, recent volcanic islands, limestone islands, atolls and small uninhabited offshore islands, often colonizing areas from the high tide mark to up elevations of 700 m or more in Fiji and to 1400 m in Tahiti (PIER 2003). It is now also present in all countries and territories of Melanesia, although still absent in some more isolated outer islands and rural areas. In most cases, it has become a noxious weed covering extensive areas in agricultural and pasture lands, along roadsides and trailsides, in open lots, wasteplaces and garbage dumps and other disturbed sites. Once established in moves into lawns, flower gardens, and disturbed sites in villages, towns, tourist resorts and other developments. It is also naturalized and invasive along streams, canals, the inner margins of mangroves and in coastal strand vegetation. It is usually found in disturbed sites, although it also seems very much at home in relatively undisturbed sites along coastlines and the margins of mangroves and swampland, often out-competing native coastal herbaceous species, most of which have important cultural utility.

Wedelia's potential to become invasive is made very clear in Macoboy's description of it in the revised edition of *What flower is that*? (1986):

> ". . . the rampageous *Wedelia* is only seen at its best in a truly tropical climate, where heat and humidity combine to help it produce great sheets of foliage starred with golden daisy flowers. Recent visitors may have admired its blanketing of the ghastly new carparks by the Royal Hawaiian Hotel. In fact, it grows over quite a climatic range, though frost may cut is back temporarily. Grow from rooted cuttings in any soil, and cut back hard if it begins to grow too thickly. Best in full sun with plenty of water, particularly in sheltered seaside gardens."

Because it is a fast-growing vegetatively-reproducing, somewhat unruly groundcover, one of the main reasons for its rapid spread is that it is routinely pruned or cut-back to keep it under control or low-growing. The easily-established cuttings are then transported to waste places, dumps (rubbish tips) or dumped

Wedelia spreading into Nabou Pine Forest, Viti Levu, Fiji.

Wedelia trilobata, Nabukalou Creek, Suva, Fiji.

Wedelia spreading along beach, opposite Beq Island, Fiji.

Wedelia spreading, behind school, Fenua Fala Islet NW of Fakaofo Islet, Fakaofo, Tokelau Group (**left**).

Wedelia infestation, Navai Village, 400 m asl, Fiji (**right**).

Wedelia on isolated stretch of River, Upper Navua River, Fiji (**below**).

along the seashore or riverbanks, or thrown in the water, where they easily establish themselves or are taken by rivers and streams, river-mouth outflows or even ocean currents to other potential sites, including offshore islands.

Is now common in tropical and subtropical areas of the Queensland coast and spreading in New South Wales and the Northern Territory. It competes with native groundcover and in North Queensland forms dense infestations along the disturbed edges of rainforest (Australian Weed Committee 2008). In Hawai'i, it has escaped on all of the main islands and on Midway Atoll (Wagner et al. 1990). In Honolulu, it has escaped from cultivation and is spreading along Manoa Stream near the University of Hawai'i, and has spread into lawns between Lincoln Hall and Jefferson Hall at the East-West Center and on some of the sports fields at the university.

In Samoa, where it is also a recent introduction, reconnaissance surveys in September and October 1999 showed that it was spreading in the capital city of Apia and in some rural villages on the island of Upolu. In downtown Apia, it was found in extensive plantings in the main rock-walled planter boxes surrounding the Samoa Visitors Bureau, as a groundcover in one plot in front and one plot in back of the recently constructed Government Building, and in the parkland seaside of the building around the monument to commemorate the Japanese rehabilitation of the Apia waterfront after the devastation caused by Tropical Cyclone Val in 1991. In the latter site, *Wedelia* was beginning to spread into the surrounding lawns and parkland. It was also found planted as an ornamental groundcover in the "island" planter box in the centre of the main waterfront road at "3-corners" where the road turns right towards "4-corners" and Apia Park, and at Mary More's Guesthouse opposite the U.S. Peace Corps Headquarters, from where it has jumped the road. It was also found planted along the road fronting at the Ah Siu residence on Taufusi (Vaea) Rd. in Chinatown where it is beginning to spread along the roadside drain. Finally, it was also seen planted and rapidly spreading in the villages of Saoluafata and Falefa to the east of Apia, in both cases, spreading rapidly. In Saoluafata it had spread into roadside lawns forming extensive "meadows". In Falefa, where it was found planted along the road frontage at one residence, it had totally covered the roadside culvert and had jumped the road into the small plot of bananas on the other side. Given time, it will probably spread along the banks of the nearby Falefa River to Falefa Falls, a popular tourist destination and recreational site.

On Tahiti, Moorea and Borabora in the Society Islands, *Wedelia* is also rampant and out of control, festooning seawalls, spreading along drains and into coastal wetlands, introduced mangroves, swamp taro gardens, prawn maricultural areas, grazing land and coconut, pine and eucalyptus plantations. On Rarotonga, it is out of control, spreading along the margins of beaches, swamp taro gardens and festooning abandoned, partially completed houses and bankrupt hotel projects. On the volcanic main island of Pohnpei in the Federated States of Micronesia it has spread from sea level where it is found along the coast and bordering mangroves up to elevations of 500 meters where it has become the dominant weed in deforested areas used for kava or **sakau** (*Piper methysticum*) planting, the expansion of which has led to extensive deforestation. On the two main islands of Palau, Babeldaob and Koror, it has escaped and now growing along the new Compact Road and is encroaching on swamp taro gardens. It is now also invasive in disturbed sites on Kosrae and Chuuk, covering much of the area bordering the land-ward side of the runways at both international airports, and is invasive in disturbed sites, and covers extensive areas of limestone on Guam. On Nauru, although only seen as an ornamental groundcover in the early 1980s, by 1987, it had invaded the upper beach and seaside borders of the main coastal road near the Meneng Hotel, displacing native coastal plants, including *Triumfetta procumbens* (**igiao**), a locally endangered medicinal plant, and by 2007 had infested the margins of Buada Lagoon, the most important agricultural and aquacultural area on the island.

On the raised limestone island of Niue, where it seems to be a fairly recent introduction, in early 1999, it was only seen in a limited number of locations, in extensive plantings at the Matavai Resort Hotel (where it was possibly introduced) and in a few houseyard gardens. From one of these gardens at the top of the Kalaone Sea Track (path to the beach) in South Alofi, *Wedelia* was rapidly spreading down the borders of the sea track and becoming naturalized. It was also present and spreading in Lakepa Village in northeast Niue. I reported this to Department of Agriculture, and, at their request, wrote a technical paper for them about its characteristics and the threat that it posed to the island (Thaman 1999). After taking no immediate action and waiting over a year for funding from the Secretariat of the Pacific Community (SPC), a control campaign commenced in early March 2001, at which time it was found at 35 sites in 11 villages. After an unsuccessful campaign to control it in early 2001, using Roundup and Gramoxone and costing almost $30,000, it was then found in 52 sites in 13 villages and covered a total area of about 1400 m2 (14 ha)(Liebregts 2001). Although there was some sign of control in some sites, it clearly looks like *Wedelia* will probably take over Niue, and have serious implications for the habitats of the ceremonially important coconut crab (*Birgus latro*) and a range of other land crabs that are important as bait and for food on Niue. On Tongatapu, the main islands in Tonga, it has also become naturalized and now covers extensive areas of limestone and disturbed sites around the main town of Nuku'alofa.

In the atolls, *Wedelia* seems to be particularly out of control. In the Marshall Islands, Lamberson (1982) reported that it was growing at the "top of the beach near pier at northeast end of Enewetak Atoll". In 1999, on Majuro Atoll, the author found it very common in houseyard gardens and beginning to spread along some roadsides and towards beaches on both the lagoon and ocean sides of the islets, expanding into wet sites in and bordering giant swamp taro (*Cyrtosperma chamissonis*) pits, forming extensive daisy meadow-like areas around the Royal Garden Hotel and a couple of other sites, and taking over the lawn of the recently completed Capitol Building. By 2004, it had spread even more widely.

In Kiribati, *Wedelia* was not seen during four surveys between 1984 and 1991, and only first recorded in 1993. By 2002, despite attempts at control by both the Agriculture Division and the Environment Unit, it had spread out of control in an area just south of the airport and just north of the Temaiku milkfish ponds and was totally out of control and spreading in numerous other sites and around the Catholic Mission at Teaoraereke on South Tarawa. It was also seen spreading out of control in a poorly drained site near Ukiangang Village on Butaritari Atoll in the north of the main Gilbert group in 2002.

In Tuvalu, where *Wedelia* was first seen present in 1993, by early 2003 it was spreading out of control and naturalized on Fogafale Islet on Funafuti Atoll in Tuvalu, where it was out-competing herbaceous strand vegetation on the lagoon side of the island south of the main settlement; in November 2006 it was seen as a serious invasive, well established in gardens on all three atolls in Tokelau and spreading from a rubbish tip onto the outer ocean beach on Nukunonu Atoll; and, on Tikehau Atoll, in the Tuamotu archipelago of French Polynesia, it has spread into coconut plantations bordering the main settlement of Tuherahera.

In Melanesia, *Wedelia* has been seen out-of-control by the senior author in all countries, except Solomon Islands, where it is reportedly also present in Honiara. The table is an attempt to assess the seriousness of *Wedelia* as an invasive in the five main areas of Melanesia. It has been a particularly serious problem in Fiji, an increasing problem in Vanuatu and New Caledonia, but apparently a more recent introduction and less well-established in Solomon Islands and Papua New Guinea, although I have not travelled as widely in these two countries as I have in the others.

In Fiji *Wedelia* has become rampant in most coastal areas, and is now found along most stretches of the main highway between Suva and Nadi, often forming unbroken carpets, covering coastal areas out to the high-water mark, extending out along the roadside from most villages, and up river banks and along drainage ditches. In the capital city of Suva, it has colonized disturbed areas bordering extensive areas of mangroves and coastal littoral sites where it grows right up to the water's edge, often extending below the high water mark. In both cases it seems to be out-competing indigenous coastal strand and mangrove species, such as the creepers *Ipomoea pes-caprae*, *Vigna marina* and *Derris trifoliata*, the shrubby *Clerodendrum inerme*, the grass, *Paspalum vaginatum*, the mangrove fern *Acrosticum aureum*, and the seedlings of important coastal species such as *Calophyllum inophyllum*, *Barringtonia asiatica* and *Terminalia catappa*, to mention only a few.

At The University of the South Pacific in Suva, in 1999, it was found planted or invasive, in at least 40 separate locations as ground cover in garden beds, around trees and shrubs, bordering parking lots, along fencelines, climbing fences, covering embankments and roadcuts, invasive in dump sites bordering roadsides, valleys, mangroves, mangrove channels and creek beds, and in a number or disturbed, poorly maintained sites. It has even been planted as a groundcover as part of the primarily indigenous coastal landscaping of the new Marine Studies complex bordering Laucala Bay, where it has already been found (and removed by the author!) in a planted seaside plot of the indigenous beach morning-glory *Ipomoea pes-caprae*.

It is currently growing in downtown Suva along the outer tidal reaches of Nabukalou Creek festooned on the cement channel walls, the growing tips extending below the high tide mark. At Muaivuso Village, one of Fiji's most important coastal fishing villages, it has spread from the village along a small creek towards the coastal mangroves. It has also become established and is spreading on coastal sites and into coconut plantations on Naigani Island, between Viti Levu and Ovalau, where it has undoubtedly spread from the nearby tourist resort; and on the beaches of the uninhabited sand cay island of Makuluva on the Suva Barrier Reef off Rewa River Delta, to where it was possibly dispersed, as a discarded cutting, by accelerated river outflow from the Rewa River system during heavy rains. It was also found in 1998 near Navai Village on Viti Levu, naturalized and spreading out of control along steam valleys at an elevation of about 700 m in the foothills of Tomaniivi, Fiji's highest mountain.

In Fiji's western Yasawa Islands, *Wedelia* was seen planted and spreading at the exclusive Turtle Island Resort and a number of other resorts and villages in the late 1990s and early 2000s. In 2000, it was seen in native coastal vegetation and spreading at Long Beach on Turtle Island, at Naisisili Village on Nacula Island, where it had spread throughout a cemetery; on a beach south of Yaqeta Village on Yaqeta Island, and in the beach vegetation on the east coast of Nanuya Lailai, north of backpacker's resorts.

Wedelia has also invaded the Sigatoka Sand Dunes National Park, a unique and spectacular ecosystem in southwestern Viti Levu, and despite repeated efforts to eradicate it, it is still spreading along the beaches and lower dunes. It has also spread and colonised the river banks in isolated sections of the Upper Navua Conservation Area, Fiji's first Ramsar Wetlands Convention site, and has become well-established and dominates significant areas in the sandy herbaceous outpost zone on Nasoata, a mangrove islet in

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the mouth of the Rewa River, which is being considered for designation as another Ramsar site. Finally, it also became established, but was fortunately eradicated from the Yadua Taba Island, a 70 ha island located off southwestern Vanua Levu and the only reserve for the endemic Fiji crested iguana (*Brachylophus vitiensis*).

In Vanuatu, it is common in Port Vila, where it is planted as a groundcover and has escaped along road cuts, roadsides and areas near resorts. In New Caledonia, it is very common in Noumea and the main groundcover at the Jean-Marie Tjibaou Cultural Centre. It is also spreading uncontrollably along roadsides and in lawns and gardens on the wetter east coast of the main island in the areas of Poindimié and Yaté. It was also seen planted and spreading from one site next to the Paradise Hotel in the Faiava area in southeast Ouvea, a raised limestone island in the Loyalty Islands to the east of New Caledonia. It is also reportedly present in Honiara, although there has been no opportunity to carry out a careful survey there. In Papua New Guinea, *Wedelia* was seen present and spreading in small coastal villages between Alotau and East Cape in Milne Bay Province.

On a positive note, there are some areas, where *Wedelia* is still not present. In Fiji, it was not seen present in 2007 in any of the four villages on the raised limestone island of Kabara in the Lau Group; on, Espiritu Santo, the largest island in Vanuatu, it was not seen present in 2002 around the Lonnoc Beach Resort and Rotol Village near Champagne Beach and in Matantas Village and the coastal and riverine areas of Vatthe Conservation area in the Big Bay area; and was also not seen in the village on Tangoa Island off the south coast of Santo. It was also not seen in two weeks on Bellona Island, south of Guadalcanal, nor in the Western Solomon Islands on Tetepare, the largest uninhabited island in the world. Suprisingly, it was also not seen in villages of tourist resorts on the beautiful Isle of Pines to the south of the main island of New Caledonia.

Habitat	Fiji	Vanuatu	N. C.	S.I.	P.N.G
Urban Areas	V	A	C	O	O
Resorts	A	O	O	?	O
Houseyard gardens	A	O	O	?	U
Urban landscaping	A	O	C	U	?
Roadsides	V	O	O	?	U
Lawns	O	U	?	?	?
Dumps	C	C	O	?	
Rural Villages	A	U	C	?	C
Gardens and Plantatations	O	?	O	?	?
Plantation forest	C	?	?	?	?
Grazing lands	A	?	?	?	?
Coastal Areas	A	O	O	?	O
Lowland Rivers	A	?	O	?	?
Mountain streams	C	?	?	?	?
Mangroves and estuaries	C	?	?	?	?
Littoral vegetation	C	O	O	?	?
Outer Islands	U	?	C	-	?
Uninhabited offshore Islands	O	?	?	?	?
National Parks	C	?	?	?	?

Table 1. Geographical extent, habitat, abundance and status of *Wedelia trilobata* in specified areas of Melanesia, based on in-the-field observations by the author and communications with reliable informants between the early 1970s and 2008 (V = very abundant, very serious, escaped and invasive; A = abundant, increasingly serious, invasive, C = common, occasionally as an escape; O = Occasional, sometimes adventive; U = uncommon; R = rare, just introduced, not escaped; - = absent).

Present and Potential Threat of *Wedelia* to Pacific Island Ecosystems

The evidence is clear that *Wedelia* (*Sphagneticola trilobata*), the daisy invader, a relatively recent introduction into the Pacific Islands, is spreading out of control on many islands in a wide range of habitats. It seems to be equally suited to dry and moist sites, and although it seems to prefer and do best in sunny sites, survives very well in shady sites under trees and bordering mangroves. It grows well on almost any soil type, including bare limestone, nutrient-poor sandy beaches and atoll soils and swampy or waterlogged soils. It is also tolerant to inundation and high levels of salinity.

Because it is very fast-growing, roots at the nodes of fast-growing stems, and is normally vegetatively-propagated, it has greater potential than most plants for rapid and uncontrolled spread. Moreover, because it is a very weedy fast-growing groundcover, it is periodically pruned and cutback, and the cuttings are normally disposed of elsewhere in waste places, at dump sites, are thrown along the banks or margins of, or even thrown into rivers, mangroves and the ocean, where the cuttings quickly establish themselves, or are dispersed to a new site where they might become successfully established.

In short, *Wedelia* has already shown itself to one of the Pacific's most serious invasive weeds, particularly in terms of its ability to colonize coastal sites, on sandy beaches, bordering mangroves, on limestone outcrops, and penetrating along mangrove channels, streams and river mouths. It clearly deserves it ranking among the world's worst 100 invasive alien organisms. Contrary to my previous assessment, almost a decade ago, when I said that it is probably most threatening on recent high oceanic volcanic islands, such as Pohnpei, Samoa, Tahiti and Hawai'i, and raised limestone islands, such as Palau, Nauru, Tonga and Niue (Thaman 1999), *Wedelia* is clearly a threat on ALL islands, including atolls and older continental islands, such as the island of the Solomons, New Caledonia and New Guinea, where it is probably a more recent arrival. It is a very serious threat to coastal, riverine and swampy ecosystems, where it severely inhibits the regeneration of indigenous herbaceous plants and tree seedlings of considerable cultural, economic and ecological importance, which it either out-competes or prohibits from ever germinating.

Niue, as a single isolated raised limestone island, some 258 km2 in area, is an example of island that could be almost totally overwhelmed by *Wedelia*, if the current attempts at eradication fail. The same can be said for atolls, where it has escaped and taken over coastal areas, limited areas of wetland, and spread like a plague through settled areas on the main atolls of the Marshall Islands, Kiribati, Tuvalu, Tokelau and Tikehau in French Polynesia. The same could happen to raised limestone islands, such a Kabara, Ouvea, Isle of Pines, Bellona and many other limestone islands and atolls in Melanesia, if it is not prevented from arriving or is not eradicated or strictly controlled, if that is at all possible. The uncontrolled spread of *Wedelia* on extensive areas of limestone and sandy, rocky soils, which would be almost impossible to clear, could have a very negative impact on the habitats and food chains of native birds, reptiles, insects, and many other ecologically important invertebrate animals, especially the economically and culturally important coconut crab (*Birgus latro*) and a range of other land and hermit crabs that are either eaten or constitute an important baits on almost all limestone islands and atolls.

Actions to be Taken to Stop the Spread of *Wedelia trilobata*

The following suggestions are put forward, as what I believe to be necessary priority actions to halt the spread of *Wedelia* in Melanesia and other Pacific Islands:

1. Declare *Wedelia* (*Sphagneticola trilobata*) a noxious weed, and develop regional and national protocols for its control and eradication from islands and habitats where it can be potentially invasive and ecologically destructive.
2. Prohibit its introduction to islands, villages and areas where it still does not exist, particularly small outer islands with tourist resorts and uninhabited offshore islands or atoll islets (motu) where it can easily escape into the surrounding coastal environments or take over entire small islands. This is particularly important, because many of our uninhabited offshore islands are relatively pest-free and, like Yadua Taba in Fiji and Tetipare in Solomon Islands are critical habitats for threatened plants and animals, such as seabirds, sea turtles and crabs, which are often threatened or extirpated (locally extinct) on inhabited main islands.
3. When possible, on islands, such as Ouvea, where it is still restricted to only a few localities, eliminate it immediately, and recheck the sites periodically to insure that it has been successfully eradicated. This needs to be done urgently, because, any wait, like that which occurred on Niue, could prove the difference between success and failure.
4. Where possible, eradicate it, especially from coastal and mangrove sites, riversides, villages and other ecosystems where it seems to be particularly invasive.
5. Mount awareness programs to alert people to the invasiveness of *Wedelia* and the problems it can cause if people plant it as a groundcover and dispose of its cuttings indiscriminately. This should especially focus on groups promoting it as a groundcover in major landscaping schemes.

In short, *Wedelia* (*Sphagneticola trilobata*), the beautiful tropical American daisy invader, may ultimately end up being considered the worst weed to ever enter the Pacific Islands. Whereas some islands, like Bellona and the Pacific islands to the west of Solomon Islands and Vanuatu are fortunate enough to be free of malarial mosquitoes; and some small offshore islands throughout the Pacific are free of rats, cats, pigs, goats and mongooses or brown tree snakes, and have healthy bird, reptile and crab populations, it is our duty to ensure that as many islands, villages, town, parks, conservation areas, mangrove forests, swamps, river banks, plantations, gardens and other areas are kept free from *Wedelia*, the daisy invader. Only through such action can we ensure that the indigenous and long-established plants and animals of cultural, economic and ecological value to Pacific peoples will survive for the benefit our children and grandchildren. To ensure that these areas are protected from *Wedelia* will require an immediate effort to alert all people, young and old alike, to the serious threat that *Wedelia* poses to the ecological, economic and cultural survival of Pacific peoples, and the actions that must be taken now to minimise the number of islands and communities that are invaded and transformed. Most importantly, there is the urgent need to stop its spread to islands and areas where it still does not exist and to eradicate it from those areas where this is still possible. Coincident with these efforts, it is hoped that other control efforts will continue in areas already infested and that a biological control agent can be found in the tropical American homeland of *Wedelia*, which can be safely introduced into the Pacific to level the island playing field that *Wedelia* increasingly dominates.


Jone Niukula of National Trust removing Wedlia from Sigatoka Sand Dunes


USP student inspects Wedelia infestation, Sigatoka Sand Dunes National Park, Fiji

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