

Chapter 10

Sonora: Non-native and Invasive Plants

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Resumen

Solamente 6.8% (246 especies) de las 4,000 especies de plantas estimadas para Sonora son no nativas. Las familias Poaceae (68 especies), Brassicaceae (20 especies), Fabaceae (15 especies) y Asteraceae (14 especies) representan el 47.6% de las plantas no nativas, las que principalmente son hierbas (78.4%) y por lo general anuales (139 especies). La gran mayoría (74.8%) provienen del viejo continente, en especial de Eurasia y África. Las no nativas del nuevo mundo (64) son principalmente tropicales nativas de México a América del Sur.

Las especies no nativas e invasoras aumentaron dramáticamente en los últimos 60 años, reflejando el crecimiento poblacional, mayor perturbación del suelo y un incremento en el movimiento de personas y mercancías. Las especies no nativas en la Región del Río Bavispe en el noroeste de Sonora aumentaron 161% de 1941 a 2007 (a 86 especies). Las especies no nativas en la Región del Río Mayo en el sur de Sonora aumentaron 586% de 1939 a 1998 (a 96 especies).

Solamente el 15.0% de especies no nativas en Sonora (37 especies) son invasoras en hábitats naturales. En el Desierto Sonorense, la mostaza del Sahara, los zacates mediterráneos y árabes, el bromo rojo y la hierba conocida como ‘hielitos’ son invasoras en el occidente de Sonora, mientras que el zacate buffel invade el norte y centro de Sonora, así como el matorral espinoso de piedemonte en el centro oriente y sur del estado. El zacate africano en el noreste de Sonora y el zacate rosado en el oriente y norte de Sonora son invasores en pastizal del desierto. El carrizo, las dos especies de pino salado, el Juan loco y el zacate Bermuda están desplazando a las especies nativas en varios hábitats ribereños. El helecho flotador gigante (*Salvinia molesta*) se ha establecido en el Río Colorado y en los principales canales de riego.

Introduction

Non-native species are damaging or threatening native species and natural vegetation in many areas in North America (Harper-Lore, this volume). Espinosa-García et al. (this volume) discuss non-native weeds in Mexico, but not the state of Sonora in detail. Sonora is the second largest state in Mexico with an area of 185,430 km², and shares a border with Arizona. The biotic diversity in the state is very rich, reflecting dramatic gradients in rainfall and elevation. The flora of Sonora is rich with an estimated about 4,000 species (Van Devender and Felger, unpubl. data). In central Sonora, desertscrub in the Sonoran Desert lowlands along the Gulf of California merge eastward into tropical thornscrub and deciduous forest, and then into the oak woodland and pine-oak forest of the Sierra Madre Occidental (SMO). Closer to the Arizona border in northeastern Sonora there are Chihuahuan desertscrub and grasslands. The most important regional gradient is the transition from the New World tropics to the northern temperate zone at about 28°30'N latitude in east-central Sonora. Here the northern limits of the tropics are as much as 4° of

latitude farther north than in northeastern Mexico, and the northern ranges of many tropical species extend up the finger-like tributaries of the Río Yaqui into or near southeastern Arizona. Biotic communities and many land uses are similar on both sides of the 590 km of international border shared between Arizona and Sonora (Stoleson et al. 2005).

In this chapter, we focus on the documented non-native species of the state Sonora, discuss dispersal routes and mechanisms, invasive species, and present accounts of some of the most serious invasive species.

Non-Native Species in Sonora

The history of non-natives in Sonora is not well documented but by regional floras we get a good idea of the non-native history and flora. In Arizona and elsewhere in the southwestern United States, the arrivals and early records of filaree/alfilerillo (*Erodium cicutarium*), Johnsongrass (*Sorghum halepense*), tree-of-heaven/nogal falso (*Ailanthus altissima*), saltcedar/pino salado (*Tamarix ramosissima*), and Russian thistle/chamizo volador (*Salsola tragus*) are well documented (Tellman 2002a). These species are in Sonora as well but their arrivals are not well documented. Information on non-native species in Sonora is available from various sources, including our own unpublished data. A few of the sources are discussed below.

White (1948) reported 1200 taxa for the flora of the Río Bavispe region based on collections in 1938 to 1941. This is a very large area in northeastern Sonora just south of the Arizona border that included various montane habitats in isolated 'sky island' mountains and foothills thornscrub, Chihuahuan desertscrub, and grassland in the intervening valleys, all in tributary drainages of the great Río Yaqui. A partial revision of the nomenclature and recheck of determinations reduced the number of taxa to 978 in the flora (Van Devender and Reina-G., unpubl. data). Only 33 taxa (3.4% of the flora) were non-native exotic species, such as tree tobacco/Juan loco (*Nicotiana glauca*), castor bean/higuerilla (*Ricinus communis*; Figure 1), and opium poppy/amapola (*Papaver somniferum*, escaped cultivar).

A total of 1346 collections in the municipios (= counties) of northeastern Sonora within 100 kilometers of the Arizona border (Agua Prieta, Cumpas, Fronteras, Huachineras, Naco, and Nacozari de García) from 2001 to 2007 added 53 non-native species to the Río Bavispe flora (Van Devender, Reina-G., and Robert L. Minckley unpubl. data). This 161% increase in 66 years reflects the completion of Mexico federal highway 2 (MEX 2), increased east-west traffic along the border, increased dispersal along U.S. Interstate Highway 10 (IH 10) from California to Arizona, increased south-north traffic (cattle northward into U.S. markets), and substantially increased local human population. Some of the Reina-Van Devender collections were vouchers for a local flora in Chihuahuan desertscrub habitat on limestone at Rancho La Calera near Agua Prieta (329 taxa, including 17 non-natives [5.2%] Van Devender and Reina-G., unpubl. data). By 2007, a total of 86 non-natives are known in northeastern Sonora (Table 1), 36.2% of the total Sonoran non-natives.

Between 1933 and 1939, Howard Scott Gentry collected plants in the Río Mayo Region (RMR) in southern Sonora and adjacent Chihuahua. His **Río Mayo Plants** reported 1276 taxa with only 14 non-native species (1.1%; Gentry 1942). Non-natives included tree tobacco, Indian rubbervine/clavel de España (*Cryptostegia grandiflora*, escaped ornamental, Figure 2), and opium poppy. The only non-native grasses reported were pitscale grass (*Hackelochloa granularis*), Johnsongrass (*Sorghum halepense*), and sweet sorghum (*S. bicolor*; escaped cultivar), although giant reed/carrizo (*Arundo donax*) and others were probably there. An update of the RMR flora by Martin et al. (1998) included subfloras for tropical deciduous forest along

the Río Cuchujaqui (Van Devender et al. 2000), coastal thornscrub along the Gulf of California (Friedman 1996), and various habitats in the Yécora area (Van Devender et al. 2005b), which increased the flora to 2825 taxa, including 96 non-natives (4.6% of 2109 taxa in Sonora). This is an increase of 586% in non-natives since 1939, and included 20 additional non-native grasses, eight non-native mustards, and castor bean, but needs to be viewed in the context that the 1998 flora was the result of a greatly expanded effort by a team of botanists with more roads, better access, and more time than Gentry had. In many areas in the Río Mayo Region (RMR), buffelgrass (*Pennisetum ciliare*) is a serious invasive species dispersing from *praderas* (pastures) in *desmontes* (cleared areas) planted to increase cattle production.

Within the broad RMR, non-natives have been documented in several local areas. The flora in tropical deciduous forest (TDF) along the Río Cuchujaqui near Álamos had 741 taxa in 21 km² with 59 non-natives (8%; Van Devender et al. 2000), probably reflecting natural (annual floods) and human disturbances (recreation, roads, cattle, etc.) in a riparian habitat. The flora in coastal thornscrub in southern Sonora within the Río Mayo Region contained 511 total taxa including 39 non-natives (7.6%; Friedman 1996) in 712 km². On the coastal plain of the Gulf of California, weeds are especially common in areas cleared for large-scale agricultural fields and associated roads through them.

The Municipio of Yécora is mostly in the Río Yaqui drainage in the northernmost RMR. The flora is highly diverse with 1744 taxa documented in an intensive floristic inventory from 1995-2007 (Van Devender and Reina-G. unpubl. data; Van Devender et al. 2005b). The non-native species can be expressed for the total flora (107 taxa, 6.1%), or for the different vegetation communities: foothills thornscrub (FTS) and TDF (62 of 834 taxa, 7.4%), and temperate montane oak woodland, pine-oak forest, and grassland (72 of 1322 taxa, 5.4%). Disturbances in the Municipio range from buffelgrass pastures in the tropical lowlands to lumber activities in the Madrean uplands. The local flora in foothills thornscrub near Tónichi on the Río Yaqui has 405 taxa with 27 non-natives (6.7%; Van Devender and Reina-G. unpubl. data). Natural disturbances in the area are related to the Río Yaqui, although historical floods have been largely controlled by reservoirs. Other disturbances in the Yécora and Tónichi areas are related to Mexican federal highway (MEX) 16 and minor dirt roads, town sites, and cattle grazing and developments.

Non-natives have been reported from other areas in Sonora, although in some cases the same species are considered native in others. In the Sierra de Mazatán, a 'sky island' 80 km east of Hermosillo, an isolated oak woodland is surrounded by TDF and FTS (Sánchez-Escalante et al. 2004). There are 534 taxa in 169 km² with 17 non-natives (3.2%). Nacapule Canyon is a relictual tropical canyon in the Sierra El Aguaje near Guaymas. The flora has 285 species with 19 non-natives (6.7%; Felger 1999). Felger (1980) reported only three non-natives (*Mollugo cerviana*, *Schismus arabicus*, and *Sonchus asper*) in a flora of 145 species (2.1%) from the hyperarid Gran Desierto of northwestern Sonora, with only native species in the isolated Sierra del Rosario. Two decades later, Felger (2000) reported 561 taxa with 88 non-natives (15.7%) for a much larger region in his **Flora of the Gran Desierto and Río Colorado of Northwestern Mexico**.

Summary of Sonoran non-natives

Although dispersals have taken place between continents many times in the last 30 million years (Van Devender 2002), the current accelerated immigration of plants from distant parts of the globe began with the European colonization of the New World. The first Spanish/Europeans immigrants to Sonora and Sinaloa, especially Jesuit priests beginning in the

late 1500s and early 1600s (e.g., Pérez de Ribas 1645, 1999), brought a great many Old World plants and animals that resulted in dramatic changes in land use, displacing traditional hunting, gathering, and agricultural practices. Concentrating indigenous peoples into mission settlements to cultivate new grains, fruit trees, and medicinal plants, and to raise domesticated cattle, horses, pigs, and sheep created new kinds of disturbance and opportunities for weeds. Table 2 presents 19 species reported as cultivated in Sonora between 1750 and 1767 (all probably brought in the 1600's) by the Jesuit Juan Nentvig (Nentvig [1764] 1971), which are now considered as non-native species in the state. They include wheat (*Triticum aestivum*), common barley (*Hordeum vulgare*), coriander/cilantro (*Coriandrum sativum*), watermelon/sandía (*Citrullus vulgaris*), and peach/durazno (*Prunus persica*). For the most part these cultivated plants have escaped cultivation for centuries without becoming established. Only giant reed, castor bean, and locally black mustard (*Brassica nigra*) have become invasive. Castor bean is interesting because today it is widespread in Sonora, especially in warmer areas. Gentry (1942) did not report it from the Río Mayo Region while White (1948) did find it in the Río Bavispe Region in northeastern Sonora. If Nentvig's *higuerilla* (the widespread New World name for the plant) was indeed this plant, it has expanded its range dramatically in the last 60 years.

Giant reed is documented by specimens for Sonora and Baja California in the late 19th and early 20th centuries, and presumably it was in Sonora much earlier. In many places it has apparently replaced the native carrizo, the common reed (*Phragmites australis*), and additionally has become established in newly formed or disturbed wetland habitats. Although both occur in Sonora, they are not known to be sympatric--only one or the other occurs at a single wetland site. Carrizo has been in the Mayo-Yaqui Indian lands in southern Sonora long before European contact, but may not have been *Arundo* (giant reed), which has long been established along the lower Río Yaqui and has been used for many purposes including house walls, roofing, fencing, and mats (Holden et al. 1936, Pérez de Ribas 1645, 1999).

The flora of Sonora has about 4,000 species (Van Devender and Felger, unpubl. data), including 246 non-native species (6.8%; Appendix 1), including those known to be established as well as those only known from few collections. This represents 38.6% of the 637 non-native exotic species known for Mexico (Espinosa-G. et al., this volume). Only 69 of the non-native species recognized here were included in a list of 697 weeds (native and non-native taxa) for Sonora (Villaseñor-R. and Espinosa-G. 1998). Four families account for 47.6% of the non-native and 62.9% of the invasive species (37 species): Poaceae (68 species), Brassicaceae (20 species), Fabaceae (15 species), and Asteraceae (14 species). The majority of the non-native species are herbs (83.3%), including annuals (139 species) and perennial herbs (66 species). Woody non-natives are less common, but include trees (23 species), shrubs (11 species), woody vines (4 species), and succulents (3 species). Growth forms of the 37 invasive species are herbs (78.4%, 16 annuals and 13 perennials) and woody plants (21.6%, with 5 trees, 2 shrubs, and one woody vine). Most (74.8%) of the Sonoran non-natives are from the Old World, especially Asia (121 species), Europe (106 species), and Africa (93 species). Sixty-six species (26.8%) are native to the New World, including South America (34 species), Central America (20 species), Mexico (29 species), the Caribbean (2 species), the United States (7 species), and Canada (2 species), plus pantropical (3 species) and worldwide (2 species) weeds.

Non-native plants can be grouped by the general occurrence in Sonora. Exotic species associated with human activities include ornamentals (garden herbs, hedges, shade trees, etc., 50 species), cultivated species (food, fiber, medicine, cultural, wood, etc., 39 species), agricultural weeds (14 species), forage (13 species), and urban weeds (13 species). More generally

distributed non-natives are found in a several different disturbed habitats (76 species), riparian habitats (24 species, including three aquatic plants), and just on roadsides (15 species). Two species (*Hackelochloa granularis* and *Pteris cretica*) are only known in Sonora in natural habitats.

Often it is difficult to know if a species is native or not, especially for widespread tropical weedy species whose original distributions are lost in history. We accept anchored water hyacinth (*Eichhornia azurea*; Figure 3), Asian spiderflower (*Cleome viscosa*), Mexican paloverde (*Parkinsonia aculeata*), slimbristle sandbur/guachapori (*Cenchrus brownii*), and threadstem carpetweed (*Mollugo cerviana*) as non-native. But Amazon sprangletop (*Leptochloa panicoides*), American black nightshade/chichiquelite (*Solanum americanum*), green carpetweed (*Mollugo verticillata*), guamúchil (*Pithecellobium dulce*), indigobush/añil (*Indigofera suffruticosa*), rattail grass (*Sporobolus indicus*), red bird-of-paradise/tabachín (*Caesalpinia pulcherrima*), sandbur/guachapori (*Cenchrus echinatus*, *C. spinifex*), and tropical sensitive pea (*Chamaecrista absus*) are considered as northern populations of widespread tropical species or natural extensions of their geographic ranges. Of these, American black nightshade, guamúchil, indigobush, Mexican paloverde, and tropical sensitive pea were present in the Río Mayo Region in the mid-1930s (Gentry 1942). The tropical sensitive pea is an interesting case. It has a pantropical distribution reaching Arizona in the United States, but was supposedly introduced from Old World. But Gentry (1942) reported it in the SMO in Chihuahua; Kearney and Peebles (1951) noted its presence in remote localities in Arizona; and more recent Sonoran localities are in relatively natural habitats. In some cases the same species can be both native and non-native. For example, lantana (*Lantana camara*) with yellow and red flowers appears to be native in tropical eastern and southern Sonora, and the Sonoran Desert in central Sonora, but the Mozelle cultivar with multicolored pink, red, and yellow flowers has escaped locally near Yécora in eastern Sonora.

Species accounts

Arugula or salad rocket (*Eruca vesicaria* var. *sativa*) is a spicy green used in salads, especially in Italy. It is a winter-spring annual in the Sonoran Region. In Arizona it is a stealth invader that has gone largely unnoticed. This European annual herb has been reported as invasive in numerous countries, although there seem to be no reports of serious damage to natural communities. In North America it is widespread from southern Mexico to Canada (Felger 2000). It was reported in Arizona from 1906 through 1962 as occasional escapes from vegetable gardens. Although it was known from near Gila Bend since 1960, it has recently exploded in this area. In the wet spring of 2005 it was the most abundant annual for 70 kilometers along IH 8 westward from Gila Bend in an area of at least several hundred square kilometers. The plants reached about a meter tall and extended in an almost unbroken carpet beyond the highway in both directions across undisturbed valleys and rocky slopes. Alarms were raised with the conservation community about arugula as an invasive species in the Sonoran Desert in Arizona below 610 m elevation. Although it was collected in the Yaqui Valley in southern Sonora in 1912, the only recent records were from Sonoyta and San Luis, also in the Sonoran Desert (Felger 2000). Our collections of arugula in pine-oak forest on hydrothermally altered soils at 900 m elevation west of Yécora in east-central Sonora in 2005, in Chihuahuan desertscrub at about 1220 m elevation from Agua Prieta east to Arroyo Guadalupe in northeastern Sonora in 2007, and in grassland at 1360 m near Janos, Chihuahua in 2007 indicate that it is not limited by cold temperatures, and is potentially invasive at higher elevations east of the Sonoran Desert.

Tree tobacco (*Nicotiana glauca*) ranges in size from 1-2 m shrubs to trees 5-6 m in height. It was present in both the Río Bavispe in northeastern Sonora and the Río Mayo in southern Sonora by the mid-1930s. Unlike most other non-native species in Sonora, this species is not Eurasian or African, but from South America. It is considered an invasive species in Querétaro in central Mexico where it was planted for erosion control (Serrano-Cárdenas et al. this volume). In Sonora it is widespread in roadside ditches from near sea level to 1900 m elevation near Yécora. It is not long-lived, and populations fluctuate in response to drought and freezing temperatures. Along the Río Sonora north of Arizpe, it is invasive with dense stands displacing native riparian species on floodplains. Interestingly, tree tobacco is a very important nectar source for hummingbirds migrating through Sonora (Van Devender et al. 2005a).

Forage/erosion control grasses. Beginning in the 1880s, the U. S. Department of Agriculture, extension agents, and botanists at land grant universities in the southwestern United States diligently experimented with a wide variety of grasses, mostly from the Old World, in search of a magic forage to solve the woes of the drought-stressed cattle industry, and to control erosion. Many of these grasses are today's invasive species in Arizona and Sonora. Some species like Lehmann lovegrass/zacate africano (*Eragrostis lehmanniana*) were widely introduced into grasslands in southeastern Arizona and adjacent Sonora, often at the expense of native bunch grasses. Other African grasses, including escapes from experimental farms near Tucson, have spread more slowly. Wilman (*Eragrostis superba*; Figure 4) and African (*Eragrostis echinochloidea*) lovegrasses were only recorded in Sonora in the last few years (Van Devender and Reina-G. 2007). Kleingrass (*Panicum coloratum*), planted as a forage grass and in grassland restoration projects, has just begun to volunteer along MEX 2 east of Agua Prieta in 2007.

Buffelgrass (*Pennisetum ciliare*), a stout shrub-like grass native to the warm parts of Africa, India, and Madagascar, is the most serious ecological threat to the Sonoran Desert. Like other commercially important non-native species, buffelgrass is viewed very differently by the conservationists and the cattle industry. As early as 1889, it was being developed as a forage grass in Starkville, Mississippi (S. M. Tracy specimen in Rancho Santa Ana Botanic Garden Herbarium, originally in the Marcus E. Jones herbarium). Additional specimens in the University of Texas at Austin Herbarium record later trials in Biloxi and at the Coastal Plain Experiment Station in McMeill from 1907-1922. The U. S. Experiment Station and the Soil Conservation Service Nursery in Tucson was experimenting with it from 1938 to 1952.

Buffelgrass was introduced very successfully in Sonora for cattle forage in the 1950s, where it is commonly planted after the native vegetation is cleared with governmental subsidies (Ibarra-F. et al. this volume). The Common Buffelgrass cultivar from the Turkana Desert of northern Kenya developed by Texas A. & M. University was introduced into Sonora (Búrquez-M. et al. 2002). In the broad valleys of the Plains of Sonora subdivision of the Sonoran Desert, buffelgrass *praderas* (pastures) resemble African savannas. Buffelgrass was also been planted along highways in Sonora to control erosion, and has spread along roads into many areas. Recurrent fires have converted much of the roadside vegetation along MEX 15 into a buffelgrass monoculture from Imuris in northern Sonora south into Sinaloa. Unfortunately, fire is not an ecological process in Sonoran desertscrub, foothills thornscrub, or tropical deciduous forest. Hot buffelgrass fires devastate native trees, shrubs, and succulents and have, or will, convert native vegetation in large areas in central Sonora to *zacate buffel* savannas (Búrquez-M. et al. 2002).

The endangered masked bobwhite quail (*Colinus virginianus ridgwayi*) was, except for a historical (1880-1884) population in the Altar Valley in Arizona, restricted to the Plains of Sonora. This area of broad valleys and fine-grained deep soils has a long history of landscape

modifications designed to increase grass and forage production for cattle (Ibarra-F. et al., this volume). Forage modifications are very likely to be directly related to dramatic population declines of the masked bobwhite in the last 15 years in the Rancho El Carrizo area south of Benjamin Hill (Mary Hunnicutt, pers. comm., 2007). In this case, a valued, but invasive, non-native forage grass has played a role in the near extinction of a native species.

Van Devender and Dimmitt (2006) mapped buffelgrass in the Arizona Upland in Arizona and northern Sonora. Buffelgrass was found commonly along highways, especially IH 10 and 19 in Arizona and MEX 2 and 15 in Sonora. It has also established stands on steep, south-facing, rocky slopes far from roads or other human developments, apparently by wind-dispersed seeds. With a few exceptions (notably along MEX 2 in the Sonoyta area), buffelgrass does not appear to have dispersed across the Arizona-Sonora border, and the Arizona infestations of buffelgrass appear to have spread from centers in Tucson and Phoenix. Transects in buffelgrass stands away from roads showed there are serious impacts on native vegetation that buffelgrass out-competes native annuals, seedlings, perennial herbs, subshrubs, cacti, and even trees for water and nutrients.

Buffelgrass is very dense along MEX 2 across much of northwestern Sonora (Felger 2000), and actively invades northward from MEX 2 into Organ Pipe Cactus National Monument (Rutman this volume). Through the diligent efforts of Sue Rutman and volunteers, buffelgrass was successfully removed from along AZ 85 and most of the Monument, but each year, they recheck the area near the border for new arrivals.

Generally buffelgrass was thought to be limited by cold to below about 1200 m elevation, and in general that is where it is most common in Arizona. It disappears at the Arizona Upland/desert grassland transition east and south of Tucson in Arizona, and northeast of Imuris, Sonora. Arriaga et al. (2004) presented a model of potential buffelgrass distribution in Sonora using an upper elevation limit of 900 m. Neither the potential distributions generated in that publication nor a map of the approximate range of buffelgrass in northwestern Mexico and southwestern United States in Búrquez-M. et al. (2002) included northeastern Sonora or southeastern Arizona in its range. However, it has been collected up to 1463 m in the Santa Catalina Mountains above Tucson, and found along MEX 2 from west of Agua Prieta nearly to the Chihuahua border at elevations of 1130-1615 m (Van Devender and Dimmitt 2006, Van Devender and Reina-G., unpubl. data). A few buffelgrass plants in desert grassland at 1265 m elevation 11 km west of Douglas along AZ 80 were the first record for Cochise County; these probably were descendents of the MEX 2 populations.

The 'Frio' cultivar released by the Texas Agricultural Station in 1999 is more cold tolerant than Common Buffelgrass (Hussey and Burson 2005). The Universidad de Sonora was testing this variety near Cananea and the nearby Sierra La Púrica (Florentino Garza pers. com., 2007). Additional study is needed to know if the MEX 2 populations east of Agua Prieta are 'Frio'. Although both Common and Frio buffelgrasses are mostly apomictic (reproduce asexually), there is the possibility of rare mutations adapting to colder conditions.

Fountaingrass (*Pennisetum setaceum*) is a large perennial ornamental grass that has been cultivated in Tucson since the late 1940s. Today it is widespread in southern Arizona including the Tucson and Phoenix areas at 300-1465 m and along the Colorado River in western Arizona at 120-385 m. Although it has recently moved into Santa Cruz County along IH 19, it has not yet reached Nogales, but is expected to eventually cross the border. Only since the 1990s has fountaingrass been used as an ornamental in Álamos, Ciudad Obregón, Hermosillo, and Magdalena de Kino, and immediately began to spread into nearby urban areas. If it is not

controlled, it could become a serious invader in some Sonoran habitats. Interestingly the non-invasive sterile hybrid purple fountaingrass (*P. xadvena*, = *P. macrostachys* X *P. setaceum*) was also being planted in street medians in Hermosillo along with regular fountaingrass.

Natalgrass (*Melinis repens*) is an attractive pink flowered bunchgrass that is a serious invasive in Durango (González-E. et al. this volume) and Querétaro (Serrano-C. et al. this volume), Mexico. At moderate elevations in southern Sonora northeast of Álamos, east-central Sonora in the Yécora area, and north-central Sonora south of Nogales and in the Sierra Pinitos, it is a serious invasive in desert grassland and oak woodland, and on roadsides. It is widely scattered and often locally abundant in desert areas, including Cañón Las Barajitas, an isolated area in the Sierra El Aguaje near Guaymas only accessible by boat in the Gulf of California.

Mediterranean annual grasses: Cheatgrass (*Bromus tectorum*) in the Great Basin and northern Mohave Desert and red brome/bromo rojo (*B. rubens*) in the Mohave and northern Sonoran Desert are winter-spring annual grasses from the Mediterranean region. In wet winters, these grasses grow very densely, crowding out native annuals, and can fuel intense fires in the following summers. Red brome fires severely damage the characteristic palo verde-saguaro communities in Arizona Upland Sonoran desertscrub. In Sonora cheatgrass is only known from a single waif collection in the Pinacate region (Felger 2000), and red brome is most common at higher elevations in the Sierra Pinacate (Felger 2000), and not widespread elsewhere. A 2007 collection from Arroyo Guadalupe east of Agua Prieta extends its range into northeastern Sonora.

Wild barley (*Hordeum murinum* subsp. *glaucum*) is another spring annual grass that is native to the Mediterranean and Middle East that is now widespread and weedy in temperate regions of the world including western North America and higher elevations in the Sonoran Desert in Arizona. In Arizona, it is well established along major washes in the eastern part of the Cabeza Prieta National Wildlife Refuge and scattered in washes and canyons Organ Pipe Cactus National Monument in southwestern Arizona, and adjacent Sonora (Felger 2000), but is not common elsewhere. Recent collections from Agua Prieta extend its range to northeastern Sonora.

The relative scarcity of these Mediterranean grasses in Sonora is surprising considering how common and invasive they are in Arizona. New research on red brome suggests that the seeds are short-lived in the soil, and a series of dry winters causes dramatic reductions (Salo 2004). Perhaps the frequency of winter drought and short seed longevity in the soil set climatic limits on the southward expansion of these Mediterranean grasses.

Feathertop (*Pennisetum villosum*) is an attractive, white plumose grass that arrived Arizona in the 1980s. It is rapidly expanding its range in the old mining town of Bisbee, where it has been cultivated as an ornamental. It is a serious invasive species in western California and in the Sierra Madre Occidental in Mexico from Durango south to Mexico City. In Durango it is a roadside dominant along MEX 40 from desert grassland in Ciudad Durango westward to at least 2700 m elevation in pine-oak forest near El Salto (González-E. et al. this volume). Considering that it grows at such high elevations, it is better adapted to cold than its congeners buffelgrass and fountain grass. It has not yet been recorded for Sonora, but is potentially invasive in montane habitats in the Sierra Madre Occidental in eastern Sonora.

Discussion

Stuckey and Barkley (1993) and various papers in Tellman (2002b) provide excellent definitions of non-native and invasive species and discussions of dispersal mechanisms and their

environmental impacts in these areas. More than 2000 species of introduced plants have become established in the United States (Vitousek 1997), and at least 637 exotic species are known for Mexico (Espinosa-G. et al., this volume). Stuckey and Barkley (1993) estimated that 18% of the California flora (6400 taxa) and 7% of the Arizona flora (3438 taxa) were non-native species (these are higher today), but these estimates are dated as non-natives have increased. McLaughlin (2002) provided a comprehensive overview of non-native species in floras in the western United States including his Sonoran Desert Province. He found that the number of exotic species in floras decreased from west to east from California to Arizona, and with increasing elevations, but other factors such as when the inventories were done, degree of disturbance, nearness of major highways and railroads, etc. hampered predictions of how many non-natives were in each area. Non-native species averaged 6.2% for 35 floras in the Madrean floristic province (in the United States) and 8.6% for the Sonoran province (United States plus northwestern Sonora [Felger 2000]).

The regional summaries of non-natives in Tellman (2002b) are confusing because of different areas of coverage and criteria for 'nativeness'. The excellent discussion and analyses in Wilson et al. (2002) report 233 non-natives for the Sonoran Desert (parts of Arizona, California, Sonora, Baja California, and Baja California Sur) but did not provide a list. This represented 11.6% of the estimated 2625 species in the Sonoran Desert (Felger 1990), West and Nabhan (2002) summarized non-native species in the islands in the Gulf of California in the Sonoran Desert and adjacent Sonora and Baja California. Nabhan et al. (2002) presented an exhaustive list of about 350 exotic species for the Sonoran Region (the Sonoran Desert plus Mohave Desert extension into the Grand Canyon). Distributions within this large area were not given and occurrences were not vouchered.

Dispersal mechanisms. Non-native species have reached Sonora by various routes, although dispersal via anthropogenic transportations has been the most significant mechanism. The earliest main transportation systems in Sonora were Indian trails and then Spanish mission and mine roads followed by Mexican dirt roads. These were followed by the railroads and then modern paved highways.

The first railroad in Sonora was completed in 1882 to carry commerce from the United States through to the port of Guaymas. In 1905 construction was begun to extend this line southward into Sinaloa, forming the modern Ferrocarril del Pacifico. There were also mine railroads from Estación Corral near Cd. Obregón north along the Río Yaqui to Tónichi, from Agua Prieta south to Nacozari de García in 1900, and side branches to several smaller mines. The secondary Ferrocarril Sonora-Baja California was completed from Mexicali to Puerto Peñasco in 1940 (Munro-Palacios 2007), and connected to Ferrocarril del Pacifico in Benjamín Hill in north-central Sonora in 1948. These were early dispersal corridors for weeds of disturbed soils and those related to agriculture and cattle ranching. Wherever the railroads went, new settlements were established. Until after World War II, the only paved road in Sonora was from Sonoyta to Puerto Peñasco.

In southern Arizona, the interstate highways are important dispersal corridors, especially IH 10 from California eastward and less so from Texas and New Mexico westward. IH 19 is a major freeway from Tucson south to Nogales, Arizona, connecting with Mexico Federal Highway 15 (MEX 15) in Nogales, Sonora. Smaller federal and state highways connect IH 10 with the east-west MEX 2 in Sonora through smaller border crossings in Lukeville (Sonoyta), Sásabe, Naco, and Douglas (Agua Prieta). As discussed above for the Río Bavispe region (Table 1), non-native species have increased dramatically in northern Sonora. There appear to be

more exotic species crossing the border from the north than from Sonora into Arizona. In Sonora the north-south MEX 15 is a major transportation artery with tens of thousands of ‘paisanos’ going south to visit relatives each Christmas season, and thousands of vegetable and cattle trucks going northward to deliver produce to the United States each year, and will be soon allowed to enter the United States. Non-native plants have been moving northward along MEX 15. Kleberg bluestem/zacate carretero (*Dichanthium annulatum*) is an African forage grass that was a common roadside weed in southern Sonora in the early 1990’s (Martin et al. 1998), as well as in south Texas (Best this volume). In recent years, it has expanded northward into the Plain of Sonora deserts scrub in central Sonora, and to higher areas near Nogales in both Sonora and Arizona (Felger et al. 2005, Van Devender and Reina unpubl. data). Asian spiderflower is a pantropical weed that was also common in southern Sonora in the 1980s (Felger unpubl. data). In 2006 it was found as far north as Tónichi on the Yaqui River, and in 2007 along MEX 15 at least 50 km north of Hermosillo.

In Sonora, MEX 2 is a major east-west dispersal corridor with heavy commercial truck traffic from Baja California east to Sonora, and from Chihuahua west across the Sierra Madre Occidental into northeastern Sonora. This highway appears to be the major route for Sahara mustard/mostaza del Sahara (*Brassica tournefortii*; see Dimmitt and Van Devender, this volume), Malta starthistle (*Centaurea melitensis*), and annual grasses (*Bromus rubens*, *Schismus arabicus*, and *S. barbatus*) dispersing from the Sonoran Desert borderlands eastward into Chihuahuan deserts scrub and desert grassland habitats east of Agua Prieta at ca. 1240 m elevation (Van Devender and Reina-G., unpubl. data). MEX 2 also appears to be the dispersal corridor for arugula (see below) and common tansymustard (*Descurainia sophia*) from Chihuahua into Sonora. Blackspot hornpoppy (*Glaucium corniculatum*) is an herb with attractive dark red flowers with black spots inside. It was first collected in Mexico in 1998 from Sonoran collections from south of Magdalena de Kino along MEX 15 and near Agua Prieta (Van Devender and Reina-G. 2007). In 2007 it appeared to be rapidly expanding from Agua Prieta westward along MEX 2.

In northern Sonora, highways are also the major dispersal corridors for cultivated trees to spread away from urban areas. These include Brazilian peppertree/pimiento/pirul (*Schinus molle*), Chinese jujube/dátil chino (*Ziziphus jujuba*), Siberian elm/olmo (*Ulmus pumila*), and tree-of-heaven. In the Sierra Madre Occidental in eastern Sonora, peach has established along MEX 16 from the Chihuahua border westward to the Yécora area. In the Guaymas area of west-central Sonora, the Asian athel/pino salado (*Tamarix aphylla*), once thought to be sterile in North America because of clonal propagation (Benson and Darrow 1981), is expanding rapidly in roadside ditches along MEX 15, often with saltcedar. The Asian Chinaberry tree/piocha (*Melia azedarach*) was a common ornamental in small towns in rural Sonora. In San Nicolás in east-central Sonora, and several other towns, it is not grown in town but has colonized nearby arroyos.

Other cultivated plants are escaping from existing or abandoned human settlements. The Australasian chaste tree/carnavalito (*Vitex rotundifolia*) is a malleable shrub widely used for ornament or hedges in southern Sonora. In 2007, it was found away from habitation in Arroyo Masiaca near Teachive and along the Río Mayo below Presa Mocúzari (Van Devender and Reina unpubl. data). The tropical American gloria de la mañana (*Ipomoea carnea* subsp. *fistulosa*) is a large, lavender-flowered ornamental morning glory shrub that has established in roadside ditches along MEX 15 near Estación Don in southern Sonora and in Sinaloa. Hog plum/yoyomo (*Spondias purpurea*) and white sapote/zapote blanco (*Casimiroa edulis*) are tropical American

fruit trees cultivated in southern Sonora that have escaped into tropical deciduous forest (Felger et al. 2001).

At least one species is both native and introduced. Jerusalem cherry/naranjito de amor (*Solanum pseudocapsicum*) is a shrub with attractive orange fruit native from Mexico to South America. However plants established near settlements on Mesa del Campanero in eastern Sonora and nearby Bermudez, Chihuahua are the hairy form that was developed as an ornamental cultivar in the Old World (Aarón Rodríguez, pers. comm., 2008) and planted by immigrants from the United States in the late 1800s.

Other non-native species in Sonora are associated with agricultural or cattle activities, and are dispersed as seed or feed contaminants. The best known of these are the European field bindweed/correhuela (*Convolvulus arvensis*), Russian thistle, and various European field mustards (*Brassica juncea*, *B. nigra*, *B. rapa*, *Hirschfeldia incana*, *Raphanus raphanistrum*, *R. sativa*, and *Sinapis arvensis*). Upland cotton/algodón (*Gossypium hirsutum*) has volunteered on roadsides sporadically in the Santa Ana de Yécora area, south of Hermosillo, and else where, likely from seeds falling off trucks. Martínez-Díaz and Jiménez-León (this volume) reported 82 species of weeds in agricultural fields and orchards in La Costa de Hermosillo, western Sonora; only 32 species were non-natives.

Other non-native species are plants that were used culturally. Tobacco (*Nicotiana tabacum*) is not a common crop in Sonora, although this plant was cultivated and smoked by many pre-Hispanic cultures in Mexico. The Mountain Pima Indians in the Sierra Madre Occidental in eastern Sonora developed a distinctive cultivar with rose pink or white flowers called papante or macuchi (Pima tobacco), which has escaped and volunteers in the Pima lands east of Yécora. We have seen occasional plants of marijuana/mota (*Cannabis sativa*; Figure 5) and opium poppy escaping from modern illicit crops.

Although less important today, non-native species also reach Sonora by ship. Beginning in the 1700s, commerce from the Caribbean, Europe, and other parts of the world reached northwestern New Spain/Mexico through the port of Guaymas. One non-native that probably reached Sonora by ship is Jamaican feverplant/toboso (*Tribulus cistoides*). It was collected by Ira Wiggins near El Llano in the Sonoran Desert in central Sonora in the 1930s, and again in the same area by Felger in 1962. In August 2007, Van Devender and Reina-G. found it in two relatively-natural habitats 45-48 km south of El Llano. Both areas are along the old wagon route from Guaymas through Rancho El Carrizo to various mining communities and Altar. This African perennial herb with pale yellow flowers likely was transported accidentally from the Caribbean to Guaymas by ship, and by mule train to central Sonora.

Wind is a dispersal mechanism that helps plants spread from established roadside populations into natural habitats. Buffelgrass patches on isolated hillsides away from roads in Arizona and Sonora were most likely established from windblown seeds (Van Devender and Dimmitt 2006). In spring 2007, we (ALRG, TRV) found London rocket in a tiny depression on a limestone hilltop and purple mustard (*Chorispora tenella*) in a dry, upland stock tank, both likely founded from windblown seeds. Wind dispersal was undoubtedly responsible for the colonization of saltcedar in the interior of Isla Tiburón in the Gulf of California more than half a century ago, and even the bottom of Elegante Crater in the Pinacate Region (Felger 2000, Felger and Moser 1985).

One of the complexities of understanding non-native species is that they behave differently in different habitats. For example, London rocket is a common, widespread European winter annual that occurs in disturbed and natural habitats in most of Arizona and Sonora, where

it mostly is well mixed with native species. However, near Janos, Chihuahua, it was in dense stands with common tansymustard in agricultural fields at 1465 m elevation. We have seen the spring annual filaree form dense monocultures on disturbed clay soils at 475 m elevation northeast of the Sawtooth Mountains in Arizona. But in northeastern Sonora, it is only an occasional roadside annual up to 1945 m elevation in oak woodland in the Sierra San Luis on the Chihuahua border.

Temporal variability is another confounding factor. The abundances of annuals, especially those that respond to cool season rainfall, closely track annual rainfall fluctuations. And exotic species, such as Sahara mustard (Dimmitt and Van Devender this volume), are notorious for exploding after lag times of decades into new habitats and areas (Bowers et al. 1991).

Invasive species in Sonora. Of the 245 non-native species in Sonora, only 37 (15.0%) are considered invasive or potentially invasive in native habitats (Table 3). Sahara mustard, Arabian and Mediterranean grasses, and ice plant are invasive in Lower Colorado River Valley desertscrub and buffelgrass along MEX 2. Red brome is invasive on the rugged basalt slopes in the Sierra Pinacate. Buffelgrass is invasive in Arizona Upland and Plains of Sonora desertscrub in northern and central Sonora, and in foothills thornscrub in east-central and southern Sonora. Lehmann lovegrass in northeastern Sonora and Natalgrass in the Yécora area in eastern Sonora and the Nogales area in northern Sonora are invasive in desert grassland. Giant reed, the shrubby saltcedar, athel, tree tobacco, and Bermuda grass (*Cynodon dactylon*) are displacing native species in riparian habitats in many areas. Giant salvinia/helecho flotador gigante (*Salvinia molesta*) is an aquatic fern that was established in the Colorado River and major irrigation canals by 2004 (A. Novelo-R., pers. comm., 2007). Indian rubbervine is a large vine from Madagascar that has large showy lavender-white flowers and poisonous latex. It was brought in either as an ornamental or for the extraction of rubber, and is now invasive in arroyos in tropical areas in eastern and southern Sonora, especially near San Javier, Álamos, and other old mining settlements.

A number of other species that are primarily along roadsides have the potential to move into natural habitats and should be watched carefully. These include Asian spiderflower and Kleberg bluestem in central Sonora, and arugula, buffelgrass, Malta starthistle, and Sahara mustard in northeastern Sonora. Fountaingrass certainly has the potential to escape ornamental plantings into natural habitats in at least the eastern two-thirds of the state.

Conclusion. We have seen dramatic increases in non-native and invasive species in Sonora the last 60 years as human populations increased with greater disturbance of the land and movements of people and commodities along new and expanded highways. The new coastal highway from San Luis Río Colorado to Puerto Peñasco, Bahía de Kino, and Guaymas will allow non-native species access to vast wilderness areas from the Grand Desierto sand sea south along the coast of the Gulf of California. Considering that these activities will continue to expand, and the inherent variability of arid and semiarid climates, we predict the arrival of new non-native plants and the continued movements of the exotics already present, and that some of them will become invasive. We urge botanists and land managers to be vigilant in observing non-natives, and aggressive in controlling those that threaten native species and natural habitats.

Acknowledgments

We thank companions and colleagues including John F. Wiens, Jeffrey Moore, Shannon Doan, Humberto Romero-Morales, Aaron Flesch, Tim Van Devender, Ben Wilder, and many

others. We thank Shelly McMahon, Brad Boyle, and Phil Jenkins for help with specimens in the University of Arizona Herbarium (ARIZ). We greatly appreciate the help of John and Charlotte Reeder also at ARIZ with grass identifications. We thank Andrew Salywon at the Desert Botanical Garden for identifications of mustards. Robert Minckley provided information on non-natives on the Rancho Los Ojos Conservation ranches in northeastern Sonora. Sonoran plant collections were made under a SEMARNAT permit to Jesús Sánchez-E. at the Universidad de Sonora. Van Devender and Reina-G. collected plants in La Frontera as part of projects funded by the National Fish and Wildlife Foundation and the U.S. Fish and Wildlife Service.

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Table 1. Non-native plants in the Río Bavispe Region of northeastern Sonora. The primary collection from 1938-1941 was deposited into the University of Michigan Herbarium (MICH). Herbaria: ARIZ – University of Arizona, ASDM - Arizona-Sonora Desert Museum, ASU - Arizona State University, BCMEX – Universidad Autónoma de Baja California, CAS - California Academy of Science, DBG - Desert Botanical Garden, GH – Gray Herbarium, Harvard University, HCIB - Centro de Investigaciones de Noroeste, MEXU – Universidad Nacional de México (includes C. Conzatti collection), IEB – Instituto de Ecología del Bajío, MO – Missouri Botanical Garden, NMC - New Mexico State University, TEX - University of Texas, US – United States National Herbarium, USON - Universidad de Sonora. Collectors: Harvey - LeRoy H. Harvey, Phillips - Edwin A. Phillips, Santos - José Vera Santos, White - Stephen S. White.

A. Non-native species cited in White (1948).

Apiaceae

Foeniculum vulgare. Sweet fennel, hinojo. *White 300*.

Asteraceae

Sonchus asper. Spiny sowthistle, chinita. *White 3197* (ARIZ)

Sonchus oleraceus. Common sowthistle, chinita. *White 3412* (ARIZ, GH, MEXU)

Brassicaceae

Brassica nigra. Black mustard, mostaza. *White 2871* (ARIZ)

Nasturtium officinale. Watercress, berro. *White 769* (MICH)

Cucurbitaceae

Citrullus lanatus. Watermelon, sandía. *White 772* (MICH)

Euphorbiaceae

Ricinus communis. Castor bean, higuera. *White 296* (ARIZ)

Fabaceae

Parkinsonia aculeata. Mexican paloverde, bagota. *White 335* (ARIZ, GH)

Phaseolus vulgaris. Bean, frijol. *White 3919* (MICH)

Liliaceae

Asparagus officinalis. Asparagus, asparrago. *White 752* (ARIZ)

Meliaceae

Melia azedarach. Chinaberry tree, lila, piocha. *White 421* (ARIZ)

Moraceae

Ficus carica. Common fig, higuera. *White 380* (ARIZ, GH)

Morus alba. White mulberry, mora. *White 452* (ARIZ, GH)

Nyctaginaceae

Mirabilis jalapa. Four o'clock, maravilla. *White 3400* (ARIZ, MICH)

Papaveraceae

Papaver somniferum. Opium poppy, amapola. *White 2876* (MICH)

Plantaginaceae

Plantago major. Common plantain, llantén. *Phillips 325* (MICH)

Poaceae

Arundo donax. Giant reed, carrizo. *Santos 1892* (MICH)

Avena fatua. Wild oat, avena. *Santos 2026* (MICH)

Cynodon dactylon. Bermudagrass, zacate inglés, zacate Bermuda. *Santos 1786* (MICH)

Echinochloa colonum. Jungle rice. *Santos 1807* (MICH)

Echinochloa crusgalli. Barnyard grass. *Santos 1945* (ARIZ, MICH)
Eragrostis cilianensis. Stinkgrass. *Santos 1811* (MICH)
Hackelochloa granularis. Pitscale grass. *Santos 1953* (MICH)
Polypogon monspeliensis. Rabbitsfoot grass, colita de ratón. *White 714* (ARIZ, GH)
Sorghum bicolor. Sweet sorghum, sorgo. *Santos 2049* (MICH)
Sorghum halepense. Johnsongrass, zacate Johnson. *Santos 1837* (MICH)

Polygonaceae

Polygonum aviculare. Prostrate knotweed. *White 3415* (ARIZ)

Portulacaceae

Portulaca oleracea. Common purslane, verdolaga. *White 434* (MICH)

Primulaceae

Anagallis arvensis. Scarlet pimpernel. *White 305* (ARIZ, GH)

Rosaceae

Pyrus communis. Common pear, pera. *White 753* (ARIZ, GH)

Simaroubaceae

Ailanthus altissima. Tree of heaven, nogal falso. *White 754* (ARIZ, GH)

Solanaceae

Nicotiana glauca. Tree tobacco, álamo loco. *White 293* (ARIZ, GH, MICH)

Zygophyllaceae

Tribulus terrestris. Puncture vine, toboso. *White 4042* (MICH)

B. Recent collections in the Municipios de Agua Prieta, Naco, and Nacozari de García (Van Devender and Reina-G., unpubl. data). *= Observation. **Beetle et al. 1991.

Anacardiaceae

Schinus molle. Brazilian peppertree, pirul. *Van Devender 2007-384* (ARIZ, MEXU, USON)

Asteraceae

Centaurea melitensis. Malta starthistle. *Van Devender 2007-380* (ARIZ, NMC, USON)

Lactuca saligna. Willowleaf lettuce. *Van Devender 2003-526* (TEX, USON)

Lactuca serriola. Prickly lettuce. *Van Devender 2003-1002* (ARIZ, ASU, HCIB, TEX, USON)

Senecio vulgaris. Common groundsel. *Reina-G. 2007-443* (ARIZ, MEXU, USON)

Brassicaceae

Brassica tournefortii. Sahara mustard, mostaza del Sahara. *Van Devender 2007-379* (DBG)

Chorispora tenella. Purple mustard, crossflower, mostaza. *Reina-G. 2007-373* (ARIZ, ASDM, DBG, HCIB, NMC, TEX, US, USON)

Descurainia sophia. Common tansymustard. *Van Devender 2007-293* (ARIZ, CAS, DBG, MEXU, NMC, TEX, USON)

Eruca vesicaria var. *sativa*. Arugula, salad rocket. *Van Devender 2007-289* (DBG, USON)

Erysimum repandum. Spreading wallflower, mostaza. *Reina-G. 2007-528* (ARIZ, ASDM, CAS, DBG, HCIB, MEXU, MO, NMC, TEX, US, USON)

Sinapis arvensis. Charlock mustard, mostaza. *Van Devender 2003-537* (ARIZ, ASU, USON)

- Sisymbrium irio*. London rocket, pamitón. *Reina-G. 2006-657* (DBG)
- Chenopodiaceae
- Atriplex semibaccata*. Australian saltbush. *R. L. Minckley SBV143138* (USON)
- **Cheopodium murale*. Nettleleaf goosefoot, chual.
- Kochia scoparia*. Mexican fireweed. *Van Devender 2002-614* (ARIZ, ASU, HCIB, MEXU, TEX, USON)
- Salsola tragus*. Russian thistle, chamizo volador. *Van Devender 2002-615* (ASU, USON)
- Convolvulaceae
- Convolvulus arvensis*. Field bindweed, correhuela. *Reina-G. 2007-445* (ARIZ, USON)
- Euphorbiaceae
- Euphorbia vellerifolia*. Spurge, golondrina. *Van Devender 2007-513* (ARIZ, CAS, HCIB, IEB, MEXU, MICH, MO, TEX, USON)
- Fabaceae
- Caesalpinia gilliesii*. Yellow bird-of paradise, tabachín amarillo. *Van Devender 2007-419* (ARIZ, ASDM, MEXU, NMC, USON)
- Medicago polymorpha*. Burclover, trébol. *Van Devender 2003-472* (ARIZ, HCIB, USON)
- Medicago sativa*. Alfalfa. *Van Devender 2007-497* (ARIZ, MEXU, NMC, USON)
- **Melilotus albus*. White sweet clover, trébol.
- Melilotus indica*. Sour clover, trébol amargo. *Van Devender 2007-506* (ARIZ, ASDM, MEXU, NMC, USON)
- Melilotus officinalis*. Yellow sweet clover, trébol. *Van Devender 2004-329* (USON)
- Fumaricaceae
- Fumaria officinalis*. Drug fumitory, huele de noche. *R. L. Minckley SBV141612* (ARIZ)
- Fumaria parviflora*. Fineleaf fumitory. *Van Devender 2004-360* (ARIZ, USON)
- Geraniaceae
- Erodium cicutarium*. Filaree, alfilerillo. *Van Devender 2007-301* (ARIZ, CAS, MEXU)
- Lamiaceae
- Lamium amplexicaule*. Henbit deadnettle. *Reina-G. 2004-396* (ARIZ, CAS, NMC)
- Marrubium vulgare*. Horehound, marrubio. *Van Devender 2005-424* (ARIZ, ASU, MEXU)
- Malvaceae
- Malva parviflora*. Cheeseweed, malva, quesitos. *Van Devender 2006-729* (observation)
- Papaveraceae
- Glaucium corniculatum*. Blackspot hornpoppy. *Van Devender 2004-334* (ASDM, ASU)
- Poaceae
- Bothriochloa ischaemum*. King Ranch bluestem. *Van Devender 2007-725* (ARIZ, NMC, USON)
- Bromus catharticus*. Rescuegrass. *Van Devender 2007-535* (ARIZ, MEXU, NMC, USON)
- Bromus rubens*. Red brome, bromo rojo. *Reina-G. 2007-337* (ARIZ, HCIB, MEXU, NMC, USON)
- Eragrostis barrelieri*. Mediterranean lovegrass. *Reina-G. 2006-701* (ARIZ, MEXU, USON)
- ***Eragrostis curvula*. Weeping lovegrass.
- Eragrostis lehmanniana*. Lehmann lovegrass. *Van Devender 2003-1000* (USON)

Festuca arundinacea. Tall fescue. *Van Devender 2007-557* (ARIZ, MEXU, NMC, TEX)
Hordeum aegiceras. Awnless common barley. *Van Devender 2007-493* (ARIZ, MEXU, USON)
Hordeum murinum subsp. *glaucum*. Smooth barley, cebada. *Van Devender 2005-399* (ARIZ, ASU, HCIB, MEXU, NMC, USON)
Melinis repens. Natal grass, zacate rosado. *Van Devender 2007-546* (ARIZ, MEXU, USON)
Panicum antidotale. Blue panicgrass. *Van Devender 2007-556* (ARIZ, HCIB, MEXU, MO, NMC, USON, TEX)
Panicum coloratum. Kleingrass. *Van Devender 2007-726* (ARIZ, MEXU, NMC, US)
Pennisetum ciliare. Buffelgrass, zacate buffel. *Reina-G. 2004-868* (USON)
Phalaris minor. Littlseed canarygrass. *Van Devender 2007-499* (ARIZ)
Schismus arabicus. Arabian grass. *Reina-G. 2007-369* (ARIZ, ASDM, MEXU)
Schismus barbatus. Mediterranean grass. *Reina-G. 2007-405* (ARIZ, NMC)
Triticum aestivum. Wheat, trigo. *Van Devender 2007-507* (ARIZ)

Rhamnaceae

Ziziphus jujuba. Common jujube, dátíl chino. *Van Devender 2003-1004* (ARIZ, HCIB, NMC, USON)

Scophulariaceae

Verbascum virgatum. Wand mullein, barbasco. *Reina-G. 2002-300* (ARIZ, USON)
Veronica anagalis-aquatica. Water speedwell. *Reina-G. 2002-275* (ARIZ, BCMEX, USON)

Tamaricaceae

Tamarix aphylla. Athel, pino salado. *Reina-G. 2006-442, Van Devender* (ARIZ, MEXU, NMC, USON).
Tamarix ramosissima. Saltcedar, pino salado. *Van Devender 2004-1187* (ARIZ).

Ulmaceae

Ulmus pumila. Chinese elm, olmo. *Van Devender 2007-294* (ARIZ, ASDM, USON)

Table 2. Plants cultivated in Sonora between 1750-1767 (Nentvig [1764] 1971) currently considered as non-native species.

Apiaceae

Coriandrum sativum. Coriander, cilantro.

Brassicaceae

Brassica nigra. Black mustard, mostaza.
Raphanus sativus. Raddish, rábano.

Cucurbitaceae

Citrullus lanatus. Watermelon, sandía.
Cucumis melo. Melons, melón.

Euphorbiaceae

Foeniculum vulgare. Sweet fennel, hinojo.
Ricinus communis. Castor bean, higuerilla.

Fabaceae

Arachis hypogaea. Peanut, cacahuete.

Moraceae

Ficus carica. Common fig, higuera.

Morus alba. Mulberry, mora (cited in White 1948).

Plantaginaceae

Plantago major. Common plantain, llantén.

Poaceae

Arundo donax. Giant reed, carrizo.

Hordeum vulgare. Common barley, cebadilla.

Triticum aestivum. Wheat, trigo.

Portulacaceae

Portulaca oleracea. Common purslane, verdolaga.

Rosaceae

Prunus persica. Peach, durazno.

Pyrus communis. Pear, pera. (White 1948).

Solanaceae

Nicotiana tabacum. Tobacco, tabaco.

Solanum lycopersicum. Tomato, tomate.

Table 3. Selected invasive or potentially invasive species in Sonora.

Sonoran Desert: Lower Colorado River Valley (LCV)

Brassica tournefortii. Sahara mustard. Invasive in LCV desertscrub, along roadsides into northeastern Sonora.

Bromus rubens. Red brome. Invasive in the Pinacate Region.

Mesembryanthemum crystallinum. Ice plant, hielitos. Invasive in sandy coastal areas and near roadside in LCV and Gulf Coast of Sonora.

Schismus arabicus. Arabian grass. Invasive in LCV desertscrub, along roadsides into northeastern Sonora.

Schismus barbatus. Mediterranean grass. Invasive in LCV desertscrub, along roadsides into northeastern Sonora.

Sonoran Desert: Arizona Upland (AZU)

Pennisetum ciliare. Buffelgrass, zacate buffel. Expanding into LCV, northeastern Sonora, and elsewhere on roadsides; also in urban areas in Caborca and Hermosillo.

Desert grassland:

Eragrostis lehmanniana. Lehmann lovegrass. Invasive in desert grassland, on roadsides.

Melinis repens. Natalgrass, zacate rosado. Invasive in desert grassland near Nogales and Yécora, widespread in other habitats, including woodlands and forests of the Álamos area.

Riparian habitats:

Arundo donax. Giant reed, carrizo. Mostly local, but apparently has replaced common reed (*Phragmites australis*) in southern Sonora.

Cryptostegia grandiflora. Indian rubbervine, clavel de España. More tropical areas in southern Sonora.

Cynodon dactylon. Bermuda grass, zacate inglés. Nearly statewide. Rivers, water holes, roadside ditches, etc.

Parkinsonia aculeata. Mexican paloverde, guacaporo.
Polypogon monspeliensis. Rabbitfoot grass, zacate cola de zorra.
Ricinus communis. Castor bean, higuera. Eastern half of state.
Tamarix aphylla. Athel, pino salado. Roadside ditches, riparian habitats.
Tamarix ramosissima. Saltcedar, pino salado. Rivers, arroyos, and roadsides.

Aquatic habitats:

Eichhornia azurea. Anchored water hyacinth. Río Mayo, southern Sonora.
Eichhornia crassipes. Common water hyacinth, patito. Río Mayo and canals, southern Sonora.
Nasturtium officinale. Watercress, berro. Most rivers in northeastern Sonora borderlands.
Salvinia molesta. Giant salvinia, helecho flotador gigante. Invasive in Colorado River and canals.

Roadsides:

Centaurea melitensis. Malta starthistle. Along MEX in Sonoran Desert and northeastern Sonora.
Cleome viscosa. Asian spiderflower. In southern Sonora, expanding rapidly northward along MEX 15 into central Sonora.
Dichanthium annulatum. Kleberg bluestem, zacate carretero. In southern Sonora, expanding northward.
Eruca vesicaria subsp. *sativa*. Arugula, salad rocket. Roadsides in Agua Prieta area, potentially invasive in AZU.
Glaucium corniculatum. Blackspot hornpoppy. Along MEX 2 near Agua Prieta.
Leucaena leucocephala. White leadtree, guaje. In southern Sonora, expanding northward to north of Imuris along MEX 15; also in urban areas.
Nicotiana glauca. Tree tobacco, Juan loco, don Juan. Also in riparian habitats, notably Río Sonora floodplain.
Sorghum halepense. Johnsongrass, zacate Johnson. Widespread in roadside ditches and riparian habitats.

Agriculture:

Brassica nigra. Black mustard, mostaza. In fields, on roadsides.
Brassica rapa. Field mustard, mostaza. In fields, on roadsides.
Convolvulus arvensis. Common bindweed, correhuella. In fields, on roadsides.
Salsola tragus. Russian thistle, chamizo volador. In fields, on roadsides, especially common near Agua Prieta and La Costa de Hermosillo.

Urban areas:

Ailanthus altissima. Tree-of-heaven, nogal falso. Escaping cultivation locally from Santa Cruz to Agua Prieta.
Descurainia sophia. Common tansymustard. In fields, on roadsides in northeastern Sonora.
Kochia scoparia. Mexican fireweed. Agua Prieta; potentially into agricultural areas.
Lepidium didymum. Procumbent pepperwort.
Pennisetum setaceum. Fountaingrass, plumitas. Recent ornamental in Álamos, Ciudad Obregón, Hermosillo, and Magdalena de Kino, spreading.

Appendix 1. Non-native plants in Sonora: 241 non-native species (6% of ca. 4,000 species, Van Devender and Felger, unpubl. data), including 37 invasive (*) species (15.5% of non-natives). Herbaria: ARIZ (University of Arizona Herbarium), ASDM (Arizona-Sonora Desert Museum), ASU (Arizona State University), BRIT (Botanical Research Institute of Texas), CAS (California academy of Sciences), GH (Gray Herbarium, Harvard University), HCIB (Centro de Investigaciones de Noroeste), IEB (Instituto de Ecología del Bahío), MEXU (Universidad Autónoma de México), MICH (University of Michigan), MO (Missouri Botanical Garden), NMC (New Mexico State University), NY (New York Botanical Garden), NYSM (New York State Museum), RM (Rocky Mountain Herbarium, University of Wyoming), RSA (Rancho Santa Ana Botanic Garden), SD (San Diego Natural History Museum), TEX (University of Texas at Austin), UC (University of California at Berkeley), UCR (University of California at Riverside), US (United States National Herbarium), USON (Universidad de Sonora), WIS (University of Wisconsin).

Acanthaceae

Justicia spicigera. Firecracker bush, niple. Ornamental shrub. Mexico to South America. Near Ónavas, *E. Joyal 2059* (CAS; Daniel 2004).

Odontonema cuspidatum. Firespike. Ornamental shrub. Mexico to Central America. Santa Bárbara, *P.D. Jenkins 91-115* (ARIZ).

Ruellia malacosperma. Softseed wild petunia. Ornamental perennial herb. Mexico. Yavaros, *A.C. Sanders 13579* (CAS).

Agavaceae

Agave fourcroides. Henequen. Cultivated rosette succulent. Mexico. Cd. Obregón, *H. S. Gentry 11361* (US).

Aizoaceae

**Mesembryanthemum crystallinum*. Ice plant, hielitos. Winter-spring annual. Africa, Eurasia. E of San Luis Río Colorado, *Reina-G. 97-512*, *Van Devender* (ARIZ, MEXU, TEX, USON).

Mesembryanthemum nodiflorum. Slenderlef ice plant, hielitos. Winter-spring annual. Africa. NE of Puerto Peñasco, *Reina-G. et al. 2002-250* (ARIZ, ASU, HCIB, MEXU, SD).

Amaranthaceae

Amaranthus albus. Prostrate pigweed, quelite. Annual. Mexico to Central America. W of Sonoyta, *Felger et al. 87-306* (ARIZ).

Anacardiaceae

Schinus molle. Brazilian peppertree, pimienta, pirul. Ornamental tree. South America. E of Agua Prieta, *Van Devender 2007-384* (ARIZ, MEXU, USON).

Spondias purpurea. Hog plum, yoyomo, ciruelo. Cultivated fruit tree. Mexico to South America. Aduana, *Felger et al. 90-651* (ARIZ).

Apiaceae

Ammi majus. Bishop's weed, encaje. Garden annual. Africa, Europe. Sierra de Álamos, *Van Devender et al. 95-265* (ARIZ, UC, USON).

Anethum graveolens. Dill, eneldo. Cultivated annual. Europe. Mayocahui, *Van Devender et al. 95-298* (ARIZ, UC).

Ciclospermum leptophyllum. Marsh parsley. Annual. South America. N of Imuris, *Reina-G. et al. 2001-658* (ARIZ, RM).

Coriandrum sativum. Coriander, cilantro. Cultivated annual. Europe. Tepoca, *Reina-G. et al.* 98-402 (CAS, USON).

Foeniculum vulgare. Sweet fennel, hinojo. Cultivated perennial herb. Africa, Eurasia. Agua Prieta, *Reina-G. et al.* 2002-302 (ARIZ, ASU, MEXU, USON).

Apocynaceae

Cascabela thevetioides (*Thevetia peruviana*). Luckynut. Ornamental shrub. Mexico to South America. E of Álamos, *Van Devender et al.* 93-160 (ARIZ, UCR).

Nerium oleander. Oleander, laurel. Ornamental shrub. Africa, Eurasia. Guadalupe Tayopa, *Van Devender et al.* 96-209 (ARIZ, MEXU, RSA).

Araceae

Colocasia esculenta. Wild taro. Ornamental perennial herb. Asia. E of Tepoca, *Reina-G.* 2001-777, *Van Devender* (ARIZ).

Arecaceae

Phoenix dactylifera. Date palm, palma datilera. Cultivated tree. Africa. Bahía de Kino, *Felger* 07-131 (ARIZ).

Washingtonia filifera. California fan palm, palma. Ornamental tree. Western United States and Canada. La Salina, *Felger et al.* 05-315 (ARIZ).

Asclepiadaceae

**Cryptostegia grandiflora*. Indian rubbervine, clavel de España. Ornamental woody vine. Madagascar. E of La Barranca, *Van Devender et al.* 96-170 (ARIZ, MEXU, RSA).

Asteraceae

Acroptilon repens. Russian knapweed. Agricultural perennial herb. Eurasia. Rancho San Bernardino, *A. Búrquez-M. s.n.* (SBV 201611, TEX).

Carthamus tinctorius. Safflower, cártamo. Cultivated annual. Asia. Sierra Libre, *Van Devender* 95-323 (ARIZ, TEX, USON).

Centaurea melitensis. Malta starthistle, tocolote. Winter-spring annual. Africa, Europe. East of Agua Prieta, *Van Devender* 2007-380 (ARIZ, NMC, USON).

Cichorium intybus. Chicory. Cultivated perennial herb. Africa, Eurasia. Northern Sonora, cited in Wiggins (1964:1655).

Chrysanthemum coronarium. Crown daisy. Garden winter-spring annual. Eurasia. La Gacela, *Van Devender et al.* 95-51 (ARIZ, USON).

Lactuca saligna. Willowleaf lettuce. Winter-spring annual. Africa, Europe. Nacozari de García, *Van Devender* 2003-526, *Reina-G.* (TEX, USON).

Lactuca serriola. Prickly lettuce. Winter-spring annual. Europe. Santa Cruz, *Van Devender et al.* 2001-678 (MEXU, TEX, USON).

Pseudognaphalium luteoalbum. Jersey cudweed. Annual. Africa, Eurasia. Yécora, *Van Devender* 2004-559, *Reina-G.* (ARIZ, ASU, MEXU, NMC, TEX).

Senecio vulgaris. Common groundsel. Urban winter-spring annual. Europe. Agua Prieta, *Reina-G. et al.* 2007-443 (ARIZ, MEXU, USON).

Silybum marianum. Milk thistle. Annual. Africa, Eurasia. San Carlos, *Felger observation* (4 Feb 2008).

Sonchus asper subsp. *asper*. Spiny sowthistle, chinita. Annual. Europe. El Papalote, Pinacate Region. *Felger* 86-100A (ARIZ).

Sonchus oleraceus. Common sowthistle, chinita. Winter-spring annual. Europe. Sierra de Mazatán, *Reina-G. et al.* 2005-210 (TEX).

Taraxacum officinale. Common dandelion, diente de león. Perennial herb. Eurasia. Yécora, *Van Devender* 95-353, *Reina-G.* (ARIZ).

Zinnia peruviana cultivar. Zinnia, india. Garden summer annual. Mexico, southwestern United States. Santa Bárbara, *Van Devender et al.* 2006-1007 (ARIZ, TEX).

Balsaminaceae

Impatiens balsamina. Garden balsam. Garden annual. Asia. Yécora, *Van Devender* 2003-1155 (USON).

Bignoniaceae

Crescentia alata. Gourd tree, ayal, tecomate. Ornamental tree. Mexico to Central America. Álamos, *R. Krizman* 9 (ARIZ).

Brassicaceae

Brassica juncea. Mustard green, mostaza. Agricultural winter-spring annual. Africa, Eurasia. Álamos, *Van Devender* 92-95 (ARIZ, UCR).

**Brassica nigra*. Black mustard, mostaza. Roadside winter-spring annual. Europe. SE of Esqueda, *Van Devender et al.* 2003-468 (ARIZ, ASU, HCIB, USON).

**Brassica rapa*. Field mustard, nabo. Agricultural winter-spring annual. Asia. Trigo Moreno Sierra El Chuchupate, *Van Devender et al.* 98-1017 (ARIZ, ASU, USON).

**Brassica tournefortii*. Sahara mustard, mostaza del Sahara. Winter-spring annual. North Africa, Europe. E of Agua Prieta, *Reina-G.* 2007-270, *Van Devender* (ARIZ, CAS, DBG, MEXU, NMC, USON).

Capsella bursa-pastoris. Shepherd's purse, bolsa del pastor. Winter-spring annual. Europe. Sierra las Avispas, SW of Nogales, *Van Devender et al.* 2005-96 (ASU, USON).

Cardamine cf. *oligosperma*. Bittercress, berro amargo. Nursery annual weed. Western United States and Canada. Álamos, *Van Devender* 2005-18 (DBG, USON).

Chorispora tenella. Purple mustard, crossflower. Agricultural winter-spring annual. Eurasia. E of Agua Prieta, *Reina-G. et al.* 2007-373 (ARIZ, ASDM, DBG, HCIB, MEXU, MO, NMC, TEX, US, USON).

**Descurainia sophia*. Common tansymustard. Winter-spring annual. Africa, Europe. Agua Prieta, *Van Devender et al.* 2005-400 (ASDM, ASU, MEXU, NMC, USON).

**Eruca vesicaria* subsp. *sativa*. Arugula, salad rocket. Roadside winter-spring annual. Europe. W of Agua Prieta, *Van Devender* 2007-460, *Reina-G.* (ARIZ, DBG).

Erysimum repandum. Spreading wallflower. Agricultural annual. Europe. SE of Agua Prieta, *Reina-G* 2007-528, *Van Devender* (ARIZ, ASDM, CAS, DBG, HCIB, MEXU, MO, NMC, TEX, US, USON).

Hirschfeldia incana. Greek mustard, mostacilla. Agricultural winter-spring annual. Europe. N of Cíbuta, *Van Devender et al.* 2004-252 (ASU, NMC, USON).

**Lepidium didymum*. Procumbent pepperwort. Urban annual. South America. Yécora, *Reina-G.* 95-459, *Van Devender* (ARIZ, USON).

Nasturtium officinale. Watercress, berro. Aquatic perennial herb. Europe. N of Imuris, *Van Devender* 2006-280, *Reina-G.* (DBG, MEXU, USON).

Raphanus raphanistrum. Wild raddish, rábano silvestre. Agricultural winter-spring annual. Eurasia. Mesa del Campanero, *Reina-G. et al.* 2001-801 (HCIB, MEXU, NMC, USON).

- Raphanus sativus*. Cultivated raddish, rábano. Agricultural winter-spring annual. Europe. Trincheras, Reina-G. et al. 2002-239 (ARIZ, USON).
- Sinapis arvensis*. Charlock mustard, mostaza. Agricultural winter-spring annual. Europe. Nacozari de García, Van Devender 2003-537, Reina-G. (ARIZ, ASU, USON).
- Sisymbrium irio*. London rocket, pamitón. Winter-spring annual. Europe. N of Hermosillo, Reina-G. et al. 96-03 (ARIZ, ASU, MEXU, RSA, USON).
- Sisymbrium orientale*. Indian hedgemustard. Winter-spring annual. Europe. Guaymas, Felger 85-417 (ARIZ).
- Thlaspi arvense*. Field pennycress. Winter-spring garden annual. Africa, Eurasia. Mesa del Campanero, Reina-G. et al. 2007-631 (DBG).
- Cactaceae
- Peniocereus serpentinus*. Snake cactus, reina de la noche. Ornamental stem succulent. Mexico. Sierra de Álamos, Van Devender et al. 94-109 (ARIZ, ASU, UCR).
- Campanulaceae
- Hippobroma longifolia*. Star of Betlehem, revienta caballo. Annual. Caribbean. Sierra de Álamos, H. S. Gentry 2276 (ARIZ), MO).
- Cannabaceae
- Cannabis sativa*. Marijuana, mota. Cultivated annual. Asia. Tepoca, Reina-G. 2005-361, Van Devender (observation, photo)
- Capparaceae
- Cleome aculeata*. Prickly spiderflower. Roadside annual. South America. S of Navojoa, O. F. Clarke 690829-13B (UCR, WIS).
- **Cleome viscosa*. Asian spiderflower, sticky beeplant. Roadside annual. Africa and Australia. N of Hermosillo, Van Devender et al. 2007-1108 (ARIZ, MEXU, USON).
- Caryophyllaceae
- Herniaria hirsuta* subsp. *cinerea*. Hairy rupturewort. Winter-spring annual. Africa, Eurasia. Sierra de la Madera, near Imuris, Van Devender 2005-786, Reina-G. (ARIZ, ASU, CAS, HCIB, MEXU, NMC, SD, USON).
- Saponaria officinalis*. Soapwort, jabón de palo. Garden perennial herb. Europe. Mesa de Campanero, Reina-G. et al. 98-975 (ARIZ, RM, USON).
- Chenopodiaceae
- Atriplex semibaccata*. Australian saltbush, chamizo. Perennial herb. Australia. Agua Prieta, Van Devender et al. 2002-616 (ARIZ, ASU, HCIB, MEXU, NMC, TEX, USON).
- Bassia hyssopifolia*. Fivehorn smotherweed, salado negro. Annual. Eurasia. Sonoyta, Felger 85-699 (ARIZ).
- Chenopodium album*. Lamb's quarters. Annual. Europe. Sierra de Mazatán, Van Devender et al. 2005-240 (MEXU, USON).
- Chenopodium murale*. Nettleleaf goosefoot, chual. Winter-spring annual. Europe. E of San Luis Río Colorado, Reina-G. 97-509, Van Devender (MEXU, TEX, USON).
- **Kochia scoparia*. Mexican fireweed, coquia. Summer annual. Asia. Agua Prieta, Van Devender et al. 2002-614 (ARIZ, ASU, HCIB, MEXU, USON).
- **Salsola tragus*. Russian thistle, chamizo volador. Annual. Eurasia. Agua Prieta, Van Devender et al. 2002-615 (ASU, USON).

Convolvulaceae

- **Convolvulus arvensis*. Common bindweed, correhuela. Agricultural perennial herb. Europe. Cananea, *Van Devender et al.* 2002-306 (USON).
- Cuscuta tinctoria*. Dodder, barba de león. Annual parasite on cultivated broadleaf pepper tree (*Schinus terebinthifolia*). Unknown. Magdalena de Kino, *Van Devender* 94-1008 (ARIZ, MEXU, USON, WLU).
- Ipomoea carnea* subsp. *fistulosa*. Bush morning glory, gloria de la mañana. Ornamental shrub. Mexico to South America. NW of Güirocoba, *Van Devender* 94-771, *D. A. Yetman* (ARIZ).
- Ipomoea xleucantha*. Morning glory, trompillo. Perennial herb. Central and southeastern United States to Mexico. Aduana, *Van Devender et al.* 92-154 (ARIZ).
- Ipomoea wrightii*. Palmleaf morning glory, trompillo. Annual vine. Mexico? Pitahaya, *Felger* 85-1264 (ARIZ).
- Merremia dissecta*. Noyau vine, trompillo blanco casero. Ornamental woody vine. Mexico to South America. Aduana, *Felger* 5074 (ARIZ).

Cucurbitaceae

- Citrullus lanatus*. Watermelon, sandía. Cultivated annual vine. Africa. Río Cuchujaqui, *Van Devender et al.* 94-468 (ARIZ, UCR).
- Cucumis anguria*. Burr cucumber, pepinito espinoso. Annual vine. Africa. E of Navojoa, *Van Devender et al.* 95-1121 (ARIZ, CAS, USON).
- Cucumis dipsaceus*. Hedgehog gourd, huevos de gato. Roadside annual vine. Africa. N of Guaymas, *Reina-G.* 2006-240, *Van Devender* (ARIZ, ASU, HCIB, MEXU, NMC, USON).
- Cucumis melo* var. *cantalupo*. Cantaloupe, melón. Cultivated annual vine. Europe. Río Yaqui near Tónichi, *Reina-G. et al.* 99-384 (ARIZ).
- Cucumis melo* var. *dudaim*. Dudaim melon, melón granada. Summer annual. Africa. Río Yaqui near Tónichi, *Reina-G. et al.* 2006-466 (ARIZ, USON).
- Cucumis sativus*. Garden cucumber, pepino. Cultivated annual. Asia. Curea, *Reina-G.* 99-474, *Van Devender* (MEXU).
- Lagenaria siceraria*. Bottle gourd, bule. Cultivated annual vine. Africa. Aduana, *Van Devender et al.* 92-1204 (ARIZ, CAS, UCR).
- Momordica charantia*. Bitter melon, melón amargo. Annual vine. Old World tropics. NW of Navojoa, *S. L. Friedman* 463-94 (ARIZ, ASU).
- Luffa aegyptiaca*. Sponge gourd, estropajo. Cultivated annual vine. Africa, Asia. Navojoa, *Van Devender* 95-1130, *Reina-G.* (CAS, USON).

Cyperaceae

- Cyperus involucratus*. Umbrella papyrus, papiro. Perennial herb. Madagascar. Río Cuchujaqui, *Van Devender et al.* 84-180 (ARIZ).
- Cyperus difformis*. Variable flatsedge. Annual. Old World tropics. Arroyo El Mentidero, Sierra de Álamos, *Van Devender et al.* 93-1307 (ARIZ, NYSM).
- Cyperus iria*. Ricefield flatsedge. Annual. Africa, Australasia. Sabinito Sur, ESE of Álamos, *A. C. Sanders* 9353 (ARIZ, UCR).
- Cyperus rotundus*. Nutsedge, coquillo. Perennial herb. Africa, Eurasia. Teachive, near Masiaca, *Van Devender et al.* 93-892 (ARIZ, ASU, NYSM, USON).

Euphorbiaceae

- Euphorbia hypericifolia*. Spurge, golondrina. Urban annual. Pantropical. Álamos, *P. D. Jenkins 93-100* (ARIZ).
- Euphorbia pepus*. Spurge, golondrina. Urban annual. Eurasia. Imuris, *Reina-G. 2005-605, Van Devender* (ARIZ, HCIB, IEB, MEXU, USON).
- Euphorbia velleriflora*. Spurge, golondrina. Roadside perennial herb. Mexico to Central America. E of Agua Prieta, *Van Devender 2007-513, Reina-G.* (ARIZ, CAS, HCIB, IEB, MEXU, MICH, MO, TEX, USON).
- **Ricinus communis*. Castor bean, higuera. Perennial herb. Africa, Eurasia. N of Álamos, *Van Devender et al. 93-1050* (USON).

Fabaceae

- Arachis hypogaea*. Peanut, cacahuete. Cultivated annual. South America. Río Sonora, near Ures, *Van Devender et al. 95-520* (ARIZ, NY, UCR, USON).
- Caesalpinia gilliesii*. Yellow bird-of paradise, tabachín amarillo. Ornamental shrub. South America. Naco, *Reina-G. et al. 2002-283* (USON).
- Gleditsia triacanthos*. Honeylocust. Ornamental tree. Central United States. N of Santa Cruz, *Reina-G. et al. 2002-703* (ARIZ, ASU, HCIB, MEXU, NMC, TEX, USON).
- Gliricidia sepium*. Quickstick, mata ratón, madre de cacao. Ornamental tree. Mexico to Central America. E of Álamos, *Van Devender et al. 93-159* (ARIZ, UCR).
- **Leucaena leucocephala*. White leadtree, guaje. Roadside tree. Mexico. S of El Oasis, *Reina-G. 98-502, Van Devender* (CAS, MEXU, NY, USON).
- Medicago lupulina*. Black medick, trébol de flor amarilla. Winter-spring annual. Africa, Eurasia. Santa Cruz, *Van Devender et al. 2001-679* (ARIZ).
- Medicago polymorpha*. Burclover, trébol. Urban winter-spring annual. Eurasia. SE of Esqueda, *Van Devender 2003-472* (ARIZ, HCIB, USON).
- Medicago sativa*. Alfalfa. Cultivated annual forage. Eurasia. E of Agua Prieta, *Van Devender 2007-497, Reina-G.* (ARIZ, MEXU, NMC, USON).
- Melilotus albus*. White sweetclover, trébol. Winter-spring annual. Europe. Hermosillo, *Reina-G. 2005-854, Van Devender* (MEXU, USON).
- Melilotus indica*. Sourclover, trébol amargo. Winter-spring annual. North Africa, Eurasia. SW of Nogales, *Reina-G. et al. 2005-720* (ARIZ, USON).
- Melilotus officinalis*. Yellow sweetclover, trébol. Roadside winter-spring annual. Eurasia. Agua Prieta, *Reina-G. 2007-488, Van Devender* (ARIZ, ASDM, ASU, CAS, HCIB, MEXU, MO, NMC, TEX, US, USON).
- **Parkinsonia aculeata*. Mexican paloverde, guacaporó. Tree. Caribbean, South America. Teachive, SE Navojoa, *Van Devender et al. 93-960* (USON).
- Pediomelum rhombifolium*. Gulf Indian breadroot. Cultivated perennial herb. Southwestern United States to Mexico. Río Cuchujaqui, Tónichi, *Van Devender 2005-278, Reina-G.* (ASU, CAS, NMC, TEX, USON).
- Phaseolus vulgaris*. Common bean, frijol. Cultivated annual. Mexico to Central America. E of Navojoa, *Van Devender et al. 95-1114* (ARIZ, USON).
- Prosopis* aff. *chilensis*. Chilean mesquite, mezquite chileno. Ornamental tree. South America. Hermosillo, *Reina G. 2003-2, Van Devender* (ARIZ).

Fumaricaceae

Fumaria officinalis. Common fumitory. Garden annual. Eurasia. Magdalena de Kino, Reina-G. 98-169, Van Devender (ARIZ, CAS, MEXU, TEX, USON).

Fumaria parviflora. Fineleaf fumitory. Garden annual. Europe. Magdalena de Kino, Reina-G. 2003-188, Van Devender (ARIZ, MEXU, TEX, USON).

Geraniaceae

Erodium cicutarium. Filaree, alfilerillo. Winter-spring annual. Europe. Sierra San Luis, E of Agua Prieta, Reina-G. 2007-301, Van Devender (ARIZ, CAS, MEXU).

Halogoraceae

Myriophyllum spicatum. Eurasian watermilfoil, pluma de perico. Aquatic perennial herb. North Africa, Eurasia. Yécora, Van Devender et al. 99-179 (ARIZ, NY, USON).

Lamiaceae

Lamium amplexicaule. Henbit deadnettle. Winter-spring annual. North Africa, Eurasia. Cíbuta, S of Nogales, Van Devender 2003-113 (ARIZ, ASU, MEXU, USON).

Leonotis nepetaefolia. Lion's ear, cordoncillo de San Francisco. Summer annual. Pantropical. Río Cuchujaqui, SE of Álamos, Van Devender et al. 92-1182 (ARIZ, UCR).

Marrubium vulgare. Horehound, marrubio. Perennial herb in cattle areas. North Africa, Eurasia. Agua Prieta, Van Devender et al. 2003-358 (ASU, HCIB, USON).

Mentha spicata. Spearmint, hierbabuena. Cultivated perennial herb. Eurasia. Yécora, Van Devender et al. 98-637 (USON).

Ocimum basilicum. Common basil, albahacar. Cultivated perennial herb. Africa. Guaymas, Van Devender et al. 2008-12 (ARIZ, MEXU, USON).

Physostegia virginiana. Obedient plant. Garden perennial herb. United States. Santa Ana de Yécora, W. Trauba 438-98 (ARIZ, USON).

Vitex rotundifolia. Chaste tree, carnavalito. Ornamental hedge shrub. Asia, Australia. Teachive, SSE of Navojoa, Van Devender 2007-35, Reina-G. (ARIZ, HCIB, MEXU, NMC, TEX, USON).

Liliaceae

Aloe vera. Aloe, sábila. Cultivated rosette succulent. North Africa. S of Álamos, Van Devender 92-652, S.L. Friedman (ARIZ).

Asparagus officinalis. Asparagus, aspárrago. Cultivated perennial herb. North Africa, Eurasia. Colonia Oaxaca, S. S. White 752 (ARIZ).

Asphodelus fistulosus. Onionweed. Garden perennial herb. Eurasia. NE of Cucurpe, Reina-G. et al. 2002-325 (ARIZ, USON).

Hemerocallis fulva. Orange daylily. Garden perennial herb. Europe. Querobabi, Reina-G. 2001-907, Van Devender (USON).

Loganiaceae

Gelsemium sempervirens. Evening trumpetflower. Ornamental woody vine. Southeastern United States to Central America. Santa Ana de Yécora, Van Devender et al. 2001-121 (ARIZ, MEXU, USON).

Malvaceae

Abutilon theophrasti. Velvetleaf. Annual garden weed. Asia. W of Yécora, Van Devender 99-499, Reina-G. (ARIZ, TEX).

- Gossypium hirsutum*. Upland cotton, algodón. Cultivated annual. Central America. S of Hermosillo, *Van Devender et al. 2007-1118* (ARIZ, MEXU, NMC, RSA, USON).
- Malva parviflora*. Cheeseweed mallow, malva. Winter-spring annual. Eurasia. Rancho Viejo near Mazatán, *Reina-G. 2005-165, Van Devender* (USON).
- Meliaceae
- Melia azederach*. Chinaberry tree, lila, piocha. Ornamental tree. Asia. Arroyo, San Nicolás, *Reina-G. 97-480, Van Devender* (ARIZ, MEXU, RSA, TEX).
- Molluginaceae
- Mollugo cerviana*. Carpetweed. Annual. Old World. Rancho San Antonio, Guaymas, *Felger 01-597* (ARIZ).
- Moraceae
- Ficus carica*. Fig, higuera. Cultivated tree. Asia. Santa Ana de Yécora, *Van Devender et al. 98-1424* (ARIZ).
- Morus alba*. Common mulberry, mora. Ornamental tree. Asia. Imuris, *Van Devender 2006-288, Reina-G.* (MEXU, NMC, USON).
- Myrtaceae
- Eucalyptus camaldulensis*. River redgum, eucalipto. Ornamental tree. Australia. Mina La Trinidad, W of Yécora, *Van Devender 2004-544, Reina-G.* (USON).
- Myrtaceae
- Psidium guajava*. Guava, guayaba. Cultivated tree. Southern Mexico to Central America. El Guayabo, ESE of Álamos, *Van Devender et al. 92-234* (ARIZ).
- Nyctaginaceae
- Mirabilis jalapa*. Four o'clock, maravilla. Ornamental perennial herb. South America. El Kípor, E of Maycoba, *Van Devender 98-1777, Reina-G.* (ARIZ).
- Onagraceae
- Oenothera speciosa*. Pink primrose. Garden perennial herb. Southeastern United States to Mexico. Yécora, *Van Devender et al. 98-755* (ARIZ).
- Papaveraceae
- **Glaucium corniculatum*. Blackspot hornpoppy. Winter-spring annual. Eurasia. Agua Prieta, *Van Devender et al. 2004-334* (ASDM, ASU, USON).
- Papaver somniferum*. Opium poppy, amapola. Cultivated annual. Europe. Arroyo El Mentidero, *Van Devender observation* (1993).
- Pedaliaceae
- Sesamum orientale*. Sesame, ajonjolí. Cultivated annual. Asia. N of Magdalena de Kino, *Van Devender et al. 97-1437* (ARIZ, CAS, MEXU, RSA, USON).
- Pinaceae
- Pinus sylvestris*. Scots pine, pino rojo. Cultivated timber tree. Eurasia. Cañón de Evans, Sierra de los Ajos, *Felger et al. 92-798* (ARIZ).
- Plantaginaceae
- Plantago major*. Common plantain, llantén. Perennial herb. Eurasia. Trigo Moreno Sierra El Chuchupate, *Reina-G. et al. 99-189* (HCIB).
- Poaceae
- **Arundo donax*. Giant reed, carrizo. Shrub. Asia. Río Cuchujaqui SE of Álamos, *Van Devender 92-496* (ARIZ).
- **Avena fatua*. Wild oat, avena silvestre. Winter-spring annual. Eurasia. N of Imuris, *Reina-G. 2005-609, Van Devender* (HCIB, USON).

- Avena sativa*. Oats, avena. Agricultural winter-spring annual. Europe. SW of Nogales, Reina-G. et al. 2005-692 (ARIZ).
- Bothriochloa ischaemum*. King Ranch bluestem, Texas yellow beardgrass. Perennial forage grass. Eurasia. E of Agua Prieta, Van Devender 2007-725, Reina-G. (ARIZ, NMC, USON).
- Bothriochloa pertusa*. Pitted beardgrass. Perennial grass. Africa, Asia. Curea, Van Devender 2005-385, Reina-G. (ARIZ, MEXU, USON).
- Bromus catharticus* var. *catharticus*. Rescue grass. Annual. South America. W of Yécora, Van Devender 2001-446, Reina-G. (HCIB, MEXU, TEX).
- **Bromus rubens*. Red brome, bromo rojo. Winter-spring annual. Africa, Eurasia. Arroyo Guadalupe, E of Agua Prieta, Reina-G. et al. 2007-337 (ARIZ, HCIB, MEXU, NMC, USON).
- Bromus tectorum*. Cheatgrass. Winter-spring annual. Africa, Eurasia. El Papalote, Felger 86-133 (ARIZ).
- Cenchrus brownii*. Slimbristle sandbur, guachapori. Summer annual. Mexico to South America. Río Cuchujaqui, Van Devender et al. 92-970 (ARIZ).
- Chloris barbata*. Swollen fingergrass, zacate borrego. Annual. Australia. Hermosillo, Reina G. et al. 2004-512 (ARIZ, ASU, HCIB, MEXU, USON).
- Chloris verticillata*. Tumble windmill grass. Perennial grass. Central United States. N of Santa Cruz, Van Devender et al. 2001-687 (ARIZ, HCIB, MEXU, NMC, TEX, USON).
- **Cynodon dactylon* var. *dactylon*. Bermudagrass, zacate inglés. Perennial lawn grass. Asia. S of Benjamín Hill, Van Devender 2007-687, Reina-G. (ARIZ, NMC, USON).
- Dactyloctenium aegyptium*. Crowfootgrass. Annual. Old World tropics. Rancho El Carrizo, S of Benjamín Hill, Van Devender 2007-913, Reina-G. (ARIZ, MEXU, NMC, US, USON).
- **Dichanthium annulatum*. Kleberg bluestem, zacate carretero. Perennial forage grass. Africa, Asia. W of Querobabi, Van Devender 2001-734, (ARIZ, USON).
- Dichanthium aristatum*. Angleton bluestem. Perennial grass. Asia. Río Cuchujaqui, SE of Álamos, Van Devender 92-612 (ARIZ).
- Digitaria bicornis*. Asian crabgrass. Perennial grass. Asia, Australia. Rancho El Carrizo, S of Benjamín Hill, Van Devender 2007-897, Reina-G. (ARIZ, NMC, US, USON).
- Digitaria ischaemum*. Smooth crabgrass. Annual. Eurasia. Trigo Moreno, Sierra Chuchupate, Van Devender et al. 98-1031 (ARIZ).
- Digitaria sanguinalis*. Hairy crabgrass. Annual. Eurasia. Sierra las Avispas, SW of Nogales, Van Devender et al. 2002-768 (ARIZ, USON).
- Digitaria ternata*. Blackseed crabgrass. Annual. Africa, Asia. NNE of Yécora, Van Devender et al. 95-835 (ARIZ, USON).
- Echinochloa colonum*. Jungle ricegrass. Annual riparian grass. Old World tropics. San Nicolás, Reina-G. 97-504, Van Devender (ARIZ, MEXU).
- Echinochloa crusgalli* var. *crusgalli*. Barnyard grass. Annual riparian grass. Asia. NNW of Yécora, Van Devender et al. 95-812 (ARIZ, USON).
- Echinochloa crus-pavonis*. Gulf cockspur grass. Annual riparian grass. Africa, Eurasia. Near Cd. Obregón. R. Alcaráz-Flores s.n. (ARIZ).

- Eleusine indica* subsp. *indica*. Indian goosegrass. Annual. Old World tropics. Agua Amarilla, NNW Tepoca, *Van Devender et al.* (ARIZ, USON).
- Eragrostis amabilis*. Bug's eye grass. Annual. Africa, Asia. Álamos, *Van Devender et al.* 2005-658 (ARIZ, ASU, MEXU, NMC, USON).
- Eragrostis barrelieri*. Mediterranean lovegrass. Annual. Eurasia. SW of Agua Prieta, *Reina-G. et al.* 2003-978 (ARIZ, USON).
- Eragrostis cilianensis* var. *cilianensis*. Stinkgrass. Annual. Africa, Eurasia. Río Yaqui, near Tónichi, *Reina-G. et al.* 98-543 (MEXU, NY, SD).
- Eragrostis ciliaris*. Gophertail grass. Annual. Africa, Asia. Río Cuchujaqui, SSE Álamos, *Van Devender et al.* 92-611 (ARIZ).
- Eragrostis curvula*. Weeping lovegrass. Perennial forage grass. Africa. S of Nogales, *Reina-G.* 2000-246A, *Van Devender* (USON).
- Eragrostis echinochloidea*. African lovegrass. Roadside perennial grass. Africa. Magdalena de Kino, *Van Devender* 2001-626, *Reina-G.* (ARIZ, CAS, HCIB, MEXU, USON).
- **Eragrostis lehmanniana*. Lehmann lovegrass, zacate africano. Perennial forage grass. Africa. S of Nogales, *Reina-G.* 2000-246, *Van Devender* (HCIB, USON).
- Eragrostis superba*. Wilman lovegrass. Perennial forage grass. Africa. Rancho Los Fresnos, W of Santa Cruz, G. Valencia-O. s.n. (*Reina-G.* 2005-1663, ARIZ).
- Hordeum aegiceras*. Beardless common barley, cebada. Roadside winter-spring annual. Asia. E of Agua Prieta, *Van Devender* 2007-493, *Reina-G.* (ARIZ, MEXU, USON).
- Hordeum marinum* subsp. *gussoneanum*. Mediterranean barley. Agricultural winter-spring annual. Africa, Eurasia. Quitovac, *G. P. Nabhan* 266, *M. A. Burgess* 64 (ARIZ).
- Hordeum murinum* subsp. *glaucum*. Foxtail barley, cebada. Winter-spring annual. Africa, Eurasia. Agua Prieta, *Van Devender et al.* 2005-399 (ARIZ, ASU, HCIB, NMC, USON).
- Hordeum murinum* subsp. *leporinum*. Mouse barley, cebada. Winter-spring annual. Africa, Europe. Yécora, *Van Devender et al.* 98-754 (ASU, NY, SD, TEX, USON).
- Hordeum vulgare*. Common barley, cebada. Winter-spring annual. Africa, Asia. Hermosillo, *A. A. Beetle* M-9151 (ARIZ).
- Lolium perenne*. Perennial ryegrass. Urban perennial grass. Africa, Eurasia. Cananea, *Van Devender et al.* 2002-303 (ARIZ, HCIB, MEXU, USON).
- Lolium temulentum*. Darnel ryegrass. Urban annual. Europe. *E. Palmer* 946 in 1899 (US).
- **Melinis repens* subsp. *repens*. Natalgrass, zacate rosado. Perennial forage grass. Africa, Asia. Sierra Las Avispas, SW of Nogales, *Reina-G. et al.* 2004-184 (ARIZ, ASU, MEXU, USON).
- Hackelochloa granularis*. Pitscale grass. Annual in natural habitats. Africa, Australasia. Sierra Las Avispas, SW of Nogales, *Van Devender et al.* 2002-730 (ARIZ, ASU, CAS, HCIB, MEXU, NMC, USON).
- Megathyrsus (Panicum) maximus*. Guineagrass. Perennial forage grass. Africa, Asia. Near Cananea, *R. Alcaráz-Flores* s.n. (ARIZ).

- Panicum antidotale*. Blue panicgrass, zacate panizo azul. Perennial forage grass. Asia.S. of Agua Prieta, *Van Devender 2007-556, Reina-G.* (ARIZ, HCIB, MEXU, MO, NMC, USON, TEX).
- Panicum coloratum*. Kleingrass, zacate klein. Perennial forage grass. Africa. E of Agua Prieta, *Van Devender 2007-726, Reina-G.* (ARIZ, MEXU, NMC, US).
- Panicum miliaceum*. Broomcorn millet. Annual. Asia. Quitovac, *Felger, G. P. Nabhan 10 July 1982* (ARIZ).
- Paspalum dilatatum*. Dallisgrass. Perennial grass. South America. Arroyo Toro Muerto, S of Arizpe, *Van Devender et al 2005-1042* (ARIZ, BRIT, USON).
- **Pennisetum ciliare*. Buffelgrass, zacate buffel. Perennial forage grass. Africa, Eurasia. Sierra de Mazatán, *Reina et al. 2004-1277* (ARIZ, USON).
- Pennisetum setaceum*. Fountaingrass, plumitas. Ornamental perennial grass. Africa, Asia. Magdalena de Kino, *Reina-G. et al. 2004-976* (ARIZ, MEXU, USON).
- Phalaris canariensis*. Canarygrass. Winter-spring annual. Africa. W of Imuris, *Van Devender 2005-601, Reina-G.* (ARIZ).
- Phalaris minor*. Littleseed canarygrass. Winter-spring annual. Africa, Eurasia. Sierra de Mazatán, *Van Devender et al. 2004-474* (ARIZ, ASU, HCIB, NMC, USON).
- Phalaris paradoxa*. Hood canarygrass. Winter-spring annual. Africa, Eurasia. Mayocahui, *Van Devender et al. 95-287* (ARIZ, USON).
- Poa annua*. Annual bluegrass. Urban winter-spring annual. Europe. Yécora, *Van Devender 2004-549, Reina-G.* (HCIB, USON).
- **Polypogon monspeliensis*. Rabbitfoot grass, zacate cola de zorra. Riparian annual. Africa, Eurasia. Sierra Azul, SW of Cananea, *Van Devender 2005-899, Reina-G.* (ARIZ, USON).
- Polypogon viridis*. Beardless rabbitfoot grass. Riparian perennial grass. Africa, Eurasia. Arroyo Guadalupe, E of Agua Prieta, *Van Devender 2007-539, Reina-G.* (ARIZ, USON).
- Schedonorus (Festuca) arundinacea*. Tall fescue. Urban perennial grass. Africa, Eurasia. Agua Prieta, *Van Devender 2007-557, Reina-G.* (ARIZ, MEXU, NMC, TEX).
- **Schismus arabicus*. Arabian grass. Winter-spring annual. Africa, Eurasia. Arroyo San Bernardino, E of Agua Prieta, *Van Devender et al. 2007-377* (ARIZ, NMC, USON).
- **Schismus barbatus*. Mediterranean grass. Winter-spring annual. Africa, Eurasia. E of Cabullona, *Reina-G. 2007-405, Van Devender* (ARIZ, NMC).
- Setaria adhaerens*. Bur bristlegrass. Urban annual. Pantropical. Santa Cruz, *Van Devender et al. 2001-674* (USON).
- Setaria pumila*. Yellow bristlegrass. Annual. Old World tropics. W of Yécora, *Reina-G. 2000-788, Van Devender* (ARIZ, ASU, HCIB, MEXU, USON).
- Setaria setosa*. West Indian bristlegrass. Perennial herb. South America. N of Imuris, *Van Devender 2006-275, Reina-G.* (ARIZ).
- Sorghum bicolor*. Sweet sorghum, sorgo. Cultivated annual forage grass. Africa. SSE of Cananea, *Van Devender 2000-672, Reina-G.* (ARIZ, USON).
- **Sorghum halepense*. Johnsongrass, zacate Johnson. Perennial herb. Africa, Asia. Cruz del Diablo, E of Huásabas, *Reina-G. 2005-995, Van Devender* (ARIZ, ASU).
- Sorghum x alnum*. Columbus grass, zacate maravilla. Perennial forage grass. South America. Tepoca, *Van Devender et al. 2007-1059* (ARIZ).

- Stenotaphrum secundatum*. St. Augustine grass. Ornamental perennial grass. Africa, South America. Álamos, *Van Devender 91-843* (ARIZ).
- Tragus berteronianus*. Spiked burgrass. Annual. Africa, Asia. Cananea, *R. Bernal s.n., R. Cuadra* (ARIZ).
- Triticum aestivum*. Common wheat, trigo. Cultivated winter-spring annual. Old World. NE of Imuris, *Reina-G. 2005-610A, Van Devender* (ARIZ).
- Urochloa reptans*. Running grass. Riparian annual. Asia. San Carlos, *Felger 84-197* (ARIZ).
- Zea mays* subsp. *mays*. Corn, maiz. Cultivated annual. Mexico. ESE Yécora, *Van Devender et al. 98-1569* (ARIZ).
- Zea mays* subsp. *mexicana*. Teosinte. Annual agricultural weed. Mexico. Maycoba, *C. W. Pennington observation in 1970*.

Polygonaceae

- Polygonum argyrocoleon*. Silversheath knotweed. Riparian annual. Eurasia. Mayocahui, *Van Devender et al. 95-293* (UCR, USON).
- Polygonum aviculare*. Prostrate knotweed. Riparian perennial herb. Worldwide. Cucurpe, *Van Devender 2003-161, Reina-G.* (HCIB, USON).
- Polygonum persicaria*. Spotted ladysthumb. Riparian perennial herb. Eurasia. Yécora, *Van Devender 98-2001, Reina-G.* (UCR, USON).
- Rumex crispus*. Curly dock. Riparian perennial herb. Africa, Eurasia. Trigo Moreno, Sierra Chuchupate, *Reina-G. et al. 99-194* (ARIZ).
- Rumex obtusifolius*. Bitter dock. Riparian perennial herb. Africa, Eurasia. El Kípor, E of Maycoba, *Reina-G. et al. 97-861* (ARIZ).
- Rumex stenophyllus*. Narrowleaf dock. Riparian perennial herb. Eurasia. Navojoa, *H. S. Gentry 7974* (ARIZ, cited in Martin et al. 1998).

Pontederiaceae

- **Eichhornia azurea*. Anchored water hyacinth. Ornamental aquatic perennial herb. Mexico to South America. Navojoa, *Van Devender et al. 93-1153* (ARIZ, ASU, UC, UCR).
- **Eichhornia crassipes*. Common water hyacinth, patito. Ornamental aquatic perennial herb. South America. Navojoa, *Van Devender 94-208, J. F. Wiens* (ARIZ).

Portulacaceae

- Portulaca oleracea*. Common purslane, verdolaga. Annual. Worldwide. Teachive, SSE of Navojoa, *Van Devender et al. 93-890A* (USON).

Primulaceae

- Anagallis arvensis*. Scarlet pimpernel. Riparian annual. Eurasia. Río Cuchujaqui, SSE of Álamos, *Van Devender 92-627* (ARIZ, UCR).
- Anagallis minima*. Chaffweed. Riparian annual. Europe. Sierra de Álamos, *A. C. Sanders 13431* (UCR).

Pteridaceae

- Pteris cretica*. Cretan brake. Perennial fern in natural habitats. Africa, Eurasia. Trigo Moreno, Sierra Chuchupate, *Van Devender et al. 98-1051* (MO, NMC, NY, USON).

Ranunculaceae

- Consolida ajacis*. Rocket larkspur. Garden annual. Eurasia. Near Bacoachi, *Van Devender 2001-570, Reina-G.* (ARIZ, MEXU, USON).

Rhamnaceae

Ziziphus jujuba. Chinese jujube, dátíl chino. Cultivated tree. Asia. E of Arroyo San Bernardino, E of Agua Prieta, *Van Devender et al. 2003-1004* (ARIZ, HCIB, NMC, USON).

Rosaceae

Prunus persica. Peach, durazno. Cultivated tree. Asia. W of Yécora, W. Trauba s.n. (ARIZ).

Pyrus communis. Common pear, pera. Cultivated tree. Eurasia. Colonia Oaxaca, *S. S. White 753* (GH, cited in White 1948).

Rutaceae

Casimiroa edulis. White sapote, zapote blanco. Cultivated tree. Mexico to South America. Río Cuchujaqui, SSE of Álamos, *Van Devender 93-47* (ARIZ, ASU, UCR).

Salviniaceae

**Salvinia molesta*. Giant salvinia, helecho flotador gigante. Aquatic perennial herb. South America. San Luis Río Colorado, *A. Novelo-R. 7 Oct 2004* (MEXU).

Scrophulariaceae

Verbascum virgatum. Wand mullein, barbasco. Urban perennial herb. Africa, Europe. Agua Prieta, *Van Devender et al. 2002-300* (ARIZ, USON).

Veronica anagallis-aquatica. Water speedwell. Riparian perennial herb. Africa, Europe. Río Altar in Tubutama, *Van Devender et al. 2002-336* (ARIZ, ASU, HCIB, MEXU, USON).

Veronica persica. Birdeye speedwell. Annual garden weed. Asia. W of Yécora, *Van Devender 2001-448, Reina-G.* (ARIZ, CAS, MEXU, USON).

Simaroubaceae

Ailanthus altissima. Tree-of-heaven, nogal falso. Ornamental tree. Asia. N of Santa Cruz, *Reina-G.2001-547, Van Devender* (ARIZ, MEXU, USON)

Solanaceae

Nicandra physalodes. Apple of Peru, Annual. South America. Agua Blanca, N of Yécora, *Van Devender et al. 98-1676* (TEX).

**Nicotiana glauca* var. *glauca*. Tree tobacco, Juan loco, don Juan, álamo loco. Shrub. South America. NW of Álamos, *Van Devender et al. 93-351* (ARIZ, ASU, UCR).

Nicotiana tabacum Mountain Pima selection. Tobacco, papante, macuchi. Cultivated medicinal annual. South America. El Kípor, E of Maycoba, *Van Devender 98-1771, Reina-G.* (ARIZ, SD).

Petunia axillaris. Large white petunia, petunia. Garden annual. South America. Mazocahui, *Reina-G. 2000-717, Van Devender* (ARIZ).

Solanum lycopersicum. Tomato, tomate. Cultivated annual. Mexico to South America. Río Cuchujaqui, SSE of Álamos, *Van Devender 94-185* (ARIZ).

Solanum pseudocapsicum. Jerusalem cherry, naranjito de amor. Ornamental shrub. Mexico to South America, but Old World cultivar escaping. Mesa de Campanero, *Reina-G. et al. 96-246* (ARIZ, MEXU, RSA).

Solanum seafortianum. Brazilian nightshade, bellísima. Ornamental woody vine. Central and South America. Río Cuchujaqui, SSE of Álamos, *Van Devender et al. 92-1142* (ARIZ, CAS, MO, SD, TEX, UCR).

**Solanum sisymbriifolium*. Sticky nightshade. Perennial herb. South America. NNE of San Pedro de la Cueva, *Reina-G. et al. 2004-464* (ARIZ, ASU, HCIB, MEXU, MO, TEX, USON).

Tamaricaceae

**Tamarix aphylla*. Athel, pino salado. Ornamental tree. Africa, Asia. W of Empalme, *Reina-G. et al. 2002-1054* (ARIZ, ASU, USON).

Tamarix ramosissima. Saltcedar, pino salado. Riparian tree. Asia. E of San Luis Río Colorado, *Reina-G. 97-522, Van Devender* (ASU, MEXU, TEX, USON).

Tropaeolaceae

Tropaeolum majus. Nasturtium, mastuerzo. Garden annual. South America. W of Yécora, *Van Devender et al. 96-500* (ARIZ, MEXU, RSA).

Ulmaceae

Ulmus pumila. Siberian elm, olmo. Ornamental tree. Asia. Animas Valley, E of Agua Prieta, *Van Devender 2007-294, Reina-G.* (ARIZ, ASDM, USON).

Verbenaceae

Glandularia pulchella. South American mock vervain, alfombrilla. Garden perennial herb. South America. Yécora, *Van Devender 97-500, Reina-G.* (USON).

Lantana camara - Mozelle cultivar. Lantana, confituría negra, negrito. Ornamental shrub. Mexico to South America. W of Yécora, *Reina-G. et al. 2007-1027* (ARIZ, MEXU, USON).

Zygophyllaceae

Tribulus cistoides. Jamaican feverplant, burrnut, toboso. Perennial herb. Africa, Australasia. Rancho El Seri, S of Benjamín Hill, *Reina-G. 2007-964, Van Devender* (ARIZ, CAS, HCIB, MEXU, MO, NMC, RSA, TEX, US, USON).

Tribulus terrestris. Puncture vine, toboso. Summer annual. Old World tropics. Álamos, *Van Devender 95-1152, Reina-G.* (ARIZ, ASU, USON).



Figure 1. Castor bean (*Ricinus communis*) was possibly brought into Sonora by the Jesuit missionaries in the 1600s. It has expanded its range dramatically since 1940. Photo by T. R. Van Devender.



Figure 2. Indian rubbervine/clavel de España (*Cryptostegia grandiflora*) is a large vine with large showy white flowers that was introduced as an ornamental or possibly to harvest latex for rubber. It is a serious invasive in tropical riparian areas in southern Sonora, especially near Álamos and La Barranca. Photo by T. R. Van Devender.

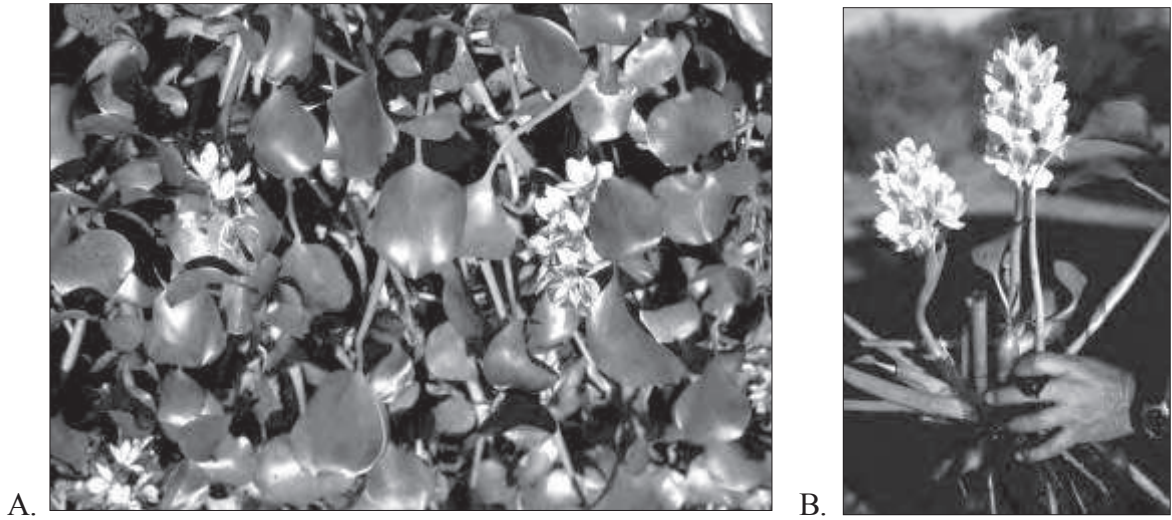


Figure 3. Water hyacinths, introduced as ornamentals with lavender flowers, are invasive aquatic plants in southern Sonora. A. Common water hyacinth, patito (*Eichhornia crassipes*). B. Anchored water hyacinth (*Eichhornia azurea*). Photos by T. R. Van Devender.



Figure 4. Some of the most serious invasive species in Sonora are African grasses introduced for livestock forage. Although Wilman lovegrass (*Eragrostis superba*) was planted experimentally near Tucson, Arizona over 60 years ago, it was first recorded in northern Sonora in 2005. Photo by T. R. Van Devender.



Figure 5. The Asian marijuana/mota (*Cannabis sativa*), a casual escape from modern illicit crops, can be found in many out of the way places in Sonora. Photo by T. R. Van Devender.