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RESEARCH ARTICLE

Conserving seeds of useful wild plants in Mexico: main issues and recommendations

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Abstract The efficient storage and germination of seeds underpin the effective use of plants for livelihoods and sustainable development. A total of 204 wild species useful for local communities of the Tehuacán–Cuicatlán Valley were collected and stored in seed banks in country for long term conservation, and 66 % (i.e., 134) duplicated in the U.K., as an effective means of ex situ conservation. Of the 204 species, 147 (122 of which also duplicated in the U.K.) were previously listed as useful plants in the ethnofloristic inventory of the Valley. Based on literature surveys, we found that one of the major impediments to the use of stored seeds of wild species is the lack of knowledge of how to germinate the seed. In detailed studies, we found that seeds of 18 useful plant species from 10 different families germinated readily and could be propagated. In contrast, four species (*Actinocheita filicina, Bursera submoniliformis, Karwinskia mollis* and *Lippia graveolens*) produced dormant seeds and therefore further studies are needed before their use can be maximised in large scale propagation programmes in support of conservation and livelihoods. Overall, this large-scale study on useful wild plant species in Mexico confirms that conventional seed banking can effectively support sustainable development and livelihood programmes.

Keywords Drylands · Seed banking · Seed dormancy · Seed germination · Sustainable development

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Introduction

Current global plant diversity extinction is estimated to be as much as 100- to 1000-fold higher than during the recent geological past (Pimm et al. 1995). In situ conservation measures, such as the protection and restoration of natural habitats, are the best methods of preserving plant diversity (CBD 2002). However, ex situ conservation acts as a back-up for certain segments of diversity that might otherwise be lost in nature and in human-dominated ecosystems, generally through the maintenance of clonal crops in field gene banks and in vitro banks, certain trees in conservation stands, and many seed-bearing species in botanic gardens and/or in conventional or cryogenic seed banks (Li and Pritchard 2009). One of the most effective ways to conserve ex situ plant diversity is through germplasm storage in seed banks, which

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allows the preservation of large amounts of genetic material in a small space and with minimum risk of genetic damage (Iriondo and Pérez 1999), at least for species with orthodox (i.e. desiccation tolerant) seeds. Such seeds tolerate drying to very low moisture contents (≤3–7 % fresh weight), and their longevity increases as moisture content and temperature are reduced (Roberts 1973). In situ and ex situ conservation approaches should be viewed as complementary rather than alternative. However, there are economic drivers working against in situ conservation, with the costs for ex situ conservation being estimated as little as 1 % of those needed for in situ, although ex situ conservation must still address some technical challenges (Li and Pritchard 2009).

Seed collecting represents a first critical step of the seed banking process, which should be adressed carefully in order to achieve high quality seed collections, capture the highest genetic diversity of the targeted populations and, at the same time, not pauperize their in situ genetic resources. In particular, seed collections may be affected by high percentages of empty or damaged (by insects or pathogens) seeds (Way 2003).

Once collected, one of the major impediments to the potential use of wild species germplasm for species reintroduction or habitat restoration is the lack of knowledge of how to break seed dormancy and enhance germination (Hay and Probert 2013). Intact viable seeds may fail to complete germination even under favourable conditions and this phenomenon is called "seed dormancy". The primary function of seed dormancy is to prevent germination during periods that are unsuitable for germination and establishment or, more precisely, when conditions are suitable for germination, but the probability of survival and growth of the seedlings is low (Fenner and Thompson 2005). Dormancy is likely to be lost during storage, and the conditions required for germination (in particular, temperature) become less specific (Probert 2000), although the rate of dormancy loss is likely to be slower in seed bank storage than it would be in room conditions (Roberts 1988). During seed bank storage, induction of dormancy can also occur (e.g. Pérez-García et al. 2007) and in the Millennium Seed Bank (MSB) of the Royal Botanic Gardens, Kew (RBG Kew) there have been instances where stored accessions have failed a germination retest carried out using the same treatments and/or conditions that were found to be optimum at the start of the storage (Hay and Probert 2013).

These issues are of particular relevance when working with wild species, whose seed dormancy breaking and germination conditions are unknown or poorly investigated and for which ex situ conservation is intended as a support to their propagation and reintroduction. Useful wild species are still poorly represented in gene banks' collections (Padulosi et al. 2002) whilst ex situ conservation of crop diversity, as a global concern, has received historic support in the development of an efficient and sustainable system recognized in international law and policy, as recently confirmed by the safety duplication collection in the Svalbard Global Seed Vault (Westengen et al. 2013). However, a more recently study concluded that the diversity of crop wild relatives is also poorly represented in gene banks, with over 70 % of taxa identified as high priority for further collecting (Castañeda-Álvarez et al. 2016).

The cultural area known as Mesoamerica (between central Mexico and northern Costa Rica) is recognized as one of the most important centres of cultural diversity and biological richness of the world (Hernández-Xolocotzi 1993; Rzedowski 1993; Toledo et al. 1997). Humans and plants have interacted here for nearly 12,000 years (MacNeish 1992) and such a long and systematic interaction has led to the construction of rich knowledge regarding the use of a wide range of plants. It has been estimated that nearly 5000–7000 species are used in Mexico (Casas et al. 1994). Nearly 90 % of these useful plants are native wild species gathered traditionally (Caballero et al. 1998), whereas nearly 20 plant species (such as corn, beans, cocoa, chili peppers, cotton, and squashes) are important economic crops on a global scale whose extraordinary diversity of landraces and populations of wild relatives constitute highly relevant genetic resources (Lira et al. 2009a).

The Tehuacán–Cuicatlán Valley (Puebla, Central Mexico) is probably the most diverse arid region of North America (Dávila et al. 2002) and it is now an important natural protected area. The relationship between humans and plants in the area is as important today as it has been historically and these interactions, from prehistory to the present day, have been well documented (Casas et al. 2001). Lira et al. (2009a) recorded a total of 1,605 useful vascular plant species (61.2 % of the total species richness of the regional

vascular flora) for this Valley, which shows the highest absolute richness of useful plants in Mexico.

Since February 2002, the RBG Kew and the Facultad de Estudios Superiores, Iztacala (Fes-I) of the National University of Mexico (UNAM) have been working together for the seed conservation of wild endemic, narrowly distributed, rare and threatened plant species or wild relatives of economically important species from the arid and semiarid areas of Mexico (León-Lobos et al. 2012). This collaboration was established under an Access and Benefit Sharing Agreement (ABSA) in the framework of the MSB Project (lately MSB Partnership). The ex situ conservation and study of useful plants of the arid and semiarid areas of Mexico has been carried out since 2007 through "The Project MGU—the Useful Plant Project" (UPP) under the umbrella of the MSBP. The UPP, managed by RBG Kew, uses an applied scientific approach to conserve and sustainibly use indigenous plants which are important to local rural communities in Mexico, Botswana, Mali, Kenya and South Africa. The project has brought together staff from RBG Kew, and a wide range of national scientific institutions, to help local communities tackle the environmental challenges threatening their livelihoods through the conservation and sustainable use of indigenous plant species (Ulian et al. 2016). The UPP in Mexico has been led by Fes-I UNAM, based in Mexico City, and has worked in the Coxcatlán municipality (Puebla) in the Tehuacán–Cuicatlán Valley. Seeds were collected and stored at the Fes-I Seed Bank and duplicated at the RBG Kew's MSB in the U.K. Propagation activities were carried out at the Fes-I UNAM and replicated in the local communtity, in the framework of the project.

Therefore, the aim of this paper was to evaluate the contribution of seed banking and germination studies on the conservation of useful wild plants as a support to sustainable development and livelihood programmes.

Materials and methods

Study area

The study area was limited to the Coxcatlán municipality in the Tehuacán–Cuicatlán Valley and in particular to the villages of San Rafael, San José Tilapa and Guadalupe Victoria, in the state of Puebla (Central Mexico). This area, which covers ca. 6 km^2, is located at ca. 1200 m a.s.l., and the local climate is semi-arid to arid. The mean annual temperature is 22 °C, varying between 25 °C in April and May, and 18 °C in January. Rainfall is concentrated in the summer, from June until September and the total annual precipitation is 394.6 mm (Medina 2000). The main communities originated from the state of Oaxaca and southern Puebla. Their understanding of the local natural resources grew through the adoption of knowledge from neighbouring villages and the discovery of new uses of the local species (Rosas 2003). The most important economic activity in the region is the production of sugarcane, beans, squashes and maize, which is complemented by the gathering of wild plants and insects (e.g. "cocopaches", *Thasus* sp., Coreidae) for direct consumption or commercialization (Pardo 2001).

Seed banking

The ethnofloristic inventory carried out by Lira et al. (2009a) for the whole Tehuacán–Cuicatlán Valley was used as a reference of useful plants present in the study area. This inventory originally counted 1605 useful plants belonging to 671 genera and 147 families (Lira et al. 2009a). For the purpose of this study, only vascular plants were considered and the list was nomenclaturaly checked and updated according to The Plant List (2013). In addition, the desiccation tolerance of the seeds of these species were evaluated using the Seed Information Database, SID (Royal Botanic Gardens Kew 2014) so that species with (or likely to have) intermediate or desiccation sensitive seeds were discarded. This led to a total of 1,162 useful vascular plants, belonging to 578 genera and 111 families, with a putative orthodox seed storage behaviour (see Appendix 1).

From 2007 to date, seed collection expeditions have been carried out in the study area as an activity of the UPP (Ulian et al. 2016). Ethnobotanical, biological, and ecological information on useful plants was documented by consultations with local communities and through literature reviews (e.g. Lira et al. 2009a). Plants with a putative orthodox seed storage behaviour (see Appendix 1) were then prioritized for seed collecting, although opportunistic collections were also made on other useful native wild species

identified in the study area. The choice of the optimal timing for seed collection, as well as harvesting methods and quantity of material to be collected, were regulated by legal (ABSA), ethical and scientific criteria that guarantee a high quality of the collected material (Way 2003) and avoided the pauperization of the in situ genetic resources (Menges et al. 2004).

The collected seeds have been stored in the Fes-I UNAM Seed Bank. Seeds of species for which a seed desiccation sensitive behaviour is reported, or could be inferred, were not collected, while collected seed lots have been banked following the procedures for orthodox seeds (Terry et al. 2003). Once in the bank, after the samples had been registered, seeds were stored in the lab (23 °C and R.H. 28 %) and cleaned manually and mechanically by a gravimetric separator (Mod. CB-1, Agriculex Inc.). Priority for the cleaning was given to fresh fruits for which seeds are separated from the pulp under running tap water and then left to dry. To achieve seed moisture content values between 3.5 and 6.5 % (Linington 2003) viable seeds were then placed in the dry room (T 14 °C and R.H. 11 %) for 4–6 weeks and then stored at −20 °C in aluminium bags. Duplicates of seed lots (when enough seeds were available) were sent after drying to the MSB (U.K.) for backup storage and testing.

In country germination experiments

Seed lots were tested for germination at Fes-I UNAM Seed Bank using an incubator (ICP-18 d-c/iv Lumistell®) set at the constant temperature of 30 °C and a photoperiod of 12 h of irradiance per day (with 10 white neon lights corresponding to 5100 lux). The incubation temperature is coherent with the requirement of high germination temperatures for species of hot deserts and semi-deserts, which range, according to their life forms, from ca. 20 to ca. 27 °C for annuals and vines, respectively (Baskin and Baskin 2014). This pattern was recently confirmed by Ordõnez-Salanueva et al. (2015), who identifed an optimum temperature for germination rate of ca. 30 °C for seeds of two *Polaskia* species collected in the study area (Puebla, Tehuacán–Cuicatlán Valley). Light requirement for seed germination is reported to be related to seed mass, with seeds smaller than 1.5 mg likely to require light for germination (Jankowska-Blaszczuk and Daws 2007). Seed mass of the collected species ranged from ca. 0.05 mg to ca. 1.2 g for *Nicotiana glauca* and *Proboscidea louisianica,* respectively (Royal Botanic Gardens Kew 2014), with 25 % of the collected species having a seed mass ≤1.5 mg (data not shown).

Cleaned seeds were sown on the top of one sheet of filter paper, in 60- or 90-mm-diameter glass Petri dishes (3 replicates of 20 seeds each), according to seed size. Seeds were sown without any pre-treatment except for those of Leguminosae which were chipped before sowing to break physical dormancy and allow water imbibition. Germination was defined as visible radicle emergence to ≥1 mm and germinated seeds were scored three times a week. Germination tests lasted 20 days and then at the end of the test, a cut-test was carried out to determine the viability of the remaining seeds. Soft, mouldy seeds were considered to be non-viable.

Seed testing at RBG Kew's MSB

Seed lots duplicated at the RBG Kew's MSB were tested after cleaning for seed lot quality and germination and viability. In order to estimate seed lot quality, empty or insect-infested seeds present in a subsample (approximately 50 seeds) of the whole seed lot were evaluated using a MX20 Faxitron X-ray unit, with a <20 µm focal spot and 5× geometric magnification (Faxitron Bioptics, LLC, Tucson, Arizona).

Seed germination was assessed about 1 month after storage at −20 °C. The number of seeds in each treatment sample was usually 20 or 50 seeds, according to seed availability. For very small collections, as few as 10 seeds were used although seed lots with less than 500 good quality seeds were left untested. Seeds were sown on 1 % water agar in plastic Petri dishes and then placed at an appropriate temperature in an illuminated incubator (8 h fluorescent light/16 h dark). Germination (usually to ≥1 mm protrusion of radicle) was recorded weekly and the germinated seeds removed and discarded. When no germination occurred during 2 weeks following 4 weeks of testing, the test was terminated and the remaining seeds evaluated by a cut-test to ascertain whether they were full, empty or mouldy. Soft, mouldy seeds were considered to be non-viable. The particular germination conditions to break seed dormancy for the investigated species (gibberellic acid in the substrate, scarification or stratification treatments) were chosen according to data accumulated previously at the RBG Kew and by information from literature (Terry et al. 2003).

Data analysis

The representativeness of each family in the inventory of useful plant families of the Tehuacán–Cuicatlán Valley (Appendix 1) was calculated as the percentage of useful species in the family against the total number of species in the inventory. The representativeness of each useful plant family against the total useful species stored at the Fes-I Seed Bank was calculated in the same way.

According to Godefroid et al. (2010), the dormancy status was determined using the following equation (Offord et al. 2004):

$$\text{Dormancy Index (DI)} = 1-(\text{seed germinated } \%/\text{viable seeds } \%).$$

The percentage of germinated seeds was calculated on the basis of tested viable seeds. For the purpose of this study this index does not include physical dormancy as seeds of species for which this was assumed (i.e. Leguminosae) were scarified before sowing for germination. The higher the value of the index the more likely that the seed lot was dormant, and DI $\geq$0.4 was used as threshold value to indicate dormancy (Offord et al. 2004).

Simple linear regressions were fitted to identify correlations among the most important families of the Tehuacán–Cuicatlán Valley and those stored at the Fes-I UNAM Seed Bank and between the DI values achieved for each species at both the RBG Kew's MSB and Fes-I UNAM. Statistical analysis were carried out using R v. 2.14.1 (R Development Core Team 2011).

Uses of species were compiled from Lira et al. (2009a) and complemented by field observations through during the UPP. The standardization of plant uses followed the first level of uses in the "Economic Botany data collection standards" (Cook 1995) revised together with the author of the standardization through the work of the UPP.

Results

Seed conservation

The families of the Tehuacán–Cuicatlán Valley which had most useful plants with orthodox seeds, were Poaceae, Leguminosae, Compositae, Cactaceae, Cyperaceae, Solanaceae, Euphorbiaceae, Malvaceae, Asparagaceae and Crassulaceae. Figure 1A reports their proportions, expressed as a percentage of the species in each family relative to the total number of species of the inventory of useful plants (Lira et al. 2009a, modified; Appendix 1). During the UPP, a total of 204 useful plant species, from 142 genera and 48 families, were collected and stored at the Fes-I UNAM Seed Bank. Of these, 147 (belonging to 104 genera and 36 families) are included in the inventory of useful plants (Appendix 1). Therefore ca. 12 % of the useful plants of the whole Tehuacán–Cuicatlán Valley is currently stored for long term conservation at the Fes-I UNAM Seed Bank. Furthermore, 134 taxa from 101 genera and 40 families are also duplicated at the RBG Kew's MSB and 122 of them (belonging to 91 genera and 36 families), included in the inventory of useful plants (Appendix 1).

The representativeness of the most important families of the Tehuacán–Cuicatlán Valley in the Fes-I Seed Bank, calculated as percentage of species in respect to the total of useful species stored at the seed bank, is reported in Fig. 1b. Representativeness of the useful plant families on the inventory and that of those stored at the Fes-I UNAM Seed Bank had the same trend ($R^2 = 0.25$; $p = 0.0008$; $y = 0.44x + 1.49$; n = 41), except for the Poaceae and Cyperaceae which are underrepresented and the Cactaceae which are overrepresented (Fig. 1B). A linear regression carried out without Poaceae and Cyperaceae confirmed this correlation ($R^2 = 0.89$; $p < 0.0001$; n = 39), with a x coefficient close to 1 (a = 1.25; Fig. 1B).

Uses

All the main categories of uses were represented by the species stored at the Fes-I Seed Bank. The most represented are species with environmental uses (22.3 %), followed by species used as medicines (18.7 %), fodder (animal food, 16.2 %) food (15.7 %) and materials (Fig. 2A). In Fig. 2B the records of uses are grouped for each of the 10 most important useful plants families (see Fig. 1A).

Leguminosae is the family with the highest number of records of uses (62), followed by Cactaceae (42),

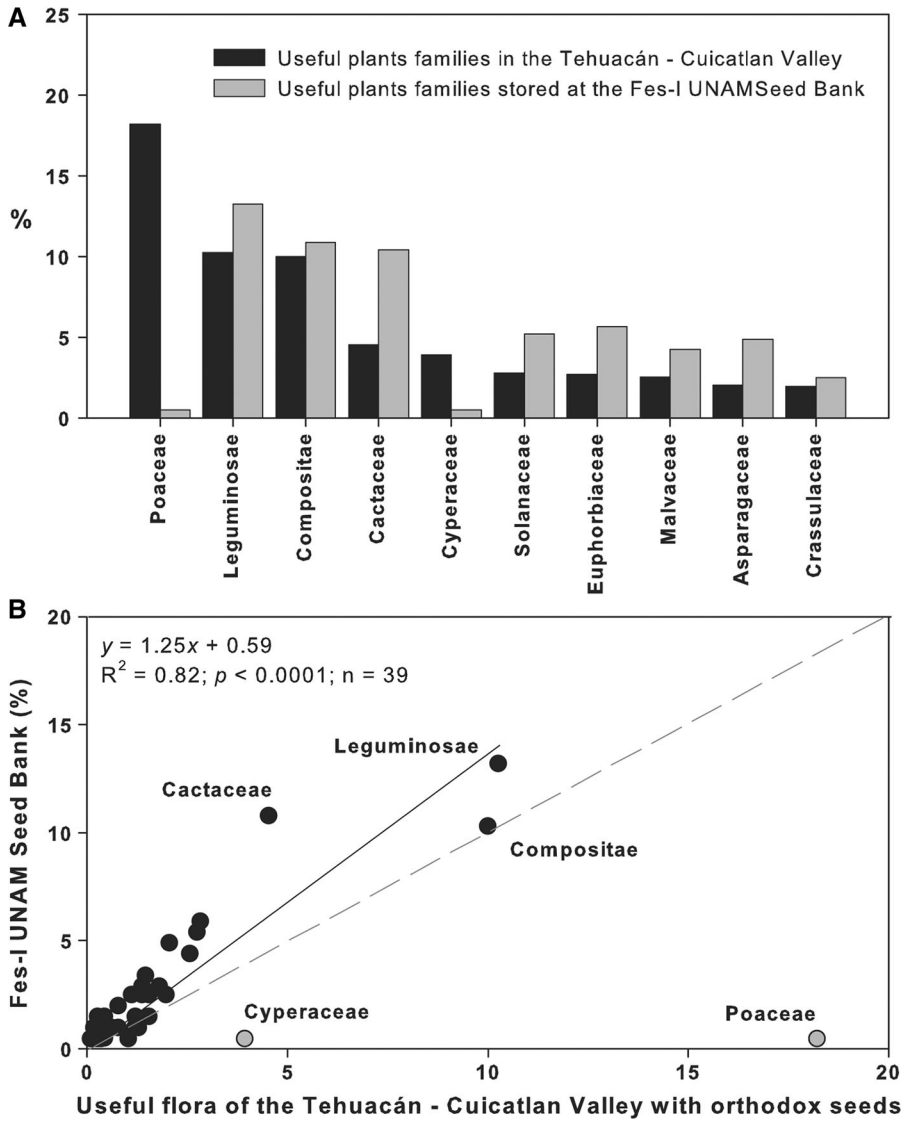

Fig. 1 **A** The 10 most important families of the Tehuacán–Cuicatlan Valley according to their representation in the bankable useful flora (i.e. species with orthodox seeds) of the Tehuacán–Cuicatlán Valley (see Appendix 1) and their representativeness in the Fes-I UNAM Seed Bank collections. Data are expressed as percentages of the total number of useful species in the inventory and of that of useful species stored at the Fes-I UNAM. **B** Correlation between representativeness of the most important families according to their richness in useful plants (Appendix 1: Lira et al. 2009a, modified) and that of families stored at the Fes-I UNAM Seed Bank. Data are expressed as percentages of the total number of useful species in the inventory (Lira et al. 2009a, modified) and of that of useful species stored at the Fes-I UNAM Seed Bank. Linear regression was calculated without considering the values of Cyperaceae and Poaceae (grey circles); n = 39. The five most important useful plant families have been labelled (see Fig. 1) and the 1:1 line has also been plotted in the graph

Compositae (39) and Asparagaceae (29; Fig. 2B). Cactaceae is the family with the highest number of species used as food, Leguminosae and Compositae have the most species used as medicines and Asparagaceae has most used as materials (Fig. 2B).

Seed lot quality

The X ray analysis was carried out on seed lots of 72 species duplicated at the RBG Kew's MSB. Only 11 *taxa* (which correspond to the 15 % of the analysed

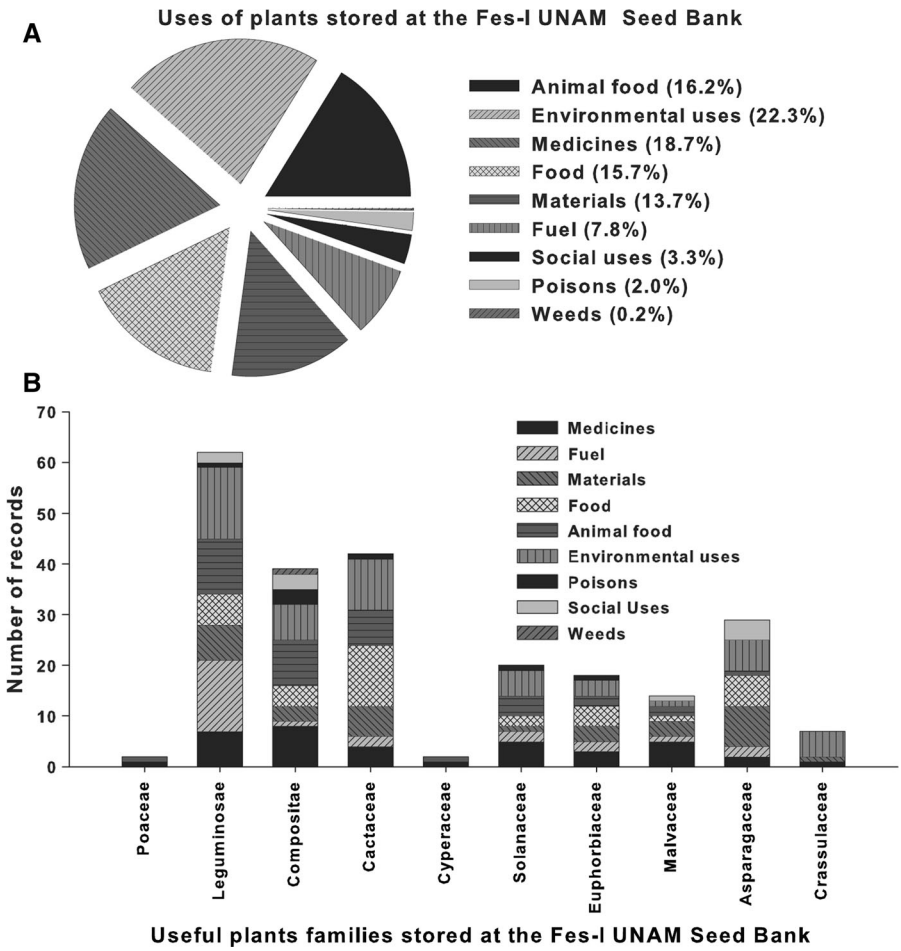

Fig. 2 Uses of the plants stored at the Fes-I UNAM Seed Bank. **A** Uses grouped according to the first level of Economic Botany data collection standards (Cook 1995, modified) as percentages of records in relation to the total. **B** Records of uses for each of the most important useful plant families of the Tehuacán–Cuicatlan Valley

taxa) had a percentage of filled seeds ≤50 % (Table 1). About 70 % of the stored species had very few empty and infested seeds with > 80 % of filled seeds.

Seed dormancy breaking and germination requirements

Seed germination experiments were carried out on seed lots of 77 species at the Fes-I UNAM Seed Bank. The results highlighted a poor seed viability for only 3 species, *Heliocarpus terebinthinaceus* (Malvaceae), *Jatropha neopauciflora* (Euphorbiaceae) and *Actinocheita filicina* (Anacardiaceae) showing values <50 % (Fig. 3). The majority of the seed lots (75 %) showed viability values higher than 90 % (Fig. 3). About 51 % of the investigated species showed Dormancy Index values lower than 0.4 (i.e. non dormant) with 27 % being completely non dormant (DI = 0; Appendix 2). On the contrary, seeds of five species were completely dormant (DI = 1): *Coursetia caribaea* (Leguminosae), *Passiflora foetida* (Passifloraceae), *Cardiospermum halicacabum* (Sapindaceae), *Melochia tomentosa* (Malvaceae) and *Bursera aptera* (Burseraceae).

Seed germination experiments were carried out on 51 species at the MSB. Results and conditions applied are listed in Appendix 2. Nine *taxa* (corresponding to 18 %) were dormant (DI > 0.4; Table 2), while the remaining 82 % of the tested species had seed lots with DI values lower than 0.4 and therefore could be considered as non dormant, with 51 % (26 species) being completely non dormant (DI = 0; Appendix 2). Differences on DI values for the same species were due to the different applied germination conditions (see Appendix 2).

Seed germination experiments were carried out both at the RBG Kew's MSB and at the Fes-I UNAM Seed Bank for 35 *taxa*. The linear regression did not

Table 1 Useful species for which a percentage of filled seeds ≤50 % was detected by X-ray analysis at the RBG Kew's Millennium Seed Bank (MSB)

Family	Taxa	Filled seeds (%)
Amaranthaceae	*Gomphrena serrata* L.	14
Compositae	*Gymnolaena oaxacana* (Greenm.) Rydb.	20
Anacardiaceae	*Amphipterygium adstringens* (Schltdl.) Standl.	27
Burseraceae	*Bursera submoniliformis* Engl.	30
Bignoniaceae	*Tecoma stans* (L.) Juss. ex Kunth	30
Leguminosae	*Prosopis laevigata* (Willd.) M.C. Johnst.	40
Malvaceae	*Heliocarpus terebinthinaceus* (DC.) Hochr.	40
Burseraceae	*Bursera morelensis* Ramirez	45
Leguminosae	*Acacia compacta* Rose	50
Burseraceae	*Bursera fagaroides* (Kunth) Engl.	50
Verbenaceae	*Lantana camara* L.	50

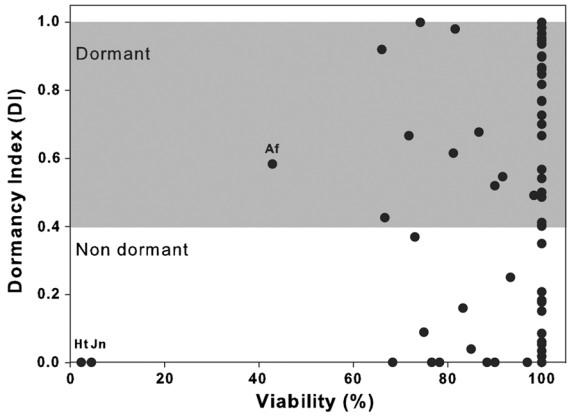

Fig. 3 Coplot indicating the common occurrence of seed viability and seed dormancy index (DI) for the 77 useful plants tested for seed germination at the Fes-I UNAM Seed Bank. The *grey area* highlights seed lots with DI >0.4 which are considered to be dormant (Offord et al. 2004). Ht: *Heliocarpus terebinthinaceus*, Jn: *Jatropha neopauciflora*, and Af: *Actinocheita filicina*

highlight any statistically significant correlation ($p = 0.97$; n = 35) between the DI values achieved for each species, mainly due to the different applied germination conditions (see Appendix 2). The *taxa* for which the dormant status (i.e., DI > 0.4) detected at the RBG Kew's MSB was confirmed by the results achieved at the Fes-I UNAM are highlighted in bold in Table 2. The 16 *taxa* for which the non dormant satus (i.e., DI < 0.4) detected at the RBG Kew's MSB was confirmed by the results achieved at the Fes-I UNAM are listed in Table 3.

Discussion

Conventional seed banking of useful plant species

Although the activities of the UPP focused in an area which corresponds to less than 1 % of the whole Tehuacán–Cuicatlan Valley, ca. 12 % of the whole flora of bankable useful plants (i.e. desiccation tolerant species; see Appendix 1) have been collected and stored at the Fes-I UNAM Seed Bank. This excludes the Fagaceae, one of the most important useful plant families in the Valley (Lira et al. 2009a), including the genus *Quercus* in particular whose species have been reported to have recalcitrant seeds (Hong et al. 1998; Xia et al. 2012) and for which alternative measures, such as cryopreservation of the embryonic axes, should be applied in order to guarantee their long term conservation (Gonzalez-Benito and Perez-Ruiz 1992). These results are of particular importance when the poor representation of underutilised species, including crop wild relatives, in ex situ gene banks' collections globally (Padulosi et al. 2002; Castañeda-Álvarez et al. 2016) is considered in conjunction with the potential loss of effectiveness of protected areas (i.e. in situ conservation) in preserving underutilised species under future climate change conditions (Lira et al. 2009b).

The most useful plant families with desiccation tolerant seeds are well represented in terms of number of useful species stored at the Fes-I UNAM Seed Bank, except for Poaceae and Cyperaceae. These two families are among the most demanded plants that are used as fodder (Lira et al. 2009a). However, their

Table 2 Useful species for which seed dormancy issues were detected at the RBG Kew's Millennium Seed Bank (MSB) (DI > 0.4; Offord et al. 2004)

Family	Taxon	MSB (DI)	Fes-I (DI)
Burseraceae	***Bursera submoniliformis* Engl.**	**0.80**	**0.84**
Bignoniaceae	*Tecoma stans* (L.) Juss. ex Kunth	0.62	0.0
Verbenaceae	***Lippia graveolens* Kunth**	**0.6**	**0.49**
Euphorbiaceae	*Jatropha neopauciflora* Pax	0.57	0.0
Malvaceae	*Ceiba aesculifolia* (Kunth) Britten et Baker f. subsp. *parvifolia* (Rose) P.E. Gibbs et Semir	0.55	0.37
Rhamnaceae	***Karwinskia mollis* Schltdl.**	**0.55**	**0.68**
Rhamnaceae	*Ziziphus pedunculata* (Brandegee) Standl.	0.55	ND
Anacardiaceae	***Actinocheita filicina* (DC.) F.A. Barkley**	**0.5**	**0.58**
Bignoniaceae	*Astianthus viminalis* (Kunth) Baill.	0.45	ND

When available, the DI values obtained for the same species at the Fes-I UNAM Seed Bank are also reported. The taxa for which the dormant status detected at the RBG Kew's MSB was confirmed by the experiments carried out at the Fes-I UNAM Seed Bank are shown in bold text. Differences on DI values for the same species were due to the different applied germination conditions

difficult taxonomic identification in the field as well as the unpredictability of their seed dispersal time, which in annual species living in semiarid environments is strongly related to rainfall patterns, affected the planning and implementation of seed collection for these species. The selection of target species for seed collections was also influenced by the preference of local rural communities for human food and multi-purpose species, such as the Cactaceae (Lira et al. 2009a), which are over-represented among the collections of the Fes-I Seed Bank. This positive bias on representativity may therefore be determined by a sort of "flag species" effect, in order to answer the needs of the communities involved in the UPP which aimed to support the improvement of their wellbeing (Ulian et al. 2016). It should also be highlighted that for conservation value, only 83 *taxa* of Cyperales (Cyperaceae plus Graminae/Poaceae) are listed in the IUCN Global Red List, with only one of them (*Carex austromexicana* Reznicek) reported as critically endangered (CR), whilst these figures increase to 596 *taxa* (32 CR) for the Cactaceae (IUCN 2015).

It should also be considered that these figures refer to the UPP only, whereas a broader seed collecting and conservation programme focusing on plant conservation in the drylands has been active since 2002 in the same region through the MSB Partnership (see León-Lobos et al. 2012).

Seed longevity under conventional seed banking conditions

High viability was detected for the stored seed lots, reaching an average of 92 %, with the majority of them (75 %) showing values higher than 90 %. These data confirm the high quality of the banked seed lots and their potentiality for use in plant propagation activities. Godefroid et al. (2010), in a study on seed germination and capacity and viability of threatened wild species stored at the National Botanic Garden of Belgium Seed Bank, found that seed viability of the 250 tested species reached on average 79 %. However, while viability tests of this study were carried out at the beginning of the storage (after one month; Terry et al. 2003), the results of Godefroid et al. (2010) refers to seed lots stored up to 26 years. As reported by the same authors, some species may have declined in seed viability during storage because they are short lived. This has been experimentally confirmed by Probert et al. (2009), who showed that longevity is related to seed structure and the climate of the area from where they were collected. Species with endospermic seeds appear to be typically short lived, and seeds from species originating in cool, wet environments are likely to have shorter lifespans than those from warm, dry environments (Probert et al. 2009). Therefore, further studies with controlled ageing tests (Newton et al. 2014) should be carried out, considering that all

Table 3 *Taxa* for which the non dormant status detected at the Millennium Seed Bank (MSB) (DI < 0.4; Offord et al. 2004) was confirmed by the experiments carried out at the Fes-I UNAM Seed Bank

Family	Taxon	MSB (DI)	Fes-I (DI)	Use
Amaranthaceae	*Chenopodium murale* L.	0.3	0.2	Environmental use
Anacardiaceae	***Amphipterygium adstringens* (Schltdl.) Standl.**[a]	**0.3**	**0.0**	**Medicines, Materials**
Apocynaceae	*Matelea trachyantha* (Greenm.) W.D. Stevens	0.0	0.1	Food, Environmental use
Asparagaceae	***Agave macroacantha* Zucc.**	**0.4**	**0.2**	**Food, Environmental use**
Bromeliaceae	*Hechtia podantha* Mez.	0.0	0.0	Environmental use
Cactaceae	***Escontria chiotilla* (A.A. Weber ex K. Schum.) Rose**	**0.1**	**0.0**	**Food, Animal food, Materials, Fuels, Environmental use**
Convolvulaceae	*Ipomoea pauciflora* M. Martens et Galeotti	0.0	0.0	Environmental use
Euphorbiaceae	*Manihot pauciflora* Brandegee	0.1	0.4	Materials
Fouquieriaceae	*Fouquieria formosa* Kunth	0.0	0.1	Environmental use
Leguminosae	*Acacia cochliacantha* Willd.	0.0	0.0	Social uses
Leguminosae	*Acacia farnesiana* (L.) Willd.	0.0	0.0	Fuels, Animal food, Medicines, Poisons
Leguminosae	*Caesalpinia melanadenia* (Rose) Standl.	0.3	0.0	Animal food, Medicines, Materials, Fuels
Leguminosae	*Coursetia glandulosa* A. Gray	0.0	0.1	Fuels, Animal food
Leguminosae	*Indigofera conzattii* Rose	0.0	0.0	Environmental use
Leguminosae	*Mimosa luisana* Brandegee	0.0	0.0	Fuels, Animal food, Environmental use
Leguminosae	***Parkinsonia praecox* (Ruiz et Pav.) Hawkins**	**0.0**	**0.0**	**Food, Environmental use**
Leguminosae	***Prosopis laevigata* (Willd.) M.C. Johnst.**[a]	**0.0**	**0.0**	**Animal food, Medicines, Materials**
Leguminosae	*Senna wislizeni* (A. Gray) H.S. Irwin et Barneby	0.0	0.0	Food

Differences on DI values for the same species were due to the different applied germination conditions. Their uses according to the first level of "Economic Botany data collection standards" (Cook 1995, modified) are also reported. Species for which plant propagation activities were already carried out on the framwork of the UPP are in bold text

[a] Species for which a poor seed quality was detected (see Table 1)

the bankable most useful plant families of the Valley, except Leguminosae, are constituted by species with endospermic seeds (Fig. 4).

Difficult seed collections

Alternative conservation measures should be considered for species producing few filled seeds (see those identified in this study in Table 1), because seed collection efforts made in the field did not produce a seed lot representative of the genetic diversity of the original population (Fig. 4). This was the case for *Gomprena serrata* (Amaranthaceae) and *Gymnolaena oaxacana* (Compositae), whose percentage of filled seeds was less than 20 %. Compositae have been listed among the families producing high percentages of empty seeds (ENSCONET 2009) and for Mexican species of this family, as well as for species of other families, this phenomenon can be related to and emphasized by the lack of water availability during seed development. When seed quality is very poor, complementary ex situ conservation measures, such as in vitro propagation, should be applied (Pence 2013).

For the other species with low seed quality identified in this study (see Table 1), conventional seed banking can still be suggested (Fig. 4), although seed collections in the field should be carried out with extra care (Way 2003). In particular, production of parthenocarpic empty fruits has been reported for *Bursera morelensis* (Ramos-Ordoñez et al. 2008), one of the most useful species of the Valley (i.e. used for fodder, firewood, wood and construction material, living fences, resins/latex, soil control, colorant; Lira et al. 2009a) and other *Bursera* species (Ramos-Ordoñez et al. 2012). Seeded and parthenocarpic fruits can be separated in the field at maturity by the

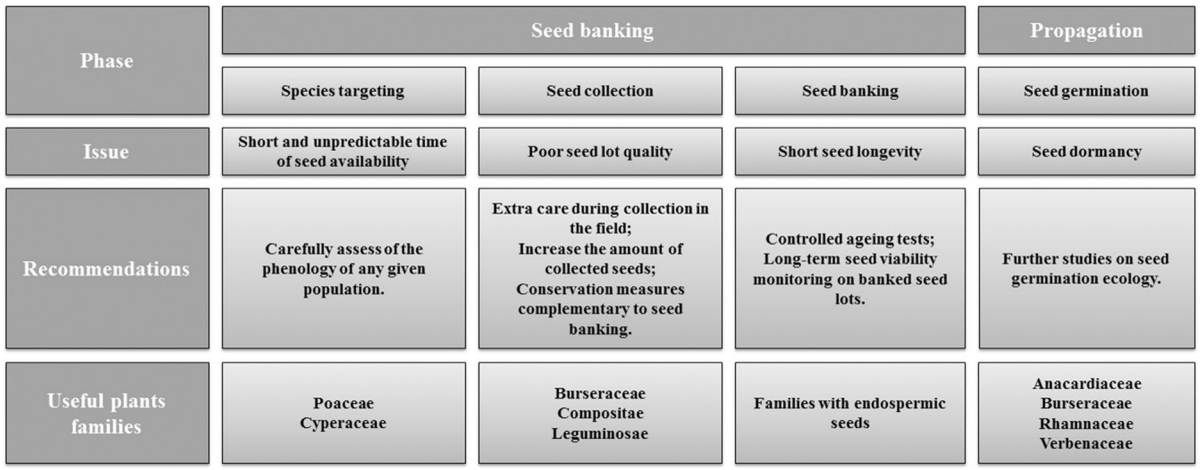

Fig. 4 Key issues identified for the main phases of seed conservation and propagation of useful plants in Mexico. For each issues, recommendations and families affected are also summarized

presence of dehiscence, which is complete in seeded and partial in the parthenocarpic ones (Ramos-Ordoñez et al. 2008). Damaged seeds in a seedlot can occur due to attack by insects or microbial pathogens at different stages in the seed life-cycle (Way 2003). Leguminosae, in particular *Acacia* and *Mimosa* species, are among the *taxa* for which damage level exceeded the 50 % of banked accessions (Way 2003) as assessed in this study for *A. compacta* and *Prosopis laevigata*. It is very difficult to distinguish in the field between viable and infested seeds on Leguminosae and the loss of viable seeds should be compensated by extra seed collecting (Way 2003).

The germination and subsequent cut tests carried out on the stored seed lots identified three species with low seed viability (<50 %), although seeds appeared filled by X-ray analysis. These species were *Actinocheita filicina* (Anacardiaceae), *Jatropha neopauciflora* (Euphorbiaceae) and *Heliocarpus terebinthinaceaus* (Malvaceae). All these species can be found in narrow populations with few individuals and therefore, the low seed viability detected could be related to inbreeding (Ågren 1996; Fischer and Matthies 1998) or pollination related problems (Fischer and Matthies 1998; Jacquemyn et al. 2002), although this should be confirmed by further studies. In addition, seeds of *J. neopauciflora* were collected before the right time of maturation because ripe seeds are available in the field only for a short period, due to their slow development and those of *H. terebinthinaceaus* are affected by high percentages of predation by insects on the plant.

Seed dormancy as an issue for plant propagation

The different seed processing and germination protocols used in the two institutions in some cases led to different germination results, highlighting the importance of published information on seed germination of wild native species (Godefroid et al. 2010; Hay and Probert 2013; Baskin and Baskin 2014). It should also be taken into account that due to facility constraints at the Fes-I UNAM Seed Bank, only one germination condition could be tested. In this study it was possible to confirm the presence of seed dormancy for four species (see Table 2): *Actinocheita filicina* (Anacardiaceae), *Bursera submoniliformis* (Burseraceae), *Karwinskia mollis* (Rhamnaceae) and *Lippia graveolens* (Verbenaceae), with limited information on seed germination being available in the literature for seed germination of these species (Fig. 4).

Fruits of *Bursera* sp. are dispersed through endozoochory which means that the seeds are protected against physical and chemical damage by hard layers (Ramos-Ordoñez et al. 2012). This woody endocarp could lead to physical (PY) or physiological (PD) seed dormancy depending on its permeability to water, whether it allows seed imbibition or not (Ramos-Ordoñez et al. 2012). Seeds of many Burseraceae are reported to have PD or to be non dormant (Baskin and Baskin 2014). Limited information is available in the literature on seed germination requirements of *Lippia* species (but see Galíndez et al. 2016)and most of the study took a common garden approach, with seeds

sown in the soil and incubated in nursery conditions (e.g., Mata-González and Meléndez-González 2005; Alui Konan et al. 2013).

For all these four species, further studies using freshly collected seeds, with a factorial experimental approach under laboratory controlled conditions, should be carried out in order to identify the best treatments and incubation conditions for seed dormancy breaking and germination (Baskin et al. 2006). Alternatively, as dormancy level is likely to change during cold storage, and the conditions required for germination become less specific (Probert 2000), the effect of storage time on seed germination should be considered and assessed, if using stored seed lots instead of freshly collected seeds, in seed dormancy studies (i.e. Vandelook et al. 2012; Mattana et al. 2014).

Useful species whose plant propagation by seed is not affected by dormancy

A total of 18 species with a non dormant status were identified (see Table 3). Among them, *Acacia farnesiana, Amphipteryngium adstringens* and *Fouquieria formosa* are reported by Lira et al. (2009a) as being most used by the local communities of the Valley. However, *A. adstringens* was identified in this study as one of the species with a low production of viable seeds and therefore the propagation by seed of this species is constrained by seed availability.

Interestingly, the majority of these species are woody or tree species, suggesting that they could be used to support reforestation programmes with useful indigenous species, as aimed for by the UPP (Ulian et al. 2016) and confirmed by the successful propagation of five of these species through the project (see Table 3). In addition, half of these species are Leguminosae which have been reported to act as "nurse plants" (e.g. *Caesalipinia melanadenia, Senna wislizeni, Parkinsonia praecox, Prosopis laevigata;* Valiente-Banuet et al. 1991; Morello-Calles and Casas 2010) and "resource islands" (e.g. *Mimosa luisana*; Camargo-Ricalde et al. 2002), for endangered cactus species of the Tehuacán–Cuicatlan Valley, such as the globose *Mammillaria carnea, M. haagena* and *Corypantha pallida* (Mandujano et al. 2002), *Myrtillocactus geometrizans, Neobuxbaumia tetetzo and Opuntia pilifera* (Garcia-Chávez et al. 2014) and *Stenocereus stellatus* (Álvarez-Espino et al. 2014), adding ecological and conservation values to their use in restoration programmes. However, it should be taken into account that seed germination is only one of the steps in the plant life cycle and other issues could be detected in seedling establishment and survival.

Seed banking and germination studies as a support to the preservation of the traditional knowledge

Knowledge on the use of plants is disappearing faster than the plants themselves (Alves and Rosa 2007). Therefore, conservation of useful plants should not be limited to the preservation of their genetic resources, but it should include the cataloguing and preservation for future generations of their traditional uses. Through the UPP, information on plant and plant products uses associated to the species stored in the seed banks have been gathered and managed through a dedicated database (Ulian et al. 2016). The uses of the ethnoflora of the Tehuacán–Cuicatlan Valley have been well investigated and documented in the past (e.g. Casas et al. 2001; Lira et al. 2009a). All the main categories of uses documented for the Valley (Lira et al. 2009a) are represented in the seed collections carried out through the UPP. Therefore, seed banking of wild useful species contributed to the preservation of the traditional knowledge of these rural communities by: (1) ensuring a back up of the genetic resources of wild useful plants; (2) providing information on their germination protocols; and (3) documenting and cataloguing the associated traditional knowledge on their uses, which represents an additional challenge in respect to the conventional ex situ conservation of either wild species or crop varieties.

Conclusions

The conservation in seed banks carried out through the UPP, contributed to delivering the GSPC Target 9 for the conservation of "genetic diversity of crops including their wild relatives and other socio-economically valuable plant species, while respecting, preserving and maintaining associated indigenous and local knowledge" (www.cbd.int/gspc) and Aichi Biodiversity Target 18 for the respect of "the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources" (http://www.cbd.int/sp/targets) in Mexico. In addition, these

results contribute to the achievement of the Target 2.5 of the United Nations' Sustainable Development Goals: "By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed" (https://sustainabledevelopment.un.org/sdgs). Moreover, the stored species may represent sources of new genetic diversity and, as for the crop wild relatives, potentially be available for plant breeding experiments, contributing a wide range of beneficial agronomic and nutritional traits (Castañeda-Álvarez et al. 2016).

The germination experiments carried out for the stored species allowed the identification of: (1) species for which more in depth studies on seed dormancy and germination are needed before considering their propagation by seed at a large scale; (2) species whose germination protocols and seed lot availability may already enhance their sustainable use through plant propagation by seed.

This study also confirmed that conventional seed banking represents an effective technique for ex situ conservation of useful wild plant species in Mexico and may complement their in situ conservation as well as the sustainable management of small scale agriculture (Blanckaert et al. 2007) and traditional homegardens (Blanckaert et al. 2004) in the preservation of plant diversity of the Biosphere Reserve of the Tehuacán–Cuicatlán Valley.

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Compliance with ethical standards

Conflict of interest The authors declare that they have not conflict of interest.

Appendix 1: The inventory of bankable useful plants of the Tehuacán–Cuicatlan Valley (from Lira et al. 2009a, modified)

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Acanthaceae	*Anisacanthus*	*gonzalezii*	Greenm.		
Acanthaceae	*Carlowrightia*	*neesiana*	(Schauer ex Nees) T.F. Daniel		
Acanthaceae	*Carlowrightia*	*pringlei*	B.L. Rob. et Greenm.		
Acanthaceae	*Elytraria*	*imbricata*	(Vahl) Pers.		
Acanthaceae	*Holographis*	*velutifolia*	(House) T.F. Daniel		
Acanthaceae	*Justicia*	*brandegeeana*	Wassh. et L.B. Sm.		
Acanthaceae	*Justicia*	*candicans*	(Nees) L.D. Benson		
Acanthaceae	*Justicia*	*gonzalezii*	(Greenm.) Henrickson et Hiriart		
Acanthaceae	*Justicia*	*spicigera*	Schltdl.		
Acanthaceae	*Justicia*	*ramosa*	(Oerst.) V.A.W. Graham		
Acanthaceae	*Ruellia*	*hirsutoglandulosa*	(Oerst.) Hemsl.		
Acanthaceae	*Ruellia*	*lactea*	Cav.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Acanthaceae	*Tetramerium*	*nervosum*	Nees		
Acanthaceae	*Thunbergia*	*alata*	Bojer ex Sims		
Aizoaceae	*Mesembryanthemum*	*cordifolium*	L.f.		
Alstroemeriaceae	*Bomarea*	*edulis*	(Tussac) Herb.		
Alstroemeriaceae	*Bomarea*	*hirtella*	(Kunth) Herb.		
Amaranthaceae	*Alternanthera*	*obovata*	(M. Martens et Galeotti) Millsp.		
Amaranthaceae	*Alternanthera*	*pungens*	Kunth		
Amaranthaceae	*Amaranthus*	*hybridus*	L.		
Amaranthaceae	*Amaranthus*	*hypochondriacus*	L.		
Amaranthaceae	*Atriplex*	*pueblensis*	Standl.		
Amaranthaceae	*Beta*	*vulgaris*	L.		
Amaranthaceae	*Chamissoa*	*altissima*	(Jacq.) Kunth		
Amaranthaceae	*Chenopodium*	*ambrosioides*	L.		
Amaranthaceae	*Chenopodium*	*berlandieri*	Moq.		
Amaranthaceae	*Chenopodium*	*incisum*	Poir.		
Amaranthaceae	*Chenopodium*	*murale*	L.		
Amaranthaceae	*Gomphrena*	*serrata*	L.		
Amaranthaceae	*Iresine*	*calea*	(Ibantz) Standl.		
Amaranthaceae	*Iresine*	*discolor*	Greenm.		
Amaranthaceae	*Iresine*	*pringlei*	S. Watson		
Amaranthaceae	*Iresine*	*schaffneri*	S. Watson		
Amaryllidaceae	*Allium*	*cepa*	L.		
Amaryllidaceae	*Allium*	*glandulosum*	Link et Otto		
Amaryllidaceae	*Allium*	*sativum*	L.		
Amaryllidaceae	*Allium*	*longifolium*	(Kunth) Spreng.		
Amaryllidaceae	*Hymenocallis*	*harrisiana*	Herb.		
Anacardiaceae	*Actinocheita*	*filicina*	(DC.) F.A. Barkley		
Anacardiaceae	*Amphipterygium*	*adstringens*	(Schltdl.) Standl.		
Anacardiaceae	*Cyrtocarpa*	*procera*	Kunth		
Anacardiaceae	*Pseudosmodingium*	*multifolium*	Rose		
Anacardiaceae	*Rhus*	*chondroloma*	Standl.		
Anacardiaceae	*Rhus*	*standleyi*	F.A. Barkley		
Anacardiaceae	*Rhus*	*virens*	Lindh. ex A. Gray		
Anacardiaceae	*Schinus*	*molle*	L.		
Anacardiaceae	*Spondias*	*mombin*	L.		
Annonaceae	*Annona*	*cherimola*	Mill.		
Annonaceae	*Annona*	*muricata*	L.		
Annonaceae	*Annona*	*reticulata*	L.		
Apiaceae	*Coriandrum*	*sativum*	L.		
Apiaceae	*Eryngium*	*bonplandii*	F. Delaroche		
Apiaceae	*Eryngium*	*pectinatum*	C. Presl ex DC.		
Apiaceae	*Foeniculum*	*vulgare*	Mill.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Apiaceae	*Petroselinum*	*crispum*	(Mill.) Fuss		
Apocynaceae	*Asclepias*	*curassavica*	L.		
Apocynaceae	*Asclepias*	*linaria*	Cav.		
Apocynaceae	*Cascabela*	*ovata*	(Cav.) Lippold		
Apocynaceae	*Cascabela*	*thevetia*	(L.) Lippold		
Apocynaceae	*Cascabela*	*thevetioides*	(Kunth) Lippold		
Apocynaceae	*Catharanthus*	*roseus*	(L.) G. Don		
Apocynaceae	*Cryptostegia*	*madagascariensis*	Bojer ex Decne.		
Apocynaceae	*Funastrum*	*pannosum*	(Hemsl.) Schltr.		
Apocynaceae	*Gonolobus*	*pectinatus*	Brandegee		
Apocynaceae	*Marsdenia*	*parvifolia*	Brandegee		
Apocynaceae	*Matelea*	*crenata*	(Vail) Woodson		
Apocynaceae	*Matelea*	*trachyantha*	(Greenm.) W.D. Stevens		
Apocynaceae	*Nerium*	*oleander*	L.		
Apocynaceae	*Orbea*	*variegata*	(L.) Haw.		
Apocynaceae	*Plumeria*	*rubra*	L.		
Apocynaceae	*Rauvolfia*	*tetraphylla*	L.		
Apocynaceae	*Sarcostemma*	*elegans*	Decne.		
Apocynaceae	*Vallesia*	*glabra*	(Cav.) Link		
Araceae	*Alocasia*	*macrorrhizos*	(L.) G. Don		
Araceae	*Anthurium*	*andraeanum*	Linden ex André		
Araceae	*Anthurium*	*crassinervium*	(Jacq.) Schott		
Araceae	*Caladium*	*bicolor*	(Aiton) Vent.		
Araceae	*Dieffenbachia*	*picta*	Schott		
Araceae	*Dieffenbachia*	*seguine*	(Jacq.) Schott		
Araceae	*Epipremnum*	*aureum*	(Linden et André) G.S. Bunting		
Araceae	*Monstera*	*adansonii*	Schott		
Araceae	*Monstera*	*deliciosa*	Liebm.		
Araceae	*Philodendron*	*pinnatifidum*	(Jacq.) Schott		
Araceae	*Xanthosoma*	*robustum*	Schott		
Araceae	*Zantedeschia*	*aethiopica*	(L.) Spreng.		
Araliaceae	*Aralia*	*humilis*	Cav.		
Araliaceae	*Hedera*	*helix*	L.		
Araliaceae	*Polyscias*	*balfouriana*	L.H. Bailey		
Arecaceae	*Brahea*	*dulcis*	(Kunth) Mart.		
Arecaceae	*Brahea*	*calcarea*	Liebm.		
Arecaceae	*Phoenix*	*dactylifera*	L.		
Asparagaceae	*Agave*	*americana*	L.		
Asparagaceae	*Agave*	*atrovirens*	Karw. ex Salm-Dyck		
Asparagaceae	*Agave*	*karwinskii*	Zucc.		
Asparagaceae	*Agave*	*kerchovei*	Lem.		
Asparagaceae	*Agave*	*macroacantha*	Zucc.		
Asparagaceae	*Agave*	*marmorata*	Roezl		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Asparagaceae	*Agave*	*peacockii*	Croucher		
Asparagaceae	*Agave*	*potatorum*	Zucc.		
Asparagaceae	*Agave*	*salmiana*	Otto ex Salm-Dyck		
Asparagaceae	*Agave*	*sisalana*	Perrine		
Asparagaceae	*Agave*	*stricta*	Salm-Dyck		
Asparagaceae	*Agave*	*triangularis*	Jacobi		
Asparagaceae	*Beaucarnea*	*gracilis*	Lem.		
Asparagaceae	*Chlorophytum*	*comosum*	(Thunb.) Jacques		
Asparagaceae	*Cordyline*	*stricta*	(Sims) Endl.		
Asparagaceae	*Dasylirion*	*serratifolium*	(Karw. ex Schult. et Schult.f.) Zucc.		
Asparagaceae	*Dracaena*	*braunii*	Engl.		
Asparagaceae	*Echeandia*	*conzattii*	Cruden		
Asparagaceae	*Furcraea*	*tuberosa*	(Mill.) Aiton		
Asparagaceae	*Nolina*	*longifolia*	(Karw. ex Schult. et Schult.f.) Hemsl.		
Asparagaceae	*Polyanthes*	*tuberosa*	L.		
Asparagaceae	*Sansevieria*	*trifasciata*	Prain		
Asparagaceae	*Sansevieria*	*zeylanica*	Roxb.		
Asparagaceae	*Yucca*	*periculosa*	Baker		
Balsaminaceae	*Impatiens*	*balsamina*	L.		
Begoniaceae	*Begonia*	*gracilis*	Kunth		
Betulaceae	*Alnus*	*acuminata*	Kunth		
Betulaceae	*Alnus*	*jorullensis*	Kunth		
Bignoniaceae	*Astianthus*	*viminalis*	(Kunth) Baill.		
Bignoniaceae	*Jacaranda*	*mimosifolia*	D. Don		
Bignoniaceae	*Parmentiera*	*aculeata*	(Kunth) Seem.		
Bignoniaceae	*Podranea*	*ricasoliana*	(Tanfani) Sprague		
Bignoniaceae	*Tecoma*	*stans*	(L.) Juss. ex Kunth		
Boraginaceae	*Antiphytum*	*heliotropioides*	A.DC.		
Boraginaceae	*Antiphytum*	*paniculatum*	I.M. Johnst.		
Boraginaceae	*Borago*	*officinalis*	L.		
Boraginaceae	*Cordia*	*curassavica*	(Jacq.) Roem. et Schult.		
Boraginaceae	*Cordia*	*oaxacana*	A. DC.		
Boraginaceae	*Cordia*	*spinescens*	L.		
Boraginaceae	*Cordia*	*stellata*	Greenm.		
Boraginaceae	*Cordia*	*alba*	(Jacq.) Roem. et Schult.		
Boraginaceae	*Ehretia*	*latifolia*	Loisel. ex A. DC.		
Boraginaceae	*Heliotropium*	*angiospermum*	Murray		
Boraginaceae	*Heliotropium*	*curassavicum*	L.		
Boraginaceae	*Heliotropium*	*procumbens*	Mill.		
Boraginaceae	*Nama*	*dichotoma*	(Ruiz et Pav.) Choisy		
Boraginaceae	*Tournefortia*	*mutabilis*	Vent.		
Boraginaceae	*Tournefortia*	*volubilis*	L.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Boraginaceae	*Wigandia*	*urens*	(Ruiz et Pav.) Kunth		
Brassicaceae	*Brassica*	*rapa*	L.		
Brassicaceae	*Brassica*	*oleracea*	L.		
Brassicaceae	*Capsella*	*bursa-pastoris*	(L.) Medik.		
Brassicaceae	*Descurainia*	*virletii*	(E. Fourn.) O.E. Schulz		
Brassicaceae	*Eruca*	*sativa*	Mill.		
Brassicaceae	*Lepidium*	*virginicum*	L.		
Brassicaceae	*Matthiola*	*incana*	(L.) R. Br.		
Brassicaceae	*Nasturtium*	*officinale*	R. Br.		
Brassicaceae	*Raphanus*	*sativus*	L.		
Bromeliaceae	*Ananas*	*comosus*	(L.) Merr.		
Bromeliaceae	*Catopsis*	*compacta*	Mez		
Bromeliaceae	*Hechtia*	*bracteata*	Mez		
Bromeliaceae	*Hechtia*	*confusa*	L.B. Sm.		
Bromeliaceae	*Hechtia*	*conzattiana*	L.B. Sm.		
Bromeliaceae	*Hechtia*	*fragilis*	Burt-Utley et Utley		
Bromeliaceae	*Hechtia*	*galeottii*	Mez		
Bromeliaceae	*Hechtia*	*glomerata*	Zucc.		
Bromeliaceae	*Hechtia*	*lyman-smithii*	Burt-Utley et Utley		
Bromeliaceae	*Hechtia*	*podantha*	Mez		
Bromeliaceae	*Hechtia*	*pringlei*	B.L. Rob. et Greenm.		
Bromeliaceae	*Hechtia*	*roseana*	L.B. Sm.		
Bromeliaceae	*Hechtia*	*sphaeroblasta*	B.L. Rob.		
Bromeliaceae	*Hechtia*	*liebmannii*	Mez		
Bromeliaceae	*Tillandsia*	*concolor*	L.B. Sm.		
Bromeliaceae	*Tillandsia*	*dasyliriifolia*	Baker		
Bromeliaceae	*Tillandsia*	*grandis*	Schltdl.		
Bromeliaceae	*Tillandsia*	*plumosa*	Baker		
Bromeliaceae	*Tillandsia*	*pueblensis*	L.B. Sm.		
Bromeliaceae	*Tillandsia*	*recurvata*	(Gaudich.) Baker		
Bromeliaceae	*Tillandsia*	*usneoides*	(L.) L.		
Burseraceae	*Bursera*	*aptera*	Ramírez		
Burseraceae	*Bursera*	*arida*	(Rose) Standl.		
Burseraceae	*Bursera*	*biflora*	(Rose) Standl.		
Burseraceae	*Bursera*	*bipinnata*	(Moc. et Sessé ex DC.) Engl.		
Burseraceae	*Bursera*	*cinerea*	Engl.		
Burseraceae	*Bursera*	*copallifera*	(Sessé et Moc. ex DC.) Bullock		
Burseraceae	*Bursera*	*diversifolia*	Rose		
Burseraceae	*Bursera*	*fagaroides*	(Kunth) Engl.		
Burseraceae	*Bursera*	*galeottiana*	Engl.		
Burseraceae	*Bursera*	*glabrifolia*	(Kunth) Engl.		
Burseraceae	*Bursera*	*laxiflora*	S. Watson		
Burseraceae	*Bursera*	*mirandae*	C.A. Toledo		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Burseraceae	*Bursera*	*morelensis*	Ramírez		
Burseraceae	*Bursera*	*schlechtendalii*	Engl.		
Burseraceae	*Bursera*	*simaruba*	(L.) Sarg.		
Burseraceae	*Bursera*	*submoniliformis*	Engl.		
Burseraceae	*Bursera*	*linanoe*	(La Llave) Rzed., Calderón et Medina		
Cactaceae	*Acanthocereus*	*subinermis*	Britton et Rose		
Cactaceae	*Cephalocereus*	*columna-trajani*	(Karw. ex Pfeiff.) K. Schum.		
Cactaceae	*Coryphantha*	*pallida*	Britton et Rose		
Cactaceae	*Coryphantha*	*pycnacantha*	(Mart.) Lem.		
Cactaceae	*Disocactus*	*flagelliformis*	(L.) Barthlott		
Cactaceae	*Echinocactus*	*platyacanthus*	Link et Otto		
Cactaceae	*Echinocereus*	*pulchellus*	(Mart.) K. Schum.		
Cactaceae	*Escontria*	*chiotilla*	(A.A. Weber ex K. Schum.) Rose		
Cactaceae	*Ferocactus*	*flavovirens*	(Scheidw.) Britton et Rose		
Cactaceae	*Ferocactus*	*haematacanthus*	(Monv. ex Salm-Dyck) Bravo ex Backeb. et F.M. Knuth		
Cactaceae	*Ferocactus*	*macrodiscus*	(Mart.) Britton et Rose		
Cactaceae	*Ferocactus*	*recurvus*	(Mill.) Borg		
Cactaceae	*Ferocactus*	*robustus*	(Karw. ex Pfeiff.) Britton et Rose		
Cactaceae	*Heliocereus*	*elegantissimus*	Britton et Rose		
Cactaceae	*Heliocereus*	*schrankii*	(Zucc. ex Seitz) Britton et Rose		
Cactaceae	*Hylocereus*	*purpusii*	(Weing.) Britton et Rose		
Cactaceae	*Hylocereus*	*undatus*	(Haw.) Britton et Rose		
Cactaceae	*Isolatocereus*	*dumortieri*	(Scheidw.) Backeb.		
Cactaceae	*Mammillaria*	*carnea*	Zucc. ex Pfeiff.		
Cactaceae	*Mammillaria*	*haageana*	Pfeiff.		
Cactaceae	*Mammillaria*	*sphacelata*	Mart.		
Cactaceae	*Myrtillocactus*	*geometrizans*	(Mart. ex Pfeiff.) Console		
Cactaceae	*Myrtillocactus*	*schenckii*	(J.A. Purpus) Britton et Rose		
Cactaceae	*Neobuxbaumia*	*macrocephala*	(F.A.C. Weber ex K. Schum.) E.Y. Dawson		
Cactaceae	*Neobuxbaumia*	*mezcalaensis*	Bravo		
Cactaceae	*Neobuxbaumia*	*tetetzo*	(F.A.C. Weber ex K. Schum.) Backeb.		
Cactaceae	*Nopalea*	*auberi*	(Pfeiff.) Salm-Dyck		
Cactaceae	*Nopalea*	*cochenillifera*	(L.) Salm-Dyck		
Cactaceae	*Opuntia*	*huajuapensis*	Bravo		
Cactaceae	*Opuntia*	*hyptiacantha*	F.A.C. Weber		
Cactaceae	*Opuntia*	*kleiniae*	DC.		
Cactaceae	*Opuntia*	*lasiacantha*	Pfeiff.		
Cactaceae	*Opuntia*	*pilifera*	F.A.C. Weber		

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Cactaceae	*Opuntia*	*pumila*	Rose		
Cactaceae	*Opuntia*	*streptacantha*	Lem.		
Cactaceae	*Opuntia*	*tomentosa*	Salm-Dyck		
Cactaceae	*Opuntia*	*decumbens*	Salm-Dyck		
Cactaceae	*Opuntia*	*depressa*	Rose		
Cactaceae	*Opuntia*	*ficus-indica*	(L.) Mill.		
Cactaceae	*Opuntia*	*imbricata*	(Haw.) DC.		
Cactaceae	*Pachycereus*	*hollianus*	(F.A.C. Weber ex J.M. Coult.) Buxb.		
Cactaceae	*Pachycereus*	*marginatus*	(DC.) Britton et Rose		
Cactaceae	*Pachycereus*	*weberi*	(J.M. Coult.) Backeb.		
Cactaceae	*Pereskiopsis*	*rotundifolia*	(DC.) Britton et Rose		
Cactaceae	*Pilosocereus*	*chrysacanthus*	(F.A.C. Weber ex K. Schum.) Byles et G.D. Rowley		
Cactaceae	*Polaskia*	*chende*	Gibson et Horak		
Cactaceae	*Polaskia*	*chichipe*	(Gosselin) Backeb.		
Cactaceae	*Pseudomitrocereus*	*fulviceps*	(F.A.C. Weber ex K. Schum.) Bravo et Buxb.		
Cactaceae	*Stenocereus*	*griseus*	(Haw.) Buxb		
Cactaceae	*Stenocereus*	*pruinosus*	(Otto ex Pfeiff.) Buxb.		
Cactaceae	*Stenocereus*	*stellatus*	(Pfeiff.) Riccob.		
Cactaceae	*Stenocereus*	*treleasei*	(Vaupel) Backeb.		
Campanulaceae	*Diastatea*	*micrantha*	(Kunth) McVaugh		
Campanulaceae	*Lobelia*	*berlandieri*	A.DC.		
Cannaceae	*Canna*	*indica*	L.		
Capparaceae	*Forchhammeria*	*macrocarpa*	Standl.		
Capparaceae	*Polanisia*	*uniglandulosa*	(Cav.) DC.		
Capparaceae	*Quadrella*	*incana*	(Kunth) Iltis et Cornejo		
Caprifoliaceae	*Sambucus*	*mexicana*	C. Presl ex DC.		
Caprifoliaceae	*Vesalea*	*floribunda*	M. Martens et Galeotti		
Caryophyllaceae	*Dianthus*	*caryophyllus*	L.		
Caryophyllaceae	*Drymaria*	*laxiflora*	Benth.		
Casuarinaceae	*Casuarina*	*equisetifolia*	L.		
Celastraceae	*Pristimera*	*celastroides*	(Kunth) A.C. Sm.		
Celastraceae	*Wimmeria*	*microphylla*	Radlk.		
Celastraceae	*Wimmeria*	*pubescens*	Radlk.		
Commelinaceae	*Callisia*	*navicularis*	(Ortgies) D.R. Hunt		
Commelinaceae	*Commelina*	*clavata*	C.B. Clarke		
Commelinaceae	*Commelina*	*coelestis*	Willd.		
Commelinaceae	*Commelina*	*erecta*	L.		
Commelinaceae	*Commelina*	*tuberosa*	L.		
Commelinaceae	*Gibasis*	*consobrina*	D.R. Hunt		
Commelinaceae	*Gibasis*	*linearis*	(Benth.) Rohweder		
Commelinaceae	*Tradescantia*	*crassifolia*	Cav.		
Commelinaceae	*Tradescantia*	*sillamontana*	Matuda		

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Commelinaceae	*Tradescantia*	*zebrina*	Bosse		
Commelinaceae	*Tradescantia*	*pallida*	(Rose) D.R. Hunt		
Commelinaceae	*Tripogandra*	*purpurascens*	(Schauer) Handlos		
Compositae	*Acourtia*	*lobulata*	(Bacig.) Reveal et R.M. King		
Compositae	*Acourtia*	*scapiformis*	(Bacig.) B.L. Turner		
Compositae	*Ageratina*	*espinosarum*	(A. Gray) R.M. King et H. Rob.		
Compositae	*Ageratina*	*hebes*	(B.L. Rob.) R.M. King et H. Rob.		
Compositae	*Ageratina*	*mairetiana*	(DC.) R.M. King et H. Rob.		
Compositae	*Ageratum*	*tehuacanum*	R.M. King et H. Rob.		
Compositae	*Archibaccharis*	*serratifolia*	(Kunth) S.F. Blake		
Compositae	*Artemisia*	*absinthium*	L.		
Compositae	*Artemisia*	*vulgaris*	L.		
Compositae	*Aster*	*novi-belgii*	L.		
Compositae	*Aster*	*subulatus*	(Michx.) Hort. ex Michx.		
Compositae	*Baccharis*	*conferta*	Kunth		
Compositae	*Baccharis*	*mexicana*	Cuatrec.		
Compositae	*Baccharis*	*salicina*	Torr. et A. Gray		
Compositae	*Barkleyanthus*	*salicifolius*	(Kunth) H. Rob. et Brettell		
Compositae	*Bidens*	*bigelovii*	A. Gray		
Compositae	*Bidens*	*bipinnata*	L.		
Compositae	*Bidens*	*pilosa*	L.		
Compositae	*Brickellia*	*scoparia*	(DC.) A. Gray		
Compositae	*Brickellia*	*veronicifolia*	(Kunth) A. Gray		
Compositae	*Calea*	*zacatechichi*	Schltdl.		
Compositae	*Calea*	*oliveri*	B.L. Rob. et Greenm.		
Compositae	*Calendula*	*officinalis*	L.		
Compositae	*Carminatia*	*alvarezii*	Rzed. et Calderón		
Compositae	*Chaptalia*	*nutans*	(L.) Polák		
Compositae	*Chrysactinia*	*mexicana*	A. Gray		
Compositae	*Chrysanthemum*	*indicum*	Thunb.		
Compositae	*Cirsium*	*mexicanum*	DC.		
Compositae	*Conyza*	*coronopifolia*	Kunth		
Compositae	*Cosmos*	*bipinnatus*	Cav.		
Compositae	*Dahlia*	*apiculata*	(Sherff) P.D. Sørensen		
Compositae	*Dahlia*	*coccinea*	Cav.		
Compositae	*Dahlia*	*merckii*	Lehm.		
Compositae	*Desmanthodium*	*ovatum*	Benth.		
Compositae	*Dyssodia*	*papposa*	(Vent.) Hitchc.		
Compositae	*Dyssodia*	*tagetiflora*	Lag.		
Compositae	*Erigeron*	*karvinskianus*	DC.		
Compositae	*Erigeron*	*longipes*	DC.		
Compositae	*Erigeron*	*bonariensis*	L.		

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Compositae	*Erigeron*	*canadensis*	L.		
Compositae	*Flaveria*	*trinervia*	(Spreng.) C. Mohr		
Compositae	*Florestina*	*simplicifolia*	B.L. Turner		
Compositae	*Galinsoga*	*parviflora*	Cav.		
Compositae	*Gnaphalium*	*attenuatum*	DC.		
Compositae	*Gnaphalium*	*canescens*	DC.		
Compositae	*Gochnatia*	*hypoleuca*	(DC.) A. Gray		
Compositae	*Grindelia*	*inuloides*	Willd.		
Compositae	*Gymnolaena*	*oaxacana*	(Greenm.) Rydb.		
Compositae	*Gymnosperma*	*glutinosum*	(Spreng.) Less.		
Compositae	*Helenium*	*mexicanum*	DC.		
Compositae	*Helianthus*	*annuus*	L.		
Compositae	*Heterosperma*	*pinnatum*	Cav.		
Compositae	*Heterotheca*	*inuloides*	Cass.		
Compositae	*Laennecia*	*sophiifolia*	(Kunth) G.L. Nesom		
Compositae	*Lagascea*	*helianthifolia*	Kunth		
Compositae	*Launaea*	*intybacea*	(Jacq.) Beauverd		
Compositae	*Matricaria*	*chamomilla*	L.		
Compositae	*Melampodium*	*divaricatum*	(Rich. ex Rich.) DC.		
Compositae	*Melampodium*	*longifolium*	Cerv. ex Cav.		
Compositae	*Montanoa*	*mollissima*	Brongn. ex Brongn.		
Compositae	*Montanoa*	*tomentosa*	Cerv.		
Compositae	*Neurolaena*	*lobata*	(L.) R.Br. ex Cass.		
Compositae	*Parthenium*	*bipinnatifidum*	(Ortega) Rollins		
Compositae	*Parthenium*	*hysterophorus*	Adans.		
Compositae	*Parthenium*	*tomentosum*	DC.		
Compositae	*Perymenium*	*discolor*	Sch.Bip.		
Compositae	*Perymenium*	*mendezii*	DC.		
Compositae	*Philactis*	*zinnioides*	Schrad.		
Compositae	*Pinaropappus*	*roseus*	(Less.) Less.		
Compositae	*Piqueria*	*trinervia*	Cav.		
Compositae	*Pluchea*	*salicifolia*	(Mill.) S.F. Blake		
Compositae	*Podachaenium*	*eminens*	(Lag.) Sch.Bip. ex Sch.Bip.		
Compositae	*Porophyllum*	*linaria*	(Cav.) DC.		
Compositae	*Porophyllum*	*punctatum*	(Mill.) S.F. Blake		
Compositae	*Porophyllum*	*ruderale*	M. Gómez		
Compositae	*Porophyllum*	*viridiflorum*	(Kunth) DC.		
Compositae	*Psacalium*	*amplifolium*	(DC.) H. Rob. et Brettell		
Compositae	*Pseudelephantopus*	*spicatus*	(B. Juss. ex Aubl.) Rohr ex C.F. Baker		
Compositae	*Sanvitalia*	*fruticosa*	Hemsl.		
Compositae	*Sanvitalia*	*procumbens*	Lam.		
Compositae	*Schkuhria*	*pinnata*	Cabrera		
Compositae	*Senecio*	*deppeanus*	Hemsl.		

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Compositae	*Senecio*	*salignus*	DC.		
Compositae	*Simsia*	*lagascaeformis*	DC.		
Compositae	*Simsia*	*sanguinea*	A. Gray		
Compositae	*Sonchus*	*oleraceus*	(L.) L.		
Compositae	*Stevia*	*lucida*	Lag.		
Compositae	*Stevia*	*microchaeta*	Sch.Bip. ex Sch.Bip.		
Compositae	*Stevia*	*origanoides*	Kunth		
Compositae	*Stevia*	*serrata*	Cav.		
Compositae	*Steviopsis*	*vigintiseta*	(DC.) R.M. King et H. Rob.		
Compositae	*Tagetes*	*erecta*	L.		
Compositae	*Tagetes*	*filifolia*	Lag.		
Compositae	*Tagetes*	*lucida*	Cav.		
Compositae	*Tagetes*	*micrantha*	Cav.		
Compositae	*Tanacetum*	*parthenium*	(L.) Sch.Bip.		
Compositae	*Taraxacum*	*campylodes*	G.E. Haglund		
Compositae	*Tithonia*	*tubaeformis*	(Jacq.) Cass.		
Compositae	*Tridax*	*coronopifolia*	(Kunth) Hemsl.		
Compositae	*Tridax*	*luisana*	Brandegee		
Compositae	*Tridax*	*mexicana*	A.M. Powell		
Compositae	*Trigonospermum*	*melampodioides*	DC.		
Compositae	*Trixis*	*pringlei*	B.L. Rob. et Greenm.		
Compositae	*Verbesina*	*gracilipes*	B.L. Rob.		
Compositae	*Verbesina*	*petrophila*	Brandegee		
Compositae	*Verbesina*	*serrata*	Cav.	var. *pringlei*	(B.L. Rob.) B.L. Rob. et Greenm.
Compositae	*Verbesina*	*virgata*	Cav.		
Compositae	*Vernonia*	*karvinskiana*	DC.		
Compositae	*Viguiera*	*cordata*	(Hook. et Arn.) D'Arcy		
Compositae	*Viguiera*	*dentata*	(Cav.) Spreng.		
Compositae	*Viguiera*	*grammatoglossa*	DC.		
Compositae	*Viguiera*	*pinnatilobata*	(Sch.Bip.) S.F. Blake		
Compositae	*Viguiera*	*purpusii*	Brandegee		
Compositae	*Zinnia*	*peruviana*	(L.) L.		
Compositae	*Zinnia*	*violacea*	Cav.		
Convolvulaceae	*Cuscuta*	*corymbosa*	Ruiz et Pav.		
Convolvulaceae	*Dichondra*	*sericea*	Sw.		
Convolvulaceae	*Ipomoea*	*arborescens*	(Humb. et Bonpl. ex Willd.) G. Don		
Convolvulaceae	*Ipomoea*	*batatas*	(L.) Lam.		
Convolvulaceae	*Ipomoea*	*cholulensis*	Kunth		
Convolvulaceae	*Ipomoea*	*coccinea*	L.		
Convolvulaceae	*Ipomoea*	*conzattii*	Greenm.		
Convolvulaceae	*Ipomoea*	*leptotoma*	Torr.		
Convolvulaceae	*Ipomoea*	*murucoides*	Roem. et Schult.		

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Convolvulaceae	*Ipomoea*	*nil*	(L.) Roth		
Convolvulaceae	*Ipomoea*	*pauciflora*	M. Martens et Galeotti		
Convolvulaceae	*Ipomoea*	*purpurea*	(L.) Roth		
Convolvulaceae	*Ipomoea*	*tricolor*	Cav.		
Convolvulaceae	*Jacquemontia*	*smithii*	B.L. Rob. et Greenm.		
Convolvulaceae	*Turbina*	*corymbosa*	(L.) Raf.		
Crassulaceae	*Bryophyllum*	*pinnatum*	(Lam.) Oken		
Crassulaceae	*Echeveria*	*gibbiflora*	DC.		
Crassulaceae	*Echeveria*	*gracilis*	Rose ex E. Walther		
Crassulaceae	*Echeveria*	*heterosepala*	Rose		
Crassulaceae	*Echeveria*	*nodulosa*	(Baker) Otto		
Crassulaceae	*Echeveria*	*nuda*	Lindl.		
Crassulaceae	*Echeveria*	*peacockii*	Croucher		
Crassulaceae	*Echeveria*	*pulvinata*	Rose		
Crassulaceae	*Echeveria*	*purpusorum*	(Rose) A. Berger		
Crassulaceae	*Echeveria*	*setosa*	Rose et Purpus		
Crassulaceae	*Echeveria*	*pallida*	E. Walther		
Crassulaceae	*Graptopetalum*	*mexicanum*	Matuda		
Crassulaceae	*Kalanchoe*	*blossfeldiana*	Poelln.		
Crassulaceae	*Kalanchoe*	*daigremontiana*	Raym.-Hamet et H. Perrier		
Crassulaceae	*Kalanchoe*	*mortagei*	Raym.-Hamet et H. Perrier		
Crassulaceae	*Kalanchoe*	*pinnata*	(Lam.) Pers.		
Crassulaceae	*Sedum*	*calcicola*	B.L. Rob. et Greenm.		
Crassulaceae	*Sedum*	*mexicanum*	Britton		
Crassulaceae	*Sedum*	*morganianum*	E. Walther		
Crassulaceae	*Sedum*	*praealtum*	A. DC.		
Crassulaceae	*Sedum*	*allantoides*	Rose		
Crassulaceae	*Sedum*	*dendroideum*	Moc. et Sessé ex DC.		
Crassulaceae	*Thompsonella*	*minutiflora*	(Rose) Britton et Rose		
Cucurbitaceae	*Apodanthera*	*undulata*	A. Gray	var. *australis*	McVaugh
Cucurbitaceae	*Citrullus*	*lanatus*	(Thunb.) Matsum. et Nakai		
Cucurbitaceae	*Cucumis*	*anguria*	L.		
Cucurbitaceae	*Cucumis*	*melo*	L.		
Cucurbitaceae	*Cucumis*	*sativus*	L.		
Cucurbitaceae	*Cucurbita*	*argyrosperma*	C. Huber		
Cucurbitaceae	*Cucurbita*	*ficifolia*	Bouché		
Cucurbitaceae	*Cucurbita*	*moschata*	Duchesne		
Cucurbitaceae	*Cucurbita*	*pepo*	L.		
Cucurbitaceae	*Cyclanthera*	*dissecta*	(Torr. et A. Gray) Arn.		
Cucurbitaceae	*Echinopepon X*	*pubescens*	(Cogn.) Rose		
Cucurbitaceae	*Lagenaria*	*siceraria*	(Molina) Standl.		
Cucurbitaceae	*Luffa*	*aegyptiaca*	Mill.		
Cucurbitaceae	*Melothria*	*pendula*	L.		
Cucurbitaceae	*Microsechium*	*palmatum*	(Ser.) Cogn.		

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Cucurbitaceae	*Parasicyos*	*dieterleae*	Lira et R. Torres		
Cucurbitaceae	*Sicyos*	*laciniatus*	Hillebr.		
Cucurbitaceae	*Sicyos*	*parviflorus*	Willd.		
Cupressaceae	*Cupressus*	*lindleyi*	Klotzsch ex Endl.		
Cupressaceae	*Cupressus*	*lusitanica*	Mill.		
Cupressaceae	*Cupressus*	*lusitanica*	Mill.	var. *benthamii*	(Endl.) Carrière
Cupressaceae	*Cupressus*	*sempervirens*	L.		
Cupressaceae	*Juniperus*	*communis*	L.		
Cupressaceae	*Juniperus*	*deppeana*	Steud.		
Cupressaceae	*Juniperus*	*flaccida*	Schltdl.		
Cyperaceae	*Bulbostylis*	*capillaris*	(L.) Kunth ex C.B. Clarke		
Cyperaceae	*Bulbostylis*	*junciformis*	(Kunth) C.B. Clarke		
Cyperaceae	*Bulbostylis*	*juncoides*	(Vahl) Kük. ex Herter		
Cyperaceae	*Carex*	*anisostachys*	Liebm.		
Cyperaceae	*Carex*	*humboldtiana*	Steud.		
Cyperaceae	*Carex*	*longicaulis*	Boeckeler		
Cyperaceae	*Carex*	*planostachys*	Kunze		
Cyperaceae	*Carex*	*scabrella*	Wahlenb.		
Cyperaceae	*Carex*	*schiedeana*	Kunze		
Cyperaceae	*Carex*	*standleyana*	Steyerm.		
Cyperaceae	*Carex*	*turbinata*	Liebm.		
Cyperaceae	*Carex*	*muehlenbergii*	Willd.	var. *xalapensis*	(Kunth) Britton
Cyperaceae	*Cyperus*	*aggregatus*	(Willd.) Endl.		
Cyperaceae	*Cyperus*	*ciliatus*	Jungh.		
Cyperaceae	*Cyperus*	*elegans*	L.		
Cyperaceae	*Cyperus*	*esculentus*	L.		
Cyperaceae	*Cyperus*	*flavescens*	L.		
Cyperaceae	*Cyperus*	*hermaphroditus*	(Jacq.) Standl.		
Cyperaceae	*Cyperus*	*laevigatus*	L.		
Cyperaceae	*Cyperus*	*manimae*	Kunth		
Cyperaceae	*Cyperus*	*niger*	Ruiz et Pav.		
Cyperaceae	*Cyperus*	*ochraceus*	Vahl		
Cyperaceae	*Cyperus*	*odoratus*	Burm.f.		
Cyperaceae	*Cyperus*	*pycnostachyus*	(Kunth) Kunth		
Cyperaceae	*Cyperus*	*seslerioides*	Kunth		
Cyperaceae	*Cyperus*	*spectabilis*	Link		
Cyperaceae	*Cyperus*	*subambiguus*	Kük.		
Cyperaceae	*Cyperus*	*surinamensis*	Rottb.		
Cyperaceae	*Cyperus*	*tenerrimus*	J. Presl et C. Presl		
Cyperaceae	*Cyperus*	*thyrsiflorus*	Boeckeler		
Cyperaceae	*Cyperus*	*laxus*	Lam.		
Cyperaceae	*Eleocharis*	*acicularis*	(L.) Roem. et Schult.		
Cyperaceae	*Eleocharis*	*geniculata*	(L.) Roem. et Schult.		
Cyperaceae	*Eleocharis*	*macrostachya*	Britton		

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Cyperaceae	*Eleocharis*	*montana*	(Kunth) Roem. et Schult.		
Cyperaceae	*Eleocharis*	*montevidensis*	Kunth		
Cyperaceae	*Fimbristylis*	*aestivalis*	Vahl		
Cyperaceae	*Fimbristylis*	*mexicana*	Palla		
Cyperaceae	*Fuirena*	*incompleta*	Nees		
Cyperaceae	*Fuirena*	*simplex*	Vahl		
Cyperaceae	*Pycreus*	*lanceolatus*	(Poir.) C.B. Clarke		
Cyperaceae	*Pycreus*	*niger*	(Ruiz et Pav.) Cufod.		
Cyperaceae	*Rhynchospora*	*macrochaeta*	Steud. ex Boeckeler		
Cyperaceae	*Schoenoplectus*	*americanus*	(Pers.) Volkart		
Cyperaceae	*Schoenus*	*nigricans*	L.		
Cyperaceae	*Scirpus*	*polyphyllus*	Vahl		
Dioscoreaceae	*Dioscorea*	*convolvulacea*	Cham. et Schltdl.		
Ebenaceae	*Diospyros*	*virginiana*	L.		
Ebenaceae	*Diospyros*	*oaxacana*	Standl.		
Elaeocarpaceae	*Muntingia*	*calabura*	L.		
Ephedraceae	*Ephedra*	*compacta*	Rose		
Equisetaceae	*Equisetum*	*hyemale*	L.		
Equisetaceae	*Equisetum*	*myriochaetum*	Schltdl. et Cham.		
Ericaceae	*Arbutus*	*xalapensis*	Kunth		
Ericaceae	*Arctostaphylos*	*pungens*	Kunth		
Ericaceae	*Comarostaphylis*	*polifolia*	(Kunth) Zucc. ex Klotzsch		
Ericaceae	*Vaccinium*	*confertum*	Kunth		
Ericaceae	*Vaccinium*	*leucanthum*	Schltdl.		
Erythroxylaceae	*Erythroxylum*	*compactum*	Rose		
Euphorbiaceae	*Acalypha*	*phleoides*	Cav.		
Euphorbiaceae	*Acalypha*	*purpurascens*	Kunth		
Euphorbiaceae	*Acalypha*	*monostachya*	Cav.		
Euphorbiaceae	*Cnidoscolus*	*tehuacanensis*	Breckon		
Euphorbiaceae	*Cnidoscolus*	*aconitifolius*	(Mill.) I.M. Johnst.		
Euphorbiaceae	*Croton*	*ciliatoglandulifer*	Ortega		
Euphorbiaceae	*Croton*	*morifolius*	Willd.		
Euphorbiaceae	*Euphorbia*	*antisyphilitica*	Zucc.		
Euphorbiaceae	*Euphorbia*	*cumbrae*	Boiss.		
Euphorbiaceae	*Euphorbia*	*dentata*	Michx.		
Euphorbiaceae	*Euphorbia*	*graminea*	Schltdl. et Cham.		
Euphorbiaceae	*Euphorbia*	*heterophylla*	L.		
Euphorbiaceae	*Euphorbia*	*lactea*	Haw.		
Euphorbiaceae	*Euphorbia*	*macropus*	(Klotzsch et Garcke) Boiss.		
Euphorbiaceae	*Euphorbia*	*peganoides*	Boiss.		
Euphorbiaceae	*Euphorbia*	*prostrata*	Burch. ex Hemsl.		
Euphorbiaceae	*Euphorbia*	*pulcherrima*	Willd. ex Klotzsch		
Euphorbiaceae	*Euphorbia*	*schlechtendalii*	Boiss.		
Euphorbiaceae	*Euphorbia*	*tirucalli*	L.		

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Euphorbiaceae	*Euphorbia*	*tricolor*	Greenm.		
Euphorbiaceae	*Euphorbia*	*berteroana*	Balb. ex Spreng.		
Euphorbiaceae	*Euphorbia*	*cumbrae*	Boiss.		
Euphorbiaceae	*Euphorbia*	*cymbifera*	(Schltdl.) V.W. Steinm.		
Euphorbiaceae	*Euphorbia*	*dioeca*	Kunth		
Euphorbiaceae	*Euphorbia*	*milii*	Des Moul.	var. *splendens*	(Bojer ex Hook.) Ursch et Leandri
Euphorbiaceae	*Jatropha*	*dioica*	Sessé		
Euphorbiaceae	*Jatropha*	*neopauciflora*	Pax		
Euphorbiaceae	*Jatropha*	*spathulata*	(Ortega) Müll.Arg.		
Euphorbiaceae	*Manihot*	*pauciflora*	Brandegee		
Euphorbiaceae	*Ricinus*	*communis*	L.		
Euphorbiaceae	*Sebastiania*	*bilocularis*	S. Watson		
Euphorbiaceae	*Sebastiania*	*pavoniana*	(Müll.Arg.) Müll.Arg.		
Fouquieriaceae	*Fouquieria*	*formosa*	Kunth		
Fouquieriaceae	*Fouquieria*	*purpusii*	Brandegee		
Garryaceae	*Garrya*	*laurifolia*	Benth.		
Garryaceae	*Garrya*	*ovata*	Benth.		
Geraniaceae	*Erodium*	*cicutarium*	(L.) L'Hér.		
Geraniaceae	*Geranium*	*schiedeanum*	Schltdl.		
Geraniaceae	*Pelargonium*	*hortorum*	L.H. Bailey		
Gesneriaceae	*Episcia*	*cupreata*	(Hook.) Hanst.		
Hernandiaceae	*Gyrocarpus*	*mocinoi*	Espejo		
Hypoxidaceae	*Hypoxis*	*decumbens*	Lam.		
Iridaceae	*Crocosmia*	*crocosmiiflora*	(Lemoine) N.E. Br.		
Iridaceae	*Iris*	*germanica*	L.		
Iridaceae	*Tigridia*	*pavonia*	(L.f.) DC.		
Krameriaceae	*Krameria*	*cytisoides*	Cav.		
Lamiaceae	*Clinopodium*	*mexicanum*	(Benth.) Govaerts		
Lamiaceae	*Leonotis*	*nepetifolia*	(L.) R. Br.		
Lamiaceae	*Lepechinia*	*mexicana*	(S. Schauer) Epling		
Lamiaceae	*Marrubium*	*vulgare*	L.		
Lamiaceae	*Ocimum*	*basilicum*	L.		
Lamiaceae	*Plectranthus*	*scutellarioides*	(L.) R. Br.		
Lamiaceae	*Salvia*	*aspera*	M. Martens et Galeotti		
Lamiaceae	*Salvia*	*cacaliifolia*	Benth.		
Lamiaceae	*Salvia*	*candicans*	M. Martens et Galeotti		
Lamiaceae	*Salvia*	*hispanica*	L.		
Lamiaceae	*Salvia*	*oaxacana*	Fernald		
Lamiaceae	*Salvia*	*pannosa*	Fernald		
Lamiaceae	*Salvia*	*podadena*	Briq.		
Lamiaceae	*Salvia*	*purpurea*	Sessé et Moc.		
Lamiaceae	*Salvia*	*sessei*	Benth.		

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Lamiaceae	*Salvia*	*thymoides*	Benth.		
Lamiaceae	*Salvia*	*tiliifolia*	Vahl		
Lamiaceae	*Salvia*	*villosa*	Fernald		
Lamiaceae	*Salvia*	*brevilabra*	Franch.		
Lamiaceae	*Salvia*	*circinnata*	Cav.		
Lamiaceae	*Stachys*	*inclusa*	Epling		
Leguminosae	*Acacia*	*acatlensis*	Benth.		
Leguminosae	*Acacia*	*angustissima*	(Mill.) Kuntze		
Leguminosae	*Acacia*	*bilimekii*	J.F. Macbr.		
Leguminosae	*Acacia*	*cochliacantha*	Willd.		
Leguminosae	*Acacia*	*compacta*	Rose		
Leguminosae	*Acacia*	*constricta*	A. Gray		
Leguminosae	*Acacia*	*coulteri*	A. Gray		
Leguminosae	*Acacia*	*farnesiana*	(L.) Willd.		
Leguminosae	*Acacia*	*macracantha*	Willd.		
Leguminosae	*Acacia*	*mammifera*	Schltdl.		
Leguminosae	*Acacia*	*pennatula*	(Schltdl. et Cham.) Benth.		
Leguminosae	*Acacia*	*pringlei*	Rose		
Leguminosae	*Acacia*	*schaffneri*	(S. Watson) F.J. Herm.		
Leguminosae	*Acacia*	*subangulata*	Rose		
Leguminosae	*Acacia*	*tequilana*	S. Watson		
Leguminosae	*Acacia*	*velvae*	L. Rico		
Leguminosae	*Aeschynomene*	*compacta*	Rose		
Leguminosae	*Aeschynomene*	*fascicularis*	Cham. et Schltdl.		
Leguminosae	*Aeschynomene*	*purpusii*	Brandegee		
Leguminosae	*Bauhinia*	*deserti*	(Britton et Rose) Lundell		
Leguminosae	*Bauhinia*	*divaricata*	L.		
Leguminosae	*Brongniartia*	*oligosperma*	Baill.		
Leguminosae	*Caesalpinia*	*cacalaco*	Humb. et Bonpl.		
Leguminosae	*Caesalpinia*	*melanadenia*	(Rose) Standl.		
Leguminosae	*Caesalpinia*	*pulcherrima*	(L.) Sw.		
Leguminosae	*Caesalpinia*	*velutina*	(Britton et Rose) Standl.		
Leguminosae	*Cajanus*	*cajan*	(L.) Millsp.		
Leguminosae	*Calliandra*	*eriophylla*	Benth.		
Leguminosae	*Calliandra*	*houstoniana*	(Mill.) Standl.	var. *anomala*	(Kunth) Barneby
Leguminosae	*Calliandropsis*	*nervosus*	(Britton et Rose) H.M. Hern. et P. Guinet		
Leguminosae	*Canavalia*	*hirsutissima*	J.D. Sauer		
Leguminosae	*Canavalia*	*villosa*	Benth.		
Leguminosae	*Cologania*	*angustifolia*	Kunth		
Leguminosae	*Cologania*	*broussonetii*	(Balb.) DC.		
Leguminosae	*Conzattia*	*multiflora*	(Robinson) Standl.		
Leguminosae	*Conzattia*	*multiflora*	(Robinson) Standl.		
Leguminosae	*Coursetia*	*glandulosa*	A. Gray		

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Leguminosae	*Crotalaria*	*incana*	L.		
Leguminosae	*Crotalaria*	*longirostrata*	Hook. et Arn.		
Leguminosae	*Crotalaria*	*pumila*	Ortega		
Leguminosae	*Crotalaria*	*rotundifolia*	J.F. Gmel.		
Leguminosae	*Crotalaria*	*sagittalis*	L.		
Leguminosae	*Dalea*	*bicolor*	Willd.		
Leguminosae	*Dalea*	*caeciliae*	Harms		
Leguminosae	*Dalea*	*carthagenensis*	(Jacq.) J.F. Macbr.		
Leguminosae	*Dalea*	*carthagenensis*	J.F. Macbr.	var. *capitulata*	(Rydb.) Barneby
Leguminosae	*Dalea*	*greggii*	A. Gray		
Leguminosae	*Dalea*	*tomentosa*	(Cav.) Willd.		
Leguminosae	*Delonix*	*regia*	(Hook.) Raf.		
Leguminosae	*Desmanthus*	*painteri*	(Britton et Rose) Standl.		
Leguminosae	*Desmanthus*	*virgatus*	(L.) Willd.		
Leguminosae	*Desmodium*	*axillare*	(Sw.) DC.		
Leguminosae	*Desmodium*	*conzattii*	Greenm.		
Leguminosae	*Desmodium*	*glabrum*	(Mill.) DC.		
Leguminosae	*Desmodium*	*molliculum*	(Kunth) DC.		
Leguminosae	*Desmodium*	*orbiculare*	Schltdl.		
Leguminosae	*Desmodium*	*prehensile*	Schltdl.		
Leguminosae	*Desmodium*	*procumbens*	(Mill.) Hitchc.		
Leguminosae	*Desmodium*	*sericophyllum*	Schltdl.		
Leguminosae	*Desmodium*	*subsessile*	Schltdl.		
Leguminosae	*Desmodium*	*amplifolium*	Hemsl.		
Leguminosae	*Enterolobium*	*cyclocarpum*	(Jacq.) Griseb.		
Leguminosae	*Eriosema*	*pulchellum*	(Kunth) G. Don		
Leguminosae	*Erythrina*	*americana*	Mill.		
Leguminosae	*Erythrina*	*coralloides*	DC.		
Leguminosae	*Eysenhardtia*	*polystachya*	(Ortega) Sarg.		
Leguminosae	*Galactia*	*brachystachys*	Benth.		
Leguminosae	*Galactia*	*multiflora*	Robinson		
Leguminosae	*Haematoxylum*	*brasiletto*	H. Karst.		
Leguminosae	*Harpalyce*	*formosa*	DC.		
Leguminosae	*Hybosema*	*ehrenbergii*	(Schltdl.) Harms		
Leguminosae	*Indigofera*	*conzattii*	Rose		
Leguminosae	*Indigofera*	*densiflora*	M. Martens et Galeotti		
Leguminosae	*Indigofera*	*suffruticosa*	Mill.		
Leguminosae	*Leucaena*	*confertiflora*	Zarate		
Leguminosae	*Leucaena*	*diversifolia*	(Schltdl.) Benth.		
Leguminosae	*Leucaena*	*esculenta*	(DC.) Benth.		
Leguminosae	*Leucaena*	*lanceolata*	S. Watson		
Leguminosae	*Leucaena*	*leucocephala*	(Lam.) de Wit		
Leguminosae	*Leucaena*	*diversifolia*	(Schltdl.) Benth.		
Leguminosae	*lndigofera*	*miniata*	Ortega		

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Leguminosae	*Lupinus*	*uncinatus*	Schltdl.		
Leguminosae	*Lysiloma*	*acapulcense*	(Kunth) Benth.		
Leguminosae	*Lysiloma*	*divaricatum*	(Jacq.) J.F. Macbr.		
Leguminosae	*Macroptilium*	*atropurpureum*	(DC.) Urb.		
Leguminosae	*Medicago*	*polymorpha*	L.		
Leguminosae	*Medicago*	*sativa*	L.		
Leguminosae	*Melilotus*	*indicus*	(L.) All.		
Leguminosae	*Mimosa*	*albida*	Willd.		
Leguminosae	*Mimosa*	*lacerata*	Rose		
Leguminosae	*Mimosa*	*luisana*	Brandegee		
Leguminosae	*Nissolia*	*fruticosa*	Jacq.		
Leguminosae	*Nissolia*	*microptera*	Poir.		
Leguminosae	*Pachyrhizus*	*erosus*	Urb.		
Leguminosae	*Parkinsonia*	*praecox*	(Ruiz et Pav.) Hawkins		
Leguminosae	*Phaseolus*	*vulgaris*	L.		
Leguminosae	*Phaseolus*	*coccineus*	L.		
Leguminosae	*Piscidia*	*grandifolia*	(Donn. Sm.) I.M. Johnst.		
Leguminosae	*Pisum*	*sativum*	L.		
Leguminosae	*Pithecellobium*	*dulce*	(Roxb.) Benth.		
Leguminosae	*Prosopis*	*laevigata*	(Willd.) M.C. Johnst.		
Leguminosae	*Rhynchosia*	*longeracemosa*	M. Martens et Galeotti		
Leguminosae	*Rhynchosia*	*pringlei*	Rose		
Leguminosae	*Rhynchosia*	*pyramidalis*	(Lam.) Urb.		
Leguminosae	*Rhynchosia*	*senna*	Hook.		
Leguminosae	*Senna*	*apiculata*	(M. Martens et Galeotti) H.S. Irwin		
Leguminosae	*Senna*	*atomaria*	(L.) H.S. Irwin et Barneby		
Leguminosae	*Senna*	*guatemalensis*	(Donn. Sm.) H.S. Irwin et Barneby		
Leguminosae	*Senna*	*unijuga*	(Rose) H.S. Irwin et Barneby		
Leguminosae	*Senna*	*wislizenii*	(L.) Roxb.		
Leguminosae	*Senna*	*holwayana*	(Rose) H.S. Irwin et Barneby		
Leguminosae	*Sophora*	*secundiflora*	(Ortega) DC.		
Leguminosae	*Sphinga*	*acatlensis*	(Benth.) Barneby et J.W. Grimes		
Leguminosae	*Tamarindus*	*indica*	L.		
Leguminosae	*Tephrosia*	*nicaraguensis*	Oerst.		
Leguminosae	*Vicia*	*faba*	L.		
Leguminosae	*Zapoteca*	*formosa*	(Kunth) H.M. Hern.		
Leguminosae	*Zornia*	*reticulata*	Sm.		
Lentibulariaceae	*Pinguicula*	*moranensis*	Kunth		
Loasaceae	*Eucnide*	*grandiflora*	(Groenl.) Rose		
Loasaceae	*Gronovia*	*scandens*	L.		
Loasaceae	*Mentzelia*	*hispida*	Willd.		
Loganiaceae	*Plocosperma*	*buxifolium*	Benth.		

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Loranthaceae	*Phoradendron*	*californicum*	Nutt.		
Loranthaceae	*Phoradendron*	*dipterum*	Eichler		
Lythraceae	*Cuphea*	*aequipetala*	Cav.		
Lythraceae	*Cuphea*	*wrightii*	A. Gray		
Lythraceae	*Punica*	*granatum*	L.		
Malpighiaceae	*Bunchosia*	*biocellata*	Schltdl.		
Malpighiaceae	*Bunchosia*	*palmeri*	S. Watson		
Malpighiaceae	*Byrsonima*	*cinerea*	(Poir.) DC.		
Malpighiaceae	*Calcicola*	*parvifolia*	(A. Juss.) W.R. Anderson et C. Davis		
Malpighiaceae	*Echinopterys*	*eglandulosa*	(A. Juss.) Small		
Malpighiaceae	*Galphimia*	*glauca*	Cav.		
Malpighiaceae	*Gaudichaudia*	*galeottiana*	(Nied.) Chodat		
Malvaceae	*Althaea*	*officinalis*	L.		
Malvaceae	*Anoda*	*crenatiflora*	Ortega		
Malvaceae	*Anoda*	*cristata*	(L.) Schltdl.		
Malvaceae	*Anoda*	*guatemalensis*	Fryxell		
Malvaceae	*Bastardia*	*viscosa*	(L.) Kunth		
Malvaceae	*Ceiba*	*aesculifolia*	(Kunth) Britten et Baker f.		
Malvaceae	*Ceiba*	*aesculifolia*	(Kunth) Britten et Baker f.	subsp. *parvifolia*	(Rose) P.E. Gibbs et Semir
Malvaceae	*Gossypium*	*hirsutum*	L.		
Malvaceae	*Guazuma*	*ulmifolia*	Lam.		
Malvaceae	*Heliocarpus*	*terebinthaceus*	L.		
Malvaceae	*Heliocarpus*	*velutina*	L.		
Malvaceae	*Herissantia*	*crispa*	(L.) Brizicky		
Malvaceae	*Hibiscus*	*elegans*	Standl.		
Malvaceae	*Hibiscus*	*phoenicus*	L.		
Malvaceae	*Hibiscus*	*rosa-sinensis*	L.		
Malvaceae	*Kearnemalvastrum*	*lacteum*	(Aiton) D.M. Bates		
Malvaceae	*Lavatera*	*trimestris*	L.		
Malvaceae	*Malva*	*parviflora*	L.		
Malvaceae	*Malvastrum*	*bicuspidatum*	(S. Watson) Rose		
Malvaceae	*Melochia*	*pyramidata*	L.		
Malvaceae	*Melochia*	*tomentosa*	L.		
Malvaceae	*Rhynchosida*	*physocalyx*	(A. Gray) Fryxell		
Malvaceae	*Robinsonella*	*chiangii*	Fryxell		
Malvaceae	*Robinsonella*	*speciosa*	Fryxell		
Malvaceae	*Sida*	*acuta*	Burm.f.		
Malvaceae	*Sida*	*ciliaris*	L.		
Malvaceae	*Sida*	*glabra*	Mill.		
Malvaceae	*Sida*	*rhombifolia*	L.		
Malvaceae	*Sidastrum*	*tehuacanum*	(Brandegee) Fryxell		
Malvaceae	*Waltheria*	*americana*	L.		

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Marantaceae	*Maranta*	*leuconeura*	E. Morren		
Marantaceae	*Thalia*	*geniculata*	L.		
Meliaceae	*Cedrela*	*aoxacensis*	C. DC. et Rose		
Meliaceae	*Cedrela*	*odorata*	L.		
Meliaceae	*Melia*	*azedarach*	L.		
Moraceae	*Ficus*	*carica*	L.		
Moraceae	*Ficus*	*cotinifolia*	Kunth		
Moraceae	*Ficus*	*crocata*	Mart. ex Miq.		
Moraceae	*Ficus*	*petiolaris*	Kunth		
Moraceae	*Ficus*	*trigonata*	L.		
Moraceae	*Ficus*	*punctata*	Thunb.		
Moraceae	*Ficus*	*velutina*	Humb. et Bonpl. ex Willd.		
Moraceae	*Maclura*	*tinctoria*	(L.) D. Don ex Steud.		
Moraceae	*Morus*	*alba*	L.		
Moraceae	*Morus*	*celtidifolia*	Kunth		
Myricaceae	*Morella*	*cerifera*	(L.) Small		
Myrtaceae	*Eucalyptus*	*globulus*	Labill.		
Myrtaceae	*Psidium*	*guajava*	L.		
Nephrolepidaceae	*Nephrolepis*	*exaltata*	(L.) Schott		
Nyctaginaceae	*Boerhavia*	*scandens*	L.		
Nyctaginaceae	*Bougainvillea*	*spectabilis*	Willd.		
Nyctaginaceae	*Mirabilis*	*glabrifolia*	(Ortega) I.M. Johnst.		
Nyctaginaceae	*Mirabilis*	*jalapa*	L.		
Nyctaginaceae	*Okenia*	*hypogaea*	Schltdl. et Cham.		
Oleaceae	*Fraxinus*	*purpusii*	Brandegee		
Oleaceae	*Fraxinus*	*uhdei*	(Wenz.) Lingelsh.		
Oleaceae	*Jasminum*	*mesnyi*	Hance		
Oleaceae	*Jasminum*	*sambac*	(L.) Aiton		
Oleaceae	*Ligustrum*	*japonicum*	Thunb.		
Onagraceae	*Fuchsia*	*encliandra*	(Zucc.) Steud.		
Onagraceae	*Gaura*	*coccinea*	Nutt. ex Pursh		
Onagraceae	*Ludwigia*	*octovalvis*	(Jacq.) P.H. Raven		
Onagraceae	*Oenothera*	*laciniata*	Hill		
Onagraceae	*Oenothera*	*pubescens*	Willd. ex Spreng.		
Opiliaceae	*Agonandra*	*obtusifolia*	Standl.		
Opiliaceae	*Agonandra*	*racemosa*	(DC.) Standl.		
Orchidaceae	*Barkeria*	*lindleyana*	Bateman ex Lindl.		
Orchidaceae	*Dichromanthus*	*cinnabarinus*	(Lex.) Garay		
Orchidaceae	*Domingoa*	*purpurea*	(Lindl.) Van den Berg et Soto Arenas		
Orchidaceae	*Laelia*	*albida*	Bateman ex Lindl.		
Orchidaceae	*Prosthechea*	*pterocarpa*	(Lindl.) W.E. Higgins		
Orchidaceae	*Rhynchostele*	*aptera*	(Lex.) Soto Arenas et Salazar		
Orchidaceae	*Rhynchostele*	*maculata*	(Lex.) Soto Arenas et Salazar		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Orobanchaceae	*Conopholis*	*alpina*	Liebm.		
Oxalidaceae	*Oxalis*	*alpina*	(Rose) Rose ex R. Knuth		
Oxalidaceae	*Oxalis*	*bipartita*	A. St.-Hil.		
Oxalidaceae	*Oxalis*	*discolor*	Klotzsch		
Oxalidaceae	*Oxalis*	*divergens*	Benth. ex Lindl.		
Papaveraceae	*Argemone*	*mexicana*	L.		
Papaveraceae	*Bocconia*	*arborea*	S. Watson		
Passifloraceae	*Turnera*	*diffusa*	Willd. ex Schult.		
Passifloraceae	*Turnera*	*ulmifolia*	L.		
Pedaliaceae	*Martynia*	*annua*	L.		
Pedaliaceae	*Proboscidea*	*fragrans*	(Lindl.) Decne.		
Pedaliaceae	*Proboscidea*	*louisianica*	(Mill.) Thell.		
Phytolaccaceae	*Phytolacca*	*icosandra*	L.		
Phytolaccaceae	*Rivina*	*humilis*	L.		
Pinaceae	*Pinus*	*herrerae*	Martínez		
Pinaceae	*Pinus*	*lawsonii*	Roezl ex Gordon		
Pinaceae	*Pinus*	*montezumae*	Lamb.		
Pinaceae	*Pinus*	*oocarpa*	Schiede		
Pinaceae	*Pinus*	*pringlei*	Shaw		
Pinaceae	*Pinus*	*pseudostrobus*	Lindl.		
Pinaceae	*Pinus*	*pseudostrobus*	Lindl.	var. *apulcensis*	(Lindl.) Shaw
Pinaceae	*Pinus*	*strobus*	L.		
Pinaceae	*Pinus*	*devoniana*	Lindl.		
Piperaceae	*Peperomia*	*campylotropa*	A.W. Hill		
Piperaceae	*Peperomia*	*umbilicata*	Ruiz et Pav.		
Piperaceae	*Peperomia*	*urocarpa*	Fisch. et C.A. Mey.		
Piperaceae	*Piper*	*amalago*	L.		
Piperaceae	*Piper*	*auritum*	Kunth		
Piperaceae	*Piper*	*sanctum*	(Miq.) Schltdl. ex C.DC.		
Plantaginaceae	*Plantago*	*australis*	Lam.		
Plantaginaceae	*Plantago*	*major*	L.		
Plumbaginaceae	*Plumbago*	*pulchella*	Boiss.		
Plumbaginaceae	*Plumbago*	*zeylanica*	L.		
Poaceae	*Aegopogon*	*cenchroides*	Humb. et Bonpl. ex Willd.		
Poaceae	*Aegopogon*	*tenellus*	(DC.) Trin.		
Poaceae	*Agrostis*	*ghiesbreghtii*	E. Fourn.		
Poaceae	*Andropogon*	*glomeratus*	(Walter) Britton, Sterns et Poggenb.		
Poaceae	*Anthephora*	*hermaphrodita*	(L.) Kuntze		
Poaceae	*Aristida*	*adscensionis*	L.		
Poaceae	*Aristida*	*curvifolia*	E. Fourn.		
Poaceae	*Aristida*	*divaricata*	Humb. et Bonpl. ex Willd.		
Poaceae	*Aristida*	*glauca*	(Nees) Walp.		
Poaceae	*Aristida*	*jorullensis*	Kunth		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Poaceae	*Aristida*	*schiedeana*	Trin. et Rupr.		
Poaceae	*Aristida*	*ternipes*	Cav.		
Poaceae	*Aristida*	*flaccida*	Trin. et Rupr.		
Poaceae	*Arundo*	*donax*	Forssk.		
Poaceae	*Avena*	*fatua*	L.		
Poaceae	*Avena*	*sativa*	L.		
Poaceae	*Bothriochloa*	*barbinodis*	(Lag.) Herter		
Poaceae	*Bothriochloa*	*laguroides*	(DC.) Herter		
Poaceae	*Bothriochloa*	*saccharoides*	(Sw.) Rydb.		
Poaceae	*Bothriochloa*	*springfieldii*	(Gould) Parodi		
Poaceae	*Bouteloua*	*aristidoides*	(Kunth) Griseb.		
Poaceae	*Bouteloua*	*barbata*	Lag.		
Poaceae	*Bouteloua*	*chondrosioides*	(Kunth) Benth. ex S. Watson		
Poaceae	*Bouteloua*	*curtipendula*	(Michx.) Torr.		
Poaceae	*Bouteloua*	*distans*	Swallen		
Poaceae	*Bouteloua*	*media*	(E. Fourn.) Gould et Kapadia		
Poaceae	*Bouteloua*	*pedicellata*	Swallen		
Poaceae	*Bouteloua*	*radicosa*	(E. Fourn.) Griffiths		
Poaceae	*Bouteloua*	*repens*	(Kunth) Scribn. et Merr.		
Poaceae	*Bouteloua*	*simplex*	Lag.		
Poaceae	*Bouteloua*	*triaena*	(Trin.) Scribn.		
Poaceae	*Bouteloua*	*uniflora*	Vasey		
Poaceae	*Bouteloua*	*aristidoides*	(Kunth) Griseb.		
Poaceae	*Brachiaria*	*fasciculata*	(Sw.) Parodi		
Poaceae	*Brachiaria*	*meziana*	Hitchc.		
Poaceae	*Brachiaria*	*mollis*	(Sw.) Parodi		
Poaceae	*Brachiaria*	*fasciculata*	(Sw.) Parodi		
Poaceae	*Brachypodium*	*mexicanum*	(Roem. et Schult.) Link		
Poaceae	*Briza*	*minor*	L.		
Poaceae	*Briza*	*subaristata*	Lam.		
Poaceae	*Bromus*	*anomalus*	E. Fourn.		
Poaceae	*Bromus*	*carinatus*	Hook. et Arn.		
Poaceae	*Bromus*	*exaltatus*	Bernh.		
Poaceae	*Buchloe*	*dactyloides*	(Nutt.) Engelm.		
Poaceae	*Cathestecum*	*brevifolium*	Swallen		
Poaceae	*Cathestecum*	*erectum*	Vasey et Hack.		
Poaceae	*Cathestecum*	*prostratum*	J.Presl		
Poaceae	*Cathestecum*	*varium*	Swallen		
Poaceae	*Cenchrus*	*ciliaris*	L.		
Poaceae	*Cenchrus*	*echinatus*	L.		
Poaceae	*Cenchrus*	*incertus*	M.A. Curtis		
Poaceae	*Cenchrus*	*multiflorus*	J. Presl		
Poaceae	*Cenchrus*	*myosuroides*	Kunth		
Poaceae	*Cenchrus*	*pilosus*	Kunth		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Poaceae	*Cenchrus*	*tribuloides*	L.		
Poaceae	*Chloris*	*ciliata*	Sw.		
Poaceae	*Chloris*	*radiata*	(L.) Sw.		
Poaceae	*Chloris*	*rufescens*	Steud.		
Poaceae	*Chloris*	*submutica*	Kunth		
Poaceae	*Chloris*	*virgata*	Sw.		
Poaceae	*Chloris*	*rufescens*	Lag.		
Poaceae	*Chondrosum*	*scorpioides*	(Lag.) Kunth		
Poaceae	*Chondrosum*	*simplex*	(Lag.) Kunth		
Poaceae	*Chondrosum*	*hirsutum*	(Lag.) Sweet		
Poaceae	*Cottea*	*pappophoroides*	Kunth		
Poaceae	*Cymbopogon*	*citratus*	(DC.) Stapf		
Poaceae	*Cynodon*	*dactylon*	(L.) Pers.		
Poaceae	*Dactyloctenium*	*aegypticum*	(L.) Willd.		
Poaceae	*Deschampsia*	*liebmanniana*	(E. Fourn.) Hitchc.		
Poaceae	*Digitaria*	*bicornis*	(Lam.) Roem. et Schult.		
Poaceae	*Digitaria*	*californica*	(Benth.) Henrard		
Poaceae	*Digitaria*	*ciliaris*	(Retz.) Koeler		
Poaceae	*Digitaria*	*insularis*	(L.) Mez ex Ekman		
Poaceae	*Digitaria*	*leucitis*	(Trin.) Henrard		
Poaceae	*Distichlis*	*spicata*	(L.) Greene		
Poaceae	*Echinochloa*	*colona*	(L.) Link		
Poaceae	*Echinochloa*	*crus-galli*	(L.) P. Beauv.		
Poaceae	*Echinochloa*	*oplismenoides*	(E. Fourn.) Hitchc.		
Poaceae	*Eleusine*	*multiflora*	Hochst. ex A. Rich.		
Poaceae	*Elionurus*	*tripsacoides*	Willd.		
Poaceae	*Elymus*	*longifolius*	(J.G. Sm.) Gould		
Poaceae	*Elymus*	*repens*	(L.) Gould		
Poaceae	*Enneapogon*	*desvauxii*	P. Beauv.		
Poaceae	*Enteropogon*	*chlorideus*	(J. Presl) Clayton		
Poaceae	*Eragrostis*	*atrovirens*	Lange		
Poaceae	*Eragrostis*	*barrelieri*	Daveau		
Poaceae	*Eragrostis*	*cilianensis*	(All.) Janch.		
Poaceae	*Eragrostis*	*ciliaris*	(L.) R. Br.		
Poaceae	*Eragrostis*	*intermedia*	Hitchc.		
Poaceae	*Eragrostis*	*lugens*	Nees		
Poaceae	*Eragrostis*	*maypurensis*	(Kunth) Steud.		
Poaceae	*Eragrostis*	*mexicana*	(Hornem.) Link		
Poaceae	*Eragrostis*	*pectinacea*	(Michx.) Nees		
Poaceae	*Eragrostis*	*pilosa*	(L.) P. Beauv.		
Poaceae	*Eragrostis*	*swallenii*	Hitchc.		
Poaceae	*Eragrostis*	*tephrosanthos*	Roem. et Schult.		
Poaceae	*Eriochloa*	*nelsonii*	Scribn. et J.G. Sm.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Poaceae	*Erioneuron*	*avenaceum*	(Humb., Bonpl. et Kunth) Tateoka		
Poaceae	*Erioneuron*	*avenaceum*	(Humb., Bonpl. et Kunth) Tateoka	var. *grandiflorum*	(Vasey) Gould
Poaceae	*Festuca*	*amplissima*	Rupr. ex Galeotti		
Poaceae	*Festuca*	*callosa*	(Piper) St.-Yves		
Poaceae	*Festuca*	*lugens*	(E. Fourn.) Hitchc. ex Hern.-Xol.		
Poaceae	*Griffithsochloa*	*multifida*	(Griffiths) G.J. Pierce		
Poaceae	*Heteropogon*	*contortus*	(L.) P. Beauv. ex Roem. et Schult.		
Poaceae	*Hilaria*	*cenchroides*	Kunth		
Poaceae	*Hordeum*	*vulgare*	L.		
Poaceae	*Ichnanthus*	*pallens*	(Sw.) Munro ex Benth.		
Poaceae	*Lasiacis*	*divaricata*	(L.) Hitchc.		
Poaceae	*Lasiacis*	*nigra*	Davidse		
Poaceae	*Lasiacis*	*ruscifolia*	(Kunth) Hitchc. ex Chase		
Poaceae	*Leersia*	*hexandra*	Sw.		
Poaceae	*Leptochloa*	*dubia*	(Kunth) Nees		
Poaceae	*Leptochloa*	*fusca*	(L.) Kunth	subsp. *uninervia*	(J. Presl) N.Snow
Poaceae	*Leptochloa*	*panicoides*	(J. Presl) Hitchc.		
Poaceae	*Leptochloa*	*mucronata*	(Michx.) Kunth		
Poaceae	*Lolium*	*perenne*	L.		
Poaceae	*Lycurus*	*phleoides*	Kunth		
Poaceae	*Melinis*	*repens*	(Willd.) Zizka		
Poaceae	*Metcalfia*	*mexicana*	(Scribn.) Conert		
Poaceae	*Microchloa*	*kunthii*	Desv.		
Poaceae	*Muhlenbergia*	*ciliata*	(Kunth) Kunth		
Poaceae	*Muhlenbergia*	*depauperata*	Scribn.		
Poaceae	*Muhlenbergia*	*distans*	Swallen		
Poaceae	*Muhlenbergia*	*distichophylla*	(J. Presl) Kunth		
Poaceae	*Muhlenbergia*	*emersleyi*	Vasey		
Poaceae	*Muhlenbergia*	*gigantea*	(E. Fourn.) Hitchc.		
Poaceae	*Muhlenbergia*	*implicata*	(Kunth) Trin.		
Poaceae	*Muhlenbergia*	*longiligula*	Hitchc.		
Poaceae	*Muhlenbergia*	*macroura*	(Humb., Bonpl. et Kunth) Hitchc.		
Poaceae	*Muhlenbergia*	*microsperma*	(DC.) Trin.		
Poaceae	*Muhlenbergia*	*montana*	(Nutt.) Hitchc		
Poaceae	*Muhlenbergia*	*pubescens*	(Humb., Bonpl. et Kunth) Hitchc.		
Poaceae	*Muhlenbergia*	*repens*	(J. Presl) Hitchc.		
Poaceae	*Muhlenbergia*	*rigida*	(Kunth) Kunth		
Poaceae	*Muhlenbergia*	*robusta*	(E. Fourn.) Hitchc.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Poaceae	*Muhlenbergia*	*spiciformis*	Trin.		
Poaceae	*Muhlenbergia*	*tenella*	(Kunth) Trin.		
Poaceae	*Muhlenbergia*	*tenuifolia*	(Kunth) Kunth		
Poaceae	*Muhlenbergia*	*vaginata*	Swallen		
Poaceae	*Muhlenbergia*	*versicolor*	Swallen		
Poaceae	*Muhlenbergia*	*dubia*	E. Fourn.		
Poaceae	*Nassella*	*lepida*	(Hitchc.) Barkworth		
Poaceae	*Nassella*	*linearifolia*	(E. Fourn.) R.W. Pohl		
Poaceae	*Nassella*	*mucronata*	(Kunth) R.W. Pohl		
Poaceae	*Nassella*	*tenuissima*	(Trin.) Barkworth		
Poaceae	*Opizia*	*stolonifera*	J. Presl		
Poaceae	*Oplismenus*	*burmannii*	(Retz.) P. Beauv.		
Poaceae	*Oplismenus*	*compositus*	(L.) P. Beauv.		
Poaceae	*Otatea*	*acuminata*	(Munro) C.E. Calderón ex Soderstr.		
Poaceae	*Panicum*	*bulbosum*	Kunth		
Poaceae	*Panicum*	*decolorans*	Kunth		
Poaceae	*Panicum*	*ghiesbreghtii*	E. Fourn.		
Poaceae	*Panicum*	*hallii*	Vasey		
Poaceae	*Panicum*	*hirticaule*	J. Presl		
Poaceae	*Panicum*	*laxiflorum*	Lam.		
Poaceae	*Panicum*	*maximum*	Jacq.		
Poaceae	*Panicum*	*obtusum*	Kunth		
Poaceae	*Panicum*	*virgatum*	L.		
Poaceae	*Pappophorum*	*pappiferum*	(Lam.) Kuntze		
Poaceae	*Paspalum*	*botterii*	(E. Fourn.) Chase		
Poaceae	*Paspalum*	*conjugatum*	P.J. Bergius		
Poaceae	*Paspalum*	*distichum*	L.		
Poaceae	*Paspalum*	*humboldtianum*	Flüggé		
Poaceae	*Paspalum*	*langei*	(E. Fourn.) Nash		
Poaceae	*Paspalum*	*notatum*	Flüggé		
Poaceae	*Paspalum*	*pubiflorum*	E. Fourn.		
Poaceae	*Paspalum*	*denticulatum*	Trin.		
Poaceae	*Pennisetum*	*crinitum*	(Kunth) Spreng.		
Poaceae	*Pennisetum*	*distachyum*	(E. Fourn.) Rupr. ex Chase		
Poaceae	*Phalaris*	*canariensis*	L.		
Poaceae	*Piptochaetium*	*angustifolium*	(Hitchc.) Valencia et Costas		
Poaceae	*Piptochaetium*	*fimbriatum*	(Humb., Bonpl. et Kunth) Hitchc.		
Poaceae	*Piptochaetium*	*virescens*	(Humb., Bonpl. et Kunth) Parodi		
Poaceae	*Poa*	*annua*	L.		
Poaceae	*Polypogon*	*interruptus*	Kunth		
Poaceae	*Polypogon*	*viridis*	(Gouan) Breistr.		
Poaceae	*Pringleochloa*	*stolonifera*	(E. Fourn.) Scribn.		

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Poaceae	*Saccharum*	*officinarum*	L.		
Poaceae	*Schizachyrium*	*sanguineum*	(Retz.) Alston		
Poaceae	*Schizachyrium*	*tenerum*	Nees		
Poaceae	*Setaria*	*italica*	(L.) P. Beauv.		
Poaceae	*Setaria*	*leucopila*	(Scribn. et Merr.) K. Schum.		
Poaceae	*Setaria*	*liebmannii*	E. Fourn.		
Poaceae	*Setaria*	*macrostachya*	Kunth		
Poaceae	*Setaria*	*parviflora*	(Poir.) M. Kerguelen		
Poaceae	*Setaria*	*tenax*	Rich.) Desv.		
Poaceae	*Setaria*	*viridis*	(L.) P. Beauv.		
Poaceae	*Setaria*	*grisebachii*	E. Fourn.		
Poaceae	*Setaria*	*verticillata*	(L.) P. Beauv.		
Poaceae	*Setariopsis*	*latiglumis*	(Vasey) Scribn.		
Poaceae	*Sorghastrum*	*nutans*	(L.) Nash		
Poaceae	*Sorghum*	*bicolor*	(L.) Moench		
Poaceae	*Sorghum*	*halepense*	(L.) Pers.		
Poaceae	*Sporobolus*	*airoides*	(Torr.) Torr.		
Poaceae	*Sporobolus*	*atrovirens*	(Kunth) Kunth		
Poaceae	*Sporobolus*	*buckleyi*	Vasey		
Poaceae	*Sporobolus*	*indicus*	(L.) R. Br.		
Poaceae	*Sporobolus*	*pyramidalis*	P. Beauv.		
Poaceae	*Sporobolus*	*pyramidatus*	(Lam.) C.L. Hitchc.		
Poaceae	*Sporobolus*	*trichodes*	Hitchc.		
Poaceae	*Stipa*	*constricta*	Hitchc.		
Poaceae	*Stipa*	*editorum*	E. Fourn.		
Poaceae	*Stipa*	*eminens*	Cav.		
Poaceae	*Stipa*	*ichu*	(Ruiz et Pav.) Kunth		
Poaceae	*Trachypogon*	*spicatus*	(L.f.) Kuntze		
Poaceae	*Tragus*	*berteronianus*	Schult.		
Poaceae	*Trichloris*	*pluriflora*	E. Fourn.		
Poaceae	*Tripsacum*	*dactyloides*	(L.) L.		
Poaceae	*Tripsacum*	*zopilotense*	Hern.-Xol. et Randolph		
Poaceae	*Trisetum*	*irazuense*	(Kuntze) Hitchc.		
Poaceae	*Triticum*	*aestivum*	L.		
Poaceae	*Zea*	*mays*	L.		
Poaceae	*Zeugites*	*americana*	Willd.		
Polemoniaceae	*Loeselia*	*coerulea*	(Cav.) G. Don		
Polemoniaceae	*Loeselia*	*glandulosa*	(Cav.) G. Don		
Polemoniaceae	*Loeselia*	*purpusii*	Brandegee		
Polemoniaceae	*Polemonium*	*caeruleum*	L.		
Polygalaceae	*Polygala*	*cuspidulata*	S.F. Blake		
Polygalaceae	*Polygala*	*scoparia*	Kunth		
Polygonaceae	*Antigonon*	*leptopus*	Hook. et Arn.		
Polygonaceae	*Polygonum*	*hydropiperoides*	Michx.		

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Polygonaceae	*Polygonum*	*lapathifolium*	L.		
Polygonaceae	*Rumex*	*acetosella*	L.		
Polygonaceae	*Rumex*	*crispus*	L.		
Polygonaceae	*Ruprechtia*	*fusca*	Fernald		
Portulacaceae	*Portulaca*	*grandiflora*	Hook.		
Portulacaceae	*Portulaca*	*oleracea*	L.		
Portulacaceae	*Portulaca*	*pilosa*	L.		
Portulacaceae	*Talinum*	*paniculatum*	Ruiz et Pav.		
Primulaceae	*Anagallis*	*arvensis*	L.		
Primulaceae	*Myrsine*	*juergensenii*	(Mez) Ricketson et Pipoly		
Ranunculaceae	*Anemone*	*mexicana*	Kunth		
Ranunculaceae	*Ranunculus*	*petiolaris*	Humb., Bonpl. et Kunth ex DC.		
Ranunculaceae	*Thalictrum*	*gibbosum*	Lecoy.		
Rhamnaceae	*Ceanothus*	*greggii*	A. Gray		
Rhamnaceae	*Karwinskia*	*mollis*	Schltdl.		
Rhamnaceae	*Rhamnus*	*humboldtiana*	Willd. ex Schult.		
Rhamnaceae	*Ziziphus*	*amole*	(Sessé et Moc.) M.C. Johnst.		
Rhamnaceae	*Ziziphus*	*pedunculata*	(Brandegee) Standl.		
Rosaceae	*Crataegus*	*mexicana*	D. Don		
Rosaceae	*Crataegus*	*orientalis*	Pall. ex M. Bieb.	subsp. *presliana*	K.I.Chr.
Rosaceae	*Malacomeles*	*denticulata*	(Kunth) G.N. Jones		
Rosaceae	*Prunus*	*dulcis*	(Mill.) D.A. Webb		
Rosaceae	*Prunus*	*armeniaca*	L.		
Rosaceae	*Prunus*	*persica*	(L.) Stokes		
Rosaceae	*Prunus*	*virginiana*	L.		
Rosaceae	*Rosa*	*centifolia*	Lour.		
Rosaceae	*Rosa*	*gallica*	L.		
Rosaceae	*Rubus*	*adenotrichus*	Schltdl.		
Rosaceae	*Rubus*	*liebmannii*	Focke		
Rubiaceae	*Bouvardia*	*longiflora*	(Cav.) Kunth		
Rubiaceae	*Bouvardia*	*ternifolia*	(Cav.) Schltdl.		
Rubiaceae	*Chiococca*	*alba*	(L.) Hitchc.		
Rubiaceae	*Crusea*	*diversifolia*	(Kunth) W.R. Anderson		
Rubiaceae	*Galium*	*fuscum*	M. Martens et Galeotti		
Rubiaceae	*Galium*	*mexicanum*	Kunth		
Rubiaceae	*Galium*	*triflorum*	Michx.		
Rubiaceae	*Randia*	*capitata*	DC.		
Rubiaceae	*Richardia*	*scabra*	L.		
Rutaceae	*Casimiroa*	*edulis*	La Llave		
Rutaceae	*Esenbeckia*	*macrantha*	Rose		
Rutaceae	*Ptelea*	*trifoliata*	L.		
Rutaceae	*Ruta*	*chalepensis*	L.		
Salicaceae	*Populus*	*alba*	L.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Salicaceae	*Salix*	*bonplandiana*	Kunth		
Salicaceae	*Salix*	*humboldtiana*	Willd.		
Salicaceae	*Salix*	*nigra*	Marshall		
Sapindaceae	*Cardiospermum*	*halicacabum*	L.		
Sapindaceae	*Dodonaea*	*viscosa*	(L.) Jacq.		
Sapindaceae	*Sapindus*	*saponaria*	L.		
Saxifragaceae	*Pterostemon*	*rotundifolius*	Ramírez		
Scrophulariaceae	*Bacopa*	*monnieri*	(L.) Wettst.		
Scrophulariaceae	*Berendtiella*	*levigata*	(B.L. Rob. et Greenm.) Thieret		
Scrophulariaceae	*Buddleja*	*cordata*	Kunth		
Scrophulariaceae	*Buddleja*	*parviflora*	Kunth		
Scrophulariaceae	*Capraria*	*biflora*	L.		
Scrophulariaceae	*Castilleja*	*arvensis*	Schltdl. et Cham.		
Scrophulariaceae	*Lamourouxia*	*dasyantha*	(Cham. et Schltdl.) W.R. Ernst		
Scrophulariaceae	*Lamourouxia*	*nelsonii*	B.L. Rob. et Greenm.		
Scrophulariaceae	*Lamourouxia*	*viscosa*	Kunth		
Scrophulariaceae	*Penstemon*	*barbatus*	(Cav.) Roth		
Scrophulariaceae	*Penstemon*	*campanulatus*	Cav.) Willd.		
Scrophulariaceae	*Russelia*	*obtusata*	S.F. Blake		
Scrophulariaceae	*Schistophragma*	*pusillum*	Benth.		
Scrophulariaceae	*Veronica*	*polita*	Fr.		
Simaroubaceae	*Castela*	*tortuosa*	Liebm.		
Solanaceae	*Datura*	*discolor*	Bernh.		
Solanaceae	*Brugmansia*	*suaveolens*	(Humb. et Bonpl. ex Willd.) Bercht. et J. Presl		
Solanaceae	*Capsicum*	*annuum*	L.		
Solanaceae	*Cestrum*	*nocturnum*	L.		
Solanaceae	*Datura*	× *candida*	(Pers.) Saff.		
Solanaceae	*Datura*	*innoxia*	Mill.		
Solanaceae	*Datura*	*stramonium*	L.		
Solanaceae	*Jaltomata*	*procumbens*	(Cav.) J.L. Gentry		
Solanaceae	*Lycianthes*	*acapulcensis*	(Baill.) D'Arcy		
Solanaceae	*Lycopersicon*	*esculentum*	Mill.		
Solanaceae	*Margaranthus*	*solanaceous*	Schltdl.		
Solanaceae	*Nicotiana*	*glauca*	Graham		
Solanaceae	*Nicotiana*	*tabacum*	L.		
Solanaceae	*Petunia*	*hybrida*	Vilm.		
Solanaceae	*Physalis*	*foetens*	Poir.		
Solanaceae	*Physalis*	*nicandroides*	Schltdl.		
Solanaceae	*Physalis*	*philadelphica*	Lam.		
Solanaceae	*Solandra*	*grandiflora*	Sw.		
Solanaceae	*Solandra*	*maxima*	(Moc. et Sessé ex Dunal) P.S. Green		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Solanaceae	*Solanum*	*adscendens*	Sendtn.		
Solanaceae	*Solanum*	*agrimoniifolium*	Rydb.		
Solanaceae	*Solanum*	*americanum*	Mill.		
Solanaceae	*Solanum*	*bulbocastanum*	Dunal		
Solanaceae	*Solanum*	*dulcamaroides*	Dunal		
Solanaceae	*Solanum*	*lanceolatum*	Cav.		
Solanaceae	*Solanum*	*nigrescens*	M. Martens et Galeotti		
Solanaceae	*Solanum*	*rostratum*	Dunal		
Solanaceae	*Solanum*	*tridynamum*	Dunal		
Solanaceae	*Solanum*	*verbascifolium*	L.		
Solanaceae	*Solanum*	*asperolanatum*	Ruiz et Pav.		
Solanaceae	*Solanum*	*erianthum*	D. Don		
Solanaceae	*Solanum*	*nigricans*	M. Martens et Galeotti		
Styracaceae	*Styrax*	*argenteus*	C. Presl		
Taxodiaceae	*Taxodium*	*huegelii*	C. Lawso		
Tropaeolaceae	*Tropaeolum*	*majus*	L.		
Typhaceae	*Typha*	*domingensis*	Pers.		
Ulmaceae	*Celtis*	*caudata*	Planch.		
Ulmaceae	*Celtis*	*pallida*	Torr.		
Ulmaceae	*Trema*	*micrantha*	(L.) Blume		
Urticaceae	*Boehmeria*	*macrophylla*	Hornem.		
Urticaceae	*Parietaria*	*debilis*	G. Forst.		
Urticaceae	*Phenax*	*mexicanus*	Wedd.		
Urticaceae	*Pilea*	*trianthemoides*	(Sw.) Lindl.		
Verbenaceae	*Bouchea*	*prismatica*	(L.) Kuntze		
Verbenaceae	*Glandularia*	*elegans*	(Kunth) Umber		
Verbenaceae	*Glandularia*	*corymbosa*	(Ruiz et Pav.) N. O'Leary et P. Peralta		
Verbenaceae	*Lantana*	*achyranthifolia*	Desf.		
Verbenaceae	*Lantana*	*camara*	L.		
Verbenaceae	*Lantana*	*involucrata*	L.		
Verbenaceae	*Lantana*	*urticoides*	Hayek		
Verbenaceae	*Lantana*	*velutina*	M. Martens et Galeotti		
Verbenaceae	*Lantana*	*horrida*	Kunth		
Verbenaceae	*Lippia*	*oaxacana*	B.L. Rob. et Greenm.		
Verbenaceae	*Lippia*	*graveolens*	Kunth		
Verbenaceae	*Phyla*	*scaberrima*	(Juss. ex Pers.) Moldenke		
Verbenaceae	*Vitex*	*mollis*	Kunth		
Violaceae	*Hybanthus*	*attenuatus*	(Humb. et Bonpl. ex Schult.) Schulze-Menz		
Vitaceae	*Cissus*	*tiliacea*	Kunth		
Vitaceae	*Vitis*	*vinifera*	L.		
Xanthorrhoeaceae	*Aloe*	*vera*	(L.) Burm.f.		
Xanthorrhoeaceae	*Asphodelus*	*fistulosus*	L.		

Family	Genus	Specific epithet	Species authors	Infraspecific rank and epithet	Infraspecific taxon Authors
Zamiaceae	*Dioon*	*caputoi*	De Luca, Sabato et Vázq. Torres		
Zamiaceae	*Dioon*	*rzedowskii*	De Luca et al.		
Zygophyllaceae	*Kallstroemia*	*hirsutissima*	Vail		
Zygophyllaceae	*Kallstroemia*	*intermedia*	Rydb.		
Zygophyllaceae	*Morkillia*	*mexicana*	(DC.) Rose et Painter		

Appendix 2: Seed germination experiments carried out at the Fes-I UNAM Seed Bank (Fes-I) and at the RBG Kew's Millennium Seed Bank (MSB)

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
Acanthaceae	*Gypsacanthus nelsonii* E.J. Lott, V. Jaram. et Rzed.	Fes-I			30	12/12	58.9	0.4
Achatocarpaceae	*Phaulothamnus spinescens* A. Gray	Fes-I			30	12/12	46.0	0.5
Amaranthaceae	*Chenopodium murale* L.	Fes-I			30	12/12	85.0	0.2
		MSB	100		25	8/16	75	0.25
Amaranthaceae	*Gomphrena serrata* L.	MSB	14					
Amaranthaceae	*Iresine discolor* Greenm.	Fes-I			30	12/12	96.9	0.0
Anacardiaceae	*Actinocheita filicina* (Turckz.) Bullock	Fes-I			30	12/12	17.9	0.6
		MSB	85	Chipped with scalpel	25	8/16	50	0.5
Anacardiaceae	*Amphipterygium adstringens* (Schltdl.) Standl.	Fes-I			30	12/12	100.0	0.33
		MSB	27	Covering structure partially removed	35/20	8/16	67	
Anacardiaceae	*Cyrtocarpa procera* Kunth	Fes-I			30	12/12	50.0	0.5
		MSB	90	Scarify with mini saw	20	8/16	90	0.1
Apocynaceae	*Matelea trachyantha* (Greenm.) W.D. Stevens	Fes-I			30	12/12	94.0	0.1

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
Apocynaceae	*Vallesia glabra* (Cav.) Link	Fes-I			30	12/12	43.3	0.5
		MSB	95		25	8/16	95	0.05
Asparagaceae	*Agave karwinskii* Zucc.	Fes-I			30	12/12	27.3	0.7
Asparagaceae	*Agave kerchovei* Lem.	Fes-I			30	12/12	82.2	0.2
Asparagaceae	*Agave macroacantha* Zucc.	Fes-I			30	12/12	79.2	0.2
		MSB	85		20	8/16	62	0.38
Bignoniaceae	*Astianthus viminalis* (Kunth) Baill.	MSB	100		25	8/16	55	0.45
Bignoniaceae	*Tecoma stans* (L.) Juss. ex Kunth	Fes-I			30	12/12	68.3	0.0
		MSB	30		20	8/16	38	0.62
Boraginaceae	*Cordia bullata* (L.) Roem. et Schult. var. *globosa* (Jacq.) Govaerts	Fes-I			30	12/12	23.1	0.8
		MSB	60					
Boraginaceae	*Cordia curassavica* (Jacq.) Roem. et Schult.	Fes-I			30	12/12	6.4	0.9
		MSB	77	Covering structure partially removed	25	8/16	100	0
Bromeliaceae	*Hechtia podantha* Mez	Fes-I			30	12/12	100.0	0.0
		MSB	54		25	8/16	100	0
Bromeliaceae	*Hechtia roseana* L.B.Sm.	Fes-I			30	12/12	13.3	0.9
Burseraceae	*Bursera aptera* Ramirez	Fes-I			30	12/12	0.0	1.0
		MSB	65					
Burseraceae	*Bursera fagaroides* (Kunth) Engl.	Fes-I			30	12/12	100.0	0.0
		MSB	50					
Burseraceae	*Bursera morelensis* Ramirez	MSB	45					
Burseraceae	*Bursera submoniliformis* Engl.	Fes-I			30	12/12	15.4	0.8
		MSB	30	Remove flesh from fruit	20	8/16	17	0.83
Cactaceae	*Escontria chiotilla* (F.A.C. Weber) Rose	Fes-I			30	12/12	96.7	0.0

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
		MSB	95		20	8/16	95	0.05
Cactaceae	*Ferocactus recurvus* (Karw. ex Pfeiff) N.P. Taylor	Fes-I			30	12/12	70.0	0.2
		MSB	91					
Cactaceae	*Myrtillocactus geometrizans* (Mart. ex Pfeiff) Console	Fes-I			30	12/12	70.0	0.2
		MSB	68					
Cactaceae	*Opuntia decumbens* Salm-Dyck	Fes-I			30	12/12	30.0	0.7
		MSB	95					
Cactaceae	*Opuntia depressa* Rose	Fes-I			30	12/12	23.3	0.8
Cactaceae	*Opuntia pilifera* F.A.C. Weber	Fes-I			30	12/12	65.0	0.4
		MSB	95					
Cactaceae	*Opuntia velutina* F.A.C. Weber	Fes-I			30	12/12	23.3	0.8
Cactaceae	*Pachycereus weberi* (J.M. Coult) Backeb.	Fes-I			30	12/12	81.7	0.2
Cactaceae	*Polaskia chichipe* (Gosselin) Backeb.	Fes-I			30	12/12	98.2	0.0
Cactaceae	*Stenocereus pruinosus* (Otto ex Pfeiff.) Buxb.	Fes-I			30	12/12	90.0	0.0
Cactaceae	*Stenocereus stellatus* (Pfeiff.) Riccob.	Fes-I			30	12/12	100.0	0.0
		MSB	89					
Cannabaceae	*Celtis pallida* Torr.	Fes-I			30	12/12	70.0	0.3
Cannabaceae	*Celtis iguanaea* (Jacq.) Sarg.	MSB	95		35/20	8/16	79	0.21
Celastraceae	*Schaefferia stenophylla* Standl.	MSB	85		35/20	8/16	93	0.07
Compositae	*Acourtia oxylepis* (A. Gray) Reveal et R.M.King	MSB	100		15–25	8/16	100	0
Compositae	*Flaveria cronquistii* A.M. Powell	Fes-I			30	12/12	59.6	0.4
		MSB	100		20–25	8/16	100	0
Compositae	*Flaveria ramosissima* Klatt	MSB	95		35/20	8/16	95	0.05

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
Compositae	*Gymnolaena oaxacana* (Greenm.) Rydb.	Fes-I			30	12/12	38.3	0.4
		MSB	20		25	8/16	75	0.25
Compositae	*Parthenium hysterophorus* L.	MSB	100		20	8/16	90	0.1
Compositae	*Porophyllum ruderale* (Jacq.) Cass. subsp. *macrocephalum* (DC.) R.R. Johnson	MSB	100					
Compositae	*Sanvitalia procumbens* Lam.	Fes-I			30	12/12	50.0	0.5
		MSB	100					
Compositae	*Viguiera dentata* (Cav.) Spreng.	MSB	100		15	8/16	100	0
Compositae	*Zinnia peruviana* (L.) L.	Fes-I			30	12/12	33.3	0.7
		MSB	65					
Convolvulaceae	*Ipomoea pauciflora* M. Martens et Galeotti	Fes-I			30	12/12	100.0	0.0
		MSB	90	Chipped with scalpel	20–25	8/16	100	0
Cucurbitaceae	*Cucumis dipsaceus* Ehrenb. ex Spach	Fes-I			30	12/12	68.3	0.1
Euphorbiaceae	*Cnidoscolus tehuacanensis* Breckon	Fes-I			30	12/12	41.7	0.5
		MSB	100					
Euphorbiaceae	*Croton mazapensis* Lund	Fes-I			30	12/12	31.3	0.6
Euphorbiaceae	*Jatropha neopauciflora* Pax	Fes-I			30	12/12	4.4	0.0
		MSB	70	Filed	25	8/16	43	0.57
Euphorbiaceae	*Jatropha rzedowskii* J. Jiménez Ram.	Fes-I			30	12/12	4.7	1.0
		MSB	70		25	8/16	100	0
Euphorbiaceae	*Manihot pauciflora* Brandegee	Fes-I			30	12/12	60.0	0.4
		MSB	90		25	8/16	90	0.1
Fouqueriaceae	*Fouquieria formosa* Kunth	Fes-I			30	12/12	91.4	0.1
		MSB	94		15–25	8/16	100	0
Hernandiaceae	*Gyrocarpus mocinoi* Espejo	Fes-I			30	12/12	18.3	0.8

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
		MSB	90	Chip both radicle tip and cotyledon ends of seed	20–25	8/16	100	0
Leguminosae	*Acacia angustissima* (Mill.) Kuntze	Fes-I		Chipping	30	12/12	100.0	0.0
Leguminosae	*Acacia cochliacantha* Humb. et Bonpl. ex Willd.	Fes-I		Chipping	30	12/12	100.0	0.0
		MSB	96	Chipped with scalpel	20–25	8/16	100	0
Leguminosae	*Acacia compacta* Rose	MSB	50	Chipped with scalpel	15–25	8/16	100	0
Leguminosae	*Acacia farnesiana* (L.) Willd.	Fes-I		Chipping	30	12/12	81.7	0.0
		MSB	66	Chipped with scalpel	20	8/16	100	0
Leguminosae	*Caesalpinia melanadenia* (Rose) Standl.	MSB	100	Chipped with scalpel	15–20	8/16	70	0.3
		Fes-I		Chipping	30	12/12	78.3	0.0
Leguminosae	*Coursetia caribaea* (Jacq.) Lavin	Fes-I		Chipping	30	12/12	0.0	1.0
		MSB	100	Chipped with scalpel	20–25	8/16	100	0
Leguminosae	*Coursetia glandulosa* A. Gray	Fes-I		Chipping	30	12/12	94.6	0.1
		MSB	100	Chipped with scalpel	25	8/16	100	0
Leguminosae	*Enterolobium cyclocarpum* (Jacq.) Griseb.	Fes-I		Chipping	30	12/12	100.0	0.0
Leguminosae	*Indigofera conzattii* Rose	Fes-I		Chipping	30	12/12	76.7	0.0
		MSB	100	Chipped with scalpel	20–25	8/16	100	0
Leguminosae	*Leucaena leucocephala* (Lam.) de Wit	MSB	100	Chipped with scalpel	15	8/16	90	0.1
Leguminosae	*Mimosa luisana* Brandegee	Fes-I		Chipping	30	12/12	88.3	0.0
		MSB	100	Chipped with scalpel	20	8/16	100	0
Leguminosae	*Mimosa polyantha* Benth.	Fes-I		Chipping	30	12/12	3.3	1.0
		MSB	95	Chipped with scalpel	20	8/16	100	0

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
Leguminosae	*Parkinsonia praecox* (Ruiz et Pav.) Hawkins	Fes-I		Chipping	30	12/12	100.0	0.0
		MSB	90	Chipped with scalpel	20–25	8/16	100	0
Leguminosae	*Pithecellobium dulce* (Roxb.) Benth.	Fes-I		Chipping	30	12/12	100.0	0.0
Leguminosae	*Prosopis laevigata* (Willd.) M.C. Johnst.	Fes-I		Chipping	30	12/12	100.0	0.0
		MSB	40	Covering structure removed and seed coat chipped	25	8/16	100	0
Leguminosae	Senna wislizeni (Rose) H.S. Irwin et Barneby	Fes-I		Chipping	30	12/12	100.0	0.0
		MSB	100	Chipped with scalpel	25	8/16	100	0
Loasaceae	*Mentzelia hispida* Willd.	Fes-I			30	12/12	13.8	0.9
Malvaceae	*Allowissadula rosei* (R.E.Fr.) D.M. Bates	MSB	90	Chipped with scalpel	25	8/16	100	0
Malvaceae	*Ceiba aesculifolia* (Rose) P.E. Gibbs et Semir	Fes-I			30	12/12	46.2	0.4
		MSB	70		20	8/16	45	0.55
Malvaceae	*Guazuma ulmifolia* Lam.	MSB	84	Chipped with scalpel	30	8/16	100	0
Malvaceae	*Heliocarpus terebinthinaceus* (DC.) Hochr.	MSB	40					
Malvaceae	*Heliocarpus terebinthinaceus* L.	Fes-I			30	12/12	2.2	0.0
Malvaceae	*Herissantia crispa* (L.) Brizicky	Fes-I			30	12/12	1.7	1.0
Malvaceae	*Melochia tomentosa* L.	Fes-I			30	12/12	0.0	1.0
		MSB	95	Chipped with scalpel	20	8/16	100	0
Malvaceae	*Waltheria indica* L.	Fes-I			30	12/12	5.4	0.9
Martyniaceae	*Proboscidea fragrans* (Lindl.) Decne.	MSB	100					
Papaveraceae	*Argemone mexicana* L.	Fes-I			30	12/12	1.7	1.0

Family	Taxon	Seed-bank	Filled seeds (%)	Pretreatment	Temperature (°C)	Photo-period (L/D; h)	Germination (%)	Dormancy Index (DI)
Passifloraceae	*Passiflora foetida* L.	Fes-I			30	12/12	0.0	1.0
Rhamnaceae	*Karwinskia mollis* Schldl.	Fes-I			30	12/12	27.9	0.7
		MSB	83	Covering structure partially removed	15	8/16	45	0.55
Rhamnaceae	*Ziziphus mexicana* Rose	Fes-I			30	12/12	10.0	0.9
Rhamnaceae	*Ziziphus pedunculata* (Brandegee) Standl.	MSB	83	Covering structure removed or chipped with scalpel	20–25	8/16	45	0.55
Rubiaceae	*Randia nelsonii* Greenm.	MSB	90		25	8/16	100	0
Rubiaceae	*Randia thurberi* S.Watson	Fes-I			30	12/12	100.0	0.0
Sapindaceae	*Cardiospermum halicacabum* L.	Fes-I			30	12/12	0.0	1.0
		MSB	60	Covering structure partially removed	35/20	8/16	100	0
Simaroubaceae	*Castela tortuosa* Liebm.	Fes-I			30	12/12	50.0	0.5
		MSB	90	GA3 250 mg/L	25	8/16	82	0.18
Solanaceae	*Datura innoxia* Mill.	Fes-I			30	12/12	23.9	0.7
Solanaceae	*Nicotiana glauca* Graham	MSB	95					
Solanaceae	*Solanum elaeagnifolium* Cav.	MSB	75					
Solanaceae	*Solanum houstonii* Martyn	MSB	100	GA3 250 mg/l + Chipped with scalpel	35/20	8/16	75	0.25
Solanaceae	*Solanum lanceolatum* Cav.	Fes-I			30	12/12	5.4	0.9
Solanaceae	*Solanum rostratum* Dunal	MSB	80					
Solanaceae	*Solanum tridynamum* Dunal	Fes-I			30	12/12	10.3	0.9
Verbenaceae	*Lantana camara* L.	Fes-I			30	12/12	43.3	0.6
		MSB	50					
Verbenaceae	*Lippia graveolens* Kunth	Fes-I			30	12/12	51.4	0.5
		MSB	95		25	8/16	40	0.6

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