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Seeds of Puerto Rican Trees and Shrubs: Second Installment

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SUMMARY

Seed weights and germination information were obtained for 119 native Puerto Rican and naturalized exotic trees and shrubs. Fruit was collected from 34 of these species, and the weights were recorded. The data are presented in tables that list the species alphabetically by scientific names.

INTRODUCTION

During the 1940's, scientists at the Tropical Forestry Experiment Station (now the International Institute of Tropical Forestry) carried on an active program of forest tree seed research. Their effort resulted in a published summary of the data gathered (Marrero 1949). Seed weights and/or germination data were recorded for 128 species, the majority of which were exotics imported for adaptability tests in Puerto Rico. Although the work represents only a small portion of the more than 650 native and naturalized tree species in Puerto Rico, it remains a valuable reference.

In the course of collecting seeds for international exchange, and as necessary data for silvical descriptions, additional data on the seeds of native Puerto Rican trees and shrubs and naturalized exotics have been obtained. Air-dried seed weights, germination periods (time from sowing to first germination), and germination percentages have been obtained for 119 species in addition to the fruit weights for 34 of the species. Weights and germination percentages for a few of these species were also reported by Marrero (1949). The weights reported by Marrero agree fairly well with the weights obtained for this report.

METHODS

The fruits and seeds were collected by a variety of methods. Many were gathered from the ground under seed-bearing trees or clipped from fruit-laden branches with pruning poles. For some species, a number of parent trees and sites are represented; however, a small number of trees on a single site were the source for most species. Replication was generally not possible due to the limited time available for collections and because a number of species are rare and seldom seen bearing seeds. When fruits were collected, they were weighed immediately or kept refrigerated until weighing could be done. The seeds were separated from the fruits by hand or by screening for the small quantities needed for research and exchange programs. Many tropical plant species have recalcitrant seeds (those that cannot withstand drying); therefore, each species was evaluated as to how much air-drying its seeds could tolerate. Seeds of most of the species collected were dried in front of an air conditioner for a few hours to 2 or 3 days. Hard-seeded legumes and species with similar seeds were dried in a solar drier.

In most cases, the seeds were weighed individually on an analytical balance. However, very small seeds were generally weighed in groups of 100; all weights are given as number of seeds per kilogram. Some of the hard-coated seeds were scarified by nicking the seed-coat with a knife blade or a file. Germination was done at ambient temperature (24 to 30 °C) in one of three substrates: potting mix in trays, sand in trays, or moistened filter paper in petri dishes (blotter method). Time lapse from sowing until the first germination occurred (germination period) and the percentage of seeds finally germinating were noted.

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RESULTS AND DISCUSSION

Seed weight, germination period, and total germination percentage for each species are given in table 1. Fruit weights for some of the species listed in table 1 are given in table 2.

The germination period indicates the time it will take seeds to begin germinating. The method of germination has some influence on this period. In the blotter method, germination was recorded when the radicle emerged from the seed. In the soil (potting mix) and sand tray methods, germination was recorded when the cotyledons became visible. For most species, these last two methods took an additional day. In a few species, such as *Mammea americana* L., a few days to several weeks are required for germination because a root system must develop before the green shoot will emerge.

The seeds of most legume species germinated rapidly and in high percentages. Legumes with hard seedcoats responded very well to mechanical scarification. Generally, recalcitrant seeds of species, such as *Andira inermis* (W. Wright) H.B.K., *Clusia rosea* Jacq., *Cupania americana* L., *Dacryodes excelsa* Vahl, *Inga fagifolia* (L.) Willd., *I. quaternata* Poepp. & Endl., *M. americana*, and *Pithecellobium arboreum* (L.) Urban, germinate well if the moisture content is kept high and the seeds are sown soon after collection. The seeds of *Acrocomia media* O.F. Cook (a thick-shelled palm) took 565 days to germinate; attempts with scarification failed. The seeds of *Bourreria succulenta* Jacq. var. *succulenta*, *B. virgata* (Sw.) G. Don, *Trema micrantha* (L.) Blume, *Cecropia peltata* L., *Guapira fragrans* (Dum.-Cours.) Little, *Miconia racemosa* (Aubl.) DC., and *Piper aduncum* L., which normally pass through a bird's gut during dispersal, may need some sort of pretreatment before they will germinate successfully.

CONCLUSION

The limitations of this data are recognized. Because of environmental and genotypical differences, seed weights sometimes vary twofold from one collection to another. Replication across the range of each species (something this exploratory study could not provide) is recommended for an accurate picture of seed variability. However, this study does provide limited data for a large number of species until detailed studies can be made. Germination varies, depending on seed quality, treatment after collection, and a host of genetically programmed inhibitors and triggers. Some species are consistent germinators; others are highly inconsistent. The data provided in this paper give an indication of the speed and success of germination that can be expected from these species.

Table 1.—*Seeds per kilogram, method of germination, time lapse to first germination, and percentage of germination for 119 Puerto Rican trees and shrubs*

Species	Sample size	Seeds/kg	Germination		
			Method*	Period†	Percent
	---------- *Number*	--------		*Days*	
Acacia farnesiana (L.) Willd.	100	7,580	B/Sc	6	56
Acrocomia media O.F. Cook	100	118	S	565	23
Adenanthera pavonina L.	100	3,550	B/Sc	6	86
Albizia procera (Roxb.) Benth.	100	25,300	B/Sc	2	99
Alchornea latifolia Sw.	100	23,600	M	31	82
Andira inermis (W. Wright) H.B.K.	100	86	M	7	30
Bauhinia monandra Kurz	100	5,680	B	4	100
B. multinervis (Kunth) BC.	100	4,240	B	6	90
B. purpurea L.	100	4,670	B	4	99
B. variegata L.	100	4,950	B	4	77
Bourreria succulenta Jacq. var *succulenta*	99	50,000	B	....	0
B. virgata (Sw.) G. Don	100	43,500	B	....	0
Buchenavia capitata (Vahl) Eichl.	100	781	M	35	87
Bucida buceras L.	10,000	84,700	S	17	16
Byrsonima spicata (Cav.) H.B.K.	100	3,120	M	33	35
Calophyllum brasiliense Jacq.	100	299	M	29	94
Cassia emarginata L.	100	41,700	B/Sc	3	96
C. grandis L.f.	100	1,940	M/Sc	7	19
C. polyphylla Jacq.	100	20,400	B	2	59
C. siamea Lam.	100	40,200	B	4	92
C. spectabilis DC.	100	45,500	B/Sc	3	95

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Table 1.—*Seeds per kilogram, method of germination, time lapse to first germination, and percentage of germination for 119 Puerto Rican trees and shrubs—Continued*

Species	Sample size	Seeds/kg	Germination		
			Method*	Period†	Percent
	--------- *Number* ---------			*Days*	
Cassine xylocarpa Vent.	100	592	M	....	0
Catalpa longissima (Jacq.) Dum.-Cours.	500	602,000	M	8	40
Cecropia peltata L.	100	1,390,000	B	....	0
Ceiba pentandra (L.) Gaertn.	100	22,100	B	3	4
Chrysobalanus icaco L. var. *icaco*	45	1,790	M	34	89
Citharexylum fruticosum L.	100	20,700	M	13	60
Clusia rosea Jacq.	100	84,000	M	4	85
Coccoloba diversifolia Jacq.	100	3,660	M	15	62
C. microstachya Willd.	100	70,400	B	16	98
Colubrina elliptica (Sw.) Briz. & Stern	100	70,400	B	11	1
Conocarpus erectus L.	100	250,000	B	9	12
Cordia alliodora (R. & P.) Oken	100	86,200	B	8	25
C. laevigata Lam.	100	2,960	M	19	91
C. obliqua Willd.	100	650	M	16	44
C. sebestena L.	100	3,790	M	45	52
C. sulcata DC.	100	10,200	M	13	21
Crescentia cujete L.	100	20,800	B	9	76
Cupania americana L.	100	2,750	M	20	53
Dacryodes excelsa Vahl	100	503	M	15	73
Daphnopsis americana (Mill.) J.R. Johnst. ssp. *caribaea* (Griseb.) Nevl.	93	40,000	B	7	2
Drypetes lateriflora (Sw.) Krug & Urban	100	2,920	M	55	54
Duranta repens L.	100	1,940	B	128	29
Enterolobium cyclocarpum (Jacq.) Griseb.	100	1,050	B/Sc	3	79
Erythrina fusca Lour.	100	1,720	M	22	86
Erythroxylum aerolatum L.	100	20,300	B	12	35
E. rotundifolium Lunan	100	21,700	B	6	72
Eugenia biflora (L.) DC.	100	9,090	M	36	4
E. maleolens Pers.	99	14,900	M	69	51
E. stahlii (Kiaersk.) Krug & Urban	100	215	M	50	73
Faramea occidentalis (L.) A. Rich.	100	3,980	B	57	96
Ficus citrifolia P. Miller	100	4,590,000	B	10	36
F. sintenisii Warb.	100	2,840,000	B	9	77
Genipa americana L.	100	19,900	M	25	60
Goetzea elegans Wydler	37	16,600	M	27	76
Gonzalagunia spicata (Lam.) Gomez Maza	100	182,000	B	....	0
Guaiacum officinale L.	100	3,550	M	17	48
Guapira fragrans (Dum.-Cours.) Little	100	45,700	M	16	1
Guarea guidonia (L.) Sleumer	50	2,090	M	26	10
Guazuma ulmifolia Lam.	1,000	239,000	B	2	46
Helicteres jamaicensis Jacq.	100	333,000	B	6	58
Hernandia sonora L.	100	358	M	35	56
Hibiscus tiliaceus L.	100	41,000	M	31	53
Hura crepitans L.	38	740	M	6	95
Hyeronima clusioides (Tul.) Muell.-Arg.	100	204,000	B	20	53
Hymenaea courbaril L.	50	253	M/Sc	14	66
Inga fagifolia (L.) Willd.	100	1,120	M	5	96
I. quaternata Poepp. & Endl.	100	420	M	8	75
Jacquinia arborea Vahl	100	51,300	B	8	100
Juglans jamaicensis C. DC.	25	115	S	41	40
Lantana exarata Urban & Ekman	500	2,400,000	B	14	19
Lepianthes peltatum (L.) Rafinesque	461	8,930,000	B	....	0
Magnolia portoricensis Bello	100	7,410	M	44	64
Mammea americana L.	31	14	M	31	97
Mastichodendron foetidissimum (Jacq.) H.J. Lam.	32	2,560	M	....	0
Melicoccus bijugatus Jacq.	60	379	M	27	63
Miconia racemosa (Aubl.) DC.	476	62,500,000	B	....	0
Morinda citrifolia L.	100	38,600	B	70	24
Moringa oleifera Lam.	200	3,140	M	7	65
Myrsine coriacea (Sw.) R. Br.	100	75,200	B	59	18

Table 1.—*Seeds per kilogram, method of germination, time lapse to first germination, and percentage of germination for 119 Puerto Rican trees and shrubs—Continued*

Species	Sample size	Seeds/kg	Germination		
			Method*	Period†	Percent
	---------- *Number*	---------		*Days*	
Ocotea coriacea (Sw.) Britton	100	1,950	M	24	67
O. floribunda (Sw.) Mez	100	1,570	M	115	73
O. moschata (Meissn.) Mez	100	146	M	26	49
Ormosia krugii Urban	89	1,390	M	22	51
Palicourea crocea var. *riparia* (Benth.) Griseb.	100	57,100	B	21	56
Parkinsonia aculeata L.	100	13,300	B/Sc	2	59
Petitia domingensis Jacq.	100	60,200	M	23	42
Picramnia pentandra Sw.	100	11,900	B	14	100
Pimenta racemosa (Miller) J.W. Moore var. *racemosa*	100	35,700	B	21	25
Piper aduncum L.	500	7,750,000	B	. . . .	0
Piptadenia peregrina (L.) Benth.	100	13,300	B	3	98
Piscidia carthagenensis Jacq.	100	20,800	M	6	66
Pisonia albida (Heimerl) Britton ex Standl.	100	98,000	B	5	70
Pithecellobium arboreum (L.) Urban	110	1,400	M	5	90
P. dulce (Roxb.) Benth.	100	6,060	M/Sc	2	50
P. unguis-cati (L.) Mart.	50	14,300	B	3	31
Podocarpus coriaceus L.C. Rich.	100	7,190	M	25	14
Poeppigia procera Presl.	100	31,400	B	4	96
Pouteria hotteana (Urban & Ekman) Baehni	64	128	M	17	86
P. multiflora (A. DC.) Eyma	69	43	M	22	99
Prosopis pallida (H. & B. ex Willd.) H.B.K.	100	37,000	B	4	48
Pterocarpus macrocarpus Kurz	100	11,500	M	5	67
Rheedia portoricensis Urban	12	101	M	30	100
Roystonea borinquena O.F. Cook	100	2,980	S	14	80
Sabal causiarum (O.F. Cook) Becc.	100	2,920	S	21	93
Spathodea campanulata Beauv.	1,000	290,000	M	8	38
Spondias mombin L.	50	1,180	M	12	22
Sterculia apetala (Jacq.) Karst.	100	870	M	10	53
Swietenia macrophylla X *mahagoni*	100	2,580	M	17	83
Tabebuia donnell-smithii Rose	500	172,000	M	7	97
T. haemantha (Bert.) DC.	100	67,100	B	6	98
Tecoma stans (L.) H.B.K.	100	208,000	B	3	97
Thespesia grandiflora DC.	20	2,550	M	6	80
T. populnea (L.) Soland. ex Correa	100	6,410	M	9	79
Trema micranthum (L.) Blume	100	4,220	B	. . . .	0
Trichilia hirta L.	100	9,520	M	18	65
Urera baccifera (L.) Gaud.	100	500,000	B	26	49
Zanthoxylum martinicense (Lam.) DC.	100	75,200	M	40	5
Ziziphus mauritiana Lam.	100	1,800	M	46	7

*S = germinated in sand, M = germinated in potting mix, B = germinated on filter paper (blotter paper method), Sc = seed scarified by mechanical means.

†When no germination occurred, germination period is shown as dot leaders.

Table 2.—*Fresh fruit type and weight for some of the species listed in table 1*

Species	Number in sample	Fruit type	Weight per fruit*
			Grams
Acrocomia media O.F. Cook	83	Drupe	24.3 ± 0.251
Alchornea latifolia Sw.	100	Capsule	0.541 ± 0.118
Bourreria succulenta Jacq.	100	Drupe	0.619 ± 0.128
B. virgata (Sw.) G. Don	100	Drupe	0.453 ± 0.093
Buchenavia capitata (Vahl) Eichl.	55	Drupe	5.46 ± 1.14
Cassine xylocarpa Vent.	100	Drupe	5.59 ± 1.10
Chrysobalanus icaco L. var. *icaco*	45	Drupe	4.36 ± 1.17
Coccoloba microstachya Willd.	100	Hypanthium	0.0517 ± 0.0075
Conocarpus erectus L.	50	Drupe	0.155 ± 0.045
Cordia laevigata Lam.	37	Drupe	1.52 ± 0.507
C. obliqua Willd.	100	Drupe	1.88 ± 0.432
C. sebestena L.	100	Drupe	8.22 ± 1.878
Dacryodes excelsa Vahl	100	Drupe	3.47 ± 0.66
Duranta repens L.	100	Drupe	0.516 ± 0.009
Erythroxylum areolatum L.	100	Drupe	0.119 ± 0.013
E. rotundifolium Lunan	100	Drupe	0.046 ± 0.008
Eugenia maleolens Pers.	99	Berry	0.181 ± 0.032
Faramea occidentalis (L.) A. Rich.	100	Drupe	0.825 ± 0.123
Ficus sintenisii Warb.	100	Syconia	0.0493 ± 0.0081
Goetzea elegans Wydler	27	Drupe	3.01 ± 1.39
Gonzalagunia spicata (Lam.) Gomex Maza	100	Drupe	0.0885 ± 0.0419
Guaiacum officinale L.	100	Capsule	0.394 ± 0.111
Guazuma ulmifolia Lam.	100	Capsule	2.79 ± 0.69
Hyeronima clusioides (Tul.) Muell.-Arg.	100	Berry	0.0176 ± 0.0045
Jacquinia arborea Vahl	100	Berry	0.315 ± 0.055
Mastichodendron foetidissimum (Jacq.) H.J. Lam.	36	Drupe	2.94 ± 0.42
Ocotea coriacea (Sw.) Britton	91	Berry	0.927 ± 0.253
Petitia domingensis Jacq.	100	Drupe	0.122 ± 0.069
Picramnia pentandra Sw.	100	Berry	0.231 ± 0.043
Pimenta racemosa (Miller) J.W. Moore var. *racemosa*	100	Berry	1.01 ± 0.33
Prosopis pallida (H. & B. ex Willd.) H.B.K.	100	Legume	2.56 ± 0.69
Pterocarpus macrocarpus Kurz	100	Legume	0.882
Urera baccifera (L.) Gaud.	100	Drupe	0.213 ± 0.076
Ziziphus mauritiana Lam.	87	Drupe	6.52 ± 1.48

*Mean and standard deviation.

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