

Mediterranean fruit fly, Ceratitis capitata (Wiedemann)

(DIPTERA: TEPHRITIDAE)¹

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INTRODUCTION: The Mediterranean fruit fly, Ceratitis capitata (Wiedemann), is one of the world's most destructive fruit pests. Because of its wide distribution over the world, its ability to tolerate colder climates better than most other species of fruit flies, and its wide range of hosts, it is ranked first among economically important fruit fly species. Its larvae develop and feed on most deciduous, subtropical, and tropical fruits and some vegetables. Although it may be a major pest of citrus, often it is a more serious pest of some deciduous fruits, such as peach, pear, and apple. The larvae feed upon the pulp of host fruits, sometimes tunneling through it and eventually reducing the whole to a juicy inedible mass. In some of the Mediterranean countries, only the earlier varieties of citrus are grown, because the flies develop so rapidly that late season fruits are too heavily infested to be marketable. Some areas have had almost 100% infestation in stone fruits. Harvesting before complete maturity also is practiced in Mediterranean areas generally infested with this fruit fly. In this age of jet transportation, the "medfly" can be transported from one part of the world to some distant place in a matter of hours, which greatly complicates efforts to contain it within its present distribution. Once it is established, eradication efforts may be extremely difficult and expensive. In addition to reduction of crop yield, infested areas have the additional expense of control measures and costly sorting processes for both fresh and processed fruit and vegetables. Some countries maintain quarantines against the medfly, which could jeopardize some fresh fruit markets if it should become established in Florida. Eradication programs are currently under way in Florida, California, and southern Mexico.

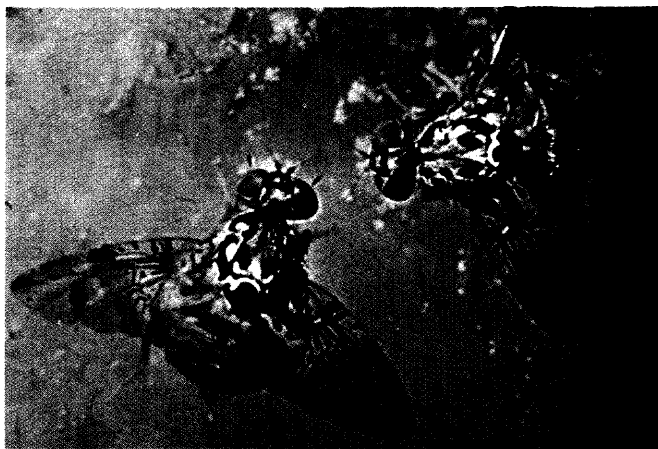


Fig. 1. Adult medflies.



Fig. 2. Medfly larvae in peach.

DISTRIBUTION: Mediterranean fruit fly infestations in the United States have occurred in Hawaii since 1910, in Florida from April 1929 to July 1930, April 1956 to November 1957, June 1962 to February 1963, June to August 1963, and 3-14 August 1981, in Texas from June to July 1966, and in California since September 1975. Other infested countries are Albania, Algeria, Angola, Argentina, Australia, Austria*, Azores, Balearic Islands, Belgium*, Bermuda, Bolivia, Botswana, Brasil, Burundi, Cameroon, Canary Islands, Cape Verde Islands, Chile, Colombia, Costa Rica, Crete, Cyprus, Dahomey, Ecuador, Egypt, El Salvador, Ethiopia, France,

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3/ An asterisk indicates those countries with occasional infestations.

Germany*, Ghana, Greece, Guatemala, Guinea, Honduras, Hungary*, Israel, Italy, Ivory Coast, Jamaica, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Madeira Islands, Malagasy Republic, Malawi, Mali, Malta, Mauritius*, Mexico* (near Guatemalan border), Morocco, Mozambique, Netherlands*, New Zealand, Nicaragua, Niger, Nigeria, Panama, Paraguay, Peru, Portugal, Reunion, Rhodesia, Rwanda, Saint Helena, San Miguel (Azores), Sardinia, Saudi Arabia, Senegal, Seychelles, Sicily, Sierra Leone, South Africa, Southern Rhodesia, Spain, Sudan, Switzerland*, Syria, Tanzania, Tasmania, Togo, Tunisia, Turkey, Uganda, Upper Volta, Uruguay, Venezuela, Yugoslavia, Zaire, and Zambia.

HOSTS: The Mediterranean fruit fly attacks more than 260 different fruits, flowers, vegetables, and nuts. Thin-skinned, ripe succulent fruits are preferred. Host preferences vary in different regions. Attached is a world list of hosts grouped according to their importance according to best available information. Although several species of cucurbits have been recorded as hosts of the medfly, they are considered to be very poor hosts. Some hosts have been recorded as medfly hosts only under laboratory conditions and may not be attacked in the field. Knowledge of the hosts in one country often aids in correctly predicting those which are most likely to be infested in a newly infested country, but what may be a preferred host in one part of the world may be a poor host in another.

IDENTIFICATION: The medfly has no near relatives in the Western Hemisphere. Adults are slightly smaller than a house fly and have picture wings typical of fruit flies (fig. 1). They can be distinguished fairly readily from any of the native fruit flies of the New World. Egg: very slender, curved, 1 mm long, smooth and shiny white. Micropylar region distinctly tubercular. Larva: elongate and pointed at head end (fig. 2). Length of 1st instar larva 1 mm or less, body mostly transparent; 2nd instar body partially transparent, fruit in gut can be seen easily; fully grown 3rd instar 6.8-8.2 mm, body fully opaque white or color of ingested food. Exact size of larva will depend on diet. Head with accessory teeth near oral hooks. Anterior spiracles in characteristic, almost parallel, pattern not on raised surface, and without rings or semicircles; typically bears 7-10 lobes or digits in a simple arc or nearly straight line (fig. 3). Caudal spiracles in characteristic almost parallel pattern, not on raised surface, and without black rings or semicircles (fig. 4). Distinct low ridge connecting 2 tubercles or posterior swellings (observed on dry larval surface). Primary larval identification characters used: mouth hooks and cephalo-pharyngeal skeleton (fig. 5), anterior spiracles, rear view of maggot (posterior view and lateral view [fig. 6] of posterior end), and shape and arrangement of caudal spiracles. Pupa: cylindrical, 4-4.3 mm long, dark reddish brown, resembling swollen grain of wheat. Adult: length 3.5-5 mm. Yellowish with brown tinge, especially on abdomen, legs, and some markings on wings. Lower corners of face with white setae. Eyes reddish purple (fluoresce green, turning blackish within 24 hours after death). Ocellar bristles present. Male has pair of

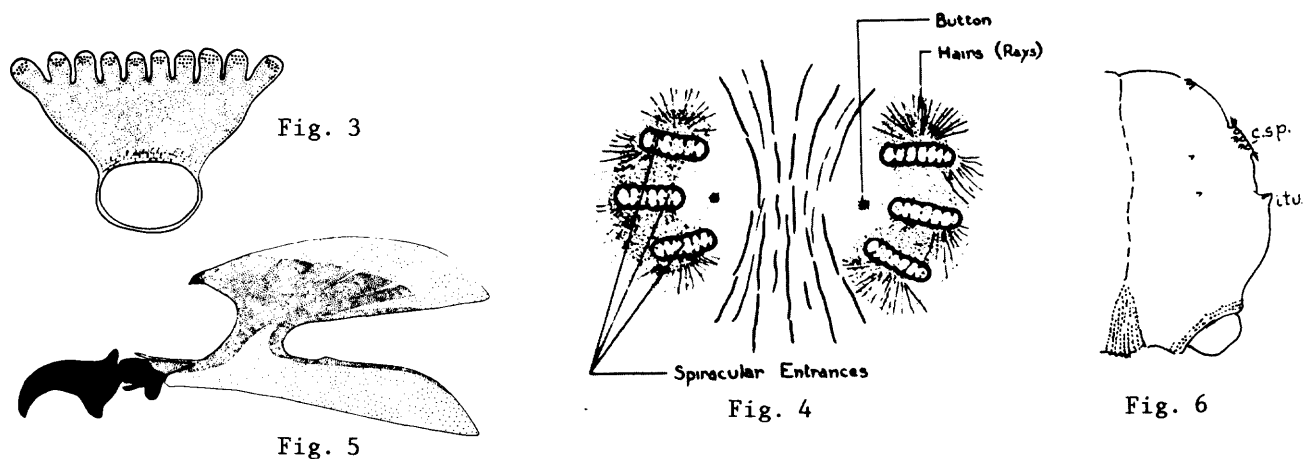


Fig. 3, Anterior spiracle of larva (after Phillips 1946); Fig. 4, Posterior spiracles of mature larva (courtesy USDA); Fig. 5, Cephalo-pharyngeal skeleton, lateral view (after Phillips 1946); Fig. 6, Caudal end of larva, lateral view (after Peterson 1951).

bristles with enlarged spatulate tips next to inner margins of eyes. Thorax creamy white to yellow with characteristic pattern of black blotches. Light areas with very fine white bristles. Humeral bristles present. Dorsocentral bristles anterior of halfway point between supraalar and acrostichal bristles. Scutellum inflated and shiny black. Abdomen oval with fine black bristles scattered on dorsal surface and 2 narrow transverse light bands on basal half. Extended ovipositor 1.2 mm long. Wings, usually held in a drooping position on live flies, are broad and hyaline with black, brown, and brownish yellow markings. Wide brownish yellow band across middle of wing. Apex of anal cell elongate. Dark streaks and spots in middle of cells in and anterior to anal cell.

LIFE HISTORY AND HABITS: The length of time required for the medfly to complete its life cycle under typical Florida summer weather conditions, and on which eradication schedules in Florida are based, is 21-30 days. A female medfly will lay 1-10 eggs in an egg cavity 1 mm deep, may lay as many as 22 eggs per day, and may lay as many as 800 eggs during her lifetime (usually about 300). The number of eggs found at any time in the reproductive organs is no indication of the total number of eggs an individual female is capable of depositing, as new eggs are being formed continually throughout her adult life. Females usually die soon after they cease to oviposit. Eggs are deposited under the skin of fruit which is just beginning to ripen, often in an area where some break in the skin already has occurred. Several females may use the same deposition hole with 75 or more eggs clustered in one spot. When the eggs hatch, the larvae promptly begin eating, and at first tunnels are formed, but may keep close together in feeding until nearly full grown. Fruit in a hard or semiripe condition is better for oviposition than fully ripened fruit. Ripe fruit is likely to be more juicy, and such fruits often are associated with a high mortality of eggs and young larvae. Females will not oviposit when temperatures drop below 60.8°F (16°C) except when exposed to sunlight for several hours. Development in egg, larval, and pupal stages stops at 50°F (10°C). Pupae carry the species through unfavorable conditions, such as lack of food, water, and temperature extremes. During warm weather eggs hatch in 1.5-3 days. The duration of the egg stage is considerably increased by lower temperatures. Larvae pass through 3 instars. Larval life may be as short as 6-10 days when the mean temperatures average 77-79°F (25-26.1°C). The kind and condition of the fruit often influence the length of the larval stage. In citrus fruits, especially limes and lemons, it appears to be longer. Thus larvae require 14-26 days to reach maturity in a ripe lemon, as compared with 10-15 days in a green peach. Larvae leave the fruit in largest numbers at or just after daybreak and pupate in the soil or whatever is available. Minimum duration of the pupal stage is 6-13 days when the mean temperature ranges from about 76-79°F (24.4-26.1°C). Back and Pemberton (1915) noted that this period may be increased to at least 19 days when the daily temperature means drop to about 69-71°F (20.6-21.7°C). Adults emerge in largest numbers early in the morning during warm weather and emerge more sporadically during cool weather. They can fly short distances, but winds may carry them a mile or more away. Copulation may occur at any time throughout the day. Newly emerged adults are not sexually mature. Males often show sexual activity 4 days after emergence, and copulation has been observed 5 days after emergence. Both sexes are sexually active throughout the day. When the daily mean temperature averages from 76-78°F (24.4-25.6°C), most females are ready to mate from 6-8 days after eclosion. Oviposition may take place as early as 4-5 days after emergence during very warm weather, but not for about 10 days when temperatures range between 68-72°F (20-22.2°C) (Back and Pemberton 1915). Adults die in greatest numbers within 2 days after emergence, or within 4 days if they cannot obtain food. Usually about 50% of the flies die during the first 2 months after emergence. Some adults may survive up to a year or more under favorable conditions of food (fruit, honeydew, or plant sap), water, and cool temperatures. When host fruit is continuously available and weather conditions favorable for many months, successive generations will be large and continuous. Lack of fruit for 3-4 months reduces the population to a minimum.

DETECTION AND SURVEY: A primary method of collecting larvae is by cutting infested fruit. Fully grown larvae, when the surrounding air temperature is warm, flex and "jump" repeatedly as much as 25 mm when removed from fruit. Adults are collected primarily by use of sticky-board traps and baited traps. Larval identification is extremely difficult, so that when feasible it is best to rear them to adults for identification. If collected larvae must be killed, they should be placed in hot Dietrich's fixative solution (60 parts water, 30 parts 95% ethanol, 10 parts formalin, 1 part glacial acetic acid) for 2 hours and then transferred to 80% ethanol. Larval identification is based primarily on characters of mature 3rd instar larvae.

REFERENCES:

- Anonymous, New Pest Detection and Survey Staff. 1975. Mediterranean fruit fly in the U. S. - 1975. p. 835-39 of Cooperative Economic Insect Report 25(43):825-39, map, 13 fig. Plant Protection and Quarantine Programs, Animal and Plant Health Inspection Service, United States Dept. Agric.
- Ayers, E. L. 1957. The two medfly eradication programs in Florida. Proc. Florida State Hort. Soc. 70:67-9.
- Back, E. A., and C. E. Pemberton. 1915. Life history of the Mediterranean fruit fly from the standpoint of parasite introduction. J. Agric. Res. 3(5):363-74, 2 pl. (4 fig.), 6 tab. United States Dept. Agric., Washington, D. C.
- Back, E. A., and C. E. Pemberton. 1918. The Mediterranean fruit fly in Hawaii. United States Dept. Agric. Bull. 536:1-119
- Back, E. A., and C. E. Pemberton. 1918. The Mediterranean fruit fly. United States Dept. Agric. Bull. 640:1-43, 33 fig.
- Christenson, L. D., and R. H. Foote. 1960. Biology of fruit flies. Ann. Rev. Ent. 5:171-92.
- Conley, K. L. 1981 (publication date not given). Field guide to medfly infestation. Cooperative Mediterranean Fruit Fly Project (California). 13 p., illus.
- De Woskin, R. 1981. Medfly training manual. Joint cooperative Mediterranean fruit fly eradication project. United States Dept. Agric., California Dept. Food and Agric., Santa Clara Co. Agric. Commissioner, Alameda Co. Dept. Agric. 215 p., 6 fig., 4 maps.
- Foote, R. H. 1967. Family Tephritidae. In Vanzolini, M., ed., A catalogue of the Diptera of the Americas south of the United States 57:1-91. Dept. Zool., Sec. Agric., São Paulo, Brasil.
- Hardy, D. E. 1949. Studies in Hawaiian fruit flies. Proc. Ent. Soc. Washington 51(5):81-205.
- Knapp, J. L. 1981. The Mediterranean fruit fly. Ent. 54. Coop. Ext. Serv., Inst. Food Agric. Sci., Univ. Florida. 3 p., 5 fig.
- Meyer, C. A. 1976. Mediterranean fruit fly impact in Central America. United States Dept. Agric. Coop. Plant Pest Rpt. 1(12):117-18.
- Mitchell, W. C., C. O. Andrew, K. S. Hagen, R. A. Hamilton, E. J. Harris, K. L. Maehler, and R. H. Rhode. 1977. The Mediterranean fruit fly and its economic impact on Central American countries and Panama. UC/AID Pest Management and Related Environmental Protection Project at the University of California, Berkeley. 189p., 17 tab., 10 appendices.
- Phillips, Venia Tarris. 1946. The biology and identification of trypetid larvae (Diptera: Trypetidae). Mem. American Ent. Soc. 12:1-161, 3 text fig., 16 pl. (192 fig.).
- Rhode, R. H., J. Simon, A. Perdomo, J. Gutierrez, C. F. Dowling, Jr., and D. A. Linqvist. 1971. Application of the sterile-insect-release technique in Mediterranean fruit fly suppression. J. Econ. Ent. 64(3):708-13.
- Weems, Jr., H. V. 1962. Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann). Ent. Circ. No. 4, Div. Plant Industry, Florida Dept. Agric. 3 p., 2 pl. (11 fig.).

MEDITERRANEAN FRUIT FLY HOST LIST

Heavily or Generally Infested

Blighia sapida K. König (Cupania sapida (K. König) Voigt), akee.

Calophyllum inophyllum L., indiagoon beauty-leaf, kamani, Alexander laurel.

Casimiroa edulis Llave, white sapote, casimiroa, Mexican apple.

Chrysophyllum cainito L., caimito, star apple.

Chrysophyllum oliviforme L., satin leaf, star apple, caimitillo, damson plum (Jamaica)

Chrysophyllum polynesianum Hillebr., chrysophyllum.

X Citrofortunella mitis (Blanco) J. Ingram and H. E. Moore (Citrus mitis Blanco), calamondin, Panama orange.

Citrus aurantiifolia (Christm.) Swingle, lime.

Citrus aurantium L., sour orange, Seville orange, bitter-sweet orange; (C. myrtifolia Raf.), myrtle-leaf orange.

Citrus limon (L.) Burm. f., lemon, except 'Eureka', 'Lisbon', and 'Villa Franca' cultivars (smooth-skinned sour lemon).

Citrus x limonia Osbeck (C. taitensis Risso), lemon.

Citrus maxima (Burm.) Merrill (C. grandis (L.) Osbeck; C. decumana (L.) L.), pummelo, pomelous shaddock, Pernambuco.

Citrus x nobilis Lour. king orange.

Citrus x paradisi Macfady, grapefruit, pomelo.

Citrus reticulata Blanco (C. deliciosa Ten.; C. nobilis Andr. var. deliciosa Ten.), mandarin orange, tangerine.

Citrus sinensis (L.) Osbeck 'Valencia' and 'Parson Brown' and 'Lue Gim Gong', Malta orange, Lambs summer orange.

Coffea canephora Pierre ex Froehn., robusta coffee, Coffea arabica L., Arabian coffee, common coffee.

Coffea liberica Bull ex Hiern, Liberian coffee.

Cydonia oblonga Mill. (C. vulgaris Pers.), quince, mannela.

Diospyros decandra Lour., persimmon.

Diospyros kaki L. f. (D. chinensis Blume; D. roxburghii Carr.; D. schi-tse Bunge), kaki persimmon, Oriental persimmon.

Dovyalis caffra (Hook. f. & Harv.) Warb. (Aberia caffra Hook. f. & Harv.), kei apple, umkokolo.

Eriobotrya japonica (Thunb.) Lindl. (Photinia japonica Thunb.), loquat, Malta plum.

Eugenia uniflora L. (E. michelii Lam.; Stenocalyx michelii Berg), Surinam cherry, pitanga, Brazil cherry, cayenne cherry, Florida cherry, French cherry.

Ficus carica L., common fig, lemon fig.

Fortunella japonica (Thunb.) Swingle (Citrus japonica Thunb.), round and marumi kumquat.

Malus pumila Mill. (M. communis Poir.; Pyrus pumila (Mill.) C. Koch), common apple.

Mangifera indica L., mango.

Mimusops elengi L., elengi tree, pogada, West Indian medlar, elengi bulletwood.

Murraya paniculata (L.) Jacq. (M. exotica L.), orange-jessamine, mock orange.

Prunus americana Marsh., native plum, American plum.

Prunus armeniaca L. (Armeniaca vulgaris Lam.), apricot.

Prunus domestica L., garden plum, Prunus domestica L. ssp. insitita (L.) Schneid., damson, bullace.

Prunus persica (L.) Batsch. (Amygdalus persica L.; Persica vulgaris Mill.), peach.

Prunus persica (L.) Batsch. var. nucipersica (Suckow) C. K. Schneid. (P. persica (L.) Batsch. var. nectarina (Ait. f.) Maxim.), nectarine.

Psidium cattleianum Sab. (P. littorale Raddi var. longipes (O. Berg.) Fosb.), strawberry guava, cattley guava, waiawi.

Psidium guajava L., guava.

Pyrus communis L., common pear.

Pyrus X leconte Rehd., leconte pear.

Syzygium jambos (L.) Alston (Eugenia jambos L.; Caryophyllus jambos Stokes), rose apple, jambos, Malabar plum.

Terminalia catappa L., tropical almond, false kamani, winged kamani.

Terminalia chebula Retz., black myrobalan, chebula terminalia.

Occasionally Infested

Annona muricata L., soursop, guanábana.

Averrhoa carambola L., carambola, star-fruit.

Capsicum annuum L. (C. frutescens auct.; C. baccatum Vell.), Conoides Group: red pepper, Grossum Group: bell pepper, sweet pepper, Cerasiforme Group: cherry pepper, Longum Group: cayenne pepper, chili, long red.

Carica papaya L., papaya, papaw.

Carica quercifolia Solms, dwarf papaya, oakleaf papaya.

Carissa bispinosa (L.) Desf. ex Brenan (C. arduina Lam.; C. acuminata A. DC.), hedge thorn.

Fragaria x ananassa Duchesne (Fragaria chilonensis (L.) Duchesne x F. virginiana Duchesne), cultivated or garden strawberry.

Garcinia mangostana L., mangosteen.

Garcinia xanthochymus Hook. f. ex T. Anderson, garcinia, gourka.

Gossypium sp., cotton.

Juglans sp., walnut.

Lycopersicon esculentum Mill., tomato.

Ochrosia elliptica Labill., ochrosia.

Persea americana Mill. (P. gratissima C. F. Gaertn.), avocado, alligator pear.

Syzygium malaccense (L.) Merrill & L. M. Perry (Eugenia malaccensis L.; Jambosa malaccensis (L.) DC.; Caryophyllus malaccensis Stokes), ohia, Malay apple, pomerack, mountain apple.

Rarely Infested

Annona reticulata L., bullocks-heart, custard apple, anona.

Arenga pinnata (Wurmb) Merrill (A. saccharifera Labill.), gomuti, sugar palm.

Artocarpus altilis (Parkins.) Fosb. (A. incisus L. f.; A. communis Forst.), breadfruit.

Carissa grandiflora (E. H. Mey.) A. DC., Natal plum, carissa.

Cestrum sp., cestrum, jessamine: C. nocturnum L., night-jessamine, Chinese inkberry, night-blooming jasmine.

Clausena lansium (Lour.) Skeels (C. punctata (Sonn.) Rehd. & E. H. Wils.; C. wampi (Blanco) D. Oliver), Chinese wampee, wampi.

Latania loddigesii Mart. (L. glauco-phylla Hort. ex Baker), blue palm.

Litchi chinensis Sonn. (Nephelium litchi Camb.), litchi, lychee.

Lycium europaeum L., European wolfberry.

Malpighia glabra L., Barbados cherry, acerola.

Manilkara zapota (L.) Van Royen (Achras zapota L.; Sapota achras Mill.; M. zapotilla (Jacq.) Gilly), sapodilla.

Musa acuminata Colla (M. cavendishii Lamb. ex Paxt.; M. nana auct.; M. chinensis Sweet), dwarf banana, Chinese banana.

Musa x paradisiaca L. (M. x sapientum L.), common banana, plantain.

Noronhia emarginata (Lam.) Thouars ex Hook., Madagascar olive, noronhia, Chinese plum.

Passiflora sp., passion flower, P. caerulea L., blue-crown passion flower, P. foetida L., tagua passion flower.

Phoenix dactylifera L., date palm.

Punica granatum L., pomegranate.

Rubus sp., blackberry, youngberry.

Santalum freycinetianum Gaudich. (S. paniculatum Hook. & Arn.), beach sandalwood.

Solanum incanum L. (S. coagulans Forssk.).

Solanum melongena L. var. esculentum Nees, garden eggplant.

Spondias cytherea Sonn. (S. dulcis G. Forst.), ambarella, otaheite apple, vi-apple, wi.

Syagrus campestris (Mart.) H. Wendl. (Cocos campestris Mart.), field syagrus palm.

Syzygium samarangense (Blume) Merrill & L. M. Perry (Eugenia javanica Lam.).

Vitis lambrusca L., fox grape, Isabella grape.

Laboratory Infestations

Acanthocereus sp., acanthocereus. A. pentagonus (L.) Britt. & Rose (Cereus baxaniensis Karw. ex Pfeiff.; C. pentagonus (L.) Haw.), barbwire acanthocereus, dildo, cactus.

Aronia arbutifolia (L.) Pers. (Pyrus arbutifolia (L.) L. f.), red chokeberry.

Coccoloba diversifolia Jacq. (C. floridana Meissn.; C. laurifolia Lindau), pigeon plum, dove plum.

Crataegus floridana Sarg., Jacksonville hawthorn.

Crataegus galbana Beadle, hawthorn.

Cucumis anguria L. (C. erinaceus Hort.; C. grossulariiformis Hort.), West Indian gherkin, wild cucumber.

Cydonia sp., quince. Cydonia sinensis Thouin (Chaenomeles sinensis (Thouin) Koehne; Pseudocydonia sinensis Schneid.), Chinese quince.

Echinocereus triglochidiatus Engelm. var. neomexicanus (Standl.) Standl. ex W. T. Marsh. (E. polyacanthus Engelm.), cactus.

Eugenia axillaris (Swartz) Willd., whitestopper eugenia.

Forestiera sp. (Adelia sp.), adelia. F. segregata (Jacq.) Krug & Urban, Florida privet.

Fortunella hindsii (Chapm.) Swingle, Hong Kong kumquat.

Fragaria chiloensis (L.) Duchesne, strawberry, chiloe strawberry.

Hibiscus sabdariffa L., roselle, Jamaica sorrell.

Hylocereus undatus (Haw.) Britt. & Rose (Cereus undatus Haw.), night-blooming cereus, pitaya.

Ilex glabra (L.) A. Gray, inkberry, gallberry.

Licania michauxii Prance (Geobalanus oblongifolius Michx.), gopher apple.

Osmanthus americanus (L.) A. Gray (O. floridanus Chapm.), wild olive, hammock osmanthus.

Solanum erianthum D. Don (S. verbascifolium auct.), potato tree, mullein nightshade.

Solanum seaforthianum Andr., Brazilian nightshade.

Solanum sisymbriifolium Lam., nightshade.

Ximenia americana L., tallow-wood.

Unknown Importance

Acokanthera sp. (Toxicophlaea). A. longiflora Stapf, Bushman's-poison.

Ananas comosus (L.) Merrill (A. sativus Schult.), pineapple.

Annona cherimola Mill., cherimoya.

Annona glabra L., pondapple, alligator apple.

Annona squamosa L., sugar apple, sweetsop.

Arbutus unedo L., strawberry madrone.

Argania spinosa (L.) Skeels (A. sideroxylon Roem. & Schult.), hardwood evergreen tree, Morocco ironwood.

Argemone mexicana L., Mexican prickly poppy, cardosanta, cardo.

Artabotrys hexapetalus (L. f.) Bhand. (A. uncinatus (Lam.) Merrill; A. odoratissimus R. Br.), fragrant tailgrape, climbing ylang-ylang.

Asimina triloba (L.) Dunal, pawpaw, pawpaw.

Asimina obovata (Willd.) Nash, big-flower pawpaw.

Asimina parviflora (Michx.) Dunal, smallflower pawpaw.

Asimina pygmaea (Bartr.) Dunal, sprawling pawpaw.

Asimina reticulata Schuttlw. ex Chapm., semioletea pawpaw, common pawpaw.

Asparagus densiflorus (Kunth) Jessop 'Sprengeri', Sprenger asparagus.

Atropa belladonna L., belladonna.

Berberis holstii Engl., barberry.

Brucea ferruginea L'Her. (B. anti-dysenterica Lam.).

Bumelia lycioides (L.) Pers., buckthorn bumelia.

Bumelia tenax (L.) Willd., tough bumelia, buckthorn.

Butia sp., butia palm. B. capitata (Mart.) Becc. (Cocos capitata Mart.), jelly palm, Brazilian butia palm, pindo palm.

Cananga odorata (Lam.) Hook. f. & T. Thoms., ylang-ylang.

Capparis citrifolia Lam., caper.

Carissa carandas L., karanda carissa.

Chrysobalanus ellipticus Soland. ex Sabine.

Chrysobalanus icaco L., icaco coco plum, gopher apple, gopher plum.

Chrysophyllum africanum A. DC. (C. argyrophyllum Hiern), African star apple.

Chrysophyllum viridifolium Wood & Franks.

Citharexylum fruticosum L. (C. cinereum L.), Florida fiddlewood.

Citrullus lanatus (Thunb.) Matsum. & Nakai (C. vulgaris Schrad.), watermelon.

Citrus medica L., citron.

Clintonia umbellulata (Michx.) Morong, speckled beadlily.

Coccoloba uvifera (L.) L., sea grape.

Cotoneaster adpressus Bois. var. praecox Bois. & Berthault (C. praecox (Bois & Berthault) Hort. Vilm. - Andr. ex Meuniss.), early creeping cotoneaster.

Crataegus azarolus L., azarole hawthorn, haw.

Crinum asiaticum L. (C. sinicum Roxb. ex Herb.) St. John's lily.

Cucumis dipsaceus C. G. Ehrenb. ex Spach, hedgehog, teaselgourd, wild cucumber.

Cucumis melo L., Cantalupensis Group: cantaloupe, Inodorus Group: casaba melon, Reticulatus Group: muskmelon.

Cucumis sativus L., cucumber.

Cucurbita maxima Duchesne, winter squash, hubbard squash.

Cucurbita moschata (Duchesne) Poir., cushaw pumpkin, Canada and winter crookneck pumpkin.

Cucurbita pepo L., pumpkin, vegetable marrow.

Cyphomandra betacea (Cav.) Sendtn., tree tomato.

Diospyros mespiliformis Hochst. ex A. DC., medlar persimmon.

Diospyros virginiana L., common persimmon, wild persimmon.

Dovyalis hebecarpa (G. Gardn.) Warb., kitembilla, Ceylon gooseberry.

Ekebergia capensis Sparrm., dog plum.

Eugenia brasiliensis Lam. (Stenocalyx brasiliensis Berg), Brazil eugenia, Brazilian plum, Spanish cherry.

Euphorbia lathyris L., caper euphorbia, gopher apple.

Euphorbia longan (Lour.) Steud. (Nephelium longan Lour.; Dimocarpus longan Lour.), longan, dragon's eye.

Feijoa sellowiana O. Berg, feijoa guavasteen, pineapple guava.

Ficus benghalensis L. (F. indica L.), glabrous tree, India fig.

Flacourtia indica (Burm. f.) Merrill (F. ramontchi L'Her.), ramontchi, governor's plum.

Fortunella crassifolia Swingle, meiwa kumquat.

Fortunella margarita (Lour.) Swingle, Eustis limequat, megami kumquat.

Gardenia sp., gardenia.

Glycosmis pentaphylla (Retz.) Correa, glycomis, Malay glycosmis.

Harpephyllum caffrum Bernh. ex C. F. Krauss, Kafir plum.

Hevea brasiliensis (Willd. ex A. Juss.) Mull. Arg., para rubber tree, caoutchoue, Brazil rubber.

Homalocladium platycladum (F. J. Muell.) L. H. Bailey, ribbon bush.

Ilex vomitoria Ait., Carolina holly, yaupon.

Juglans hindsii (Jeps.) Jeps.

Landolphia sp., gumvine.

Lycium carolinanum Walt., Carolina wolfberry, boxthorn.

Lycium chinense Mill. (L. carnosum Hort.), (L. campanulatum Drege ex Dun.), boxthorn.

Lycium horridum Thunb., African buckthorn.

Maclura pomifera (Raf.) C. K. Schneid. (M. aurantiaca Nutt.; Toxylon pomifera Raf.), osage orange.

Malpighia punicifolia L., Barbados cherry, acerola.

Mammea americana L., mamey, mammee apple.

Marrubium vulgare L., common hoarhound.

Mastichodendron foetidissimum (Jacq.) Lam. (Sideroxylon mastichodendron Jacq.; Sideroxylon foetidissimum Jacq.), mastic, jungle plum, ironwood.

Melicoccus bijugatus Jacq. (Melicocca bijuga L.), mamoncillo, mamon, Spanish lime, genip.

Melothria pendula L., creeping cucumber.

Mespilus germanica L., medlar.

Mimusops sp., milkwood.

Mimusops caffra E. H. Mey. ex A. DC., Kafir bulletwood.

Mimusops kirkii Bak.

Momordica balsamina L., balsam apple.

Monstera deliciosa Liebm. (Philodendron pertusum Kunth & Bouche), ceriman.

Morus sp., mulberry.

Myrciaria edulis (Vell.) Skeels (Eugenia edulis Vell.), willow-leaved eugenia.

Nyssa ogeche Bartr., ex Marsh., ogeche lime, ogechi plum, ogeechee tupelo.

Nyssa sylvatica Marsh., sour gum.

Nyssa sylvatica Marsh. var. biflora (Walt.) Sarg., black gum, swamp black tupelo.

Olea europaea L., common olive.

Opuntia sp., prickly pear. O. humifusa (Raf.) Raf. (O. compressa (Salisb.) Macbr.; O. opuntia (L.) Karst.; O. rafinesquei Engelm.; O. mesacantha Rafin.), O. humifusa Raf. 'Variegata', O. dillenii Haw., O. tuna (L.) Mill. (O. humilis Haw.; O. horrida Salm-Dyck ex DC.), O. polyantha Haw., O. vulgaris Mill. (O. monocantha (Willd.) Haw.; O. nana DC.).

Opuntia ficus-indica (L.) Mill. (O. engelmanni Salm-Dyck; O. megacantha Salm-Dyck; O. occidentalis Engelm. & Bigel.), Indian fig, spineless cactus.

Passiflora edulis Sims, purple granadilla, lilikoi, passion fruit.

Passiflora incarnata L., wild passion flower, maypop.

Passiflora laurifolia L., yellow granadilla, water lemon, Jamaica honeysuckle.

Passiflora ligularis Juss., sweet granadilla.

Passiflora mollissima (HBK) L. H. Bailey, lilikoi, soft-leaf passion flower.

Passiflora quadrangularis L. (P. macrocarpa M. T. Mast.), giant granadilla.

Peponia mackennii Naud., wild cucurbit.

Pereskia aculeata Mill. (P. pereskia (L.) Karst.), Barbados gooseberry.

Phaseolus limensis Macfady., lima bean.

Phaseolus lunatus L., sieva bean, cibet bean.

Phaseolus vulgaris L., kidney bean, haricot, string bean.

Phyllanthus acidus (L.) Skeels, otaheite gooseberry, leafflower, Ceylon gooseberry.

Physalis peruviana L., cape gooseberry, pohá.

Pimenta dioica (L.) Merrill (P. officinalis Lindl.), allspice, pimenta.

Pleiogynium cerasiferum (F. J. Muell.) R. Parker (P. solandri (Benth.) Engl.; Spondias solandri Benth.), burdekin plum.

Podocarpus elongatus (Ait.) L'Her. ex Pers., yellowwood, fern podocarpus.

Poncirus trifoliata (L.) Raf., trifoliate orange.

Pouteria campechiana (HBK) Baehni (Lucuma nervosa A. DC.; L. rivicoa Gaertn. f.), canistel incuma, egg fruit.

Pouteria sapota (Jacq.) H. E. Moore & Stern (Calocarpum sapota (Jacq.) Merrill; C. mammosum auct.; Lucuma mammosa auct.), sapote.

Prunus cerasus L. (Cerasus caproniana DC.), sour cherry.

Prunus dulcis (Mill.) D. A. Webb (P. amygdalus Batsch; P. communis (L.) Arcang.) almond.

Prunus japonica Thunb., Chinese bushcherry, plum.

Prunus salicina Lindl., Japanese plum.

Prunus umbellata Ell., wild plum, flatwoods plum.

Psidium guineense Swartz, Brazilian guava.

Psidium littorale Raddi var. littorale (P. littorale Raddi var. lucidum (Degener) Fosb.), yellow cattley guava.

Putranjiva roxburghii Wallich, wild olive, India amulet plant.

Pyracantha coccinea M. J. Roem. 'Lalandei', laland firethorn.

Ribes sp., currant, gooseberry.

Robinia sp., locust.

Rosa sp., rose.

Royena pallens Thunb. (R. pubescens Willd.), pale-branched royena.

Salix sp., willow leaf.

Santalum album L., sandalwood, white sandalwood.

Scaevola plumieri (L.) Vahl, goodenia beechberry.

Schinus molle L., California pepper tree (blossoms).

Sechium edule (Jacq.) Swartz (Chayota edulis Jacq.), chayote, christophine.

Selenicereus pteranthus (Link & Otto) Britt. & Rose (Cereus nycticalus Link; Cereus pteranthus Link ex Dietr.), cactus.

Serenoa repens (Bartr.) Small (S. serrulata (Michx.) Nichols; Brahea serrulata H. Wendl.; Chamaerops serrulata Michx.; Sabal serrulatum Shult. f.), saw palmetto.

Severinia buxifolia (Poir.) Ten. (Atalantia buxifolia (Poir.) D. Oliver; Triphasia monophylla DC.), Chinese box orange.

Sideroxylon inerme L., ironwood.

Smilax beyrichii Kunth, Smilax sandwicensis Kunth, smilax.

Solanum aculeatissimum Jacq., solanum, Sodoms apple, nightshade.

Solanum capsicastrum Link ex Schauer, solanum cherry, false Jerusalem cherry.

Solanum carolinense L., Caroline horse nettle.

Solanum melanocerasum All. (S. nigrum L. var. guineense L.), solanberry, black nightshade, garden huckleberry.

Solanum pseudocapsicum L., Jerusalem cherry.

Solanum sodomium L., apple of Sodom.

Sorbus sp., mountain ash.

Spondias sp., West Indian plum.

Spondias mombin L. (S. axillaris Roxb.; S. lutea L.), yellow mombin, Spanish plum, hog plum, jobo, cajamerin.

Strychnos atherstonei Harv., cape teak.

Strychnos pungens Solered., poison nut, wild orange.

Syzygium cumini (L.) Skeels (S. jambolana (Lam.) DC. Eugenia cumini (L.) Druce; E. jambolana Lam.), jambolan, Java palm.

Teclea trichocarpa (Engl.) Engl.

Terminalia pallida Brandis, terminalia.

Theobroma cacao L., cacao, cocoa.

Thevetia peruviana (Pers.) K. Schum. (T. neriifolia A. Juss. ex Steud.; Cerbera thevetia L.), yellow oleander, be-still, lucky nut thevetia.

Vaccinium cereum Forst. f., blueberry.

Vangueria edulis Vahl (V. madagascariensis J. F. Gmel.), vangueria.

Vangueria infausta Burchell, wild medlar, vangueria.

Vicia faba L., broad bean, horse bean.

Vitis sp. (hybrid), beacon grape.

Vitis vinifera L., wine grape, European grape.

Wikstroemia phillyreifolia Gray, wikstroemia.

Ziziphus jujuba Mill. (Z. vulgaris Lam., Z. sativa Gaertn.), jujube, Chinese date.

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