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LUTHER BURBANK'S PLANT CONTRIBUTIONS

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LUTHER BURBANK'S PLANT CONTRIBUTIONS¹

W. L. HOWARD²

INTRODUCTION

IN THIS historical study, conducted over a period of ten years, the purpose has been to search out and record, as far as possible, all the plant contributions made by Luther Burbank of Santa Rosa, California.³ Burbank was born in Massachusetts in 1849 and died in Santa Rosa in 1926. During his working lifetime (1873–1926) he probably contributed or introduced more plants than any other single American in our history. Many of his productions have been of great importance to horticulture, past and present. Yet no one hitherto has attempted to catalog them all, giving their dates, sources, and descriptions, sketching their history, and estimating their value.

Burbank was not connected with a learned institution and indeed had little scientific training. Starting his professional life as a market gardener in Massachusetts about 1870, he attempted to improve his vegetables by crossing varieties. To meet competition he tried to produce earlier-maturing types; but he had little success because he did not then know the importance of continuing his crosses to the second and third generations.

His curiosity led him to sow the contents of a single seed pod that he found on a plant of the Early Rose potato, a well-known variety with a red skin. Of the twenty-odd seedlings that resulted, one produced a cluster of tubers that were uniformly large, smooth, and white-skinned. This was sold to a dealer who named it the Burbank. After seventy years, this variety is still grown commercially in some parts of the country—for example, the Delta region of California. In other places, such as southern Idaho, it has been improved slightly and renamed. In Idaho alone it is the basis of a huge industry.

Like Thomas Edison, Burbank was a self-made man. In the 1850's and 1860's he attended the village schools and, for one year, the Lancaster Academy. This education, though inadequate, was better than most boys of his day enjoyed. With his father's death, when Burbank was nineteen, his schooling ended.

He had given much thought to the improvement of economic plants. Darwin's books, especially *Variation of Animals and Plants under Domestication*, strongly impressed his youthful mind and showed him how to attain improvements through variation and selection. After his success with the potato, he definitely decided to make plant breeding his lifework.

Financed by the sale of his new potato, and braving family disapproval of his occupation, he migrated to California. This was in October, 1875.

Two years later, without capital, in the midst of a financial depression that followed the failure of several San Francisco banks, he started his own small nursery in Santa Rosa. Previously, besides working in a Petaluma nursery

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³ Descriptions of less important varieties in this bulletin are condensed. For a complete version, see manuscript of the same title in the University of California archives at Berkeley and Davis. For additional information about Burbank and his work, see: W. L. Howard, *A Factual Study of Luther Burbank*, Chronica Botanica Company, Waltham, Mass.

for a few months, he had devoted considerable time to collecting seeds and bulbs of wild flowers, which he sold to eastern seedsmen.

The times proved favorable for the nursery business. The first transcontinental railroad had recently been completed, and there was much interest in sending dried fruits to eastern states. Fresh fruits could not be shipped, since refrigerator cars had not yet been invented. The California sunshine was ideal for drying prunes, peaches, and apricots; and good prices for them were obtained in Chicago. Prunes especially were wanted; the existing nurseries could not meet the demand for trees to plant. Then Burbank did a spectacular thing by filling an order from an impatient customer for 20,000 prune trees to be propagated from seed to budded trees, complete and ready for planting, between the months of January and December of a single year. The task was accomplished by "June budding"—a method certainly not original, but apparently not used before in California.

Burbank was a hard worker, a shrewd business man, and more than a match for his older rivals. From the outset he gave much attention to "novelties"—new or little-known old things, the unusual in fruits and flowers. It was an established custom with nurserymen and seedsmen to be always on the lookout for new and, presumably, better items that would command higher prices than the standards. The chief sources of novelties were chance seedlings, plants collected from the wild, and importations from distant places, preferably foreign. Also, to a limited extent, controlled breeding was practiced.

Every dealer hoped to offer one or several "new" items each year—the more numerous, the more profitable. If, however, he was conscientious, the novelties were few. The dealer who offered an undue number was viewed with jealous eyes or with downright suspicion. By following conventional procedure, nurserymen and seedsmen could not hope to acquire many promising innovations in a year. But Burbank was unconventional. Though he prospered in the general nursery business, with few novelties, all his interest was in new things.

His career was definitely launched in 1885, when he luckily imported an assortment of plums from Japan. Two of these became famous; and others served as breeding stock for producing many varieties now of great economic importance in California and wherever else the Japanese type can be grown.

By 1888 Burbank felt justified in selling his standard nursery and keeping only his novelties. He was now committed to the policy of conducting a private, or commercial, experiment station, since all the expenses and the profits, if any, must be derived from the sale of his products. From the start he tried to avoid multiplying his new things and selling them at retail, which would keep him in the conventional nursery business. Instead he endeavored to transfer to a dealer, for a lump sum, the entire stock of each new product—seeds, bulbs, or trees—with complete rights and control of propagation and resale. Among the most prominent retail firms handling these productions were John Lewis Childs of Floral Park, New York; Stark Brothers of Louisiana, Missouri; and J. M. Rutland of the Santa Rosa Nurseries and Orchards, Kiewa, Victoria, Australia.

He could never quite achieve his ideal. Every year, one or more items would fail to sell. To hold them over he must repropagate them and sometimes retail

them in small lots, not to a dealer but to persons who would plant them. Occasionally, too, a dealer purchased half interest in an article, leaving Burbank the control and sale of the other half.

Prices for complete rights to a novelty depended upon its supposed economic importance and upon the amount of stock on hand. For example, \$300 to \$800 was asked for a single quince or prune tree; \$1,500 for eight trees of a hybrid plum (afterwards named the Giant); \$3,000 for another hybrid plum (afterwards named the Golden), the stock comprising "one original tree, twelve small ones, and some grafts in old trees." The hybrid plum Perfection, afterwards renamed Wickson, consisting of the "original tree, six good-sized young trees and fifty grafts," was quoted at \$2,000. These prices were thought high; only the more affluent dealers could afford them. As a result, so much stock was left on his hands that Burbank was compelled to propagate it, care for it, and then sell it at retail, thus remaining in the nursery business in spite of himself.

This state of affairs continued until, in 1912, the Luther Burbank Company, a private corporation, agreed to purchase the exclusive right to handle everything he could produce. When, four years later, the company failed, Burbank took back the remnants of his business; but he never again became a nurseryman. Instead he devoted his entire attention to the growing and selling of seeds; and this arrangement continued until his death in 1926.

Burbank's fame as a mass breeder was much publicized by Hugo de Vries, who visited California in 1904 and 1906. Both times, De Vries spent one to three days with Burbank. Ostensibly he had come west to deliver special lectures at the University of California; but, as his writings reveal, the real motive was to see Burbank, whom he credits with being the greatest mass breeder of plants in either Europe or America.

De Vries hoped that Burbank, from his vast experience, could explain the origin of mutants, or new characters; but he was disappointed. Burbank denied the existence of mutants, as such, maintaining that all new characters in hybrids—including what De Vries called mutants—resulted from pre-existing old characters, recombined by crossing.

Burbank's sole object in making crosses was to cause variation in the seedlings; he could then improve them by selection. As a disciple of Darwin he had learned this lesson thoroughly. He found noticeable variation in his first-generation seedlings, but no desirable recombinations until the second and third generations.

For the most part his crosses were uncontrolled and therefore unscientific. Reputable scientists like De Vries, Vernon Kellogg, and George H. Shull have testified, however, that he was an unusually keen observer and that probably he could name the staminate parents of many of his hybrids with a high degree of accuracy. But he was not interested in parentage *per se*: he desired only to bring out the characters that promised even a step toward the particular improvement he might be seeking.

Further crosses might be necessary—backcrosses with one or both parents, or crosses among the hybrid seedlings. As with the Shasta daisy, another species might be introduced into the combination to secure a wanted characteristic such as whiteness. Data on parentage were not carefully kept. The

Carnegie Institution of Washington, after a five-year study of such records as were available, unfortunately did not report their findings.

Burbank's limited records were designed for his own working information and not for other eyes—certainly not for scientific analysis. His observations related always to the particular economic purpose his hybrids would probably serve as fruits to eat, flowers to gladden the eye. For these purposes he employed a simple system of cabalistic figures and designs, intelligible only to himself.

He had to be brief, for he worked alone, confided in no one, had no understudy, and left no successor. After his death the experimental orchard at Sebastopol was taken over by an eastern nursery firm, which up to 1942 has introduced 34 varieties of fruits and nuts from the hybrids he had on trial.

Exactly how many varieties of fruits, flowers, and other plants were introduced by Burbank during his working life of fifty-three years will probably never be known, since he left no systematic account. The present study has been centered upon his introductions as announced in catalogs and price lists; he did not advertise in either newspapers or trade journals. Apparently no one—even himself—kept a complete file of his publications. Isolated copies exist in libraries and private collections from California to Massachusetts. A total of 127 pieces have been unearthed and abstracted. While there is no assurance that all his announcements (with one exception) have been found, the evidence points to that conclusion: (1) When the titles are arranged chronologically, all years are accounted for with one or more publications. (The lack of publications in 1896 was caused by illness and by his divorce from his first wife.) (2) Contemporary literature (agricultural and trade papers) covering his most productive years, those from 1888 to 1926, mentions no introductions beyond those listed in his catalogs. An imperfect set of the catalogs has been assembled and is now in the library of the College of Agriculture, University of California, Davis.

Another main source of information was the huge scrapbook, containing nearly 5,000 pages, which Burbank kept for fifty years. Still another is the twelve-volume autobiography, in which he reviews what he considers to be his chief triumphs. Finally, many of his varieties are described in books on fruit growing and in the special publications of the New York Agricultural Experiment Station at Geneva.

Because Burbank at first conducted a commercial nursery and later a general seed business, and in both instances sold things that he himself did not originate, it is difficult or impossible to know whether to accredit certain varieties to him or to discard them as standards. In the lists here presented, mistakes may have been made; the writer cannot claim to be familiar with all the hundreds of fruit and flower varieties current twenty to forty years ago. Doubtful items, however, are usually omitted.

Briefly, Burbank introduced over 200 varieties of fruits alone, consisting of 10 different apples, 16 blackberries, 13 raspberries, 10 strawberries, 35 fruiting cacti, 10 cherries, 2 figs, 4 grapes, 5 nectarines, 8 peaches, 4 pears, 11 plumcots, 11 quinces, 1 almond, 6 chestnuts, 3 walnuts, and 113 plums and prunes.

Plums were Burbank's most valuable contribution. Twenty of his varieties—18 per cent of the total introduced—are still widely planted throughout

the United States and other countries. Ten of the number are standard shipping varieties wherever Oriental plums are grown for marketing, as in California, South Africa, Argentina, and Australia. In California alone they form the basis of a major industry. At present there is, in this state, a total of about 24,000 acres of Burbank varieties—upwards of 2,000,000 trees. Thousands of carloads of fruit are shipped annually; and the money returns run into the millions—not a bad showing for the industry of one man.

In the following catalog of Burbank's productions, the variety names are given, together with the dates they were first announced in print. The statements made about each variety represent, in the main, the present writer's own conclusions. The accounts (including scientific names) given in Burbank's catalogs, scrapbook, and autobiography have been critically reviewed in the light of standard horticultural literature. In cases of uncertainty, Burbank's own statements are given in quotation marks. The whereabouts of each Burbank catalog is indicated in the "Literature Cited."

In addition to the publications cited, a bill of sale to the Luther Burbank Company of San Francisco was found. It was dated August 21, 1914, and listed 30 varieties of fruits, flowers, and vegetables that are not mentioned elsewhere. Presumably they were resold to the public. Though little is known about them, they are included as a matter of record. The bill of sale, found among Burbank's effects, may have been only a memorandum, for the document was unsigned; but this does not alter the validity of the names.

FRUITS⁴

APPLE

None of Burbank's apples attained fame at all comparable with that of his plums. His prestige, however, caused them to be widely planted in private gardens and apparently, in a few instances, raised for local markets. Published testimonials indicate that individuals thought highly of certain varieties, particularly the Goldridge and the Winterstein.

Autumn Russet.—1920. Season, fall. (118, p. 6.)

Bonita, or Red Maiden Blush.—1919. Seedling of Gravenstein. (115, p. 2.)

Crimson.—1919. Seedling of Garden Royal. (115, p. 3; 118, p. 2.)

Goldridge.—1911. Seedling of Newtown. (86, p. 14; 102, p. 11.)

New Fall Golden Russet.—Listed in the 1914 bill of sale.

Peron.—1914. Listed in the 1914 bill of sale.

South.—1912 (?). Color photograph of fruit. (135, vol. 4, p. 181.)

Star.—1919. Seedling of Baldwin. (115, p. 2.)

Tokapuna Russet.—1901 (?). Imported from New Zealand in 1886. (191.)

Winterstein.—1901. A Gravenstein seedling. (56, p. 5.)

BALLOON BERRY

Cardinal.—1911. This is evidently a seedling of *Rubus illecebrosus*, generally known as strawberry-raspberry. (86, p. 17; 113, p. 4.)

⁴ Italic numbers in parentheses, at the close of each discussion of a variety, refer to "Literature Cited" at the end of this paper. As a rule, specific pages in these publications are indicated.

Rubus.—1900 (?). An unidentified species of *Rubus*, imported from Central China. Berries orange-colored. Canes long and thick, semitrailing. Distributed by John Lewis Childs. (*Rural New Yorker*, about 1900; 7, vol. 4, p. 151.)

BLACKBERRY

Autumn King.—1893. Lawton × Oregon Everbearing. (34, p. 33.)

Himalaya.—1885. A second-generation selected seedling from seeds imported from India "through exchange." It was "extremely vigorous; annual growth 10 to 20 feet; heavy bearer (average 3 tons per acre); late." August or September; long fruiting season (4 to 8 weeks). Canes perennial. Probably several types in existence—some practically barren. Readily pollinated by other blackberries. As a rule, not hardy in the North and East. Reaches best development in California and Washington, where it is still widely grown. Originally announced by Burbank in a special circular, now lost. (42; 45, p. 3; 95, p. 3; 100; 135, vol. 6, p. 30.)

Humboldt, or Hybrid 18234.—See also Phenomenal. (34, p. 26; 35, p. 13.)

Iceberg.—1894. A third-generation, selected hybrid, from a cross between Lawton and Crystal White. Sold to John Lewis Childs. Widely planted by amateurs because of intensive advertising. Never a commercial success. The berries had considerable merit, but consumers did not want a white blackberry. Has long since disappeared. (35, p. 11.)

Japan.—1886. Imported from Japan in 1883. Chiefly ornamental. (20, p. 12.)

Paradox.—1893. A fourth-generation selection from a cross between the Crystal White blackberry and Shaffer's Colossal raspberry. "Produces an abundance of oval, light-red berries of good size, larger than either progenitor and of superior quality." Judging from a photograph, the fruit closely resembles the modern Boysenberry. Does not seem to have been much planted; the fruit was too soft for handling. Burbank maintained that this hybrid, a perfect blend between the blackberry and raspberry, should be regarded as a new species. (34, p. 13; 35, p. 29.)

Peerless (C-11).—Listed in the 1914 bill of sale.

Phenomenal.—1894. First described by Burbank in 1893 as "Hybrid Berry V. C. 18,234." The next year, 1894, he called it a blackberry-raspberry hybrid and named it Humboldt. In 1909 it was sold to John Lewis Childs, who rechristened it Phenomenal, the name it bore ever afterward. A newspaper clipping in Burbank's scrapbook states that it was introduced by the California Carnation Company of Loomis, California, as one of Burbank's "New Offerings for 1905." It is a second-generation hybrid from crossing the California wild dewberry with the Cuthbert raspberry, and was regarded by Burbank as a new species. It bears a marked resemblance to the Loganberry, but is considered by growers as superior to that variety. Phenomenal is still found in the markets of California. (7, vol. 4, p. 297; 34, p. 26; 35, p. 13.)

Primus.—1893. The first of Burbank's blackberry-raspberry hybrids that he advertised as a new species. According to him, the parents were the California dewberry (blackberry) (*Rubus vitifolius*, horticultural variety Aughinbaugh) and a Siberian raspberry (*R. crataegifolius*). The Primus

was selected from the first lot of seedlings, was sold to John Lewis Childs, and was of some importance as a market berry on the Pacific Coast, particularly in Oregon, for fifteen or twenty years. It is, however, no longer planted. The berries were too soft; it also did not yield heavily. (34, p. 24; 137, p. 249.)

Prolific (D-2).—Listed in the 1914 bill of sale.

Red Hybrid Blackberry.—1897. "Similar to Logan but larger and of much better quality." No further information. (42.)

Rubus.—See page 34.

Santa Rosa.—1920. A thornless blackberry. "Long, strong vines like a grape, which commence to bear one year later than other berries, but more than make up in abundance of fruit." Ripens very late—September to November. Very sweet. No information as to origin or importance. (102, p. 11; 118, p. 3.)

Sebastopol.—1920. Same as Santa Rosa, but later and sweeter. (102, p. 11; 118, p. 3.)

Snowbank.—1916. Seedling of Iceberg. "A great improvement on that variety. . . . Too soft for market." (102, p. 12.)

Superb.—1916. Seedling of Himalaya Giant, the first name given to the Himalaya. Was considered an improvement over the parent. (102, p. 11.)

Triumph (A-17).—Listed in the 1914 bill of sale.

BLUEBERRY

Announced in 1909 as New Hybrid. Introduced by John Lewis Childs, who said of it: "Absolutely new species of berry plant . . . from two distinct wild species, one from West Africa and the other from the west coast of America." No further information. (7, vol. 10, p. 18.)

BUFFALOBERRY

Announced in 1918. Apparently a selected seedling from some wild type of *Shepherdia argentea*. Occasionally cultivated in northern regions, where fruits are scarce, since 1840. Used for ornament as well as fruit. (113, p. 6; 127, p. 3.)

CACTUS, FRUITING TYPE

Most cultivated forms of *Opuntia* belong either to *O. ficus-indica*, the Indian fig, or to *O. tuna*, the prickly pear. Economically considered, the opuntias are by far the most important of the cacti. *O. vulgaris*, the barberry fig, is a form of prickly pear that is hardy even in New England.

For several years Burbank maintained a huge collection of cactus species, mostly belonging to the genus *Opuntia*, which he assembled from various parts of the world. Perhaps the largest number of forms came from Mexico. Over a period of twenty years, more than 60 varieties, mostly the product of selection or hybridization, were offered for sale, some being recommended for their fruit, some exclusively for forage, and still others for both purposes. A few of the fruiting kinds deserved to survive and indeed may yet be found in numerous private gardens throughout the milder parts of California; but nearly always the variety name has been lost.

Some of the fruiting varieties bore vicious spines, while others were almost (if not entirely) spineless. Forage varieties, on the other hand, were usually

devoid of spines, or practically so. The fruit varied greatly both in quantity and quality: it might be high or low in sugar, seedy or almost seedless.

Cactus fruit is particularly valued in Mexico and Mediterranean countries for its numerous uses. It is peeled and consumed fresh, but also may be converted into confections, jellies, jams, sirups, or fermented drinks. Pulp from the "leaves" is used for flavoring candies, both here and abroad.

According to the late David Griffiths, a United States Department of Agriculture authority on cactus, many of the *Opuntia*, especially the species known as tunas, yield agreeable, refreshing, and nourishing fruits, which in parts of Mexico are much eaten by the poorer natives and are marketed both fresh and dried. They present a wide range in color, flavor, and size. The so-called Tapuna pear, illustrated, but not discussed, by Griffiths in one of his bulletins, is described by Burbank as the hardiest of the semitropical opuntias (135, vol. 8, p. 190); he says that it "bears superior fruit in the greatest profusion, and when quite young. The Tapunas seem to be almost as hardy as the fig and will withstand moisture better than most of the others." (66, p. 11.) He mentions a variety, the Hayne, as being of the "Tapuna class," and elsewhere calls it a fruit of the "Tapuna strain of the *Opuntia*."

Several varieties could, under favorable conditions, produce large quantities of forage. Despite the publicity, however, few persons used cactus as a cattle feed, the purpose for which it was chiefly recommended; although palatable, a fairly good supplementary feed, it apparently was impractical—simply not good enough to cause dairymen and feeders of meat animals to change their established habits of caring for their herds.

By and large, no one made money out of cactus except the dealers, who must have taken in huge sums during the craze of 1909 to 1915. All bought only for the purpose of selling to someone else. Fantastic prices were sometimes paid for a single slab of a new variety. Burbank once sued an express company for \$10,000 for a single shipment to Australia, which he claimed had been lost through carelessness.

But bubbles are fleeting. This one burst because the industry was wholly speculative. Burbank believed in cactus, at least at first—that it could be made the basis of a solid industry. Much to his chagrin, however, the speculators took it out of his hands. Conditions laid the industry wide open to fraud. The Burbank Company, a private enterprise that took over all his products in 1912, gave the cactus as a business, in this country, its deathblow.

Abundant.—1915. Origin not given. (99.)

Actual.—1911. A cross between *Anacantha* and Smith. (80, p. 20.)

Anacantha (U. S. 3,423).—See page 43.

Arbiter.—See page 43.

Avalon.—See page 43.

Banana.—1911. A seedling of the variety White Fruit, a half-spineless variety introduced by John Rock of San Jose, California, about 1870, and widely distributed in California and Florida. Lemon-yellow fruit with crimson blush; flesh banana-colored, firm, sweet, unusually good; seeds not abundant. (80, p. 19.)

Bijou.—1911. "A combination and selection from the little, thorny *Opuntia vulgaris* (Barberry fig) of New England . . . and *O. Rafinesquei* (*O.*

humifusa) of the Western Plains." Scarlet fruits 1 to 1½ inches long, ¾ inch thick. Said to ripen early, before strawberries, and to be very good to eat. Offered because of its hardiness. Partially spiny (80, p. 21; 87, p. 15.)

Catania (U. S. 3,642).—1907. Sicily. "Received by Bureau of Plant Industry through W. T. Swingle, July, 1900. Said to be a very good fruiting opuntia. Has not borne fruit here." (66, p. 11.)

Colorado.—1907. From near Tepic, Mexico. Similar to Morado, but with smaller leaves. Fruit good; dark red; size and shape of hen's egg. (66, p. 12.)

Corfu.—1907. Imported by E. R. Skelley in 1889 from the island of Corfu in the Adriatic Sea, where it has been grown for centuries. "Mr. Skelley writes that the fruit is delicious. Has not fruited here." (66, p. 11.)

Eldorado.—1911. Seedling of White Fruit. Hardy and extremely productive. Unusually large, thin-skinned fruit of high quality. Color olive-green shaded with lemon-yellow and rose-pink; flesh pale yellow or straw color; rich, melonlike flavor; nearly seedless. (80, p. 18.)

Elegant.—1911. Same origin as Bijou. Both leaves and fruit larger than Bijou. Has an occasional spine. Hardy in New England. (80, p. 21; 84.)

Fresno.—1907. Both fruit and forage. See page 44.

Gravity.—1912. Selected seedling, but parentage not given. "Nearly spineless." Fruit large, up to ½ pound; yellow, shaded-orange; flesh yellow, sweet, with few, small seeds; ripe October to March. (87, p. 13.)

Guayaquil.—1907. Seeds from Guayaquil, Ecuador. Said to be as hardy as the Barberry fig class (*Opuntia vulgaris*). Spines absent and "the bristles so reduced as to be harmless. The strain from which this variety originated bears large, delicious, yellow fruits." (66, p. 19.)

Gymnocarpa (U. S. 12,402).—1907. Selected seedling of the Indian fig class. "Very few, small weak spines and rarely any bristles." Fruit red, flesh crimson, good quality. Recommended for fruit rather than forage. (66, p. 11.)

Hayne.—1907. "Seems to be a cross between the Tapuna and Indian fig classes. No spines and almost no bristles." Collected in Mexico by William Ashton Hayne, as promising for fruit. (66, p. 13.)

Malta (U. S. 9,352).—1907. "Received through my esteemed friend David G. Fairchild." Selected form of the Indian fig class. "Very few, short, weak, hair-like spines; bristles wholly absent." Fruit large—4 inches long, 2 inches thick. Skin yellow, turning to light red when fully ripe; flesh salmon with crimson shadings, sweet but not of best quality. Bears abundantly. (66, p. 11.)

Market.—1911. Seedling of Smith, an import from North Africa about 1897. Like its parent, Market bears heavily of brilliant, crimson, 6- to 7-inch fruits with thin, easily removed skin. Flesh violet-crimson, sweet but seedy. Half spiny. (80, p. 20.)

Mission, or Hall.—1907. A selected seedling of the Indian fig class. Presumably from Sicily, being described as very similar to Skelley, which came from Sicily in 1895. "Only a few scattering, weak spines and no bristles." Fruits size of a hen's egg; red, seedy; fair quality. (66, p. 12.)

Monelova.—1907. Collected near Monelova, Mexico, by Carlos T. Plant. "Although this is called a thornless cactus, the short spines and bristles do not recommend it for forage." Said to produce excellent fruit. (66, p. 13.)

Myers.—See page 45.

Niagara.—1911. Seedling of Smith, an old, so-called spineless variety. "Plant and fruit both somewhat bristly but not nearly so much so as the parent." Also a heavier producer of fruit, which is bright crimson with crimson flesh. Seedy. (80, p. 21.)

Opaline.—See page 45.

Quillota.—1911. Hybrid of Anacantha and White Fruit. Fruit large, handsome; yellow, with crimson blush; skin thin, readily removed; flesh pale-greenish, almost white. "Unlike other *Opuntias*, it drops at once like apples when just ripe, thus saving the trouble of picking," September to April. (80, p. 21.)

Rosamel.—See page 45.

Royal.—1911. Seedling of Anacantha which "has, no doubt, been grown for ages in all cactus countries. . . . During my early experiments it was received . . . from almost every quarter of the globe." Not completely spineless. Fruit of the Royal is handsome, compact, smooth; pale-yellow skin, with crimson blush, easily removed; flesh yellow, seeds few, tomatolike; sweet, quality high. (80, p. 19.)

Saffrano.—1918. "Produces a large yield of superior, orange-yellow fruits." (111, p. 6.)

Skelley.—1907. Of the Indian fig class. Imported from Sicily in 1895 by E. R. Skelley of Riverside, California. A few weak thorns and bristles. Said to produce fine fruit, extensively used as a food in Sicily. (66, p. 15.)

Smith.—1907. Indian fig class. Imported from North Africa by Emory E. Smith about 1893. "One of the parents of many of my spineless hybrids." Extensively grown in Southern Europe and North Africa for the fruit markets. Leaves and fruit "generally well supplied with bristles and some spines." Fruit large—2 × 5 inches. Skin thin; flesh crimson; quality excellent. Ripens early. (66, p. 10.)

Sugar.—1912. "Deliciously sugary, large, pale-green fruit, which ripens through all the fall and winter months." Recommended for both fruit and forage. (87, p. 12.)

Superb.—1912. "A hybrid seedling from a cross of Smith and Anacantha." The slabs are almost covered with large, oval fruit, pale-yellow, shaded with olive-green and crimson. Skin thin and easily removed. Flesh pale-amber, rich, sweet. Seeds few. Ripens early and remains in good condition for 4 months. (87, p. 14.)

Taormina (U. S. 9,353).—1907. Indian fig class. Imported by Lathrop and Fairchild from Taormina, Sicily, in 1903. "Both leaves and fruit are heavily armed with most diabolical spines and bristles." Fruit ripens late; size 2 × 3½ inches; pale-yellow, shaded red. Flesh greenish-white, sweet, fine flavor; seeds small. (66, p. 13.)

Watson.—1907. Received from Professor J. R. Watson of central Mexico. "Of the Tapuna class." Only a few spines and bristles. Fruit size and shape of hen's egg, bright red, seedy but good. Highly productive. (66, p. 14.)

White Fruit (U. S. 3,186).—1907. Introduced by John Rock of San Jose, California, early in the 1870's. Of the Indian fig class. Strong grower. Nearly free of spines and bristles. A promising *Opuntia* for both fruit and forage. (66, p. 13.)

CHERRY

Burbank made numerous crosses with cherries, but introduced only a few varieties. In his hybridization experiments he mentions using our common cherries, varieties from South America, the wild chokecherry of New England (*Prunus demissa*, which he called *P. virginiana*); the eastern black cherry (*P. serotina*); the bird cherry (*P. pennsylvanica*); the Catalina or Islands cherry (*P. Lyonii*); and the sand cherry (*P. Besseyi*). His experience led him to declare that the last-named species behaved more like a plum than a cherry. Having made the crosses, he usually selected what he judged to be the most promising seedlings, after one season's growth in the nursery row, and grafted them upon a certain old cherry tree in the Sebastopol orchard. There they fruited a year and a half later, the grafts being far out on the old branches, where they matured rapidly. As individuals were removed, to be discarded or propagated for further trial, new ones took their places. In this manner he claimed to have had 400 hybrids under constant observation from about 1908 on. While this figure is probably an exaggeration (to judge from an inspection of the tree some years after Burbank's death), there certainly were half that number of grafts on the tree in 1933; Burbank was a skillful workman.

Though Burbank, during his lifetime, did not see fit to launch many new varieties from the populous "colony" on this mother tree, five (Black Giant, Honey-Heart, Early Honey-Heart, Red-n-Gold, and Great Blood Heart) have been introduced since his death by Stark Brothers, who purchased the rights to the orchard and who have still other varieties under observation.

Abundance.—1911. Seedling of Napoleon (Royal Ann). Supposed to ripen a week later than its parent. Not sufficiently superior to Napoleon to be of commercial importance. Not liked by the canners. (34, p. 124; 85, p. 7; 90, p. 3; 169.)

Black Giant.—1911. Mentioned casually in his autobiography, where a color photograph of the fruit is shown. Parentage not given. "The product of crossing between the various highly developed members of the cherry 'colony' represents one of the newest varieties developed by Mr. Burbank." Introduced by Stark Brothers about ten years after Burbank's death. (11, p. 81; 135, vol. 2, p. 221-27.)

Boss.—Listed in the 1914 bill of sale.

Botan.—1914. Mentioned incidentally in the autobiography (135), where it is shown in a color photograph by the side of Black Giant. It is pale red and apparently as large as its companion. Has never been introduced under this name. (135, vol. 4, p. 81.)

Burbank.—1903. Seedling of Early Purple Guigne. Wickson (189, p. 232), who calls it the Early Burbank, says it was purchased and introduced by a group of Vacaville (California) growers. Very early. An important shipping variety in California for nearly forty years. Now on the wane, but still found in all important markets. (73, p. 4.)

Giant.—1900. Hedrick (152, p. 259) says this variety was announced by Burbank in 1900 but was not introduced until 1914—by the Luther Burbank Company of San Francisco. Probably the same as Black Giant. Untried. (96, p. 8.)

Improved Giant.—A seedling of Black Giant. Color photograph shown in his autobiography. No record of its having been introduced. (135, vol. 2, p. 223.)

1909 Fine.—Listed in the 1914 bill of sale.

Oval Black.—Listed in the 1914 bill of sale.

South Giant.—1911. Apparently a seedling of the Burbank. Referred to (169, p. 124) as a temporary name for a new variety contemporaneous with Late Napoleon (afterwards named Abundance). Probably was not introduced during Burbank's lifetime.

DEWBERRY

The four unnamed hybrid berries that follow were advertised in 1893. As they did not appear in the next announcement (that is, for 1894), presumably they were sold, and were given names by those who purchased or introduced them.

Hybrid V. C. 628.—1895. From the same cross that produced the Phenomenal; but unlike that variety it has the color and flavor of a red raspberry and usually separates from the stem like a blackberry. Said to retain a very high flavor when dried. (34, p. 27.)

Hybrid V. C. 16,407.—1893. Seedling of an improved California dewberry (Aughinbaugh) and Cuthbert raspberry. "Larger than the largest berry ever before known; bright crimson raspberry color; . . . the berries grow in clusters of 5 to 10 or more each, and individual berries often measure 3 inches around one way by 4 the other." (34, p. 26.)

Trifoliate No. 1.—1893. "A curious, medium-sized, unusually sweet dewberry produced by crossing the California dewberry and Siberian raspberry . . . vines long, slender . . . multiplies rapidly from tips." (34, p. 27.)

Trifoliate No. 2.—1893. "Similar to No. 1 and grown from the same berry but larger and not quite as sweet as No. 1." (34, p. 27.)

ELDERBERRY

Announced in 1915 as New Superb. Apparently a selection from the wild. "The berries are especially fine for cooking, not having the usual bitter taste of ordinary elderberries." The New Superb is now unknown, probably because other wild berries were of equal value. (100.)

FIG

Foundling.—1885. Found in Sonoma County, California, in a shipment of White Smyrna trees imported from the eastern Mediterranean. This single tree bore fruit of a light, yellowish-brown color, unusually large and of fine flavor. Probably of the Adriatic type, for it bore two crops in a season. (13, p. 10.)

Hardy Japan.—1887. Two varieties . . . one black, one white. Probably imported from Japan. (20, p. 10.)

GOOSEBERRY

Announced in 1921 (?) as California. "Produces abundantly large, oval, pale-pink to almost white berries of extra fine quality." (120.)

GRAPE

Australis.—1915. A seedling of the Pierce, which in turn is a bud sport from Isabella. "Color, blue-black; quality, the very best." Very early and productive. Evidently differed in origin from the *Australis* mentioned by Hedrick. No known plantings. (100; 150, p. 436.)

Christmas.—1915. "Another Pierce seedling which, like the *Australis*, has been fully tested during the past 15 years." Blue-black. Productive. If protected from rain, the fruit hangs on until nearly Christmas. Clusters 6 to 8 inches. Planted in home gardens in California. (100.)

Montecito.—1913 (?). A seedling of Pierce. Claimed to be the earliest black grape known. "It was temporarily called Early Black, but was rechristened Montecito by John M. Rutland of Kiewa, Victoria, Australia, who purchased it for introduction in Australia." (135, vol. 6, p. 206.)

Vitis Davidii.—1918. A Chinese grape received from a missionary in Shantung, China, in 1909. Although the variety had been known to botanists much earlier, this seems to have been a pioneer effort at introducing the *Davidii* as a fruit plant. More useful as an ornamental. Bears sparingly. Fruit best used for cooking. Leaves very large and glossy, coloring beautifully in autumn. Canes prickly. Suitable for planting only in a mild climate. (113, p. 6; 116, p. 8.)

JUNEBERRY

There are a dozen or more species of *Amelanchier* indigenous to North America, but there is no evidence that Burbank conducted breeding experiments with them. He announced only one variety.

Success.—1897. Probably a selected wild form of this treelike shrub, which is valued chiefly for its snow-white flowers in early spring. The fruit is edible, though lacking in quality. (42; 50, p. 16.)

MULBERRY

A variety called New Dwarf was announced in 1888. Seedling of the black mulberry (*Morus nigra*). Originated on Burbank's grounds. While this is the species grown for its fruit in Europe, it is here used more as an ornamental. (25, p. 6.)

NECTARINE

Big String.—1914 (?). The only information is a bare mention, with a color photograph, in the autobiography. Deep red, with yellowish flesh. (135, vol. 4, p. 163.)

Bully.—1914 (?). Same authority as the preceding—a color photograph. Medium-sized; blunt round; light red, with yellow flesh. Freestone. No record of any sale to a distributor. (135, vol. 4, p. 165.)

Gold.—1927. From a cross of Muir peach and New White nectarine. Ripens August 10 to 25. Large, deep golden-yellow, nearly half covered with crimson. Flesh a brilliant yellow; firm, rich, subacid. Freestone. Announced after Burbank's death. (134, p. 7.)

Muir.—Listed in the 1914 bill of sale.

Yellow.—1920. "New, large, crimson, rich, yellow flesh. Enormous and constant bearer." No further information. Possibly renamed Gold and introduced again in 1927. (118, p. 2.)

OSOBERY

First announced in 1918. Supposed to be an improved variety of osoberry (*Osmaronia cerasiformis*), which is sometimes planted for its fruit. (110; 113, p. 6.)

PEACH

Early.—1920. "A new productive home peach, of surpassing beauty and excellence for home use." (118, p. 2.)

Exquisite.—1914 (?). Mentioned incidentally, with color photograph, in the autobiography. No description. Seems to be a yellow freestone with yellow flesh; red at the pit. The editor of the biography calls this one of Burbank's many seedlings, but gives no clue to its parentage. Hedrick (153, p. 357) lists a variety of this name, a freestone with yellow flesh, red at the pit and ripe in September; originated in Georgia before 1858. (135, vol. 4, p. 147.)

Leader.—1911. Presumably a cross between Muir and Early Crawford. Globular; bright yellow with deep crimson blush; flesh yellow, meaty, firm, sweet. Stone small and quite free. Never commercially planted. (36, p. 13; 82, p. 3.)

Lemon Muir.—1913. "So named because of its lemon-tinted color." A seedling of Muir pollinated with New White nectarine. Apparently never offered for sale. Mentioned in the autobiography, where a color photograph is shown. (135, vol. 6, p. 155.)

National.—1911. A cross between Muir and Early Crawford. Trees vigorous. Fruit globose; yellow, with deep crimson blush and crimson dots. Stone small, free. Ripens after the Leader and before the Muir. (86, p. 13; 90, p. 3.)

Opulent.—1901. Originated from a Muir-Wager seedling pollinated with New White nectarine. "Skin creamy white, slightly downy and usually about half covered with crimson dots and blushes." Flesh of light straw color throughout. Flavor an unusual blend of sugar and acid, but too sharp for most tastes. Rather widely planted for home use for several years. Now rarely met with. (56, p. 4; 96, p. 7.)

Peach × Almond Hybrid.—1899. Wager peach × Languedoc almond. Supposed to be valuable as a rootstock to impart vigor to the trees, but little used for this purpose. Produced scanty crops of smallish peachlike fruit with a thin layer of edible flesh. The stones, slightly pitted, resembled almonds. (50, p. 17; 60.)

Quality.—1919 (?). "The best flavored of all my Muir-Crawford hybrids." No further information. Hedrick (153, p. 449) lists a variety of this name, originated by J. W. Kerr of Denton, Maryland, about 1903. The two were probably not related. (115, p. 7.)

PEAR

Berger.—1926. A pear sport discovered by a woman in San Diego County, California, in 1925. "A large pear shaped like a big apple or a quince; color greenish-yellow, with numerous russet dots and spots here and there. Skin slightly tough. Ripens last of September into October. Flesh pure white, firm and exceedingly fine texture and grain. Very delicious. Fruit solid; very heavy." No information about the parent tree. (134, p. 2.)

Big Productive.—1920. A hybrid between Bartlett and Le Conte. No description beyond the remark that it was a fall pear. (118, p. 2.)

Seut Lea.—1885. An importation. "A curious Chinese weeping evergreen pear." Leaves large and glossy; long slender branches. "It has not fruited here yet, but from all reports from China the fruit is very sweet and valuable." Probably more of a curiosity than a source of food. (14, p. 4.)

Test.—1911. A product of random crosses between Chinese and Japanese pears and our native varieties. "In form much like Bartlett and in quality more like Le Conte." Four weeks later than Bartlett. No exact information as to parentage. (86, p. 14.)

PLUM AND PRUNE

Burbank's most lasting fame will always be associated with the long list of plum varieties he introduced—some by direct importation, some by hybridization. Others had imported plums from Japan, to be sure; but only two varieties—Kelsey and Chabot—were available until Burbank entered this field of endeavor. To him, therefore, belongs the credit for introductions that started huge horticultural industries in all parts of the world where early-flowering fruits can be grown. Well-known varieties are only briefly described here, since details about them may be found in numerous horticultural publications.

Abundance.—1888. Imported from Japan in 1884. Introduced by John T. Lovett, Little Silver, New Jersey, in 1888. Originally known as Botan. Listed as Abundance by the American Pomological Society's fruit catalog for 1897. Perhaps planted more widely than any other Japanese plum, although others, because of their shipping qualities, have a much larger acreage, especially in the South and on the Pacific Coast. (151, p. 136.)

Ace.—1927. "A medium-size, crimson plum. Firm. Crimson all over. Light-crimson flesh; half freestone. Rich, sweet, delicious. Fruit covered with pale-blue bloom." Still grown in isolated localities, particularly in Placer County, California. Has not proved popular. (134, p. 5.)

Alhambra.—1905. Mentioned by De Vries, who called it a "sevenfold combination" including *Prunus Simonii*, *P. Pissardi*, *P. domestica*, *P. triflora*, *P. americana*, and *P. nigra*. (41, p. 342; 151, p. 141.)

America.—1898. Seedling of Robinson fertilized with pollen of Abundance (Botan)—a successful cross between *Prunus triflora* and *P. Munsoniana*. Widely planted, but never important in the fruit markets. (48, p. 3.)

Apple.—1898. "Its parentage is not known, except that it is a second generation seedling from cross-bred seedlings, and no doubt Satsuma and probably Robinson are in its line of ancestry." Satsuma characters, especially the hard, red flesh, are very noticeable. Has never been important here, but is well known in South Africa. Stock sold in this country to Isaac Hicks and Son, address not given. (7, vol. 10, p. 22; 48, p. 2.)

Aroma.—"The earliest of all plums," according to the 1914 bill of sale.

Ballena (The Whale).—1906. Seedling of the Bartlett. "Strikingly unique in form, resembling a huge, well-fattened almond, averaging about six by nine inches in circumference. Color light yellow, mostly covered with clear crimson; flesh firm, pale yellow with a rich Bartlett pear flavor. Freestone." Intro-

duced (in Australia) by J. M. Rutland. "This variety has not been disposed of for propagation in America yet." (174, p. 20.)

Bartlett.—1896. Cross between Simon (*Prunus Simonii*) and Delaware. Fruit oval, yellow, mostly overspread with crimson, turning to a deep crimson when fully ripe, with flakes and dots of yellow. Size medium. Light salmon-colored flesh, tender, sweet, with a peculiar but pleasant flavor suggestive of the Bartlett pear. Widely planted throughout the United States, but never popular as a market plum. (50, p. 9.)

Beach (Improved).—1897. Beach plum is the common name for *Prunus maritima*, a wild plum found in the sand dunes along the northern Atlantic Coast. No information as to whether the improved form is a hybrid or merely a selected seedling. "Compact, handsome tree, enlarged in all respects and the fruit is a beautiful purple, dotted white, with a white bloom and delicious to eat fresh from the tree, not having a trace of the original bitter taste. . . . Flesh deep yellow, freestone. . . . Ripens with the common beach plum. . . . Trees bloom . . . later than any other plum." (42; 56, p. 12.)

Beauty.—1911. "The product of a very complicated heredity including several species." One of the most important of the Japanese plums—200,000 to 250,000 crates being shipped annually from California alone. Also important in South Africa. (86, p. 7; 90, p. 4.)

Beauty Junior.—1920. A seedling of Beauty. "Very large, round, deepest crimson . . . long keeper." Ripens September and October. Unimportant. (118, p. 2.)

Beejay.—1927. Origin not given. Brought out and named after Burbank's death, although he had it marked for introduction. He said of it: "Undoubtedly the best of all. The plumcot plum (because of its flavor; it has a distinctly apricot suggestion, but more tart, juicy, and delicious). . . . Pure light crimson, with numerous indistinct yellow dots and a curious pale-blue bloom. Flesh yellow, fairly firm, but very sweet and juicy. . . . Freestone . . . ripe last of August." Not important. (134, p. 5.)

Berckmans.—1887. *Prunus triflora*. Imported from Japan. Introduced by Burbank in 1887 as Botan (Abundance); but P. J. Berckmans of Augusta, Georgia, noticing that his own trees were different, called them Sweet Botan. Seeking to end the confusion, L. H. Bailey changed the name to Berckmans. Inferior to Abundance. Now, happily, out of the trade. (30, p. 2; 151, p. 159; 187, p. 133.)

Botan.—See Abundance.

Botankio.—1887. Probably a direct importation from Japan. "Similar to Botan; larger, but not as sweet; ripens here August 10." Never became of commercial importance. (20, p. 8.)

Botankio No. 2.—1887. Probably imported from Japan. "The leaves of this variety do not resemble any of the other Japan plums; has not borne fruit here yet. The tree might easily be mistaken for an apricot." Unknown today. (20, p. 8.)

Bully.—1914 (?). Mentioned in the autobiography. Color photograph. No information regarding parentage. Perhaps never offered for sale. Named from a visitor's comment—a convenient method for those who are forced to find large numbers of names. (135, vol. 5, p. 241.)

Burbank.—1888. A seedling imported from Japan in 1885. Name suggested in 1887 by Professor H. E. Van Deman, Pomologist, U. S. Department of Agriculture. Grown extensively throughout the United States. A leading shipping variety in California: 1938, 171,000 crates; 1940, 117,000. Popular in South Africa for fifty years. (2, p. 3; 25, p. 4; 100.)

Callao.—1916. "A very large, deep purple, hybrid plum. Flesh yellow. Sweet, rich. Freestone. Ripe August 10." No further information. Unimportant. (102, p. 8.)

Cazique.—1919. No information as to parentage. About one week earlier than the Santa Rosa. Similar to Beauty in appearance. "Large, round, purple; flesh shaded yellow and crimson like the well-known Santa Rosa." Local plantings. (115, p. 3.)

Chabot.—1885. Hedrick says this variety was imported from Japan by a Mr. Chabot of Berkeley, California, but was introduced to the trade by Burbank, who, in his 1885-86 announcement, calls it "an improved variety of the Kelsey." In the ghosted autobiography Burbank is made to say that he imported it. Apparently the "ghost" was incorrect. (14, p. 4; 135, vol. 5, p. 28; 151, p. 172.)

Chalco.—1898. A Simon-Burbank cross. Burbank says it was produced after twelve years' work in crossing *Prunus Simonii* with Japanese and American plums. Widely planted, but never an important market variety. (48, p. 4.)

Challenge.—1914 (?). "Of Chinese heritage." Probably a seedling of *Prunus Simonii*. Never advertised for sale by Burbank, but may have been privately disposed of to some one else who introduced it. No further information. (135, vol. 5, p. 61.)

Choice.—1911. A seedling of America (which is a cross between Robinson and Abundance). Trees said to be upright in habit and unusually vigorous. Fruit globular, large, pure lemon yellow, clingstone. Flesh golden yellow, firm, rich, subacid, handsome; good keeper. Ripe July 20 to August 5. Important only for home planting. (86, p. 8.)

Climax.—1899. Cross between Simon and Botan (Abundance). Originally called Royal, but renamed Climax. Widely planted. Once an extremely important shipping variety, but now on the decline. Still about 1,000 acres in bearing in California alone. (50, p. 2.)

Coin.—1927. Announced after Burbank's death. Parentage not given, but evidently a multiple cross between Japanese and American varieties. "A fine, round plum. Slender stem—one and one-half inches long. Skin yellow with large dots and shadings which make the fruit look like bird's eggs. Flesh clear pale amber; mild and sweet. Rich. Freestone." Probably suitable only for home planting. (134, p. 6.)

Combination.—1901. Japanese type. Probably a mixture of *triflora*, *Munsoniana*, and *Simonii*. "An extremely large, early, light-crimson plum . . . ripening here July 12 . . . about as early as Climax." Extensively planted for shipping purposes for twelve to fifteen years. Now of little importance. (56, p. 7; 135, vol. 5, p. 211.)

Conquest.—1911. A *Prunus domestica* × *P. insititia* hybrid effected by pollinating the French or Prune d'Agen with the bullace or wild plum of France known as the *sans noyau* or seedless plum. Several generations of reciprocal

crosses were required to produce the Conquest, which has only the rudiments of a seed. Practically the same size and ripening season as the French. Widely planted by amateurs, who used it as a plum; but never dried as a prune. (79, p. 5; 86, p. 9; 135, vol. 5, p. 132-37.)

Cranberry.—1919. No information as to origin; the description suggests that it may have been a selected myrobalan. "A small, brilliant, rosy plum, in appearance like a beautiful mammoth cherry . . . borne in ropes all over the tree. Fruit one inch in diameter; flesh pure white. . . . Ripe October 10 to November 10." May have been planted by amateurs. (115, p. 4.)

Crimson Cluster.—1920. No historical information on this; but it is undoubtedly a Burbank hybrid (134, frontispiece). "Latest of all—ripening in November; enormously productive." (119, p. 6.)

Delaware.—1893. Satsuma $\times$ Kelsey. Introduced by John Lewis Childs. Tree semidwarf. Fruit medium-sized; roundish-conical; dark purple with thick bloom; flesh red, juicy, sweet; clingstone; midseason. Home use; not known in the markets. (34, p. 18.)

Discovery.—1915. No history of its origin. Extract from Burbank's field notes: "Ripe July 10. New. Good bearer. Earlier than Climax. . . . Sweet, rich, firm flesh, rosy-crimson. Cling. Skin rich, deep crimson." Unimportant. (98, p. 9.)

Doris.—1894. "A seedling of Satsuma which grows as readily from cuttings as a quince or currant." Myrobalan was probably the male parent. Introduced by Stark Brothers in 1895. Fruit soft, juicy, sweet. Home use; too soft for marketing. (35, p. 9.)

Duarte.—1900. Burbank's description: "From seeds of America and Climax pollen, 1900. Skin deep purple, big yellow dots, blue bloom. Flesh purple crimson, nearly freestone." Ripe August 1 to 5. One of the popular Japanese-type market varieties. Approximately 2,000 acres in cultivation in California alone; 254,000 crates shipped in 1940. Introduced (1911) by the Pioneer Nursery Company of Monrovia, California. (7, vol. 13, p. 282.)

Early Crimson.—1914 (?). "A combination of the wild California, European and Japanese." Color photograph, but no history or description. (135, vol. 5, p. 229.)

East.—1908. A cross between Combination and the beach plum. "Prolific. Shape globular; pale-yellow, half covered with a crimson bloom and numerous indistinct dots; flesh pearly-yellow; quality good. Season August 1 to 15. Too soft for shipping. Sold to a well-known California fruit grower." (135, vol. 5, p. 211.)

Eldorado.—1904. *Prunus triflora* $\times$ *P. Simonii* (?). "Many years ago a small black Japanese hybrid plum was produced on my Sebastopol place . . . ripening early in July . . . but too small . . . at last in 1904 Eldorado appeared, just like the little purple All Summer, but about ten times as large." Different from the Eldorado mentioned by Hedrick. Grown commercially in California for more than thirty years, 36,000 crates having been shipped in 1939. (113, p. 2; 151, p. 441.)

Epoch.—1911. *Prunus Besseyi* $\times$ America. Fruit 1½ inches in diameter, produced in ropes. Crimson with shades and dots of yellow. Ripe August 15. (86, p. 11.)

First.—1901. Wild Goose and “five other late-ripening species” are claimed as the origin of the First, reputed to be the earliest-ripening variety—about 3 weeks ahead of Red June. Hedrick represents Burbank as saying, “This variety is one of the second generation of a combination cross of Hawkeye, Hammer, Milton, Wyant, Wayland and Burbank.” Originally announced under the number 31,288. This was in 1899. Fruit medium sized; roundish; yellow with faint blush; flesh yellow, sweet, juicy. (50, p. 17; 56, p. 6; 57; 135, vol. 5, p. 204; 149, p. 128; 151, p. 446.)

Flickenger.—1921 (?). On August 12, 1921, Burbank wrote as follows to M. Sharpe of Vacaville, California: “The Flickenger is a gigantic plum, also a good bearer and probably a fine shipper, though its light yellow—almost white—color is somewhat against it for selling in the Eastern states. Ripens just a little after El Dorado.”

Formosa (Wickson Challenge).—1907. A mixture of *triflora* species and several others. Introduced by Fancher Creek Nurseries of Fresno, California. Rights for Southern Hemisphere sold to J. M. Rutland in 1909. See their announcements for 1907–08 and 1909. Fruit red; flesh pale yellow, firm, sweet; flavor rich apricot; quality good; nearly freestone. One of the best and most successful of the Japanese type in all countries where grown. Shipments from California in 1940 amounted to 53,000 crates and 2,000 boxes. (96; 100; 151, p. 447.)

Fourth of July.—About 1901. According to an undated clipping from the *California Fruit Grower* entitled “Burbank Wonders,” this is a second-generation seedling from crosses involving a French prune (Prune d’Agen) and Japanese and American plums. “Flavor delicious.” (7, vol. 2, p. 176.)

Garnet.—About 1888. “Cross between Wickson and Satsuma.” Named by H. E. Van Deman, Pomologist of the U. S. Department of Agriculture. “Ripens a month earlier than Satsuma.” (7, vol. 2, p. 114; 173.)

Gaviota.—1900 (?). *Prunus triflora* × *P. americana*. First introduced under the name Rice Seed. According to Hedrick (151, p. 45), it originated with Burbank about 1900 and probably contains admixtures of species other than the two mentioned. Introduced by Fancher Creek Nurseries of Fresno, California, in 1909. Still grown commercially in California after nearly forty years, 44,000 crates having been marketed in 1940. Long planted in parts of Australia, but now being discarded because of weak trees and poor quality. Still important in South Africa. Introduced in the Southern Hemisphere in 1909 by J. M. Rutland. (7, vol. 9, p. 11; 71; 96, p. 15; 176.)

Geewhiz.—1911. A hybrid between *Prunus triflora* and *P. americana*. A seedling of America. “Fruit globular, two inches in diameter; crimson blush with numerous crimson dots on yellow ground. Flesh firm, pale-amber, apricot-like in texture, rich; freestone; good keeper. Ripens July 25 to August 10.” Of little importance. (86, p. 7.)

Giant.—1893. *Prunus domestica*. First announced as A. P. No. 90. Result of pollinizing French (Prune d’Agen) with Pond (Hungarian). Originally called a prune, but rarely used as such. Widely, but not extensively, planted as a shipping plum. Large, coarse, dry, but of fair quality. First exhibited at the California State Horticultural Society’s meeting in 1888. Introduced by Burbank in 1894. (35, p. 7.)

Giant Maritima.—1905. "A second generation hybrid from an improved beach plum pollinated with one of the hybrid Japanese plums." Planted by amateurs only. (135, vol. 5, p. 206–10.)

Gigantic.—1914. No information as to origin. "The most remarkable plum in size ever produced . . . green in color until ripe when it turns to a clear lemon-yellow. Nearly a freestone. Flesh a lemon-yellow . . . sweet." Ripens August 20 to September 15. Although Gigantic was given as a provisional name, there is no evidence of its having been changed. Unknown today. (96, p. 11.)

Globe.—1914 (?). *Prunus triflora* type. "The plum is a complex hybrid but the red flesh betokens a Satsuma ancestor." The color photograph shows the skin and flesh to be identical in color, a uniform deep red—an unusual characteristic. May never have been distributed. (135, vol. 5, p. 225.)

Glow.—1911. *Prunus maritima* × *P. americana*. "Product of a very complicated heredity including several species—*maritima*, *subcordata*, *nigra*, *americana*." (79, p. 14.)

Gold.—See Golden.

Golden.—1893. From a seed of Robinson fertilized by Abundance (Sweet Botan). Stark Brothers, the purchaser, changed the name to Gold; but that name is not recognized by the American Pomological Society, the accepted authority on nomenclature. Besides, another variety by that name was originated in Iowa by H. A. Terry. The Golden is hardy even in New England and has been widely planted, mostly for home use but occasionally for the market. Its sale is still pushed vigorously because it is both worthy, and beautiful to look upon. (34, p. 17; 79, p. 5; 151, p. 224; 187, p. 213.)

Goldridge.—1926. Announced posthumously. Of *triflora* type, but no historical data available. Fruit very large, a clear crimson; flesh yellow and solid; sweet. "In quality very much like Wickson and Climax." Unimportant. (134, p. 6.)

Hale.—1893. Kelsey × Satsuma. Originally announced as J-3972, and the next year as Prolific. In 1894 it was sold to J. H. Hale of South Glastonbury, Connecticut, who introduced it as Hale. Widely planted but unsuccessful—trees not hardy, and fruit too tender to ship. (7, vol. 2, p. 2; 34, p. 19; 35, p. 6; 79; 187, p. 236.)

Hermosillo.—1906. No information about its origin. "A plum of medium size, deep purple skin and flesh firm, shaded pale-yellow . . . small stone—nearly free. Very early. . . . Tree a strong, upright grower." Introduced by J. M. Rutland. (7, vol. 10, p. 273.)

Home Chestnut.—1915. "Of complex ancestry. Salmon skin, covered with pale-crimson, with numerous yellow dots. Flesh lemon-yellow. Firm but juicy." Recommended for home planting. (98, p. 10.)

Honey Prune.—1894. "A seedling of the well-known French prune (Prune d'Agen), which it surpasses considerably in size of fruit . . . flattened-ovoid in form; white, semi-transparent with a heavy white bloom." No record of its sale or planting. (35, p. 8.)

Hybrid Plum No. 38,674.—1899. "Of enormous size." Flesh white and juicy like a peach. No record of parentage. An enthusiastic testimonial by Wickson is quoted. No record of its having been named or introduced. (50, p. 17.)

Improved French.—See Morganhill.

Inca.—1919. No information about its origin. A midseason plum recommended for home use. Oval, greenish-yellow, tinged with crimson; flesh firm, yellow, sweet. Season, early to late September. (115, p. 3.)

Jordan.—1914 (?). "Remarkable because it is the only Japanese plum having snow-white flesh, instead of the yellowish or reddish flesh that characterizes other varieties." Color photograph shows the fruit to be medium in size, ovoid, and red. May never have been distributed. (135, vol. 5, p. 57.)

Juicy.—1893. *Prunus Munsoniana* × *P. triflora*. A seedling of Robinson pollinated by Botan (Abundance). Widely planted, but unsuccessful. Quality inferior. Introduced by John Lewis Childs. (34, p. 20; 187, p. 257.)

Late Shipper.—1914 (?). *Prunus Simonii* × *P. triflora*. "The Simon or Chinese parentage is shown in the short, thick, apple-like stem, clinging to the fruit, and the yellowish flesh. The influence of the Japanese parent is shown in the form of the fruit and in the stone." Color photograph. (135, vol. 5, p. 51.)

Leopard Prune.—1926. Announced posthumously. Parentage not stated. *Prunus domestica* type. "A deep yellow, heavily spotted, crimson prune. Petite, rattle-free stone. Very firm, dry, sweet fruit. Ripe September 1." Unknown. (134, p. 8.)

Lieb.—1914 (?). "Of complex heritage. Among its ancestors are the Burbank and the Satsuma. But there are numerous other strains represented in its heredity." Color photograph. Local plantings. (135, vol. 5, p. 37.)

Long Fruit.—1886. *Prunus triflora*. Imported from Japan in 1885. An inferior variety, long since discarded in favor of better ones. (14, p. 5.)

McKevitt.—1926. "Large round winter plum, ripening late in November. Yellow, with a pale white bloom. Flesh deep, pure yellow; firm, rich, sweet, subacid." No information as to parentage. Named in honor of F. B. McKevitt, a pioneer fruit grower of Vacaville, California. Unimportant. (134, p. 6.)

Madeira.—1906. "An enormous early hybrid plum." No information regarding parentage. Rights for Southern Hemisphere sold in 1909 to J. M. Rutland, who said of it: "Somewhat subject to rot in Sebastopol, California. Should do well in a warm climate. This variety has not been disposed of for propagation in America yet." Unknown now even in Australia. (7, vol. 10, p. 273.)

Maritima.—1899. A selected seedling of the wild beach plum, *Prunus maritima*, of the North Atlantic Coast. (50, p. 16.)

Marketman.—1893. *Prunus triflora*. A seedling of Satsuma. Male parent undetermined. Originally called the Shipper. Name changed by Waugh. Fruit oval, light red with a white bloom; firm and sweet, yet juicy. Introduced by John Lewis Childs. Unimportant. (7, vol. 2, p. 111; 34, p. 18; 151, p. 491; 187, p. 138.)

Masu (Maru).—1885. *Prunus triflora*. A direct importation from Japan. Rather widely planted for a few years, then discarded in favor of better varieties. (14, p. 4; 187, p. 138.)

Maynard.—1897. *Prunus triflora* × *P. Simonii*. Introduced by the Oregon Nursery Company of Salem, Oregon, in 1903. Named for Professor T. S. Maynard of the Massachusetts Agricultural College. Widely planted and still listed by nurserymen. (7, vol. 3, p. 90; 15, p. 275.)

Midsummer.—1926. Announced posthumously, with no information as to its parentage. "A large, egg-shaped plum. Orange yellow, dotted all over with crimson. Juicy, sweet, rich. Flesh, orange yellow; clingstone. Ripe August 15." (134, p. 6.)

Miller.—See Morganhill.

Miracle.—1901. *Prunus insititia* × *P. domestica*. A second- or third-generation cross between the wild so-called stoneless plum of France, the *prunier sans noyau*, and the French prune (Prune d'Agen). Apparently selected from a lot of third-generation seedlings in which the French prune was the staminate, the stoneless plum the pistillate parent, whenever the hybrids in each generation produced seeds suitable for planting. The Miracle, which resembles the French in outward appearance, is almost seedless. Though advertised as a prune, it was treated as a plum by amateurs who grew it. We have no information as to what would be the result of drying a pitless prune. The Miracle was introduced by the Oregon Nursery Company of Salem, Oregon, in 1906, and was widely planted as a curiosity. (55, p. 14; 63, p. 3; 135, vol. 5, p. 156; 151, p. 285.)

Morganhill.—1908. *Prunus domestica*. A seedling of the French (Prune d'Agen). Sold to Leonard Coates of Morgan Hill, California, who at first called it the Improved French prune, later the Morganhill. (135, vol. 5, p. 107.)

Nixie.—1911. A seedling of *Prunus subcordata*, the Sierra wild plum. "The forerunner of a wholly new class of fruits. Tree is a fairly good compact grower, remarkable bearer. Fruit nearly globular, one and one-half inches in diameter, most brilliant scarlet; flesh deep golden yellow, firm, sweet." Freestone. Ripe August 15 to 25. Recommended for home use. (86, p. 10; 135, vol. 5, p. 216.)

Occident.—1899. *Prunus triflora*. A cross between Wickson and Satsuma. First called Garnet, then Sultan. Finally Waugh changed the name to Occident. Resembles Satsuma more than it does Wickson. Ripens with Burbank. Keeps and ships well. Red over a greenish ground; dots numerous, yellowish. Flesh dark red, firm, sweet, acid, changing to subacid. Freestone. (50, p. 8; 151, p. 295; 187, p. 221.)

October (Purple).—1892. Said to be a cross between Satsuma and a seedling *Prunus triflora*. Fruit large, dark purple, with yellow flesh. Its chief merit was very late ripening. Fruit large, attractive, but not outstanding. Introduced by Stephen Hoyt's Sons, New Canaan, Connecticut, in 1897. Widely planted, but never an important market variety. Still offered for sale by the Pickstone Nurseries at Simondium, Cape Town, South Africa. (7, vol. 2, p. 111; 79, p. 6; 151, p. 297.)

Othello.—1914 (?). Selected *Prunus Pissardii* seedling. Fruit large; very early, but soft. No information as to when it was introduced. (135, vol. 5, p. 222.)

Pasha.—1897. No historical information, but evidently a *Prunus triflora*. Fruit large oval, light crimson, yellow flesh. Freestone. Season August 10 to 20. Recommended for home use and nearby markets. Too soft for shipment. (86, p. 8; 90, p. 4.)

Peach.—1901. A seedling of *Prunus maritima*. No further information. Certainly not the French plum of this name. (135, vol. 2, p. 136, 309.)

Pearl.—1898. *Prunus domestica*. A seedling of the French prune (Prune d'Agen), but much larger than its parent. Flattened-ovoid; golden yellow, with a heavy white bloom. Flesh deep yellow and very sweet, with a mildly aromatic pleasant flavor. Excellent as a prune, but difficult to dry in the open. Most successful as a plum for the home and nearby market. (48, p. 5; 135, vol. 5, p. 102; 151, p. 311.)

Perfection.—See Wickson.

Pride.—1908. A cross between the beach plum and Combination. "Sold to a well-known fruit-grower of California in 1908. [Probably George C. Roeding.] Apple-shaped. . . . Skin deep red with a whitish bloom. Flesh dark red—showing Satsuma blood—too soft to ship. Season July 20." Entirely different from one mentioned by Hedrick (151, p. 341) as synonymous with Shipper. (134, p. 341; 135, vol. 5, p. 212.)

Prize.—1911. Two different historical statements as to its origin. One says it is a seedling of Bartlett (which came from a Simon-Delaware cross), with large, "almond-formed [shaped?]" fruit; deep crimson color; rich, sweet, firm yellow flesh; a freestone; ripening August 10. The other source of information, a color photograph, fits the same description, but states that Prize is a cross between Burbank and Satsuma—apparently the correct version, for the fruit shows no Simon influence. It was recommended as a shipper. (86, p. 8; 135, vol. 5, p. 27.)

Prolific.—See Hale.

Purple-leafed Hybrid K. P. 193.—1893. A seedling of Kelsey pollinated with *Prunus Pissardii*. The characters of the male parent predominate in the hybrid with the exception of the size and the time of ripening—later than *Pissardii*, earlier than Kelsey. Size intermediate between these two. Dark purple, with numerous white dots; thin blue bloom; flesh reddish-purple throughout; firm, subacid. "Its great value lies in its large purple leaves, which hold their color all summer, and its handsome wineglass form." Probably never sold or disseminated except at retail by Burbank. (34, p. 16; 119, p. 6.)

Rajah.—1926. *Prunus domestica* (?). "A late and giant plum. . . . Brilliant crimson all over; yellow flesh; half freestone." Ripe September 10. No further information. Announced posthumously. Probably planted only in home orchards. (134, p. 5.)

Rice Seed.—1904. Early name for Gaviota. *Prunus triflora*. "With small seeds instead of a stone." Announced by Fancher Creek Nurseries, Fresno, California, in 1907. Hedrick (151, p. 450) correctly mentions it as a synonym for Gaviota. (7, vol. 4, p. 181; 151, p. 609; 168.)

Royal.—1898. *Prunus triflora*. A cross between Simon and Botan (Abundance). Very large, oval, deep reddish-purple; yellow flesh; almost freestone. Ripens before Willard or Red June. "Earliest plum known." Very different from the Royal mentioned by Hedrick, which is a *Domestica*. (151, p. 534; 173, p. 605.)

Rubio.—1909. No description or information as to origin. Sold to J. M. Rutland. (7, vol. 10, p. 273.)

Sachem.—1919. No history except that it is an "early hybrid plum." Presumably *Prunus domestica*. "Large, egg-shaped; purple color; flesh rich magenta, firm and sweet. Freestone." (115, p. 5.)

Santa Rosa.—1906. A complex hybrid containing a mixture of *Prunus triflora*, *P. Simonii*, and *P. americana*, with the *triflora* characters predominating. Just what varieties were involved in the crosses will never be known, but the red flesh would indicate that the Satsuma played a part. In 1914 Burbank regarded the Santa Rosa as one of his four best plums, the others being Formosa, Beauty, and Wickson. Thirty years later (1944) this is probably still true, judging by the extent to which Santa Rosa is planted. Widely grown, it is usually the leading variety of the *triflora* type in the United States, Southern Europe, North Africa, South Africa, and all the fruit-growing states in Australia and New Zealand. In California alone the latest statistics (1939) show 5,160 acres under cultivation. It was introduced by George C. Roeding of the Fancher Creek Nurseries, Fresno, California. The San Francisco *Bulletin* stated: "This plum will leave Burbank's hands this winter for the first time for introduction throughout the fruit-growing world" (175). The Australian rights were secured by J. M. Rutland; and the South African by H. E. V. Pickstone and Brother of Simondium, Cape of Good Hope. (7, vol. 10, p. 273; 96, p. 15; 135, vol. 5, p. 65, 74, 223; 145.)

Satsuma.—1886. *Prunus triflora*. On December 20, 1885, a shipment of fruit trees was received from Isaac Bunting, an export-import merchant of Yokohama, Japan, consisting of a few apricots and ornamentals, and twelve seedling plums. One of the twelve was a plum Burbank had read about in a travel book by a sailor. This was the "Blood Plum of Satsuma," named for the province where it was grown; he had especially commissioned Mr. Bunting to find it and send it to him. Buds were sold under the original name in 1887; but at the suggestion of H. E. Van Deman, Pomologist of the United States Department of Agriculture, the name "Blood Plum of Satsuma" was changed to Satsuma. The trees were first sold in 1889. Unattractive appearance has mitigated against the Satsuma as a shipping plum; but quality and true worth have given it supreme importance in local markets and home plantings. It is a prime favorite for home use and for limited shipping, in all countries where plums are grown; and it is still as popular as ever. (19; 20, p. 9; 21, p. 2; 24, p. 2; 135, vol. 5, p. 14; 151, p. 337.)

Shipper.—See Marketman.

Shiro.—1899. A combination of Robinson, myrobalan, and Wickson. A seedling of Wickson. Known in South Africa as Shiro Smomo. Tree characters described as resembling a myrobalan; but Hedrick found that it most resembled a *triflora*. Ripens two weeks before the Burbank "and is nearly, or quite as productive." Season short. Color light to deep yellow, with a pale blush and numerous very small, inconspicuous dots. Flesh light yellow, semi-transparent, juicy, sweet, mild. Widely planted, but mostly for home and local markets. (50, p. 11; 151, p. 342.)

Sky-blue.—1926. No information as to origin. "Deepest, clearest blue. Also blue bloom. Flesh crimson and yellow intermingled. Half freestone. . . . Quality good." Ripe August 15. (134, p. 6.)

Sonoma.—1926. No information regarding parentage. Probably *Prunus triflora*. "Beautiful crimson fruit; small dots of yellow. Flesh white, firm, very banana-like. Clingstone. Ripe June 28 to July 4." No information as to subsequent behavior. (134, p. 5.)

Splendor Prune.—1886. *Domestica*. A cross between Pond (Hungarian) and French (Prune d'Agen). Sold, as "Cross-bred Prune A. P.-318," to Stark Brothers for \$3,000 and by them named Splendor. Unsatisfactory as a prune, because it clings to the tree after ripening. Fruit is double the size of the French; dark purple, heavy bloom, yellow flesh, rich and sweet. A successful plum, but not extensively planted. (7, vol. 2, p. 24; 34, p. 15; 79, p. 6; 135, vol. 5, p. 110, 112; 151, p. 547.)

Standard Prune.—1911. *Prunus domestica*. A cross between Tragedy and Sugar. A fine combination of drying and shipping plum. More successful as a plum than as a prune, even in California. Freestone. Seeds very small. Widely planted in plum-growing regions. (79, p. 9, 10; 86, p. 3; 135, vol. 5, p. 121; 151, p. 548.)

Sugar Prune.—1899. *Prunus domestica*. A seedling of the French (Prune d'Agen). A heavy producer; but because of the brittle wood the trees require annual pruning, the new growth being cut back to short stubs (4 to 6 inches). Extensively shipped as a plum. In California also used as a prune. Noted for its high sugar content, both fresh and dried. (50, p. 5; 135, vol. 2, p. 235-69; vol. 5, p. 115.)

Sultan.—See Occident.

Sweet Botan.—See Berckmans.

Three-string.—1914 (?). *Prunus triflora*. No history. Mentioned with color photograph in the autobiography. Named from Burbank's habit of indicating the relative merits of his hybrids by attaching one or more strips of cloth to the tree or branch. Three strings indicated a high degree of excellence. Probably never introduced. (135, vol. 5, p. 209.)

Toyland.—1927. No history, but apparently a myrobalan. A posthumous introduction. Burbank's working name for it was "Crimson Cluster." Brilliant scarlet, crimson, uniform in size, enormously productive. Long slender stems. "Fruit wreathed the branches. Flesh almost pure white; firm, very delicious. A perfect freestone." Ripe October 15. (134, p. 4.)

Turkey Egg.—1914 (?). *Prunus domestica* (?). Brief mention with color photograph in the Burbank autobiography. Probably never introduced. (135, vol. 5, p. 237.)

Valleda.—1919. No history. "Fruit oval, deepest crimson. . . . Flesh crimson, sweet, rich, extra fine quality. Freestone. . . . Ripe August 1." (114, p. 3.)

Vesta.—1911. No history. "Fruit very large, oval . . . good keeper. For shipping and home use." Unknown. (86, p. 9.)

Vesuvius.—1907. Probably a cross between *Prunus Pissardii* and *P. triflora*. Unusually large leaves of a metallic-crimson color. Branches same color. "Its fruit is of a deep, rich color, possessing a pleasing, acid flavor." Introduced by Fancher Creek Nurseries, Fresno, California, in 1907. Chiefly valuable as an ornamental. (7, vol. 6, p. 278; 96, p. 14; 145; 151, p. 559.)

Victory.—1911. *Prunus Munsoniana*. A seedling of America. "Fruit nearly globular, pure crimson. Flesh pale amber, peach-like in texture, dry, rich, sweet, delicious. Small stone, half cling. . . . Ripe July 20 to August 5. . . . Far better than any Japan plum." Little known. (86, p. 8.)

Wickson.—1892. *Prunus triflora* × *P. Simonii* (Burbank × Simon). First advertised for sale as Perfection. A few early shipments were sent out under

the name of Eureka. While not of the best quality, it is known wherever plums are grown. On the decline in California; but there were still 2,000 acres under cultivation in 1940. Shipments that year amounted to 186,000 crates. The California acreage of this in 1941 was surpassed by only four other Burbank varieties—Beauty, Duarte, President, and Santa Rosa. (7, vol. 2, p. 31; 34, p. 21; 35, p. 5.)

Zulu.—1916. No history. "A very large hybrid plum ripening after the others are marketed. Dark purple. Crimson flesh. Firm, rich, delicious. . . . Ripens here September 10 to 25. A superior home and shipping plum." (102, p. 8.)

PLUMCOT

Burbank has been much criticized for claiming that he had crossed the plum and apricot and produced fruit with fertile seeds, which, when planted, grew into trees that yielded fruit with characters resembling both parents. There appears, however, no longer to be any reason for doubting the authenticity of this claim; the feat has been duplicated by Dr. C. O. Hesse, a plant breeder in the United States Department of Agriculture (stationed at Davis, California) and by Millard Sharpe, a fruit grower and amateur fruit breeder of Vacaville, California, at least one of whose hybrids is now cultivated under the variety name of Sharpe. Burbank's first success came from pollinating a Japanese plum (*Prunus triflora*) with apricot pollen. Later, the opposite cross was successfully made. Some of the hybrids had flowers without pistils, and some of the cross-bred seeds were not viable. Many of the hybrid trees were weak and almost barren. Others were just "poor producers"; or the fruit was discouragingly small, or of inferior quality. Improvements were slow because viable seeds were scarce. Most of the successful hybrids came from plum seeds.

Although the plum-apricot hybrids were announced in 1901, their defects prevented their being offered for sale until several years later. One shortcoming, apparently common to them all, was that they were shy bearers. Burbank described the plumcot as having "the general form of an apricot and the same general outside appearance, but often more highly colored than either a plum or an apricot with a skin unique-soft, slightly silky-downy, with a shadowy bloom. Seed more often resembles the plum pit, but often vice versa." (56, p. 13; 135, vol. 5, p. 275–302.)

Abundance.—1914 (?). Color photograph. The flesh resembles the Satsuma plum. "The fruit holds the apricot shape and has the short stem and blossom-end of the apricot. In other fruit characters it resembles the plum parent—the serrations of the leaf, however, being those of the apricot." No record of its having been offered for sale. (135, vol. 5, p. 287.)

Apex.—1911. A cross between an apricot and a Japanese plum. Ripens about the middle of June. "The tree is a stout, compact, upright grower. . . . The fruit is extremely handsome and very large for an early fruit—globular . . . beautiful deep pink or light crimson; freestone; flesh honey-yellow, firm, rich, aromatic, apricot-like." Now regarded as a Japanese plum. (86, p. 12; 100.)

Bearer.—1914 (?). Color photograph, with the following comment: "This is the plumcot named the Bearer. At first view the fruit gives the impression of a Japanese-American hybrid plum, but the short, thick wood, the prominent

buds, peculiar bark, and especially the fuzz indicate apricot parentage. The apricot characters are prominent in the tree; but the fruit is, on the whole, distinctly plum-like in appearance." From a study of the only available picture of the fruit and a small leaf, one would not hesitate to call it a plum. (135, vol. 5, p. 285.)

Burbank.—1914 (?). "This is one of the most delicious of the plumcots. It will be seen from the direct color photograph print that this variety resembles the common cultivated crabapple in appearance." It looks like a myrobalan plum. (135, vol. 5, p. 301.)

Burbank "Nickle."—Listed in the 1914 bill of sale.

Cherry.—1914 (?). The color photograph is accompanied by the following statement: "This beautiful fruit is a curious combination. The fruit itself is a true plumcot, whereas the stem and leaves are distinctly those of the plum. The coloring and dotting of the skin are characters that reveal the plum parentage; but the other qualities of the fruit are closely suggestive of the apricot." Looks like a well-colored cherry plum. (135, vol. 5, p. 293.)

Corona.—1914 (?). "Fruit beautiful, large, golden yellow, with a red cheek. Flesh yellow, fairly firm, sweet, delicious. Clingstone. Tree a strong, upright grower. Productive. Ripens here, Santa Rosa, California, July 25." (86, p. 13.)

Rutland.—1905. Probably was exhibited at the Pan-American Exposition at Buffalo, New York, in 1901, as one of several plum-apricot hybrids. Burbank received a special gold medal for the interesting display. Introduced in 1905 by John M. Rutland, who purchased the rights for the Southern Hemisphere, including South Africa, and named it the Rutland. The following year George C. Roeding of the Fancher Creek Nurseries, Fresno, California, introduced it in the United States. Burbank believed the Rutland to be a cross between an apricot and the Satsuma plum. "The fruit is about the size of an ordinary apricot with a deep purple velvety skin . . . its brilliant flesh . . . of a strong subacid flavor rendering it suitable for cooking, jellies, and jams. When fully ripe it is an excellent dessert fruit possessing an apricot-plum flavor." The Rutland is now definitely regarded as a large hybrid plum, with perfect flowers, but with flesh of poor quality. (7, vol. 7, p. 81; 71; 96, p. 19; 135, vol. 5, p. 292.)

Silver.—1919. "A firm, long oval-flattened, deep silvery purple fruit; deep yellow, juicy, subacid flesh, almost the exact flavor of finest cranberries, and when cooked the color, quality and flavor the same. Juice like that of strawberries; delightful for soda fountains. . . . The best of its class." No further information. (115, p. 5.)

Sweet.—1914 (?). "A variation of the combination of the plum and the apricot. This variety closely resembles the apricot in quality of its flesh." The color photograph strikingly suggests an apricot. (135, vol. 5, p. 281.)

Triumph.—1911. "Almost the exact opposite from Apex in most respects. Trees productive, of weeping habit, with long slender branches. Fruit apricot-like in form, six inches around, with a purple velvety skin, finely dotted and mottled scarlet. Flesh firm, apricot-like in texture, deep crimson with lighter shades near the stone. Rich apricot flavor with plum accompaniment. . . . Ripens August 15." (86, p. 13.)

POHAIBERRY

This pohai berry or Cape-gooseberry (*Physalis peruviana*) was imported from Hawaii in 1906 and announced in the same year. The old, well-known husk tomato. Very dwarfish. Low, trailing on the ground. Represented as much superior to the common type. (65, p. 2.)

QUINCE

Alpha.—1893. A selected seedling from a Japanese quince used both as an ornamental shrub and for its fruit. Both "*Pyrus (Chaenomeles) Maulei* and *Pyrus (Chaenomeles) Maulei* var. *superba* have been recommended as the best of the Japan quinces for fruit. From many thousands of seedlings, one has been obtained which produces large, handsome, light crimson blossoms and extremely large orange-like, waxy, yellow fruit in the greatest profusion." Recommended for jelly making. (34, p. 14.)

Burbank.—1914 (?). Perhaps a Rae's Mammoth seedling. Described as being somewhat larger than the Orange and better shaped. Devoid of wool on the skin—smooth like an apple. Still in cultivation. Distributed by James W. Robinson of the Cash Nurseries, Sebastopol, California. (135, vol. 4, p. 223.)

Childs.—1893. Originally introduced as Santa Rosa. The name was changed by John Lewis Childs, who purchased the rights to its distribution. A seedling of Rae's Mammoth. Believed to be a third-generation cross between Rae's Mammoth and the Portugal. "Remarkable for its great size, exquisite beauty of form, polished light lemon-yellow, almost white skin, productiveness, tenderness of flesh, delicious flavor and diminutive core." The tree resembles Rae's Mammoth in form and growth but, unlike it, grows readily from cuttings. (34, p. 13; 135, vol. 4, p. 220; 187, vol. 2, p. 6.)

Chinese.—1888. A selected seedling of the Cathay pear or Chinese cucumber quince. Burbank says he first began making hybridizing tests with these Oriental quinces—used mostly as ornamental shrubs—as early as 1884; but none of the hybrids proved useful. The *Chaenomeles sinensis* is not hardy in the northern part of the United States. Flowers and leaves highly ornamental. The fruit somewhat resembles a cucumber; green in color, hard, bitter, very fragrant but inedible, however prepared. (25, p. 6; 135, vol. 4, p. 224.)

Elephant.—1919. Selected from "more than twenty-five thousand seedlings of the old, unique, fragrant but inedible Cathay quince . . . before this superb variety appeared." Very large (up to 6 inches in diameter); smooth, bright orange, flesh yellow, turning to a deep pink when cooked. Quality poor. (115, p. 5; 122.)

Hong Kong.—1885. "An extraordinary fruit; oblong, of immense size, often weighing over two pounds. Growth and foliage distinct from other kinds." No further information. (14, p. 5.)

1909 Burbank.—Listed in the 1914 bill of sale.

Pineapple.—1899. A seedling of Rae's Mammoth, "the culminating product of fifteen years of selective breeding." In form and size the fruit very much resembles the Orange; but the shape was considered to be more globular, and the color a much lighter yellow. When well ripe it can be eaten out of hand like an apple. The flavor is suggestive of pineapple. After forty years this variety

is still sold by nurserymen. Widely planted in California both for home and market. H. A. Bassford sent shipments to eastern markets as early as 1910. (50, p. 12; 56; 96, p. 17; 135, vol. 4, p. 221.)

Santa Rosa.—See Childs.

Seedling No. 80.—1894. A seedling of Rae's Mammoth. Deep orange color in every part. No green. Nearly round. Flesh lemon yellow. "Not quite so tender as the California, and not quite so juicy; it is a better keeper." Probably a seedling of Rae's Mammoth. No record of its sale, although it probably was sold and received a name from the introducer. (35, p. 3.)

Van Deman.—1893. A seedling of Portugal pollinated by Orange. Introduced by Stark Brothers. Named in honor of H. E. Van Deman, Pomologist of the United States Department of Agriculture. First exhibited at a meeting of the American Pomological Society in Washington, D. C., in 1891, where it was awarded the Wilder Medal. Widely planted and, after nearly half a century, still popular wherever quinces are grown. (7, vol. 2, p. 24; 34, p. 11; 135, vol. 4, p. 214.)

RASPBERRY

Climax.—Phenomenal type. Listed in the 1914 bill of sale.

Dictator.—1893. A blackcap resulting from a cross between Gregg and Shaffer. Plants resemble Shaffer, but the berries are larger than in either parent; the flavor is a combination of both. No record of its having been sold. (34, p. 28.)

Eureka.—1893. A third-generation selection resulting from a cross between Shaffer and possibly Gregg. Fruit "bright, red, firm, very productive." This was the first hybrid raspberry Burbank introduced, according to his own statement. Similar to Shaffer in flavor, but nearly twice as large. No further information about its introduction. (34, p. 27; 135, vol. 6, p. 47.)

Hybrid E. 11,546.—1893. "Third generation from cross of Souhegan and Gregg . . . medium sized red berries [ripening] in October." No more information. (34, p. 31.)

Hybrid S. S. 147.—1893. "This is the first practical cross of the cap and sucker raspberries ever made. . . . All the plants from the first cross were almost or totally barren. . . . The second generation gave many curious forms and colors, flavors, etc. The third generation, from the best of these, gave me this and the next mentioned berry. The seedlings of these improved ones are now proving to be generally fertile and productive." This account is confusing and unsatisfactory; the one clue to the parentage is the reference to the "next mentioned berry" in his catalog, the Sugar Hybrid, which resulted from a Shaffer-Souhegan cross, both blackcaps. Such carelessness in records exasperates the historian. This prodigy was priced at \$400—half what was asked for the Paradox and Phenomenal. There is, however, no evidence that it was ever sold. (34, p. 28.)

Hybrid S. S. 6,701.—1893. "A berry of extraordinary dimensions, growing on strong, vigorous, dark-blue canes, having short prickles, and with unmistakable marks of both Souhegan and Shaffer. Same cross as S.S. 8,183 and E. 11,546." Again an inconsistency, for E. 11,546 is listed as a Souhegan-Gregg cross. Probably sold locally, although there is no information as to what became of it. (34, p. 31.)

Hybrid S. S. 8,183.—1893. "Third generation from Shaffer and Souhegan . . . very dark red." No further information. (34, p. 31.)

Hybrid S. S. 8,940.—1893. "This variety originated from the same lot of seed and is similar in growth and general appearance to S.S. 6,701. Berry more conical; firm; dark rich purple color." No more information. (34, p. 31.)

Japanese Golden Mayberry.—1893. Cross between Cuthbert and a wild variety from Japan (*Rubus palmatus*). Sold to J. J. H. Gregory and Sons of Marblehead, Massachusetts, who described it as "the earliest known raspberry. Berries of a golden straw color, as large as Cuthbert and ripens a month before Hansell." (34, p. 23; 135, vol. 2, p. 99.)

Mendocino.—1887. A native wild blackcap, collected in Mendocino County, California, in 1881. Berries large, black, sweet. No further information. (20, p. 13; 137, p. 216.)

October Giant.—1893. Described as a seedling of Eureka, although this variety was announced the same year. "Remarkable for its habit of bearing in October, as well as for its unusual size." (34, p. 31.)

Rubus.—1894. Burbank listed this as *Rubus capensis*. "This peculiar berry plant came to me by way of New Zealand and South Africa and is probably the one that Stanley speaks so highly of as growing in places on the Dark Continent. . . . The canes grow to a height of 6 to 10 feet, bending over and rooting from the tips like black-cap raspberries; . . . the fruit is fully as large or larger than Shaffer, of a purplish wine or mulberry color, and of excellent quality, though the berries do not separate from the receptacle as freely as they should." No record of its having been sold. (35, p. 16.)

Sugar Hybrid.—1893. Second-generation hybrid from Shaffer × Souhegan. "The sweetest of all red raspberries; Brinkle's Orange even is not to be compared with it in sweetness and aroma. Berries quite large; about the size of Marlboro; of a dark red color." No information as to who distributed it. (34, p. 29.)

SALMONBERRY

First announced in 1895. Grows wild in moist places along the coast of California, Oregon, and Washington. "Red and yellow varieties mixed. Remember this is the true *Rubus spectabilis* with red flowers and enormous berries." Evidently a mixture of two species, *spectabilis* and *parviflorus*, since the former has yellow or salmon-colored fruit and the latter red fruit. Judging from his description of the canes, Burbank may have collected some natural hybrids. (39, p. 16.)

STRAWBERRY

Experiments with strawberries consisted of crossing many of the common cultivated varieties of the day, besides hybridizing numerous wild species from this and other countries. *Duchesnea indica*, a more or less ornamental species supposed to have come from India, refused to hybridize with any of the true strawberries. Species from Norway and Alaska and two wild forms native to California (*Fragaria chiloensis* and *F. californica*) were used in different combinations with cultivated varieties, without profitable results. The last-mentioned species and other wild forms were found to vary widely in different localities; in the Yosemite Valley, California, they ranged from utter insignificance to a quality equaling that of the cultivated strawberry.

Abundant.—1916. History not given. Everbearing. Berries large, conical, bright pink. Quality not the best. (102, p. 12.)

Black Leaf.—1920. Origin not given. Everbearing. Produces runners sparingly. Berries large, dark-crimson, best quality. Heavy producer. Recommended for greenhouse culture. (116, p. 4.)

Evergreen White.—1920. The parent stock was a "variety that I grew in my childhood back in Massachusetts, and which was said to have come from Virginia." There, it was merely a curiosity of no value. It was hybridized with one or more varieties that gave it size and quality. (116, p. 5; 135, vol. 6, p. 100.)

Exquisite.—1916. No historical statement. "A new departure in hybrid strawberries. Fruit large, conical, sometimes flattened. . . . A berry with a delicious wild strawberry flavor." (102, p. 12.)

Giant.—1919. No history. Everbearing; bush type. Medium-early, very large, bright-red berries; subacid. (115, p. 9.)

Patagonia.—1910. Seeds were imported from Chile, and selected seedlings were crossed with Brandywine, Longworth's Prolific, Monarch, Marshall, "and some of our native California berries, but no striking results were observed until the second generation, where among the very numerous hybrid seedlings under test was found this unique berry." Testimonials acclaimed its quality in flattering terms, but apparently it was planted only by amateurs. (73, p. 1.)

Perpetual.—1919. No history. Everbearing. Berries medium-sized, oval, light crimson. Almost devoid of runners. (115, p. 9.)

Ramona No. 2.—Listed in the 1914 bill of sale.

Robusta.—1920. "After crossing with others and raising and testing thousands of seedlings, Robusta appeared." Considered to be the best of all his everbearers. Strong, numerous runners. Berries large, oval, scarlet and of excellent quality. May have been planted in gardens, but now unknown. (116, p. 4.)

Yosemite.—1887. Collected from the wild in Yosemite Valley, California. Propagated and sold without hybridization. Planted sparingly in home gardens. (20, p. 15.)

SUNBERRY

(See Wonderberry)

WONDERBERRY

The original sunberry (wonderberry) was produced in 1905—a second-generation hybrid between *Solanum guineense*, the staminate or male parent, and *S. villosum*, the pistillate or female parent. Both parents were inedible species, though not poisonous. The fruit of the hybrid, named Sunberry, however, proved pleasing when cooked, especially when made into pies; but less so when raw, unless thoroughly ripe. This hybrid was accepted as a new species and named *S. Burbankii*. Introduced by John Lewis Childs, who changed the name to Wonderberry. Extravagant claims by the introducer precipitated a notable controversy. Burbank disapproved the change in name, calling it unwarranted, and spoke with bitterness of the "misstatements that have gained currency regarding the origin of the plant." Critics gave the opinion that because of its close botanical relation to the nightshade (*S. nigra*) it was probably poisonous, disregarding the fact that the tomato, eggplant, and

common potato are also closely related to the nightshade. The fruit was widely grown by amateurs, but never became a market commodity. It is now rarely met with. (6, p. 3182; 79, p. 25; 114, p. 8; 135, vol. 13, p. 105-33.)

Improved Sweet.—1913. Seedling selection. No further account. (93, p. 39.)

Orange.—1922. Seedling selection. No further account. (124, p. 31.)

Upright.—1914. Seedling selection. No further account. (95, p. 43.)

NUTS

ALMOND

The almond variety Palatine was offered in 1911. A seedling of the Jordan grown from meats imported from Spain. Much planted in California over a period of several years, but now rarely met with. (86, p. 14; 190, p. 139.)

CHESTNUT

California Golden.—1894. Selected seedling of *Castanopsis chrysophilla*, a native chinquapin of the northern coastal region of California. Burbank may be referring either to the giant chinquapin, a tall tree that occurs among the redwoods, or to the variety *minor*, known as the golden chinquapin, a shrub 3 to 15 feet high, found in the high mountains and also along the dry ridges adjacent to Monterey Bay. He speaks of both as the golden chestnut. The two are really the same species, although botanists regard the latter as a variety of the former. (37; 135, vol. 11, p. 122.)

China.—1888. No information except that it is "similar to the Italian, but more dwarf." Probably a Japanese seedling. (21, p. 6.)

Coe S.-8940.—1893. *Castanea crenata*. One of three unnamed seedlings of the Japan Mammoth purchased by Judge A. J. Coe of Meridan, Connecticut, who called one of them the 18-Month. Soon afterward, the judge died and the three seedlings came into the possession of J. H. Hale of South Glastonbury, Connecticut, who rechristened the 18-Month as Coe and introduced it in 1897. The other two were named Hale and McFarland. The Coe had also been referred to as Coe's Early, Coe's Mammoth, New Japan Mammoth, and Sweet Japan. All three of the seedlings were dwarfish; the Coe was exceedingly so and also precocious, actually bearing the second year after planting. All bore sweet nuts, were widely planted, and have survived. In Missouri forty years ago, the trees bore so heavily that they grew to only about 3 feet and were weak and unadapted to field culture. (3, p. 21; 34, p. 10; 35, cover; 38; 135, vol. 11, p. 108.)

Hale.—1897. See Coe S.-8940.

McFarland.—1897. See Coe S.-8940.

Miracle.—1918. Probably another seedling of Japan Mammoth. An extreme dwarf. "Bears at once and continuously, large, sweet chestnuts, even when only a foot high." (113, p. 7; 116, p. 7.)

PINE NUT

Announced in 1921 as Nevada Pine Nut. This is *Pinus monophylla*, the one-leaf piñon. The well-known nut pine of the desert ranges. From earliest times this pine seed has served as an important food for the Indians. (122.)

Fig. 1.—*Juglans Vilmoriniana*. The oldest known hybrid between *J. nigra* and *J. regia*. Planted in 1816 by M. Louis de Vilmorin and still standing in the Vilmorin Arboretum at Verrieres, near Paris. Photographed in 1925 when 109 years old. Now (1944) over 100 feet high and the trunk more than 3 feet in diameter.

WALNUT

Burbank tells us that from 1878 to 1885 he experimented extensively with our native nut trees: the black walnut of the eastern United States, *Juglans nigra*; the California black walnut, northern variety, *J. californica* var. *Hindsii*; the Persian or cultivated walnut, *J. regia*; the Asiatic species, *J. Sieboldiana* and *J. mandshurica*; the butternut, *J. cinerea*; "and a dozen or more other species." He obtained his first hybrid in 1878, a cross between *J. regia* and the variety *Hindsii*, which later (1893) he named Paradox. The

next year, he succeeded in crossing the variety *Hindsii* with the eastern black. This hybrid he named Royal. Dr. Shull writes, May 12, 1943: "In *New Creations*, 1893, the parents of this cross are reversed, *Juglans nigra* being mentioned first as if it had received pollen from *J. californica* var. *Hindsii*, instead of vice versa."

Burbank's hybrids between the Persian and Asiatic species possessed no particular merit and were not introduced. Paradox and Royal, however, have become famous for their rapid growth and the large size of the trees. Their chief value is for timber. They reach usable size in half the time required by the ordinary black walnut, either northern California or eastern black, and yield fully twice as much saw stock.

Seedlings from first-generation Royal trees have been successfully used as rootstocks for cultivated walnuts; but Paradox seedlings are less dependable, because of wide variation in growth habits. Moreover, the Paradox—even the old trees—are shy bearers of nuts. The Royal, on the other hand, produces abundantly, and the seedlings have the vigor of the first-generation hybrid. In the next generation, however, this vigor is mostly lost; they become no better than the parent species in this regard. Lack of knowledge on these points undoubtedly accounts for much of the dissatisfaction with Royal as a stock for cultivated walnuts.

Natural hybrids of Paradox and Royal are frequently found in California, for the different species of walnuts cross readily. If they did occur before Burbank's time, they were not reported; he deserves full credit for performing the experiment independently. He has declared that he was not aware of their existence when he made his first experiments between 1875 and 1880.

A notable hybrid tree in the Vilmorin gardens at Verrieres, near Paris, France, differed so markedly from any other known walnut that it was regarded as a new species. It was planted by M. Louis de Vilmorin in 1816, to commemorate the birth of a grandson, and was named *Juglans Vilmoriniana*. Engelmann, the botanist, writing in 1891 (144, vol. 4, p. 51), pronounced the tree to be a cross between *J. nigra* and *J. regia*. Its seeds were planted widely, especially in botanic gardens. In 1895 Felix Gillett, a pioneer nurseryman and experimenter of Nevada City, California, claimed to have planted the Vilmorin walnut as early as 1887-88, and stoutly maintained that it was the same as Burbank's Paradox; this precipitated a controversy in California over the origin of the Paradox. Though the origin of the Vilmorin walnut is unknown, it does possess many of the Paradox characteristics. There is scarcely a chance, however, that it was the same as the one derived from the northern California black, one of the parents of the Paradox, which was unknown in France until a century later and which indeed was scarcely known in America until the middle of the nineteenth century.⁵ Its native range is confined to a restricted

⁵ While gathering information on the walnut industry in France in 1921-22, the present author observed that an abnormal number of walnut trees, mostly aged ones—100 to 300 years old—were dying. Examination disclosed that they were infected with oak root fungus, *Armillaria mellea*. A resistant rootstock was recommended for new plantings. Upon the return to California in the fall of 1922, seeds of the northern California black walnut, *Juglans californica* var. *Hindsii*, were sent to M. Jacques de Vilmorin and also to the Ministry of Agriculture, in Paris. The Vilmorins were familiar with *J. nigra*, but not with either the *californica* or the *Hindsii*. This is believed to be the first introduction of the *Hindsii* (one of the parents of Paradox) into France.

district in the interior of central California. If a tree of Paradox and the Vilmorin *nigra* $\times$ *regia* hybrid could be compared, point by point, while growing side by side, they would probably appear almost identical. (135, vol. 11, p. 52; 143, vol. 2, tab. 73; 165, p. 112; 167, p. 197-201; 181, p. 154-63.)

Fig. 2.—Burbank hybrid walnut, variety Paradox, *Juglans regia* $\times$ *J. californica* var. *Hindsii*. Photographed in 1939 when about twenty-five years old.

Paradox.—1893. The result of a cross between the Persian or cultivated walnut, *Juglans regia*, and the northern California black walnut, *J. californica* var. *Hindsii*. The foliage of the hybrid is variable, but mostly resembles that of the *regia*, as do the nuts; the habit of growth is very nearly like that of the *Hindsii*. Burbank stated in his original announcement: "This hybrid originated in 1888 from a cross made the year before." This date, however, appears to have been an error in printing. Dr. George H. Shull, geneticist in

Princeton University, includes a discussion of this matter in a letter of May 12, 1943:

The history of these trees [the Paradox] is essentially as follows: In 1877 Mr. Burbank applied pollen of the Persian to a tree of California black; the nuts were stratified and planted (1878) with the result that among a very large number of obviously pure California blacks, "some 5 or 6" were plainly hybrids. There was some variation in size and vigor, and only the finest and largest one was retained for propagation, and this was the first Paradox. Two of the other hybrid seedlings were sent to the Sebastopol grounds where they served as stocks for numerous Persian grafts.

The Paradox was first mentioned in *Pacific Rural Press*, for February 12, 1887, but the name Paradox was first used in 1893 when it was offered for sale in the first edition of *New Creations*. By a typographical error the date was given in *New Creations* for 1893, as 1887 for the original cross instead of 1877, and this date was copied far and wide, and De Vries, in *Plant Breeding*, page 174, even gives a date as late as 1891.

Dr. Shull spent nearly five years—1906 to 1911—in Santa Rosa as a representative of the Carnegie Institution of Washington. It was his duty to check on Burbank's current activities and to collect and record all obtainable information about his previous achievements. The passage above is from his unpublished report.

Burbank's hybrid walnut trees are characterized by their rapid growth and immense size. For the first few years it was feared that they would be sterile, since they flowered but did not fruit. At the age of about ten years they began to produce a few fertile nuts; and thereafter they continued to produce, but sparingly. A fine specimen of Paradox, about twenty-five or thirty years old, now stands in the remnant of the original Burbank garden in Santa Rosa, California, and continues to bear light crops annually.

Paradox was recommended as a timber tree and as a rootstock for cultivated walnuts. It was never popular for the latter purpose; its seedlings vary extremely in vigor, and in succeeding generations the hybrid vigor is lost. The late Dr. W. W. Fitzgerald of Stockton, California, a pioneer authority on walnuts, advocated hybrid walnuts as stocks, but preferred Paradox to Royal. He advised using only the first-generation seedlings resulting from using *regia* pollen on northern California black. Introduced by George C. Roeding of the Fancher Creek Nurseries, Fresno, California, in 1906. (34, p. 9; 135, vol. 11, p. 193; 178.)

Royal.—1893. This hybrid was the result of a cross between the northern California black walnut, *Juglans californica* var. *Hindsii*, and the black walnut of the eastern and middle United States, *J. nigra*. The tree is of noble size and fine proportions. Its characteristics recall both parents, but it is much larger than either. The nuts are like the eastern black, but larger. About 1884 five of the first of these hybrids were planted in and around Santa Rosa, California, in different soils, so that their behavior might be observed. At least two are still living—one at the Burbank Sebastopol orchard; the other at the home of Joseph W. Miller in Santa Rosa. The Miller tree is now 3½ feet in diameter at breast height, and 100 feet high, with a branch spread of 125 feet. It has always borne abundantly, the largest yield in any one year being 1,931 pounds. During his lifetime Burbank purchased all the nuts, presumably reselling them as stocks for cultivated walnuts. A few nurserymen who specialized in walnuts used Royal as a stock, but they seem to have preferred the

Paradox. The Royal will find its greatest usefulness as a timber tree. It was introduced by the Fancher Creek Nurseries of Fresno, in 1906. (34, p. 10; 48, p. 4; 100; 108, p. 3; 135, vol. 11, p. 193; 175.)

Fig. 3.—Burbank hybrid walnut, variety Royal, a cross between *Juglans californica* var. *Hindsii* and *J. nigra*. Planted by Joseph W. Miller at his home on Sebastopol Road, Santa Rosa, California. He says Burbank gave him the tree, one of five of the original Royal hybrids—but then unnamed—in 1884 or 1885, three or four years before it was introduced. Photographed in 1939 when the tree was about fifty-five years old, 3½ feet in diameter, and 100 feet high.

Santa Rosa Soft Shell.—1901. A selected seedling from a heavy-bearing tree in a private garden in San Francisco that produced “the most valuable nuts of the kind that had ever been seen in California.” Burbank’s attention was called to the tree about 1894. This walnut was crossed with a variety—

in itself useless—that was almost devoid of shell. The result was two new varieties or types, one of which bloomed very early and the other very late, but both having very soft shells. One of these, the early one, was known as Maddoci's strain; and the other, the late bloomer, as the Analy strain. Both were introduced by the Analy Nurseries of Sebastopol, California, in 1906. These varieties possessed considerable merit, but were probably discredited because too many persons still held the idea that a variety could be successfully propagated by planting the nuts, instead of taking the trouble to bud or graft their trees. (4, p. 4; 7, vol. 7, p. 137, 139.)

GRAINS, GRASSES, AND FORAGE PLANTS

Aside from cactus, Burbank did not go in heavily for forage plants, grasses, and grains. Beginning about 1907, more than fifty cactus varieties were turned out in four or five years. Approximately half were recommended for forage and half for their fruit, though the latter could also be used for forage. With the failure of the Luther Burbank Company of San Francisco, which in 1912 had purchased the right to distribute all of his introductions, the cactus craze subsided. A few more varieties continued to be announced up to 1925. Burbank's list of grains and grasses was comparatively short; but the announcement of his grains, in particular, caused him to be severely criticized, state and federal agronomists charging that two or three of them were old, discarded varieties that had been renamed.

BARLEY

Following his habit of collecting the curious and unusual in seeds and plants from distant lands, Burbank evidently experimented with barley from one of the Eastern Mediterranean countries, perhaps Syria or Turkestan. In 1920 he offered for sale an old, but practically unknown variety—the Pearl, a "white" barley, that is used in that part of the world. (117, p. 15; 124, p. 14; 138, p. 132.)

In 1918 he offered Blue Arabian Hull-less, with no comment regarding its origin. It was probably a selection from a cultivated variety or type in its native land. Burbank says, "During the past several years, this, by selection, has been greatly improved . . . threshes out clean like wheat with no skin or hull. Dark blue plump grain, like wheat." Amateurs may have purchased this variety. It was never included, however, in the many comparative tests made by the different barley-growing states and by the United States Department of Agriculture. Unknown. (112, p. 6.)

CACTUS, FORAGE TYPE

For five or six years—1907 to about 1913—Burbank industriously promoted cactus planting for both fruit and forage, but chiefly the latter. When he left off and the Luther Burbank Company of San Francisco took over the marketing of his products, sales were pushed for another three or four years. On theoretical grounds (that is, with insufficient evidence) Burbank undoubtedly believed that cactus, if rid of its spines, would become a valuable stock feed.

Though not guilty of many of the charges leveled at him, Burbank had undeniably loosed a flood that left disillusion and sometimes downright fraud in its wake. He sold "spineless" cactus to anyone who would buy it, but mostly to dealers who expected to propagate it for resale. And, as always when he believed in a thing, he made enthusiastic claims. The dealer then added other claims and occasionally filled his orders with cactus that Burbank never saw. There was an avalanche of selling. Few bought cactus to use, but many intended to sell to someone else. Here and there a poultryman found that his hens liked it. Dairymen, too, testified that their cows thrived on it, and cattlemen on the arid southwestern ranges readily admitted that it was a good emergency feed, though impractical.

Burbank had envisioned for his cactus a major use as cattle feed on the dry ranges where little else would grow. He did not realize that under arid conditions the cactus, too, grows but slowly and that cattle grazing indiscriminately upon a spineless form would eat it into the ground. Fencing it off for emergency use, the cattlemen said, would involve too much expense or trouble. In times of stress they preferred to singe the spines from the native cactus, which is often abundant because the cattle ordinarily do not touch it.

Poultrymen and dairymen do not have this problem; they generally harvest their succulents and give them to the livestock. Then why did they stop using cactus? The reason is not clear. Doubtless they expected too much and were disappointed.

Anacantha.—1907. The original stock was received from David Fairchild, Agricultural Explorer for the United States Department of Agriculture, in 1899, under the introduction number 3,423. It came from the western part of Chaco Province, Argentina, a region of arid, sandy soil, where it was said to withstand a temperature of 27° F. Being almost devoid of spines, it was used by Indians as a forage for their cattle. Burbank recommended it for both fruit and forage, proclaiming it to be nearly or quite the best of all the older varieties for stock feed. (66, p. 9.)

Arbiter.—1911. No history. "One of the best for fodder and will greatly please those who have been obliged to handle the common kinds heretofore generally known as 'spineless cactus.' " (80, p. 19.)

Avalon.—1925. No history. "A giant new, absolutely spineless cactus. The slabs are generally two feet long, eight inches wide and two inches thick." The fat, white fruit, produced sparingly, "is very large, of exquisite quality and lasts in good condition on the plants for months." Burbank considered this to be the best all-round cactus ever produced. (131, p. 10.)

Blanco.—1907. A collected variety of the Indian-fig class received from Walter Bryant of Tepic, Mexico, and known in its native land as the white cactus. (66, p. 12.)

Burbank Standard.—1911. Presumably produced by selective breeding.

Fourteen years ago the first scientific experiments for the improvement of cacti were first instituted on my farms. Eight years later . . . the United States Department of Agriculture became interested and some \$10,000 or more was authorized for a search for "thornless" ones—the result was a failure. Thus there was never a spineless cactus in existence except those produced by my own efforts. Beware of the so-called spineless cactus sent out by the Department of Agriculture!

Burbank made this strong statement to offset what he considered was an effort by officialdom to discredit him. Four years earlier, however, Burbank had been selling the *Anacantha* variety which he himself had received from the Department of Agriculture and had advertised as having "no bristles and only a few short, weak, spines." (79, p. 23.)

Buster.—1911. "Very similar to Competent and Signal. Enormous long, warted or corrugated, pale-green slabs which are absolutely spineless." (80, p. 20.)

California.—1907. "Very much resembles Sonoma in its strong, upright growth and light colored leaves which are twenty-two inches long by about twelve wide and extremely thick. Spines and spicules, though not absolutely absent, are so rare and so insignificant as to be almost imperceptible." (66, p. 16.)

Chico.—1907. "Tapuna class. One of the two best of my new *Opuntias* of this class . . . an upright, compact grower with large, smooth, greenish-white pads which are absolutely spineless." Introduced by the American Cactus Farming Company of Los Angeles. (7, vol. 6, p. 170; 66, p. 17.)

Columbia.—1912. "Remarkably strong, compact grower, great multiplier with the smoothest of thick, dark green oval slabs. Very hardy." (87, p. 9.)

Competent.—1911. "A second generation, smooth hybrid seedling, absolutely free from either spines or spicules. The leaves, which are generally two to three feet long, by six to eight inches wide, and often three inches thick, are curiously warted and corrugated when young and as smooth as an apple when grown." Devoid of spines or spicules. (80, p. 20.)

Feeder.—1916. "This was selected four years ago from many thousands as one of the best of all." Extremely compact growth and peculiar glossy, grass-green leaves, 10 inches long and 8 inches wide; smooth, succulent, juicy. (104; 111, p. 7; 131, p. 10.)

Fresno.—1907. Indian-fig class. "A crossbred seedling of Smith and unlike its parents and all its seedlings, heretofore, has no thorns and no bristles." Promising also for its fruit. Distributed by the American Cactus Farming Company of Los Angeles. (7, vol. 6, p. 170; 66, p. 17.)

Hemet.—1909. "Tapuna class. A smooth cactus with thick, pearly white, roundish leaves or slabs. Hardier than the ordinary tunas." (69, p. 1.)

Marin.—1907. "The only one of the older *Opuntias* which is absolutely without spines or bristles. Small plants, rather tender and of no special use as a forage plant now that better ones are known. . . . Received from Florida, Hawaiian Islands, Mexico. . . . This *Opuntia* is often called 'Marine' in Hawaii and is said to have been introduced . . . by Don Francisco de Paula Marin in 1791." (66, p. 14.)

Melrose.—1909. Belongs to the "Tapuna or pearly-leaved" class. Smooth, thick, oval, pearly-white leaves. Strong grower . . . hardier and more nutritious than the Indian-fig class. (69, p. 1.)

Model.—1912. A seedling of Smith. "Model has no thorns and is as vigorous and hardy as the old Smith, with large, very thick, dark green slabs which are as smooth as watermelons." (87, p. 9.)

Monterey.—1907. "Tapuna" class. "Generally more dwarf and even more productive of fruit than the Indian-fig class; the fruit is usually smaller and

more egg-shaped, sometimes almost globular. The most rapid-growing *Opuntia* and has the largest and heaviest pads, slabs or leaves, of any of this class in my whole collection. . . . Wholly free from spines except rarely a few short ones here and there; bristles, cottony, harmless." Introduced by American Cactus Farming Company of Los Angeles in 1907. (7, vol. 6, p. 170; 66, p. 17.)

Morada.—1907. "Tuna class." From near Tepic, Mexico. "Similar to Blanco but with dark green leaves twelve inches long by six wide and quite thick; some weak spines and bristles." (66, p. 12.)

Myers.—1907. Believed to be a natural cross between "Tapuna" and Indian-fig types. Discovered by Frank N. Meyers near Irapuato, Mexico. "Always absolutely free from even the least trace of spines." (66, p. 11.)

Opaline.—1911. "Produces abundantly, large, oval, pale green slabs fifteen to eighteen inches long by five to eight inches wide . . . no thorns, no bristles. The fruit is of medium size, pale yellow and of fine quality. Ripens September to November and can be handled without any brushing; no other good Tuna fruit so far known, can be." (80, p. 20.)

Pyramid.—1909. Indian-fig class. Strong upright grower, with large, thick, heavy, light green smooth slabs. One of the very best for stock and poultry. (69, p. 1.)

Robusta.—1911. "A new crossbred cactus which originated on my grounds six years ago. The thick, heavy pale green slabs . . . are smooth, medium size, two to five pounds each. Fruit medium size, good, but best suited for stock and poultry feeding." (80, p. 17.)

Rosamel.—1915. No history or description. Burbank merely refers to it as a new, hardy, forage cactus never before offered. (99.)

Santa Rosa.—1907. Indian-fig class. Burbank writes:

A strong, compact grower . . . the fat, dark green slabs are often two feet long by ten inches wide, smooth and with no thorns and no bristles. The first of its kind. . . . One leaf of this with the right to sell in the Southern Hemisphere, including all of Africa, has been sold to John M. Rutland of Melbourne, Australia, for one thousand dollars. The number of plants [slabs?] on hand by September 1, 1907, should be about four to six hundred. Price for the complete stock, \$10,000.

This was probably Burbank's highest-priced plant. The entire stocks of most of his cactus varieties that he regarded highly were quoted at \$2,000 to \$3,000. Distributed in the United States by the American Cactus Farming Company of Los Angeles. (7, vol. 6, p. 170; 66, p. 15.)

Signal.—1911. A crossbred seedling. "Leaves long, thick, and when young with deep corrugations or knobs, later becoming as smooth as a nectarine and attaining in cases a length of more than four feet and a weight of ten to twenty pounds each." Spineless. (80, p. 20.)

Solano.—1909. Indian-fig class. "Compact, rapid growing, weeping cactus, with large, smooth, oval, light green slabs. This variety seems to be specially adapted to warm dry locations." (69, p. 1.)

Sonoma.—1907. "Pale yellow leaves twenty inches long by ten wide and of most remarkable thickness, in this respect excelling all others. Like Santa Rosa, it has no thorns and no bristles. . . . One leaf of this has also been sold to Mr. Rutland of Melbourne, Australia, with right to sell in the Southern Hemisphere." All the remaining stock was quoted at \$5,000. (66, p. 16.)

Special.—1911. "Of the Tapuna section [class?] with round, silvery leaves or slabs, a true spineless cactus. . . . The slabs of this variety are about as smooth as watermelons. . . . The slabs average from three to five pounds each." Too tender for Arizona winters. (80, p. 18.)

Texas.—1925. "Developed here on my farms from a wild, thorny, Texas one; wholly spineless. . . . The thick, dark green oval slabs average ten inches long by six inches wide and one and one-half inches thick." Hardy in temperatures down nearly to zero. (131, p. 10.)

Titania.—1911. "One of the most remarkable of all known hybrid spineless *Opuntias*. Leaves or slabs, light grass-green, often three to nearly four feet long, eighteen inches wide and one and one-half to three inches thick." (80, p. 19.)

Trailing.—1907. "Curious, rapid growing, but still small, spreading plant. Leaves glossy, green, always free from a trace of bristles, but a single, long slender spine will appear here and there on the plant. . . . Leaves average six inches long by three wide and are quite thick." (66, p. 14.)

Vertex.—1911. A selected hybrid. "A tree-like stout, upright grower, with bluish green, thick, heavy, oval leaves, one and a half to two feet long and seven to ten inches wide; smooth, wholly free from spines or spicules." (80, p. 23.)

"Wooly."—1911. "A curious *Opuntia* with wooly leaves, height about four feet, almost wholly spineless, probably not hardy except in mild climates." (80, p. 23.)

Zalisco.—1912. "Another strong growing Smith seedling. Much like Model in most respects, but the slabs are longer, not as thick and light green." (87, p. 10.)

FLAX

The flax variety Burbank was offered in 1918. It was produced by selection from seeds of a light brown East Indian flax furnished by a "company of French artists [who] urgently requested me to produce a flax which would make a natural, limpid white oil, as the clear colors of their pictures were blurred and deadened by the oils which they were obliged to use." The Burbank flax may have been grown in France or elsewhere, but seems to be unknown in this country. (111, p. 1.)

GRASSES, MISCELLANEOUS

Beginning about 1906, several grasses were introduced; but most of them were already known to the experiment stations. Australian Red Top (*Tricholaena rosea*), the Natal grass of its native South Africa, was known in this country before 1906. Although Burbank obtained camel grass or Rhodes grass (*Chloris Gayana*) direct from Cecil Rhodes's South African ranch in 1894, he did not offer it for sale until 1906, four years after it had been introduced by the United States Department of Agriculture. Golden crown grass (*Paspalum dilatatum*), better known as Dallis grass, was offered in 1906, but had long been known here. Peruvian winter-grass (*Phalaris tuberosa* var. *stenoptera*), advertised in 1922, is the well-known Harding grass, now important on the ranges of California. According to Hitchcock it was distributed from the Toowoomba Botanic Gardens in Queensland, Australia, about 1907.

Likewise Sudan sorghum (*Sorghum vulgare* var. *sudanese*), announced in 1919 as a "wonderful new forage grass," was already familiar to the experiment stations of the country. See also Teosinte, page 48. (65; 114, p. 9; 117, p. 13; 121, p. 13; 124, p. 15, 32; 157.)

OAT

Burbank's four oat varieties are not listed by authorities on that grain, who might be expected to mention them had they been of much economic importance or even if they had existed before Burbank announced them. Also, by key identification, they surely would have been detected had they been old varieties with new names. Apparently, therefore, he originated them, as he said, by selection from some parent type or variety.

Corriente.—1922. Selected from a sample of oat seeds received from Peru. "A big yellow oat of great weight and unequalled uniformity." No further information. Apparently unknown today. (124, p. 16.)

Eclipse.—1917. No information except that this is a white oat. May have been an old variety, as Burbank did not claim to have originated it. He merely said: "Reselected seed. The heaviest yielder . . . on my grounds. . . . Early and unusually productive, a thin-hulled, heavy white oat." (109, p. 4.)

Opaline.—1922. No explanation as to the origin of this white, hull-less oat; only a sales talk: "This new oat is a wonderful yielder of clean, heavy white grain which threshes out like wheat and makes the best of feed for man or animals, and especially for poultry." (124, p. 14.)

White Avalanche.—1918. Another variety of white oat, but with no historical information. "An extremely early, very productive oat of the very best quality as well as a heavy yielder. A field of this when ripening appears almost as white as snow." (112, p. 6.)

QUINOA

Burbank first offered guautli, or quinoa, in 1887 as *Chenopodium Quinoa*, saying that it was introduced from Brazil. In 1918 he offered the same plant under the botanical name, *Amaranthus leucocarpus*, giving Sereno Watson as authority for the name. Seed may have been obtained from Peru. According to Bailey (6, vol. 2, p. 737), quinoa is a highly important plant in western South America, the seeds being used as a food; there are white- and red-fruited forms; and it is sometimes cultivated in this country as a curiosity. Burbank called it the "new breakfast food, a forgotten cereal of the ancient Aztecs." He claimed to have improved it by selection over a period of ten years. About the time he first offered quinoa for sale, he mentioned having in a safe-deposit box half an ounce of a precious seed, the only seed of its kind in the world (probably meaning the small sample of his own selection). This "remarkable" find went the rounds of the Sunday supplements. (21, p. 8; 111, p. 1.)

RYE

From the descriptions, the two varieties of rye offered for sale belong to the group of *Secale cereale* known as the Monstrous, and are of Turkish ancestry. "The monstrous rye," says Carleton, "is similar to the common rye, but has more than one spikelet to each internode of the rachis." This feature, had

he known of it, would have appealed to Burbank, who was ever on the lookout for the unusual. (138, p. 154.)

Paragon.—1920. Undoubtedly a selection from some Turkish variety. "Tall-growing, heavy yielding variety with large, light colored grain. I have been making selections for some years." Though perhaps planted by amateurs, it never attained economic importance. (117, p. 15.)

White Giant.—1921. Probably has the same history as the Paragon. "A giant in growth and productiveness, and better still, the grain is very light colored, large and fat." (119, p. 8; 121, p. 17; 124, p. 14.)

TEOSINTE

Announced in 1919. According to Hitchcock (157) there are only two species of teosinte: *Euchlaena mexicana*, an annual, and *E. perennis*, a perennial. Burbank produced a single variety, Early Harvest, which he listed as *Reana luxurians*. Since, however, it was an annual, recommended for silage, it must have been the *E. mexicana* sometimes cultivated in the Southern States as a green forage. Burbank developed it by "selective breeding" from types requiring a mild climate and a long growing season. He claimed that it would ripen throughout most of the United States. Evidently it was not a success, for it now appears to be unknown. (114, p. 9.)

WHEAT

Institutional workers everywhere tend to speak in conservative terms of new economic plants introduced by themselves or by others, until the varieties have been tested widely. They view with suspicion anyone who does not—in their opinion, at least—observe these precautions. Burbank was already somewhat mistrusted in institutional circles, particularly by officials of the United States Department of Agriculture, before he began to introduce cereals. When he first offered his wheats in 1917, when World War I had stimulated unusual efforts to augment the supply of foodstuffs, he inferred, at least, that the purchase of one of his wheat varieties—at \$5.00 a pound, \$300.00 a bushel—would solve the food problem. "The very life of the Nation now depends upon more and better grains." Although his claims were perhaps no more intemperate than those of certain highly respectable competitors, government agronomists reacted violently and tried to discredit him. Evidence was brought forward, and has since accumulated, to show that his Super was only Jones Fife, an old wheat of Russian origin, introduced by the United States Department of Agriculture in 1893.

Burbank himself was perhaps deceived. By his hit-and-miss methods of selection, a few grains of Jones Fife could have found a place in his seedbed. Supposed new varieties have arisen in this way; and the experimenter, if unfamiliar with varieties, is liable to be misled by appearances. Such a "find" should be submitted to an acknowledged authority. Burbank, however, was not in the habit of consulting others. Besides, he might have feared that the court would not be unprejudiced. He surely knew in what disregard he was held by institutional scientists; so he went his way alone, shrugging off criticism.

Burbank.—See Super.

Quality.—1918. No information as to its origin. By inference, it was a chance seedling or produced by selection. There usually was a chance for natural crossing to occur in Burbank's plots, but he does not tell us what varieties his tests involved. Clarke (139, p. 19) thinks Quality to be an obscure Australian variety named Florence.

The straw of Quality is white and fairly short; the heads, beardless or with a few rudimentary beards; the chaff, yellowish-white and smooth; the kernels, hard and white (or amber), not red as in Marquis. Quality matures about the same time as Ruby or 5 to 7 days earlier than Marquis; is not resistant to stem rust; yields an average of 23 to 26 bushels per acre. Burbank recommended it as an "early white wheat suited to all climates . . . as a summer wheat in the cold far northern climates and as a winter crop in the United States and most wheat growing countries." Although he was roundly criticized for his extravagant statements and high introductory price, \$5.00 per pound, Quality proved to be excellent for certain climates, notably the Dakotas, Minnesota, Idaho, and Washington. Clarke and Bayles (140) say that it is distinctly a spring wheat, not winter hardy when fall-sown; also that it is resistant to some forms of bunt and shatters badly in dry climates. They call it "the most widely grown variety of white wheat in the North Central States."

Quality was distributed throughout the northern states in 1923 by the Pillsbury Flour Mills Co. of Minneapolis, Minnesota. In 1929 the total estimated area under cultivation was over 250,000 acres. (112, p. 3; 124, p. 13; 140, p. 53.)

Quantity.—1918. An inferior variety that did not survive early tests. No information as to its origin; only the statement that it had "long, drooping, well-filled heads laden with extra large, fat, light-colored berries" and that it had "a stiff, four-foot straw which stands up bravely with its long, heavy, well-filled heads averaging on ordinary soils, five to six, and sometimes seven inches in length." From the photograph it appears to have been of the Prohibition type. Clarke and Bayles do not mention it. The former, in a letter dated May 14, 1941, declares: "We have never fully identified the Quantity wheat. From our notes it appears to be a winter wheat, although Professor Hyslop of the Oregon Station, identified the variety as Pacific Bluestem. Our early notes indicated that it was similar to Martin Amber. We have not grown it for many years as it did not become commercially important." Distributed by H. J. Barker, nursery-seedsman, Fond du Lac, Wisconsin, in 1918. (112, p. 4; 140, p. 53.)

Super.—1918. Originally introduced in 1917 as Burbank. The next year, without explanation, it was advertised as Super with extravagant claims. No information was given about its origin. Although a good variety, it turned out, as already mentioned, to be the Jones Fife. In the storm of criticism, everyone forgot that his highly successful Quality had been produced by the same technique as Super—that is, by selection, a method used here and abroad in producing dozens or scores of new varieties, many of which have proved to be old sorts reappearing in contaminated seed.

The so-called Super wheat was distributed by the State Seed and Nursery Company of Helena, Montana. Other names for Jones Fife were Canada Hybrid, Crail Fife, Fishhead, Silver King, Velvet Chaff, and Winter Fife; but these were never publicized like Super. (109; 112, p. 5; 140, p. 92.)

VEGETABLES

As a very young man in Massachusetts, Burbank became interested in improving vegetables. He tried especially to breed types that would mature earlier than existing varieties and, he tells us, actually grew and marketed a new, early sweet corn ahead of his competitors. His most signal innovation, of course, was the famous Burbank potato, the proceeds from which enabled him to go to California in 1875. Having brought a few of the potatoes with him, he turned them over to his brother in Tomales, California, to multiply. As early as 1878 he offered them for sale; and in 1880 he advertised a seedling of the Burbank. Of all the vegetables he ever originated or introduced, his potato was the most lasting, and his rhubarb was, to him, the most profitable. Except his potato, none of the vegetables became so justifiably famous as his fruits, especially the Japanese plums.

ARTICHOKE

Burbank began working with artichokes about 1908, using the French Globe, the Oval Brittany, and the Paris, or so-called perpetual artichoke. Nothing outstanding resulted.

Burbank Perpetual.—1922. No further description. (*125*, p. 3.)

Giant Green.—Listed in the 1914 bill of sale.

Improved Spanish.—1918. Globe type. No information as to its origin. (*113*, p. 8; *116*, p. 3.)

Mammoth Crimson.—1922. Globe type. (*124*, p. 3.)

New French White.—1919. Probably a selected form of some old variety. Said to be of the "tuberous [Jerusalem?] type." (*115*, p. 13; *116*, p. 3; *119*, p. 7.)

Santa Rosa.—1911. "Originated from seed sent me direct by King Victor Emanuel of Italy, from his own private garden." Burbank claimed that this produced the largest heads known, with flowers sometimes over 3 feet in circumference. (*86*, back cover.)

Seeds of hybrids, presumably related to the Santa Rosa, were offered in 1920. If any were sold, there is no record of the names given to them. (*117*, p. 11.)

ASPARAGUS

Eight or ten asparagus varieties were offered for sale by Burbank at one time or another. Early in his business life, when he was in the general nursery trade, he handled the standard varieties of the time, including two or three popular in Europe, particularly France and Germany. Though he grew the different kinds—green, purple-topped, and white—only the last showed any variation from the established type and served as the basis for a new variety.

Quality.—1901. Probably a selection from the Giant White Erfert. In 1901 Burbank said, "Many years ago I produced and introduced a new large, white asparagus, which excelled in flavor all others known. In the passing of the years since, even this has been greatly improved. . . . Quality produces very large, sweet, light-colored stalks." (*21*, p. 7; *55*, p. 3; *56*, p. 7; *109*, p. 4; *116*, p. 2; *135*, vol. 7, p. 222.)

Rustproof.—1920. Probably one of the George Washington or Martha Washington types perfected by the United States Department of Agriculture. (116, p. 2.)

BEAN

“Almost my first experiment in hybridizing,” wrote Burbank in 1912 (135, vol. 7, p. 97), “was made by crossing the horticultural pole-bean or wren’s egg with another variety of pole-bean.” He also tried crossing the pole bean with the lima. This was in Massachusetts, when he was about twenty-three and before he produced his famous potato. Technically speaking, both experiments succeeded; but neither yielded a new variety worthy of introduction. Forty years later, he claims, he resumed his study of beans. It is difficult to determine whether he actually originated something new by selective breeding; but he did introduce at least a few novelties.

Aztec.—1921. Purported to have been discovered in a sealed vase in an ancient Aztec dwelling in New Mexico. “It is a perennial bush bean, and in mild climates the tubers (much like small sweet potatoes) continue to reproduce a crop year after year, though a fair crop is produced from the seed the first season. . . . The largest edible bean so far seen.” Hedrick (156, p. 97) lists the Aztec as *Phaseolus multiflorus*, a synonym of Barteldes Bush Lima, introduced about 1890 by F. Barteldes & Co., who obtained the seed from Colorado; he admits, however, that Aztec had become the accepted name. According to Irish (159, p. 142), Scarlet Runner and Painted Lady are familiar examples of the type; it is grown chiefly as an ornamental (121, p. 14; 156, p. 97; 159, p. 142.)

Burbank Crazy.—1915. “These unusual beans are the result of a cross among several types. The product is beans of all colors, while the bushes remain uniform.” (98, p. 6.)

Giant Stringless Green Pod.—1926. Probably the old Jones Stringless, described by Jarvis. (133, p. 33; 160, p. 188, 196, 260.)

Improved Pea or Navy Bean.—1920. “None of better quality and few as productive as this new strain.” Announcement followed by a testimonial from Judge S. F. Lieb of San Jose, California: “We are delighted with your new white beans.” (117, p. 13.)

New Boston Brown.—1909 (?). Accredited to Burbank (5, p. 28), but not advertised by him. He himself explained in 1917: “The common white Navy or Boston bean is the best and most popular of all field beans and the one here offered is earlier, far more uniform in growth and time of ripening and is nearly or quite twice as productive as the common variety.” This would indicate that it was one of his selections. (105, p. 8; 7, vol. 12, p. 19.)

New Costa Rica Black.—1921. Probably an importation; apparently there is no reason to believe that Burbank originated it. (121, p. 14.)

New Tree Bean.—1919. “A wonderfully productive small white bean . . . yields very heavily even on poor soils.” (114, p. 13.)

Paraguay.—1921. Introduced from Paraguay, where it is grown by the Guanaco Indians. It produces a bush plant on poor soils, but under the best conditions becomes almost a pole bean. Always highly productive. (121, p. 14.)

“White Pod” Valentine.—1918. No information. Probably a selection from an old variety. (111, p. 8.)

BEET

Though Burbank advised extensively on sugar beets, he never bred them himself. He dabbled in garden beets, but announced only one variety. He seems to have been mainly interested in the so-called asparagus beet. (See also Chard.)

CABBAGE

As a young market gardener in Massachusetts, Burbank tells us, he found it easy to cross cabbage with cauliflower "and other members of the tribe." The cabbage-cauliflower crosses yielded only inferior hybrids. The reason, he said later, was that he had not then discovered the importance of carrying them into the second generation. He had more success in crossing the purple-leaved cabbage with other varieties, and developed a purple hybrid "with a very large head." (135, vol. 7, p. 65.)

China Cabbage (Pak-Choi).—"A species of large-stalked sweet mustard." Perhaps *Brassica juncea*. Probably an importation, although it has long been known in this country. (114, p. 13.)

Mrs. Wiggs.—About 1905. A clipping in his scrapbook contains a vague statement that he had produced a cabbage variety called Mrs. Wiggs. This may possibly be the purple hybrid mentioned above. (7, vol. 5, p. 284.)

CANTALOUPE

No information is available regarding Burbank's interest in cantaloupes—that is, whether he worked with them little or much. Presumably, however, it was little, for he announced only one new variety, Melting. This appeared in 1919. No information on its origin; only the statement that it is "productive, large, oval, heavily netted; thick, sweet, delicious flesh." (114, p. 14.)

CARROT

Burbank met with little success in his efforts to change the established growth habits of the carrot. The wild forms could be greatly improved, but not enough to compare favorably with varieties already in cultivation. In 1920 he offered Perfection: "The most highly bred in form and quality for table use of any carrot. Early, short, oval, sweet, tender roots." No additional information. (117, p. 13.)

CASABA

Announced in 1913 as the New Burbank (the Winter Melon). "Is a winter muskmelon which is very good to eat from September first to January first." Medium sized, roundish-oval, with a rough skin; very thick, rich, sweet meat; and a small seed cavity. A year later this was called the New Burbank "Christmas Cassaba." Probably a selection from an imported type. (93, p. 40; 95, p. 41.)

CELERY

No breeding was attempted with celery. One variety was, however, imported from Chile. This was announced in 1914 as New Burbank Chilean Perennial. "This unique celery is unlike the ordinary kind in size, being more like parsley. The flavor of the seeds, stalks and leaves is very much more pungent than the ordinary celery." Produced for its seeds, which are used for flavoring. (95, p. 41; 111, p. 6.)

CHARD

Besides attempts at improving chard, which he called asparagus beet, Burbank also worked with the foliage beets, finally producing a hybrid between the latter and a garden beet.

Asparagus Beet.—1911. "Broad white stalks all the season. Tiptop 'greens.' Best poultry green feed except the improved Burbank cactus." Probably little different from the old Swiss chard. (81.)

Burbank Swiss.—1914. Evidently a selected form of the old Swiss chard. (95, p. 42.)

New Rainbow.—1918. This is a cross between the "improved Swiss chard and the sweet table beet . . . succulent stalks and leaves exhibit a mingling of iridescent rainbow shades. The leaves are deeply crimped and pitted like Savoy cabbage." (111, p. 8; 114, p. 11.)

Sugar.—1924. "This is a rare new combination of the white sugar beet and my Rainbow chard." (128, p. 12.)

CHIVE

Work on the onion family—especially the improvement of the chive—began some time (perhaps ten or eleven years) before 1910, at which time Burbank first offered chive seed for sale. He was interested in the chive both for ornament and as food. Knowing the plant to be extremely variable, he obtained a variety from Europe and undertook selective breeding. The original plants bore dull crimson flowers. For five years seeds were planted, and selections made for the most acceptable flowers. "There was considerable tendency to vary within narrow limits, some plants being deeper in color than others, but the divergence was not at first very marked. In the third year, however, there suddenly appeared a mutant having a blossom of bright red color instead of the usual rather dull crimson."

He explains that he could have perpetuated this variety by multiplying the bulbs, but chose to go on selecting from seed to see what would happen. Out of thousands of seedlings, nearly all reverted to pink. This color continuing to predominate, he began selecting for size of bulb. "In the course of five or six generations, I developed the bulb so that the average size is about twenty times that of the bulbs of the stock with which we began." He thus secured the double-purpose variety that he had in mind at the beginning. He also found it relatively easy to increase or decrease the odor of the bulbs. (135, vol. 7, p. 145-51.)

Canadian.—1918. Probably an introduction; possibly an old variety, although he calls it new and it may have been new in this country. (111, p. 7.)

Giant Hybrid.—1911. One of his selections, presumably from stock secured from Europe. He claimed it was hardy from Alaska to Patagonia. "The tops are used for flavoring soups, salads, etc." (82; 111, p. 7; 116, p. 19.)

Imperial.—1921. "Originated on my grounds. It stands about eighteen inches in height, being about twenty-five times larger than the common chives." (122.)

New Burbank Pink.—1911. "A most useful vegetable and poultry food . . . makes also a handsome perennial border plant." (85, p. 3; 93, p. 40.)

Rose Flowering.—1911. Probably a selection from an imported European variety. (82.)

Ruby Gem.—1921. "A large, handsome, red-flowering variety . . . but they do not reproduce exactly from seed." (122.)

CORN

Corn breeding interested Burbank as early as 1870, when he was growing vegetables for market in Massachusetts. He crossed the sweet corn of the day in an effort to produce an earlier variety, but failed because he did not continue beyond the first generation. Incidentally, he was able to mature his green corn a week before his competitors; the grains he planted were pre-sprouted, having been mixed with a warm compost of fresh stable manure and leaf mold. He also crossed yellow field corn with Early Minnesota and other sweet-corn varieties in an effort to produce a sweet corn with yellow kernels, for which there was a demand. Promising hybrids were obtained; but the desired characters had not become fixed when the work was interrupted by his removal to California in 1875.

Considerable attention was given to ornamental types of corn. In 1908 he secured seed of a variegated corn from Germany. Only two stalks bore colored leaves. From these he selected through several generations, developing a new race of "rainbow" corn with stripes consisting of four colors. Later, two more colors showed up. He always suspected that his original seed was a hybrid between the common green-leafed dwarf corn and the old Japanese variegated corn, *Zea Mays variegata*, known already for thirty years. When he first found a few stalks with coloring that pleased him, he multiplied them rapidly by removing suckers from the old plants, causing them to take root, then planted them in the field. All were hand-pollinated and isolated from other corn.

Aurora.—1914. The result of five or six years of selective breeding with a variegated type believed to be a hybrid of *Zea Mays variegata*, and a variety of common green-leafed dwarf corn. Advertised as an ornamental, but also recommended as a food. The stalks were said to be even in size, and the leaves uniform in color. "The ears of the Aurora are five inches long, uniformly well filled, and of handsome golden yellow." (95, p. 26.)

Burbank.—1911. Improved by selection from Burpee's Early Bantam sweet corn. Whereas the Burpee Bantam had eight rows of grains to the ear, the Burbank product had twelve. This type was first called the Improved Early Bantam, then Burbank Improved Bantam, then New Bantam, and, finally, Burbank. "No other sweet corn . . . produced such uniformly fat, deep, sweet kernels as this on the smallest of cobs." (80; 95, p. 42; 111, p. 5; 121, p. 8.)

Burbank Field.—1918. Apparently the same variety introduced as California Field corn and two years later renamed Burbank. No information as to parentage. "A very early short-stalked, extremely productive hard, yellow field corn, which has been under selection for earliness and productiveness for many years." (111, p. 5; 117, p. 6.)

Burbank's Early Sweet.—1914. Probably a selected form of Stowell's Evergreen. "The ears are unusually large and the corn is plump, sweet and white for a very early corn. It is unusually prolific . . . as I have selected it for bearing two well filled-out ears to the stalk." (95, p. 42.)

Burbank's World Wonder Sweet Corn.—1914 (?). "Derived from Golden Bantam through selection and cross-pollination." Never advertised by Burbank. (136.)

Florida Sweet.—1909. Not advertised by Burbank, but referred to by H. C. Bailey. (5, p. 28; 7, vol. 12, p. 19.)

Giant Golden Sweet.—1922. "This fine new corn produces large, handsome ears suitable for market gardeners, but the cob is quite large in proportion to the kernels." Parentage not given. (124, p. 4.)

Papago Corn.—1919. "A yellow, wrinkled, sweet corn growing about eight feet high and bearing a dozen or twenty succulent stalks with abundant foliage. . . . The best corn for silos and fresh green feed, and is also a fairly good sweet corn for home use." No information as to its origin. (114, p. 8; 117, p. 8.)

Rainbow Corn.—See page 75.

Select Orange (Burbank).—1915. "A popular mid-season variety. The stalks are strong, vigorous growers and generally produce two fine ears. Is of a delicious flavor." No further information. (98, p. 6.)

Sorghum Pop.—1917. A cross between Burpee's Improved Stowell's Evergreen and the white gooseneck Kaffir corn, the former being pollinated by the latter. The cross was first effected about 1912 after numerous trials had failed. The grains from the hybrid ear were planted, but all the resultant plants except two were like the pistillate parent. The two exceptions ripened two weeks earlier:

Almost true Kaffir corn with compact, crooked, drooping heads, containing many scattering hard, round kernels, also bearing gooseneck drooping ears, somewhat resembling popcorn. The next season all were planted and a new corn, in many respects resembling white rice popcorn, but with more nearly globular kernels was produced, but the ears were branched or many-fingered and bore kernels, not only on the outside, but on the inside of the ears, producing an enormous number of kernels to the cluster. As these had to be crushed to obtain the corn, selections were made of short, stubby ears, which bore kernels only on the outside. . . . [The corn] pops out pure white, sweet, and with whirlwind vehemence. This amazing production is of great interest, not only to growers, but also to botanists.

Agronomists have been skeptical of any such cross having been made and say that the so-called Sorghum Pop is only the old Japanese hull-less corn. Although the cross is a difficult one, and one which has perhaps never been repeated, the present author believes that Burbank made it essentially as reported. The same objection was made to his claim of having successfully crossed the plum and apricot; but the feat was later duplicated, as reported on page 30. (105, p. 5; 121, p. 7.)

CUCUMBER

In writing of his work, Burbank says little about cucumbers. Apparently he interested himself in this crop only during the last ten or fifteen years of his life. He blended some existing varieties and tried, unsuccessfully, to hybridize distantly related species.

Arctic White.—See Iceland.

Capital.—1920. This variety probably had the same origin as the Iceland. "Exactly like the Iceland in every respect except color, which is bright green." (117, p. 10.)

Iceland.—1917. First advertised in 1915 as "Burbank's New Cucumber." In 1917 and later, it was called Iceland. A cross between the lemon cucumber and Burpee's Long Snow White. Claimed to be superior in crispness and delicacy of flavor and also to be very large. In 1926 Burbank advertised an improved variety of the Iceland, originated by a grower in northern British America and called the Arctic White. (100; 105, p. 7; 111, p. 4; 133, p. 33.)

Japanese Climbing.—1925. Probably an importation. "Fully equal to any of the common cucumbers with the added ability of the vines to climb fences and trellises by tendrils, like a grape vine." (130, p. 8.)

Unnamed Hybrids.—1925. "These are all first class cucumbers which have originated here from combinations of the common cucumbers and the delicious short, lemon cucumbers." (130, p. 8.)

EGGPLANT

While conceding the possibilities for improving the eggplant, Burbank devoted very little time to its study. In fact, he advertised but one variety (1926); and that may have been one already in cultivation, as he gave it no variety name. (133, p. 23.)

GARLIC

Garlic was found difficult to hybridize because of its small flowers; but with care the task could be accomplished. Attempts to hybridize it with onions were unsuccessful. Experiments were made with a wild species from the mountains of Chile—thought to be distinct from the common garlic, "having much larger bulbs and a taller stalk similar to that of the leek." In 1919 Burbank announced the variety Elephant. It was possibly a cross between *Allium sativum* and a Chilean form. "More than ten times as productive as any other. A single clove of the Elephant is as large as a whole cluster of the ordinary garlic." (114, p. 10.)

GOBO

Gobo is the Japanese name for our common burdock—here a weed, but in Japan esteemed as a vegetable. Burbank introduced this plant as *Lappa major* in 1894. No breeding was done; it was merely imported. "A most delicious, perfectly hardy, biennial vegetable. The young leaf-stalks resemble rhubarb in form, and are almost exactly like asparagus in flavor." (37.)

MUSKMELON

Florida.—1910 (?). A Santa Claus type of melon supposed to have come from Syria. A selected seedling resulting from several crosses within the Santa Claus type. Keeps well until midwinter. A longish-oval muskmelon with red and green stripes. Stock sold to a company in Florida, who gave the melon its name. (135, vol. 7, p. 45–46.)

Improved Winter.—1909. No information except a mention by H. C. Bailey. (5, p. 28; 7, vol. 12, p. 19.)

PARSNIP

Burbank announced in 1919 a variety of parsnip that he called Imperial Hollow Crown. According to him, it was "a carefully selected strain of the smooth, sweet Hollow Crown. The best of all," (114, p. 14.)

PEA

Experiments with garden peas began in 1904 or 1905, because of an order from J. H. Empson, a canner at Loveland and Greeley, Colorado, who desired a particular type of pea for his trade—something small like the *Petite Pois* of France, of uniform size, sweet, and reaching the desired maturity all at the same time so that harvesting and hulling could be done by machinery. Burbank contracted to fill the order in six years; but by growing two crops in a season, he fulfilled his obligation in half the time. The improvement was effected through six generations of selection, no cross-pollination being involved, since the peas were already of superior quality “and showed enough variation as to all the desired characteristics to offer material for selection. . . . It should be explained that the pea is normally self-fertilized, so that there is the closest inbreeding, and it is, therefore, relatively easy to fix a type. Moreover, the pea is a very pliable plant, producing new varieties with little care and labor as compared with many other plants.”

Three varieties were submitted to Burbank for improvement—Admiral, Alaska, and Horsford, all standard canning sorts. The Alaska and Horsford, not coming up to expectations, were eliminated. The Admiral yielded five subtypes, graded according to size of pea; and all were sold under a can label stating that they were “created by Burbank.”

The Kuner-Empson Company has supplied a copy of Burbank's letter dated February 29, 1908, when the peas were shipped to Mr. Empson:

By express today I sent you all the peas raised from the *one best* of all my selections. This one is the one which produced the most peas to the pod, the most pods to the vine, had the most uniformly filled pods and in all respects was the most productive and best; on the whole, the best pea, taking quality, quantity and everything into consideration, which I have ever seen. They are fifteen per cent smaller on the average. One other thing which I have added to them is that they are *sweeter* than the pea which you first sent me. They all came from *one single vine* which was the *best* in all respects and the seed has been reselected through six generations.

If you wish to use my name in connection with these improved peas in your business, I shall have no objection, if used in an honorable way, and I know you will never use it otherwise, for I feel proud to have done something for your model canning establishment in any way whatsoever.

After the filling of the Empson order, selection was continued; and at least one additional variety was developed and offered for sale.

Burbank Admiral.—1908. A sixth-generation selection from the well-known Admiral variety. A collective name for five separate strains differing only in size of pea. After being canned they were sold by the Empson Company under the following trade names: no. 1 size, Tiny; no. 2 size, Little Ones; no. 3 size, Primrose; no. 4 size, Columbine; no. 5 size, Apex. A letter from the Kuner-Empson Company of Longmont, Colorado, dated March 31, 1943, states that “these titles, with but few changes, are still in use” and that 1,500 to 2,000 acres of the peas have been grown annually since 1908. (158, p. 114; 135, vol. 7, p. 75.)

Model.—1918. Described as a new, sweet, canning pea. Evidently a selection from the Admiral, “but better and more productive, in fact, the most productive of all peas grown here.” (111, p. 5.)

Sugar.—1909. Mentioned by H. C. Bailey. No description. Probably refers to the Burbank strain of the Admiral developed for the Empson Company of Longmont, Colorado. (5, p. 28; 7, vol. 12, p. 19.)

PEPPER

Burbank maintained that the breeding of peppers promised considerable reward, even for the amateur. He made numerous crosses, using Chilean and Mexican forms, on our cultivated varieties.

Anaheim Hot.—1920. "A productive, long, red, cayenne pepper." No further information. May possibly be a standard variety. (109, p. 6.)

Burbank.—1918. A selection from a pepper received from Mexico about 1908. "A giant sweet pepper of great size and fine flavor . . . fruits nine inches long and four inches through with a thick sweet meat." (111, p. 2.)

Burbank Giant.—1915. "The largest, best formed, most productive, sweet pepper so far produced." Possibly the same as the Burbank, although in 1918 the Burbank was described as being offered for the first time. (98, p. 6.)

Golden Horn of Plenty.—1922. No historical information. "An extremely early, very handsome and unusually productive lemon-yellow pepper." (124, p. 12.)

POPCORN

Little information is available regarding Burbank's activities in the improvement of popcorn. When he took back his products, after the Company fiasco, he seems to have given some attention to popcorn; but he advertised only three varieties.

Garnet.—1926. No information as to its origin. Perfected, but not offered for sale until after his death. Described as "a neat, tight, rather small, fat ear . . . a brilliant, gem-like dark red, flashing and glowing, deep and rich." (133, p. 40.)

Pure Gold.—1917. Undoubtedly a selection, but exact origin unknown. "Three and four long, beautiful, pure golden, well-filled, uniform ears to each stalk." (105, p. 8; 114, p. 7.)

Select Rice.—1917. Evidently an improved old variety. "By careful selection this has been made more uniform, earlier, and more productive." (105, p. 9.)

POTATO

Burbank's first claim to renown came when he produced a new variety of potato. He was then about twenty-four and was living on a farm in Massachusetts. As a grower of vegetables, he was keenly alive to the importance of improvement in various directions and hybridized a few plants with this object in view. When, however, he planted the fateful seeds that produced his potato he had no idea, grandiose or otherwise, of bettering the crop. On the contrary, he planted through curiosity—to see what would happen. Under Massachusetts conditions, apparently, the Early Rose potato seldom flowered; any seed balls that chanced to appear were objects of interest. Most observers were content to wonder and pass on; but young Burbank kept the single capsule that he had seen, and planted the seeds, with astonishing results.

Burbank refers to his potato as a discovery—something he came upon by chance. Many products of this nature have brought more or less fame to their

discoverers—the Concord grape, navel orange, Fife wheat, the Delicious apple. Burbank's good fortune, however, fired his imagination; he resolved to spend his life in bringing about improvements in ways suggested by Darwin, not merely waiting for chance to throw improvements in his way. Using the proceeds from the potato, he went to California and in a few years entered upon his lifework. His further efforts with potatoes had no conspicuous results. The Darwin potato, *Solanum Maglia*, a wild, yellow-fleshed species from Chile, was crossed with the common potato; but, of the many curious hybrids that resulted, none were valuable enough to be introduced. The *S. Maglia*, however, normally produced unusually large seed balls; and one of the hybrids had balls of tomatolike flavor and was introduced for its fruit. Burbank also made crosses with the *S. Cammersoni* from the Mercedes River section of eastern Argentina; the squaw potato of the Southwest, *S. Jamesii*; and an unidentified Mexican species. About 1895 a Pacific Coast cultivated variety, known as Bodega Red, was hybridized with the Burbank. This hybrid was announced but never introduced.

Burbank.—1873. Introduced in 1876 by James J. H. Gregory, a seedsman of Marblehead, Massachusetts, as "Burbank's Seedling." A first-generation seedling of an open-pollinated Early Rose. From a single seed ball Burbank planted twenty-three seeds. Every one germinated and grew, producing a cluster of tubers. All but two were worthless. One of these was later discarded, while the other was multiplied as rapidly as possible. In 1875 the entire stock was sold for \$150 to Mr. Gregory, who permitted Burbank to take ten of the tubers with him to California. In his catalog for 1876, Mr. Gregory (148) says:

I sent out this season for the first time the new potato, Burbank's Seedling. This, like the Early Ohio, is a seedling of Early Rose, but is of Massachusetts origin. Unlike its parent it is white skinned. The remarkable productiveness of this new seedling will be seen in the fact that the first year from the seed ball the yield was three pounds three ounces, all large sized potatoes! Since then it has yielded 36 pounds to a rod of row, has averaged a bushel to nine hills and 435 bushels to the acre. Planted side by side with Early Rose, New York Late Rose, Peerless and Brownell's Beauty, it has excelled them all in yield. In beauty of form it is unexcelled, the proportions being all that can be desired, while it does not grow prongy, and is never hollow hearted. It has the good characteristic of yielding almost no small potatoes; while but five sixths of the Early Rose, growing side by side were of market size, of the Burbank forty-nine fiftieths were marketable. Hardly a rotten potato has been found thus far in its history, while standard varieties growing side by side under precisely similar circumstances have rotted badly. It has but few eyes, which are sunk but little below the surface. In quality it is firm grained, of excellent flavor either boiled or baked, is dry and floury, is fine, is all that can be desired. It ranks between the very early and very late varieties.

The Burbank potato has had a truly remarkable history. Adaptable to extremes of soil and climate, it was widely distributed. During its career, the production of potatoes has become a highly specialized business, certain varieties being grown in particular places to meet special marketing conditions. Under these circumstances the Burbank has not always been the favorite; but still, after seventy years, it is important in certain districts—for example the great Delta region of California—although more so in the humble home gardens of half the states of the Union.

All varieties of useful plants that enjoy a long life undergo modifications and improvement. Today there are several different strains of this potato.

The Russet Burbank, known to the trade as Idaho Baker, is among them. Ninety per cent of the crop in the well-known district near Twin Falls, Idaho, in 1940 were of this variety. Others are the Notted Gem and the Pride of Multnomah. Styles change. Originally the Pacific Coast preferred potatoes with a red skin. The white-skinned Burbank had to overcome this prejudice in California and Oregon. Now the tendency again is toward a skin with some color, and the Burbank had to undergo modification. Other slight changes, too, have been necessary and will no doubt continue to be made; but the essential Burbank characteristics remain. (135, vol. 1, p. 56-65; vol. 2, p. 280-84; vol. 7, p. 114, 129-44, 267-304; vol. 12, p. 76.)

Burbank's Sport.—1880. "Originated at Tomales, California, from the celebrated Burbank Seedling. It is four to six weeks later, averages twice as large and has a shade of pink around the eyes when first dug. . . . Introduced through a San Francisco firm. But the potato did not differ sufficiently from the Burbank to maintain its individuality, and it is not now known as a separate variety." (9; 135, vol. 7, p. 296.)

Golden Flesh.—1909. Mentioned by H. C. Bailey (5, p. 28). Probably a selected form of the so-called Darwin potato, *Solanum Maglia*, or, more likely still, a hybrid between the *Maglia* and the common potato. (7, vol. 12, p. 19.)

Mexican Wild.—1899. Received from a collector in Mexico. Species not given. Sometimes known as the snake potato. Probably a mere curiosity. (50, p. 16.)

Pomato.—1912 (?). A hybrid secured by crossing the Darwin potato, *Solanum Maglia*, and the common potato, *S. tuberosum*. Recommended not for its tubers, but for its enlarged fruits or seed balls, which had a tomato flavor. "White when ripe . . . highly pleasing aroma." (135, vol. 12, p. 283.)

Potato Seedlings.—1893. An offering of seedlings of the Burbank and of a cross between the Burbank and the Chile or Bodega Red. "The best of several thousand seedlings—have been tested for five years." (34, p. 48.)

Potato Seeds.—1906. "A most unique mixture of species and varieties including *Solanum Cammersoni*, *S. Maglia*, *S. tuberosum*, and many rare ones from Mexico, South America and Africa." (65, p. 2.)

Vanadio.—1922. Collected by R. A. Grigsby in Peru at an altitude of 14,000 feet. "Color, crimson, with bright, golden flesh, shaded with rose . . . resists under all circumstances all of our common potato diseases." A late potato, probably of the *Maglia* type. (125, p. 9.)

RADISH

In 1925 Burbank announced new hybrids of radish, parentage not given. "The most remarkable radishes are produced from this seed—earliest white, pink, red, scarlet, blue, giant, dwarf, long, round, oval, etc." (130, p. 12.)

RHUBARB

Activities with rhubarb consisted of importing a winter-growing type from New Zealand, improving it by "selective breeding" and also "by crossing this type with various races of ordinary rhubarb, in particular with the improved variety known as the Burbank Giant. The crosses were made mostly by using the winter rhubarb as the pistillate parent, but reciprocal crosses were also

made. The progeny, as is often the case with hybrids, showed great vigor of growth."

Judging from the literature of the day, the Burbank rhubarb was rather widely grown, especially in California but also in England, Italy, and South Africa, and was even taken back to New Zealand and Australia. Several varieties were announced over a period of twenty years; but, not being hardy, they were not useful in cold climates.

Burbank has not told us why he wanted New Zealand rhubarb in the first place, for it had little importance in its native country. He has told us, though, that it was difficult to obtain; that three shipments were necessary before a few half-dead roots finally arrived; that in those days, the middle nineties, steamship refrigeration was unknown; that the shipment of live plants across the equator involved grave problems in packing. Evidently he wanted the insignificant plant at any cost. Being always on the lookout for the unusual, he probably valued its tendency to grow in the winter. At any rate, he nursed the roots into life and was rewarded with stalks which were about the size of a lead pencil, but which continued to grow all winter and far into the summer. Improvement in size came later by selection. Still later, he hybridized his imported plants with native rhubarb.

A cherished theory of Burbank's, not supported by acceptable proof, was that plants removed from one hemisphere to another, especially to where the seasons are reversed, tend to change their growth habits. And thus he explained the behavior of the New Zealand rhubarb in California, forgetting his earlier statement that at home it tended to grow in winter. H. S. Williams, chief editor of his autobiography endeavored to prove that the New Zealand rhubarb, when removed from the Antipodes, was compelled to follow the calendar rather than the immutable seasons. Burbank casually voiced this theory, but Williams devoted pages to it.

Australian Crimson Winter.—1900. The original stock was obtained from D. Hay and Son of Auckland, New Zealand, about 1895. Insignificant at first, it was rapidly improved by selection alone. This variety—or type—undoubtedly started a new industry in California and other places with a mild winter climate. In time, however, the growers gradually developed new types better suited to their own soil, climate, and markets. The Burbank rhubarbs are now rarely heard of, even in California, although some modern varieties are probably lineal descendants.

The original Crimson Winter was described in 1900 as follows:

The stalks are of medium size, well-grown ones averaging twelve to eighteen inches in length and about three-fourths to one inch in diameter. They are of a pale greenish crimson color, turning when cooked to a light clear crimson, and are of the very best quality. The plants are somewhat more inclined to bloom than the older kinds, which is easily remedied by topping. Starts to grow vigorously by October and continues to produce stalks continually until after the common varieties make their first appearance some six months later. In our rainless California climate, it reluctantly takes a short rest during midsummer but if kept moist will produce stalks abundantly at any season; it is, in fact, absolutely perpetual.

The variety was sold to John Lewis Childs, whose 1903 catalog lists it as the Crimson Winter or Ever-Ready. In 1908 Burbank announced the Giant Crimson Winter, saying it "is like the famous Crimson Winter except that it is

three times as large and rarely produces seed. It is a sport from the Crimson Winter and will not come true from seed."

E. J. Wickson, Professor of Horticulture in the University of California during the Burbank era, declares (188, p. 279) :

The Crimson Winter, introduced from Australia by Luther Burbank about 1895, and sold by him to the trade in 1900, has revolutionized rhubarb growing in California by completely reversing the market season. This variety and its improvements by Mr. Burbank and by others who have practiced selection since he sold it out, notably by J. B. Wagner, of Pasadena, has multiplied the rhubarb acreage of the state and vastly increased the serviceability and commercial suitability of the plant. It has precluded forcing in California and promises to render forcing unprofitable even in the wintry parts of the country because of the large supplies of open air rhubarb which are available for shipment from this state at all times of the year when the summer varieties grown in wintry climates are unproductive.

(See also 7, vol. 4, p. 24 and 95; 52, p. 2; 77, p. 1.)

Burbank Giant.—1909. Also known as the Perpetual and New Crimson. Apparently a selection from the Crimson Winter. "Not profitable out of doors where the eucalyptus, orange, and fig cannot be grown." (77, p. 2; 113, p. 8.)

Burbank's Wonder Winter.—1907. Claiming exclusive rights of introduction, a California nursery (146) announced this variety as having been developed from the Crimson Winter and about the same time advertised "Mrs. Freeman's Triumph," presumably a selection of her own. (7, vol. 7, p. 94, 97.)

Giant Crimson Winter.—1910. A hybrid resulting from a cross between the winter rhubarb and the Burbank Giant. "This Giant new rhubarb . . . must not be confounded with the Crimson Winter, as it is much more productive." Jones and Rosa (163, p. 95) say of it: "This variety is somewhat like Victoria. It is supposed to be one of Burbank's introductions. It is grown to some extent in the interior valleys of northern California and was formerly shipped during the winter from southern California. The large, greenish stalks are characterized by a speckled-pink color." This variety is not hardy. (7, vol. 12, p. 19; 95, p. 46.)

Giant Winter.—1910. Apparently the same as Giant Crimson Winter. (100.)

Improved Crimson Winter.—1906. Sometimes referred to as the "Mortgage Lifter." Apparently a selection from Crimson Winter. (65, p. 2.)

Hybridized Rhubarb Seed.—1922. "From crossings of the Giant Perpetual with the best European and American varieties, some remarkable giant, early, and fine-flavored varieties are being produced." (124, p. 11.)

Monarch.—Perpetual type. Listed in the 1914 bill of sale.

SQUASH

Work with the squash began as early as 1873 and consisted of hybridizing experiments with the Canada crookneck, which was then popular. No important improvements were effected. About 1900, or earlier, squash seeds were received from a collector in Chile. From these two sources, varieties were developed through hybridization and selection. Gourds from Australia and South America were experimented with, but no varieties were announced.

Chiloe.—1907. Also known as the sugar squash. "The original . . . somewhat resembled the acorn squash—having the form of a rather irregular acorn in its cup, giving it a unique appearance. This is of very large size, and it will

grow on dry land where other squashes do not thrive, attaining a great weight." The seedlings were variable. Promising strains were hand-pollinated; and, through several generations of selection, the Chiloe was finally developed. "It was named Chiloe by the company who introduced it." (7, vol. 7, p. 137; 135, vol. 7, p. 58.)

Begonia-leaved.—1893. "A mammoth squash which produces abundant crops for stock feeding and has bright golden variegated leaves. This unusual leaf variegation appeared four years ago on a single vine, and by selection, has become so fixed that at least ninety-five per cent are variegated. The form, size and uniform appearance . . . has also been improved." (34, p. 48.)

New Sweet Hubbard.—1918. This is the old Hubbard with its original sweetness restored by selection covering a few generations. (111, p. 6.)

Patagonia.—1906. "Grown by the Indians of Chile, where it was reputed to be sweet as sugar. Several seasons have been required to fix the type. Though of medium size, this new squash averages thirty pounds each, resembling a cannon ball in specific gravity; the seed is packed solidly in a little space, all the rest of the squash being solid, sweet, dark orange-colored flesh which is three to four inches thick. The Patagonia is apple-shaped with a broad protuberance at the blossom end packed solid with the large, heavy, reddish brown seeds. Color green, white, and yellowish, intermixed with mottling, spots, and stripes." (65, p. 1.)

TOMATO

No noteworthy work was done toward the improvement of tomatoes. Although several new varieties were announced, they seem to have met with only indifferent success. One, a special-purpose variety—for preserving—was carried in stock by a nationally-known seed company for many years. How much attention was given to breeding is not clear. Some hybridizing was done, and much selection. Only one importation was made from a foreign country. After Burbank engaged in the general seed business, from about 1918 onward, it is not always easy to determine just which of the varieties offered had been originated by him. Payne's Victory, advertised in 1920, is an example: "In a comparative trial test here among twenty-four varieties offered by growers, this was the one selected as really new." Burbank adds, "It is rather late for this climate and does not yield here as heavily as Santa Rosa or Burbank (Belgiano), but is a superior new variety." It is not included in the present list of his varieties.

Belgiano.—1915. Originally introduced as the New Burbank Early, but in 1922 rechristened Belgiano. "The earliest, smoothest, largest, and most productive of all early tomatoes." It was described as bright crimson, thick, smooth, firm, medium to large in size, of fine quality, a heavy and continuous bearer throughout the season. The skin was said to peel freely from the flesh, even when fully ripe. Reported to ripen 2 weeks ahead of the Earliana. Origin not given. (7, vol. 15, p. 136; 98, p. 7; 111, p. 2.)

Brazilian Prickly.—1922. "A new fruit for North America, though it had long been a favorite in Brazil." The whole plant contained prickles, which he was unable to remove by breeding; but he did cause the fruit to drop, when ripe, from its spiny husk, something it had not previously done. (124, p. 31.)

Burbank Preserving.—1905 (?). "An unusual type of preserving tomato produced on stocky plants having very deep green foliage. The tomatoes are round, three-fourths of an inch in diameter and of a rich scarlet color." One of the big seed companies (136) listed this variety for sale in 1906 and continued to do so for more than ten years. (7, vol. 5, p. 141-50; 98, p. 7.)

Burbank Trailing.—1915. "Fruit similar to the Burbank Preserving tomato, but the habit of the vine is trailing instead of upright." (100.)

Combination.—See page 98.

Golden West.—1918. "A large, smooth, productive golden yellow tomato of superior quality." It is listed here with some misgiving as to whether it is a Burbank production. (111, p. 3; 114, p. 6.)

Santa Rosa.—1918. No information as to origin. "Enormous thick, smooth, deep rose-colored fruits of superior quality. Most productive general crop tomato and especially valuable for canners and home use." (7, vol. 12, p. 19; 111, p. 3; 114, p. 6.)

ORNAMENTALS

Of the several hundred ornamental plants introduced by Burbank the Shasta daisy was undoubtedly his greatest contribution. This flower has traveled around the world, being widely planted in European countries, South Africa, and elsewhere. In modified form it is still as popular today as it was when first announced, nearly forty years ago. Only a few varieties were offered.

For sheer number of varieties developed through hybridization and selection within a single genus, *Amaryllis*, *Hippeastrum*, and *Crinum* hybrids easily stand at the top of his list of introductions, followed by lilies, including *Hemerocallis*; then by *Watsonia*, poppies, gladioli, dahlias, and roses, somewhat in the order named. But none became so famous as the Shasta.

Fame is measured in two ways: by the length of time a variety is offered for sale and by its popularity while it is in the trade, although that period may not be measured by decades. The average commercial life of a flowering annual, or even a bulbous or herbaceous perennial, rarely exceeds ten years; then, usually, it is superseded by an improved type under another variety name. Since styles and tastes in ornamental plants may change as rapidly and as illogically as styles and tastes in clothing, no given variety can be called unimportant simply because it disappeared from the seedsmen's catalogs after only a few years.

Scores of Burbank's hybrid ornamentals were sold to the trade without names. The dealers supplied names of their own selection, and thus the origin of the varieties was lost, so far as credit to Burbank is concerned. Certainly it is now impossible to trace these transactions.

ABUTILON

Burbank announced a variety of abutilon in 1914 as Pride of Chile (Burbank Strain). Apparently this was the same thing that was offered in 1911 under the name "*Abutilon vitifolium*, Pride of Chile." Probably imported from Chile. The Burbank strain is evidently a selected seedling. (82; 95, p. 18; 111, p. 16; 126, p. 28.)

AGAPANTHUS

Apparently only selection experiments were carried on with the African lily or lily of the Nile. Starting with the conventional blue *Agapanthus*, a pure white form was obtained.

Lily of the Nile.—1899. A selected seedling "bearing heads of snow-white flowers, on strong stems, nearly four feet in height." This was said to have been developed from an agapanthus with small, blue flowers. (50, p. 16; 111, p. 9.)

New Agapanthus (Cape Colony Lily).—This agapanthus was announced in 1916 and designated as *Agapanthus albo gigantea*. Since the description is almost exactly the same as for the foregoing, the statement "Never before offered" need not be taken too seriously. The species name, *albo gigantea*, must have been coined for the occasion. (103; 106, p. 11.)

ALSTROEMERIA (LILY OF THE INCAS)

Lily of the Incas was successfully crossed with the native California lily *Lilium pardalinum*; but since the hybrids lacked vigor, all were eventually abandoned.

The species "*Alstroemeria Chilensis* (*versicolor*)," announced in 1910, cannot have been both *chilensis* and *versicolor*, although the two species of Chilean lily are much alike. The description seems to favor the *versicolor*. Described as "one to three feet high with an abundance of flowers resembling small lilies; yellow in every shade—orange, scarlet crimson and pink, spotted, striped and selfs." (76, p. 2; 82.)

AMARANTHUS

Combustion.—1925. The entire stock of this variety appears to have been sold to some dealer as soon as announced; but the name of the firm is not given. No information as to which species of *Amaranthus* it was derived from or whether it was a hybrid. It originated in 1922. "The plants grow four feet in height by three feet in diameter... with broad coleuslike leaves... of a surprisingly brilliant, iridescent color... being of a clear, glistening, fiery, rosy crimson." A truly gorgeous decorative plant. (130, p. 16.)

Molten Fire.—1922. Origin not given. The description is much like that for Combustion. (124, p. 17; 128, p. 16; 130, p. 16.)

Sunshine.—1924. No information as to origin. "The general effect is of a glistening scarlet semi-transparent rose color.... The plants begin to color when only a few inches in height and increase in brilliance through the summer." (128, p. 17; 130, p. 17.)

AMARYLLIS

This being a horticultural, rather than a botanical study, *Hippeastrum*, *Crinum*, and *Sprekelia* are here all included under amaryllis. Burbank gave active attention to this group throughout twenty to twenty-five years and watched some of his hybrids even longer. *Hippeastrum* was the first group experimented with—*H. vittatum*, *H. Reginae*, and *H. Johnsonii*. The last-mentioned is itself a hybrid, bred by an amateur breeder in England in 1799,

so that a cross between it and *H. vittatum* (one of Burbank's early successes) represented a union between a hybrid and one of its parents. In the next generation *H. auricum* was introduced and then *H. Reginae*, the other parent of *H. Johnsonii*. Beginning with the fifth generation, Burbank tells us, "several other species of *Amaryllis* were introduced into the combination." There were then crosses and recrosses among the various hybrids. After about twelve years, he says, his "colony of mixed hybrids . . . showed wide departures from any of the ancestral forms." This is the history of his new race known as the Giant Amaryllis.

When he felt that he had reached the practical limits of variation to be attained by hybridizing the different species of *Hippeastrum*, he extended the experiments "by crossing the new Amaryllis hybrids with other allied genera, notably with *Sprekelia* and *Crinum*." The *Hippeastrum-Sprekelia* cross was at least a partial success:

I have worked on the *Sprekelia* more or less for twenty years, raising probably a hundred thousand seedlings [doubtless an exaggeration]. But I succeeded only once in hybridizing the plant, with the production of fertile offspring.

The hybrid amaryllis (*Hippeastrum*), that made union with the Jacobean Lily [*Sprekelia formosissima*] was my *vittatum* type [his Giant Amaryllis], having pale red flowers striped with white. Only a single hybrid of this union bloomed, but from this a number of seedlings were grown. The hybrid offspring of these plants of different genera had long, narrow, strap-shaped leaves much like those of *Sprekelia* (the pollen parent), but the blossoms were very much larger than those of that plant, and they had very curiously twisted petals, unlike those of either parent.

Now comes the controversial claim to having successfully hybridized *Amaryllis* with the genus *Crinum*:

Interesting hybrids were produced by crossing the *Crinums*, not with the members of the *Hippeastrum* colony (this proving impossible), but with the form of true amaryllis known as *Amaryllis Belladonna*. The hybrids thus produced were a curious lot. They seemed undecided whether to take on the flat, strap-shaped leaves of the amaryllis or the tunicate leaves of the other parent. The compromise led to the production of a leaf with a long, curious neck.

The *Crinum* used might have been *americanum*, *amabile* (*augustum*), *asiaticum*, *Moorei*, or *longifolium*, for he tried them all.

At this late date, who can say whether the *Amaryllis-Crinum* cross was really effected? Although some have doubted, it was probably made. Dr. George H. Shull, who spent nearly five years in Santa Rosa checking Burbank's experiments for the Carnegie Institution of Washington, supports this belief, at least passively. He has kindly supplied a paragraph from the manuscript of his unpublished report, with the comment that he could "only vouch for the fact that the following statement had Mr. Burbank's approval:"

Another noteworthy hybrid which Mr. Burbank produced was between *Amaryllis Belladonna* and *Crinum Americanum*, the amaryllis being the seed-parent. While these amaryllis-crinum hybrids are of little economic value, they are of much interest scientifically. The leaves of the amaryllis are flat and strap-shaped, and those of the crinum are curved and overlapping or rolled together in such a manner as to form a distinct neck to the bulb. In the hybrids the leaves seem to be distinctly intermediate between these two types, being more or less curved at the base and becoming strap-shaped above, sometimes exhibiting a distinct offset between these two portions of the leaf. The flowers are intermediate between the two parents being smaller than the *Amaryllis Belladonna* and more tubular, but varying through light pink to deep rosy crimson like the Belladonna lily. These curious and graceful

hybrids multiplied quite rapidly and are easily grown, but have never borne any seed. Efforts to cross them with the two parents have also been without result. None of these hybrids have been distributed, and only a few remain in existence at the present time.

The other achievement with amaryllis was the development of the giant-flowered race of hybrids.

Apparently only eight or ten named varieties of amaryllis were introduced; but a large number of hybrids were announced—136 at one time—and sold without names. Likewise, according to a statement by Burbank, crinum hybrids were sold without names and without advertising. So far as can be determined, all have now disappeared from the trade or have been further improved and their original names lost. (135, vol. 9, p. 71–101.)

Amaryllis Hybrids.—Listed in 1905 as *Amaryllis vittata hybrida*, these were a collection of hybrids from which individual types had been selected and given variety names. (62, p. 3.)

Boy Rolf.—About 1905. No information; merely a brief mention in a clipping from an unknown periodical. Possibly one of the *vittata* hybrids. (7, vol. 4, p. 6.)

Burbank's Dwarf Everblooming Fragrans.—1909. Apparently sold to John Lewis Childs, and first announced by him in his catalog for 1909. No information as to its origin, although Burbank once spoke of having received a dwarf *Hippeastrum* from southern Chile. (7, vol. 10.)

Burbank's Giant Hybrid.—1906. This was a race of large-flowered amaryllis that Burbank claimed required ten generations of breeding to produce. The first step appears to have been a cross between *Hippeastrum Johnsonii* and *H. vittatum*. Then *H. aulicum* and *H. Reginae* were brought into the combination, followed, in the fifth generation, with "several other species." A few of these hybrids were given variety names before sale, but a far greater number were sold unnamed. One of the types was apparently sold to John Lewis Childs about 1909. (7, vol. 10; vol. 15, p. 87; 65, p. 3; 85, p. 2; 93, p. 13; 95, p. 16, 100.)

Coronado.—1913. The name was provisional, the inference being that this variety might be sold and given some other name. A giant hybrid with a complicated ancestry, said to be an early bloomer and a "prodigious" multiplier. "The flowers, surrounded by a foliage of light green, are of a pure intense scarlet with varied shades of oriental crimson, set three or four to the stalk." Flowers 8 inches across; petals 3 inches. If the variety survived long, it must have been under some other name. (93, p. 13.)

Crinum Hybrids.—See page 76.

Martinique.—1909. A cross between *Sprekelia formosissima*, the Jacobean lily, and *Amaryllis (Hippeastrum) vittata*. This was considered to be a unique hybrid among bulbous plants. "The flowers are a fiery crimson—like those of the Jacobean lily but very much larger. The blooms are nine inches in diameter and are even more remarkable for their long, curious, twisted petals, which give the flower a strange appearance which is not found anywhere among the Amaryllidaceae. The leaves are pale green, upright, strap-shape, one inch wide and eighteen to twenty inches long." Following his usual custom of getting rid of new things, *in toto*, Burbank offered his entire stock of 58 large bulbs and 57 small ones of Martinique, without reserve, for \$350. He added

that seed capsules were produced abundantly, but rarely with a viable seed. (70, p. 2; 93, p. 11.)

Mrs. Burbank.—1901 (?). No information beyond a brief announcement in a county newspaper (177) : “In size the variety will average about eight inches across. They increase slowly.” Perhaps a hybrid of the same origin as Martinique. (7, vol. 15, p. 87.)

Fig. 4.—Giant amaryllis, variety Martinique. This unique hybrid resulted from a cross between *Amaryllis* (*Hippeastrum*) *vittati* and the Jacobean lily, *Sprekelia formosissima*.

Pomona.—1913. Provisional name. One of the Giant Hybrids. Described as a very regular flower with a clear, fiery bloom and broad petals, much overlapping and recurved. “An exceptionally free bloomer, having four to seven flowers to each stalk. The flowers measure nearly two feet around and have a sharp, narrow, white stripe on four petals.” No information as to whether it was renamed. (93, p. 13.)

Portola.—1913. Provisional name. Another Giant Hybrid that may, if sold to a dealer, have been given another name. No record of it has survived. Described as having an immense flat flower measuring 9 inches across, pure white, ground-lined, and flaked with carmine. "The bulbs are prodigious bearers, having several stocks to a bulb and four flowers to a stock." (93, p. 15.)

Profusion.—1903. One of the early hybrids, presumably between *Hippeastrum vittatum* and *H. Johnsonii*. Years later Burbank referred to Profusion as the most abundant bloomer of its time. In 1909 John Lewis Childs offered a variety under the name of "*Vittata Profusion Amaryllis*," claiming that it was "a superior type of the giant race of *Amaryllis* × *Vittata* hybrids." His meaning is not clear. Perhaps the reader was meant to infer that Profusion, too, was one of the Giant Hybrids then being flamboyantly announced. And so it was; but, unlike the others, it had not had the benefit of two or three additional years of improvement. (7, vol. 4, p. 27; 135, vol. 9, p. 92; vol. 10, p. 141–47.)

Seedling Amaryllis.—1909. Burbank announced 136 numbered hybrids at the same time. All were the result of a series of complicated crosses involving four or five species. These, collectively, were known as the Giant Amaryllis.

There were 3,117 bulbs in the lot, priced at an average of about \$1.55 each. The number of bulbs to each number ranged from one to over two hundred. In all cases the purchaser was offered the entire stock of a particular hybrid with full control. A red-ink notation on the front cover page, in Burbank's handwriting, announced "50 per cent discount to the trade"; and a conspicuous notice pasted on the inside declares that he can now offer the seedlings described at greatly reduced prices from those originally quoted. Presumably they did not sell too well; the prices were thought high, or the buyers wanted more than one item but did not care to invest more than a moderate sum at one time. At any rate, almost without exception, those sold were in the low price brackets, indicating that they went to small dealers and amateurs. All were announced in a single publication. (70, p. 4–14.)

ARABIS

Only one variety of *Arabis blepharophylla*, namely, Purple, was listed; this was in 1905. It was probably collected from the wild. (62, p. 3.)

ARGEMONE

In 1916, unnamed seedlings—possibly crosses between *Argemone mexicana* and *A. grandiflora* were announced. (111, p. 10; 128, p. 19.)

ASPARAGUS YAM

The 1914 bill of sale announced the importation of a plant called Asparagus Yam, described as "a distinct new perennial ornamental decorative vine from Chile." Probably a species of *Dioscorea*.

ASTER

Comparatively little breeding was done with asters beyond collecting native California species, planting them with existing varieties, and letting them mix naturally. Hand-pollination may have played a part, but a minor one.

In 1925 Burbank's Fluffy Giant was offered. This was not a single variety, but a collection of seedlings consisting of fluffy-petaled forms with pastel shades "containing all the desired and worthy colors." (130, p. 19; 132, p. 21.)

Crimson Cloud, Desert Sunset, Queen of the Market, and Wreath of Snow, offered for sale from 1916 to 1923, were probably all standard varieties of the times.

AUSTRALIAN STAR FLOWER

This plant was announced in 1906 under the name *Cephalipterum Drummondii*. Collected in western Australia. "One of the so-called everlastings, resembling a Rhodanthe (*Helipterum*), but distinctly different. Greatly improved by hybridization and selection." The color photograph shows that the clusters of star-shaped, rosy-crimson and white flowers possessed much beauty. Annual, produced only from seeds. Difficult to grow. Thrives only on virgin soil. Apparently the same thing was introduced by the Luther Burbank Company of San Francisco, California, in 1914, as the Australian "Everlasting Star Flower, Burbank Strain." Distributed by Vaughan's Seed Store, Chicago, Illinois. (7, vol. 5, p. 107; 65, p. 1; 95, p. 18; 135, p. 135.)

BAMBOO OR DRYLAND TULE ("GALLILEA")

This plant was listed in the 1914 bill of sale. No further description.

BARBERRY

Beauty Leaf.—1921. Received from Chile "several years ago," along with a collection of wild plant seeds; "although it seems to have no name, yet the abundant foliage is so remarkably beautiful that it should be distributed." (121, p. 28.)

Chilean.—1911. *Berberis dulcis*, or *B. buxifolia*. Imported from Chile. Known to botanists since 1880. (86, p. 16.)

BLUEBELL

A Burbank strain of *Campanula rotundifolia alba* named Blue Bells of Scotland (White Variety) was announced in 1911. It has white instead of the usual blue flowers. (82; 93, p. 29.)

BOLTONIA

A variety of *Boltonia* called New Dwarf was announced in 1920. It was possibly a seedling of *Boltonia latisquama*, a variable species sometimes producing dwarf forms. According to Burbank, the New Dwarf originated on his own grounds. (117, p. 16.)

BOTTLEBRUSH

A cultivated species of bottlebrush, *Callistemon speciosus*, was imported from Australia in 1921; but it probably was already in the trade in this country. "One of the most beautiful and unique of the Australian shrubs. Tender." (121, p. 23.)

BRAZILIAN PERFUME

In 1918 Burbank announced Brazilian Perfume (*Origanum* sp. ?). From the description it appears to be *Origanum Majorana* or a closely related

species. "Lately discovered [?] in Central Brazil . . . one foot high, of surpassing fragrance . . . now first offered." Apparently the same thing was offered several years later as Brazilian Fragrance. (111, p. 6; 130, p. 12.)

BRIZA

This species of ornamental grass, probably imported from Australia, was announced by Burbank in 1906 as *Briza Australis*. His description was as follows: "Lately discovered in Western Australia, much larger than the other brizas. The black spotted shoulders make it unusually ornamental." (65, p. 1.)

BRODIAEA

A species of *Brodiaea* listed as *Brodiaea grandiflora major* was introduced in 1910. Probably *B. californica*, which grew wild near Burbank's home. Superior to *B. grandiflora*. (82.)

BULRUSH

A plant, probably imported, was announced in 1918 as Flowering Bulrush. It was evidently a form of *Scirpus*, but the species cannot be identified. "Curious . . . plant from Chile. Pink flowers in earliest spring on bulrush leaves." (111, p. 17.)

BUTTERFLY WEED

Burbank announced in 1911 the Chile variety of Butterfly Weed (evidently *Asclepias*). According to him, this species of milkweed was "found growing on the high plateaus of Chile about the nitre beds where only one other plant thrives." (82.)

CACTUS, ORNAMENTAL TYPE

Favorite.—1911. Listed by Burbank as *Echinopsis Mulleri* and in a later catalog as *E. Pentlandii*. Peruvian hedgehog cactus. Imported. (80, p. 23; 88; 106, p. 14.)

Opuntia Species.—1911. Listed as *Opuntia basilaris*. Probably collected from the California-Arizona desert, where it is native. (80, p. 23.)

Quisco.—1911. First listed as *Echinocactus chilensis* and later as *Cereus chilensis*. Probably imported from Chile, its native country. Said to resemble *E. Visnaga* in appearance. "A corrugated, handsome, tall, barrel-shaped cactus having very numerous, but not vicious spines." (80, p. 23; 88; 106, p. 14.)

CALANDRINIA

Announced in 1911. Similar to *Calandrinia umbellata* except that it is described as an annual. Imported from Chile. "New species from Chile. Annual. Produces an abundance of large flowers of deepest glossy rosy crimson or solferino. Trailing." (82.)

CALLIOPSIS (COREOPSIS)

What was evidently a form of *Coreopsis bicolor* was announced in 1915 as Burbank Tiger. "Wholly different from any now known." Flowers of various shades—deepest purple, almost black, orange, light and deep yellow. (100.)

CAMASSIA

Burbank evidently began collecting and hybridizing wild forms of *Camassia* about 1900 or earlier. Several species are indigenous to northern California or southern Oregon. Purdy (6, vol. 2, p. 640) considers *Camassia Leichtlinii* the best of them all. Burbank reported in 1917, "The improvements made with these fine, hardy plants on my own grounds during the past twenty years have been about all that has ever been done for them since nature fitted them for their wild environment. These new hybrids show a very great improvement. . . . The blossoms are larger, set closer to the stem, are brighter in color, and vary far more widely than before." (135, vol. 7, p. 242-49.)

Burbank Hybrids.—1911. "Gigantic bulbs, gigantic flowers, new colors, dark blue, sky blue and purplish shades." (85, p. 2.)

Camassia Hybrids.—1918. "Often called Indian Potato. . . . Largest and brightest colors known in this genus." (111, p. 17.)

Camassia Leichtlinii.—1906. Collected from the wild in California. Perhaps the finest of the native species. "Western Hyacinth—hardy, purple and white mixed." (65, p. 3.)

Compacta.—Listed in the 1914 bill of sale.

Multiplier.—1927. Developed by hybridizing native species, but exact parentage not given. "The only one . . . that multiplies from bulbs by natural division each season." (133, p. 20.)

CANNA

A canna of the Crozy type was successfully crossed with the wild swamp canna of Florida, *Canna flaccida*. This cross produced the so-called orchid canna. Though similar crosses had already been effected by breeders in Italy, Burbank performed the feat independently, perhaps using a different strain of Crozy. Later crosses and selections between his strains produced a race of hybrids from which many varieties were developed, two of the best being Burbank and Tarrytown. (85, p. 1; 135, vol. 9, p. 235.)

Burbank.—1899. Doubtless a cross between a Crozy and *Canna flaccida*. "A fine orchid-flowering, yellow variety." Height 3½ feet. Introduced by Vaughan's Seed Store of Chicago, who described it as "truly gigantic in size, the upper petals spreading fully seven inches and the form really semi-double. Toward the inner part the petals show fine, crimson spots; all the rest of the flower a rich canary yellow." A slight discrepancy between Burbank's and Vaughan's descriptions is that the latter said it was "five to six feet high, leaves with a rubber-like texture." Apparently Burbank retained some measure of control after selling to Vaughan, for he offered the variety at retail in 1911, and the Luther Burbank Company of San Francisco (Burbank's temporary distributor) did likewise in 1915. (7, vol. 2, p. 142; 85, p. 3; 100; 116, p. 12; 171.)

California.—1920. No information, but doubtless one of his numerous hybrids developed years earlier. (116, p. 13.)

Conowingo.—1920. Origin not given. Possibly not a Burbank variety. Described as "extra large, deep fiery scarlet flowers. Foliage softly shaded bronze and green." (116, p. 13.)

Cristata.—1922. "This canna originated on my grounds from seed last summer and is so unique and has multiplied so rapidly that a few plants can be distributed. . . . The plants are in height four feet with broad very dark green foliage; the flowers are large, of the orchid type." (125, p. 12.)

Fire.—1920. No history. "Almost an exact duplicate of Firebird but larger flowers and a better grower." (116, p. 13.)

Firebird.—1907. No history. "Clearest brilliant scarlet flowers of great size, borne on large trusses well above the foliage. Height five feet." (116, p. 13.)

Rainbow.—1907. No history. "This is one of the great and good novelties in ornamental foliage plants, and in the elaborate coloring of its foliage it is equalled only by the New Giant or Rainbow-Leaved coleus." (7, vol. 7, p. 66.)

Tarrytown.—1895. Resulted from a cross between a Crozy and the Florida species, *Canna flaccida*. Rates as an orchid type. Foliage large and dark green. Height 3½ feet. Flowers vermilion-salmon color, with broad light-yellow band around each petal. Apparently very popular for a few years. Gold medal at the Pan-American Exposition, Buffalo, New York, in 1901. (50, p. 18; 93, p. 29; 135, vol. 9, p. 235; 171.)

Wyoming.—1913 (?). No history. May have been sold without announcement. Merely editorial mention in the autobiography. The color photograph shows the flowers to be yellow with streaks of red. (135, vol. 9, p. 234.)

Yellow King Humbert.—1918. Perhaps a Burbank selection. "Identical with King Humbert in all respects but with yellow flowers, dotted red and green foliage. Five feet." (113, p. 13.)

CARNATION

The carnation, cultivated for over two thousand years, proved difficult to improve. Present types and varieties have been developed slowly over a long period. By crossing a white variety with the deep crimson *Dianthus chinensis*, Burbank, according to his editor, grew a hybrid with flowers that are

snow white in the morning, when they first open, yet which at noon are bright pink, and which, finally, toward evening assume a deep crimson color. Each flower goes through this process during the first day, but sometimes the changes in color take place a little more gradually; so that each morning one may see on the same plant carnations that are crimson, a few that are pink, and freshly opened ones of white.

This chameleonlike curiosity resembled its Chinese parent—was about 9 inches high and of stocky growth. (135, vol. 10, p. 122.)

Burbank Everblooming.—1925. No history, but probably a selection from Chabaud's Everblooming, a variety which he had for sale. (130, p. 20; 133, p. 20.)

Carnation Marguerite (Royal or Burbank Strain).—1910. From the description given, this strain or variety probably was very similar to, perhaps identical with, the marguerite carnation offered by every seed house—merely an early-flowering selection from the group of carnations that has been developed from *Dianthus Caryophyllus* L. Much dwarfed in size. (74, p. 3; 75; 93, p. 29.)

CELOSIA

A Burbank strain of Celosia named Ostrich Plume was announced in 1911. It appears to have been a selection from an old variety. (82; 100.)

CHERRY

In 1911 Burbank offered Evergreen Patagonia ciruelo, the South American Black Cherry. Also called Evergreen Patagonian Ciruela and Evergreen Patagonian Ciruelillo. Ciruelo, the Spanish for plum or cherry, is probably correct; Ciruelillo is the diminutive form for the same word. Although this undoubtedly belongs to the genus *Prunus*, the species is not given. Received from the "Sociedad Explotadora de Terra del Fuego of Rio Aysen, South of Chile, in May, 1913." It was first announced, however, in 1911, when it was merely called the South American Wild Black Cherry—like the North American, but evergreen. In 1918 the tree was declared to be very ornamental, the fruit better than the North American black cherry, and the wood highly recommended for timber purposes. (86, p. 15; 113, p. 6; 116, p. 11; 119, p. 6.)

CHILEAN BLUE FLOWERING BULBOUS PLANT (BURBANK SELECTION)

Announced in 1914. "Specific name not yet ascertained." Collected in Chile and sent to Burbank for improvement. Had been proposed as a national flower. "This summer blooming bulbous plant throws up stems two feet in height, bearing *Solanum*-like flowers of the most intense cobalt blue. Also white spotted and of various shapes." (95, p. 21.)

CLEMATIS

Efforts to improve clematis consisted of the planting, on an extensive scale, of *Clematis Jackmanii* seeds, with subsequent selections from the numerous seedlings; and hybridization experiments with *C. coccinea*, pollinated by "various other species—among these being *C. crispa*, known as Blue Bells, *C. Davidiana*, *C. Freemontii*, *C. ligusticifolia*, *C. Douglasii*, *C. verticillaris*, *C. occidentalis*, *C. Fortunei*, *C. Viticella*, and others, no attempt being made to keep the various crosses separate."

"By selection," declares another publication, "several varieties were produced [from the *Jackmanii* seedlings] that bore very handsome double flowers of peculiar form, varying in color from blue, pink and ashy gray to pure white." Several of the best varieties of these improved clematis vines were introduced through a dealer. But it was subsequently related that the clematis disease had destroyed most of them.

The hybrid progeny of *Clematis crispa*, pollinated by various species, showed a great amount of variation in both color and texture of the flowers; "in their general habit, and their herbaceous stems, the hybrids seem uniformly to follow the seed parent." A few of the "most beautiful forms" were selected and "without specific names" were placed with a florist, Mr. J. C. Vaughan of Chicago, for introduction. In 1894 Burbank announced: "This season I have the pleasure of offering a new race of clematis, produced by crossing the beautiful coral-scarlet *coccinea* and the bell-shaped *crispa*." Earlier still, in 1888 and 1890 he offered unnamed seedlings of *Jackmanii*, *patens*, and *lanuginosa* types; and in 1899 new hybrids "produced by crossing *Viorna*, *coccinea*, *Freemontii* and others." (24, p. 6; 27; 35, p. 22; 50, p. 18; 135, vol. 10, p. 219.)

Clematis Hybrids.—1893. Probably open or self-pollinated seedlings of *Clematis Jackmanii*, *C. crispa*, and *C. coccinea*. Five numbered hybrids were described. One was later named Snowdrift, another Ostrich Plume, and still another Waverly. (34, p. 45.)

Double Clematis.—1894. *Jackmanii-lanuginosa* types. (35, p. 23.)

Jackman Hybrid Seedlings.—1892. Probably the original announcement of the numbered seedlings. (30, p. 3.)

Ostrich Plume.—1894. A double white seedling. (35, p. 23.)

Paraguay.—1922. Probably sent from South America by one of Burbank's collectors. "Most nearly resembles our native *C. verticillaris*. A new climbing variety from the mountains of Western Paraguay." (125, p. 8.)

Snowdrift.—1894. Another double white seedling. (35, p. 23.)

Waverly.—1894. A seedling of *Clematis Jackmanii*. (35, p. 23.)

COLUMBINE

Considerable hybridization work was done with *Aquilegia* species. "An old cultivated variety which has lost its spurs" was crossed with *A. caerulea* "and others." "The hybrids of this spurless form, with the other species, produced beautiful large, clematis-like flowers, some of them three or four inches in diameter," and all were spurless. Other species were then brought into the combination "until my columbine colony carried the strains of more than a dozen recorded species . . . revealing nearly all the colors of the rainbow . . . and were introduced to the trade as mixed varieties as it did not seem to be worth while to fix the different types."

Burbank's New Clematis-flowered.—1903. A cross between *Aquilegia caerulea* and a spurless variety. Introduced by Vaughan's Seed Store, Chicago, Illinois. (7, vol. 4, p. 24; 184.)

New Hybrids.—1894. Mixed types—no varieties. (37; 117.)

COREOPSIS

(See also Calliopsis)

A Burbank strain known as *Coreopsis lanceolata grandiflora* was listed in 1911. It was probably nothing more than a selected seedling. "A perennial . . . producing . . . gold and yellow flowers all summer." (82; 93, p. 29.)

CORN, ORNAMENTAL TYPE

(For account of corn-breeding experiments, see page 54.)

Aurora.—1914. Same origin as Rainbow, but supposed to be an improvement on that variety. (95, p. 26.)

Rainbow.—1911. The parent form of "quadri-colored" corn was secured from Germany in 1908. Second-generation selfed seedlings showed six colors in the leaves. "Nothing further was necessary than to select seed from the plants that showed the most even distribution of the stripes, and the most vivid display of color." In the earlier generations there had been a marked tendency to variation, some plants producing only a single stripe of red, some only a stripe or two of yellow or white. "By rigid selection through several years these variants were eliminated." Rainbow corn was looked upon as a rare curiosity, and Burbank received much publicity for his part in perfecting

this new ornamental. Although corn with rainbow-colored leaves is commonly sold by seed dealers, Burbank's name now is rarely or never mentioned. (82; 95, p. 26; 135, vol. 8; p. 19.)

CRINUM

I have grown about twenty species, some of them of tropical origin. Numerous crosses were made among these species until I had a crossbred strain of *Crinums* of ancestry as complex as that of my *Hippeastrums*. The seed parent of a larger proportion of the hybrids was the species known as *Crinum Americanum*, but a few were grown from the seed of *C. amabile (augustum)* and *Asiatica*.

Thus wrote Burbank. He claimed that in the various crosses, the traits of the temperate-zone species appeared to be dominant. Several of the hybrids were sold as numbered seedlings, but there is no information as to whether any have survived. (17, p. 141; 135, vol. 9, p. 97.)

Some of his crosses were formally listed as Burbank Hybrids in 1901, 1906, 1914, and 1927. "A cross of the best greenhouse species with a hardy one." (57; 65, p. 4; 95, p. 20; 134, p. 3.)

DAHLIA

Experiments designed to improve the dahlia were of three kinds: crossing cultivated varieties of the time with the cactus dahlia of Mexico, *Dahlia Juarezii*; production of a fragrant dahlia; and attempts at hybridizing the dahlia with the related genus, *Bidens atrosanguinea*, the so-called black dahlia.

The first project resulted in several varieties of double-flowered dahlias; but the perfectly doubled forms were seedless. "A number of varieties were thus perfected, and these were, I believe, the only entirely double dahlias that were ever produced." This appears to have been a mistake, for Miller and Alexander (6, p. 953) report: "In 1826 there were already sixty [double] varieties cultivated by the Royal Horticultural Society."

Dahlias usually have a fairly strong but unpleasant odor, or none at all. When a faint, but pleasing odor, "comparable to that of magnolia blossoms," was finally detected in the flowers of a single plant, the seeds were sown; and by repeated selection a few, at length, were found with a pronounced fragrance. Since, however, fragrance did not seem compatible with other desirable traits of flower and form, none of the fragrant-flowered seedlings were named or introduced, "except three or four, which were purchased by Vaughan, of Chicago," who presumably introduced them under names of his own. "Further experiments in selective breeding, aided probably by hybridization, will be necessary before the quality of fragrance is combined with satisfactory qualities of size and form and color."

The black dahlia (*Bidens atrosanguinea*) refused to hybridize with true dahlias; but it was improved by selective breeding, the flowers being doubled in size, the petals made rounder and fuller, extra petals added, and the color changed from the usual purplish crimson to a light crimson approaching scarlet—"in a few cases to a pale pink approaching white." The species worked with was a Mexican form. For two or three generations the flowers seemed fixed. Since hybridization with another species failed, it was necessary to depend upon selection alone. After four or five years the experiments were discontinued.

Burbank's dahlia varieties seem to have left no definite impress, although a few remained in the trade as long as new varieties can be expected to survive until superseded by something else that attracts the public fancy. Two—Lavendera and Sebastopol—experienced a rather long run and, possibly, may still be found in cultivation. (135, vol. 9, p. 203.) In a recent letter from the New Jersey Agricultural Experiment Station, Professor Charles H. Connors, an authority on dahlias, declares:

Dahlia varieties are ephemeral. Of the list of varieties published in Standardized Plant Names about 1930, only a score probably survived in catalogs. I find in a publication by J. B. S. Norton as of 1924 "Seven Thousand Dahlias in Cultivation," that two of the [Burbank] varieties which you mention, are included. This list is based upon 223 catalogs of the years 1921, 1922, and 1923. Lavendera was listed in six catalogs and Sebastopol in eleven.

Burbank.—1903. Cactus type. Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92; 185.)

Burbank Dahlias.—1914. "Giant single mixed includes all shades of color with a preponderance of 'extremely brilliant' scarlet and crimson shades." (95, p. 27.)

Burbank's Selection.—1903. Evidently a collection of hybrids, probably of the cactus type. Announced in Vaughan's catalog for 1903. (7, vol. 4, p. 25.)

California.—1903. "Gigantic yellow." Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92; 184.)

Caviota [Gaviota?].—1903. "Absolutely snow white" dahlias. Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92; 184.)

Coronato.—1910. "The new single fragrant dahlia. Blooms freely first season from seed." (74, p. 3.)

David Burpee.—No information except a mention by Burbank in 1922 that he had produced a dahlia variety by this name. (124, p. 30.)

Dazzling.—1918. "A brilliant fiery scarlet unique dahlia from a cross of the twisted-petal cactus type and a wild scarlet dahlia lately discovered in Mexico by Dr. Purpus." First announced in 1910 as Mountain Dahlia, *Dahlia Purpusi*. (76, p. 2; 82; 113, p. 16.)

Estrelia.—1903. "Snow white cactus with a trace of lemon yellow in the heart." Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92.)

Golden West.—Mentioned by Burbank in 1922. No further information. (124, p. 30.)

Lavendera.—1918. A seedling of Geisha. Popular for perhaps two decades. (113, p. 16.)

Marigold.—1903. "Raised from a selection of the Gloria dahlia sent out from Europe several years ago, the only double one obtained from this strain." Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92.)

Mariposa.—1903. "A very beautiful dahlia with the new upright habit of California. Pale yellow flowers." Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92.)

Mountain Dahlia.—See Dazzling.

Oakland.—1918. "Gigantic, eight-inch pure white; selected as the official flower of the city of Oakland, California." A publicity stunt; Oakland has no official flower. (111, p. 11.)

Santa Rosa.—1903. "Cactus, somewhat fragrant, like magnolia blossoms; lighter shade of red than Burbank, with a salmon tint." Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92.)

Scarlet.—1918. Selected from *Dahlia Purpusi*. "Single cactus type. . . and as far as I know is the only scarlet dahlia known." (110; 128, p. 21.)

Sebastopol.—Probably introduced about 1905. "The shade is a deep orange-red." A popular variety for twenty or thirty years. (95, p. 20.)

Sonoma.—1903. "Decorative, lemon yellow. . . Never shows a single center." Sold to Vaughan's Seed Store, Chicago. (1; 7, vol. 6, p. 92.)

Sunset.—1915. A cross between the two Mexican species of *Dahlia Purpusi* and *D. variabilis*, the latter a single dahlia. "Flowers resemble tiger lilies at a distance." (98, p. 3.)

DAISY

Creation of a new race of daisies by breeding and selection was one of Burbank's outstanding accomplishments. While there may be room for skepticism regarding his claims about certain productions, there should be no honest doubt about the Shasta daisy. Though the details of the ancestry are incapable—at this late day—of scientific proof, the fact that he did produce the Shasta daisy by breeding, essentially as claimed, is attested by Professors E. J. Wickson of the University of California and Hugo de Vries of the University of Amsterdam. Both these writers viewed the evidence on the ground. Others have suggested that Burbank merely took the wild ox-eye daisy, *Chrysanthemum Leucanthemum*, near Mt. Shasta in northern California, where it is a showy wild flower in moist, shady places, and improved it by selection. He did begin with a wild daisy, which may have come from the Mt. Shasta region, for he was acquainted with that attractive flower; but his biographers, Harwood and Hall, who had opportunities for consulting him, leave the impression that his foundation stock of wild daisies came from New England. On the other hand De Vries, who visited Burbank in Santa Rosa in 1904, only three years after the new daisy was announced, wrote (142): "It is one of his improvements of a perennial daisy which grows wild in Shasta County and is very variable."

Regardless of whether Burbank started with a wild form from the eastern or western parts of the United States, he first tried to improve it by selection. Though the seedlings were variable in some respects, there was no marked improvement. He then crossed it with one of the wild daisies of Europe, *Chrysanthemum maximum*, using pollen from this flower to fertilize the best specimens of the American daisy that he was able to produce. The hybrids of this cross being unsatisfactory, he introduced a third species, *C. lacustre*, obtaining the seeds from a dealer in Germany. This he used as the pollen parent, crossing it with the best of the hybrids. By selection for "five or six years," he secured a daisy "obviously superior to any one of the original forms as to size and beauty of flower, and fully equal to any of them in ruggedness and prolific blooming but the flowers were still disappointing in that they lacked that quality of crystal whiteness which was to be one of the chief charms of my ideal daisy."

The best specimen of the last hybrid was multiplied until "I thus secured a large bed of daisies that combined approximate whiteness with all the other

good qualities I was seeking yet the purest of them did not appear to my eye unqualifiedly white."

The final step in the breeding program was then taken by bringing in the fourth and last member of the combination—the Japanese species, *Chrysanthemum nipponicum*. In most respects, this daisy was inferior to the other species; but it had a pure white flower, the only quality that was lacking in all the others. When this was in bloom it was used as the pollen parent in a cross with the *Leucanthemum-maximum-lacustre* hybrid. The first results were not reassuring, but no more crosses were made.

The rest of the story was one of selection that continued over a period of "five or six ensuing seasons, the best individuals being selected and the others destroyed," until at last one was found "with flowers as beautifully white as those of the Japanese and larger than the largest of those that the hybrid plants had hitherto produced." The work was begun about 1884 and completed in 1901.

For all practical purposes the Shasta became a new race of daisies. It was an immediate success in this and other countries and is as popular now as it was forty years ago. Of course, it has been greatly improved; but it is still often found in its original form, as first introduced. (135, vol. 2, p. 7-38.)

Abundance.—1913. A seedling of one of the Shasta selections, of which there were many. (93, p. 18; 95, p. 36.)

Alaska.—1904. Three years after the appearance of the original Shasta daisy, varieties began to be announced. Alaska, one of the first three, was probably a sister hybrid of the original Shasta, although possibly it was either a seedling of the latter or one of its closely related hybrids. There would scarcely have been time to grow a new variety from seed of the Shasta and have either seeds or roots in sufficient quantity for filling orders in three years. (60, p. 6; 86, p. 17; 96, p. 27.)

California.—1904. Same origin as Alaska. (61, p. 6.)

Double Fluted Shasta.—1915. A selected seedling from the numerous Shasta hybrids. Referred to as a "chrysanthemum-like daisy." Fluted and frilled petals, glistening white. (95, p. 35.)

Shasta Daisy Hybrids.—1901. Original announcement (*Chrysanthemum Leucanthemum hybridum*). A quadruple hybrid including *Chrysanthemum Leucanthemum*, *C. maximum*, *C. lacustre*, and *C. nipponicum*. Hardy herbaceous perennial with long stems and pure white flowers that quickly proved its adaptability to a wide range of temperate-zone climates in all countries. Often referred to as Burbank's best accomplishment. As a type of daisy, the Shasta promises to survive indefinitely. Improvements on the original and its siblings, although given distinctive variety names, will doubtless always be referred to as Shasta daisies. (54, p. 1-2; 63, p. 10-15.)

Shasta Giant.—1925. Probably a seedling of one of the many hybrids. Flowers fully as large and beautiful as Alaska but borne on 3- to 4-foot stems. (131, p. 9.)

Westralia.—1904. Same history as Alaska. "Distinguished by its branching habit, which is a strong character in one of the parents of the whole Shasta daisy family—the Japanese field daisy, *Chrysanthemum nipponicum*." (61, p. 8.)

DELPHINIUM

Experiments with larkspur consisted in planting seeds of the species, *Delphinium hybridum* Hort., and in selecting from the lot of seedlings a single specimen that most nearly approached the ideal in mind. Seeds from this were planted; and from the progeny, one was given a variety name. Others were disposed of as unnamed seedlings. Efforts to cross the tall, wild form, *D. californicum*, did not result in anything of value. Although offered for sale for more than twenty years, none of Burbank's hybrids seem to have survived to the present day. (135, vol. 10, p. 167.)

Burbank Hybrids.—1910. Apparently seedlings of *Delphinium hybridum*. (73, p. 3.)

Burbank's Giant Perennial Hybrids.—1911. Seedlings of *Delphinium hybridum*. (82; 116, p. 20.)

Burbank Select Hybrid.—1915. Seedling of *Delphinium hybridum* Hort. (98, p. 2; 100; 106, p. 12; 111, p. 9; 131, p. 11; 133, p. 17.)

Unnamed Larkspur (Delphinium).—1918. "New species. A beautiful new yellow larkspur very lately discovered near Bodega Bay, California." (111, p. 9.)

DICENTRA

This golden eardrop, *Dicentra chrysantha*, was announced in 1895. Golden yellow flowers. Collected from the wild in the Coast Range mountains of northern California. Listed under the old name of *Diclytra chrysantha*. (41.)

DIMORPHOTHECA

"The result of many crossings of the African orange daisy." They were announced in 1915 as Burbank Hybrids. (98, p. 3.)

ERYSIMUM

This was listed under the old name of *Erysimum grandiflorum*, in 1904. Probably collected from the wild. (59.)

EVERLASTING

(See *Cephalipterum*)

GALIUM

Announced in 1899, under the name of *Galium boreale*. Collected from the wild in the province of Saskatchewan in Canada. A perennial 15 inches high, with feathery, white flowers. (50, p. 15.)

GLADIOLUS

During his lifetime, Burbank introduced over fifty varieties of gladiolus. He says he first began experimenting with them about 1882. His first variety, although sold in 1889, was not announced until 1892. His last was announced in 1925. The old-time variety, or species, *Gandavensis*, and the then new variety *America*, played important parts in the early hybridization experiments. Bailey (6, vol. 3, p. 1340), wrote in 1914: "The recent Burbank strains have

been developed from the variety *America* as the seed-parent. These are said to comprise many very large-flowered forms, with brilliant coloring."

Burbank really made some valuable gladiolus contributions; several of his varieties remained in the trade ten to twenty years or even longer. His first success was a type with a hyacinthlike flower arrangement. This was lost by freezing after being sold. New and perhaps improved forms were developed. Discouraged, however, by the ravages of gophers, which destroyed whole rows of valuable bulbs, he sold the entire gladiolus collection of breeding stock to Mr. H. H. Groff, a fancier in Simcoe, Ontario, Canada. Some years later, Groff stated (6, vol. 3, p. 1340): "Burbank had given particular attention to varieties calculated to withstand the hot dry winds of California, and had originated several with specially stiff petals, quite different from the ordinary types. The peculiarity of the flowers blooming around the spike like the hyacinth was also his contribution." (135, vol. 9, p. 167.)

Abutilon.—1917. A dwarf probably related to *America*. (106, p. 5.)

Acanthus.—1917. No history. (106, p. 5.)

Arica "D."—Listed in the 1914 bill of sale.

Benetta.—1926. No further description. (133, p. 13.)

Best Blue in Existence.—Listed in the 1914 bill of sale.

Betty Jane.—1926. Origin unknown. Probably a complex hybrid. (134, p. 13.)

California.—1889. A *Gandavensis*-*America* hybrid, with *America* as the seed parent. "The flowers of this remarkable freak are closely packed all around the spike like a hyacinth and are often double, having from ten to sixteen petals each; light cherry-rose, striped lilac-crimson." Sold to A. Blanc and Company of Philadelphia, who lost the entire stock by freezing. (26.)

Cisco.—1899. Probably a *Gandavensis*-*America* hybrid, closely related to the *California*, which was lost. "Clear rose pink, with salmon tint." (26.)

Conquest.—1911. Probably a seedling of *America*. Pollen parent unknown. (85, p. 2.)

Dazzling.—1911. Same origin as *Conquest*. (85, p. 2.)

Del Oro.—1925. Complex hybrid. (129; 132, p. 19.)

Del Rosa.—1925. A complex hybrid. (129; 131, p. 12.)

Dog Star.—1925. No history. Offered posthumously. (133, p. 13.)

Doro.—1926. No history. (132, p. 19.)

Elegance.—1911. No history. (85, p. 2.)

Elena.—1926. Seedling of *Elora*. (133, p. 14.)

Elora.—1917. No history. (106, p. 5; 113, p. 10; 133, p. 14.)

Esthetic.—1911. "Peculiar rosy crimson." (85, p. 2.)

Fire.—1917. No information. (106, p. 4.)

Gigantic.—1911. No history. (85, p. 2.)

Good Morning.—1925. No history. (133, p. 13.)

Graceful.—1911. "Large salmon scarlet flowers." (85, p. 2.)

Harmonious.—1911. No further description. (85, p. 2.)

Igo.—1889. *Gandavensis*-*America* hybrid. (24, p. 9; 26.)

Kiva.—1925. A multiple hybrid. (129; 131, p. 19.)

Luther Burbank.—1926. A complex hybrid. Named, announced, and distributed after Burbank's death. (133, p. 12.)

Mariposa.—1889. Probably a *Gandavensis*-America hybrid. (26.)

Mary Ellen.—1925. No historical information. (133, p. 13.)

Modesto.—1889. Same as Igo. (24, p. 9; 26.)

Mono.—1889. *Gandavensis*-America hybrid. (24, p. 9; 26.)

Navajo.—1926. No history. Result of numerous crosses. (133, p. 13.)

Opaline.—1911. Probably one of the *Gandavensis*-America hybrids. (85, p. 2.)

Pentstemon.—1917. Evidently a seedling with a much-mixed ancestry. (106, p. 5.)

Perla.—1926. Multiple hybrid. (133, p. 14.)

Pinnacle.—1911. Probably a descendant of the *Gandavensis*-America cross. Burbank writes of it as follows: "Flowers wide open . . . broad petals of unusual substance; color, salmon and scarlet crimson; throat shaded and dotted with gold and white and finely feathered crimson; stamens violet purple." (85, p. 2.)

Pohono.—1889. Probably a *Gandavensis*-America hybrid. (24, p. 9; 26.)

Radio.—1911. Probably a *Gandavensis*-America hybrid. First announced as Rajah, but later as Radio. (85, p. 2.)

Santa Rosa.—1889. Apparently one of the *Gandavensis* type. (26; 30, p. 3.)

Scarlet.—1917. No information as to origin. (106, p. 5.)

Seedling Gladioli.—1893. Burbank mentions having introduced six (presumably unnamed) seedlings in 1889. He later offered ten more by number, with brief descriptions. (34, p. 43.)

Seedlings of California Strain.—1890. No further information. (27.)

Seeds of Burbank New Hybrid Gladioli.—1914. Apparently derived from seedlings of the America type, pollinated by *Gandavensis*. (95, p. 25.)

Shasta.—1889. Probably a *Gandavensis*-America hybrid. (24, p. 9; 26.)

Signal.—1911. Probably a distant offspring of the *Gandavensis*-America cross. (85, p. 2.)

Summit.—1926. Seedling of a mixed hybrid. (132, p. 18.)

Symmetry.—1911. Origin same as Signal. (85, p. 2.)

Tiger Face.—1926. Seedling of mixed hybrids. (132, p. 19.)

Waukena "F."—Listed in the 1914 bill of sale.

GODETIA

Jepson (6, vol. 3, p. 1354) gives Burbank credit for having introduced a new species of *Godetia* from Patagonia.

Burbank's New Lavender Trailing.—1910. Seeds sent in by Burbank's Chilean collector, who found the plants growing wild in Patagonia. This proved to be a new species; and botanists accepted the name *Godetia Magellanica*, which he had suggested as only a provisional name. "Beautiful lavender-colored *Godetia*, a color not before seen in this class of flowers. . . . The first of the season it is trailing, but when blooming the plants become upright, attaining a height of two feet. The flowers are nearly two inches across." (76, p. 2; 82; 93, p. 33; 111, p. 12.)

Godetia Hybrids.—1910. Seedlings from probably open-pollinated crosses. Announced as *Godetia amoena* hybrids. (76, p. 2; 82.)

GOLDENROD

No very serious work was done with goldenrod. Although several species of *Solidago* were kept under observation and allowed to hybridize naturally, there was disappointment when the seedlings showed little variation. Two selections were made and introduced. (135, vol. 10, p. 74.)

Golden Fluff.—1916. Selected seedling. (102, p. 15; 113, p. 15.)

Pale Gold.—1916. Selected seedling. (102, p. 15; 113, p. 15.)

GRASSES, ORNAMENTAL TYPE

No profitable breeding was done with ornamental grasses, but collectors sent in a few interesting forms from Australia and South America. Some of these were introduced. Two varieties of a new lawn cover, *Lippia repens*—the Dixie and the Mohave—were offered in 1911; but it is possible that Burbank was not the first to announce them. (74, p. 2; 76, p. 4; 82; 83.)

Bonita.—"A distinct new pampas grass." Listed in the 1914 bill of sale.

New Dwarf Pampas Grass.—1901. Properly, this should be listed as *Cortaderia Quila*, although called *Gynerium jubatum* by Burbank. Described as having been discovered in the high mountains of South America, where it bloomed 2 months earlier than the common pampas grass. Introduced by John Lewis Childs in 1903. (7, vol. 4, p. 27; 55; 57.)

New Paraguay Fountain Grass.—1921. "Collected for me by the Guanaco Indians from the wilds of South America under the guidance of P. Francisco Müller, a Paraguayan missionary. It is a perennial grass." (121, p. 19.)

Pennisetum Ruppellianum.—1895. Modern nomenclature gives this as *Pennisetum Ruppelii*. Probably imported from Ethiopia, where this species is native. (41.)

HAWTHORN

The Chinese edible hawthorn (*Crataegus pinnatifida*) was announced in 1929. Seeds of this hawthorn were received in 1909 from Professor Joseph Bailie of the University of Nanking, China. (116, p. 9.)

HEMEROCALLIS (DAY LILY)

It is not clear what was done with the *Hemerocallis* or day lillies—that is, whether they were hybridized or merely selected. Four varieties were introduced.

Burbank.—1917. Advertised as a hybrid; but there is no available information on this point. Stout (182) says the plants were "as much as thirty-four inches tall and the flowers yellow with rather narrow segments. Very like *Hemerocallis Thunbergii*." Distributed by Carl Purdy, Ukiah, California. (106, p. 8; 113, p. 12; 182, p. 43.)

Calypso.—1918. No history. Distributed by Carl Purdy. (106, p. 8; 113, p. 12; 182, p. 44.)

Cygnets.—1924 (?). Stout (182, p. 46) says of the Cygnets: "Mentioned by Mr. Morrison in 1924 [in *House Beautiful*, vol. 55, p. 69] and origin credited to Burbank." (142, p. 46.)

Miss Clara Barton.—Listed in the 1914 bill of sale.

Surprise.—1917. Spoken of as a “cross-bred seedling.” No other information. (106, p. 8; 113, p. 12.)

Surprise No. 2.—Listed in the 1914 bill of sale.

HERBERTIA

In 1910 Burbank announced Little Blue Tigridia (*Herbertia pulchella*), giving the origin as Chile (75; 85, p. 2). A year later he listed *H. platensis*, saying it was like the preceding species in form and color, but larger. In a later catalog he says it “resembles the gigantic type of Tigridia.” It was used unsuccessfully for hybridizing with tigridias. (85, p. 2; 93, p. 37.)

HEUCHERA

In 1906 Burbank announced *Heuchera cristata*, a fourth or fifth generation inbred seedling of *H. micrantha*. The original “wild geranium” was collected by Burbank on a rocky ledge high up on Mount Saint Helena, California, at an altitude of about 4,000 feet. In a cluster of plants, one showed a slight leaf variation—a tendency to crinkle. Seeds from this were collected and planted. The seedlings were kept isolated; they were either self-pollinated or crossed with their siblings. The fourth generation showed all the seedlings to have crinkled leaves although “there were, of course, individual specimens that excelled and these were chosen to the exclusion of the others. Their progeny bore uniformly crinkled leaves of the most pronounced type, and they constitute the new species *Heuchera cristata* as it grows today.” (65, p. 1; 135, vol. 9, p. 7–14.)

HOREHOUND

In 1921 Golden Marrubium was announced. Collected from the wild. “Among the thousands of wild plants by the roadside, one was noticed with two or three branches of a pure golden yellow and from seeds of these branches a variety has been produced . . . 60 per cent or more coming with pure golden foliage.” (121, p. 19.)

IRIS AND SISYRINCHIUM

Experimental work with iris consisted, chiefly, of planting seeds of the Japanese species, *Iris laevigata*, and observing the seedlings. “The combination of colors was beautiful beyond description, varying in all shades of the rainbow. . . . Some were tall and lanky, others short and compact. The range of variation was from dwarfed forms of eight inches to giants of four feet. Since new varieties were not then in demand. I ultimately sold the entire lot . . . as a mixture, without names or number.” (135, vol. 10, p. 42.)

A closely related plant, Chilean Giant Sisyrinchium, was announced in 1911. Burbank gave this as *Sisyrinchium striatum*. It was imported from Chile. Known also as satin flower, rush lily, and blue-eyed grass, it is described as a gigantic species of blue-eyed grass with broad flat leaves and clusters of yellow flowers. The height was 3½ feet. (74, p. 2; 82; 128, p. 27.)

LAVENDER

One variety of lavender, the Pinnacle, was announced in 1923. It has no history, but was evidently sold directly to a dealer. (141.)

LILY

Burbank worked extensively with lilies. At least one lily specialist—not a Burbank enthusiast, either—has voiced the opinion that his most valuable contributions were probably in this field. (While this may approximate the truth as regards ornamentals, his varieties of Japanese plums were of far greater economic importance.) Besides the true lilies he also worked with *Agapanthus*, the so-called lily of the Nile or African lily; *Alstroemeria*, the so-called lily of the Incas, a bulbless lilylike plant with yellow flowers; *Heimerocallis*, or yellow day lily; *Herbertia*; *Richardia*, or calla lily; and *Tigridia*, or tiger lily, which are discussed under these headings.

But it was with the true lilies that the grand-scale experiment in breeding was carried on. Of this work Slate (139) says:

What is probably the most extensive lily-hybridizing project ever undertaken was started by the late Luther Burbank about 1875 and by 1894. . . . He had three acres of hybrids. *Lilium pardalinum* was the seed parent and crosses were made with a wide range of species. *L. Humboldtii* and the other Pacific Coast species were used sparingly as seed parents. Although many of the Old World and eastern American species were used as parents, their influence was not evident in the hybrids. There was ample evidence that the Pacific Coast species were successful parents. Purdy considered the hybrids to be chiefly from crosses of *L. pardalinum* with *L. Washingtonianum*, *L. Humboldtii*, *L. Parryi*, and *L. maritimum*:

There were heavy losses from dwindling away and disease, but a few lilies were put into circulation and reached England. It is very doubtful, however, if any remain in cultivation, although the name *Burbankii* is still applied to several hybrids of *L. Parryi* × *L. pardalinum*.

The best account of Burbank's mass hybridization experiments was written in 1895 by Carl Purdy (170) of Ukiah, California, an authority on Pacific Coast lilies, who says:

His work with lilies began some eighteen years ago, with a form of *Lilium pardalinum*, one of the native plants of this coast. . . . Some bulbs, of a form found near the Geysers, were first cultivated and the seed planted. Extreme types of these seedlings were selected and cross-fertilized. The same process was repeated several times. Several years ago I saw a field of lilies, the result of this crossing, and the variety was wonderful. Every intermediate form could be found, from giants nine feet tall to dwarfs from six inches to a foot in height, while the flowers ranged in color from yellow centers and scarlet tips through orange to light yellow centers with pale red tips. These variations, although valuable in themselves, only formed a base for succeeding work, for when by repeated cross-fertilizations a form begins to break, it is more susceptible to the influence of the pollen of another species.

Using some of these varieties of *Lilium pardalinum* as pistillate parents, Mr. Burbank crossed upon them the following lilies: *L. auratum*, many varieties; *L. Batemanniae*, *L. Brownii*, *L. candidum*, *L. Catesbaei*, *L. chalcedonicum*, *L. elegans*, *L. Humboldtii*, *L. longiflorum*, *L. Martagon*, *L. maritimum*, *L. Parryi*, *L. parvum*, *L. speciosum*, *L. superbum*, *L. tigrinum*, *L. Wallichianum*, *L. Washingtonianum*, *L. purpureum* and some other Pacific Coast lilies were also used as the pistillate parents for a few thousand crosses. . . .

Four years ago I saw the seed-pans containing these hybrids, then a year from seed. The little plants, numbering four hundred thousand in all, made a wonderful study in leaf variation. These hybrids flowered last year, and the present season reached maturity. . . . In the field above one hundred thousand of the hybrids were in bloom on the fifteenth of June; a small portion had not reached maturity. . . . Nearly all, unlike *Lilium pardalinum*, were fragrant.

Among so large a number of hybrids with so many violent crosses, freaks and monstrosities were to be expected, but, outside of a few exceptions, it can be said that all are symmetrical in form and beautiful in coloring. In form the range is from the closely recurved form of the typical *L. pardalinum* to a very flat flower, in which the petals approach the horizontal, a form which, so far as I know, was heretofore unknown among lilies, and most nearly ap-

proached by *L. candidum* and *L. tigrinum*. Then there are many running into the trumpet forms, but none with the long trumpets of the *L. longiflorum* type.

In color the flowers range from the usual yellow or orange centre and scarlet tip of *Lilium pardalinum* to dark red on one hand and rich orange red, lemon, and a few white and pale lemon or straw-colored flowers on the other. Nearly all are spotted or dotted, many faintly, and some are clear lemon-yellow. The traces of all the staminate parents can be seen in the leaves and in the bulbs. My own examination and Mr. Burbank's information is that the result is equally various. In one particular, it is especially notable and valuable. Mr. Burbank, I need hardly say, is a careful and successful grower, yet with very many of the lily species he has the sort of success so many of us are too well used to. His bulbs dwindle away or suffer from disease until a few bulbs are all that are left to represent a plantation of hundreds. The hybrids, however, have inherited the strong constitution of *L. pardalinum* and its freedom from disease. In most cases, also, they inherit its tendency to rapid propagation. I also noted that hybrids of *L. Parryi* and *L. Humboldtii* show a vigor which neither parent possesses.

There is another, and, doubtless, very potent reason for their vigor. In Mr. Burbank's work with lilies the doctrine of the survival of the fittest had been carried out to an unusual extent. About two million seedlings have been grown altogether; in this last lot a hundred thousand are left out of four hundred thousand. There must certainly have been a pretty thorough elimination of the less vigorous seedlings. A healthier lot than the survivors would be hard to find.

In fragrance the seedlings rather follow the fragrant staminate parents than the odorless *Lilium pardalinum*. Practically all are fragrant, many exquisitely so. With a favorable wind the odor from these great lily-fields can be perceived at a distance of five miles.

All are extremely floriferous, thirty to fifty flowers to a plant being common, and a few having over a hundred. One of the most curious forms was one in which *Lilium pardalinum* var. *minor*, had been crossed with an unknown species. This might be called a tree lily. The bulb threw up many stalks. One of these branched about a foot from the ground into eight branches. The largest branch had forty-three blossoms, while the bulb bore two hundred and seven—this at six years from seed. An equally wonderful plant is a cross between *L. pardalinum* and *L. Wallacei*, which at the same age, had thirty-seven stalks flowering. Many plants clearly show the influence of *L. elegans* in the very dark red flowers, and in the leaves of others can be seen the blood of *L. giganteum*. Crosses between *L. pardalinum*, var. *minor*, and *L. maritimum* are remarkable for vigor and very numerous fine flowers.

In retrospect, after half a century, this experiment in hybridization still appears to have been boldly conceived and audaciously executed, especially since our knowledge of breeding was limited at the time and since the experimenter was compelled to make his ventures pay cash dividends. From a scientific viewpoint the experiment yielded much information on the possibilities of commingling the characters of an interesting group of American species and at least pointed the way toward introducing some of their virtues, such as perfumes and hardiness, into Old World varieties. Other workers were stimulated to experiment further with hybridizing the western American lilies. According to Slate, however, none of the hybrids—Burbank's included—have survived weaknesses that may yet be overcome by a sustained process of breeding to eliminate the virus disease and adapt them to a wider range of soil and climatic conditions. Although virus diseases were of course not known or understood in Burbank's time, he should have tried out his hybrids for adaptation to conditions other than his own, and possibly might have been able to remedy defects. Unfortunately for both science and practice, his wholesale crossing and quick distribution of the hybrids—converting them into cash as soon as possible—did not permit him to be thorough. (135, vol. 9, p. 248-68; 170, vol. 8, p. 328-29; 180, p. 34, 160, 216, 217.)

Burbank.—1909(?). A cross between *Lilium pardalinum* and *L. Washingtonianum*. Distributed by J. J. H. Gregory & Sons, Marblehead, Massachusetts. (7, vol. 2, p. 138.)

Hybrid Lilies.—1893. First announcement of results from Burbank's notable experiment in hybridizing the western American species of lilies. "Sixteen years ago I commenced experimenting in crossing our native Pacific Coast lilies, adding from time to time all the exotic species and varieties which seemed to promise favorable results." The following is "a list of some of the lilies combined in these hybrid seedlings":

Lilium auratum, *Batemanniae*, *Brownii*, *Bloomerianum* [*Humboldtii*], *ocellatum*, *bulbiferum*, *cordifolium*, *candidum* varieties, *callosum*, *canadense* varieties, *columbianum*, *carolinicum*, *Catesbaei*, *chalcedonicum*, *elegans*—many varieties—*giganteum*, *Grayi*, *Hansonii*, *Humboldtii*, *japonicum*, *Krameri*, *longiflorum*, *longiflorum eximium*, *Leichtlinii*, *Martagon* varieties, *maritimum*, *pardalinum*—many varieties, *Parryi* varieties, *parvum* varieties, *philadelphicum*, *speciosum* varieties, *superbum*, *Sarana* [Sayi?], *Takesima*, *tigrinum* varieties, *tenuifolium*, *umbellatum* varieties, *Wallacei*, *Wallichianum*, *Wallichianum superbum*, *Washingtonianum*, and *Washingtonianum purpureum*. . . I am still planting from one to three pounds of hybridized lily seeds every season.

The Burbank lily hybrids were widely disseminated both in this country and in Europe. For the most part, however, they seem to have met the same fate as many other promising hybrids in the lily family—namely, succumbing to what is now known as mosaic disease, or becoming so weakened that the varieties gave a poor account of themselves and were eliminated by discouraged growers. Had Burbank possessed our present knowledge of virus disease, many of the varieties might have been spared to enrich our gardens. Lack of adaptation to new environments may also have been a reason for failure: the hybrids were disseminated before there was any information, save analogy, as to whether they would thrive in a given soil or climate.

There is much indirect and some direct evidence that dozens or scores of individuals and firms purchased the hybrids piecemeal through this and succeeding years, although Burbank doubtless would have preferred to sell the collection in a lump, as was his custom. Indeed the next year, 1894, he announced that as yet he did not have a large stock of certain hybrids. He made, however, this statement:

The number of varieties being so great, I will offer the control of some very handsome, hardy ones at from \$250 to \$10,000 each; and, having a multitude of other new things to absorb my attention, will offer *all these lilies* to any responsible party or parties for \$250,000, including all unbloomed hybrid seedlings and all the hybrid seed produced this season; this offer holds good only to November 1, 1894.

In the year 1893, from the huge collection of hybrids, only two were offered for sale as varieties. (34, p. 39–40; 35, p. 18.)

Hybrid P-2,854.—1893. "A . . . large-flowering *Lilium pardalinum* growing two feet high, with short, broad, glossy leaves in whorls." (34, p. 40.)

Hybrid P-72,721.—1893. Evidently a selected seedling of *Lilium pardalinum*. The original wild plant, a dwarfish form, was collected in north-central California on Pluton Creek, near the geysers, in 1876. "From this, many curious seedling forms have developed by constant selection, the most remarkable being a variety growing only ten inches high and producing from

twenty to forty blossoms on each of the short stalks—the usual number for the species being from three to eight.” Sold to John Lewis Childs. (34, p. 41.)

Wild Species of Lily.—In 1888 Burbank grew and listed for sale a wild lily from northern California, *Lilium maritimum*. It had then been known to botanists only a few years. “California bog lily; dwarf, reddish orange, spotted” (24, p. 10). In 1891 he selected another form from the wild, *L. Humboldtii*, which he placed in the same list with *L. Bloomerianum* (29).

LIPPIA

Lippia repens (properly *L. canescens*) was probably first introduced into this country by F. Franceschi of Santa Barbara, California, in 1898, who obtained the seeds from the Botanic Garden in Rome, Italy. Burbank claimed to have obtained seeds, independently, from his collector in Chile, who found them in the wild. By a process of selection, two varieties were derived. (74, p. 2).

Dixie.—1909. Recommended as a substitute for lawn grass. “The foliage is very small and closely placed on slender stems and is of a pleasing, glossy, dark green color.” Widely used in California. (74, p. 2; 76, p. 2; 82; 93, p. 35.)

Mohave.—1911. A larger and more rapid grower than Dixie and therefore recommended as a cover for steeply sloping grounds subject to erosion. Likes free sunlight. “With all their tenacity in resisting storms, drought and constant trampling, none of these lippias become weeds, as they produce no underground stolons.” (83.)

MARIGOLD

Marigolds were selected from seedlings of *Calendula*; and the French and African races, *Tagetes patula* and *T. erecta*, were crossed with “native species . . . from Arizona, sent me by Professor Lemon, whose name it bears. This native form is a shrub about four feet high and in the fall it bears a mass of beautiful single golden flowers about the size of the French marigold.” Some attention was given, also, to a Chilean marigold “with reference to its possible value as a pot-herb for its fragrance and flavor.” Presumably this effort was not a success: although a Chilean plant was offered for sale, nothing was said about using it for flavoring. (135, vol. 10, p. 174–78.)

Calendula Hybrid.—1915. Listed as *Calendula hybrida*. “Both single and double in various shades of orange, yellow and white.” (100.)

Chilean Fragrant.—1911. Imported from Chile. (82.)

Corona.—1925. A hybrid of unknown ancestry. “Originated on my home place several years ago.” (130, p. 21.)

Giant Calendula.—Probably a hybrid, but ancestry not given. (95, p. 19.)

MECONOPSIS CALIFORNICA

(See page 92)

MIMULUS

Some work was done with wild and cultivated forms of *Mimulus*. In 1904 Burbank announced New Hybrids under the name *Mimulus cardinalis*. “A wonderful range of colors has been developed in these cardinal flowers. Besides the usual red, this strain produces in profusion large flowers in various

shades of yellow, orange, rose, pink, light crimson and white." One variety, *M. grandis*, was also offered for sale as a "rather rare California perennial," with "mammoth yellow blossoms"; this was evidently collected from the wild. (59; 62, p. 2; 65, p. 3.)

MONTBRETIA

In 1888 Burbank announced the New California strain of *Montbretia*. No history. Probably collected from the wild. "Flowers in long spike like small gladioli. New California Strain." (24, p. 10.)

MORNING-GLORY

Burbank's Giant Crimson morning-glory was listed in 1913. "New Imperial carmine . . . rosy-carmine flowers two and one-half to three inches across, with pure white throat." No further information. (93, p. 35.)

MYRTLE

Improved Chilean.—1916. Listed as *Myrtus Ugni*. Imported from Chile. Said to be the best wild fruit grown in Chile. "Size of large huckleberries; bronzy-red, spicy and fragrant. . . . Handsome evergreen shrubs two to three feet high." (102, p. 13.)

New Myrtle.—1893. A silver variegated form "which originated on my grounds in 1882 from seed of the common green-leaved variety" of *Myrtus communis*. (34, p. 46.)

NICOTIANA

Although several hybrids were produced from crosses between *Nicotiana* species and offered in 1893, no named varieties were announced. Species involved were *Nicotiana alata*, *N. glauca*, *N. purpurea* (var. *grandiflora*?), *N. suaveolens*, *N. affinis* (var. *grandiflora*?), *N. colossea* (*tomentosa*?), "and others." The crosses were effected with much difficulty; all hybrids were infertile and had to be propagated from cuttings of stem or roots. "I have perennial varieties with glaucous green foliage, edged, marbled and mottled with white, bearing pink flowers in cymes often two or three feet across, with from 500 to 2,000 blossoms in each cyme . . . five to eight feet high." Strains differed considerably in flower colors and in size and habit of growth of the plants. (34, p. 47.)

NICOTUNIA

The novelty *Nicotunia* was brought out in 1893. The cross that produced this hybrid was stated to have been *Petunia hybrida* var. *grandiflora* × *Nicotiana wigandoides* var. *rubra*, the petunia pollen being used to fertilize the *Nicotiana*. No seed was ever produced in the hybrids, but they were readily multiplied by cuttings. Mostly they were semitrailing annuals, the tobacco characteristics predominating; yet when held over in the greenhouse until the second season and again planted out of doors, "they soon began to show the influence of their mixed heritage. Some of them turned crimson, and others pink; yet others remaining green." Some were distinct trailers the second season, while others grew to a height of 4 feet and had large leaves like those of tobacco.

Because Burbank abhorred the use of tobacco, the latter were all weeded out and discarded. The remainder, toward fall, showed a distinct lack of

vitality. Their finish was accidental: left unprotected, all were frozen; and thus perished this interesting hybrid. (7, vol. 4, p. 2144; 34, p. 46; 135, vol. 4, p. 275-80.)

PEACH, ORNAMENTAL TYPE

An ornamental peach called Double Flowering appeared in 1915. No history. "A new Burbank production . . . profuse bloomer. . . . An upright grower, producing dark pink blossoms." (100.)

PENTSTEMON

Burbank Scarlet Bugle.—1915. No history. "The pentstemon here offered for the first time has flowering spikes one and one-half to two feet high Perennial." (98, p. 5.)

Crimson.—Listed in the 1914 bill of sale.

PLATYCODON

Japanese Bell.—1910. Species name, *Platycodon grandiflora*. "Burbank selection." "A beautiful giant bellflower which covers itself all summer with enormous blue and white flowers." (75; 95, p. 29.)

New Double White.—1919. "Hardy perennial never before offered . . . double snow-white flowers. Plants dwarf—eighteen inches to two feet." (113, p. 23.)

"PLUM," CHINESE CLIMBING

Mao-li-dzi.—1910. Evidently *Actinidia chinensis*. Received from one of Burbank's collectors in western China. Grows at an altitude of 5,000 feet. Ornamental vine with edible fruit, in size and shape much resembling a plum, but having a thin downy skin, like a peach, with the general appearance of an oval white fig or guava. Seeds small, as in a strawberry. (72.)

Tara.—1910. Called *Actinidia agrita* [*arguta*?] by Burbank. From Korea. A high-climbing vine with edible fruit. Difficult to propagate. (72.)

Yang-tao.—1910. (*Actinidia* sp.) "Not so hardy as the Mao-li-dzi. Similar in fruit." This and the foregoing are both called "hairy plums." Also from western China near Kiatingfu. Probably *Actinidia chinensis*. (72.)

PLUM, ORNAMENTAL BLACKLEAF

A form of ornamental plum was brought out by Burbank in 1919 under the name Thunder Cloud. Probably a selected form of myrobalan or cherry plum, *Prunus cerasifera*. Commended for the metallic purple-crimson luster of its foliage. (115, p. 2.)

POPPY

Burbank considered the production of a blue-flowered poppy to be one of his minor triumphs as a plant breeder. He first set out to modify the form of the petals of the corn or Shirley poppy, *Papaver Rhoeas*, which seemed to him "lacking in gracefulness, being too flat and without character." He selected four or five flowers that showed the lighter shades of scarlet, crimson, and pink and some that were altogether white. He chose large flowers, especially those that had the most delicate petals, with firm texture and some suggestion of waviness. This procedure continued for several years. "At first

progress was very slow. It was easy to find specimens that were semi-double and those that showed the black spots, but there was very slight tendency to crimping of the petals." Eventually he was able to introduce two varieties of "improved Shirley poppy."

Further selection produced a specimen a shade different in color from any other previously seen. "I seemed to detect, underlying the normal color, a smokiness suggestive of a half concealed blue pigmentation." The search now took a new direction. "Finally, after several years of selection, I had a strain in which about one-third of the plants bore flowers of various shades of blue, some smoky or seemingly mixed with black pigment, and others fairly clear, if not bright, blue color." The blue was never firmly fixed; some of the seedlings always tended to revert to the more familiar colors. At a little distance, however, the plot of poppies would appear uniformly blue.

Another minor achievement was the development of a crimson *Eschscholtzia* or California poppy, from the common wild yellow form, by selection. Burbank changed the flowers of the wild *Papaver californicum* by giving a five-petaled sport six petals; "but the color of the original—a pale orange—refused to budge." He devoted some attention to the tulip poppy, *P. glaucum*, as well as the opium poppy, *P. somniferum*; the Iceland poppy, *P. nudicaule*; and the poppylike *Argemone*. (129; 131; 132; 135, vol. 9, p. 112–18.)

Burbank Crimson Eschscholtzia.—1904. Developed through selection from a wild plant, over a period of years. Sold to W. Atlee Burpee of Philadelphia. (7, vol. 5, p. 169; 74, p. 2; 93, p. 33; 133, p. 25; 179.)

Burbank Mixture of Blue Shades.—1913. Evidently Shirley type. Probably the same as Celestial Strain, which see.

Burbank Reselected Giant White.—1911. Evidently California type. "By far the best white ever offered." (82; 93, p. 33.)

Burbank Selected.—1910. This particular strain of Tulip poppy, *Papaver glaucum*, was "selected for its intense, brilliant, fire crimson color and large flowering proclivities." (74, p. 2; 93, p. 37.)

Burbank Strain.—1911. Shirley type. "This strain has been . . . built up . . . by more than ten years of selection. The flowers are extra large, the petals beautifully crimped." (82.)

Celeste.—1911. Shirley type. "Beautiful sky-blue, lavender and gray shades." (82.)

Celestial Strain.—1910. Shirley type. "White, light salmon and light pink shades; petals beautifully crimped." (74, p. 2.)

Extra Mixed.—1900. California type. A strain developed by selection. "All colors. Burbank hybrids . . . all the sheens of crimson, yellow and white." (74, p. 2; 93, p. 33.)

Firefly.—1915. California type. A variety selected from a large collection of hybrids. So-named "because of their flame-like color. A beautiful rosy-crimson merging into a lemon yellow." (98, p. 3.)

Giant Shirley.—1920. Result of a cross between the Shirley (*Papaver Rhoeas*) and Tulip poppies, *P. glaucum*. (117, p. 21.)

Golden Cup.—1907. California type. "A new crimson just produced. A very rare *Eschscholtzia*." Distributed by the Chamber of Commerce, Santa Rosa, California. (7, vol. 10, p. 68, 147.)

Mariposa.—1922. Prickly type. Probably selected from the wild in California, where it is indigenous. "New prickly poppy, Chicalote, with blossoms of a deep rosy crimson color." (124, p. 18.)

Meconopsis.—1906. A wind poppy under the name *Meconopsis californica* (more properly, *M. heterophylla*) was offered in 1906. Probably collected from the wild, being indigenous to California. (65, p. 1.)

Mixed.—1911. California type. White, yellow, crimson, orange, carmine, and pink. "Large flowers; beautiful new shades." (82.)

Mixed California Hybrids.—1926. "These hybrids . . . have been developed from the California wild poppy." (133, p. 22.)

New Everblooming Crimson-scarlet Perennial Hybrid.—1916. A cross between *Papaver somniferum* and *P. orientale*. The latter is a perennial; the former an annual. In a mild climate the hybrid blooms continuously for 10 to 12 months. Flowers single, of various shades of scarlet-crimson and orange, borne on long stems. (103; 106, p. 12; 111, p. 10.)

New Large Flowering Hybrids.—1918. Prickly type. "Pale green spiny foliage with silvery veins. Satiny poppy-like flowers, three inches across. Deep yellow to creamy white." (111, p. 10.)

Orange Cream.—1919. California type. This is the true California poppy of the botanists—*Papaver californicum*. A selected seedling, the parents of which were collected from the wild in California. (114, p. 22; 117, p. 21.)

Pink Eschscholtzia.—1900 (?). No description. Sold to W. Atlee Burpee of Philadelphia. (7, vol. 2, p. 164.)

Queen.—1892. Opium type. A selected form of *Papaver somniferum*. No description. (31.)

Rosy Giant.—1921. Opium type. "The most charming of all the giant peony-flowering poppies. . . . Height three feet." (121, p. 24.)

Santa Rosa Strain.—1904. A Shirley poppy improved by several years of selection. "Unusually large flowers, remarkably clear colors, including new striped, new salmon shades, and new bluish one, all mixed." Introduced by J. C. Vaughan of Chicago and by John Lewis Childs, in 1904. Vaughan (185) is quoted as saying, "We introduced this poppy in 1904, having purchased Mr. Burbank's entire stock." (7, vol. 4, p. 101; vol. 5, p. 169; 17; 65, p. 1.)

Shirley Art Poppies.—1921. "Combination shades of salmon, soft rose pink and white semi-transparent crepe-like flowers." (117, p. 21.)

Silver Lining.—1893. Shirley type. "By six years' selection from a sport of *Papaver Rhoeas*, var. *umbrosum*, I have succeeded in producing a variety, now nearly, or quite fixed, which, instead of being crimson and black on the inside of each petal, is a glistening silvery white; the outside remains the same brilliant crimson." Distributed by W. Atlee Burpee of Philadelphia. (34, p. 46.)

PRIMROSE, EVENING

Selections were made from a wild evening primrose collected in the mountains of Chile. This was supposed to be *Oenothera acaulis*; but the size and shape of the flowers being different, Burbank called it *Oenothera* "America." Apparently he was not offering it as a new species; but he did announce it as a new variety. Later he hybridized this "Chilean race with the common *O. acaulis* or *taraxacifolia*, and produced a number of intermediates. . . . These

hybrids seem to come absolutely true in the second generation, so far as foliage is concerned, being in all cases intermediate between the two species." He remarked that this result might have been expected in view of observations made by Professor De Vries, who worked extensively with *Oenothera*. There is no record of Burbank's offering these hybrids for sale. (135, vol. 10, p. 68-70.)

In 1910 Burbank announced America, a New Gigantic Evening Primrose. It had been collected in Chile for *Oenothera acaulis*, but "among the seedlings (which varied widely) was one with a flat flower instead of the usual somewhat saucer shape, and instead of being two to three inches across, as is usual, the flowers of this new one were nearly four inches across. The whole plant also was stronger in growth with larger and darker stems and leaves." Selecting "for size, snowy whiteness, and for abundance of bloom," Burbank produced a variety "four and a half to five and a half inches in diameter, perfectly regular, flat and of purest white," which came true from seed. (76, p. 1; 93, p. 36.)

QUINCE, ORNAMENTAL TYPE

A variety of flowering quince called Dazzle was offered for sale in 1893. No information, but probably a selected form of the common Japanese quince *Chaenomeles japonica*. (34, p. 14.)

RAINBOW CORN

(See page 75)

RICHARDIA (ZANTEDESCHIA)

Marked results followed selection experiments with calla lilies, *Richardia albo-maculata* and *R. hastata*. The first was a spotted, dwarf form, whereas the second, known as Pride of the Congo, was a strong upright grower. Then he hybridized the two, making reciprocal crosses. Later, *R. Elliottiana*, *R. Pentlandii*, *R. melonoleuca*, *R. Nelsonii*, and *R. Rehmanni* were introduced and hybridized with one another and with the two species that had been used for selection purposes. There was wide variation in both form and flower among the hybrids. Altogether, some half dozen varieties were introduced. *Tigridia* and *Ferraria* species appear to have been extensively hybridized. Efforts were made to cross them with *Herbertia* to impart some much-needed vigor, but all attempts failed.

Dwarf Everblooming.—1901 (?). Probably a selection from Little Gem. (129, vol. 3, p. 17.)

Dwarf Scented.—1894 (?). Probably the same as Fragrance. Distributed by the Conrad and Jones Company of West Grove, Pennsylvania. (7, vol. 2, p. 142.)

Fragrance.—1894. A second-generation seedling from the variety Little Gem. Out of a lot of "several thousand" Little Gem seedlings, one was observed to have mild perfume, in marked contrast to most callas, which have an unpleasant odor or none at all. First-generation seedlings of this sport showed no improvement over their parents; "but in the second generation, as so often happens, there was a marked tendency to variation and . . . I was able to select one that had a fully developed and really delightful perfume." (34, p. 28; 135, vol. 9, p. 254.)

Giant.—1893. "A sport that appeared among my white callas . . . from a seedling of the common calla, but doubtless represents a natural cross between different strains of this species." "White" and "common" calla probably refer to the *Richardia albo-maculata*. There seems to have been another Giant calla with pale yellow flowers, renamed Lemon Giant in 1897. (34, p. 39; 135, vol. 9, p. 254.)

Giant Selected.—1893. Name changed in 1897 to Lemon Giant, which see.

Golden Variegated.—1893. Selected from a seedling of *Richardia hastata*, Pride of the Congo. (34, p. 39; 135, vol. 9, p. 250–51.)

Hybrids.—1901. These were hybrids of *Richardia aurata*, *R. Elliottiana*, *R. maculata*, *R. hastata*, and *R. Pentlandii*. "Unusually robust, foliage unequalled in size, beautifully maculated, flowers yellow, pale yellow and pure white." (55; 135, vol. 9, p. 250–51.)

Lemon Giant.—1893. Originally introduced as Giant, selected. Resulted from a cross between *Richardia albo-maculata* and *R. hastata*. (47; 135, vol. 9, p. 248–50.)

Snowflake.—1893. A seedling of Little Gem and only half as tall. "Produces in profusion tiny, snow-white flowers." (34, p. 38.)

Variegated Little Gem.—1893. A variation that occurred in a field of Elliott's Little Gem. "One plant produces beautiful golden-marbled leaves. . . . The blossoms are whiter than those of the plain Little Gem." (34, p. 38.)

Willie Hearst.—1904 (?). Probably a hybrid of *Richardia hastata* × *R. albo-maculata*. According to a clipping in the scrapbook, "the latest product of Wizard Burbank of California is a yellow calla lily." (7, vol. 4, p. 135.)

Yellow Calla.—1911. Related to the Pride of the Congo, *Richardia hastata*. No definite information. (85, p. 3.)

ROSE

Experiments with roses began in the middle eighties or earlier. The first variety (Santa Rosa) was announced in 1898. Several more followed—just how many is not known, but a dozen or more; some were unnamed seedlings, and some may have been sold without being announced. The seeds from half-a-dozen seed pods from a Hermosa type of Bourbon rose, "which rarely bears seed, even in California," were planted and the resultant seedlings hybridized with Bon Silene and "at least three or four others." Two varieties resulted.

New Rambler hybrids were produced by crossing the Crimson Rambler with "the Empress of India, the Cecile Bruner and dozens of others." In color these hybrids were said to vary through crimson, scarlet, and pink to snowy white; some even resembled the Japanese primrose in color. Other breeding stocks were used: the white and buff Banksias, *Rosa gymnocarpa*, *R. chinensis*, *R. rugosa*, and General Jacqueminot, which were hybridized with Hermosa. Direct and reciprocal crosses between the Persian rose and the Tea, Perpetuals, Banksias, Multifloras, Bourbons, and Wichurianas were complete failures, it being explained that the Persian is completely sterile and therefore never forms viable seeds.

As Burbank has confessed, he did not know the exact ancestry of any of his hybrid varieties: "The parents . . . being themselves hybrids of complicated

ancestry, it is obvious that the pedigrees in a few generations became so complicated that if one were to attempt to trace them there would be little time left for any other experiments . . . so I have contented myself with watching for results among the hybrid progeny of my roses of multiple ancestry."

Finally, he had some success in producing a blue rose, as is attested by a color photograph. This unusual color character evidently was not stable, however, for no blue variety was announced. (7, vol. 9, p. 41-66.)

Burbank.—1899. A cross between Bon Silene and a seedling of Hermosa. Named and introduced by W. Atlee Burpee of Philadelphia, Pennsylvania, in 1900. Awarded the gold medal as the best bedding rose at the Louisiana Purchase Exposition at St. Louis, Missouri, in 1904. A precocious bloomer. Flowers large, nearly three inches across; double and of good form; fragrant; bright rose-pink shading lighter. Survived for many years; reintroduced by Stark Brothers of Louisiana, Missouri, about 1936. (7, vol. 9, p. 42-45; 50, p. 14; 98; 135, vol. 4, p. 188 and vol. 5, p. 171; 164, p. 27.)

Coquito.—1901. A cross between Bon Silene and Hermosa of the same class as Burbank, but "with larger blossoms and flowers of less pronounced rosy-crimson. . . . Color clear, deep rose." Introduced by James Sproule & Company (address not given) in 1893. (56, p. 11.)

Corona.—1911. "A Crimson Rambler seedling of mixed heritage. . . . A semi-climber . . . rosy crimson, very much resembling Chinese primroses." This is the much-photographed rose that Burbank chose to grace his own home veranda. Apparently of different origin from Corona, seedling of White Lady. (7, vol. 9, p. 62; 86, p. 17; 93, p. 19.)

Garland.—1918. A cross between Cherokee and Crimson Rambler. "Fine foliage. . . . Flowers of a light shell-pink color in enormous clusters." (113, p. 16.)

Hacienda.—Listed in the 1914 bill of sale.

La Paloma No. 60.—Listed in the 1914 bill of sale.

Peachblow.—1893. "Seedling rose M-17,806." A hybrid Tea from mixed seed. "The inside of the petals is a pale, silvery, peach-pink, like La France; the reverse, dark, bronzy carmine-pink." A Peachblow, a hybrid Tea (Madam Butterfly $\times$ Yellow Seedling No. 10), was announced by L. B. Codding of Murray Hill, New Jersey, forty-four years later; but is evidently something different. (34, p. 35.)

Pipette.—1909. "The hybridization of the Japanese rose with Bon Silene and with other strains, including the Hermosa, produced a number of admirable roses that I have introduced, including the Pipette." (7, vol. 9, p. 63.)

Rose of Oregon.—1909. "Sent by Burbank to the Portland Rose Carnival February 22, 1909." No description. (7, vol. 10, p. 23.)

Rugosa Hybrids.—1893. "A climbing pink rose is attracting attention. It received a medal from the California Floral Society. Also some . . . large double hybrids from *Rosa rugosa* $\times$ *General Jacqueminot*, *R. rugosa* $\times$ *La France*, *R. Rugosa* $\times$ *Paul Neyron*, *R. rugosa* $\times$ *Banksiae*, *R. rugosa* $\times$ *R. sinica* [*laevigata?*], and others." (34, p. 38.)

Santa Rosa (Hybrid Bourbon Tea).—1898. A second-generation seedling of Hermosa crossed with Bon Silene. Precocious blooming habit of the Her-

mosa. "Flowers a rich shell pink, inclining to crimson, full, double reflexed petals; plants grow in rather compact, bushy form." Introduced by Burbank himself, who sold it at retail. (7, vol. 2, p. 29; 48, p. 8.)

Seedling Rose H. 813.—1893. "A seedling of Hermosa and like it in its habit of blooming. . . . The blossoms are of a much clearer, richer pink and stand upright instead of drooping." (34, p. 37.)

Seedling Rose J. 26,940.—1893. "A most graceful and brilliantly colored rose, much resembling General Jacqueminot." (34, p. 37.)

Seedling Rose M. 11,120.—1893. "Grown from mixed seed . . . everblooming." (34, p. 35.)

Seedling Rose M. 19,928.—1893. No history except that it was grown from mixed seed, resembled Papa Gontier, but was "more double and blooms more profusely." Distributed by Sunset Seed and Plant Company of San Francisco. (34, p. 35.)

Waynoka No. 59.—Listed in the 1914 bill of sale.

SCILLA

One or more species of squill were imported from "South America"—presumably Peru. Species from elsewhere were also under observation; but there is no evidence that hybridization experiments were undertaken with any of them. Seedlings were grown, however, and selections made. Squill was successfully hybridized with camassia. The hybrids showed conspicuous changes in the bulb, both in color and in size. (135, vol. 7, p. 251.)

Burbank Scilla.—1914. Offered by a distributor as Burbank *Scilla peruviana*. "Never before offered." Probably imported from Peru. "An improvement on the well-known blue scilla . . . deep blue flowers." (95, p. 34.)

German Scilla.—1914. *Scilla autumnalis*. "Never before offered." Selected seedlings, blue and white mixed. Distributed by the Luther Burbank Company of San Francisco. (95, p. 34.)

SCYPHANTHUS

In 1908 Burbank offered *Scyphanthus elegans*, probably imported from Chile. "Unique deep, golden, saucer-shaped flowers." (74, p. 2; 82; 95, p. 30.)

SILPHIUM

In 1916 Burbank offered the "Square" Plant, *Silphium laciniatum*. This is the wild rosinweed or compass plant of the Mississippi Valley, improved by selection. Stalks sharply square, 4 to 6 feet high. Flowers yellow, 3 to 4 inches across. (102, p. 15.)

STAR FLOWER

(See Australian Star Flower)

SUNFLOWER

Little information is available regarding the work done with the genus *Helianthus*. Apparently hybridizing experiments were confined to types and varieties of the common sunflower, *Helianthus annuus*, with an admixture of *H. californicus*, the object being to increase the size of the flower and the yield of seeds.

California.—1919. No information except that the flowers were double and pure yellow. (114, p. 23.)

Manteca.—1917. "Manteca was produced on my place several years ago by crossing the well-known black-seeded double California sunflower with the Giant Russian, which has black, striped seeds. The result was . . . a greatly improved Pure White Seeded Giant Russian." (105, p. 6; 111, p. 3.)

Primrose Colored.—1891. No description or other information. (29, p. 1.)

Prolific White.—1920. "Great single heads of purest white seeds." Yield said to be better than Manteca. Height 3 feet. (117, p. 5.)

Single Helianthus (Burbank Strain).—1914. "Remarkable for their stately growth and brilliancy and size of their flowers." (95, p. 28.)

Snow.—1915. "Plants grow to a height of 10 feet with immense flowers sometimes 20 inches across with seeds of snowy whiteness." (100.)

SWEET PEA

Burbank's Long Season.—1913. A cross between "one of the best of the extra early with the late Spencer type." (93, p. 37.)

Perennial.—1918. No information except that it is referred to as a Burbank strain "raised here for a quarter of a century." (111, p. 12.)

Pride of California.—This is *Lathyrus splendens*, a tender native plant indigenous to dry locations along the Coast Range mountains of California. (41, p. 1.)

TELLIMA

Burbank announced Woodland Star (*Tellima affinis*) probably in 1909. This is a wild California perennial herb 9 to 16 inches high with greenish or white flowers. Suitable for the wild garden. Distributed by John Lewis Childs. (7, vol. 10.)

TEOSINTE

In 1926 Burbank offered Burbank New Rainbow. This was presumably a cross between teosinte and variegated corn, for he indubitably did make corn-teosinte crosses, as attested by numerous published color photographs of the hybrids. "This astonishing new hybrid grows much taller and its brilliant colors last much longer than with the Rainbow Corn. It also produces an abundance of miniature ears six to twelve, and occasionally eighteen to the plant." (132, p. 20; 133, p. 28.)

TIGRIDIA (TIGER FLOWER)

Cultivation and crossing of Tigridias, or Tiger Flowers, began late in the eighties, the foundation stock being *Tigridia Pavonia* and its varieties. These crossed readily with each other and with *T. conchiflora* and *T. buccifera*. Species of the allied genus *Ferraria*, from the Cape of Good Hope, were next introduced and successfully hybridized with species of *Tigridia*. Then an effort was made to introduce a species of still another genus into the combination, but without success. This was *Herbertia platensis*, a tall-growing plant closely resembling the tigridias, but having the hardier constitution that was badly needed. John Lewis Childs began introducing *Tigridia* hybrids in 1904 and continued to offer them for several years thereafter. (7, vol. 4, p. 87; 17; 135, vol. 10, p. 77-84.)

Burbank New Hybrids.—1914. "The first to cross the various *Tigridias* some twenty-five years ago. Those now offered are all new shades." The first published announcement of *Tigridia* hybrids appeared in 1894. (38; 95, p. 34.)

Chilean Dwarf.—1920. "The pale blue flowers are borne on stalks six inches in height from small, slender bulbs." (117, p. 24.)

New Hybrid Tigridias.—1899. Grandiflora hybrids. "New combinations of colors never before seen in *Tigridias*." (50, p. 18; 56, p. 10.)

Tigridia (Large White Flowered).—1888. Listed as *Tigridia grandiflora alba*. "New, large, pearly white—base of each division tigered with reddish brown spots on yellowish ground." (24, p. 10.)

Tigridia (Mexican).—1910. Listed as *Tigridia Mexicana*. Collected from the wild in Mexico. No description. (75, p. 1.)

TOMATO, ORNAMENTAL TYPE

Combination.—1893. A cross between the common tomato, *Lycopersicon esculentum* and *L. pimpinellifolium*, the so-called currant tomato. An attractive ornamental. Plants about 12 inches high by 15 inches across. The leaves are curiously plaited, twisted and blistered, but handsome. The fruit has little or no value. (34, p. 49.)

Ornamental Cross-bred.—1893. Another cross between *Lycopersicon pimpinellifolium* and *L. esculentum*, the latter being the Dwarf Champion variety.

TOMATILLO, CHILEAN

In 1910 Burbank offered a variety of the Chilean tomatillo, named Burbank Selection. It was probably brought from Chile. A semitropical perennial "with large bright scarlet fruits one-half to three quarter inches in diameter"; and it resembles *Solanum Pseudo-Capsicum* except that the fruits are larger. (76, p. 2; 100.)

TRITOMA

Burbank has not told us much about his activities with what he called *Tritoma*—more correctly, *Kniphofia*. He mentions two species, *Tritoma grandiflora* and *T. Macowanii*, and also refers to some of his offerings as hybrids. It is not clear, however, what crosses were made.

Cazique.—Listed in the 1914 bill of sale.

Exquisite.—1914. No historical information. "The best of the Luther Burbank productions in tritomas to this date. The plants produce tufts of dark green leaves which remain fresh throughout the year. Flower spikes . . . attain a height of three and one-half feet" (95, p. 37; 96, p. 11.)

Flameflower or Torch Lily.—1926. Listed as *Tritoma hybrida*. "Newest varieties mixed, including both my Exquisite and my new Tower of Gold." (132, p. 27.)

Hybrid Seedlings (Red-Hot Pokers).—1911. "Mixed colors, pale and dark yellow, orange, red, rose, carmine and intermediate shades." (85, p. 2.)

Tower-of-Gold.—1923. Presumably a hybrid; but no history. "A giant new tritoma which produces abundantly all summer, golden yellow flowers." (2, p. 6; 127; 130, p. 28.)

VERBENA

The production of a fragrant verbena by selective breeding was the chief attainment with this species. Several years later the feat was accomplished a second time. Unfortunately, no adequate record was made of the steps by which the change was brought about. Burbank does say that among thousands of plants being grown for seed purposes, some were observed to possess a slight fragrance, especially in the evening. A search revealed a single specimen that was distinctly fragrant. From this foundation stock, selections were made for several generations, during which time the flowers were considerably increased in size and the fragrant quality was fixed to Burbank's satisfaction. In the beginning, hybridization may have played a part in causing variation; but this is not certain. In the early nineties verbenas of the Mayflower type were listed in practically every florist's catalog. (135, vol. 10, p. 107-16; 162, p. 67.)

Elegance.—1901. No history. "The first of a new type in color plan, having a white center extending fully half across the breadth of the flower with outer shadings of lavender-purple and is as fragrant as a rose." Elegance was developed six years after the original fragrant verbena, which had been lost. (56, p. 10.)

Fragrance.—1901. No history. Originally distributed by the Conrad and Jones Company of West Grove, Pennsylvania, under the name of New Fragrance. Twelve years later it was offered by the Luther Burbank Company of San Francisco as Burbank's Fragrance, 1913 Selection. Being contemporaneous, Elegance and Fragrance probably had a common origin; no doubt the two varieties were selected from the same lot of seedlings. (7, vol. 2, p. 192; 93, p. 38.)

Giant Mayflower.—1910. "Powerfully fragrant, like the trailing arbutus." (82.)

Hybrids.—1910. Given as *Verbena hybrida*. Described as "superb mixed, mammoth, including some of Burbank's Mayflower which is extremely fragrant." (75.)

Mayflower.—1901. The original Mayflower, the first fragrant verbena. Originated about 1895 and, apparently, sold to John Lewis Childs without being announced. Says Burbank:

I introduced the plant through a prominent horticulturist, but he apparently found it difficult to reproduce it with sufficient rapidity from cuttings, so attempted to propagate it more rapidly from seed. Unfortunately the verbenas are so mixed a tribe, and the various races so little fixed, that they do not breed true from the seed. And so when I myself sent to the horticulturist for a sample of the fragrant Mayflower verbena a few years later, I received a plant that had but a reminiscence of the distinguishing quality of the original. In the meantime, however, I had developed another race of fragrant verbenas, which was introduced in 1901 under the name of Elegance.

Burbank gives a long account of the origin of Mayflower, but very little history of Elegance. (111, p. 18; 135, vol. 10, p. 107.)

Mayflower Pink.—1900. "Varies from light to deep pink like the arbutus." Judging from this announcement in Child's 1900 Spring Catalog, there were color differences among the flowers of the original Mayflower, and these strains were given separate names. (7, vol. 2, p. 122.)

WATSONIA

Experiments with *Watsonia* species began shortly after the new white South African *Watsonia Ardernei* reached this country through European bulb dealers—that is, between 1895 and 1900. This was crossed with *W. coccinea*, with a “reddish pink species,” and with a pink variety of *W. Ardernei*. These crosses and re-crosses resulted in multiple hybrids from which many varieties were selected and introduced from 1908 to 1917. During this period, too—as well as later—an undetermined number of unnamed hybrids were sold to dealers who introduced them under names of their own giving, or used them as breeding stocks for further improvement. The principal production from *Watsonia* was a pure white form with double flowers, wherein the doubling was “brought about, not by the transformation of stamens, as in the case of a double rose, or dahlia, but by growing a new circle of petals outside the old ones . . . sometimes spoken of as supernumerary doubling, to distinguish it from the usual type in which each new petal takes the place of a stamen.” Other improvements were the production of single whites with larger and more open blossoms than their forebears, and of unusually tall forms as well as dwarf, compact types. Perhaps the most interesting development, from the viewpoint of science, was the successful crossing of *Watsonia* with a gandavensis type of *Gladiolus*. The hybrids were weak and unsatisfactory, however, and eventually died from “gladiolus diseases.” (135, vol. 9, p. 269–86.)

Combustion.—1917. “Very dwarf plant, with short, slender foliage . . . flowers of intense fiery scarlet salmon color.” (106, p. 7; 113, p. 12.)

Crimson.—1915. “Dwarf, compact crimson flowers—the darkest pure rich crimson so far produced in this class of flowers.” (100.)

Garland.—1915. “A beautiful rosy-lavender color, something new in Watsonias . . . flowers with broad petals borne on branching stems.” (100.)

Hybrid Seedlings.—1908. “Enormous flowers, various colors and habits. . . . From \$100 to \$500 for . . . complete control of each variety.” (67.)

Hybrid Seedlings (Burbank New).—1911. “Most beautiful flowers: white, pink, crimson, scarlet and salmon shades.” (85, p. 2; 113, p. 11.)

Hybrids (Burbank).—1918. “Giant white, single and double; yellow, orange, pink, rose, crimson, purple, salmon and scarlet.” (111, p. 17; 131, p. 10.)

Meteor.—1915. “Tallest of all known Watsonias . . . flowers three and a half inches across; cherry pink, shading to lavender—a new shade in Watsonias.” (100.)

Paragon.—1915. “Deep crimson purple; saucer-shaped flowers, three inches across of a color never seen before among Watsonias. Height 5 feet.” (100.)

Radiance.—1915. Early, almost perpetual bloomer. “Flowers, soft, clear cerise salmon, only equalled in beauty of color by some rare orchids.” (100.)

Royal White.—1917. “Purest white flowers.” (106, p. 7; 113, p. 11.)

Salmonia.—1917. “Fiery salmon flowers.” (106, p. 7; 113, p. 11.)

Snow Storm.—1917. “A perfect storm of snowiest white, graceful, open, saucer-shaped flowers.” (106, p. 7; 113, p. 10.)

Vesta.—1915. “Snow-white flowers are two and a half to fully three inches across produced in royal profusion.” (100.)

WAX-MYRTLE

Hybrid wax-myrtle was announced in 1894. "An improved variety of the Eastern species, *Myrica cerifera*. The wax produced by the Eastern species is of a pale green color ; that of the Western species is purplish." (35, p. 27.)

ZAUSCHNERIA

A variety of *Zauschneria*, Improved Coast Crimson, was offered by Burbank in 1904. Probably this was *Z. californica*. Known as California fuchsia or hummingbird's trumpet. A selected wild form described as "large flowering." (59.)

ZINNIA

Crossing of zinnias appears to have been carried on to a limited extent. No information as to what species or varieties were used to produce seedlings for selection purposes.

Burbank Dwarf.—1918. No history. "New . . . brilliant red and yellow shades of most perfect doubles." (111, p. 12.)

Burbank's Giant.—1913. "This gigantic strain has flowers . . . of the most brilliant colors, in a variety of quaint shadings of scarlet, pink, salmon, yellow, white and bronze." (93, p. 38.)

Burbank Giant Dahlia Zinnia.—1925. "Enormous double flowers, just like dahlias, of various . . . improved colors." (130, p. 28.)

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17. ———
1886. Santa Rosa Nurseries. February 1, 1886. (Postal-card price list of pear seeds, etc.; identical with the preceding. In possession of Mrs. Burbank.)
18. ———
1886. Santa Rosa Nurseries. February 1, 1886. (Postal-card price list of seeds, etc. In possession of Mrs. Burbank.)
19. ———
1887. Rare buds by mail. 1 p.
20. ———
1887. Catalog of fruit and shade trees, ornamental plants and roses. 24 p. (Illus.)
21. ———
1887. Special descriptive circular of some new, rare and very desirable trees, and plants, grown and for sale. 8 p.
22. ———
1888. The nine hundred thousand olive trees which I offer for sale this season are grown by a new process. September 1, 1888. (Postal card: olives, walnuts.)

^o Unless otherwise indicated, all Burbank's publications as listed are on file at the Library, University of California College of Agriculture, Davis. All were issued from his "Farms" at Santa Rosa, except nos. 89-100, inclusive, which were issued by the Luther Burbank Company, San Francisco. In his "bulletin" sequence, nos. 66, 67, and 68 are missing, but were apparently never issued.

23. BURBANK, LUTHER (*Continued*)

1888. Office of Burbank's Olive Nursery. Cash price list for September and October September 10, 1888. 1 p.
24. ———
1888. A few horticultural novelties and other plants. 10 p. (Illus.)
25. ———
1889. Olives, rare nut trees and horticultural novelties. 8 p.
26. ———
1889. Gladiolus, the new California strain. 4 p. (In possession of Mrs. Burbank.)
27. ———
1890. California bulbs, and plants, extra quality; all grown on my own grounds. 1 p.
28. ———
1890. Special wholesale list of surplus stock for January, February, and March. 1 p.
29. ———
1891. Trade list. California seeds. September 1, 1891. 1 p. (In possession of Mrs. Burbank.)
30. ———
1892. New gladioli. Little Gem calla. Clematis, shade trees, Japan walnuts, bulbs, etc., February, 1892. 8 p.
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1895. Giant prune and Wickson Japan plum. 16 p. (Illus.)
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1895. Burbank's Experiment Farms. October, 1895. 1 p. (Price list. In Library, U. S. Department of Agriculture, Washington, D. C.)
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1897. Surplus stock and a few novelties. February, 1897. (In possession of Mrs. Burbank.)
43. ———
1897. Supplementary seed list. November 1, 1897. (Copy; original in Department of Pomology, Cornell University, Ithaca, N. Y.)
44. ———
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45. BURBANK, LUTHER (*Continued*)

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46. ———
1897. Price list of seeds. September 15, 1897. 1 p. (In Library, U. S. Department of Agriculture, Washington, D. C.)
47. ———
1897. Headquarters for the new Richardias (callas). November 1, 1897. 1 p. (In possession of Mrs. Burbank.)
48. ———
1898. The 1898 supplement to "New creations in fruits and flowers." 8 p. (Illus.)
49. ———
1898. Important. Apple plum. September 1, 1898. (Postal card about mistakes in sending out grafts. In possession of Mrs. Burbank.)
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1899. The 1899 supplement to "New creations in fruits and flowers." 16 p. (Illus.)
51. ———
1899. Price list for season of 1899 and 1900. November 15, 1899. 4 p.
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1900. Special rhubarb circular. November 1, 1900. 6 p.
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1901. The 1901 supplement to "New creations in fruits and flowers." 16 p.
57. ———
1901. Trade prices. New fruits and flowers of past seasons. January 1, 1901. 1 p.
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1904. To the trade—some valuable novelties for 1905. September 1, 1904. 4 p.
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68. ———
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69. ———
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70. ———
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71. ———
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72. ———
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73. ———
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74. ———
1910. Burbank's flower seeds. The best that twentieth century science, forty years experience and California soil and climate can produce. Abridged list for spring of 1910. 4 p.
75. ———
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76. ———
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77. ———
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78. ———
1910. *Feijoa* (Fa-e-he-a) *Sellowiana*. 1 p.
79. ———
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80. ———
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81. ———
1911. Special. April and May, 1911. (Postal card.)
82. ———
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83. ———
1911. *Lippia repens*. January 1, 1911. 1 p. (In possession of Mrs. Burbank.)
84. ———
1911. Prices for summer of 1911. 1 p.
85. ———
1911. Burbank's twentieth century gladiolus, offered for the first time with other new and rare bulbs, mostly unobtainable elsewhere. 1911–12. To judge novelties . . . look to their source. 4 p.
86. ———
1911. Twentieth century fruits. 1911–12. 16 p. (Illus.)
87. ———
1912. The gold medal newest agricultural-horticultural opuntias. Spineless cactus. May 1, 1912. 24 p. (No price list. Apparently revised edition of no. 80. Still

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another edition with essentially the same matter, but with 16 more pages, was sent out in 1914 as "Luther Burbank's Spineless Cactus.")

88. ———
1912. Spineless cactus. Prices for summer of 1912. May 1, 1912. 1 p. (Price list to accompany no. 80.)
89. ———
1912. To nurserymen. July 15, 1912. (Postal-card price list.)
90. ———
1912. Advance offering of pedigreed Burbank novelties, fruits and flowers . . . direct from Burbank nurseries. Season 1912-1913. 8 p. (In Library, New York Agricultural Experiment Station, Geneva, N. Y.)
91. ———
1913. List of Luther Burbank's creations introduced up to January 1, 1913. 1 p. (No descriptions or prices.)
92. ———
1913. Luther Burbank's spineless cactus. 32 p. (Illus.)
93. ———
1913. The Burbank seed book. 42 p. 2 color pl. (In Library, Massachusetts Horticultural Society, Boston, Mass.)
94. ———
1913. Nursery catalog 1913. 16 p. (In Library, U. S. Department of Agriculture, Washington, D. C.)
95. ———
1914. Burbank seed book 1914. 80 p. 4 color pl.
96. ———
1914. Nursery catalog 1914. 40 p.
97. ———
1915. Burbank seed and nursery book 1915. 80 p. (Illus. Includes several pages of standard varieties of fruits, flowers, etc., not originated by Burbank.)
98. ———
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99. ———
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100. ———
1915. Burbank price and descriptive catalog. Plants, seeds, and trees. Season 1915-16. 48 p. (In Library, Massachusetts Horticultural Society, Boston, Mass.)
101. ———
1915. Three of Luther Burbank's most valuable productions. 4 p.
102. ———
1916. Twentieth century fruits—1916-17. 16 p.
103. ———
1916. The Burbank gladiolus and other new bulbous and similar ornamental plants. 16 p. (In Library, U. S. Department of Agriculture, Washington, D. C.)
104. ———
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105. ———
1917. Burbank's 1917 new creations in seeds and some older ones of special value. 16 p.
106. ———
1917. Burbank's bulb catalog and how to judge novelties. 16 p.
107. ———
1917. The birth of a new industry. The Royal walnut. . . . 8 p.
108. ———
1917. The birth of a new industry. The Burbank Royal walnut. . . . 8 p. (Apparently a reprint of no. 107, with slight change in title.)

109. BURBANK, LUTHER (*Continued*)
1917. The new Burbank wheat. August, 1917. 4 p.
110. ———
1918. Wholesale list for lining out and forestry. January, 1918. 1 p.
111. ———
1918. Burbank's 1918 new creations and special new selections in seeds. 16 p. (Illus.)
112. ———
1918. Burbank's 1918 new standard grains. 8 p. 1 fig.
113. ———
1918. Burbank's 1918 offering of twentieth century fruits, flowers and various economic plants. 16 p. (Illus.)
114. ———
1919. Burbank's 1919 new creations and special new selections in seeds. 32 p. (Illus.)
115. ———
1919. Burbank's 1919 offering of twentieth century fruits, flowers and various economic plants. 16 p. (Illus.)
116. ———
1920. Burbank's 1920 offering of twentieth century fruits, flowers and various economic plants. 20 p. (Illus.)
117. ———
1920. Burbank's 1920 new creations and special new selections in seeds. 32 p. (Illus.)
118. ———
1920. Very special. Burbank's 1920 list of new and standard fruit trees, walnuts, and berries. . . . 4 p. 1 fig.
119. ———
1920. The birth of a new industry—the Royal walnut, Patagonia cherry. . . . 8 p. (In possession of Mrs. Burbank.)
120. ———
1921(?). A new gooseberry—the California. 1 p.
121. ———
1921. Burbank's 1921 new creations and special new selections in seeds. 32 p. (Illus.)
122. ———
1921. Burbank's offering of twentieth century fruits . . . March, 1921. 16 p. (Illus. In Library, U. S. Department of Agriculture, Washington, D. C.)
123. ———
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124. ———
1922. Burbank seeds—1922. Bulletin no. 61. 32 p. (Illus.)
125. ———
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126. ———
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127. ———
1923. Burbank's March 1923 offering of 20th century fruits, flowers and various economic plants. Bulletin no. 64. 16 p. (Illus. In Library, U. S. Department of Agriculture, Washington, D. C.)
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133. ———
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