Literature Cited

1. Angelo, E. 1939. The development of cold resistance in strawberry varieties. Minn. Agr. Exp. Sta. Tech. Bul. 135:7-19.
2. Damiano, C. 1979. Cold storage maintenance and resuming of propagation of *in vitro* strawberry culture Ann. 1st Sper. Frutt. 10:53-58.
3. Druart, P. 1985. *In vitro* germplasm preservation technique for fruit trees. In: Schafer-Menuhr A (Ed) *In vitro* Techniques: Propagation and Long Term Storage. Martinus Nijhoff Publishers, Dordrecht pp. 167-171.
4. Lundergan, C. and J. Janick. 1979. Low temperature storage of *in vitro* apple shoots. HortScience 14:514.
5. Marino, G., P. Rosati and F. Sagrati. 1985. Storage of *in vitro* cultures of *Prunus* rootstocks. Plant Cell Tissue Organ Culture 5:73-78.
6. Mullin, R. H. and D. E. Schlegel. 1976. Cold storage maintenance of strawberry meristem plantlets. HortScience 11:100-101.
7. Murashige, T. and F. Skoog. 1962. A revised medium for rapid growth and bioassay with tobacco tissue cultures. Physiol. Pl. 15:473-479.
8. Nord, S. M. and G. G. Hanniford. 1989. *In vitro* storage of *Pelargonium* x *domesticum*. Am. Soc. Hort. Sci. Annual Meeting Program and Abstracts. Abstract 158, p. 78.
9. Reed, B. M. 1991. A new system for *in vitro* cold storage of strawberry germplasm. Plant Cell Reports, in press.
10. Wanas, W. H., J. A. Callow and L. A. Withers. 1986. Growth limitation for the conservation of pear genotypes. In: Withers LA, Alderman PG (Eds). Plant Tissue Culture and its Agricultural Applications (p. 285-290). Butterworths Publishers, London.
11. Wilkins, C. P., H. J. Newbury and J. H. Dodds. 1988. Tissue culture conservation of fruit trees. FAO/IBPGR Plant Genetic Resources Newsletter 73/74:9-20.

Fruit Varieties Journal 46(2):102-107 1992

'Segundo,' 'Byrongold' and 'Rubysweet' Plums and BY69-1637P Plumcot— Fruits for the Southeastern United States

W. R. OKIE, J. M. THOMPSON, C. C. REILLY,[1] F. I. MEREDITH, J. A. ROBERTSON AND B. G. LYON[2]

Abstract

Since 1984, the USDA plum breeding program at Byron, GA has released 3 plums and a plumcot adapted to the humid southeastern United States. 'Segundo' is an early "green plum" type, ripening in early June. It is suitable for local use. It turns from yellow-green to red as it ripens and has yellow flesh. 'Byrongold' is a firm, yellow shipping plum ripening in mid-late June. 'Rubysweet' also ripens in mid-late June but has blood-red flesh with a golden-bronze skin. All these plums have very good tree health relative to older varieties. 'Segundo' is somewhat smaller, not quite as firm, and higher in acidity, soluble solids and total sugars than 'Rubysweet' and 'Byrongold.' 'Rubysweet' was rated highest by the sensory panel on the hedonic like-dislike scale, followed by 'Segundo' and 'Byrongold.' A plumcot breeding line, BY69-1637P, has also been released. This selection produces light-medium crops of tart, orange-fleshed fruit. The black skin has a very short fuzz. It was released for use in further breeding.

Most Japanese-type shipping plums (*P. salicina* Lindl. hybrids) grown in California are highly susceptible to the diseases epidemic in the southeastern United States and cannot be grown successfully. Since its inception by V. E. Prince in 1964, the USDA plum breeding program at Byron, Georgia has released 5 Japanese-type plums and 1 plumcot adapted to the humid Southeast. 'Explorer,' a mid-season black-skinned plum, and 'Robusto,' an early "green-plum," were released in 1980 (1, 2, 3). Four more recent releases have not been described in the literature. 'Segundo,' 'Byrongold' and 'Rubysweet' plums and BY69-1637P plumcot are described in this

[1]Research Horticulturist, Geneticist (retired) and Pathologist, USDA-ARS, Southeastern Fruit and Tree Nut Research Laboratory, P.O. Box 87, Byron, GA 31008.
[2]USDA, R. B. Russell Agricultural Research Center, Agricultural Research Service, P. O. Box 5677, Athens, Georgia 30613.

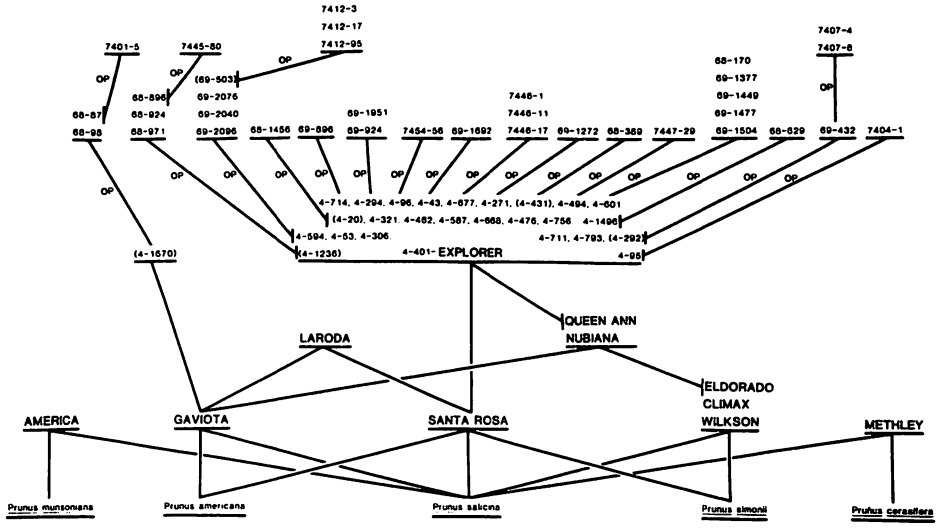

Figure 1. Pedigrees of important plum cultivars used in developing plums adapted to the southeastern U.S. 'Segundo' (BY68-971) and 'Byrongold' (BY7401-5) are in upper left. BY7-335 (see upper left Fig. 2) is probably the pollen parent of both 'Segundo' and 'Byrongold.'

paper. 'Rubysweet' was released by W. R. Okie; the others, by J. M. Thompson.

Segundo

'Segundo' was released in 1984 to extend the "green-plum" season established by 'Six Weeks,' 'Bruce' and 'Robusto.' These cultivars are from hybrids of the Japanese plum, *Prunus salicina* Lindl., and the local edible species, *P. angustifolia* Marsh. Fruit are early-ripening and are usually picked green or with a trace of color on the suture. In this condition they hold well in cold storage. Two days at room temperature will cause them to ripen to their mature red color. Fruit may be consumed either green (firm but tart) or ripe (sweeter but watery), or made into jams and jellies when ripe. These "green plums" appeal primarily to consumers in the Southeast. Although they are an improvement over the native plums, which they resemble in flavor and texture, they are inferior to the California Japanese-type plums in their flavor, texture and firmness.

'Segundo,' tested as BY68-971, was an open-pollinated seedling of BY4-1236 planted by Prince at Byron in 1968. BY4-1236 resulted from open-pollinated (probably by 'Santa Rosa') seed of 'Queen Ann,' that was obtained from John Weinberger (USDA) in Fresno, California. The pollen-parent of 'Segundo,' as well as of 'Robusto' and 'Byrongold,' is thought to be BY7-335, a very vigorous and well-adapted seedling of Ozark Premier X *P. angustifolia*. This putative pedigree is represented in Fig. 2.

'Segundo' flowers, borne in pairs, are white, about 2 cm in diameter. Cross pollination is required. Specific pollinators have not been determined but adapted cultivars such as 'Six Weeks,' 'AU Amber' or 'Methley' are suggested. The wild plum parentage (Figs. 1, 2) gives tremendous tree vigor and profuse flowering over an extended period of time. Nearly every year enough blooms escape frosts to set a heavy crop, which requires substantial thinning to obtain large size (Fig. 3). 'Segundo' usually ripens about 3-6 days after 'Robusto,' but in some years they

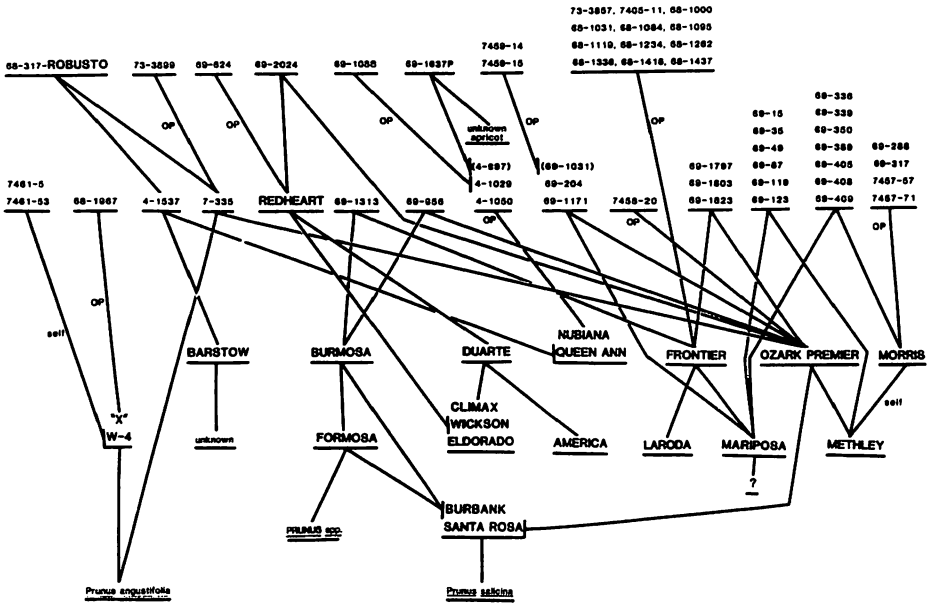

Figure 2. Pedigrees of plumcot BY69-1637P (upper center) and 'Rubysweet' (BY69-350-upper right) as related to other Byron selections and California plum cultivars.

ripen together. Ripe fruit quality is somewhat bland and watery for eating out of hand.

The 'Segundo' leaf resembles the wild parent (Fig. 4, left center). Leaf shape is elliptic—obovate with an acute tip and acute base. The leaf blade is reflexed with the edges rolled upwards. The blade is slightly wavy with a fine, glandular-tipped, crenate margin. The leaf is fairly glossy, yellow-green and glabrous above; lighter green and glabrous below, except along the main vein. Usually 2-3 globose glands appear on the petiole at the end of the blade.

'Segundo' has excellent resistance to bacterial canker (*Pseudomonas syringae* pv *syringae* van Hall), bacterial leaf spot and twig canker (*Xanthomonas campestris* pv *pruni* (Smith) Dye), and black knot (*Dibotryon morbosum* (Sch.) Th. and Syd.). The high tree vigor generally delays the debilitating effects of plum leaf scald (*Xylella fastidiosa* Wells *et al.*). Heavy pruning is required to keep the trees manageable since they grow vigorously to produce a spreading tree with many branches, making it difficult to maintain an open-vase shape.

Byrongold

'Byrongold,' tested as BY7401-5 and released in 1985, resulted from an open-pollinated seed of BY68-87. BY68-87 was an open-pollinated seedling of BY4-1670, itself an open-pollinated seedling of 'Gaviota' (Fig. 1). The pollen parent of BY4-1670 is thought to be BY7-335 (see Fig. 2). BY7-335 presumably conferred excellent tree vigor, although less than that inherited by 'Robusto' or 'Segundo.' 'Byrongold' trees show good resistance to *P. syringae*, *X. campestris* and *D. morbosa* and tolerance to plum leaf scald. As with 'Segundo,' at least 8-10 years of tree life can be expected on 'Lovell' peach rootstock in the Southeast, which is superior to all California plums grown here.

The leaf (Fig. 4, right center) resembles that of the wild parent but is

Table 1. Comparison of 'Bruce' and 'Santa Rosa' plums with USDA cultivars at Byron, GA.

Clone	Selection no.	Seedling planted	Seedling selected	Bloom date[1] (days)	Self-fertile	Pollen shed[2]	Ripe date	Fruit size (cm)	Skin color[3]	Flesh color[3]	Tree health
Bruce				-3	yes?	L	5/24	4.0	G-R	Y-R	Fair
Robusto	BY68-317	1968	1973	-1	no	L	6/1	4.0	R	R	Very good
Segundo	BY68-971	1968	1973	-3	no	L-M	6/7	4.5	Y-R	R	Very good
Santa Rosa				0	partly	H	6/12	4.3	R	Y-R	Poor
Rubysweet	BY69-350	1969	1973	-2	no	M	6/21	5.0	BZ	DR	Good
Byrongold	BY7401-5	1974	1976	-3	partly	H	6/24	5.0	Y	Y	Good
BY69-1637P	BY69-1637P	1969	1976	-6	yes	L	6/27	5.0	B	Y-O	Fair
Explorer	BY4-401	1964	1967	+1	no	M	6/27	5.0	P-B	A	Good

[1]Bloom date relative to Santa Rosa (about March 11, similar to a peach rated 750 chill hours).
[2]Pollen shed: L = light, M = medium, H = heavy.
[3]Color: Y = yellow, R = red, B = black, O = orange, G = green, P = purple, A = amber, BZ = bronze, DR = dark red.

much larger. Leaf shape is ovate-elliptic with an acuminate tip and acute base. The leaf blade is slightly reflexed and somewhat rugose or puckered along the main blade with the sides folded upwards slightly. The leaf margin is irregularly, finely crenate, with scattered glandular tips. The leaf is fairly glossy green above, lighter below, glabrous except along the main vein underneath. The red petiole has 1-2 small globose glands at the base of the blade.

'Byrongold' flowers are white, about 2 cm in diameter, borne in groups of three or four. Other adapted cultivars are suggested as pollenizers. 'Byrongold' requires about 550-600 chill hours for normal bloom. Fruit set is usually very heavy; with adequate thinning however, 5 cm fruit size can easily be obtained (Fig. 5). Although fruit can be picked with a trace of green and held in storage, fruit maturity cannot be determined by color alone. 'Byrongold' fruit may appear ripe 1-2 weeks before they soften and develop good flavor. Ripe fruit have a shiny, yellow skin over a deep yellow flesh. A slight red blush may develop with hot, dry weather. Fruit quality and firmness are good to very good. The pit is semi-clingstone.

Rubysweet

'Rubysweet,' tested as BY69-350 and released in 1989, resulted from a cross of Mariposa X Methley made by V. E. Prince in 1969 (Fig. 2). J. M. Thompson selected it in 1973. 'Rubysweet' has better tree health than either parent, being moderately resistant to both

Table 2. Physical and chemical characteristics of 'Segundo,' 'Rubysweet' and 'Byrongold' plums.[a]

Characteristics	'Segundo'	'Ruby-sweet'	'Byron-gold'
Size (mm)	44	52	45
Weight (gm)	47	72	55
Firmness (Newtons)	17	24	32
Minolta color values			
"L"	46.7	47.8	58.6
"a"	6.6	6.8	-7.9
"b"	13.3	15.3	29.3
Hue angle	62	66	105
Acidity (% as malic)	1.9	1.4	1.6
Soluble solids (%)	14.1	12.1	11.8
Sugars			
Sucrose (%)	0	5.3	5.8
Glucose (%)	5.5	1.2	1.1
Fructose (%)	4.8	1.4	1.0
Sorbitol (%)	1.3	1.1	1.2

[a]Fruit harvested when firm-mature but not ripe.
[b]Values are the mean of 15 fruit.

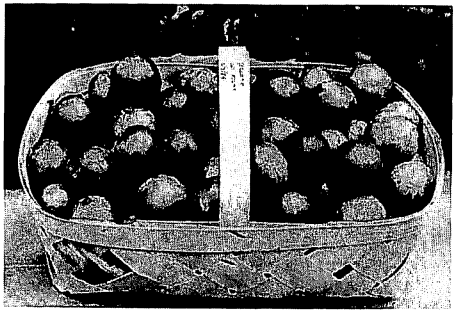

Figure 3. Ripe fruit of 'Segundo' plum. Fruit diameter about 4.5 cm.

Pseudomonas and *Xanthomonas*. Tree vigor is good and growth is generally upright.

Leaf shape is elliptic-obovate, with an acuminate tip and acute base (Fig. 4, left). The leaf blade is somewhat reflexed and the sides may roll upwards. The margin is doubly crenate with glandular tips. The leaf is fairly glossy, dark green and glabrous above; lighter green and glabrous below except along the main vein. The petiole and main vein may have a reddish tinge, with 1-5 globose glands on the petiole near the base of the leaf blade.

Flowers of 'Rubysweet' are white, about 2 cm in diameter, and borne in clusters of 2-3. Cross pollination is required; other adapted cultivars such as 'Methley' or 'Byrongold' are suggested as pollenizers. Fruit set is usually good; therefore, thinning is required to produce satisfactory fruit size. Skin color of the fruit is reddish-gold bronze with a heavy wax bloom. Flesh color is blood red, similar to 'Mariposa.' The flesh is freestone, very firm, and very good eating quality. Fruit shape is generally round.

Table 3. Sensory characteristics of artificially ripened[a] 'Segundo,' 'Rubysweet' and 'Byrongold' plums.

		'Segundo'	'Rubysweet'	'Byrongold'
Hedonic Score[b]		5.4	5.9	4.6
Sweetness[c]				
Too sweet	%	5	10	0
Somewhat too sweet	%	5	24	8
Just about right	%	65	54	30
Somewhat not sweet	%	15	10	44
Not sweet	%	10	2	18
Sourness[c]				
Too sour	%	5	0	4
Somewhat too sour	%	5	2	18
Just about right	%	65	48	42
Somewhat not sour	%	15	40	30
Not sour	%	10	10	6

[a]Ripened at 20°C and 75% RH for 3 days.
[b]Hedonic values are based on a 9-point scale, 1 = dislike extremely and 9 = like extremely.
[c]Values under sweetness and sourness categories represent percentages of total response (n = 20, 'Segundo'; n = 50, 'Rubysweet' and 'Byrongold').

Fruit Quality

Table 2 shows a comparison of the quality characteristics of 'Segundo,' 'Rubysweet' and 'Byrongold.' It is interesting that 'Segundo' fruit did not contain any sucrose but had much higher contents of glucose and fructose than 'Byrongold' or 'Rubysweet.'

'Rubysweet' was rated highest by the sensory panel on the like-dislike scale, followed by 'Segundo' and 'Byrongold' (Table 3). Distribution of percent responses for 'Just-about-Right' scales indicated that 'Byrongold' lacked an ideal level of sweetness despite soluble solids similar to 'Rubysweet.' Sweetness of 'Rubysweet' and 'Segundo' was 'Just-about-Right.'

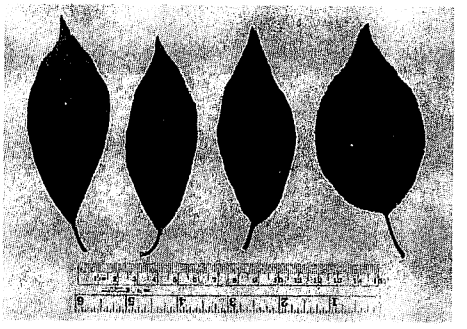

Figure 4. Leaves of 'Rubysweet' plum (left), 'Segundo' plum (left center), 'Byrongold' plum (right center) and BY69-1637P plumcot (right).

BY69-1637P

BY69-1637P was released as germplasm in 1984 when USDA began encouraging formal release of material not fully improved for cultivar use. It originated in 1969 from a open pollinated seedling of the plum BY4-997, an open-pollinated seedling of 'Nubiana.' The pollen parent of BY69-1637P was apparently a seedling apricot. 'Nubiana,' a California Japanese-type plum, probably has *Prunus americana* Marsh., *P. salicina* and *P. simonii* Carr. in its pedigree (Fig. 1).

Leaf (Fig. 4, right) and tree characters are intermediate between plum and apricot. Leaf shape is broadly elliptic-obovate with an acuminate tip and obtuse base. The leaf blade is wavy with a crenate, glandular margin. The leaf is dull, dark green and glabrous above, lighter green and glabrous below except for pubescence along the main vein. The petiole may have 1-4 stalked globose glands. From its plum parent, BY69-1637P apparently inherited relatively high tree vigor and resistance to bacterial diseases. Although not as long-lived as 'Segundo,' it has better tree health and vigor than any apricot or other plumcot grown at Byron. Apricots rarely live 5 years in our climate.

Figure 5. Ripe fruit of 'Byrongold' plum. Fruit diameter is about 5 cm.

Blossoms of BY69-1637P resemble apricot in their rose color, reddish calyx and cup, pubescent style, self-fertility, and solitary position. They resemble plum in size and fragrance. Open-pollinated seedlings of this selection are mostly dark-skinned plumcots with various degrees of vigor and fruit set. One seedling, BY81-46-6, has set heavy crops of small, tart plumcots for four consecutive years. BY69-1637P has produced fruit in back crosses to both plum and apricot but it produces scant pollen. When interplanted in a plum block, it produces a light to moderate crop, which is superior to other named plumcots tested at Byron. Fruit is of good size and it is very firm. Flavor is acceptable but acidic. A black skin, nearly smooth but with very short pubescence, covers the apricot-colored freestone flesh.

This plumcot was formally released for use by other breeders. It could be used to improve the freeness of stones in early plums and to improve tree health and productivity of apricots in our climate.

Trees of all the Byron plum cultivars are available from commercial nurseries in Tennessee. Limited amounts of budwood of BY69-1637P plumcot are available from W. R. Okie.

Literature Cited

1. Thompson, J. M. and V. E. Prince. 1981. 'Explorer' plum. HortScience 16:797.
2. Thompson, J. M. and V. E. Prince. 1982. 'Robusto' plum. HortScience 17:91.
3. Thompson, J. M. and V. E. Prince. 1982. Robusto—a new vigorous and precocious plum for the southeastern United States. Fruit Var. J. 36:112-114.