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‘Eclipse’ Thornless Semi-erect Blackberry

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‘Eclipse’ is a thornless, semierect, high quality blackberry (*Rubus* subg. *Rubus* Watson) that has firm, uniformly shaped, dark fruit suited for the fresh market and that ripen in the early season for this type of blackberry. ‘Eclipse’ was released by the U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS) breeding program in Corvallis, OR in cooperation with Oregon State University’s Agricultural Experiment Station. ‘Eclipse’ is introduced as a high quality blackberry that has medium-sized, uniformly shaped berries that ripen in the early, semierect blackberry season where it is firmer or earlier than current standards. ‘Eclipse’ and ‘Galaxy’, released with a similar ripening season, have many characteristics in common, including high-quality fruit in the early semierect season and vigorous productive plants; ‘Eclipse’ fruit tend to be more uniformly shaped, slightly smaller and firmer than those of ‘Galaxy’. ‘Eclipse’ should be adapted to areas where other semierect blackberries can be grown successfully. A U.S. Plant Patent, USPP 30,448, was granted.

Origin

‘Eclipse’, tested as ORUS 2816-4, was selected in Corvallis, OR in 2004 from a cross made in 2001 of ORUS 1392-1 (‘Illini Hardy’ × ‘Chester Thornless’) and ‘Triple Crown’. An incorrect pedigree was submitted in the USDA release notice and the plant patent (Finn, 2019); the pedigree analysis that revealed this was just recently available and is discussed further in this release notice. ‘Illini Hardy’, U.S. Plant Patent 8,333, is a cold-hardy cultivar developed in the Midwestern United States with marginal fruit quality (Skirvin and Otterbacher, 1993); ‘Triple Crown’ and ‘Chester Thornless’ are semierect blackberries from the USDA-ARS (Galletta et al., 1998a) that are standard cultivars in the industry. As with the other erect and semierect thornless cultivars, ‘Eclipse’ has the ‘Merton Thornless’ source of thornlessness (botanically ‘‘spineless’’ but commonly referred to as ‘‘thornless’’ in industry and research communities) (Crane, 1943; Jennings, 1986). Firm, medium-sized fruit that are uniformly sized and shaped, ripen early in the semierect blackberry season, and have excellent flavor are the primary factors that distinguish ‘Eclipse’ from other semierect cultivars.

‘Eclipse’ was evaluated most extensively in trials at Oregon State University’s North Willamette Research and Extension Center (OSU-NWREC; Aurora, OR), USDA-ARS (Corvallis, OR), and Enfield Farms Inc. (Lynden, WA). In the Oregon trial plantings, standard cultural practices for semierect blackberry production were used, including annual pre- and postemergent herbicide applications, spring nitrogen fertilization (78 kg N/ha), postharvest removal of floricanes, topping of primocanes at 1 m to encourage branching, training of primocanes to a two-wire trellis, and application of 2.5 to 5.0 cm of irrigation per week during the growing season, depending on rainfall. Delayed dormant applications of liquid lime sulfur and copper hydroxide were made to control leaf and cane spot (*Septoria rubi* Westend), purple blotch [*Sphaerulina westendorpii* (Westendorp) Verkley, Quaedvlieg & Crous (formerly *Septoria rubi* Westend)], rust [*Kuehneola uredinis* (Link) Arth.], and anthracnose [*Elsinoe veneta* (Burkholder) Jenk.] as a standard practice without any knowledge of the susceptibility of the selections in trial to these diseases. The cooperating grower in Washington is primarily a red raspberry (*Rubus idaeus* L.) grower and even though plants were spaced and trained similarly to those in the Oregon trials, they were irrigated and received nitrogen fertilizer rates that were standard for red raspberry but greater than typical for blackberry. At OSU-NWREC, ‘Eclipse’ was planted in a replicated trial in 2013, along with other selections and the standards ‘Chester Thornless’ and ‘Triple Crown’ in a randomized complete block design with three replications (Galletta et al., 1998a, 1998b). Each experimental unit consisted of three plants. Each replication was harvested once a week to determine harvest season, yield, and average fruit weight (based on a randomly selected subsample from each harvest) (Finn et al., 2005; Finn and Strik, 2014). ‘Chester Thornless’ accounts for the largest area planted of semierect blackberry grown for the wholesale fresh market in the Pacific Northwest. ‘Triple Crown’ is commonly grown for roadside and farmers’ market sales where its large fruit size and outstanding flavor are prized, but its softness and tender skin prevent it from being shipped a significant distance. A weighted mean fruit mass was calculated that adjusts the average mean fruit mass based on the proportion of the total yield harvested on each pick. These data, collected from 2015

through 2017, were analyzed as a split plot in time with a fixed effect model with cultivar as the main plot and year as the subplot with mean separation by the least significant difference (LSD; SAS PROC GLM, Cary, NC). LSD was only applied when there were significant differences for the trait. Of the multiple genotypes harvested from this replicated trial, only the data from 'Eclipse' and the named cultivars were included in the analysis (Table 1). The cultivar × year interaction was significant for yield but not for fruit weight, and the means for yield in each year are presented and compared.

Fruit evaluations were made during the harvest seasons using a 1 to 9 scale (9 = the best expression of each trait). The subjective fruit ratings included drupelet fertility (rating of drupelet set), firmness (as evaluated by hand in the field on six to eight fruit), color (ideal is a solid, dark black), shape (with a uniform, long conic berry being ideal), texture (as rated when chewed while tasting berries in the field), separation (how easily the ripe fruit were separated from the plant), and flavor (rated by tasting fruit in the field) (Table 2). Fruit glossiness (ideal is glossy), skin toughness (while holding fruit, thumb was rubbed across the fruit surface, and ideally the skin surface did not break and "bleed") and tolerance of heat/ultraviolet light damage (when fruit were fully ripe the incidence of bleached or sunburned fruit was scored where 9 = no evidence of injury) were rated in 2015–17. The number of fruit per lateral was determined based on counting the fruit on five typical fruiting laterals in each plot once during the season in 2015–17.

Table 1. Berry weight and yield in 2015–17 for 'Chester Thornless', 'Eclipse', and 'Triple Crown' blackberries at Oregon State University's North Willamette Research and Extension Center (Aurora, OR); planted in replicated trial (three plots of three plants each) in 2013.

	Berry wt (g)	Yield (kg/plant)			
Year/cultivar	2015–17	2015	2016	2017	2015–17
2015	7.1 a				8.69 b
2016	7.1 a				9.29 b
2017	8.0 a				13.61 a
Chester Thornless	6.3 b	8.40 b	10.89 a	15.60 a	11.63 a
Eclipse	6.4 b	6.65 b	7.20 b	12.71 bc	8.85 c
Triple Crown	8.1 a	11.44 a	9.14 a	14.39 ab	11.66 a

[z]Means within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

In 2014, fruit were harvested from single observation plots of 'Chester Thornless', 'Navaho', 'Triple Crown', and 'Eclipse' for evaluation of fresh market storage quality (Table 3). Once a week for 4 weeks, firm, fully colored fruit were handpicked into three 125-g vented, plastic clamshell containers (unknown manufacturer). Separate samples were taken at the same time to determine percent soluble solids (°Brix) at harvest. Samples were weighed and then refrigerated (1 to 2 °C) for 1 week and then placed on a laboratory bench for 3 d at room temperature. The containers were reweighed to determine percent weight loss and scored for appearance (1–9 scale; 1 = very unattractive; 9 = uniformly shaped with no drupelet breakdown), leakage (1–9 scale; 1 = most berries leaking; 9 = no berries leaking), and incidence of mold based on the percentage of fruit showing mold infection.

Percent soluble solids, pH, and titratable acidity were determined from fruit harvested in the same year of a number of cultivars (Table 4). Fruit samples of 'Black Diamond', 'Columbia Giant', 'Columbia Star', 'Eclipse', 'Galaxy', and 'Marion' were analyzed for the concentration of anthocyanins using previously described separation and identification procedures (Finn et al., 2014; Lee and Finn, 2007) with a longer high-performance liquid chromatography column (Synergi Hydro-RP 80Å, 250 mm × 2 mm, 4 µm; Phenomenex, Inc., Torrance, CA) (Table 5).

In separate trials, fruit were also evaluated informally as a thawed, individually quick frozen product by growers, processors, and researchers.

In 2009, 'Eclipse' was planted along with a number of other genotypes in plots at Enfield Farms Inc. (Lynden, WA) to assess cold hardiness. Observations were made on these plants from 2010 through 2012, but the winters were relatively mild (minimum temperature –12.2 to –10.0 °C in Dec. 2009, Nov. 2010, and Jan. 2011). Although the winters in Oregon from Fall 2009 through late Winter 2017 were relatively mild, an unusual cold event in Dec. 2013 provided some insight into what conditions may cause cold damage in 'Eclipse' as the OSU-NWREC experienced temperatures of –13.3 to –12.7 °C over two nights; on those same two nights it was –16.6 to –16.0 °C in Corvallis. In addition, single plots of multiple plants were planted at Berry Haven Farms (Abbotsford, BC, Canada), North Carolina State University (Raleigh, NC), the University of Arkansas (Clarksville, AR), Nourse Farms (Whatley, MA), and Willems Family Farm (Kingsburg, CA) to assess adaptation to these diverse climates.

The fruit-ripening season in Oregon was characterized by the dates on which 5%, 50%, and 95% of the total fruit were harvested (Table 6). Plant ratings were conducted once each year during the fruiting season for primocane and floricane vigor, flowering or fruiting lateral length (1 = very short; 5 = very long) and strength (1 = weak, droopy; 5 = stiff, sturdy), and damage due to winter injury (9 = no injury; 1 = dead) (Table 7).

Description and Performance

'Eclipse' was moderate yielding with yields comparable to the other commercial cultivars in trial (Table 1). Over the three harvest years, 'Eclipse' was lower yielding than 'Chester Thornless' and 'Triple Crown'; however, in individual years, it was statistically similar to one or the other. In this and other trials (Table 1, data not shown), 'Eclipse' plants seem slower to establish in the field, and yields during the first harvest years were lower than once plants were well established (data not shown).

There were cultivar effects but no significant year effects or an interaction between fruit weight and year. 'Eclipse' fruit were comparable in weight to 'Chester Thornless' and lighter than those for 'Triple Crown' (Table 1). 'Eclipse' had an excellent size for clamshell packaging. The number of fruit per lateral for 'Eclipse' was comparable to 'Triple Crown' and much fewer than 'Chester Thornless' (Table 2; Figs. 1 and 2). 'Eclipse' had a more uniform and attractive, somewhat blocky shape compared with 'Chester Thornless' or 'Triple Crown', which tended to be lumpier (Fig. 3). Fruit shape can be affected by drupelet fertility, and although 'Eclipse' had the highest rating for fertility, it was not statistically different from the other two cultivars (Table 2; Fig. 3) (Strik et al., 1996).

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Table 2. Subjectively evaluated flowering date and fruiting traits in 2015–17 for 'Chester Thornless', 'Eclipse', and 'Triple Crown' blackberries at Oregon State University's North Willamette Research and Extension Center (Aurora, OR); planted in replicated trial (three plots of three plants each) in 2013.[z]

		Fruit/heat/ultraviolet skin									
Cultivar	Drupelet fertility[y]	Firmness	Color	Shape	Texture	Separation	Flavor	Lateral	Damage	Toughness	Glossiness
Chester Thornless	6.0 a	8.4 a	9.0 a	6.0 b	5.1 b	7.6 a	5.2 b	19.3 a	4.9 b	8.3 a	7.8 b
Eclipse	6.9 a	8.6 a	9.0 a	6.9 a	5.9 a	6.1 b	7.3 a	10.0 b	6.8 a	8.4 a	8.8 a
Triple Crown	6.5 a	6.1 b	8.8 b	6.1 b	5.5 ab	8.1 a	7.2 a	9.9 b	7.1 a	5.5 b	7.9 b

[z]A 1 to 9 scale was used where 9 = the best expression of each trait and 1 = the worst for all traits except for fruit/lateral, which was a count.
[y]Means within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

Table 3. Storage trials for 'Eclipse', 'Chester Thornless', 'Navaho', and 'Triple Crown'. Soluble solids (%) at harvest and weight loss, appearance, leakage, and mold (%) were assessed after 1 week in clamshells under refrigeration (0.5 to 1.0 °C) and 3 d at room temperature.

			After 1 wk in refrigeration and 3 d room temp			
Cultivar	Soluble solids at harvest (%)	Wt loss after 1 wk refrigeration (%)	Wt loss (%)	Appearance	Leakage	Mold (%)
Chester Thornless	11.8 b	2.9 a	18.1 a	4.5 ab	4.3 ab	10.7 a
Eclipse	13.4 a	3.4 a	13.6 b	5.2 a	5.0 a	8.4 a
Navaho	13.4 a	2.8 a	17.0 a	5.1 a	3.7 b	7.1 a
Triple Crown	13.8 a	2.4 b	18.0 a	4.2 b	3.9 b	5.5 a

Table 4. Soluble solids, pH, and titratable acidity for the new releases 'Eclipse' and 'Galaxy' and 12 other blackberry cultivars harvested in the same year from plants grown at Oregon State University's North Willamette Research and Extension Center (Aurora, OR) and harvested in 2011–17.

Cultivar	Soluble solids (%)[z]	pH	Titratable acidity ($g \cdot L^{-1}$ as citric acid)
Black Diamond	11.29 d	3.36 d-g	12.70 c-e
Čačanska Bestrna	9.72 e	3.29 e-g	11.50 d-f
Chester Thornless	12.43 cd	3.28 e-g	10.67 e-g
Columbia Giant	11.40 d	3.17 g	18.74 a
Columbia Star	12.32 cd	3.23 fg	13.98 c
Columbia Sunrise	13.61 a-c	3.64 ab	7.46 hi
Eclipse	13.50 a-c	3.41 c-f	9.71 fg
Galaxy	12.26 cd	3.45 b-e	10.75 e-g
Hall's Beauty	13.46 a-c	3.35 d-g	13.05 cd
Marion	13.45 a-c	3.20 g	16.05 b
Navaho	14.41 ab	3.36 d-g	10.26 fg
Osage	12.01 cd	3.70 a	8.82 g-i
Triple Crown	14.95 a	3.53 a-d	9.30 gh
Tupy	12.86 b-d	3.66 a	8.56 g-i
Von	12.35 cd	3.56 a-c	6.93 i

[z]Means within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

Table 5. Anthocyanin concentrations (mg cyanidin-3-glucoside/100 g) of the semierect 'Eclipse' and 'Galaxy' along with 'Black Diamond', 'Columbia Giant', 'Columbia Star', and 'Marion' trailing blackberries harvested in 2015 from trials at Oregon State University's North Willamette Research and Extension Center (Aurora, OR).[z]

Cultivar	Cyanidin-3-glucoside	Cyanidin-3-rutinoside	Cyanidin-3-xyloside	Cyanidin-3-malonylglucoside	Cyanidin-3-dioxalylglucoside	Total
Black Diamond	69.0 (76) [y]	20.6 (23)	0.4 (0)	1.1 (1)	Not detected	91.0
Columbia Giant	78.4 (66)	39.5 (33)	0.6 (1)	0.3 (0)	Not detected	118.9
Columbia Star	98.2 (70)	39.9 (29)	0.3 (0)	1.1 (1)	Not detected	139.5
Eclipse	61.7 (86)	3.9 (5)	2.1 (3)	0.6 (1)	3.1 (4)	71.5
Galaxy	82.8 (90)	1.4 (2)	3.0 (3)	1.6 (2)	3.1 (3)	91.9
Marion	98.2 (70)	37.9 (27)	0.7 (0)	1.2 (1)	3.2 (2)	141.1

[z]Anthocyanin listed in the order of high-performance liquid chromatography elution. Values in parentheses are percent proportions of the total anthocyanins.
[y]Possibly cyanidin-hydroxymethylglutaroylglucoside (Jordheim et al., 2011) but needs confirmation by an additional independent research group.

'Eclipse' had excellent black color that was comparable to 'Chester Thornless', and although statistically darker than 'Triple Crown', the color was not meaningfully different from 'Triple Crown'. 'Eclipse' was rated as having comparable firmness and skin toughness to 'Chester Thornless' and rated much better than the softer, more tender-skinned 'Triple Crown' (Table 2). This combination of firmness, uniformity of shape, medium size, and excellent skin toughness make 'Eclipse' an excellent candidate for shipping in clamshells in the wholesale fruit market. When eaten fresh, 'Eclipse' fruit texture was comparable to 'Triple Crown' and more pleasant than 'Chester Thornless' (Table 2). 'Eclipse' fruit were harder to pick than either of the other cultivars in the trial (Table 2). When eaten fresh, 'Eclipse' fruit flavor was as good as the highly regarded 'Triple Crown' and better than 'Chester Thornless' (Table 2). In general, the semierect and erect blackberries show more symptoms of heat damage than do the trailing types. Although we cannot rule out a genetic component to this, we suspect it is largely due to the earlier ripening of the trailing types when there are fewer incidents of high temperature. All of the semierect blackberries compared showed symptoms of heat injury; however, the symptoms were much more severe on 'Chester Thornless' than they were for 'Eclipse' or 'Triple Crown' (Table 2). In California, 'Eclipse' held up well and was still sweet and firm after hot (43 °C) temperatures (Willems Family Farm, personal communication).

In the 2014 storage trial, the percent soluble solids at harvest were higher for 'Eclipse', 'Navaho', and 'Triple Crown' than for 'Chester Thornless' (Table 3). There were minimal losses in fruit weight after 1 week in

Table 6. Ripening season estimated as the date at which yield passed the given percentage of total yield in 2015–17 for the semierect 'Chester Thornless', 'Eclipse', 'Triple Crown', and 'Von'; the trailing 'Black Diamond', 'Columbia Star', 'Hall's Beauty' and 'Marion'; and the primocane fruiting 'Prime-Ark® 45' at Oregon State University's North Willamette Research and Extension Center (Aurora, OR); planted in 2013.

	Harvest season (percent total yield)		
Cultivar	5%	50%	95%
Columbia Star	20 June	26 June	7 July
Hall's Beauty	22 June	26 June	10 July
Black Diamond	20 June	30 June	17 July
Marion	24 June	30 June	15 July
Von	10 July	17 July	4 Aug.
Eclipse	15 July	17 July	7 Aug.
Triple Crown	17 July	31 July	9 Aug.
Chester Thornless	17 July	2 Aug.	21 Aug.
Prime-Ark®45	25 Aug.	13 Sept.	29 Sept.

Table 7. Subjectively evaluated plant traits in 2015–17 for 'Chester Thornless', 'Eclipse', and 'Triple Crown' blackberries at Oregon State University's North Willamette Research and Extension Center (Aurora, OR). Planted in replicated trial (three plots of three plants each) in 2013.

			Lateral		
Cultivar	Primocane vigor[z]	Floricane vigor	Length	Strength	Winter injury
Chester Thornless	8.6 a	8.3 b	4.9 a	1.6 c	9.0 a
Eclipse	8.3 b	8.5 ab	3.8 b	3.3 a	8.8 a
Triple Crown	8.8 a	8.9 a	5.1 a	2.7 b	8.8 a

[z]A 1 to 9 scale was used where 9 = the best expression of each trait and 1 = the worst for all traits except lateral length and strength, which were on a 1 to 5 scale, where 1 = short, weak and 5 = long, strong, and winter injury where 9 = no observable injury and 1 = killed to the ground. Means within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

Fig. 1. Typical flowering cluster of 'Eclipse'.

Fig. 2. Typical fruiting laterals with ripe fruit of 'Eclipse'.

storage. After 1 week of refrigeration followed by 3 d at room temperature, 'Eclipse' had the lowest weight loss, along with 'Navaho'; had the most attractive fruit along with 'Chester Thornless' and 'Navaho'; and had comparable leakage to 'Chester Thornless' but not as desirable as 'Navaho' or 'Triple Crown'. There were no differences in the percentage of moldy berries among the cultivars trialed.

In multiple years of evaluation, 'Eclipse' had percent soluble solids comparable to most cultivars but was much higher than for 'Black Diamond', 'Columbia Giant', and 'Čačanska Bestrna' (Table 4). The pH of 'Eclipse' fruit puree was in the range we typically see for blackberries; it was higher than that for 'Columbia Giant' and 'Marion' and lower than that for 'Columbia Sunrise', 'Osage', 'Tupy', and 'Von'. 'Eclipse' fruit had a titratable acidity that was higher than for 'Von' and 'Columbia Sunrise' but was lower than most of the trailing blackberries including 'Columbia Giant', 'Columbia Star', 'Hall's Beauty', and 'Marion'. This combination of high soluble solids, moderate pH, and low titratable acidity levels puts 'Eclipse' in a range that is desirable for fresh consumption because the fruit are perceived as being sweet.

A blackberry's anthocyanins contribute to its overall appearance, flavor, and potential health benefits (Lee et al., 2012). They are important quality constituents that consumers relate with positive purchasing drivers (Farruggia et al., 2016). Detailed anthocyanin profiles of newly released cultivars are also essential for future blackberry—and blackberry product—authenticity work (Lee et al., 2012). For all the blackberry cultivars evaluated, cyanidin-3-glucoside was the predominant anthocyanin (Table 5). The total anthocyanin concentration for 'Eclipse', 'Galaxy', and 'Black Diamond' was much lower than the other three trailing blackberries. The proportion of the various anthocyanins was different for 'Eclipse' and 'Galaxy', as they had much lower proportions of cyanidin-3-rutinoside than the trailing blackberries. 'Eclipse', 'Galaxy', and 'Marion' were the only cultivars with detectable levels of cyanidin-3-dioxylaylglucoside, although at relatively low proportions.

The trailing cultivars reached 50% ripe 14 to 18 d ahead of 'Eclipse' (Table 6). 'Von' started and finished harvest a few days earlier than 'Eclipse', but they had the same 50% harvest date. The 50% harvest date for 'Eclipse' was 14 d ahead of 'Triple Crown' and 16 d ahead of 'Chester Thornless'. Not surprisingly, based on ripening season, 'Eclipse' began flowering 10 d before 'Chester Thornless' and 'Triple Crown' (Table 2). All cultivars ripened their crop much earlier than 'Prime-Ark®45'.

The primocanes of 'Eclipse' were slightly less vigorous than those of 'Chester Thornless' and 'Triple Crown'. Although differences were noted for floricane vigor, they were not significant; all three of these cultivars grow well. What could not be captured with a rating score was how erect 'Eclipse's growth was after tipping the primocanes in summer (Fig. 4). The lateral branches that broke after tipping, grew nearly vertically up to a meter above the trellis (C. Finn and B. Strik, personal observation). Although no other pruning practices were tried, tipping the primocanes at a shorter height and then allowing the laterals that break to fill the trellised canopy, as opposed to being above it, may increase production within the trained canopy area. 'Eclipse' had shorter and stronger fruiting laterals than either of

Fig. 3. Flat of hand harvested fruit of 'Chester Thornless' (left) vs. 'Eclipse' (right).

Fig. 4. Entire fruiting plant of 'Eclipse' with very erect-growing primocanes.

the two other cultivars (Table 7). All of the cultivars showed excellent winter cold tolerance wherever they were trialed in the Pacific Northwest. Although 'Eclipse's overall adaptation to the eastern United States is not well tested, it has proven to be winter hardy in Arkansas (J.R. Clark, personal communication) and North Carolina (G.E. Fernandez, personal communication), but not in Massachusetts (P. Rizzo, personal communication).

With a minimal spray program, no significant incidence of foliar or cane diseases occurred in Oregon. With a commercial raspberry fungicide program in Lynden (WA), there were no foliar or cane disease symptoms. In Arkansas, 'Eclipse' was susceptible to diseases common in warm summer, high humidity environments such as anthracnose and in North Carolina, fusarium wilt (*Fusarium oxysporum* f. sp. *mori forma specialis* nov.) damaged plants.

As with all semierect or erect blackberry genotypes growing in the western United States, 'Eclipse' is susceptible to redberry mite (*Acalitus essigi*) and spotted winged drosophila (*Drosophila suzukii*).

'Eclipse' is a thornless, semierect blackberry that produced good yields of firm and excellent-flavored fruit that should be well suited to fresh market production in the early season for a semierect blackberry. 'Eclipse' had high yields and larger, better-flavored, or firmer fruit (or a combination of these) than cultivars currently ripening in this season. Although 'Eclipse' is expected to be adapted to areas where other semierect blackberries (e.g., 'Chester Thornless', 'Triple Crown') can be successfully grown, it should be trialed in colder regions before being widely planted.

Microsatellite analysis using a fingerprinting set of eight simple sequence repeat markers (Zurn et al., 2018) indicated either sampling error or inaccurate pedigree. We re-collected leaf samples from four 'Eclipse' plants and from grandparents of the possible parent based on notes in the crossing records. Repeated microsatellite analysis confirmed that the actual parents were ORUS 1392-1 and 'Triple Crown', and the alleles amplified in 'Eclipse' were found in the grandparents ('Illini Hardy' and 'Chester Thornless') or the other parent 'Triple Crown' (Table 8).

'Eclipse' nuclear stock has tested negative for *Arabis mosaic virus*, *Cherry leaf roll virus*, *Cherry rasp leaf virus*, *Prunus necrotic ringspot virus*, *Raspberry bushy dwarf virus*, *Raspberry ringspot virus*, *Strawberry necrotic shock virus*, *Tobacco ringspot virus*, *Tomato black ring virus*, and *Xylella* by ELISA. It also tested negative for *Apple mosaic virus*, *Blackberry chlorotic ringspot virus*, *Beet pseudo yellows virus*, *Blackberry virus E*, *Blackberry virus X*, *Blackberry virus Y*, *Blackberry yellow vein–associated virus*, *Black raspberry necrosis virus*, *Impatiens necrotic spot virus*, *Raspberry latent virus*, *Raspberry leaf mottle virus*, *Rubus yellow net virus*, *Strawberry latent ringspot virus*, *Tomato ringspot virus* in reverse transcriptase polymerase chain reaction assays and for phytoplasmas and *Xylella* in PCR assays. It was also negative in bioassays when it was grafted onto *R. occidentalis* 'Munger'.

When this germplasm contributes to the development of a new cultivar, hybrid, or germplasm, it is requested that appropriate recognition be given to the source. Further information or a list of nurseries propagating 'Eclipse' is available on written request to Mary Peterson. The USDA-ARS and Oregon State University do not sell plants. In addition, genetic material of this release has been deposited in the National Plant Germplasm System as CRUB 2802 (PI 682659), where it will be available for research purposes, including development and commercialization of new cultivars.

Table 8. Genetic profiles of the grandparents 'Illini Hardy' and 'Chester Thornless', the male parent 'Triple Crown', and the offspring 'Eclipse' at each of the eight simple sequence repeat (SSR) markers in the blackberry fingerprinting set (Zurn et al., 2018). Allele composition for all four genotypes is listed for each SSR.

Genotype	RH_MEa007aG06			Ro942				RH_MEa0008cF01				RH_ME0013dA06			
Chester Thornless	107	127	139[y]	100	110	224	138	134	143	152[y]		218	227		
Eclipse	127	139[y]	142[z]	124[z]	138			143	146[z]	152[y]		227	233[y]		
Illini Hardy	107	127	136	110	138			134	143	149		227	233[y]		
Triple Crown	107	127	142[z]	124[z]	132	138		134	143	146[z]	155	216	218	227	230

Genotype	RH_MEa0006bG05			ERubLRSQ_07-4_D05	RH_MEa0015cE06			RH_MEa011dG03a		
Chester Thornless	264[y]	275[y]	281	240	232[y]	249	335	241	347	350
Eclipse	264[y]	275[y]	281	240	232[y]	249	341	350		
Illini Hardy	264[y]	275[y]		240	249	249	341	344	350	
Triple Crown	281			240	244	249	341	350		

[z]Alleles shared only with 'Triple Crown'.
[y]Alleles inherited from one or both grandparents ('Illini Hardy' or 'Chester Thornless').

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