‘Polares’ Blackcurrant

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Polares is a new blackcurrant (*Ribes nigrum* L.) cultivar released from the *Ribes* breeding program conducted for many years at the Research Institute of Pomology and Floriculture (now the Research Institute of Horticulture) in Skierniewice, central Poland (Pluta et al., 2000; Pluta and Żurawicz, 1993, 2009). Bushes of ‘Polares’ have a low-plant vigor, upright plant habit, and are moderately productive. They have low susceptibility to economically important leaf diseases and are resistant to the blackcurrant gall mite (*Cecidophyopsis ribis* Westw.). Gall mite (not found yet in the United States) is the most serious pest of blackcurrant, especially in Europe and New Zealand, devastating its flower and leaf buds and spreading the *Blackcurrant reversion virus* (Brennan et al., 2008). ‘Polares’ is resistant to the powdery mildew (American gooseberry mildew) (*Sphaerotheca mors-uvae* Schwein./Berk. et Curt.), moderately susceptible to anthracnose (*Drepanopeziza ribis* Kleb.) and slightly susceptible to white pine blister rust (*Cronartium ribicola* Fish.). Fruit of ‘Polares’ are rather small, with a medium level of soluble solids and acidity, and are very rich in anthocyanins and ascorbic acid. ‘Polares’ is a late-season cultivar, which requires fertile soils for successful fruit production. Fruit of ‘Polares’ can be easily collected by different types of harvesters.

Origin

‘Polares’, tested as PC-7/13, is a seedling from a S12/3/83 × EMR 1834/113 cross made at the Fruit Breeding Department of the Research Institute of Pomology and Floriculture, Skierniewice, Poland. Crossing of parental forms was made in Spring 1994, by S. Pluta, and the seedling, from which the cultivar was developed, was selected in 1999. The female parent, S12/3/83, originated from the blackcurrant breeding program conducted by R. Brennan at the James Hutton Institute (formerly the Scottish Crop Research Institute – SCRI) in Invergowrie, Dundee, UK. It derives

from an open pollinated (op) progeny of C2/1/62, an old breeding lines from a complex cross {Ben Nevis × [(Baldwin × unknown redcurrant) op]} × {N40/15 × [(Baldwin × unknown redcurrant) op.]} made by Malcolm Anderson at SCRI in the mid-1970s. S12/3/83 was a seedling with fairly good agronomic traits, including a very upright habit from the maternal parent. However, as for most of the progeny, berry size was small and the fruit quality only average in terms of anthocyanin and vitamin C content (R. Brennan, personal communication). The male parent, EMB 1834/113, was obtained from the East Malling Research Station, Maidstone, Kent, England (now East Malling Research) by Knight et al. (1974). EMB 1834/113 inherited a dominant *Ce* gene, controlling resistance to gall mite. This gene was introduced to blackcurrant from gooseberry (*Ribes grossularia* L.). Large-fruited, self-fertile blackcurrants of commercial potential were obtained in the third backcross (Keep et al., 1982; Knight et al., 1974). In the agroclimatic conditions of Poland both parental cultivars differ in many traits determining their productive value.

The cross pollination was intended to produce late-season genotypes combining high productivity and good fruit quality as well as low susceptibility to leaf diseases and high resistance to gall mite. Seedling plants of the cross were planted in the selection field of the Experimental Orchard of the Research Institute of Pomology and Floriculture at Dąbrowice (central Poland) in Spring 2000. ‘Polares’ was selected for its good fruit productivity, upright plant habit, good fruit quality, and high resistance to fungal diseases in July 2006 by S. Pluta. The name of ‘Polares’ derives from initial letters of words—Poland and resistance.

Description and Performance

‘Polares’ has been tested in a field trial at the Experimental Orchard in Dąbrowice, Poland. The cultivar trial was established in Autumn 2002 and was conducted until 2010. In the experiment beside ‘Polares’ nine other cultivars were planted. These cultivars were or are commonly grown in Poland, including ‘Öjebyn’ and ‘Ben Lomond’, which served as the standards. Cultivars grown in the experiment are shown in the tables (Tables 1–3), and they are arranged according to their fruit ripening time. The experiment was conducted on a soil of medium fertility, forecrop was a mustard-green manure. It was established in a random block design, in three replications.

Bushes of all cultivars were planted in a density of 3.0 × 0.75 m, with five bushes on a plot. All management practices were applied as recommended for commercial blackcurrant plantations in Poland. No plant protection against main diseases was conducted and only very limited sprayings against aphids and red spider mite were applied.

Observations and measurements included plant growth, flowering and harvesting time, fruit yield, fruit size, chemical composition of fruit, and susceptibility of plants to leaf diseases. Results as the averaged values for 5 years of full cropping (2006–10) are presented in tables (Tables 1–3).

Bush growth and flowering. ‘Polares’ is characterized by a low-plant vigor shown by the bush size index (width × height of the bush) and for this cultivar is only 1.66 m² (Table 1). The trial shows that ‘Polares’ is significantly less vigorous than the standard cultivar Öjebyn (2.21 m²), and also has smaller bush size index than most of the cultivars evaluated in the trial; however, its vigor is similar to the second standard cultivar Ben Lomond (1.87 m²). This indicates that ‘Polares’ requires fertile soils and provision of good cultivation measures on the plantations. ‘Polares’ also has a high plant habit index (0.75), which is significantly higher than that of both ‘Öjebyn’ and ‘Ben Lomond’ (0.63 and 0.61, respectively). It shows that ‘Polares’ has a compact and upright plant habit (Fig. 1). Leaves of ‘Polares’ are of medium size, five-lobed, and light green, with an extended center lobe (Fig. 2). The inflorescences are single and/or double, of medium-length. In central Poland, the bloom period of ‘Polares’ is medium-late (end of April or beginning of May depending on the year). In that regard ‘Polares’ is similar to ‘Ben Lomond’ and 4–5 d later than ‘Öjebyn’.

Harvest date, yield, and fruit size. ‘Polares’ is a late-ripening cultivar. Under the agroclimatic conditions of central Poland its fruit ripen in the second half of July, on average 8 d later than the fruit of ‘Öjebyn’ and 2 d later than the fruit of ‘Ben Lomond’ (Table 1). ‘Polares’ is highly self-fertile, similar to the standard cultivars Öjebyn and Ben Lomond and it produces similar yields as both standard cultivars. However, ‘Polares’ is significantly less productive than the Polish blackcurrant cultivars tested in this experiment, such as Tisel, Tiben, and Ruben, which are also characterized by much greater plant growth vigor (Pluta and Żurawicz, 2002, 2004). In the experiment, fruit were picked by hand and the average fruit yield of ‘Polares’ was 1.45 kg/bush (≈7.2 t·ha⁻¹). It was similar to the fruit yield harvested from plants of ‘Öjebyn’ (1.75 kg/bush) and ‘Ben Lomond’ (1.77 kg/bush), but almost 50% less than for three other Polish cultivars—Tisel, Tiben, and Ruben. The mature bush requires regular pruning, which stimulates an intensive growth of new shoots. Fruit of ‘Polares’ ripen uniformly within the strig and the bush, so machine harvest is easy.

For evaluation of fruit size, samples of about 1.5 kg of berries were collected from

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Table 1. Origin, plant growth, flowering, harvest date, and cropping of 'Polares' in comparison with other blackcurrant cultivars (Skierniewice, average for 2006–10; n = 150).

Cultivar	Country of origin	Plant growth		Full flowering time	Harvest date	Fruit yield (kg/bush)
		Bush size index ^x (m ²)	Bush habit index ^y			
Tisel	Poland	2.41 ef	0.73 de	26 Apr.	10 July	2.81 d
Öjebyn	Sweden	2.21 de	0.63 ab	28 Apr.	12 July	1.75 abc
Ben Gairn	United Kingdom	1.31 a	0.72 cde	29 Apr.	14 July	1.04 a
Ores	Poland	2.30 ef	0.62 a	28 Apr.	16 July	2.11 bcd
Ben Lomond	United Kingdom	1.87 bc	0.61 a	2 May	18 July	1.77 abc
Tiben	Poland	2.74 g	0.65 ab	30 April	18 July	2.55 cd
Foxendown	United Kingdom	2.04 cd	0.66 abc	30 April	18 July	1.23 ab
Ruben	Poland	2.49 f	0.69 bcd	3 May	19 July	2.96 d
Polares	Poland	1.66 b	0.75 e	2 May	20 July	1.45 ab
Ben Hope	United Kingdom	2.02 cd	0.73 de	3 May	22 July	1.49 ab

^xIndex calculated as bush height × width (m²).^yIndex calculated as bush height/bush width.^zMeans within columns marked with the same letter do not differ significantly at $P \leq 0.05$ according to Duncan's multiple range test.

Table 2. Fruit size and content of chemical compounds in fruit of 'Polares' in comparison with other blackcurrant cultivars (Skierniewice, average for 2006–10; n = 150).

Cultivar	Fruit wt of 100 berries (g)	Soluble solids (%)	Acidity (%)	Anthocyanins (mg/100 g)	Ascorbic acid (mg/100 g)
Tisel	92.8 c ^z	19.3 d	3.18 c	332.2 a	298.2 d
Öjebyn	75.2 b	16.9 bc	2.88 b	323.2 a	112.8 a
Ben Gairn	92.7 c	16.9 bc	2.78 ab	326.0 a	128.0 a
Ores	83.5 bc	15.3 a	3.72 e	331.4 a	224.4 c
Ben Lomond	92.0 bc	16.7 bc	3.47 d	367.4 ab	233.8 c
Tiben	85.3 bc	17.7 c	3.83 e	361.4 ab	180.6 b
Foxendown	61.3 a	16.2 ab	2.77 ab	362.8 ab	196.2 b
Ruben	103.4 d	16.9 bc	3.46 d	336.2 a	183.4 b
Polares	61.8 a	15.4 a	2.58 a	406.4 b	283.0 d
Ben Hope	91.1 c	16.1 ab	3.21 c	376.2 ab	197.2 b

^zMeans within columns marked with the same letter do not differ significantly at $P \leq 0.05$, according to Duncan's multiple range test.

Table 3. Susceptibility to leaf diseases of 'Polares' in comparison with other blackcurrant cultivars (Skierniewice, average for 2007–10; n = 150).

Cultivar	Powdery mildew ^z	Anthracnose ^z	White pine blister rust ^z
Tisel	1.00 a ^y	2.64 a	1.00 a
Öjebyn	1.00 a	3.15 abc	2.76 d
Ben Gairn	1.00 a	2.67 a	1.83 bc
Ores	1.00 a	2.66 a	1.05 a
Ben Lomond	2.86 b	3.19 abc	2.20 c
Tiben	1.00 a	3.58 c	1.70 b
Foxendown	1.00 a	3.31 bc	1.69 b
Ruben	1.00 a	2.92 ab	1.00 a
Polares	1.00 a	3.02 abc	1.58 b
Ben Hope	1.00 a	3.31 bc	3.02 d

^zRanking scale (1–5), where 1 = no visible symptoms of infection, 3 = moderate infection, and 5 highest infection.^yMeans within columns marked with the same letter do not differ significantly at $P \leq 0.05$, according to Duncan's multiple range test.

each plot, from which three samples of 100 fruits were randomly chosen, and then the average fruit weight (in g) was calculated. As shown in Table 2 and Fig. 2, 'Polares', similar to the British cultivar Foxendown, produces small fruit, significantly smaller than the fruit of all other cultivars in the trial.

In another trial conducted at the Experimental Orchard at Dąbrowice near Skierniewice, Poland, the suitability of 'Polares' for machine fruit harvesting was studied from 2009 to 2012. The research was carried out on a 3.0-ha trial plantation including several Polish cultivars (Tisel, Tiben, Ores, Ruben, Tines, Gofert, and Polares), as well as two standard cultivars: Öjebyn and Titania. The

plantation was set up in Autumn 2005 and bushes were planted at a spacing of 3.8 × 0.5 m, separately in adjacent rows, each 250 m long and containing 500 bushes. The experiment had a randomized block layout with four plots (replicates) of 50 plants each. Fruit harvesting was carried out with the use of the self-propelled Polish made harvester (type KPS-4B, Research Institute of Pomology and Floriculture, Skierniewice, Poland). An average fruit yield for 'Polares' of 5.3 t·ha⁻¹ was achieved, very similar to 'Öjebyn' (4.9 t·ha⁻¹) and 'Titania' (5.7 t·ha⁻¹). The combined fruit harvesting efficiency of 'Polares' was above 96%. The shoots of 'Polares' were sufficiently flexible, which allowed the fruit to be shaken

Fig. 1. Bush of *Ribes nigrum* 'Polares'. Fig. 2. Leaf and strigs with fruits of *Ribes nigrum* 'Polares'.

from the bush. No visible symptoms of shoot damage caused by the harvester have been observed (data not shown).

Chemical composition of fruit. Content of chemical compounds comprised soluble solids (%), acidity (%), anthocyanins (mg/100 g of fresh fruit) and ascorbic acid (mg/100 g of fresh fruit) (Table 2). For chemical analysis, samples containing about 1.5 kg of fully matured fruit were collected randomly at harvest from each plot. Collected fruit were washed, sealed inside plastic bags, and frozen at -25 °C. Before analysis, the samples were disintegrated in a frozen state and mixed thoroughly to obtain uniform material. In the case of organic and ascorbic acid determination, the frozen material was homogenized in 6% HPO₃ solution and, after filtration, analyzed by high-performance liquid chromatography using a Hewlett-Packard 1100 chromatograph equipped with two Supelco LC-18 25 columns in sequence. For the determination of anthocyanins, calculated as cyanidin-3-O-rutinoside/100 g of raw material, the extinction coefficient for the calculation was 28,800 and the molecular weight 595 (Kapasakalidis et al., 2006; Wrolstad, 1976). Content of soluble solids, anthocyanins, titratable acidity, and ascorbic acid were analyzed in five consecutive seasons (2006–10) and average results are presented in

Table 2. Fruit of 'Polares' are not rich in soluble solids (15.4%). The berries contain significantly less of these compounds than two standard cultivars Öjebyn (16.9%) and Ben Lomond (16.7%) and much less than, for example, Tiben (17.7%) or Tisel (19.3%). Fruit of 'Polares' are also low in acidity (2.58%), significantly lower than the standard cultivars Öjebyn (2.88%) and Ben Lomond (3.47%) and most of the other cultivars tested in this experiment. However, fruit of 'Polares' are very rich in anthocyanins and ascorbic acid. In terms of the content of anthocyanins, 'Polares' (406.4 mg/100 g of fruit) significantly exceeds the two standard cultivars. In regard of ascorbic acid, 'Polares' (283.0 mg/100 g of fruit) is also significantly better than other cultivars in this experiment with the exception of Tisel, well known for its high content of ascorbic acid in fruit (Pluta and Żurawicz, 2002).

Frost, pest, and disease susceptibility. The bushes of 'Polares' are winter hardy. Until now in Poland, no frost damage on shoots has been observed, even if winter temperatures were very low (−30 °C) and snow cover was not always present. However, flower buds, flowers, and fruit sets of 'Polares' suffer from late-spring frosts. Susceptibility to fungal diseases included powdery mildew, anthracnose, and white pine blister rust. For evaluation of these diseases, a ranking scale (1–5) was used, where 1 = no visible symptoms of infection, 3 = moderate symptoms of infection, and 5 = highest symptoms of infection, and the results are presented in Table 3. Based on the average results (2007–10), 'Polares' is resistant to the powdery mildew, similar to the other cultivars evaluated in the trial except Ben Lomond, which was moderately affected by the pathogen. None of the tested cultivars was resistant to anthracnose; however, significant differences were evident. In that respect, 'Polares' was classified as moderately affected by the disease (3.0 points on the 1–5

ranking scale), quite similar to both standard cultivars. More pronounced differences between the evaluated cultivars were observed in the susceptibility to white pine blister rust. 'Polares' was classified as slightly susceptible (1.58 points on the 1–5 ranking scale) and was significantly less susceptible than both standard cultivars—Öjebyn' (2.76) and Ben Lomond (2.20). Of the tested cultivars, only Tisel, Ores, and Ruben were resistant to this pathogen. In the trial, 'Polares' was only slightly affected by red spider mite (*Tetranychus urticae* Koch.); however, in some years 'Polares' showed medium susceptibility to blackcurrant aphid (*Cryptomyzus ribis* L.) and blackcurrant stem midge (*Resseliella ribis* Marik.) (data not included). In another field trial, conducted in three consecutive years from 2008 to 2010 at the Experimental Orchard in Dąbrowice, Poland, 'Polares' was grown among blackcurrant bushes heavily affected by gall mite. No symptoms of gall mite infestation were observed on 'Polares' bushes (Łabanowska and Pluta, 2010). Molecular analyses performed at the James Hutton Institute showed that 'Polares' contains the major *Ce* gene, which confers the full resistance against this pest (R. Brennan, personal communication).

Availability

'Polares' has been registered and included in the Polish National List of Fruit Plant Varieties by the Polish Research Center for Cultivar Testing (*in Polish* Centralny Ośrodek Badania Odmian Roślin Uprawnych). In Europe, 'Polares' is protected by Community Plant Variety Rights. At the end of 2012, applications were submitted to the United States Patent and Trademark Office in the United States (application number: US 61/848,162) for plant patents, and to the Canadian Food Inspection Agency for Plant Breeders Rights in Canada (application number: 12-7833). Certified 'Polares' plants are

being already propagated by a licensed nursery in the United States, the names of which will be supplied on request. Growers and nurseries interested in cultivating or propagating this cultivar in the United States and Canada may contact Greg Quinn, Walnut Grove Farm, LLC, 59 Walnut Lane, Staatsburg, NY 12580; E-mail: ghquinn@Currants.com.

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