

TARNISHED PLANT BUG INJURY ON SIX STRAWBERRY CULTIVARS

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Fruit Varieties Journal 47(3):137-142 1993

Breeding of Fruit Crops in Poland

T. JAKUBOWSKI¹

Abstract

The main centre of fruit breeding in Poland is the Research Institute of Pomology and Floriculture in Skierniewice. Breeding work began there almost 40 years ago. Minor breeding programs are also conducted by Agricultural Academies in Warsaw, Poznań and Lublin. The breeding objectives for almost all fruit crops are similar: adequate winter hardiness, resistance to serious diseases and/or pests, high productivity, good eating and processing quality. As a result of controlled hybridization and local selection, over 40 cultivars have been introduced and many advanced selections show enough promise to be named and released soon.

Introduction

Poland is a medium size, mid-European country situated between the

Baltic Sea and Carpathian Mountains, from 49° to 52°N latitude. Poland lies in the temperate zone, but its climate is too cold for wide commercial production of grapes, apricots or peaches.

According to long-term meteorological observations taken at Skierniewice, every second winter in average the minimum temperature reaches or surpasses -20°C. Once every 10-15 years, very severe winters occur with temperatures dropping below -30°C.

Major fruit crops grown in Poland include apples, strawberries, black currants, tart cherries, plums and pears. Average yearly production calculated

¹Research Institute of Pomology and Floriculture 96-100 Skierniewice, Poland.

in thousands of metric tonnes during the period of 1981-1985 is as follows: apples, 1508; strawberries, 198; currants, 153; plums, 135; and pears, 102. Following the last severe winter of 1986-1987 almost 50% of all fruit trees in Poland were killed or seriously injured. This loss emphasized the need for developing new, more hardy cultivars for all tree fruit species grown in Poland.

Fruit Breeding

Poland does not have a long fruit breeding tradition. Systematic breeding work began at the Institute of Pomology in Skierniewice a few years after its establishment in 1951. Breeding of apple cultivars and rootstocks was initiated early on and then expanded to include: apricot, peach, tart and sweet cherry, pear, black currant, strawberry, raspberry and plum.

By 1992, active breeding programs were devoted only to apple, plum, black currant, strawberry and raspberry. Fruit breeding programs were or are also carried out by Agriculture Academies in Warsaw (apple and blueberry), Poznań (apple and tart cherry) and Lublin (strawberry). There are only a few amateurs conducting limited breeding and selection of fruit crops. Since 1987, all cultivars recommended for production must be included in the Cultivar Register and newly introduced cultivars can be protected by law.

As a result of almost 40 years of breeding and selection, many new cultivars have been developed (Table 1). New cultivars are readily accepted and grown by private Polish farmers. There is also an international interest in some of this material, especially the dwarf apple rootstocks P 22 and P 16, apple cultivars: 'Ligol,' 'Lodel,' 'Alwa' and the primocane raspberry 'Polana.'

Apple

Dr. A Rejman initiated the first apple breeding work at Skierniewice in the

early 1950's and his work was later continued in the 1970s by Drs. S. W. Zagaja and A. Przybyla. The early breeding objective was to develop new cultivars well adapted to Polish growing conditions, and preferably of early or late ripening fruit. The main objective for the current program is to introduce resistance to apple scab (*Venturia inaequalis* (Cke.) Wint.) and powdery mildew (*Podosphaera leucotricha* (Ell. & Ev.)). Five cultivars have been developed so far:

'Primula'—this preliminary name obtained the PRI 1255-100 selection in early 1970s. 'Primula' was used mainly for breeding purposes as a source of scab resistance. It has tasty and attractive but very small fruit.

'Fantazja' ('McIntosh' x 'Linda') has very tasty fruit, but has a tendency for biennial bearing. Marketing season is from November to January.

'Alwa' ('Macoun' seedling) was obtained in 1950s and tested as I-96. It is a winter hardy, vigorous cultivar. Marketing season is from late December to early May.

'Lodel' ('Lobo' x 'Red Spur Delicious') was selected in 1979 and then tested as VI-132-D2. It possesses high resistance to apple scab. Marketing season is from November to January.

'Ligol' ('Linda' x 'Golden Delicious') was selected in 1979 and tested as XIX-148-D1. 'Ligol' possesses tolerance to apple scab, has large fruit of 'Golden Delicious' type but with more blush. Marketing season is from February to May. Trees of 'Ligol' are rather vigorous and should be preferably propagated on dwarf rootstocks.

'Redcroft' ('1295-100' x 'Bankcroft') was selected in 1980 and then tested as VI-17-D2. 'Redcroft' has tasty, attractive fruit and is only slightly infected by apple scab. Marketing season is from December to March.

Table 1. List of fruit and nut cultivars bred or selected in Poland.

Species	Cultivars and clones
Cultivars	
Apple	Fantazja, Primula ⁽¹⁾ , Delikates, Alwa, Lodel,° Ligol,° Witos ⁽¹⁾ , Sawa ⁽¹⁾ , Redkroft
Plum	Wegierka Lowicka ⁽²⁾ , Wegierka Dabrowicka
Pear	Albigowianka, Bojniczanka, Bratanka, Hnidzik, Siowianka
Sweet cherry	Lotka Trzebnicka ⁽²⁾
Tart cherry	ISS: 189 (Wanda), 289 (Sabina), 389 (Lucyna) PPR: 188, 288, 388, 488, 588, 688, 788, 888, 988
Peach	ISS: 191, 291,° 391, 491
Apricot	Somo
Walnut	Albi ⁽²⁾ , Resovia ⁽²⁾ , Dodo ⁽²⁾ , Silesia ⁽²⁾ , Targo ⁽²⁾ , Tryumf ⁽²⁾
Hazelnut	Syrena ⁽²⁾
Black currant	Bona,° Ceres°
Raspberry	Beskid, Polana°
Strawberry	Kama, Dukat, Paula, Real, Syriusz,° LGR: 190,° 290,° 390°
Lingonberry	Masovia ⁽¹⁾⁽²⁾
Rootstocks	
Apple	P.1, P.2, P.13 ⁽¹⁾ , P.14, P.16, P.18 ⁽¹⁾ , P.22, P.60, Polan 59°
Quince (for pear)	S1 ⁽¹⁾⁽²⁾ , S3 ⁽²⁾
Mahaleb (for tart cherries)	Piast ⁽²⁾ , Popiel ⁽²⁾
Peach	Rakoniewicka ⁽²⁾ , Mandzurska

¹Not applied for registration by the end of 1992.²Local selection.

°Cultivars or clones for which breeders rights applications have been made.

Apple mutation breeding was conducted at Skierniewice for about a decade in 1970s but appeared to be less effective than traditional breeding and was discontinued.

The apple breeding program for scab resistance at Warsaw Agriculture University-SGCW was started in 1975. Two advanced selections under the names 'Witos' and 'Sawa' are now tested in advanced country trials.

'Witos' ('Fantazja' x 'Primula') was selected in 1983 and tested as U 1111. 'Witos' is resistant to apple scab and has big, tasty fruit. Marketing season is from September to October. Trees of 'Witos' are vigor-

ous and should be propagated exclusively on dwarf rootstocks.

'Sawa' ('Fantazja' x 'Primula') was selected in 1985 and then tested as U 1127. 'Sawa' is resistant to apple scab and has very attractive, tasty fruit. Marketing season is from September to December.

As a result of breeding works carried out at the Agriculture Academy in Poznań, one cultivar has been obtained:

'Delikates' ('James Grieve' x 'Cortland') was bred by Dr. M. Maćkowiak. It is a moderately vigorous, productive cultivar; marketing season from September to January.

Pears

As a result of selection carried out at Albigowa Experimental Field Station situated in southeast part of Poland, five promising clones have been obtained. They were reported to the Cultivar Register in 1992 and will pass to country wide trials.

Plums

In Poland, only European-type plums can be grown and among them, plums of 'Wegierka' type ('Common Prune' type) are the most popular. 'Wegierka Lowicka' originated as a chance seedling and was found in central Poland. This is a very productive, early ripening plum, but its main disadvantage is high susceptibility to plum pox virus (PPV).

'Wegierka Dabrowicka' originated from open pollinated seed of 'Wegierka Zwykła,' it has larger fruit size and is more tolerant to PPV. An active plum breeding program at the Research Institute of Pomology and Floriculture was initiated in 1991, to develop new cultivars with tolerance or possibly resistance to PPV (sharka). Other traits of interest include improved hardiness, productivity, self-fertility, size and quality of fruit.

Tart Cherries

Lutówka' (considered to be equivalent to 'Schattenmorelle') and its sub-clones are the most widely grown tart cherries in Poland. It accounts for 70% of all tart cherry production. With the aim to obtain new cultivars with different ripening periods and increased tolerance to diseases, the breeding program was started at the Research Institute of Pomology and Floriculture in 1968. Three leading cultivars: 'Lutówka,' 'Nefris,' and 'Köröser' were crossed with cultivars of different origins. From a population of 1500 seedlings, several promising individuals were selected and tested in a replicated trial (4). The three most promising clones, named: 'Lucyna,' 'Sabina,' and 'Wanda' were placed in advanced country wide trials.

Tart cherry breeding is also conducted at the Agriculture Academy in Poznań. Ten clones from this program were advanced to country wide trials.

Peaches

Peaches are grown commercially on a small scale in the warmest, southwest part of Poland. There are, however, many people interested in growing peaches in home gardens, in spite of the risk of irregular cropping. The breeding project, with the goal to develop winter hardy peaches, was started at Skierniewice in 1964 (7). Winter hardy Chinese selections, namely: 'Hui-hun-tao' and 'Winter Peach,' brought by Dr. S. Pieniazek from China in 1957, were crossed with several commercial cultivars. The most promising F₁ hybrids were either selfed or backcrossed and the F₂ generation was grown in the field. Some F₂ hybrids appeared to be good enough for introduction and registration in the Register of Cultivars. The most attractive, yellow-fleshed clone 'No. 571' (ISS 291) possesses greater winter hardiness than 'Redhaven' peach (3).

Peach breeding was partially supported financially by the USDA until 1984. The program was discontinued two years later, but some of the F₃ hybrids were maintained for further evaluation.

Apricots

The first small active apricot breeding program was initiated by K. Somowski at Skierniewice in 1952 (5), with the objectives to develop winter hardy cultivars and broaden the genetic variability. The second stage of breeding program aiming at developing late blooming apricots was initiated in the mid 1960's.

This program was discontinued in 1984 because of lack of expected progress and lack of financial support. Some F₃ generation seedlings flowered 7 to 10 days later than commercial cultivars, but unfortunately bore small fruit.

Apricot breeding work has resulted in the introduction of the 'Somo' cultivar. 'Somo' (XI-NS-5 x Rakovsky) is a late ripening cultivar with a high wood and bud hardiness but producing small fruit size.

Walnut

Throughout the southern part of Poland runs the boundary of natural distribution of walnut (*Juglans regia*). Surveys of the local seedlings of walnut were conducted during the period of 1968-1970. From the population of about ten thousand trees a total of 54 were selected. From that number 25 selections have been established in the collection orchard at Albigowa Field Station. Six from them have been named and reported into the Cultivar Register in 1992.

Black Currant

Poland is the biggest world producer of black currants. Fruit production has increased since mechanical harvesting was introduced.

A small black currant breeding program was initiated by K. Somorowski at Skierniewice in the early 1960s, and later on was continued by Dr. J. Gwozdecki. As a result of this work two cultivars: 'Bona' and 'Ceres' suitable for home gardens were released in the late 1980s. 'Bona' (tested as 72/69) is an early cultivar characterized by large sized and tasty fruit. 'Ceres' (tested as 76/69) carrying resistance to gall mites.

A new systematic breeding program was initiated in the late 1980s. The goal is to develop new cultivars suitable for mechanical harvesting and with resistance to spring frosts, powdery mildew (*Sphaerotheca mors-uae* (Schw.) Berk., anthracnose (*Drepanopeziza ribis* (Kleb.) von Höhn.) white pine blister rust (*Cronartium ribicola* Fisch.) and black currant gall mite (*Cecidophyopsis ribis* (Westw)), a major vector of reversion disease.

Raspberries

Raspberry breeding is conducted by Dr. J. Danek at Brzezna Fruit Experimental Station located in the south of Poland. The breeding objectives include developing cultivars with resistance to low temperatures, and serious diseases, and are also suitable for mechanical harvesting.

By the end of 1992, two cultivars have been introduced. 'Beskid' is a traditional type of raspberry ripening in July, and distinguished by high productivity and good fruit quality (2). 'Polana' is a primocane type, ripening from the mid-August to the first days of November, or to the first autumn frosts (1).

Strawberry

Poland is one of the world's largest producers of strawberries. 'Senga Sengana,' bred near Berlin, Germany, is the most widely grown cultivar. It is a very productive cultivar, however fruits are soft, and often are infected with grey mold (*Botrytis cinerea*). It occupies more than 70% of total strawberry production.

Generally because of poor adaptability of foreign strawberry cultivars, none tested so far can be grown successfully. Therefore, breeding programs established in the early 1970s, focused on developing new cultivars suitable for harsh Polish environmental conditions, having different ripening periods, tolerance to grey mold, and suitable for freezing and processing.

By the end of 1992, five new cultivars were introduced. Four of these cultivars including 'Kama,' 'Dukat,' 'Real,' and 'Syriusz' were developed at the Research Institute of Pomology and Floriculture (11, 12) and the fifth 'Paula' was developed at the Agriculture University in Lublin. Three other selections developed at Skierniewice were placed in advanced country wide trials.

Apple Rootstocks

The apple rootstock breeding program was initiated by Dr. S. W. Zagaja in 1954. Hardy apple cultivars 'Antonovka' and 'Longfield,' were crossed with M.9, M.4, and M.11. Several promising selections were identified mainly among the 'Antonovka' progeny, and all were designated with the P letter (7). The parentage of these rootstocks is as follows: P.1 (M.4 x 'Antonovka'), P.2 and P.22 (M.9 x 'Antonovka'), P.13 ('Longfield' x M.4), P.14 (M.9 x open pollination), P.16 ('Longfield' x M.11), P.18 ('Antonovka' x M.4).

The most dwarfing of these P.22 rootstock has growth control characteristics comparable to M.27; P.16 is comparable to M.9; P.2 is more vigorous than M.9, and P.1 and P.14 are comparable to M.26. Vigorous P.18 is not recommended for intensive orchards in Poland.

The second stage of rootstock breeding began in 1968. Among hybrids obtained during the period of 1968-1972, several promising individuals have been selected (9). Rootstock P.60 has been recently introduced into commercial production (10). Polan 59 is still being tested in advanced trials. Both rootstocks originated from a cross between A.2 and Budagovski 9 and have purple colored leaves, wood, and root tissues. Scions grafted on P.60 are more vigorous than those grafted on M.9. Scions grafted on Polan 59 are less vigorous than those grafted on M.9.

During the period of 1975-1979, over 40 crossings have been made (8), and over 25 thousand seeds were obtained. Produced seedlings were inoculated with water suspension of zoospores and mycelia of *Phytophthora cactorum*. Over 5800 seedlings that survived inoculation were planted into a breeding nursery. Plants that were susceptible to mildew, having many spines and

rated as poor rooters were discarded. From this population, over 50 promising clones were selected; 16 from them passed to orchard test and another 20 clones are currently tested in a stoolbed.

Acknowledgements

I would like to thank Dr. R. E. C. Layne from the Agriculture Canada Harrow Research Station, Harrow, Ontario, Canada, for encouraging me to prepare this paper, for his assistance in revising the manuscript and valuable comments.

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