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VALORIZATION OF AUTOCHTHONOUS FRUIT GENETIC RESOURCES IN ITALY: GENETIC TRAITS FOR BREEDING PROGRAMMES

by Carlo Fideghelli, Petra
Engel

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The Italian competence on Plant Genetic Resources (PGR) for food and agriculture is shared between the Ministry of Agriculture (MiPAAF) and the Regions which, thanks to the Rural

Development Programmes (RDP) 2000-2006 and 2007-2013, have taken advantage of important financial support to dedicate to activities targeted at the realization of the objectives set out in the different international agreements to which Italy is a Member State.

The FAO International Treaty (IT) on PGR for food and agriculture has been ratified by Italy in 2004; the respective national law entrusts the competences to achieve the objectives of the Treaty to Regions and autonomous Provinces. The Ministry of Agriculture maintains the international coordination, while regional activities are dedicated to the recovery, characterization, conservation and valorization of PGR. The new Rural Development Programme 2014-2021 will continue to support the national activities in this regard.

After the CNR (Consiglio Nazionale delle Ricerche) project coordinated by Scaramuzzi in the 1980es which resulted in the first national inventory of the fruit genetic resources present in Italy, currently the most important national project on PGR, financially supported since 2004 by the MiPAAF, is coordinated by CRA-Centro di Ricerca per la Frutticoltura of Rome and includes 27 CRA (Council for Agricultural Research and Economics) structures, the CNR - Institute of Biosciences and Bioresources in Bari and the NGO "Rete Semi Rurali".

In 2008, the MiPAAF also approved the National Programme on Agricultural Biodiversity (PNBA).

One of the most important aims of the project is the creation, maintenance and periodic updating of an Inventory of the plant genetic resources for food and agriculture conserved ex situ in Italy. The relative database is accessible via internet, through the portal PlantA-Res (<http://fru.entecra.it>), both in Italian and English.

In this paper, according to the consulted literature, the most interesting traits of the autochthonous varieties of the species almond, apple, apricot, sweet cherry, peach, pear and European plum are singled out.

As autochthonous varieties we consider the old varieties originated through natural or human selection within the Italian territory, mainly from open pollinated seedlings, almost all of unknown genetic origin.

According to the survey carried out, currently 19.665 accessions belonging to fruit species, are being conserved throughout the country (**tab.1**), being stone and pome fruits the two most important groups, followed by grape and olive.

Italy is the European country with the highest number of PDO (Protected Designation of Origin)and PGI (Protected Geographical Indication) productions; the plant products, according to MiPAAF records are 150 practically made of fruits, vegetables and olive oil. PDO and PGI products are widely based on autochthonous varieties or varieties grown in

the territory since long times and their commercialization under these international quality labels is one of the most important way of their valorization.

Concerning research activities, interest is mainly targeted at the detection within old varieties of positive agronomical and pomological traits to be utilized by breeders in order to offer attractive products to the consumers, give farmers new cultivation opportunities, while contributing to sustainable agricultural production.

Not few of the old autochthonous varieties are carrying traits of stress resistance (biotic and abiotic) and of fruit quality (flavor and nutraceutical components) which are of particular interest for breeding programmes.

Within stone fruits (**tab.2**) prevails the trait “low susceptibility to brown rot”, present in the five considered species for a total of 45 varieties; interesting is also the “tolerance to Plum Pox Virus (PPV)”, identified in 8 apricot and 5 peach varieties. The tolerance to the bombyx *Euproctis chrysorrhoea* is common to sweet cherry and European plum. The remaining considered resistances/tolerances refer to single species: apricot (*Tranzschellia pruni-spinosae*, *Xanthomonas pruni*, ACLR phytoplasma), sweet cherry (cherry fly, *Myzus cerasi* aphid), almond (*Fusicoccum amygdali*), peach and nectarines (leaf curl, powdery mildew, medfly), European Plum (several aphids, *Anarsia* sp.).

The resistance to medfly, singled out in the old canning clingstone variety *Percoca di Romagna 7*, so far unknown and characterized by a peculiar aromatic profile different from any other susceptible variety compared, is of particular importance.

Among the fruit and tree traits, interesting is the low chilling requirement of sweet cherry present in two varieties of which *Kronio* seems the most promising one, as it is, at the same time, also self-fertile and very early ripening. Low chilling requirement has also been found in 3 apricot varieties. Self-fertility is a trait frequently present in autochthonous almond varieties; almond cultivars from Apulia are the base of the modern world breeding for this trait.

Other positive traits of single species are: apricot (late blooming and white flesh, this last associated to a very good organoleptic quality), sweet cherry easy separation of the fruit from the peduncle (a trait recognized for the first time by Bargioni (1970) and which is becoming of increasing commercial importance), peach and nectarine (red flesh for the high anthocyanin content, and “stony hard” flesh for a better postharvest behaviour).

Apples and pears (**tab.3**) have several interesting traits in common (scab and powdery mildew resistance, resistance to codling moth and to *S. Josè* scale, red flesh). Other traits refer to the single species: apple (resistance to grey aphid, woolly aphid, AP phytoplasma; “spur” tree habit), pear (fire blight tolerance, resistance to pear psilla, low susceptibility to internal breakdown of early ripening varieties). Resistance and low susceptibility to scab controlled by several genes, is of particular importance to be associated to the vertical

resistance of the modern scab resistant varieties.

Numerous and of great interest are the varieties carrying resistance to codling moth and to pear psilla, both for their cultivation in organic farming systems and for breeding programmes. Red flesh is of great importance for human health and for market aspects.

Table 1: Accessions of fruit species conserved *ex situ* in Italy

Genus	Species (crops)	no. of accession	institutions
<i>Arbutus</i>	Strawberry Tree	5	Uni VT
<i>Actinidia</i>	Pau-pau	15	CRA-FRU
<i>Actinidia</i> (incl. botanic species)	Kiwi	241	CRA-FRU, Uni UD
<i>Carya</i>	Pecan	44	CRA-FRU
<i>Castanea</i> sp.	Chestnut	68	CRA-FRU, CRA-FRC, Uni TO
<i>Citrus</i> and similar	Citrus	603	CRA-ACM
<i>Corylus</i> sp.	Hazelnut	172	CRA-FRU, CRA-FRC, Uni TO, CNR FI
<i>Cydonia</i>	Quince	118	CRA-FRC, Uni BO, Uni PC, Uni VT, Uni FI, ALSIA
<i>Diospyros</i>	Perseimmon	188	CRA-FRC, Uni FI, Uni NA, CNR FI
<i>Eriobotrya</i>	Loquat	59	CRA-FRC, Uni VT, ALSIA
<i>Feijoa</i>	Feijoa	95	CRA-FRU, CRA-FRC, ALSIA
<i>Ficus</i>	Fig	114	CRA-FRU, CRA-FRC, Umbria Region, CNR SS, ALSIA, Archeologia Arborea
<i>Fragaria</i>	Strawberry	277	CRA-FRC, CRA-FRF, CRA-MPF, Uni AN, ALSIA
<i>Juglans</i>	Walnut	224	CRA-PAV, CRA-FRU, CRA-FRC, Uni NA, Uni TO
<i>Malus</i> (incl. botanic species and interspecific hybrids)	Apple	3.596	CRA-FRU, CRA-FRC, CRA-FRF, Scuola Malva, Umbria Region, Uni AN, Uni BO, Uni MI, Uni NA, Uni PA, Uni PC, Uni PD, Uni PI, Uni TO, Uni UD, Uni VT, CNR FI, CNR SS, CRPV, LAIM, ERSA, ASSAM, Sesiva, Archeologia Arborea, Veneto Agricoltura
<i>Olea</i>	Olive	883	CRA-PAV, Uni PG, CRA-OLI, Uni BA, Umbria Region
<i>Opuntia</i>	Cactus pear	3	CRA-FRC
<i>Persea</i>	Avocado	17	CRA-FRC, ALSIA
<i>Pistacia</i>	Pistachio	48	CRA-FRU
<i>Prunus</i> (incl. botanic species and interspecific hybrids)	Apricot, Cherry, Almond, Peach, Plum	6.700	CRA-PAV, CRA-FRU, CRA-FRC, CRA-FRF, CRA-SCA, Uni BA, Umbria Region
<i>Punica</i>	Pomegranate	5	CRA-FRC
<i>Pyrus</i> (incl. botanic species and interspecific hybrids)	Pear	2.100	CRA-FRU, CRA-FRC, CRA-FRF, Umbria Region, Scuola Malva, Uni AN, Uni BO, Uni NA, Uni PA, Uni BC, Uni PD, Uni TO, Uni VT, CNR FI, CNR SS, CRPV, ERSA, Archeologia Arborea, Veneto Agricoltura
<i>Ribes</i>	Currant	58	CRA-FRC, Uni TO
	Gooseberry	25	Uni TO
<i>Rubus</i>	Raspberry	126	CRA-FRU, Uni AN, Uni TO
	Blackberry	35	CRA-FRU, Uni TO
<i>Vaccinium</i>	Blueberry	147	CRA-FRU, CRA-FRC, Uni MI, Uni TO
<i>Vitis</i>	Grape	3.699	CRA-PAV, CRA-VIT, Uni BA, Umbria Region
Total		19.665	

Table 2: Positive traits and respective number of autochthonous stone fruit varieties so far identified as carrying these traits

Species	Trait	no. of varieties
APRICOT		
Biotic stress	a) Fungus diseases	
	- low susceptibility to <i>Monilinia laxa</i>	17
	- low susceptibility to <i>Tranzschelia pruni-spinosae</i>	5
	b) Bacterial diseases	
	- low susceptibility to <i>Xanthomonas pruni</i>	1
	c) Virus, viroid, phytoplasma	
- tolerance to Plum Pox Virus (sharka)	8	
- resistance to <i>ACLR phytoplasma</i>	20	
Tree and Fruit traits	- low chilling requirement	3
	- late blooming	6
	- white flesh	2
SWEET CHERRY		
Biotic stress	a) Fungus diseases	
	- low susceptibility to <i>Monilinia laxa</i>	11
	b) Insects	
	- resistance to <i>Rhagoletis cerasi</i>	2
- resistance to <i>Myzus cerasi</i>	3	
- tolerance to <i>Eoprocitis chrysorrhoea</i>	6	
Tree and Fruit traits	- low chilling requirement	2
	- very late ripening	2
	- self-fertility	9
	- low susceptibility to cracking	14
	- easy stalk separation from fruit	20
ALMOND		
Biotic stress	a) Fungus diseases	
	- resistance to <i>Fusicoccum amygdali</i>	1
- resistance to <i>Monilinia laxa</i>	11	
Floral biology	- self-fertility	32
PEACH AND NECTARINE		
Biotic stress	a) Fungus diseases	
	- low susceptibility to <i>M. laxa</i>	1
	- resistance to leaf curl (<i>Taphrina deformans</i>)	3
	- resistance to powdery mildew (<i>Sphaerotheca pannosa</i>)	2
	b) Virus, viroid, phytoplasma	
	- resistance/tolerance to Plum Pox Virus (sharka)	5
	c) Insects	
- resistance to Mediterranean fruit fly (<i>Ceratitis capitata</i>)	1	
Fruit traits	- red flesh	4
	- non melting flesh	1

EUROPEAN PLUM

Biotic stress

a) Fungus diseases	
- low susceptibility to brown rot (<i>M. laxa</i>)	5
b) Insects	
- tolerance to <i>Hyalopterus pruni</i>	3
- tolerance to <i>Brachycaudus pruni</i>	7
- tolerance to <i>Brachycaudus persicae</i>	1
- tolerance to <i>Euproctis chrysorrhoea</i>	4
- tolerance to <i>Anarsia lineatella</i>	1

Table 3: Positive traits and respective number of autochthonous stone fruit varieties so far identified as carrying these traits

Trait	no. of varieties	
	Apple	Pear
<u>Biotic stress</u>		
a) Fungus diseases		
- resistance to <i>Venturia inaequalis</i> var. <i>pirina</i>	79	35
- low susceptibility to <i>Venturia inaequalis</i>	63	-
- resistance to <i>Podospaera leucotricha</i>	34	10
- low susceptibility to <i>P. leucotricha</i>	13	-
b) Bacterial diseases		
- resistance to fire blight (<i>Erwinia amylovora</i>)	-	2
c) Insects		
- resistance to <i>Dysaphis plantaginea</i>	3	-
- low susceptibility to <i>Eriosoma lanigerum</i>	2	-
- resistance to <i>Cacophylla pyri</i>	-	18
- resistance to <i>Cydia pomonella</i>	9	33
- resistance to <i>Quadrastipilotus perniciosus</i>	1	9
d) Virus, viroid, phytoplasma		
- resistance to "Apple Proliferation" phytoplasma (AP)	4	-
<u>Tree and Fruit traits</u>		
- spur habitus	67	-
- red flesh	1	6
- absence of internal breakdown	-	2

Carlo Fideghelli

CRA-FRU, Via di Fioranello 52 - 00134 Roma – Italy

isfrmfid@gmail.com