CHERRY BIODIVERSITY OF CAMPANIA REGION (ITALY): CONTENTS OF ESSENTIAL ELEMENTS

BIODIVERSITÉ DE LA CERISE DE LA RÉGION CAMPANIE (ITALIE) : CONTENUE EN ÉLÉMENTS ESSENTIELS

BIODIVERSITÀ DEL CILIEGIO CAMPANO: CONTENUTI IN ELEMENTI ESSENZIALI

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Abstract

The contents of some nutrients [Phosphorus (P), Potassium (K), Magnesium (Mg), Iron(Fe), Calcium(Ca), Selenium(Se), Zinc(Zn) and Sodium(Na)] and trace metals [Vanadium (V), Nickel (Ni), Chromium (Cr), Lead (Pb), Copper (Cu), Aluminum (Al) and Cadmium (Cd)] were determined in 30 cherry accessions from a farm for collections of Campania Region. Data have highlighted a high nutrient contents in the local accessions and often higher than commercial ones. In particular, it was observed that the Bologna accession showed higher contents of P, Mg, K and Se, and also high concentrations of Ca, Na, Zn, Fe. Moreover, they are of a good quality because the concentrations of trace metals, commonly found as pollutants in the environments, did not exceed, where provided, the law limits imposed.
Key-words: *cherry biodiversity, Campania Region, nutrient contents, trace elements*

Résumé

Le contenu des éléments essentiels [Phosphore (P), Potassium (K), Magnésium (Mg), Fer (Fe), Calcium (Ca), Sélénium (Se), Zinc (Zn) et Sodium (Na)] et des trace-éléments [Vanadium (V), Nickel (Ni), Chrome (Cr), Plomb (Pb), Cuivre (Cu), Aluminium (Al) et Cadmium (Cd)] ont été déterminées dans 30 écotypes de cerise de la Région de la Campanie. Les résultats obtenus ont montré souvent une plus grande quantité des éléments essentiels dans les différentes écotypes locales auprès de ces commerciales. En particulier, nous avons observé que le écotype Bologne a concentrations élevées de P, Mg, K, Se, et de Ca, Na, Zn, Fe. En outre, les variétés locales analysées ont montré une bonne qualité pourquoi les concentrations des métaux en trace, et qui sont contaminants de l'ambiant, ne dépassent pas, dans les cas prévus, les limites imposées.
Mots-clés: *biodiversité de la cerise, Région Campanie, éléments essentiels, trace-éléments*

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Riassunto

I contenuti di diversi nutrienti [Fosforo (P), Potassio (K), Magnesio (Mg), Ferro (Fe), Calcio (Ca), Selenio (Se), Zinco (Zn) e Sodio (Na)] ed elementi in tracce [Vanadio (V), Nichel (Ni), Cromo (Cr), Piombo (Pb), Rame (Cu), Alluminio (Al) e Cadmio (Cd)] sono stati determinati in 30 accessioni di ciliegio della Regione Campania. I dati ottenuti hanno evidenziato contenuti elevati in nutrienti in molte delle accessioni locali e spesso anche più che in quelle commerciali. In particolare, si è osservato che l'accessione Bologna ha i contenuti maggiori di P, Mg, K e Se ed anche alte concentrazioni di Ca, Na, Zn, Fe. Inoltre, le accessioni locali finora analizzate hanno evidenziato una buona qualità in quanto le concentrazioni dei metalli in traccia, più comunemente rinvenute come contaminanti ambientali, non superano, laddove previsti, i limiti imposti dalle normative vigenti.
Parole chiave: *biodiversità del ciliegio, Regione Campania, elementi essenziali, elementi in traccia*

Introduction

Plants require for normal growth and to complete their life cycle some nutrients so defined essentials. Moreover, they represent the first ring of the food chain and, therefore, the suitable concentrations of these elements are important for organisms that, eating them, can obtain a right nutritional supply (Khan et al., 2008).
Many factors can influence the nutrient and antioxidant compounds concentrations in fruits and vegetables, but often the differences of content among the cultivars from a same geographical area are more important. In this view the local cultivars, less known and often forgotten, but well-adapted to local environmental conditions and able to resist or tolerate the diseases typical of a culture, sometimes may be better than those commonly found in commerce into a nutritional standpoint.
The common concept of "quality" of the agri-foods, especially fresh fruit, refers to a very different and heterogeneous set of parameters. Particular attention is turned to palatability, but hardly to the nutritional value, which should still be the priority (Re and Possetto, 2003). Today the interest in natural and healthy eating involves a significant number of consumers and it is important to underline how the nutritional value of fruit production has been totally ignored in the quality definition. A rational valorization of these productions may not preclude the formulation of the their nutritional value. The "nutritional characterization" could be an excellent improvement element for the local cultivars (Re and Possetto, 2003).
The fresh fruit, also, just for his daily consumption in the diet, is a reliable indicator of environmental pollution for the detection of trace metals. Considering the potential toxicity and the frequent consumption of fruit, which occurs especially in our country, it is advisable to analyze these products in order to ensure the levels of these contaminants to meet global requirements (Radwan and Salama, 2006). The trace metals may concentrate in the food chain, increasing the risk to the humans

health and other organisms (Ekholma et al., 2007). Predicting the effect of their assumption is rather difficult, due to the variability of dietary habits on the varying degrees of contamination in any environment, interaction with other elements at the time of absorption, the chemical form in which the metal is present, and other social habits. As a result an individual can take daily a quantity of contaminants equal to the weekly dose limit provided (Xiu-Zhen et al., 2009) and sometimes higher than that.

In this way the aim of this study is to determine the essential nutrients and trace elements concentrations in different cherry accessions. This study is part of the project "Network for the Protection and Management of Genetic Resources, Agro-Food" (AGRIGENET), funded by the Campania Region, which includes the creation of a research network for the protection and management of plant Genetic Resources of the Campania Region.

The cherry belongs to the Rosaceae family, subfamily Prunoideae, genus Prunus and, currently, is cultivated in Europe, Asia, Australia and America. Nevertheless, Italy is one of the major productive country with a lot of varieties. On nutritional standpoint, the cherry fruit is composed of 80% water, sugar, vitamins A, B and C, and also nutrients such as Fe, Ca, K, Mg, Na, P, Zn, Mn, Co, Cu. It also contains flavonoids, that are essential for the fight against free radicals, and galacturonic acid, able to link heavy metals allowing their elimination from organism.

Two commercial cultivars (Del Monte e Della Recca) and different local accessions (Cornaiola, Nera Dura di Mugnano, Marfatana, Paesanella, Pomella, Zuccarenella, Mulegnana Riccia, Pagliaccio, Don Vincenzo, Montenero, Ciauzara, Silvestre, Camponica, Bertiello, Mulegnana Nera, Antuono, Cannamela, Imperatore, Patanara, Lattacci, Pagliarella, Bologna, Della Calce, S. Anna, Maiatica di Taurasi, Lauretana, Corvina e Cervone) have been compared for their contents of essential elements (P, K, Mg, Fe, Ca, Se, Zn, Na).

Besides, since, as said before, fruit represents a good way of transfer of the trace elements, just for its daily consumption in the diet, the contents of some of the common contaminants (V, Ni, Cr, Pb, Cu, Al and Cd) were also determined in all studied accessions.

Materials and methods

Cherry samples were taken from a farm for plant collections (ex IMPROSTA) of Campania Region. The fruits of each accession were weighed and homogenized by the homogenizer GRINDOMIX Retsch GM 200 with titanium blades to prevent contamination. The homogenized samples were dried in the vacuum oven HERAEUS 9901R at 75 °C until constant weight and then ground to a fine powder by a Fritsch Pulverisette 6 with an agate pocket. Aliquot of the powdered samples (250 mg) were mineralised in a Milestone Microwave Laboratory Systems (Ethos 900), endowed with temperature control, by a combination of hydrofluoric and nitric acid (HF 50%:HNO_3 65%=1:2). After digestion the solutions were diluted by deionised water to a final volume of 50 ml. The nutrient (P, K, Mg, Fe, Ca, Se, Zn,

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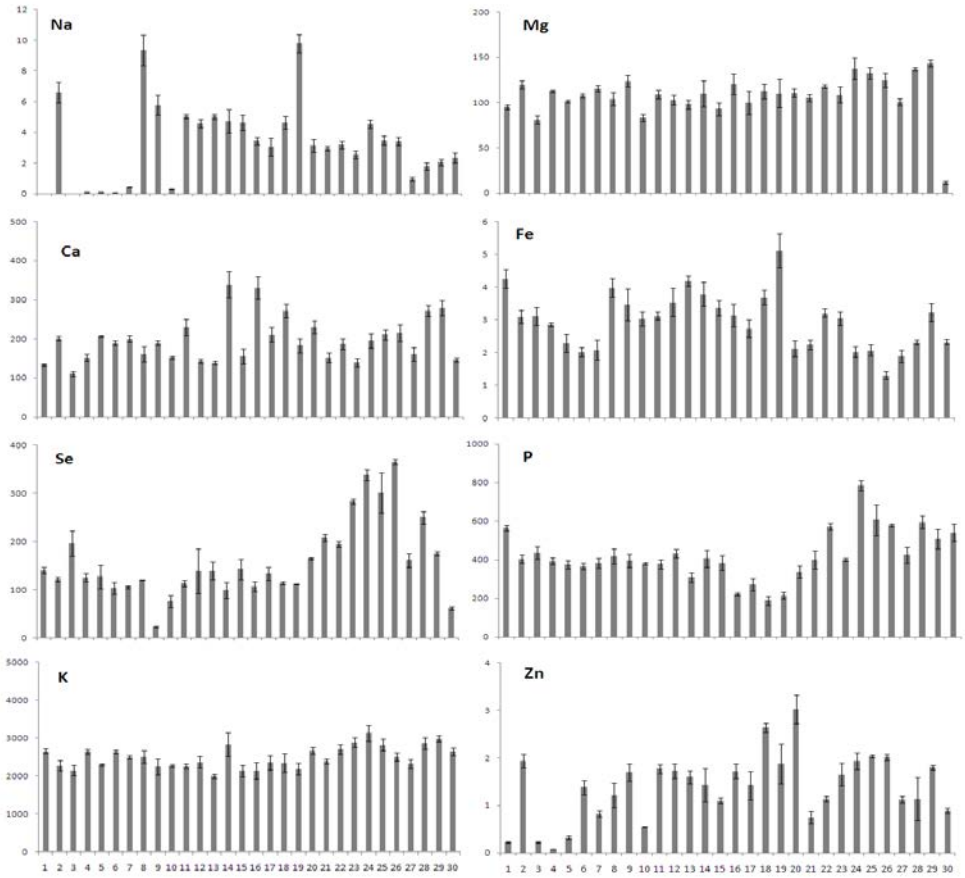
Na) and trace element (V, Ni, Cr, Pb, Cu, Al, Cd) concentrations were quantified by atomic absorption spectrometry (SpectrAA 20 Varian) using standard solutions (STD Analyticals, Carlo Erba). Accuracy was checked by analysis of standards (Resource Technology Corporation, Laramie, WY). The recovery was higher than 90 %.All the analyses were performed in triplicate for each accession and expressed as mean ± SD. The significance of differences was tested by one-way analysis of variance (ANOVA) followed by Tukey test (MINITAB INC 13).

Results and discussion

Figures 1 and 2 show the contents of the essential elements, per gram of the fresh weight, in the cherry accessions.

Figure 1 – *Nutrient contents (mg/Kg f.w.) in the cherry accessions (1=Del Monte, 2=Della Recca, 3= Nera Dura di Mugnano, 4=Marfatana, 5=Paesanella, 6=Pomella, 7=Zuccarenella, 8=Mulegnana Riccia, 9=Pagliaccio, 10=Cornaiola, 11=don Vincenzo, 12=Montenero, 13=Ciauzara, 14=Silvestre, 15=Camponica, 16=Bertiello, 17=Muklegnana Nera, 18=Antuono, 19=Cannamela, 20=Imperatore, 21=Patanara, 22=Lattacci, 23=Pagliarella, 24=Bologna, 25=Della Calce, 26=S.Anna, 27=Maiatica di Taurasi, 28=Lauretana, 29=Corvina, 30=Cervone).*



Respect to the two accessions present in the local markets (Del Monte, Della Recca) the concentrations of P, Mg and K were significantly higher in the Bologna ($p<0.01$); in addition, Lauretana and Corvina ($p<0.01$) had significantly higher Mg contents and Cervone the lower one ($p<0.001$). Cannamela showed the highest Fe concentration ($p<0.05$); Don Vincenzo, Silvestre, Bertiello, Antuono, Patanara, Loreto and Corvina, instead, had the highest Ca concentrations ($p<0.05$) whereas Nera Dura di Mugnano, Pagliarella, Bologna, Della Calce, S. Anna and Lauretana had the highest concentrations of Se ($p<0.01$). The Zn content was significantly higher in Antuono and Imperatore ($p<0.01$); Mulegnana Nera and Cannamela showed, on the contrary, the highest Na concentrations ($p<0.01$).

Table 1 – *Trace element contents (µg/Kg f.w.) in the cherry accessions. The data are mean ± 5% SD.*

	V	Cd	Pb	Cr	Cu	Ni	P	Al
Del Monte	5.81	3.66	5.18	2.39	722	56.62	565	640
Della Recca	10.41	4.71	5.84	60.44	661	40.79	404	703

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Cornaiola	4.62	3.39	8.01	2.69	647	60.24	380	1540
Nera Dura di Mugnano	9.01	2.15	4.78	2.23	591	65.44	437	662
Marfatana	18.52	2.69	1.54	33.64	1053	65.03	392	773
Paesanella	14.33	2.61	2.61	13.21	1084	73.16	376	1962
Pomella	18.72	8.15	10.77	25.19	835	56.74	365	2693
Zuccarenella	17.15	8.69	2.90	23.85	727	70.38	383	933
Mulegnana Riccia	21.70	3.52	11.76	13.91	772	68.55	419	1069
Pagliaccio	12.82	3.58	12.18	73.51	770	36.84	395	1572
Don Vincenzo	6.54	8.71	11.64	12.66	731	25.53	377	632
Montenero	15.68	3.21	4.59	9.76	594	55.45	433	1007
Ciauzara	17.46	5.13	7.52	17.06	740	43.21	309	1875
Silvestre	14.12	4.46	1.12	23.33	854	31.28	406	1284
Camponica	12.90	2.80	1.75	9.61	815	12.62	384	1353
Bertiello	4.94	4.45	3.27	12.51	752	18.93	221	1230
Mulegnana Nera	8.17	4.10	4.14	6.69	915	42.93	271	1768
Antuono	7.30	6.01	9.79	3.07	785	54.50	189	1048
Cannamela	10.66	4.30	9.01	16.39	771	59.72	215	1583
Imperatore	15.11	2.58	4.85	4.77	1234	40.63	337	1024
Patanara	45.99	9.26	53.03	62.51	995	131.61	401	1134
Lattacci	44.58	15.81	70.64	92.84	1416	129.85	572	981
Pagliarella	74.15	14.86	76.54	126.32	1178	162.38	401	1565
Bologna	10.32	2.19	51.84	8.71	1050	68.97	785	2516
Della Calce	10.50	4.96	23.78	21.47	1013	27.92	606	2251
S.Anna	24.33	3.57	7.83	16.40	680	24.97	579	1525
Maiatica di Taurasi	3.21	2.07	32.20	28.95	587	45.17	424	1296
Lauretana	20.51	4.47	42.47	30.75	930	35.10	595	2206
Corvina	7.62	2.96	44.14	19.18	822	86.91	509	1066
Cervone	18.24	3.07	29.63	16.02	767	82.54	541	912

Table 2 - *Nutrient contents in cherry accessions compared to the food composition database for Epidemiological Studies in Italy (Salvini et al.. 2008) expressed in mg/100g f.w..*

	***mg/100g f.w.**	***Del Monte***	***Della Recca***	***Cornaiola***	***Nera Dura di Mugnano***	***Marfatana***	***Paesanella***
K	*229*	**266**	227	227	215	**264**	230
Fe	*0.6*	0.43	0.31	0.30	0.31	0.29	0.23
Ca	*30*	13.34	20.03	15.14	11.06	15.17	20.70
Zn	*0.1*	0.02	**0.19**	0.05	0.02	0.01	0.03
Mg	-	9.51	11.95	8.32	8.08	11.26	10.15
Na	*3*	0.001	0.661	0.032	0.001	0.012	0.012
P	***18***	**56.45**	**40.44**	**38.03**	**43.67**	**39.21**	**37.58**
Se	-	14.02	12.13	7.58	19.55	12.46	12.66

		Pomella	***Zuccarenella***	***Mulegnana Riccia***	***Pagliaccio***	***Don Vincenzo***	***Montenero***
K	*229*	**264**	**249**	**250**	224	225	**236**
Fe	*0.6*	0.20	0.21	0.40	0.35	0.31	0.35
Ca	*30*	18.91	19.99	16.10	18.95	22.95	14.30
Zn	*0.1*	**0.14**	0.08	**0.12**	**0.17**	**0.18**	**0.17**
Mg	-	10.74	11.54	10.40	12.39	10.92	10.30
Na	*3*	0.011	0.043	0.936	0.577	0.503	0.460

P	***18***	**36.51**	**38.30**	**41.93**	**39.53**	**37.68**	**43.27**
Se	-	10.23	10.56	11.96	2.33	11.27	13.85

		Ciauzara	***Silvestre***	***Camponica***	***Bertiello***	***Mulegnana Nera***	***Antuono***
K	*229*	199	**283**	213	214	**235**	**235**
Fe	*0.6*	0.42	0.38	0.34	0.31	0.27	0.37
Ca	*30*	13.76	**33.83**	15.49	**33.02**	21.07	27.14
Zn	*0.1*	**0.16**	**0.14**	**0.11**	**0.17**	**0.14**	**0.26**
Mg	-	9.82	11.00	9.28	12.06	10.03	11.25
Na	*3*	0.503	0.473	0.465	0.344	0.306	0.465
P	***18***	**30.92**	**40.59**	**38.39**	**22.10**	**27.11**	**19.93**
Se	-	13.89	9.86	14.23	10.62	13.34	11.34

		Cannamela	***Imperatore***	***Patanara***	***Lattacci***	***Pagliarella***	***Bologna***
K	*229*	218	**267**	**239**	**270**	**288**	**313**
Fe	*0.6*	0.51	0.21	0.22	0.32	0.31	0.20
Ca	*30*	18.29	22.95	15.11	18.65	13.93	19.53
Zn	*0.1*	**0.19**	**0.30**	0.07	**0.11**	**0.16**	**0.19**
Mg	-	11.02	11.05	10.54	11.78	10.85	13.76
Na	*3*	0.979	0.313	0.296	0.318	0.255	0.455
P	*18*	**21.51**	**33.72**	**40.10**	**57.20**	**40.15**	**78.45**
Se	-	11.19	16.48	20.72	19.45	28.32	33.78

		Della Calce	***S.Anna***	***Maiatica di Taurasi***	***Lauretana***	***Corvina***	***Cervone***
K	*229*	**281**	**250**	231	**286**	**298**	**264**
Fe	*0.6*	0.21	0.13	0.19	0.23	0.32	0.23
Ca	*30*	21.08	21.50	16.04	27.19	27.90	14.61
Zn	*0.1*	**0.20**	**0.20**	**0.11**	**0.11**	**0.18**	0.09
Mg	-	13.23	12.46	10.09	13.69	14.36	1.16
Na	*3*	0.348	0.344	0.097	0.179	0.206	0.233
P	*18*	**60.64**	**57.94**	**42.42**	**59.45**	**50.85**	**54.10**
Se	-	30.05	36.49	16.07	24.97	17.48	6.14

**from Salvini et al. 2008*

As it is well known, the correct nutrient supply is important for human health. For example P is indispensable in metabolism and in the stimulation of muscle contractions; K is important element in the functioning of the skeletal muscles and the myocardium and in the regulation of excitability neuromuscular; Fe is indispensable element in the processes of cellular respiration as well as in collagen synthesis and in the metabolism of nucleic acids; Ca is important element in the regulation of muscle contraction and in the construction of the skeleton and teeth; Na is important regulator of cell membrane permeability (TukdogEan et al., 2002).
Table 1 compares the essential element contents of the 30 cherry accessions to those reported by the food composition database for Epidemiological Studies in Italy (Salvini et al., 2008) expressed as mg/100g f.w.. In particular, the concentrations of each element in the local accessions are highlighted in bold when their values were higher than those of database. Generally, the content of K, P and Zn, in most of the cherry accessions, are higher than their relative values reported in this data bank.
Regarding the trace element contents, table 2 evidences that all cherry accessions analyzed not exceed, where established, the limits imposed by Italian decree

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(1881/2006 for Cd: 0.05 mg / kg f.w. and for Pb: 0.10 mg / kg f.w., and 149/2008 for Cu: 5mg/kg f.w.).

Conclusions

The data has highlighted a high essential element contents in different local accessions than commercial ones. In particular, it was observed that the Bologna accession showed higher contents of P, Mg, K and Se, and also of Ca, Na, Zn, Fe.
Moreover, because the concentrations of the trace elements did not exceed the limits imposed by the new Italian decrees the fruits of the local accessions of cherry are of good quality. These data may be, together with the biochemical, molecular, nutraceutical and healthy characterization provided by other research groups involved in the project, an important enhancement, and thus, may open new research lines on local germoplasm.
Besides, the re-discovery and re-introduction into specialized crop of old local accessions becomes important not only to allow an expansion of the range offering local products, which are closely tied to the territory, but also to make more nutritional elements, which play a crucial role in health, respect to the varieties of national interest.

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