Capsicum newsletter

Number *2*

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edited by

-P. Belletti

- M. O. Nassi

- L. Quagliotti

Institute of Plant Breeding and Seed Production

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The picture in the cover is derived from the

“Herbario nuovo di Castore Durante”,

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FOREWORD

As the judgment passes on "Capsicum Newsletter" No. 1 during the 5th Eucarpia Meeting on the pepper (Plovdiv, 1983) was favorable, we had edited this second issue and, according to the agreements taken during the Meeting, we extended it also to the eggplant (Solanum melongena L.).

This new issue has unfortunately come out late, as the offset of our Faulty, which was used to print it, was not available when we expected.

We were afraid there might be a scarcity of contributions, since the Plovdiv Meeting might have dealt with all the material available for 1983; actually, many more were sent in than for 1982 (56 as against 40).

All the contributions we received have been accepted and none of them has been corrected, even in those cases where the text had to be retyped. Hence the responsibility for each paper, with regard to both the scientific content and the form, lies exclusively with its author.

The size of this second issue forces us to make a stricter rule for the further: all articles exceeding one page in length will be refused.

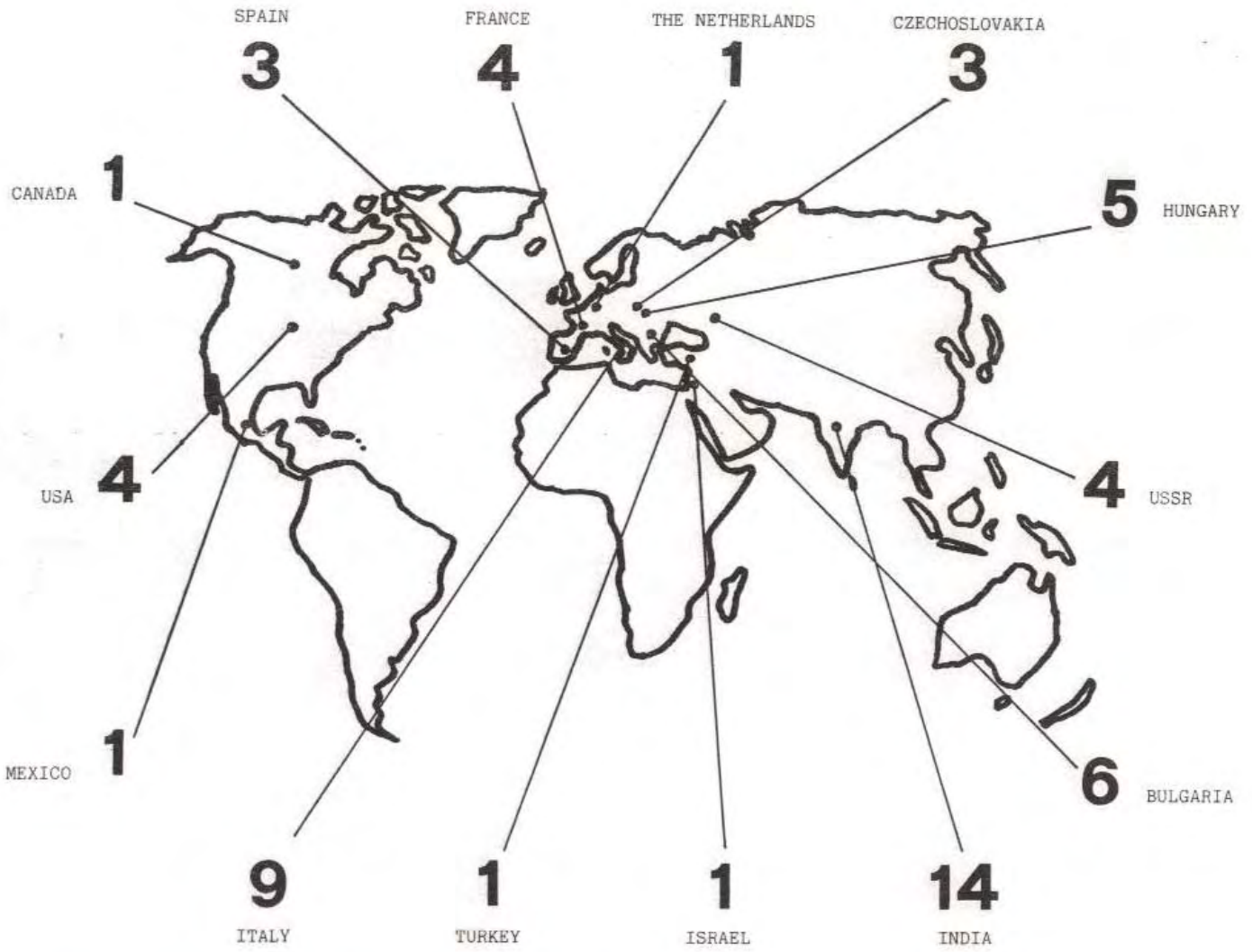
For the next issue we shall also have to solve the financial problem, as we have so far been unable to get help in Italy; from the first to the second issue expenses for materials and costs of postage have gone up a great deal, partly owing to the increased number of contributions.

In any case we are very pleased that so many research workers from so many different countries have sent in papers. This means that the "Capsicum Newsletter" enables to make know throughout the world, the experimental works on the pepper, including that of authors who are unable to attend Eucarpia meetings.

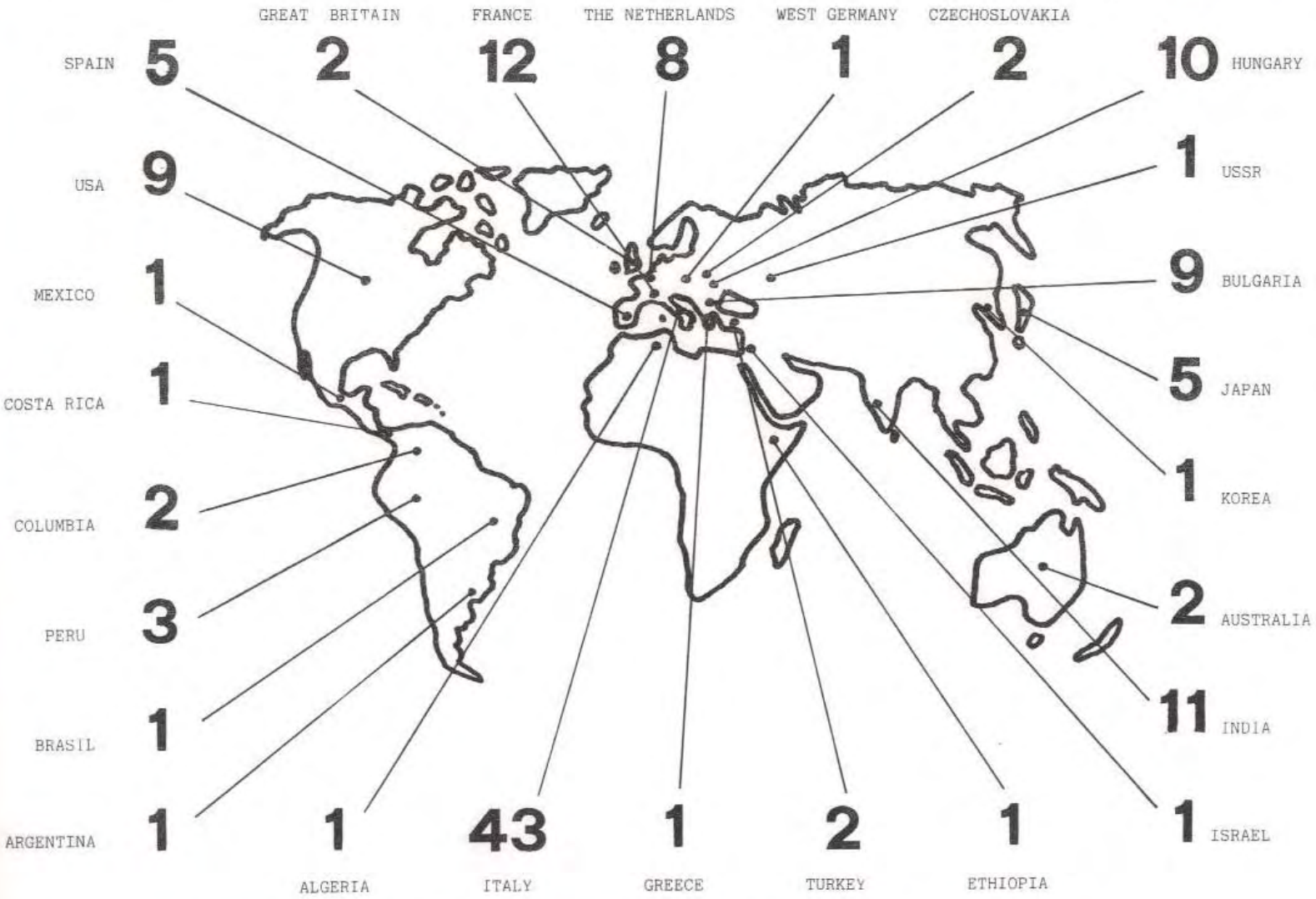
In this way cooperation between pepper breeders can be extended well beyone the bounds of opportunity for personal meetings. That is to say, it can also become a reality for researchers in countries less wealthy than those of Europe.

Piero Belletti, Ornella Nassi, Luciana Quagliotti
Institure of Plant Breeding and Seed Production
of the University

Turin, 28th December 1983



Geographic distribution of the contributors to "Capsicum Newsletter" n. 2 (1983)



Geographic distribution of the recipients of "Capsicum Newsletter" n. 1 (1982)

LI ST OF THE AUTHORS

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LIST OF THE CONTRIBUTIONS

GERMPLASM RESOURCES OF CAPSICUM FROM MEXICO

Costa, J.*; Palomares, G.**; Cuartero, J.***; Nuez, F.**

*CRIDA 07. Marcia.
**Departamento de Genética. Universidad Politécnica de Valencia.
***Estación Experimental La Mayora (CSIC). Málaga.

During July of 1982 Scientists of I.N.I.A., U.P.V. and C.S.I.C. made a trip to the Republic of Mexico to collect native germplasm resources of Capsicum. The trip sponsored by the Spanish Government was made in collaboration with the National Institute of Agricultural Research of Mexico.

The objective of the trip was to gather as many samples as possible of spontaneous and cultivated Capsicum species and varieties, but not to try to cover all the genetic variability.

A table is included with the names of the species, sampled areas, identification number of the samples, altitude and local names (when possible).

Species and Identifiation number	Locality and State	Altitude (m)	Local name	Observations
C. chinense	Telchac	s.1.	Habanero rojo	Very hot. Plumshaped, weigh 11 grs., 5.6x3.2
ME-4	(Yucatán)			cms., 3 loculi, red color.
ME-3	Telchac	s.1.	Habanero	Similar to ME-4, with orange colour.
	(Yucatán)		naranja	
ME-20	Felipe Carrillo	s.1.	Habanero rojo	Plumshaped, weight 10 grs., 4x3 cms., red colour;
	P.(Qunitana			3-4 loculi. Very hot.
	Roo)			
ME-23	Felipe Carrillo	s.1.	Habanero	Similar to ME-20, with orange colour.
	P.(Qunitana		naranja	
	Roo)			
C. annuum ME-1	_canaton	s.1.	Pablano	Trapezoid shape, weight 85 grs., 12 5x5.5 cms., 3
	(Yucatán)			loculi, red colour, Sweet.
ME-2	Telchac	s.1.	Scatic	Lengthened, weight 4 grs., 14x3 cms., 2-3 loculi.,
	(Yucatán)			Hot.
ME-5	Telchac	s.1.	Mach	Heartshaped-rectangular, weight 2 grs., 2.6x1.2
	(Yucatán)			cms., 2-3 loculi. Hot.
ME-6	Telchac	s.1.	Mach	Similar to ME-5.
	(Yucatán)			
ME-7	Motul	s.1.	Pablano	Quadranglar, wirht 60 grs., 13x4 cms., 3 loculi.
	(Yucatán)			Sweet.
ME-8	Motul	s.1.	Chava	Lengthened triangular, weight 32 grs., 13x2.5
	(Yucatán)			cms., 2-3 loculi. Hot.
ME-9	Motul	s.1.	Yatchic corto	Lengthened sharp-pointed, weight 40 grs., 9x2
	(Yucatán)			cms. Hot.
ME-10	Da_dzanum	s.1.	Yatchic corto	Lengthened, weight 30 grs., 8x3.5 cms. 3 loculi.
	(Yucatán)			Hot.
ME-11	Da_dzanum	s.1.	Scatic corto	Lengthened, weight 35 grs. 8x2.5 cms., 2-3 loculi.
	(Yucatán)			Hot.
ME-12	Da_dzanum	s.1.	Scatic rojo	Similar to ME-2.
	(Yucatán)			
ME-13	Dz_tbalché	s.1.	Rojo pequeño	Heartshaped, weight 16 grs., 6x2.3 cms., 2-3
	(Campeche)			loculi. Hot.
ME-14	Da_dzanum	s.1.	Scatic	Similar to ME-2.
	(Yucatán)			
M3-15	Da_dzanum	s.1.	Scatic	Similar to ME-2.
	(Yucatán)			

Species and Identification number	Locality and State	Altitude (m)	Local name	Observations
ME-16	Tenabo (Campeche)	s.l.	Poblano	Similar to ME-7.
ME-17	Tikimul (Campeche)	s.l.	---	Very lengthened, 10x1.3 cms., 2 loculi, Hot.
ME-18	Tikimul (Campeche)	s.l.	Poblano	Similar to ME-7.
ME-19	Tikimul (Campeche)	s.l.	Poblano	Similar to ME-1.
ME-21	Felipe Carrillo P.(Quintana Roo)	s.l.	---	Similar to ME-17.
ME-22	Felipe Carrillo P.(Quintana Roo)	s.l.	Mach	Similar to ME-5.
ME-24	Felipe Carrillo P.(Quintana Roo)	s.l.	---	Heartshaped, weight 10 grs., 6x2 cms. Hot.
ME-25	Felipe Carrillo P.(Quintana Roo)	s.l.	{a;a	Triangular narrow, weight 18 grs., 13x2.4 cms., 3 loculi. Hot.
ME-26	Felipe Carrillo P.(Quintana Roo)	s.l.	Scatic	Similar to ME-2.
ME-27	Ocotlan (Oaxaca)	1500	Guajillo	Lengthened, weight 17 grs., 8x12 cms., 2-3 loculi. Very hot.
ME-28	Ocotlan (Oaxaca)	1500	Serranito	Lengthened cylindrical, weight 6 grs., 4x2 cms. 2-3 loculi. Very hot.
ME-29	Ocotlan (Oaxaca)	1500	Huauchinango	Lengthened triangular, weight 13 grsr., 5.5x2.5 cms. Hot.
ME-30	E_la (Oaxaca)	1500	Poblano	Trapezoid shape weight 85 grs., 13x5 cms., 3-4 loculi. Sweet.
ME-31	Oaxca (Oaxaca)	1500	De_ánool	Lengthened, sharp-pointed, thin, weight 4 grs. 5x1 cms. Very hot.
ME-32	Ocotlan (Oaxaca)	1500	Tabiche	Lengthened, weight 16 grs., 7x2.5 cms., 3-4 loculi. Hot.
ME-33	Ocotlan (Oaxaca)	1500	Pasilla	Lengthened, weight 18 grs., 8x3 cms., 3-4 loculi. Hot.
ME-34	Ocotlan (Oaxaca)	1500	Criollo del Agua	Lengthened triangular, 8x3 cms. Hot.

Species and Identification number	Locality and State	Altitude (m)	Local name	Observations
ME-35	Ejutla (Oaxaca)	1550	Tusta	Weight 4grs., 2.5x1.6 cms., 2-3 loculi. Very hot.
ME-36	Oaxaca (Oaxaca)	1550	Costeños	Lengthened, 6x1.5 cms., 2-3 loculi, weight 10 grs. Hot.
ME-37	Oaxaca (Oaxaca)	1550	Piquin	Weight 2.5 grs., 31.5 cms., 2-3 loculi. Very hot.
ME-38	Huauchinango (Puebla)	1600	Huauchi nango	Similar to ME-29
ME-39	Huauchinango (Puebla)	1600	Poblano	Similar to ME-30
ME-40	Huauchinango (Puebla)	1600	Piquin	Similar to ME-37
ME-41	S. Francisco C. (Oaxaca)	s.l.	Piquin	Similar to ME-37
ME-42	Santiago Ixcuintla (Nayarit)	s.l.	Cola de rata	Lengthened curved, weight 4 grs., 5x1 cms., 2 loculi, one fruit/node. Hot.
ME-43	Santiago Ixcuintla (Nayarit)	s.l.	Cola de rata	Similar to ME-42 with some fruits/node. Hot.

The seed samples of the collection are actually under the process of multiplication and any geneticist interested in it could get a sample-making request to

Joaquín Costa García
Dto. Hortofruticultura. INIA
La Alberca, Murcia, Spain

CAPSICUM COLLECTIONS I THE PERUVIAN NORTHERN AREA

Cuartero, J.[+]; Nuez, F.[++]

[+]Estación Experimental La Moyora. C.S.I.C. Málaga.
[++]Departamento de Genética. Universidad Politécnica de Valencia.

A series of Capsicum collections was carried out in the Peruvian northern area (Lambayeque, Cajamarca and La Libertad) in June 1983 by Spainish C.S.I.C. and U.P.V. investigators, in co-operation with the Peruvian INIPA. The herewith Table shows the sampled areas, recollected types and reference numbers, as well as some of the most outstanding characteristics. The 18 samples are pungent

Sample number	Site altitude Departament	Local name	Fruit characteristics
P – 1	-	Rocoto amarillo	8 cm long x 4 cm wide. Yellow before ripeness
P – 2	-	Rocoto rojo	6 cm long x 3 cm wide. Red
P – 3	-	Rocoto verde	7 cm long x 4 cm wide. Green before ripeness.
P – 4	Reque 40 m Lambayeque	Rocoto redondo	Spherical fruit. Diameter 4 cm. Yellow before ripeness.
P – 5	-	Ji escabeche	7 cm long x 1.5 cm wide. Yellow before ripeness
P – 6	Temblandera 380 m Cajamarca	Aji escabeche	Similar to P – 5
P – 7	Reque 40 m Lambayeque	Aji limo	Rhomboidal fruit. 3 cm long x 2.5 cm wide. Yellow before ripeness
P – 8	Reque 40 m Lambayeque	Aji escabeche	4 cm long x 2.5 cm wide. Red
P – 9	Reque 40 m Lambayeque	Rocoto rojo	6 cm long x 3 cm wide. Red
P – 10	Reque 40 m Lambayeque	Aji morado	4 cm long x 1 cm wide. Baconish coulour before ripeness
P – 11	Reque 40 m Lambayeque	Aji rojo pequeño	3 cm long x 1 cm wide. Red

Sample number	Site altitude Departamento	Local name	Fruit characteristics
P – 12	Reque 40 m Lambayeque	Aji rojo pequeño	Similar to P-11 but with narrow point. 4 cm long x 1 cm wide. Red
P – 13	Reque 40 m Lambayeque	Aji rojo pequeño	Pear shaped fruit. 2 cm long x 1.5 cm wide. Red
P – 14	Reque 40 m Lambayeque	Aji Colorado	4 cm long x 1.5 cm wide. Red
P – 15	Tamarindo 80 m La Libertad	Aji panca	6 cm long x 1 cm wide
P – 16	Tamarindo 80 m La Libertad	Aji chaparingo	2 cm long x 0.5 cm wide
P – 17	Reque 40 m Lambayeque	Aji cereza	Spherical fruit. 1 cm diameter
P - 18	Trujillo 20 m La Libertad	Pinguita de mono	1 cm long x 0.3 cm wide

These materials are in reproduction phase and samples will be provided to colleagues upon request. Address correspondance to:

J. Cuartero
Estación Experimental La Mayora CSIC
Algarrobo-Costa
Málaga
Spain

BIOCHEMICAL EVALUATION OF THE PEPPER GENE POOL

By V.K. Andryushchenko, V.I. Zatuliveter and A.P. Samovol

Moldavian Institute for Reseach in Irrigated Agriculture & Vegetable Growing

Mira Str. 50, 278000, Tiraspol, Moldavia, USSR

In conducting breeding work directed at developing varieties and hybrids of sweet pepper having a high content of biologically valuable substances in fruit, it is highly significant to create identifiable by given traits "germ plasma banks" as well as the elaboration of express methods for determining these substances in fruit. Since peppers are an extremely important sourc of polyvitamins, a biological estimation of the genus Capsicum collection was carried out. For the appraisement, samples of C. annuum /semicultivated forms/, in all 1500 samples, C. chinense – 100 samples, C. pendulum – 200 samples, C. frutescens – 100 samples, C. conicum – 20 samples over 300 samples of cultivars were taken. The content of dry matter, sugars, ascorbic acid, carotene, thiamine, riboflavin, pectic substances, amino acids, macro- and microelements were determined in the fruit. Analyses were made by conventional methods. On evaluating C. chinense, it was found that the ascorbic acid content in fruit of different forms variated from 55 to 292 mg.%, B-carotene –0.3-15.0mg%, thiamine content in fruit of this species was high and reached 2.9 mg. %. Within the species C. frutescens with a content of ascorbic acid up to 400.0 mg.% were distinguished. The thiamine content in fruit of C. frutescens attained – 2.4 mg.%, while B-caroted reaches –2.6-14.0mg.%. The ascorbic acid content in fruit of semicultivated forms of C. annuum has surpassed by 1.5 times its level in fruit of cultivars and had a content of 350 mg.%, thiamine 0.2-1.4 mg.%, riboflavin –0.4 mg.%, B-carosene 4.7-18.0

mg.%. It is well known that carbohydrates are highly significant in the determination of dietary, flavour and technological traits in fresh as well as processed products. In fruit of cultivated varieties, the saccharose content amount to 0.1 to 0.4, while in fruit of the wild species C. frutescens – 1.4 to 1.8. The semi-cultivated variety – var. ornamentale is distinguished by a maximum content of fructose – 3.7 %.

The quality of keeping ability of pepper fruit in storage are greatly influenced by their content of pectic substances. According to our data the total pectin content in fruit of semicultivated varieties totaled 222 go 785 mg.%, in C. pendulum samples it was from 249 to 941 mg.%, including aqueous – from 27 to 225 mg.%, and protopectin from 222 to 716 mg.%. In cultivated varieties the total pectin was from 109 to 581 mg.%. Protopectin prevailed over water-soluble pectin by 3-5 times.

Flavor quality of fresh vegetables and their processed products are significantly determined by the amount and proportion of amino acids. It was found that crude protein in dry matter of pepper fruit flesh amounts of 18.0%, of which the fraction of free essential amino acids from crude protein depending on variety makes up 30 to 50 %. The free essential amino acid content in fruit of wild species and semi-cultivars is on a level with cultivated varieties or slightly higher.

Among biologically valuable substances, traces elements are especially important as co-factors of various ferments. The Fe content in mg./100 gm. fresh weight in pepper fruit within 160 to 670, Zn from 130 to 660, Cu – from 4.8 to 190, Mn. – from 60 to 14.8, Co from 1.2 to 11.5.

A high content of dry matter in pepper fruit is of great importance in the production of paprika and also influences the quality of canned produce. It was found that in the fruit of C. chinense with a pericarp thickness of I mm., the content of dry matter reaches up to 23%, while in the cultivated varieties with a pericarp thickness of 5-6 mm. Their content is from 8 to 13%. However, a significant degrease in the thickness of the pericarp worsens the flavour of the pepper. Largefluctuations in the content of dry matter in the fruit indicates big oppor-

tunities in breeding for the given trait.

In breeding work, much attention is paid to establishing correlative connections between traits. However, data on correlations between ch3emical indices and other characters are not plentiful. We have found that the value of the correlation coefficients is largely determined by the degree of maturity of the fruit. Thus, the correlation coefficient (r) between the dry matter and sugars content in the technical stage of ripeness of fruit – amounts of 0.03, while in the biological stage of ripeness it is – 0.55; the correlation coefficient between the sugars and ascorbic acid content in the technical stage of maturity amounts to 0.04, and in the biological stage to – 0.31.

MEIOSIS IN PMC's IN VIRUS INFECTED PLANTS FROM DIFFERENT VARIETIES AND FORMS OF CAPSICUM ANNUUM L. AND CAPSICUM PENDULUM WILLD.

V. Mirkova, E. Mdlohova
Institute of Genetics, Sofia 1113, Bulgaria

It is known from literature that viruses may induce deviations from the normal cytological process in plants. Different abnormalities in meiosis such as reduced chiasma frequency, lagging chromosomes and bridges in A1 and II, formation of chromosome mosaic cells, binucleate cells, monads, dyads, micronumlei in tetrads and et.c. have been described by Swaminathan et al (1959) in highly infected with mosaic and leaf roll viruses C. annuum plants and by Kazimierski and Kazimierska (1969) in virus infected plants belonging to the Papilionaceae family. Mirkova and Milhova (1983) have established different degrees of chiasma frequency reduction in virus infected plants of C. annuum and C. pendulum.

The purpose of the resent investigation was to study meiotic disturbances as a criterion for receptivity to TMV in different varieties and forms of C. annuum and C. pendulum, which were grown in the field as well as the relations between chiasma frequency, meiotic abnormalities in later phases and pollen fertility.

MATERIALS AND METHODS

Two pepper varieties – Sivria and Zlaten medal; rediplodized form 144 and C. annuum var.nigrum (N15) from C. annuum and three forms of Smith's collection from C. pendulum (N9, 10, 11) have been studied. Flower buds were fixed in 1:3 acetic acid – absolute alchol mixture and squashed in 4% acetic-carmine. At least 200 PMC's were scored for each meiotic phase in every slide.

RESULTS AND DISCUSSION

The infected with TMV plants which were found in the field have displayed the symptoms of disease in different degrees. Under the same conditions of plant cultivation and infection the mosaic symptoms were expressed in greatest degree in Sivria, Z1.medal and rediploidized form 144 and significantly lower in C. annuum var.nigrum and in the three forms of C.pendulum.

The frequencies of meiotic disturbances in the first and second divisions of healthy and virus infected plants are presented in Tables 1 and 2.

Frequency of abnormalities in the first meiotic division in healthy (K) and virus infected plants (sick) of C.annuum and C.pendulum (in per cent)

Material	Mean x-ta frequency		MI		AI		TI	
	K	Sick	K	Sick	K	Sick	K	Sick
Z1.medal	1,58	1,25	5,7	1,31	3,3	2,92	0,6	1,05
Sivria	1,53	1,19	5,6	1,32	4,2	3,05	0,5	1,12
144	1,63	1,18	4,9	1,14	2,3	2,09	0,4	9,1
15	1,45	1,33	8,1	1,48	6,9	2,26	5,3	1,21
9	1,82	1,67	3,1	5,2	1,2	6,7	0,2	3,6
10	1,81	1,64	3,6	5,8	1,3	6,9	0,3	4,1
11	1,80	1,63	3,8	6,8	1,3	7,4	0,3	4,3

Table 2

Frequency of abnormalities in the second division of meiosis in healthy (K) and virus infected plants (sick) of C.annuum and C.pendulum and pollen fertility (in per cent)

Material	AII		TII		Tetrads		Pollen fertility	
	K	Sick	K	Sick	K	Sick	K	Sick
Z1.medal	1,9	1,89	0,9	1,02	0,8	1,22	94,55	61,70
Sivria	2,0	1,93	0,9	1,07	0,8	1,26	93,87	57,36
144	1,6	1,52	0,7	8,9	0,6	9,7	96,43	66,33
15	3,5	1,60	4,6	1,28	5,1	1,28	85,43	70,09
9	1,1	5,6	0,5	3,9	0,5	3,0	98,55	86,85
10	1,2	6,1	0,6	4,4	0,6	3,2	97,65	84,85
11	1,3	6,3	0,7	4,7	0,6	3,4	95,89	81,25

In all virus infected and healthy plants there were found some abnormalities of meiosis like univalents in MI, lagging chromosomes and bridges in AI and II, TI and II and micronuclei in tetrads. However, in all virus infected plants we observed

PMC's with different chromosome number in AI (most frequently with 11 and 13 chromosomes), non-synchronized division in AII, micronuclei in TI and II, formation of dyads, triads and polyads. The greatest quatity of different tipes of these disturbances was found in Sivria and Z1.dedal and significantly lower in the three forms of C.pendulum. In C.annuum var.nigrum plants infected with TMV a comperatively higher frequency of meiotic abnormalities was established but it was noted that this variety was normally characterized with 5,2% abnormal PMC's and 2,9% micronuclei in microsporocytes (Molhova 1964).

The investigated sick plants showed decreased pollen fertility in comparison with the healthy. The pollen fertility in Sivria, Z1.medal and form 144 was reduced with 30-40% while in C.annuum var.nigrum and C.pendulum with 10-15%.

Similar meiotic abnormalities in virus infected C.annuum varieties, kept in isolation in a glass house have been described by Swaminathan et al.(1959).

It should be said in conclusion that significant differences between both studied species in relation to chiasma frequency, quantity of meiotic disturbances and pollen fertility and lower degree of infection of C.pendulum plants in comparison with C.annuum ones, cultivated in identical field conditions, directly depend on their resistance in to TMV.

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EXOCARP ANATOMY AND CONSUMPTION TYPE IN CAPSICUM

I. Fischer and M. Fári

Research Institute for Vegetable Crops
Station Budatétény, Budapest P.O. Box 95.
Hungary

The results of the following studies concerning the analysis of the pericarp thickness of Capsicum are reported here.

a/ The anatomy of the exocarp and its microdiagnostic possibilities

By microtechnical methods we have found that the exocarp of the "Fehérözön" variety is covered by continuous cuticle: cutine is accumulated in the epidermis cell walls of ripe fruits as well. In the layers underneath the epidermis cutline cannot be found. In the exocarpt of the rest of varieties we have examined/Táltos, Góliát, Hatvani/ the subepidermal tissues contain 1 to 6 layers of cutine accumulation thus thickening the pericarp, enlarging its resistance and possibility imparing digestibility /Figure 1./.

Figure 1. The anatlmy of capsicum exocarp in the condition of full maturity

a/ Fehérözön b/ Hatvani ep: epidermis hy: hypodermis
Pa: parenchyma black fields: cutline /cu/

Having performed cutine-specific maceration /$KClO_3$, Potassiumchlorate/ and subsequently painting the remaining indigestile cuticle with SUDAN-III we found that minimum cutine is accumulated in the percarp of "Fehérön" variety as opposed to the others / Táltos, Góliát, Hatvani/

b/ The comparison of different exocarp measuring methods

We have compared three methods to find the most satisfactory exocarp measuring procedure. The methods differed in preparation. We measured the thickness of macerated, of cooked, of deep-frozen and then cooled exocarp deprived of the pulp. We measured 6 varieties. The thinnest and the thickese exocarp was represented by varieties Fehérözön and Hatvani, respectively. The results are givn in Table 1.

Table 1. Results of pericarp measuring by different procedures

Variety	Procedure					
	Macerated		Cooked		Deep-frozen then cooked	
	Micron	%	Micron	%	Micron	%
Fehérözön	29	45	39	61	64	100
Táltos	35	37	66	70	64	100
Soroksári	30	34	76	87	87	100
Albaregia	44	40	80	73	109	100
Góliát	35	41	67	79	85	100
Hatvani	84	45	-	-	188	100
Mean		41		63		100

There are significant differences in the results of measuring after different ways of preparation. The higher value resulted from preparation after deep-freezing, the lowest by maceration. As compared to the data of the thickness of deep-frozen preparations the mean of the maceratd one was less by 59 per cent and that of the freshly cooked one by

37 per cent.

Thus when evaluating the data of exocarp measuring it is significant to be familiar with the variation due to the method. If we have this information all data achieved by any measuring method can be compared having reduced them on the basis of the ratios given in Table 1. In the “Fehérözön” variety, where cutine accumulation is minimal, the lowest are the results of pericarp measuring as well. /39, 29 and 64 microns/ Such values indicate easily digestible pepper with low cutine content which can be consumed by people suffering from disease of the digestive system without unfavorable effect.

PLEIOTROPIC EFFECT OF L1 GENE CONTROLLING RESISTANCE TO TMV IN THE PEPPER : MODIFICATION OF LOCAL LESIONS INDUCED BY CMV-N STRAIN.

In search for quantitative systems of evaluation of partial resistance to CMV, we sue currently an abnormal strain of this virus : N stain from Fulton (1). This strain gives local lesions or diffuse spots on the inoculated pepper or tobacco leaves and is unable to induce systemic mosaic in normal temperature conditions. It affords a simple, non destructive method for the counting of primary sites of infection in the inoculated leaves (2,3).

We soon observed that different types of local reactions are formed depending on the variety : small necrotic spots with well delimited central zone and brown deposit at the periphery or diffuse, larger spots, sometimes displaying concentric green and yellow and occasional irregular necrotic spots.

Here we show that these two types are associated respectively with the presence of $\underline{L^1}$ gene and its $\underline{L^+}$ allele controlling resistance and susceptibility to TMV, pahtotype 0.

This association it complete in the progeny of the cross between "Yolo Wonder" (small necrotic CMV spots and $\underline{L^1}$) and "Perennial" (diffuse CMV spots and $\underline{L^+}$). In order to avoid eventual interaction between successive inoculations by 2 different viruses, we used separate samples of homozygous lines directly issued from the origional cross through androgeness (ADH lines). The results appear in Table 1.

Table 1. Distribution of ADH lines issued by androgenesis from F1 "Perennial" x "Yolo Wonder"; CMV-N : type of local reaction; TMV (0) : resistance or susceptibility (L^1 and L^+ alleles, respectively) (total 34 ADH).

	CMV-N	
	Small necrotic Local lesons	Diffuse sots
L1 allele (TMV resistance)	12 (Yolo Wonder)	0
L+ allele (TMV susceptibility)	0	22 (Perennial)

In the varietal collection, also, susceptibility to TMV appears associated with diffuse reaction to CMV-N (ex. "Doux de Landes", "Avelar", "Moura", PM 217"; "PM 687" …). On the contrary, resistnace to TMV is associated with typical lcal necrotic spots in the presence o CMV-N (ex. "Doux d'Alger" "Algronomico 8", "LP1", "Florida VR2" …).

Thus, a functional "gene" like L1 consists probably in a set of closely linked genes, some of them being specific with regard to particular strains of one virus (TMV, pathotype 0), others being non specific, controlling the process of hypersensitive reaction induced by different initial agents.

In 1982, we showed the peperties of Riv gene which is also able to modify the formation of local lesions induced by both TMV and CMV, but in a different manner (4).

Major genes, in some cases, appear associated with minor genes displaying non specific quantitative effects.

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LINKAGE BETWEEN PARTIAL RESISTANCE TO CMV AND SUSCEPTIBILITY TO TMV IN THE LINE "PERRENIAL" : ANALYSIS ON ANDROGENETIC HOMOZYGOUS LINES.

E. Pochard, R. Dumas de Vaulx and Augustine Florent

I.N.R.A. Vegetable Breeding Station, 84140 Montfavet-Avignon (France)

"Perennial" is a Capsicum annuum line of Indian origin. In 1977, Singh and Thakur (1) revealed some of its very intesting properties : 3 weakly linked recessive genees were shown to control resistance to respectively : TMV, CMV, and Leaf-curl (Indian isolates).

During several years, we studied the response of "Perennial" and its progenies to europtean strains of TMV and CMV. A very different picture emerged.

"Perennial" appears susceptible to all the TMV strains so far studied, whatever the pathotype (0,1-2 or 1-2-3) with regard to L alleles.

Resistance to CMV in open field or in different kinds of artificial tests appears partial and polygenic, very few plants or lines being as resistant as "Perennial" in the F2 progeny or in androgenetic doubled haploid lines (ADH) directly issued from the F1 "Perennial" x "Yolo Wonder". Several different mechanisms actually play a role in the low disease incidence : reduction of infection rate, slow speed of diffusion of the virus through the plant and weak symptoms even in heavily infested plants (unpublished data).

It appears difficult to associate the L^1 gene (from "Yolo Wonder") controlling hypersensitivity to TMV pathotype 0 to high levels of field tolerance to CMV (from"Perennial").

78 ADH lines issued from the F1 "Perennial" x "Yolo Wonder" were observed in the filed in 1981 (partly) and 1982 for the CMV susceptibility, incidence of other viruses being very low. TMV resistance was checked by mechanical inoculation on cotyledons, the lines falling clearly in one of the two parental classes (table 1).

One can see that none of the CMV partly resistant lines is resistant to TMV whereas 15 of the CMV most susceptible lines are resistant to TMV like "Yolo Wonder". The probability for a random distributions of L^1 gene is less than 0.001 (x^2 11.01 and 13.63 respectively); the mean proportion of resistant lines in the whole sample is 28/78, that is 35.9%, far from the expected 50%.

It was previously reported that the transmission of L^1 gene through androgenesis was abnormally low in the cross : "Perennial" x "Yolo Wonder" (2).

The best CMV tolerant ADH lines (249, 260, 268, 293) were backcrossed to "Yolo Wonder" in order to try to find recombinant F2 plants displaying simultaneously the resistance to the two viruses.

Table 1. Androgenetic doubled haploid lines (ADH) issued from the cross "Perennial" x "Yolo Wonder" (F1→ ADH) : linkage between field resistance to CMV and susceptibility to TMV.
A : group of the 20 less susceptible to CMV in the field.
B : group of the 20 more susceptible to CMV in the field.

0 = without symptom; 5 = maximum susceptibility
Total number of ADH = 78 ; 50 susceptible to TMV; 28 resistant to TMV.
TMV test on cotyledons, strain Vign., pathotype 0.

A				B			
ADH Line	CMV 1981	1982	TMV (po)	ADH Line	CMV 1981	1982	TMV (po)
206	1.2	0.5	s	204	-	3.0	r
211	-	0	s	208	2.4	2.0	s
227	1.2	0	s	209	3.5	2.5	r
230	0.9	0.5	s	214	-	3.0	r
232	0.8	0	s	219	-	2.0	r
234	-	0.5	s	220	2.5	2.0	s
242	1.1	0.5	s	224	2.8	1.5	r
248	0.6	0.5	s	225	-	2.5	s
249	0.5	0.5	s	229	-	3.0	r
252	-	0	s	231	-	3.0	r
255	1.4	0.5	s	233	1.8	3.0	s
258	1.2	0.5	s	236	3.5	2.0	r
260	0.5	0.5	s	238	1.8	3.0	r
265	-	0.5	s	239	-	2.5	r
267	0.9	0.5	s	245	3.8	2.5	r
268	0.6	0	s	247	2.8	2.0	r
283	-	0.5	s	266	-	3.0	r
293	-	0	s	270	-	2.0	r
294	-	0.5	s	285	-	2.5	s
295	-	0	s	286	-	2.5	r
Perennial	0.5	0	s	Yolo Wonder	3.5	2.5	r

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THE INHERITANCE OF THE "UMBRELLA" BRANCHING HABIT IN PEPPERS, CAPSICUM ANNUUM L.

Kenneth R. McCammon and Shigemi Honoma

Department of Horticulture, Michigan State Unviersity, E. Lansing, MI USA

Three inbred lines, MSU 78-101, MSU 79-221 and MSU 74-230 were used to determine the inheritance of the "umbrella" branching habit in peppers. MSU 79-221, exhibiting the umbrella phenotype, was crossed with MSU 78-101 (dwarf) and MSU 74-230 (intermediate growth habit). Segregating populations were separated on the basis of plant growth habit and fruit bearing habit.

The results of genetic analysis suggested that the umbrella phenotype was controlled by three major recessive genes, ct, and dt determining plant habit and fa determining fruit bearing habit. When the dominant alleles Dt and Ct are in the homozygous dominat or heterozygous condition, they effect a dominant epistasis which results in an indeterminate phenotype. A fourth major gene, Su, is a dominant suppressor which acts to suppress the epistatic action of the Ct gene. Modifiers were involved in the control of branching in the umbrella plants. Linkage was also noted between the genes for indeterminate plant habit and non-clustered bearing habit.

METHOD FOR GCA EVALUATION. II.

M.L. Gomez-Guillamón and J. Cuartero
Experimental Station "La Mayora". C.S.I.C. Algarrobo-Costa (Málaga) . Spain.

This experiment has been an attempt to find out the possibility of using polycrosses technique on peppers, as a practical method for GCA evaluation.

The varieties used, as well as the method employed to carry out polycrosses and the results obtained for characters such as crotch height, number of true leaves up to crotch, number of primary branches, length of the first three internodes and plant height, were described in Capsicum Newsletter, n. 1. Thereinafter, other characters were measured in order to verify if results obtained last year can be made extensive to the different stages of a plant's biological cycle. These characters were: number of flowers per node, resistance of primary branches to breakage, leaf length and width, fruit length, girth, flesh thickness, number of locules, weight and fruit orientation, number of fruits per plant, early and total yield.

GCA estimations for each parental in the diallel were calculated by means of Griffing's diallel analysis, Experimental Method 1, Model I (GRIPPING, 1956). Average phenotypic values observed for each character and for each descendance obtained through polycross was considered as a GCA estimation of each parental line used as mother. By comparing GCA estimations obtained through both methods we attempt to know up to which point parental average phenothypic values can be considered valid as SEA estimation of a set of varieties.

Correlation between both series of values is very significative for all the studied characters (Table 1). Nevertheless, the scarse variation observed among different parental's phenotypic values, regarding number of flowers per node, must be pointed out. Therefore, correlation between both estimations, although quite considerable, must be taken cautiously. Regarding resistance of primary branches to breakage, correlation observed is lower, although significative; this character was measured by means of a dynamometer which end was placed at the 7th node level of one of the primary branches, and whilst this branch was held above the node, the other end of the dynamometer was pulled until the branch broke. This measurement method implied some mistakes that might have been responsable for the low correlation observed.

Following these results the conclusion can be that average phenotypes of descendances obtained from each parental, can be considered as an GCA estimation of such parentals. This has been so for all the studied characters, except for number of primary branches probably owing to the scarse variability showed by the used parentals.

Polycross technique can be considered perfectly valid for peppers as a practical method for GCA estimation of a set of varieties. The use of this technique means simplifying number of crossings to be carried out, as well as reducing the work of evaluation of descundances. Therefore, this means a clear advantage with regard to the classical diallel crossing method.

Table. GCA estimations obtained by both experimental methods.

		Parental lines							
Character		1	2	3	4	5	6	7	r
Flowers/node	G	-0,1	-0,05	-0,06	-0,05	-0,04	0,34	-0,07	0,90
	P	1,3	1,01	1,01	1,04	1,07	1,14	1,00	
Breakage	G	0,0	0,20	0,10	0,10	-0,30	-0,60	0,20	0,74
	P	5,0	2,60	5,20	4,50	5,10	4,00	4,80	
Leaf length	G	0,0	0,30	0,00	-0,10	-0,40	-0,10	0,20	0,81
	P	17,0	19,40	13,40	16,70	13,80	15,70	17,40	
Leaf width	G	1,0	1,20	0,00	-1,00	-2,00	-0,60	0,90	0,89
	P	9,0	10,90	7,50	7,50	6,80	8,00	9,10	
Fruit length	G	0,9	0,09	0,05	0,03	-0,19	0,00	0,07	0,90
	P	18,40	17,19	15,55	17,20	13,40	16,30	17,30	
Fruit girth	G	0,16	0,00	0,10	-0,27	-0,49	0,00	0,22	0,98
	P	15,80	15,09	15,24	11,30	9,20	15,20	16,45	
Thickness	G	0,06	-0,15	0,05	-0,19	-0,30	0,10	0,23	0,94
	P	3,70	3,50	3,52	3,00	2,80	4,10	4,60	
Locules	G	0,01	005	-0,02	-0,12	-0,11	0,00	0,07	0,91
	P	3,20	3,40	2,90	2,90	2,70	3,10	3,40	
Fruit weight	G	0,27	001	0,18	-0,44	-0,87	0,03	0,43	0,96
	P	100,60	82,13	82,97	55,50	35,30	92,30	122,90	
Orientation	G	0,30	0,33	0,39	0,12	-0,63	-0,74	0,30	0,97
	P	2,70	2,80	2,70	2,70	2,00	2,10	2,70	
Fruits number	G	-0,16	-0,19	-0,11	0,39	0,65	0,06	-0,39	0,95
	P	53,50	67,60	66,10	86,10	107,50	71,10	56,90	
Early yield	G	0,49	-0,68	0,45	-0,72	-1,37	0,41	0,81	0,95
	P	3,25	1,63	3,67	1,68	1,69	4,67	3,88	
Total yield	G	0,23	-0,13	0,11	-0,14	-0,40	0,03	0,16	0,91
	P	9,20	5,38	8,52	6,26	5,52	9,39	7,97	

G: GCA Griffing. P: Phenotypic values polycross.

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GENETICS OF STOMATAL LENGTH IN PEPPER *(Capsicum annuum L.)*

C. De Toma, E. Silvetti and M. Bioni
Instituto di Genetica, Università di Bologna. Italy.

Yield, grow rate and several other biological characters depend upon the stomata, the opening through which transpiration, gas diffusion and above all carbon dioxide adsorption take place.

A general valid equation for the rate of diffusion of a gas is expressed by Fick's law, which states that the rate of diffusion of a gas is directly proportional to the cross-sectional area of the path, to the difference in density of the gas along the path and is inversely proportional to the length of the same.

Then the efficiency of stomata as pathways for gas diffusion depend essentially on size and frequency in the epidermis, so it would seem that large stomatal openings or a great number of stomata per unit of leaf area could permit greater rates of photosynthesis by decreasing the diffusive resistance to carbon dioxide uptake.

The results obtained from the 9 x 9 diallel cross show that stomal length is genetically determined.

In fact, as shown by table --, genetical additive variation amongst the parental varieties is present, but because the parental mean is greater than the progeny mean also dominance is present. On the contrary mean maternal effect is not significant.

The genetical additive variation is shown by the male and female effect but in an independent way, as it appears bythe significance of male x female interaction; so it seems harley difficult to select the best male or female parental variety that might be used in a selection programme.

The varieties used in our study appear to have very different behavior with reference to the estimates of g.c.a., s.c.a. and maternal effect. Some g.c.a. estimates approach or exceed, negatively or posively, the unity. All the varieties present positive or negative non additive effect as shown by the s.c.a. estimates. Only four varieties present high estimates of maternal effect. A new confirmation of the presence of the additivity and dominance is given

by the second analysis of variance according to Hayman's model (1954 b.). In fact the D and h value are highly significant, also H^1 and H^2 show significance, however with lower level.

It is interesting to note significant presence of the environment effect as component of the variance, but its value is lower than the genetic components. Moreover the observed sharacter is genetically determined be a set of blocks of genes showing dominance among which the mostdominant genes are negative (correlation coefficient positive), that is for short stomata. Following the assumptions of Flick's law (i.e. the density of the gas along the path and, perhaps, the length of the same), it seems possible from our results to plan and carry out selection programmes both for length and number of stomata (Silvetti, 1981) to improve the adaptability of pepper crops to drought areas.

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Table 1. ANOVA according to Hayman 1954a (I) and 1954b (II) on stomatal length.

I

	d.f.	M.S.	F
a	8	18.46	10.49**
b	36	4.30	
c	8	1.09	.66
d	28	4.47	3.69**
b_1	1	12.34	30.10**
b_2	8	4.16	1.58
b_3	27	4.04	4.16**

II

D	2.03**	± .43
F	1.49	± .99
$\hat{H}_1$	1.87*	± .81
$\hat{H}_2$	1.94*	± .81
$\hat{h}^2$	14.44**	± .54
$\acute{E}$	.46**	± .13

THE EFFECT OF MUTAGENIC FACTORS ON BECOMBINATION PH>CESSES IN PEPPER (C. annuum L.)

REPORT 1. THE INDUCED ALTERATION OF SEGREGATION TYPE FOR MONOGENIC MARKER CHARACTERS IN P2

A. P. Samovol, A. A. Zhuchenko

Department of Genetics, Moldavian Academy of Sciences, lKishinev USSR

Summary

The effect of Fl pepper seed treatment by mutagenic factors [different concentration of mitomycin C, 1, 4 bis - DAB, 2-tioxantine combined with centrifugation (exposition 1 hour, acceleration 10 thousands) and gamma-irradiation (dose 10 kR)] on segregation of three marker characters (a12 - lack of anthocyani color of hypocotyl, b - yellow color of stamens and pi - chlo roplast instability) in the progeny of self-pollinated plants was determined. On the basis of conductid experiments the possibility of considerable distortion of segregation type in F2 for each pair of alternative qualitative characters studied was estahl ished.

Experimental Part and Discussion

Segregation data for phenotype in F2 are given in Table 1. In analysis calculated x^2 values we may come to the conclusion that for alternative marker characters Al2:al2, B:b and Pi:pi in the control variant there exists a ratio close to the normal mendelian segregation. At the same time seed treatment by mitomycin C resulted in the increasing of recessive fraction, i.e. in highly significant deviations from normal segregation. In this case in the variant of mitomycin C treatment (concentration 0,0002%) for al2 and b genes significant deviation in comparison with the expected (3:1) and the control variant ($P<0,001$) was established Similar results (shifting of F2 population toward the increasing number of recessives) were obtained after seed treatment by 1,4 bis-DAB (concentration 0,002%) + gamma-irradiation. It is assumed that the causes of shifting are prezygotic and probably not connected with selection of gametes.

It's worth to mention the opposite directedness of mutagenic factor effects for pi locus (chloroplast instability). Thus in variants of mitomycin C

treatment (concentration 0,05%) and 1,4 bis DAB + gamma-irradiation the excess of dominant forms both in comparison with the expected 3:1 and with the control was proved. The induced alteration of F2 segregation towards the increasing number of dominant forms for pi gene may be explained both by decreased competitiveness of gametes carrying the recessive allele and by zygotic lethality. The latter was established in comparison of plants number at the stage of the first true leaves with the number of seeds sown. The analysis of induced distortion of mendelian segregation for monogenic characters studied (a12, b, pi) in F2 allows to conclude, that the direction and degree of segregation distortion in F2 depends on marker genes, mutagene type, its concentration and probably on ecological conditions of Fl hybrid plant cultivation.

Table 1 – The alteration of F2 marker segregation type under the influence of chemical and physical factors on pepper hybrid seeds (F1)

Experiment variant	Marker	Treatment (t) Plant number	Segregation x^2 ratio	3:1	(Quantity)	Control (c) Plant number	Segregation x^2 ratio	3:1
Mitomycil C – 0,002%	a12	273	1,3:1	46,40	21,98	470	2,8:1	0,34
Mitomycin C – 0,01% + gamma-irradation		239	2,1:1	6,63	2,86			
2-Tioxantine – 0,02% + centrifugation		295	1,9:1	15,42	6,71			
1,4 bis DAB – 0,002% + gamma-irradation		181	2,2:1	4,05	3,20			
Mitomycin C – 0,002%	b	165	1,3:1	32,50	14,80	283	2,8:1	0,34
2-Thioxantine – 0,02% + centrifugation		159	1,8:1	8,81	3,70			
1,4 bis DAB – 0,02% + gamma-irradation		103	1,7:1	8,26	4,20			
Mitomycyn C – 0,05%	pi	225	4,9:1	9,02	4,40	432	3,2:1	0,41
1,4 bis DAB – 0,002% + gamma-irridation		145	5,3:1	6,49	3,84			
2-Thioxantin – 0,05%		301	4,1:1	5,67	1,70			

Note: Critical x^2 for 0,05, 0,01 and 0,001 are 3,84, 6, 64, and 10,83 respectively.

THE EFFECTS OF MUTAGENIC FACTORS ON RECOMBINATION PROCESSES IN PEPPER

REPORT II.THE INLUCED ALTERNATION CF DIHYBRID SEGPEGATION FOR LINKED AND UNLINKED MARKERS IN F2

A. A. Zhuchenko, A. P. Samovol

Department of Genetics, Molidavian Academy of Sciences, Kishinev, USSR

Introduction

As is known the loci of different linkage groups follow the law of independent inheritance. At the same time in literature we meet data indicating the possibility of distortion of segregation independence in monhomologous chromosome markers - “quasilinkage”. The establishment of facts (quasi-linkage) and induced alteration of unlinked gene recombination frequencies gives real additional possibilities for the manipulation of recombination.

Experimental Part and Discussion

While studying the character of dihybrid segregations for a12-pi genes we had established that segregation ratio in the control variant isn’ t different from the independent segregation (recombination frequency f=52%), i.e. these genes are on different chromosomes (Lippert et al . , 1966) . In the most variants of treatment by mutagenic factors definite tendency towards the decreasing of recombination frequency in comparison with the control and the level of 50% was traced.

Combined treatment by mitomycin C (concentration 0,01%) ± gamma-irradiation contributed to the lowering of recombination frequency (f=42,5%). In the variant of mitomyc n C treatment (concentration 0,002%) the induced distortion of segregation independence, i.e. quasi-linkage was noted. The alteration of recombinat on frequency in this variant (f=4O,7%) is significantly less than 50%.

In studying the influence of mutagenic factors on formative process the must interest presents recombinogenic action of these factors conditioning the increased level of recomvination exchanges in the chromosome. However antirecomvination action of mutagenes also presents definite practical interest. It may be supposed that similar effect (antirecomvinational) proves to be rather useful in solving the problem of heterosis prolongation for one of the economically valuable characters in F2 and subsequent generations, e.g.

for yield.

In our studies while analyzing the character of dihybrid segregation for a12 and b genes in the control variant rather tight linkage was established (rf= 11,9 ±2,69%, table 1). During the further analysis of the obtained data we learned how mutagenic factors influence crossing over frequency between the markers mentioned. It should be noted that F1 hybrid seed treatment by mitomycin C solutions results in highly significant decreasing of crossing - over frequency in comparison with the control variant. In this case lower mutagene concentration makes significant influence on the size of crossing— over frequency decreasing effect (Table 1). The greatest decrease of crossing over frequency was observed in the treatment variant 1,4 bis-DAB + centrifugation (rf=l ,7%) . Tendency towards the mild effect of crossing over frequency increasing was noted in the variant of combined by DES + gamma-irradiation.

Table 1. – The influence of mutagenic factors on crossing over frequency between a12 and b markers

(taking into consideration the distortion models)

Experiment variant	Total plant number	Method of products		Distortion model	
		rf (%)	t	rf (%)	t
Control	275	13,3 ± 3,3	-	11,9 ± 2,7	-
Mitomycin C – 0,01%	136	12,8 ± 4,7	0,1	12,7 ± 2,7	0,21
Mitomycin C – 0,01% + gamma - irridation	114	9,4 ± 4,9	0,7	5,0 ± 2,7	1,82*
Mitomycin C – 0,002%	164	9,6 ± 4,9	0,6	4,1 ± 1,8	2,16**
Mitomycin C – 0,05%	139	8,5 ± 4,2	0,9	5,6 ± 2,3	1,75*
DES- 0,02% + centrifugation	90	13,4 ± 5,8	0,0	11,0 ± 4,4	0,17
Des – 0.02% + gamma – irradation	234	15,6 ± 4,6	0,4	15,2 ± 3,7	0,72
1,4 bis DAB – 0,002% + gamma - irradation	105	9,7 ± 4,9	0,6	8,2 ± 3,1	0,91
1,4 bis DAB - 0,002% + centrifugation	147	4,4 ± 4,6	1,6	1,7 ± 1,7	3,19***
2-Thioxantine, -0, 02%	148	6,1 ± 4,2	1,4	3,8 ± 2,1	2,38**
2-Thioxantine -,- 2% + centrifugation	129	8,1 ± 4,4	0,9	7,3 ± 2,8	1,18
2-Thioxantine – 0,05%	182	11,1 ± 4,1	0,2	10,9 ± 3,0	0,25

Note: *, **, *** - differences from the control are significant with P-0,1, 0,05 – 0,02 and 0,01 respectively

NATURALLY OCCURING PLOYPLOID IN CHILLI PEPPER (Capsicum annuum L.)

C. S. PATHAK, A.A. DESHPANDE and D.P. SINGH

Division of Vegetable Crops, Indian Institute of Horticulture Research 255, Upper Palace Orchards, Banglor – 560- 080, India.

The genus Capsicum includes, five domesticated species and several wild species. All the Capsicum species are diploid, 2 n = 24 with only one exception of a pepper breeding programme spontaneous tetraploid was observed. This pepper presents the detailed study of the tetrraploid plant.

A single plant with thick leaves was isolated in the bacc-cross (BC_{1-2}) progeny of the cross between IHR 149-1 (Green leaves) and IHR 45-7 (Purple leaves and flowers). The growth of the plant was slow in the beinning but gradually it picked up. Flowering was delayed by about 15 days. There was enlargement in all the floral parts. The color of the stem leaves, flowers and immature fruits was deep purple. However, the fruit turned to deep red on maturity. Comparative details of morphological characters of diploid and tetraploid is presented in Table 1.

For cytological studies flower buds were fixed in 1 : 3 acetic-alcohol fortified with iron. Acetocarmine preparations revelaed 2 n 4 x = 48 chromosomes in all the pollem mother cells observed. Quadrivalents both ring and chain type ranging from0 – 2 per cell trivalent 0 – 1 were observed (Table 2). Chiasma frequency was 0-81 per chromosome. Diploid plants in the population was ronal with mostly bivanelt formation. In comparison to 96% pollen fertility of diploid the tetraploid had only 40% pollen fertility. There was increase in the size of pollen grains in the tretraploid plant when compared with diploids. Selfed seed were produced for further studies.

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Constribution No. 332/83, Indian Institute of Horticultural Research, Bangalore, Indian.

Table 1 – Morphological char5acters of diploid and tetraploid plant.

	Height (cm)	Spread (cm)	No. of fruits/plnat	Wt. Of dry frutits/plant (g)	Fruit length (cm)	Fruit width (cm)	No. of seeds/fruit
2n	4500	4030	3800	2800	1000	100	4800
4n	3860	3420	830	8.30	8.32	1.28	731230

Table 2 – Chromosoma association in diploid and tetraploid plants. Values are given in mean per cell and range (in parenthesis).

	Quadrivalent		Trivalent	Bivalent		Univalent	Ciama frequency per chromosome	Pollen fertility
	Ring	Chain		Ring	rod			
Diploid	–	–	–	8.44 (7-10)	3.34 (2-5)	0.22 (0-2)	0.84 (0.79-0.91)	96%
Tetraploid	1.37 (0-2)	0.75 (0-2)	0.12 (0-1)	12.62 (8-18)	6.12 (1-10)	1.62 (0-5)	0.81 (0.70-0.93)	40%

USE OF INDUCED MUTATIONS IN DEVELOPING PEPPER FORMS RESISTANT TO PHYTOPHTORA CAPSICI Leonian

V. Sotirova, St. Daskalov – Institute of Genetics, Sofia 113, Bulgaria
E. Ilieva – Institute of Plant Protection, Kostinbrod, Bulgaria

Introduction

Wild forms can be used as donors of disease resistance, but the transfer of resistance genes from them is connected with considerable difficulties and a long period of time. Often this genes are linked to genes controlling economically undesiderable characters. From a practical point of view, of greatest interest are these disease resistant mutants, which possess along with the resistant cultivars by experimental mutagenesis. Saccardo (1997, 1982) and Todorova (1980) report about pepper disease resistance resulting from the application of various mutagenic factors. The present work reports the results of gamma-ray induced resistance to Phytophtora capsici in a cultivar possessing valuable biological and economic characters.

Material and methods

Cv. Kourtovska kapyia, which has valuble biological and economic characters, was used as stock. Dry seeds were gamma-irridated by dose of 6000, 8000, 10000 and 12000 rad. A considerable number of M_2 plants inoculated with Ph. capsici were studied in order that the disease resistant plants could be selected. Inoculation was affected when the plnats were at the phase of 3-4 true leaves. The inoculum was applied around the root neck of each plant. Plant infection was recorded on the 21st day using the following 5 grade scale: 0 – absence of diseased plants; 1 – slight necrosis of the root nect; 2 – necrosis of the root neck and a slow wilting of the leaves; 3 – necrosis of the neck and of the stem base and wilting of the leaves; 4 – progressing stem necrosis and wilting of the plants. The infecton of the fruits was recorded on the 10th day after the following 5 grade scale: 0 – necrosis; 1 – ¼ of the fruit necrotic; 2- ¼ to ½ of the fruit

necrotic; 3 – ½ to ¾ of the fruit necrotic and 4 more than ¾ of the fruit necrotic.

Plants graded 0 and 1 were recorded as resistant, while those graded 2, 3 and 4 susceptible.

Three hundred M_3 plants and 1000 M_4 were tested for resistance to Phytophtora capsici.

Results and discussion

M_2 plants resulting from treatment with various gamma ray doses were analyzed following Phytophtora capsici incoculation. Results obtained are presented in table 1.

Table 1. Reaction of gamma irradation M_2 plants of cv Kourtovska kapyia to Ph. Capsici

Mutagen and Dose of gamma irradiation	Percentage of plants in different graded Groups of infection					Percentage	
	0	1	2	3	4	R	S
6.000	1.59	5.45	6.64	13.94	70.37	7.04	92.95
8.000	5.26	4.96	7.47	14.94	67.24	10.34	89.65
10.000	7.22	11.40	12.47	10.80	58.10	18.62	81.37
12.000	1.53	5.36	10.94	16.59	69.59	6.02	94.97
Kourtovska kapyia (test)	0.63	2.36	3.94	16.59	76.47	2.99	97.00

Highest percentage of resistant plants were scored in the treatments irradiated by 8.000 and 10.000 rad.

The results obtained of the inoculating the fruits of M_2 indicated that the highest percentage was recorded in the treatments with irradiation doses of 8.000 and 10.000 rad.

The M_2 resistant plants were tested for Ph. capsici resistance in M_3 and M_4. Data obtained are present in table 2.

Table 2. Ph. capsici resistance of M_3 and M_4

Progeny	Dose of gamma rays	Percentage of plants in different graded Groups of infection						
		0	1	2	3	4	R	S
M_3	6.000	3,46	6,19	17,14	30,00	42,20	9,64	90,34
	8.000	5,56	12,87	17,91	28,00	37,65	18,43	82,56
	10.000	12,30	20,12	19,79	17,63	30,15	32,42	67,57
	12.000	3,09	6,60	18,65	27,22	44,43	12,39	89,99
M_4	6.000	3,92	7,74	14,15	32,22	40,26	11,36	88,63
	8.000	10,56	25,87	19,91	18,00	25,36	36,43	63,56
	10.000	21,23	20,13	20,08	20,12	25,64	49,36	50,63
	12.000	8,55	8,14	23,30	26,35	10,43	10,99	89,00

Ten lines resistant to Ph. capsici were selected in M5. Three of them were distinguished by resitance of grades o and 1, while the other still segregated within a range of 0 to 4.

The results from our studies prove that the use of mutagenic factors with the purpose of obtaining resistant forms is promising, particularly when cultivars with valuable biological and economic characters are treated.

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INDUCTION OF MUTANTS IN CAPSICUM ANNUUM L. BY N-NITROSO-N-METHYLUREA TREATMENT.

J. Vagera and P. Havránek[x)].
Institure of Experimental Botany, Czechoslovak Academy of Science, Experimental Station, 772 000 Olomouc, Czechoslovokia[x)] Research Institute of Vegetable Breeding, 772 36 Olomouc, Chzechoslovakia

A recent paper on spontaneous mutability (CSILLERY, 1983) and a successful induction of mutants resistant to Phytophora capsici (SOTIROVA and DASKALOV, 1983) by means of ionizing radiation again demonstrated that the studies of mutagenesis in Capsicum are very useful. Particularly suitable is the application of some chemomutagens with respect to the survival of M_1 plants at a high frequency of pints mutations in M_2 and to marked sector somatic chlorophyll deficiencie in M_1 predicting a mutagenic effect.

Seeds of sweet pepper (a breeding line of cv. Vesna) were washed for 48 h and then treated with previously tested 0.5 mM concentration of N-nitroso-N-mehtylurea (MNU) using standard technique (VAGERA, 1972). The treated plants (M_1) were kept in greenhouses from the spring of 198 to the spring of 1982. The spectrum and frequency of incuduced mutants in M_2 were studied on the basis of the progenies and succession of fruits from M_1 plants. The chlorophyll mutants were classified after LAMPRECHT (1960). Two-dimensional immunoelectrohoresis (AXELSEN et al. 1973) was used for he demonstration of protein phenotypes of leaves of the standard (control) and selected mutants. For this prupose, antiserum against soluble proteins was prepared from pepper leaves and it was added at 4% concentration to agarose gel. The tests for the induced resistance were performed using a ringspot strain of cucumber mosaic virus (R-CMV). The virus was inoculated on three leaves of pepper seedlings at the age of 30 days. The plants were examined after a 14-day incubation in lighting greenhouse at 23 - 28°C. Those exhibiting no symptoms of disease even after three-times repeated inoculations were considered potentially resistant.

The frequency of mutants was 0-22% per progeny. Exceptionally two progenies reached higher level of mutation frequency – a progeny with 47.4% low mutats with deeply green broad leaves and the another progeny with 25.1% of xantha mutants with necrotic tips of cotyledons. The induced mutnts were segregated by 69.6% of the studied progenies with 1-5 forms of mutants per progeny. The measurements of total soluble proteins (BRADFORD 1976) revealed a double amount of proteins in the leaves of the broadleaf mutant compared to the plants of standard phenotype. Changes of protein patterns were immunoelectrophoreticall recored in xantha and xantha virescens mutants (Fig. 1). In the xantha mutant the main protein peak practically disappeared (ribulosediphosphate carboxylase/ oxygenase). The frequencies of mutants from seeds harvested from gradually maturing fruits of the same mother plant were similar (4-10 fruits per plant evaluated). There was no direct correlation between the progenies with the highest frequency of induced

Table 1. Spectrum and frequency of mutants induced by 0.5 mM MNU treatment in pepper (a breeding line of cv. Vesna)

Type of induced mutation	No. of induced mutants	Percentage of induced mutants from the total no. of plants evaluated
Albino var. maculata	43	0.52
Chlorino var. maculata	35	0.42
Xantha	52	0.63
Xantha-chlorescens	20	0.24
Xantha-virescens	2	0.02
Xantha with necrotic tips of cotyledons	174	2.10
Xantha with three cotyledones	8	0.10
Chlorina	13	0.16
Chlorina with narrowed leaves	25	0.30
Chlorina with slow growth	31	0.38
Viridissimus	15	0.18
First right leaf grass-like	7	0.09
Low plant with deeply green broad leaves and increased protein content	101	1.22
Plant resistant to R-CMV	13	0.16
Other	26	0.32
Total	565	6.82

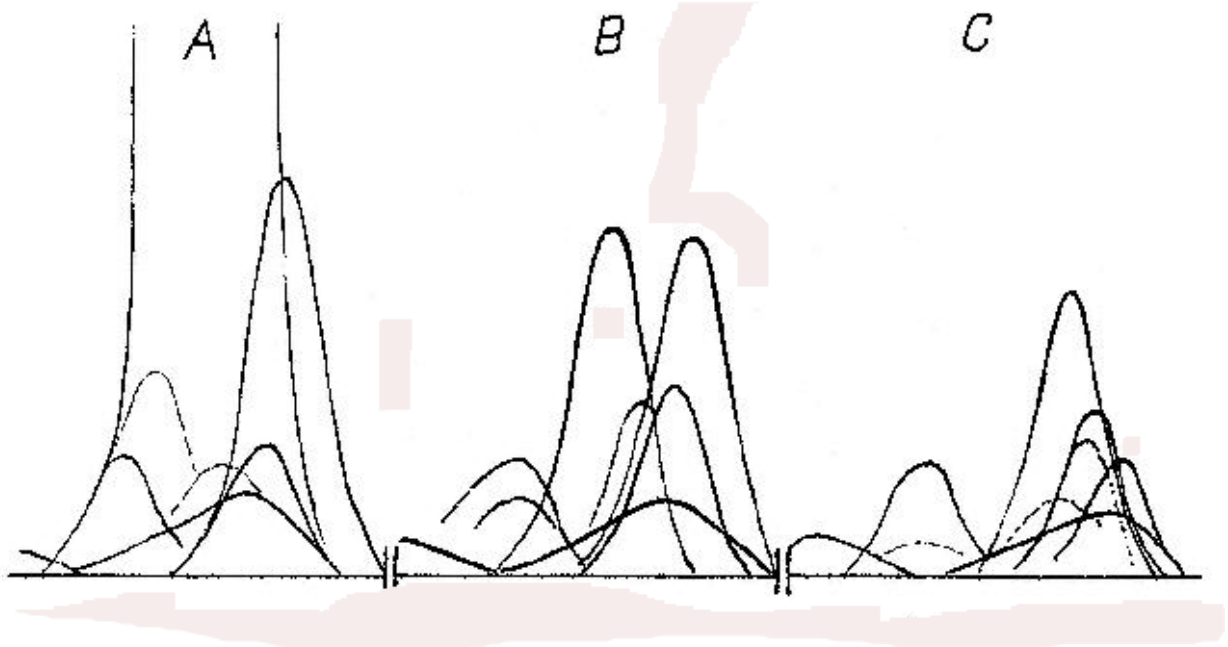

Fig. 1. Immunochemical patterns of soluble proteins from leaves of pepper plants. A = normal phenotype, B = mutation xantha-virescens, C = mutation xantha. (Note the missing peak of RuDP carbonxylase/oxygenase in picture ad C).

mutants and M_1 mother plants with the most marked somatic chlorophyll deficiencies. Of the total number of induced mutants, 2.3% were potentially resistant to R-CMV. They will be the subject of our further studies. The frequency and spectrum of induced mutants are demonstrated in Table 1.

The effect of a chemical mutagen (MNU) on a valuable breeding pepper line reached the relative high level of 565 mutations from some 9000 plants of M_2 population (Tab. 1). The use of immunoelectrophoresis enables a detailed verification of some mutations on the basis of changes in protein patterns. In case of chlorophyll deficiencies, there is a possibility to make more exact the rather complicated visual colour classification system of mutatants (Lamprecht 1960) and make more objective the differences, particularly in types of similar clour where the subjective differences in the evaluation of the materialoccur most frequently. For example, in the first phases the mutants xantha and xantha virescens, exhibiting the same colour, markedly differ in the presence of RuDP carboxylase peak. The content of this enzyme in xantha virescens mutant is much lower than in the control (Fig. 1).

The high frequency of some mutants (e.g. the low, deep green mutants with broad leaves and increased protein content) enables to detect the diplontic and haplontic selection agains cells with induced mutations. The phenomenon of the decrease in mutation frequency from late proplagues (GAUL 1964) was not occurred in our experiment but it could not be excluded.

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DWARF PEPPER TYPES (CAPSICUM ANNUUM L.) OBTAINED BY CHEMICAL MUTAGENESIS

F. Restaino – Research Institute for Vegetable Crops, Salerno, Italy.

A research by mutagenesis on the genetic improvement of local sweet pepper variety "Friariello" (Capsicum annum L.) is in progress in Salerno farming area.

This variety is characterized by subconical-acuminated fruits about 10 cm long (Table 1).

The main objectives of the breeding were referred to plant size reduction of resistance against Verticuillium dahliae Kleb. To cut down on soil disinfestations.

Mutagenic treatments were effected on quiescent seeds by increasing doses of chemical (EMS) and physical (Y-rays) agents.

EMS was employed in aqueous solution for 13 hours at 20°C, at the following doses: 0%, 3%, 6%, 9%, 12%, 15%.

Y-rays acute treatments were effected with doses of O Krad, 10 Krad, 15 Krad, 20 Krad, 25 Krad, 30 Krad.

Recessive brachytic mutants present in M4 (the trait heredity is now being studied) were isolated from progenies obtained fro 6% and 9% EMS doses.
These lines are referred to:

-Mutant K 80/78: brachytic type mainly characterized by extremely "compact" habit, marked reduction in stem and branches length and their internodes (Table 1).

-Mutant K 80/112: brachytic type mainly characterized by average "compact" habit, slight reduction in stem length and itsinternodes, marked

shortening of branches and their internodes (Table 1).

Such mutants are provided with moderate resistance against Verticillium wilt.

Under the commercial production aspect, the highest yield lines gave, at normal density, production significantly not different from those ones provided by the original variety.

Different plant density trials for the assessment of production values under major densities are in progress.

Tab. 1 – Main biometric parameters (mean values in cm)

GENOTYPE	Height of plant	Stem internodes		Branches internodes		Fruits			Leaves
		N°	Length	N°	Length	Length	Width	Pericarp thickn.	Lamina surface
CV "Friariello"	45,0	9,0	2,7	7,1	4,5	9,9	2,4	0,23	18,0
Mutant K80/78 (EMS 0,6%: 13h)	24,6*	8,8	1,9*	5,0*	3,7*	9,3	2,6	0,25	20,4
Mutant K80/112 (EMS 0,9%: 13h)	27,3*	8,0*	2,3	5,4*	3,7*	9,6	2,7	0,27	21,6*

*Significantly different values at P = 0,05 from values of original variety.

EFFECT OF NEUTRONS AND GAMMA RADIATIONS ON THE FLORAL APPARATUS IN M_2 GENERATION

M.M. Joshi and A.S. Khalatkar
Department of Botany, Nagpur University Campus, Nagpur, India

Genetically pure seeds of Capsicum annuum (2n = 24) with uniform size and shape were exposed to different doses of neutrons and gamma radiations. The effects obtained on M1 parameters were dose dependent. Seeds collected in M_1 generation were utilized to raise M_2 population. It was observed to have a number of plants with variation in floral parts. The linear relationship between the dose and frequency of floral variants was apparent. Mutagens are known to bring about alterations in different floral parts. Many times, these changes are disadvantageous, though some of them may be useful in plant type improvement programmes. In the present communication, the data on the effect of neutrons and gamma radiations on floral structure are discussed.

Genetically pure and physiologically similar diploid (2n = 24) seeds of locally grown variety of C. annuum equilibrated to a moisture content of 8.6% were exposed to 200, 400, 600, 800 and 1000 R doses of neutrons and 2, 4, 8, 12, 16, and 20 kR doses of gamma radiations. A common was maintained for all doses. Seedling injury was calculated as per cent control. Root tips from the treatment seeds were used for mitotic study. M_1 population raised from treated seeds, was studied for meiotic chromosomal aberrations and pollen sterility. M_2 population was raised from the seeds collection in M_1. It was screened for flower variations. The flower variants included, fasciflora, polypatalous mutant, petaloidy of calyx, formation of staminoides,

male sterile, early flowering types.

TABLE 1. Effect of different exposures of neutrons and gamma radiations in M1 and M2 generations.

Treatment	M_1 parameters				Flower variants per 100 M_2 plants
	% seedling injury	% mitotic aberrations	% meiotic aberrations	% pollen sterility	
Neutrons					
200 R	19.1	9.10.8	4.70.4	8.40.5	0.3
400 R	21.4	13.10.7	4.60.5	9.51.0	1.7
600 R	24.2	15.01.2	8.90.9	14.21.1	1.8
800 R	24.4	19.61.8	14.40.6	19.82.1	2.3
1000 R	29.4	2131.6	18.41.5	22.22.4	3.0
Control	0.0	0.00.0	0.00.0	3.61.2	0.0
Gamma rays					
2 kR	-	6.20.8	3.30.4	5.71.0	1.1
4 kR	-	9.21.2	4.20.5	8.71.8	1.3
8 kR	12.7	11.91.0	7.60.8	10.61.0	1.1
12 kR	23.0	15.42.1	10.91.5	11.81.2	1.6
16 kR	25.8	19.41.6	14.81.2	25.92.5	2.1
20 kR	30.1	22.72.4	21.82.1	32.83.2	2.4

The date on the effect of different exposures of neutrons and gamma radiations on M1 and M2 parameters are summarized in Table 1. Seedling injury in M1 was dose dependent and increased with higher doses of both the mutagens, although lower doses of gamma radiation had stimulatory effect (Joshi and Khalatkar, 1981). Maximum dose of neutrons (1000 R) and that of gamma radiations (20 kR) induced 29.4 and 30.1% seedling injury, respectively over that of control. This can be attributed to increased physiological imbalance by inhibition of auxin systhesis (Gordon, 1957).

Linear relationship of mitotic and meiotic aberrations with increasing doses of both the mutagens during the present investi-

gation can be attributed to failure of terminalization, break in chromosome and discrepeancies in spinal formation by mutagen treatment (Katiyar, 1978). Alsok, dose dependence of pollen sterility with neutrons and gamma radiations both, can be cited as severe consequences of induced chromosomal aberrations. Both neutrons and gamma radiations induced flower structure variants whose frequencies were dose dependent in M_2 generation.

Certain parameters affected by mutagen treatments in M_1 generation led to induction of alterations in genome and control the final expression of phenotype in M_2 (Khalatkar, 1982; Scccardo et al., 1982). 200, 400, 600, 800 and 1000 R doses of neutrons induced 1.3, 1.7, 1.8, 2.3 and 3.0% whereas 2, 4, 8, 12, 16 and 20 kR doses of gamma radiations induced 1.1, 1.3, 1.1, 1.6, 2.1 and 2.4% flower variants, respectively. Even though the before discussed M1 parameters were affected more by gamma radiations than neutron; the latter induced higher frequencies of flower variants than the former.

From the present study, it can be concluded that neutrons are more potent than gamma radiations as far as their effects on the floral apparatus are concerned.

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STIMULATING EFFECT OF ACTIVATED CHARCOAL IN THE INDUCTION OF IN VITRO ANDROGENESIS IN CAPSICUM ANNUUM L.

J. Vagera and P. Havránek[x)]

Institure of Experimental Botany, Czechoslovak Academy of Science, Experimental Station, 772 00 Olomouc, Czechoslovakia[x)] Research Institure of Vegetable Breeding, 772 Olomouc Czechoslovakia

Dihaploidization of the products of in vitro androgenesis genetically stabilizes complicated chenotypes. A promising utilization of this method in plant breeding, however, it still limited by the possibility to induce the androgenesis and to obtain a reasonable number of dihaploi8d plantlets. Several studies have been preformed in this respect with Capsicum, based on the changes of media and modes of cultivation (SIBI et al. 1979), increased temperature in the first days of anther culture (VAULX et al. 1981) and combination of increased temperature with high doses of 2,4-D, kinetin, vitamin B 12 cuscrose (CHAMBONNET and VAULX, 1983), in all cases followed by the transfer of anthers to another medium. The aim of our studies in 1980-1982 was to verify the specificity of the culture medium to compare the effects of different factors enhancing the androgenic response in the same material as well as to utilize the obtained androgenic material.

Breeding lines of sweet pepper (Capsicum annuum L., cvs. Severka anti Vesna) and 24 variants of culture agar media (minimal media - agar and sucrose only, complete media - see MURASHIGE and SKOOG 1962, GAMEORG et al. 1968, NITSCH 1969, SIBI et al. 1979 and their modifications), Bacto agar (Difco), charcoal Norit A (Serva), carrot extract (Daucus carota L. cv. Nantes), distilled water from a glass distilled apparatus and chemicals of p. a. purity were used in the experiment. The axenic culture of anthers with uninuclear microspores taken from extirpated buds (calyx with crown of the same length or with crown slightly exceeding the calyx, anther surface slightly violet) was performed on the surface of slanting agar solidified medium. The charcoal media contained 0.2-1.0% of charcoal. The cultivation was performed in tubes with aluminium caps and the cultures were maintained for 16 months. The embryoids were isolated mechanically and transferred on the tip of an injection needle.

The androgenesis in vitro occurred in all standard media, but at a low frequency, i. e., 0.01-0.22 embryoids and 0.0032-0.012 complete plants per one cultured anther. No more than 0.03 to 0.40 complete plantlets arose per one embryoid. Sporadic embryoids arose in anthers with callus too. The apical part of embryoids became hypertrophied and green, the basal part formed root hairs and root. Most of theni later necrotizod, complete plants developed in the anthers only occasionally. Less frequently there occurred albicant, perfectly cotyledonal embryoids, which after transfer outside the anther grew to complete plants independently of ~the specificity of the culture medium.

dihaploids (by fusion of two equivalent nuclei in the same microspore corroborates the data of the cited author. The final decision valid for quantitative properties can be made on the basis of the comparison of genetic variance within and between the progeny of androgenic origin and within and between progeny of plants grown from seeds of long-maintained haploids are equal. They originate by the fusion of two gametes with the full number of chromosomes arising probably during irregular meiosis of the true haploid.

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IN VITRO SHOOT TIP CULTURES OF SOME CAPSICUM SPECIES

FÁRl, M. and CSILLERY, G.
Research Institute of Vegetable Crops, **Station Budatétèny**
H-1775 Budapest, P.O.B. 95.

The importance of clonal multiplication of valuable breeding lines, mutants, tester genotype and rare interspecific hybrids in research is amply recognized.

Five years' results of attempting the multiplication of Capsicum species by cutting in greenhause are summarized in the present Newsletter /Csilléry, 1983/. In this report description and results of an alternative technique are given. The in vitro shoot tip culture even more clearly distinguishes between taxa of different cloning ability.

Medi a used:

1. Murashige and Skoog /1962/ basil medium /MS/ vitamin: B_5; hormone: -; saccharose: 30g/l
2. MS macroelements /half dose/ + Heller microelements + Morel vitamins hormone: IBA 0,5 mg/l; saccarose: 30 g/l /Dumas de Vaulx, 1983/ personal communication/
3. Murashige and Skoog /1962/ basal medium vitamin: B_5; hormones: BAP o,1 + o,5 + GA_3 o,5 mg/l carbo activatus: 2 g/l; saccarose: 30 g/l
4. Marashige and Skoog /1962/ basal medium vitamin: B_5; hormones: K3 + IAA o,5 mg/l; saccharose 30 g/l
5. Nitsch /1968/ medium /N/ hormone: -; saccarose: 20 g/l
6. Nitsch /1968/ medium hormones: K3 + IAA o,5 mg/l; saccharose: 20 g/l

Culture and results /Table I ./:

Plant s have been taken from desinfected seeds /method see at Fári and Czakó, 1981/ or exscised embryos /Fári et al., 1983/. Shoot tips have been cut with stems of 1-2 cm and 1 or 2 true leaves attached put on a fresh medium in loo ml Erlenmeyer Flasks, sealed with polyethylene foil /FOLPACK, Hungary/. /Table 1./

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HISTOLOGICAL ANALYSIS OF ADVENTITIOUS SHOOT BUD FORMATION IN PEPPER /CAPSICUM ANNUUM L./ HYPOCOTYL EXPLANTS CULTURED IN VITRO

M. FÁRI

Research Institute of Vegetable Crops, Station Budatétény
H – 1775 Budapest, P.O.B. 95

In earlier papers adventitious shoot bud formation in hypocoyl explants in pepper has been described / Fári and Czakó, 1980, 1981/, as well as the possible relation between the endogenous cytokinin content and the patterns of organogenesis postulated /Fári et. Al., 1982/.

Recently, the histological process of the adventitious bud formation has been explored. A short summary of the results obtained Capsicum annuum cv. T. Hatvani is the subject of the present paper.

INITIA HISTOLOGY OF PEPPER HYPOCOTYL EXPLANTS

The cross section of the hypocotyls near to the root neck / section 6, in Fári and Czakó, 1981/ shows a remarkable endoderm with Caspary points and strips /Figure 1b, Cen/, whereas in the uppermost region /section 1, in Fári and Czakó, 1981/ the inner layer of the cortex is represented by a starchy sheet/ Figure la, ear/.

The upper pole of the hypocotyls is a transition to the typical stem, where the four xylem and phloem bundles are already distinct and “endarch” i.e. with the protoxylem elements inside.

HISTOLOGICAL CHANGES DURING INCUBATION OF THE HYPOCOTYL EXPLANTS /MS medium + BAP 2 mg/liter, IAA 1 mg/liter, in Fári and Czakó, 1981/

The permanent structure of the tissues of the hypocotyls segments is transformed during the first week by the increasing frequency of cell division /Figure 2b/. On the parts in touch with the medium, i.e. epirm and hypoderm/ as well as in the basal pole of the explants the cortical cells started intense cell division, which seems to be uncoordinated initially /Figure 2c/. In the centers of meristematic activity/ meristemoids/ distinct organization of a basal meristem ring /bm/ and meristem strands /bp/ moreover the formation of lateral meristem /lm/ and of procambium /lp/ are visible.

On the 8^{th} to 14^{th} days days of incubation the dedifferentiation proceeds to show signs of some functional integration /Figure 2d/. The basal meristem ring

and the lateral meristem are organogenic tissues of the adventitious shoot buds, whereas the lateral procambium produces the bundles /transporting tissues/.

The lateral meristem started either from a single cell of the epiderm /homogenous origin/ or, more frequently, from the ensable of epidermal and cortical cells/ heterogenous origin/.

The 14^{th} to 28^{th} days display the formation of vegetative shoot promordia /sb/ which are interconnected from the procambium /Figure 2b, 2d/. The structure of the adventitious buds is not entirely uniform, as revelaed by our analysis. Some of them only seem to be complete /tunica 1+2 layers and the corpus/ /Figure 2g/, most of the buds, however, are deficient either in the tunica or in the corpus.

Those buds develop mostly leaves or leaf bunches, or turn into callus knobs /Figure 2e/.

Adventitious roots develop endogenously on the hypocotyls explants just as in the intact plants /Figure 2g/.

Our results indicate the relations between the anatomical structure of the hypocotyls explants and the adventitious bud initiation, as well as that they de novo shoot buds formed under given culture conditions tend to be mostly deficient in structure and function.

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STUDY ON THE ANTHER CULTURE in vitro OF PEPPER (Capsicuin annuum)

K. Abak

Ankara University, Faculty of Agriculture, Department of Horticulture, ANKARA (Turkey).

Haploid plants have great importance in the plant breeding programs and genetic studies. Obtention of haploids through anther culture in pepper (Capsicum annuurn) was first reported in 1973 by WANG et al. (1), but the number of plants produced was low in comparison to the number of anther cultured. Later, workers in the Vegetable Breeding Station at Avignon in France have elaborated a new culture media (2) with a new technique (3, 4), which is now commonly used in different breeding programs and genetical studies on pepper (5, 6). This technique and media were found unsuccessful on the material of Turkish origine, even in the same laboratory (tab. 1),

In this study, we tried to find another culture media to produce haploid plants with the varieties of Turkish origine. The plant material used in this experiment is the descendants (BC_2 to Ince Sivri 35) of the cross Ince Sivri 35"X" P. M. 217". The anther doner plants were selected for their resistance to Phytophthora capsici before collecting the buds. The anthers were cultured according to the procedure described in DUMAS DE VAULX et al. (4), except the growth substance, iron and sugar composition of the basic C medium. This medium was modified by the addition of 5 mg/1 kinetine and 5 mg/l 2, 4-D, In the experiment, four different sugar (30-60-90-120 g/1) and two iron (simple: 18.65 mg/1 Na_2 EDTA + 13.90 mg/1 Fe $SO_4.7\ H_2O$, double: 37.30 mg/1 Na_2EDTA + 27.80 mg/1 Fe SO_4 * 7 H_2O) concentrations were tested. After twelve days of culture on this medium, anthers were transferred to R medium without modifications.

Table 1 Effect of genotype on androgenesis in vitro,

Genotypes	No. of cultured anthers	No. of observed embryos	No. of obtained plants	No. of plant per 100 anthers
Yolo Wonder	120	17	9	7. 50
Ince Sivri 35	244	0	0	0.00
Descendants of ''IS 35''X''PM 217"	740	0	0	0.00

Embryo emergence was generally observed after approximately five weeks of culture in the pollen sacs and around the filaments: between the 6th and 9th weeks, part of these embryos transformed to plants. The results are summarised in tab. 2 ; and at this table the effects of sugar and iron can be seen clearly. Plant formation was observed in 90 and 120 g/l sugar

media, while there was no err bryo formation in the media containing 30 and 60 g/l sugar. In addition by doubling ftc concentration of the iron this effect was strengthened.

Table 2 Effects of sugar and iron on I ormation of embryos and anther -derived plants.

Sugar (g/l)	Iron	No. of cultured anthers	No. of observed embryos	No. of obtained plants	No. of plants per 100 anthers
30	Simple	378	0	0	0.00
	Double	365	0	0	0.00
60	Simple	320	0	0	0.00
	Double	334	0	0	0.00
90	Simple	395	17	2	0. 51
	Double	187	31	9	4.81
120	Simple	412	38	22	5.34
	Double	366	68	38	10. 38

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INFLUENCE OF PHYSIOLOGICAL FACTORS ON THE CUTTING POSSIBILITIES OF CAPSICUM SPECIES AND ON THE HYPERSENSITIVE REACTION OF TMV-INOCULATED LEAVES

G. Csilléry

Research Institute for Vegetable Crops
Station Budatétény, Budapest P.O. Box 95.
Hungary

At our Institute a tissue culture laboratory has been working since 1979, one of its main task is to support our pepper breeding activities with this new method. Now that the laboratory is functioning we returned back to a problem we were dealing with in 1977 and 1978 but could not solve because had no possibilities for tissue and organ culture and for investigating the endogene hormone content. An account of the new results is given by Fári and Csilléry /1983/. In this paper the experiments made 5 years ago are reviewed.

In 1977 while testing TMV in our variety assortment - containing 41 items at that time - we found that some items are not totally homozygous on the L locus. To elaborate our single lesion technique /Csilléry - Ruskó 1983/ a guaranteed homozygous stock was needed. Propagation by grafting proved laborious so we attempted cutting. We were of the opinion that if this technique proved good we could use it for propagating valuable mutations or maintaing rare genotypes of maternal and paternal lines containing e.g. several male sterility genes.

The experiments on for one and a half year /from July 1977 to December 1978/ in greenhouse so that we could analyse the influence of seasons and the age of the plants on the size and number of lesions and on the possibilities of cutting. We sowed, inoculated and propagated by cutting monthly. By January 1978 we had a complete assortment i.e. we bad all kinds of plants from seedlings sown one month before to six-month-old plants with flowers and fruits, Plants were raised in 3-litre synthetic containers in traditional soil. At the beginning of each month we inoculated 5 plants out of six age groups of the plants examined respectively with the U_1 line of TMV by the traditional and by the single lesion technique. The leaves of another set were taken and inoculated with the U_1 line of TMV in an excised leaf test. The stems deprived leaves were cut into cuttings with 2 buds and without buds. The cuttings dipped into powder of carbo activatus were planted into perlite expanded previously by water. The cuttings made from the different nodes represented the cotyledonary node, first true leaf node etc. and ultimately the apical parts of the same plant, successively.

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The experiments went on for one and a half year /from July 1977 to December 1978/ in greenhouse so that we could analyse the influence of seasons and the age of the plants on the size and number of lesions and on the possibilities of cutting. We sowed, inoculated and propagated by cutting monthly. By January 1978 we had a complete assortment i.e. we had all kinds of plants from seedlings sown one month before to six-month-old plants with flowers and fruits, Plants were raised in 3-litre synthetic containers in traditional soil. At the beginning of each month we inoculated 5 plants out of six age groups of the plants examined respectively with the U_1 line of TMV by the traditional and by the single lesion technique. The leaves of another set were taken and inoculated with the U_1 line of TMV in an excised leaf test. The stems deprived of leaves were cut into cuttings with 2 buds and without buds. The cuttings dipped into powder of carbo activatus were planted into perlite expanded previously by water. The cuttings made from the different nodes represented the cotyledonary node, first true leaf node etc. and ultimately the apical parts of the same plants, successively.

The species and items in the experiment:

Item	Origin	Abbreviated name
C. annuum var. annuum		
cv. Javított Cecei	Hungarian variety	JC
cv. D. Cece	"	DC
cv. Fehérözön	"	Fö
C. baccatum var, pendulum		
"Bulgarian pentlillUE"	Bulgaria	pen-1
pen 4. 372.6.2.	E. Pochard	pen-9
AC 2060	P.G. Smith	pen-12
C. chinense		
Mishme 381 R.7l.	E. Pochard	chi-l
3651	?	chi-2
PI. 159236	Hyland	chi-14
C. frutescens		
Tabasco	P.G. Smith	fru-7
?	?	fru-9
C.fru x ann F_4 W 129—2	P.G. Smith	fru-11

- TMV inoculation

We have already published a paper on the differences after leaf inoculation in the size of the lesions of different items /representing alleles of the L locus/ /Csilléry - Ruskó, 1983/. The age of the plants /1 to 6 months/, the position of the leaf /from which nodus it comes from/ and the season all influence the number and size of the lesions on the inoculated leaves. Lesions develop on cotyledons inoculated by TMV and the items with light brown, large lesions, containing L^1 allele and those with dark brown, small lesions, containing L^3 allele can be distinguished. On the leaves of 4 or 5-month-old plants lesions either cannot be produced or one or two lesions can be produced on the upper, young leaves. The chi--1 item is the only exception, it nearly always produces lesions. The chi-4 item is the other extreme because lesions frequently do not occur even at the optimal time when the plants have 4 or 6 leaves. The fact that Sowell /1982/ did not have local lesions in some PI. items, among them on some plants of the PI. 159236 item /chi-l4/ may be attributed to such conditional causes. The leaves are much more tender under poor light conditions of autumn, winter and spring and at this time more lesions can be produced on the leaves of older plants than in summer,

- Cutting

The monthly performed cutting each was evaluated a month later. Callus development, rooting /scale 1 to 5 each/ and the number of leaves emerging from the upper bud were examined on the cuttings with two buds. On the internodes without buds the intensity of callus development /scale 1 to 5/ and that of rooting /scale 1 to 5/ was noticed. Our data are summarized in Table 1.

C. annuum items are difficult to be propagated by cutting. Though Pochard and Dumas de Vaulx reported a successful attempt of cutting /1971/. On the 2-node cuttings of C. baccatum callus development was strong but there was only slight rooting. On internodes without buds we observed callus development but only in some cases root development. On the 2-node cuttings of C. chinense and C. frutescens items very strong callus and root development was observed and vigorous leafy shoots developed. On the internode parts without buds callus development was strong too /66 per cent in fru-12/ and there was a profuse rooting in the chi-2 item /5 per cent/ which is unique.

3 or 4-month-old plants are the most suitable for cutting. All parts of the primary axis can be propagated by cutting, the stem parts above the first cymous branching are suitable too, but not the cuttings with too long internodes /above 5 or 6 cm/. The influence of the season is not too significant but spring cutting /March or April/ was the most successful.

As C. annuum practically cannot be propagated by cutting while very strong callus, root and shoot differentiation was observed in some C. chinense and C. frutescens items, the F_1 - F_6 plants of the interspecific hybrids produced partly in the TMV resistance breeding program have been analysed from the point of view of cutting too.

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MORPHOLOGICAL TRAITS OF SWEET PEPPER

M. Valšíková, V. Střelec, K. Kopec

Research and Breeding Institute for Vegetable and Special Crops, Hurbanovo, Czechoslovakia.

Sixteen morphological properties in 28 cultivars of sweet pepper were studied experimentally. The obtained data are divided according to the morphological traits of plants, leaves, flowers and fruits, thus forming the morphological characteristics of the genus Capsicum annuum L. and of individual cultivars. The main morphological differences between cultivars are evaluated in table, serving as a basis for breeding work.

Material and methods

We tested 28 cultivars of sweet pepper. They were grown on plots of Research and Breeding Institute for Vegetable and Special Crops at Hurbanovo. We studied morphological properties of cultivars according to the International classification.

A/ Morphological traits of plant: 1. classification of growth. 2. plant height, 3. type of branch, 4. shape of stalk in crosscut, 5. colour of stalk, 6. colour of stalk-knee.

B/ Morphological traits of leaves: 1. density, 2. shape, 3. colour

C/ Morphological traits of flowers: 1. colour, 2. size.

D/ Morphological traits of fruits: 1. standing of fruits on the plnat, 2. weight, 3. colour in technological maturity, 4. colour in physiological maturity, 5. hotness.

Results of discussion

A/ Assortment of sweet pepper can be divided according to shape of plantto cultivars with bulky, middle bulky and tiny growth. This information can be used in deciding on planting distance: 60x30, 60x25 or 60x15 cm. We found cultivars middle high /46-65/,

low /25-45/ and very low /below 25 cm/. All cultivars had irregular branching. The shape of stalk in cross-cut was four-edged in all cultivars. Colour of stalk and stalk-knee was green or purple.

B/ The weak density of leaves was examined by cultivars Bjala kapia and PCR while others were with middle or considerable density. Egg-shaped leaves are characteristics for the most of cultivar. Depending on cultivars, the colour of leaves was heterogeneous: dark green, green and light green.

C/ White coloured flowers were noticed excluding the cultivars Golden California which was white-green. The size of pepper flowers was 15-25 mm or more than 25 mm.

D/ The standing of fruits on the plant was mostly hanging. Property of fruit standing is genetically determined. According to weight of fruit we distinguished 3 groops: 30-60, 60-100 and 100-200 g. According to technological maturity we found in tested assortment. At physiological maturity the colour was dark red, red and orange. The hot taste of fruits was observed only by cultivars PCR and Yellow Castle.

Conclusion

The results of studied assortment of sweet pepper show the following typical characteristics: plant height 25-45 cm, irregular branching, four-edged shape of stalk in cross-cut, green colour of stalk and purple colour of stalk-knee, egg-shaped leaves with dark green colour, size of flowers 15-25 mm in white colour, hanging fruits on the plants, weight of fruits 60-100 g, dark green colour of fruits in technological and dark red in physiological maturity and sweet taste of fruits without hotness.

VARIANTS IN CHILLI PEPPER (Capsicum annuum L.)

A.A. Depshpande, C.S. Pathak and D.P. Singh

Division of Vegetable Crops, Indian Institute of Horticulture Research Hesseraghatta Lake P.O., Bangalore – 560 089, India.

Chillie pepper (Capsicum annuum L.) is an often cross pollinated crop thereby making the effect of recessive genes in the natural population. In course of our chilli breeding programme during the period 1978-82 we have come across a number of various thrown out on artificial selfing of individual plant selections in various populations and local chilli selections. Few of such variants are presented below:

(1) Plant habit:

(a) Dwarf plant: Plants are dwarf (<30 cm height), compact and bushy. The leaves are expanded and large. Internodes are short (<1 cm). The fruits are borne singly unlike bunchy bearing habit of those reported by Deshpande (1944) and Murthy and Murthy (1962). It differs from the one reported by Csillery (1981) in plant height and number of nodes. It was first recovered as a variant among the progeny of IHR 349-12. The character has been breeding true.

(b) Branching at narrow angle: A single erect plant was located in the second generation selfed progeny of IHR 354-28 and is breeding true. No secondary branches arise from the base of the plant. Secondary branches, arising at a height 25-30 cm from the base, run almost parallel to the erect growing main stem.

(c) Prostrate plant: Four variants with prostrate plant habit were observed in the fifth generation progenies (in a population of forty plants) of IHR 348-4, thus indicating the character to be controlled by a few recessive genes. The main stem of such plants bend and run along the ground. Similarly side branches run prostratly on to the ground.

(2) Leaf variants:

(a) Virdescent leaves: Plant with viridescent leaves were obtained as

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segregants in the selfed progenies of IHR 352-7-4. The leaves are papyrine and yellowish green.

(b) Rolled leaves: Two plants segregants with leaves partially rolled inwards over the dorsal surface, were isolated in the second generation progenies of IHR 352-7.

(c)Glowing yellow top mutants: A single plant with young expanding yellow leaves was located in the line IHR 307-13-6. The leaves later turned green gradually. The characters appears to be controlled by more than one recessive gene. The character is more pronounced early in the morning. All these leaf characters can be useful as seedling markers.

(3) Longitudinal fruit crack: Longitudinal fruit cracking on ripening was observed in a plant of the progeny of IHR 525-5-4-1-2 and is found to be true breeding. The fruits appear to crack because of high seed content.

(4) Decidyous calyx: The clayx is papyrine and dries up before the fruits mature red: thus giving an impression of direct insertion of pedicel into the fruit. This character is associated with abnormal flowers having curved style and stigma which are attached to partially petaloid anthers. A single such mutant was spotted in the third generation progeny of line cosss 197-5-8-80.

The detailed inheritance of all these variants is being worked out.

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POLYPHENOL OXIDASE ACTIVITY AND CHEMICAL COMPOSITION OF SOME

SWEET PEPPER VAIETIES

K.L. Bajaj, G. Kaur and Jarnail Singh

Department of Vegetable Crops, Landscaping and Floriculture Pujab Agriculture University, Ludhiana 141001 (India)

Peppers (Capsicum annuum) having low capsaicin content have much petential for being used for salad purposes. The present communication reports the chemical analysis of eight sweet pepper varieties out of which six were developed from natural cross of Malguche variety obtained from France. The crop was grown I triplicae in randomized block design suing 60 kg N, 30 kg P_2O_5/ha, half amount of Nitrogen and the whole of superphosphate was applied at the time of transplanation and the balance of nitrogen was applied 30 days after transplantation. From fresh mature fruits, polyphenol exidase activity was determined by the method of Taneja & Sachar (1974), ascorbic acid and capsaicin content were determined by the methods of Bajaj & Kaur (1981) and Bajaj and Kaur (1979) respectively. Total alcoholic extract, crude fibre and total ash contents were determined by A.O.A.C. (1975) methods.

Results

Data given in Talble 1 show that dry matter content among these genotypes ranged from 9.95 % (S_{27}) to 19.65 % (My-9-1). Ascorbic content range was from 70 (S_{27}) to 176.8 mg/100 g (My-9-1). The varieties My-8, My-10-1; and My-5-1 were also rich in ascorbic acid content. Polyphenol oxidase activity was maximum in My-12-4 and minimum in the variety My-9-1. In addition to the variety My-9-1, the varieties My-10-1 and S_{27} were also having low polypenol oxidase activity, hence suitable for processing.

The varieties Kaloscai E-15 and S_{27} were having very low capsaicin content (0.03 %). The maximum capsaicin content was found in the variety H-6 (0.1 %), other varieties having low capsaicin content were My-10-1 and My-12-4. Total alcohol extractable matter was found maximum in the variety My-10-1 (25 %) and minimum in the variety My-12-4. Other varieties rich in alcohol extractable matter were My-9-1, My-3-1, and S_{27}. Maximum crude fibre content on dry weight basis was found in the variety My-12-4 (22.74 %). The promising lines with low fibre content were Kaloscai E-15 and S_{27}. The varieties My-10-1, My-5-1 and My-8 were having intermediate fibre content. There was not much difference between the ash content of different varieties, its value ranged from 3.6% (My-9-1, My-12-1) to 5.2 % (My-3). In conclusion, the variety My-9-1, having maximum dry matter, ascorbic acid. Low polyphenol oxidase activity maximum colouring matter, intermediate capsaicin content rich in alcohol soluble matter, low ash content in suitable for salad as well as for processing purposes.

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Table 1. Polypheno oxidase activity and chemical constituents of some sweet pepper varieties.

Vareity	Dry matter	Ascorbic acid	Polypheno oxidase activity	Percentage			
				Capsaicin	Alcohol soluble extract	Crude fibre	Ash
My-8	16.4	160.4	1.2	0.10	13.0	14.8	4.3
Kaloscai E-15	15.93	80.2	0.9	0.03	16.50	8.51	4.8
My-10-1	15.66	140.8	0.5	0.06	26.0	10.75	4.9
My-9-1	19.65	176.8	0.3	0.09	23.0	17.90	3.6
My-3	12.62	85.7	1.3	0.10	15.00	17.40	5.2
My-12-4	13.35	91.7	1.4	0.10	11.50	22.74	3.6
My-5-1	14.38	131.4	1.0	0.16	21.00	13.03	5.0
S_{27}	9.95	70.0	0.4	0.05	21.50	7.74	4.7

THE MORPHOLOGICAL FEATURES OF A LOCAL VARIETY OF PEPPER

P. Bellettie and S. Lanteri

Institure of Plant Breeding and Seed Production, University of Turin Via P. Giuria, 15 – 10126 Turin, Italy

There is a long tradition of pepper growing in the south-east of the province of Asti (Fiedmont, northern Italy), above all at La Motta di Costigliole. The crops are grown under plastic tunnels and ripen very early. The types grown, though related to several varieties, are almost all connected with the 'Quadro d'Asti' bell pepper: a large , sweet, squarish pepper with thick walls. For these reasons they are sold for a very high price.

A scheme for the identification of the morphological features of the berries has been started, to quality 'La Motta peppers', as it has been felt that the crisis, which has been hitting pepper production too during recent years, can only be overcome by offering customers the gurarantee of a choice product.

The work of establishing the morphological features of the 'La Motta pepper', begun in 1983, will take several years to complete. It consists in gathering a certain number of berries at intervals during the season, so as to get a representative sample of the population. Measurements and analyses of the berries are made, partly following the criteria laid down in the International Board of Plant Genetic Resources "descriptor list for Capsicum"

These analyese and measurement concern particularly colour and form, dimensions, volume and weight, pungency and wall thickness of the berry. A minimum standard will be laid down for each feature and berries will be required to comply with these standards to quality for the denomination of 'La Motta pepper'. A special effort is beign made to find a correlation between the thickness of the wall (the most important feature of the "La Motta pepper') and some other more readily assessable feature.

AGROBIOLOGICAL STUDIES ON SOME LOCAL SAMPLES OF PEPPER

Krâsteva L., E. Vesselinov
Institute of Introduction and Plant Resources “K. Malkov”, Sadovo, Bulgaria

The local cvs and population of pepper in Bulgaria represent a considerable popential value. Having been formed in the course of several years and adapted to different conditions in the country, the local forms of pepper are a valuable genetic fund, which can be broadly used for breeding purposes. In this respect studies on pepper have been relatively fet /1,2/.
Material and Methods: Studies were carried out from 1979 to 1981. The object of the research were 63 accessions collected locally during explorations which took place in 1978 in different districts of Northern Bulgaria. In the assortment there were accessions from the districts of Northern Bulgaria. In the assortment there were accessions from the districts of Târgovishte – 22 in number; Vratza – 16; Mihailovgrad 14; Russe – 6; Shumen – 3 ans Vidin – 2. As standard cvs Albena, Byala Shipka and Kurtovska Kapya were used. The indexes examined are those stipulated by the Counci for Mutual Economic Aid /3/. Results and Discussion: The accessions according to shrub height were divided into three groups, viz, short, average and tall. In the first group there were 20 in number, in the second 24 and in the third 19. As to the structure of the brush the compact habitus group were 32, semi-diffused 20 and diffused 11. A large part of the collection 61% has leaves with an eggshaped structure, while the other 49% has an elongated eggshpaped one.
There are differences among the accessions even as concerns the position of the pistil. In 28% of them the pistil is situated below the stamen, while in the remining 62% it is on the same level. As concerns the fruit here too the accessions can be divided into three groups: those with hanging fruits 42 in number; protruiding fruits – 11; and mixed fruits – 10.
In the collection accessions with elongated cone-shaped fruits 30 in number were predominat; with trunkshaped fruits there were 14 accessions; cone-shaped 13; prismatic 3 and with flatty round fruits there were 3 accessions. As far as length is concerned they were divided into four groups: very short, medium, long and very long fruits. Accessions 6436 and 6602 with fruits from

2,4 to 2,6 cm in length belong to the first group. The largest number were samples with medium length fruits – 49. Those long capsules were accessions: 6427, 6426, 6660, 6607, 6608 and 6613, those with very long capsules were 6628, 6629, 6617, 6604 and 6448. The accessions whose capsules were dark green at the phase 'commercial ripeness' were 28; light-green – 22; milky-white and violet 5 each. As far as fruit surface texture is concerned the accessions were divided into 1 – smooth surface 60%, 2 – slightly ribbed surface 34% and heavily ribbed surface 6%.

The indexes which determine the technological qualities in the collection, greatly differ. For example, in pericarp thickness which is from 1 to 6 mm the accessions were selected into: 18 with a very thick pericarp; 20 – thick; 17 – medium and 9 thin. They were also selected according to fruit skin thickness which is fro 20 to 100 MKM. 12 were found to have medium thick skin and 11 just thick. 76% of the accessions had capsules which turn red on reaching the botanical ripeness, 10% - orange, 6% - yellow, 5% dark red and 3% orange red. The number of seeds in a single fruit ranges from 70 to 200.

Observations on the proceedings of the phenophases show, that with the following accessions: 6424, 6447, 6660, 6609, 6627 flowering takes place 75-80 days after sprouting. In the remaining accessions this takes place 90 days after sprouting. The continuation of flowering stretches from 66 to 70 days for 38% of the accessions and 75 to 80 days for the remining lot. The ime for sprouting to botanical ripeness ranges from 120 to 155 days. A larger part of the samples ripe early – 28%; 18% - mid-early and 17% - late.

The indexes average weight and number of capsules to a plant are most important for assessing pepper productivity. The average weight of the accessions ranges from 10 to 140 gr. Accessions 6436, 6437 and 6603 have the smallest capsules (10 to 15 gr), while 6432, 6604, 6628 have the largest (120 to 155). The capsules to an accession gives a general idea as to the expected yield. The variation in the number of capsules n separate accession is from 15 to 45. Accessions 6414, 6435, 6436 and 6425 have the largest number of capsules.

The complex evaluation of an assortment of accessions allows for the selection of perspective material for breeding and practical purposes.

From the investigation carried out the following conclusions can be drawn:

1. The accessions are characterized by a considerable variety of indexes.
2. The accessions in the collection belong to varieties, conoides, kapia and shipka. Accesssons 6608 and 6614 var. conoides can be pointed out as perspective in as far as they surpass by 3 – 5 % the standard cv. Albena in productivity. The accessions 6424, 6607, 6627 and 6660 ripen earlier than the standard cv Kurtovska Kapya.

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OBJECTIVE QUALITY EVALUATION OF FRUIT OF SOME SWEET PEPPER VARIETIES FOR FRESH CONSUMPTION

A. Testoni, P. Eccher Zerbini, A. Sozzi

Instituto Sperimentale per la Valorizzazione Technologica dei Prodotti Agricoli Via G. Vnezian, 26 – 20133 Milano Italia

For the best evaluation of sweet peppers for fresh consumption, it appeared necessary to assess the quality of the berries on the ground of objective parameters which permit to characterize and qualify the varieties from this point of view.

Sixteen different sweet pepper lines and cultivars were studied for two years and several quaility indices were measured on twenty berries for each cv.: weight of the berry, specific gravity, thickness of the pericarp, per cent waste after coring, and two texture indices: shear resistance of the pericarp and punturre resistance of the esocarp.

Results are summarized in tables 1 and 2.

In general cultivars Golia Giallo, Yolo Wonder and lines 80-333, 80-44, 80-72, 81-245, 81-508, 81-499 showed good results in all the parameters examined. Other lines on the contrary while showing good results in some features are bad in others, as e.g. Pimiento Select which shows the highest specific gravity but also the highest per cent waste after coring, or as Corrida, Venus and Lungo Rubens which shows low values of shear resistance.

Table 1: Mean values of weight, specific gravity, thickness of the pericarp, percent waste after coring, shear resistance of pericarp, puncture resistance of the escocarp, of sweet pepper berries grown in 1981.

	Weight g	Spec. grav. g/cm^3	thickness mm	% waste	Shear resis. Kg/cm	Punture resis. Kg
Corno toro r.	145.2	-	4.57	16.33	2.67	0.59
Corrida	116.7	-	3.94	15.99	2.37	0.53
Golia r.	164.5	0.423	4.26	18362	2.65	0.63
Golia g.	197.3	0.457	4.93	19.50	2.4	0.67
Pimiento s.	57.3	0.630	3.60	37.70	2.49	0.69
Trottola c.	142.8	0.519	5.13	21.02	2.49	0.75
Venus	114.5	.561	5.13	21.51	2.30	0.75
Yolo w.	176.1	0.519	5.31	22.67	3.01	0.69
Linea 80-44	144.4	0.509	5.35	26.41	2.92	0.74
Linea 80-72	146.2	0.501	5.03	23.61	3.14	0.85
Linea 80-83	101.2	0.596	4.58	33.73	2.75	0.90
Linea 80333	205.8	0.433	4.74	18.41	3.13	0.79
Linea 80-431	85.8	0.466	4.13	20.38	2.43	0.47
Linea 80-529	74.8	0.553	4.23	24.32	2082	0.85
Linea 80-532	111.5	0.544	4.87	25.98	3.08	0.90
Linea 80-557	93.4	0.493	3.62	25.51	2.74	0.67
M.D.S.	33.33	0.044	0.73	4.86	0.41	0.16

Table 2: Mean values of weight, specific gravity, thickness of the pericarp, per cent waste after coring , shear resistance of the pericarp, puncture resistance of the esocarp, of sweet peper berries grown in 1982.

	Weight g	Spec. grav. g/cm^3	thickness mm	% waste	Shear resis. Kg/cm	Puncture resis. Kg
Corrida	99.5	0.504	4.18	18.66	2.00	0.55
Lungo r.	107.3	0.495	4.51	17.48	2.28	0.61
Super Golia	198.6	0.426	5.17	18.19	2.61	0.57
Trottola c.	155.8	0.513	5.77	24.60	2.34	0.65
Venus	120.1	0.540	5.71	27.51	2.66	0065
Yolo w.	206.8	0.550	6.31	24.99	2.85	0.66
Linea 80-305	148.7	0.465	5.05	22.51	2.38	0.58
Linea 80-309	155.7	0.464	4.93	17.51	2.81	0.60
Linea 80-375	177.9	0.442	5.19	21.24	2.77	0.63
Linea 80-426	93.2	0.513	4.39	19.83	2.13	0.62
Linea 81-230	188.3	0.498	5.86	23.56	2.53	0.64
Linea 81-239	164.3	0494	6.25	23.57	2.85	0.70
Linea 81-245	162.4	0.609	7.62	29.11	3.08	0.62
Linea 81-375	143.6	0.544	5.48	26.59	2.63	0.67
Linea 81-499	202.7	0.427	5.31	20.66	2.89	0.68
Linea 81-508	144.4	0.431	5.09	22.43	2.90	0.63
M.D.S.	29.66	0.034	0.71	3.42	0.47	0.10

LOW TEMPERATURE ADAPTATION IN GLASSHOUSE SWEET PEPPER

G. Pet
Institute for Horticultur Plant Breeding (IVT)
P.O.Box 16, 6700 AA Wageningen, The Netherlands.

As energy costs form a large part of the total costs of Dutch glasshouse sweet pepper production (l), a program for selection of genotypes with adaptation to low temperatures was started at the IVT in the winter season 1979-1980.

For this research 85 varieties out of our Capsicum collection, representing most countries where peppers are grown, were chosen to compare growth and fruit set at low temperature.

At first a temperature regime had to be found which discriminates between varieties with a good and those with an unsufficient growth and fruit set at poor energy conditions.

Three different temperature regimes were compared: a) 23/20°C, d/n and after 5 weeks 21/16°C, (normal), b) 23/12°C, d/n and c) 18/12°C, d/n. In the treatments b) and c) the soil temperature was kept at ± 16°C by soil heating, in a) at ± 22°C (normal). Seeds were sown on 3-l0-'79, seedlings raised at a usual temperature (23/20°C, d/n) and transplanted in the glasshouse compartments with the different temperature regimes on 19-12-'79. As it proved that the regime of 18/12°C was too low for all the varieties, the temperature in this compartment was changed to 20/14°C from half February on.

The performance of the varieties in the 2 compartments with low temperature was similar, with considerable differences in growth between varieties. Only some varieties had good fruit set. The varieties with the best growth and fruit set were selected and crossed with the Dutch variety Bruinsma Wonder in order to obtain the desired fruit characters for the Dutch market. Also crosses between the selected varieties were made.

In the next winter season the obtained hybrids and their parents were grown at two temperatures 23/20°C (d/n) and 20/14°C (d/n). Sowing and planting dates were similar to those of the previous year. Differences found between some of the best varieties and hybrids are demonstrated in table 1. The best varieties were 'Kalocsai 504', 'Poznanska Slodka' and 'Sweet Banana'.

'Jubilanska' was moderately good but has the advantage of rather good, blocky fruits. The selected varieties and their hybrids were more vigorous than the standard variety 'Bruinsma Wonder', at normal as well as at low temperature. Some F_1's showed hybrid vigour. Vigour has proved to be an important character for growing under rather low temperatures. Remarkable is the over all better fruit set at low temperature in comparison with a temperature of constant 23/20°C. The best plants of the best hybrids were selfpollinated and backcrossed to Bruinsma Wonder.

In the winter season 1981-1982 F_2's, some BC's, F_1's and P's were grown in a glasshouse at a temperature of 22/12°C, d/n and a soil temperature of 18°C. Growth, flowering and fruit set were observed. Some results are given in table 2. Some F_2-plants had a better fruit set than the best plants of the parent with good fruit set, also indicated by the range of number of fruits in the last column in the table. Only a few plants of the standard variety had 1 or 2 fruits, while in the F_2's plants with 10 to 15 fruits were present.

It can be concluded that at rather low temperatures and light intensity our breeding material had a much better growth and fruit set than the standard variety. Seeds from selfing of the best plants of the best populations, including also acceptable plant types and fruit forms, were issued to Dutch breeding firms which use the material in their own breeding programs for low temperature adaptation in pepper. The breeding firms have to incorporate many other desired characters into the released material in order to create commercial varieties. This can be done by backcrosses and combination crosses. When backcrosses are made much of the character good fruit set can be lost (table 2).

A last trial with this breeding material in the winter of 1982-1983 confirmed the results of the foregoing year. We did no research on the genetical background of the involved character. In general characters like adaptation to low temperatures are very complex and are probably based on many genes The data indicate that the character low temperature adaptation may be inherited in an intermediate fashion.

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Table 1. Growth and fruit set of sweet pepper varieties and hybrids in relation to temperature. (1980-1981)

Variety or Hybrid	Plant length (cm) on 27/2		Number of fruits on 3/3	
	20°/14°	23°/20°	20°/14°	23°/20°
Kalocsai 504	54	76	7,1	1,2
Poznanska Slodka	68	95	4,7	0,9
Sweet Banana	70	91	6,4	2,2
Jubilanska	69	85	1,7	0
F_1 Poznanska x Br.Wonder	61	87	3,5	0
F_1 Kalocsai x Sw.Banana	77	95	4	2,0
F_1 Jubilanska x Poznanska	73	92	6,7	0,9
F_1 Br. Wonder x Kalocsai	66	91	2,3	0
Bruinsma Wonder	36	57	0	0

Table 2. Growth and fruit set of F2's, F1's, BC's and varieties at a temperature of 22°C/12°C day/night (1981-1982)

Population or variety	Growth[1] on 28-2-'82	% plants with fruit set on 8-2-'82	Mean number of fruits per plant on 2-3'82
F2 Kalocsai 504 x Sweet Banana	6,8	51	4,9 (0 – 11)
F2 Poznanska Slodka x Bruinsma Wonder	6,7	24	3,3 (0 – 12)
F2 Weiner halblanger x Sweet Banana	7,2	41	7,3 (1 – 15)
F2 Jubilanska x Poznanska Slodka	7,2	37	4,5 (0 – 12)
F2 Bruinsma Wonder x Jubilanska	6,2	9	2,3 (0 – 7)
F1 Kalocsai 504 x Sweet Banana	7,7	67	7,0 (4 – 10)
F1 Poznanska Slodka x Bruinsma Wonder	7,3	33	4,0 (2 – 5)
F1 Jubilanska x Poznanska Slodka	7,3	38	6,5 (1 – 11)
BC1 Br.Wonder x (F1 Br. Wonder x Poznanska)	6,0	0	0,8 (0 – 6)
BC1 Br.Wonder x (F1 Jubilanska x Pozanska)	6,3	29	3,2 (0 – 8)
Poznanska Slodka	7,0	78	6,2 (2 – 10)
Wiener halbanger	6,3	0	3,1 (0 – 9)
Sweet Banana	7,3	28	6,7 (5 – 11)
Jubilanska	6,3	0	2,7 (0 – 7)
Kalocsai 504	6,0	72	3,9 (0 – 6)
Bruinsma Wonder	4,7	2	0,1 (0 – 2)

1) growth rated on a scale of 1-9 with 1 = extremely poor, 9 = very strong

PERFORMANCE OF PEPPER CULTIVARS GROWN IN DOUBLE POLY TUNNELS

A.R. Maurer

Agriculture Canada, Research Station, Agassiz, B.C., Canada.

The production of peppers in British Columbia accounts for only 2% of consumption, the remainder being imported. In the coastal areas of British Columbia the summer season is variable and is often unsuited to pepper production due to rain and lark of sunshine. Pepper production is this area, under the protection of double polyethylene tunnels may have a good potential.

Eighteen cultivars of variable genetic background, were seeded in a heated greenhouse (20°C day - 16°C night) in early January and transplanted to a double poly tunnel in mid February. The tunnel was maintained at a minimum temperature of 15°C and maximums reaching up to 25°C, depending on available solar radiation. Plants were spaced at 120 x 60 cm and, when fully developed, were trimmed to a height not exceeding 160 cm.

Vegetative growth under tunnel conditions was much greater than in the field. No problems were encountered with pollination but botrytis affected blossoms and some stems and had to be controlled with Benlate.

The earliest harvest date was June 16 and the latest November 17 (Table 1.). Of the cultivars under tests, Big Bertha, Gedeon and Clovis were adapted bell peppers to tunnel conditions. Each of these produced an average of over 3 kg marketable fruit per plant. Amongst the yellow Hungarian types, Hungarian Yellow Wax was superior in yield to Taltos and Feherezon. The hot peppers yielded profusely and could be grown for specialty markets. Further assessment trials are underway.

ACHIEVEMENTS AND PROBLEMS IN PEEPER BREEDING AND INTRODUCTION IN BULGARIA

D.Popova, L.Krasteva — IIPGR, Sadovo

l. Todorov – 2ZK"Maritza, Plovdiv

Pepper takes fifth place in area and production among the vegetable crops in the world and second place in our country. Over 90% of the pepper area is grown with Bulgarian cultivars. Pepper breeding in Bulgaria has a long history. The names of the first plant breeders who screened the multiforms of this new crop in Europe and stabilized the strain in form and quality of varieties type 5Yaba5, 5Ratund5, 5Kapiya5, are not known, but they developed a rich stock not only for the Bulgarian but also for the world.

It is not by chance that our country is considered to be the secondary formative center (Popov,1940). Purposeful breeding and introduction work was initiated by Academitian P.Popov in 1933 at the Research Institute for Vegetable Crops "Maritza", Plovdiv, at that time a Research Station. During the first stage of the research work the wealth and the wide range of local forms were studied. Parallel with the local forms in the collection nursery are included, maintained and studied over 1010 pepper cultivars, origined from 39 countries in Europe, Africa, Asia and America.

It was found out from the former researches that the direct introduction of foreign pepper cultivars gave in most of the cases unsatisfactory results (Christov, Todorov, 1981). Goodresults were recently obtained by the Hungarian semideterminate red pepper cultivar for grinding "Kolochai M-622" (Todorov, 1882). Among the USSR cultivars studied most interesting were "Padorok Moldavvii" and "Lastotchka", distinguished for comparative high resis-

tance to Verticilium. Trough a mass negative selection were improved, stabilized and distributed the Bulgarian pepper populations “Ratund Green”, “Shumenski Ratund”, “Kalinkov Green”, “Momino Sartze”, “Sivriya”, “Techeran Ljit”, “Gorogled’ , “Koshi Roga” and others.

By the method or individual and individual-family selection was bred a range of pepper cultivars, which are still wildly distributed - “Kurtovska kapiya”, “1916”, ”Sofiiska kapiya”, “Tochoradjiiski”, “Zlaten medal 17”, “Kalinkv 860/7”, “Gorogled 6” and others.

The red pepper cultivars for grinding “Buketen” and “Buketen 50” are a result of the hybridazation between C.annuum and C.fasciculatum. Among the latest breeding materials resulting from interspecific hybridization, most prespective are “Kapiya Haber” and “Kapiya 1300”.

The heterosis work with pepper was initiated by Acad.P.Popov and continued by Senior Res.Worker C.Christov, who bred the first heterosis cultivar “Kalinkov x Sivryia” (Popov, Christov,57).

Later Popova (1973), Institute of gcnetics, Sofia, carried out a wide research work on the biology of flowering, pollination, fertilization and heterosis in pepper.

Daskalov (1971) on the base of male - sterile mutants worked out and experimented a new more effective technology of hybrid seed production.

The hetrotic cultivars “Krichimski Ran” and “Ljulin” are bred and distributed for early production and fresh consumption.

According to the specific characteristics, tendencies of pepper production and destination or pepper fruits in our country, pepper breeding is carried out in the following main directions:

1.Breeding of red pepper cultivars for grinding which should be with good fruit uniformity, suitable for mechanical harvesting

3. Breeding of pepper cultivars for early and medium-early field production for fresh consumption, export and for canning.

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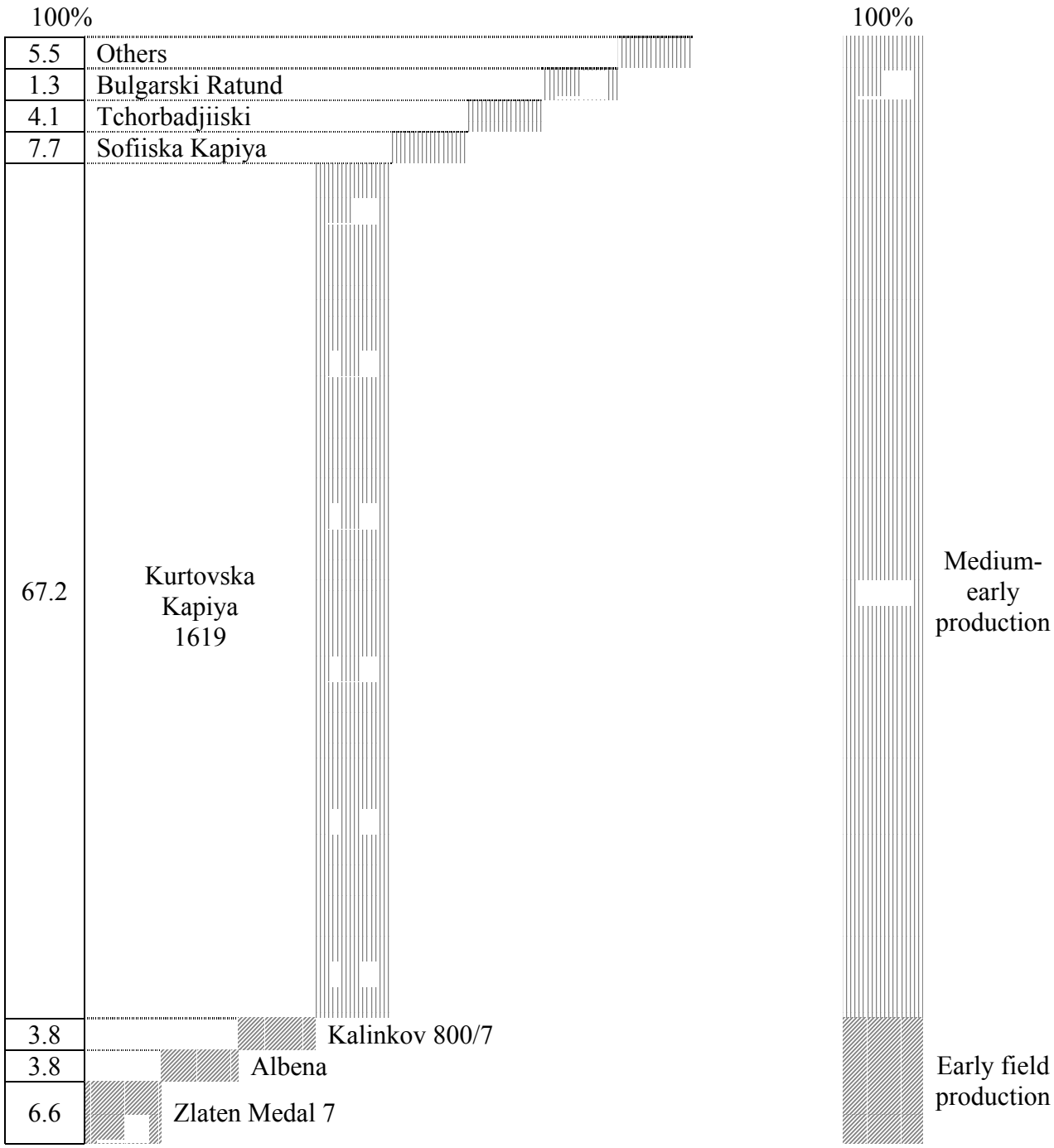
Fig. 1. Variety structure and directions of production in green pepper*



*/The variety structure and directions of production are given according to sowings in % for 1981.

MALE AND FEMALE STERILITY IN CHILLI PEPPER (Capsicum annuum L.)

C.S. Pathak, D.P. Singh and A.A. Deshpande

Division of Vegetable Crops, Indian Institute of Horticultural Research, Bangalore, India

During the course of our studies on different pepper varieties, male and female sterile plants were isolated. This paper deals with detailed studies on these plants.

MALE STERILITY: The male sterile plant was isolated spontaneously from cv. Kalyanpur selection. The plant had compact habit with small size of leaves. The flowers had stamens transformed into petaloid structures, thus each flower had two whorls of corolla. The gynoecium was normal and the fruits developed after out crossing were curved. To determine the inheritance of male sterility. G_4 and female sterile plant. The F_1 plants were normal with restored fertility and good fruit setting. F_1 plants were selfed for raiwing F_2 population. The segregation ratio in F_2 genereation and chi-square alaysis clearly indicated that, male sterility is governed by a single recessive gene (Table 1).

Similar findings have been reported in Capsicum by Shifriss (1973) and Daskaloff (1971). So far eight non-allelic genes i.e., ms1, ms2, ms3, ms4, ms5, ms6, ms7 and ms8 have been reported to control male sterility in Capsicum and these genes are mainly expressed through pollen sterility. Although allelic tests of the present male sterile has not been carried out with the existing 'ms' genes, but transformation of anthers to petaloid structures as found in the present case indicate the existence of another 'ms' gene for male sterility. Association of several other morphological characters like, compact plant habit, small leaf size and curve fruits with the male sterile plants indicate the pleitoropic effect of 'ms' gene or close linkage.

FEMALE STERILITY: The female sterile plant was isolated from cv. Kalyanpur Red and it was indistinguishable from normal plants of the variety except for flowers, which were devoid of style and stigma, ovary being intact and there was no fruit setting. Anthers were normal with 85 per cent pollen fertility.

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Meiosis was normal with 2n = 24 chromosomes.

As discussed earlier the F_1 plants between male sterile x female sterile plants were fertile, showing normal development of androecium and gyneocium which resulted in normal fruit setting. The segregation ratio observed in F2 and back-cross population indicate that the female sterility caused by the absence of style and stigma is controlled by a single recessive gene. A similar styleless mutant controlled by a single recessive gene has been reported by Bergh and Lippert (1965).

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Table 1 – Segregation of male fertile and male sterile plants in F_2

Crosses and generation	Male Fertile	Male Sterile	Expexted male fertile:sterile ratio	X^2	p
ms x CV. G_4 F_2	59	18	3:1	0.075	0.50-0.95
ms x fs F_2	49	13	3:1	0.003	0.95-0.99

Table 2 - Segregation of female sterile plants in F2 and back-cross progenies

Crosses and generation	Female Fertile	Female Sterile	Expected female fertile:sterile ratio	X^2	p
ms x fs F_2	45	16	3:1	0.4468	0.50-0.95
ms x fs BC_{1-2}	30	33	1:1	0.0714	0.50-0.95

TYPES OF MALE STERILITY IN CHILLI PEPPER (Capsicum spp.)

A.A.Deshpande, C.S.Pathak and D.P.Singh

Indian Institute of Horticultural Research
Hessaraghatta Lake P.O., Bangalore 560 089, India

Genic and/or cytoplasmic genie male sterility in Capsicum annuum L., has been reported by several workers (Peterson, 1958; Hirose, 1965; Daskaloff, 1971; Novak et al., 1971; Shifriss and Frankel, 1971). Some new sources of male sterility that we have come across during our chilli breeding program are presented here.

Thirty one male sterile plants have been isolated as segregants/mutants from lines — Cross 197, Kalyanpur selection, Kalyanpur red, Kalyanpur yellow, Kalyanpur chaman, CA 960, G4, T65, IHR 240 A-1-2, IHR 267-5-1-4, IHR 404, IHR 156 IHR 425 and interspecific corss between C. pendulum and C. annuum during the period 1978-1983. However, these male sterile plants can be grouped into five categories depending upon morphological changes exhibited in androeccium. These are:

(a) Androecium transformed into petaloid structure (in Kalyanpur selection). It is controlled by single recessive gene (Pathak et ai., 1983).

(b) Rudimentary or shriveled anthers devoid of pollen grains (in Cross 197, Kalyanpur red, T_{65}, Kalyanpur chaman, IHR 404, IHR 425, 1HP 240 A1-2). At least three different alleles are found to independently control the above type of male sterility.

(c) Anthers appear to be normal but pollen grains are sterile and are found in clumps (in Cross 197).

(d) The yellow anther lobes are flattened laterally to give an appearance of a fan blade and are devoid of pollen grains. The flower appears to be normal hut do not set fruits. This association between male sterility and non setting of fruits has been observed in two segregants originating in two entirely different populations (Variety G_4 and line IHR 267-5-1-4). This is the first report of male sterility with such anther modifications.

(e) Cytoplasmic male sterility have been located in IHR 156 and also in two

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segregants of a double cross hybrid involving (IHR 517A-2-2-5 x 334-9); where IHR 517A-2-2-5 belongs to C. pendulum and rest to C. annuum. Two of the four plants of double cross origin have been observed to be sterile and other two fertile. The progenies from male sterile plants obtained through a number of directional crosses as well as open pollinated ones, turned to be all male sterile indicating cytoplasmic nature of sterility. Androecium of such male sterile plants consists of filament alone and is devoid of anther lobes. Work is in progress to locate restorer genes in order to utilise it in hybrid seed production.

All these male sterile types are found to be stable in the field under different environmental conditions. Inheritance of these male sterile types is being worked out.

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CLOSED FLOWER MUTANT IN CAPSICUM ANNUUM L.

C.S.Pathak, D.P.Singh and A.A.Deshpande

Division of Vegetable Crops, Indian Institute of Horticultural Research, 255, Upper Palace Orchards, Bangalore - 560 080, India

Several studies dealing with mutation research have been reported in Capsicum, mainly on Sweet Pepper (Csillery, 1980; Saccardo and Vitale, 1982; Daskaloff, 1977 etc.). Adding to the present list of mutations, the present paper reports the existence of closed flower mutant in hot pepper.

A single plant was observed in the natural population of hot chilli Cv. Cross 197 having closed flowers. The calyx were enlarged covering half portion of the corolla, which remained rolled and never opened. Although the flowers remained closed, the style was protruding out in most of the flowers. The protruding style was found even in the young flower buds. The mutant plant was dwarf (37 cm) and bushy with many branches. Anther development was normal with about 80% pollen fertility which was determined by the method of acetocarmine stainability. The leaves were slightly narrower than normal plants. Fruit setting was very poor. The fruits were of small size and deep red in colour.

Cytological examination of pollen mother cells revealed normal meiosis and 2n = 24 chromosomes.

To determine the inheritance of the mutant traits, the closed flower mutant was crossed with normal plants of Cv. Cross 197. The crosses were successful in both the directions when the mutant was used as male and female parent. The F_1 plants and F_2 progenies from individual F_1 plants after selfing and F_1 a test cross progeny between closed flower mutant x F_1 plant were grown in rows of 5- x 40 cm in the field. Ratio of normal and mutant plant was determined in F^2 and test progeny. The x^2 (Chi-square)thst was cr of normal and mutant plant was used to test the goodness of fit of the observed frequency of the mutant.

The F plants were all normal and morphologically similar to the normal parent. The test cross revealed a ratio of 1:1 closed flower mutant to

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normal plants. The F_2 generation ratio of segregation between normal plants and closed flower mutant was 3 : 1.

These findings indicate monogenic recessive nature of closed flower mutation. The gene responsible to this is designated as 'cf'. As most of the flowers in the mutant had protruded style which comes out even in bud condition, and there is quite good seed setting after artificial pollination, this mutant could be exploited for hybrid seed production.

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Table 1- Segregation of closed flower mutant plants in F_2 and test cross.

Cross	Generation	Number of plants		Expected ratio	Goodness of fit 'p'
		Normal plants	'cf' plants		
Closed flower mutant x Cv. Cross 197 (Normal plant)	F1	55	0	-	-
	F2	217	71	3 : 1	0.80-0.90
Test Cross 'cf' mutant x F_1 Plant	BC1	172	163	1 : 1	0.50-0.70

POSSIBLE CONTRIBUTION OF CLEISTOGAMY IN CAPSICUM

Chen Shifriss, Dept. of Genetics and Plant Breeding, The Volcani Center,

Bet Dagan, 50250, POB 6, Israel

In certain areas of Israel ripe red fruits show internal mold caused by Alternaria alternata. Information obtained suggested that the fungus enter the developing fruit at the flowering stage via the stigma and the style (1). It is suggested that the closed flower may serve as a protectant or a barrier against ingress of the fungus. Thanks to Dr. S. Subramanya who found the cleistogamy trait (2) seeds were obtained and the character is being studied.

Dr. Subramanya described variation in the expression of the trait. In addition it is necessary to know how long the petals remain closed. Preliminary greenhouse observations (October 1983) suggest that in comparison with normal flowers, cleistogamous ones remain closed a rather short time (one day) following anthesis. An effort is carried out to select for strong expression and longevity of the character.

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PARTHENOCARPY IN CHILLIES (Capsicum annuum L.)

C.S.Pathak, D.P.Singh and A.A.Lleshpande

Division of Vegetable Crops, Indian Institute of Horticultural Research, Hesseraghatta Lake P.O., Bangalore 560 089, India

Parthenocarpic fruited plants were isolated in the selfed progeny of a chilli variety Kalyanpur chaman, during 1978. These plants were more or less identical to the normal plants except the underdeveloped seedless fruits. The fruit size was reduced tremendously. Detailed morphological studies of flowers indicated that the ovules were normal in the beginning and the degeneration started after two days of flower opening. Gradually these underdeveloped ovules became brown colored and then completely degenerated after five days.

Pollen fertility was also highly reduced (10%) in such plants. Cytological studies revealed normal meiosis with perfect bivalent formation but the degeneration of microspores starts after tetrad stage. However, artificial pollination from fertile plants also failed to induce seed setting in such plants. Germination of pollen grains was found normal over the stigma and the pollen tubes also travel down in the style. It is speculated that either the pollen tube fails to enter the embryo sac or the fertilized embryo aborts afterwards. Selfed progeny of some of the normal plants in the line, again segregated into normal and parthenocarpic plants. Genetical studies were carried out in the progeny of two such heterozygous plants. The segregation ratio observed in the progeny of these heterozygous plants indicated monogenic recessive nature for the parthenocarpic character which can be termed as ‘pf’.

There is no report of naturally occuring parthenocarpy in chillies elsewhere, however, parthenocarpy has been induced through interspecific crosses between Capsicum annuum x C. pubescens and C. pendulum x C. annuum (Malhova, 1977). Besides this treatment with morphactin produced parthenocarpic fruits in C. annuum var. NP 46 A (Jayakaran, 1973). Low temperature also found to induce parthenocarpy in C. annuum var. California Wonder (Rylskl, 1973).

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Genetically controlled parthenocarpy has been reported in Cucumber and Tomato. Ponti and Garretsen (1976) reported that parthenocarpy was controlled by three independent major genes with additive action in Cucumber. However, monogenic control was reported in Tomato (Falavigna et al., 1978) as also found in the present case of chilies. The reduction in the pollen fertility indicates a pleiotropic effect of the gene controlling parthenocarpy or close linkage.

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SEGREGATION FOR NODE NUMBER IN A CAPSICUM INTERSPECIFIC CROSS AND ITS SIGNIFICANCE

R. Subramanya
IFAS, University of Florida
P.O. Drawer A
Belle Glade, Florida 33430

One of the breeding objectives in our pepper breeding program is to develop a variety with a greater node number prior to first furcation. Inheritance of this trait in Capsicum annuum L. was reported to be simply inherited with dominance for a fewer number of nodes (Mansour and Honma, 1967). The segregating populations of the cross Delray Bell (Capsicum annuum L.) x P.I. 159236 (Capsicum chinense Jacq.) indicated that more than one gene was responsible in the control of node number in this cross.

The F_1 generation was intermediate in node number. In the segregating populations (BCP_1, BCP_2, and F_2), transgressive segregation was observed (Table 1). A few plants in each generation were selfed for observation in the next generation. In the 1981 planting the transgressive segregation was more pronounced (Table 1). Although a genetic model could not be proposed in this study, the results indicated that the genes controlling node number in the two parents were at different loci.

A selection from the BCP_1 F_2 generation possessing a greater node number (30 nodes) on the main stem was backcrossed to the recurrent parent and the resulting F_1 (BC_2F_1) generation showed plants with 18-19 nodes, which was significantly greater than the high node parent (P.I. 159236, Table 1) used in this study. This indicated that the selection used in the latter backcross had recombinant genes from both species; and because of the transgressive segregation observed in this cross, accomplishing the breeding objective (greater node number on the main stem) appears to be faster than expected.

In addition to the greater node number on the main stem, the segregates of this cross should be valuable since both parents are virus tolerant (Subramanya, 1982) and the possibility of transferring multiple flowers from C. chinense to C. annuum (Subramanya, 1983).

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Table 1. Segregation for node number prior to first furaction in a cross between Capsicum annuum and Capsicum chinense.

Population	Previous gen. & node #		No. of nodes range	No. of plants	x
			Fall 1980		
Delray Bell (P_1)			9-10	8	9.4
C. annuum					
P.I. 159236 (P_2)			13-16	16	14.7
C. chinense					
F_1			12-13	8	12.3
BCP_1			5-18	69	10.5
BCP_2			7-22	65	13.1
F_2			6-18	48	11.7
			Fall 1981		
P_1	-	-	8-11	32	9.5
P_2	-	-	13-16	64	14.1
BCP_1F_2	BCP_1	16	10-20	21	16.6
-“-	-“-	16	11-20	17	16.1
-“-	-“-	18	13-20	17	22.8
-“-	-“-	15	11-32	22	16.4
-“-	-“-	13	9-17	24	13.1
-“-	-“-	13	10-18	12	13-9
-“-	-“-	12	10-16	16	12.4
-“-	-“-	13	10-21	13	14.0
-“-	-“-	11	9-14	20	11.8
-“-	-“-	8	5-15	20	5.3
-“-	-“-	8	6-16	19	8.9
-“-	-“-	8	4-17	23	9.9
-“-	-“-	6	3-11	23	7.0
-“-	-“-	5	4-12	18	6.8
BCP_2F_2	BCP2	19	10-16	18	13.9
-“-	-“-	20	13-25	20	15.8
F_3	F_2	14	8-23	23	12.1
-“-	-“-	14	7-20	22	13.7
-“-	-“-	13	6-15	23	11.3

ESTIMATES OF NATURAL CROSS-POLLINATION IN SERRANO PEPPER (Capsicum annuum L.)

OCTAVIO POZO CAMPODONICO.
Institution Nacional de Investigaciones Agrícolas, Apartado Postal c-1, Tampico, Tam.México-

The procedures that should be followed in the pepper genetic improvement and seed production programs are determined greatly by the degree of natural cross-pollination that occurs within the cultivars. The lack of knowledge about this can delay, in many cases, the breeding programs where pure lines are handled, resulting in losses in time, efficiency and economy in the study.

LITERATURE REVIEW

Breeders and seed producers do not agree on their opinion with respect to the percentage of natural cross-pollination that occurs in pepper; it is reported that the amount of cross-pollination can depend on the characteristics of the cultivar, on the site, or on the environment within the site. Thus, Odland and Porter in 1941, determined cross-pollination percentages ranging from 9.1% to 31.8% with different types of pepper. Franceschetti, in 1972, also registered different degrees of natural crossing in pepper. Erwin, in 1932, indicated that only 40% the flowers were self-pollinated and the rest were pollinated by bees.

Research has been done to try to explain the high degree of crossing that is registered in some types of pepper; thus Erwin, in 1931, consigned that the flowers open during the early morning and the anther dehiscence is registered five to six hours later. This was confirmed by Murthy and Murthy in 1962.

MATERIALS AND METHODS

A line with yellow fruits at maturity was used as a genetic marker (with a pair of recessive genes); and “Tampiqueño-74’ that bears red fruits, as pollinator.

The evaluation was done in the field in two sites: In the state of Tamaulipas, which is located on the Gulf of Mexico; and in the state of Nayarit on the Pacific coast. The treatments consisted in different spacings between the marker (yellow) and the pollinator (red); this spacing was done using multiples of the distance between rows; where the markers were surrounded by pollinators.

The degree of cross-pollination was determined by identifying the hybrids (F_1), the plants with red fruit, of the seeds from the marker plants.

RESULTS AND DISCUSSION

The results indicate that as the spacing increased, the degree of cross-pollination decreased (Table 1).

Table 1. Percentage of Cross-Pollination in Serrano pepper at different spacing.

Treatment number	Gulf of Mexico			Pacific Coast		*
	Spacing Radius m	% crossing		Spacing Radius m	% Crossing	
1	0.30	21.10		1.00	54.91	a
2	0.60	22.80		2.00	45.10	a b
3	0.92	10.98		3.00	26.31	b c
4	1.84	7.90		4.00	26.87	b c
5	2.76	3.86		5.00	23.57	b c
6	8.68	3.55		6.00	16.84	c
7	4.60	2.60		7.00	12.90	c
8	5.52	1.77		8.00	14.14	c
9	-			9.00	17.60	b c
10	-			10.00	11.13	c

* Treatments with the same letter are in the same range, according to Duncan's test (0.05).

These data indicated that is necessary to overcome the cross-pollination through the use of artificial protection mechanisms like plant isolation or self-pollination in order to assure the production of certified seeds or the obtention of pure lines in breeding programs.

Differences are also observed in the degree of cross-pollination between sites, being greater in the Pacific coast than in the Gulf coast. This difference can be due to the great extensions of vegetation, infrequent winds and to the presence of large population of pollinator insects, that together can be responsible for the high degree of cross-pollination that is registered in this site.

In the Gulf of Mexico region the situation is different. The percent of cross-pollination is lower than in the Pacific coast; this may be due to the fact that there is less vegetation surrounding the plots, therefore there are less pollinating insects;

besides, in this area there are frequent insecticide applications to control insects in pepper as well as to other crops.

Some observations were made on the Serrano pepper flower, verifying that the pistil is longer than the stamen, therefore the stigma extends beyond the anthers. It was observed also that the flowers open during the first hours of the morning and the dehiscence of the anthers occurs a few hours later. This observation agrees with Erwin (1) and with Murthy and Murthy (4). The period of receptiveness of the stigma is not well known, but apparently it functions only during the first day that the flower opens.

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OSMO-PRIMING OF PEPPER SEED

J .W.Hennart

Institute of Plant Breeding and Seed Production

University of Turin

Via Giuria 15, 10126 Turin, Italy.

The germination of pepper seeds is not always easy and requires high temperature. It would be beneficial for growers to increase, hasten and group the germination and consequently the plantlets emergence. I tried to evaluate the effects of the osmotic-priming , as defined by HEYDECKER in 1975 , on invigoration of the seeds of two Italian cultivars' Quadrato d'Astigiallo' and ' Corno di toro rosso '.

The seeds were first superficially disinfested by soaking 5 minutes in a 0,8 % NaOCl commercial solution and afterwards rinsed in running, tap water. For each priming treatment, the seeds were placed in Petri dishes between two sheets of filter paper, in contact with differently concentrated solutions of poly-ethylene glycol (P.E.G.) and $KN0_3$. The treatment lasted 14 days at the constant temperature of 15°Cand light for 8 hours a day. After the treatment the seeds were thoroughly washed in running tap water and surface dried with paper towels. The germination was checked immediately after priming and after priming and drying back at initial water content. (The seeds were left one month at room temperature). The germinated seeds (rootlets protruding) were checked daily for the 14 days of the germination test. The germination tests were made in Petri dishes on filter paper according for light and temperature to the recommendations of the Italian Ministry of Agriculture and Forest (8 hours of light a day, light temperature of 30°C and night temperature of 20°C. Results (see table 1 and 2)

Generally priming treatments do not modify the final germination

percentage, but the use of the highest concentration of KNO_3 reduces it.

The mean germination time is clearly reduced by all the treatments.

It is highly shortened using $KN0_3$ at the - 8 bars osmotic potential. The mean germination time of the recently treated seeds is in this case reduced from 7,8 to 1,9 day.

The germination uniformity can also be modified by treatment but only the $KN0_3$ at the lower concentrations improves it.

Seed drying after the treatment reduces the priming effect. However after the drying and the storage of 1 month at room temperature, the treated seeds always germinate quicker and in some case more uniformly than the control.

Osmo-priming using $KN0_3$ at the - 8 and – 10 osmotic potentials can be successfully used to increase the speed and the uniformity of the germination. The seedlings from invigorated seeds also emerge quicker than those from untreated seeds, in the emergence tests at optimal temperature (25°C day/20°C night) and at suboptimal temperature (25°C/15°C).

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Treatment	% Germination		M.G.T.		$T_{85} - T_{15}$	
Control	81,0		7,8		4,7	
	. A	. B	. A	. B	. A	. B
P.E.G.						
- 6 bars	83,6	73,2	3,6 **	3,9**	6,7**	5,0
-8 bars	82,2	83,1	3,6 **	3,1**	4,8	4,8
-10 bars	80,4	84,1	5,3 **	5,6**	5,8	5,5
-12 bars	87,3	84,5	4,4 **	3,9**	4,7	4,2
KNO_3						
- 8 bars	82,9	79,2	1,9 **	3,2**	2,0**	3,5
- 10 bars	83,1	84,8	2,7 **	3,3**	3,2	3,0
- 12 bars	81,5	82,4	3,3 **	3,3**	4,0	4,3
-14 bars	77,7**	77,9**	4,9 **	5,0**	7,0**	5,4

Table 1 : Effect of osmo-priming with P.E.G. and KNO3 on pepper seed Cultivars : 'Corno di tor rosso'.

Treatment	% Germination		M.G.T.		$T_{85} - T_{15}$	
Control	79,9		8,3		6,0	
	. A	. B	. A	. B	. A	. B
P.E.G.						
- 6 bars	82,9	83,2	4,7 **	4,6 **	8,6 **	6,8
- 8 bars	79,2	84,6	5,3 **	5,8 **	7,4	7,2
- 10 bars	83,0	82,1	6,5 **	6,3 **	6,9	6,1
- 12 bars	79,6	83,4	6,9 **	6,1 **	6,8	5,8
KNO3						
- 8 bars	81,1	80,3	1,8 **	2,8 **	2,0 **	3,5 **
- 10 bars	78,2	74,7	2,9 **	3,7 **	4,1 **	4,1 **
- 12 bars	75,1	78,5	3,9 **	4,2 **	5,1	5,6
- 14 bars	75,6	75,8	6,2 **	6,0 **	5,1	4,1 **

Table 2 : Effect of the osmo-priming with P.E.G. and KNO3 on pepper seeds Cultivar : 'Quadraot d'Asti gillo'.

Results of the germination tests made just after the osmo-priming (A), or after the osmo-priming and drying back at initial water content (B).

M.G.T. = Mean germination time.

$T_{85} - T_{15}$ = Number of days between the 15 and 85 % of germination.

** = Significantly different from control at the 1% level according to Duncan multiple range test.

THE GERMINATION OF THE SEEDS OF PEPPER (CAPSICUM ANNUUM L.) IN DIFFERENT ENVIRONMENTAL CONDITIONS

S. Accossato and L. Quagliotti

Institute of Plant Breeding and Seed Production, University of Turin Via P. Giuria, 15 - 10126 Turin, Italy

During the last four years, the behaviour of the seeds of some varieties of pepper, in connection with the germination at different environmental conditions, has been examined. The effect of four temperatures (20-25-30-35° C) with or without constant light was compared with the situation prescribed in the methods of Italian Ministry of Agriculture and Forestry for the seeds of pepper (20% in the dark for 16 hours and 30°C in the light for 8 hours).

The trials were carried on in Petri dishes with five replications of 100 seeds each; the seeds were checked daily and they were considered germinated at root let (2-3 mm) protrusion, in order to be able to calculate the mean germination time.

The trials lasted 45 days but the results were analized either with the data collected at the 14th day (according to the ISTA methods) either with the data collected during the all 45 days period.

The observations regard the mean germination time (in days) and the percentages of germinated seeds, of fresh ungerminated seeds, of dead seeds and of abnormal seedlings.

Seeds of commercial lots of the following cultivars were tested: ‘Corno di toro’ (from a grower); ‘Caiennea’ (from Sais); ‘di Cueno’ (from a grower); ‘Quadrto d’Asti giallo’ (Sais); ‘Trottola di Cuneo’ (Olter); ‘Lungo Rosso Rubens’ (Olter); ‘Quadrato d’Asti giallo’ (Tézier); ‘Caienna’

and ‘Yolo Wonder’ (Clause);

and of the Fl hybrids:

‘Gildor’, ‘Grecor’ and ‘Heldor’ (Clause); ‘Lamuyo’ (Tézier).

The results show that, in the conditions prescribed by M.A.F. the seeds have the highest germination percentage, either after 14 days either after 45. At 35°C the germination is clearly depressed. Whereas the results less different from those obtained at M.A.F. conditions, are induced by the constant temperatures of 25°C, if the data are considered at the 14th day, and of 20° or 25°C at the 45th day.

The effect of the light or of the darkness on the percentage of germination shows interaction with the effect of the genotypes: so that the seeds of some varieties (mostly the cultivars) germinate better in the dark while some others (the Fl hybrids) seem to have the highest germination in the light.

Moreover the mean germination time is a bit longer with the light.

The fresh ungerminated seeds are often frequent after 14 days also in the optimal conditions; but they go down (and totally disappear) in the Fl hybrids after 45 days. The number of the fresh ungerminated seeds is quite different in the various varieties; it is particularly high in ‘Trottola di Cuneo’ and in ‘Caienna’.

The number of the abnormal seedlings grows up at 30° and 35°C, in the samples that show some of them also in the optimal conditions.

As only one lot of each variety has been examined till now, the differences we found between varieties can be due not only to genetic variability huE also to phisiological features connected with the story of each lot of seed.

HYPERSENSITIVE RESISTANCE IN A C. ANNUUM GENOTYPE TO XANTHOMONAS CAMPESTPIS PV VESICATOPIA RACES 1 AND 2.

A.M. Hibberd
Vegetable Crops Dept.
Univ. of Florida
Gainesville, FL

R.E. Stall
Plant Pathology Dept.
Univ. of Florida
Gainesville, FL

R. Subramanya
AREC
Univ. of Flordia
Belle Glade, FL

Hypersensitive resistance to bacterial leaf spot, incited by Xanthomonas campestris pv vesicatoria Race 1 was found in the United States Department of Agriculture accession P.I. 271322 (C. annuum L.) by kim (1983). Resistance was conferred by a single dominant gene and characterized by rapid tissue necrosis when leaf tissue was infiltrated with high concentration inoculum (10^8 colony forming units ml^{-1}).

We tested 166 plants of P.I. 271322 against isolates of Race 1 and 2 collected from pepper in Florida, U.S.A. and Queensland, Australia. Inoculum of each isolate at 10^8 CFU ml^{-1} was infiltrated into mature leaves of the P.I. 271322 plants, and into control plants of the susceptible cultivar Early Calwonder and its near-isogenic line l0R which possesses hypersensitive resistance to Race 2 isolates. Hypersensitive tissue collapse occurred within 30 hr, but 4-45 days in a fully susceptible reaction.

Typical hypersensitivity did not occur with 4 of 8 Race 1 isolates in any plant of P.I. 271322. Plants hypersensitive to one of the remaining 4 Race 1, or to one of the 8 Race 2 isolates were hypersensitive to all 4 Race 1 or 8 Race 2 isolates, respectively. Various combinations of hypersensitivity occurred in the following frequencies of P.I. 271322 plants.

		Race 1 Hypersensitivity	
		Present	Absent
Pace 2 Hypersensitivity	Present	47	18
	Absent	76	25

Thus 47 (28.3%) of plants of P.I. 271322 were hypersensitive to both Races, and 25 (15.1%) were hypersensitive to neither Race.

The non-hypersensitive reaction in these plants was qualitatively different from the susceptible reaction in Early Calwonder. It occurred more rapidly (about 3 days in general), and was not preceded by the typical watersoaked appearance of the inoculated site before complete tissue collapse occurred.

We concluded that I.I. 271322 possesses a valuable combination of hypersensitive resistances to bacterial leaf spot never before detected in C. annuum. However, evidence exists for a third race of the bacterium, previously masked within the Race 1 classification. More detailed characterization of these possibilities is to follow.

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FRUIT ROT OF HOT PEPPER (CAPSICUM ANNUUM L) CAUSED EY COLLETOT RICHUM ACUTATUM.

S.KAUR, M.R. THAKUR, J.SINGH AND B.S.S00CH

DEPARTMENT OF VEGETABLE CROPS, LANDSCAPING AND FLORICULTURE, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA (PUNJAB) INDIA.

Fruit rot of hot pepper has became a serious problem in the pepper growing areas of India. Different species of Colletotrichum has been reported to be associated with fruit rot of pepper by several workers (Rai and Chohan, 1966; Bansal and Grover, 1969; Verma,1973).

A new species of Colletotrichum was isolated from hot pepper seedlings which were showing leaf spots in the nursery beds in the month of February, 1983. The fungus was identified as C.acutatum Simmonds after its purification and multiplication. The pathogencity of this species with respect to fruit rot has been studied and reported in this investigation.

MATERIAL AND METHODS: The fungal isolations were made from the diseased plants by tissue isolation technique on potato dextrose agar (FDA) medium. The purified 10-12 days old culture was used for inoculation.

The fruit rot infection was studied in seven varieties viz. Puss Jwala, Jullundri, Hatvani, JED 4-2-2, S 118-2-1, Perennial and Lorai. Detached fruits of these varieties were inoculated with the spore suspension of C.acutatum by pin prick method. The fruits were incubated

at 26 ± 1°C and kept in moist chambers for 48 hours, after which they were transferred into Petri dishes and further incubated at the same temperature. The observations were recorded ten days after inoculation.

The degree of fruit rot was judged by visual observations on the extent of development of the lesion. Depending upon the disease reaction, the varieties were classified as resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible (Chester, 1950).

RESULTS AND DISCUSSION: The inoculated fruits developed the disease symptoms within two days of inoculation as water soaked areas at the site of inoculation which further spread according to the degree of reaction. It was found that the variety Puss Jwala was highly susceptible followed by Jullundri, S 118-2-1, Perrenial and Hatvani. The fungus did not develop beyond the point of inoculation in the variety JED 4-2-2 and Lorai. These two varieties were hence categorised as resistant.

In the highly susceptible varieties there was heavy sporulation on the seeds of the inoculated fruits whereas there was less sporulation in Hatvani and practically no sporulation in JED 4-2-2 and Lorai.

Earlier workers have reported the fruit rot by C. capsici (Chowdhry, 1957; Narain and Des, 1970; Kaur et al. 1982) C.gloeosporoides (Verma et al. 1973; Kaur et al. 1982) and C. piperatum (Winstead et al.1960; Grover and Bansal 1968)

but so far no record has been found of C.acutatum causing fruit rot of pepper in India although other hosts of this pathogen have been reported by Simmonds (1966) and Kulsheshta (1976).

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RESISTANT SOURCES FOP ANTHRANOSE FRUIT ROT (Colletotrichum capsici) IN CHILLI PEPPERS (Capsicum spp.)

R.D.Rawal, A.A.Deshpande, D.P.Singh and C.S.Pathak

Indian Institute of Horticultural Research,
Hessaraghatta Lake P.O., Bangalore 560 089, India

Anthracnose fruit rot chillies (Capsicum annuum L.) is a serious problem in India when the environmental conditions are congenial for the disease development. Major portion of the chilli crop is grown under rainfed conditions and therefore chemical control becomes uneconomical besides being less effective. Anthracnose disease is caused by several species of Colletotrichum (Verma, 1982), however, the fruit rot due to Colletotrichum capsici (Syl)Butler and Bisby is widespread and is capable of causing 10-75 per cent yield loses (Choudhar, 1957; Rai and Chohan, 1965). Therefore chilli genotypes were screened to isolate the resistant sources to be used in our breeding programme.

Four hundred and fifteen chilli lines were screened against fruit rot caused by C. capsici over a five years period 1978-82; the field crop being grown from June to November each year. The crop was inoculated by spraying 20-25 spore/microscopic field at 10 x only once at the fruiting stage. Reaction of the disease on fruits as well as leaves were recorded separately on the plants/ line as follows:

Reaction	Fruit infection
Resistant	with no fruit infection
Moderately resistant	1-5 % of fruits showing infection
Moderately susceptible	6-10 % of fruits showing infection
Susceptible	11 % and above fruits showing infection

Infection on leaves was scored as per disease rating of Ullasa et al. (1981).

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Only two lines free from leaf symptoms were resistant to fruit infection also viz., IHR 275-13-5 and IHR 345-6. Line IHR 332-10 was resistant to fruit infection with manifestation of leaf symptoms. Lines IHR 270-31-1-1, IHR 300-1-5-I and IHR 525-5-4 showed complete resistant reaction to leaf spot symptoms but behaved as susceptible to fruit reaction. Lines IHR 292, IHR 310 and INK 327 were susceptible to both types of infection. The lines showing consistantly resistant reaction to fruit infection viz., IHR 275-13-5, IHR 332-10 and IHR 345-6 are being used in our further breeding programme.

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Cucumber mosaic virus isolates on pepper in Hungary

Tóbiás I.

Research Institite for Vegetable Crops, Station Budatétény
1775 Budapest, Park u. 2. P.O.B. 95.
Hungary

On bases of our 8 years investigation we can conclude, that in our door the most important virus problems of pepper in Hungary appear to be due to cucumber mosaic virus /CMV/. CMV is the most common and widespread causing severe losses to the crop.

The most common symptoms occurred by CMV are: 1. light mosaic, 2. severe mosaic with leaf deformation, 3. mosaic with malformation and deformation of the plant, 4. necrotic rings and spots on the leaf, seldom on the fruit, and mosaic. In order to study correlation of symptoms and virus strains, the virus isolates were characterized by following test plants: Capsicum annuum cv. Fehérözön, Datura stramonium, Oucumis sativus, Nicotiana glutinosa, N. tabacum cv. Xanthi-nc and serologically by ELISA technics.

ELISA test were performed by CMV-K8 and CMV-S4 strains as described by Tóbiás et al. /1982/.

72 isolates were studied from different part of Hungary.

With ELISA technics there was no possibility to differentiate the CMV isolates.

On basisi of symptoms on Nicotiana glutinosa and N. tabacum cv. Xanth-nc.

the isolates could be separated into two groups, according to Marrou et al. /1975/, symptomatological group B and C.

Out of 72 isolates 55 belonged to symptomatological group B and caused etching and ring on inoculated leaf of N. glutinosa and N. tabacum cv. Xanthi-nc. 17 isolates would belong to symptomatological group C, caused local chlorotic sports or latent infection on inoculated leaf of tobacco plants.

There was no correlation between symptoms on pepper and symptomatological grouping on test plants.

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BREEDING FOR RESISTANCE TO AND EPIDEMIOLOGICAL STUDIES ON VIRAL DISEASE OF PEPPER

M. Marte

Institute for Plant Pathology, Perugia University, Perugia, Italy.

Developing a breeding program for resistance to viruses, 77 new pepper (Capsicum annuum L.) lines have been tested in greenhouse experiments with an Italian isolate of tomato mosaic virus(ToMV) (see Marte and Conti, 1982, for methods). As many as 54 lines proved to be resistant to the virus and, in field trials, some of them also showed interesting productive features. Resistance to ToMV was always associated with a typical hypersensitive response, i.e. necrotic local lesions and avcission of inoculated leaves. No systemic infection with mosaic symptoms was usually detected on hypersensitive plants, which only developed rare systemic necrosis after the local lesions. Systemic necrosis, a well known phenomenon, though not fully understood (Boukema, 1982; Dijkstra et al., 1977), does not seem to affect significantly the resistant plants under the natural infection pressure.

Problems arise, however, from the so called "pepper strains" of tobacco mosaic virus (TMV) which overcome the resistance of pepper to ordinary pathotypes of TMV and related viruses. As in other countries, pepper strains of TMV have been recently found in Italy (Betti et al., 1982) and an isolate with such characteristics has also been obtained in our laboratory from peppers of a TMV-resistant hybrid from Sicily. This virus has been identified by Prof. C.Wetter (Saarbrüchen Univeristy) as a new tobamovirus, called pepper mild mottle virus (PMMV), first isolated by Prof. M.Conti (National Research Council, Turin), also from peppers grown in Sicily (Wetter et al., 1984, in press). In infectivity tests with our isolate of PMMV we always recorded systemic infections (with mosaic sysmptoms) on ToMV-resistant peppers (C.annuum) with some plants of C.chacoense Hunz., P.I.260429, reacted hypersensitively to the inoculation, in agreement with previously reported results (Boukema, 1982).

Researches on the epidemiology of main viruses of pepper and other solanaceous crops in Umbria (Central Italy) are also carried out at our Institute. Previous observations, indicating that potato virus Y (PVY) is very frequent on tobacco but rare on pepper, have been fully confirmed by two-years' investigations. However, no corresponding differences have been recorded in the density of winged aphids – including some species considered efficient vectors of the virus – when caught in tobacco and pepper by yellow pan water traps. Also, the infection pressure of PVY, evaluated by the bait-plant method, seems to be substantially the same in both crops. The role of aphid vectors in determining this uneven distribution of PVY will be further investigated, with special reference to the occurrence and activity, at the vegetation level, of colonizing species on each crop.

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REACTION OF DIFFERENT GENOTYPES OF HOT PEPPER TO LEAF CURL VIRUS

O.P. SHARMA, J.S. HUNDAL, B.S. SOOCH AND M.R. THAKUR

DEPARTMENT OF VEGETABLE CROPS, LANDSCAPING AND FLORICULTURE
PUNJAB AGRACULTURAL UNIVERISTY, LUDHIANA-141004, INDIA.

Hot pepper of chilli (Capsicum annuum L.) is one of the major cash crops and export commodity, but it suffers heavily from leaf curl disease caused by tobacco leaf curl virus transmitted by Bemisia tabaci Genn. in India. Breeding for resistance is the only effective method to combat the disease. With this in view a large number of genotypes were screened over the last five years under natural epiphytotic disease conditions at the farms of the Department. The genotypes S 20-1, Lorai, Perennial, S 118-2, Longi, Pant C-1, X-200, S 41-1-5, H6, 76 289-1-3-1-1 exhibited resistance/tolerance where disease severity was very mild to moderate in the growing season.

STUDIES ON A NEW TOBAMOVIRUS FROM TMV-RESISTANT PEPPERS

M. Conti

Instituto di Fitovirologia Applicata, Consiglio Nazionale delle Ricerche, Torino, Italy.

The characterization of tobamovirus (tobacco mosaic virus group) isolated from TMV-resistant peppers in Sicilly has been completed. Work has been done in cooperation with Prof. C. Wetter (Saarbrücken, W. Germany) and Dr. M. H. V. van Regenmorel (Strasbourg, France), and their coworkers. The virus, provisionally called pepper mild mottle virus (PMMV), could be distinguished by sysmptomatology and hostrange from other tabamoviruses. In particular, it infected several TMV-resistant lines of Capsicum spp-including C. annuum, C. frutesncens, C. chinense and others-by invading all of them systemically. From the length distribution histogram a normal length of 312 nm was determined. Angled layer aggregates were observed in the cytoplasm of infected pepper leaf cells. Antisera to PMMV, prepared by Prof. C. Wetter, had homolgous titers of 1:2048 and 1:4096. After absorption with eight heterologous wild strains of TMV, the PMV antisera still reacted strongly with the homolgous virus. The amino acid composition indicated the PMMV is distinct from all other well-established tobamovirus species.

The full description of PMMV is in press in Phytopathology. A preliminary survey of viruses infecting pepper in the horticultural area near Tarquinia, Central Italy, has been carried out. Cucumber mosaic and alfalfa mosaic viruses appeared to be the most widespread pathogens but diagnosis work is still in progress on some samples.

BIOLOGICAL AND SEROLOGICAL CHARACTERIZATION OF POTATO VIRUS Y STRAINS AFFECTING PEPPERS AND OTHER RELATED STRAINS

K. Gebré Sélassié, G. Marchoux, E. Pochard *
Institut National de la Recherche Agronomique
Station de Pathologie Végétale
* Station d'Amélioration des Plantes
Domaine St. Maurice- 84140 MONFAVET

Surveys conducted in the fields of South-East of France during the last 6 years, enaled us to characterize few of the PVY isolates and compare them to PVY strains of different origins (Table 1). The studied isolates come from: Tomato (To – 72), Potato (P.de T.-N), Solanum nigrum (SON 41), Pepper (Israël-82; VR-2), Portulacca oleracea (N17-E).

Evolved strains like SON-41, VR-2 and N 17-E have not been found singly in nature up to now. These strains were obtained by several successive passages on "Yolo Y" or "Florida VR-2" or keeping the inoculated plants over long period.

Plant tests included Pepper varieties and indicator plants (1-5). Among them, varieties "Yolo Wonder", "Yolo Y" and "Florida VR-2" allowed to charcterise the 3 pathotypes: PVY-O, PVY-1, PVY-1-2 (Table 1).

For the serological tests, we have prepared antierum agains the local strain PVY-To 72. Immunserum of Potato strain was received from Dr Maury (I.N.R.A. – Versailles). E.L.I.S.A. and Immuno Electron Microscopy methods were applied.

Hosts reactions

Potato strain was not infectious to any of the pepper varieties. Conversely strains pathogen on pepper are not infectious on potato "Bintje".

Ability to induce nectrotic reactions on "Anaheim F 6" and "Bastidon" belongs to the 3 pathotypes. Strain N 17-E does not induced necrotic reactions on these 2 varieties while Israeli strain induced local lesions only on "Anaheim F 6". All strains except N 17-E, induced similar type of reactions on C. amarticolor, P. floridana and N. tabaccum car. Xanthi.

Serological reactions

All strains except N 17-E gave close reaction when tested against the two antiseras (Table 2).

Table 1. Susceptibility and symptom expression of selected pepper varieties and indicator host plants to the different strains

Differential hosts	Strains	P. de T. N	To-72	SON-41	ISRAEL 82	VR-2	N 17-E
	Fathotypes	0	0	1	1	1-2	1-2
Solanum tuberosum var. Bintje		- / M	R	R	R	R	R
Capsicum annuum var. Anaheim F6		R	LL / NM	LL / NM	LL / NM	LL / NM	- / M
Bastidon		R	- / NM	- / NM	- / M	- / NM	- / M
Yolo Wonder		R	- / M	- / M	- / M	_ / M	- / M
Yolo Y		R	R	- / M	- / M	- / M	- / M
Florida VR-2		R	R	R	R	- / M	- / M
Serrano VC		R	R	R	R	R	R
Chenopodium amarticolor		LL / -	LL / -	LL / -	LL / -	LL / -	R
N. tabaccum var. Xanthi		- / VC-M	- / VC-M	- / VC-M	- / VC-M	- / VC-M	R
Physalis floriana		LL / M	LL / M	LL / M	LL / M	LL / M	- / m

Symbols:
LL : Local lesions
M : Mosaic
m : Mottle
R : Absence of systemic infection
VC : Vein clearing

- / - . Numberator indicates reaction of inoculated organ
Denominator indicates reaction of non-inoculated organs

Table 2 : Results of Immune Electron Microscopy
Serological test of the different strains

Strains	To-72	P. de T N	SON-41	ISRAEL	VR-2	N 17-E
Pathotypes	0	0	1	1	1-2	1-2
Antiserum						
PVY – To 72	+++	++	+++	++	+++	ε
PVY – P. de T. N	++	+++	++	++	++	ε

Symbols:
+++ : strong coating at ½ 048 dilution of the antiserum
++ : strong coating at 1/1 024 dilution of the antiserum
ε : strong coating at ¼ dilution of the antiserum

In short, none of the tested isolates have been found infectious to both pepper and potato.

Also, one can note a certain independence between the 3 properties : serological relation, virulence on pepper genotypes, induction of necrotic reaction on the susceptible varieties.

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OLIGOGENIC RESISTANCE TO POTATO VIRUS Y PATHOTYPE 1-2 IN THE LINE "PERRENNIAL".

E. Pochard, K. Gebré Selassie* and G. Marchoux*
I.N.R.A., Vegetable Breeding Station and * Plant Pathology Station
84140 Montfavet-Avignon (France).

In the south of France, local population of PVY and related viruses appeared rather complex. Isolates can differ in the symptoms induced on susceptible genotypes (necrotic or not necrotic), in the virulence properties (1, 2, 3) and in serological reactions (this issue and unpublished data). Moreover, it is possible to reveal highly virulent components, probably preexistent in the natural population, when retro inoculating repeatedly "resistant genotypes" (3). Thus, the resistance carried by "Florida VR2" and similar varieties is inefficient in the presence of strains N17-E or VR2 (pathotype 1-2).

Among the few varieties able to control N17-E strain, the Indian line "Perennial" appeared the more efficient. This variety is also resistant to pathotype 0 and 1 but the resistance is incomplete with some strains belonging to pathotype 0 (unable to attack "Yolo Y").

In the crosses between "Perennial" and "Yolo Wonder" or "Florida VR2", resistance to pathotype 1-2, is recessive (unpublished data). In F2 or backcrosses to "Perennial", there is a continuous range of disease severity, the classification of the plants with regard to parental phenotypes is very uncertain. Moreover disease symptoms can appear a long time after inoculation on plants previously supposed resistant.

Homozygous lines issued by androgenesis from F1 generation offer a unique possibility : every genotype can be checked by several strains, at different stages and on different organs; dominance effects are absent; notations concern homogeneous samples and not individual plants as in classical populations.

We studied a sample of 78 androgenetic lines (ADH) issued from the F1 "Perennial" x "Yolo Wonder" inoculated by 2 very different strains, one belonging to pathotype 0 the other to pathotype 1-2. The plants are inoculated on the cotyledons and the disease indeed is recorded after 15 and 30 days. Samples of the most resistant lines are transplanted and observed up to fruit maturity. The results are show in table 1.

One month after inoculation, there is about ¼ of the lines susceptible to the 2 strains and ¼ as resistant as "Perennial". The intermediate groups are very heterogeneous, and comprises more than 2 classes. At the adult stage, weak symptoms appear on most of the lines classified as resistant but mainly on the oldest leaves. Only 3 lines are without symptoms, as "Perennial".

One can admit that most part of the resistance is controlled by 2 independent (recessive) genes but complete resistance needs the presence of modifier geneses.

Table 1. Distribution of ADH lines issued by androgenesis from the cross "Perennial" x "Yolo Wonder" for their response to PVY, strain To-72 pathotypes 0 and strain N17-E pathotype 1-2 (78 ADH lines). (R = resistant; S = susceptible; I = intermediate).

Pathotype	(0)	(1-2)	(0)	(1-2)	(0)	(1-2)
Response	R	R	I	I	S	S
Frequency of ADH	22		35		21	
Theorical frequency (1:2:1) (2 indep. genes)	19, 5		39		19, 5	

$X^2 = 0.846$; Prob. > 0.50

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PROGRESS AND PROBLEMS IN EGGPLANT BREEDING

Chr. Petrov, M. Doikov and D. Popova

V. Kolarov Higher Instititute of Agriculture – Plovdiv, Bulgaria

The eggplant is traditional vegetable crop in Bulgaria. Abe out 65% of its fruits are used as raw material for processing in the canning industry. There are specific requirements for the fruits intended to be used in households. Our studies were made in this direction /1, 2, 3, 4/.

The following productive habits of the crops have been studied – earliness, total yield and production quality, technological fruit qualities and resistance to Verticilium wilt. Analyses have been made on some characters related to the single mechanized harvesting – rate of fruit bearing, the way of fruit setting and the resistance of fruits at picking. In the present pepper some results are given from the study on the cultivars and the progress made in the eggplant breeding.

Results and Discussion

The data about the productive habits of the promising cultivars are given in table 1.

Earlieness and Total Yield

Cultivar	Earlienss		Total yield	
	Kg/dka	%	Kg/dka	%
Eggplant 12	1502	100.0	6049	100.0
Kolarovetz 35	1962	122.6	7022	110.1
Konservnyi 10	1445	90.7	6200	102.0
Erevan's Long	1148	78.0	5720	95.0

The data obtained from the investigation about technological qualities are given in table 2.

Table 2.

Chemical-Technological Characters/%/

Cultivars	Usable part	Dray matter	Total sugars	Internal tissue gases	Darkening of pulp /min/
Cultivars	94.54	8.31	3.49	45.61	4
Kolarovetz 35	94.79	8.05	2.55	47.83	13
Konservnyi 10	96.75	8.53	2.64	52.62	8
Erevan's Long	96.23	8.63	3.54	44.01	16

In our studies they were established much higher values for the contents of proteins, sugars, and dry matter in the tested cultivars than many of those reported in literature. This can be explained with the soil medium fertility and better soil-climatic conditions under which the field experiments were carried out.

During the past years the breeding work was directed maily to studying and developing cultivars resistant to Verticulium wilt. To this end samples from India, China, and Japan have been tested. The great amplitudes in the weather and natural conditions to the formation of samples with equal rates of Verticulium wilt damages. The analyses of the material has show that some of the samples originating from these regions are characterized with a comperatively high from these regions field resistance to this disease. But by their economical and technological charcters these samples do not meet our requirements. The could be used as a germplasm in the direction of breeding. This necessitiated our starting of breeding work on the basis of artificial infection and cultivatin of prevocational samples and cultivars for resistance to Verticilium wilt. The data are given in Table 3.

Table 3.

Damages and resistance to Verticilium wilt

Cultivar	Damages[x]	Resistance[x]
Eggplant 12	2-3	2-3
Kolarovetz 35	0-1	0-1

x very slight 0-1	x very slight 4
slight 1	slight 3
average 2	average 2
great 3	high 1
severe 4	very high 0-1

The cv. Kolarovetz 35 is characterized with increased field resistance to Verticilium wilt. This contributes to its better productivity. In earlieness it is superior to this present standard by 15034% and total yield – by – 7-14%. Its fruits are with very good technological qualities. They are characterized with a regular pyriform, slightly elongated, dark violet/colour and white tender meat

Reference

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THE ACCUMULATION OF SOLANINE IN THE FRUIT OF EGGPLANTS AND MEANS OF DECREASING IT

By V.K. Andryushchenko, A.D. Pilipenko,
V.I. Karovani, I.A. Dvornikova, T.N. Kudina
Moldavian Institute for Research in Irrigated
Agriculture & Vegetable Growing
Mir Str. 50, 278000, Triaspol, Moldavia, USSR

A basic demand required of eggplants as a raw material for processing is the absence of bitter taste which is induced by the presence of solanine in the fruit. The limited data on this subject indicates that the maximum accumulation of solanine is observed in eggplant fruit in the biological stage of maturity.

What should the minimum solanine content in newly developed varieties be, so that bitter tast6e should not e perceptible? A sensory evaluation of various solanine concentrations conducted by us (in relation to standard solutions of coffein) has shown that the majority of panelists sense a slight bitter taste at concentrations of 0.7-1.5 mg. In 100 ml. Volume of acidified water.

An especially urgent problem is the development of varieties with a low solanine content in the fruit because of a wide introduction of industrial technologies for raising vegetable crops – an obligatory requirement of which is combine harvesting of the yield. Since the formation of the fruit on the plants does not occur uniformly, a part of the yield uncombined harvesting will be in the prebiological stage of maturity. Culling of fruit at the prebiological stage of maturity out of the total yield by visual estimation is not possible because of rater close coloring of fruit at the technical and prebiological stages of maturity. Because of this it is necessary to develop eggplant varieties with a low solanine content in the technical as well as prebiological stages of maturity, which will greatly facilitate a wide application of combine harvesting.

The solanine content in eggplnat fruit was determined by the photometric method modified by us. The estimation of a number of saple varieties of eggplants for solanine content in fruit has shown that is level changes greatly depending on the variety (table 1) and the degree of maturity of the fruit. (table 2)

Table 1

The solanine content in eggplant fruit at the technical stage of maturity

Sample variety	Solanine content in fruit, mg./100 gm. fresh weight
Black Beauty	1.7
Violette longue	13.7
Black Beautiful	15.4
Sinkuro	17.1
Halblange Violette Delicates	19.6
Donskoi 14	24.8
Ne York Improved Spineless	38.5
Buck Bees White	44.4
Violette ronde	0.4
Dwarf Nagasaki	52.1
Egg Purple Extra Early Dwarf	61.5
Violetta Rotonda Precoce	71.8
Round White	130.8

The solanine content in one and the same variety in different years may change significantly. Thus, in 1975, the solanine content in the fruit of the variety Donskoi 14 was 24.8 mg. Per 100 gm. fresh weight in the technical phase, while in 1979 it was 13.5 mg. Per 100 gm. fresh weight.

In growing eggplants under different backgrounds of nitrogen supply there is no significant difference in solanine accumulation in fruit of one and the same variety. However, varietal differences remain.

Moisture deficiency in soil leads to a significant increase of solanine content. Thus, in growing Dniestrovets variety

under a background of no irrigation, the solanine content in fruit of technical maturity – amounted to 24.2 mg. Per 100 gm. of fresh weight, while in a background of preirrigated soil moisture at 70% of least water holding capacity it was 12.5 mg. Per 100 gm., and in a backgound of a preirrigated soil moisture at 80% of least field capacity it was – 7.7 mg. Per 100 gm. of fresh weight.

Table 2.

Solanine content in fruits of eggplant at various stages of maturity

Sample variety	Solanine content in mg./100 gm. fresh wt.		
	Technical	Prebilogical	Biological
Kairyohakata naga	8.85	16.80	25.28
Londia Ronde	10.96	17.86	34.97
Hagaoka Half F_I	12.20	15.80	19.68
Donskoi I4	13.37	17.44	38.75
Long Violette	15.29	43.29	83.57
Adonis	17.46	18.05	37.05
New Hampshire F_I	17.95	50.68	138.67
Dniestrovts	18.82	25.27	77.50

Recently, much attention is being paid to retaining the anthocyanic coloration of eggplant fruit in the prebiological and biological stages of maturity of the fruit with the aim of improving their commercial value. However, whithout taking into account the solanine content in fruit – it is not possible to solve comprehensively the problem of improving the quality of the produce.

MORPHOLOGICAL AND CYTOGENETIC ANALYSES OF AN INTERSPECIFIC HYBRID EGGPLANT, SOLANUM MELONGENA L. X SOLANUM TORVUM SW.

K.R. McCammon and S. Honma

Department of Horticulture, Michigan State Univerisity, E. Lansing, MI USA

Interspecific hybrids between Solanum melongena L. cv. Millionaire and S. torvum Sw. were produced by hybridization using S. torum as the pollen parent. The progeny was determined to be hybrid based on morphological and cytological observations. Reciprocal attempts to self and backcross the hybrid to the parental species were unsuccessful. Observations of the pollen from the F_1 plants indicated low viability. Meiosis in the parents appeared normal. Cytological observations of hybrid PMCs indicated abnormalities at all meiotic stages. In light of the difficulty in distinguishing between genic and chromosomal sterility cytologically, it appears that the sterility may be due to lack of homology and/or genic imbalances of the parental genomes.

PATHOGENIC VARIATION OF FUSARIUM SEMITECTUM AND FUSARIUM OXYSPORUM CAUSING FRUIT ROT IN EGGPLANT (SOLANUM MELONGENA L.)

S. KAUR[1], R. KAUR[2], AND P. KAUR[3]

1. DEPARTMENT OF VEGETABLE CROPS, PUNJAB AGRICULTURAL UNIVERSITY LUDHIANA (PUNJAB) INDIA.
2. DEPARTMENT OF PLANT PATHOLOGY, PUNJAB AGRICULTURAL UNIVERISTY LUDHIANA (PUNJAB) INDIA.
3. NBPGR, NEW DELHI, INDIA

Studies were carried out with two different species of Fusarium i.e. F. semitectum (Berk & Rav.) and F. oxysporum (Schlecht.) in order to compare their pathogenic abilities in causing the fruit rot of eggplant.

The isolate of F. semitectum was collected from vegetable far, PAU, Ludhiana and F. oxysproum from Indical Agricultural Research Insititute type culture collection, Delhi. The cultures were maintained and multiplied on potato dextrose agar (PDA) medicum.

The fruit rot infection was studied in three varieties viz. Pusa Purple Long, Punjab Camkila and Sm 17-4. The detatched fruits of each variety were inoculated with the spore suspension of 10-12 days old cultures of F. semitectum and F. oxysporum by knife injury method (Tandon and Misra, 1969). The inoculated fruits were incubated at 28 ± 1°C and kept in moist chambers for 48 hours. The observations were taken upto 20-30 days after inoculation.

The inoculated fruits of the varieties Pusa Purple Long and Punjab Chamkila developed the fruit rot symptoms as small water soaked areas at the site of inoculation within four days of inoculation. The lesion size increased gradually

and supported the white fluffy mycelial growth within 15-20 days in the varieties which were inoculated with F. semitectum where as in F. oxysporum, a small area was involved in disease infection.

The size of the lesion (Table 1) in the two varieties i.e. Pusa Purple Long and Punjab chamkila was larger in F. semitectum which appears to be highly pathogenic, as compared to F. oxysporum which is weakly pathogenic. The infection did not develop beyone the point of inoculation in the variety, SM 17-4 whith both the species.

Earlier workers have reported the fruit rot of egg plant by F. moniliforme, F. oxysporum, and F. solani, (Laxminaryanan and Reddy 1979; Datar, 1980) but so far no record has been found on F. semitectum causing fruit rot however this pathogen was found to be associated with brinjal seeds by Agarwal (1981).

In the present studies it has been found that the isolate of F. semitectum was more pathogenic than the isolate of F. oxysporum in causing rotten of the brinjal fruits.

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Table 1. Pathogenc variation of F. semitectum and F. oxysporum in fruit rot of egg plant.

Varieties	Lesion size (mm)							
	F. semitectum				F. oxysporum			
	Length		Breadth		Length		Breadth	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Punjab Chamkila	24-29	21.6	10-16	11.8	8-12	9.4	5-9	6.6
Pusa Purple Long	12-22	15.4	8.14	10.4	6-9	7.4	4-5	4.4
SM 17-4	-*	-	-	-	-	-	-	-

*- Did not grow beyond the point of inoculation.

COMPARISION OF BIOCHEMICAL CHANGES INDUCED IN ROOTS OF DIFFERENT VARIEITES OF BRINJAL (Solanum melongena) To Meloidogyne incognita

S. Ahunja*, P. Kapur, R. Mohan and S.P. Ahuja

Departemtns of *Vegeatable Crops & Biochemistry
Punjab Agricultural Univ., Ludhiana – 141 004, India

Nematode infestations of plant roots increase in the levels of protein, lipids, minerals, nucleic acids (Dropkin, V.H., 1972, OEPP/EPPO Bul. 6, p. 23). However, the nature of proteins and lipids thus accumulated hasnot been studied (Ahunja, S. and Ahunja, S.P., 1980, Nematol medit., 8, p. 207). In the present study, the effects of M. incognita infestation of brnjal (S. melongena) varieties, showing different degrees of susceptibility, on the composition and activities of oxidative enzymes of roots has been compared.

Five weeks old seedlings of different varieties of brinjal were transplanted in a field heavily infested with M. incognit during the first weeks of April and August 1983 and uprooted in the end of Sept. ’83. The root knot index (RNI) was determined (No infestation, 1; 1-25%, 2; 26-50%, 3; 51-75%, 4; 75-100%, 5; confluent, 6). The fresh roots were sued for determination of dry matter, total lipids, steroils, phospholipids, phenols, soluble proteins and oxidative enzymes. Expect for varieties T_3 and Punjab Camkila, the total lipids are higher in roots of varieties showing higher leels of RNI (Table 1) as compared to the resistant variety S. sisybriiforlium. To a lesser extent similar are the trends with phospholipds and sterol contents (Table 1). The exogenous sterols have been considered essential for growth and development of nematodes and insects (Cole, R.J. and Krusberg, L.R., 1967, Exptl. Parasitol, 21, p. 232), therefore, varieties have more sterols may be better hosts for the nematodes. As compared to the resistant variety S. sisymbriifolium the phenol content of roots increases with M. incognita infestation of almost all the varieties expect Punjab Camkila (Table 2) but this increase is not proportionate to the level of RNI. Similar is the case with soluble poteins except for varieties Punjab Chamkila, Azad hyrid, P_8^*, 91-2 (Table 2). However, the increase appears to be closely related with the level of RNI (Table 2). The increase

in protein content is partially due to increase in activities of polyphenol oxidase (PPO) or peroxides (PO) or both. The response of Punjab Chamkila may be modified in some different manner after the infestation. The results (Tables 1,2) indicate that, as a protective measure against nematode infestation, different varieties of brinjal respond by increasing phenols, proteins (oxidative enzymes) or both so as to increase the local concentrations of toxic quinines and semiquinones, in the area of infestation.

Table 1. Comparasion of changes in the total lipids (mg %), sterols, phospholipids (ug/100 mg roots) of brinjal roots showing different degrees of susceptibility to M. incognita

Variety	RNI	Total lipids	Sterols	Phospholipids
S_{16}*	6	1.89	200	599
S. terbum*	6	3.31	391	574
Punjab Chamkila	5	1.74	154	430
S_4	4	2.22	255	1090
Green Oblong	4	2.14	214	644
White Oblong	4	1.91	248	571
T_3	4	1.67	175	402
Annimalai	3	1.92	196	520
Chandigarh selection	2	1.58	190	Not done
91-1	2	1.91	248	422
P_8	2	1.80	280	491
91-2	2	2.02	182	196
S. sisymbriifolium*	1	1.62	208	558

* Transplanted in April 1983.

Table 2. Compaison of changes in the soluble proteins (mg %), phenols (ug/100 mg wet roots), peroxidase (PO) a,d polyphenoloxidase (PPO) (units/100 mg wet tissue) of brinjal roots showing different degrees of susceptibility to M. incognita

Variety	RNI	Phenols	Soluble proteins	PO	PPO
S_{16}*	6	120	2.02	1590	149
S. tarbum*	6	108	2.68	489	175
Chandigarh selection *	5	144	2.30	1930	77
Punjab Chamkila	5	66	0.58	533	102
Pusa hibryd	4	144	1.73	610	76
S_4	4	108	1.30	150	82
Green Oblong	4	102	1.66	700	164
T_3	4	102	1.87	1016	110
Azad hybrid	4	98	0.72	474	71
Chandigarh selection	3	156	3.02	339	69
Annamalai	3	138	1.51	790	109
P_8*	3	90	0.64	395	96
Chandigarh selection	2	120	1.15	547	22
91-1	2	96	1.87	755	60
P_8	2	84	1.08	1212	94
91-2	2	122	0.64	750	22
S. sisymbriifolium*	1	72	0.86	645	15

*Transplanted in April 1983.

RESPONSE OF DIFFERENT VARIETIES OF BRINJAL TO Meloidogyne incognita IN ABSENCE OR PRESENCE OF THE ATTACK OF SHOOT AND FRUIT BORER Leucinodes orbonalis Guen.

S. Ahuja and A.S. Sidhu

Dept. of Vegetable Crops, Lanscaping and Floriculture
Punjab Agric. Univ., Ludhina – 141 004, India

The screening of brinjal (Solanum melongena L.) varieties agains root-knot nematode Meloidogyne incognita was carried out over a period of six years. The varieties of brinjal were grown in seedbeds heavily infested with M. incognita and transplanted after five weeks in the field in which a root-k not susceptible crop was grown. Three replications of 30 plants each were tried for each variety. Interplant and inter-row distances were 45 cm. Normal cultural practices were followed. The seeds were sown in Feb., June, and November and transplanted after five weeks. Every month thereafter, the plants were uprooted and severity of infestation was recorded. The varieties were cat3egorized according to the degree of infestation (Table 1).

The observations during various years indicate that in the absence of shoot and fruit borer, the roots of Chandigarh selection and Punjab 8 varieties are free from galls or sometimes show 10-25% infestation. The tolerant and less susceptible varieties (Table 1) become highly susceptible to M. incognita after the attack of brinjal shoot and fruit borer Leucinodes orbonalis Guen and the highly susceptible varieties become wilted. These results indicate that predisposl to shoot borer enhances the susceptibility of brinjal roots to M. incognita.

Table 1. Variation in the susceptibil8ty of brinjal varieties to M. incognita in field.

1. Highly susceptible (50-100% infestation)

   Japanese long, Pusa purple long, Pusa purple cluster, Dhingra multiple perfection, Orrisa Round, Black Beauty, Pusa Kranti, Black Round, Punjab Bahar, Punjab Chamkila, Ropar, Green Oblong, White Oblong, Hinga Dorla, M. Gota, Jambhala, Dorla, Gulati Dorla, Tambal Wadi Oblong, Local Taligao, Sultanpur, Local Agassium, Co-brinjal, Brinjal D-1, T3, T2, K1, K2, K3, K 202-9, K 202-14, S16, S4, S5, IMK, RHR-58, RHR-51, PBR 129-5, R 34, ARU 1-C, ARU 2-C, BR 112, DMP, RC 14943, IC 34745, IC 32248, IC 34731, IC 29*9250, IC 34055, IC 34032, IC 34452, IC 34422, IC 34442, IC 34734, IC 34943, Selection 134, Sel 126-A, H4, KK-3, S. Khasianuam and S. tarbum.

2. Les susceptible (25-50% infestation)

   Annamalai, Aad Kranti, Arkasheel, Arkanaveneet, Arka Kusumakar, Shankar Vi jay, Yates selection, PH_4, T_1, PBR 91-1, PBR 91-2.

3. Tolerant (0-25% infestation)

   P_8 Chandigarh selection.

4. Resistanct (No infestation)

   Solanum sisymbriifolium

ANNOUNCEMENTS

MEETING OF THE EUCARPIA "PEPPER AND EGGPLANT" WORKING GROUP

Lilija Milkova

The 5th Meeting of the "Pepper and Eggplant" Working Group was held in Plovdiv (Bulgaria) on July 4-7, 1983 in the Lecture Hall of the Union of Research Workers. It was organized by the Institute of Genetics at the Bulgarian Academy of Science in Sofia, the Maritsa Institute of Vegetable Crops and the V. Kolarov Higher Institute of Agriculture in Plovidv. Sixty six participants of 15 European states and of other continents (Bulgaria, Cuba, England, France, Hungary, Israel, Italy, Japan, Mexico, the Netherlands, Poland, Spain, Tunisia, USA and Yugoslavia) attended the Meeting. Forth two reports were presented, 4 of them concerning the eggplant.

Part of the reports were devoted to problems concerning the geographical distribution of some domesticated species, preservation of genetic sources, cytological investigation of interspecific pepper hybrids, male sterility studies, induced mutagenesis, tissue culture and the inheritance of various quantitative characters.

Another group of reports dealt with the breeding of synthetic and hybrid cultivars, red pepper breeding, hot pepper breeding etc. Numberous reports were concerned with genetic studies on the resistance to the disease – TMV, CMV, Phytophtora, Verticillium, Leveillula etc.

During the general discussion it was decided:

- The Capsicum Newsletter will be continued and also cover breeding research on Eggplant.
- The next Meeting of the "Pepper and Eggplant" Working Group will be held in Spain, in 1986.

Visits of the participants to the Maritsa Institute of Vegetable Crops, to the "Rakovski" AIC and to the "G. Dimitrov" NIU in Plovidv were organized. The reports were published on offset and Proccedigs were sent in advance to the participants.

The Proceedings of the Meeting of the Eucapia "Pepper and Eggplant" Working Group in 1983 are available at the address: Bulgaria, Sofia 113, Institute of Genetics, Bulgarian Academy of Science, prof. M. Stoilov. Price 10$.

The participants at the 5th Meeting of the Eucarpia "Pepper and Eggplant" working group.

PROCEEDINGS

EUCARPIA CAPSICUM AND EGGPLANT '83, Vth MEETING
4-7 July 1983, Plovdiv, Bulgaria
Institute of Genetics, Bulgarian Academy of Sciences, Sofia 1113, Bulgaria

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Zaragoza, 23-25 de Marzo de 1982

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NATIONAL SEMINAR ON THE PRODUCTION TECHNOLOGY OF TOMATO AND CHILLIES

Coimbatore, 1983

Tamil Nadu Agricultural University, Faculty of Horticulture, Coimbartore 641 003, India

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HUNGARY

International Meeting "PAPRIKA BREEDING AND PRODUCTION IN HUNGARY"
Budapest, Auguest 8-10, 1984

The meeting is organized by the Section of Vegetable Crops of the Hungarian Society of Agronomy and its Local Group in Békés Country, National Council of the Production Cooperatives, Reasearch Institute for Vegetable Crops, "6 Oktober" Production Cooperative, Economic Association of Production of South Békés, Canning Factory of Oroshaza.

For further information, please contact the secretariat of the Meeting at the following address:

Dr. Sandor GYÖRFFU
Reasearch Institute for Vegetable Crops
Station Budatétény
Budapest, Pf. 95
H – 1775, HUNGARY
Tel. 264-060 pr 666-853. telex 226080

ITALY

Has been published by INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES Secretariat, the report "Genetic resources of Capsicum".

The content of the report is:

- Economic and nutritional importance
- Taxonomy
- Distriution, origin, and diversity
- Genetic improvement
- Major collections
- Collecting activities
- Conseration
- Documentation
- References
- Appendixes
    - List of participants at IBPGR/CATIE Meeting of Capsicum genetic resources
    - Diagnostic descriptions of the five domesticated species and key for field identification
    - Major collectios of Capsicum
    - Capsicum collecting in Mexico
- Descriptor list for Capsicum

For further information on the report, please contact:

IBPGR Executive Secretariat
Crop Genetic Resources Centre
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla, 00100 Rome, Italy

ANALYTICAL INDEX

PEPPER

LIST OF RECIPIENTS

ALGERIA
- Ougouag B., Department d'Agronomy Génèrale, Institut National Agronomique, EL HARRACH – ALGER

AUSTRALIA
- Gillespie D., Redlands Horticultural Research Station, Dalancey Street, ORMISTON – QUEENSLAND 4163

ARGENTINA
- Hunziker A., Instituto Botanico, Universidad de Cordaba, CORDOBA 5000

BRAZIL
- Becker Reifschneider J. F., CNP Hortaliças, C. P. 11.1316, 70.000 BRASILIA D.F.
- Beck M. A., Centro Nacional de Pesquisa de Hortaliças, C. P. 11.1316, 70.000 BRASILIA D.F.
- Della Vecchia P. T., CNP Hortaliçcas, - EMBRAPA, C. P. 11.1316, 70.000 BRASILIA D.F.
- EMBRAPA – CNPH, Sector de Informaçao e Documentaçaio, BR 060 km 0, 9, C. P. (11)13, BRASILIA D.F.

BULGARIA
- Daskalov S. (*)
- Doikova M. (*)
- Gradinarski L., Institute of Plant Physiology of Bulgarian Academy of Sciences, Academican Bouchevstr., 6, SOFIA
- Ilieva E. (*)
- Krasteva L. (*)
- Mdlhova E. (*)
- Milkova L. I. (*)
- Mirkova V. (*)
- Petrov Chr. (*)
- Popova D.Sotirova V. G. (*)
- Todorov J. (*)
- Vesselinov E. (*)

CANADA
- Maurer A. R. (*)

COLUMBIA
- Holle M., FAO/IBPGR Regional Officer for Latin America, c/o CIAT, Aparta do Aereo 67-13. CALI'
- Jaramillo Vasquez J., Coordinador Programa de Hortalizas, ICA, AA 233 PALMIRA

(*) address: see contribution

COSTA RICA

-HEINZE H., Centro Agronomico Tropical de Investigacion y Enseňanza, TURRIALBA

CZECHOSLOVAKIA

- Betlach J., Vegetable Research Institute, OLOMOUC 772 36
- Havranek P. (*)
- Kopec K. (*)
- Novak F., Vegetable Research Institute, OLOMOUC 772 36
- Strelec V. (*)
- Vagera J. (*)
- Valsikova M. (*)

ETHIOPIA

- Engles J. Project Manager, GTZ, Plant Genetic Resources Center, P. O. Box 30726, ADDIS ABEBA

FRANCE

- Basterreix-Vergez C., Société Clause, Mas St. Pierre – La Galine, 13210 ST. REMY DE PROVENCE
- Chambonnet D., INRA, Vegetable Breeding Station, 84140 MONTFAVET-AVIGNON
- Chermat M., Institut de Recerche Vilmorin, La Menitre, 49250 BEAUFORT EN VALLEE
- Daubèze A.M., INRA, Vegetable Breeding Station, 84140 MONTFAVET-AVIGNON
- Dumas de Vaulx R. (*)
- Florent A., (*)
- Gebre-Selassiè K. (*)
- Ginoux J.P., Ets Gautier, B.P. n. 2, 13630 EYRAGUES
- Giraud C., Graines Caillard, Le Moulin, 84260 SARRIANS
- Hallard J., 19 rue de l'Epargne, 91700 S.TE GENEVIEVE DES BOIS
- Laterrot L., Station d'Améloiration des Plantes Maraichères, Domaine Saint Maurice, 84140 MONTFACET
- Marchoux G. (*)
- Nicolet J.L., Les Graines Caillard S.A., Domaine du Moulin, 84260 SARRIANS
- Pochard E. (*)
- Prud'homme J.R., St. Marsem Agri, Mas de Rouzel, route de Génerac, 30.000 NIMES
- Treillet L., Ets Tézier Frères, B. P. 223, 26002 VALENCE

GREAT BRITAIN

- Pickersgill B., Plant Sciences Laboratories, University of Reading, Witheknights, READING RG6 2AS

(*) address: see contribution

HUNGARY

- Andrasfalvy A., Research Institute Crops, Budatéteni Station, Park n. 2, P. O. B. 95, 1775 BUDAPEST
- Barta A., Seed Production and Trading Co., Research Institute, P. O. Box 41, 6601 SZENTES
- Csilléry G. (*)
- Csorba I., Hungarian Seed Producing and Trading Co., Research Institute, P. O. Box 41, 6601 SZENTES
- Fàri M. (*)
- Fisher I. (*)
- Harmath I., Research Stationof Agricultural University, 4014 PALLAGDEBRECEN
- Làszlo M., Research Institut for Vegetable Crops, Budatéteni Station, 1775 BUDAPEST
- Nemeth G., Seed Productin and Trading Co., Research Institute, P. O. Box 41, 6601 SZENTES
- Salmon P., Research Institute for Plant Protection, Pf. 102. 1025 BUDAPEST
- Tòbiàs I. (*)
- Zatykò L, Research Institut for Vegetable Crops, Budatéteni Station, 1775 BUDAPEST

INDIA

- Ahuja S. (*)
- Ahuja S. P. (*)
- Bajaj K.L. (*)
- Chhonkar V.S., Dept. of Horticulture, Banaras Indu Univeristy, VARANASI 221005
- Deshpande A. (*)
- Hundal J.S. (*)
- Joshi M.M. (*)
- Kapur P. (*)
- Kashikar S.G., Ankur Agricultural Research Laboratories, Ganeshpeth – 27 New Cotton Market, NAGPUR 440010
- Kaur M.G. (*)
- Kaur M.P. (*)
- Kaur M.R. (*)
- Kaur M.S. (*)
- Khalaktar A.S. (*)
- Mohan R. (*)
- Pathak C.S. (*)
- Rao V.P., Regional Fruit Research Station, ANATHARAJUPET 516 105, Cuddapah District, A.P.

(*) address: see contribution

- Rawal R. D. (*)

- Sharma O. P. (*)
- Sidhu A. S. (*)
- Singh D. P. (*)
- Singh J. (*)
- Sooch B. S. (*)
- Thakur M. R. (*)
- Thind T. S., Department of Plant Pathology, Punjab Agricultural University LUDHIANA 141004

ISRAEL

- Cohen S., Div. Virol., Agric. Res., Org., Volcani Center, BET DAGAN
- Shifriss C. (*)

ITALY

- A. I. D., contrada S. Orsola, Blocco Palma 1°, 65100 CATANIA
- Accossato S. (*)
- Belletti P. (*)
- Bianco V.V., Institute of Agronomy, via Amendola 165/A, 70126 BARI
- Bioni M. (*)
- Canfarini L., p.zza Albizzi 11, 47023 CESENA FO
- Conti M. (*)
- Conti S., Institute of Plant Breeding, via Filippo Re 6, 40126 BOLOGNA
- Cristinzio G., Institute of Plant Pathology, 80055 PORTICI NA
- De Toma C. (*)
- De Groot E., Peto Italiana, via Canneto di Rodi, Borgo Sabotino, 04100 LATINA
- Di Vito M., Institute of Plant Nematology, via Amendola 175/A, 70126 BARI
- Eccher Zerbini P. (*)
- Gavazzi G., Biology Department, via Celoria 26, 20133 MILANO
- Ghisleni P.L., Institure of Horticultural, via delle Piagge 23, 56100 PISA
- Hennart J.W. (*)
- Lanteri S. (*)
- Lepori G. (*)
- Lorenzetti F., Institure of Plant Breeding, Borgo XX Giugno, 06100 PERUGIA
- Lorenzoni C., Institute of Plant Production, p.le Kolber 4, 33100 UDINE
- Marte M. (*)
- Martinetti L., via Orazio 22, 20023 CERRO MAGGIORE MI
- Matta A., Institute of Plant Pathology, via Giuria 15, 10126 TORINO
- Monti L., Institute of Plant Breeding, 80055 PORTICI NA
- Moschini E., Institute of Vegetable Crops, via delle Piagge 23, 56100 PISA

(*) address: see contribution

- Nassi M.O., Institute of Plant Breeding, via Giuria 15, 10126 TORINO
- Noto G., Institue of Vegetable Crops, via Valdisavois 5, 95123 CATANIA
- Parrini P., Institute of Arboriculute, via Donizetti 6, 50144 IRENZE
- Porceddu E., Institute of Germplasm, via Amendola 165/A, 70126 BARI
- Porcelli S., Experimental Institute of vegetable Crops, via Conforti 11, 84100 SALERNO
- Quagloitti L. (*)
- Restaino F. (*)
- Saccardo F., ENEA, Casaccia, 00060 SANTA MARIA DI GALERIA RM
- Santini, S.A.I.S. S., via Ravennate 214, 47023 CESEAN FO
- Scarascia G.T., Institute of Plant Breeding, 01100 VITERBO
- Semencoop, via Calcinara 1430, 47020 MARTORANO DI CESENA FO
- Silvetti E. (*)
- Van Sloten D., Plant Production and Protection Division C706, FAO/IBPGR, via delle Terme di Caracalla, 00100 ROMA
- Soressi G. P., Experimental Institute of Vegetable Crops, via Paullese 60 20075 MONTANASO LOMBARDO MI
- Sozzi A. (*)
- Terzolo G., Olter Sementi, c.so Venezi 93, 14100 ASTI
- Tes R., Institute of Vegetable Crops, via delle Piagge 23, 56100 PISA
- Testoni A. (*)
- Uncini L., Experimental Institute of Vegetable Crops, 63030 MONSAMPOLO DEL TRONTO AP

JAPAN

- Ohta Y., Institute of Agriculture and Forestry, University of Tsakuba, Sakura-Mura, IBARAKI-KEN 300-31
- Sakata T., Company C. P. O., Box Yolohama 11, YOKOHAMA 220-91

MEXICO

- Pozo Campodonico O. (*)

THE NETHERLANDS

- Boukema I.W., Institute for Horticultural Plant Breeding, Mansholtlaan 15, WAGENINGEN
- Enza-Zaden B.V., Postbus 7, 1602 AA ENKHUIZEN
- Koolstra J.W., Rijk Zwaan B.V., P.O. Box 40, 2678 ZG DE LIER
- Mulder A.D., Royal Sluis, P.O. Box 22, 1600 AA ENKHUIZEN
- Pet M.G. (*)
- Rast A.T.B., Glasshouse Crops Research and Experiment Station, P.O. Box 8 2670 AA NAALDWIJK
- Van den Berkmortel L.G., Bruinsma Hybrid Seed Co., P.O. Box 24, NAALDWIJK
- Vreugdenhil D., Vandenberg B.V., P.O. Box 25, 2670 AA NAALDWIJK

(*) address: see contribution

PERU

- Delgado de la Flor B.F., Departmento de Horticultua, Universidad Nacional Agraria, Apartado 456, La Molina, LIMA

SPAIN

- Celada V., Asgrow Seed Company, Apartado 670, ALMERIA
- Costa Garcia J. (*)
- Cuartero J. (*)
- Gomez-Guillamon M.L. (*)
- Gil Ortega R., I.N.I.A., Carretera de Montanana 177, Apartado 202, ZARAGOZA
- Nuez F.
- Palomares G. (*)

TAIWAN

- Chang W.N., Dept. of Horticulture, Nat. Chung Hsing Univ., 250 Kuokuang Road, TAICHUNG

TUNISIA

- Verlodt H.A.J., Laboratories de Cultures Maraichères, Institut National Agronomique de Tunisie, 43 Avenue Charles Nicolle, 1002 TUNIS Belvedere

TURKEY

- Abak K. (*)

U. S. A.

- Agrigenetics Corporation, Research Department, 9870 Fairview Road, P.O. Box 1438, HOLLISTER, California 95023
- Asgrow Seed Company, Pacific Coast Breeding Station, P.O. Box L, SAN JUAN BAUTISTA, California 95045
- Atlee Burpee Co., Research Station, 335 Sputh Briggs Road, SANTA PAULA, California 93060
- Cook A.A., Dept. Plant Pathology, Univeristy of Florida, GAINESVILLE, Florida 32611
- Hardy Eshbaugh M.W., Dept. of Botany, Miami University, OXFORD, Ohio 45056
- Hibberd A.M. (*)
- Honma S. (*)
- McCammon K.R. (*)
- Northrup King Co., 27805 S.W. 197 Ave., HOMESTEAD, Florida 33031
- Petoseed Company Inc., P.O. Box 4206, SATICOY, California 93003
- Stall R.E. (*)
- Subramanya G. (*)

(*) address: see contribition

U.S.S.R.

- Alpathiev A.V., Research Institute on Vegetable Crops, Breeding and Seed Production, 143080 Odintsov District , Moscow Region
- Andryushchenko V. (*)
- Dvornikova L.A. (*)
- Karovia V.J. (*)
- Kudina T.N. (*)
- Pilipenko A.D. (*)
- Samovol A.P. (*)
- Zatuliveter V.Y. (*)
- Zhuchenko A.A. (*)

WEST GERMANY

- Reimann-Philipp R., Bundesforschunganstalt für Gartenbauliche Pflanzenzüchtung, Bornkampsweg, 2070 AHRENSBURG, Holst.

(*) address: see contribuion

QEUSTIONNAIRE

If you wish to receive a copy of the next "Capsicum Newsletter", please complete this questionnaire and send it to:

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