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The picture on the cover is derived from the “Habanero nuovo di Castore Durante”,

Venetia, MDCXXXVI

FOREWORD

We are glad to present the fourth issue of "Capsicum Newsletter". The high number of contributions and the great interest aroused among breeders and research workers that deal with pepper, confirm the usefulness of the publication.

As for the past, none of the contributions published have been corrected, even when the text had to be retyped. Therefore the Authors only must be held responsible for both scientific content and the form of the reports.

The present issue is still sent free of charge to all the recipients listed at page 85, but financial problems will impose us to send the next issue only to the contributors and those who explicitly will ask for it.

We hope that in the Eucarpia Capsicum and Eggplant Meeting at Zaragoza (October 1986) we will have the opportunity to discuss this and other problems concerning the "Capsicum Newsletter" publication.

In any case we are very glad to have the opportunity, by the unpretentious work of editors of "Capsicum Newsletter", to contribute somehow to link research workers from countries so far away in the world.

Piero Belletti, Ornella Nassi, Luciana Quagliotti

Institute of Plant Breeding and Seed Production
of the University of Turin

Turin, 31st December 1985

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CAPSICUM GERMPLASM COLLECTING IN GUATEMALA

C.A. Azurdia and M.M. González

Agronomy School of Universidad de Sn. Carlos and Sciences and Technology Institute, Guatemala, C.A.

Starting in 1982, The Agronomy School of the National University and The Sciences and Technology Institute have been developing a program on the collecting and characterization of Guatemalan native germplasm. This program being supported by the International Board of Plant Genetic Resources (IBPGR) includes Capsicum of which has been collected so far, 205 accessions involving the following taxa:

Capsicurn annuum L. 144, C. annuum var. aviculare (Dierb) D'arcy & Eshbaugh 21, C. pubescens Ruiz & Payon, 35 and C. chinense Jacq. five. The main bank for these materials is in the Plant Genetic Resources Department of CATIE, Turrialba, Costa Rica, whereas the secondary bank is in the Agronomy School of the National University in Guatemala.

Chili peppers are not so important as crop in Guatemala because, even they are cultivated in many localities, this done in so small areas that hardly fulfill local requirements. Besides this consideration are the improved varieties that are used in the industry.

The demand for improved varieties in the market is displacing local varieties. However, the variable ethnic composition of Guatemala, permits that each of the local varieties keeps a close relation with its germplasm, in such a way that every community protects its own cultivars very jealously.

GERMPLASM RESOURCES OF CAPSICUM FROM SPAIN

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A project designed for collecting several vegetable crop species germplasma in Spain was undertaken during 1984 and 1985. The project was partially supported by I.B.P.G.R./F.A.O. Pepper was enclosed in this project because it is one of the most important crops in Spain. 198 accessions have been collected, all of them belonging to the Capsicum annuum specie. Samples of all of them have been sent to the Institute for Horticultural Plant Breeding of Wageningen. These accessions are currently in reproduction and characterization phase.

Table 1 shows the items collected. There are two groups according to size and flesh consistence: Group 1 = fruits of big size or consistent flesh and Group 2 = fruits of small size or no consistent flesh.

Table 1. A : Identification label. B: Group. C: Fruit purgency : 0 = no purgent; 1= low; 3 = purgent; 5 = high or very high; 7 = variable. D : Local name (when possible).

Sampled area : Andalucía.

A	B	C	D	A	B	C	D
AN-CA-1	1	0	-	AN-CA-39	1	0	-
AN-CA-2	2	3	Guindilla	AN-CA-40	1	0	-
AN-CA-3	1	0	Cuatro cascos	AN-CA-41	1	0	-
AN-CA-4	1	0	Cuatro cascos	AN-CA-42	1	0	-
AN-CA-5	1	0	De farolillo	AN-CA-43	1	0	-
AN-CA-6	2	0	Erúlico	AN-CA-44	1	0	-
AN-CA-7	1	0	Castellano	AN-CA-45	2	0	Cornicabra
AN-CA-8	2	0	Cornicabra dulce	AN-CA-46	2	0	-
AN-CA-9	2	3	Blanco picante	AN-CA-47	2	0	Cornicabra
AN-CA-10	2	3	Picante	AN-CA-48	1	0	Cuatro cascos
AN-CA-11	2	3	Picoso	AN-CA-49	1	0	Cuatro cascos
AN-CA-12	2	0	Dulce de matanza	AN-CA-50	2		Cornicabra
AN-CA-13	2	3	Picante corto	AN-CA-51	1	0	Tres cascos
AN-CA-14	1	0	De matanza	AN-CA-52	2	3	Chile
AN-CA-15	1	0	Dulce de matanza	AN-CA-53	2	0	Cornicabra
AN-CA-16	2	3	Picante largo	AN-CA-54	2	0	Cornicabra
AN-CA-17	1	0	Dulce	AN-CA-55	2	0	Largo
AN-CA-18	2	3	Picante	AN-CA-56	2	0	Largo

A	B	C	D	A	B	C	D
AN-CA-19	1	0	Bolilla	AN-CA-57	2	0	Largo
AN-CA-20	1	0	Dulce	AN-CA-58	1	0	Morrón
AN-CA-21	1	0	Dulce	AN-CA-59	2	0	Largo
AN-CA-22	2	3	Cornicabra picante	AN-CA-60	2	0	Malagueño
AN-CA-23	1	0	Dulce de matanza	AN-CA-61	1	0	Morrón
AN-CA-24	2	3	Picante	AN-CA-62	2	3	Cerecilla grande
AN-CA-25	2	3	Picante mediano	AN-CA-63	2	3	Cerecilla chica
AN-CA-26	2	3	Picante corto	AN-CA-64	1	0	Cuatro cascos
AN-CA-27	2	3	Picante largo	AN-CA-65	2	3	Ñora
AN-CA-28	1	0	Del lugar	AN-CA-66	1	0	Cuatro cascos
AN-CA-29	1	0	Cuatro cascos	AN-CA-67	1	0	Blanquillo
AN-CA-30	2	3	Cerecilla	AN-CA-68	2	0	De secar
AN-CA-31	2	3	De matanza	AN-CA-69	1	0	Bombacho
AN-CA-32	2	0	Sin cascos	AN-CA-70	2	0	De freir
AN-CA-33	1	0	Hocico de buey	AN-CA-71	2	0	Roteño
AN-CA-34	2	0	Cuatro cascos	AN-CA-72	2	0	Corto
AN-CA-35	1	0	-	AN-CA-73	2	0	Cornicabra dulce
AN-CA-36	1	0	-	AN-CA-74	2	7	De Padrón
AN-CA-37	1	0	-	AN-CA-75	2	0	Blanco
AN-CA-38	1	0	-				

Sampled area : Región mediterránea.

A	B	C	D	A	B	C	D
V-CA-1	2	0	Tres cantos o de cuerno	V-CA-41	2	3	Pebrera
V-CA-2	2	0	Tres cantos	V-CA-43	2	3	Pebrera
V-CA-3	2	0	Valenciano	V-CA-45	1	0	-
V-CA-4	2	0	Valenciano	V-CA-46	2	5	Pebrera
V-CA-5	2	0	Valenciano	V-CA-47	2	5	Pebrera
V-CA-6	2	0	Tres cantos	V-CA-48	1	0	-
V-CA-7	2	5	Pebrera verde	V-CA-50	2	7	De Padrón
V-CA-8	2	5	Pebrera blanca	V-CA-51	2	1	Pebrera cornicabra
V-CA-9	2	0	Cornicabra	V-CA-52	2	0	De adorno
V-CA-10	1	0	Cuatros cantos	V-CA-56	1	0	Morrón
V-CA-11	2	5	Cerecilla	V-CA-57	1	0	Grande
V-CA-12	2	3	Guindilla	V-CA-58	1	0	Gordo
V-CA-13	2	5	Cerecilla	V-CA-59	2	3	Guindilla
V-CA-14	2	3	Cerecilla blanca	V-CA-60	1	0	Morrón
V-CA-15	1	0	Rojo	V-CA-61	2	3	Picante
V-CA-18	1	0	Morrongo	V-CA-62	2	0	Pequeño
V-CA-19	1	0	Cuatros cantos	V-CA-65	2	0	Para vinagre
V-CA-20	2	1	Picante	V-CA-66	1	0	-
V-CA-21	1	0	Morrongo	V-CA-68	1	0	Morrongo
V-CA-23	2	3	Nora	V-CA-69	2	3	Pebrera
V-CA-27	1	0	-	V-CA-71		3	Guinilla blanca
V-CA-28	2	0	Nora	V-CA-76	2	3	-
V-CA-30	2	3	Nora	V-CA-77	2	3	Cerecilla roja
V-CA-32	1	0	Cuatro cantos	C-CA-1	1	0	Morrón
V-CA-33	2	0	-	C-CA-2	2	0	Cuerno de toro
V-CA-35	2	3	Pebrera	C-CA-3	2	0	Pebrera
V-CA-36	2	3	Pebrera	C-CA-4	2	3	Pebrera

A	B	C	D	A	B	C	D
V-CA-37	2	5	Pebrera	C-CA-5	2	3	Pebrera
V-CA-38	2	5	Pebrera	C-CA-7	2	3	Pebrera larga
V-CA-39	1	0	De asar	C-CA-8	1	0	Para pimentón
V-CA-40	2	3	Pebrera	C-CA-9	2	3	Picante

* Remarks: V-CA-50 : from Galicia. V-CA-57: possible resistant to viruses.

Other areas

A	B	C	D	A	B	C	D
E-CA-1	2	2	Guindilla	E-CA-17	2	3	Largo
E-CA-2	1	0	Gordo	E-CA-18	2	0	Lago
E-CA-3	1	0	Grueso corto	E-CA-19	1	0	Gordo
-CA-4	1	0	Grueso largo	E-CA-20	2	3	Botijillos
E-CA-5	1	0	Bola de relleno	E-CA-21	2	3	Bola
E-CA-6	2	0	Fino de colgar	E-CA-22	2	0	Cornicabra largo
E-CA-7	2	3	Guindillas de bola	E-CA-23	2	3	De secar agrio
E-CA-8	2	3	Guindilla larga	E-CA-24	1	0	De asar
E-CA-9	1	0	Gordo	E-CA-25	1	0	Morrón
E-CA-10	1	0	Gordo de asar	E-CA-26	2	0	Largo sequero
E-CA-11	2	0	Largo	E-CA-27	2	0	Cornicabra
E-CA-12	2	0	Largo dulce	A-CA-2	2	3	Guindilla
E-CA-13	1	0	Gordo de asar	A-CA-3	2	3	Guindilla
E-CA-14	1	0	Gordo	A-CA-4	2	0	Cuernocabra
E-CA-15	1	0	Gordo largo	A-CA-5	1	0	Morro de vaca
A-CA-16	2	3	Bolilla picante	A-CA-6	1	0	Morrón
A-CA-7	1	0	Morrón	CM-CA-5	2	0	Cuerno de cabra
A-CA-8	1	0	Morrón de bola	CM-CA-6	2	0	Cuerno de cabra fino
A-CA-9	1	0	Morrón	S-CA-1	1	0	Del país
E-CA-10	1	0	-	S-CA-2	2	0	Delgado
CM-CA-1	2	3	Picante	S-CA-3	1	0	Grueso del país
CM-CA-2	1	0	Mangones	S-CA-4	2	0	-
CM-CA-3	1	0	-	S-CA-5	2	0	Largo de Santibañez

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CAPSICUM CHARACTERIZATION IN GUATEMALA

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Supported by the International Board for Plant Genetic Resources (IBPGR) .the Agronomy School of the National University and the National Agricultural Sciences and Technology Institute (ICTA) have been developing, since 1964, a program on the characterization of Guatemalan native crops which includes Capsicum.

So far, there are two assays in the field phase, one is in the result analysis phase, and the other one is concluded. Regarding to the last one, we include the following abstract.

The assay was done in the ICTA Agricultural Experiment Station located in the Chimaltenango area at an elevation of 1786 meters above sea level. It included 14 accessions belonging to Capsicum annuum L. two to C. pubescens Ruiz & Pavon, five to C. annuum var. aviculare (Dierb) D'arcy & Esbaugh and four belonging to C. annum L. hut with flower characters close to those of C. ciliatum (HBK) Kuntze.

The cultivars showed great variability, regarding to both groups of characters quantitatives and qualitatives, excepting stem type and fruit persistence, which are uniform. Fruit size and fruit wall thickness showed positive correlation with the following characters: branching habit, flower position during anthesis, plant width, foliar area, filament length and seed width; also the number of fruits per axils shows negative correlation. On the other hand, the fruit size and fruit width are negatively correlated with the position of the stigma with respect to the anthers.

(GENETIC RESOURCES OF CAPSICUM SPP. IN TURRIALBA, COSTA RICA

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The Tropical Agricultural Research and Training Center (CATIE) has, through the Plant Genetic Resources Unit, started research on exploration, collection, conservation, documentation and exchange of genetic resources of Capsicum spp. Samples have been collected from Mexico, Central America and South America and been maintained in cold stores designed especially for this purpose.

CATIE has been nominated by the International Board for Plant Genetic Resources (IBPGR) to keep a basic world collection of Capsicum spp. In 1981 work was initiated on the preliminary characterization of the collected material. In 1985 this work was strengthened by the financial assistance of the IBPGR in Rome, Italy; enabling more in depth evaluation of 450 introductions. The main objectives of this research is the characterization of taxonomic, agronomic, morphologic and chemical aspects using the IBPGR descriptors.

The collection includes 1425 introductions from 25 countries in Central America (58%), South America (21%), North America (11%), and the rest of the world (10%). However, 70% of this collection has not yet been identified to the species level (about 826 introductions).

The number of evaluated introductions per country, and range in yield per plant is given in Table 1. Of the material evaluated to date, capsaicin content has varied between 0.44% and 1.06%; accession numbers 7810, 7813, 7320 and 9221 exhibiting both high fruit yield and high capsaicin content (Table 2).

Table 2. YIELD AND CAPSAICIN CONTENT OF 10 CATIE ACCESSIONS

Introduction No	Yield [1]	Capsaicin [2]	Origin
7810	12.44	7	Guatemala
7813	10.91	7	Guatemala
7320	10.90	7	Panamá
9221	9.90	7	México
11708	7.88	3	Colombia
8052	7.42	7	México
0851	5.84	7	México
8057	5.60	5	Guatemala
11250	5.60	5	Guatemala
10917	5.38	3	Honduras

(1) Total fresh weight per plant

(2) Range of capsaicin content

3. Low (0.01 – 0.49 %)

5. Medium (0.50 – 0.99 %)

7. High (1.00 – 1.50 %)

Table 1. YIELD OF CAPSICUM SPP. BY CONTRY

Accession	Number of Introduction	Mean	Yield (g/plant) High	Low
Colombia	1	7.88	-	-
Costa Rica	148	2.10	8.70	0.00
Ecuador	1	1.00	-	-
El Salvador	16	0.89	4.20	0.00
Guatemala	55	2.83	12.44	0.00
Honduras	18	2.28	6.70	0.00
India	1	2.60	-	-
Mexico	55	1.87	9.90	0.00
Panama	20	3.45	10.90	0.63
Peru	8	2.77	7.64	0.53
Philippines	2	1.54	2.50	0.58
Puerto Rico	1	2.60	-	-
U.S.A	3	0.51	0.55	0.48

VARIETAL DIFFERENCES IN RADIO—SENSITIVITY IN CHILIES (CAPSICUM ANNUUM L.)

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During our mutation breeding program in chilies, seeds of ten varieties were irradiated with gamma rays at different doses rancing from 10 k Rad to 60 k Rad. The treated seeds were planted in replicated trial along with untreated controls. Studies were made on the germination and survival of the plants at various treatments. Seed germination was gradually reduced with the increase in radiation dose in most of the varieties (Table 1).

Few varieties, e.g. ‘Jwala , ‘Pant C-1 , ‘NP46A’ , ‘G-4’ and ‘CA (P) 247’ showed improved germination over controls al lower doses, however, at higher this trend was reversed. The varieties which showed comparative radio resistance or the germination parameter were ‘CA (9) 247’, ‘Jwala’ , ‘Kalianpur yellow’ and ‘K-2’.

Survival percentage of plants also decreased with the increase in radiation dose, in all the varieties (Table 1). Variety ‘CA (2) 247’ was again found to be comparatively radio resistant followed by ‘K-2’ and ‘CA 960’, whereas varieties ‘NP 46 A’ and cross ‘197’ were found to be radio sensitive.

Table 1 Germination / Survival Studies in 10 varieties of Chilies irradiated at different doses

GERMINATION (Data bases on percentage of Control)

Doses	Varieties									
	Cross 197	Cross2 06	K2	Pant C1	NP46 A	Jwala	G4	CA96 0	CA(P) 247	K. Yellow
CONTROL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
10 K Rad	92.0	88.7	104.0	08.0	104.3	160.4	102.1	86.4	108.3	97.5
20 K Rad	70.8	94.3	77.5	100.4	83.5	119.1	86.3	72.8	110.9	85.2
30 K Rad	64.6	45.1	44.9	67.2	46.3	96.8	60.4	68.6	79.0	68.8
40 K Rad	15.6	16.9	36.7	22.5	8.5	43.3	29.6	36.1	60.2	22.5
50 K Rad	4.1	9.7	23.1	2.6	6.7	8.3	7.5	32.5	48.7	8.6
60 K Rad	3.1	2.4	4.8	0.0	2.4	14.7	0.0	2.4	15.7	7.8
				SURVIVAL						
CONTROL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
10 K Rad	86.7	80.8	86.9	101.8	100.7	107.9	85.3	73.3	102.2	118.7
20 K Rad	61.2	75.1	75.1	94.8	63.4	96.0	62.4	57.6	98.3	89.3
30 K Rad	53.0	29.3	30.7	52.3	9.3	61.1	35.6	52.7	81.4	59.3
40 K Rad	1.0	7.8	6.5	6.5	0.0	6.3	9.3	18.2	55.2	7.9
50 K Rad	0.0	1.0	10.4	0.9	0.0	0.0	0.0	9.7	41.0	0.0
60 K Rad	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0

STOMATAL FREQUENCY IN SOME PEPPER VARIETIES

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It is common knowledge that the stomata regulate plant - water relations. Most of the water loss, about 90 %, escapes through the stomata of the leaves. The number of stomata per unit leaf surface has an important role as well as the opening and closing of stomata and size of the aperture, in respect of the water loss in vapor from plants.

In our previous study, we have investigated the stomatal structure and density of l3 vegetable species widely grown in Turkey and determined that pepper has an amphystomatic stoma type. Number of stomata per mm^2 on upper and lower surface of leaves were 35 and 150 respectively (1).

In present report, we have examined stomatal density of 16 pepper varieties come from different origin and species (C. annuum, C. baccatum, C. frutescens) and 12 doubled haploid lines issued through another culture.

Plants were grown in a glasshouse in the period from March to June in 1985. The number of stomata per mm^2 was determined only on the lower surface of mature leaves using cellulose acetate ‘‘peel’ technique as described by Mc Donald (2). According to this method, 1/3 aceton was mixed up with nail varnish and applied to the leaf surface. 5 minutes later, the film was stripped off for examination under microscope. For each variety, forty accountings were made.

Results are summarized in Table 1. As shown in the Table, there are significant differences between certain pepper varieties in respect of stomatal frequency. Generally stomatal density of Turkish originated materials (Ata 100,’ Incesu 118’, ‘Corbaci) are lower than foreign varieties. Some lower stornatal density lines (’84-103’, ’84-122’, ‘84-124’, ‘84-140’) were determined as well as higher ones (’84- 135’) in doubled haploid lines series.

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Table 1. Average number of stomata on the lower surface of different pepper varieties

Varieties of lines	Number of stomata / mm²	Varieties of lines	Number of stomata / mm²
Ata 100 (local variety)	112.1 ± 5.3	84 – 116 (DH)	141.4 ± 6.1
İncesu 118 (local variety)	134.5 ± 5.8	84 – 117 (DH)	145.7 ± 5.6
Corbaci (local variety)	115.5 ± 5.0	84 – 118 (DH)	154.3 ± 6.0
Yolo Wonder	154.4 ± 7.6	84 – 119 (DH)	150.0 ± 5.4
Hung. Yellow Wax	124.1 ± 4.7	84 – 121 (DH)	125.9 ± 5.5
Serrano Vera Cruz	137.1 ± 5.3	84 – 122 (DH)	112.1 ± 5.3
Moura	170.7 ± 5.7	84 – 124 (DH)	114.7 ± 5.1
Linea 29	198.3 ± 6.4	84 – 129 (DH)	122.0 ± 5.4
Anu 5	149.1 ± 6.9	84 – 133 (DH)	106.9 ± 5.7
YPR 10	144.0 ± 5.4	84 – 135 (DH)	262.9 ± 6.8
Singh 1	163.8 ± 5.8	84 – 140 (DH)	121.1 ± 4.9
PM217	141.4 ± 6.1	Süs 2 (C. frutescens)	149.1 ± 7.0
PN477	225.9 ± 6.9	Süs 3 (C. frutescens)	133.6 ± 5.7
84 – 144 (DH) *	138.8 ± 5.1	Süs 3-4 (C. baccatum)	171.6 ± 5.6

- Doubles haploid lines issued from different cross's through another culture.

INVESTIGATION ON THE STOMATAL DENSITY IN CERTAIN PEPPER LINES AND THEIR F_1 HYBRIDS.

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Stomata have a great role in maintaining the plant's water regime as well as providing gas diffusion. Although the number of stomata per unit leaf surface is influenced by the environmental conditions, it also depends on genetical structure of plants.

In our previous study, we determined that there was a great variation in stomatal frequency of pepper varieties (1).

The aim of the present study is to determine if there is a difference of stomatal density between some F_1 hybrids and their respective parent lines.

The varieties used in this study were four inbred lines (two bell types 84 – 101 and 84 – 111 , one conical type : 84 – 103 and one long : type 84 - 134) and their three F_1 hybrids (84 – 101 x 84 – 111; 84 – 101 x 84 – 134 , 84 – 134 x 84 – 103)

The number of stomata was measured using Mc Donald's (2) cellulose acetate "peel' technique only on the lower surface of the leaves and counted forty times in each lines or F_1 hybrids.

Results are summarized in Table 1. There are marked differences between each F_1 hybrid and their parental lines, and these differences are more distinct as the fruit type of parental forms differ.

Table 1. Stomatal frequency in three hybrid peppers and their parental forms.

Lines or hybrids	Number of stomata / mm²	Difference between hybrids and their parents
84 – 101 (bell type)	198. 8 ± 6.4	
84 – 134 (long type)	134.4 ± 5.6	49.4
84 – 101 x 84 – 134 F_1	117. 2 ± 6.3	
84 – 134 (long type)	134.4 ± 5.6	
84 – 103 (conical type)	165.5 ± 5.4	31.8
84 – 134 x 84 – 103 F_3	118.1 ± 6.1	
84 – 111 (bell type)	212.9 ± 6.0	
84 – 101 (bell type)	198.8 ± 6.4	13.6
84 – 111 x 84 – 101 F_1	192.2 ± 6.7	

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CHEMICAL CHARACTERISTICS OF SOME LOCAL PEPPER POPULATIONS

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According to studies carried out by Popov (1943), the content of vitamin C in large sized peppers belonging to the longum varietal group varies from 73.33 to 156.65 mg% of the fresh mass.

The aim of our studies was to establish the content of vitamin C, sucrose, acids and dry matter of 20 local pepper populations belonging to Capsicum annuum var. Kapia.

The vitamin C quantity was determined in mg% of the fresh mass using Moorry's method, acid quantity – % malic acid – dry matter was fixed by means of weighing and total sucrose – % of the fresh mass.

The results are presented in Table 1. They show that the quantity of vitamin C in all tested samples, except 'E131', is higher than the standard cultivar '1619'. The samples 'E115', 224.8 mg%, '7939' 221, 54 mg% and 'El37'203. 59 mg% have the highest value. Malic acid measured in mg% varies within the range of 245 to 405 mg%. 'E48' 0, 405 mg% has the highest content. Total sucrose measured in percentage of the fresh mass ranges from 2.38 in 'E116' to 8.64 in 'E79'. Out of all the samples tested only 8 exceed the standard as far sucrose content is concerned. Dry matter in 15 samples exceeds that of 'Kourtovska kapia 1619', while '7939' – 14, 86 has the highest value.

From the investigations carried out one can draw the following conclusions: the local pepper populations are very well adapted to the conditions of our country, when industrially ripe they surpass cultivar 'Kourtovska kapia 1619' in vitamin C content, and sugars and acids. They can successfully be used as initial material in breeding programs.

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1. Popov, p. 1943. Vitamin content in Bulgarian peppers during industrial ripeness and the range of variation in different forms.

Within the species Capsicum. Magazine of Bulgarian agricultural institutes 1, p 38- 42

Table 1

Ser. No	Description of samples	Vitamin C in mg%	Malic acid in %	Dry matter %	Total sucrose %
1.	E^1 149	181.56	0.400	10.81	5.40
2.	E^1 131	147.02	0.323	9.67	6.26
3.	E^2 49	189.00	0.248	9.45	2.64
4.	E^2 37	174.62	0.335	10.43	6.89
5.	E^2 79	182.68	0.428	9.47	8.64
6.	E^2 111	184.00	0.334	10.08	4.54
7.	E^2 115	182.37	0.400	10.42	4.84
8.	E^2 96	177.84	0.350	10.36	3.93
9.	7014	175.44	0.287	10.48	4.64
10.	E^1 47	171.15	0.245	8.95	3.74
11.	7158	196.04	0.352	10.47	6.03
12.	7939	221.54	0.348	14.86	4.02
13.	E^1 5	195.43	0.313	8.94	3.34
14.	7543	156.67	0.329	9.05	5.84
15.	E^1 48	175.84	0.405	8.59	5.27
16.	E^1 49	200.32	0.339	10.63	2.84
17.	E^1 112	186.04	0.329	10.19	2.44
18.	E^1 115	224.80	0.324	10.07	2.39
19.	E^1 116	196.04	0.376	9.42	2.38
20.	E^1 137	203.59	0.324	8.8	3.12
21.	Standard	162.20		9.43	

A NEW HYBRID 'WONKYO 306' WITH THE MULTI – RESISTANCE IN CAPSICUM ANNUUM

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Yield of red pepper is severely reduced when infected by Phytophthora capsici and viruses (TMV, CMV). So far the efficient control method against P. capsici and those viruses has not been established except that proper rotation system drastically reduce the occurrence. Thus we considered that this problem can only be solved by the breeding of varieties which have multi-disease resistance.

For the purpose of developing varieties with multi-resistance to P. capsici and viruses (TMV, CMV), the red pepper breeding program initiated in 1979. A Korean landrace, 'Taenjaelae' was crossed
With 'Gimjanggochu'. 'Taenjaelae' high yielding capability but susceptible to P. capsici. In 1980 the F1 hybrid was crossed with Gimjanggochu' derived from Thai local variety which has resistance to viruses (TMV, CMV). The three – way F1 hybrid was selfed and subsequent selections were made to F6 generation. Each generation seedlings were inoculated artificially with P. capsici, TMV, CMV in greenhouse and indexed in the field after transplanting. In 1985 'Wonkyo 306' was selected.

In comparison with many other varieties the indexing result indicated that "Wonkyo 306" was highly resistant to me mixed isolates (Eumsong and Kwangsan) of P. capsici, while Cheonanjaelae was susceptible. "Wonkyo 306" was also resistant to P. capsici in the field condition. "Wonkyo 306" probably has genes governing mu1ti – resistance. The result confirmed that it is possible to breed a red pepper variety with resistance to P. capsici, TMV, and CMV.

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Fig 1. Pedigree diagram of multiple resistance “Nonkyo No. 306”

Year	Generation	Taeanjaelae (♀) Gimjanggochu (♂) X (79-10-12) (102-2-8)	Taigukgochu (111-1-4)	No. of plants	Major Proceedures
1979	Cross	↓	↓		Select line of P. capsici resistance
1980	F_1 Cross	37— x---------- (♀)	-------(♂)		
1981	F_1	↓ 17			Select line of TMV resistance
1982	F_2	1…….9……..13……	..27	306	Artificial inoculation select
1983	F_3	1……3…….	….8	313	Plant and seed production
1984	F_4	1 2 3		918	
1984	F_5	1 2 3		730	
1985	F_6	1 2 3		29	

Table 1. Reaction of ‘Nonkyo 306’ to *Phytophthora capsici.*

Variety	Artficial inoculation (% disease suseptibility Date after Inoculation 7 14 21 61	Field Resistant	Evaluation
Nonkyo 306	0 0 0 0.03%	R	R
Shinhong	5 23 32 75	M	M
Cheonan jaelae	10 70 70 95	S	MS

Table 2. Reaction of ‘Wonkyo 306’ to Virus, Anthracnose, and Bacterial Leaf Spot.

Variety	Virus	Anthracnose	Bacterial Leaf Spot
Wonkyo 306	R	MR	MR
Shinong	S	MS	MS
Cheonan	S	M	S

CORRELATION BETWEEN SEVERAL FEATURES OF PEPPER FRUITS

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La Motta di Costigliole (province of Asti, northern Italy) has a long tradition in pepper growing. The crop is grown under plastic tunnels and therefore the berries ripen early.
Nevertheless in recent years a crisis has hit the production of pepper. This crisis could be overcome by offering to the consumer the guarantee of a choice product.
To this aim the job of identifying the morphological features of the berries was undertaken.
In the years 1983 and 1984, 276 pepper fruits were picked, at intervals throughout the season, so as to get a representative sample of the population.
On these berries an analysis was made and measurements were taken, concerning the colour, form, size, volume, weight and wall thickness.
Among some of these features the correlation was evaluated, in order to single out the correlation between the thickness of the wall (the most important features of the 'La Motta pepper') and some other more readily assessable features.
The features intercorrelated were the following:

a) volume
b) total weight
c) edible weight
d) ratio edible weight/total weight
e) ratio total weight/volume
f) wall thickness

The following table shows the significance of the correlation coefficients:

	b	c	d	e	f
a	+	+	n.s.	+	+
b		+	n.s.	n.s.	+
c			+	n.s.	+
d				n.s.	n.s.
e					+

n.s. = no significance
\+ = significance at level 0.01

The results were confirmed using only the berries with a weight of more than 200 g. This is the minimum weight required for the fruit to be considered a true 'La Motta pepper'.

GENETIC PARAMETERS IN PEPPER (Capsicum annuum)

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An experiment was carried out for studying the progeny of seventeen "mother" plants of pepper (Capsicum annuum) from the 'Español' type. The initial material was prospected in the Isla de la Juventud, south of Cuba, in 1978. Plant height, number of fruits per plant, average fruit weight, fruit diameter, pericarp, thickness, yield per plant and total yield were studied and analyzed the correlations between them.

A positive correlation (P/ 0,05 and P/ 0,01) was found between total yield and number of fruits per plant, which suggest that this is the component with the highest effect on yield. As expected there is a negative correlation (P/ 0,05 and P/ 0,01) between number of fruits per plant and average fruit weight. There is a positive correlation (P/ 0,05 and P/ 0,01) among average fruit weight, fruit diameter and pericarp thickness, which is a favorable effect as any of them increases.

THE ANATOMICAL STRUCTURE OF PEPPER FRUIT EXOCARP

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One of the characteristic features of the quality of sweet pepper is the thickness, the anatomical structure of the exocarp and how it changes in accordance with the development of the fruit.

The exocarp of some Hungarian and foreign varieties of determinate and indeterminate growth was examined in five phases of development. On the basis of the results obtained by microtechnical methods varieties can be classified in three groups according to the anatomical structure of the exocarp.

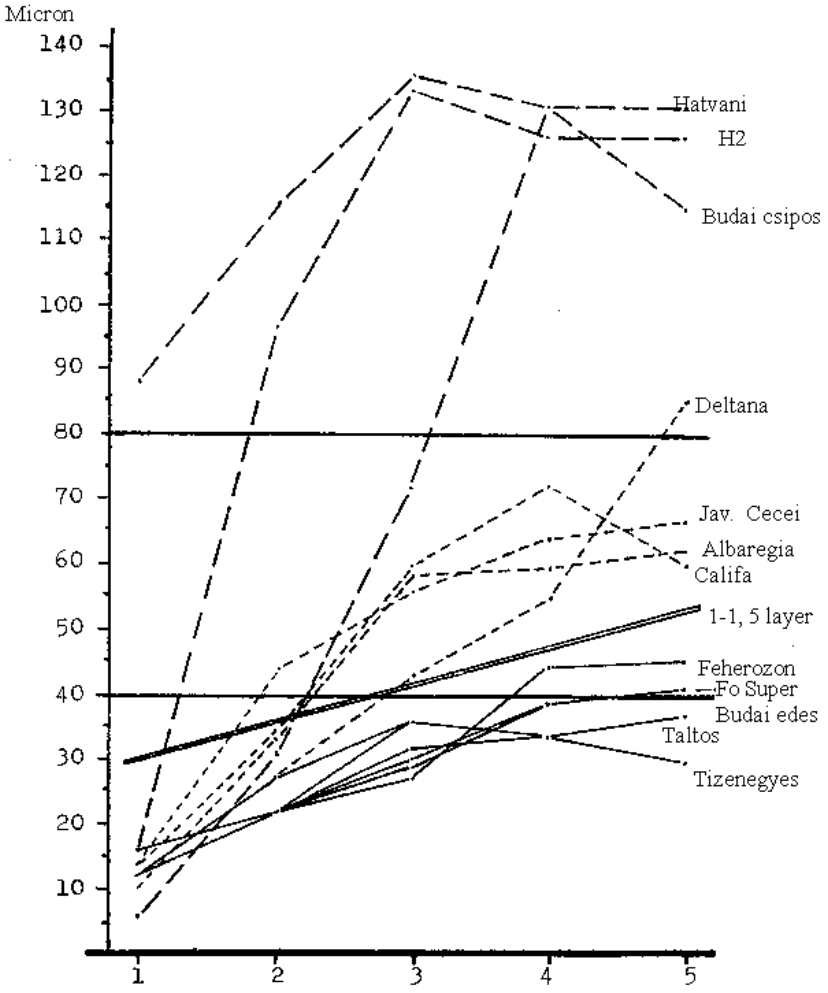
1. Varieties with an exocarp of 0 to 40 microns. On the average these varieties have only one epiderm layer containing cutin. Such are the new Hungarian determinate varieties and Táltos. From the point of view of the consumer these types with thin exocarp are the most palatable as they are easy to digest.

2. Varieties with an exocarp of 40 to 80 microns containing cutin in the epiderm and in some layers of the subepidermal tissue. Such are the examined foreign and older Hungarian varieties.

3. Green, long varieties for forcing with several subepidermal layers containing cutin can produce an exocarp of more than 80 microns.

An intermediate position is taken by varieties that can be listed in group 2 in the market ripe stage but later, after a considerable cutin accumulation they produce a thick exocarp and more layers containing cutin, characteristic for group 3 (e.g. ˙Budai csipôs).

The change of exocarp thickness of sweet pepper varieties in various phases of growth



1. Young growing fruit
2. Full size attained
3. Market ripe
4. Start of ripening process
5. Biological maturity

WATER SUPPLY SYSTEM ACCOMODATING TO THE HEAT DEMAND OF PEPPER

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Pepper requires not only a considerable amount of water but high temperature as well. Sprinkling should not be started or repeated until a certain amount of thermal energy evaporates the water available for the pepper from the soil. This way the water demand of the plant can be met with the least possible heat loss and sprinkling. In the experiments and in the elaborated watering system thermal energy – for practical reasons – is expressed in heat amount (ºC) calculated from daily mean temperature whereas the amount of water to be made up for by sprinkling or rain is expressed in mm.

Particular (determinate, indeterminate) varieties and plants of different technologies differ in the use of water and their demand of water reserve. The amount of heat meeting the demand of water supply has been determined. In practical terms we have determined how big an amount of heat (ºC) evaporates the amount of water reserve that can be made up for by one mm of rain or sprinkling water.

Directly sown “Fehérözön”(determinate) demands 1mm of water by 6 – 7 ºC heat amount

Directly sown “Táltos” (indeterminate) demands 1mm of water by 7 ºC heat amount

Transplanted “Fehérözön” demands 1mm of water by 5 ºC heat amount

Transplanted ” Táltos” demands 1mm of water by 7 ºC heat amount

Sprinkling of 30 to 40 mm can be determined this way.

In the five years of the experiment (1980 – 1984) the frequency sprinkling varied according to the rain and temperature conditions of the given year. The average frequency of sprinkling according to the various treatments:

5 ºC heat amount	1mm	sprinkling 8 times
6 ºC heat amount	1mm	sprinkling 6 times
7 ºC heat amount	1mm	sprinkling 4 times

The Effect of Various Amounts of Water Accommodating to Heat Demand on the Yield of Variety types and Production Methods of Pepper Budateteny 1980 - 1984

Treatment			Yield ton/hectare			Mean Mass of Fruit in Grams
Amount of Sprinkling Water	Production Method	Variety	To 31st August	To 30th September	To 31st October	
1 mm water supply by 5o C heat amount	Directly sown	Fehérözön	-	4, 19	14, 08	48
		Táltos	-	5, 29	14, 71	56
	Transplanted	Fehérözön	18, 69	25, 47	37, 28	59
		Táltos	17, 60	25, 28	36, 77	67
1 mm water by 6o C heat amount	Directly sown	Fehérözön	-	5, 1	15, 31	50
		Táltos	-	4, 82	16, 65	58
	Transplanted	Fehérözön	15, 91	23, 67	37, 21	68
		Táltos	17, 77	23, 98	34, 49	58
1 mm water by 7oC heat amount	Directly sown	Fehérözön	-	3, 68	15, 45	48
		Táltos	-	5, 54	17, 27	56
	Transplanted	Fehérözön	15, 46	23, 13	36, 91	70
		Táltos	15, 95	22, 32	32, 91	60
Control without sprinkling	Directly sown	Fehérözön	-	1, 51	12, 12	45
		Táltos	-	2, 00	11, 35	49
	Transplanted	Fehérözön	9, 56	15, 13	25, 67	55
		Táltos	9, 27	14, 85	26, 36	53

Remark : Each treatment with 30 mm of water

EFFECT OF GROWTH REGULATORS ON THE ECONOMIC CHARACTERS OF SWEET PEPPER (CAPSICUM ANNUUM L.)

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The studies were carried out to investigate the effect of growth regulators on the economic characters (market as well as seed crop) of sweet pepper (Capsicum annuum L.) in the plains of Punjab during 1981 – 82 and 1982 – 83. Growth regulators: Gibberellic acid (10 ppm, 25 ppm and 50 ppm), Napthyl Acetic acid (5 ppm and 10 ppm), Ethrel (25 ppm and 50 ppm), Cycocel (100 ppm), Miraculan of triacontanol (100 ppm) and Paras or Mixtalol (100 ppm) were sprayed on the foliage at the initiation of flowering and again after 30 days. Two cultivars, 'Selection – 27' and 'California Wonder' were used in the experiments. Among the treatments of growth regulators, none of them gave significantly better results for the characters fruit yield per plant (marketable as well as red), number of fruits per plant (marketable as well as red), length and width of fruit (marketable), ascorbic acid content (marketable), seed yield per plant, average seed weight, number of seeds per fruit and percentage germination of seeds. However, increase in plant height affected by Gibberellic acid (50 ppm) and Ethrel (50 ppm) decreased the total yield of a plant. Meanwhile, among cultivar 'Selection – 27' was found be superior to 'California Wonder' in the plains of Punjab for: fruit yield per plant (marketable and red 181.25% and 220.30% more respectively), fruit number per plant (marketable and red more than thrice and twice, respectively), seed yield per plant (more than four times) and number of seeds per fruit (188.75% more).

Effect of Ethrel on the Coloring Promotion of Red pepper

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Ethrel is used for the increase of yield in Red pepper as an usual practice yield of red fruit is increased by ethrel treatment (800 – 1200 ppm), [2] but yield of total fresh fruit is decreased by the treatment due to defoliation and chlorosis of leaflets [1 3]

To solve this problem, two methods of ethrel treatment were compared; immersion (1, 30, 60 min. with the concentration of 300 and 500 ppm) of freshly harvested fruits (40 days from flowering) and spray on the plant with ethrel (300 and 500 ppm). In order to find out the possibility of yield increase by ethrel immersion of detached green fruits continuously from fruit setting period, yield obtained by immersion method with fixed concentration at 300 ppm and 30 minute was compared with that from conventional harvesting method which is harvested consecutively in field.

With the immersion treatment the percentage of red coloring fruit was significantly increased. Red – coloring of the treated fruit was over 90% at 3 days after treatment regardless of the ethrel concentrations and the treated periods (Fig. 1). With the spray on the foliage, the percentage of fruit coloring increased to about 80% at 6 days after the treatments (Fig. 2).

The immersion of fresh fruits provided almost 100% coloring by the use of 500 ppm ethrel solution at 5 days after treatment, while the foliage treatment about 92% with the same concentration at 12 days after treatment. Thus, the percentage of coloring could be increased within comparatively short period by the immersion treatment of fresh fruits. Even though differences between varieties were recognized in Table 1, yields of red pepper were increased by the immersion treatment of freshly harvested green fruits from setting period than that from conventional method which is harvested consecutively in field. Not much differences were shown in the contents of capsanthin of the fruit, while a slight difference in capsaicin contents of fruits appeared.

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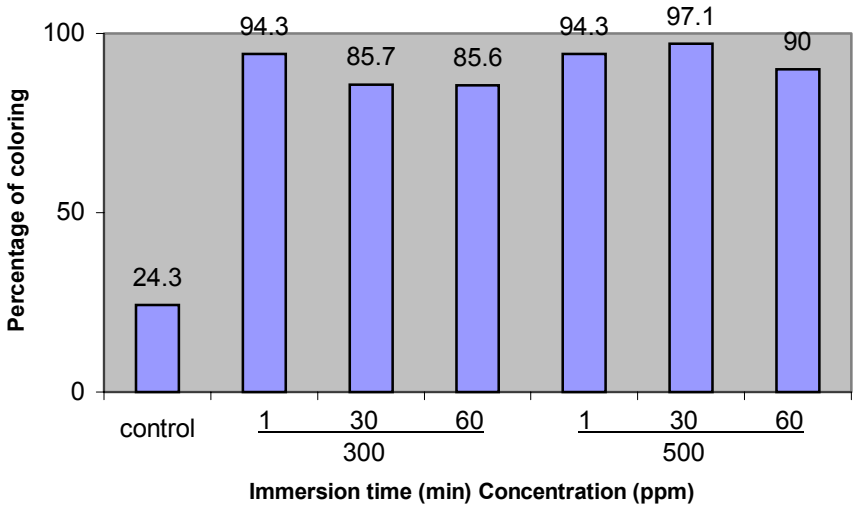

Fig. 1 : Effect of ethrel on the coloring of fresh fruit with the immersion treatments (fruits were harvested 40 days after flowering and coloring was recorded 3 days after treatment).

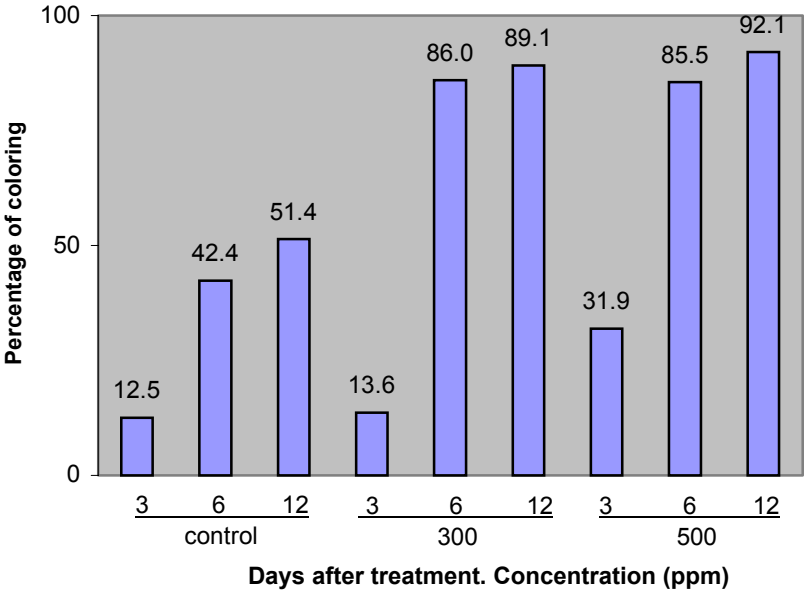

Fig. 2: Effect of ethrel on the coloring of fresh fruit with the spray treatments on the foliage (fruit were harvested 40 days after flowering).

Table 1. Effect of ethrel of the yield of red fruit with the immersion treatment of freshly harvested green fruits continuously from fruit setting period (immersion for 30 min. with 300 ppm concentration).

Variety	Yield		Capsanthin		Capsaicin	
	Control	Immersion	Control	Immersion	Control	Immersion
	Kg/20 plants		Mg/g		Mg/g	
Shinhong	7.4	9.0	3.7	3.9	3.5	3.0
Hongilpum	6.3	10.0	2.9	3.0	2.2	1.5

EFFECT CF LIGHT INTENSITY ON THE VIABILITY OF PAPRIKA POLLEN

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The vitality of paprika pollen has been studied under controlled environment at different light intensities with four varieties for forcing. Pollen tube growth was examined in vitro on sugar solution substrate and determined by the percentage of developed tubes. Pollen fertility was determined by the fruit setting percentage of pollinated flowers.

Pollen tube growth and fertility were much better in the case of pollen grains developed at light intensity of 15 000 lux ran at 1500 lux. Significant differences were found with each of the four varieties studied.

Tube growth of pollen grains developed at 15 000 lux was 11 to 63 per cent. At 1500 lux, 0 to 14 per cent pollen tube growth occurred (table 1.) Differences were found between varieties and on the effect of substrate concentration.

The percentage of fruit setting was 50 to 81 per cent with pollen developed at 15 000 lux and 25 to 44 per cent with pollen developed at 1500 lux light intensity (table 2). The data obtained on pollen fertility differed from those on pollen tube growth in vitro. Consequently, fertilizing ability cannot be predicted on the basis of testing pollen tube growth in vitro.

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Table 1

Pollen tube growth percentage in some paprika varieties (tested on 6 and 0 per cent sugar solution).

Variety	15’000 lux		1’500 lux	
	6%	9%	6%	9%
Hatvani	33.2	62.40	0.00	0.00
Soroksári hajtató	24.94	22.68	3.73	12.13
Fehérözön	19.73	11.18	3.72	14.65
HRF	63.35	44.65	0.00	4.04

Table 2

Fertilizing ability of paprika pollen tested by crossing

Female parent variety	Male parent variety							
	H	S	F	HRF	H	S	F	HRF
	15’000 lux				1’500 lux			
Hatvani /H/	75	75	50	75	25	50	75	50
Soroksári hajtató /S/	50	75	0	50	0	50	25	25
Fehérözön /F/	25	100	75	25	75	75	25	50
HRF	75	75	75	75	0	0	50	0
Average	56	81	50	56	25	44	44	31

EXOCARP THICKNESS OF PEPPER IN F_1

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Exocarp thickness is related to the consumer qualities sunburn resistance, keeping ability and transportableness of pepper. Fisher (l974) found considerable differences in the exocarp thickness of various pepper types as well as changes in its thickness depending on conditions of growing and manner of measurement (fresh, dry or restored state).

The aim of the present study was to assess the inheritance of exocarp thickness in F_1. Lines '16-54k' and '17k' developed by remote hybridization with C. pendulum Wild. (Roussenova – Kondareva, 1968) distinguished by high combining ability for earliness (Daskalov et al., 1973) and cvs 'Sivriya 600', 'D-103'and 'Zlaten medal', as well as the F_1 hybrids obtained by crosses between them were used in the study. The lines, cultivars and crosses were grown in the field and pericarp samples from 20 typical fruits of each variant in technical maturity were investigated. After cooking the samples the exocarp was stripped, dried between filter paper and measured by a micrometer. The inheritance of exocarp thickness was determined after Falconer (1960).

The exocarp of cv.'Zlaten' medal proved 62% thicker than that of cv. 'Sivriya 600' (Table 1). The thickness of one exocarp varied not only between cultivars, but also within the cultivars (from 11.16 to 20.12) and within the hybrids (from 13.03 to 19.73). The data were statistically significant. The mode of exocarp thickness inheritance varied from incomplete dominance ('16-51k' x 'Silvriya 600' and '16-51k' x 'D-103') Dominance of the thinner ('Sivriya 600' x 'D-103', '17k' x 'Zlaten medal') or of the thicker exocarp ('17k' x 'Sivriya 600' and '17k' x 'D-103') prevailed.

In order that F_1 hybrids with thin exocarp can be developed, both pa rents have to possess this character.

Conclusions: 1. The inheritance of exocarp thickness in F_1 is strictly specific.
2. A thin exocarp in the hybrid is ensured only if both parents possess this character.

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Table 1. Exocarp thickness of pepper lines, cultivars and hybrids (microns)

Variant	M+m	VC	P	d/a
16-51^{k}	27.353 ± 1.335	20.12	4.88	-
17^{k}	33.313 ± 0.929	11.16	2.79	-
Sivriya 600	23.138 ± 0.765	17.18	3.31	-
D-103	25.118 ± 0.727	11.93	2.89	-
Zlaten medal	37.441 ± 1.052	16.39	2.81	-
16-51^{k} x Sivriya 600	30.380 ± 1.279	17.85	4.21	2.44
16-51^{k} x D-103	34.882 ± 1.104	13.05	3.17	7.73
16-51^{k} x Zlaten medal	35.000 ± 1.588	18.71	4.54	-0.52
17^{k} x Sivriya 600	34.600 ± 1.712	19.17	4.95	1.25
17^{k} x D-103	34.625 ± 1.129	13.04	3.25	1.32
17^{k} x Zlaten medal	32.250 ± 1.050	13.03	3.26	1.51
Sivriya 600x D-103	22.889 ± 0.750	19.73	3.29	1.25

NON-FLOWERING MUTANT IN CHILLIES (CAPSICUM ANNUUM L.)

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Several mutants have been reported from our Laboratory in Capsicum annuum (Pathak et al., 1983a, 1983b, and 1983c). Adding to this list is the non-flowering mutant, which was isolated from the segregating progeny of a local collection made from the Northern part of the country during 1981. These non-flowering plants were tall and had less number of branches in comparison to normal flowering plants. No flowering was observed in such plants throughout the growing season of the crop.

Selfed progenies of some of the normal plants in the line segregated again into normal plants and non-flowering plants. Genetical studies carried out in the progeny of three, such heterozygous plants revealed monogenic recessive nature for the non-flowering character (Table 1). The gene controlling this trait can be termed as 'nf'.

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Table 1. Segregation of non-flowering mutant plants in the progeny of heterozygous plants

Plant Progeny	Number of plants		Expected Ratio	Goodness of fit 'p'
	Normal plants	'nf' plants		
1	114	36	3 : 1	0.70 - 0.80
2	50	18	3: 1	0.70 - 0.80
3	31	11	3 : 1	0.80 - 0.90

ABNORMAL SEGREGATION RATIO IN A 'LUTESCENS" HYBRID IN CAPSICUM BACCATUM

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One item of Capsicum baccatum var. pendulum (which originated from Bulgaria and our serial number pen-l) was maintained by single plant method for 10 years when was found spontaneous lutescens mutant. It was described as a monogenic recessive lutescens (lut-1) mutant (Csilléry, 1980). The cotyledons and the leaves are completely yellow or whitish yellow and the homozygote lut-l / lut-1 plants are very susceptible to the environmental effects (semi lethal),but it is impossible to maintain in summer by self-pollination in greenhouse. We compared 54 heterozygote pen-1 plants (lut-1 / lut-1^+) with normal pen-1 plants (lut-1^+ / lut-1^+) and found the phenotype was the same. The heterozygous plants segregated 1556 plants (76.53%) normal pen-1 lut-1^+ / lut-1^+ or lut-1^+ / lut-1 and 477 plants (23.46%) yellow pen-1 lut-1 / lut-1.

The normal pen-1 item is very productive in summer (the fruit shape is 2x2 cm, from waxy to red fruit color), but in the winter season it does not flower. The other C. baccatum var. pendulum item from Dr Pochard (pen-4.372.6.2. our serial number pen-9) is not so susceptible to lack of light, therefore is productive in summer and winter (the fruit shape 6x1 cm, from green to red color). We prefer the pen-9 item with the lut-1 marker gene in our interspecific hybrid program. We have the tetraploid pen-9 lines also. Therefore we made some hybrids between pen-9 lut-1^+ / lut-1^+ and pen-1 lut-1 / lut-1. The F_1 plants were very productive, the color of the leaves normal green, but the segregation ratio in F_2 generation was abnormal. Instead of the two phenotypes were found three types of the leaf color. The new phenotype was pale yellow and the name given is: pallid lutescens (plut-1). The summarized results of the segregations ratio of 14 self-pollinated F_1 plants in the F_2 generation were close to the 12:3:1 -1489 plants (76.12%) normal green: 358 plants (18,30%) pale yellow: 109 plants (5,57%) yellow.

We also self-pollinated many F_2 plants and made some BC with $P_1$and F_2 parents and with the F_1 hybrids. At the moment we have the results of some self-pollinated F_2 plants. Among the self-pollinated green F_2 plants were three types: no segregation, therefore only green; segregation green - yellow; and segregation green - pale yellow - yellow. We did not find green - pale yellow segregation type. All of the self-pollinated pale yellow F_2 plants segregated only pale yellow - yellow type. The self-pollinated yellow F_2 plants did not segregate.

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CSILLERY G., 1980, Gene maping of the pepper needs more initiatives Contribution to the gene list. IVth Eucarpia Capsicum Meeting, Wageningen, Holland, 5-9.

JUDICIOUS CHOICEOF OF FEMALE PARENTS TO ENHANCE HYBRID SEEDS YIELDS IN CHILLI PEPPERS

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Exploitation of heterosis in chilli peppers has been hampered by the uneconomical number of seeds obtained per pollination and absence of suitable male sterile lines.

Pointed tip and pungency of fruits in chillies are known to be governed by dominant gene(s). A study was initiated to explore the possibilities of employing two bell pepper lines (around 300 seeds per fruit*)* in crosses with three pungent chilli peppers (around 60 seeds per fruit).

All the six hybrids tested were heterotic for green fruit yield even over the best chilli parent (IHR 471-5) Table 1. The highest yielder was 'IHR 321-4'X 'IHR 324-16' (704 g/plant) with an increase of 100 percent over the best chili parent. Flesh thickness in the F_1's was intermediate and the fruits were of acceptable chilli shape, size and pungency. Since the green fruit and red dry fruit yields are generally correlated, breeding F_1 hybrids chillies using large fruited many seeded bell peppers as female parents and judiciously selected small, thin, pungent chilli lines as male parents offers a distinct possibility.

Table 1 Yield and average fruit weight in parents and hybrids

	Average fruit weight (g)	Green fruit yield per plant (g)	No of seeds per fruit
Bell pepper (♀) :			
Sel-13	68.9	389.0	310
IHR 321-4	69.9	352.6	295
Chillies (♂) :			
IHR 324-16	2.8	311.7	67
IHR 423-16	3.5	205.7	57
IHR 471-5	3.5	351.7	58
F1 hybrids :			
Sel-13 x IHR 324-16	11.2	364.6	-
Sel-13 x IHR 423-16	11.5	657.3	-
Sel-13 x IHR 471-5	10.0	430.3	-
IHR 321-4 x IHR 324-16	10.5	704.0	-
IHR 321-4 x IHR 423-16	12.4	642.7	-
IHR 321-4 x IHR 471-5	12.1	486.0	-
'F' Value	57.36 **	3.95 **	-
C.D. 5%	6.39	270.7	-
C.D. 1%	8.6	364.5	-

MEIOSIS IN PMC OF INTERVARIETAL PEPPER HYBRIDS AND IN LATE GENERATIONS OF THE INTERSPECIFIC HYBRID CAPSICUM PENDULUM Willd. X CAPSICUM ANNUUM L. (VAR. NIGRUM)

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It is known from the literature that the investigations connected with chromosome behavior in meiosis are concentrated generally on different species and on abnormalities caused by non-homology of chromosomes in the early interspecific hybrid generations. Studies of this type are insufficient in F_1 intervarietal hybrids and in late interspecific hybrid generations.

Investigated F_1 hybrids from C.annuum between rediploidized form 144 (with stabile meiosis) and varieties Sivriya and Zlaten medal are characterized with regular meiosis like their parental forms (Table 1). It was noted that this hybrids exhibited increase of chiasma frequency respectively 17,2% and 16,5% in comparison with their parents (Mirkova, Molchova 1983).

The spectrum of meiotic disturbances in the F_1 hybrid 144 x C. annuum var.nigrum and in the fertile plants from interspecific hybrid C.pendulum x C.annuum var.nigrum (F_{17}-F_{18}) is similar to that described by Molchova (1964) in the paternal form and included besides abnormalities like univalents in MI and lagging chromosomes at AI and AII the PMC's with micronuclei at telophase I and II and tetrads (2,5-3%). Meiotic peculiarities specific for the paternal form are expressed in lower degree in hybrids (Table 1). It was due probably to the influence of the female form.

A significant increase in frequency of mentioned meiotic aberrations as well as the appearance of PMC's with non-synchronized division of daughter nuclei, a pycnosis in different meiotic stages, triads, pentads and hexads have been established in the sterile plants from this interspecific hybrid. These plants possessed lower chiasma frequency that initial parental forms. It was noted that the number of the bivalents with one chiasma increased, moreover, in 22% of PMC's several univalents here observed (Mirkova, Molchova 1983). Probably, some plants from the interspecific hybrid progeny do not possess the optimal level of chiasma frequency which leads to meiotic abnormalities and reduced pollen fertility (Table 1). These data confirmed the conclusion reported by Molchova and Michailova (1983) that after selfpolination consolidated fertile hybrid generations could not be obtained.

Table 1 Meiotic aberrations in intervarietal and interspecific hybrids

Material	Mean frequency of aberrations in %					
Stages :	MI	AI	TI	AII	TII	Tetrads
144	2.45	1.87	0.57	1.35	0.50	0.75
Sivriya	2.68	1.98	0.75	1.79	0.73	0.88
Zlaten medal	2.59	1.91	0.69	1.70	0.67	0.82
C. annuum var. nigrum	7.09	6.70	4.30	3.52	3.21	4.28
C. pendulum	1.86	1.02	0.35	1.00	0.23	0.63
144 x Sivriya	2.00	0.90	-	0.80	-	-
133 x Zlaten medal	1.85	0.78	-	0.67	-	-
144 x C. annuum var. nigrum	5.25	3.58	2.05	3.68	2.98	2.70
C. pendulum x C. annuum var. nigrum – fertile	5.24	3.96	2.24	2.28	2.86	2.96
C. pendulum x C. annuum var. nigrum	47.12	39.70	21.09	19.28	18.35	36.45

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REACTION OF DIFFERENT GENOTYPES OP PEPPER TO CUCUMBER MOSAIC AND TOBACCO MOSAIC VIRUSES

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Hot pepper or chilli (Capsicum annuum L.) suffers heavily from virus diseases particularly Tobacco Leaf Curl, Cucumber Mosaic and Tobacco Mosaic Viruses in Punjab. Breeding for resistance is the only effective and economical method to combat these diseases. With this aim a large number of genotypes were screened over a period of five years under natural epiphytotic disease condition at the farms of the Department. The genotypes 'Pant C - 1' 'S -118- 2', 'Lorai', 'Loungi', and 'Perennial' exhibited resistance/tolerance to CMV/TMV under field conditions showing very mild to moderate symptoms in the growing season. These genotypes have also got resistance/tolerance to Tobacco Leaf-Curl Virus (Sharma et al., 1983).

REFERENCE

SHARMA O.P., HUNDAL J. S., SOOCH B. S., THAKUR M. R., 1983 Reaction of different genotypes of hot pepper to leaf curl virus. Capsicum Newsletter, 2, p.132.

CUCUMBER MOSAIC VIRUS RESISTANCE IN CAPSICUM ANNUUM L.

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Ten selections of P.I. 286419 and seven selections of P.I. 288941 were mechanically inoculated and tested using indirect Enzyme-linked immunosorbent assay (ELISA), for the presence of CMV. Of those selections, seven selections of P.I. 286419, and one selection of P.I. 286941 appeared to be systemically resistant. The progeny of these plants were similarly tested for CMV resistance. Sixty-two percent of the P.I. 286419 progeny plants were resistant, with resistance among selections varying from 47% to 86%. It was determined that these plants localized the virus in the inoculated leaves. The P.I. 286941 progeny plants were not resistant. Definite conclusions as to the node of inheritance could not be drawn on the basis of these results.

ESTABLISHING TMV-RESISTANT PEPPER VARIETIES

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Pepper plants, including outdoor varieties, are bred at our Research Station. Our best-known varieties, 'Almapaprika' (product code: 5.12.1.17) and 'Paradicsomalakú zöld szentesi' (product code: 5.12.2.05), are much in demand in the food-processing industry. Every effort is being made to improve the quality and virus resistance of our varieties.

As crossing partner we have chosen 'Florida VR-2' containing the TMV L_1 gene. Selections were carried out in the F_2 and F_3 generations with the aim of virus resistance, and stable homozygous resistant lines were established. In the further generations these lines were stabilized through selection of the required type. Virus resistance tests and selections were performed via the well-known leaf-test method.

During recent years, 'Almapaprika' and 'Paradicsomalakú zöld szentesi' lines that are better in both yield and quality features than the control plants have been established. These meet the demands of the processing industry. The selected and propagated lines are intended for approval.

After establishment of the system, our program will certainly include other varieties and we aim to produce new varieties through stabilization of the new combinations derived from crossings.

SEED TREATMENTS TO ELIMINATE SEED-BORNE TOBACCO MOSAIC VIRUS IN PEPPER SEEDS

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In the epidemiology of tobacco mosaic virus (TMV), the seed transmission of virus on peppers is of great importance because the small amount of seed-borne virus would be main infection source to cause serious losses in the production areas. Furthermore, the plants grown from diseased seeds can give rise to infection in healthy pepper plants during the cultural practices necessary to production of the crop. So, it is necessity to prevent the spread TMV through pepper seeds.

For this purpose, seeds were collected from the field grown pepper plants with TMV and various treatments were applied to these seeds for the elimination of TMV.

The results from the present study showed that treating seeds with trisodium phosphate (12,5%, 20 min.) heating (78^0C dry heat for 2 days), chloramin T (0,3%, 10 min.), hydrochloric acid (5%, 5 hours) and sodium hypochlorite (2%, 20 min.) greatly reduced TMV infection in pepper seeds. Moreover, it was found that these types of treatments did not negatively influence the germination rate of seeds, even when the seeds were stored for 12weeks following treatments.

SOURCES OF RESISTANCE TO DIFFERENT GROUPS OF THE BACTERIAL SPOT PATHOGEN, XANTHOMONAS CAMPESTRIS PV. VESICATORIA

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Following a survey based on 46 isolates of the bacterium which came from different Brazilian states we detected 33 isolates which belonged to group 2, 10 to group 3 and 3 to group 5 [(2)]. The methodology employed for the identification of groups was that described by Cook & Stall [(1)]. The results obtained were further checked by infiltration with 10^3 CFU/ml, which allowed the quantification of the response.

Both inoculation techniques were used to evaluate possible sources of resistance within the Capsicum collection available at our institution. Table 1 lists sources of resistance to the different groups of Xanthomonas campestris pv. vesicatoria evaluated through hypersensitive response. Table 2 lists sources of resistance detected through 10^3 CFU/ml. infiltration.

CNPH 148 is of especial interest since it is highly resistant to Phytophthora capsici and presents reasonable levels of resistance to groups 3 and 5 of the bacterium. Request of germaplasm may be directed to the second author.

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2. REIFSCHNEIDER, F.J.B., BONGIOLO NETO, A. & TAYATSU, A., 1985, Reappraisal of Xanthomonas campestris pv. vesicatoria strains their terminology and distribution. Fitopatologia Brasileira 10: 201-204 (in english).

TABLE 1. Sources of resistance to bacterial spot based on hypersensitive response

CNPH Introduction No	Groups		
	2	3	5
42	S	S	R
60	S	R	R
70	S	S	R
275	S	S	R
277	S	S	R
280	S	S	R
281	S	S	R
638	S	S	R

TABLE 2. Sources of resistance to bacterial spot based on infiltration of 10^3 CFU / ml

CNPH Introduction No	Groups		
	2	3	5
60	S	R	R
70	R	R	R
145	S	S	R
148	S	R	R
569	S	R	R
575	S	R	R
594	S	R	R
599	S	R	R
636	S	R	R
637	S	R	R
639	S	R	R

EVALUATION OF SOME PEPPER INTRODUCTIONS FOR RESISTANCE AGAINST BACTERIAL SPOT

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Resistance to bacterial spot (Xanthomonas campestris pv. vesicatoria (Xcv)) in pepper is evaluated by various methods. Some authors measure the lesion size in leaves (1), (2). Others have described the symptoms in detail, producing a scale of resistance (4). SOWELL and LANGFORD (5) applied the defoliation index, evaluating the percentage of leaf area abscissed, using a scale from 0 to 5.

We have elaborated an evaluation method using artificially infected systems on the basis of the above procedures. Two kinds of evaluation indices were used at the same time. These were calculated at the level of population of breeding lines.

1. Defoliation index D_i.= d/p x 100, where D_i = percentage of leaves abscissed, d = number of leaves defoliated, p = number of leaves produced.

2. Infection index $I_i = \frac{20 \sum (a \times b)}{c}$, where I_i = percentage of infection of whole leaf area, a = number of infected leaves on basis of infection scale, b = infection scale value, c = number of leaves evaluated, 20 = constant. Infection scale value = from 0 to 5, where 0 = no spot, 1 = spot, from trace to 10%, 2 = 10-20%, 3 = 20-40%, 4 = 40-75%, 5 = 75-100%.

In 1985 we tested introductions already described as resistance sources to bacterial spot in Capsicum (5), (3). Plants were inoculated using a race 1 isolate of Xcv: NPA2 18 (M. Hevesi, Plant Prot. Inst., Hung. Acad. Sci.). Six-week-old seedlings were sprayed with the inoculum containing 5 x 10^8 cells/ml, and then placed in a moist chamber (25 ^{0}C) one day before infection, where they remained for 2 days during incubation. Evaluations were carried out weekly.

Suinina D_i and I_i refer to the susceptibility of the pepper introductions, and D_i. and I_i to the expression of the susceptibility.

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COMPARISON BE7LWEEN TWO METHODS OF INOCULATION OF PHYTOPHTORA CAPSICI ON PEPPER ADULT PLANTS

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A highly heterogeneous response is usually obtained within pepper lines with a certain level of resistance to P. capsici when detopped stems of adult plants are inoculated by the Pochard and Chambonnet (1972) method, with mycelial discs of P. capsici. This method does not give the possibility to control the inoculum concentration, which may be one of the causes of such heterogeneity. To check that hypothesis, the mycelial disc was substituted by a microdroplet containing either 22,400 or 6,000 zoospores and the results were compared with those obtained by the first method described. Four varieties with different resistant levels to P. capsici were used and data were recorded on different dates after inoculation (Table 1).

The new method, although less expensive arid less time-consuming than the first one, did not improve the response of the varieties, measured by the coefficients of variation (Table 1). Moreover, during the first periods after inoculation, breeding line 'Linea n^{o}10' showed a higher level of resistance by the microdroplet method than by the mycelial disc method. Therefore, the highly heterogeneous response obtained with certain pepper breeding lines must be explained in terms of the genetic variability of either the host or the parasite.

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Table 1. Coefficients of variation of P. capsici mycel growth rate after inoculation by two different methods. Four varieties, seven to nine plant variety, were used. Data were recorded on different dates after inoculation.

VARIETY	METHOD OF INOCULATION		PERIOD AFTER INOCULATION			
			0-7	7-14	14-21	21-35
LUESIA (INIA 225) [1]	Microdroplet	6000 zoosp/pl	8.3	9.7	-	-
		2240 zoosp/pl	18.3	9.1	-	-
	Mycelial Disc.		7.8	8.3	-	-
PHYO 636	Microdroplet	6000 zoosp/pl	23.5	59.6	66.7	81.8
		2240 zoosp/pl	36.7	60.4	104.2	163.2
	Mycelial Disc.		17.7	61.6	70.7	211.4
LINEA NO 10	Microdroplet	6000 zoosp/pl	187.5	180.8	242.9	233.3
		2240 zoosp/pl	62.4	88.2	92.3	116.7
	Mycelial Disc.		15.4	55.6	43.2	80.9
PI 201232	Microdroplet	6000 zoosp/pl	0.0 [2]	182.2	0.0 [2]	0.0 [2]
		2240 zoosp/pl	200.0	163.6	300.0	0.0 [2]
	Mycelial Disc.		35.0	200.0	0.0 [2]	0.0 [2]

[1] All the plants were dead 14 days after inoculation

[2] There is no growth of parasite in any plant. The very high coefficients of variation in other cases are due to the fact that in those cases most of the plants did not show any growth parasite, while some small growth took place on some of the remaining plants.

STUDIES ON THE SENSITIVIY OF PHYTOPHTORA CAPSICI ISOLATES TO METALXYL

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For estimating the sensitivity levels of P. capsici, 47 isolates were tested on metalaxyl-amended PDA. Results of these assays for distribution of the isolates in confirmity with their ED_{50} values were presented in Table 1.
capsici
Table 1. Effect of metalaxyl on the growth of P. capsici isolates.

Number of isolated tested	Number of the isolates with ED_{50} values (µg/ml)						
	0.05	0.05-0.5	0.5-5.0	5.0-10.0	10.0-20.0	20.0-50.0	50.0
47	0	1	19	9	9	5	4

Date on Table 1 showed that ED_{50} values of the isolates under test distributed in great variation.

In vitro conditions, after 5 transfers of a P. capsici isolate which was sensitive to 0,5 µg /ml metalaxyl, the isolate in question was adapted to a dose of 25 µg /ml. Furthermore, there was no significant difference between the virulences of the adapted isolate and the sensitive one.

SELECTION SYSTEM FOR BREEDING PEPPER VARIETIES RESISTANT AGAINST PHYTOPHTHORA CAPSICI

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One of the main points of an effective selection method is to use the most aggressive isolates during the experiments. As P. capsici has not been isolated yet in Hungary, 9 isolates from abroad were used in our experiments. The isolates originated from France, Spain and Italy (their original codes are as follows: E. Fochard S 101, S 107, S 197; S.P. Espanol Blasco, Ejea, G. Christinzio 90 7/1/84, 93 7/1/84, Ph 230).

Infections were carried out with zoospores in a climatic chamber (temperature 25º C, humidity 75%, illumination 1100 lux in 16 hours, 1000 zoospores/plant/ml, evaluation after 21 days), using susceptible and resistant pepper varieties. The isolate S 197 proved to be the most pathogenic one in the A_1 mating type. With this isolate 17 potentially resistant sources were infected. The results are as follows: in parenthesis: the percentage of the resistant individuals: 'P 51' and HP 2258' (100%), 'L 29' and 'PL 201232 (96.7%), 'Criollo de Morelos 334' (90%),'PM 217'= PI 20l234' (56.6%),'Yolo Wonder Y' (33.3%),'PI 123469'(26.6%) 'PH 28'(20%), 'PI 188476'and Podarok moldavii' (10%), 'SZ-20' (6.6%). All the Hungarian varieties tested proved to be susceptible.

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EFFECT OF CAPSICUM ANNUUM ROOTS ON ZOOSPORANGIAL FORMATION IN PHYTOPHTHORA CAPSICI.

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Interaction between plant hosts and their soilborn pathogens starts before the contact between the two partners, and involve root exudation and rhizospheric microflora (MITCHELL, 1976). Breeding programs for resistance to soilborn pathogens seldom take early rhizospheric interactions into consideration; indeed plants are inoculated by direct application of pathogen propagules on the host tissues. In order to breed Capsicum annuum for resistance to Phytophthora capsici, POCHARD set up a method (unpublished) involving incubation of P. capsici mycelium in the proximity (but not in contact) of Capsicum roots in a liquid medium. Formation of zoosporangia and release of zoospores are required for rapid dissemination and infection of the host, in this method as in natural conditions (HICKMANN, 1970, HWANC and KO, 1978). In order to establish the time course of infection in this test and to detect early interaction between host and parasite we observed the sporangium formation and zoospore release by P. capsici during interaction with different C. annuum lines.

Three resistant lines of C. annuum (Phyo 636, PM 217, CM 334) and a susceptible one (Yolo Wonder) where sown in a sand-peat mixture. Two weeks old seedlings were transferred into liquid medium in non sterile conditions, and inoculated one week after the transfer by introducing mycelial plugs of a monozoospore isolate (S15-12-A) in the medium. Total and mature zoosporangia (which have released their zoospores) were numbered at different times after inoculation.

In liquid medium, rapid zoosporagium formation occurred after 12 hours. Sporangium maturation (or zoospore release) occurs between 24 and 36 hours (fig. 1), and primary infection, very intense at this time, seems to be achieved 44 hours after inoculation. The time course of zoospore production is approximately the same whatever the host genotype is, and it appears well synchronized. However, the quantity of zoospores produced depends of the presence on a host and on the host genotype. The susceptible line Yolo Wonder stimulates zoosporogenesis compared to the control without plantlets, whereas resistant lines restrain both sporangial formation and maturation. Such an effect can be due to qualitative or quantitative differences in materials present in root exudates, acting directly or after microorganism transformation. The inhibitory response is probably the net result of both stimulatory and inhibitory material as is many other host pathogen interactions (MITCHELL, 1976; WEINHOLD and coll., 1980). The chemical requirements for zoosporangial differentiation in P. capsici (YOSHIIKAWA, 1977; ZENTMYER, 1970) give many handles to host control.

Moreover, if we assume the number of zoospores per sporangium to be constant (approximately 10/sporangium) and these zoospores to be motile during 2 hours before encystment we can estimate the inoculum pressure between each sampling time (fig. 2). Inoculum pressure appears to be much greater for Yolo Wonder (525 zoospores/plant) than for resistant lines (75 to 165 zoospores/plant). Considering the importance of inoculum density on disease incidence in the interaction C. annuum-P. capsici (see PLAAOIX et al., this issue) it seems probable that partial control of sporogenesis by root extruded chemicals plays a role in resistance of C. annuum to P. capsici, at least in the conditions of this test.

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RELATIONSHIP INOCULUM DENSITY - DISEASE INCIDENCE IN THE INTERACTION CAPSICUM ANNUUM - PHYTOPHTHORA CAPSICI

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Genetic resistance of Capsicum annuum to Phytophthora capsici in known as partial and influenced by environmental factors. Particularly, high doses of inoculum can produce the breakdown of induced resistance in the fields as in artificial infections (POCHARD 1983 ; BARKSDALE, 1984 ; ORTEGA, 1984). lnoculum density - Disease incidence relationship has been studied in many host - pathogen interactions -(MITCHELL, 1978) and is an important step in attempting to elucidate quantitatively the overall interactions between host, pathogen and environment. Therefore we tried to establish this relation for different Capsicum genotypes susceptible and resistant to P. capsici.

Three resistant lines (PM 217, Phyo 636, CM 334) and a susceptible one (Yolo Wonder) were sown in a sand-peat mixture. Two weeks old seedlings were transferred into liquid medium and were inoculated one week later by soaking roots in controlled zoospore suspensions of the monozoospore isolate S15-12-A. Six days later, percentage of dead plants is recorded for each genotype at different inoculum levels (ranging from 60 to 2 x 10^5 zoospores/plant).

In the susceptible line Yolo Wonder, mortality is proportional to inoculum level, whereas in resistant lines the ratio Mortality/Inoculum dose decreases when inoculum increases (fig. 1). This indicates propagules competition for susceptible sites on resistant roots, but not on susceptible roots. Figure 1 also indicates the occurrence of a threshold to induce mortality at least 20 zoospores/plant are required to initiate mortality in Yolo Wonder and Phyo 636, whereas 1000 zoospores/plant and 4000 zoospores/plant are necessary for PM 217 and CM 334 respectively. This threshold is the minimum propagule number required to overcome genetic resistance and to kill the host, but root lesions are conspicuous at every inoculum doses, indicating that infection occurs even at very low doses, whatever the host genotypes is. Regression lines after Log-Probit transformation allow estimation of Lethal Dose 50 % (LD 50*)* (GILLIGAN, 1983). LD 50 differs greatly between resistant varieties. The low threshold inducing mortality and the low LD 50 for Phyo 636 confirms the loss of resistant components in this line, obtained by backcrossing PM 217 to Yolo Wonder (POCHARD, 1983). Regression lines are significant at 0.01 level and slopes of resistant varieties differ significantly (0.01 to 0.05 level) with the slope of the susceptible one. Different slopes are reliable to differences in host defense mechanisms (DIMOND, 1965; BAKER, 1971). The common genetic origin of resistance in Phyo 636 and PM 217 (Slopes 0.44 and 0.43 respectively) could explain their similar behavior, whereas CM 334, unrelated to PM 217 gives a different slope (0.58).

Analysis of the relationship Inoculum dose - Disease incidence proved very useful in evaluating resistant genotypes and discriminating different levels of partial resistance. According to our previous work, no genotype is immune and lines may show themselves resistant or susceptible, depending on the conditions of the test. lnoculum level in the soil is a determinant factor for disease development and severity, and complete resistance evaluation must include early rhizospheric interaction between host and pathogen. Indeed host genotype seems to influence zoospore production and resistant lines might be able to partially control inoculum pressure before infection, as suggested in the following communication (PALLOIX et al., this issue).

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THE RESPONSE OF PEPPER CULTIVARS TO INFECTIOT BY THE IMPORTANT CAUSAL AGENTS

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In earlier studies, Phytophthora root rot, Verticillium wilt and tobacco mosaic virus (TMV-pepper strain) were found to be the main disease agents in most pepper growing areas of Turkey. As known, there is no affectivie control measure for infection by these diseases. The best way of control would be the use of resistant or sufficiently tolerant cultivars. So, in the present study 90 pepper cultivars were tested for resistance.

In this study, the 7 to 10 days old pure cultures of fungi above and a purified preparat of TMV were used for inoculating pepper plants. Inoculation was done at the flowering stage. The works were carried out in three replications, each of which included five plants. The evaluation of data from studies was performed according to the rate of infected plants.

In conclusion, it was found that the plants belonging to Capsicum chacoense species were almost not affected at all by these causal agents whereas all of other cultivars were infected by the same agents, though different in severity. In the same work, moreover, it was experimentally determined that TMV could be transmitted via seeds in most of pepper cultivars under test.

SCREENING AND BREEDING FOR VERTICILLIUM WILT RESISTANCE IN CAPSICUM

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24 Hungarian and foreign Verticillium isolates were used in testing and selection experiments (infection in the 2-cotyledonous stage, roots dipped in a suspension of 10^6 colony forming units/ ml, soil temperature 24^0 C, evaluation after 28 days).

The main results of the experiments were as follows: (i) V.dahliae and V. alboatrum showed pathogencity to Capsicum species. Isolates of pepper, artichoke, eggplant and tomato were pathogenic to pepper plants. (ii) The various isolates belonged in the same aggressivity range. (iii) After infection with the most aggressive strain (SZMC 0150), the following resistance rates were recorded: 'Podarok moldavii' 18.6%, 'Lastocbka' 8%, 'Kalocsai V-1' 6.5%, Kalocsai determinált 601' and 'Kalocsai merevszáru 622' 6%, 'Szentesi almapaprika' 3%. Other Hungarian varieties examined proved to be susceptible. (iv) When a higher infection pressure (10^8colony forming units/ml) was applied, all the resistance sources behaved as susceptible ones. (v) 'Podarok moldavii' was selected three times without any change in its resistance level, which suggests the polygenic nature of the resistance.

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INHERITANCE OF RESISTANCE TO CERCOSPORA LEAF SPOT DISEASE IN CHILLIES

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Cercospora leaf spot (caused by Cercospora capsici Heald and Wolf) is a serious disease in chillies. Besides substantial reduction in yield the disease causes reduction in both size and quality of the fruit. The present investigation was undertaken at the Indian Institute of Horticultural Research, Bangalore to study the mode of resistance to Cercospora leaf spot disease.

Two resistant parents viz.,'328 and '344-9' and two susceptible parents viz. '292- 2' and '388' were used in this experiment. The six generations namely P_1, P_2, F_1, F_2, B_1 and B_2 of five crosses were planted in Kharif, 1981. The plants were spray inoculated twice i.e. 75 and 90 days after transplanting and visually scored for disease severity. Based on the number of spots per leaf a grading scale of 0 - 2 was used. The data were analyzed both qualitatively (Chi square test) and quantitatively (generation mean).

Resistance to Cercospora leaf soot was found to be inherited as a recessive character. The data showed a good fit with the genetic ratio 27 susceptible: 37 resistant plants indicating that the inheritance of resistance to this disease was governed by a group of three complimentary genes. This was confirmed by the backcross ratio, which gave a good fit to 1 susceptible: 7 resistant plants. The quantitative analysis indicated that both the types of gene actions namely additive (d) and dominance (h) were important. It is desirable to resort to repeated backcrossing using the resistant parents as donors of resistance, as it is governed by three complementary genes.

STUDY OF PHENOLIC CONSTITUENTS OF RESISTANT AND SUSCEPTIBLE LINES OF CHILLIES (CAPSICUM ANNUUM) IN RELATION TO CERCOSPOPA LEAF SPOT DESEASE.

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Chilli (Capsicum annuum) is one of the most important crops grown for its fruits, the spice of commerce. Cercospora leaf spot (Cercospora capsici Heald and Wolf) disease causes severe spotting of leaves and petioles resulting in defoliation of the plants. Studies were conducted at IIHR, Bangalore to reveal quantitative difference, if any, in the total phenols of resistant and susceptible lines of chillies to cercospora leaf spot.

Two resistant lines viz., '328', '344-9' and two susceptible lines '292-2' and '388' were used. Seeds were sown in June 1981 and seedlings were transplanted after forty-five days. Thirty days after transplanting the leaves were clipped off from the four lines. Total phenols were determined by the method of A.O.A.C. (1965). The phenol equivalent was expressed in terms of tannic acid. The total phenol content in the resistant lines '328' and '344-9' was '385' and '460 mg/100g of fresh weight respectively. However, the phenol contents in the resistant ('328') and susceptible ('388') lines were sane i.e. 385 mg/100 g fresh weight. Thus the phenolic contents of different lines were variable and there was no correlation with resistance to cercospora leaf spot disease.

RESISTANCE TO FRUIT ROT DISEASES UNDER FIELD CONDITIONS IN PEPPER CAPSICUM ANNUUM L.)

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The prevalent fruit rot diseases of pepper (Capsicum annuum L.) under Punjab (India) conditions were found to be caused by Colletotrichum spp. Phytophthora spp. Alternaria spp. and Fusarium spp. Two of the diseases, caused by C. capsici and Ph. capsici were very serious and infectious causing the loss up to 60 per cent (Bansal and Grover, 1969).

A total number of 30 varieties were screened for fruit rot diseases under natural field conditions. The results suggested a strong differential host-parasite response. The varieties resistant to one pathogen were found susceptible to the other. However, some of the varieties like 'Lorai Perennial','S-27' 'S-41-1' and '77-16-1-2-1'were identified possessing resistance to most of the fruit rot pathogens under natural field conditions. So these varieties present a valuable material for the breeding program, whereas the varieties, 'Puss Jwala', 'Jalandhri', 'H6' and 'My 12-6-1-6'were susceptible to all the fruit rot pathogens.

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C.CHINENSE SOURCE OF RESISTANCE TO LEVEILLULA SOLANACEARUM F. SP. CAPSICI GOL. AND TOBACCO MOSAIC VIRUS

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C. Chinense is carrier of resistance to TEV, TMV, Verticillium etc. (Kapeller 1971, Boukema 1978, Saccardo 1978) and has a good cross-fertility with C. annuum. In the research prior to the present announcement it was ascertained that C. Chinense -TEV Resistant 'AC 2176' obtained from USA is almost immune to the strains of Leveillula solanacearum Gol. which are widely spread in Bulgaria (Kounovsky, Todorova 1983).

In order to obtain lines of peppers suitable for productions, hybrization was carried out between the variety 'Albena' and C. Chinense -TEV Resistant. The selection in F_2 and F_3 was made in respect to resistance to pepper powdery mildew and only those plants with 0_+ of resistance were selected. The analysis of the hybrid lines according this indicator specified that the resistance to Leveillula solanacearum Gol. is being defined by a dominant gene (Todorova, Kounov sky 1985), therefore in F_3 for analysis were used only heterozygotic and homozygotic plants resistant to pepper powdery mildew (figure 1).

In F_4 both the heterozygotic an homozygotic plants were infected with tomato strains of TMV-C-65 (lvanova, Souhov 1982). The results obtained from this infection revealed that the homozygotic lines save generation also with homozygotic resistance to TMV, and in the offsprings of the heterozygotics were observed both resistant and sensitive plants. This permits to construct a hypothetic presumption of an eventual interconnection or spatial nearness in location of both genes of resistance.

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C. annuum and C. Chinense for their reaction to Leveillula solanacearum Gol. (under print).

RESISTANCE IN SWEET PEPPER TO GLASSHOUSE WHITEFLY

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In our previous paper (Láska, Betlach, Havránková, 1982) we tested fourteen cultivars, one F_1 -hybrid and one half-wild type (CIND) of sweet pepper for resistance to glasshouse whitefly. During the test sweet pepper plants were infested both with whiteflies and their parasitoid -Encarsia formosa - which cause the blackening of whitefly puparia. The blackened puparia only were counted, being easily visible, enabling an easier, and more rapid evaluation of the number of black puparia present. 'California Wonder' appeared to be the most resistant, and 'Granát' was the most susceptible. In 'CIND' an initial high number of adults settled was observed but according to a number of puparia the 'CIND' was rather resistant.

The aim of our recent work was to find out to what extent the length of development, mortality during the development and selection of plant and oviposition of adults take share in total resistance. Two extreme cultivars and the type 'CIND' were selected for these experiments. Glasshouse whitefly development under controlled conditions (20^0 C, 16-hour-photoperiod) took 29.1 days on 'Granát', 30,1 days on 'CIND', and 32.3 days on 'California Wonder'. 18.9 % of individuals on 'CIND', 29.9% of those on 'California Wonder', and 64.8% on 'Granát' have finished their development. Adult whiteflies, being without a choice, laid significantly more eggs on 'Granát' and 'CIND' compared to 'California Wonder'. With a possibility of choice the adults settled rather on 'Granát' and 'CIND' than on 'California Wonder'. The combination of 'CIND' characters (the highest mortality during the development of whitefly) and those of 'California Wonder' (the lowest acceptance and oviposition of whitefly) provides with a potentiality of further increasing a plant resistance.

LÁSKA P., BETLACH J., HAVRÁNKOVÁ M., 1982 Resistance to the glasshouse whitefly (Trialeurodes vaporariorum Westw.) in sweet pepper (Capsicum annuum L.). Euphitica, 31 : 977-980.

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EFFECT OF BELL PEFFER PLANT AGE (CAPSICUN ANNUUM L.) ON TOBACCO ETCH VIRUS TRANSMISSION BY MYZUS PERSICAE (SULZ).

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Tobacco etch virus (TEV) causes severe losses to bell pepper crops in Cuba (Fernández, 1979) and is transmitted efficiently by Myzus persicae (Sulz.) under our conditions. Among the factors influencing the virus transmission by aphids, infection source and healthy plants age play an important role, and must be taken into account in planning better programs of control against the virus.

Adult apterous aphids were fasted during 1 hour and then set on TEV infected pepper plants (cv. 'California Wonder') of different age for an acquisition period of 3-5 minutes. Transmission rate and the effect of receptor plant age were studied transferring the aphids (five per plant) to healthy plants of different ages for inoculation. They were killed by pesticide application 24 hours later and the plants wee maintained at the glasshouse until evaluation.

Greatest rate of transmission occurred to healthy plants 20 days after transplantation, decreasing quickly; plants tested two months after transplantation were not infected (Fig. 1). The best age for infection source plants was between 30-50 days (Fig. 2) and always with plant infected 20 days before.

FERNANDEZ, T., 1979, Incidencia del virus del grabado del tabaco (TEV) en diferente regions productoras de pimiento y tomate en Cuba. Agrotecnica de Cuba 11(1): 109-114.

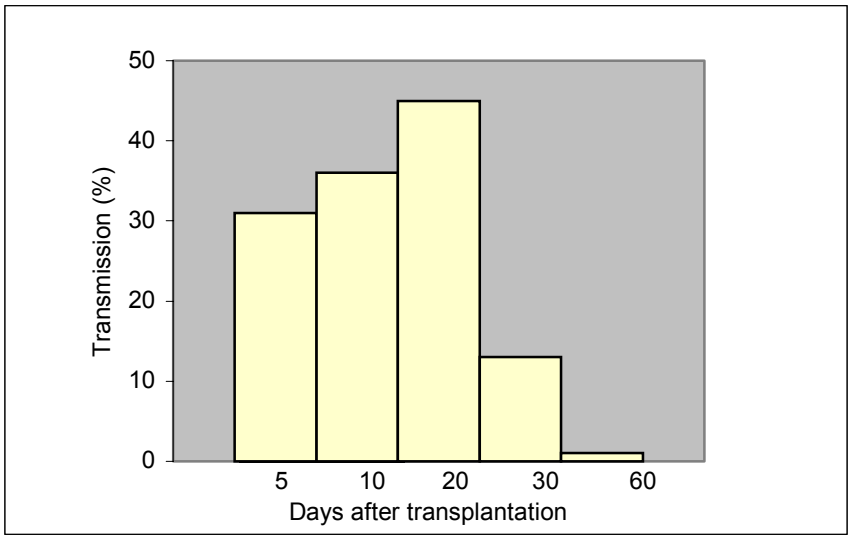

Fig. 1 Relationship between test plant age and aphid transmission of TEV

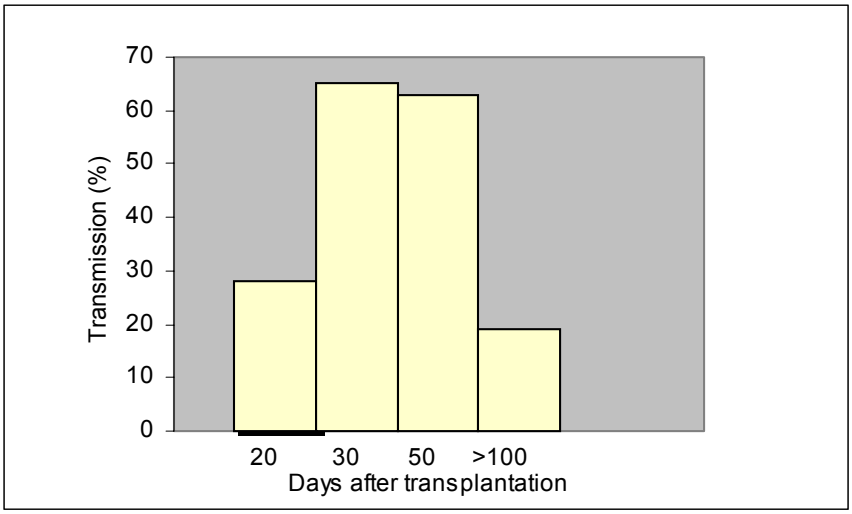

Fig. 2 Relationship between TEV source plant age and aphid transmission

CHILLI PEPPER GENOTYPES RESISTANT TO THRIPS, SCITROTHRIPS DORSALIS HOOD

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Chilli thrips, Scitrothrips dorsalis Hood is a major pest of chilli pepper (Capsicum annuum Linn.) in India often resulting in 25 to 50% yield loss (Ayyar et al, 1935; Ananthakrishnan, 1973). Both nymphs and adults lacerate the tender plant tissue and suck the oozing juice causing leaf curl and stunted plant growth. During early 1985 chilli pepper genotypes were evaluated for resistance against S. dorsalis Hood to identify lines, which could be used in breeding program.

Materials and Methods

Nursery sowing for 157 lines was done in March 1985 when the thrips population is known to be at its peak. After 30 and 45 days of sowing, 5 plants from each line were uprooted and thrips population was extracted in laboratory using 60% alcohol. The population was filtered on Whatman filter paper No.1 and number counted under microscope. Two replications for each line were maintained.

Results

Out of 157 lines tested, five viz, 309-1-15, 300-1-5-1, S-118, 632 and 565 showed high degree of resistance with a thrips population of less than 10 thrips per 5 plants against 85 to 142 thrips per 5 plants in susceptible lines. Table 1. Nineteen lines snowed moderate resistance with a population ranging from 11 to 25 thrips per 5 plants. The resistant lines will be further tested under field conditions during summer season, 1986.

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Table 1. Thrips population on resistant and susceptible chilli lines.

Genotype	No. thrips / 5 plants after 30 days	45 days	Reaction
309—1—15	0.0	3.50	R
300—1-5-1	1.0	8.0	R
S—118	1.0	8.5	R
632	4.0	9.0	R
565	*	9.5	R
864	17.00	142.5	S
616	12.00	89.00	S
897	43.00	87.00	S

- could not be tested.
- R = Resistant S = Susceptible

CHILLI PEPPER GENOTYPES RESISTANT TO TRIPS, SCITROTHRIPS DORSALIS HOOD

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Referances

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897	43.00	87.00	

* could not be tested. R = Resistant S = Susceptible

NEW SOURCES OF P0T'IDERY MILDEW RESISTANCE IN CAPSICUN SPECIES

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To, augment the available sources of resistance (Ullasa et al., 1981; Deshpande et a1., 1984) 207 germplasm lines were screened against powdery mildew (Leveillula taurica (Lev.) Am.) during 1984 and 1985. The data on powdery mildew (PM) infestation were recorded as: resistant (R) -no disease; moderately resistant (MR) -traces (mild growth with no defoliation).

The results are presented in Table-1. It is interesting to note that of the 170 Capsicum annuum lines (76 -bell pepper types and 93 chilli pepper types) both the lines resistant to PM were from El Salvador. Besides these$_1$ ten other lines exhibited moderate resistance. None of the bell pepper types were resistant or even moderately resistant. This may be due to lack of any selection pressure on these populations, because of absence of PM in these areas. Earlier studies have also shown lack of resistant sources in C.annuum for PM. However, C.baccatum and C.fruitescens among the cultivated species seen to have built-in resistance (Table-1). perhaps these two, species and the pathogen share the same Center of origin allowing natural selection to fix resistant genes in the host genotypes.

Crosses have been made between C.baccatum and C.fruitescens and also with C.annuum to study the genetics of resistance in different species and to transfer resistance into C.annuum.

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Table 1. Resistant sources of powdery mildew (Levillula taurica) in different species of Capsicum

See source (country)	No. of lines screened	No. of resistant liens (R)	No. of moderately resistant line (MR)	Seed source (country)	No. of lines screened	No. of resistant lines (R)	No. of moderately resistant lines (MR)
Capsicum annuum				Capsicum baccatum			
Argentina	1	-	-	Bulgaria	3	3	-
Australia	8	-	-	Columbia	5	5	1
Bolivia	1	-	-	Peru	2	1	1
Brazil	2	-	-	U.S.A.	1	1	-
Bulgaria	8	-	-	Capsicum frutescens			
Columbia	5	-	-	Brazil	1	-	-
Costa Rica	2	-	1	Columbia	2	2	-
El Salvador	2	2	-	Costa Rica	3	2	-
Guatemala	1	-	-	El Salvador	1	1	-
Hungary	39	-	-	India	2	2	-
India	49	-	7	Nigeria	1	1	-
Iran	2	-	-	Capsicum chacoense			
Italy	5	-	-	Argentina	1	1	-
Japan	1	-	-	Bolivia	2	2	-
Korea	2	-	2	Capsicum praetermissum			
Malaya	2	-	-	Brazil	2	2	-
Mexico	6	-	-	Mexico	1	-	-
Spain	1	-	-	U.S.A.	2	-	-
Turkey	1	-	-	Capsicum eximium			
U.S.A.	13	-	-	Mexico	1	1	-
U.S.S.R.	5	-	-	Capsicum ‘Tovari’			-
Yugoslavia	14	-	-	Mexico	1	1	-
				Unidentified species			
				Inida	5	5	-
				Columbia	1	1	-
				Total	207	33	12

GERMPLASM RESOURCES OF SOLANUM MELONGENA FROM SPAIN

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Our group started, in 1984, a project for collecting vegetable crop species germplasm in Spain, which was partially supported by I.B.P.G.R./F.A.O. Eggplant was enclosed in this project as it.is one of the traditional vegetable crops in Spain of significant economic importance.

We have so far collected a total of 35 Solanum melongena specie accessions, shown in Table 1. Samples of all of them have been sent to Institute for Horticultural Plant Breeding of Wageningen, The Netherlands.

Table 1. Accessions collected. Identification

Label	Locality	Local Name	Observations
V-S-1	Alcira	Redonda jaspeada	Mareled
V-S-2	Gandía	Bola	Marbeled.Grown in plastic-housse.For frying.
V-S-3	Gandía	Larga roja	Grown in plastic-house. For roasting.
V-S-4	Gandía	La negra	Long, dark purple fruit. Grown in plastic house. For frying.
V-S-5	Jaraco	De Gandia	For frying.
V-S-6	Jaraco	Negra de Gandia	Long fruit. To export.
V-S-7	Jaraco	Redonda jaspeada	Marbeled.
V-S-8	La Punta	Jaspeada	Marbeled.
V-S-9	La Aparecida	Verde	For pickling.
V-S-10	La Aparceida	Negra	Early crop.
C-S-1	Tortosa	Blanca	
C-S-2	Bitem	Berenjena	
C-S-3	Torosa	Larga negra	
C-S-4	Bitem	Redonda	Big size.
C-S-5	Bitem	Negra	
C-S-6	Garcia	Berenjena	Short cycle.
AN-S-1	Cordoba	Berenjena	Very big. Dark purple and white fruit. For pickling.
AN-S-2	Velez-malaga	Berenjena	Long, black fruit.
AN-S-3	Castro del Rio	Da rabo largo	Long peduncle. For pickling and stewing.
AN-S-4	Castro del Rio	-	For frying/
AN-S-5	Castro del Rio	De rabo largo	Long peduncle. For pickling and stewing.

Table 1. Continuation Identification

Label	Locality	Local name	Observation
AN-S-6	Ugijar	Berenjena	Late crop. Grown at 900 m of altitude.
AN-S-7	Laroles	Berenjena	Grown at 1010 m of altitude.
AN-S-8	Benojan	Morada	Dark purple fruit. For frying an stewing.
AN-S-9	Competa	Gorda	Big size.
AN-S-10	Cometa	Gorda	Big size.
AN-S-11	Algeciras	De brillo	For boiling.
AN-S-12	La linea de la Concepcion	De pincho	For frying and stewing.
AN-S-13	Benaocaz	Berenjena	Grown at 800 m of altitude.
AN-S-14	Benaocaz	Berenjena	Grown at 800 m of altitude.
AN-S-15	Grazalema	Berenjena	Grown at 825 m of altitude.
AN-S-16	Grazelema	Negra	Color change.
AN-S-17	Tarifa	-	Big size. Green fruit.
AN-S-18	Rota	De bombilla	For boiling.
CM-S-1	Ratamose de la Jara	Berenjena	Think and curved fruit.

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INFLUENCE OF THERMIC REGIME AND CULTIVAR FACTOR ON THE PRODUCTION OF PEPPER AND EGG-PLANT IN GREENHOUSE

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The influence of thermic regime and cultivar response of 24 cv of pepper and 16 cv of egg-plant cultivated in warm (thermostat at 13°C) and cold (thermostat at 6°C) greenhouses was examined. The parameters recorded were: number of days from transplant to beginning of flowering, setting and harvesting; early and total production (number of fruits per plant, mean weight of fruits and production per plant); profits from the single cultures and heating cost in the two greenhouses.

The pepper cultivar giving the highest early production at low temperature were ‘Dolce Saladino’ and ‘Blue Star’, with nonsignificant differences when compared to the warm greenhouses crops.

Significant positive correlations were found between mean fruit weight and early and total production in the peppers.

The egg-plant cultivar showing the highest early production in the cold greenhouse were ‘Samba I’, ‘Bonica Ovale’ and ‘Milionaire . There proved to be significant positive correlations between total production and average fruit weight.

The influence of the thermic regime was less evident in the eggplant than in the pepper, in relation to the lower thermic requirements of the first species.

COBRELATION IN EGG PLANT

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Egg-plant is one of the traditional vegetable crops in Bulgaria(1). In plant breeding, the establishment of correlations between yield elements is important for the combination of a larger number of economically valuable traits.

Material and methods. At the IIPR, Sadovo,7 egg-plant cultivars were subject of study,6 of them being received from France and 1 from Bulgaria. The experiment was carried out on the block method in 4 replication. The coefficients were computed by the method of Plokhinsky(2).

Results and discussion. The vegetative and productive indices of cultivars tested are shown in table 1. The stem height varies from 45 to 82cm. Cultivar 'Chine –OS-I' forms the greatest number of flowers per plant -25. Cultivar 'Chine-LS-I' has the largest fruits - 2l0gr.The same cultivar has the longest fruits -17.5 cm. Coefficients of correlation between productivity and its elements were computed (table 2). Productivity is in low correlation with stem height. The coefficients of correlation are between the limits from - 0.268 to + 0.530. A mean correlation was established within the limits from + 0.394 to 0.480 between productivity and number of flowers per plant. Correlation between productivity and fruit number per plant is high. Variation among the cultivars is within the limits from + 0.548 to + 0.710. Interrelation between productivity and average weight of fruit is mean to high —from + 0.504 to + 0.697. Correlations between productivity : fruit length and productivity: fruit width are low. Fruit number and average fruit weight have substantial importance for defining productivity in egg—plant. This is proved by the high correlation coefficients obtained with the cultivars tested.

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Table 1. Vegetative and Reporductive Indices of the Plants for an 2 year average.

Cultivars	Stem height Cm	Number of flowers	Fruits Number	Average weight g	Length cm	Width Cm
Boenras	76	23	13	160	13.0	5.0
Bonica	79	18	10	180	9.5	6.1
Burga	45	20	11	100	12.8	3.1
Nprecoce	84	16	8	110	14.2	3.9
Chine-OS-I	50	25	15	130	4.7	7.4
Chine-LS-I	82	20	10	210	17.5	6.5
Egg-plant	72	18	9	200	16	8

Table 2. Correlation Coefficents for an 2 year average.

Cultivars	Productivity					
	Stem height	Number of flowers	Number of fruits	Average weight	Length of fruit	Width of fruit
Boenras	+0.312	+0.480	+0.548	+0.694	+0.180	+0.160
Bonica	+0.330	+0.410	+0.610	+0.504	+0.210	+0.115
Durga	+0.294	+0.400	+0.710	+0.527	+0.243	+0.108
N. precoce	+0.273	+0.427	+0.647	+0.618	+0.201	+0.194
Chine-OS-I	+0.300	+0.394	+0.593	+0.598	+0.237	+0.172
Chine-OS-I	+0.308	+0.461	+0.587	+0.564	+0.220	+0.131
Egg-plant	12+0.268	+0.415	+0.618	+0.547	+0.231	+0.124

ANNOUNCEMENTS

VI EUCARPIA CAPSICUM & EGGPLANT MEETING

According to the agreements in Sophia, the VI Eucarpia Capsicum and Eggplant Meeting will be held in Zaragoza (Spain), very probably on October 1986.

The organization in the south of our country is not going to be possible because it is difficult to manage from Zaragoza a Meeting to be held 1.000 km away. Anyhow, several Stations in the south of Spain are in disposal to receive an organized visit of the partecipants who want to travel there in the following days after the Meeting.

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