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The picture in the cover is derived from the “Herbario nuovo di Castore Durante”, Venetia,

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FOREWORD

After eleven years since EUCARPIA's first meeting about pepper (Turin, 16-17th September 1971), we are glad and proud to start the publication of "Capsicum Newsletter". We are grad because this new initiative, expected by many research workers who carry out experiments into pepper genetics and breeding, means that this group of people, who originated in Turin and later met in Budapest (1974), Montfavet (1977), and Wageningen (1980), has developed successfully and become more and more interested in working together. We are proud, too, since the first issue of "Capsicum Newsletter" is published in Turin, Piedmont, where sweet peppers are widely produced and consumed by a long established tradition.

We do realize that the present work is lacking as far as many details are concerned: in particular not all the people, whom we would have liked to collaborate at the review, have actually been able to do so and give their contribution to "Capsicum Newsletter"; for all, we can but apologize. Yet we are aware that it was not easy for us to begin and that some contributions have caused us some difficulties, owing also to our inexperience. Moreover it must be clearly stated that all the works, which arrived before the 30th of October 1982, have been accepted; in those cases when some works, typographically not clear enough, had to be retyped, the originals have been reproduced with absolute accuracy. Therefore only the authors must be held responsible for both the scientifically contents and the final draft of the articles.

We hope that in the meeting which is to take place in Plovdiv (4-7/7/1983) we will have the opportunity to discuss all the details concerning organization, about which we still have some doubts, as well as all those suggestions and criticisms we may get from our readers, provided we receive them before the meeting itself.

We confide above all that our efforts will actually be useful as a valuable instrument of bibliographical research for research workers operating in this field, as well as an opportunity to meet and exchange information among all those interested in Capsicum's genetics and breeding.

As far as we are concerned, we wish to dedicate this first issue to Professor Pier Luigi Ghisleni, who was the convenor of the meeting which took place in Turin and directed this small but active Institute during those years (from 1/11/1967 to 1/11/1971); all the less young among us have learnt from him (who is now the director of Milan's Institute of Agronomy) something for which they feel grateful even after so many years.

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Turin, 29th November 1982

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LIST OF THE CONTRIBUTIONS

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CAPSICUM GENETIC RESOURCES

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The International Board for Plant Genetic Resources (IBPGR), in collaboration with the Food and Agriculture Organization (FAO) of the United Nations, is organizing a global network of genetic resources centres. This network is intended to safeguard and make available for crop improvement purposes, the genetic variability of the major world crops.

The IBPGR is paying considerable attention to the genetic resources of vegetables and encourages, promotes and supports the collection, conservation, characterization, documentation and utilization of these crops and their wild relatives.

An expert meeting in 1980 formulated an action plan for Capsicum genetic resources. The report, with additional information compiled by the IBPGR Secretariat, has been finalized (IBPGR, 1982a). This outlines the priorities for collecting, the highest priority having been assigned to Latin America (Argentina, Bolivia, Brazil, Central America, Ecuador, Mexico and Peru) and the IBPGR already sponsored collecting missions in Mexico in 1981 and in Peru during 1982. The germplasm will be conserved in IBPGR designated genebanks in Costa Rica (CATIE, Turrialba), India (NBPGR, New Delhi) and the Netherlands (IVT, Wageningen). A number of Capsicum collections exist, which need to be duplicated for long-term safe storage in the above genebanks. During 1981 the IBPCR therefore funded genetic resources programmes in Greece, Peru and Spain to multiply and describe their Capsicum collections for this purpose.

The IBPGR gathers information on the content of existing germplasm collections throughout the world and publishes this in the form of directories of collections. The directory of vegetable collections has just been finalized (1BPGR, 1982b) and this contains a section on Capsicum with information on 40 important genetic resources collections.

Further information and the two publications mentioned below can be obtained from the IBPGR Secretariat.

IBPGR 1982A Genetic Resources of Capsicum (in press)

IBPGR 1982b Directory of Germplasm Collections. IV. Vegetables (by Jane Toll and D.H. van Stolen; in press)

COLLECTION AND EVALUATION OF PEPPER GERMPLASM

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Since 1979, with the financial support of the Region Piedmont, the search of local varieties of sweet pepper has been started, in order to store them as germplasm useful for future breeding work. As a matter of fact Piedmont is a centre of established tradition for sweet pepper growing: since very long time the seed used for these cultivations, which mainly concern small farms run by single families, is reproduced on the farm itself.

The cultivated areas are mainly in the open air (in the surroundings of Cuneo, Carmagnola, Alessandria), and their crop is employed for immediate consumption or for industrial processing; on a minor scale (in the areas near Asti and Carmaqnola) the sweet pepper is cultivated under plastic tunnels so as to obtain an early crop.

Cultivars with sweet berries of Capsicum annuum, variety grossum and var. longum are generally used; only for small areas pungent types of C. a. acuminatum are seldom used.

Only since few years commercial lot of seeds has begun to be used and new cultivars have been introduced.

It has been considered necessary to single out, characterize and preserve the local varieties and the ecotypes which were still to be found among the farmers, before the unavoidable disappearance of such material.

The seed samples are evaluated mainly in relation to the following features: moisture, weight of 1000 seeds, germinability, frequency of fresh seeds.

Then it is possible to proceed to long term storage of the seeds of the gathered material (kept at temperatures of -20 ^{0}C and in air tight glasscontainers, con taining silico-qel)

In the meantime the gathered material is characterized through the cultivation of some plants and accurate surveys of the morpholonical features (growth habit, shape, colour, dimension of leaves, flowers and fruits), of the genetic features (self-incompatibility and male-sterility), agronomical aspects (yield, earliness), important elements as far as industrial processing is concerned (thickness of the pericarp and pungency of the berries), sanitary features (resistance to the principal diseases).

Finally, when the seed samples gathered are not large enough, the seed regeneration of the seed itself must be effected This takes place in plots of ten plants covered with plastic net isolator. A similar work is carried out as far as the commercial material which can be found in Italy is concerned, both in Italian and foreign firms. The quantity of seed asked of the firms, which do not usually send it free, amounts to 50 g. It has been decided that commercial seed with a percentage of germination inferior to 90% should be refused for storage.

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TRANSLOCATION STUDIES IN CAPSICIJM ANNUUM L.

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Studies were performed with Capsicum annuum L. races belonging to different geographical areas in an attempt to analyse, if there are any differences in them with regard cytological activity. Altogether, 15 races of C.annuum representing five geographical areas, namely Central Mexico, U.S. New Mexico, Central America, Peru (South America) were analysed. The material was kindly provided by Dr. P.G. Smith (U.S.A.). In order to ascertain genomic relationships among the races, crosses were performed among them, F_1's were produced and analysed. One race from each of the geographical areas was chosen for performing crosses. In F_1 plants, chromosome pairing was analysed at metaphase I of meiosis.

The data given in Table 1 showed that out of 13 F_1s analysed at metaphase I of meiosis, 8 showed bivalents only, whereas the remaining 5 F_1's had not only bivalents, but also translocations of 4, or 6 chromosomes. These translocations were observed only in the crosses in which one of the parents had the columbian race 88 of South America.

The percentage pollen fertility was considerably very low in the F_1 plants derived from reciprocal crosses of race 88 with the races of Central Mexico, U.S .New Mexico and Central America. This can be explained ,because due to the formation of translocations, irreguiar se - gregations and meiotic abnormalities occur resulting in higher pollen sterility.

These results show that in the columbian race of South America certain chromosomes pair preferentially with some of the chromosomes in the races of C .annuum belonging to the regions of Central Mexico, U.S. New Mexico and Central America.

Table 1 - Chromosome associations in the F_1 plants derived from crosses among the different races of Capsicum annuum (2n=24).

Crosses	Chromosome association cit MI in PMC of F_1's
$66S_1$ (Central Mexico cultivated X 1534 (Central Mexico)	12_{II}
$66S_1$ X 1713 (C. Mexico)	12_{II}
$66S_1$ X 427 (U.S. New Mexico)	12_{II}
$66S_1$ X 1655 (Central America)	12_{II}
$66S_1$ X 88 (South America, Columbia)	$10_{II} + 1_{IV}$; $9_{II} + 1_{VI}$
427 (U.S. New Mexico) X 1655 (Central America)	12_{II}
427 X 2118 (S. America, Peru)	12_{II}
427 X 88 (S. America, Columbia)	$9_{II} + 1_{IV}$; $10_{IV} + 1_{IV}$;$9_{II} +2_{I} + 1_{IV}$
1655 (Central America) X 2188 (S. America, Peru)	12_{II}
1655 X 88 (S. America, Columbia)	$10_{II} + 1_{IV}$; $8_{II} + 2_{IV}$
88 (S. America, Columbia) X 1978 (Central Mexico)	$9_{II} + 1_{VII}$; $9_{II} + 1_{I} +1_{V}$
88 X $54A_{1-2}$ (Central Mexico)	$10_{II} +1_{IV}$
1981 (Florida) X 1713 (C. Mexico)	12_{II}

ACTIVITY OF ENDOGENOUS CYTOKININS AND THE ORGANIZATION OF ADVENTITIOUS SHOOTS IN "IN VITRO" EXPLANTS OF PEPPER SEEDLINGS

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There are good reasons to apply successfully advanced techniques of tissue culture in studying the organogenesis in pepper /Gunay - Rao 1978, Fári- Czakó l980, Saxena et al. 1981/

The present experiments are based on the relatively high regenerative potential of pepper seedlings, subjected however, to endogenous as well as exogenous effects. It was claimed that under controlled conditions details of the mechanism of regeneration could be explored accurately.

Earlier a gradual loss of the regenerative ability in aging seedling explants of cv. Hatvani and other cuitivars has been stated, as the number of newly formed initials declined /Fári -Czakó 1980. Apical sections of the hyrocotyl organize as a rule more buds than basal ones /Fári- Czakó 1981.

Endogenous free cytokinins have bean determined by soya cotyledon biotest in C. annuum L. cv. Hatvani seedlings, three and four weeks after germination started, when parallelly the isolation of the explants was made /Table I/.

Results show clearly that cytokinin activity declined with age. Top explants, i.e. with the cotyledons attached, contain the most endogenous cytokinin independently from the age of the seedling, whereas lower sections of the hypocotyl are clearly inferior in this respect.

Positive correlation seems to be between the frequency of shoot bud formation and the amount of endogenous cytokinins.

Most of the cytokinins in the seedling explants is zeatin, or at least belongs to the zeatin-riboside group according to their Rf. values.

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Fári M. - Czakó M. 1980: Capsicum, Eucarpia Working Group 21 - 24

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Saxena, P.K., Gill, R., Rashid, A., and Maheshwari, S.C. l98l. Protoplasma l08: 3/4:357-360.

TABLE I. DISTRIBUTION OF CYTOKININ ACTIVITY IN DIFFERENT SECTIONS OF PEPPER SEEDLINGS ABOVE THE ROOT NECK REGION
Results of Soya Callus Biotest made with extracts of aseptically raised seedling, 600 plants per sample/.

Part of the seedling	Fresh weight of soya callus				Callus growth in per cent	
Age of the seed1ings						
	3 weeks		6 weeks		3 weeks	6 weeks
	g	%	g	%		
Cuttings with cotyledons	3.95	44.7	l.02	34.6	100	25.8
Upper part of hypocotyl	3.19	36.2	1.14	38.8	100	35.7
Lower part of hypocotyl	1.68	19.1	0.78	26.6	100	46.4
Total	8.83	100	2.94	100	100	33.3

LOCATION OF vy^2 AND fa GENES BY TRISOMIC ANALYSIS

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Eleven out of the 12 possible primary trisomics are available in Capsicum annuum (1). Localization of 8 different genes was performed in 1977 (2). namely: L^1, A, MoA, up, C, y, xan3 and xan8. Two new genes are now localized: vy^2 and fa.

vy^2 gene, issued from "Florida VR2", controlling resistance to pathotypes 0 and 1 of Potato Virus Y, is located on the chromosome corresponding to triso-mic OR (1) (table 1) - This gene received previously the symbol y^a (3); this denomination does not seem correct because y is the symbol currently used for the yellow colour of the fruit. The locus vy comprises a number of different alleles (4, 5 and unpublished data)

Table 1. Distribution of the plants in the F_2 generation according to the origin (2n or 2n+1); (xy^2): number of plants resistant to PVY, isolate To/72, pathotype O.

Original	Total	(vy2)	%	x2(1:3)	Prob.
Control	219	59	26.9	0.27	>0.50
TRIS. IN	86	21	24.5	0.02	>0.50
TRIS. VE	106	26	24.5	0.01	>0.50
TRIS. JA	87	15	17.2	2.79	>0.10
TRIS. OR	89	6	6.7	15.82	<0.001
	70	6	8.6	10.08	<0.01
	68	4	5.9	13.25	<0.001
TRIS. RO	100	24	24.0	0.05	>0.50
TRIS. NO	86	23	26.7	0.14	>0.50
TRIS. BR	77	21	27.3	0.21	>0.50
TRIS. BI	92	19	20.7	0.93	>0.30

fa gene issued from "Csokros csūngo" controls the determinate habit of growth. It is located on the chromosome corresponding to trisomic BR (1) (table 2). Two different genes are already localized on this chromosome: L^1 and MoA.

Table 2. Distribution of the plants in the F_2 generation according to origin; (fa): number of plants with fasciculate phenotype, determinate habit.

Origin	Total	(fa)	%	x^2 (1:3)	Prob.
Control	67	18	26.9	0.12	>0.50
TRIS. IN	93	22	23.7	0.09	>0.50
TRIS. BL	57	14	24.5	0.006	>0.50
TRIS. VE	51	11	21.6	0.32	>0.50
TRIS. JA	68	17	25.0	0	>0.50
TRIS. OR	75	18	24.0	0.004	>0.50
TRIS. RO	111	28	25.2	0.001	>0.50
TRIS. PO	90	21	23.3	0.13	>0.50
TRIS. NO	121	25	20.7	1.21	>0.20
TRIS. BR	86	7	8.14	13.04	<0.001
TRIS. BI	27	7	25.9	0.01	>0.50

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SOME NEW POLYPLOID STRAINS

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More date about the production of polyploid strains are known /Pal, 1939; Gyorffy, 1939; Ohta, 1962/ but we haven't got any proof about their practical advantage. Molhova /1967/ used the polyploid strain of C. annuum for interspecific crosses /C.annuum 4n x C. pubescens 2n / but unfortunately, she didn't got any practical result from these hybrids because the unic F_1 plant was entirely sterile.

In 1965 polyploid strains were produced in our Institute too they are incorporated in our collection. In 1973 an in 1976 new polyploid strains were produced. In this paper we should like to show our present collection on the base of some morphological markers. / Table 1./
This year we produced srveral interspecific and variety hybrids with these polyploid strains. We shall give an account on the result in the future.

Table 1. Morphological markers telling telling dioloids from tetraploids

Item/	Capsicum annuum								C.bac. var. pen.			
Character	Soroksári		Cecei		Hatvani		Danube		pen 9		pen 11	
	2n	4n	2n	4n	2n	4n	2n	4n	2n	4n	2n	4n
Chromosomes counted in root tips	24	48	24	48	24	48	24	48	24	48	24	48
Cotyledon l/w	2,1/1,0	2,4/1,3	2,0/0,8	2,2/1,1	2,0/0,6	2,1/0,9	2,1/l,0	2,5/l,4	2,0/0,6	2,2/l,0	2,1/1,0	2,3/1,2
Leaf 1/w	11/7	12/l0	10/5	14/9	9/4	12/7	15/9	16/11	11/7	15/10	15/11	20/15
Length of main stem /cm /	14	17	12	15	12	18	14	22	15	25	50	75
Length of stomata /micron /	32	40	30	46	32	44	32	45	30	41	36	45

l/w = length/width in cm

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MUTATIONS OF PRATICAL VALUE INDUCED IN PEPPER BY GAMETE IRRADIATION

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In pepper (Capsicum annuum L.) gametes were irradiated with 750 rad of gamma rays. As a comparison, seeds were irradiated with 2400 rad of fast neutrons. In M_2 all the observed mutations were classified into chlorophyll or morphological mutations. The material coming from the different treatments was subject to the same selection procedure from M_2 and onwards: in M_3 only mutations which could have a practical interest were carried out, that the mutations for height (determinate type), flowering time, fertility, fruit weight and size fruit color and thickness of the pulp. From M_5 on, only lines with agronomic performance were selected.

Results from game to irradiations at different developmental stages showed that the mutation frequencies gradually increased (Table 1) from the pre-meiotic stage over mononucleate to binucleat pollen stages. Although the number of lines selected for morphological traits was larger after seed irradiation in the earlier generations, a repeated selection for economically important traits favored mutant lines derived from gamete treatments. In M_7 43 lines were grown, 8 of them originated from seed irradiation and the remaining 35 lines from gamete treatments.

Table 1 – Number of pepper mutant lines cv. Pimiento selected in M3 – M7 after irradiation of gametes and seeds.

Stage Irradiated	Treatment (rad)	Total number of mutants in M_2	Number of lines selected in: M_3	M_4	M_5	M_6	M_7
Both gametes [(+)] (premeiotic PMC)	Y – 750	16	2	2	1	-	-
Both gametes (mononucleate microspore)	Y – 750	33	17	15	13	10	10
Both gametes (binucleate gameotophyte)	Y – 750	133	39	36	35	25	25
Seeds	fn – 2400	132	44	35	28	15	8

[(+)] For a good synchronism in the development stages of both gametophytes is refered to the male situation.

THE EFFECT OF GAMMA RADIATIONS ON THE MALE GAMETOP HYTE IN VIVO AND IN VITRO.

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Several experiments have point out the effects of the gamma irradiation on the plant gametes and their usefulness in mutation breeding (Devreux et al., 1968; Donini et al.1970 ecc.). It has been also dimonstrated that the ionizing radiations are able to stimulate differentation in callus cultures (Pandey and Sabharwal, 1978) and to increase the rate of haploids production after in vitro culture of potato anthers (Przewozny et al.,198O).

This note reports premiminary results of experiments carried out with Capsicum annuum (cv. Quadrato d'A sti) in order to verify the efficiency of gametes irradiation methodology for the induction of mutations and for increasing the rate of haploids production in such species through in vitro anthers culture.

In table 1 is reported the frequency of mutations isolated in M_2 after irradiation of floral buds in different developmental stages. It is shown that the irradiation (750 rad) of pollen in the binucleate stage show a lower sensitivity in respect to the mononucleate and PMC stages, with a percentage of fertile fruits decreasing from 74% to 43% (PMC). Nevertheless, a higher percentage of morphological mutants is found among the M_1 plant progenies derived from floral buds, irradiated when the gametes are in the binucleate stage in respect mononucleate and PMC. This fact can be due to a higher selection of not damaged gametes after irradiation of PMC or mononucleate pollen. These results agree with other authors (Contant et al. 1971). On the contrary a higher percentage of chlorina and anthocianinless mutants found after irradiation of mononucleate pollen show that the irradation of these stages may be useful for the isolation of true gene mutations, while the irradiation of the binucleate stage increases probably the number of mutants involving chromosomes aberrations.

The experiments of in vitro germination after gametes irradiation with gamma rays showed that there is a stimulating effect of low doses of radiations. In fact with 0, 50, or 100 rad, the percentage of pollen germination is respectively 5.5, 20.44 and 10.77after 6 hours of culture. In vitro culture of anthers performed using the method by Dumas De Vaulx (1979), on normal or irradiated anthers showed that the haploids induction is quite low with a percentage ranging from 2-3 haploid plants on 100 cultivated anthers. These values where similar for control experiments as well as after irridation with 50 or 100 rad.

It has been observed that the irradation stimulate callus production and the percentage of haploids regenerated is practically the same, in same cases it has been observed that there is an increase of microspores with more than 2 cells after 2 weeks of in vitro culture after irridation of gametes in the mononucleate stage.

These last observations if confirmed could be important for the increase the rate of haploid production in pepper.

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Table 1-% of fertile fruits harvested and frequency of mutations in M_2 of Capsium annuum (cv. Quadrato d'Asti) after 750 rad of gamma irradations on floral buds in different developmental stages.

Stage	Floral buds	Fertile	M_1 plants	% of mutations per M1 plant		
Irradated	treated No	fruits %	analysed No	chlorina	anthocya-ninless	morphological
Premeiotic=PMC	88	43	--	--	--	--
Mononucleate Microspore	1491	69	491	3.66	1.42	0.20
Binucleate Gameotphyte	1486	74	1199	2.25	0.91	1.50

RESULTS FROM A STUDY OF QUANTITATIVE CHARACTERS IN PEPPER

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The aim of the study was to assess the genetic control 14 economically important quantitative characters in pepper in with relation with hybrid breeding. Griffing's method 2, method model I (1956) was used in studing the gene balance of additive and non-addditive gene effects in 4 X 4 and 5 X 5 diallel crosses.

Results from the analysis of variance of the general and specific combining abilities are presented in table 1. These data indicate that, with a few exceptions, both additive and non-additive gene effects are statistically significant for all characters. Additive gene effects predominate over the non-additive ones in all characters excepting number of leaves (1974, 1975). Their predominance differs in various characters. It is most prenounced in fruit index, length of pedicel and thickness of pericarp, less in mean fruit weight, number of locules, percentage of solids, plant height, number of length of internodes, number of seeds and least in fruit number and weight. The introduction of a new cultivar in the diallel cross (1974, 1975) can change the balance of additive and non-additive gene effects, which proves the greater importance of specific combining ability. The balance of additive and non-additive gene effects is different not only for the various quantitative characters in the diallel cross, which represents a model population, but also for each of the studied cultivars. Highest heterosis effect can be expected for the characters number of leaves and fruits, weight of fruits and number of main branches.

From a hybrid breeder's point of view of highest interest for F_1 hybrid cultivar development are the cultivars which manifest a relatively greater influence of non-additive gene effects for more of the characters.

1. Analysis of variance of combining

Character	GCA —F exp.				SCA —F exp.			
	1972	1973	1974	1975	1972	1973	1974	1975
Plant	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
height	105,8	72,9	40,4	96,5	31,5	28,8	7,7	18,4
Number of	xxx	xxx	xxx	xxx	xxx	xxx	xxx	
internodes	61,8	24,3	30,1	57,4	13,2	5,6	7,1	1,2
Number of	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
leaves	31,9	41,6	28,1	33,2	9,9	27,2	106,3	106,9
Length of	xxx	xxx	xxx	xxx	xxx	xxx	x	xxx
internodes	21,5	31,5	12,6	15.8	9,6	15,2	2,1	19,5
Number of	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
branches	61,2	48,0	17,0	13,0	28,5	26,0	4,0	4,0
Weight of	xxx	xxx	xxx	xxx	xxx	xxx	x	x
fruits	14,4	18,9	9,7	8,5	14,5	14,3	2,1	2,7
Number of	xxx	xxx	xxx	xxx	xxx	xxx		xxx
fruits	29,8	27,6	12,0	13,0	16,6	19,0	0,7	6,6
Index of	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
fruits	386,9	499,9	456,3	888,4	13,2	17,5	14,7	30,3
Thickness of	xxx	xxx	xxx	xxx	x	x	xx	xxx
pericarp	56,5	31,3	56,5	83,4	2,9	2,5	3,8	4,3
Length of	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
pedicel	68,3	75,8	160,3	195,0	6,9	10,9	7,8	3,9
Mean fruit	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx
weight	29,1	92,5	42,8	49,1	26,7	17,5	2,8	6,2
Number of	xxx	xxx	xxx	xxx		xxx	xx	
locules	15,8	12,1	28,8	10,4	1,0	8,0	3,6	1,2
Number of	xxx	xxx	xxx	xxx	xxx	xxx	x	
seeds	91,7	64,2	9,3	18,1	26,9	20,9	2,7	5,7
Solids,	xxx	xxx	xxx	xxx		xxx	xx	xxx
%	31,9	16,1	11,8	25,8	0,8	6,9	3,6	7,3

1972, 1973; $F_{0,05;\,0,01;\,0,001}$ /3;27/ - 2,96; 4,60; 7,27

$F_{0,05;\,0,01;\,0,001}$/6;27/ - 2,46; 3,56; 5,31

1974, 1975; $F_{0,05;\,0,01;\,0,001}$ /4;42/-2,59;3,80;5,64

F0, $_{05;\,0,01;\,0,001}$ /10,42/ - 2,06; 2,78; 3,83

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COMPONENTS OF GENETIC VARIANCE FOR QUANTITATIVE CHARACTERS IN CHILLI

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A ten parent non-reciprocal diallel cross with their 45 F_1S and F_2S were evaluated for estimating the nature and magnitude of gene action through componet analysis for shell content, seed content and non-edible stalk content of fruit, fruit number and dry chilli yield. The estimates of non-additive components (H_1 and H_2) were higher in magnitude than those of (D) additive component in both the generations for all the five characters studied (see table). However all the three estimates were found to be significant for shell content, seed content, fruit number in both the generations and for dry chilli yield in F_1, revealing the importance of additive and non-additive components of genetic variation. For non–edible stalk content only non-additive components were significant. Presence of over dominance was observed in both the generations for all the characters.

Table Estimate of genetic components of variation in F_1 and F_2 progenies for five characters in chilli

Components	Generation	Shell Content	Seed Content	Non-edible stalk	Fruit number	Dry yeild
D	F_1	34.61++ ± 9.86	42.06++ ± 9.68	1.29 ± 0.86	484.90++ ± 95.67	218.60++ ± 58.57
	F_2	40.42++ ± 10.87	36.07++ ± 10.67	0.79 ± 0.54	284.50+ ± 100.84	78.06 ± 37.28
H_1	F_1	142.00++ ± 20.98	135.70++ ± 20.62	6.70 ± 1.83	1333.00++ ± 203.66	613.50++ ± 124.67
	F_2	550.00++ ± 92.59	514.80++ ± 90.89	15.44 ± 4.62	3845.00++ ± 858.59	1754.00++ ± 317.47
H_2	F_1	105.80++ ± 17.83	99.58++ ± 17.52	4.08 ± 1.56	949.50++ ± 173.09	496.40+ ± 105.96
	F_2	420.00++ ± 78.69	403.10++ ± 77.25	11.98 ± 3.93	3533.00++ ± 729.70	1548.00+ ± 269.81
h^2	F_1	2.16 ± 11.94	5.15 ± 11.73	0.31 ± 1.04	215.26 ± 115.86	36.65 ± 70.92
	F_2	10.26 ± 52.66	10.19 ± 51.70	-0.66 ± 2.63	404.42 ± 488.38	24.48 ± 180.59
F	F_1	53.19 ± 22.75	62.78+ ± 22.35	3.40 ± 1.99	542.00+ ± 220.76	53.45 ± 135.14
	F_2	129.20 ± 50.19	111.10 ± 49.26	2.59 ± 2.50	210.90 ± 465.33	26.79 ± 172.06
E	F_1	0.51 ± 2.97	0.62 ± 2.92	0.22 ± 0.26	2.98 ± 28.84	1.32 ± 17.66
	F_2	0.25 ± 3.27	0.27 ± 3.21	0.11 ± 0.16	1.05 ± 30.40	1.74 ± 11.24

+ Significant at P = 0.05 ++ Significant at P = 0.01

INHERITANCE OF SOME QUANTITATIVE CHARACTERS IN CHILLI PEPPER (CAPSICUM ANNUUM L.) I. FRUIT YIELD, NUMBER AND SIZE.

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The present investigation was carried out in six different environments to get precise estimation and genetic parameters, in two crosses Elephant Truck x Perennial and Koloscai E-15 x Perennial. The generation means were analyzed on pooled data by following the method as described by Mather and Jinks (1971). The estimates and gene effects showed prime importance of additive genes in the inheritance of total yield, fruit number and fruit diameter. Therefore, simple breeding techniques like single seed descent method can be successfully employed for the improvement of these characters in chilli pepper.

INHERITANCE OF SOME QUANTITATIVE CHARACTERS IN CHILLI PEPPER (CAPSICUM ANNUUM L.) II. EARLINESS, SEED NUMBER FRUIT WEIGHT AND PLANT HEIGHT

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The six basic generations (P_1 P_2 F_1 F_2 B_1 B_2) of two crosses Elephant Trunk (ET) x Perennial (P) and Kolascai E-15 (KE-15) x Perennial were planted in 6 environments consisting of two planting dates and 3 spacings. The generation means were analysed as pooled data for days to fruiting, number of seeds, average fruit weight and plant height following the method as described by Mather and Jinks (1971). The estimates of gene effects showed that both additive and dominance gene effects were important for days to fruiting and plant height, where as only additive gene effects for seeding number and average fruit weight. Significant additive x additive, gene effects was obtained for days to fruiting and average fruit weight, additive x dominance and x dominance gene effects were obtained for average fruit weight and plant height.

GENETICS OF CAPSAICIN CONTENT IN CHILLI PEPPER (CAPSICUM ANNUUM L.)

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The cross between two varieties of chilles namely Perennial (pungent) and Koloscai E-15 (non-pungent) was made and the six basic generations viz; P_1, P_2, F_1, F_2, B_1 and B_2 were planted following single plant randomization. The capsaicin content fron the fruits of each plant was determined by colorimetric determination with the Folio Coicalteu reagent. The generation means were analysed by the method as described by Mather and Jinks (1971). The mean value of F_1 indicated pungency to be dominant over non-pungency. The estimates of gene effects showed additive, dominance and dominance x dominance component to be significant; however the magnitude of additive component was higher, which indicated pre-dominance of additive gene effects in the inheritance of capsaicin content and that can be exploited by simple selection.

METHOD FOR GCA EVALUATION

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To find out GCA with a relatively small effort, we attemp to verify if the polycross technique is applicable to peppers.

With several scarcely related varieties, Duce Italiano (1), Cristal (2) Cubanelle (3), Pabellón fruto claro (4), Loreto 74 fruto fino (5), Csokros felallo (6) y Valenciano (7), a complete diallel crossing and an artificial polycross was carried out. The latter, by extracting pollen out of each line and mixing it in approximately equal parts. With the obtained mixture of pollens, each one of the lines was pollinated. By doing this, seven descendences of half-sibs were obtained with known mother and unknown pollen origin.

Both in the diallel and half-sibs descendences characters were measured: height and number of true leaves up the crotch, number of primary branches, length first three internodes and height of the plant. The average phenotypic values of each descendence (P) and GCA estimations obtained through Griffing's diallel analysis (G) are given on Table 1.

It is remarkable that the correlation between both series of values is very significative in all cases, except for number of primary branches, probably owing to the scarce variability that the mentioned character showed in the used parentals.

Other vegetative characters and characters related with fructification are being studied in order to prove if this close correlation between both estimations is extensible to all the biological cicle of the plants.

Table 1. GCA estimations obtained by both experimental methods.

x = p<0,05; r = correlation between G-P.

		Parental lines							
Character		1	2	3	4	5	6	7	R
Height Crotch	G	-1,1	3,7	-1,7	2,7	-4,9	-3,3	4,8	0,75*
	P	13,1	17,6	14,3	17,6,	21,5	16,1	18,0	
Leaves	G	-1,3	-0,6	-0,7	0,7	1,7	0,1	0,6	0,83*
	P	11,3	13,0	13,4	13,5	14,8	12,6	13,2	
Branches	G	0,01	-0,19	0,06	-0,04	0,12	0,05	0,05	0,64
	P	2,3	2,3	2,8	2,3	2,6	2,8	2,8	
Internodes	G	-0,4	-0,6	-2,9	3,1	4,5	-1,1	-0,2	0,94*
	P	21,8	22,9	22,1	25,9	27,7	21,8	23,6	
Height Plant	G	-11,9	11,4	-12,2	24,2	36,0	-23,4	-4,4	0,97*
	P	99,3	114,8	87,5	131,2	141,8	78,5	102,1	

HETEROSIS FOR ASCORBIC ACID CONTENT IN CHILLI

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Ten inbred lines and their 45 F_1 diallel hybrids were studied for the ascorbic acid content (mg/100 g) in chili. Thirteen crosses Kovilpatti-l x CA 1068, Kovilpatti-1 x G_3, Kovilpatti-1 x LIC 23, CA 1068 x Kalianpur-1, G_3 x Kalianpur-1, G_3 x G_4, G_3 x Jwala, G_3 x CA 960, G_3 x LIC 23, G_5 x Jwala, Kalianpur-1 x G_4, Kalianpur- x CA 960, C x LIC 23 exhibited significant positive mid parent heterosis ranging from 2.21 to 30.93 per cent. Among the 45 hybrids the crosses CA 1068 x Kalianpur-1, G_3 x Kalianpur-1 and G_4 x LIC 23 exhibited significant better parent heterosis ranging from 2.06 to 12.52 per cent.

The ascorbic acid content of the three crosses ranged between 185.0 to 284.9 mg. However none of the 45 crosses exceeded the best parent regarding ascorbic acid content in ripe fruit thereby indicating partial dominance of genes for low ascorbic acid.

PHOTOSYNTHESIS IS OF CAPSICUM HYBRID PLANT IN CONDITIONS OF BLUE AND RED ILLUMINATION

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Introduction

The data about pepper obtained up to now have shown (Popova & Krastenva, 1980) that the more intensive growth and the accumulation of more biomass as far as the budding phase correlates with a high fruit yield. Since this period is characterized by an intensive photosynthetic activity, we studied the potential photosynthetic abilities of the parent lines and their hybrids so far to use them for relatively early evaluation of the heterosis effect.

Materials and Methods

Studied were the hybrid combinations Chekhska Kaba x Ran, having a weak hetereosis effect, Biala kapija x D-103, with a strong heterosis effect, and the respective parent forms. The controlled experiments were carried out at about 18°-20°C°, in conditions of prevailing blue and red light provided by Philips luminescent lamps with a known precision wave performance used in twelve-hour light periods.

The analysis made use of 50-day plants. The chlorophyll content was determined in an acetone extract by means of a spectrophotometer employing Vernon's formula. Net photosynthesis was established by the method of Nichiporovich.

CHLOROPHYLL CONTENT OF PEPPER LEAVES

Table 1

Parent lines & hybrids	Blue light		Red light	
	50-day plants		50-day plants	
	Mg% fresh leaves	Mg per one plant	Mg% fresh leaves	Mg per one plant
Chekhska kaba	205,2	112,9	298,6	72,1
Ran	192,8	62,3	290,4	103,9
C. Kaba x Ran	213,6	144,2	306,1	122,1
Biala Kapija	237,4	158,4	315,4	135,9
D-103	223,1	188,6	288,5	194,6
B. Kapija x D-103	233,4	219,2	307,0	146,7

IN DECES OF PEPPER PRODUCTIVITY

Table 2

Parent lines And hybrids	Blue light		Red light	
	Net photosynthesis $(g/dm^2)/24$ h	S1 – S2 /2 dm^2	Net photosynthesis g/dm^{201069}	$S^1 - S^2$ / 2 dm^2
Chekhska kaba	0,0365	0,328	0,0683	0,532
Ran	0,0451	0,558	0,1069	0,772
C. Kaba x Ran	0,0491	0,934	0,1074	1,149
Biala Kapija	0,0432	1,033	0,0749	1,248
D-103	0,0375	0,752	0,0403	0,967
B. Kapija x D-103	0,0486	1,338	0,1074	1,553

Data and Discussion

The chlorophyll content in the leaves of both hybrids represented the heterosis effect in relation with the mean values in the initial forms, but the difference between investigated hybrids was not essential in this respect. The strong heterotic effect with regard to the yield was found to be preceded by enhanced photosynthesis of plants. The indices obtained with the use of red light Could successfully be used for the early diagnosis of heterosis effects.

ON THE INTERSPECIFIC CROSSABILITY BETWEEN CAPSICUM ANNUUM L. AND CAPSICUM PUBESCENS R. & P.; CAPSICUM ANNUUM L. AND CAPSICUM PENDULUM WILD. (SIN BACCATUM)

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As far as we know there are no data in the literature on the crossing of Capsicum annuum L. with C. pubescens R. & P. in the genus Capsicum. The attempts of Gasenbusch (1958) to cross C. pubescens H. & P. with C. annuum L. have been fruitless, as subsequently confimed by Heiser and Smith (1948). Smith and Heiser (1957), Ohta (1962), Dascalov and Russinova (1963), Saccardo and Ramulu (1977), Picersgill (1980) reported that the pollination of C. annuum L. with C. pubescens R. & P. and reciprocal produces no fruits, or at best seedless pods. Proceeding from the results of the interspecific crossings of C. pubescens R. & P. with other species of the genus Capsicum the authors concluded that C. pubescens R. & P. differs most in morphologjcal traits and it is the most distant on the C. annuum L.. There are little data in the literature on the crossing of C. annuum L. with C. pendulum willd, when C. annuum L. was used as female component (Russinova-Kondareva, 1968; Dumas de Vaulx et Pitrat, 1977). Treatment with acidi borici applied to the female gametophyte of C. annuum L. with pollination by C. pendulum willd. Russinova-Kondiareva (1968) obtained somewhat more fruits and seed-set and cultivated sterile F_1 plants.

Using double pollination method, i.e. crossing C. annuum L. as the female with the pollen from the C. pendulum willd. and 24 hours to 5 days later pollination with C. annuum L., polen itself, nitric oxide treatment applied to the female gametophyte of C. annuum L. before or after pollination by C. pendulum willd. (sin. baccatum) were obtained somewhat more fruits and seed-set. These data were reported by Dumas de Vaulx and Pitrat (1977).

For initial parent forms in the hybridization we used C. annuum L. variety Sivriya, Pazardjishka kapiya, D-103 x Sivriya-tetraploid No 144 and No 144 (D-103 x Sivriya)-unstabilized tet-

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raploid with appearance of diploid plants, three forms of C. pendulum var.longissilicum (sin.baccatum), C.pendulum var.bicoloratum (sin.baccatum) and C.pubescens R. & P.. From the possible crosses we have done where the underline forms and varieties were involved we obtained single seeds from the combinations C.annuum L. x C.pendulum willd. 2 (where C.annuum L. was involved with diploid form of unstabilized tetraploid No 144) and seeds not of full value were obtained from them. Some of the seeds germinated an and a hybrid sterile plant was developed. In the hybridization between C.annuum L. and C.pubescens R.&.P. single seeds are obtain when mother is the tetraploid C.annuum L.. The hybrid C. annuum L. x C.pubescens R. & P. was a sesquidiploid of intermediate type and it was sterile. Hybrid seeds were obtained with difficulty in the crossings of C.pendulum willd. x C.annuum L. and plants with partial fertility were cultivated. The F_1 plants of C.annuum L. x C.pendulum willd, were of intermediate type the habitus of C.annuuin L. and flowers of C.pendulum willd.

Single seeds were obtained in the sterile hybrid C.annuum L. x C.pubescens R.& P. (3x) by multiple vegetative propagation - inoculation on C.annuum L. for prolongation of its development out of which three plants in F_2 were obtained by embryoculture, also sterile, but generated single seeds. The plants of F_2 C.annuum L. x C.pubescens R.& P. were sesquidiploids and recur the specimen of F_1 C.annuum L. x C.pubescens R. & P. on habitus.

The hybrid C.annuum L. x C.pendulum willd. in F_1 was sterile, but after multiple self pollination it generated single not completely developed seeds which did not germinate in normal conditions. By embryoculture we succeded to cultivate one plant in F_2 which generated seeds with different rate of incomplete di.tferentiotion of embryo and normal seeds with good vitality, out of which we cultivated hybrid plants in F3 respective with segregation and diversity, combining the characters of the two parents. The hybrids were with higher field disease resistance to Phytophtora capsici.

The influence of different genotypes we used in our investigations established that the share of unstabilized diploid of C.annuum L., passed through tetraploid condition, is a suitable component of overcoming the incompatibility between C.annuun L. and C.pendalum willd. and the tetraploid C.annuum - for overcoming the incompatibility between C.annuum L. x C.pubescens R.& P.

The sterility was overcome in: 1) hybrid plants of C.annuum L. is C.pubeocens R. & P. by elongation of their development with vegetative propagation - grafting and cultivating of incomplete differentiated seeds in vitro; 2) the hybrids C.annuum L. is C.pendulum willd. by cultivation of seeds with incomplete differentiated embryo in vitro.

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THE TRANSFER OF MULTIPLE FLOWERS PER NODE FROM

CAPSICUM CHINENSE JACQ., TO CAPSICUM ANNUUM L.

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F_1, B_1, B_2, F_2, B_1S, B_2S, and F_3 generations of an interspecific cross between the pepper cultivar Delray Bell (Capsicum annuum L.), which has a single flower per node, and P.I. 159236 (Capsicum chinense Jacq.) which has multiple flowers per node, were generated. The F_1 generation had double flowers per node. A minimum 3 genes probably controlled the multiple flower trait. A few individuals in the B_1S and F_3 generations had the multiple flower character of C. chinense. The backcross method can be used to transfer the double and multiple flower trait, with the double flower trait being the easier of the two.

DISEASE RESISTANCE STUDIES AND NEW RELEASES FROM FLORIDA

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Cultures of the leaf spot bacterium (Xanthomonas campestris pv vesicatoria) originally isolated from pepper in several different countries throughout the world were identified to pathotype. Race 2 of the bacterium was found to occur only in Florida and Guadeloupe while race 1 was found in every location except Guadeloupe but including Florida. Hypersensitive resistance to race 1, identified in Capsicum chacoense was transferred to C. annuum types and found to be inherited as a dominant character.

Four cultivars with various combinations of disease resistance will be released from Florida when seed supplies have been increased. These cultivars include Florida VR-4 resistant to pepper mottle, potato Y, and tobacco etch and tobacco mosaic viruses. Florida XVR 3-25 is resistant to potato Y and tobacco etch viruses and both pepper races of the leaf spot bacterium; USAJI-5 produces medium length, conical, pungent fruit on plants resistant to potato Y and tobacco etch viruses; Florida VR-3-25 was selected for production of fruits with smooth (not depressed) blossom ends on plants resistant to potato Y, tobacco etch and tobacco mosaic viruses.

Resistance to cucumber mosaic virus in a cultivar obtained originally from Dr. Chen Shifriss (Israel) was determined to be heritable and preliminary results are indicative that resistance results from a recessive character. However, some resistant plants have been observed to develop symptoms in one or more axillary branches that arise from near the bases of inoculated plants.

VIRAL DISEASES OF PEPPER: A RESEARCH PROGRAM ON EPIDEMIOLOGY AND BREEDING FOP RESISTANCE.

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In Italy the virus diseases of peppers (Capsicum spp. L.) are mainly due to cucumber mosaic virus (CMV), tobacco mosaic virus (TMV), tobacco rattle virus (TRV), potato virus Y (PVY), broad bean wilt virus (BBWV) and alfalfa mosaic virus (AMV) (Canova and Martelli, 1980; Belli and Conti, 1980). CMV is usually the most common and widespread, causing sometimes-severe losses to the corp. TMV, mostly occurring as "tomato" strains (= tomato mosaic virus or (TMV), is also very frequent, especially in peppers grown under plastic tunnels or greenhouses (Conti and Masenaga, 1977). The other pepper viruses are normally less important, though some of them may reach high incidence and cause great damage in some pepper-growing areas.

Effective control measures against virus disease may result from advanced knowledge of the ecology and epidemiology of the parasites involved as well as of the resistance potentialities of the host genome. Our research work on virus disease of pepper therefore includes epidemiological investigations and contributions to breeding programs.

The epidemiological studies mainly deal with factors affecting occurrence and distribution of viruses and virus strains in pepper and other solanaceous crops in Central Italy. The infection pressure of aphid-borne viruses (especially PVY and CMV) is detected by the bait-plant method and by vector-traps, placed both in pepper and tobacco fields. The most common isolates of PVY and CMV are characterized, comparing those obtained from pepper with those collected from tobacco and tomato. The role of weeds as virus reservoirs and inoculum sources for the crop in Central Italy is also investigated. The first results indicate that in this area PVY infects tobacco more frequently than pepper, although the infection pressure of the virus seems to be the same in both crops. Possible explanations for this phenomenon are under examination.

As to the breeding program, many pepper types obtained by other Italian research groups are tested for resistance to local isolates of ToMV and PVY. Pepper seedlings of the types to be tested are mechanically inoculated when they are 30-40 days old and then kept under standard environmental conditions for the experiment duration. Plant responses to the infection (i.e. susceptibility or resistance) are judged on the basis of symptom expression and isolation tests carried out on shoots of inoculated plants. Susceptible plants are soon eliminated while resistant ones are inoculated again in two different stages of their development, in order to confirm the resistant behavior. Up to date various ToMV-resistant types, that also show other interesting characters and are therefore promising for future work, have been found.

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RESEARCH ON PEPPER – INFECTING VIRUSES AT THE ISTITUTO DI FITOVIROLOGIA APPLICATA, C.N.R., TURIN

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Investigation on viruses which infect pepper were started in Northwestern Italy about ten years ago. They include: identification and characterization of viruses; incidence of each single virus in both open and protected fields studies on epidemiology, natural virus sources and vectors. Similar investigations were begun two years ago also in Central Italy, in cooperation with Dr. M. Marte, University of Perugia.

The following viruses were found in peppers in Italy: alfalfa mosaic virus (AMV), broad bean wilt virus (BBWV), cucumber mosaic virus (CMV), potato virus y (PVY), tobacco mosaic (TMV) and tomato mosaic (ToWV) viruses and tobacco rattle virus. (TRV). Very occasionally, tomato bushy stunt (TBSV) and tobacco necrosis (TNV) viruses were also isolated.

The non-persistent, aphid-borne viruses – AMV, BBMV, CMV, and PVY – prevail in open fields while TMV and ToMV prevail in protected crops. TRV occurs both in Northwest and Central Italy but only in some restricted areas.

The most important virus problems of pepper in Italy appear to be due to CMV in outdoor and both TMV and ToMV in indoor crops.

NEW STRAIN OF TOMATO MOSAIC VIRUS OCCURED ON RESISTANT VARIETIES OF PEPPER /CAPSICUM ANNUUM/ IN HUNGARY.

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Mosaic and viruslike symptoms on TMV resistant pepper /Fehérözön/ were reported in glasshouses and plastic houses in different districts of Hungary. In order to establish the distribution of that supposedly new virus disease, samples were taken from important pepper growing districts of Hungary /Mihálytelek, Jászágó, Kondoros, Csákvár, Felcsut, Sárbogárd, Fábiánsebestyén, Tolna, Szabadbattyán, Mözs/.

The samples originated from Bogyiszlói /L^+/, Budatétényi F_1 and Fehérözön /L^1/ pepper varieties. The most common symptoms are: 1. light to severe mosaic, 2. yellow or yellow spotted leaves, 3. mosaic with leaf deformation 4. browning of pepper fruit. Mechanical inoculation was made to Nicotiana glutinosa, Nicotiana tabacum cv. Xanthi – nc, Nicotiana tabacum cv. Samsun, Nicotina sylvestris, Capsicum annuum vc. Fehérözön and Capsicum annuum cv. Javitott Cecei /L^+/ test plants. From 70 samples 64 contained Tomato Mosaic Virus, i.e. it infected Nicotiana sylvestris locally only and C. annuum cv. Fehérön /L^1/ pepper systematically. On basis of our results we can conclude that the new strain of ToMV, breaking through the resistance gene /L^1 allele/, is widely distributed in pepper growing districts of Hungary.

SUGGESTIONS FOR AN EXPERIMENTAL HOST RANGE TO BE USED IN CLASSIFCATION OF PEPPER STRAINS OF TMV.

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With reference to a paper by Tobiás et al. (1982) the following test plants appeared useful in studies on strains of TMV in pepper.

As pepper strains may differ in their pathogenicity towards the genus Capsicum it will be necessary to include at least four members of this genus in a proposed host range. In this connection it is recommended to adopt the differential Capsicum hosts referred to by Boukema, elsewhere in this Newsletter.

True pepper strains of TMV are apparently characterized by their non-infectivity towards tomato (Green leaf et al., 1964; Feldman & Oremianer, 1972; Rast, 1979). It is therefore essential that Lycopersicon esculentum is represented by one or more cultivars of known TMV resistance genotype.

In order to differentiate pepper strains from tobacco and tomato strains it is suggested to use Nicotiana tabacm 'Xanthi nc' and N. sylvestris or the more rapidly growing 'necrotic' line of N. tabacum 'White Burley'. N. tabacum 'Xanthi nc', although normally reacting with local lesions to TMV, may become systemically infected with certain pepper isolates (Csilléry & Ruskó, 1980).

N. tabacum 'Samsun' and N. glutinosa should be constantly available for the general purposes of virus propagation and bioassays, respectively. However, in case N. tabacum 'Sans-un' appears unsatisfactory as a propagation host, it may be replaced by N. clevelandïi.

The test plant species Petunia hybrida, P. nyctagyniflora and Plantago major are particularly interesting as they may be used for a further characterization of pepper strains of TMV.

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RESISTANCE TO A NEW STRAIN OF TMV IN CAPSICUM CHACOENSE HUNZ.

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INTRODUCTION

At the last Eucarpia Capsicum meeting at Wageningen it was reported (Boukema et al., 1980) that a new strain of TMV had appeared which can systemically infect the C.chinense accessions carrying the L^3-allele (Boukema, 1980) for resistance. In the same paper a new denomination of the L-alleles was proposed. With this system the name of the TMV strains reveals which genotype the strains can infect with systemic mosaic (Table 1).

RESISTANCE TO STRAIN $P_{1.2.3}$

It seems highly probable that pepper genotypes resistant to strain $P_{1.2.3}$ are also resistant to strain $P_{1.2}$ (Table I). To avoid spreading of the new strain $P_{1.2.3}$ through screening large numbers of plants, 34 accessions of different Capsicum species, not tested before, were therefore first inoculated with strain $P_{1.2}$. Only some plants of the C.chacoense accessions PI 260429[1)] and SA 185[2)], both originating from Argentina, showed local lesions without systemic symptoms .All other plants showed systemic mosaic. Cuttings from the resistant plants reacted also with local lesions after inoculation with strain $P_{1.2.3}$.

INHERITANCE OF THE RESISTANCE

Progenies of the resistant plants (from open pollination (o.p.) and from crosses with C.annuum cv. Bruinsma Wonder (L^1L^1)) were tested with strain $P_{1.2}$. Some of the o.p. progenies seregated 3 resistant: 1 susceptible and the corresponding F_1's 1 resistant: 1 susceptable, other progenies were entirely.

1.) Obtained from the Southern Regional Plant Introduction Station, Expeniment, Georgia, USA.

2.) Obtained from the University of California, Davis, USA.

resistant, pointing to heterozygosity and homozygosity for one dominant resistance gene, respectively. From an $F_{1,}$ which segregated for resistance, detached leaves from 20 non-inoculated plants were inoculated with $P_{1.2}$ and undetached leaves with $P_{1.2.3.}$ Nine plants of which the detached leaves showed local lesions with $P_{1.2}$ also showed lesions with $P_{1.2.3}$. From the eleven other plants the detached leaves showed no lesions with $P_{1.2}$ and the tops showed systemic mosaic with $P_{1.2.3}$. From this it may be concluded that the same gene governs resistance to $P_{1.2.3}$ and to $P_{1.2}$. Whether this gene is also an allele of the L-locus will be studied further on progenies from the cross (C.chacoense x C.annuum L^1L^1) x C.annuum L^+L^+.

HYBRID STERILITY

The C.chacoense x C.annuum hybrids had larger leaves and were much more vigorous than the C.chacoense parent, but they were all male sterile (no stamens or only rudiments). Crosses made with these sterile plants as a female resulted in seed set, but so far these seeds have not been tested. Some of the male sterile hybrids gave parthenocarpic fruit set, but these fruits can be distinguished from fruits with seed because they are shorter and wrinkled.

SYSTEMIC NECROSIS

It was found that if very young plants of C.chacoensce (2 or 3 leaves) are inoculated, these plants may become systemically necrotic. Csillery* (personal communication) noted that C.chinense PI 159236 (L^3L^3) became systemically necrotic after inoculation with $P_{1.2}$ at ± 28° In preliminary tests in which C.chacoense plants homozygous for the resistance gene and C.chincrise PI 159236 (L^3L^3) were inoculated with $P_{1.2}$ at ± 30° we found that plant size at the time of inoculation (or the number of leaves inoculated) determined to a large extent whether the virus became localized in the inoculated leaves or became systemic, resulting in necrosis in stems and tops. Most plants with about eight leaves, of which the lower three were inoculated, did not react with systemic symptoms. The C.chacoense plants did not show local lesions on the inoculated leaves @ 30°C, but the whole leave became necrotic and dropped. The C.chinense plants showed the same lesions as at 22°C. At 22°C the lesions on the C.chacoense plants appeared some days later than on C.chinense . Lesions on the C .chacoense x C.annuum hybrids appeared even later and inside chlorotic spots. More extensive tests will

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be carried out in the phytotron to study the influence of temperature, plant size, concentration of the inoculum and heterozygosity versus homozygosity of the resistance gene on the localisation of the virus after inoculation. That a low light intensity promotes systemic necrosis in L^3L^+ genotypes had already been reported (Boukema et al., 1980).

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Table 1. Relation between genotypes for resistance in Capsicum and strains of TMV.

			TMV strains			
		Isolate name:	Tomato strains	P_{11}	P_8	P_{14}
		Proposed name:	P_0	P_1	$P_{1.2}$	$P_{1.2.3}$
Capsicum cv. or accession	Proposed genotype					
C. annuum cv. EC	L^+L^+		+	+	+	+
C.annuum cvs. VG, BW	L^1L^1	(L^iL^i)*	-	+	+	+
C. frutescens cv. Tobasco	L^2L^2	(LL)*	-	-	+	+
C.chinense PI 159236	L^3L^3		-	-	-	+

+ = systemic mosaic, - = local lesions on inoculated leaves, no systemic mosaic.

Abbreviations used: EC = Early Calwonder, VG = Verbeterde Glas, BW = Bruinsma Wonder

* symbols between brackets: gene symbols after Lippert et al. (1965)

DISTRIBUTION OF TMV-$_{P0}$ SUSCEPTIBLE AND RESISTANT DOUBLED HAPLOID LINES FROM ANOTHER CULTURE OF HETEROZYGOUS L^+/L^1 HYBRIDS.

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The anther culture technique elaborated in our laboratory (1) is now commanly appolied to breeding and genetical studies on Capsicum annuum.

212 doubled haploid (DH) lines were obtained from six hetosygous (L^+/L^1) hybrids between susceptible (L^+/L^+) and resistant (L^1/L^1) cultivars, to Tobacco Mosaic virus (Po pathotype) (2).

For live DH progenies the expected 1:1 distribution is clearly observed (table 1). But amoung the DH lines from F_1 (Perennial x Yolo Wonder) we noticed a systematic deficit or resistant DH lines (37.7 %). The observed x^2 value is very near the critical 0.05 level. This resistant deficit is not observed among the other DH progenies involving "Perennial" or "Yolo Wonder".

All cumulated results from the six crosses give 112 susceptible DH lines and 100 resistant ones, which is not significantly different from the 1:1 distribution.

These results show that gene distribution can be modified, after anther culture, with some particular genotypes combinations. So far this kind of genetic study it is necessary to :

- clearly mention the cultivars used
- analyse several cultivar combinations

Table 1 - Distribution of TMV susceptible and resistant doubled haploid lines obtained after anther culture of six heterozygous L^+/L^1 hybrids.

		Double haploid lines		% DH	x^2	
F_1 hybrids		Susceptible	Resistant	Resistant	(1:1)	Prob.
B 107 (S)*	** x Yolo Wonder (R)	17	22	56	0.64	> 0.30
PM 687 (S)	x Yolo Wonder (R)	24	21	46	0.20	> 0.50
PM 217 (S)	x Yolo Wonder (R)	8	11	57	0.47	> 0.30
Doux des Landes (S)	x Florida VR2 (R)	17	14	45	0.29	> 0.50
Perennial (S)	x Yolo Wonder (R)	38	23	37	3.69	$\simeq$0.05–0.06

Perennial (S)	x Florida VR2 (R)	8	9	52	0.05	> 0.50
		112	100	47	0.67	> 0.50

* Cultivars susceptible to TMV-$_{PO}$ pathtype.
** Cultivars resistant to TMV-$_{PO}$ (hypersensibility: local lesion)

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A MAJOR GENE WITH QUANTITATIVE EFFECT ON TWO DIFFERENT VIRUSES CMV and TMV

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In the search for mechanisms of partial resistance to CMV infection, a local lesion assay based on the use of an abnormal strain of this virus (strain N) is currently applied to Capsicum germplasm (1). Among varieties or populations displaying a reduced number of local lesions on the inoculated leaves, a wild population collected by B. Pickersgill in the vicinity of Rama city in Nicaragua seemed particularly interesting: C. annuum var. minimum, ref. 417, PM 646 "Rama".

In crossing with standard susceptible varieties, the tendency to reduce the number of lesions appears nearly completely dominant; while it is recessive in the other studied cases (table 1).

Table 1. Number of local lesions induced by CMV strain N on pepper leaves: 2 susceptible controt varieties, 5 party resistant introductions and F_1 hybrids.

	Varieties		F_1 x Yolo W.		F_1 x Yolo Y.	
	mean	range	mean	range	mean	Range
Yolo Wonder	203	136-257				
Yolo Y	308	230-400				
Rama	0.2	0-1	1.6	0-3	0.6	0-2
PM 642	22	6-31	91	39-125	156	130-211
Perennial	0	0	232	216-260	265	160-360
PM 660	9.4	4-19	209	176-300	225	180-322
PM 662	0.5	0-1	170	120-260	216	116-264

During the successive back-crosses to the susceptible varieties "Yolo Wonder" and "Yolo Y", the distribution of the plants in the segregation populations with regard to the number of local lesions is always bimodal, the two classes, of equivalent importance, corresponding to parental phenotypes (figure 1).

After 4 back-crosses to "Yolo Wonder" or "Yolo Y" and 2 selfing, homozygous lines are obtained wich are similar to "Rama", reducing the number of local lesions by a factor 200 to 300. This property is also effective against normal, virulent strains of CMV but the reduction fractor is then much less (around 10) (table 2).

R^2 (Rama x YW^3)

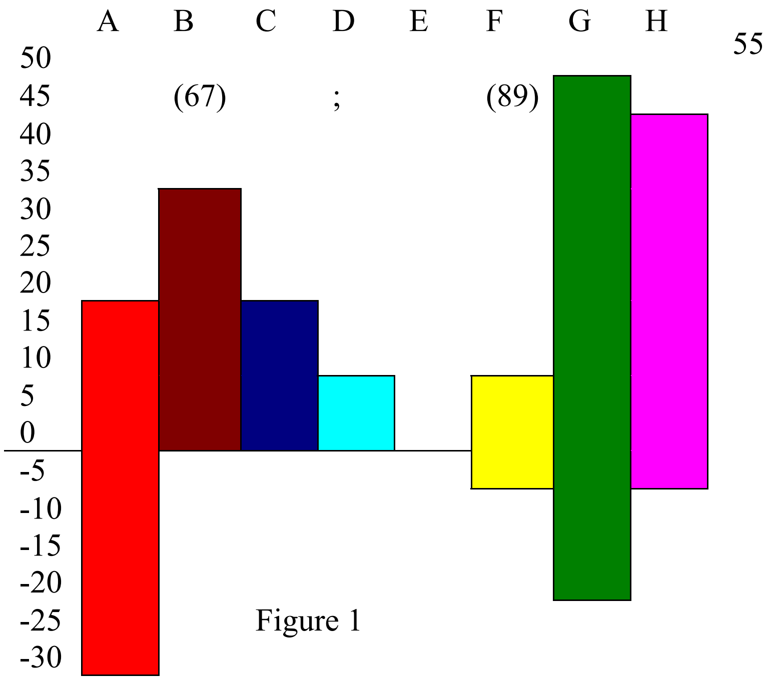

Figure 1

Figure 1. Distribution of the plants in the second back-cross "Rama" x "Yolo W."3 or x "Yolo Y"[3] and in the parents (below) for the number of local lesions on adult leaves (CMV-N); A=0; B=1-2; C=3-6; D=7-14; E=15-30; F=31=62; G=63-126; H>127

R^2 (Rama x YY^3)

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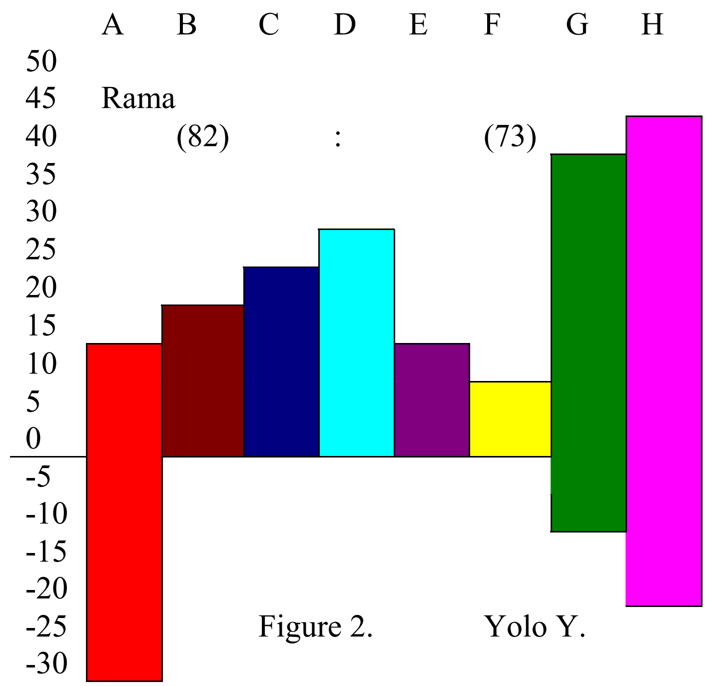

Figure 2.

Strain	Genotype $^+/^+$			Genotype Riv/Riv			Ratio
CMV-N	Yolo W	104.4	± 12.7	(Rama x YW^5)	0.37		284/1
CMV-N	Yolo Y	144.4	± 19.8	(Rama x YY^5)	0.55		259/1
CMV-TL	(Rama x YW^5)	110	± 22	(Rama x YW^5)	13.3	± 3.9	8/1

The observations tend to show the existence of a major dominant gene controlling a quantitative effect: the reduction of the probability of an effective multipublication of CMV in the pepper leaves after mechanical inoculation. We propose, for this gene, the symbol Riv: resistance to infection by viruses.

It appears, indeed, that the effect of this gene is not limited to a single virus. It modifies also the reaction to TMV in the presence of L gene. In this case, the number of lesions is not modified but the type of the lesions wich are smaller, turning more slowly to vein necrosis and leaf abscission (table 3).

Table 3. Pleiotropic effect of Riv gene in response to CMV (number of lesions on the 4th leaf) and to TMV (speed of vein necrosis). Independant notation by two groups of observers; CMV "Rama" 0 lesion, "Yolo W." 1 to 20 lesions; TMV: "Yolo W." or "Yolo Y": quick vein necrosis; "Rama" gives very small lesions, probably liked to a particular L allele lost during the back-crosses; number of plants of the 4th back-cross in each class.

Family	Recurrent parent YW					Recurrent parent YY				
	CMV/TMV	slow	int.	quick	2I		slow	int.	quick	2I
A	(0)	22	8	2		C	22	3	0	
	(1-20)	2	5	21	38.2*		5	2	28	48.9*
B	(0)	20	5	1		D	24	6	1	
	(1-20)	3	7	24	39.6*		3	5	21	41.0*

2I test : * probability less than 0.001 for random distribution.

A case of partial resistance to several different viruses was studied more than 20 years ago by Holmes, in the Tobacco (2). In the line TI 245 and its progeny, the number of local lesions and, sometimes, the size of the lesions are modified. This behavior is controlled by 2 incompletely recessive genes.

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THE VALUE OF BACTERIAL LEAF SPOT RESISTANCE GENES IN S.E. QUEENSLAND

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Selection for resistance to leaf spot incited by Xanthomonas campestris pv. vesicatoria (Doidge 1920) Dye 1978 was practised amongst field planted progeny of the cross Yolo Y (susceptible) x Hungarian Yellow (partially resistant) during the years 1979/81.

Several F_6 lines varying in fruit size and colour were yield trialled against bell cultivars in a naturally heavily infected planting in autumn 1981. Infection originated from a nearby manually innoculated planting of other selected material. The following mean yield data were obtained from replicated single row plots of 15 plants with inter and intra-row spacings of 0.85 and 0.40 m respectively.

Cultivar/Breeding Line	Mean Yield per 15 Plant Plot		Wt. Per Fruit	Bact. Spot
	Number Fruit	Weight (kg)	(g)	Rating[1]
Yolo Y	9.0	1.53	174	8.5
Tambell I	16.7	1.86	113	8.1
Maor	9.7	1.36	146	7.7
Bellamy	1.7	0.22	130	8.3
*C26	120.0	8.18	68	6.3
*C7-1	82.7	9.91	120	5.4
*G72-1	90.7	10.68	118	5.8
CV%	28.7[2]	23.6[2]	9.0	5.8

1. Bacterial spot severity rating was on a scale of 2-9 with 2 being extremely resistant, 5 partially susceptible, and 9 extremely susceptible.

* Breeding lines. These matured fruit from first flush of flowers - all others did not.

2. High CV's due to erratic yield of cultivars Yolo Y, Tambell I, Maor and Bellamy under heavy disease pressure.

These data indicate the yield benefit conferred by partial resistance, and the extreme susceptibility of commercial cultivars.

Other progenies are established to gain greater bacterial spot resistance (ratings 2 and 3 for severity) than from this cross.

COMPARISON OF THREE DIFFERENT SOURCES OF RESISTANCE TO PHYTOPHTEORA IN CAPSCIUM ANNUUM.

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It has been shown, previously that the partial resistance issued from line "PM 217" (derived from "PI 201234') comprises at least 3 different components (1). It was soon recognized that most part or the resistance was induced by the fungus itself (2, 3). This central mechanism is flanked by 2 components: one preexisting to infection (= receptivity), the other modifying the duration of the induced resistance (= stability).

Two Capsicum annuum lines of Mexican origin (4) are studied at 2 temperatures and compared to "PM 217" and "Phyto 636" (issued from "PM 217" but less resistant for their reaction to 3 P. capsici strains, the most aggressive and/or weakly inductive isolated in south-eastern France.

The infection test on detopped plants follows the method already described (1).

The 3 components of the resistance are easily identified, every line being remarkable with regard to a particular component.

Line "Criollo de Morelos 334", of the "Serrano" type (S.C.M.) shows a very low receptivity, i.e. slow initial seed of stem necrosis whatever the strain or the temperature used (table 1).

Table 1. Receptivity: mean speed of stem necrosis (mm.day^{-1}) during the 3 days following inoculation, at 2 temperatures: 3 very aggressive strains S73, 107, 197; F test: deg. of freedom for error: 33 and 15 (22°C and 32°C) * probability less than 0.001.

	22°C			32°C		
	S73	S107	S197	S73	S107	S197
Phyto 636	9.5	9.1	8.9	13.7	13.6	13.5
PM 217	10.5	9.7	8.1	13.7	14.0	11.3
L29	10.4	9.5	8.7	12.4	12.2	12.7
S.C.M.	7.0	5.9	5.9	7.3	6.3	5.7
F Test	36.5*	35.7*	33.6*	25.8*	27.7*	49.7*
S.C.M./PM 217	0.66	0.61	0.73	0.53	0.45	0.50

Line "L29" shows a better inductibility than the other genotypes for all the temperature and strain combinations (table 2).

Table 2. Inductibility deceleration of the speed of stem necrosis between 3rd and 7th day (22°C) or 3rd and 5th day (32°C), in $mm.day^{-2}$; same strains as in table 1; Duncan test: a, b, c: significative difference at level 0.01.

	22°C				32°C			
Variety	S73	S107	S197	mean	S73	S107	S197	mean
Phyo 636	-0.51	-0.59	-0.47	-0.52 c	-2.50	-2.41	-1.29	-.207 b
PM 217	-0.55	-0.32	-0.18	-0.35 c	-1.03	-1.59	-0.67	-1.09 c
L 29	-1.70	-1.74	-1.12	-1.52 a	-3.26	-3.82	-3.46	-3.51 a
S.C.M.	-1.29	-1.20	-0.72	-1.07 b	-2.46	-2.29	-1.88	-2.21 b
L29/PM 217	3.1	5.3	6.3		3.2	2.4	5.2	
Strains	-1.02 a	-0.96 a	-0.64 b		-2.31 ab	-2.52 a	-1.82 b	

Line "PM 217' has the best ability to maintain an effective induction of resistance during a long period (the best stability). On the Contrary, the resistance appears unstable in "Phyto 636" and "L29": the speed of stem necrosis is increasing again after 14 days (22°C) or 10 days (32°C) (table 3).

Table 3. Stability of induced resistance: comparison of the speed of stem necrosis during two successives periods: 10-14th and 14-17th day (22C) or 7-10th and 10-14th day (32°C) (in $mm.day^{-1}$).

22°C		10-14th day		(A)		14-17th day		(B)	Ratio
	S73	S107	S197	mean	S73	S107	S197	mean	B/A
Phyo 636	2.38	3.29	6.31	3.99	1.83	2.69	7.06	3.86	0.96
PM 217	2.79	3.95	3.69	3.45	1.31	1.58	1.47	1.45	0.42
L29	0.08	0.23	0.92	0.41	0.06	0.44	1.19	0.56	1.37
S.C.M.	0.04	0.10	0.13	0.09	0.06	0.08	0.08	0.07	0.78
32°C	7-10th day				10-14th day				
Phyo 636	5.44	8.44	11.44	8.44	5.92	7.36	13.41	8.91	1.06
PM 217	6.83	7.50	4.89	6.41	0.96	0.92	1.67	1.18	0.18
L 29	0.78	1.83	1.17	1.26	0.46	1.38	3.29	1.71	1.36
S.C.M.	0.33	0.06	0.17	0.19	0.08	0.29	0	0.12	0.70

The two new sources of resistance to P. capsici of Mexican origin appear very efficient for the control of the most dangerous strains isolated in France. Differences between strains of the fungus appear quantitative. Specific interactions (for example, S197 on "Phyo 636") are probably linked to threshold effects (in this case, the least inductive strain on the most unstable line tables 2 and 3).

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TRANSMISSION OF RESISTANCE TO PHYTOPHTEORA CAPSICI ON ROOTS AND STEMS OF PEPPER PLANTS : STUDY OF DOUBLED HAPLOID LINES ISSUED FROM THE CROSS "PM 217" x "YOLO WONDER" THROUGH ANTHER CULTURE.

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Two methods of artificial inoculation are currently in use for the quantitative evaluation, at the level of individual plants, of the resistance to Phytophthora capsici Leon. In the first one, plants are detopped before anthesis and the stems are inoculated by mycelial discs. The speed of the stems necrosis is recorded twice a week during 3 weeks (1,2). This test needs time and space I growth chambers. The second method is based on the inoculation of young plantlets by a suspension of zoospores in a liquid medium, roots being the only organ in contact with the fungus (unpublished method).

Comparison of the two methods on several varieties or lines tend to show a good correspondence, resistance being generally effective in the two types of organs, a few genotypes being resistant only in the stem (unpublished data).

In this study, we are trying to know if resistance in the roots and stems is under the control of the same genes or transmitted, to some extent, independently.

A single cross is studied; "PM 217" (resistant) x "Yolo Wonder" (susceptible to P. capsici). The progeny comprises 27 homozygous doubled haploid lines (DH) obtained from the F1 through anther culture (3). The two inoculations are made independently with the strain S101, moderately aggressive and very inductive of resistance mechanisms (1).

Test on the stem of adult plants follows the current process (1). For the test on the roots, the seeds are sown in a 2:1 mixture of peat:sand. Fourteen days later, young seedlings are gently uprooted and samples of 25 plantlets are put together into glass jars filled with 100 ml of a nutritive medium. On the 7th day, the level is adjusted so that only a limited portion of the roots dives into the medium. The root tips are cut off and a disc of fungal culture is added, without direct contract with the roots. Zoospores are emitted in the liquid medium one day later. Symptoms are recorded five days later according to the following scale: 0 = no symptom; 1 = slight root browning; 2 = browning or necrosis of the root up to the crown; 3 = partial necrosis of hypocotyle axis, adventitious rooting prevented; 4 = severe lesions on axis and wilting; 5 = plants destroyed. The susceptibility index of a sample is the sum of individual notes, 125 being the maximum.

The results are summarized in table 1. It appears a continuous gradation between completely susceptible (eventually more susceptible than "Yolo Wonder") up to fairly resistant DH lines. Considering the 2 types of test on the 29 genotypes (DH and parents), it does exist a good correlation between roots and stems scaling (table 2).

Table 1. Susceptibility index of parental lines and homozygous doubled haploids progenies (DH) towards P. capsicum strain 101; test on the roots of young plantlets (A:0 to 125) and test on the stems of adult plants (B1 : initial speed of stem necrosis; B2 minimum speed of stem necrosis during the first 3 weeks, in $mm.day^{-1}$); left : resistant or partially resistant genotypes; right : susceptible genotypes at the seedling stage.

Genotypes	A	B1	B2	Genotypes	A	B1	B2
PM 217	4	3.7	0	Yolo Wonder	114	9.0	7.9
DH 306	0	4.9	0	DH 301	125	8.7	8.9
DH 315	3	6.1	0.7	DH 311	125	7.3	2.7
DH 322	9	4.7	0.3	DH 342	125	6.2	0.1
DH 324	18	5.3	0	DH 347	125	9.4	8.5
DH 340	43	4.2	0.1	DH 348	125	6.2	0.9
DH 313	46	5.4	0	DH 326	123	10.2	9.8
DH 337	49	4.2	0.1	DH 308	122	8.0	5.5
				DH 319	122	8.7	3.6
DH 318	74	5.0	1.5	DH 323	120	7.7	3.1
DH 314	74	7.1	2.5	DH 317	117	7.9	1.7
DH 327	77	6.0	1.5	DH 310	106	8.3	5.9
DH 321	81	6.2	1.5	DH 320	106	8.7	7.5
DH 309	85	6.5	2.9				
DH 329	89	6.2	1.6				
DH 330	90	5.8	0.7				
DH 328	94	6.8	1.1				

Table 2. Correlation between susceptibility index on the roots at the seedling stage (A) and the speed of stem necrosis at adult stage: B1 or B2 as in table 1; 27 DH lines + 2 parents; * probability less than 0.01.

Origin	Correlation Coefficient	Regression	F test
A and B2	r = 0.775	Y = 4.16 + 0.031x	40.4*
A and B1	r = 0.616	Y = -0.85 + 0.044x	16.5*
B1 and B2	r = 0.887	Y = -7.93 + 1.598x	99.7*

Nevertheless, a part of the resistance could be organ specific. If all the root resistant, lines show a low receptivity and a high inductivity in the stem (1st group, table 1), the group of 12 DH lines as "Yolo Wonder" on the roots appears heterogeneous : 2 line (DH 342 and 348) as are resistant in the stem in spite of root sensitivity.

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AGGRESSIVITY OF VARIOUS PHYTOPHTEORA CAPSICI ISOLATES FROM TURKEY ON TWO PARTLY RESISTANT PEPPER LINES

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Pepper, Capsicum annuum L. , is a very important crop in Turkey. Its production varies around 500-600 000 tons per year. The root rot brought about by Pytophthora capsici is the main limiting factor for pepper crop in most areas. Appearance of this fungus in Turkey was reported for the frst time by Karahan and Maden in 1974 (1). In our first studies, 8 lines were tested for resistance (2). Among them "PM 217" was the only genotype sufficiently resistant. In 1979, we started a crossing program using "PM 217" as resistant parent (3).

The aim of the present study is to compare the aggressivity of 12 new P. capsici isolates obtained in different areas of Turkey to that of 2 well known isolates from France and to evaluate relative efficienty of "PM 217" an "Serrano Criollo de Morelos" (S.C.M.) as potential genitors of resistance. This last material is given for resistant to all the Mexican strains (Guerrero-Moreno and Laborde, 4). In the trails, a susceptible control genotype is added "Ata 100".

Pure culture of the fungus are prepared on V8 juice-agar and the plants are grown in a greenhouse until they had 7 or 8 expanded leaves, then transferred to a growth chamber at 22°C and 12 h photoperiod. They are inoculated at the apical part of the stem following a method previously described (5). The length of necrosis is measured twice a week during 3 weeks and the speeds of progression are calculated for periods of 3 or 4 days.

Results are presented in tables 1 and 2.

All the Turkish isolates are pathogenic and most of them are very aggressive. Significant differences appear in "PM 217" for the 3 studied parameters. On this variety, some Turkish strains (T12, T10) are probably more dangerous than S197: the minimum speed of necrosis does not fall below 3.5 mm a day. No significant difference is discernible in S.C.M.

The Mexican line appears very interesting. The initial speed of necrosis is slower than in "PM 217" and begins to decrease 3 days after inoculation, while this is happening between the 7th and 10th day in "PM 217". Consequently the length of the necrosis is much shorter.

Table 1. Effect of isolates on the speed of stem necrosis (in mm.day^{-1}) on three pepper varieties. Values followed by different letters in each column differ significantly at the 0.05 level.

Isolates	Initial speed of necrosis			Minimum speed of necrosis		
	ATA 100(S)	PM9 217 (R)	S.C.M. (R)	ATA 100(S)	PM 217 (R)	S.C.M.(R)
T1	19.7 a	9.2 b	6.4	8.8	0.2 bc	0.8
T2	12.2 cde	7.9 cde	6.2	11.6	0.1 c	0.3
T3	15.6 b	7.2 def	5.4	9.0	1.3 bc	1.0
T4	12.4 bcde	7.1 ef	6.9	10.1	2.0 abc	0.2
T5	13.7 bcde	6.4 fg	6.0	8.6	0.3 bc	0.0
T6	12.5 bcde	7.3 def	6.8	11.0	2.3 ab	1.6
T7	10.9 de	6.5 fg	6.4	9.4	1.4 abc	0.5
T8	15.4 bc	8.7 bc	6.0	8.7	1.7 abc	0.5
T9	15.9 b	8.3 bcd	7.1	6.7	1.7 abc	0.1
T10	12.7 bcde	7.2 def	5.9	9.1	3.5 a	1.1
T11	11.8 de	7.2 def	6.4	8.2	0.9 bc	0.9
T12	14.3 bcd	8.8 bc	7.2	9.6	3.6 a	0.4
S101	10.2 e	5.5 g	3.9	8.8	0.8 bc	0.5
S197	14.2 bcd	10.7 a	7.0	9.5	1.8 abc	1.1

Table 1. Effect of isolate aggressivity on the final length of necrosis in the two resistant lines.

Isolates	PM 217	S.C.M.	Ratio SCM/217
T12	157 a	44 abc	0.28
T10	130 ab	49 abc	0.38
T197	129 abc	62 a	0.48
T9	123 bc	34 bc	0.28
T6	121 bcd	62 a	0.51
T8	121 bcd	43 abc	0.36
T1	112 bcd	44 abc	0.39
T4	110 bcd	37 bc	0.34
T2	109 bcd	35 bc	0.32
T3	106 bcd	50 ab	0.48
T11	104 bcd	43 abc	0.41
T7	102 cd	43 bc	0.42
T5	95 d	37 bc	0.39
S101	54 e	30 c	0.55

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RESISTANCE IN CAPSICUM TO PHYTOPHTHORA CAPSICI INTRODUCED BY USING GAMMA-RAYS

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Among the many cultivars of Capsicum annuum L. including the French resistant line "Phyo 636" so far tested we have not found out one single cv cully resistant to our isolates of Phytophthora capsici L. We have so tried to introduce resistance by using gamma rays. For this purpose we exposed the susceptible "Yolo Wonder" seed to 7,000 Rads. Since May 1981 we have inoculated nearly 10,000 seedlings M_2 derived from 941 progeny M_1 which in turn were derived from irradiate seeds. The fungus was grown into 90 mm diam. Petri dishes on V-8 juice agar at 21±1°C for 7 days with an on/off light cycle of 12 h. Inoculum was prepared by adding 1.000 mL distilled water to each Petri dish in a Sorvall ONMI-MIXER. This material was homogenized at half sped for 25-30 sec. Ten ml of the inoculums were pipetted into each pot containing plants in the two-to four-leaf stage. The pots were watered immediately after inoculation and at alternate days thereafter.

The results so far obtained are as follows: 115 plants M_2 of 55 progeny M_1 do not seem suscettible to the root rot caused by P. capsici. We hope that the resistance will be maintained in the M_3 progeny.

VIRULENCE VARIATION AND DIFFERENTIAL HOST REACTION OF COLLETOTRICHUM SPP. ON CHILLIES (Capsicum annuum L.)

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Three isolates belonging to Colletotrichum capsici and one to C. gloeosporoides were tested on eight different genotypes viz. Longi (local) S_{41-1}, H_6, H_1, S_{20-1}, S_{118-2}, Perennial and Lorai for their pathogenic ability. The varietal reaction indicated that the variety Longi was highly susceptible followed by S_{41-1}, S_{20-1}. The varieties like Perennial and Lorai revealed some degree of resistance.

The studies also indicated that isolated from Jullundur was the most virulent whereas the other obtained from Nakodar ws the least. The degree of virulence of C. gloeosporoides was less than the isolates of C. capsici. The specific interaction between varieties and Colletotrichum spp. Was also studied and it was found S_{41-1} and S_{20-1} were in general susceptible to all the four isolates whereas Perennial H_6, H_1 and Longi showed distinct differential host response. The variety 'Lorai' was resistant to moderate resistant to all isolates tested.

RESISTANCE OF CAPSICUM TO ROOT-KNOW NEMATODES (MELOIDOGYNE SPP.)

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In Italy root-knot nematodes, Meloidogyne spp., greatly reduce the yield of pepper (Capsicum annuum L.), especially in intensively cultivated areas (Di Vito et al., 1982; Lamberti, 1979). Chemical control of plan parasitic nematodes is expensive, requires appropriate equipment and may cause general pollution (Basile et al., 1979). Resistant cultivars can provide effective, safe and cheaper control of these pests. Therefore, several years ago and investigation was initiated with Capsicum spp. To identify genes which were responsible or resistance to Meloidogyne spp. (Di Vito and Saccardo, 1979) and to transfer this resistance into Italian cultivars of pepper. Lines of C. annuum, C. chacoense Hunz, C. chinese Jacq., C. frutescense L. and C. pendulum Wild., were tested for their reaction to some Italian populations of M. incognita (Kofoid et White) Chitwood, M. javancia (Treub) Chitwood and M. arenaria (Neal) Chitwood. All lines of C. frutescens and C. annuum tested were highly moderately resistant, respectively, to all species of root-knot nematodes. An exception was "Tabasco" of C. chinese, which was resistant only to M. incognita and M. arenaria. The reaction was tested on F_1, F_2, and F_1BC_1 progenies obtained by crossing a resistant line of C. frutescens with the Italian cultivar "Corno di Toro Rosso", which is susceptible to M. incognita. The results showed that 100, 72 and 42%, respectively, of the three progenies were resistant to M. incognita. Therefore, it appears that genetic resistance to M. incoginita in C. frutescens is monogenic dominant.
A similar study, using C. chinense, revealed that in this species genetic resistance to root knot nematodes is due to recessive factors (Di Vit, 1979).

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PEPPER INTRODUCTION AND BREEDING IN BULGARIA

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Pepper is basic and traditional vegetable crop in Bulgaria of great economic importance. It covers an area of 12% in the vegetable - growing; 73% of green and red pepper are grown for the home market, 7% - for grinding and 20% - for export. High yielding pepper with good quality is produced due to the favorable climatic and soil conditions in combination with the great experience and mastership of the gardeners in pepper growing. The average ha yield for the country is approximately 20 tons, while this obtained by the leading growers in some cultivars reaches 70-80 tons.

Pepper fruits in technical and botanical ripeness contain many nutritional substances and vitamins valuable for the system (Table 1). Fruit dry matter ranges 8, 5 - 12 % in sweet peppers and reaches 20% in hot peppers destined for grinding. Vitamin C content varies between 114 and 168 mg % in green peppers; 185 and 268 mg % in red peppers and over 300 mg % in small hot peppers (chilies shipkas). Sugar content varies between 2, 70 and 6, 90 acids between 0, 124 and 1, 410 mg % and carotine between 3, 76 and 16,8 mg %.

For the successful development of pepper growing plant introduction and plant breeding have played and continue to play a very important role. Those two activities originate from more than 3 and a half centuries. First of all known and unknown in those days Bulgarian amateurs and gardeners and folk breeders introduced and spread this crop beyond our regions following their intuition. Later on the dilletantish pepper crop turned to be a basic vegetable crop.

Throughout many decades gardeners carried out selection in pepper and developed their own varieties and populations like ‘Kalinkovski’, ‘Merinkovski’; ‘Baiyovski’; ‘Djylyunska Shipka’; ‘Shumenski ratund’ and others that became pure bulgarian varieties. Traveling Bulgarian gardeners carried those varieties away from Bulgaria to neighbour countries - Romania, Yugoslavia, Hungary, Russia etc. where they were used as initial material for pepper breeding in the institutes and breeding stations of those countries.

Real pepper introduction and breeding on a scientific base started in 1932 by academician Ravel Popov, Agricultural Experimental Station, Plovdiv (6). On the base of introduced varieties and mostly local pepper populations here was established a rich collection plantation in which using the mass and individual selection method were developed varieties like ‘Sivriya 600’, ‘Kalinkov 805/7’, ‘Pa zardzhishka kapiya 794’, ‘Gorogled 6’, ‘Novoselska kapiya 379’, ‘Zelen ratund 1071’, ‘Djyulyunska shipka 1021’, ‘Kozi Roga 59’ etc. Some of those varieties are still taking a large part in the variety structure of pepper crown in Bulgaria.

After the triumph of the Socialist Revolution in 1944 introduction and breeding activities in pepper expanded and extended. Pepper collection in the Institute of Introduction and Plant Resources, Sadovo, includes by the end of 1981 - 1191 accessions (Table 2).

Each variety and accession of the collection is estimated by its most important morpholoical, agrobiological and economic characteristics, important for pepper breeding and pepper growing. Data are stored in a computer for processing and utilization.

Using the genetic resources collected, plant breeders from the Institute ‘Maritza’, Plovdiv, Institute of Genetics, Sofia have in the period of 1962 - 1972 bred heterosis pepper varieties: ‘Kalinkov’ x ‘Sivriya’; ‘D 103’ x ‘Pazardzhishka kapiya’; ‘D 103’ x ‘Byala kapiya’; ‘Gorogled’ x ‘Kalochenski’; ‘Kalinkov 805’ x ‘Severen Tzar’ etc. Characteristic for those varieties were their high productivity, high index of early maturity, good fruit uniformity. But labour-consuming hybrid seed production was the reason that those varieties were not used widely in the production practice.

Considerable research on introduced and local variety populations and breeding new pepper varieties was done in the same period at the Experimental Station, Negovan, Sofia. New pepper varieties ‘Byala kapiya 1’, ‘Zlaten medal 7’ and ‘Sofiiska kapiyq’ by the method of individual selection of the popultion of ‘Byala kapiya’ were bred here. Those three varieties take up to 40-50% of the pepper areas in our country (1, 2, 3).

Pepper varieties ‘Byala kapiya’ and ‘Sofiiska kapiya’ have the same growth habit, form of fruits and flesh consistency, but different colour of fruits. In techical ripeness the fruits of ‘Byala kapiya 1’ are white green in colour while fruits of ‘Sofiiska kapiya’ - dark green. Besides for fresh consumption both varieties are suitable for pickles and canning. They are high yielding varieties – 3-5 tons/dka. Their vegetation period is 140-150 days.

Pepper variety ‘Zlaten medal 7’ is one of the earliest maturing and most grown varieties. It is unequalled in productivity. It yields 7-8 tons/dka. Its fruits are 15-18 cm long with a diameter of 6-7 cm, light green to milk-green in colour in technical ripeness and red with a shade of orange - in botanical ripeness. SW table for salad, pickles and canning.

A great achievement in bulgarian pepper breeding is the variety ‘Buketen 3’ bred in IZK ‘Maritza’, Plovdiv (8). Its fruits are projecting piled in clusters, suitable for mechanical harvesting. This variety is destined for grinding and the red pepper obtained is with a high dry matter content and rich in capsantin.

A newer variety is ‘Buketen 50’ which exceeds ‘Buketen 3’ in higher intensity of fruit colouring substances.

Latest achievements in pepper breeding in the last 2-3 years are the direct varieties ‘Albena’ (4), ‘Kamchiiska kapiya 2’ and ‘Ruben’ (6). The newly bred direct and heterosis varieties are distinguished for high productivity and good biochemical qualities.

The main tendency in pepper breeding today is to develop disease resistant, early maturing, uniformly ripening varieties suitable for mechanical harvesting as well as hybrid varieties on male-sterility base.

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Table I. Chemical composition of fruits in some pepper varieties.

Variety	Green fruit				Red Fruit			
	Dry matt. %	Vit C mL%	Sugars total %	Acids (malic)%	Dry matt. %	Vic C mL %	Sug tot. %	Acids (malic)%
Shumenski ratund	8, 82	155	3,35	0, 234	11,42	185	3, 89	0, 261
Pazardzhishka kapiya	7, 86	114	3,37	0, 175	12,29	219	6, 02	0, 336
Byala kapiya	8, 22	149	3,89	0, 124	11,25	216	6, 46	0, 282
Zlaten medal	8, 21	135	2,70	0, 125	10,54	199	4, 75	0, 590
Djulyunska shipka	14, 75	168	4,33	0, 360	22,36	258	6, 90	1, 410

Table 2. Structure of the pepper collection available at the Institute of Introduction and Plant Resources, Sadovo, by December 30th, 1981.

Type of collection varieties	Number of accessions
1. Introduction varieties	1004
2. Local varieties and variety populations collected during expeditions inside the country	155
3. Distributed varieties	32
T O T A L	1191

HOW TO USE SYNTHETIC VARIETIES IN PEPPER

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In order to meet the needs of growers to develop more efficient technologies, and save the environment from undue pollution we are able already to offer resistance to strains of tobacco mosaic virus /TMV/ Tomato mosaic virus /ToMV/, cucumber mosaic virus /CMV/, verticillose, bacteriose /Xanthomonas vesicatcria/, spider mite, moreover in the future to potato virus Y /PVY/, Phytophthora capsici and root knot nematods, incorporated into new Hungarian varieties, variety candidates and breeding lines.

Our final project, i.e. to combine most of those qualities in a single genotype cannot be accomplishedas quickly as the changes in the growing praxis and in consumption may require it. However, breeding lines belonging to the main types of pepper varieties grown in Hungary, “Fehérözön” and “Táltos”, are representative for one or two of the resistances or tolerances mentioned above. Those lines are eligible to be combined into synthetics within a period of some years ready to be grown on a countywide scale according to the actual needs determined by the ruling epiphytotics or pests. As the pepper may be highly autogamous, the constituent lines ought to be combined in a diallele, and the F_1 comvinations grown together, mixed I adequate ratios to be open pollinated and selfed up to the F_4 generation, when the quantity of seed is sufficient for distribution.

The same procedure may apply to other agronomical traits alternatively suitable to different technological or local conditions and thus minute intergradations can be can be obtained, provided the most important characters are held uniform.

As the recombination of genes may continue in a synthetic variety by intercrossing, uncontrolled change od quantative traits may occur, therefore synthetics ought to be renewed within short terms.

BREEDING FOR MECHANICAL HARVESTING

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The aim of the research about peppers is to obtain cultivars with high concentration of fruit maturation and with low fruit detachment force for mechanical harvesting.

Moreover, researches about a new prototype of pepper harvesting machine are carried out. The fundamental mechanism of the prototype is made by two conical rollers, one clockwise moving the other counter-clockwise moving. The detachment of peppers is caused by a twisting action on the fruits.

EFFECT OF METEOROLOGICAL ELEMENTS ON THE CAPSANTINE CONTENT OF TWO PEPPER VARIETIES

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Effects of meteorological elements on the capsantine content in the new selection KORAI PARADICSOMALAKU and in the variety PARADICSOMALAKU ZOLD PALLAGI were observed over five years.

We have found that:

1. There is a positive correlation between capsantine content and gcal/cm^2 values, consequently the effect of meteorolonical elements can be measured with gcal/cm^2 values.

2. ‘The differences among the gcal/cm^2 values related to the capsantine content of both paprika varieties is not significant therefore.

3. No significant difference is found between the two paprika varieties either in components compared earlier in capsantine content.

4. Capsantine content in tomato-shape paprika varieties is favorably influenced by the temperature maximum and number of sunshine hours as they increased the value of gcal/cm^2 too.

<u>EVALUACION DE LINEAS DE AJI CAPSICUM</u> SP.

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La evaluación de líneas de ají constituye uno de los proyectos de línea que se vienen realizando periódicamente para evaluar, propagar, y mantener las diferentes líneas que se encunetran en el Banco de Germoplasm. En la presente oportunidad se evaluaron 89 líneas de las cuales correspondieron a : Capsicum baccatum, var. pendulum, 43 líneas Capsucum annum 20 límeas. Capsicum Chinensis 18 líneas; Capsicum frutescens 8 líneas. Se senalan las características principales para diferenciar una especie de otora. Las líneas de Capsucum frutescens florearon muy poco y su fructi_ficación fue muy deficiente. De todas las líneas se obotovo semillas que fueron guardadas en el Banco de Germoplasm.

STUDIES OF SOME FACTORS INFLUENCING GERMINATING POWER IN PEPPER SEEDS DURING STORAGE

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The germinating power of pepper seeds as required by standard can be maintained in general for 3 years with usual storing methods. Unfavorable environmental conditions, however, can result in earlier deterioration.

Storage trials beginning in 1972 and aiming at preserving pepper seed quality, revealed factors having a decisive part in influencing viability.

Using proper drying methods, seeds of 8-10 % moisture content are best suited for long-term storage. No advantage was observed when drying seeds to lower water content.

Temperature between 5-10°C favored pepper seeds. ± deviations caused some decrease in the germinating power.

Results indicate that viability of seeds can only be maintained for longer period if the water content remains constant. Containers are needed in which seeds, despite of changes of temperature and air humidity of the store room, are able to keep moisture constant.

Hermetically sealed glass jars and plastic bags can be used with best results. According to our results air-tight sealing of the container is the most important factor influencing viability.

In our experiments of 9 years, pepper seeds maintained their initial viabi1ity 9 years under optimal conditions, described above. Plants issued from those seeds were not inferior to others in development and productivity.

Table 1.

Evolution of germinating power in a bell pepper variety from 1972.

Treatments			Year of germination					
Solidscontent of seed	Way of storage	Storage temperature	1973 Germinating Power %		1977 Germinating Power %		1981 Germinating Power %	
93% /Without afterdrying/	Cheesecloth bag	Room temperature 5-10°	77 77	95 95	- 81	- 88	- 3	- 5
	Glass Jar	Room temperature 5-10°	77 77	95 95	86 87	92 93	74 67	94 96
95% / With after drying/	Glass Jar	Room temperature 5-10°	74 74	94 94	86 94	89 96	67 67	93 92
	Plastic flask	Room temperature 5-10°	78 78	90 90	95 49	97 85	88 70	95 94
96% /With afterdrying/	Glass jar	Room temperature 5-10°	86 86	90 90	90 78	94 86	76 87	93 96
95% /With after drying/	Polyethylene bag	Room temperature 5-10°	78 78	90 90	13 89	42 92	- 3	- 8
	Aluminium foil	Room temperature 5-10°	78 78	90 90	- 90	- 95	- 4	- 9

RESEARCH ON THE STORAGE OF THE SWEET PEPPER SEED. EFFECTS OR THE ENVIRONMENT CONDITIONS ON ITS AGEING

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

Within the scope of a programme financed by the Ministry of Aguiculture and Forestry, the research on the effects of environment conditions of storage or the viability of pepper seed was started in 1980. The research had also the purpose to check whether there are differences concerning the storability of the seeds of different genotypes. The research started on commercial seed of the 'Quadrato d'Asti qiallo', having at the beginning the following distinctive features:

weight of 1000 seeds	q	6, 668
moisture		5, 88 %
percentage of germination		87 , 5 %
ungerminated fresh seeds		0, 5 %
dead seeds		7, 5 %
abnormal seedlings		4, 5 %

Storage treatments consist in the combination of three temperatures (room temperature, 25°C and 35°C) and four levels of relative humidity (20 - 35 - 55 - 75 %), which have been obtained by means of saturated solutions of respectively: potassium acetate, magnesium chloride, calcium nitrate, sodium chloride.

In the first place the time necessary for the seed samples to reach equilibrium with the relative humidity in the different environment conditions has been checked; the level of humidity reached has been tested as well: the period of time ranged from 42 to 56 days, the humidity reached varied from 4, 86% (35°C - 20% R.H.) to 9, 85 % (35°C - 75% R.H.).

Subsequent germination tests repeated at least at three months intervals have shown the rate of the loss of viability in relation to the passing of time. At 76% R. H. the percentage of germination is highly reduced or completely eliminated after only four months at temperatures of 25°C and 35°C. Low R. H. (20 and 35 %) highly reduce the differences of the effects of the temperatures. High R. H. seem to cause dormancy. The checks are still being carried on now and will go on until the death of the seeds or the exhausting of the samples.

ANNOUNCEMENTS

Bulgaria

5th Meeting of *Capsicum* Working Group of EUCARPIA

Plovdiv, July 4-7, 1983

The meeting is organized by the Institute of Genetics at the Bulgariani Academy of Sciences.

The topics of the meeting are: taxonomy and cytogenetics: genetics and breeding; physiology and biochemistry; resistance to diseases and parasites; seed production.

For further information, please contact the secretariat of the meeting on the following address:

Bulgaria, Sofia 1113
Bulgarian Academy of Sciences
Institute of Genetics
Capsicum Eucarpia Meeting

Italy

The Proceedings of the Eucarpia Meeting on "Genetics and Breeding of *Capsicum*" held in Turin in 1971 are still available.

If you are interested to receive them, you can address to:

Institute of Plant Breeding and Seed Production
Via P. Giunia, 15
10126 Torino, Italy

Mexico

On June 22-24, 1982 took place at San Miguel Allende, the National Pepper Conference organized by the Instituto Nacional de Investigationes Agricolas. The Chairman of the Conference was Dr. J. A. Laborde C. to whom you can get in contact for further informations. You can address to:

C. A. E. B.
Apartado 112
38000 Celaya, Gto.
Mexico

Peru

The Agricultural National University of La Molina - Lima has organized in October 1982 an expedition of one month in the area of Cuzco, Ayacucho and Puno, to search and collect sample of Capsicum and Lycopersicum spontaneous species.
For further information, address to:

Ing. Francisco Delgado de la FIor
Universidad Nacional Agraria
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La Molina, Lima
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STOCKS FOR EXCHANGE

J. Singh

Department of Vegetable Crops, Landscaping and Floriculture, Punjab Agricultural University, Ludhiana 141004, India

Hot pepper genotypes

1. Perennial – Resistant to TMV, CMV, PVY & Leaf curl viruses. Anthracnose (Colletotrichum capsici)

2. S_{20-1} – Resistant to TMV, CMV, -PVY & Leaf curl viruses.

3. S_{41-1} – Resistant to TMV, CMV, PVY & Leaf curl viruses.

4. Lorai – Field resistant to Mosaic & Leaf curl virus and resistant to Anthracnose (Colletotrichum capsici).

5. S_{118-2} - Resistant to TMV, CMV, PVY & Leaf curl viruses.

ANALYTICAL INDEX

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Institute of Plant Breeding and Seed Production

Via P. Giuria, 15
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