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The picture in the cover is derived from the
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FOREWORD

The present issue of "Capsicum Newsletter" shows itself as a 'double number'. So we have been able to recover the delay accumulated in the past years. Beginning from the next issue (the 10th, forecast publication by the summer 1991), we hope to be more punctual and to be able to publish the Newsletter within the forecast time.

In this issue, the invited paper dealts with haploidy and pepper breeding. It has been kindly written by R. Dumas de Vaulx and we are sure that all the readers will find it very interesting. We remind that any suggestion'on subjects and/or authors to be considered for the next issue of "Capsicum Newsletter" will be appreciated.

The survey of 'literature review' is again present in this issue. We hope it will be useful and we impress on the recipients' mind to send us a copy of their articles, mainly those published on journals of limited diffusion.

We have been asked to include in the Newsletter the tomato and to exclude the eggplant. Due to affinity with the EUCARPIA Group to which we refer, we are sorry not to be able to take into account this suggestion. In the meantime we cannot reduce the size of the- journal, as we publish the papers as the authors send us them.

We remind that a service of subsciption to the Newsletter has been activated. The subscription rates are not changed: 20 U.S.D. for normal subscribers and 100 U.S.D. for supporters. The fee has to be sent directly to EUCARPIA Secretariat. Please, do not send us any cheque, for we are not allowed to run any financial activity by Italian law.

Although several contributions have not been accepted, we have not modified any of the published papers. Therefore the authors onl.y are responsible for both the scientific content and the form of the reports.

Again we have to complain about the short observance of the instructions to the authors we give in the sample sheet. Please, cooperate with us following very carefully these instructions. Otherwise we will not accept the contributions and they will be sent back to the authors.

Thank you for your cooperation.

Piero Belletti, Maria Ornella Nassi, Luciana Quagliotti

Turin, 30th September 1990

LIST OF THE AUTHORS

LIST OF THE CONTRIBUTIONS

Capsicum Newsletter, 8-9 (1990), 13-17. Invited paper.

HAPLOIDY AND PEPPER BREEDING : A REVIEW

R. DUMAS DE VAULX

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Haploidy is not a new subject on Capsicum but it has been developed by all increasing number of laboratories for application to pepper breeding during the last ten years .

Haploids of pepper can be obtained by different ways from the female or male gametophyte.

In 1943, Christensen and Bamford reported the spontaneous development of haploids of pepper in the form of twin embryos. Morgan and Rappleye (1950) developed the study of pairs and triplets and obtained moye than 100 haploid plants. In 1954, they showed, that in -9n-n pairs, the -*9n* partnei always results from hybridization and that the haploid partner is always of maternal type.

In 1965, Pochard started an important work on haploidy from twin seedlings. Pochard and Dumas de Vaulx (1971) showed the possibility to obtain haplold plants at sufficient high rates (0.8 per 1000) in agronomical material arid to use it for breeding purposes. Some selected diploidized haploids can give high baploid rates (Morgan and Rappleye, 1950;, Pochard and Dumas de Vaulx, 1971) and enables the breeder to improve varieties for this property.

Parthenogenetic haploid production strongly depends on the genotype of the female parent but also (in the same proportion) depends oil the region whel-e the plaiiLs grew (Pochard and Dumas de Vaulx, 1979).

Some works have been made to increase the haploid rate using interspecific pollinations or pollen treated by chemicals, in order to disturb the second pollen mitosis or the fertilization process. These treatments were riot successful except the application of Nitrous oxide (N20), under pressure on female flower 4 or 8 hours after pollination (Dumas de Vaulx and Pochard, 1974).

From 1973, the in vitro androgenesis has offered new and more efficient (or regular) possibilities to produce haploid plants of pepper. The first haploid plants obtained thanks to anther culture were described the same year (in 1973) by Wang et al. in China and George and Narayanaswamy in India. In 1974, Saccardo and Devreux obtained high percentage of callus formation and they regenerated a few plants from Italian cultivars.

The anther culture technique was then improved by different laboratories. Sibi et al. (1979) published a modified technique with cold pretreatment oij flower buds and specific culture media. An originality of this techniqije was the transfert of the anthers after 12 days of culture on a medium supplied with 2, 4-D and kinetin to a new medium supplied with kinetin but

no 2,4-D. The most important improvement of this technique was the treatment at +350C in darkness during the first 2 or 8 days of cultuie (Dumas de Vaulx et al., 1981) allowing haplmd production f rom a large range of genotypes or cultivars and at sufficiently high rates for practical use (5-10 plants per 100 cultured anthers).

Vagera and Havranek (1983, 1985) showed a significant effect of activated charcoal added in the culture medium for plant production.

Morrison *et al* (1986) obtained haploids from an interspecific hybrid, between *C. annuum* and *C. chinense***,** using cold pretreatment on buds, culture at +35°C for 8 days on a medium containing charcoal.

The effect of low irradiation on buds at the uninucleate micyospore stage was not efficient before anther culture, (Pandeva, 1986). Wu and ZhauL~ (1986) tried to stimulate pollen division by anther treatment w1th acridjnt~ yellow. They only induced anomalies in anther cells, microspores and exine morphology. More recently Munyon *et al* (1989) obtained good results using the incubation of anthers at 29*C under continuous light.

In conclusion, the anther culture technique is now sufficiently elaborated to allow haploid production for practical application to breeding programmes.

Pochard first used pepper haploids

- In the progeny of a haploid plant from the cv. "Doux des Landes", fie found plants with 25 chromosomes. These p1mos have been sm-ted into phenotypic groups corresponding to primary trisomics (Pochard, 1970). Trisomics are usefull to make the chromosome map of the pe"er and recently for application of molecular markers (RFLP).

- In 1971, Pochard and Dumas de Vaulx suggested to use doubled baploids for breeding. The haploids, from twin seedlings, were obtained from P. plants selected in the cross "Yolo Wonder" x B107. 48 doubled haploid (DH) lines were observed after colcbicin treatment and compared to F5 lines selected by pedigree method in the same cross. Some of the DH lines showed yield characteristics close to those of the F, hybrid derived from the two parents. Their mean vigour was not weaker than that of inbred lines. In some cases, their fertility (seed production) was abnormaly low.

In the literature several applications to breeding have been described. Chen (1984) studied 79 DH lines and showed a considerable variation between DH lines. However, characters were uniform within DH lines and between the generations of each DH line.

Jiang and Li (1989) studied the main fruit characters of DH lines derived from the F, sweet x hot pepper hybrid. During 5 generations, DH lines were uniform but the yields were not higher than the yield of the F,. Chen (1985) tested the combining ability of DH lines and obtained hybrids with high yields (especially early yield).

Morrison (1987) evaluated several DH lines from 2 culLivars for several traits in the fields. Some gametoclonal variation was detected. Generally,

lines were shorter but for other characters both beneficial and deleterdous variation were observed. One mutant (upright f ruited) was detected in a DH line obtained from a callus of the cv. "Wonder". Some DH lines produced a few seeds.

Genprally, the DH lines are homogeneous and stable (with some exeptions) and allow practical use. The lack of seed fertility may result from inbreeding effects. Haploidy is now commonly used by breeding laboratories belonging to both governmental Institutes and private seed companies. New commercial F, hybrids may have a DH line as parent.

In pepper, haploidy is now commonly used for genetic analysis. This original practice has been initiated and developed by Pochard. In 1982, *ABAK et al* studied the transmission of resistance to *Phytophtohra capsici* on roots and sterris by studying DH lines obtained from the cross PM 217 x "Yolo Wonder". A similar study was made by Hendy *et al* (1985) for *Meloidogyne* resistance.

The method, described by Pochard *et al (1986)* and Daubuze (1988) is quite simple. Haploids and DH lines are obtained by culture of anthers collected aftey the meiosis of F, hybrids including a standard cultivar and a resistant genitor (generally of wild type) bearing interesting gene combinations (for disease resistance). The study of recombination of the parental genes (or linked genes) is made at the completely boyfiozygous level. Homozygocity makes the analysis easier, because all the genes are expressed without allelic interactions. Moreover, the main advantage is the possibility to repeat different tests on every genotype. For instance, for disease resistance it is possible to check separately a large set of pathogens and stra-Lns, to compare the reaction of different organs, to study the effect of plant age and to measure the incidence of environmental factors. This method is now commonly applied, and in this Issile of Caps.icmw *Newsletters* one can find a report from Daubuze et al on the resistance of androgenetic DH lines of pepper to *Phytophthora capsici* and to Tobacco Mosaic Virus at high temperature.

In conclusion, haploid and doubled haploid lines obtained by efficient anther culture techniques are now commonly used in pepper breeding. The DH lines offer new possibilities for rapid fixation of genotypes and genetic analysis. It can be an excellent support for molecular analysis and location of quantitative traits.

ABAK, K., POCHARD E., DUMAS DE VAULX R., 1982.
Transmission of resistance to *Phytophthora capsici* on roots and stencs of pepper plants: study of DH lines issued from the cross "PM 217" x "Yolo Wonder"through anther culture. Capsicum Newsletter, 1:62-64.

CHEN, X.S., 1984
Genetic expression of major characters in sweet pepper lines derived bv anther culture. Acta Horticulturae Sinica, 11:113-118.

CHEN, X.S., 1985.
Determination of combining ability and analysis of heterosis in pollen lines of Capsicum *annuum* var. grossum Sendt. Acta Horticulturae Sinica, 12:267-272.

CHRISTENSEN, H.M., BAMFORD R., 1943.
Haploids in twin seedlings of pepper Capsicum annuum L. Journal of Heredity, 34:99-104.

DAUBEZE, A.M., 1988.
Utilisation de lign6es haploides doubl6es issues d'androgenèse pal 1'6tude de 1expression de la resistance aux maladies. M6moire de DESU, Acad. de Montpellier, USTL, 29 pp.

DAUBEZE, A.M., PALLOIX A., POCHARD E., 1990,
Resistance of androgenetic autodiploid lines of pepper to *Phytophthora* capsici and Tabacco Mosaic Virus under high temperature. Capsicum Newsletter, 8 (A paraltre)

DORE, C., DUMAS DE VAULX R., 1989.
Utilisation de I'haplo-idie dans lam6lioration de quelques espi-~ces potagO-res (asperge, chou, piment, aubergine et melon). Cinquantenaire de la Culture in vitro. Versailles (France) 24-25 oct. 1989. Ed. INRA Paris, 1990 : Les colloques de PINRA, 177-185.

DUMAS DE VAULX, R., POCHARD E., 1974.
Essai d'induction de la parth6nogen6se haploide par action du protoxyde d'azote sur les fleurs de piment (*Capsicum annuum L.).* Ann. Am6lior. Plantes, 24:283-306.

DUMAS DR VAIJT,X, R., CHAMBONNET D., POCHARD F., 1981.
Culture in vitro d'antheres de Piment (*Capsicum annuum L.)* amelioration des taux d'obtention de plantes chez diff6rents genotypes par des traitements A +35°C. Agronomi e, 1:859-864.

DUMAS DE VAULX, R., POCHARD E., 1986.
Parthénogenèse et androgenèse chez le piment. Role actuel dans les programmes de s6lection. Le S61ectionneur Fran~ai , 36:3-16.

GEORGE, L., NARAYANASWAMY S., 1973.
Haploid *Capsicum* through experimental androgenesis. Protoplasma. 78:467-470.

HENDY, H., POCHARD E., DALMASSO A., 1985.
Transmission de la r6sistance aux nematodes *Meloidogyne* chitwood *(Tylenchida)* portee par 2 ligntees de *Capsicum annuum L.* Etude des descendances homozygotes issues d'androgenese. Agronomie, 5:93-100.

JIANG, Z.R. ` LI C.L., 1984.
Observations and experiments on later generations of sweet x hot pepper derived by anther culture. Acta horticulturae Sinica, 11:191194.

KUO, C.S., WANG Y.Y., CHIEN N.F., KU S.C., KUNG M.L., HSU H.L., 1973.
Investigations on in vitro anther culture of *Nicotiana tabacum L.*. and *Capsicum annuum L.* Acta horticulturae Sinica, 15:37-52.

MORGAN, D.T., RAPPLEYE R.D., 1950.
Twin and triplet pepper seedlings. A study of polyembryony in *Capsicum frutescens.* Journal of Heredity, 41:91-95.

MORRISON, R.A., KONING R.E., EVANS D.A., 1986.
Anther culture of an interspecific hybrid of Capsicum. J. Plant. Physiology, 126:1-9.
MORRISON, R.A., 1987.
Gametoclonal variation in pepper. Diss. Abstracts, Internat. B (Sciences and Engineering), 48:1226.
MUNYON, T.P., HUBSTENBERGER J.F., PHILLIPS G.C., 1989.
Origin of plantlets and callus obtained from chile pepper anther cultures. In vitro cellular and developmental biology, 25:293-296.
PANDEVA, R., 1986.
Cytological study of androgenesis in anther cultures of some red pepper varieties. Genetika i Selektsiya, 19:431-432.
POCHARD, E., 1970.
Description des trisomiques du piment (Capsicum annuum L.) obtentis dans la descendance d'une Plante haploide. Ann. Am6lior. Plantes. 20:233-256.
POCHARD, E., DUMAS DE VAULX R., 1971.
La monoploidie chez lepiment (Capsicum annuum L.). Z.Pflanzenziichtung, 65:23-46.
POCHARD, E., DUMAS DE VAULX R., 1979.
Haploid parthenogenesis in Capsicum annuum L-Inter. Symp. Biol. Taxon. Solanaceae, Birmingham (GBR) The Biology and taxonomy of the Solanaceae, 442-455.
POCHARD, E., PALLOIX A., DAUBEZE A.M., 1986.
The use of androgenetic autodiploid lines for the analysis of complex resistance system on the pepper. VI "Eucarpia Meeting on Genetics and Breeding of Capsicum and Eggplant, Zaragoza (ESP), 1986/10/21-24, 105110.
SACCARDO, F., DEVREUX M., 1974.
In vitro production of plantlets from anther culture of *Capsicum* annuum. In Genetics and Breeding of Capsicum, C.R. Eucarpia Meeting, Budapest (BUL), 1-4 July, 45-50.
SIBI, M., DUMAS DE VAULX R., CHAMBONNET D., 1979.
Obtention de plantes haploides par androgen~-.se in vitro chez le piment (Capsicum annuum L.). Ann. Amblior. Plantes, 29:583-606.
VAGERA, J., HAVRANEK P., 1983.
Stimulating effect of activated charcoal in the induction of in vitro androgenesis in Capsicum annuum L. Capsicum Newsletters, 2:63-65.
VAGERA, J., HAVRANEK P., 1985.
In vitro induction of androgenesis in Capsicum annuum L. and its genetic aspects. Biologia Plantarum, 27:10-21.
WANG, Y.Y., SUN C.S., WANG C.C., CHIEN N.F., 1973.
The induction of pollen plantlets of triticale and Capsicum *annuiini* from anther culture. Scientia Sinica, 16:147-151.
WANG, Y.Y., KUO C.S., LI C.L., CHANG C.R., 1981.
A preliminary report on the study of pollen plants of sweet peppers (Capsicum annuum L. var. grossum Bell.).Proe. Symp. Tissue Culture, London (UK), Pitman Publishing Ltd., 243.
WU, H.M., MANG S.Z., 1986.
Effect of acridine yellow on development of anthers of Capsicuw *frutescens* var. longum cultured in vitro. J. Agri.. Sci., Jiangsu Acad., 2:34-39.

Capsicum Newsletter, 8-9 (1990), 18-19.

INTERNATIONAL HOT PEPPER TRIAL NETWORK UNTHOPE)

J.M. Poulos, S.K. Green, G.L. Hartman and S.C.S. Tsou The Asian Vegetable Research and Development Center (AVRDC), P.O. Box 42, Shanhua, Tainan 74199 TAIWAN - R.O.C.

The International Hot Pepper Trial Network (INTHOPE) was initiated in 1988 in response to discussion at the International Symposium on Integrated Management Practices for Tomato and Pepper Production in the Tropics. The objective of the network is to facilitate the exchange and evaluation of popular hot pepper landraces and elite germplasm across international test environments. Local selections with at least field tolerance to important diseases (especially w.al) should be prioritized. The coordination of the network is the responsibility of AVRDC, whose principle role is to receive, evaluate, multiply (includes selection), and redistribute germplasm, from and to the network collaborators. Each participant is expected to evaluate at least one multi-locational trial per year, in their own country, and provide feedback (data) on the performance and acceptance of the germplasm. Participation of farmers is encouraged. Standardized evaluation sheets will be provided by AVRDC.

At AVRDC, the INTHOPE evaluation trials will be sown in April and September. In addition, September sowings will be conducted for seed multiplication so that by February; a supply of seed is available for distribution. All entries will be screened for reaction to the pathogens: CW, CVNTV, PVMV, PeW, PVY' TMV, ToMV, PMMV, *Xanthomonas campestris pv. vesicatoria, Phytophthora capsici, Colletotrichum capsici* and *C. gloeosporio ides.* Capsaicin content will also be quantified. Evaluation results will be compiled and distributed to all INTHOPE participants.

Please submit new INTHOPE entries (5 g per entry) to AVRDC (c/o Pepper Breeding) before I April or I August of each year. Hybrids may enter into the evaluation for comparison, but we obviously cannot maintain these entries. Any contributor of hybrids should supply a seed quantity large enough for regional trials. At AVRDC, we plant 90 plants per trial (30 plants in each of three replications). There are at least 16 cooperators in the network, who are expectcted to have at least one multi-locational trial per year.

A list of current INTHOPE entries is shown in Table 1.

Additional references

YOON, J.Y., GREEN, S.K., TSCHANZ, A.T., TSOU, S.C.S. and L.C. CHANG. 1989. Pepper improvement for the tropics: problems and the AV-RDC approach pp. 86-98 In S.K. Green (ed.) Tomato and pepper production in the tropics: proceedings of the international workshop on integrated management practices. AVRDC, Shanhua, Tainan.

Table 1. Entries in the 1989-1990 INTHOPE program at AVRDC

Entry	Origin of seed source
1AC Ubatuba. Cambud R.	Brazil
Tabasco	Holland
Ludhiana Long Selection	India
Extra Long Selection	India
Punjab Lal	India
Jawahar 218	India
Gwangju	Korea
Cheongryong	Korea
MC 4	Malaysia
MC 5	Malaysia
MC 6	Malaysia
MC 7	Malaysia
C10-Malay	Malaysia
Langkap	Malaysia
Atarodo	Niger
Nainang Local	Senegal
Safi	Senegal
Salmon	Senegal
Ssuchuan 1	Taiwan
Chicken Heart	Taiwan
Yangjiao	Taiwan
Long Fruit	Thailand (two selections)
Huaruar	Thailand
EKU Cluster	Thailand
Haue See Toan	Thailand
Unknown Y21	Thailand
Unknown Y22	Thailand
Unknown Y23	Thailand
PSR212A88	USA
PSR209688	USA

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CZECHOSLOVAK SWEIET YEPPER CULTIVARS

Magdeldna Valsiková

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Nowadays are grown 15 cultivars of sweet pepper in Czechoslovakia /Tab. 1/. Their properties are described in TabIe 2.

Cultivars	Date from	For open field	For indoor growing
'Andrea'	1987	-	+
'Citrinia'	1977	+	-
'Eva'	1989	-	+
'Dora' F_1	1985	-	+
'Grandova'	1987	+	-
'Jara'	1987	-	+
'Jova'	1989	+	-
'Jubila'	1987	+	-
'Klenot'	1983	+	-
'Konikaa'	1983	+	-
'Morava'	1977	+	-
'PCR'	1961	-	+
'Perla'	1977	+	-
'Rubinova'	1988	+	-
'Vesna'	1982	-	+

Properties of cultivars Tab. 2

Cultivars	Average plant height /mm/	Average fruit size /lxd/ /mm/	Position of fruits	Colour in technol. Maturity	Colour in physiol. Maturity	Maturity
'Andrea'	460	119 x 62	pendant	Light green	Red	Early
'Citrinia'	480	116 x 42	pendant	Light green	Red	Medium early
'Eva'	720	128 x 64	pendant	Light green	Red	Early
'Dora' F_1	650	162 x 57	pendant	Light green	Red	Medium Early
'Grandova'	320	107 x 71	pendant	Light green	Red	Late
'Jara'	600	124 x 57	pendant	Light green	Red	Medium Early
'Jova'	380	56 x 75	Pend. mixed	Light green	Red	Early
'Jubila'	420	124 x 61	pendant	Light green	Red	Very Early
'Klenot'	453	111 x 56	pendant	Light green	Red	Early
'Konikaa'	516	113 x 54	pendant	Light green	Red	Very Early
'Morava'	396	117 x 45	pendant	Light green	Red	Medium Early
'PCR'	810	113 x 45	pendant	Light green	Red	Early
'Perla'	368	126 x 43	pendant	White	Red	Medium Early
'Rubinova'	440	120 x 51	pendant	Green	Red	Early
'Vesna'	470	142 x 49	Pendant	Light green	Red	Early

Capsicum Newsletter, 8-9 (1990), 22-23.

PAPRIKA GERMPLASM CONTRAST QUALITATIVE TRAITS FROM KATRAINT (INDIA)

S. Joshis, P.G. Thakur, T.S. Verma and H.C.Verma

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The increasing commercial importance of paprika both as a spice and a vegetable with the large-scale cultivation in both tropical and temperate regions has resulted in establishing breeding programmes for its improvement in many countries. Germplasm with diverse genetic base is the major basic source, necded essentially for crop improvement. The germplasm pieservaition is a world vdide concern and conservation of the specific diverse gene pools will be useful to breecers to ensure the effectiveneSs of breeding. The main objective of presenting the description of the genotypes (Table 1) with contrast qualitive traits viz; purple pigmentation, anthocyninless antherspabundant pubescence and deciduous fruit persistence be a valuable information to breeders in evolving high quality paprika varieties The documented, data is based on the IBFGR descriptots, so that there must be an internatidnal uniformity. Here the inlividual genotype possess unique characters and can be utilized as a marker gene, most potential in making genetic studies, as i-11can be isolated phenotypically from rest of the population/ genotypes.

A small arpount of seed for experimental use of these cenotypes can be obtained by writing directly to the authors or through the Director, National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi – 110012.

Table 1. Germplasm characterization and premliminary evaluation data with contrast traits.

Collected/ Introduced from	Kt-Pl-2-1 Tezpur	LCA-235 T.N.Univ.Kerala	EC 2C3585 Hungary	Kt-Pl-17 Gauhati
Heritable traits				
Plant growth habit	Erect	Erect	Compact	Erect
Stem and leaf pubescence	Abundant*	Glabrous	Glabrous	Abundant*
Stem colour	Green	Green	Green	Purple*
Pedicel position at anthesis	Erect	Pandent	Erect	Erect
Corolla colour	White	White	White	Violet*
Calyx margin shape	Dentante	Dentante	Intermediate	Dentate
Fruit position	Erect	Declining	Erect	Erect
Fruit colour immature	Green	Green	Yellow*	Purple*
Fruit colour mature	Red	Red	Red	Red
Fruit length	Short	Medium	Medium	Short
Fruit shape	Elongate	Elongate	Conicla*	Elongate
Fruit shape at peduncle sttachment	Acute	Acute	Cordate	Acute
Fruit shape at blossom end	Pointed	Pointed	Blunt	Pointed
Fruit persistance	Deciduous	Persistent	Persistent	Persistent
Fruit pungency	Intermediate	High	Sweet	High
Anther colour	Pale Blue	Yellow	Yellow*	Purple*
Fruit width (cm)	0.9	0.6	5.0	0.8
Fruit weight (g)	4.2	5.0	39.1	3.6
Fruit wall thickness (cm)	<0.1	>0.1	<0.3	>0.1
Fruit yield/plant (kg)	0.124	0.160	0.932	0.141

Note: These genotypes did not show any severe symptoms of important disease viz; anthracnose (Collectrichum sp.) and bacterial leaf spot (Xanthomonas vesicatoria_ in Katrain (temperate) conditions.

* Contrast traits of horticultural importance.

Capsicum Newsletter, 8-9 (1990), 24.

INFLUENCE OF VARIOUS DATES ON THE YIELD PERFORMANCE OF CHILLIES UNDER FAISALABAD CONDITIONS.

A. HUSSAIN; M.N. AHMAD
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Virus "smalling of leaves", Colletotrichum and Phytophthora disease in Chillies are the major chnstraints for the reduction of yield of chillies in Pakistan. When the disease is severe especially during rainy season, the crop fails altogether. Under these circumstances these studies were planned to shift the transplanting time to see its effects on the yield of chillies.

Four dates of transplanting at 14 days interval during the period of 10th February to 30th March were studied for this purpose for two years.

Optimum transplanting date range in chillies under Faisalabad condition was found from 10th February to 10th March for getting high yield.

Table
Showing the data of fresh ripened red fruit of Chillies.

Sr.	Yield in metric tons per acre						
Treatment/	1st Year				2nd Year		
No. date	G.P.	Khundari	Av.	Trt./date	G.P.	PS-I	Av.
1. 10/2	3.382	1.089	2.235	17/2	3.46	3.88	3.67
2. 24/2	3.173	0.959	2.060	3/3	2.46	3.25	2.85
3. 10/3	2.159	0.636	1.397	16/3	1.86	3.51	2.20
4. 24/3	1.615	0.032	0.824	30/3	0.91	1.52	1.21
Mean: 2.591		0.678			2.17	2.80	
Cd_1 for trt. Date.		0.631		Cd_1 for trt. Date		0.55	
Cd_2 "		0.907		Cd_2 "		0.79	
Cd_1 for varities		0.253		Cd_1 for varieties		0.25	
Cd_2 "		0.354		Cd_2 "		0.37	
G.P. = 'Gola Peshawari'			PS-1	= 'Peshawar Selection No. I.'			

Capsicum Newsletter, 8-9 (1990), 25.

NATURAL CROSS-POLLINATION DATA FROM BULGARIA

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The studying of natural cross-pollination (ncp) began several years ago in Bulgaria. Daskalov and Popov published the first results in 1941. The ncp occured from 0 to 75 % at the studied varieties and lines. It depended on the fruit size (small fruit - higher ncp) and on the flower structure. Hristov - Genchev (1965) studied the length of stigma. The small fruit types had longer stigma and therefore the ncp was 20 - 25 % in Sofia. More ncp data were published from Hungary, Italy and Spain in the Capsicum Newsletter and at the Eucarpia Capsicum Meeting in the recent past. Thes ' e results originated from the repeated experiments. Our data originated from the pepper field of Novo Zelezare Cooperative (District Plovdiv). The cooperative grows pepper on 30 hectars every year. The cv.'Albena'(anthocyanin less) and the cv. 'Sofiska kapial (normal anthocyanin content) are the main varieties.The distance of rows is 0.7m, the distance of plants is 0.2m. The Cooperative used the classical Bulgarian irrigation ditch method. We harvested the fruits only from the cv. Albena plants at the end of August
(flowered in June) and in the middle of September (flowered in July). From the directly neighbour raw (the first cv.'Albena'row was 0.7 m to the first cv. Sofiska kapia row) we harvested 23 fruits in August and. 30 fruits in September. From the tenth row (the tenth.row was 7.0 m to the first cv.'Sofiska kapial row) were harvested 20 fruits.in August and 30 fruits in September. The average seed/fruit was Ill in August and 145 in September. We analysed the color of hypocotyl (the hypocotvl of cv. 'Albenalis green, the hypocotyl of cv.'Sofiska kapialand the F hybrid is lilac) and from the number of green and lilac hypocotyl was calculaled the percentage of ncp.

The ncp was in the first row 8.84 % in June, 7.19 % in July and in the tenth row 0.32 % in June, 0.48 % in July.

This year the climate was extreme in Bulgaria and probably this was the reason o f low percentage of ncp.

References

DASKALOV, H. - POPOV, P. 1941. Osnowhy na zelentchukoizvodstvo v Bulgaria Sofia?

HRISTOV, S. - GENCHEV, S., 1965 ' A study of some problems of floral biology of pepper (Capsicum annuum L.) in relation to heterosis and hybrid seed production. Sofis Z. 2.5:605-615.

POPOVA, D. - MIHAILOV, L., 1974. Situdies on the biological basis of hybrid seed production in pepper (Capsicum annuum I.) IInd Eucarpia Capsicum Meeting, Budapest 1974: 71-80.

Capsicum Newsletter, 8-9 (1990), 26-27.

GENETICS OF SIX QUANTITATIVE TRAITS IN SWEET PEPPER (CAPSICUM ANNUM L.)

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The genetic research done on sweet pepper improvement has revealed that fruit yield in this crop is mainly determined by traits, number of fruits per plant, number of primary branches fruit length and plant height (Joshi and Singho, 1983% fhe knowledge about the nature and magnitude of gene effects of these horticultural traits may greatly help breeders in formulating an efficient breeding programme. Therefore, the analysis of gene action following generations mean analysis was s udied in six generations by estimation of six parameters (m,d,h,i,j,l) in three interacting crosses of sweet pepper diverse nbreds, 'HC-21C' (210). 'Rub King' (RK) and 'California wonder' (CW) with 'Elephant Trunk' (TET).

The value of estimates for six met ric traits in three crosses are given in the table. The results revealed the important role of epistasis in the control of those traitst as having higher values of interaction parameters in eneral than the values of d and h parameters with an Mortant role of duplicate type epistasiso Which largely depends upon the signs of h and 1 (i.e. similar signs have predominance of complementary while, different signs indicate duplicate type epistasis. Among epistatic, 1 effects are the most important followed by 1, effects, However, it is suggested that dominance components could be exploited through heterosis breeding as has also been found feasible in this crop (Joshi and Singh 1987). Methods, which exploit non-additive, gene actions such as reciprocal recurrent selection cou hold promise for improvement of the characters studied.

Table : Estimates of gene effects and type of epistasis for six metric traits in three crosses

Trait	Interactin	Gene effects	Type of

	g Crosses	M	D	H	I	K	L	epistasis
Plant height	RK X ET	55.2*	-1.64	-46.5*	-55.5*	-0.1	71.4*	D
	210 X ET	44.9*	-2.07	-46.0*	-48.1*	1.8	69.8*	D
	CW X ET	51.8*	1.13	-30.6*	-34.3*	-1.1	42.03*	D
Number of primary	RK X ET	5.1*	-0.05	-1.0	0.6	5.1*	-2.3	C
	210 X ET	5.3*	0.26	-1.0	-1.2	0.9	2.5*	D
	CW X ET	5.0*	0.03	0.2	-0.6	0.7*	3.6*	C
Branches Fruit Length	RK X ET	10.2*	-.340*	5.4*	6.2*	1.2	-34.3*	D
	210 X ET	9.5*	-0.63	14.2*	14.9*	3.9*	-18.4*	D
	CW X ET	9.2*	0.64	13.5*	930*	5.4*	4.2	C
Fruit circumference	RK X ET	10.9*	1.40	16.2*	20.9*	-1.1	-32.9*	D
	210 X ET	12.6*	2.23*	11.7*	13.5	-0.3	-18.9*	D
	CW X ET	10.5*	1.93*	17.4*	21.4*	-1.6*	-26.7*	D
Number of fruit per plant	RK X ET	10.6*	-0.76	5.0	7.6	1.6	-11.3*	D
	210 X ET	9.5*	-1.10*	0.7	1.9	4.5*	-5.4*	D
	CW X ET	15.1*	-0.47	5.8	1.4	-0.1	5.4*	C
Fruit Yield per plant	RK X ET	0.3*	0.02	0.21*	0.33*	0.02	-0.59*	D
	210 X ET	0.3*	-0.02	-0.01	-0.02	0.06*	-0.07*	C
	CW X ET	0.4*	0.05	0.17	0.06	-0.05	0.21	C

*Significant at 5% level, d=duplicate, c=Complementary.

REFERENCES:

Joshi, S. and Singh, B., 1983. Variability studies in sweet pepper (Capsicum annuum L.), Haryana J. Hort.Sci.12 (1-2): 124-129.

Joshi, S. and Singh, B.1987. Results of the combining ability studies in sweet pepper (Capsicum annuum L.) Capsicum Newsletter, 6, 49-50.

Capsicum Newsletter, 8-9 (1990). 28.

INHERITANCE IN SWEET PEPPER (Capsicum annuum L.)

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The heritable components of variation can be assessed by concerned number of genes. To work out the inheritance of quantitative traits in number of genes or effective factors have been devised in biometrical analysis on the concept of Mendelian genetics. The genes or groups of genes showing non-detectable phenotypic differences are considered as effective factors (Mather and Jinks, 1982). The estimation of number of genes or effective factors is obscured by complex allelic and non-allelic interactions. Therefore estimates were made assuming all the loci are unlinked and have equal effect.

The present studies were made to estimate the number of genes or effective factors governing ten quantitative traits in sweet pepper, adopting the method proposed by Wright (1968). The observations were recorded on 8 varieties and their 20 F_1 and F_2 generations, raised during 1981.

Analysis of data revealed that gays taken to flowering, plant height, number of branches per plant, number of fruits per plant, average fruit weight, fruit shape index, flesh thickness, days to first harvesting, early yield and total yield per plant are governed by 9, 7, 25, 8, 3, 25, 95, 18, 18 and 12 gene groups or effective factors, respectively. Dempsey (1960) reported 3 pairs of polymeric genes control plant height while fruit wall thickness was affected by 8 pairs of genes. But in the present case these values are higher, might be due to lesser variation in size of their effect. Thakur et al. (1980) found that days to first harvesting and early yield per plant are governed by 31 genes each showing close association. But in the present findings 18 genes control each of these traits. It can presumed that same gene group is responsible for expression of both the traits. Total yield per plant is governed by 12 genes. Nandpuri and Kumar (1973) found 9 gene groups affecting this trait in chilli.

References

Dempsey A.H., 1960. Inheritance studies of certain fruit and plant characters in Capsicum frutescens. Diss. Abstr. 20, LC. Card Mic, 59, 5372, 2506-2507.

Mather K. and Jinks J.C., 1982. Biometrical Genetics. Chapman and Hall, London.

Nandpuri K.S. and Kumar J.C., 1973. Inheritance of fruit characters in chilli yield. J. Res. PAU., 10 (1), 49-52

Thakur P.C., Gill H.S. and Bhagchandani P.M., 1980. Diallel analysis of some quantitative traits in sweet pepper. Indian J. Agric. Sci., 50 (1), 811-817.

Wright S., 1968. Evolution and Genetics of Population. Vol. 1, Genetics and Biometric Foundations, Univ. of Chicago.

Capsicum Newsletter, 8-9 (1990), 29-30.

GEtMTIC VARIATION IN P 2 GENERATION OF CHILLI

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The genetic variability in the base population is a prerequisite for effective crop Improvement prograrm've. A stik3y was therefore, undertaken in chilli involving F progenJe- of 451intervarietal crosses obtained from a 10 X 10 parental set (excluding reciprocals) with 12 quantitative cba-racte-rs juruic rabi seasons of 1937-88 and 1983-89 at the Horticultural Research Station, Orissa University of Agriculture and Technology, Bhubanes.

The results (Table) revealed that the maximum genotype variance was for seeds/fruit and mimimum variance was for seeds/fruit and minjimum, for 100 seed weight. Dry yield/plant, fruit/plant, plant spread and plant height showed higher genotypic variances and followed seeds/fruit. The genetic coefficients of variation ranged from 9.19 for fruit girth to 36.26 for dry yield/plant. The estiuaates of heritability varied from 54.37 % for fruit girth to 98.74 % for dry yield/p1ant. Genetic advance was the highest (29.23) for seeds/fruit and loyes, for 100 seed weight.

High genotypic coefficient of variation alongwith hiegh heritability and genetic advance will provide better information than either of the parameters alone. Dry yield/plant, plant spread fruits/plant, dry weight of fruits and seeds/fruit exhibited high genotypeic coefficient of variation, high heritability and genetic advance and these are the characters, which are to be taken into consideration for effective selection in chilli.

Table Genotropic and phenotypic variances and coefficients of variation, heritability, genetic advance for various quantitative characters in F2 generation of a 10 x 10 diallel cross in chilli (Pooled data of 2 seasons)

Character	Genotypic variance	Phenotypic variance	Genotypic coefficient of variation	Phenotypic coefficient of variation	Heritability in broad sense (%)	Genetic advance	Genetic advance as % of them
Dry yield per plant (g)	74.70	74.66	36.26	36.49	98.74	17.69	74.23
Plant height (cm)	22.56	23.89	11.41	11.74	94.43	9.51	22.84
Plant spread (cm)	42.54	43.91	24.60	24.96	97.11	13.26	49.96
No. of primary branches	0.60	0.69	20.68	22.09	87.65	1.50	39.89
Fruit length (cm)	1.93	0.69	16.19	16.86	92.15	2.75	31.97
Fruit girth (cm)	0.084	2.10	9.19	12.46	54.37	0.44	13.96
No. of fruits per plant	57.99	0.15	24.55	24.74	98.48	15.57	50.19
Weight of 10 fresh fruits (g)	26.38	27.74	17.89	18.12	95.11	10.32	35.50
Weight of 10 dry fruits (g)	4.52	4.87	26.89	27.90	92.85	4.22	53.35
Seed weight per fruit (g)	0.0097	0.0014	31.36	33.94	95.40	0.19	60.31
No. of seeds per fruit	219.08	38.39	27.04	28.21	91.90	29.23	53.40
Weight of 100 seeds (g)	0.0068	0.0079	14.44	15.50	86.78	0.16	27.87

Capsicum Newsletter, 8-9 (1990, 31-32.

TRANSGRESSIVE SEGREGATION FOR DRY YIELD IN CHILLI (CAPSICUM ANNUUM L.)

C.

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A 10 x 10 half diallel set involving geographical divergent parents was studied for dry yield/plant in F generatio to assess the potentiality of the crosses towards the irequency of positive transgressive segregants (PTS) and the magnitude of transgression during Rabi 1988-89 at the Regional Research Statio Orissa University of Agriculture and Technology, G. Udayagiri (ORISSA). The frequency of positive transgressive segregants and magnitude of transgression for dry yield/plant were calculated as per the wethod suggested by Senapati (1988).

The ranges of variation in the F_2s and the respective parental range (over both the parents) aloigwith other parameters of transgressive segregation for yield are presented in Table 1. Assulting the environmental fluctuations were of similar order bot in parents and F_2 a,, a comparision of the limits of variation in F9 with those oi parental ranges would indicate whether or not there was transgressive segregation.

A joint consideration of FPTS, PTSM and MrI (mean of top 10%) would show that (‘J-218'x'KCS-l’), (‘BR-Red’x'CA-58’), (‘J-218’x'CA-586’) and (‘J-218’x'Pusa Jwala’) are crosses of high potential for iaprovement in yield.

REFERENCE

Senapati, N. 1988. Nature of gene action and F 2 segregation pattern as related to parental diversity, Heterosis and combining ability in wheat. Unpublished M.Sc. (Ag.) Thesism O.U.A.T., Bhubaneswas, 1988.

Table 1. Frequency of positive transgressive segregation and magnitude of transgression of promising F2 progenies for dry yield per plant (gm) in 10 x 10 half diallel cross of chilli

Crosses	Parental range (g)	Higher parental mean	F F2 range (g)	F2 mean	Frequency of PTS (FPTS)	Mean of PTS (PTSM)	Average transgression (APT)	Mean of top 10% (MTI)
1 x 2	18.20-27.94	23.46	10.42-51.41	38.67	24	48.92	25.46	71.32
1 x 3	16.48-26.14	20.73	14.72-37.84	27.67	12	31.84	11.11	60.84
1 x 4	17.52-25.32	20.89	16.84-50.91	37.71	30	41.34	20.45	73.98
1 x 6	18.20-31.42	25.96	13.93-65.83	52.09	35	64.82	38.86	99.32
1 x 7	15.48-25.32	20.56	12.34-48.46	31.22	20	31.00	10.44	61.24
1 x 8	13.82-29.02	21.96	15.06-49.73	38.07	27	40.04	18.08	73.20
1 x 10	18.20-28.90	23.42	16.80-49.08	38.64	16	40.50	17.08	70.84
2 x 4	17.52-27.94	23.46	15.94-44.04	41.14	32	38.42	14.96	78.40
2 x 5	19.82-30.84	26.25	14.87-50.80	36.36	20	40.21	13.96	61.20
2 x 7	15.48-27.94	23.46	17.72-48.94	33.15	18	39.82	16.36	64.00
2 x 8	13.92-29.02	23.46	16.84-50.24	33.11	15	42.42	18.96	60.40
6 x 10	19.87-31.42	25.96	14.89-51.08	36.76	19	40.72	14.76	70.20

N.B. : - 1 to 10 are parents
1. 'J-218' 2. 'BR-Red' 3. 'G-4' 4. 'CA-586' 5. 'K-2' 6. 'KCS-1'
7. 'S-118-2' 8. 'Pusa Jwala' 9. 'Sindur' 10. 'Lax-x-235'

Capsicum Nmsletter, 8-9 (1990), 33.

F_2 DIALLEL ANALYSIS IN CHILLI (CAPSICUM ANNUUM L.)

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In a F2 diallel analysis, the performance of 45 F2 progenies involving 10 genetically diverse chilli cultivars (‘J-2l9,'BR-Red, 'G-4’,'CA-586’, 'K-2', ‘KCS-1’, ‘S-118-21', 'Pusa Jwaia’, 'Sindur', 'Lam-x-235’) were stiadied for yield and other character performance, combing ability and gene action at t~-jo locations with 12 quantitative *characters* (plant height, plant spread, Primary branches/plant, fruit length, fruit girth, fruits/plant, weight of 10 fresh fruits, weight of 10 dry fruits, dr yield/ plant, seed weight/fruit, seeds/fruit, 100-seed weight during Rabi 1988-89.

The analysis of variance for R.B.D. under diallel analysis showed highly significmt differences among treatments for all the characters. The mean performance for dry yield/plant showed that (J-2l8'x'KCS-I’) was the best cross studies on combining ability revealed that variances for GCA- and SCA were highly significant In all the characters. The magmitude of GCA variance was higher than that of SCA in all the characters except plant height, plant spread and 100 seed weight indicating preponderance of additive genetic component in these characters. BR-Red was the best general combiner for yield and yield attributing characters. The estimates of additive genetic variance (D) were significant for plant spread, seed weight/fruit, seeds/fruit and 100 seed weight. Two estimates of genetic variance (H1) and (H2) were significant for all the 12 characters. Over dominance was observed in all the characters since the ration of ¼ (H1/D) ½ is more than unity.

The outstanding cross combinations (J-2 lEt x Vk-580, 218'X'CA-586’), (Pusa Jwala'x'Sinduir’) and (‘Sindur’ x 'Lax-x-235’) offer excellent material for further improvement through selection for isolating superior lines of transgressive segregants.

Capsicum Newsletter, 8-9 (1990). 34-35.

VARIATION IN FASCICULATION IN F4-POPULATIONS OF PEPPER

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Fascicination in pepper (Capsicum annuum L.) is expressed as a shortening of internodes, resulting in compact, bushy plants.
The inheritance of this character to be monogenetic recessive (symbol fa).
Variation in fasciculation has been observed in our breeding programme, while studying the descendance of FaFa x fafa for other purposes: not always all internodes are shortened, which results in an incomplete fasciculation of the plant.
Variation in fasciculation permits a discrimination in different growing types (figure 1). Classification is based on differences in the number of shorted internodes and the nodelevel on which the fasciculation starts. The criterium for fasciculation is the development of three or more flowers on a bunch which morphologically means at least two shortened internodes. Fa-1 shows fasciculation at the first node-level fa-2 at the second, etc.. Furthermore, fasciculation on a certain node-level can be repeated on a following level, for example fa-1,2. fa-3 doesn't necessarily demonstrate fasciculation at all third node-levels of the same plant; this is the same for fa-4 etc…
In F4 (FaFa x fafa)-populations observation have been made for different growing types; results are summarized in figure 2. All populations have the same local breeding line as fasciculate parent. The fa-gene originates from 'SM 477'. All plants of the observed F1's were phenotypically of normal growing type and F2's had significant 3:1 segregation for normal and fasciculate types, which supports the3 monogenetic recessive inheritance of fa. In the F3 fafa-plants have been selected, except in the case of M2: for this population a heterozygous F3-plant have significant 3:1 segregation for normal and fasciculate types in the F4.

The populations showed a variation in reparitition of the fasciculate growing types. E2 for examples is highly fasciculated with 90% fa-1. Its F3 was also a plant of fa-1 growing type. Apparently selection is possible for fa-1. Unfortunately the growing ypes of the other F3-selections have not been registered. It is not unlikely that minor genes could be involved in the expression of fasciculation, operating in the presence of fa-gene.

DESHPANDE, R.B., 1944. Inheritance of bunchy habit in chilli (Capsicum annuum L.), Indian Jour. Genet. Plant Breed., 4:54-55.

Capsicum Newsletter, 8-9 (1990), 36-37.

TRANSGRESSANT LINES FOR CAPSAICINOIDS CONTENT IN OLEORESIN OF HOT PEPPER (CAPSICUM ANNUUM L.)

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Oleoresin capsicum is the product obtained by solvent extraction of the dried ripe fruits of capsicum and the subsequent removal of the solvent. Oleoresin have found increasing industrial use in place of ground chillies, being used in food industry, beverages and pharmaceuticals. There is an increase of about 50 per cent in foreign exchange earnings due to additional value of processing charges, solvent cost and packing. For pharmaceutical purpose only high capsaicinoids oleoresin is used which is made from highly pungent varieties of chillies.

'Pusa jwalal has, therefore, been developed for high capsaicinoids content (Pankar and Magar, 1978; Tewari, 1979). 'Pusa jwalal has also been reported to be an excellent variety for giving high yield of oleoresin (Krishnakumari and Peter, 1986). Capsicum frutescens are famous for their pungency world over and are official of the British pharmacopaea. 'Pusa jwala' was therefore crossed with a variety of C. frutescens "I.C. 31339' for enhancing capsaicinoids in oleoresin in Indian chillies. The cross 'Pusa jwala' x 'I.C. 313391 has given exceptionally good quality lines superior over parental varieties. The transgressant lines 'P.S. 31-3' and 'LG-1' have attained superiority over both the parental varieties by possessing 20 per cent and 27.5 per cent capsaicinoids in oleoresin, respectively. The parental varieties 'Pusa Jwala' and 'I.C. 31339' have capsaicinoids in oleoresin 8 and 15 per cent, respectively (Fig.).

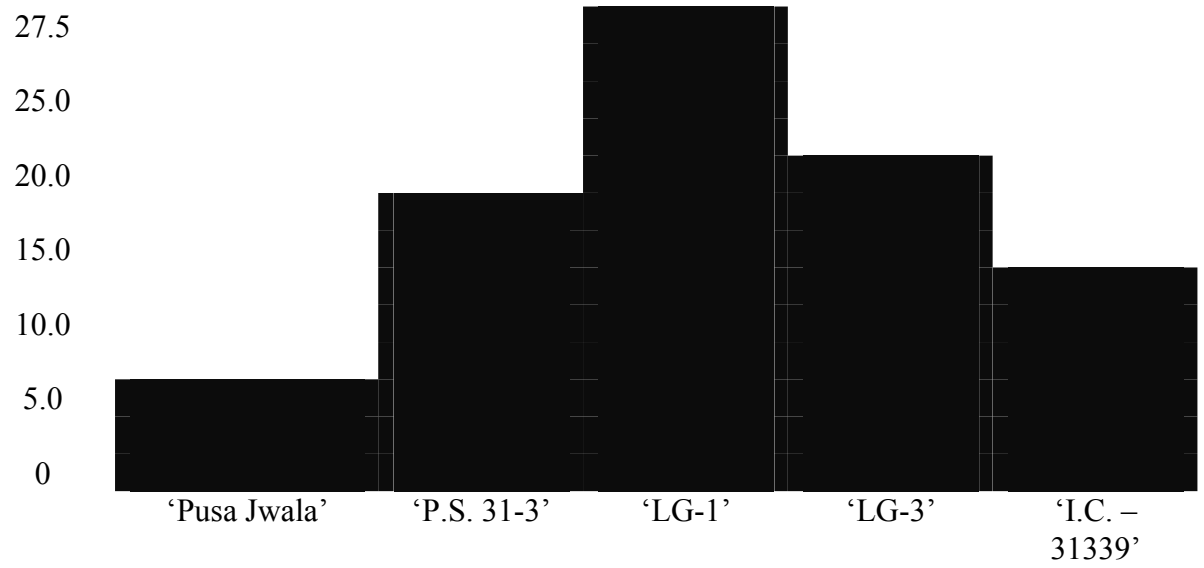
REFERENCES

Krishnakumari, K. and Peter, K.V. (1986). Genetic distance and heterosis in intersp:2~ific crosses of Capsicu . Agric. Res. J., Kerala, 24(2): 122-27.

Pankar, D.S. and Magar, N.G. (1978). Capsaicine, total colouring matter, ascorbic acid contents in some selected varieties of chillies (Capsicum annuum L.). jour. MAU 3(2) : 116-19.

Tewari, V.P. (1979). Increasing capsaicin content in chillies Ind. Arecanut spices and coconut jour. 2: 90-91.

HISTOGRAM OF VARITION OF HIGH
CAPSAICIN OLEORESIN STRAINS OF
THE CROSS ‘PUSA JWALA’ X ‘I.C. 31339’



Verticle: Capsaicin per cent

Capsicum Newsletter, 8-9 (1990), 38-39.

MONITORING INTERSPECIFIC HYBRIDIZATION BETWEEN CAPSICUM BACCATUM C. CHACOENSE AND C. ANNUUM WITH ISOENZYMES.

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We have studied electrophoretic Phenotypes of 13 enzymes in 15 plants form three species: Capsicum annuum cv. 'Poznanska Slodka', C. baccatum and C. chacoense using standard starch gel electrophoresis (Valleyos 1983, McLeod et al. 1983). These plants were used in interspecific hybridization program.

Superoxide dismutase (SOD) electrophoretic variants were species specific. Variants of glutamate oxaloacetate transaminase (GOT), phosphoglucomutase (PGM), isocitrate dehydrogenase (IDH) and shikimate dehydrogenase (SKDH) differentiated between C. chacoense and C. annuum but not between C. baccatum and C.a. nnuum. These differences were used to verify hybrid origin of progeny in crosses: C. baccatum x C. annuum and C. chacoense x C. annuum. All hybrid progeny shows heterozygous electrophoretic phenotype expected in crosses between parents with different al le le (Fig. 1).

Enzymes were extracted from a small portion of leaf tissue in young seedlings without killing a plant. This procedure allows eliminating seedling produced by accidental self-fertilization in early stages of breeding program. Details of electrophoretic procedure can be obtained from the second author on request.

Some data were collected from mature F1 generation to describe differences between parental species used for crosses and hybrids. (Tab.1)

Backcross and F2 progeny have been produced and studies on transmission of morphological differences and linkage tests for marker isozyme genes will be conduct.ed in 1990.

References:

Valleyos E-1983. Enzyme activity staining. In : S.D.Tanskley, T.J.Orton (eds.) Isozymes in Plant Genetics and Breeding. Elsevier Science Publishers B.V., Amsterdam pp.469-517

McLeod et all. 1983. Peppers (Capsicum). L.c. pp.189-201

Fig. 1 Electrophoretic phenotypes of 5 marker enzymes in three parental species and their hybrids.

A- Capsicum annuum cv. 'Poznanska Slodka'
B- Capsicum baccatum
C- Capsicum chaocense
B x A – F1 hybrids between B and A
C x A – F1 hybrids between C and A

B	B x A	A	A x C	C	
			-------	------	SOD superoxide dismutase E.C. 1.15.1.1

	-------	--------	-------		
	-------				GOT glutamate oxaloacetate transminase E.C. 2.6.1.1.
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-------	-------	-------	-------		
			-------		PGM phosphogluomutase E.C. 2.7.5.1
			-------	--------	
-------	-------	-------	-------		IDH isocitrate dehydrogenese E.C. 1.1.1.42
			-------	-------	
			-------	-------	SKDH shikimate dehydrogenese E.C. 1.1.1.25

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			-------	-------	

Table 1. Morphological characteristics of parental species, and their hybrids.

Charcter	N =	B 5	B x A 15	A 5	C x A 15	C 5
Fruit weight	(g)	4.4	12.2	61.4	1.3	0.4
Fruit length	(cm)	5.8	7.6	11.5	2.6	1.2
Fruit width	(cm)	1.3	2.4	5.1	0.9	0.5
No. of fruits/plant		92.3	26.2	24.7	108.7	72.6
Yield/plant	(g)	217.3	219.5	1447.4	64.9	16.0
Plant height	(cm)	105.8	96.3	66.1	131.5	85.5

Capsicum Newsletter, 8-9 (1990), 40-41.

ORGANOGENESIS IN CAPSICUM BACCATUM

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The present investigation has been carried out with an aim to produce callus regeneration in Capsicum.

Seeds of Capsicum bapcatum 'II HR 768 ‘ were surface sterlised f or 1 min in 70% alcohol and 5 min in 0. 1% HgC 12 and rinsed several times with sterile distilled water and germinated on Murashige and Skoog (MS) medium. The explants (cotyledon, hypocotyl and shoot tip)were excised from 3-4 week old seelding and placed on MS medium with different hormonal concentrations (Table 1).

Green and globular callus was observed in the explants, cotvledon, hypocotyl and shoot tip in the mediun supplemented with MS +2 mg/l IAA, I mg/1 Kn and CW 15% (Fig.1). When the callus was subcultured on the same medium after 25-30 days the proliferation was vigourous with simultaneous shoot and root formation along with scanty callus. The sufficiently developed shoots were excised and cultured on medium with MS + 1.0 mg/l IAA to produce roots (Fig.2). The regenerated plants were transferred to pots with vermiculite and later to the soi 1.

In order to confirm the callus regeneration histologically, the microtomy standard preparations were made. The callus sections clearly exhibited the dedifferentiated tissues (Fig. 3).

Table 1
Response of the explants cotyledon, hypocotyls and shoot tip to MS medium fortified with different concentrations of auxins and cytokines

Hormones (mg/1)	C	R	S	Nature of callus	Colour of callus
2,4 D 2 + Kn 1	+++	NR	NR	Friable	Cream
IAA 2 + Kn 1	+	+++	NR	Compact	White
NAA 2 + Kn 1	+	+++	NR	Compact	White
BAP 3 + IAA 1	+	NR	++	Compact	Light green
IAA 2 + Kn 1 + Cw 15%	++	+	NR	Compact	Dark green

C = Callus ; R = Root; S = Shoot; + About 25%; ++ About 50%; +++ Above 50%

Capsicum Newsletter, 8-9 (1990), 42.

STUDY ON SHOOT-TIP MERISTEM CULTURE IN CAPSICUM

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Meristem culture is a very useful technique for rapid mass propagation. Up to now, studies on meristem culture in Capsicum have not been reported in China. The purpose of present study was to establish a realistic technique for the rapid mass propagation via in vitro of shoot-tip meristem in Capsicum.

Accessions of 4 species of Capsicum (C. annuum 'Qiemen', C. frutescens 'No. 310', C. praetermissum 'No. 234' and C. baccatum 'No. 85008') were used. The medium was MS with 3% sucrose and 0.6% agar at PH 5-5.8, supplemented with different kinds and concentrations of hormones. Each treatment was inoculated with 20-24 explant pieces of shoot-tip meristem, cultured under 1,000 lux light for 10 hours/day, the temperature being 26-28'C.

In the initial culture, all the explant-s of different species grown at the optimal medium for 3 to 4 weeks could develop into shoots with 3 to 4 leaves. The best explants were those excised from 3 weeks seedl-Ings. The plantlets could be directly obtained from the accession 'No. 234' growing at the medium MS supplemented with IAA at the concentration of 0.05 mg/l. The hormone levels required in the medium were different, depending on the accessions. However, the hormone composition and the various auxin ano cytokinin combinations had a similar effect on the growing of different shoot-tips. The optimal medium for initial shoot-tip culture was the MS with 1 mg/l BA, 0.5 mg/l IAA and GA, 3% sucrose and 0.6% agar at pH 5.8. The shoot-tip growing at the optimum medium for 3 to 4 weeks formed 2 to 6 axillaty buds. The buds developed from shoot-tip were again used as explants for sub-culture. Different multiplication rates were found in the axillary buds excised from different positions. The shoot-tips excised from accessions with high branching potential showed a significantly higher frequency of axillary bud formation than those excised from accessions with poor branching. The medium MS with 0.5 mg/I BA and GA and 0.1 mg/l IAA promoted the axillary bud formation and growing of most accessions. Sub-culture times did not greatly.affect the multiplication rate of axillary buds. Supposing a single plantlet growing for 4 weeks have 3.5 axillary buds meanly and the sub-culture is repeated for 11 times, one billion of plantlets could be theoretically obtained from a single shhot-tip explant in one year. Buds were differentiated from the shoot-tip meristem of accession 'Qiemen' growing at the medium MS supplemented with 2.5 mg/l BA and 0.1 mg/1 NAA (a), the medium MS with 2 mg/l BA and 0.05 mg1I NAA (b) and the medium MS with 2 mg/I BA and 1 mg/l IAA (c) for 3 to 4 months. The buds generated planlets when transferred onto the root formation medium. The best differentiation was obtained at (a). Many budlets were generated from each shoot.-tip meristem of accession 'No. 310' cultured at medium N with 3 mg/l KT, 0.1 mg/I NAA, 0.5 mg/l IAA and 3% glucose as well as at meAum MS with 2 mg/l BA, 0.5 mg/I NAA, 1 mg/l IAA and 0.5 mg/l GA for 3 months.

Capsicum Newsletter, 8-9 (1990), 43.

'MULTIPLOID SPOROCYTES' CONDITION IN RED PEPPERS

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A mutant exhibiting 'Multiploid Sporocytes' condition, a genetically controlled meiotic abnormality was isolated, for the first time in M 4 generation 40 kR gamma ray treated plants of the variety 'Sindhur. This abnormality was associated with marked phenotypic alteration. The plant was tall (100 cm), low spread (60 cm) displayed fasciation of stems and leaves and small globular fruits which varied in length from 0.5 - 2.5 cm. Internodal growth was suppressed in terminal branches so that all the leaves were aggregated into bunches. Pollen sterility was as high as 75% and fruit and seed set was low.

Meiotic studies revealed the formation of sporogenous tissues into plasmodium like masses that varied in size from anther to anther in which chromosomes were lying in groups. At diakinesis and metaphase I, a maximum grouping of 6 nuclei was observed. In certain cases smaller plasmodial masses containing variable num.ber of chromosomes were even observed. These had definite boundaries and appeared like polyploid cells of large size. The chromosome number varied from 2n = 24-144. The presence of multivalents when more than 24 chromosomes were present at diakinesis and metaphase I is suggestive of the fact that the fusion of cells should have occurred before the process of synapsis. Other divisions were highly irregular with unequal segregation, large number of laggards, division of univalents, fragments, stickiness of chromosomes, formation of polyads and many micronuclei. Inheritance studies revealed no discernable pattern of segregation. The Imultiploid' sporocytes' condition is obtained probably as a result of suppression of wall formation during pre-meiotic mitosis.

It is concluded in Capsicum, it does not follow monogenic inheritance as in barley (Smith, 1942) and pearlmillet (Manga and Panthulu, 1971) but is as a result of bringing together of certain gene combinations and like other pre-meiotic abnormalities this may also be polygenic in nature.

Capsicum Newsletter, 8-9 (1990), 44.

PISTILLATE FLOWER MUTANT IN CAPSICUM ANNUUM L.

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Increased genetic variability due to induced mutation permit selection for desirable trait. This pap-pr reports induction of pistillate flower mutant in Capsicum annuum L. by gamma rays, EMS, alone and in combination.

Soaked seeds (24 hr) of Capsicum annuum ('G4') were treated with gamma rays (30 kR), 0.1% Ethylmethane sulphonate (EMS) for 24 hr (singly and in combination). The treated seeds were thoroughly washed and sown along with control. M1, plants were harvested separately and sown in M 2 generation on plant progeny basis.

Pistillate flower mutants were isolated in Capsicum annuum in a frequency of 2.1, 1.2 and 2.6 following gamma rays, EMS, and gamma rays + EMS respectively. The mutant was identical to the control in morohological features. However in the pistillate flower mutant the number of petals were ten and arranged in two whorls of five each while in control they were only five in a single whorl and the stamens were absent. Gradation of ovule size, ranging from tiny and underdeveloped to round and plumpy ovules were observed in the transverse section of the ovary. The numbers of pistillate flowers produced per plant were more than hundred, nevertheless fruit setting upon manual pollination was very low and a small percent (5%) of seeds were viable. The inheritance of the mutant was studied by performing cross between control (parent) and pistillate mutant. The F1, plants obtained were bisexual. Further investigation and the possibility of exploitation of the mutant for breeding programme will be evaluated.

Capsicum Newsletter, 8-9 (1990), 45-46.

SEEDLESS FRUIT MUTANT IN CAPSICUM

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In Capsicum, experiments for enlarging variability in quantitative characters by applied mutagenesis has been explored (Sadanandam 1981, Subhash and Rajam, 1985). This paper deals with the description of the seedless fruit mutant in Capsicum annuum induced by the combination effect of Gamma Rays and Hydrazine.

Soaked (24 hr) seeds of Capsicum annuum cv 'CA 960; were treated with 25 kR Gamma irradiation followed by 0.1% Hydrazine for 6 hrs. After thorough washing the seeds were sown along with control. M, plants were harvested seperately and sown in M 2 generation on plant progeny basis.

Seedless fruit mutants were isolated from M 2 progeny. Fruits were small and showed seedless nature. Plants were characterized by increased height and woody stems. Around 200 fruits were produced in the mutant as comoared to 30 in control (Table 1). Placenta was deformed and pericarp was thick and fleshy. Flowering was significantly delayed. Ascorbic acid content inthe mutant was as high as 95 mg/100 g while in the control it was 55. , mg/100 g.

The mutant was vegetatively propagated through stem cuttings.

The meiotic observations revealed high frequency of chromosomal alterations. Inheritance pattern of mutation in lines seggregating for seedless fruit mutant in M 2 generation is set out in Table 2.

The Seedless fruit mutant can be of practical significance because of elevated ascorbic acid content and high yielding.

REFERENCES

Sadanandam A., 1989, Ph.D., thesis, Kakatiya University, India.
Subhash, K., Rajam, M.V., 1985, Indian J Bot., 8: 101-105.

Table 1. Variation in morphological charcters of control and seedless fruit mutant in Capsicum annuum cv CA 960.

Characters	Control	Mutant
Plant height	70.1 ± 80.31	108.24 ± 0.69
No. of branches	48.7 ± 21.05	64.89 ± 1.09
Length of leaf (cm) including petiole	5.21 ± 0.31	4.48 ± 0.36
Breadth of leaf (cm)	2.65 ± 0.29	2.34 ± 0.39
Days to flower	62.2 ± 10.72	73.84 ± 0.89
Length of petal (cm)	0.87 ± 0.39	0.91 ± 0.48
Breadth of petal (cm)	0.47 ± 0.39	0.61 ± 0.48
Length of style	0.61 ± 0.29	0.64 ± 0.28
Weight of 100 fruits	92.18 ± 0.85	28.42 ± 0.72

A Mean ± S.E.

Table 2. Inheritnce pattern of the mutation in lines seggregatin for seedless fruit mutant.

No. of fruits	Phenotype	Observed	Expected (3:1)	x^2	P-value
7	Control	180	168		
	Mutant	44	56	3.42	< 3.84
		224	224		

Capsicum Newsletter, 8-9 (1990), 47-48.

RESISTANCE OF ANDROGENETIC AUTODIPLOID LINES OF PEPPER TO PHYTOPHTHORA CAPSICI AND TOBACCO MOSAIC VIRUS UNDER HIGH TEMPERATURE.

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The Mexican pepper line 1CM 3341 (GUERRERO-MORENO and LABORDE, 1980) is resistant to a very aggressive strain of Phytophthora capsici (S 197) and to Tobacco Mosaic Virus, pathotype 0. The main original trait of TM 334, is that these resistances remain stable in a large range of temperature, even when temperature is maintained above 3O*C during several days. Whereas under such conditions, the resistances of the other-genitors are broken down (POCHARD et al, 1983; POCHARD and DAUBEZE, 1989).

A genetic analysis of the resistances of 'CM 3341 was performed using doubled haploid lines obtained by in vitro androgenesis (DH lines). A first set including 30 DH lines (HD702) was obtained from the F, hybrid ('CM334' X 'YOLO WONDER'). The second set included 38 DH lines (HD591) obtained from the Fl hybrid (TAT' X 1CM334% 'VAT' is a susceptible to TMV, but is partially resistant to P.capsici.

The two sets of DH lines were tested for resistance to P.capsic at 22*C and 32*C. The stem inoculation procedure was performed according to POCHARD and DAUBEZE, 1980. In this test, the speed of necrosis progression (fungal growth) decreases to a minimum value between the lOt' and the 17"2 day after inoculation, when resistance is induced. This minimum speed of necrosis (Vm) is considered as a measure of the resistance level of the DH lines (PALLOIX, 1986). Considering the 2 sets of DH lines, high correlations were observed between Vm at 22*C and Vm at 32*C (table 1, fig.D. This indicated that most of the resistance genes from 'CM334' were efficient against P.capsici whatever the temperature.

The two sets of DH lines were also tested for resistance to TMV(O) at 22°C and 32°C. For the HD591 lines (the parental line 'VAT' is TMV susceptible) we observed a resistant/susceptible ratio close to 1/1 (table 2), indicating that resistance of 'CM3341 to TMV is controled by one single gene. More over, the lines displaying resistance at 22*C were also resistant at 32*C and reciprocally: i.e. one single locus in 1CM334' controls resistance to TMV(O) and stability under high temperature. In the progeny HD702 (the parental line 'YOLO WONDER' bears the L 'allele and is TMV(O) resistant), no line displayed susceptibility to TMV at 22°C, suggesting that the gene from 'CM334' is allelic to L'. Allelism tests confirmed this result : ICM3341 bears a gene of resis ' tance to T~ that is located at the L1 locus, it shows the same specificity toward TMV pathotypes as L1, but it is efficient under high temperature. We named this allele Ll.

In the figure 1, the DH lines resistant to TMV at T2°C were figured by a these lines did not seem to be resistant to P.capsic , indicating that LIc is not genetically or functionally linked to resistance to P.capsici.

This analysis showed that the expression under high temperature of the resistances from 1CM334' seems directly controlled by the resistance genes itselves. No independant modifier genes acting on both resistances to TMV and P.capsici were detected. However, DH lines with interesting gene associations will be introduced in our programs in order to breed varieties with an improved resistance under unfavorable environments.

GUERRERO-MORENO A., LABORDE J.A., 1980, Current status of pepper breeding fo resistance to Phytophthora capsici in Mexico, Synopses 1Vth Meeting Eucarpia Capsicum Working group, 1980/10/14-16, Wageningen (NLD), 52-56.

PALLOIX A., 1986, Potential et limites d'une résistance polygénique. La résistance du Piment (Capsicum annuum) a Phytophthora capsici. These Dr. es Sciences (Amelioration des Plantes). Univeriste Claude Bernard, Lyon I, 134 p.
POCHARD E., DUABEZE A.M., 1980, Recherche et evaluation des compasantes d'une resistance polygenique : la resistance du piment a Phytophthora capsici. Ann. Amelior. Plantes, 30, 377-398.
POCARD E., MOLOT P.M., DOMINGUEZ G., 1983, Etude de 2 nouvelles sources de resistance a Phytophthora capsici Leon. Chez le piment. Confirmation de l'existence de 3 composantes distinctes dans la resistance. Agronomie, 3 (4), 333-342.
POCHARD E., DAUBEZE A.M., 1989, Systemes genetiques conditiionnant l'expression a haute temperature de la resistance par hypersensibilite a la Mosaique du Tobac chez la Piment. 1 Congres SFP 1987/11/19/20, Rennes. Ed. ENSAR.

	Corr. Coef.	t. student	Prob.
HD 702	0.808	7.26	<1%
HD 591	0.624	4.76	<1%

Table 1. : Correlation coefficients between resistance to P. capsici at 22°C and resistance to P. capsisi at 32°C for the 2 sets of DH lines.

TMV(O)	HD 702	HD 591	'CM 334'	'YOLO W.'	'VAT'
22°C	30R – 0S	20R –18S	$R(L^{1C})$	$R(L^{1})$	$S(L^{1})$
32°C	14R – 16S	20R – 18S	$R(L^{1C})$	$R(L^{1})$	$S(L^{1})$

Table 2 : Number of DH lines resistant (R) and susceptible (S) to TMV(O) at 22°C and at 32°C

THE APPLICATION OF THE ToMV -Ob STRAIN IN THE TMV L^4 RESISTANCE BREEDING

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The P 1.2. pathotype of TMV was isolated first time in Hungary in 1978. It is a special strain and we named ToMV- Ob. Csillery and Rusko (1900), Tobids et al. (1982). Csillery et al.(1981). The pmptoms of the infected leaf of susceptible L^+ and the resistant L1 and L2 pepper plants are typical yellow/green mosaic, the fruits are deformed. Later we isolated from the L1 cv. Fehdrbzbn the same pathotype (P 1.2.) of TMV, but the serotypes were different (SL, U1, P 11). Tobios and Csillery (1983). It is very interesting that the ToMV –0b strain never spread in Hungary and we could isolate only from cv. Soroksari hajtato L+.
The diagnosis of ToMV -Ob is-very easy and therfore we are using in our L3 resistant breeding program. 4
When we started the work with L4 resistance gene, received from I.W. Boukema, in C. chacoense'P.I. 260 429'b-ackground, we received the P 8 , P 11 and P14 virus strain from Th. B. Rast too.
In our TMV resistance breeding practice we are-using the hypocotyl test and the excised leaf test. It seems that the P 14 strain is not suitable for these methods and therefore we tried to use our ToMV -Ob strain. In the comparative experiments the lesions appeared later and the number of lesion were fewer if we use the P14 strain. (Table 1.) The quick result (appearance day) is very important if we apply the excised leaf test, because the leaves became rotten 5-6 days after the cutting.
If we use the ToMV -Ob strain (and not the P14 strain) in the L4 resistant breeding, in this case it is v5ry important that the source of susceptible parents does not contain the L3 gene. Our experience suggest from the beginning of work that the L4 resistant source is not homazygote. In the F2 and the BCF2 generations we found some plants having darker and smaller lesion that the others. Pochard's opinion was the same in 1985. "Heterozygous for the unusual genes" (personal communication).

References

CSILLERY,G. -J. RUSKO , 1980., The control of a new Tobamovirus strain by a resistance linked to anthocyanin defficiency in pepper C. annuum L.
IVth Eucarpia Capsicum Meeting, Wageningen, 14-16 October, 40-43.

TOBIAS, I. - A.Th. B. RAST - O.Z. MAAT. 1982., Tobamoviruses bf pepper, eggplant and tobacco: comparative host reaction and serological relationships.
Neth. J. Pl. Path. 88:257-268.

Csillery, G. - T6bids, I. - Rusk6, J., 1983. A new pepper strain of Tomato mosaic virus.
Acta Phytopath. Acad. Sci. Hung. 18 (4): 195-200.

Table 1. Symptoms of ToMV –Ob and TMV P14 infected L3 and L4 resistant pepper cotyledon and excised leaf

Characters of lesion	Type of test	L^3 res.	L^4 res.	
		Ob strain	Ob strain	P 14 strain
Apprearance in hours (optimal size and colour of lesion)	Cotyledon	72	96	108
	Excised leaf	72	84	96
Number of lesion piece/cm2	Cotyledon	5 - 6	3 - 4	2 - 3
	Excised leaf	8 - 12	7 - 8	5 - 6
Diameter of lesion mm	Cotyledon	1.0 - 2.0	3.0 - 3.5	3.0 - 3.5
	Excised leaf	1.0 - 1.5	2.0 - 2.5	2.0 - 2.5
Color of lesion	Cotyledon	Dark brown	Light brown	Light brown
	Excised leaf	Dark brown	Light brown	Light brown
Border of lesion	Cotyledon	Merked	Unmarked sinnous	Unmarked sinnous
	Excised leaf	Marked	Unmarked sinnous	Unmarked sinnous

SELECTION TO CMV TOLERANCE IN COTYLEDON PHASE WITH CMV FULTON STRAIN

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The CMV is the most dangerous virus pathogene in the open field in Hungary. The majo.-ity of-the Hungarian varieties are CMV susceptible. The cv. Tá1tos (waxy fruit type) has one of the best CMV tolerances. The source of tolerance is originated from the-French variety Antibois. The level of this tolerance is not sufficient in Hungary and therefore we started to work with the Indian Perennial line received from J. Singh. For the CMV tolerance selection of Perennial hybrids we used the local Hungarian CMV strains and the CMV FUlton strain (received from E. Pochard). We published the first result of infection in 1980 (Rusk6 and Csillfty). In the first pBriod we used the Pochard's method. He proposed the infection in 6-8 leaves stage. In the new publications Pochard and Daub6ze (1909) inoculated the seedlings in cotyledon phase with di ' fferent types of CMV (Fulton, I - 17F, Ter 75, 34 F). The CMV tolerance is a polygenic recessive character and therefore we have to analyse more and more segregating plants. In this experiment the infection was made with CMV Fulton strain in the cotyledon stage, 4-5 days after the germination. The ledons were visible 4-5 days after the infection. The size of cotyledon is not so big; therefore the maximum number of lesions is 4-5 leEions per cotyledon (on the susceptible types). On the cotyledon of original Perennial line we could not cause lesions. Because in the number of lesions the difference is not so high.between the susceptible and tolerant plants, this method.is not regardEd perfect. Therefore in this experiment in the 6th day we eliminated the seedlings with lesions and we transplanted the seedlings without lesion. On the 6-8 leaves stage we infected these plants with CMV Fulton strain second time, and the lesions appeared after 6-7 days. In each repetition some susceptible plants were transplanted for control and it seems that the efficiency of pre-selection is 70-80 %. In the most part of pre-selected plants the second infection caused few lesions. In corlsequence of polygenic character sometimes we harvest lots of single plants, but for the great number of items it is very difficult to analyse the level of resistance on the pots in 6-8 leaves stage or on the field. Therefore we made this pre-selection method in winter season in climate boxes and we sow the best lines to the field experiment.

References RUSKO, J. - G. CSILLERY., 1980. Selection for CMV resistance in pepper by the method developed by Pochard IVth Eucarpia Capsicum Meeting, Wageningen 14-16 Octobre 1980:37-39. POCHARD, E. - A.M. DAUBLE., 1989. Progressive construction of polygenic resistance to Cucumber mosaic virus in the pepper. VIIth Tucarpia Capsicum Meeting, Kragujevac, 27-30 June 1989:187-192.

Capsicum Newsletter, 8-9 (1990), 52-53.

TEST FOR RESISTANCE TO CUCUMBER MOSIAC VIRUS (CMV) IN CAPSICUM ANNUUM-L. GERMPLASM

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Several colleagues interested in CMV resistance suggested recently that some of their accessions might be of value in terms of CMV resistance. Hence different lines were sent from the USA, Yugoslavia and France.

The seedlings were grown in the greenhouse and routinely mechanically inoculated three times starting at the first true leaf stage. Within the tested material (Table-1) resistance was not found, however significant differences in response to the virus were demonstrated among the various lines.

Several lines showed eit1ter Susceptibility or segregation to tolerance while all the material from E. Pochard demonstrated uniform pattern of tolerance. In Pochard's material clear mosaic symptoms were obtained but a tendency of recovery and continous growth was demonstrated. Such level of tolerance is used in our breeding program in Israel. In addition oneshould keep in mind that the tested material was not yet tested under natural field infection.

Table 1 : Reaction of Capsicum annuum L. germplasm to mechanical inoculation with CMV.

Accessions	No. of Plants		
	Tolerant	Susceptible	Source
1986	0	15	B.W. Bosland
1987	0	7	"
Yellow Jalopens	2	27	B. Villalon
Sweet Chile Long	0	17	"
Hidalgo Serrano	0	34	"
11	0	17	N. Marinkovic
28	0	17	"
30	0	19	"
86	0	17	"
87	2	15	"
88	1	16	"
89	1	16	"
65	0	17	"
66	0	11	"
67	2	15	"
HD 210	9	0	E. Pochard
HD 230	11	0	"
HD 248	9	0	"
HD 249	16	0	"
HD 260	11	0	"
DM 815	15	0	"

EVALUATION OF COMPONENTS OF RESISTANCE TO XANT110MONAS CAMPESTRIS PV. VESICATORIA IN LEAVES OF CAPSICUM ANNUUM L.

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A preliminary experiment was conducted to evaluate components of resistance to X. campestris pv. vesicatoria in inoculated pepper leaves. The host plants evaluated were S3-derived lines from CNPH 191 (susceptible), CNPH 722 (susceptible) and CNPII 703 (resistant). CNPH 191 and CNPH 722 were previously observed to differ in lesion development. Lesion expansion was often greater in CNPII 191 than in CNPH 722; whereas, lesion number was often greater in CNP11 722 than in CNP11 191. CNP11 703 has group nonspecific resistance to the bacterial spot pathogen. The objecfives of the experiment were to compare lesion number and lesion expansion as quantitative components of resistance to bacterial infection, and to determine which component of resistance had the most practical application for disease screening.

Seeds were planted on 11 July 1987 and seedlings were transplanted into plastic pots on 31 July 1987 in a randomized-complete block design, with four blocks as rcplicaflons. Each block was situated on a different grcenhouse bench. For each of the three-genotype treatments, dicre were five plants per block. Four expanded leaves per plant and four subsamples per leaf were inoculated by leaf infiltration on 25 August 1987 with a bacterial suspension of approximately 5 x 10 cfu ml- I of X. campestris pv. vesicatoria Group 2 (sensu Rcifsclincidcr ct al., 1985). A fifth leaf of each plant was inoculated with sterile distilled water as a control. The third, fourth, fifth and sixth leaves were detached at intervals of 6, 10, 15 and 20 days after inoculation, respectively. One plant of each genotype from a different block was sacrificed from the experimental design at each interval to judge whether leaf age was an important source of treatment variation for lesion development. Lesion number cm-2 and average lesion diameter (mm) were determined by observation under a steroomicroscope. A cardboard template was used to delimit I cm2 of inoculated leaf tissue, and a slide micrometer was use to measure lesion diameter. Means of die four blocks at each time interval are presented in Fig. 1. Conversion of the components lesion number and lesion diameter gave an estimate of total lesion area [lesion area = n(lesion diaincter+2)2 (lesion number)].

Fifteen (lays after inoculation (DAT) was recommended as an appropriate time to evaluate resistance components. After fifteen DAI, lesions began to coalesce in the susceptible checks and lesion numbers were less accurately counted. Differences among genotypes were noticed by 10 DA1, but the differences among resistant and susceptible genotypes were more clearly defected at $\pm$15 DAI. No lesions appeared on control leaves and components of resistance were not influenced by differences in leaf age of plants inoculated at 45 days after sowing. Although [tic two susceptible hosts diff6red slightly for the components lesion number and lesion diameter, both genotypes were equally susceptible on the basis of total lesion area. An estimate of total lesion area may be a useful way of combining the two components of resistance.

In other'sludics, actual gains due to selection were 5 1 % when sclccfion was based on total lesion area. compared to 22% and 3% for lesion diameter and lesion number, respectively.

References:

Reil'schneldcr, F.I.B., Bongiolo, A., and Takatsu, A. 1985. Reappraisal of Xanihomonas campestris pv. vesicaloria strains - their terminology and distribution. Filopalol. bras. 10(2):201-204.

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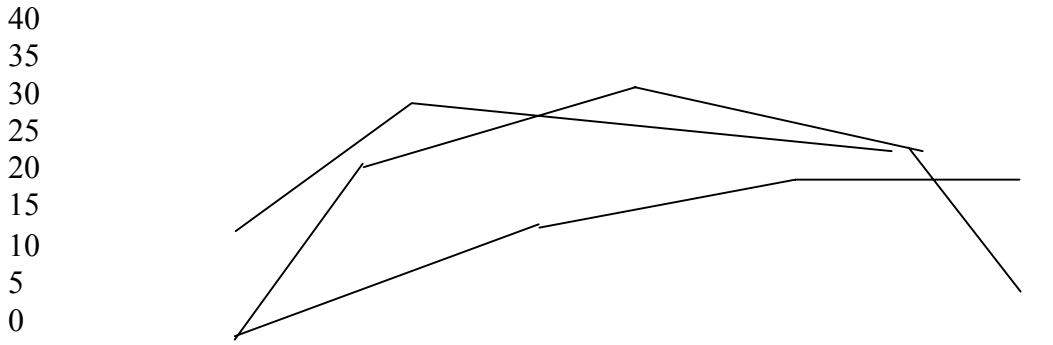

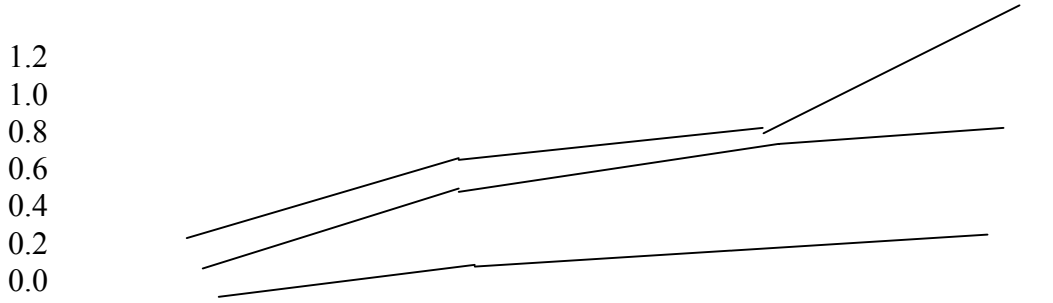

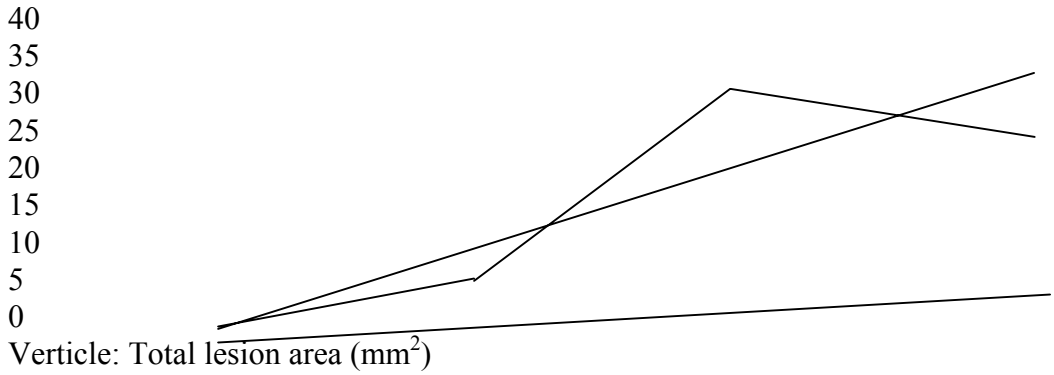

DAYS AFTER INOCULATION

Fig 1. Components of resisitance; lesion number (A), average lesion diameter (B), and total lesion areaa (C), to Xanthomonas campestris pv. Vesicatoria in leaes (cm-2) of Capsicum annuum L. leaves were inoiclated by leaf infiltration with a low concentration (5 x 103 colony forming units ml-1) of the bacterium. Host plants CNPH 191 (■), CNPH 722 (▲), and CNPH 703 (□). Verticle bars represent $\pm$ SE (n = 4).

Capsicum Newsletter, 8-9 (1990), 56-57.

EFFECT OF STYLAR OPENING ON THE OCCURRENCE OF INTERNAL MOLD (ALTERNARIA SP.) IN TWO PEPPER CULTIVARS.

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Previous reports have documented internal mold (Alternaria sp.) invasion of pepper pods via stigma and style (Halfon-Meiri and Rilski, 1983), injuries (Bruton et al., 1989) or stylar opening (Dempsey and Cochran, 1965; Zat~T_ko_, 1989). According to our own results, internal mold was associated to the presence of stylar opening in the mature fruits of two open grown cultivars (Table 1). Nevertheless, absence of stylar opening did not always mean lack of Alternaria infections, particulary in 1988 when 32% of fruits with no stylar opening were infected. The summer of that year was stormy. High relative humidity has been pointed out as the cause of increasing Alternaria conidial densities (Bruton et al., 1989). Under these circumstances, blossom end and subsequent placenta infections could take place via the remaining stigma and style (Halfon-Meiri and Rylski, 1983). In a few cases where pods with no apparent stylar opening resulted infected at placenta level without corresponding blossom end infection, either fruitworm or sunscald injuries were checked as the cause for fungal invasion.

Zatyko (1989) has suggested selecting for great fruit size, particularly great "blossom end - placenta" distance, as a mean of avoiding Alternaria sp. infection in tomato-shaped pepper varieties. That suggestion cannot be taken as a general rule in pepper breeding because according to our own results, quite similar damage caused by Alternaria sp. was obtained on short (tomato) as well as on long (blunt) fruits of cv. Infantes (Table 2)

Dempsey and Cochram (1965) have proposed to select pointed fruits with no stylar opening instead of blunt-shaped ones to avoid internal mold on pimiento pepper varieties. To test this possibility, the association between fruit shape and internal mold was also studied in 1989. Blunt and tomato-shaped fruits were found to have a higher incidence of internal mold than pointed fruits on both cultivars (Table 2). Therefore, blunt, off-typed fruits of cv. 'Piquillo' should be rejected in selection programmes. The case of cv. 'Infantes' is troublesome since the blunt shaped fruits are considered as the standard type from a marketable point of view. Selection for stylar closure associated to blunt shape -was started in 1988 with no response to selection in 1989. In the case of blunt shaped varieties and probably in tomato shaped ones, breeding for real resistance to Alternaria sp. instead of avoidance (stylar closure-pointed fruit shape) seems to be the correct response.

Table 1. Percentage of pepper mature pods showing internal mold (Alternaria sp.) when stylar opening was or was not present

Cultivar (Pod weight)	Stylar opening	Year	
		1988	1989
Infantes (225 g)	Present	92	73
	absent	32	4
Piquillo (45 g)	Present	-	82
	absent	-	0

Table 2. Percentage of pepper mature pods showing internal mold (Alternaria sp.) by shape

Cultivar	Pod shape	%
Infantes	Pointed	4
	blung (standard)	33
	tomato	43
Piquillo	Pointed (standard)	0
	blunt (off-type)	82

LITERATURE

Bruton, B.D., Chandler, L.D., Miller, M.E., 1989, Relationship between pepper weevil and internal mold of sweet pepper, Plant Disease, 73, 170-173.

Dempsey, A.H., Cochran, H.L., 1965, Effect of fruit shape on the occurrence of internal mold in cannery pimientos, Plant Disease Reporter, 49 (2), 157-158.

Halfon-Meiri, A., Rylski, I., 1983, Internal mold caused in sweet pepper by Alernaria alternata: Fungal ingress, Phytopathology, 73, 67-70.

Zatyko, L, 19889, The “greygo”, a new type of close blossom end tomatenform paprika, VIIth Eucarpia Meeting on Capsicum and Eggplant, Kragujevac (Yugoslavia), 113-115.

Capsicum Newsletter, 8-9 (1990). 58.

STUDiES ON DISEASE RESISTANCE OF INDUCED TETRAPLOIDS OF CAPSICUM ANNUUM L.

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Of the various f cliar diseases reported on the genus Capsicum, leaf spot disease caused by Cercospora sps. was considered to be most important causing severe defoliation.

While making cytogenetical studies on induced tetraploids of Capsicum it was observed that the colchiploids when compared to diploids seem to be quite healthy and less prone to Cercospora leaf spot disease. So, in order to test the disease resistance of tetraploids to Cercospora leaf spot, preliminary studies were made on the pathogen employing diploids and tetraploids as host plants.

Data revealed that the percentage of spore germination and germ tube length were significantly reduced or, leaf surface, leaf exudates and leaf. Extracts of tetraploids when compared to those of the diploids. Anatomical studies revealed that there was a. significant reduction in stomatal frequency when compared to diploid with a concommitant increase in its size. The total phenolic content increased in leaves from diploids (susceptible) to tetraploids (resistant).

It can be concluded that the disease resistance exhibited by tetraploids against leaf spot disease of Cercospora may be attributed to altered morphology (increased leaf thickness and low frequency of stomata) and high phenolic Content.

Since the polyploids are apparently disease free and offer some resistance to Cercospora leaf spot disease, they may form an important germplasm source for the synthesis of disease resistant varieties of Capsicum if further studies are continued in this direction.

Capsicum Newsletter, 8-9 (1990), 59.

PROTECT CHILLIES CROP FROM PHYTOPHTHORA

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A- Prior to the year 1986, the Phytophthora disease was not known in Pakistan, but during the crop season 1986 on account of excessive and prolonged rains during the months of April and May, the disease was observed for the first time in chillies growing areas cf the country. The growers due faced heavy losses to attack of the disease and failure of the chillies crop. The production of chillies has been reduced to 68,000 tonnes during 1988-89 as compares to the normal production of 92,000 torines and the Government had to import chillies from abroad.

B- Symptoms

- All plant parts; seedlings, stem, branches and fruit are affected.
- The nursery plants after emergence are killed in the nursery beds.
- On the adult plarit, symptoms of it may develop on the stem on the soil level and leasions may extend up two inches above the soil level and the plants may wilt and die.
- The branches are also affected and brovin to dark brown leasions appear.
- The disease also attacks the fruit as well. The invadeu, fruit tissue become dark green and water soak. Under high humidity white mold and fungus spores develop on the affected area and the fruit may rot in few days. Such fruit dry out rapidly, shrink and wrinkle but remain attached with the plants.
- Epiphytotics are encouraged by rain and warm conditions with the results that the entire field is damaged

C. Control Measure

Farmers are being recommended proper control measures of the disease lice.

- Use of healthy seed obtained from healthy plants.
- Treatmant of seed with Captan or Ridomi I M.Z. @ 2.0 grams per: kg of seed.
- Treatment of nursery plants with 0.1% solution of Ridomil M.Z. before planting.
- Planting on the top of the ridges.
- Spraying the crop in the field (if disease appears) with 0.2% solution of Ridomil M.Z.
- Hoeing and earthing up should aiso be done.
- Rotation should be followed.
- Excessive irrigation and-flooding be avoided.

Ayub Agricultural Research institute, Faisalabad.

Capsicum Newsletter, 8-9 (1990), 60,61.

SEARCH FOR VERTICILLIUM DAHLIAE RESISTANCE IN CAPSICUM SP.

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Several Capsicum accessions were screened for Verticillium dahliae resistance in three experiments: two in the field, in highly V. dahliae - infected plots, and one by artificial inoculation in a climatized greenhouse (24 - 16'C). The accessions belong to C. annuum (121 accessions) C. chinense (9) C. frutescens (7), C. baccatum (14), C. pubesc~ ns (3), C. chacoense (4), C. galapagoense (2), C. praetermissum (6) and C. eximium (3) (Table 1).

Five months after planting in the field or two and a half months ifter artificial inoculation by root inmersion for 3 mfn. in a 10 con/ml suspension, plants were evaluated for Vert-ic-'llium symptoms using a 0-4 scale, where 0 = no symptoms, I = partial wilting, 2 = general wilting, 3 = above symptoms, plus loss of leaves or stunting, 4 = death. The cultivars 'Riguel' and 'Podarok Moldovy' were included respectively as a susceptitle and a resistant control in each of the three screenina test. The sum of the evaluations of all the plants of each accessicn, usually ten, divided by the number of plants, was considered the disease index of each accession in each of the screening tests. In order to simplify data presentation, when an accession was included in more than one test, the highest of tne aisease indexes was considered as the disease index for such accessicn. After that, all the accessions were classified by the (~Lsease index in four qroups (Table 1).

In C. annuum, only the accession C. annuum var. minimum 'G9' (disease index 1 .1 -2) has shown better response than C. annuum resistant controls (disease index 2.1-3). In other species several accessions were detected with disease index 0-1. In C. chinense other chinense, 'G303/AC2139' and 'Miscucho' stood out. In C. f rutescens, the best two accessions proved to be 'Capsicum sp. Colombia' (Aleksic et al., 1976) and 'G283/AC1249'. Saccardo and Sree Ramulu (1977) resistance to V. dahliae in C. chinense and C. frutescens, while other authors did not detect resistance accessions in these species (Iglesias-Olivas et al., 1 987; Woolliams et al., 1962). In C. pubescens, two resistant accessions were detected 'Rocoto Rojo P-7' and 'C5O' though these data should be considered cautiously as they come f rom 'a single experiment, moreover a field one, where the infection level was lower and not so uniform than under artificial inoculation. Satisfactory resistance in C. pubescens has not been usually found by other authors (Iglesias-Olivas et al., 1987, Marinkovic et al., 1989). The best five C. baccatum accessions were 'Escabeche P5' (Cl31), 'Aji naranja P68', '3-4', 'Escabeche' and 'Escabeche P8'. 'Escabeche P5' was also the best one among all the tested accessions. In C. baccatum no resistance was found by Saccardo and Sree Ramulu (7977), Iglesias-Olivas et al., (1 987) or Woolliams et al., (1962), but recently, Marinko%ic et al., (1989) have also reported a high level of resistance in Ifs-c~-heche PS', what would confirm the interest of 'Escabeche', the mam cultivar of C. baccatum var. pendulum, as a source of resistance to V. dahliae.

C. eximium, C. chacoense, C. galapagoense and C. praetermissum accessions screened 'in our works did not s1To_w=oeciaj interest as V. dahliae resistance sources in comparison -to the group of te above cited five cultivated species. Saccardo and Sree Ramulu (1977), Iglesias-Olivas et al. (1987) and Marinkovic et al., (1989) have obtained similar p_er~`ormances with these wild species.

Table 1 . Number of Capsicum accessions screened for resistance to V. dahliae and classified by the disease index.

	Disease index (0-4)			
Species	0-1	1.1-2	2.1-3	3.1-4
C. annuum	0	1	3	117
C. chinense	2	1	3	3
C. frutescens	2	2	1	2
C. baccatum	5	5	1	3
C. pubescens	2	1	0	0
C. chacoense	0	0	1	3
C. galapagoense	0	0	1	1
C. praetermissum	0	2	1	3
C. eximium	0	0	0	3

LITERATURE

Aleksic, Z., Aleksic, D., Sutic, D., 1976, Evaluation de la r6sistance du piment au Verticillum albo-atrum Reinke et Berth. et determination de la virulence des souches de parasite, Agriculturae Conspectus Scienctificus, 39 JL91, 63-70.

Iglesias-Olivas, J. Bosland, P.W., Lindsey, D.L., 1967, Resistance of Capsicum species to Verticillium dahliae K, Capsicum Newsletter, 6, 73-74.

Marinkovic, N., Mijatovic, M., Aleksic, Z., 1989, Resistance to Verticillim albo-atrum and tobacco mosaic virus JIDVI in some Capsicum species, 7th Eucarpia Capsicum Eggplant Meeting, Kragujevac (Yugoslavia), 153-158.

Saccardo, F., Sree Ramulu, K.S., 1977, Mutagenesis and cross breeding in Capsicum for disease resistance against Verticillim dahliae, 3rd Eucarpia Capsicum meeting, INRA-Montfavet (France), 161-162. -

Woolliams, G.E., Denby, L.G., Manson, S.F., 1962, Screening sweet and hot peppers for Verticillium wilt resistance, Canadian Journal of Plant Science, 4i, 515-520.

Capsicum Newsletter, 8_9 (1990), 62-

BIPOLALRIS SPICIFERA - A NEW SEED-ROTTING PATHOGENE OF CAPSICUM ANNUUM.

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Sporulation of Bipolaris spicifera /Bain./ Subram. Was observed on rotted seeds of Capsicum annuum as a velvety, blackish mold. Pure cultures were made, and the fungus was identified by culture characters and microscopic observations according to Domsch et al. /1980/. The pure cultures were maintained on potato dextrose agar medium.
Colonies were reaching 3-4,5 cm diameters in five days at 22 0 C' and were brown to blackish. The fungus sporulated well in the cultures. Its conidia were 24-38,4 x 12-19,2 micrometers, mostly three-distoseptate, and germinated bipolar in water.
However Chidambaram et al. /1973/ reported few other Bipolaris species occurring on seeds of C. annuum, we have not any other information on occurrence of B. spicifera on this host substrate. The other identified, Bi2olaris was the B. sorokiana /Sacc./ Shoem in our trials. Both were sporadically occurring.

Referenoes: Chidambaram, P., Mathur, S.B. and Neergaard, P. /1973/: Identification of seed-borne Drechslera species. - FRIESIA, 10: 165-207.

Domsch, K.H., Gams, W. and Anderson, T. -H. /1980/: Compendium of soil fungi. - ACADEMIC PRESS, London + mailing address: H-1115 Budapest, bartblc B', 14, HUNGARY

Capsicum Newsletter, 8-9 (1990), 63.

NaC3. INFLUENCE ON SWFM PEPPER GERMINATION

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Soil salinity is nowadays an important agriculture problem hence the acknowledge of plant resistance to this trouble represents a goal for many researchers all over the word.

One of the employed methods in thip study is to observe the rate of germination in saline substrate.

In our case the effect of soil salinity on seed germ~nation of two breeded Cuban sweet pepper varieties was studied. Six-soil salinity levels were tried (from 0 to 0,5 % of NaCl,), teraperature was kept at 25 $\pm$ 3 ° C and four repetitions were made.

Statistics showed significant differences at 0,1 % for soil salinity level effect on seed germination, as well as on varieties.

Seed germination decreaseawhen soil salinity level increased. It was only 4 % in I Espadol Liliana variety when going from 0 to 0,5 %, so it is an outstanding material and it is important to follow the york with it; decrease was 24,5 % in ‘SC 81’ pepper variety.

Capsicum Newsletter, 8-9 (1990), 64-65.

CRYO-PRESERVATION OF PEPPER AND EGGPLANT SEEDS

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Liquid nitrogen (LN .2) storage is known as a good system for germplasm conservation: in seeds stored at -1961C all sources of metabolic deterioration are greatly reduced, thus providing a very prolonged preservation. Apart from the problems related to the
survival-time of seeds stored in this condition, important factors of the seeds cryo-preservation are the cooling and rewarming rate of the seeds to and from –1,6°C, the number of complete cycles of cooling and rewarming to which the seeds could be subjected and the moisture content of the seeds.

In order to verify possible damages caused by repeated cooling and rewarming cycles to the viability of seeds, the following experiment was carried out: samples of seeds of pepper (cv 'Corno di toro rosso') and eggplant (cv 'Prospera') were subjected, within a few months, up to 50 cycles of c6bling and rewarming. For every species, seeds with three different moisture contents were examined. On the basis of a previous research (Belletti et al., 1990), a rate of cool ing-rewarming called "quick" was chosen: the seeds were directly transferred from room temperature to -1960C and warmed back at 30°C for 1 hour soon after removing from LN 2. The response of the seeds was evaluated by germination tests according to ISTA (1985) methods: moreover the frequency of abnormal seedlings (considered as a symptom of loss of vigour of the seed) and the mean germination time were recorded.

Seeds of pepper subjected up to 50 cycles of cooling and rewarming proved the loss of their viability in a very small amount (fig. 1). The moisture content of seeds subjected to a short period of storage did not affect the seed viability. However, it is likely that the source and the vigour of the sample under examination play an important role in the response to the treatments.

The behaviour of eggplant seeds was different. Seeds with the highest moisture con-tent (w.c. 11.4%) showed a decrease of their viability already after 10 cycles (fig. 2).

References

Belletti P., Lanteri S., Lepori G., Nassi M.O. and Quagliotti L., 1990. Factors related to the cryo-preservation of pepper andeggplant seeds. Adv. Hort. Sci., in press.

ISTA, 1985. International rules for seed testing, rules 1985. Seed Sc. and Techn., 13, 199-355.

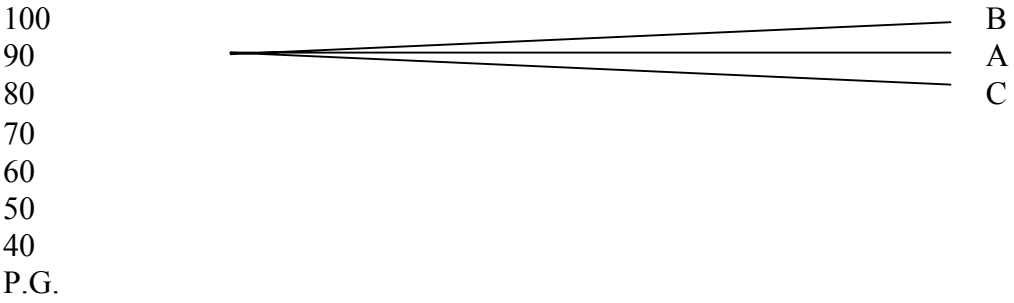

Fig. 1 – Percent of Germination (P.G.) of pepper seeds with three moisture contents (A = 4.9, B = 6.3% and C = 10.4%) subjected to cycles of cooling and rewarming.

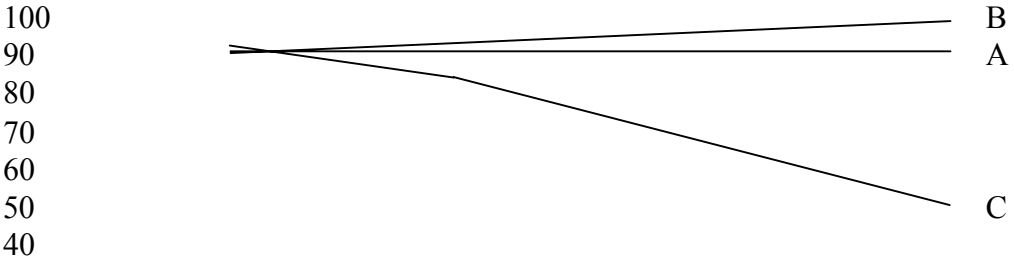

Figure 2 – Percent of Germination (P.G.) of eggplant seeds with three moisture contents (A = 4.8%, B = 6.3% and C = 11.4%) subjected to cycles of cooling and rewarming.

Capsicum Newsletter, 8-9 (1990), 66-67.

STUDIES ON COHERITABILITY FOR YIELD COMPONENTS IN EGGPLANT

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Coheritability is a general genetic parameter which indicates thu changes in pairs of characters during selection process. Goheritabilit% is the ratio between genotypic covari6nce and phenotypic covariance which refers to the coheritance of different character pairs and indicates the genetic Progress which would result from the joint selection of characters.

Nineteen cultivars of eggplant collcutcd Irom diffurcicult parts of country were planted in a randomized block design with two replicatioi-is during kharif 1988. The coheritabili Ly values for different pairs of characters were calculated and presented in thct Tible. The coheritability estimates of days of flower with plant height, plaiit height with number of branches per plant, fruit number, fruit weight and fruit yield, number of branches per plant with fruit length and fruit yield, number of fruits per plant with fruit yield, fruit weight with fruit length and yield and fruit and length with fruit yield were found to be isodirectional while in all the other traits there was an opposite relationship.

Fruit yield showed higher coheritability with number of fruits per plant and number of branches. This indicated that good progress in' yield improvement could be expected by selection for these characters in eggplant.

Table : Coheritability values for different characters in eggplant.

Character	Plant height	Number of branches per plant	Number of fruit per plant	Fruit Weight	Fruit Length	Fruit Yield
Days to flower	0.184	-0.046	-0.223	-0.033	-0.076	-0.362
Plant height	-	0.147	0.238	0.163	-0.342	0.043
Number of branches per plant	-	-	0.489	-0.097	0.243	0.398
Number of fruits per plant	-	-	-	-0.324	-0.127	0.694
Fruit Weight	-	-	-	-	0.093	0.088
Fruit Length	-	-	-	-	-	0.2006

Capsicim News],-tter, 0 9 (1990). 68-69.

PATH ANALYSIS OF YIELD COMPONENTS IN EGGPLANT

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Path analysis studies provide precise information on direct and indirect effects of yield components on yield. The direct and indirect contributions of different traits on fruit yield were studies in F3 progenies of eggplant cross 'Ep27'X'Ep47' as per method suggested by Dewey and Lu (1959).

Number of fruits per plant had the largest direct yield (Table). However, its effect through fruit Length and weight was negative. Days to flower registered negative direct effect and offer traits recorded negative effects via this trait indicated the least importance of this trait. The path analysis suggests the importace, in order of number of fruits per plant, number of branches per plant, plant height and fruit weight on fruit yield in eggplant.

Literature:

Dewey, D.R.and K.H.LU.1959. A correlation and path coefficient analysis of components of crested wheat grass seed production.
Agron.J.51:515-518.

Table : Path analysis showing direct and indirect effects of yield components on fruit yield.

Traits	Days to flower	Plant height	Number of branches per plant	Number of fruits per plant	Fruit length	Fruit weight	Correlation with fruit yield
Days to flower	-0.272	-0.056	0.014	-0.026	0.024	0.019	-0.297
Plant height	-0.241	0.394	-0.219	-0.298	-0.060	0.018	0.406
Number of branches per plant	0.013	0.016	0.488	0.009	-0.064	-0.072	0.390
Number of fruits per plant	-0.187	-0.134	-0.072	0.794	0.144	0.098	0.643
Fruit length	-0.036	-0.165	0.061	0.192	0.249	0.176	0.477
Fruit weight	-0.014	0.119	-0.022	-0.065	0.215	0.257	0.490

Blockletter figures denote direct effects Residual effect = 0.3680

Capsicum Newsletter, 8-9 (1990), 70

ASSESSAMILNT OF RESISTANCE IN' ECGPLANT AGAINST SCLERCTINIA WILT WITH A NEW SCREENING TECHNIQUE

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Sclerotinia sclerotiorum (Lib.) de Bary is a cosmopolitian fungal pathogen and occurs wold wide. It is known to encompass 19 species belonging to 10 genera in family Solanaceae (Purdy, 1979). Though the eggplant is said to be native of Inida, the pathogen has been found rasing its ugly head in the seed producing areas of Northern India only recently (Kapoor, 1988). At present no control measures are available for the disease; this study aimed to find source(s) of resistance in eggplant to the disease by development of screening method.

Detached colonized petal technique developed earlier by Kapoor et al. (1985) to screen cauliflower germplasm was extended to screen eggplant seedlings with slight modifications against this desiase. Five weeks old seedlings of different lines were grown in 10 cm diameter plastic of different lines were grown in 10 cm diameter plastic pots filled with steam sterilized soil for screening. The petals were coloinized with S. sclerotiorum. These were cut with snarp razor in distilled water into small visible pieces each of which was placed in the center of leaf with the help of a drop of water. Inoculated plants were placed in a dew champer at 80-10 per cent relative humidity at room temperature (22-25 C). The inoculated petal segments, however, were removed from leaf surface after 24h in order to keep uniform inoculum load. The symptoms developed after third day with typical signs on sixth day. Fifty varieties and breeding lines were screened and seedlings were scored after six days of inoculation using 0-5 scale where 0 designates no spread beyone the3 site of inoculation and 5 designates spread of disease to the stem through petiole resulting in death and defoliation. The cultivars which shoed a low disease score (less than 3) were considered as resistant.

LITERATT.RE CITED

KAPOOR, K.S.; GILL, H.S. and SHARMA, S.R. 1985, A techinicue for artificial inoculation of cauliflower seedlings with Sclerotinia sclerotiorum (Lib.) de Bary, Phytopath., Z. 112 191-192.

KAPOCL, K, S, 1988. Sclerotinia sclertiorum – A threat to seed production of eggplant, Capsicum Newsletter, 7, 92.

PURDY, L. H. 1979. Sclerotinia scierotinia. History, Disease and Symptomatology, Host Range, Geographic Distribution and Impact. Phytopathology, 69, 875-880.

ANNOUNCEMENTS

EUCARPIA MEETING

The VIIIth EUCARPIA Meeting on "Genetics and Breeding on Capsicum and eggplant" will be held in Casaccia, Rome (Italy) at the ENEA-CRE during the first fortnight of September 1992.

The organization of the Meeting is devolved to the Cattedra di Miglioramento genetico, University of Naples (via Universit6 100, 80055 Portici, Naples) and the Institute of Plant Breeding and Seed Production, University of Turin (via P. Giuria 15, 10126 Turin).

PROCEEDINGS

The Proceedings of the Vlth EUCARPIA Meeting on "Genetics and Breeding on Capsicum and Eggplant" held in Zaragoza, Spain in 1986 are still freely available.

If you are interested in receiving them you can apply to:

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Apartado 727
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A MISCALCULATION

We have been using for several years, different methods for Phytophthora capsici inoculations by zoospore suspensions. Recently, we have detected a miscalculation when evaluating the zoospore concentration in those suspensions. Accordingly, in all our publications dated before 1990, the zoospore concentrations reported as used by our research team should be divided by 16. That is to say, the concentration most commonly used by us, 300,000 zoospores/ml, is in fact 18,750 zoospores/ml. That error does not change the conclusions of our works. However, we would like to apologize for it.

We have chosen Capsicum Newsletter for this information because we have published there most of our concerned reports and because it is the most direct way of contacting those persons possibly interested in this information.

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LITERATURE REVIEW

Capsicum

ADO S.G. and SAMARAWIRA 1. , 1988. Estimates of genetic parameters of yield components in pepper (Capsicum annuum L.). East African Agricultural and Forestry Journal, 52: 136-140.

ASHTANKAR C.M. and JAIPURKAR M.A., 1988. Heterosis and inbreeding depression in chilli (Capsicum annuum L.). Annals of Plant Physiology, 2: 193-203.

ASTHANA A., DIXIT K., TRIPATHI N.N. and DIXIT S.N., 1989. Efficacy of Ocimum oil against fungi attacking chilli seed during storage. Tropical Science, 29: 15-20.

BAGGETT J.R. and KEAN D., 1988. 'Marbles' and 'Riot' dwarf ornamental peppers. HortScience, 23: 1097.

BAKKER J.C., 1989. The effects of air humidity on flowering, fruit set, seeds set and fruit growth of glasshouse sweet pepper (Capsicum annuum L.). Scientia Horticulturae, 40: 1-8.

BARAI B.K. and ROY K., 1989. Variability and correlation studies in chilli. Environment and Ecology, 7: 34-38.

BYUNG-SOO K., 1988. Characteristics of bacterial Spot resistant lines and Phytophthora blight resistant lines of Capsicum pepper. Journal of the Korean Society for Horticultural Science, 29: 247-252.

CAD J.S. and SU Z.Y., 1988. A study on heterosis and combining ability in hot pepper (Capsicum annuum L.). Acta Horticulturae Sinica, 15: 57-63.

COONS J.M., KUEHL R.O., OEBKER N.F. and SIMONS N.R., 1989. Seed germination of seven pepper cultivars at constant or alternating high temperatures. Journal of Horticultural Science, 64: 705-710.

DASKALOV S. and MIHAILOV L., 1988. A new method for hybrid seed production based on cytoplasmatic male sterility combined with a lethal gene and a female sterile pollenizer in Caosicum annuum L. Theoretical and Applied Genetics, 76: 530-532.

DE DONATO M., PERUCCO E. and MOZZETTI C., 1989. Protoplast culture and callus proliferation from cotyledons of Capsicum annuum. Advances in Horticultural Science, 3: 17-20.

DESHPANDE A.A., ANAND A. and RAMACHANDER P.R., 1988. Ideotype differentiation of horticultural groups in Capsicum spp. Genetica Agraria, 42: 357-364.

DIOP-BRUCKLER M., 1989. Effect of climatic factors on development of Leveillula taurica and susceptibility of Capsicum annuum at different vegetative stages. Journal of Phytopathology, 126: 104-114.

DOIJODE S.D., 1988. Solute leakage in relation to loss of seed viability in chilli cultivars. Indian Journal of Plant Physiology, 31: 285-287.

DUFOUR 0., PALLOIX A., SELASSIE K.G., POCHARD E. and MARCHOUX G., 1989. The distribution of cucumber mosaic virus in resistant and susceptible plants of pepper. Canadian Journal of Botany, 67: 655-660.

ESPINOSA J., DEPESTRE T. and GOMEZ 0., 1988. A ne~ source of adaptation for the Capsicum genus found in Cuba. Agrotecnia de Cuba, 20: 15-17.

ESQUIVEL M., SHAGARODSKY T., KRIEGHOFF K., RODRIGUEZ B. and HAMMER K., 1988. Collecting plant genetic resources in Cuba. Report on the second mission, 1986. Kulturpflanze, 36: 4.37-449.

FANGJ. and ZHANG S.Z., 1988. Tapetum dimorphism and its histochemical study in sweet pepper (Capsicum annuum var. grossum). Acta Botanica Sinica, 30: 352-356.

FERRARI V., CELANI G. and PORCELLI S., 1988. Research metodology on the pungency of chilli peppers (Capsicum annuum L.). Sementi Elette, 34: 9-15.

HERRINGTON M.E. and GILLESPIE D., 1988. Partial resistance to bacterial leafspot in pepper cultivar Hungarian Yellow. Queensland Journal of Agricultural and Animal Sciences, 45: 49-52.

HIBBERD A.M., GILLESPIE D., NAHRUNG G.C. and PERSLEY D.M., 1988. 'Redlands Sweet Sue' pepper. HortScience, 23: 1095-1096.

HIBBERD A.M., STALL R.E. and BASSETT M.J., 1988. Quantitatively assessed resistance to bacterial leaf spot in pepper that is simply inherited. Phytopathology, 78: 607-612.

HWANG B.K. and SUNG N.K., 1989. Effect of metalaxyl on capsidiol production in stems of pepper plants infected with Phytophthora capsici. Plant Disease, 73: 748-751.

INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES, 1988. report on a Capsicum germplasm-collecting trip - Bolivia 1987. IBPGR Report, 88: 25.

KARLSEN P., 1989. Daily and nightly variation in content and distribution of glucose and sucrose in young plants of Capsicum annuum L. Scientia Horticulturae, 38: 217-222.

KAUL B.L. and SHARMA P.P., 1988. Heterosis and combining ability studies for some fruit characters in bell pepper (Capsicum annuum L.). Vegetable Science, 15: 171-180.

KIM Y.J., HWANG B.K. and PARK K.W., 1989. Expression of age-related resistance in pepper plants infected with Phytophthora capsici. Plant Disease, 73: 745-747.

KUHN, C.W., NUTTER F.W.Jr. and PADGETT G.B., 1989. Multiple levels of resistance to tobacco etch virus in pepper. Phytopathology, 79: 814-818.

KUMAR O.A., HARINI I., PANDA R.C. and RAO K.G.R., 1988. Colchicine induced cytomorphological variation in two strains of chili pepper (Capsicum annuum L.). Indian Journal of Botany, 11: 1-7.

KUMAR O.A., PANDA R.C. and RAO K.G.R., 1988. Cytogenetics of interspecific hybrids in the genus Capsicum L. Euphytica, 39: 47-51.

KUNTZ M., EVRARD J.L., D'HARLINGUE A., WEIL J.H. and CAMARA B., 1989. Expression of plastid and nuclear genes during chromoplast differentiation in bell pepper (Capsicum annuum) and sunflower (Hellanthus annuus). Molecular and General Genetics, 216: 156-163.

LAKSHMI N., MURTHY N.S.R., PRAKASH N.S., RAO Y.R. and HARINI 1., 1989. Leafy calyx: an useful mutant in chilli (Capsicum annuum L.). Journal of Heredity, 80: 80-82.

LAKSHMI N. and NALINI P., 1989. Tertiary trisomic in Capsicum annuum L. Cytologia, 54: 395-399.

LAKSHMI N., PRAKASH N.S., HARINI 1. and RAO Y.R., 1989. A case of spontaneous cytomixis coupled with desynapsis in Capsicum annuum L. Cytologia, 54: 287-291.

LAKSHMI N. and RAO N.B., 198. Radiation-induced stout fruit mutant of chilli (Capsicum annuum). Indian Journal of Agricultural Sciences, 58: 311-312.

LIVNEH 0. , NAGLER Y. , TAL Y. , HARUSH S. B. , GAFNI Y. , BECKMANN J. S. and SELA 1., 1990. RFLP analysis of a hybrid cultivar of pepper (Capsicum annuum) and its use in distinguishing between parental lines and in hybrid identification. Seed Science and Technology, 18: 209-214.

LOAIZA-FIGUEROA F. and TANKSLEY S.D., 1988. Genetics of a second locus determining pungency in chilli peppers (Capsicum). Journal of Heredity, 79: 314-315.

MARCHOUX G. and GEBRE-SELASSIE K., 1989. Virus variability in Solanaceous vegetables: consequences for research on control methods. Phytoma, 404: 49-52.

MARWOTO B., 1988. Response of various pepper cultivars to root knot nematodes (Meloidogyne spp.). Buletin Penelitian Hortikultura, 16: 1-4.

MEJIA L.A., HUDSON E., GONZALES DE MEJIA E. and VAZQUEZ F., 1988. Carotenoid content and vitamin A activity of some common cultivars of Mexican peppers (Capsicum annuum) as determined by HPCL. Journal of Food Science, 53: 1448-1451.

MINSAVAGE G.V., DAHLBECK D., WHALEN M.C., KEARNEY B., BONAS U., STASKAWICZ B.J. and STALL R.E., 1990. Gene-for-gene relationship specifying disease resistance in Xanthomonas campestris pv. vescicatoria – pepper interactions. Molecular Plant-Microbe Interactions, 3: 41-47.

MUNYON I.P., HUBSTENBERGER J.F. and PHILLIPS G.C., 1989. Origin of plantlets and callus obtained from chili pepper anther cultures. In Vitro Cellular & Developmental Biology, 25: 293-296.

NARAYAN R. and POONAM D., 1988. Field reaction of chilli germplasm to different viral diseases. Plant Disease Research, 3: 69-70.

NARIKAWA T., SAKATA Y., KOMOCHI S., MELOR R., HENG C.K. and JUMALI S., 1988. Collection of Solanaceous plants in Malaysia and screening for disease resistance. Japan Agricultural Research Quarterly, 22: 101-106.

NATARAJAN S., PAPPIAH C.M., RANGASWAMY P. and DAVID P.M.M., 1988. Evaluation of chilli (' Capsicum annuum L.) genotypes under semi-dry condition. South Indian Horticulture, 36: 8-12.

OGBADU G.H., AINA M.A. and OLAREWAJU J.D., 1989. Total capsaicinoid content of some Capsicum species grown in Northern Nigeria. Tropical Science, 29: 151-155.

PALLOIX A. , DAUBEZE A.M. and POCHARD E. , 1988. Time sequences of root infection and resistance expression in an artificial inoculation method of pepper with Phytophthora capsici.. Journal of Phytopathology, 123: 12-24.

PALLOIX A. , DAUBEZE A.M. and POCHARD E. , 1988. Phytophthora root rot of pepper. Influence of host genotype and pathogen strain on the inoculum density-disease severity relationship. Journal of Phytopathology, 123: 25-33.

PASSAM H.C., KARAVITES P.I., PAPANDREOU A.A., THANOS C.A. and GEORGHIOU K., 1989. Osmoconditioning of seeds in relation to growth and fruit yield of aubergine, pepper, cucumber and melon in unheated greenhouse cultivation. Scientia Horticulturae, 38: 207-216.

PATEGAS K.G., SCHUERGER A-.C. and WETTER C., 1989. Management of tomato mosaic virus in hydroponically grown pepper (Capsicum annuum). Plant Disease, 73: 570-573.

PESHNEY N.L. av%d MOGHE P.G., 1988. resistance of chilli (Capsicum species) to tobacco mosaic and cucumber mosaic virus. Indian Journal of Agricultural Sciences, 58: 720-721.

PRAKASH N.S., LAKSHMI N. and HARINI 1., 1988. A note on spontaneous mixoploid in Capsicum. Current Science, 57: 435-436.

RAJAM M.V., 1988. Plastid mutations induced in red pepper by nitrosomethyl urea. Current Science, 57: 436-438.

RAY R.C. and SINGH R.P., 1989. Leaf area estimation in Capsicum annuum L. Scientia Horticulturae, 39: 181-188.

ROUTARAY B.N., SAHOO H. and DAS S.N., 1988. Evaluation of some chilli cultivars against Meloidogyne incognita and Rotylenchulus reniformis. Journal of the Indian Botanical Society, 67: 220-221.

SADANHA A., CHANDRA N. and KOTHARI S.L., 1988. Shoot tip culture of pepper for micropropagation. Current Science, 57: 1347-1349.

SADHANA A., CHANDRA N. and KOTHARI S.L., 1989. Plant regeneration in tissue cultures od pepper (Capsicum annuum L. cv. mathania). Plant Cell, Tissue and Organ Culture, 16: 47-55.

SALGARE S.A., 1989. Induction of male sterility by dalapon in Capsicum frutescens L. Advances in Plant Sciences, 2: 33-38.

SCHULTEIS J.R., CANTLIFFE D.J., BRYAN H.H. and STOFFELLA P.J., 1988. Improvement of plant establishment in bell pepper with a gel mix planting medium. Journal of the American Society for Horticultural Science, 113: 546-552.

SHARMA O.P., SHARMA P.P. and CHOWFLA S.C., 1989. Inheritance of resistance to potato virus Y in garden pepper (Capsicum annuum L.). Euphytica, 42: 31-33.

SHIFRISS C., ZACKS J. and GOLDMAN A., 1989. Some notes on the association **between** fruit dimensions and fruit weight in Capsicum annuum L. Euphytica, 43: 275-277.

SINGH R.K. and GUPTA S.N., 1988. Abnormal meiosis in Capsicum annuum. Indian Journal of Genetics & Plant Breeding, 48: 1-4.

SRIPICHITT P., NAWATA E. and SHIGENAGA S., 1988. Radiati on- induced mutation by using in vitro adventitious bud, technique in red pepper (Capsicum annuum L. cv. Yatsufusa) - analysis of the variant appeared in M 1 generation. Japanese Journal of Breeding, 38: 141-150.

STOFFELLA P.J., DI PAOLA M.L., PARDOSSI A. and TOGNONI F., 1988. Root morphology and development of bell peppers. HortScience, 23: 1074-1077.

STOFFELLA P.J., PARDOSSI A. and TOGNONI F., 1988. Temperature and seed treatment effects on taproot growth of young benn peppers. Advances in Horticultural Science, 2: 8-10.

SUBHASH K. and CHRISTOPHER T., 1988. Direct plantlet formation in cotyledon cultures of Capsicum frutescens. Current Science, 57: 99-100.

SUNDSTROM F.J. and PEZESHKI S.R., 1988. Reduction of Capsicum annuum L; growth and seed quality by soil flooding. HortScience, 23: 574-576.

SZABO A.S. and TEJEDA M.A.J., 1989. Investigation on the chemical composition-change in horticultural plants as a function of X-ray stimulation doses. Acta Agronomica Hungarica, 38: 45-47.

THOMAS P. ahd PETER K.V., 1988. Heterosis in intervarietal crosses of bell pepper (Capsicum annuum var. grossum) and hot chilli (C. annuum var. fasciculatum). Indian Journal of Agricultural Sciences, 58: 747-750.

TRIPP K.E. and WIEN H.C., 1989. Screening with ethephon for abscission resistance of flower buds in bell pepper. HortScience, 24: 655-657.

VANCANNEYT G., SONNEWALD U., HOFGEN R. and WILLMITZER L., 1989. Expression of a patatin-like protein in the anthers of potato and sweet pepper flowers. Plant Cell, 1: 533-540.

VILLALON B., DAINELLO F.D. and BENDER D., 1988. 'Rio Grande Gold' yellow wax sweet pepper. HortScience, 23: 1094-1095.

WILLIAMS P.D., WILKINSON A.K., LEWIS J.A., BLACK G.M. and MAVITUNA F., 1988. A method for the rapid production of fine plant cell suspension culture. Plant Cell Reports, 7: 459-462.

XUE Q.H. and HENSHAW G.G., 1989. In vitro induction of chromosomal variation in plant cells by actinomycin D. Acta Genetica Sinica, 16: 276-281.

YAGISHITA N., HIRATA Y., MIZUKAMI H., OHASHI H. and YAMASHITA K., 1990. Genetic nature of low capsaicin content in the variant strains induced by grafting in Capsicum annuum L. Euphytica, 46: 249-252.

YAN L., BAI X.Y., LI X.L. and CHEN Z.L., 1988. Studies on increased vigour in cucumber, tomato and Capsicum seeds treated in an electrostatic field. Acta Horticulturae Sinica, 15: 115-119.

Eggplant

AUBERT S., DAUNAY M.C. and POCHARD E., 1989. Steroidal saponins of aubergine (Solanum melongena L.) 1. Food value, methods of analysis and localization in the fruit. Agronomie, 9: 641-651.

CHADHA M.L., HEDGE R.K. and BAJAJ K.L., 1988. Heterosis and combining ability studies of pigmentation in brinjal (Solanum melongena L.). Vegetable Science, 15: 64-71.

DEB D.B., 1989. Solanum melongena, S. incanum versus S. insanum (Solanaceae). Taxon, 38: 138-139.

ENE-OBONG E.E. aywd KANU J.I., 1989. Response of F interspecific hybrids of Solanum to nitrogen fertilization, insecticide and fungicide treatments. Tropical Agriculture, UK, 66: 181-183.

ESTEBAN R.M., MOLLA E., VILLARROYA M.B. and LOPEZ-ANDREU F.J., 1989. Changes in the chemical composition of eggplant fruits during storage. Scientia Horticulturae, 41: 19-25.

FILIPPONE E. and LURQUIN P.F., 1989. Stable transformation of eggplant (S,. melongena) by cocultivation of tissues with Agrobacterium tumefaciens carrying a binary plasmid vector. Plant Cell Reports, 8: 370-373.

GOWDA P.H.R., SHIVASHANKAR K.T. and JOSHI S., 1990. Interspecific hybridization between Solanum melongena and Solanum macrocarpon: study of the F 1 hybrid plants. Euphytica, 48: 59-61.

GURI A. and SINK K.C., 1988. Interspecific somatic hybrid plants between eggplant (Solanum melongena) and Solanum torvum. Theoretical and Applied Genetics, 76: 490-496.

GURI A. and SINK K.C. , 1988. Organelle composition in somatic hybrids between an atrazine resistant biotype of Solanum nigra and Solanum melongena. Plant Science, Irish Republic, 58: 51-58.

GURIA. and SINK K.C., 1988. Agrobacterium transfornation of eggplant. Journal of Plant Physiology, 133: 52-55.

JAIN R.K., DHAWAN R.S., SHARMA D.R. and CHOWDHURY J.B., 1988. Selection and characterization of NaCl tolerant cell cultures of brinial (Solanum melongena L.). Indian Journal of Plant Physiology, 31: 431-433.

KALDA T.S., SURAN B.S. and GUPTA S.S., 1988. Phenotypic; genotypic variation and heritable components of some biometrical characters in eggplant. South Indian Horticulture, 36: 110-113.

KHAPRE P.R., WANJARI K.B. and DEOKAR A.B., 1988. Inheritance of fruit colour in Solanum melongena L. X Solanum indicum L. Journal of Maharashtra Agricultural University, 13: 97-98.

KHURANA S.C., KALLOO G., SINGH C.B. and THAKRAL K.K., 1988. Correlation and path analysis in eggplant (' Solanum melongena). Indian Journal of Agricultural Sciences, 58: 799-800.

LI G.G. and ZHANG L.Y., 1988. Regeneration of fertile plants from cotyledon protoplasts in Solanum melongena L. Acta Genetica Sinica, 15: 181-184.

MALAUSA J.C., DAUNAY M.C. and BOURGOIN T., 1988. Preliminary research on the resistance of aubergine to the glasshouse whitefly, Trialeurodes vaporariorum Westwood (Homoptera, Aleyrodidae). Agronomie, 8: 693-699.

NARIKAWA T., SAKATA Y., KOMOCHI S., MELOR R., HENG C.K. and JUMALI S., 1988. Collection of Solanaceous plants in Malaysia and screening for disease resistance. Japan Agricultural Research Quarterly, 22: 101-106.

PASSAM H.C., KARAVITES P.I., PAPANDREOU A.A., THANOS C.A. and GEORGHIOU K., 1989. Osmoconditioning of seeds in relation to growth and fruit yield of aubergine, pepper, cucumber and melon in unheated greenhouse cultivation. Scientia Horticulturae, 38: 207-216.

QUAGLIOTTI L. and ROTA A., 1989. The effect of test condition, seed age and cultivar upon the germination of eggplant. Advances in Horticultural Science, 3: 36-37.

RANDHAVA J.S., KUMAR J.C. and CHADHA M.L., 1988. Studies on the assessment of pollen tube growth, stigma receptivity, pollination and fertilization in eggplant (Solanum melongena L.). Indian Journal of Horticulture, 45: 304-306.

RAO Y.V. and RAO B.G.S., 1988. Cytogenetic studies on the F 1 hybrids of Solanum pubescens with S. melongena var. insanum. Indian Journal of Botany, 11: 22-28.

RASHID M.A., MONDAL S.N., AHMED M.S., AHMAD S. and SEN D.K., 1988. genetic variability, combining ability estimates and hybrid vigour in eggplant (Solanum melongena L.). Thai Journal of Agricultural Science, 21: 51-61.

SIDHU A.S. and CHADHA M.L., 1988. Metroglyph and index score analysis in brinjal. Indian Journal of Horticulture, 45: 85-88.

SIHACHAKR D., HAICOUR R., CHAPUT M.H., BARRIENTOS E., DUCREUX G. and ROSSIGNOL L., 1989. Somatic hybrid plants produced by electrofusion between Solanum melongena L. and Solanum torvum Sw. Theoretical and Applied Genetics, 77: 1-6.

SINGH B. and KUMAR N., 1988. Studies on hybrid vigour and combining ability in brinjal (Solanum melongena L.). Vegetable Science, 15: 72-78.

SINGH D.K., GAUTAM N.C., AWASTHI C.P. and SINGH R.D., 1988. Biochemical composition of fruits of promising brinjal varieties and hybrids (Solanum melongena L.). Vegetable Science, 15: 141-148.

SINGH N.D. and MITAL R.K., 1988. Genetics of yield and its components in eggplant (Solanum melongena). Indian Journal of Agri-cultural Sciences, 58: 402-403.

SWAMY M.S., CHRISTOPHER T. and SUBHASH K., 1988. Multiple shoot formation in embryo culture of Solanum melongena. Current Science, 57: 197-198.

YOSHIHARA T., HAGIHARA Y., NAGAOKA T., CHIBA S. and SAKAMURA S., 1988. Fungitoxic compounds from the roots of the eggplant stock. Annals of the Phytopathological Society of Japan, 54: 453-459.

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