capsicum newsletter
NUMBER 10

1991

DI.VA.P.R.A.
Section of Plant Breeding and Seed Production
Via P. Giuria, 15 – 10126 Turin – Italy
EDITORS
P. Belletti, M.O. Nissan, L. Quagliotti

DI.VA.P.R.A.
Section of Plant Breeding and Seed Production
Via P. Giuria, 15 - 10126 Turin - Italy
Fax: int. code + 11/650.27.54

SCIENTIFIC COMMITTEE

- A. Andrasfalvy, Hungary
- R. Gil Ortega, Spain
- E. Pochard, France
- L. Quagliotti, Italy

- C. Shifriss, Israel

SUBSCRIPTION

Annual subscription rate: 20 U.S.$ (normal) or 100 U.S.$ (supporter) including carriage charges. Subscription to be sent to EUCARPIA Secretariat (c/o Breeding Station Wiersum, Rendierweg 10, 8251 PD DRONTEN, The Netherlands) and payed into the Netherland Bank, current account A.B.N./539128090, specifying the name and the cause of the payment.

JUNE 1991

The picture in the cover is derived from the "Herbario nuovo di Castore Durante", Venetia, MDCXXXVI

Printed in Italy
CONTENTS

Contents ........................................................................................................................................3
Foreword .......................................................................................................................................5
List of the authors .....................................................................................................................7
List of the contributions ..........................................................................................................9
Contributions ..........................................................................................................................13
Announcements .......................................................................................................................67
Literature review .....................................................................................................................69
Order form ................................................................................................................................75
Analytical index .......................................................................................................................77
Mailing list ...............................................................................................................................79
FOREWORD

That's done! Thanks to the double issue that we published last year, we are now on time with our publications. So, starting from this issue (by the way, have you noticed that "Capsicum Newsletter" is celebrating its decennial?) we are going to do our best to be punctual and to go on publishing the Newsletter by the planned time, the summer of each year.

In this issue, we are happy to show no less than three invited papers. They have been kindly written by S. Daskalov (mutagenesis in pepper), A.A.Cook (pepper breeding for disease resistance) and A.T.B.Rast (resistance to viruses in eggplant). We are sure that all the readers will find them very interesting. In the next issue we hope to be able to publish invited papers on RFLP mapping and male-sterility in pepper. S. Tanksley and G. Csillery have already been contacted and have confirmed their availability to write them. Anyway, we would like to remind you that any suggestions on the subjects and/or authors being considered for the invited papers of the following issues of "Capsicum Newsletter" will be appreciated.

Although several contributions have not been accepted, we have not modified any of the published papers. Therefore the authors themselves are not only responsible for the scientific content but also for the form of their own reports.

The survey of 'literature review' is again present in this issue. We hope it will be useful and we would like to remind you to send us a copy of your articles, mainly those published on journals of limited circulation.

Please, remember that a subscription fee to the Newsletter is requested. The subscription fees have not been changed: 20 U.S.$ for normal subscribers and 100 U.S.$ for supporters. Starting from this issue it is
possible to book your own copy of the journal: just fill in the order form on page 75 and send it to us. In the meantime your chosen subscription fee should be paid directly to EUCARPIA Secretariat (please notice that the address has been recently modified). Please, do not send cheques to us in Turin, as we are not allowed to run any financial activity by Italian law.

Again we have to complain about the lack of attention paid by some authors to the instructions on the enclosed sample sheet. Please, cooperate with us and follow these instructions very carefully. Otherwise we will not accept the contributions and they will be sent back to the authors.

Lastly, we have to announce that the journal's Scientific Committee is going to be modified: Edmond Pochard has now retired and has asked to be released from his engagements with "Capsicum Newsletter". We wish to thank Dr. Pochard very much for his useful work with us. He will be replaced by Alain Palloix (who is now in charge of the Pepper Breeding Laboratory at INRA, Montfavet-Avignon) in the Scientific Committee. Welcome and fruitful work with us!

Piero Blelletti, Maria Ornella Nassi, Luclana Quagliotti

Turin, 31st May 1991
<table>
<thead>
<tr>
<th>Author Name</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ado S.G</td>
<td>47</td>
</tr>
<tr>
<td>Ahmed M.K.</td>
<td>47</td>
</tr>
<tr>
<td>Aliyu L</td>
<td>43, 47</td>
</tr>
<tr>
<td>Andrzejewska E.</td>
<td>55</td>
</tr>
<tr>
<td>Andrzejewski R.P.</td>
<td>55, 57</td>
</tr>
<tr>
<td>Camino V</td>
<td>49</td>
</tr>
<tr>
<td>Cook A.A.</td>
<td>21</td>
</tr>
<tr>
<td>Costa J</td>
<td>33, 45</td>
</tr>
<tr>
<td>Daskalov S.</td>
<td>13</td>
</tr>
<tr>
<td>Depestre T.</td>
<td>49</td>
</tr>
<tr>
<td>Diez M.J.</td>
<td>33</td>
</tr>
<tr>
<td>Doijode S.D.</td>
<td>62</td>
</tr>
<tr>
<td>Espinosa J.</td>
<td>49</td>
</tr>
<tr>
<td>Fernandez de Cordova P.</td>
<td>33</td>
</tr>
<tr>
<td>Galmarini C.</td>
<td>61</td>
</tr>
<tr>
<td>Galmarini H.</td>
<td>61</td>
</tr>
<tr>
<td>Joshi S.</td>
<td>53</td>
</tr>
<tr>
<td>Kordus R.</td>
<td>51</td>
</tr>
<tr>
<td>Lakshmi N.</td>
<td>37, 39</td>
</tr>
<tr>
<td>Ltifi A.</td>
<td>50</td>
</tr>
<tr>
<td>Milkova L.</td>
<td>41</td>
</tr>
<tr>
<td>Morone Fortunato I.</td>
<td>59</td>
</tr>
<tr>
<td>Navarro F</td>
<td>45</td>
</tr>
<tr>
<td>Nuez F.</td>
<td>33</td>
</tr>
<tr>
<td>Raghuvanshi R.K.</td>
<td>35</td>
</tr>
<tr>
<td>Rast A.T.B.</td>
<td>26</td>
</tr>
<tr>
<td>Riahi L</td>
<td>50</td>
</tr>
<tr>
<td>Samaras S.</td>
<td>41</td>
</tr>
<tr>
<td>Saxena A.</td>
<td>35</td>
</tr>
<tr>
<td>Senetiner A.</td>
<td>61</td>
</tr>
<tr>
<td>Simay E.1.</td>
<td>64, 65, 66</td>
</tr>
<tr>
<td>Srivalli T.</td>
<td>37, 39</td>
</tr>
<tr>
<td>Thakur P.C.</td>
<td>53</td>
</tr>
<tr>
<td>Tudisco M.</td>
<td>59</td>
</tr>
<tr>
<td>Van der Beek J.G.</td>
<td>50</td>
</tr>
<tr>
<td>Verma H.C.</td>
<td>53</td>
</tr>
<tr>
<td>Verma T.S.</td>
<td>53</td>
</tr>
<tr>
<td>Yusuf Y</td>
<td>43</td>
</tr>
</tbody>
</table>
LIST OF THE CONTRIBUTIONS

Daskalov S.

Experimental mutagenesis and mutation breeding in pepper

invited paper) .................................................................13

Cook A.A.

Pepper breeding for disease resistance (invited paper) ..............................21

Rast A.T.B.

Screening germplasm of Solanum melongena for resistance to the eggplant
strain of Bell Pepper Mottle Virus (BPMV) and other tobamoviruses

(invited paper) ...........................................................................................................26

Nuez F., Costa J., Diez M.J. and Fernandez de Cordova P.

Capsicum accessions of the Polytechnical University Genebank of Valencia ........33

Raghuvanshi R.K. and Saxena A

Cytogenetical study in inter-varietal crosses of Capsicum annuum L ..................35

Lakshmi N. and Srivalli T.

A case of chromosome numerical mosaicism in C. annuum variety 'jawahar ..........37

Lakshmi N. and Srivalli T.

A case of partial asynapsis and fragmentation in an autotetraploid chilli ............39

Milkova L. and Samaras S.

A new method of estimating the number of locules in pepper (C. annuum L.) ........41

Aliyu L. and Yusuf Y.

Response of two chilli pepper (Capsicum frutescens) varieties to intra-row
spacing and nitrogen levels .................................................................43
Navarro F. and Costa J.

Color evaluation of selected Capsicum

Aliyu L., Ahmed M.K. and Ado S.G.

Relationships between some characters in chilli pepper (Capsicum frutescens) ...........47

Espinosa J., Depestre T. and Camino V.

A new resistant sweet pepper variety .................................................................49

Ltifi A., Van der Beek J.G. and Riall L.

'Wafer' - A new variety for protected growing and open field production in Tunisia ...50

Kordus R.

Heterosis in F 1 hybrids of hot pepper (Capsicum annuum L.) .........................51

Joshi S., Thakur P.C., Verma T.S. and Verma H.C.

Intervarietal crossing of bell and hot pepper augments the hybrid seed yield ..........53

Andrzejewski R.P. and Andrzejewska E.

Study of interspecific hybridization between Capsicum chacoense and C. annuum

cv 'Poznanska Slodka' with use of isoenzymatic analysis ....................................55

Andrzejewski R.P.

Evaluation of genetic parameters of selected traits in interspecific hybridization between

Capsicum chacoense with C. annuum cv 'Poznanska Slodka' ...............................57

Morone Fortunato I. and Tudisco M.

In vitro shoot tip, cotyledons and first leaf cultures of pepper (Capsicum annuum L.) ...59

Galmarini C., Senetiner A. and Galmarini H.

Breeding pepper (Capsicum annuum L.) for resistance to Phytophthora capsici Leonian

in Argentina: 'Calafyuco INTA', a new cultivar ...................................................61
Doijode S.D.

Influence of seed position in fruit on seed viability and vigour during ambient storage of chilli (Capsicum annuum L.) fruits .................................................................62

Simay E. I.

Results of seed tests. X. Occurrence of Fusarium oxysporum Schlecht. on stored seeds of Capsicum annuum L. .................................................................64

Simay E.I.

Results of seed tests. XI. Seed and seedling rot of Capsicum annuum L. caused by Trichotecium roseum (Pers.) Link ex Gray ..........................................................65

Simay E.I.

Results of seed tests. XIII. Some pathogenic fungi occurring on seeds of eggplant ...... 66
EXPERIMENTAL MUTAGENESIS AND MUTATION BREEDING IN PEPPER
S. Daskalov
Institute of Genetics "Acad. D. Kostoff"
1113 SOFIA, Bulgaria

Experimental mutagenesis at present is an established method for increasing the genetic variability in many crop plants and according to IAEA more than 1,300 mutant varieties have already been released.

In the last 20-25 years a considerable number of mutation studies in pepper were undertaken and a lot of mutants were obtained which were used in plant breeding as well as in genetical, cytological, biochemical, etc. investigations.

Abbreviations
DES = diethyl sulphate
DMS = dimethyl sulphate
El = ethylenimine
EMS = ethyl methansulphonate
NEU = N-ethyl-N-nitroso urea
NMU = N-methyl-N-nitroso urea

Mutation research
Daskalov (1968, 1971, 1972, 1973, 1974, 1977, 1986) has investigated the mutagenic effect of gamma rays, X-rays and EMS and obtained several useful mutants, e.g. male sterile mutants, gene markers, dwarfs, changed fruit form and colour, etc. Terzyan and Sahakyan (1974) have found a dose dependant increase of the frequency of morphological mutations and a different mutability after X-ray irradiation. The mutagenic effect of various chemical mutagenes (EMS, DES, El, NEU, NMU) has been investigated by Kalovkyan (1968), Videnin et al. (1968), Batikian and Galuklan (1971), Solomatin (1973), Videnin aT'd Skripnikova (1971, 1972), Skripnikova (1976, 1978), Rajam (1988). Batikian and Galuklan (1971) have observed a significant difference of mutability of the cultivars used and induction of multiple mutations after NEU and NMU treatments. According to Skripnikova (1976) the highest mutation rate was induced by NEU but mutants having valuable characters were observed more frequently after low doses of NEU and DMS. Patil and Meshram (1981) reported a considerable increase for quantitative characters in M generation after treatment with EMS and DMS. Zubrzycki and von der P&en (19712) have compared the efficiency of X-rays' and EMS. EMS proved to be more efficient in the induction of chlorophyll mutations while no difference in the induction of morphological mutations was observed. In another study the same authors
(1973) have obtained data showing that EMS induces higher frequencies than X-rays of both chlorophyll and morphological mutations. A study of the efficiency of recurrent X-ray treatments with alternating treatments by X-rays and DES has been undertaken by Sethupathi Ramalingam (1977). The obtained data did not indicate any of these treatment procedures to increase the rate of chlorophyll mutations significantly but an alteration of the mutation spectrum was observed. Auni et al. (1978) applied gamma irradiation to various development stages (dry seeds, germinated seeds, gametophytes, zygotes, 15 and 30 days embryos). The highest rate for both chlorophyll and morphological mutations has been obtained following treatments of either dry seeds or both gametophytes. Saccardo (1983) and Saccardo and Monti (1984) have reported data concerning the gametophyte irradiation technique indicating some advantages, the most important being that the M1 plants are non-chimeric and seeds for the M2 generation may be harvested from the whole M1 plant. But there are some disadvantages, e.g. one additional generation is required and the treatment conditions can not be precisely monitored. Samovol (1987) reported data of changed values of some quantitative characters by treatments of F1 hybrid seeds with 1,4 bisdiazooacetylbutane. Sripichitt et al. (1988) used 12 days old seedlings for irradiation and subsequent in vitro culture to regenerate plants. Some M1 plants showed changed traits, most of which were maintained in M2.

**Mutagenic treatment procedures**

For induction of mutations mainly seed treatments have been used. Only in rare cases gametophyte treatment (pollen grains, whole anthers, female gametophyte) has been applied.

Dose range and treatment conditions used in mutation experiments are shortly summarized:

- dry seeds: 100-400 Gy X-rays (Daskalov, 1968, 1971, Sethupathi Ramalingam, 1977); 60-400 Gy gamma rays (Daskalov, 1973, Bansal, 1973, Auni et al., 1978, Todorova and Daskalov, 1979); 2-40 Gy fast neutrons (Bansal, 1973, Saccardo and Sree Ramulu, 1977, Todorova and Daskalov, 1979); 20-24 hrs treatment with 0.2-0.6% EMS (Zubrzycki and von der Pahlen, 1972, 1973, Saccardo et al., 1976, Saccardo and Sree Ramulu, 1977); 3-9 hrs treatment with 1% EMS (Todorova and Daskalov, 1979); 20 hrs treatment with 0.05-0.005% DMS (Rubzov and Solomatin, 1974, Skripnikova, 1976); 20 hrs treatment with 0.02-0.005% El (Rubzov and a, 1976); 20 hrs treatment with 0.05-0.012% Solomatin, '1974, Skr ♃k*ovL NEU (Rubzov and Solomatin, 1974, Skripnikova, 1976); 8-24 hrs treatment with 0.1 NMU (Rajami, 1988); 200-400 Gy X-ray recurrent treatment (Sethupathi Ramalingam, 1977).

- pre-soaked seeds: 18 hrs pre-soaking, 18 hrs treatment with 0.02-0.008% El (Batikian and Galukian, 19710; 18 hrs pre-soaking, 18
hrs treatment with 0.05-0.012% NEU (Batikian and Galukian, 1971); 18 hrs pre-soaking, 18 hrs treatment with 0.012-0.008% NMU (Batikian and Galukian, 1971); 12 hrs pre-soaking, 6 hrs treatment with 0.3% EMS (Bansal, 1973); 12 hrs pre-soaking, 6 hrs treatment with 0.01-0.03% NMU (Bansal, 1973).

- germinated seeds: 12-20 Gy gamma rays (Auni et al., 1978).
- male gametophyte (pollen or anthers): 5-20 Gy gamma rays.

The M₁ plants usually are raised on isolated plots (approximatively 700 m apart from other pepper plantings) to prevent cross pollination. The use of gene markers is advisable because it would help to detect contamination from cross pollination. At least 3,000-5,000 M₁ plants must be raised per experiment. It is recommended to harvest the fruits from the main bifurcation or those from each main branch since their seeds segregate more often mutations (Saccardo and Sree Ramulu, 1977, Hermelin et al., 1983). For the purpose of mutation breeding in most cases the M₁ progeny method has been used (Daskalov, 1968, 1972, 1973, Saccardo and Sree Ramulu, 1977, Bansal, 1973, Skripnikova, 1976). Applying this method 20-25 M₂ plants per M₁ plant or 10-15 M plants per M fruit (with 2-3 fruits per M₁ plant) have to be grown. If the desired character is very easily and distinctely recognizable on a single plant basis the M₁ bulk method may be used. In this case, from each M₁ plant 2-3 fruits from the main bifurcation and the main branches should be harvested and up to 15 seeds taken from each fruit to form the M₁ bulk. The size of the M₂ population, according to my experience, that can be handled by one person is approx. 70,000-100,000 plants. The selection of mutants usually is carried out in M generation. Only when monoplold material is being used selection J mutants may start in M₁ generation (Pochard, 1970).

Useful mutant characters

A great number of mutants have been obtained and described as a result of mutation experiments. The gene symbols as well as a short description of the known mutants (spontaneous or induced) are given in the gene list (Lippert et al., 1965, Daskalov, 1973). Csillery (1980, 1983) has described 113 additional spontaneous mutants.

- Male and female sterile mutants

Daskalov (1968, 1973) obtained 5 male sterile mutants after irradiation of dry seeds with X-rays and gamma rays which were denoted as ms-3, ms-4, ms-6, ms-7 and ms-8. The genes ms-3 and ms-8 were used for developing hybrid cultivars (Daskalov, 1976). The ms-3 gene was used for testing a new method for hybrid seeds production (Daskalov, 1973, 1976). Pochard (1970) obtained 3 male sterile mutants after treatment of monoplold material with EMS which were denoted as mr9, mc705 and mc509. The latter was used for establishing hybrids (Breuils and Pochard, 1975). Rubzov and Solomatin (1974) reported male sterile mutants.
obtained after treatment of dry seeds with DMS. Daskalov and Mihailov (1983) developed a new method of hybrid seed production based on the use of a female parent combining male sterility with a recessive conditional lethal gene. In F1 all plants resulting from self-pollination of the female parent die at the cotyledonary stage ensuring 100% purity of the hybrid plantation. Daskalov (unpubl.) obtained two conditional female sterile mutants (cfs) which are characterized by excessive permanent flowering during the whole vegetative period. Daskalov and Mihailov (1988) proposed the use of the female sterile mutants as pollenizer in the hybrid seed production.

- Disease and pest resistant mutants

Karasz (1974) reported induction of a CMV resistant mutant which was released as cultivar. Saccardo and Sree Ramulu (1974) have screened for resistance to CMV in M2 progenies after treatment with fast neutrons and EMS and have obtained some plants showing no symptoms. In another experiment the same authors (1977) after fast neutron and gamma irradiation have obtained some plants showing no symptoms to _Verticillium dahliae_ Kleb. Todorova and Daskalov (1979) have investigated the effect of gamma rays, fast neutrons and EMS on inducing resistance to powdery mildew. After screening a large M2 population 3 resistant plants were established. The progenies of these plants consisted of plants expressing different degrees of resistance. After subsequent selection up to M generation 8 resistant lines were developed. Lakshmi et al. (198T) obtained a leafy calyx mutant which showed some resistant to _Spodoptera_ litura (fruit borer) as the leafy calyx protected the fruit base from penetration.

- Fruit colour mutants

Daskalov (1974) has obtained after treatment of dry seeds with X-rays a mutant with orange mature fruits. Probably a mutation involving the _Y_ gene has occurred and the interaction of the genes _Y_ and _Cl_ determines the orange colour. The fruits are characterized by increased beta carotin (provitamin A). A mutant with sulfury white immature colour (gene mutation of the allele series _sw_) was reported by Daskalov (1974).

- Dwarf and compact type mutants

Sethupathi Ramalingam (1977) has induced by gamma irradiation a compact type mutant with determinate growth pattern and a number of desired characters. Daskalov (1973, 1974) described two dwarf mutant denoted as _dw_ and _dw-2_ which were obtained after gamma irradiation. Skripnikova (1976) described a compact type mutant following NEU treatment. The compact type mutants are suitable for mechanized cultivation and once over harvest. Another possible use of such mutants as well as dwarfs is to serve as a tool in genetic and mutation research (Daskalov, 1981).

- Mutants with changed fruit form

A mutant with short conic fruits was obtained by Daskalov (1972)
after irradiation of dry seeds with X-rays. Rubzov and Solomatin (1974) and Skripnikova (1976) described mutants with conic fruits after treatments with NEU. A tomato form mutant was obtained by Skripnikova (1976) following treatments with El. Lakshmi and Rao (1988) obtained mutants with short, stout and conical fruits with thick pericarp.

- Gene markers

Easily recognizable gene markers are very useful in hybrid seed production, mutation breeding and genetical investigations. Daskalov (1973, 1974) has induced 3 anthocyaninless (al) mutants after gamma irradiation. The mutant phenotype (lack of blue stain on the hypocotyl, nodes, fruits and anthers) is easily recognizable. Mutants with marbled leaves, yellow cotyledons, light green leaves, etc. were described by Daskalov (1972, 1974).

- Mutants affecting quantitative characters

Videnin et al. (1968, 1971, 1972), Dolgich (1970), Rubzov and Solomatin (1974), Skripnikova (1978), Batiklan et al. (1980) applying chemical mutagens succeeded in inducing higher yielding mutants. Mutants with enlarged fruits were reported by Rubzov and Solomatin (1974), Skripnikova (1976), Batikian et al. (1980). A mutant with increased dry matter content of the fruits was obtained by Skripnikova (1976) after treatment with NEU. Rubzov and Solomatin (1974) have discovered a mutant with thick pericarp and increased weight of the fruits after treatments with NEU. Early ripening mutants were obtained by Videnin et al. (1968), Dolgich (1970), Rubzov and Solomatin (1974), Skripnikova (1976) after treatments with chemical mutagens.

Released mutant cultivars

- 'Horgoska,slatka-X-3' (Karasz, 1974), resistant to CMV.
- 'Albena' (Daskalov, 1975), early and high yielding, more attractive fruits and better flavour.
- 'Krichimski ran' (Daskalov and Milkova, 1976), very early and high yielding hybrid.
- 'MDU.1' (Sethupahi Ramalingam, 1977), compact plant, type, high yield and capsaicine content.
- 'Lyulin' (Milkova and Daskalov, 1983) very early and high yielding hybrid.
- 'Friari KS80' (Restaino, 1985), increased fruit production, tolerant to Verticillium dahliae Kleb.
- 'Pirin' (Todorova et al., 1991, unpubl.), resistant to powdery mildew.
- 'Orangeva kapia' (Daskalov et al., 1991, unpubl.), high content of beta carotin (Provitamin A).

A more comprehensive review was written by Daskalov (1986).


DASKALOV, S., 1977. Induced mutations in sweet pepper (C. annuum L.). In: C. R. 3me Congress EUCARPIA Piment: 155

DASKALOV, S., 1981. Value of dwarf or compact type mutants as a tool in breeding programmes-, exemplified with C. annuum L. In: Induced Mut. a Tool in Plant Research, IAEA: 501.


VIDENIN, K., RODIONOV, V., KOROVIN, V. and VANYATOV, D., 1968. The use of chemical mutagens in breeding of ornamental, vegetable and fruit plants. in: Mutation Breeding, Moscow: 149.


Pepper is one of the most popular garden vegetables throughout the world. Many horticultural forms are grown and the crop is cultivated under widely differing environmental conditions. Irrespective of the geographic location and the horticultural form(s) grown, disease(s) constitute a major constraint to successful production everywhere. For many of the major diseases of pepper, there presently are no cultural means for satisfactory field control which leaves genetic resistance as the only realistic alternative. Fortunately, many disease resistance characters have been found within the genus Capsicum, but there remains a continuing challenge to find and utilize still more heritable factors for disease control. A summarization of pepper breeding has been published by Greenleaf (12).

Virus diseases are the most consistent problem for pepper production throughout the world. The importance of virus infection in herbaceous crop plants, including pepper, stems from the fact that there is no remedial procedure for a plant once it has become infected, and the infection can result in loss of all salable produce from that plant. Some of the most troublesome viruses affecting pepper are efficiently transmitted in nature by insects which, themselves, often are difficult to control and thereby reduce virus spread. Further complication is added by the capability for significant pathogenic variation between strains of a given virus, viz. tobacco mosaic.

Response in pepper to tobacco mosaic virus infection was first studied by Holmes (15) and found to be governed by a series of three alleles (16). A fourth allele has now been postulated for this series (1, 25) which is unique in that specific genotypes of infected plants are phenotypically distinguishable. Although tobacco mosaic is not generally transmitted by insects and usually is of little consequence in the field, one biotype of this virus can be seedborne in pepper (19). Viruses commonly grouped together according to biological characteristics and called "potyviruses" are among the most frequent and troublesome problems of pepper world wide. Some of these viruses have distinctive strains that have been distinguished (2, 4) and may serve to complicate development of resistant varieties equally as much as distinct viruses. Resistance to isolates of potato Y, tobacco etch, pepper mottle and pepper veinal mottle viruses have been reported (5, 27, 28, 30) but resistances have not been identified for alfalfa mosaic nor potyviruses from Argentina (11) or Venezuela (10). Although
differences in pathogenicity of specific pathotypes of each virus add significant complication to a breeding program, demonstrated linkage of resistances to potato Y and tobacco etch viruses (3) can be used to advantage. Epidemiological importance of the two potyviruses from South America, i.e. pepper severe mosaic in Argentina and pepper mild mosaic in Venezuela, remains to be determined.

In some locations, viz. Europe, Southeast Asia, cucumber mosaic virus is a major problem in pepper but in other locations it is seen only on occasion. The search for usable resistance to cucumber mosaic is complicated because verifiable infection of candidate plants is not so consistent as with some other viruses, viz. potyviruses, and symptom expression is much more erratic. Partial resistance has been reported (22, 24). Tomato spotted wilt and an unidentified gemini virus have come into prominence in the USA in recent years and may command attention in the future.

Hypersensitive resistance to tobacco mosaic infection is conferred by single, dominant characters in both C. annuum and C. frutescens. Effective but incomplete localization of infection (resistance) is recessive to hypersensitive resistance but dominant to systemic (mottling) susceptibility. The intermediate (resistance) allele must be in the homozygous condition to be effective for disease control. In plants heterozygous for this allele and the recessive (mottling) allele, tobacco mosaic infection induces infection systemic necrosis. All known resistances to potyviruses are conferred by single, recessive alleles when homozygous.

Bacterial leaf spot, caused by *Xanthomonas campestris pv vesicatoria*, is not generally so pervasive as virus infections in pepper, but, under favorable environmental conditions of warm, wet, windy weather can be quite damaging. Sprays with copper compounds, beneficial if weather is completely favorable, are mostly ineffective under conditions that encourage disease development. Resistance to that form of the bacterium predominant in Florida (USA) in the 1960's was found in an accession of C. annuum (PI 163192) (7). Field testing of breeding lines that included this resistance led to discovery of another biotype of the causal bacterium (8) found later to be the more prevalent biotype worldwide (9). Resistance to this second biotype of the bacterium was found in C. chacoense (6) and transferred into cultivars resembling and compatible with C. annuum. Still a third biotype of the bacterium was distinguished from inoculation of PI 271322 (13) used as a source of resistance to bacterial spot in Hawaii (17). Resistances to all three biotypes of the bacterium are conferred by single, dominant, independent genes (14).

A black spotting disease (29) was observed on fruits of several different cultivars in USA, Hungary, Australia and New Zealand in the 1970's. Presumed resistance to this disease of unknown cause was noted.
(personal communication) but heritability was never demonstrated.

Resistance in pepper to Phytophthora capsici has been reported (18, 23, 26) but incidence of the disease has not been sufficient to warrant a concerted effort to develop resistant varieties.

Much of the breeding for disease resistance in pepper has been directed toward control of virus diseases which are the most widespread and damaging problem in this crop irrespective of horticultural type. Each disease must be considered a single entity until information about heritability of resistance has been acquired. Likewise, biotypes of the bacterial spot organism must be considered in the same fashion until heritability of resistance is proven. Only then can a program to combine appropriate resistances be formulated and horticultural characters added. Throughout the entire breeding program, it is necessary to inoculate progenies-plants to recover-verify specific resistances. Field screening for such purpose is an invitation to disaster. Seed increase from plants with multiple resistances must be performed with extreme care to avoid outcrossing if the continuity of these traits is to be maintained (20, 21).

Creation of pepper cultivars effectively resistant to virus infection and bacterial spot disease is a formidable task but the horticultural needs of the commercial grower and industry must also be considered in a breeding program for it to be completely successful. Incorporation of horticultural characters many of which are multigenic in nature further complicates a breeding program based largely on simply inherited dominant and recessive characters. Breeding peppers horticulturally acceptable with disease resistances effective for a specific location certainly is a challenging task for the researcher who must be capable as a Plant Pathologist and Horticulturist.

References
SCREENING GERMPLASM OF SOLANUM MELONGENA FOR RESISTANCE TO THE EGGPLANT STRAIN OF BELL PEPPER MOTTLE VIRUS (BPMV) AND OTHER TOBAMOVIRUSES

A.Th.B. Rast Institute for Plant Protection (IPO), Wageningen, c/o Glasshouse Crops Research Station (PTG), P.O. Box 8, 2670 AA Naaldwijk, the Netherlands.

Abstract

Germplasm of Solanum melongena, comprising 526 accessions, was screened for resistance to the eggplant strain of bell pepper mottle virus (BPMV), tobacco mosaic virus (TMV), tomato mosaic virus (ToMV) and pathotype P 1.2 of pepper mild mottle virus (PMMV). Resistance based on hypersensitivity was found to TMV, ToMV and PMMV, but not to BPMV.

Introduction

In 1979 a mosaic disease, caused by a tobamovirus, occurred in glasshouse crops of eggplant in the Netherlands. In subsequent investigations (T6bids et al., 1982; Rast, 1985) the tobamovirus appeared almost identical to the unusual pepper strain of tobacco mosaic virus (TMV) described by Feldman and Oremianer (1972). This pepper strain was later classified as a distinct tobamovirus and renamed bell pepper mottle virus (BPMV) so that the tobamovirus isolated from eggplant had to be referred to as the eggplant strain of BPMV (Wetter et al., 1987). Meanwhile the Solanum melongena accessions of the Centre for Plant Breeding and Reproduction Research (CPRO) in Wageningen were tested in vain for resistance to the eggplant strain. The search was thereupon continued to comprise the entire germplasm collection of the U.S. Department of Agriculture. In the tests, performed over a period of five years, the eggplant strain was compared to TMV, tomato mosaic virus (ToMV) and pepper mild mottle virus (PMMV), the latter described by Wetter et al. (1984). The results are reported in this paper.

Materials and methods

The seeds of the S. melongena accessions were routinely soaked in a 100 ppm solution of gibberellic acid (CA3) for 24 hours before sowing. Germinated seedlings were transplanted in three rows of five or six seedlings in potting soil in styropor boxes measuring 60 x 40 x 7 cm. The seedlings were mechanically inoculated when the first true leaf had a diameter of about 2 cm. The inoculum consisted of infective, crude leaf sap or a purified virus suspension with 600 mesh carborundum added as an abrasive and was applied with a plug of cotton-wool. After inoculation excess carborundum was washed off the plants with water. Symptoms were read after 7 and 21 days. In case plants remained symptomless, they were sometimes assayed on Nicotiana glutinosa, a local lesion host for tobamoviruses. The tobamovirus isolates used for inoculation were Al, MA, SPS and P8 representing the eggplant strain of BPMV, TMV, ToMV and the pathotype P1.2 of PMMV respectively. For each accession of S. melongena BPMV was inoculated to 30 - 36 plants, grown in two boxes. TMV, ToMV and PMMV were each used to inoculate one of the three rows of plants, grown together in one box.
Results

In the symptoms observed two main types of reaction could be distinguished. Infected plants reacted either with mosaic symptoms of varying intensity or with necrosis, which remained localized or spread systemically. The severities of the symptoms were suggestive of differences in virulence between the tobamovirus isolates used. For any given S. melongena accession mosaic symptoms were consistently more distinct with BPMV than with TMV or ToMV. The plants inoculated with PMMV mostly remained symptomless. Occasional assays on N. glutinosa indicated that such plants were either systemically infected or were free from virus. Necrotic reactions were also most severe with BPMV and caused death of the plants by a rapidly progressing systemic necrosis. With TMV the plants usually survived a similar systemic necrosis. SPS caused only local necrotic lesions and abscission of the inoculated leaves. Again with P8 the plants, except for rare, tiny necrotic lesions in the inoculated leaves, remained symptomless and no virus could be detected in the non-inoculated top leaves. Of the many symptom readings some were selected as examples of S. melonae accessions reacting with mosaic symptoms only (Table 1) or with both mosaic and necrotic symptoms (Table 2). The examples given are representative of the 363 and 163 accessions listed under their Plant Introduction numbers in Appendices 1 and 2 respectively. The accessions of which more than half of the plants reacted with necrosis are indicated by an asterisk in Appendix 2.

Discussion

It is obvious that the S. melongena accessions, which largely reacted with mosaic symptoms, were susceptible to infection with the tobamoviruses used. In the other accessions the necrotic symptoms suggest a resistance based on hypersensitivity, which is effective against ToMV and PMMV, less effective against TMV, but ineffective against the eggplant strain of BPMV. However, it should be realized that the lethal systemic necrosis caused by BPMV in our tests resulted from deliberate seedling inoculation and may not occur with random chances for infection of older plants under field conditions. An effort to obtain uniformly resistant lines by selfing plants, which had reacted only, with necrotic, local lesions to BPMV (see P.I. no 381281 in Table 2) failed as there was no substantial increase in the proportion of such plants in their progenies. So, whenever the necessity should arise for breeding resistance to BPMV into S. melongena, another source of resistance should be sought for among related species. From observations at a private breeder's holding it was learnt that in accessions of S. aethiopicum a hypersensitive type of resistance to BPMV does exist.

Acknowledgement

I am greatly indebted to Dr. George A. White, Beltsville, Maryland, and Dr. Gilbert R. Lovell, Griffin, Georgia, both of the Agricultural Research Service of the U.S. Department of Agriculture, and their staff for providing me with the seed samples for this work.

References


Table 1. Reaction of Solanum melongena accessions to inoculation with BPMV, TMV, ToMV and PMMV.

<table>
<thead>
<tr>
<th>P.I. nos</th>
<th>BPMV Plants</th>
<th>N.O. Plants</th>
<th>TMV N.o. plants</th>
<th>ToMV N.o. Plants</th>
<th>PMMV N.o. plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>164757</td>
<td>Lc/SM</td>
<td>30</td>
<td>Lc/SM</td>
<td>6</td>
<td>Lc/SM</td>
</tr>
<tr>
<td>171855</td>
<td>Lc/SM*</td>
<td>36</td>
<td></td>
<td></td>
<td>-/-</td>
</tr>
<tr>
<td>188816</td>
<td>-/Sm</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>320505</td>
<td>-/Sm*</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>419000</td>
<td>-/Sm</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>411917</td>
<td>Lc/SM</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symbols used for description of symptoms on inoculated leaves/symptoms from systemic infection: c = chlorosis, L = local lesion reaction, M = clear mosaic, m = mild mosaic, m* = very mild mosaic or mottling, n = necrosis, n! = lethal necrosis, S = systemic reaction, s = latent infection, - = no symptoms

Table 2. Reaction of Solanum melongena accessions to the eggplant strain of BPMV, TMV, ToMV and PMMV.

<table>
<thead>
<tr>
<th>P.I. nos</th>
<th>BPMV Plants</th>
<th>N.O. Plants</th>
<th>TMV N.o. plants</th>
<th>ToMV N.o. Plants</th>
<th>PMMV N.o. plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>140460</td>
<td>Ln/Sn*</td>
<td>1</td>
<td>Ln/-</td>
<td>2</td>
<td>-/-</td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>29</td>
<td>Ln/Sn</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>179498</td>
<td>Lc/Sm*</td>
<td>23</td>
<td>Ln/-</td>
<td>3</td>
<td>-/s</td>
</tr>
<tr>
<td></td>
<td>Ln/Sn</td>
<td>4</td>
<td>Ln/Sn</td>
<td>2</td>
<td>-/-</td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>181897</td>
<td>Lc/Sm*</td>
<td>22</td>
<td>Ln/-</td>
<td>2</td>
<td>-/-</td>
</tr>
<tr>
<td></td>
<td>Ln/Sn</td>
<td>4</td>
<td>Ln/Sn</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>10</td>
<td>Ln/Sn!</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>381182</td>
<td>Ln/Sn*</td>
<td>11</td>
<td>Ln/-</td>
<td>5</td>
<td>-/-</td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>15</td>
<td>Ln/Sn</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>381281</td>
<td>Ln/-</td>
<td>1</td>
<td>Ln/-</td>
<td>5</td>
<td>Ln/-</td>
</tr>
<tr>
<td></td>
<td>Ln/-</td>
<td>5</td>
<td>Ln/Sn!</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>320506</td>
<td>Ln/SM*</td>
<td>32</td>
<td>Ln/-</td>
<td>5</td>
<td>-/-</td>
</tr>
<tr>
<td></td>
<td>Ln/Sn!</td>
<td>4</td>
<td>Ln/Sn</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

For symbols see Table 1.
Appendix 1. List of Plant Introduction nos of *Solanum melongena* accessions reacting largely with mosaic symptoms to BPMV, TMV and ToMV

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>102727</td>
<td>164288</td>
<td>169665</td>
<td>176759</td>
<td>200856</td>
<td>286100358243</td>
</tr>
<tr>
<td>105346</td>
<td>164293</td>
<td>169666</td>
<td>176762</td>
<td>200881</td>
<td>286101358244</td>
</tr>
<tr>
<td>115507</td>
<td>164294</td>
<td>169667</td>
<td>176764</td>
<td>204731</td>
<td>286103358245</td>
</tr>
<tr>
<td>115508</td>
<td>164305</td>
<td>171847</td>
<td>177073</td>
<td>206472</td>
<td>286104362727</td>
</tr>
<tr>
<td>115509</td>
<td>164321</td>
<td>171848</td>
<td>177074</td>
<td>206993</td>
<td>286105368821</td>
</tr>
<tr>
<td>115511</td>
<td>164358</td>
<td>171849</td>
<td>177075</td>
<td>207517</td>
<td>286107368822</td>
</tr>
<tr>
<td>116063</td>
<td>164359</td>
<td>171850</td>
<td>177545</td>
<td>212040</td>
<td>288629368823</td>
</tr>
<tr>
<td>116064</td>
<td>164458</td>
<td>171851</td>
<td>179045</td>
<td>213025</td>
<td>288631370046</td>
</tr>
<tr>
<td>116536</td>
<td>164462</td>
<td>171852</td>
<td>179046</td>
<td>213026</td>
<td>288633370049</td>
</tr>
<tr>
<td>116677</td>
<td>164483</td>
<td>171855</td>
<td>179048</td>
<td>213027</td>
<td>290468370050</td>
</tr>
<tr>
<td>120798</td>
<td>164661</td>
<td>173104</td>
<td>179494</td>
<td>214177</td>
<td>290469370051</td>
</tr>
<tr>
<td>121359</td>
<td>164710</td>
<td>173105</td>
<td>179495</td>
<td>220120</td>
<td>291374370601</td>
</tr>
<tr>
<td>140448</td>
<td>164721</td>
<td>173106</td>
<td>179496</td>
<td>222628</td>
<td>292269371849</td>
</tr>
<tr>
<td>140451</td>
<td>164757</td>
<td>173107</td>
<td>179497</td>
<td>222833</td>
<td>302805379541</td>
</tr>
<tr>
<td>140452</td>
<td>164811</td>
<td>173109</td>
<td>179499</td>
<td>222834</td>
<td>302811379542</td>
</tr>
<tr>
<td>140453</td>
<td>164812</td>
<td>173110</td>
<td>179500</td>
<td>223016</td>
<td>302812379543</td>
</tr>
<tr>
<td>140455</td>
<td>165505</td>
<td>173807</td>
<td>179659</td>
<td>223844</td>
<td>304839379544</td>
</tr>
<tr>
<td>140456</td>
<td>165519</td>
<td>173967</td>
<td>179744</td>
<td>226529</td>
<td>304840379545</td>
</tr>
<tr>
<td>140457</td>
<td>166994</td>
<td>174360</td>
<td>179760</td>
<td>227254</td>
<td>304841381159</td>
</tr>
<tr>
<td>140459</td>
<td>167373</td>
<td>174361</td>
<td>179761</td>
<td>229543</td>
<td>320501381160</td>
</tr>
<tr>
<td>141968</td>
<td>167381</td>
<td>174362</td>
<td>180000</td>
<td>229730</td>
<td>320503381161</td>
</tr>
<tr>
<td>141969</td>
<td>199640</td>
<td>174364</td>
<td>180001</td>
<td>230333</td>
<td>320505381162</td>
</tr>
<tr>
<td>141970</td>
<td>199643</td>
<td>174367</td>
<td>180342</td>
<td>230334</td>
<td>320507381166</td>
</tr>
<tr>
<td>143402</td>
<td>169647</td>
<td>174368</td>
<td>180343</td>
<td>230335</td>
<td>321017381169</td>
</tr>
<tr>
<td>143404</td>
<td>169648</td>
<td>174369</td>
<td>180344</td>
<td>232078</td>
<td>321018381170</td>
</tr>
<tr>
<td>143405</td>
<td>169649</td>
<td>174370</td>
<td>180345</td>
<td>232079</td>
<td>323322381171</td>
</tr>
<tr>
<td>143407</td>
<td>169650</td>
<td>174374</td>
<td>180346</td>
<td>249569</td>
<td>323324381172</td>
</tr>
<tr>
<td>143408</td>
<td>169651</td>
<td>174375</td>
<td>180347</td>
<td>249570</td>
<td>349612381173</td>
</tr>
<tr>
<td>143411</td>
<td>169652</td>
<td>175909</td>
<td>181806</td>
<td>249571</td>
<td>350320381174</td>
</tr>
<tr>
<td>155511</td>
<td>169653</td>
<td>175910</td>
<td>181807</td>
<td>256077</td>
<td>351129381175</td>
</tr>
<tr>
<td>163264</td>
<td>169654</td>
<td>175911</td>
<td>181895</td>
<td>257419</td>
<td>352678381176</td>
</tr>
<tr>
<td>163265</td>
<td>169655</td>
<td>175912</td>
<td>181986</td>
<td>268428</td>
<td>358233381177</td>
</tr>
<tr>
<td>163267</td>
<td>169656</td>
<td>175913</td>
<td>181962</td>
<td>269653</td>
<td>358234381178</td>
</tr>
<tr>
<td>163268</td>
<td>169657</td>
<td>175914</td>
<td>181963</td>
<td>269662</td>
<td>358235381179</td>
</tr>
<tr>
<td>163270</td>
<td>169658</td>
<td>175915</td>
<td>182300</td>
<td>269663</td>
<td>358237381186</td>
</tr>
<tr>
<td>163271</td>
<td>169659</td>
<td>175916</td>
<td>183356</td>
<td>271411</td>
<td>358238381188</td>
</tr>
<tr>
<td>163272</td>
<td>169660</td>
<td>175917</td>
<td>183476</td>
<td>271412</td>
<td>358239381189</td>
</tr>
<tr>
<td>164277</td>
<td>169661</td>
<td>175918</td>
<td>188816</td>
<td>271520</td>
<td>358240381190</td>
</tr>
<tr>
<td>164283</td>
<td>169662</td>
<td>176756</td>
<td>193599</td>
<td>276103</td>
<td>358241381192</td>
</tr>
<tr>
<td>164286</td>
<td>169664</td>
<td>176757</td>
<td>198331</td>
<td>286099</td>
<td>358242381196</td>
</tr>
</tbody>
</table>
Appendix 1 (continued)

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>381213</td>
<td>381248</td>
<td>381286</td>
<td>386270</td>
<td>413781</td>
<td>419117452124</td>
</tr>
<tr>
<td>381214</td>
<td>381254</td>
<td>381287</td>
<td>386272</td>
<td>414372</td>
<td>419118470273</td>
</tr>
<tr>
<td>381215</td>
<td>381255</td>
<td>381288</td>
<td>386273</td>
<td>418975</td>
<td>419119476415</td>
</tr>
<tr>
<td>381219</td>
<td>381262</td>
<td>386008</td>
<td>386275</td>
<td>418976</td>
<td>419120478388</td>
</tr>
<tr>
<td>381222</td>
<td>381268</td>
<td>386251</td>
<td>391645</td>
<td>418977</td>
<td>419157478389</td>
</tr>
<tr>
<td>381223</td>
<td>381270</td>
<td>386253</td>
<td>391646</td>
<td>419000</td>
<td>419159478390</td>
</tr>
<tr>
<td>381224</td>
<td>381272</td>
<td>386254</td>
<td>391647</td>
<td>419001</td>
<td>419161478391</td>
</tr>
<tr>
<td>381225</td>
<td>381274</td>
<td>386255</td>
<td>391648</td>
<td>419002</td>
<td>419198478392</td>
</tr>
<tr>
<td>381227</td>
<td>381275</td>
<td>386258</td>
<td>391649</td>
<td>419003</td>
<td>430664491192</td>
</tr>
<tr>
<td>381229</td>
<td>381276</td>
<td>386261</td>
<td>408973</td>
<td>419020</td>
<td>436679508502</td>
</tr>
<tr>
<td>381236</td>
<td>381282</td>
<td>386266</td>
<td>408974</td>
<td>419035</td>
<td>436680508503</td>
</tr>
<tr>
<td>381247</td>
<td>381285</td>
<td>386268</td>
<td>408975</td>
<td>419054</td>
<td>452122</td>
</tr>
</tbody>
</table>

Appendix 2. List of Plant Introduction nos of Solanum melongena accessions reacting partly with mosaic, partly with necrotic symptoms to BPMV, TMV and ToMV

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>105347</td>
<td>164813</td>
<td>169663</td>
<td>182996</td>
<td>223534</td>
<td>269659302809</td>
</tr>
<tr>
<td>115505</td>
<td>164941</td>
<td>171853</td>
<td>183718</td>
<td>224690</td>
<td>269660302810</td>
</tr>
<tr>
<td>115506*</td>
<td>165059</td>
<td>173108</td>
<td>198330</td>
<td>228363</td>
<td>276104320500</td>
</tr>
<tr>
<td>115964</td>
<td>165579</td>
<td>173111*</td>
<td>198332</td>
<td>233016</td>
<td>277283720502</td>
</tr>
<tr>
<td>116061</td>
<td>166995</td>
<td>173968</td>
<td>199516</td>
<td>234632*</td>
<td>277288320504</td>
</tr>
<tr>
<td>120770</td>
<td>166996</td>
<td>174359</td>
<td>204630</td>
<td>241594</td>
<td>277289320506</td>
</tr>
<tr>
<td>121992</td>
<td>167077</td>
<td>174365</td>
<td>210026</td>
<td>24016</td>
<td>279872320508*</td>
</tr>
<tr>
<td>140446</td>
<td>167101</td>
<td>174372</td>
<td>211631</td>
<td>246932</td>
<td>279873320509</td>
</tr>
<tr>
<td>140447</td>
<td>167208</td>
<td>176758</td>
<td>212627*</td>
<td>249568</td>
<td>279874320510*</td>
</tr>
<tr>
<td>140460</td>
<td>167209</td>
<td>176763</td>
<td>213191</td>
<td>251506</td>
<td>279875320511*</td>
</tr>
<tr>
<td>143403</td>
<td>167220</td>
<td>177076</td>
<td>213193*</td>
<td>256078</td>
<td>286102*320512</td>
</tr>
<tr>
<td>143409</td>
<td>167328</td>
<td>179498</td>
<td>213194*</td>
<td>263727</td>
<td>286106323323</td>
</tr>
<tr>
<td>143410</td>
<td>169639</td>
<td>179998</td>
<td>217962</td>
<td>267104</td>
<td>286108350318</td>
</tr>
<tr>
<td>163266</td>
<td>169641</td>
<td>181897</td>
<td>220685</td>
<td>267116</td>
<td>288634530319*</td>
</tr>
<tr>
<td>163269</td>
<td>169642</td>
<td>181921</td>
<td>222267</td>
<td>269600*</td>
<td>290467352677*</td>
</tr>
<tr>
<td>164529</td>
<td>169644</td>
<td>182296</td>
<td>223015</td>
<td>269601</td>
<td>29103352679*</td>
</tr>
<tr>
<td>164581</td>
<td>169645</td>
<td>182994</td>
<td>223017</td>
<td>269655</td>
<td>302807358232</td>
</tr>
<tr>
<td>164672</td>
<td>169646</td>
<td>182995</td>
<td>223018</td>
<td>269656*</td>
<td>302808370047</td>
</tr>
</tbody>
</table>

29
Appendix 2 (continued)

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>381180</td>
<td>381237</td>
<td>381284</td>
<td>386262</td>
<td>386271</td>
<td>413783*491260</td>
</tr>
<tr>
<td>381181</td>
<td>381242</td>
<td>386252</td>
<td>386263</td>
<td>386274</td>
<td>413784*</td>
</tr>
<tr>
<td>381182*</td>
<td>381243</td>
<td>386256</td>
<td>386264</td>
<td>391644</td>
<td>419158</td>
</tr>
<tr>
<td>381187</td>
<td>381277*</td>
<td>386257</td>
<td>386265</td>
<td>401533</td>
<td>419160</td>
</tr>
<tr>
<td>381191*</td>
<td>381281*</td>
<td>386259</td>
<td>386267</td>
<td>401717*</td>
<td>452123*</td>
</tr>
<tr>
<td>381232</td>
<td>381283*</td>
<td>386260*</td>
<td>386269</td>
<td>413782*</td>
<td>462370</td>
</tr>
</tbody>
</table>

*) *S. melonzena* accessions in which more than half of the plants reacted with necrotic symptoms.
ACCESSIONS OF THE POLYTECHNICAL UNIVERSITY GENEANK OF VALENCIA
F. Nuez*, J. Costa**, M.J. Diez** and P. Fernandez de Cordova*
* Biotechnology Departement, Polytechnical University, 46020 Valencia, Spain.
** Regional Center of Agricultural Research, La Alberca, Murcia, Spain.

The establishment of the Project “collection, Multiplication and Evaluation of the Genetic Resources for their conservation of Genebank”, subsidized by the National Institute of Agricultural Reasearch (INIA) in 1988, allowed our team to continue the task of collecting, characterization and multiplication of vegetable germplasm initiated in 1982 (Nuez et al., 1985, 1987).

Besides the collection carried out in the Iberian Peninsula, it is necessary to emphasize the work done at the Canary Island. These Islands acted during the colonization period as a bridge for the exchange of materials between Europe and Latin America and also at present follow playing this role. Still today it is possible to find there material of interest.

Table 1 showes the accessions of Capsicum collected in each community. The classification proposed by Pochard has been followed to set up every accession according to their morphological characteristics.

In group A are included the American type peppers. ‘Yolo Wonder’ is a representative variety of this group. Most part of the accessions are enclosed in B and C groups. A typic variety of B is ‘Trompa de Vaca’ and in this group are comprised the “moron” peppers. Nearly all the accessions collected in Canary Islands has been included in Group C, peppers not so big and fleshy like the ones belonging to group B and longer and thinner. In these Islands it is very important the cultivation of pungent peppers, utilized as flavouring in one typical dish Island, the “mojo picon”. Group N and P are less important. Group N is made up of “Noras” type, decoration peppers cultivated in pots and “pungent cherries”. The eight accessions of P group are all used for processing.

The sampling that constitutes these 384 accessions collected in Spain, reveals the diversity of types in materials locally adapted existing currently, in spite of the fact that most part of the consumption of peppers proceed from commercial varities. It is necessary to show up the coincidence between the characteristics of the accessions collected (75% of them belongs to Group B and C) and the preferences of the Spanish market: a type of pepper long and with thin flesh (Group C) and more fleshy and thick (Group B). The 36 accessions belonging to Group A probably come from commercial hybrids introduced some years ago in Almeria area for their intensive cultivation, since this type of pepper is not the typic in our country.

Literature:

Acknowledgements:
We are extremely grateful to the National Institute of Agricultural Research (INIA) for the subvention through the Project “Collection Evaluation and Multiplication of the Genetic Resources for their conservation in Genebanks” of most part of the works included in this paper.
Table 1 – Accessions collected

<table>
<thead>
<tr>
<th>COMMUNITIES</th>
<th>Andalucia</th>
<th>Canary Islands</th>
<th>Castillia La Mancha</th>
<th>Extremadua</th>
<th>Murcia</th>
<th>Valencia</th>
<th>Others</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>17</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>6</td>
<td>22</td>
<td>15</td>
<td>79</td>
</tr>
<tr>
<td>C</td>
<td>24/22</td>
<td>44/31</td>
<td>4/9</td>
<td>16/3</td>
<td>7/3</td>
<td>11/18</td>
<td>9/19</td>
<td>115/105</td>
</tr>
<tr>
<td>N</td>
<td>9/3</td>
<td>2/1</td>
<td>1/-</td>
<td>5/2</td>
<td>3/-</td>
<td>9/4</td>
<td>1/1</td>
<td>30/11</td>
</tr>
<tr>
<td>P</td>
<td>2</td>
<td>--</td>
<td>3</td>
<td>--</td>
<td>2</td>
<td>1</td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>68/26</td>
<td>49/32</td>
<td>15/9</td>
<td>33/5</td>
<td>22/3</td>
<td>52/22</td>
<td>29/20</td>
<td>268/116</td>
</tr>
</tbody>
</table>

No Punctent/Pungent
Group A: Quadrangular longitudinal section, as long as wide. Thick flesh.
Group B: Quadrangular longitudinal section, more long than wide. Thick flesh.
Group C: Tirangular longitudinal section. Long pepper with thin flesh.
Group N: Spherical fruit (Nora type).
Group P: Heartshaped fruit (for processing).
CITOGENETICAL STUDY IN INTER-VARIETAL GRUSSES OF CAPSICUM ANNUUM L.

R.K.- RaghuVranshi and Anita Saxena
Botany Department, University of Rajasthan, Jaipur-302004, India

85 single as well as reciprocal crosses were made in Capsicum annuum L. ('Pusa Jwala'x'California Wonder' in order to combine some desirable characters from these two distinct genotypes.

In both the cultivars, all PMC’s studied, recorded 12 bivalents at diakinesis and M1. Their configuration occurred more commonly in cv 'Pusa Jwala', F1 hybrid and P1.2, P1.3 and P1.4 in F2 generation (Table I). Univalents were not observed in parents but were invariably found in F1 and F2 plants. The chiasma frequency chromosome was lower in cv 'Pusa Jwala', F1 hybrid and all 4 F2 generation plants, in comparison to the cv ‘California Wonder'. Unlike parents, the meiosis was fairly irregular in both F1 and F2 plants. The common meiotic abnormalities occurred were unorientation of chromosome(s), chromosome bridge, unequal separation of chromosome(s) and different types of sporads. F1 hybrid differed significantly from both parents in total meiotic abnormalities % as well as pollen viability %. Because of high rate of flower abscission and very poor pollen viability in F1 hybrid, only one fruit could be obtained whereas all four F2 plants remained fruitless mainly due to blackening of young flower buds followed by 100% bscission. Weak F1 hybrials have been reported by Kumar et al. (1987) from the crosses between Capsicum chinense x C. frutescens whereas Nwanliiti (1981) obtained fertile F1 ybrid's from a cross between var. ‘OS/UN/60’Tatasi' of chilli, but by using artificial pollination techniques. He attributed the lack of self-fertility to the pattern of arrangements of reproductive organs.

REFERENCES


Table 1.
Chromosome configuration in parents and their hybrids.

<table>
<thead>
<tr>
<th>Type</th>
<th>Configurations</th>
<th>Chiasma frequency/Chromosome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>OII</td>
</tr>
<tr>
<td>Cv ‘California Wonder’</td>
<td>0.0</td>
<td>6.02</td>
</tr>
<tr>
<td>Cv ‘Pusa Jwala’</td>
<td>0.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>(2-12)</td>
<td>(0-10)</td>
</tr>
<tr>
<td>F1 hybrid</td>
<td>2.02</td>
<td>4.97</td>
</tr>
<tr>
<td></td>
<td>(0.4)</td>
<td>(3-8)</td>
</tr>
<tr>
<td>F2 generation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI.1</td>
<td>13.57</td>
<td>2.62</td>
</tr>
<tr>
<td></td>
<td>(12-16)</td>
<td>(2-16)</td>
</tr>
<tr>
<td>PI.2</td>
<td>2.87</td>
<td>3.44</td>
</tr>
<tr>
<td></td>
<td>(0.4)</td>
<td>(1-5)</td>
</tr>
<tr>
<td>PI.3</td>
<td>4.00</td>
<td>2.94</td>
</tr>
<tr>
<td></td>
<td>(2-6)</td>
<td>(2-6)</td>
</tr>
<tr>
<td>PI.4</td>
<td>0.51</td>
<td>4.25</td>
</tr>
<tr>
<td></td>
<td>(0-2)</td>
<td>(2-6)</td>
</tr>
</tbody>
</table>

* Significant at 1% level.

Capsicum Newsletter, 10 (1991), 37-38.
A CASE OF CHROMOSOME NUMERICAL MOSAICISM IN C. ANNUUM VARIETY 'JAWAHARI.'

N. Lakshmi and T. Srivalli
Cytogenetics Laboratory, Department of Botany, Nagarjuna University,
Nagarjuna Nagar - 522 510 (A.P) India.

The existence of two or more than two different chromosome numbers in the meiocytes of the same anther is termed as chromosome numerical mosaicism. This is an infrequent cytological abnormality encountered both in root tips and anther cells. This phenomenon may arise either spontaneously or be induced through physical and chemical treatments.

A mosaic with different chromosome numbers of $2n = 24$, $26$ and $28$ was encountered while making the cytological scrutiny of open pollinated tetraploids of C. annuum variety 'Jawahart'. Phenotypically this plant was quite distinct having more spread and light green foliage. However, there was decrease in leaf length, breadth and thickness. There was no appreciable difference in the size of the flowers.

Detailed meiotic analysis of the plant revealed three types of chromosome numbers. Of the 136 cells analysed at diakinesis, 4 cells showed the chromosome number of 24 (mean chiasma frequency of $17.75 \pm 0.41$ per cell), 33 cells 26 (mean chiasma frequency of $20.18 \pm 0.19$ per cell) and 99 cells 28 (mean frequency of $17.54 \pm 0.16$, per cell) - Chromosome distribution at anaphase I was regular in 76.92% of cells while lagging chromosomes and bridges were observed in 23.08% of the cells. Telophase II abnormalities like micronuclei and polyads were encountered in higher percentage, in cells showing $2n = 28$ number (72.19%) followed by $2n = 26$ (24.26%) and $2n = 24$ numbers (2.95%). In addition to the normal bivalents, univalents, trivalents and quadrivalents were observed in low frequency.

Pollen fertility was very low being 6.43%. The plant was highly sterile. Only three fruits could be secured on open pollination.

The chromosome mosaicism encountered in the present study may be attributed to the effect of colchicine which might have affected both the spindle and normal physiological processes in the plant causing cellular effects.
Table 1. Variation in chromosome number and chiasma frequency in the mosaic of *C. annuum* var. 'Jawahar'.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Chromosome number</th>
<th>Percentage</th>
<th>Chiasma frequency per cell + SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2n = 24</td>
<td>2.95</td>
<td>17.75 + 0.41</td>
</tr>
<tr>
<td>2.</td>
<td>2n = 26</td>
<td>24.26</td>
<td>20.18 + 0.19</td>
</tr>
<tr>
<td>3.</td>
<td>2n = 28</td>
<td>72.79</td>
<td>17.54 + 0.16</td>
</tr>
</tbody>
</table>
A CASE OF PARTIAL ASYNAPSIS AND FRAGMENTATION IN AN AUTOTETRAPLOID CHILLI.

N. Lakshmi and T. Srivalli
Cytogenetics Laboratory, Department of Botany, Nagarjuna University
Nagarjuna Nagar - 522 510 (A.P.), India.

In ‘Jawahar’, a local cultivar of C. annum in C3 generation of autotetraploids, in addition to the normal tetraploids, a tetraploid exhibiting failure of pachytene pairing for some chromosomes along with fragmentation was encountered. Hence this is described as a partial asynaptic tetraploid.

The asynaptic tetraploid was different from the normal tetraploid in having stunted growth and flower buds of irregular size and shape. The plant was completely sterile and fruit set was totally absent.

Detailed meiotic analysis of the asynaptic tetraploid revealed that there was a significant decrease in the frequency of quadrivalents and bivalents with concurrent increase in the frequency of univalents both at diakinesis (37.20 ± 0.69) and metaphase 1 (36.52 ± 0.51), when compared to the normal autotetraploid (0.13 ± 0.09 at diakinesis, 0.24 ± 0.13 at metaphase 1) (Table I). In autotetraploid, anaphase I segregation was regular in 75.21% of the cells while in the asynaptic tetraploid, the univalents were randomly distributed throughout the cytoplasm. The remarkable increase in the number of univalents at diakinesis (30-44 per cell) and metaphase 1 (30-42 per cell) which far exceeded the other associations suggested the asynaptic condition.

The mean chiasma frequency per cell was significantly less (7.24 ± 0.42 at diakinesis and 7.00 ± 0.44 at metaphase I) than that observed in normal autotetraploid (Table I). Another interesting feature was the occurrence of small innumerable fragments in the asynaptic tetraploid in 32% of cells. The high frequency of univalents and fragments lead to highly irregular meiosis resulting in complete sterility of the plant.

Asynapsis has been attributed to a variety of causes such as abnormal external conditions, chromosomal deficiencies, genetic combinations and other biochemical and physiological conditions. Since the plant was completely sterile it was not possible to assess the cause of asynapsis correctly. However, since all the tetraploid plants are grown under uniform agroclimatic conditions, the cause is inferred as genetic.
Table 1. Chiasma frequency and chromosome association in normal and asyaptic autotetraploids of C. annuum var. ‘Jawahar’.

<table>
<thead>
<tr>
<th>Tetraploid</th>
<th>Stage</th>
<th>No. of cells</th>
<th>Mean frequency of univalents</th>
<th>Mean frequency of bivalents</th>
<th>Mean frequency of quadrivalents</th>
<th>Chiasma frequency per cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal autotetraploid</td>
<td>Diakinesis</td>
<td>50</td>
<td>0.13 ± 0.09</td>
<td>19.47 ± 0.35</td>
<td>2.23 ± 0.17</td>
<td>34.87 ± 0.29</td>
</tr>
<tr>
<td>Asynaptic tetraploid</td>
<td>Metaphase</td>
<td>50</td>
<td>0.24 ± 0.13</td>
<td>18.76 ± 0.37</td>
<td>2.56 ± 0.17</td>
<td>35.32 ± 0.30</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>Diakinesis</td>
<td>37.20 ± 0.69</td>
<td>3.00 ± 0.34</td>
<td>1.00 ± 0.14</td>
<td>7.24 ± 0.42</td>
</tr>
<tr>
<td></td>
<td>Metaphase</td>
<td>50</td>
<td>36.52 ± 0.51</td>
<td>2.66 ± 0.33</td>
<td>1.04 ± 0.13</td>
<td>7.00 ± 0.44</td>
</tr>
</tbody>
</table>
A NEW METHOD OF ESTIMATING THE NUMBER OF LOcules IN PEPPER

(C. annuum L.)

L. Milkova 1 1 S. Samaras 2

1. Institute of Genetics - Bulgarian Academy of Science, Sofia - Bulgaria
2. Greek Gene.Bank, Salonica Greece

Fruit uniformity in pepper (C. annuum L.) at optimum environmental conditions depends mainly on the number of locules. For "Cal. Wonder" type pepper fruits with 1 locules, are preferred, but for "Kapiall" type pepper fruits with 2 locules are favoured. The number of locules is usually counted at the stage of technological- or botanical fruit maturity.

In pepper, however, the number of fruits is a small- part in comparison to the large number of all formed reproductive organs. Therefore, this estimating method based on counting only the number of locules of the fruit is imperfect. The locules are formed at a very early stage of organogenesis (Loskutova et al., 1988). Because of this, the aim of the investigation was to estimate the number of locules in all formed buds and to compare the results with the traditional method i.e. estimating the number of locules in fruits.

Material and methods

In greenhouse (1988-89) and in the field (1989) at the Institute of Genetics - BAS, the number of locules in varieties 11PT-25" ("Cal.Wonder" type), "PT-3611 (tomato type) and PT-169 ("Kapiall" type) from Greek Gene Bank and"Zhlaten medal" (Bulgarian "Kapiall type) as control, were counted.

From each variety 3 plants were grown in 6 replications. In 3 replications the number of locules in buds was counted and in the other 3 the number of locules in botanical maturity fruits. From each variety 18 plants were grown in greenhouse and 18 plants in the field. The total number of plants evaluated in the trials was 14.4.

By the new method once a week all formed buds and flowers are picked and cross-sectioned and by the aid of a magnifying lens the number of locules were counted. The total number of counts was 341 for fruits and 4124 for buds.

Results and discussion

The results are given in table 1. From table we see that in "Cal. Wonder" type ("PT-25") the number of locules was estimated in 927 buds and 58 fruits. Observation shows that the buds are with 2, 3 and 4 locules.

The fruits in greenhouse are with 2 and 3 and in field with 3 and 4 locules only.

In tomato type ("PT-3611) 1118 buds and 67 fruits were studied. The results from buds and fruits are similar.

In "Kapiall type ("PT-16911 and "Zhlaten medal") 933 and 135, 1146 and 81 buds and fruits were studied, respectively. The buds give us more detailed information in comparison to the number of locules of fruits.

The estimating of the number of locules in the early stage, in all formed buds gives us the possibility to reach the following conclusions:

1. By the new method we estimate 6 - 12 times more reproductive organs and that gives us almost full information about the number of locules in pepper varieties.
2. Both methods give us similar information but through bud counts information is more detailed.
<table>
<thead>
<tr>
<th>No.</th>
<th>Variety and type</th>
<th>Place of cultivation</th>
<th>Object of estimating</th>
<th>% of buds and fruits with:</th>
<th>Total number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 loc.</td>
<td>3 loc.</td>
</tr>
<tr>
<td>1.</td>
<td>“PT-25”</td>
<td>Greenhouse field</td>
<td>Buds</td>
<td>8</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>“Cal.Wond”</td>
<td></td>
<td>Fruts</td>
<td>31</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Buds</td>
<td>11</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruits</td>
<td>-</td>
<td>85</td>
</tr>
<tr>
<td>2.</td>
<td>“PT-36”</td>
<td>Greenhouse field</td>
<td>Buds</td>
<td>22</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Tomato</td>
<td></td>
<td>Fruts</td>
<td>32</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Buds</td>
<td>10</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruits</td>
<td>10</td>
<td>57</td>
</tr>
<tr>
<td>3.</td>
<td>“PT-169”</td>
<td>Greenhouse field</td>
<td>Buds</td>
<td>93</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruts</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Buds</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruits</td>
<td>81</td>
<td>19</td>
</tr>
<tr>
<td>4.</td>
<td>“Zaten medal”</td>
<td>Greenhouse field</td>
<td>Buds</td>
<td>77</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruts</td>
<td>95</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Buds</td>
<td>57</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruits</td>
<td>67</td>
<td>33</td>
</tr>
</tbody>
</table>

Literature:
RESPONSE OF TWO CHILLI PEPPER (Capsicum frutescens)
VARIETIES TO INTRA-ROW SPACING AND NITROGEN LEVELS

L. Aliyu and Y. Yusuf
Department of Agronomy, Ahmadu Bello University, Samaru Zaria, Nigeria.

A preliminary trial was conducted at Samaru, Nigeria during 1990 wet season to study the response of two chilli pepper varieties to three intra-row spacings (50, 40 and 30 cm) and four nitrogen levels (0, 60, 120 and 180kg N/ha). It was a split plot design with three replications.

The results showed that there was no significant difference in the performance of the two varieties with respect to the parameters analysis. Reducing intra-row spacing from 50 cm to 40 cm significantly increased plant height, fruit number and fruit diameter whereas total yield/ha was conversely, inarrasud. However, with the exception of fruit number, there was no significant response in those parameters when the spacing was further reduced to 30 cm. All parameters were significantly increased with nitrogen application. Leaf number was significantly increased with each additional nitrogen level up to 130 kg/ha. Other parameters were not significantly affected by the application of 180 kg N/ha when compared with 1200-N/ha. The two levels however, significantly increased branch number, fruit diameter, fruit number and total yield when compared with 60 kg N/ha. The difference between 60 and 120 kg N/ha was not significant with respect to plant height (Table 1).
Table 1. Response of chilli pepper (Capsicum frutesens) varieties to intra-row spacing and nitrogen levels at Samaru, during 1990 wet season.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant Height (cm)</th>
<th>Leaf number (9WAT)</th>
<th>Branch number (9WAT)</th>
<th>Fruit number (15WAT)</th>
<th>Fruit diameter (mm)</th>
<th>Fresh fruit yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varieties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UL 2289</td>
<td>34.83</td>
<td>251.31</td>
<td>41.56</td>
<td>148.33</td>
<td>8.70</td>
<td>2143.34</td>
</tr>
<tr>
<td>PL 2289</td>
<td>36.42</td>
<td>273.45</td>
<td>43.52</td>
<td>157.12</td>
<td>8.91</td>
<td>2251.18</td>
</tr>
<tr>
<td>SE ±</td>
<td>1.124</td>
<td>15.655</td>
<td>1.859</td>
<td>6.215</td>
<td>0.149</td>
<td>76.250</td>
</tr>
<tr>
<td>Intra-row Spacing (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>38.31a</td>
<td>166.34a</td>
<td>35.69</td>
<td>50.11a</td>
<td>9.11a</td>
<td>2032.61b</td>
</tr>
<tr>
<td>40</td>
<td>36.25b</td>
<td>160.14ab</td>
<td>34.14</td>
<td>179.93a</td>
<td>8.43b</td>
<td>2942.98b</td>
</tr>
<tr>
<td>30</td>
<td>35.51b</td>
<td>159.17b</td>
<td>34.00</td>
<td>108.35c</td>
<td>8.00b</td>
<td>2953.12a</td>
</tr>
<tr>
<td>SE ±</td>
<td>1.450</td>
<td>3.420</td>
<td>1.360</td>
<td>15.367</td>
<td>.560</td>
<td>36.517</td>
</tr>
<tr>
<td>Nitrogen (kg/ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>30.21c</td>
<td>150.00d</td>
<td>26.00c</td>
<td>106.61c</td>
<td>7.45c</td>
<td>563.30c</td>
</tr>
<tr>
<td>60</td>
<td>46.51b</td>
<td>165.30c</td>
<td>29.45c</td>
<td>222.58c</td>
<td>8.13b</td>
<td>1658.38b</td>
</tr>
<tr>
<td>120</td>
<td>50.63ab</td>
<td>185.48b</td>
<td>31.32a</td>
<td>263.44a</td>
<td>8.89a</td>
<td>2747.41a</td>
</tr>
<tr>
<td>180</td>
<td>54.12a</td>
<td>206.31a</td>
<td>32.67a</td>
<td>220.00a</td>
<td>8.23a</td>
<td>2253.31a</td>
</tr>
<tr>
<td>SE ±</td>
<td>2.00</td>
<td>4.031</td>
<td>.450</td>
<td>26.789</td>
<td>.576</td>
<td>56.865</td>
</tr>
</tbody>
</table>

Means a column of any set of treatment within each parameter, followed by unlike letter(s) are significantly different at 5% significance level using DMRT.

: WAT = Weeks after transplanting.
COLOR EVALUATION OF SELECTED CAPSICUM

F. Navarro and J. Costa

- Departamento de Quimica Fiesica. Universidad de Murcia.
+ Centro Regional de Investigaciones Agrarias (CRIA). La Alberca. Murcia.

Plant breeding and selection of pepper cultivars Capsicum annuum L. for paprika and oleoresin has been carried out at CRIA. Along the selection process, several varieties of dark red colour with chlorophyll retainers genes and conventional red colour have been obtained (Costa et al., 1989).

The presence of chlorophyll in ripe fruits of some dark red cultivars modifies the colour ratings determined by eye. LL16 in 1970 indicated that varieties with higher chlorophyll compounds in their fruits have also more carotenoids pigments.

To evaluate grounded and dehidrated paprika fruits, visual colour rating in normaly used. This method is very common in factory but it is not very accurate.

Useful colour parameters for the industry have been obtained by light reflexion using the spectrophotometer Hitachi V-3200.

Figure I shows the comparison of colour spectra from conventional' red (a and b) and dark red pepper varieties with chlorophyll retainers genes (c and d). At 670 nm wavelenght, a valley is formed due to the presence of chlorophyll.

Figure 2 has been drawn with the CIE coordenates of reflected colour; from it we can see that all varieties with chlorophyll retainers genes (PP.19, PP.34, PO.12 and PO.2) are located on the left and by the opposite conventional red cultivars are on the right.

REFERENCES:


RELATIONSHIPS BETWEEN SOME CHARACTERS IN CHILLI PEPPER (Capsicum frutescens)


*Department of Agronomy, Ahmadu Bello University, Samaru, Zaria, Nigeria.

**Department of Plant Science, Institute for Agricultural Research Zaria, Nigeria

Knowledge of the association between characters is very useful in breeding programmes. Characters such as yield are quantitative in nature and are often strongly related to other characters. For this reason, knowledge of the relationship between yield and other characters is very important for effective yield improvement.

Results of a correlation study for characters of two chilli pepper varieties indicated that there was a positive and highly significant relationship between fruit yield and fruit number, plant height, leaf number, and branch number. The correlation between fruit number and plant height, leaf number and branch number was also positive and highly significant. Fruit diameter was positively correlated with plant height, leaf and branch number. Days to 50% flowering were negatively correlated with other characters. Similarly, there was a negative correlation between fruit length and fruit diameter. The correlation between days to 50% flowering and fruit yield, fruit number and leaf number was significant.
Table 1: Simple correlation coefficients between some characters in chilli pepper.

<table>
<thead>
<tr>
<th>Characters</th>
<th>Fruit yield</th>
<th>Fruit number</th>
<th>Fruit diameter</th>
<th>Fruit length</th>
<th>Plant height</th>
<th>Leaf number</th>
<th>Branch number</th>
<th>Days to 50% flowering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit yield</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit number</td>
<td>0.975::</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit diameter</td>
<td>0.143NS</td>
<td>0.614::</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit length</td>
<td>0.244NS</td>
<td>0.11INS</td>
<td>–0.016NS</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant height</td>
<td>0.816::</td>
<td>0.791::</td>
<td>0.4111</td>
<td>0.392NS</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf number</td>
<td>0.893::</td>
<td>0.516::</td>
<td>0.513t</td>
<td>0.4191</td>
<td>0.359NS</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Branch number</td>
<td>0.7411:</td>
<td>0.548::</td>
<td>0.4821</td>
<td>0.38INS</td>
<td>0.366NS</td>
<td>0.423:1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days to 50% Flowering</td>
<td>-0.415t:-0.451:</td>
<td>-0.05INS</td>
<td>-0.132NS</td>
<td>-0.314NS</td>
<td>-0.482t</td>
<td>-0.243NS</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

It = Highly significant t = Significant NS = Not significant
A. NEW RESISTANT SWEET PEPPER VARIETY

J. Espinosa, T. Despestre and Vidalina Camino

“Liliana Dimitrova” Horticultural Research Institute
Carretera Dejucal-Quivian km 33½. La Salud. Habavana Cuba.

A new sweet pepper variety ('Liliana SC 81') was obtained by selection at “Liliana Dimitrova” Horticultural Institute. The plants of this new variety reach a height of 50 – 60 cm and a diameter of 50 cm; they have 4 or 5 primary branches. The leaves are dark green. Flowering begins 45 – 50 days after transplanting and 5-7 days later fruit setting takes place. At maturity fruits are dark green turning dark red later. These fruits are 7-10 cm long; 3 cm in diameter and 3 mm in pericarps thickness; usually they have 2 locales. There are 18-20 fruits per plant with 10 g mean fruit weight. Seventy per cent of the fruits can ripe at the same time: for this reason only 4-5 harvestings are necessary, so it lets to extend this variety to greater areas in our conditions. At 110 days after sowing begins harvesting. The vegetative cycle in 160-170 days. In Cuba the fruits are used fresh for cooking because they are sweet and very aromatic, its flavour is similar to ‘Chay’: a traditional variety used for the same purpose. Sowing can be made all the year round. Yields are 18 t/ha average. The seed is sown at a density of 50 000 – 60 000 plants/he. It is resistant to TMV (Pat 0); PVY (Pat 0) and CMV. As well as Xanthomones carpestris pv. Vesicatoria.
A new variety 'Wafer' was developed at the Experimental Station of Manouba (SAM) through crosses breeding between three varieties 'Anaheim', 'SM 477', and 'LP1'.

This variety is easy to harvest including the genes ep (easy picking) and up (straight fruit).

The plants are about 90 - 100 cm tall with strong stem and 2 - 3 main branches.

The fruits are green, smooth, weighing 25 - 30 g, glossy, 12 - 15 cm long, 2 - 3 cm wide, with 2 locules, 3.8 - 4.0 rmm-n thickness of pericarp, 16.2 Z dry matter and the acidity expressed as citric acid is 1.55 - 1.60 %. The fruits are characterised by good transportability and possibilities for long storage.

The variety 'Wafer' is suitable for protected growing and open field production especially for Harissa" which is a hot past.
HETEROIS) IrAI F HYDRIDS OF HOT PEPPER (CAPSICUM ANNUUM L.)

R. Kordus
University of Agriculture, Department of Horticultural
Plant Breeding, GO-190 Poznan, Zqorzolocka 16, Poland

Six parental lines /B0-2, PA-5, Cp-4, Hi-3, FG-1 and L-36/ and thirty F I hybrids of hot pepper, obtained from a complete diallel crossing, were tested at the same time in two environments: in open field conditions and under plastic cover. This report presents the results on heterosis effects /calculated in relation to the superior parental form/, for seven characters significantly correlated with yield /K'ordus, 1991/. The following features were considered: 1. total yield of fruits/plant, 2. yield of physiologically mature /red/ fruits/plant, 3. total number of fruits/plant, 4. number of physiologically mature fruits/plant, 5. mean fruit weight, 6. number of days from sowing to the beginning of flowering, 7. number of days from sowing to the beginning of ripening.

Generally, the studied F I hybrids showed higher heterosis effects in field conditions. That suggested better adaptability of the F I hybrids to less favorable environment for pepper growing.

The heterosis effects over 50% were only observed in the field experiment for the F I hybrids coming from crosses between low yielding lines. Heterosis in yield of some F I hybrids was a result of higher fruits number per plant, primarily. The highest heterosis, effects %, were noted in the yield and number of physiologically mature fruits, especially in the field experiment. Heterosis for the remaining studied features was rather low.

REFERENCE

Table: Analysis of heterosis effects in F$_1$ hybrids of hot pepper

<table>
<thead>
<tr>
<th>Character</th>
<th>Environment</th>
<th>Percentage of heterosis</th>
<th>Number of heterosis hybrids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Field Under plastic</td>
<td>2 2 3 - 1 - 1</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>Field Under plastic</td>
<td>3 5 6 3 - 1 - 1</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Field Under plastic</td>
<td>5 3 1 - - - -</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Field Under plastic</td>
<td>9 7 4 1 - - - -</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>Field Under plastic</td>
<td>11 1 - - - - -</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Field Under plastic</td>
<td>14 - - - - - - -</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>Field Under plastic</td>
<td>9 - - - - - - -</td>
<td>9</td>
</tr>
</tbody>
</table>

Character 2, 4, and 5 had the highest number of heterosis hybrids.
INTERVARIETAL CROSSING OF 32LI, ANU HOT PEPPER AUGMENTS THE HYBRID SEED YIELD


Indian Agricultural Research Institute, Regional Station Katrain (Kullu Valley) H.P. 175129 INDIA

Hybrids are now so widely used in agriculture that everyone wants to grow hybrids for commercial cultivation inspite of high seed costs. Joshi (1986) reported, that heterosis breeding in Capsicum is feasible due to its low seed rate per hectare besides, quality attributes improved through favourable dominant gene combinations. Hybrid seed production through conventional methods of artificial emasculation and pollination is very costly affair in spice paprikas. Exploitation of heterosis in this group has been hampered as hybrid seed, production is not economical as only few seeds are produced in each pollination and non-availability of desirable genetic male sterile line or chemically induced sterilily. Therefore, the studies were undertaken to cope up the high seed costs and to find out the possibilities of economical hybrid seed production by crossing two intervarietal divergent groups of Capsicum annuum L. var. grossum (bell) and var. fasciculatum (hot pepper). These combinations were made for exploring the dominant traits of male hot pepper parents (~GB’and 235’) viz., pointed blossom end and pungency and more number of seeds per fruit (200-300) of the female parents CM11and'02). Adopting this technique the number of hybrid seeds per pollination is increased to 298 and 204 in bell pepper than 64 and 110 seeds in hot, pepper (table 1), Both -the hybrid s’CVI’xGB’ and 'OZ x'235' exhibited heterotic effect for all the characters studied against male parent, except for number of fruits per plant which is intermediate. Both hybrids gave 324.6 and 45.6y. Higher yields respectively over male parent, with superior fruit quality, deep crimson red coloured berries desired for spice paprika. Heterosis for yield mainly resulted from the combined heterosis for plant height, fruit size and number of fruits per plant. Thomas and Peter (1988) also reported similar results in their heterosis studies.
Table 1: Mean performance of parent s and hybids.

<table>
<thead>
<tr>
<th>Variety</th>
<th>No. of seeds/fruit</th>
<th>Plant height (cm)</th>
<th>Fruit size (cm)</th>
<th>No. of fruits/plant</th>
<th>Ripe fruit yield/plant (kg)</th>
<th>Flesh thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length</td>
<td>Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell pepper (o+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘California Wonder’ (CW)</td>
<td>298.2</td>
<td>85.0</td>
<td>5.8</td>
<td>6.4</td>
<td>15.9</td>
<td>0.398</td>
</tr>
<tr>
<td>‘EC 203602’ (02)</td>
<td>204.7</td>
<td>78.7</td>
<td>4.4</td>
<td>7.6</td>
<td>17.1</td>
<td>0.938</td>
</tr>
<tr>
<td>Hot pepper (o-&gt;)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘KT-PI-17’ (GB)</td>
<td>64.5</td>
<td>98.7</td>
<td>3.7</td>
<td>0.6</td>
<td>102.0</td>
<td>0.150</td>
</tr>
<tr>
<td>‘LCA-235’ (235)</td>
<td>117.7</td>
<td>84.0</td>
<td>7.3</td>
<td>0.9</td>
<td>129.5</td>
<td>0.532</td>
</tr>
<tr>
<td>F1 hybrids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘CW’ x ‘GB’</td>
<td>-</td>
<td>106.7</td>
<td>8.6</td>
<td>1.9</td>
<td>73.7</td>
<td>0.637</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.2)</td>
<td>(132.4)</td>
<td>(216.6)</td>
<td>(-27.7)</td>
<td></td>
</tr>
<tr>
<td>‘02’ x ‘235’</td>
<td>-</td>
<td>90.0</td>
<td>7.7</td>
<td>2.4</td>
<td>67.7</td>
<td>0.775</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.1)</td>
<td>(5.4)</td>
<td>(166.6)</td>
<td>(-47.7)</td>
<td>(45.6)</td>
</tr>
<tr>
<td>‘F’ value</td>
<td>-</td>
<td>9.42</td>
<td>12.12</td>
<td>116.11</td>
<td>14.46</td>
<td>30.31</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>10.07</td>
<td>1.67</td>
<td>0.82</td>
<td>35.89</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>C.D. at 1%</td>
<td>2.31</td>
<td>1.14</td>
<td></td>
<td>49.71</td>
<td>0.21</td>
<td></td>
</tr>
</tbody>
</table>

Heterosis percentage over male parent in the parenthesis.

REFERENCES
Joshi, Subodh, 1986, Results of heterosis breeding on sweet pepper (Capsicum annuum L.) Capsicum Newsletter, 5, 33-34.

Capsicum Newsletter, 10 (1991), 55-56.
STUDY OF INTERSPECIFIC HYBRIDIZATION BETWEEN CAPSICUM CHACOENSE AND C. ANNUUM CV. ‘POZNANSKA SŁODKA’ WITH USE OF INSONSYMATIC ANALYSIS.

P.R. Andrzejewski, E. Andrzejewska**

*Dept of Genetics and Plant Breeding, University of Agriculture, Zgorzelecka Street 16, 60-198 Poznan, Poland
**Dept. of Genetics A. Mickiewicz University, Dabrowskigo Street 165, 60-594 Poznan, Poland

The paper presents the study of electrophoretic phenotypes observed in interspecific cross Capsicum chacoense x C. annuum cv. ‘Poznanska Słodka’. The electrophoretic method used in the study was described previously by Andrezejeski R.P. et al. (1990).

The four enzyme systems glutamate oxaloacetate transaminase (GOT), phosphoglucomuase (PGM), isocitrate dehydrogenase (IDH) and shikimate dehydrogenase (SKDH) were studied in six generations of Capsicum plants. Figure 1 presents observed electrophoretic variants found in the parental plants, in the hybrids F1 and their backcrosses and also in F2 generation C. charoense x C. annuum cv. ‘Poznanksa Slodka’.

The paper presents also mean values of six metric characters for interspecific cross: fruit weight, fruit length, fruit width, plant height, number of the fruits per plant and yield per plant (tabl 1).

Reference
Monitoring interspecific hybridization between Capsicum baccatu, c. chacoense and C. annuum with isoensymes, Capsicum Newsletter, 8-9, 38-39.
Fig. 1 Electrophoretic phenotypes of 4 marker enzymes in interspecific cross between *Capsicum chacoense* x *C. annuum* cv. ‘Poznanska Slodka’

<table>
<thead>
<tr>
<th>Isoenzyme</th>
<th>C P1</th>
<th>A P2</th>
<th>(C X A) F1</th>
<th>(C X A)XC B1</th>
<th>(C X A)XA B2</th>
<th>C X A F2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PGM</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>IDH</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SKDH</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

C – *Capsicum chacoense*
A – *Capsicum annuum* cv. ‘Poznanska Slodka’

Table 1. Morphological characteristics of six generations of interspecific cross between *Capsicum chacoense* x *C. annuum* cv. ‘Poznanska Slodka’

<table>
<thead>
<tr>
<th>Character</th>
<th>C P1</th>
<th>A P2</th>
<th>(C X A) F1</th>
<th>(C X A)XC B1</th>
<th>(C X A)XA B2</th>
<th>C X A F2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit weight (g)</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>(g)</td>
<td>0.3</td>
<td>41.1</td>
<td>0.7</td>
<td>0.2</td>
<td>2.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Fruit length (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cm)</td>
<td>1.2</td>
<td>10.7</td>
<td>2.3</td>
<td>1.1</td>
<td>3.3</td>
<td>3.2</td>
</tr>
<tr>
<td>Fruit width (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cm)</td>
<td>0.6</td>
<td>4.3</td>
<td>0.8</td>
<td>0.5</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>no. of fruits/plant (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.3</td>
<td>16.2</td>
<td>70.6</td>
<td>48.4</td>
<td>63.3</td>
<td>47.7</td>
<td></td>
</tr>
<tr>
<td>Yield/plant (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.7</td>
<td>1067.5</td>
<td>25.9</td>
<td>6.8</td>
<td>72.7</td>
<td>30.2</td>
<td></td>
</tr>
<tr>
<td>Plant height(cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cm)</td>
<td>47.7</td>
<td>61.3</td>
<td>66.5</td>
<td>71.0</td>
<td>111.7</td>
<td>71.6</td>
</tr>
</tbody>
</table>

54
EVALUATION OF GENETIC PARAMETERS OF SELECTED TRAITS IN INTERSPECIFIC HYBRIDIZATION BETWEEN CAPSICUM CHACOENSE AND C. BACCATUM WITH C. ANNUUM CV. ‘POZNANSKA SLODKA’.

R.P. Andrezjewski

Dept. of Genetics and Plant Breeding, University of Agriculture,
Zgorzelecka Street 16, 60-198 Posnan, Poland

The paper contains partial results of the experiment concerning the way of inheritance of some traits in the three interspecific crosses between Capsicum chacoense x C. annuum cv. ‘Poznanska Slodka’, C. baccatum x C. annuum cv. ‘Poznanska Slodka’ and C. annuum cv. ‘Poznanska Slodka’ x C. annuum cv. ‘Posnanska Slodka’ x C. baccatum.

The action of the genes in six generations (P1, P2, F1, F2, B1 (F1 x P1), B2(F1 x F2) of three interspecific crosses of Capsicum was studied by estimation of six genetic parameters (m, d, h, I, j, l) after Mather and Jinks (1982).

The value of estimates for three metric traits: mass fruits, length fruits, width fruits in interspecific cross are given in the table. The results proved the important role of epistasis in the control of these traits.

Reference
Evaluation of genetic parameters and their standard deviations.

<table>
<thead>
<tr>
<th>Interspecific cross</th>
<th>( C.a ) x ( C.b )</th>
<th>( C.b ) x ( C.a )</th>
<th>( C.cv ) x ( C.a )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameters</strong></td>
<td><strong>Mass fruits</strong></td>
<td><strong>Length fruits</strong></td>
<td><strong>Width fruits</strong></td>
</tr>
<tr>
<td></td>
<td>( M )</td>
<td>( [h] )</td>
<td>( [d] )</td>
</tr>
<tr>
<td></td>
<td>10.33 * 6.49</td>
<td>130.9 * 5.14 +</td>
<td>20.72 * 2.06 +</td>
</tr>
<tr>
<td>( [l] )</td>
<td>7.731 * 5.62</td>
<td>-15.62 * 13.24</td>
<td>-57.84 * 5.64 +</td>
</tr>
<tr>
<td>( [j] )</td>
<td>-30.72 * 4.74 +</td>
<td>23.28 * 4.62 +</td>
<td>36.58 * 3.19 +</td>
</tr>
<tr>
<td>( [l] )</td>
<td>-8.26 * 9.38</td>
<td>13.96 * 8.29</td>
<td>37.80 * 3.62 +</td>
</tr>
<tr>
<td></td>
<td>( [d] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.79 * 1.77 +</td>
<td>6.45 * 1.36 +</td>
<td>9.61 * 1.67 +</td>
</tr>
<tr>
<td>( [d] )</td>
<td>2.46 * 0.19 +</td>
<td>-2.16 * 0.19 +</td>
<td>-4.76 * 0.16 +</td>
</tr>
<tr>
<td>( [h] )</td>
<td>10.06 * 4.41 +</td>
<td>0.16 * 3.42</td>
<td>-18.50 * 3.68 +</td>
</tr>
<tr>
<td>( [l] )</td>
<td>4.46 * 1.76 +</td>
<td>1.80 * 1.35</td>
<td>-3.66 * 1.67 +</td>
</tr>
<tr>
<td>( [j] )</td>
<td>-2.65 * 1.21 +</td>
<td>2.79 * 0.98 +</td>
<td>5.13 * 0.73 +</td>
</tr>
<tr>
<td>( [j] )</td>
<td>-4.80 * 2.72</td>
<td>2.33 * 2.13</td>
<td>11.13 * 2.05 +</td>
</tr>
<tr>
<td></td>
<td>( [j] )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.48 * 0.62 +</td>
<td>2.10 * 0.66 +</td>
<td>2.80 * 0.37 +</td>
</tr>
<tr>
<td>( [d] )</td>
<td>1.50 * 0.09 +</td>
<td>-1.50 * 0.09 +</td>
<td>-1.84 * 0.08 +</td>
</tr>
<tr>
<td>( [h] )</td>
<td>2.90 * 1.14 +</td>
<td>0.24 * 1.90</td>
<td>-5.19 * 0.83 +</td>
</tr>
<tr>
<td>( [l] )</td>
<td>1.28 * 0.61 +</td>
<td>0.66 * 0.65</td>
<td>-0.38 * 0.36 +</td>
</tr>
<tr>
<td>( [j] )</td>
<td>-2.47 * 0.34 +</td>
<td>1.29 * 0.46 +</td>
<td>2.09 * 0.24 +</td>
</tr>
<tr>
<td>( [l] )</td>
<td>-2.35 * 0.82 +</td>
<td>-0.31 * 2.16</td>
<td>3.15 * 0.50 +</td>
</tr>
</tbody>
</table>

+ significant at 5% level

\( [d] \) – additive action of genes
\( [h] \) – domination action of genes
\( [l] \) – non allelic interaction
\( [I] \) – homozygote x homozygote
\( [j] \) – homozygote x heterozygote
\( [l] \) – heterozygote x heterozygote

\( C.a \) – \textit{Capsicum annuum} cv. ‘Poznanska Slodka’
\( C.b \) – \textit{Capsicum baccatum}
\( C.ch \) – \textit{Capsicum chacoense}
IN VITRO SHOOT TIP, COTYLEDON'S AND FIRST LEAF CULTURES
OF PEPPER (CAPSICUM, ANINUUM L.)

I. Morone Fortunato - M. Tudisco
Istituto di Agronomia generale e Coltivazioni erbacee
Universita di Bari - Via Amendola, 165/A - 70125 Bari (Italia)

Some media that are able to stimulate the organogenesis of Capsicum are shown. These results depend on genetic factors and culture conditions (exocenous and endogenous factors) as is reported in the literature. For these reasons the study was concentrated on four different cultivars and three explants.
Cultivar: 'Rosso d'Asti'; 'Tondo liscio'; 'Corno di toro rosso o uiallo'; 'Verde piccolo persoftaceto.
Explant: Shoot tip; Base section of cotyledon after emergence; First leaf.
The main medium utilized was:
Macrolelements: Murashige-Skoog (1965); Microelements: Nitsh-Nitsh (1969); FeEDTA 0,025 g/l; Thiamine HCL 0,04 g/l; S(Ar-rose 20 g/l; Algar 6 g/l.
The hormonal concentrations (ppm) and combinations of the media were:
1) 2ip: 0,5 - 1 and 5; 2) Kin: 0,5 - 1 and 5;
3) BAP: 0,5 - 1 and 5; 4) IAA: 1 and 5;
5) BAP 5 + IAA 1; BA21 5 + IAA 5; 6) Control
The growing conditions were as follow: temperature 24°C ±1; photoperiod: 16 hours of light.
The table indicate that the cultivars behaved differently and the organogenesis is strongly stimulated by hormonal mixtures.

REFERENCES
<table>
<thead>
<tr>
<th>Media</th>
<th>Test</th>
<th>2ip</th>
<th>2ip</th>
<th>2ip</th>
<th>Kin</th>
<th>Kin</th>
<th>BAP</th>
<th>BAP</th>
<th>BAP</th>
<th>IAA</th>
<th>IAA</th>
<th>BAP</th>
<th>BAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explant</td>
<td>0,5</td>
<td>1</td>
<td>5</td>
<td>0,5</td>
<td>1</td>
<td>5</td>
<td>0,5</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>IAA</td>
<td>IAA</td>
</tr>
<tr>
<td><strong>Cv. ‘ROSSO D’ASTI’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoot tip</td>
<td>R</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>First leaf</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>R</td>
<td>B</td>
</tr>
<tr>
<td>Bises section of cotyledon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>B</td>
</tr>
<tr>
<td><strong>Cv. ‘TONDO LISCIO’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoot tip</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>First leaf</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>B</td>
<td>B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bises section of cotyledon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cv. ‘CORNDO DI TORO ROSSO O GIALLO’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoot tip</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>First leaf</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bises section of cotyledon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td><strong>Cv. ‘VERDE PICCOLO PER SCOTTALGTO’</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoot tip</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>First leaf</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Bises section of cotyledon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

R = Roots; B = Buds, C = Callus.

Capsicum Newsletter, 10 (1991), 61.
BREEDING PEPPER (CAPSICUM ANNUUM L.) FOR RESISTANCE TO PHYTOPHTHORA CAPSICI LEONIAN IN ARGENTINA: ‘CALAFYUCO INTA’, A NEW CULTIVAR.

Claudio GALMARINI, Alberto SENETINER and Humberto GALRARINI.
Estacion Experimental Agropecuaria "La Consulta".
C.C.8 - 5567 - La Consulta - MENDOZA ARGENTINA.

About 13,000 has of pepper are yearly grown in Argentina. Bell type peppers are grown for fresh market and heart-shaped-peppers ("Calahorra") for processing.

The soilborne disease caused by Phytophthora capsici Leonian (P.c.) is one of the most serious factors that limits pepper crop in our country, specially in irrigated zones.

At La Consulta Experiment Station, a breeding program has been conducted to introduce resistance against local strains of P.c. in both, bell and hearttype peppers. As result of the program, the resistant bell-type pepper'Fyuco INTA' was released (Galuarini, H. and Senetiner, A., 1986). Since that time our aim has been to obtain a resistant "Calahorra" type pepper.

A sexican hot pepper, the accesión line'493-4-1-2' from Dr. P. Smith of the U.C. Davis, was used as initial source of resistance; 'Perfection' and 'Calatauco INTA' (a heart- shaped cultivar resistant to TMV) was used as recurrent parents in a backcross program.

In order to test P.c. resistance, an adaptation of the Pochard-Chambonnet (1972) proposed methodology was used: In young-potted plants with 8 to 10 leaves, the fourth leaf was removed. The stem surface was inoculated with a 4 mm diameter disk of P.c. mycelial culture. The plants were then covered with plastics bags for 48 hours. Susceptible plants died and resistant material grew normally. Field trials in infected soils were carried out for several years.

The resistant lines were selected for agronomic conditions and regional trials were displayed.

Several lines showed resistance to P.c., 'Calatauco INTA' and 'California wonder' plants used as controls were susceptible. From the resistant lines, we developed a new cultivar: ICALAFYUCO INTA' this variety has a heart-shaped fruit, with dark-red coloration at maturity; thick walls and an average weight of 130 g. In field trials, I CALAFYUCO INTA yielded 25,000 Kg/ha; It has good quality for processing and dehydration, and it combines resistance against both P.c. and TMV.

We are doing regional trials at different production areas of Argentina, in order to prove this new cultivar.

REFERENCES:

INFLUENCE OF SEED POSITION IN FRUIT ON SEED VIABILITY AND VIGOUR DURING AMBIENT STORAGE OF CHILLI (Capsicum annuum L.) FRUITS

S. D. Doijode
Indian Institute of Horticultural Research, Bangalore-560080; India

High seed quality comprising high viability and vigour is prerequisite for successful establishment of seedlings in field as well as for high crop production. Seed viability is predominantly dependent on nature age of seeds (Harrington and Satyati-Farjadi 1966) and method of storage. The present experiment was conducted with the to study, ’effects of position of seed in fruit or viability and vigour during ambient storage of chilli fruits.

Materials and Methods
Fruits of chilli cv. ‘Arka Lohit’ were stored in cloth bags and glass container at ambient conditions (16-35°C, 25-90%RH). The moisture content of fruit and seed were 9.7 and 8.3 per cent respectively during storage. See viability was tested after 18 months of storage. Fruit was divided into three portions: base, middle and tip. Seeds were removed separately and germinated on top of paper at an alternate temperature of 20-30°C for 16-3 hours respectively in Clelands seed germinator. Seed viability was expressed in percentage of germination and seedling vigour in terms of coefficient of velocity of emergence, crop growth rate and vigour indices I and II, which were calculated by multiplying percentage of germination with seedling length and dry weight respectively.

Results and Discussion

Seed viability was significantly affected by the position in fruit. Seedc from basal region exhibited high ’s-erminability over middle and tip portion in fruit, stored both in cloth and glass containers (Fig. 1). Emergence of seedlings was also earlier in seeds of basal region. Similarly the coefficient of velocity of emergence, virour indices and crop r)rowth rate were g-reater for seeds of basal. ref.,ion of the fruit (Table 1). Viability and vigour of seeds were comparably greater for seeds of middle portion. While seeds of tip region exhibited lower viability and vigour. It might be owing to inadequate supply of nutrients. Hence not suitable for storage. Therefore it is advantatrcours to reserve seeds, from basal to middle portion of the fruit for retaining high viability and vigour for longer period.

Reference

Fig. 1 Percentage of seed germination after 6\textsuperscript{th} (----) and 14\textsuperscript{th} (----) days of sowing in chilli seeds extracted from different portion of the fruit.

Table 1. Seedling vigour of chilli seeds as influenced by the position in chilli

<table>
<thead>
<tr>
<th>Storage Containers</th>
<th>Portion of the fruit</th>
<th>Coeff. of emergence</th>
<th>Vigour indices</th>
<th>Crop growth rate</th>
<th>Seedling length (cm)</th>
<th>Dry wt (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloth</td>
<td>Base</td>
<td>13.9</td>
<td>425</td>
<td>277</td>
<td>0.56</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>13.0</td>
<td>417</td>
<td>264</td>
<td>0.62</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Tip</td>
<td>11.4</td>
<td>260</td>
<td>185</td>
<td>0.30</td>
<td>0.17</td>
</tr>
<tr>
<td>Glass</td>
<td>Base</td>
<td>14.3</td>
<td>462</td>
<td>329</td>
<td>0.59</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>12.1</td>
<td>443</td>
<td>289</td>
<td>0.61</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Tip</td>
<td>10.2</td>
<td>170</td>
<td>117</td>
<td>0.27</td>
<td>0.19</td>
</tr>
<tr>
<td>LSD 5%</td>
<td></td>
<td>1.7</td>
<td>189</td>
<td>101</td>
<td>0.14</td>
<td>NS</td>
</tr>
</tbody>
</table>
RESULTS OF SEED TESTS. X. OCCURRENCE OF FUSAPTUM OXYSPORUM SCHLECITT. ON STORED SEEDS OF CAPSTCICLUM ANNUUM L.

Endre I. SIMAY +
I.A.Q. Research Centre for Agrobotany, Tipieozele

+ present address: Enterprise for Extension and Research in Fruit Growing and Ornamentals, Budapest
mailing address: H-1115 Budapest Szakasits 38/a
HUNGARY

134 seed-saples of Capsicum annuum L. reserved in the Hungarian gene bank were tested during the routine germination tests in 1988. The tested seeds were stored at 0/4°C for 6 years before the germination, and 12 samples were selected out with Fusarium oxysporum Schlecht. contamination. The fungus caused pinkish mould on the infected seeds and brownish discoloration was also observed. The infected seeds were rotted and the germination was often retarded at the surrounding ones, too. The fungus was successfully isolated from the seed-surface and was cultured on potato dextrose agar /PDA/ and 2% malt extract agar /MEA/ media.

The isolates were fast growing, reaching 4,8-5,6 cm diameters on PDA and MEA. The aerial mycelium was rather abundant, and its color was whitish to peach with a purplish tinge. This purplish coloration was more intensive at the stromatic agar surface. Among of conidia-type micro-conidia were developed abundantly in the aerial mycelium, while the macro-conidia were borning at the agar surface. Chlamyclospores were also developed, especially in the stroma. These chlamydomspores were formed terminally or intercalary in hyphae.

Fusarium oxysporum Schlecht. is a world-wide distributed soil-inhabiting fungus /Domsch et al., 1980/, and can cause wilts on numerous hosts, too /Booth, 1971/. Its seed-transmission is well known on different plants /Neergaard, 1979/ even on chillies /e.g. Ridulescu and Negru, 1971/. The seed-transmission of F. oxysporum has an epidemiological role, too /Gambogi, 1983/. However some pathogenic fungi were reported to survive the storage /Hewett, 1987/, to the author's best knowledge this is the first report on occurrence of the F. oxysporum on long term stored seeds of Capsicum annuum.

REFERENCES:
RESULTS OF SEED TESTS. XI. - SFFD AND SEEDLING ROT OF CAPSICUM ANNUUM L. CAUSED BY TIPTCHOTECTUM ROSEUM /PERS./ LINK EX GRAY

Endre I. Simay+
I.A.Q. Research Centre for Agro-hotany, T.qpi6szele

+ present address: Enterprise for Extension and Research in Fruit Growing and Ornamentals, Budapest
mailing address H-115 -Budapest Szakasits 38/a
HUNGARY

Trichotecium roseum /Pers./ Link ex Cray was observed as pink mould on rotted seeds and seedlings of Capsicum annuum L. The fungus contaminated tao seed sariiples of 115 tested during the seed health tests in the Hungarian gene bank. T. roseum was isolated from the diseased seeds and seedlings and was identified from pure cultures according to Domsch et all. /1980/. Its pathogenicity on germination% seeds was also investigated.

The cultures of T. roseum were pink and powdery from conidia. The conidiophores were erect. to 1.5-2 mm long, bearing at the tip in zig-zag chains. The conidia were 2-celled, 12,4-24 x 7,8-11,6 micrometers, and were developed abundantly in cultures grown on both potato dextrose agar /PDA/ and 21A,91 malt extract apar /MFA/ media.

The pathogenicity of the funCuo was investigated on artificially infected seeds. The seeds were surface sterilized by 70,06' ethanole solution and then they were soaked in conidium-suspension of T. roseum. The conidia were washed from cultures grown on PDA and the conidium-suspention was adjusted to low conidium/ml. The seeds were treated with this suspension for ten minutes and were germinated on blotter under sterile conditions.

T. roseum caused a stronrr inhibition of seeds were germinated in while the untreated ones were in 14-16%. The germination of seeds vlas also blocked in case of untreated ones placing in ring around the treated seeds. This effect may be caused by toxins of T. roseum, which were tested on different plants le.g. Desai and Siddaramaiah, 1980; Domsch, 1963/.

R E F E R E N C E S:

RESULTS OF SEED TFSQTS. XIII. - SOME PATHOGENIC FUNGI OCCURRING

OR SEEDS OF EGGPLANT

Endre I. Simay+

I.A.Q. Research Centre for Agc-botany, Tipi6szele

+ present address: Enterprise for Extension and Research in Fruit
Growing and Ornamentals, Budapest

mailing address: H-1115 Budapest Szakasits 38/a HUNGARY

In course of routine seed health tests 4 seed samples of eggplant /Lolanum melonpena/ were tested for pathogenic fungi. The seeds were germinated without-IL-1 surface sterilization or moistened blotter in 1 10 cm diam. Pet ri-dishes, placing 50-50 seeds per dishes and using two replicates. The developing sporulation of fungi was used for identification of fungi and the known seed-pathogens /Neergaard, 1979/ were studied in pure cultures, too. These pure cultures were also used for pathogenicity tests. The pathogenicity of the fungi was investigated by infecting seeds artificially and sowing the infected seeds into heat-sterilized perlite. The infection of seeds was carried out by soaking the surface sterilized seeds in conidium-suspensions containing low conidium/ml.

Alternaria alternata and Fusarium oxysporum were the predominants among known seed-pathogens. Sporadical occurrence of Alternaria solani, Lusarium pallidoroseum and F. Poae was also registered. These fungi would infect the seeds in pathogenicity tests, too. The main symptoms were the blocking of the emergence and rotting the seeds in perlite, but rotting of emerged seedlings was also observed. The fungi could cause root and/or hypocotyl rot on seedlings. The pathogenicity of Alternaria alternata, Alternaria solani and Fusarium oxysporum Wa,3 registered on plants grown on field, too.

Alternaria alternata and A. solani infected the leaves causing spots on them. A. solani could also infect the stems, especially at the base of leaves and long lesions were formed by the fungus. Fusarium oxysporum caused vascular wilt and root rot on the field, and symptoms on aerial part of plants caused by this fungus were not observed. However these fungi are well known from seeds of different plants /Neergaard, 19.79/ even from eggplant seeds /Radulescu and Negru, 1971/, this is the first report on their occurrence on seeds of Solanum melongena in the Hungarian gene bank seed-stocks.

REFERENCES:


ANNOUNCEMENT

EUCA RP I A
EUROPEAN ASSOCIATION FOR RESEARCH ON PLANT BREEDING

VIIIth Meeting on Genetics and Breeding of Capsicum and Eggplant
ENEA Casaccia Center, Rome (Italy), September 7-10, 1992

FIRST ANNOUNCEMENT

As decided at the VIIth Meeting in Kragujevac (Yugoslavia), the next Meeting will be held in Italy and will be organized by:
- Institute of Agronomy, University of Naples;
- Institute of Plant Breeding and Seed Production, University of Turin;
- National Committee for Research and Development of Nuclear and Alternative Energy (ENEA), Rome.

Participants - All researchers involved or interested in Genetics and Breeding of Capsicum and Eggplant are invited to participate and to present the results of their scientific work.

Language - The official language of the Meeting will be English: no translation facilities are planned.

Lodging - Hotel accommodations will be available both in Rome and in Bracciano. More information will be given in the 2nd circular.

Variety demonstration - During the Meeting, the participants will have the opportunity of showing Capsicum and Eggplant varieties or lines. The plants will be cultivated in a field in Tarquinia (Viterbo). Those who are interested in using this facility, are kindly requested to send the seeds before March 10, 1992 to: Mr. P. Papalini, E.R.S.A.L., Centro di Dimostrazione Agraria, Loc. Portaccia, Strada Litoranea km 1,800, 01016 Tarquinia (Viterbo), Italy, tel. 0039-766-88778.

Excursions - During the Meeting a "field day" will be organized to visit demonstration fields and pepper growers as well as archeological sites in the surroundings of Rome.

Proceedings - It is purpose of the Organizers to print a special issue of "Capsicum Newsletter" with the Proceedings of the Meeting. It will be printed in time to be given to the participants during the Meeting.

Second announcement - A second circular with further details of the scientific and social programme will be sent in January 1992 to all those who have shown interest by filling in and returning the enclosed registration form before November 30, 1991 to:

Mrs. Maria Luisa CALDARI
EUCA RP I A Meeting on Genetics and Breeding of Capsicum and Eggplant
ENEA C.R.E. Casaccia - Servizio Organizzazione Corsi e Seminari
S. P. Anguillarese, 301 - 00060 ROMA - Italy
Tel. 0039-6-3048.4044 - Fax 0039-6-3048.4488
LITERATURE REVIEW

Capsicum


Genetic nature of low capsaicin content in the variant strains induced by grafting in *Capsicum annuum* L. Euphytica, vol. 46, 3: 249-252.


**Eggplant**


ORDER FORM FOR "CAPSICUM NEWSLETTER" No. 12, 1992
(To be published in the summer of 1992)

If you want to receive promptly the next issue of "Capsicum Newsletter", please fill in this form and return it together with a copy of the payment order to:

DI.VA.P.R.A.
Section of Plant Breeding and Seed Production
Via P. Gluria, 15
10126 TORINO - Italy
Fax (11)61-0.27.54

To "Capsicum Newsletter" Editorial Board

Please, when available, send me a copy of "Capsicum Newsletter" No. 12 (1992). I am sending the subscription rate (20 U.S.$ for normal and 100 U.S.$ for supporter subscribers) directly to EUCARPIA Secretariat Wo Breeding Station Wiersum, Rendierweg 10, 8251 PD Dronten, The Netherlands), paying into the Netherland Bank, current account ABN/539128090.

Dept/Inst

Name .................................................................................................................................

Dept/Inst
......................................................................................................................................
......................................................................................................................................
......................................................................................................................................

Address.........................................................................................................................
......................................................................................................................................

City .................................................................Country ......................................................

Date ........................................................................

Signature .........................................................................................................................
### ANALYTICAL INDEX

**Pepper**

**Breeding**

- Earliness ................................................................. 47
- Fruit colour .............................................................. 16, 45
- Fruit number ............................................................. 47, 53
- Fruit shape .............................................................. 17, 41
- Fruit size ............................................................... 47, 53, 57
- Fruit yield ............................................................... 47
- Plant habit ............................................................. 16, 47, 53
- Quantitative characters ............................................. 17

**Capsicum**

- baccatum .................................................................. 57
- chacoense ................................................................ 22, 55, 57
- chinense .................................................................. 35
- frutescens ................................................................ 22, 35, 43, 47

**Cytogenetics** .......................................................... 35, 37, 39

**Cultivar** ................................................................. 17, 49, 50, 61

**Disease and pest resistance**

- Bacteria
  - *Xanthomonas campestris* .......................................... 22, 49
- Fungi
  - *Phytophthora capsici* ............................................... 23, 61
  - *Verticillium dahliae* ................................................ 16
- Insects
  - *Spodoptera litura* .................................................... 16
- Viruses
  - CMV ........................................................................ 16, 49
  - PMV ........................................................................ 21
  - PVMV .................................................................... 21
  - PVY ........................................................................ 21, 49
  - TEV ........................................................................ 21
  - TMV ...................................................................... 21, 49

**Fertilization** ................................................................ 43

**Genetic marker** ....................................................... 17, 55

**Germplasm** ............................................................. 33

**Heterosis** ................................................................. 51, 53

**Interspecific cross** .................................................. 55, 57

**In vitro culture** ......................................................... 59

**Male-sterility** .......................................................... 15

**Mutagenesis** ........................................................... 13

**Plant spacing** .......................................................... 43

**Seed-borne disease** .................................................. 64, 65

**Seed production** ...................................................... 53

**Seed storage** ........................................................... 62
Eggplant

Disease and pest resistance

Virtuses

- BPMV .................................................................26
- PMMV .................................................................26
- TMV .................................................................26
- ToMV .................................................................26

Seed-borne diseases .......................................................67

Solanum aethiopicum ......................................................27
MAILING LIST

ALGERIA
Dept. d'Agronomy Anbraje, IM. Nalionat Agrono0que, EL HARRACH-ALGER

ANTIGUA
C.A.R.D.I., P.O. Box 766, Friais Hill, ST. JOHN'S

ARGENTINA
Catedra Re Fitoteenia, Fac. Ciencias Agrarias, (4700) CATAMARCA
Estación Experimental La Consulta, (I.N.T.A.), Casilla. de Correo 8/5567, La Consulta MENDOZA

AUSTRALIA
Department of Primary Industries, G.P.O. Box 46, BPISBANE-Queensland 4001
Department of Primary Industries, Bundaborg Research Station, Mail Service108, Ashfield Road, BUNDABERC-Queensland 4670
Department of Primary Industries, Horticultural Research Station, P.O.Box538, BOWEN-Queensland 4805
Department of Primary Industries, PlaanL Pathology Branch, Meiers Road,INDOOROOPILLY
Queensland 4068 Department of Primary Industries, Redlands Horticultural Research Stat., A.M.Hibber, P.O.Box 327, CLEVELAND-Queensland 4163

AUSTRIA
Inst. fUr Pharmakognosic, Universitlit Wien, 0hringerstrasse 25, 1090 WIEN

BOLIVIA
Centro Fitojenvticu Pairumani, A.A. 128, COCHABAMBA

BRASIL
DELLA VECCHIA Paulo T., Rua Teudoro Sampaio 2550-0 andar, 05406-SAO PAULO-Sp
Dept. de Fitotecnia, Universidade Federal do Vigosa, 36.570 VICOSA M.G.
Dept. de Genética, ESALQ, Calxa Postal 83, 13.400 PIRACICABA - SAO PAULO
EMBRAPA, lica-Cenargen, C.P. 10.2372, 70.000 BRASILIA DF
EMBRAPA-CNPH, C.P. 07.0218,30.399 BRASrlIA OP
EMBRAPA-UEPAE-Belen, C.P.130, BELEM - PARA 66.000
Fundacao insk A3rnnomico d! ParanA, Area do Documentaqao, Rodavia Celso
Garcia Cid - km 375, Caixa Postal 1331, 86100 LONDRINA-PARANAI
InsL. Agronomico do Campinas, Cx PosLal 28, 13028 CAMPTNAS SP
Univer.de Sao Paulo, Esc.Sup.de AgrLcultura 'Luiz do Queiroz', Insk Re
GeneLica-Sekde Cit., Av.Padua Dias 11 -C.P.83, 13400 PIRACICABA-SAO PAULO

BULGARIA
Institute of Genetics and Plant Breeding, 1113 SOFIA
Institute of Introduction, and Plant Resources, SADOVO 4122
Institute of Plant Physiology, of Bulgarian Academy of Sciences, Academican
Bouchevstr. 6, SOFIA
Institute of Plant Protection, KOSTINBROD 97113
The MARITSA, Vegetable Crops Research Institute, 4003 PLOVDIV
V. KOLAROV, Higher InsLiLuto of Agricultture, PLOVDIV

BURKINA PASO
IRAT, B.P. 910, BOBO DIOULASSO
CANADA
Agriculture Canada, Research Station, P.O.Box 1000, AGASSTZ-B.C.
PADATA, 627 Aquarius Rd. RR 2, VICTORIA - B.C. V9B 5B4
Stokes Seeds Limited, Research Center, '19 James St.-P.O.Box 10, ST.
CATHARINES-Ont. L2R 6R6

CAPE VERDE
INTA, C.P. 84, PRAIA

CHILE
CASSERES Ernesto, La Pastora 181 Dep. 140, SANTIAGO 10
Universidad Austral de Chile, Inst. de Produccion Vegetal, Facultad de Ciencias Agrarjas, Casilia 567, VALDIVIA

CHINA P.R.
DepL. of Horticulture, Northweslern A.-ric. Univers.it-y) YANGLTN - Shaanxi 712100

COLOMBIA
I.C.A., A.A. 5176/4, MEDFLLIN
I.C.A., Pro.-rama Hortalizas, A.A.233, PALMIRA
Universidad Naciona,l cle Colombia, Apartado Acreo 23-17, PALMIRA

COSTA RICA
CATTIE-MTP, 7170 TURRTALBA

COSTA RICA
Orton Memorial Li-brary, ITCA-CIDIA, TURRIAMIA
Proyecto Resional Manejo Tntegrado, De Plagas-Coorclinaduria Costa Rica, Apdo. 843-2050 San Pedro,
MONTES DE OCA-SAN JOSE
Sede Universitaria Re.-ional, del Atl-Antiro, Universidact de Costa Rica, Apdo 119, TUJO-ZIALBA
Unidad de Recursos Gen6ticos, CATLE1, TURRIALBA 7170

CUBA
Centro Agronomico Tropical, de Investigation y Ensen;ih,za, Apartado 74, TURRTALBA
Centro de Informacion, y Dorumentacion Agropecuar-io, Gaveta Postul 14149, LA HABANA 4
Dept. de l1roteccion de Plantas, INIFff cane 1 osquina 2, (Santia--o de Las Vc-gas), CIUDAD DE LA HABANA
Horticultural Inst. Lilliana Dimit.rova, km '33-L Carretera Bejucal a Quivican, LA SALUD-LA IIA13ANA
Inst. de Tnvest-igaciones Fund"Amentalos, (Agricultura Tropical, call- 1 esq. a 2 (Santial-lo de Las Vegas), CIUDAD HABANA

CZECHOSLOVACKIA
Dept. of Genetic Resources, Div. of Genetics and Plant- Breeding, Inst. of Plant Production, l1uzyn6 507, 161 06 PRAGUE 6
Inst. of Experimental Botany, Czechoslovak Academy of Science, SokolovskA 6, 772 00 OLOMUC
Research and Breeding. inst., for Vegetable and Special Plants, 94701 HURBANOVO
Research Inst. of Vegetable Growing, and Breeding, 772 36 OLOMOUC
Slachtitelska Stanica, PSC 925 24, PRALOVA PRI SENCI
Vyskumny a slaschkLaSky, ustav zeleniny-VIIIIANOVO, SlachLitelska stanica,
93041 KVETOSLAVDV

EGYPT
Faculty of Agriculture, P.O.Box 84, KAFR-EL-SHLIKII

EL SALVADOR
Centro Nacional, do Tecnologia Apropecuaria, Km 33-1 carretera a Santa Ana, SAN ANDRES-LA
LIBERTAD

ETHIOPIA
Bako Agricultural Research Center, P.O.Box 3, BAKO SHOA
Horticultural Development Project, P.O.Box 62320, ADDIS ABEBA
Plant Genetic Resources Center, P.O.Box 30726, ADDIS ABEBA

FRANCE
Centro de Recherche Tézivr, Domaine de Maninet, Route de Beaumont, 26000 VALENCE
CIRAD-IRAT-DocamentaLion, B.P. 5035, Av.VaL Je Montfortand, 34032 MONTPELLIER
Clause Semences Professionnelles, Dr. C.Basterreix-Vergez, Mas St. Pierre, La Gatine, 13210 ST.
REMY DE PROVENCE Ecole Nat. Sup. d'Horticulture, 4 rue Hardy, 78009 VERSAILLES
Ets Asgrow-France, B.P. n.5, Saint Martin le Beau, 37270 MONTLOUIS-SUR-LOTRI,
Ets Gautier, B.P. n.2, 13630 EYRAGES
Ets Vilmorin, Division Recherche, LA MENITRE, 49250 BEAUFORT EN VALEE
Griffaton Seeds, Mas d'Aptel, 30510 GENERAC HENNART J.W., 26 his Puech du Tuil, 30000 NIMES
I.N.R.A., Station d'Amélioration, des Plantes Maraichères, B.P. 94, 84140 MONTFAVET
I.N.R.K, Station de PaLbologic Ug6tale, B.P. 94, 84140 MONTFAVET
I.N.R.A.-G.E.V.E.S., Domaine d'Olonne BP 1, Les Vignereres, 84300 CAVALLOON
Institut de Recherches Vilmorin, Centre de la Costibre, Ledenon, 30210 REMOULKS
IRAT-CTR-97487 Saint-Denis Cedex, REUNION (Ile Do La Reunion)
Laboratoire de Phytomorphologie, Expérimentale-Unversité de Provence, 3 Place V. Hugo, 13331
MARSEILLE CEDEX 3
Laboratoire du Phytotron, C.N.R.S., 91190 GIF-SUR-YVETTE
Les Graines Gaillard S.A., Domahne du Moulin, 84260 SARRIANS
MINISTERE de VAGRICULTURE, Groupe d'Etudes des Varietes, et Semences-Domaine d'Olono, B.P.
I-Les Vianeres, CAVALLOON 84300
ORSTOM, 2051 Av. du Val de Mont Ferrana, B.P. 5045, 34032 MONTPELLIER
POCHARD E.-INRA, SLaLion d'AméliuraLion, des Plantes Marachiéres, B.P. 94, 84140 MONTFAVET
Royal Sluis France Society, C. Durantun, Mas do Rouzel-Chemin des Canaux, B.P. 1431, 30017 NIMES
KAM Clause, 91220 BREIGNY-SUR-ORGE
Station d'Améliaration des Plantes, I.N.R.A.-C.N.R.A., Route de Saint Cyr, 78000 VERSAILLES
Wier, Centre de Recherche, Dgmaine de Maninet, Route du Beaumont, 26000
VALENCE SUR RHÔNE

FRENCH WEST INDIES
INRA-CRAAG, BP 1212, 97184 POINTE-A-PITHE-GUADELUCUPE
GERMANY
AGRI-Saaten Gmbf1, P.O.Box 28 03 65, 2000 HAMBURG 28
Inst. fdr Obst und GemUsebau (370), Universitdt Hohenheim, Peregraswe., 17100 STUTTGART 70
Plant Physiology Inst., TerminicaL UniversiLv of Munich, 3050 FREISING-WEIIENSTEPHAN
Zentralinstitut fur Genetik und Kulturpflanzenforschung, Corrensstrasse 3, 4325 GATERSLEBEN

GHANA
A.A. Opoku, P.O.Box 8977, KUMASI

GREAT BRITAIN
C.A.B. International, Plant Breedin'-, AbsLract, Wallingdorf, P.O. Box 100,
OXON OX10 8DE
Dept. of Agricultural Botany, plant Sciences Laboratories, University of
Reading-, READING RG6 2AS
Horticulture ReseArch International, WELLESBOUPNE, WARWICKCV35 9EF
Institute of Horticultural Research, Worthing Poad, L. TTLEHAMPTON, West Sussex BN17 6LP
Library and Information, Services Section, N.R.I., Contra]. Av. - Chathain
Maritime, KENT ME4 4TB
Plant Biology Dept., Birminliam University, P.O.Box 36", BIRMINGHAM B15 2TT
Schering Agrochemicals Ltd., Chesterford Part-, Research Stat., SALLRON
WALDEN-Exess CB10 1XL
Scottish Crop Research Inst., Inverglowrie, DUNDEE DD2 5DA

GREECE
Greek Gene Bank, North Greece Agricultural Center, THESSALONTKI
Inst. of Vegetable Crops, HERAKLION-CRETET 711 10
Plant Protection Inst., 71110 HERAKLION-CHTFE

GRENA//A
C.A.R.D.I., P. O. Box 270, ST. GEORGES

GUATEMALA
ICTA, Ave. La Reforma P-60, Zojia '), Edificio Galerias Reforma, GUATI, MALA
Universidad de San Carlos de Guatemala, Facultad de Agronomia, Centro de documentacion, e
informacion agricola, GUATEMALA

GUYANA
C.A.R.D.I., 44 Brickdam, Stabrock-, GEORGETOWN

HONDURAS
Escuela Agricola Panamericana, Box 93, TEGUCTCALPO

HUNGARY
Agricultural Research inst. of, the Hungarian Acactemy of Sciences, Marx L61 2, 2462
MARTONYVASAR
ANDRASFALVY A., Agricultural Biotechnology Conter, Institute for Plant
Sciences, P.O.B. 170, 11-2101 GODOLO
Enterprise for Extension and Research, in Fruit Growing and Ornamentals,
Dept. Ornamentals, H-1223 BUDAPEST, Park u. 2
Institute for Fruit;, and Ornamental Growing, PERTOD 11-9431

78
Kerala Agricultural University, Collene of Horticulture, P.O. VeLlanikkara-680 654, TRICHUR - KERALA
Library, Punjabrao Krishi- VidyapeelLh, AKOLA - 444 104 (Maharashtra)
Library, Tamil Nadu Agricultural University, COIMBATORE 641 003
Library, University of Horticulture, and Forestry, SOLAN (P.O.: NAUNT) - 17 230 H.P.
MUKADA SEEDS, Boman Baug, Kher Pada, GHØ[NAD - Dist. Thane (W.RLY.)
NATHSEEDS Ltd., Adalat Road, AURANGABAD 431005
NEHRU Library, Haryana Agricultural UniversiLy, HISSAR
Regional Agric. RQscarch Station, Lam - GUNTUR 522 034
Regional Fruit Research Statton, Cuddapah District A.P., ANANTHARAJUPET 516 105
Self Employment Training Tnst., Pudupudur, S.R.W. Post, (Via)
Perlanalckenpalayam, COIMBATORE 641 020 (Tamilnadu)
Sher-e-Kashmir University, of Agricultural Sc. and Tech., Shalimar, SRINAGAR 191 121
Tamil Nadu Agricul-tural Univ., Agricultural Research Station, South Arcot
District, TAMILNADU - PALUR 607 113
Tamil Nadu Agricultural Univ., FacuLy of Horticulture, COIMBATORE 641 003
Tamil Nadu Agricultural Univ., Horticultural Research Station, Vijayanagaram,
UDHAGAMANDALAM 643 001
V. Ramsundar, 7 Karia Kara Vilai, East of CLock Towlr, NAGERCOIL 629001

INDONESIA
Balai Penelititan Hortik"ILurn, Jn. Tangkuhan Perahu 517, LEMBANG - BANDUNG 40391
LEHRI, Project ATA 395, Kotak Pos 428, BANDUNG 40 001

ISRAEL
Agricultural Research Org., Gilat Regional Exp. Station, MOBILE POST NEGEV
Dept. of Medici-nal, Spice ed Aromatic Plants, The Volcan! Center, P.O.Box 6, BET DAGAN 50250
Dept. of Plant Pathology, The Volcani Center, P.O.Box 6, BET DAGAN 50250
Dept. Plant Genetics and Breeding, The Volcani Center, P.O.B. 6, BET DAGAN 50250
Div. Virol., The Volcani Center, P.O.Box 6, BET DAGAN
Hazera Seed Company, Mivhor Farm, POST SDE GAT 79570
SHIFRISS Chen, The Volcani Center, P.O.Box 6, BET DAGAN

ITALY
Biblioteca, IstitLuto Agronomia Generale, Via Filippo Re 6-8, 40126 BOLOGNA - BO
Cattedra di Mi-glioramento Genetiko, Facolta di Agraria, 80055 PORTICI - NA
Dl.V.A.P.R.A., Sezione Miglioramento Genetico, e Produzione delle Sementi, Via
P.Giurla 15, 10126 TORINO - TO
DIXA.P.R.A., Sezione Patologia Vegetaie, Via P. Gfuria 15, 10126 TORINO - To
Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio, Via Michelangelo 32, 10126
TORTNO - TO
Dipartimento di Biologia, Sezione Genetica e Microbiologia, Via Celoria 26,
20133 MILANO - MI
Dipartimento di Genetic, e di Microbiologia, UniversitA, Via S. Epifanio 14, 27100 PAVIA - PV
ENEA - Biblioteca, c/o CRE Casaccia, 00060 S. MARIA DT GALERIA - RM
ENEA Casaccia, Dipartimento FARE, C.O. 2400-Via Anguillarese 301, 00100 ROMA - RM

80
Dept. of Greenhouse Cultivation, V.O.C.R., TAKETOYO - CHISTA - AICHI
Faculty of Agriculture, Kagawa University, Miki-machi - Kida-gun, KAGAWA - KEN 761-07
Faculty of Agriculture, Nagoya University, Chikusa, NAGOYA 464
Faculty of Gen. Ed., Tokyo University, of Agriculture and Technology, FUCHU TOKYO 183
Kihara Inst. for Biological Res., Yokohama City Univ., Kanagawa-ken 232, YOKOHAMA-SHI
Lab. of Veg. and Ornamental Hortic., Fac. of Agriculture, Oiwa-cho, Kita-shirakawa,
KYOTO 606
Laboratory of Horticulture, Kyoto University, Shimogano Sakyoku-ku, KYOTO 606
Morioka Branch, V.O.C.R.S., ShimoRuriyagawa, MORIOKA 020-01
National Inst., of Agrobiological Resources, Tsukuba Science City, YATABE IBARAKI
National Research Inst. of Veget., Ornamental Plants and Tea, Lab. of
Breeding Solanaceous Vegetables, ANO AGE-GUN MIE 514-23
NIHON HORTICULTURAL, PRODUCTION INSTITUTE, 207 Kamishiki, Matsudo-shi,
CHIBA-KEN 271
OHTAYasuo, Takezono 3-608=102, Tsukuba-shi, IBARAKI - KEN 305
SAKATA SEED Company, P.O.Box Yokohama Minami n. 20, 1-7 Nagata Higashi
3-chome, Minami-ku, YOKOHAMA 232
SAKATA SEED Corp., Plant Biotechnology Center, 358 Ucbikoshi, SODEGAURA
Seed Storage Laboratory, Div. of Genetics, Dept. of Physiology and Genetics,
National Inst. of Agric. Sciences, TSUKUBA IBARAKI 305
Shizuoka Agricultural, Experimental Station, 678-1 Tomioka -Toyota IwaLa, SHIZUOKA
The Nippon Shinyaiku InstiLute, for Botanical Research, Oyake Sakanotsuji-cho
39, Yamashina-ka, KYOTO 607
YUKURA Yasuo, 46-7 3-Chome, Miyasaka Setagaya-Ku, TOKYO

KOREA
Breeding Institute Choong Ang Seed Co., 14 Bangkyo Dongtan, HWASUNG KYOUNGGI
Dept. of Horticulture, College of Agriculture, Kyungpook National University, TAEGU 635
Dept. of Vegetable Breeding, Horticultural Experiment Station, Office of
Rural Development, Imokdong 475, SUWEON 170
Horticultural Experiment Station, 20 Gandong-dong Buk-gu, PUSAN 57111
NONG-WOO SEEDS, Plant Breeding Research Institute, 387-2 Sasa-20, Panwol
HWASONG 445-820
SEOUL SEED INTERNATIONAL Co., 3rd Floor - Chung TI B/D, 736-17 YeoR Sam-Dong,
Kang Nam-Ku, SEOUL 135-080

LEBANON
Plant Breeding Dept., Agricultural Research Inst., P.O.Box 923, TRIPOLI

LIBERIA
Central Agricultural Res. Inst., P.O.Box 32, GBARNGA-BONG COUNTY

LIBYA
National Bureau for Agricultural, Consultations and Studies, P.O.Box 2761, TRIPOLI

MALAYSIA
Dept. of Agronomy and Horticulture, University of Agriculture Malaysia,
SERDANG - SELANGOR
MARTINIQUE

MEXICO
Centro de BotAnica, Colegio de Postgraduados, 56230 CHAPINGO-Estado de Mexico
Centro de investigaciones, A2rkolas do el Pai-io, INIA-SARH, Apartado Postal 112, CELAYA-GTO 38000
Centro de Invest-igacionun, Anricolas do! Norte, INIA-SAR11, Apartado Postal 81, 33000 CD. DELICTAS - CHIP.
Empacadora GAB, Guanajuato 117, CRKAYA-GTO. 18040
IBPGR, Oficina para Lalinnampirica, c/o CIMMYT, Apartado Postal 6-601, MEXICO 06600 D.F.
Instituto Nacional de Forustales y Agropecuarias, Obispo de Las Casas n.109 Alton, AparLado Postal 41, 93400 PAPANTLA - VERACRUZ
Ynstituto Nacional, de TnosLipacioneh Agricoias, AparLado Postal C-1, Sue. Aeropuerto, TAMPOCO
Library C.T.F.A.P., Campo F%perimental del- Sur de Tama"l;l;pas, Apartado Postal C-1, Km 55 CarrptorN Tampico ManN, TAMPOCO

NEW ZELAND
J. WATTIE CANNERIES Ltd, King Supot-P.O.Box 439, HASTINGS
The Librarian (serials), Massey University, PALMERSTON NORTH

NICARAGUA
IsLituto Superior Ciencias Anropecuarias, RECEN, Km 12.5 Carretera Norte, MANAGUA

NIGERIA
Dept. of Agronomy, Inst. for AgriculVaral Research, Almoadu Belk University, P.M.B. 1044, SAMARU - ZARIA
Dept. of Botany, UniversiLy of Nigeria, NSUKKA
Dept. of Crop Science, University of Nigeria, NSUKKA
National Horticultural Research fnsk, 1di-Eshin PMB 5432, IPADAN

NORTH YEMEN
Hits Yemen (Cal Poly), P.O.Box 379, SANA'A Y.A.R.

NORWAY
Dept. of Vegetable Crops, the AnricuLtural University of Norway, Box 22, 1432 AAS-NLH

PAKISTAN
Vegetable Research Qslihuko, FAISALABAD

PERU
Dept. de Ciencias Agropecuarias, Universidad Nacional de San Agustin, Casilla 23, AREQUIPA
Dept. de FLI-opatologia, Univorgidid Narional Agraria, Apartado 456, LA MOLINA-IJMA
PHILIPPINES
Dept. of Agriculture, College of Agriculture, Un. of the Philippines, at Los Baños, College - LAGUNA 3720
EAST-WEST(SEEDCOMPANYINC,P.O.BOX1187,MAKATIMANila)
Inst.ofPlantBreeding,UniversityofthePhilippines,atLosBanos,LAGUNA3720

POLAND
Academy of Agriculture, Inst. of Genetics and Animal Breeding, Warszawska 71, 60-625 POZNAN
ANDRZEJTEWSKI R.P., 1111, Molt-le-0 11/8, 60-72 T10 ZNAN
Dept. of Genetics, A. Yugoslavia University, DabrowskieLo,c Street 165, 60-594 POZNAN
Dept. of Horticulture, Inst. of Plant Breeding, University of Agriculture, Zgorzelecka Street 16, 60-198 POZNAN
Inst. of Plant Genetics, Polish Academy of Sciences, Strzeszynska 34, 60-479 POZNAN

PORTUGAL
I.N.I.A., Estacao Agronomica Nacional, Quinta do Marques, OETRAS

PUERTO RICO
Univ. de Puerto Rico Rec. de Mayaguez, Colegio de Ciencias Agricolas, ESTACION EXP. AGR. Subest. de Isabela, Apartado 506, ISABELA 00662

ROMANIA
Research Inst. for Vegetable and Flower Culture, VI-DRA Jtjd. GIURGIU

SOUTH AFRICA
Division of Plant and Seed Control., Pvt. Bag X 179, PRETORIA 0001

SPAIN
ASGROW SEED Company, Apai-tado 171), 0470 1, E'J1,D0 (ALIMERIA)
C.R.I.A., La Alberca, MURCIA
Clause Iberica S.A., Apartado 162, PATFIRNA (Valericit)
Department Protection Vegetal, T.N.I.A.-CRTDA 03, Apartado 202, ZARAGOZA 16
Diputacion General de, Aragon, Servicio Investigacion Agraria, Seccion Documentacion y Biblioteca, Apartado 727, 50080 ZARAGOZA
Escuela de Capacitacion Agraria, Apartado 71, DON BENITO (Badajoz)
I.N.I.A., Estacion Experimental La Mayora, ALGARROBO-COSTA MALAGA
ORTEGA 61.1, R., D.G.A.-S.I.A., Apart-ado 727, 50080 ZARAGOZA
Semillas Fite, Ctra N-2, BELLPUIG (Lerida)
SEIMILLAS RAMIRO ARNEIDO, C/Avda d- 1 1 1 1 1 it r r 8 B, CALAHORRA-LOGRONO
Servicio de Investi.-acion Agraria, Apartado 727, 50080 ZARAGOZA
Slius Groot Semill.'ts, Apdo de Carreos 57, EL EITDO-ALMERIA.
Universidad Politecnica de Valencia, Camino de Vera 14, 46020 VALENCIA

SRI LANKA
Agricultural Research Station, MAJAILLUPPALLAMA
Food Technology Section, Ceylon Inst. of Scientific, -d Industrial Research, P.O.Box 787, COLOMBO
ST. LUCIA
C. A. R. D. I., P. (). Box- 971 , CASTRIES

SUDAN
Agricultural Research Corporation, Box 1-26, WAD MEDANJ

SUISSE
Nestec S.A., Av. NesL16 55, CII-1800 VEVEY

TAIWAN - ROC
Asian Vegetable Research and Development Center, P.O.Box- 42, SIJANHUA
TAINAN 74199
DA S, 350 Lin-Sed Road Sec. 1, TAINAN
Dept. of Horticulture, Nat. Chiang Mai Univ., 250 Kuohuan.- Road, TAICHUNG
40227
Dept. of floricultural I ur, NaL. Taiwan Uni iversi ly, TAIPE'I
Fengshan Ti-opical Itor- L. Exp. Stat. , Fen., sman - KAOISIUNG
Library, Taiwan Agric. Research Invest., 189 Chung-cheng Road, WAN-FENG WU-FENG
TAICHUNG
Library, The Asian Vegetable and Research, and Development Center, P.O.Box 42,
SHANHUA TAINAN 76199
National Chiayi Inst. of Agricultur-e, CHIAYI
Taiwan Seed Improvement, and Propagatioij Station, shinshieh, TAICHUNG

THAILAND
APTA, Phaya Thai Court, Soi Golit - Phaya Thai Road, BANGKOK 10400
AVRDC, Thailand Outreach Program, Kasetsart University, P.O.Box 91010, (Kasetsart) BANGKOK
1090
CHIA TAJ. Company Limited, 299-301 Soi L-sawad Road, BANGKOK 10100
Div. of floricultural-e, Dept- of A, l'-i,('DUlure, Bapkker) - BANGKOK
EAST-WEST Seed Co. Ltd. , 1). 0. Box 3, Batilli Bua Thon-a, NONTHABURI 11110
Faculty of A,,-i-iculhrire, Chi-ang Mai Univet-sity, CHIA MAI.

THE NETHERLANDS
Bruinsma Hybu-id See(t Co. , P.O.Box '24, NAALDWILJK AA 2670
Chronica Horticulturac, C11-TS11S, De Drei.jen (), 6703 BC WAGENINGEN
De Ruiter Zonen b.v., N-laadwijkseweg 400, 2691 RA 'S GRAVENZANDE
Enza Zaden, P.O.Box 7, 1600 AA ENKHU JZEN
EUCARPIA Secretarial, e/o llueed--ng SLation Wiersum, Rendierl4e-, 10,' 8251 PD DRONTEN
Gebi . Bakker Zaatdceell-, Zaadhanel , Oostelijke Randwegl 12, 1723 LM NOORDSCHARWOUEDE
Glasshouse Crops Research, and Experiment Station, P.O.Box,8, 2670 AA NAALDWIJK
Tnstitute of lort-icultural, I'Lant BreediftP., Mansholtlaan 15-P.O.Box 16, 6700 AA WAGENINGEN
Leen de Mos BV, P.O.Box 54, 2690 AB 'S GRAVENZANDE
Nickerson Zwaan b.v., Gebioken Neeldijk 74-P.O.Box 19, 2990 AA BANRENDRECHT
Nunhenis Zaden BV, P.O.Box 400 1), 6080 AA HAELEN
Rijk Zwaan B.V., P.O.Box 40, 2678 ZG DE LIER
Royal Sluis, P.O.Box 22, 1600 AA ENKIIUIZLN
Scientia Horticultu-ae, P.O.Box 330, AMSTERDAM
Sluis en Groot B.V., P.O.Box 13, 1600 AA ENKIIUIZEN
Sluis en Groot Research, Blaker 7, 2678 LW DE LIER
Van der BEEK J.G., Ro-ghost- 191, 6708 K.J. WAGENINGEN
Van der Zaden B.V., Beetbovenstrant 62, 5102 XB DONGEN

TUNISIE
Ecole Superieure d'Horticulture, CHOTT-MARIEM-SOUSSE
Inst. National Agronomique de Tunisie, Avenue de l'Indépendance, 2049 ARIANA
Inst. National Agronomique de Tunisie, Lab. Cultures Maraichères et Florales,
43 Avenue Charles Nicolle, 1002-TUNIS BELVEDERE
Station d'Appui de la Medjerda, 2010 MANOUBA

TURKEY
Aegean Regional Agricultural Research Inst., P.O.Box 9, MENEMEN-TZMIR
Ankara University, Faculty of Agriculture, Department of Horticulture, ANKARA-Diskapi
Atatürk Horticultural Research, Yalova Inst., ISTAMBUL
Department of horticulture, Fac. Agriculture-Univ. Of Cukurova, C.U. Ziraat
Fakültesi, Bahçeçi Bilkileri B61dmd, ADANA
Ege Universitesi, Ziraat Fakültesi, Bitki Koruma B61dmd, BORNOVA 35100-IZMIR
Uludag Univ., Faculty of Agric., Dept. of Horticulture, BURSA

U.S.A.
ASGROW E.P.G., 7000 Portage Road, KALAMAZOO 1 Michigan 49001
ASGROW SEED Company, Dr.R. Heisey, Pacific Coast Breeding Station, P.O.Box L,
SAN JUAN BAUTISTA - CaliFornia 95045
Chili-Queen, 6336 Oracle Rd. Suite 326319, TUCSON - ARIZONA 85704
College of Agricultural Sciences, University of Delaware, Department of Plant
Sciences, NEWARK - Delaware 19717-1303
College of Agriculture, and Home Economics, Box 3530, LAS CRUCES - New Mexico
88003
College of Agriculture, University of Guam, UOG Station-Mangilao, GUAM 96923
Cornell University, Albert R. Mann Library, ITHACA - New York 14853-4031
DE MARS Lawrence, 5017 York Ave. So., MTNNEAPOLIS-Minn 55410
Dept. of Agr. Engineering, Michigan State University, EAST LANSING -Michigan
48824-1323
Dept. of Agronomy and Horticulture, Dr.P.W. Bosland, Box 30003 Dept. 3Q, New
Mexico State University, LAS CRUCES-New Mexico 88003-0003
Dept. of Biology, Indiana University, BLOOMINGTON - IN 47405
Dept. of Botany, Miami University, OXFORD - Ohio 45056
Dept. of Horticultural Sciences, New York Agricultural Expt. Stat., Prof.
R.W.Robinson, P.O.Box 462, GENEVA-New York 14456-0462
Dept. of Horticulture and, Plant Genetic Engineering Laboratory, New Mexico
State University, LAS CRUCES - NM 88003-0003
Dept. of Horticulture, Louisiana Agricultural Exp. SLat., 137
Agronomy-Horticulture Building, BATON ROUGE - LA 70803-2120
Dept. of Horticulture, Michigan State University, EAST LANSING – Michigan 48824
Dept. of Plant Pathology, University of Florida, GAINESVILLE - Florida 32611
Dept. of Vegetable Crops, Cornell University, Plant Science Building, ITHACA - N.Y. 14853-0327
Dept. of Vegetable Crops, University of California, DAVIS - California 95616
Dept. Plant Breeding & Biometry, Cornell University, 252 Emerson Hall, ITHACA - N.Y. 14853-1902
Dept. Plant Pathology, and Crop Physiology, Prof. L.L.Black, Louisiana State
University, BATON ROUGE - Louisiana 70803
Desert Botanical Garden, Richter Library, 1201 North Galvin Parkway, PHOENIX - ARIZONA 85008
DNA Plant Technology Corporation, 2611 Branch Pike, CINNAMINSON-New Jersey 08077
Extension-Research Center, P.O.Box 189, ATTAPULGUS-Georgia 31715
Genetics Department, North Carolina State University, Box 7614, RALEIGH-NC 27695
Hortinnova Research Inc., Joseph Stern, 910 Duncan Ave., SAN JUAN BAUTISTA -California 95045
IFAS, University of Florida, ARES BELLE GLADE - Florida 33430
IPAS, University of Florida, Agric. Research and Education Center, P.O.Box 248, FORT PIERCE - Florida 33454
IFAS, University of Florida, Agronomy Department, Building 164, GAINESVILLE Florida 32611-0621
Inst. A Food and Agricultural Sciences, University of Florida, 345 South Congress Avenue, DELRAY BEACH-Florida 33444
Library CORNELL University, New York State Agricultural, Experiment Station, GENEVA-New York 14456
National Seed Storage Laboratory, U.S. Dept. Agriculture, Colorado State University, FORT COILINS-Colorado 80523
New York Botanical Garden, Library Serials & Exchange, BRONX-N.Y. 10458 - 5126
NORTHROP KING Co., Steven J. Czaplewski, 10290 Greenway Road, NAPLES -Florida 33961
Pepper Research Inc., 980 S.E. 4Lh Street, BELLE GLADE-FL 33430
Petoseed Florida Research, P.O.Box 249, FELDA - Florida 33930
Petoseed Woodland, Ken Owens, Rt. 4 - P.O.Box 1255, WOODLAND - California 95695
Phyto Dynamics Inc, 626 S. 775 E. - P.O.Box 5418, LAFAYETTE - IN 47903
Suburban Experiment Station, University of Massachusetts, 240 Beaver Street, WALTHAM-Ma 02254
Texas Agr. Exp. Station, The Texas University, 2415 East Hwy. 83, WESLACO -Texas 78596-8399
Universal Foods-Chili Products Div., P.O. Drawer H, GREENPIELD-CA 93927
USDA, Rt. 1 Canta Line Rd., DOZIER - AL 36028
USDA, National Agricultural Library, Current Serial Records Rm 002, BELTSVILLE - Maryland 20705
USDA-ARS Southern Regional, Plant Introduction Station, EXPERIMENT-Georgia 30212
USDA-ARS, GermPlasm Resources Unit, New York State Agric. Exp.Qat., Cornell University, GENEVA - New York 14456-0462

U.S.S.R.
Bolshoy Haritoniewsky, Perenlok Dom 21, MOSKVA B-78
Department of International Book Exchange, Central Scientific Agricultural Library, Orlikow Street 3, 107804 GSP-MOSCOW, H-139
Inst. of Ecological Genetics, of the Academy of Sciences, Lesnaya 20, KISHINEV-277018
Moldavian Inst. for Research, in Irrigated Agricultural & Vegetable Growing, Mira str. 50, 278000 TIRASPOL-MOLDAVIA
N.I.Vavilon All-Union, InA. of Plant Industry, Herzen Street 44, 190 000 LENINGRAD
Opytma stantsiya, V.I.R., MAIKOP
Research Inst. on Vegetable Crop., Breeding and Seed Production, Moscow region, 143080 ODINTSOV district

UGANDA
Library, Kawanda Research Station, P.O. Box 7065, KAMPALA
The Editorial Board of “Capsicum Newsletter” thanks the following supporter subscribers, whose financial contribution has been determinant for the publication of the present volume:

- Dr. P.W. Bosland, New Mexico State University, Las Cruces, U.S.A.
- Dr. S. Subramanya, Pepper Research Inc., Belle Glade, U.S.A.