CAPSICUM & EGGPLANT

NEWSLETTER

University of Turin
DI.VA.P.R.A.
Plant Breeding And Seed Production
Italy

No. 13 **1994**

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

EDITORS
P.Belletti, L.Quagliotti

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

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FOREWORD

This issue of "Capsicum and Eggplant Newsletter" includes a very important "invited paper'. It deals with the gene nomenclature of Capsicum and has been written by S. Daskalov with the co-operation of J.M.Poulos: we would like to thank them very much for their kind willingness to increase the scientific value of our Newsletter. Our thanks must also be expressed to P.W. Bosland, who prepared the rules of Capsicum gene nomenclature. With the publication of the Daskalov and Poulos' paper, our Newsletter has become the official reference for the reporting of pepper genes, as defined by the Capsicum Genetics Cooperative coordinated by P.W. Bosland. A Committee (constituted by the Scientific Committee of CENL, P.W.Bosland and J.M. Poulos) has been established, which is in charge of improving communications between geneticists from all over the world as well as the definitive acceptance of gene denomination. The new gene symbols should be regularly published in "Capsicum and Eggplant Newsletter'.

The other “invited papers” deal with the situation of pepper breeding in Tunisia and Turkey: they have been written respectively by M.B. Allagui and K. Abak. Many thanks also to them. As usual, we appreciate any ideas on countries to be considered in the next issue and people to contact for writing the articles.

The co-operation between our Newsletter and the Food and Agriculture Organization (FAO) is continuing. In this way we have been able to distribute our journal more widely: it is now sent to Institutions in more than 130 countries in the world.

Please, remember that a subscription fee to the Newsletter will be much appreciated. The fees are the same as the past, although the exchange rate between U.S.Dollar and Dutch florin has been slightly modified. Remember also that now it is possible to book your own copy of the journal, so quickening its delivery. Just fill in the order form on page 121 and send it to us, together with a copy of the payment order, which must always be made to EUCARPIA. In case you decide to pay by credit card, please use the voucher on page 123. We prefer this way of paying because of lower bank costs.

The deadline for the submission of articles to be included in the next issue of the Newsletter (No. 14, 1995) is **February 28, 1995.** Please note that it is also possible to submit the paper on computer disk. Details can be found in the enclosed sample sheet.

Piero Belletti and Luciana Quagliotti

Turin, 30th June 1994

LIST OF THE CONTRIBUTIONS

LIST OF THE AUTHORS

Capsicum and Eggplant Newsletter, 13 (1984): 11.

Capsicum Gene Nomenclature

It is being proposed by the Capsicum and Eggplant Newsletter Committee for Capsicum Gene Nomenclature that the **Capsicum and Eggplant Newsletter** be the official reference for Capsicum genes. The Committee and the Capsicum and *Eggplant Newsletter* hope to serve an important function in standardizing and articulating the gene symbols used by Capsicum researchers. A standardized and unified nomenclature system is needed and desired. This is important because some Capsicum researchers work with more than one species at a time. The "Rules for Gene Nomenclature of Capsicum" are presented to assist in unifying Capsicum genetic researchers. Additions, deletions, and corrections to the rules of gene nomenclature are welcomed by the Committee.

Capsicum and Eggplant Newsletter, 13 (1994): 13-14.

Rules for Gene Nomenclature of Capsicum

Prepared by the CENL Committee for Capsicum Gene Nomenclature

1. The Capsicum *and* Eggplant Newsletter shall be the official reference for the reporting of Capsicum genes and the official publication of the Capsicum gene list,

2. A seed sample of each named and accepted gene stock shall be deposited in the Capsicum Genetics Cooperative at New Mexico State University, USA. Furthermore, a duplicate gene stock(s) shall be retained by the originator or maintained in a separate location other than the Capsicum Genetics Cooperative.

3. Names of genes shall describe a characteristic feature of the mutant type in a minimum of adjectives and/or nouns in English or Latin.

4. Genes are symbolized by italicized or underlined Roman letters, the first letter of the symbol being the same as that for the name. A maximum of three (3) letters should be used to label the gene.

5. The first letter of the symbol and name is capitalized when the mutant is dominant, and all letters of the symbol and name are in lower case if the mutant gene is recessive. The "+" symbol should be avoided.

6. A gene symbol shall not be assigned to a character until supported by statistically valid segregating data for the gene (i.e. F2 or BC populations).

7. Mimics, i.e. mutants having similar phenotypes, but controlled by different genes, may either have distinctive names and symbols or be assigned the same gene symbol, followed by a hyphen and unique Arabic numeral or Roman letter printed at the same level as the symbol (e.g. ms1 and ML-2j. The suffix -1 is used to designate the original gene in the series, Allelism tests shall be made before a new gene symbol is assigned.

8. Multiple alleles have the same symbol, followed by a Roman letter or Arabic number superscript (e.g. gta and gj[f.] Similarities in phenotype are insufficient to establish multiple alleles; the allelism test must be made.

9. Modifying genes may have a symbol for an appropriate name, such as intensifier, suppressor, or inhibitor, followed by a hyphen and the symbol of the allele affected (e.g. Mo-A, modifier of A). Alternatively, the gene may be given a distinctive name unaccompanied by the symbol of the gene modified (e.g. t, complementary to B, carotene content).

10. When the same symbol has been mistakenly assigned to different genes, or more than one symbol designated for the same gene(s), priority in publication should be the primary criterion for establishing the preferred symbol, Incorrectly assigned symbol will be enclosed in parenthesis on the gene list. Exceptions can be considered on individual basis.

Capsicum and Eggplant Newsletter, 13 (1984):116-26. invited paper

UPDATED CAPSICUM GENE LIST

S. Daskalov* and J.M. Poulos**
*Institute of Genetics "Acad.D.Kostoff',1113 Sofia, Bulgaria; "Asian Vegetable Research and Development Center, Shanhua, Tainan, POB 42, Taiwan 74199..

The first gene list for the pepper including 49 genes as well as the basic rules for naming and symbolizing the genes was published by Lippert et al. 1965. In 1966, the same authors increased the list to 75 genes. Daskalov (1973a) in Bulgarian described all genes known at that time. Csillery (1980a,1983) described 46 and 67 spontaneous mutants, respectively. Greenleaf (1986) corroborated the Capsicum gene list for application to pepper breeding. An international consensus on newly reported genes, assigning gene symbols and the maintenance of genetic stocks is needed. In conjunction with efforts of the Capsicum Genetics Cooperative (Bosland, 1989), it is our hope that the CENL will become a forum for the adoption and reporting of Capsicum gene symbols (Poulos, 1994). Here we are making an attempt to compile all known genes (excluding molecular markers) and to reassign and standardize some erroneous or confusing symbols of the past. Not withstanding dogma, we have put brackets around symbols that we feel should be dropped or further revised for an "official gene list for Capsicum". Some of these symbols are omitted as main entries, but are listed in cross reference with the more acceptable or suggested notation. For the benefit of all readers we reiterate the rules for assigning gene symbols adopted from the above papers and the Tomato Genetics Cooperative 0 970).

1. The normal or wild type standard genotypes are the nonpungent C. annuum varieties 'California Wonder' or 'Doux Long des Landes'. Normal or wild type alleles are designated with the superscript plus sign (+). e.g. A+
2. A gene symbol is assigned by letters, a maximum of three, which best abbreviate the gene name. The gene symbol and the ene name should begin with the same letter. The gene symbol begins with a capitaf letter for dominant gene mutants and is all lower case for recessive mutants e.g. Bzt, for the dominant mutant 'bentazon herbicide tolerance'.
3. A gene name is a combination of adjectives or nouns that best describe the mutant phenotype (example above). [Latin names] or English derivatives are recommended.
4. Additional loci (polymeric and/or mimics) are assigned a number in addition to the gene symbol whenmore than one 10 effects or represents the same trait et, al

Assignment of additional loci should be validated by allelic and complementation tests, unless the trait is found in more than one species where barriers to interspecific hybridization make genetic studies difficult. Genes from other species should be clearly indicated in the description of the trait. Numbers are written on the same line as the gene symbol. Hyphens do not seem to be necessary.

5. Multiple alleles at a locus are noted b superscripts. Capital letter or Arabic number superscripts are used for dominant alleles; lower case letters for recessive alleles. Recessive mutants for which dominant alleles are later discovered are noted by the recessive gene symbol (lower case) with a capital letter superscript (e.g. vgm, vgv, vgH). Order of dominance of alleles should be put in the description using > > > (e.g. L4 > L3 > L2 > Ll > L+). Assignment of multiple alleles should be validated by allelic tests.
6. The entire gene symbol should be italicized or underlined. New symbols should never be assigned in opposite case to an already assigned symbol nor should the same trait be described by different symbols.

Symbol	Character
A	basic gene for anthocyanin color in plants, flowers, and immature fruits, incompletely dominant (Deshpande, 1933; Peterson, 1959; Odland,1960). [F] Also used for the same character (Hagiwara and Oomura, 1947).
A*l*1 to al5	anthocyanin-less, prevents purple color in plants; nodes green, anthers yellow, lack of purple spots on immature fruits ; in some genotypes and especially in cold and rainy weather purple spots on the nodes and immature fruits may be observed (Deshpande, 1939; Odland, 1960, Daskalov, 1973b; Csillery, 1980a,1983); also replaces [b] used by Cook 0 961 b) for yellow anther color.
Al6, al7	anthocyan i n- less in C *chinense* (Csillery, 1983).
al8	anthocyanin-less in C *chacoense* (Csillery, 1983).
anv	angustifolia variegada'; elliptical cotyledons, long and narrow leaves (Zubrzycki and Pahlen, 1974).
As	style with anthocyanin; purple in absence of A or Asf (Hagiwara and Oomura, 1947); reassignment of P (Lippert et al., 1965).
Asf	style and filament with anthocyanin; purple in absence of A (Odland, 1960); reassignment of [M (Lippert et al., 1965)
aur	'aurea'; golden cotyledons and leaves (Zubrzycki and Pahlen, 1974)
B	high beta-carotene content in mature fruits (Brauer, 1962); interacts with for range of levels.
bl	branchless; stems terminate in leaf and flower pedicel at first branching; female sterile with occasional seedless fruits (Lippert et al., 1965).
brl	braquitica latifoliata'; shortened stem internodes, leaf blades wide, large, round and dark green with short thickened petioles (Zubrzycki and Pahlen, 1974).
Bsl, Bs2, Bs3	hypersensitive resistance to races of bacterial spot *Xanthomonas campestris pv.* vesicatoria (Cook and Stall, 1963; Hibberd et al., 1987).
bV	bushy variegated; plants small, excessively branched with creamy white green mottled leaves (Bergh and Lippert, 1964).
Bzt	bentazon herbicide tolerance; plants exhibit a high level of tolerance to bentazon[(3-1-methylethyl)-(lH)-2,1,3-benzothiadiazin-4 (3H)-one 2,2 dioxide]. Fery and Harrison, Jr, 1990).
[C]	capsaicin or pungent fruit, variable expression (Deshpande, 1935); needs revision (see pun).

cl, c2	carotene pigment inhibitors, (Kormos and Kormos, 1960; Kormos, 1962, Hurtado-Hernandez and Smith, 1985); previously [c] and [01, respectively (Lippert et al., 1965).
[c2]	capsaicinoid inhibitor; nonpungency, polymeric with [C+J (Loaiza Figueroa and Tanksley, 1988); needs revision (see pun)
ca	canoe; margins of cotyledons and leaves are bent rolled upward by hyponasty, the stem is weak and tumbling (Csillery, 1983).
Cal1	callus roliferation as tiny warty structures scattered on stem, leaf and cotylexon, more pronounced on the abaxial surface (Csillery, 1983); formerly [call1] drop one T to conform to rules for nomenclature.
ce	calyx enclosed around the fruit base, originally *[e]* (Deshpande 1933).
cf	closed flower; cleistogamy; the petals remain attached to one another at anthesis, giving a characteristic ballooning of the flower (Subramanya and Ozaki, 1983,1984).
cfs	conditional female sterile; mechanism unknown; plants are vigorous and characterized by permanent abundant flowering; hundreds of normally developed flowers are formed containing fertile pollen; at the end of the vegetation period fruits with a diverse number of seeds (1-216) are formed (Daskalov and Mihailov, 1988).
chl	chlorina; greenish-yellow variegation or chlorophyll deficiency (Kormos and Kormos, 1955a; Lippert et al., 1965).
cl	chlorophyl retainer in mature fruit; combines with y+ (red) or y (yellow) to produce brown and olive green mature fruit color, respectively (Smith, 1948, 1950); synonymous with [g] (Brauer, 1962).
ct	compact; controls the extent of lateral axillary shoot development prior to the first bifurcation; at maturity the plants have more numerous and erect axillary shoots, are about half as tall as the normal but internodes are not as short as in dwarfs; the plants are several days later in fruit maturity (Bergh and Lippert, 1975).
[Cy2]	hypersensitive resistance to potato virus Y strain and pepper mottle virus; 'C' from 'Criollo de Morelos 334' (Palloix et al., 1990); (symbols for various potyvirus resistance need revision).
[div3]	'diversa'; diverse seedling traits such as deformed leaves, yellow-green virescent leaves and lethaTalbinos (Zubrzycki, and Pahlen, 1974).
drn	diminished morphology (suggested reassignment); formerly 'small leaf'; leaves are extremely small (2 cm length by I cm width) but of normal shape; the main stem before the first cyme has 18-20*internodes; stem

and flowers are equall tiny; moderate water stress causes wilting as in *sd* (Csillery, 1983); see *[7-11.*

Dms — dominant genetic male sterility; mutation from [ms5l (Daskalov, 1987).

ds — desynapsis; occurrence of randomly distributed univalents, bivalents, and hiXr chromosome associations during meiosis; causing a high degree of sterility; modifying genes may effect incomplete penetrance and variable expression of the desynaptic gene (Panda et al., 1987)

dt — determinate growth; conditions determinate growth habitus; *dt*+ and *ct*+ condition indeterminate growth, and are epistatic to one another; in the homozygous dominant or heterozygous condition, *ct*+ is epistatic to *A* whereas, *dt*+ is epistatic to *ct* (McGamon and Honma, 1984).

dtr — datura leaves; normal cotyledons, most of the leaves on the 5-12 nodes are irregularly dentate like leaves of jimson weed, with maximal expression around the I Oth leaf (Csi I lery, 1983); formerly [dt-1 I

dvg 1 — 'deforme variegada'; deformed and undulated green virescent variegated leaves (Zubrzycki and Pahlen, 1974).

Dw1 — dwarf; thick curly dark green leaves, very short internodes, height of the plants 12-15 cm., normal flowers, 1-2 almost normal fruits (Daskalov, 1974).

dw2 — dwarf; thick dark-green leaves, short internodes, height of the plants 15 20 cm., 2-3 almost normal fruits (Daskalov, 1974).

[etcl, etc2, eta, etav, eya, etf] — tobacco etch virus resistance in various combinations of pleiotropy or allelism with potato virus Y and pepper mottle virus resistance derived from C *chinense, C annuum* and/or C *frutescens,* respectively (Cook and Anderson, 1960; Cook, 1961a; Lippert et al., 1965; Greenleaf, 1956, 1986); now invalid. (symbols for various potyvirus resistance need revision).

[F] — resistance to Brazilian strain, Yf, of potato virus Y (Nagai, 1968, 1983); (symbols for various potyvirus resistance need revision).

fa — fasciculate; short internodes, compact, bushy plant, and flowers and fruits borne in clusters (Deshpande, 1944; Murthy and Murthy, 1962b; Lippert et al., 1965); symbol [cn by (Meshram, 1983) seems invalid.

fb — fruit base non-bulging, originally M (Deshpande, 1933, Lippert et al., 1965).

fc — fasciflora, female sterile plants, 27-55% pollen fertility, seedless fruits (Pahlen, 1967).

Fi — filiform (Cook, 1961 b, Lippert et al., 1965).

Flv	flavi; yellow green leaves, plants shorter and less vigorous (Daskalov, 1987).
Fr	frilly; leaf margins are marked by undulation (Csillery, 1980a).
fs	female sterile (Bergh and Lippert, 1964).
fv	fan vein; the veins of the leaves are branching like a fan, the leaf blade is often dissected, segments are curled like tendrils, corolla and other flower parts are irregularly reduced, but in spite of that fruits may develop, found in *C chacoense* (Csillery, 1980a).
gd	glossy diminutive, also female sterile (Bergh and Lippert, 1964).
Gi	graft incompatible with *Capsi*cum* and other *Solanaceae* (Kormos and Kormos, 1955b; Lippert et al., 1965).
[*H],*[Hl]	symbol used by Holmes 0 934) to designate non-pubescent or hairless stem, see *H* and *Sm.*
[H]	hypersensitive resistance to Brazilian strain, yn, of potato virus Y (Nagai, 1968, 1983); (symbols for various potyvirus resistance need revision).
H	hairy or pubescent leaf surface, interacts with *Sm* (Shuh and Fontenot, 1990)
im	intermediate maturity of purple in originally non-purple immature fruit, red mature fruit (Lippert et al., 1965); relation to A unknown.
k	peduncle easy detachment from node, related to flower and young fruit abscission (Uzo, 1984)
L 1, L2L3 L4	localization of tobacco mosaic virus, allelic series L4 > L3 > L2 > L^{1c} > Ll> L+ (Holmes, 1934, 1937; Lutes 1954; Boukema et al., 1980; Boukema, 1984; Rast, 1988).
L1C	localization of tobacco mosaic virus, TMV(O), resistance at high temperature ; 'C' for 'Criollo de Morelos 334'; allelic at *L locus* (Daubeze et al., 1990)
lsm	light sensitive mosaic; in normal planting cotyledons are green, but if the seeds germinate on light the cotyledons develop mosaic like leaves; the loss of chlorophyll is related to the length of light exposure; 5-6 days light exposure before the full expansion of the cotyledons is sufficient to produce plantlets like xantha (Csillery, 1980b).
lutl to lut14	lutescens; yellow reen mutants, cotyledons and leaves are uniformly yellowish, lighter than normal green, however, distinct accessions may differ in color intensity, and varietal background may alter the expression

substantially; *lutl* appeared in C baccatum var. *pendulum, l*ut5 in C. *frutescens x C annuum* hybrids, lut9 and lutl 1 in C baccatum var. *pendulum x* C annuum h brids, lutl4 in C pubescens, and the rest in

I

C *annuum (Csillery,* 1980Z1 I

[M 1*, M2* M3] multiple flowers (Shuh and Fontenot, 1990); we reassigned to *Mf.*

ml to m4 marbled; distinct green and white zones on foliage and immature fruits (Lippert et al., 1965; Daskalov, 1977). In the open field the m2 phenotype is expressed only on the first 4-8 leaves; under glasshouse conditions the mutant character is expressed on all leaves; the m3 phenotype is expressed both under open field and glasshouse conditions; mutant plants are shorter and less vigorous than the control (Daskalov, 1974).

Mel, Me2, Me3, Me4, Me5 *Meloidogyne s*pp. (root-knot nematodes) resistance (Hendy et al., 1985; originally designated as [NJ by Hare, 1957).

MoA modifier of A, intensifies purple color with A, originally [B] (Deshpande, 1939, Lippert et al., 1965).

Mf 1, Mf2, MF3 multiple flowers per node; polymeric genes; Mfl determines expression of multiple flowers when a dominant allele is present at either *Mf2* or *MO,* or both; recessive homozygosity at *Mfl* modifies the expression and reduces the multiple-flower nodes in spite of dominant alleles present at both Mf2 and *Mf3;* recessive homozygosity at any two loci is epistatic to the dominant allele present at the third locus; originally *[Ml, M2,* M31 (Shuh and Fontenot, 1990); we reassigned to Mf

mosl to mos52 mosaics; the cotyledons are either normal or display the mosaic variegation of the leaves; mosl to mos5l found in C *annuum, m*os52 in C baccatum var. *pendulum (Csillery,* 1980a, 1983).

ms I to ms4, ms6 to ms 11 genic male sterility; anthers are shrunken, reduced in size and do not contain fertile pollen grains or in some cases only a very small amount of fertile and sterile pollens are formed; no allelic tests are performed among all described mutants (Shifriss and Frankel, 1969 -msl; Shifriss and Rylski, 1972-ms2,, Daskalov, 1968 - ms3; Daskalov, 1971 - ms4; Daskalov, 1973b, c -ms6, ms7, and ms8; Pochard, 1970; Breuils and Pochard, 1975 - [m*r9, mc509 and mc7051 reassigned to ms9, ms 10 and ms 11, respectively.

O oblate fruit shape (Khambanonda, 1950; Peterson, 1959).

pcl,pc2,pc3 polycotyledons; the number of cotyledons is frequently 3-4, the stem is fasciated, sometimes after 3 or 4 nodes a pseudo-dichotomous branching with unequally developing of shoots may occur (Csillery, 1980a).

ph procumbent hypocotyl, seedlings are easy to recognize in early stage by a constriction below the cotyledonary node marked with a bright green

	ring; later at 2-3 leaf stage the hypocotyl bends down, the stem touching the ground; found in an interspecific hybrid between *C chinense* and *C annuum* (Csillery, 1980a).
Pi	plastid instability; green and white variegation (Hagiwara and Oomura, 1947., Lippert et al,, 1965).
Ps	pod separates; easily separation of mature fruits from calyx; behaves as incomplete dominant; expressivity of the gene can be modified by the genes which control the fruit form, calyx and placenta (Spasoevic, 1976); Ps, now distinct from S (Smith, 1951; jeswani et al., 1956; Kormos and Kormos, 1957; Greenleaf, 1986).
Pt	pointed fruit apex, not fully dominant to blunt (Deshpande, 1933), reassignment for [D] (Lippert et al. 1965).
Pun 1, Pun2	pungency (suggested symbols); presence of capsaicinoids in fruit; variable expression may be controlled by other genetic and environmental factors; formerly [C] and [c2+1, respectively (Deshpande, 1935, Loaiza Figueroa and Tanksley, 1988); revision conforms with nonpungent wild type, however, *Pun 1* +,1 Pun2+ probably function as intermediaries to block capsaicinoid synthesis.
[R 1, R2]	p9l for purple flower color-,Yclornsid Mgmeric genes 41. ered complementary [C] for purple flower color and with *IF]* for purple immature fruit color (Hagiwara and Oomura, 1947); needs comparison to A and MoA.
rl	roundleaf; the length/width ratio is reduced from 1.50 to 1.24, the leaves are characterized with a blunt tip; because round leaf is readily distinguishable from normal and the gene does not produce obvious pleiotropic deleterious effects, it is useful as a marker gene (Greenleaf and Hearn, 1976).
ru 1, ru2	rugose; the cotyledons are fleshy and curved downwards rather than flat as in normal plants, the mature leaves are rugose or savoy and appear darker green in the field than normal plants, seed and plant viability are good, but mature plants seem less productive (Csillery, 1983).
S	soft flesh, now distinct from Ps (Smith, 1951; jeswani et al., 1956; Kormos and Kormos, 1957; Greenleaf, 1986).
sd	scabrous diminutive, foliage surface rough as compared to glossy surface of gd (Bergh and Lippert, 1964).
S1	styleless, lacking normal style or stigma, incomplete female sterile (.Bergh and Lippert, 1965).
[sl-1]	small leaf; leaves are extremely small (2 cm length by 1 cm width) but of normal shape; the main stem before the first cyme has 18-20

internodes; stem and flowers are equally tiny; moderate water stress causes wilting as in *sd* (Csillery, 1983); we reassign as dm.

SM smooth or glabrous leaf surface, interacts with H (Shuh and Fontenot, 1990)

(S) rf1 rf 1 rf2rf2

c t plasmic male sterility, originally [S msms] (Peterson, 1958). Novac et ar,01971 demonstrated that male-sterile cytoplasm interacted with two nuclear restorer genes; the expression of the male sterility is not stable and depends on the environment and the genotype; during warm summer seasons sterility is well expressed, whereas, under winter-season glasshouse conditions, anthers contain 20-30 % fertile pollen grains.

Sp spinach, ground level whorl of odd, limp leaves; flower buds completely lacking (Bergh and Lippert, 1964).

SU suppresser of indeterminate growth, suppresses the epistatic action of ct+ (McCammon and Honma, 1984).

swl, sw2. . swn, sulfury white immature fruit color; dominant alleles control various green shades; number of genes and whether cumulative or duplicate in action not clearly established (Odland and Porter, 1938; Odland, 1948; jeswani at al., 1956; originally [G] Murthy and Murthy, 1962a and [G1, G2, etc.] (Lippert et al., 1965).

t high beta-carotene content, complementary with B (Brauer, 1962).

tu tube; cotyledons and leaves are rolled up like a tube or a cigar, only the abaxial surface is exposed (Csillery, 1980a).

Tl taphrina leaf; leaves are deformed and rugose as peach leaves with symptoms of the parasitic fungus *Taphrina deformans;* the stem is thin tending to prostration (Csillery, 1983)

un undulate; small -dark green leaves with undulate surface (Pahlen, 1966).

up 1, up2 upright or erect peduncle; reassignment of [p] and [u] (Lippert et al., 1965; Gopalakrishnan et al., 1990).

[v 1, v2] vein-banding resistance, combine to provide four virus expressions (Simmonds and Harrison, 1959); (symbols for various potyvirus resistance need revision).

VgM variegated mottled, allelic to vgv (vg+ > vgm > vgv) (Lippert et al., 1964).

vgv variegated virescent, allelic to vgm (Lippert et al., 1964).

vir 1, vir2 variegation of viridis type, homozygous lethal (Kormos and Kormos, 1955a; Lippert et al., 1965); virl formerly vir, vir2 formerly [vir-al.

[vir-a]	viridis- a; the young leaves are yellowish but later they change to normal green; the mutant phenotype depends on 12 hr day (Pahlen, 1966); we reassign as vir2.
[vy1,vy2]	resistance to potato virus Y, renamed by Pochard and Dumas de Vaulx 0 982); vy I from ' Yolo V, vy2 from I F lorida VR-2', wi Id type vy+ f rom 'Yolo Wonder' (symbols for various potyvirus resistance need revision).
[w]	resistance to Brazilian stralln, Yw, of potato virus Y (Nagai, 1968, 1983); (symbols for various potyvirus resistance need revision).
Wl	willow leaf; leaves narrow but wider than fi, practically female sterile (Bergh and Lippert, 1964).
[xa1]	kanthaii; completely lack of chlorophyll, homozygous lethal (Kormos and Kormos, 1955a, Lippert et al., 1965).]; relation to *xa 1 - xa 10* unknown.
xa 1 to xa8	xantha; the seedlings are white or yellow at emergency, cotyledons are normally expanded but the plants dies in 10-15 days; found in C. *annuum* (Csillery, 1980a, 1983).
xa9	xantha; found in C *baccaturn var. pendulum* (Csillery, 1983).
xalO	xantha; found in C *pubescens* (Csillery, 1983).*[*
[xa2a,xa2b]	[xantha2l, similar to [xanthali, but controlled by two complementary genes (Kormos and Kormos, 1955a, Lippert et al., 1965); relation to xa I xa 10 unknown.
y	yel low mature fruit color, combination of cl, c2, cl, y and their alleles provide range of mature colors (Deshpande, 1933; Smith, 1948, 1950; Kormos and Kormos, 1960; Kormos, 1962; Hurtado-Hernandes and Smith, 1985), replaces [r] as a proper symbol (Lippert et al., 1965).
[yaor y]	resistance to C and N strains of potato virus Y in C. *annuum* derived from P1 1 (PI 264281) (Cook and Anderson, 1960; Nagai, 1968, 1983); (symbols for various potyvirus resistance need revision).
YC	yellow cotyledon; yellow-white cotyledons, leaves yellow green, yellow ovary, golden-yellow immature fruits, light red mature fruits (Daskalov, 1987).
YS	yellow corolla spot of C *baccatum* var. *pendulum;* acts as dominant in crosses with other species.
yt 1, yt2	yellow top; only the young expanding leaves are yellow and they turn green gradually (Csillery, 1980a); relation to vir2 unknown.

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PEPPER GROWING IN TUNISIA: PRESENT AND FUTURE

M. Bechir ALLAGUL Laboratoire de Cryptogamie, INTRAT
rue Hedi Karrav 2080, Ariana. Tunisia

CROP IMPORTANCE

In 1992, the pepper growing area in Tunisia was 17,000 ha 'in open fields with a total production of 190,000 t and a mean yield of 11 t/ha (F.A.0., 1992). The same year, greenhouse pepper growing area reached 746 ha that represents a rate of 5501`0 of the greenhouse total surface (Minist&e de I'Agriculture, 1992). Main regions for pepper protected cultivation in the coastal area are 'Monastir', 'Mahdia!, 'Sfax' and 'Sousse', while open air summer growing takes places mainly at 'Cap Borf, 'Kairouan!, 'Sidi Bouzid! and 'Bizerte'. In the South of Tunisia, taking profit of hot spring-water for irrigation and heating, new greenhouse areas are being developed. There, peppers will find optimal soil and climatic conditions, which makes that area very promising for pepper growing.

In Tunisia, according to total cultivation area and total production and yield, pepper is the fourth vegetable crop after tomato, potato and melon.

In Africa, Tunisia is the fourth pepper producer after Nigeria, Egypt and Algeria (F.A.0., 1992). Tunisia is also the second exporter African country after Morocco and the fourth after Spain, Hungary and Germany if we consider the European countries (F. A.0- 199 1).

Since 1989 till 1991 pepper total yearly production and area, in open air, have been increased respectively from 110,000 to 190,000 t and from 11,000 to 17,00 ha, while yield remained almost the same, around 10- 11 t/ha. These yields are low probably due to diseases and lack of disease resistant high yielding cultivars.

MAIN CULTIVARS

In Tunisia pepper local varieties are not well studied and most of them are kept as population varieties. Some decades ago, land varieties were specific for each main growing area but the introduction of varieties of diverse origin has promoted varietal contamination. Besides, growers make choice of fruits for seeds without any breeding process.

The selection of local varieties is considered of main significance after fixation of patterns for each local variety. Several breeding procedures were established to obtain well-fixed traits in uniform and stable varieties (INRAT, 1979). Nevertheless, those works must be complemented by the creation of organization that keep those selected varieties free from pollen and seed contamination.

Cultivars, selected from local varieties by INRAT are: 'Beldi', 'Bak-louti', 'Semmene', N.abeul 2', 'Edhirat, 'Meskifort de Korba' and 'Bar Abid. Not all of these selected varieties are vet cultivated by growers, who usually produce their own seeds often as seed mixtures. Most of these cultivars have triangularly shaped, pointed fruits

of different lengths but all of them are hot because Tunisian consumers prefer hot cultivars.

Main varieties used in open field summer cultivation are: 'Beldi' and 'fort de Korba', both with triangular shaped, pointed, hot fruits, 'Baklouti' with quadrangular shaped, hot fruits, and 'Meski'with rectangular shaped fruits that are long, thick walled and sweet. Besides, many other non identified types are also grown,

On the contrary, for greenhouse growing, uniform clearly identified cultivars are being used. They were obtained by breeding and seed companies market them. The main of the cultivars are: 'B26% early, pointed and long fruited F1 hybrid, J27% TMV resistant F1 hybrid, earlier and more productive than 'B26, and 'Baker, early standard variety. Furthermore, local, hot varieties as 'Beldi' and 'Baklouti' are also grown for early production. Some foreign varieties are also being introduced but they are relatively less cultivated.

Special cultivars for processing are not known in Tunisia apart from 'Bar Abid' with fleshed, long, pointed, hot fruits used for canning. Niora!, is used for paprika production, but due to its sweet taste it is less cultivated.

'El harissa!, the main Tunisian processed pepper extract speciality, is obtained from the pepper production not sold for the fresh market, as all the varieties are accepted by factories processing this specialty. The same situation is found for paprika production. Red, desiccated fruits arranged as necklaces are also marketed. For this speciality, varieties with long, thin fleshed, hot, dark red fruits are preferred.

In our opinion, the selection or introduction of pepper varieties for processing is essential. The varieties should be adapted to mechanical harvesting and selected to improve its quality.

MAIN DISEASES

Many are the parasites producing important diseases in Tunisia.0

Fungus diseases

Lever1lula taurica, a leaf parasite, is well adapted to tunisian climatic conditions and have a continuous and copious growth in greenhouse and in open field pepper cultivation. The effects of this disease are favoured by two facts. First, all the cultivated varieties are susceptible to this parasite and, second, chemicals to control it are of very limited efficiency (Khamassi and Verlodt, 1982, Molot et al., 1990). A breeding prograrnme based on the hybridization with resistant lines is being developed now (INRAT, 1992, Allagui, 1993).

Phytophthora root rot is another important disease that causes high mortality rates in seedling and adult plant stages. It can lead to the destruction of whole fields. The causal agent for this disease is a *Phytophthora* species that can attack the collar and roots and it is characterized by the presence of brown neat lesions on them. After isolation, identification and artificial inoculation, we have proved that the causal agent

is Phytophthora nicotianae iar. parasitica sensu Stamps and al.(1990). Presently, our research on this host-parasite system is going on.

Verficillium dahliae, the causal agent of an important disease in the Mediterranean area, is not a major parasite in the tunisian pepper fields. We have only detected sporadic attacks at 'Cap Bon' and 'Bizerte'. Nevertheless, this parasite is not frequent, but we find that most the plants are affected if a plot is infected. A detailed analysis of factors that avoid the development of this disease should be of interest.

Botrytis and *Sclerotinia* cause important diseases when greenhouse growing is combined with high relative humidity.

Vims Diseases

Main viral agents identified in tunisian pepper crop are : potato virus Y (PVY), tobacco mosaic virus (TMV), cucumber mosaic virus (CMV) (Mehani,1975, Cherif and Spire,1983), alfalfa mosaic virus (A.MV) and tomato bushy stunt virus (TBSV) (Cherif and Spire, 1983) and potato virus X (PV*X) (Cherif, personal communication). From all these viruses only PVY and TMV are highly spread with important economical incidence. TMV has been isolated from most areas for greenhouse pepper growing. Jemmali (1987) has distinguished at least four biotypes. Some F I hybrids are presently being tested for TMV resistance.

Now PVY is considered the most threatening viral agent, particularly when associated either with TMV or CMV (Mehani, 1975). According to khadmaoui (199 1) pathotypes PVY-0 and PVY- I should be present in pepper fields. A breeding program to transfer the PVY resistance genes from 'CM334' ('Serrano Criollo de Morelos 334') to the cultivated varieties is presently in course at INRAT.

Besides the above mentioned problems, aphids and mites bring also important difficulties when insecticides are not properly used. Presently, the evolution of these insects to chemical resistant races is a threat.

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PEPPER PRODUCTION IN TURKEY, BREEDING PROGRAMS AND THEIR OBJECTIVES

K.Abak University of (;ukurova, Faculty of Agriculture, Department of Horticulture, 01110 Adana, Turkey

INTRODUCTION

Vegetable growing area in Turkey was estimated at 800,000 ha with the production of 17 million tonnes. In addition to vegetable growth in the open field, thewe is 26.500 ha protected cultivation area (11,500 ha greenhouse and 15.000 ha plastic tunnel) (Anonymous 1993 a and b) . Pepper is a kind of vegetable, which has a special place in Turkish Cuisine and can be consumed either fresh or processed all over the year. The protective and open field pepper cultivation, therefore, is increasing rapidly.

In this article, pepper production, its problems and important breeding studies in Turkey will be discussed briefly.

P-EPPER-PRODUCTION, DEVELOPMENT AND DISTRUBITION

Pepper production in Turkey shows a steady increase. Rate of annual increase in production is about 4 to 10 % year to year. As a result, pepper production has increased from 300.000 ton in 1970 to 375.000 ton in 1975, 580,000 ton in 1980, 725.000 ton in 1985 900.000 ton in 1990 and over 1 million ton in 1992 and pepper growing area exceded 50.000 ha (Anonymous, 1991).

Thirtythree percent of pepper production is realised in the coastal area of Mediterranean Region. This is followed by Aegean, Marmara, and Black Sea Regions and each of them has a portion of 17-18 % in production. These regions, which occupy almost half of the country's agricultural area, produce 85 % of the country's total pepper production,

Protected pepper cultivation in the Mediterranean coats IS concentrated especially in the province of 19el and Antalya, Popper is grown under greenhouse especially in Kazanli region of 19el province, and Demre region of Antalya province and under plastic tunnel in Tarsus region of 19el, Protected pepper production, which is estimated to be 10 % of total production, is realised at a rate of 8 % under glasshouse 92 % under plastichouse and tunnel (Erkal and Ergun 1993).

Ninety percent of pepper produced is marketed as fresh while the remaining 10 % is processed. The most important processing forms of pepper are paste and paprika. Pepper is processed as paste

generally in the Marmara and Aegean Regions whereas as paprica in East Mediterranean (Kahramanmara) and South-East Anatolia (anliurfa) regions. In addition, especially in the Marmara region a s.mall amount is canned and frpezed (for the domestic deepfreezers).

Almost all of the production is consumed within the country and only a small amount is exported. Although the amount of export has changed from year to year, it is around 20.000 ton which is only 2 % of the total production (Ytcel and Erkan, 1993). The main buyers are mid and north European countries (such as Germany, Austria and Holland), which host considerable number of immigrated Turkish workers, and middle East Countries.

MAJOR PROBLEMS OF PEPPER GROWING

Farm Structure

One of the most important problems in the pepper cultivation is the farm structure, Most of the pepper growing farms is of small-scale and they involve in the production of some other products as well. A survey revealed that average pepper growing farms are 5,4 ha and pepper cultivation covers only average 0.64 ha of total farm area (Yucel and Erkal, 1993). Scales are smaller in the case of protected cultivation and an average greenhouse is 750 m2. It is 5.000 m2 at maximum 550 m2 at minimum (Abak and Tekinel, 1993). This makes of use of new and modern growing techniques difficult.

Seed supply

The seed material used in cultivation comes only from local varieties and regional populations. Growers obtain seeds from their own farm or from neighbour grovers. The rate of certificated seed use is only 30 % and most of it is provided by local private seed companies. The use of low quality seed is one of the reasons for low yield and average yield is 20 ton/ha for open field and 35 ton/ha in the case of protected cultivation. The most common varietie types used are Carliston' (30 % of total production), 'Sivri' (15 % total production) and 'Dolma' (15 % of total production). Apart from these, some other local varieties are grown. Bell-type, large-fruit varieties are also grown in small quantities (less than 1 %) for canning and freezing.

Carliston' and 'Dolma' are sweet whereas 'Sivri' include hot and sweet varieties, In contrast to other vegetables, use of F.1 hybrid varieties is almost negligible in the case of pepper even

for the protected cultivation. All varieties are open pollinated.

Growing Techniques

In he cultivation, seedlings is commonly used. Seeds are sown directly into soil only in the East Mediterranean and-South East Anatolia regions in which pepper is dry processed. For open field cultivation, avarage number of plants in a hectar is 40.000 while it is 36,000 for protected cultivation. Irrigation is made by furrow method completely in open-field and 50 % in protected cultivation, Recently, drop irrigation has become popular in protected cultivation, Soilless culture has no use yet. Fertilizers are applied by water in the farms which has drop irrigation system and directly into soil in others.

Another important problem in protected cultivation is low temperature, Since regular heating is not provided in greenhouses, pollination problems are existe between December to February, As a result parthenocarpic and low-quality fruit is yielded.

Pests.- and Diseases

Viruses are among the most serious agents of disease of pepper. The most wide-spread virus disease is CMV and this followed by PVY (Yildiz et al., 1990). TMV and TEV are the other important viruses which cause damage. Although PMMV and TSWV are seen in Turkey, they do not cause considerable damage.

The most important fungal disease of pepper is Phytopthore capsicum. It is common all over the country but the damage is more pronounced in open field cultivation. It is seen at a rate of almost 100 % in some regions such as Kahramanmaras, However the involment of relatively low temperature in the case of protected cultivation, growing on ridges and drop irrigation result in lower damage, The second important fungal factor is powder mildew. Its damage is more effective at the end of the cultivation season. Fusarium and verticillium wilt can become important time to time.

From bacterial disease, only Xanthomonas campeatris py. yesicatoria has been reported (Yildiz et al. 1993).

The most important pests, which cause damage in pepper, are aphids and white fly recpectively. In addition, red spider mite (Tarsolemus sp) and nematodhes (Melojdogyne sp) cause damage especially in protected cultivation.

BREEDING PROGRAMS AND OBJECTIVES

Since the varieties of pepper consumed in Turkey are different than the ones produced in other countries, it is not possible to use foreign varieties in cultivation.

Thus, the selection of varieties pepper populations and development of new varieties are determined as primary important for breeding studies. As series of breeding studies is being carried out by the research institutes of The Ministry of Agriculture: Mediterranean region population Demre in Antalya Greenhouse Research Institute, Aegean region material in Izmir Aegean Agricultural Research Institute, a Marmara region population in Yalova Horticultural Research Institute, Mid-Anatolia populations in Eskisehir Gecitkusagl Research Institut and a population which is used commercially for production of paprica and paste in South-East Anatolia, in Diyarbakir Agricultural Research Institute.

Another area of study for breeding is to obtain F3. hybrid varieties tolerante to low-temperature protected cultivation. This topic is being studied in East Mediterranean Region by Horticultural Department of Cukurova University and Alata Horticultural Research Institute, and in West Mediterranean region by Antalya Greenhouse Research Institute and two commercial seed firms. The joint study of Qukurova University and Alata Institute yielded 3 new Fi hybrid varieties and they are applied for registration.

There have not been a lot of studies in the f ield of disease resistance. So far only Phytophthora capsici has been studies (Abak and Pochard, 1982, Abak et al. 1992). Two different studies for obtaining new varieties for the use of protected cultivation and processing are beeing carried out by a joint programme of Cukurova University and Alata,

In addition a study of virus resistance (CMV and PVY) of different varieties is about to be relaised by a joint programme of Cukurova University and INRA of France. In the contex of this study, so far, viruses and their races have been determined and the results have been published in this issue of Capsicum Newsletter (see Palloix et al.). Now, breeding studies are going to start for resistance.

Apart from the above programs, studies of obtaining haploid plants with anther culture to reduce the breeding periods are being undertaken by qukurova University and Ankara University. Although some positive results have been obtain (Abak et al. 1992) this technics has not yet been started to be used in the breeding studies.

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COLLECTION AND CHARACTERIZATION OF HOT PEPPER GERNPLASK IN SUDAN

El Tahir Ibrahim Mohamed Horticultural Germplasm Unit, Agricultural Research Corporation, P.O.Box 126, Wad Medani, Sudan

Introduction

Hot pepper (Capsicum spp) is one of the most popular vegetables in Sudan. It is used extensively by the Sudanese people either by adding its red dried powder or green berries to cooked foods or salads. Its pungency is the most important criterion for the Sudanese, and the majority prefer the hotest types than those with mild pungency.

Hot peppers in Sudan are produced all over the country by rains or irrigation. Almost all the cultivars grown are of indigenous types which are characterized by a wide range of observable variability. The popularity of the crop and its production in small holdings by individual farmers, in diverse environmental conditions of the different regions substantially contributed to the observable vast variability of this crop in the Sudan (Geneif, 1984).

The danger of losing some of this variability is increasing due to several factors. One of them is the drought spells that hit the country in some seasons, especially in Kordofan and Darfur regions in west where rainfed hot peppers are grown. Selection of superior varieties that is practised by the growers in their fields, in addition to introduction of new cultivars can contribute to the genetic erosion in local Sudanese hot pepper germplasm.

Some efforts have been carried out within the last years to collect, conserve and evaluate the indigenous cultivars of hot pepper in Sudan. This paper describes some of these efforts and the results out of them.

Collection and conservation

Organized collection of hot pepper landraces in Sudan was undertaken in 1970 as a response to a request from the government of Sri Lanka for large quantities of hot peppers from the Sudan (Geneif, 1984). Further collections have been made as a part of a horticultural germplasm programme funded by the International Board for Plant Genetic Resources (IBPGR) in the years 1982, 1983 and 1984. This programme was executed by the Horticultural Research Section in the Agricultural Research Corporation of Sudan (ARC). 15 accessions of local hot pepper cultivars were collected in 1982 from some areas of Central and Eastern regions (Hassan et al, 1983), 18 and 23 accessions in 1983 from Darfur and Kordofan regions successively (Hassan et al, 1984) and 8 accessions were collected in.1984 from Northern region (Geneif et al, 1986).

At present a total number of 237 accessions of hot pepper landraces are preserved in the horticultural germplasm unit of the ARC in Wad Medani, at -200C,in deep-freeze chests. This number comprises some of the collections made previously in 1970, and some of the.resulting breeding lines selected from them in the successive years (Geneif, 1984) in addition to the collections made through the IBPGR-funded programme.

Characterization and variability observed

A general multiplication and characterization programme has been adopted since 1986 for the various horticultural crops collections in the genebank unit. A total number of 116 hot pepper accessions was characterized for different morpho-agronomic traits in the seasons 1986/87, 1987/88, 1990/91 and 1992/93. Characterization has been done following a descriptor list derived from the IBPGR descriptor list for Capsicum (IBPGR, 1983).

A wide range of variability between and within the hot pepper accessions has been observed. Several variants could be observed within every accession for mostly each single character. Therefore, considering each single character (descriptor), every accession could be divided into a number of variants or sub-accessions equivalent to or less than the number of descriptor states. This indicates the highly variable collection of hot pepper landraces that could be obtained from Sudan. Table 1 shows the frequency percentage of each descriptor state out of the total variants between and within those accessions. Although an evidenceof wide variability between and within the accessions could be seen, but a degree of less variability and a general trend towards certain descriptor states have been shown in the following characters:

- Stem colour: more than 75 % of the variants (sub-accessions) have green stem colour.
- Corolla colour: about 73 % of the variants produce flower with white corolla.
- Fruit shape: about 50 % of the variants have conical fruits, and 39 % have elongate fruits.
- Fruit length: 92 % of the variants produce fruits which are short in length i.e. between 1-7.5 cm.
- Colour of immature fruits: most of the accessions have green immature fruits, and only few of them produce immature fruits with light or dark green colours.

Fruit colour at full ripe stage in those accessions was observed to be variable between dark red, purplish red, red and orange.

For the qualitative character: fruit pungency, although not systematically evaluated, but three categories could be found: mild hot, hot and very hot.

Conclusion

This preliminary study reflects the highly variable collection that is preserved in the Horticultural Germplasm Unit of the ARC - Sudan, which in turn gives a good idea about how rich the genetic resources of hot peoper in Sudan.

The variability and mixes within the accessions are also great which necessitate purification and separation of lines from them. This proposes for a suitable breeding programme within such highly adapted and popular hot pepper landraces, a programme which was started by Geneif (1984) in the late seventies and early eighties and needs continuation at present.

Further collections and studies are needed to cover new areas in the country and new aspects for evaluation especially for fruit pungency.

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Table 1.Fr equency percentages of descriptor states out of the total variants (sub-accessions) between and within the hot pepper accessions

Descriptor	Descriptor state and its frequency percentage			
1. Growth habit	Prostrate 6.4 %	Compact 59.6 %	Erect 34 %	
2. Stem pubescence	Glabrous 29.3 %	Sparse 42.3 %	Intermediate 23.9 %	Abundant 4.5 %
3. Stem colour	Green 76.2 %	Green with purplish nodes 15.4 %	Green with purplish streaks 8.4 %	
4. Leaf pubescence	Glabrous 37 %	Sparse 41.3 %	Intermediate 19.1 %	Abundant 2.6 %
5. Pedicel position at anthesis	Pendant 57 %	Intermediate 21.2 %	Erect 21.8 %	
6. Corolla colour	White 73.6%	Greenish 26.4%		
7. Calyx margin shape	Intermediate 59.3%	Dentate 40.7%		
8. Fruit position	Declining 57.8 %	Intermediate 14.9 %	Erect 27.3 %	
9. Fruit shape	Elongate 39.8%	Oblate 2.3%	Conical 50.9%	Bell 7%
10. Fruit length	Short 1-7.5cm) 92.6%	Medium (7.6-12.5cm) 7.4%		

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INTERNATIONAL HOT PEPPER TRIAL NETWORK (INTHOPE) AT NAZARETH, ETHIOPIA

Yayeh Zewdie

Nazareth Research Center, P-0-Box 436,Nazareth Ethiopia

Introduction

The International Hot Pepper Trial Net Work (INTHOPE), which is coordinated by the Asian Vegetable Research & Development Center (AVRDC) , was initiated with the objective of facilitating the exchange and evaluation of popular hot pepper landraces and elite germplasm across international test environments (2). Ethiopia is one of the cooperative countries.

In Ethiopia hot pepper is one of the most important ingredients for preparation of Ethiopian dishes. The medium pungent peppers are preferred for daily use. The green pod 'Karial is eaten raw as a salad. Dry red pods ground into powder and added to the local sauce 1wot'. Pepper also has high potential for export. About 5 % of the total production goes to the processing plant for extraction of oleoresin for export. The national yield level is 400 kg dry pod per hectare. one major limiting factor, which contributes to low yield is lack of high yielding, disease and insect resistant or tolerant cultivar(s). There is an urgent need to improve or develop new cultivars. In order to fulfill this objective, evaluation of introduced or locally collected germplasm is required. This report summarizes the results of the International Hot Pepper trials which were conducted at Nazareth, Ethiopia.

Materials and Methods

The experiments were carried out at Nazareth, Ethiopia in 1991 under irrigation and in 1992 under rainfed. Including the local check a total of 43 entries were evaluated in randomized complete block design with 3 replications in 1991 and 2 replications in 1992. Seedlings were planted in the field at a spacing of 80 and 40 cm in 1991 and 70 and 30 cm in 1992 between rows and plants respectively. Disease scores were made for powdery mildew (0-100%) and virus (0-5 scale). The incidence of powdery mildew in the 1992 trial was minimal. Data were collected based on the guidelines given by AVRDC. Color value of the entries (in 1991) was analyzed by the Ethiopian Spice Extraction Company. Yields were adjusted to dry pod basis by oven drying. Data were statistically analyzed.

Results and Discussion

Data of yield, plant and fruit characteristics are presented in tables 1 & 2. A number of entries gave higher fruit yield than the check, 'Bako Local', and the difference among the entries was statistically significant. In the seed bed, just at the soil level, the stem of many seedlings were cut by the insect, Gonocephlum simplex. As the result of this, in 1992 entries were

evaluated in 2 replications due to lack of sufficient seedlings for 3 replications.

INTHOPE #1

The incidence of powdery mildew was severe in most entries, High disease scores (>50 %) were recorded an lines PBC376, PBC210, PBC233, PBC266, PBC270, PBC374 and PBC378 (table 1). Leaves which were affected by powdery mildew shed after a few days. This may have had an influence on the photosynthetic activity of the plant. Tolerating the disease pressure, however, PBC376 gave higher yield than the check. PBC151 and PBC171, belonging to Capsicum baccatum and C. chinense, respectively, were free from powdery mildew disease under field conditions. These lines may serve as gene sources for developing powdery mildew resistant materials. PBC270, PBC377 and PBC511 had high color value, which was above the minimum requirement of the Ethiopian Spice Extraction Company (90,000 I. C. U) (table 1) .

INTHOPE #2

Virus disease symptoms were observed in all entries and none of the entries were found to be better than 'Bako Local' (check) in their reaction. On the average the high yielder entries gave 75 % more marketable fruit yield (table 2). However, most of the high yielders had small fruit size. Even though their yield level was lower than the local check, PBC204, C00002 and PBC384 had good pod characteristics. In this experiment plant height and width have positive correlation with fruit yield ($r = 0.663$, and 0.873, respectively). The relation was statistically highly significant ($P < 0.001$). On the other hand, days to flowering did not show any influence on yield. Similar results were reported by GomezGuillamon and Guartero (1). Pod diameter and length were negatively correlated with yield, but the relation was not statistically significant.

Entries selected in both experiments based on their high fruit yield, good pod characteristics, field resistance to powdery mildew and high color value were advanced for further evaluation.

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Table 1. INTHOPE #1, Data of yield, plant and fruit characteristics.

Under irrigation, Nazareth, Ethiopia 1991.

Entry	Days to flowering from trans-planting+ (cm)	Plant height+ (cm)	Fruit length (cm)	Fruit diameter (cm)	Marketable yield, dry (Kg/plant)	Average+ color value (I.C.U)*	Disease score (0-100 %) D a t e		
PBC066	64	79.00	8.563	1.690	0.040	85,915	5	30	15
PBC067	64	76.40	4.860	0.587	0.054	20,526	0	5	5
PBC076	55	38.80	10.57	0.780	0.161	50,745	20	40	20
PBC140	57	30.80	8.130	0.056	0.088	30,316	0	5	5
PBC146	51	60.00	8.583	1.013	0.075	82,945	0	5	5
PBC147	53	55.00	6.007	0.830	0.059	86,818	0	5	5
PBC148	57	40.00	4.593	0.783	0.026	77,226	5	5	5
PBC151	64	78.00	3.810	3.300	0.287'	74,981	0	0	0
PBC155	56	62.00	5.523	0.430	0.075	45,320	0	10	5
PBC156	56	31.00	5.303	0.473	0.051	ND	0	5	5
PBC157	61	56.40	3.897	0.470	0.079	ND	0	5	5
PBC171	65	38.00	3.297	1.657	0.072	ND	0	0	0
PBC207	51	53.40	12.633	0.917	0.178	75,867	50	20	10
PBC210	46	43.60	13.803	1.050	0.117	60,806	80	50	25
PBC233	53	54.00	10.963	0.747	0.214	72,379	80	50	20
PBC266	53	20.00	7.800	0.950	0.051	53,901	60	10	5
PBC270	54	43.00	10.023	1.660	0.081	102,000	50	30	10
PBC373	55	52.00	11.623	0.320	0.129	51,003	0	10	5
PBC374	45	37.40	8.993	1.180	0.081	ND	50	25	5
PBC375	53	41.00	9.123	1.003	0.092	27,228	30	20	5
PBC376	53	41.00	10.373	1.017	0.347*	76,479	80	35	5
PBC377	51	40.00	7.767	0.847	0.058	92,916	30	10	5
PBC378	55	29.00	8.690	1.037	0.061	81,422	70	40	10
PBC186	51	83.75	10.573	1.663	0.041	76,281	25	10	5
PBC398	59	39.00	6.457	0.667	0.069	32,637	15	10	5
PBC401	54	51.20	6.207	0.603	0.084	50,672	10	10	10
PBC402	54	64.00	4.133	0.427	0.091	46,893	0	5	5
PBC405	55	32.60	3.977	0.400	0.049	34,938	0	5	5
PBC511	59	38.00	10.247	0.873	0.053	116,277	20	5	5
Bako Local	64	38.80	11.750	1.353	0.132	65,208	0	5	
Mean	103.6	48.238	7.942	0.959	0.103				
LSD(5%)			0.9968	0.7309	0.1462				

Key - Significantly different from 'Bako local' (check) according to Least Significance Difference test (P = 0.05).
+ = Statistically not evaluated.
# = International color unit
ND= Not determined
@= Powdery mildew

Table 2. INTHOP #2. Data of fruit yield, plant and fruit characteristics. Under rain fed, Nazareth, Ethiopia 1992.

Entry	Plant height (cm)	Plant width (cm)	Fruit diameter (cm)	Fruit length (cm)	Days4' to flowering	Marketable yieldy (kg/plant	Virus disease score (0-5 scale) DATE 08/25	08/31	09/21/'9&
PBC199	77.10	83.48	0.405	4.58	68	0.103*	.5	3.25	3.25
PBC384	63.98	53.80	1.235	11.85	52	0.026	1.0	2.5	3.0
PBC204	59.30	51.15	1.680	7.69	80	0.007	1.5	2.5	3.25
C00002	44.15	36.90	1.740	13.55	40	0.019	2.5	3.25	3.75
PBC174	20.10	24.40	0.510	5.45	53	0.005	3.5	2.75	3.0
C00373	67.25	62.20	1.495	8.80	59	0.039	1.0	3.0	3.25
PBC362	45.95	49.80	1.335	10.80	45	0.034	2.0	2.5	3.25
PBC462	42.08	66.15	0.715	6.60	49.5	0.040	1.5	3.0	3.25
C00595	71.40	58.30	0.535	4.80	76	0.028	2.0	3.0	3.5
PBC426	51.15	47.98	1.475	11.63	62	0.020	2.5	3.0	3.0
C01092	54.70	51.85	0.890	7.25	50	0.023	3.0	3.25	3.5
C00574	72.67	70.55	0.435	9.55	52.5	0.065*_	1.0	3.0	3.5
PBC468	27.48	32.15	0.360	3.70	65	0.001	2.5	3.0	3.5
Bako Local	46.00	49.08	1.265	10.03	46	0.032	2.0	2.75	3.0
Mean	53.09	52.70	1.005	8.306	57	0.0316			
CV (%)	10.90	13.18	12.15	13.62	12.33	44.49			
LSD (5%)	12.50	15.01	0.2646	2.444	15.18	0.0304			

Key-Significantly different than the check ('Bako Local') according to Least Significance Difference test (P = 0.05).

\+ Days to 75 % flowering from transplanting.

**Scoring scale

0 = No symptom
1 = Faint mosaic or general chlorosis
2 = clear mosaic or general chlorosis/ necrotic spot
3 = score 1 or 2 plus leaf malformation, stunted veins, fan leaf, curling, crinkling, fruit malformation.
4 = stunting or dwarfing of the whole plant
5 = leaf drop and dying.

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HOT JALAPENO PEPPER CROP IN VERACRUZ, MEXICO

Juan Hernandez Hernandez Experiment station Papantla, INIFAP. P.O.Box 41, 934oo Papantla, Veracruz, MEXICO

There are a wide diversity of cultivated and wild types of peppers Capsicum annuum in Mexico, they are, differents on their characteristics about shape, size, color, flavor and uses. However hot jalapefio pepper is the most commercial of the cultivated peppers because of having more acceptability for fresh market con sumption and for processing industry.

The fresh green and red fruit can be eaten several forms such as stuffed pepper (chiles rellenos), salads, sauces or as a condiment with any foods. Matured red fruit generally is dehydrated by smoke called (chiles,chipotles) then, processed in powder form to use as a condiment in meals especially mexican foods (mole, tamales, etc.). The processed product can be eaten as pickled, chile chipotle or powder form and is used to flavor a lot of dishes. The native jalapeno pepper was named jalapeno for the city of Jalapa, the capital of Veracruz. Jalapa was a central market for shipping the pepper throughout the country.

CROP GENERALITIES

The production of hot jalapeno pepper in Mexico, was about 34 100 ha in 1993. The states of Veracruz, Chihuahua and Oaxaca are the leading producers. Veracruz produced about 11 500 ha of hot jalapeno pepper in 1993, with a mean yield of 6 ton/ ha and 69 000 ton of peppers annually are obtained.

Jalapeno pepper is one of the most important vegetable in Veracruz, in acreage, hand labor, value and export. It generates quite jobs to control weeds, pests, diseases and harvesting mainly. It needs about 150 workers to realize the different cultivation practices.

Annual production of Jalapeno pepper is mostly marketed into the national market in three main centers of distribution: Mexico city, Monterrey and Guadalajara, Lately, also it is exported to the U.S.A. 95% of the total production is directly sold by growers to middleman; 4% to processors and 1% is taken directly by growers to the centers of distribution.

JALAPENO SUBTYPES

There are three subtypes of commercial jalapeno called Espinalteco, Candelaria

and Tipico all of them are differents and their characteristics on fruit and plants.
Tipico. It is known also as "tres lomos", plants grow 65 cm tall, compact plant and it has strong main stem with several branches in horizontal or vertical, glabrous or little pubescence. It has semi-concentrated fruit setting (two to three harvesting). In general the fruits are conical, cylindrical or triangular (tres lomos), 4 to 8 cm long X 3 to 5 cm wide, blunt end, and mature to dark green to red, medium cracks (30 to 60%) with thick walls (0.4 to 0.6 cm). The firmness fruit makes them excellent for processing industry and for making of chiles chipotles. The leading counties about tipico subtype are Sontecvmapan, Acayucan, is la and Perla del Golfo.

Peludo Candelaria. Plants are very vigorous, taller and grows between 1.0 to 1.5 tall with quite pubescence on stem, branches and leaves (peludo). It is ready for harvest approximately 150 days from direct sowing with continuous fruit setting which allows for multiple harvests and are usually harvested 4 to 6 times at 15 day intervals, Candelaria subtype appears to possess higher levels of resistance to moisture stress than Tlipico and Espinalteco subtype. The fruits are elongated shape, semi-smooth, cracks less than 20% and measure approximately 6 to 9 cm long X 3 to 4 cm wide with 3 to 4 locules. Fruit mature medium green to red, with and angular, blunt shape and thick walls. And it is used primarily for fresh market. This creole variety grows in following counties; Papantla, Cazones, Tihuatl5n, Tecolutla, Guti6rrez Zamora,and Nautla.

Espinalteco. The plant of this variety grows to 60-70 cm in height-An early matu. rity approximately 120 days from direct-sowing and a concentrated fruit setting (1 to 2 harvesting) are the most important characteristics of this subtype. The fruits show higher heterogeneity onJorm, size and color, but generally are conical, cilindrical, measures 6 to 9 cm long X 2.5 to 3 cm wide. The fruit mature dark green to red with a blunt shape and thick walls. Fruit are semi-smooth, cracks less than 10%. Espinalteco plants are more sensibles to moisture stress (drought). This creole variety grows good in the counties of Papantla,'Espinal, Coyutla, Tihuatsn and Coatzintla.

MAIN CULTIVATION PROBLEMS

In general terms, pests, diseases, weeds and cultivars are the main production constraints in Veracruz.

processing industry, because of having more flavor and aroma than other cultivars.

In Veracruz, lower yields and inferior external quality reflect these horticultural characteristics. Because of that, it is very important to horogenize commercial jalapeno native cultivars in order to obtain a higher quality fruit with horticultural characteristics required in the mexican and foreing market. Veracruz paththology state represents a ideal place for making myriad studies about entomology, plant pathology, genetic, weeds, etc. Therefore it is necessary to make research proyects on pepper with international research institutions to solve common problems about pepper product ion.

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RARE AND NOVEL CAPSAICINOID PROFILES IN CAPSICUM

M. Collins and P. Bosland
New Mexico State University, Department of Agronomy and Horticulture, Box 30003, Dept. 3Q, Las Cruces, New Mexico 88003

Capsaicinoids are the chemical constituents responsible for pungency in the plant genus *Capsicum,* and are major determinants in evaluating chile pepper quality. The seven capsaicinoids normally referred to in the literature are: capsaicin, dihydrocapsaicin, nordihydrocapsaicin, norcapsaicin, homocapsaicin, nornorcapsaicin, and homodihydrocapsaicin. Capsaicin and dihydrocapsaicin are considered the major capsaicinoids, as they normally occur in the highest concentrations (Bennett and Kirby, 1968), while nordihydrocapsaicin, norcapsaicin, homocapsaicin, nornorcapsaicin, and homodihydrocapsaicin occur in smaller amounts and are considered minor capsaicinoids.

Unique profiles could be used to identify appropriate parents for genetic studies of the inheritance of capsaicinoids and for cultivars with increased levels of these minor compounds. As persons sense each capsaicinoid differently (Krajewski and Powers, 1988), it should be possible to genetically manipulate the capsaicinoid profile to produce not only a chile pepper with a certain "amount" of heat, but also with a certain "type" of heat. The first step in this procedure is the identification of novel capsaicinoid profiles. All qualitative work was accomplished using high performance liquid chromatography and utilizing methods devised and refined in our lab.

More than 300 *Capsicum* accessions were tested for unique capsaicinoid profiles. These accessions included C. *annuum,* C. *baccatum,* C. *cardenasii,* C. *chacoense,* C. *chinense,* C. *frutescens,* C. *pubescens,* and C. *tovari.* Even though most C. *annuum* accessions have capsaicin as the most abundant capsaicinoid, two accessions of C. *annuum* from Thailand had dihydrocapsaicin as the predominant capsaicinoid. Several C. *pubescens* also had dihydrocapsaicin as the most abundant capsaicinoid (Fig. la, b). In addition, several C. *pubescens* accessions exhibited nordihydrocapsaicin and dihydrocapsaicin areas larger than capsaicin (Fig. 2a,b). These patterns have not been previously reported. A C. *cardenasii* accession produced a nordihydrocapsaicin amount almost as large as capsaicin (Fig. 3). This is the first time this profile has been reported in natural *Capsicum* samples. Several C. *pubescens* accessions also showed this pattern. In addition, some extracts initially screened by HPLC were sent to McCormick Spice Company, who provided LC-MS data and tentatively identified peaks nornordihydrocapsaicin, homohomodihydrocapsaicin, tetrahomocapsaicin, trihomodihydrocapsaicin, and tetrahomodihydrocapsaicin. These are likely novel casaicinoids, for they have never been previously identified in *Capsicum* studies.

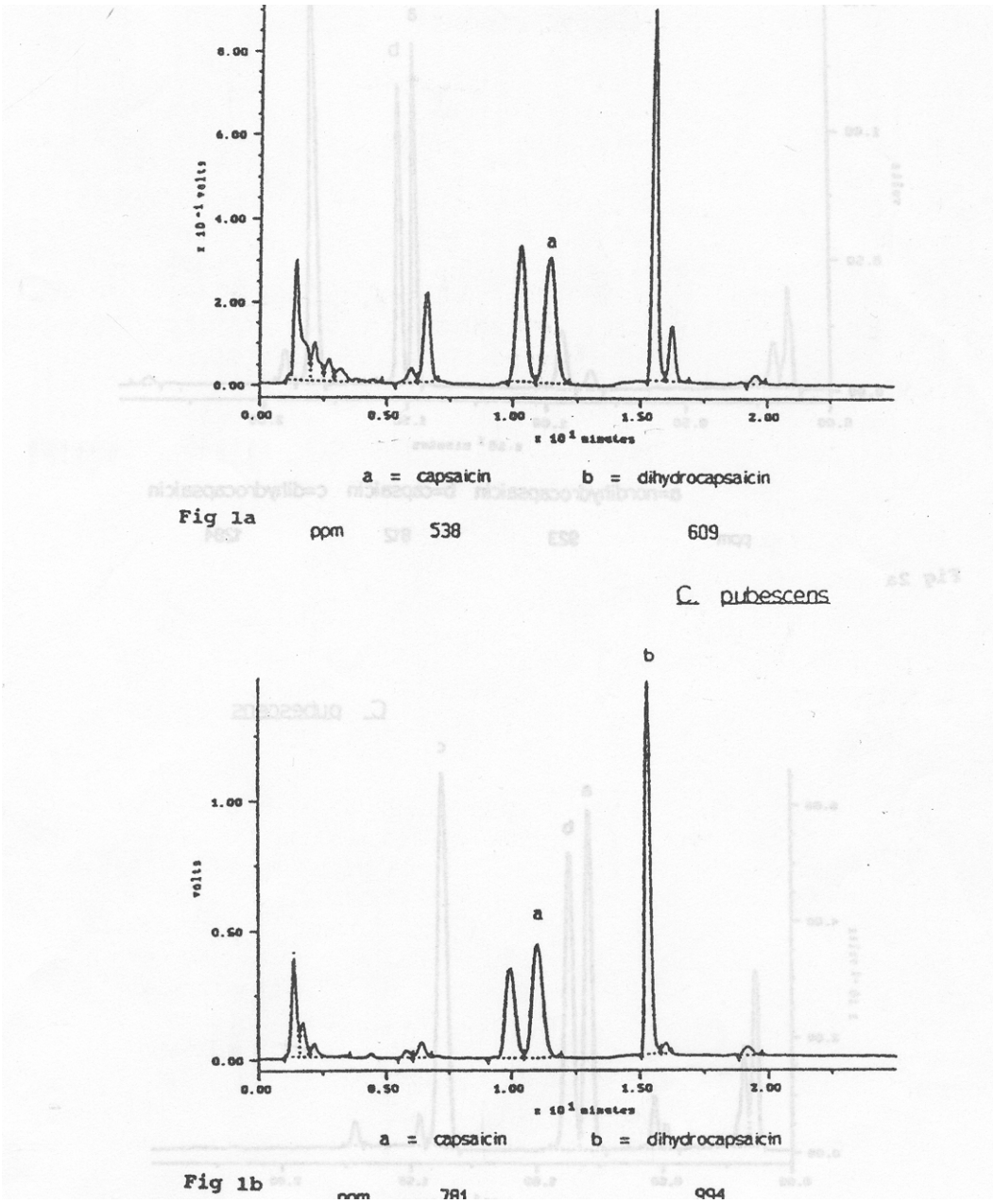

Fig 1a,b- HPLC chromatographic profiles of two disparate C. pubescens accessions showing dihydrocapsaicin as the most abundant capsaicinoid.

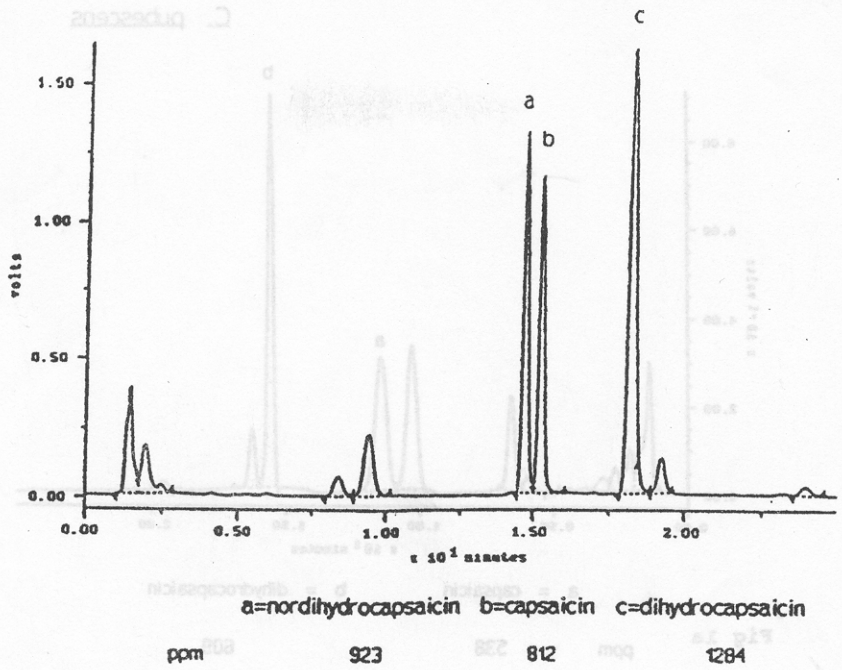

Fig 2a

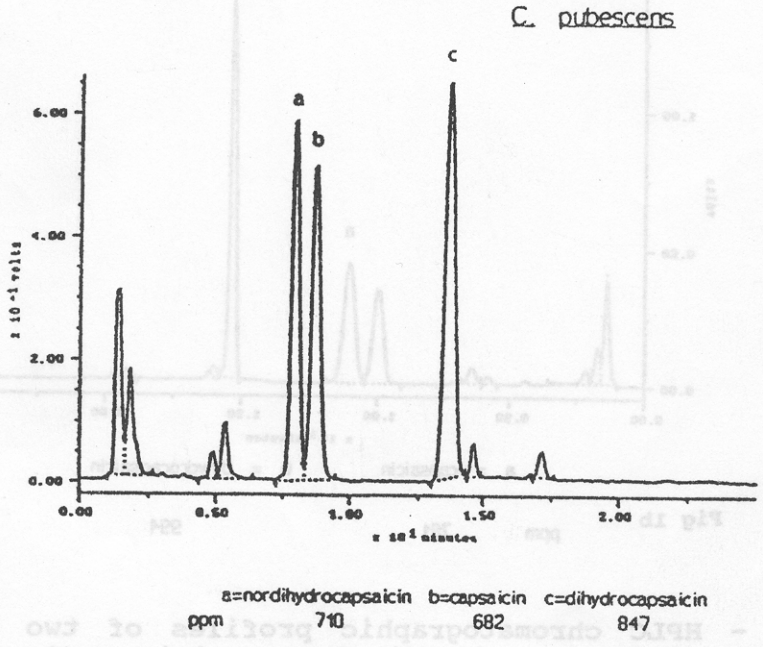

Fig 2a,b – HPLC chromatogram of two different C. pubescens accessions demonstrating nordihydrocapaicin and dihydrocapsaicin amount larger than capsicin.

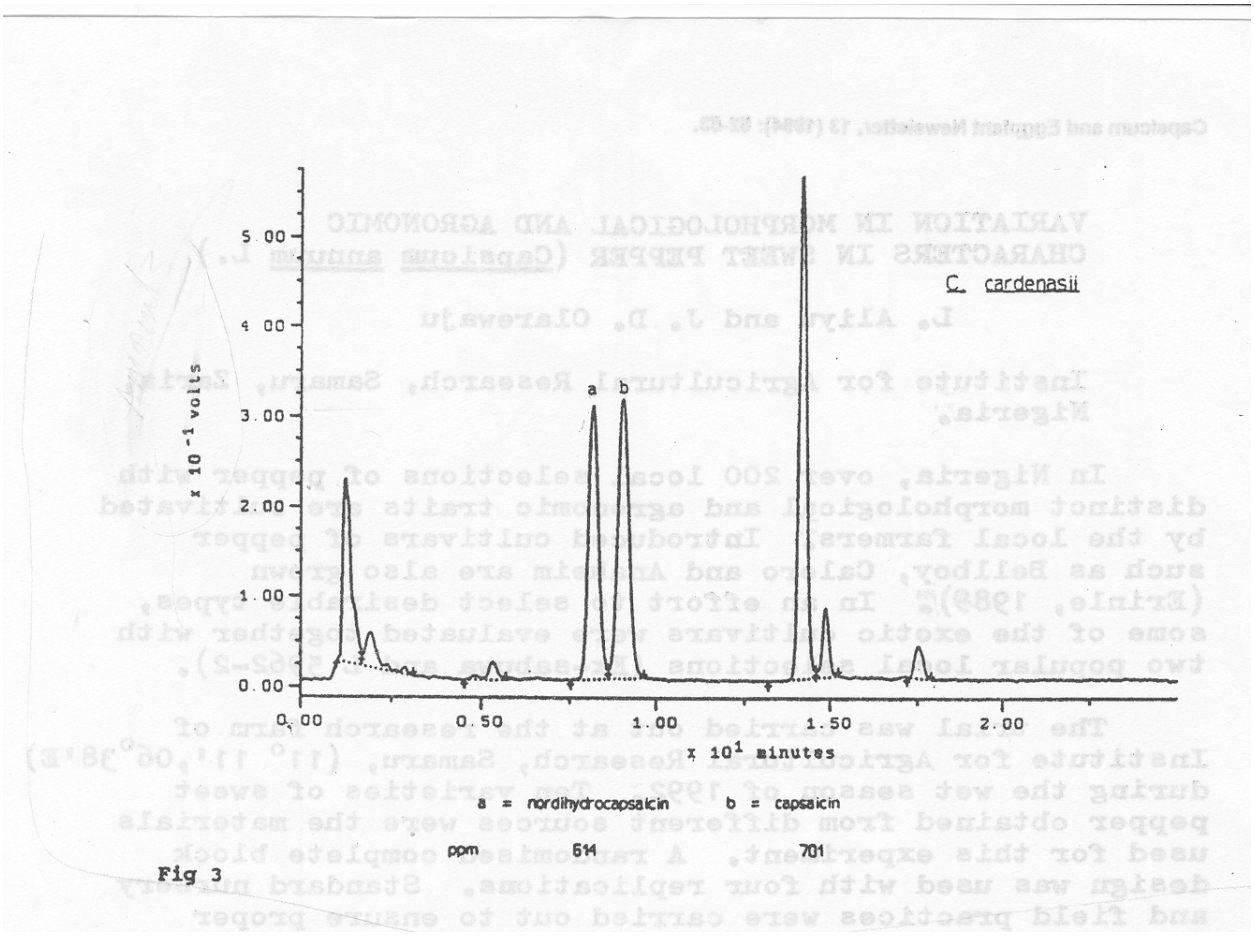

Fig 3- HPLC chromatogram of C. cardensii exhibiting nordiydrocapsaicin amout almost equal to capsaicin.

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VARIATION IN MORPHOLOGICAL AND AGRONORIC CHARACTERS IN SWEET PEPPER (Capsicum annuum L.)

L. Aliyu and J. D. Olarewaju

Institute for Agricultural Research, Samaru, Zaria, Nigeria

In Nigeria, over *200* local selections o£ pepper with distinct morphological and agronomic traits are cultivated by the local farmers;' Introduced cultivars o£ pepper such as Bellboy, Caloro and Anaheim are also grown (Erinle, 198,') In an effort to select desirable types, some of the exotic cultivars were evaluated together with two popular local selections (Ex-sabuwa and L 5962-2).

The trial was carried out at the research farm of Institute for Agricultural Research, Samaru, (11^0 11^1,06°.38'E) during the wet season of 1992. Ten varieties of sweet pepper obtained from different sources were the materials used for this experiment. A randomised complete block design was used with £our replications. Standard nursery and field practices were carried out to ensure proper establishment and growth of the crop. Gross and net plot sizes were 18 and 12m2 respectively. Measurement on morphological and agronomic traits were done at the beginning of harvest. The data collected were summarised and analysed statistically.

Result on the variation in the traits studied are presented on Table 1. Plant height ranged from .30.98cm 'to 47.80cm for Ex-sabuwa and Caloro respectively. Ex-sabuwasimilarly had the lowest number of branches and leaves (8.8.3 and 4.3.56 respectively). Whilst L 5962-2 and Santafe Grande recorded the highest number of branches (11.38) and Leaves (71.6.3) respectively. Fruit length and diameter ranged from 4.0 to 9.0cm and 2.0 to 4.5cm respectively for 'cherry red and Santafe Grande. Anaheim 1M' out yielded other cultivars while pipianto had 'the lowest yield of (60.6.3g); Inspite of its high yielding ability, Anaheim 'M' is not popular as a salad vegetable probably due to the poor colour appeal of the immature fruit. L 5962-2 a moderate yielder is cherished both for salad and puree because of the desirable colour, compact a fleshy nature of the fruit. Among the characters, plant height is the least variable with a c.v. of ;13.428; while .fruit length is the most variable with a c.v. of 26.297.

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ASSESSMENT OF THE VEGETATIVE, REPRODUCTIVE CHARACTERS AND FRUIT PRODUCTION PATTERN OF PEPPER CULTIVARS (Capsicum spp.)

A.O. Olutolaj1 and M.J. Makine
National Horticultural Research Institute, P.M B. 5432, Ibadan,
Nigeria.

INTRODUCTION

Capsicum L., belong to the family Solanaceae and there are two main species, Capsicum annuum L. (chillies, red or sweet peppers), usually annual and Capsicum frutescens L. (bird. chillies) which are shrubby perennials with inflorescence of sevearal flowers. The increasing economic value of pepper cannot be over-emphasized, farmers now embark on " its production on a large scale in the humid tropics. In Nigeria, pepper: is regarded as a third most important vegetable after onions and tomatoes (Fawusi, 1978). It is an important component in stew in terms of flavor and aroma. Using the fruit shape (EpeIlhuijsen, 1974) classified the local varieties crown in Nigeria into two croup.. Capsicum annuum L. CVs 'Rodo', 'Tatase' (Round and Bell shape); C. frutescens L. Cvs 'So.bo' and 'Atawewe' (Slim, elongated and slim short). Most of these cultivars are pungent but C. annum are not as pungent as the C. frutescens. However, due to the high variability in the two species in aeras of fruit shape, size, colour and pungency; demand is often based on one or more of these characters.
It is therefore necessary to assess some of the vegetative, reproductive and fruit production pattern in an attempt to estimate and consequently improve the yield of pepper.

Materials and Methods

EXPERIMENT I: Eight cultivars of pepper were selected from the Institute's germplasm collection. The cultivars include Capsicum annuum - bell shaped type, Ca Bell-1, 'Ca Bell-3', C. annuum - Round type, 'Ca Round--4', 'Oa Round-5' and,9.. frutescence - slim type, 'Of Sl18-7', 'Of Slim-8', 'Of Slim-9' and 'Of Sl18-10'.

EXPERIMENT II: The second experiment involved evaluation of the flower production, fruit setting and fruit production pattern of three ('Oa Bell-1 " 'Ca Round-5' and 'Cf Slt.- 7') pepper cul tivars. . In the two experiments, seeds were sown in nursery trays and at 6 weeks seeiliD«s were transplanted on 1 x 2m plots at 50 x 5Oom spactnc between and vi thin the rows. There were four replicates arranged in a randomized complete block desicn for each experiment. Two weeks after transplant1nc, NPX 15115115 was applied at the rate of 60kg N ha-1.
Plants were also sprayed with cypermethrine at 50~ a.i. ha-1 every two weeks throughout the growth period of the crops.
Harvesting was done twice a week from 14 weeks to 24 weeks and subsequently once a week up till 30 weeks, when the experiments were terminated.
The data were analyzed statistically using a two-v&J analysis of variance from which the least significant difference at 5% leYel were calculated for each experiment.
Tabel 1: Morphological and agronomic characters of Sweet Pepper varieties grown at Samaru, Nigeria. 1992

	Characters							
	Number of						Fruit colour	
Variety	Plant hight(cm)	Branches	Leaves	Fruit length(CM)	Fruit diameter(cm)	Fruit yield g/plant	Immature	Ripe
Anaheim' M'	41.87	10.67	63.71	7.5	2.3	123.31	Palegreen	Red
Caloro	47.80	9.75	60.00	5.0	3.5	101.56	Beautiful Yel.	Red
Cherry Red	34.40	9.17	61.74	4.0	2.0	96.35	Reddish	Brignt green
Cubanelle	38.80	10.83	48.51	9.2	3.7	83.41	Green	Maroon
Ex-sabuwa	30.98	8.83	43.56	7.3	4.0	90.00	Green	Red
Lamuyo	37.68	9.67	50.00	5.0	3.0	75.63	Green	red
L 5962-2	32.75	11.83	71.03	7.0	4.0	100.13	Green	Red
Mild califorina	42.18	10.75	68.19	8.5	3.6	118.75	Green	Red
Pipianto	41.23	11.25	70.05	6.0	4.2	60.63	Darkgreen	Red
Santa Fe Grande	43.65	9.33	71.63	9.0	4.5	70.00	Green	Dirty red
SE+	5.310	1.431	10.783	1.813	0.783	21.000		
c.v.	13.428	9.718	16.770	26.297	23.416	22.003		
X	39.134	10.208	60.842	6.850	3.480	91.977		

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Results

The mean performance of the cultivars for the vegetative and reproductive character are shown in Table1. Generally, there were variations within and between the species. The C. annuum (Bell) and (Round) types have shorter (34cm) heights than the C. Frutescens (slim) with a mean height of (38cm) at flowering. The number of days from sowing to flowering and maturity were specie specific, such that 'Ca Bell " and Ca Round, tend to go into flowering earlier (74 days) than the Cf slim with a mean of (83 days) to flowering.

Of the tree types, 'Ca Bell' has the biggest (14g) fruit weight, individual frit weight, the fewer the fruit. The higher the individual fruit weight the fewer the fruit number per plant. Thus, Ca Bell and Ca Round are annuals with bigger but fewer; 20 and 102 fruits per plant respectively. While the Cf Slim are perennials with numerous; (239.0) but small fruits per plant. The fruit number paralleled the fruit yield such that Ca Bell and Ca Round recorded a mean fruit yield of 300 and 344g per plant respectively. Among the C. Frutescens Ca Slim-10 gave the highest (530 fruit) and yield of 58g plant-1 Also the C. annuum. Ca Round-4 gave the highest (124 Fruits) and a yield of 360 plant –1 (Table 1). How ever a slight deviation occurred within the C, Frutescens in which Cf Slim-7 and CF Slim –9 produced 102 and 152 while the yield was the reverse (316 and 106 plant-1) respectively.

The results of the second experiment shoed a gradual increase in the number of flowers fruits set number and weight of mature fruits up till 18 weeks after which there was a decline in the reproductive character of the three pepper type (table2). The number of flowers produced was in the order CF slim Ca Round Ca Bell with 6852, 3087 and 1289 flowers per cultivar respectively.

Thus Capsicum Frutesence produced the highest number of flowers while Capsicum annuum-Bell type recorded the least. Using a scale of one hundred, Ca Bell Ca Round and Cf slim gave a mean of 20.7, 41.7 and 73.6% fruit set and 16.1, 21.5 and 33.3 % mature fruit production respectively. OF the three pepper type, Ca Bell appears least efficient in fruit setting (20.7%) but highly efficient in mature fruit production (78%). However, Ca Bell appears moderately efficient both in fruit setting (41.7%) and in mature fruit production (52%). Of the tree types CF slim was the most efficient in terms of fruit setting (73%) and moderately efficient for mature fruit production (45%) (Table 2).

Of the three selected pepper types (Ca Bell –1, Ca Round and CF slim- 7) gave a cumulative yield of 29, 31 and 38.5 tonnes ha-1 fruit respectively.

Discussion

In both experiments, Capsicum Frutescence which posses the smallest fruit size recorded the highest number and weight of fruit. However the reverse was the case with Capsicum annuum-Bell type. It was similarly reported (Ahmed, 1984) that yield increases in pepper were due to increase in number of fruit set per plant rather than in fruit production and any genetic factor ofthe individual pepper type dealt with in these experiments the cumulative yield of the harvest (Table 2) was comparable to the results of previous studies done (Epenhijsen, 1974)

Futer studies should there fore focus on improving the fruit setting capacity of Capsicum annuum – Bell types; whereas, with careful plant selection and adequate agronomic imput, the yield of Capsicum annuum Round type can still be improved.

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Table 1 the vegetative and reproductive character of pepper cultivars .

Cultivars	Heigh at flowering	Height at maturity(cm)	Days to flowering	Days to fruiting	Fruit length (cm)	Fruit diameter (cm)	Average fruit weight (g)	Fruit nmber plant 1	Fruit weight (g) plant 1
'Ca Bell-1	33.7	36.6	75.7	80.3	9.0	4.5	15.1	20.0	302.0
'Ca Bell-3	30.3	38.0	69.0	73.7	7.0	3.4	13.0	23.0	299.2
'Ca round-4	37.7	39.0	75.0	81.0	2.0	2.4	2.9	124.1	360.0
Ca Round5	34.0	36.2	75.3	84.0	2.1	2.0	4.1	80.0	328.0
LSD PmO.05	3.86	4.90	6.52	4.78	3.26	2.77	2.53	37.58	43.05
'CF Slim-7	40.0	42.3	77.0	80.7	4.0	1.2	3.1	101.9	316.2
'CF Slim8	40.0	43.3	86.7	103.0	2.5	1.0	1.0	172.1	172.0
'CF slim 9	30.0	42.7	82.0	88.7	1.9	1.0	0.7	152.3	106.4
Cf slim 10	43.3	45.7	86.3	92.3	2.3	1.3	1.1	530.2	583.0
LSD (p=0.05)	7.38	3.78	9.60	16.37	0.64	0.05	0.78	46.03	75.62

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Tables 2: Fruit production pattern of pepper cultivars

Weeks after sowing	No. of Flowers	No. of Fruit set	No. of mature fruit	Weight of mature fruit (kg0	Average fruit weight (g0	Fruit yield tones ha-1
Ca Bell-1						
14	431	79	60	1.473	24.6	14.73
18	663	142	123	1.128	9.2	11.28
22	136	34	16	0.0233	14.6	2.33
26	34	10	7	0.079	11.3	0.79
30	25	2	2	0.011	5.5	0.11
Total	1289	267	208	2.924		29.24
LSD (=0.05)	220.0	23.0	173.0	0.163		
Percent yield	100	20.7	16.1			
‘Ca Round- 5						
14	335	208	145	0.890	6.1	8.90
18	1488	667	412	1.671	4.1	16.71
22	692	217	101	0.370	3.7	3.70
26	369	150	30	0.135	4.5	1.35
30	176	63	18	0.050	2.8	0.50
Total	3087	1305	679	3.116	-	31.16
LSD(=0.05)	264.0	81.0	48.0	0.807		
Percent yeild	100	41.7	21.5			
‘CF Slim- 7						
14	1674	962	301	0.736	2.45	7.36
18	3524	2852	1449	2.333	1.61	23.33
22	1432	1093	496	0.692	1.40	6.92
26	182	122	34	0.070	2.06	0.70
30	40	17	4	0.017	4.23	0.17
Total	6852	5046	2286	3.848		38.48
LSD(P=0.05)	823.0	475	209.0	0.178		
Percent yield	100	73.6	33.3			

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INHERITANCE OF YIELD AND YIELD ATTRIBUTING CHARACTERS IN PEPPER(Capsicum annuumL)

Nazeer Ahmed: M.Y. Bhat : M.I. Tanki and G.H. Zargar
1. Division of Olericculture, S.K. University of Agricultural Sciences and Technology, Shalimar Campus, Srinagar -191 121, India
2. Associate Dean. FOA; SKUAST, Wadoora, Sopore (J&K), India.

Introduction

In any improvement programme through hybridization, the nature and magnitude of gene effects operative in the inheritance of different characters is a prerequisite. Therefore, with this objective the present investigation was undertaken to know the type of gene effects from two intervarietal crosses of pepper.

Materials and Methods

Inheritance of fruit length (cm), fruit breadth (cm), fruit number, average fruit weight (g) and total fruit yield (g) was studied fron') basic set of six generations (P_1, $P_{2'}$ F_1 $F_{2'}$ BC, and 8CJ of two intervarietal crosses viz. Shalimar Long x Pusa Jwala (SL x PJ) and ShalimarLong x Punjab Lal (SL x Pb. Lal). The experimental material was planted in a randomized "block design with three replications during Kharief 1989 at Vegetable Farm, S.K. University of Agricultural Sciences and Technology, Shalimar, Srinagar, India. The generation means were analysed following the methods as described by Mather and Jinks (1971).

Results and Discussion

The F_1 mean performance in both the crosses indicated over dominance of high fruit number and high fruit yield thereby suggested presence of heterosis and directional non- additive effects while for fruit length no dominance was observed indicating predominance of additive genes. Partial dominance was observed for fruit breadth and average fruit weight. The simple additive dominance model was found adequate only for average fruit weight of cross S L x P J (T able-1) where both additive as well as dominance components were significant. For rest of the characters in, both the crosses the three parameter model was inadequate indicating presence of non-allelic interactions. To explain the total genetic variation of interacting crosses a perfect fit model which includes non-allelic interactions was lifted. In this six parameter model, the additive component was significant in all the characters of both crosses whereas the dominance component was found significant only for fruit breadth of cross SL x PJ and for ail the characters of cross SL x Pb. Lal except total fruit yield with dominance value being negative for fruit breadth and fruit length of cross SL x PJ and SL x Pb. Lal respectively (Table-2). Among interallelic interactions the aqditive x additive component was significant in all the characters of cross SL x Pb. Lal while additive x dominar1ce component was significant in all the characters of both the crosses except total fruit yield of cross SL x PJ and fruit breadth of cross SL x Pb. Lal.

Table-1: Three parameter model m, [h] of two crosses

Parameter	Fruit length	Fruit breadth	Fruit number	Average fruit weight	Total fruit yield
(Cross SLx PJ)					
M	10.988**± 0.05	1.193** + 0.007	45.421**+ 0.321	5.330**+0.032	187.010**+0.681
[d]	1.381**+0.050	0.372**+0.010	21.841**+ 0.319	1.588**+0.032	33.467**+0.686
[h]	0.142**+0.134	-0.048**+0.018	2.632**+0.707	-0.458**+0.065	56.255**+2.023
x	45.01**	77.64**	133.58**	2.55**	67.92
(Cross SLx Pb.Lal)					
m	9.325**+0.049	1.157**+0.0007	40.769**+0.365	5.567**+0.066	175.602**+0.593
[d]	3.099**+0.048	0.392**+0.006	17.862**+0.364	1.499**+0.035	23.202**+0.586
[h]	-0.046**+0.331	0.128**+0.015	16.247**+0.801	-1.418**+0.140	85.446**+2.083
x	31.82	53.81**	250.58**	327.04	387.58**

Table- 2; Six parameter model m, [d] ,[h], [I], [j] and [l] of two crosses

Parameter	Fruit length	Fruit breadth	Fruit number	Average fruit weight	Total fruit yield
(Cross SLx PJ)					
M	11.320**+064	1.32**+0.077	30.98**+4.32		161.12**+16.47
[d]	1.42**+0.50	0.34**+0.007	22.24**+0.33		33.43**+0.63
[h]	-1.84**+1.57	-0.54**+0.192	-5.53**+10.10		46.01**+40.04
[I]	-0.30**+0.64	-0.12**+0.077	7.48**+4.31		26.28**+16.46
[j]	-1.18**+0.40	0.24**+0.52	-8.69**+2.38		6.45**+10.19
[l]	1.68**+0.99	0.44**+0.119	18.97**+6.06		49.79**+24.46
Cross SL xPb. Lal					
m	11.53+0.59	0.71**+0.080	15.29**+4.90	3.01**+0.35	145.13**+14.29
[d]	3.15+0.05	0.39**+0.074	17.73**+0.38	1.65**+0.35	23.24+0.59
[h]	-4.44**+1.42	1.13**+0.187	44.78**0.38	4.23**+0.83	26.63**+33.78
[I]	-2.24**+0.59	0.44**+0.080	26.66**+4.88	2.02**+0.35	32.08**+14.28
[j]	-1.22+0.35	-0.02+0.04	14.20+2.75	3.04+0.20	50.07+8.04
[l]	1.84+0.89	-0.78+0.113	3.16+6.92	-2.34+0.50	114.83+20.44

***Significant at 1% and 5% respectively

The dominance x dominance component was found significant in most *of* the characters except fruit length *of* cross SL x PJ and fruit number *of* cross SL x Pb. Lal.

In general, the results revealed significant additive gene effects for fruit length in both the crosses. Singh and Singh (1977) and. Ahmed (1981) also observed importance *of* additive genes. Such fixable gene effects can be improved through simple selection. For fruit' breadth and average fruit weight both additive as well as non-additive gene effects were important in their inheritance whereas for fruit number and total fruit yield the non- additive gene ,effects were more predominant with dominance and dominance x dominance components reinforcing each other in exhibiting the complementary gene action and thus contributing to positive heterosis. Although in both the crosses the genes with non additively were more important however effects of additive genes were also important in contributing to fruit number and total fruit yield. The importance *of* both additive as well as non-additive genes in the inheritance of various characters has also been reported (Ahmed.. 1981, Milkova, 1986 and Gaddagimath, 1988}. Hence under this type of situation, the most suitable breeding procedure for improvement of these traits would be to intermate the desirable segregants followed by selfing and selecting superior genotypes.

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ELECTROPHORETIC PROFILES OF SEED PROTEINS IN THE GENUS CAPSICUM

R. Vladov. and R. Pandeva

Bulg.Acad. .Sci. Institute of Genetics ‘Acad. D. Kostov'1113 Sofia, Bulgaria

The predominant storage proteins in dicots including the genus Capsicum are globulins being with common structural

organization (Borroro and Dure, 1987). Usually storage globulins are bound in oligomers which are slightly or not at all water soluble. They consist of two major molecule classes according to their molecules weight; 7 to 8 S vicilin- like, , in soybean B – conglycinin and 11 to 14 S legumin- like in soybean glycinin Larkins, 1981). Information about seed proteins of species cultivars from the genus Capsicum is very limited. Tsonev et al. (1971) have used various protein fraction. For the characterization of pepper heterosis hybrids.

Urea is widely used as a dissolving and dissociating factor. The aim of the present investigation was to assess the possibilities for species and cultivate identification in the genus Capsicum using electhoretic spectra of seed urea extract

MATERIAL AND METHODS

The investigation included seeds of: 8 Capsicum species- C. baccatum var. pendulum (3 accessions), C. chinense (2

accessions), C.frutesecens, C.eximium, C.pubescens . (2 accession), C.praetermissum, C.chacoense, C. annuum var. glabriusculum: 12 cultivars of Cannuum var. annuum-‘ Kalinkov’, 'Sofiiska Kapiya', 'Byala Kapiya', 'Pazadjishka Kapiya’, Kurtovska Kapiya', 'Albena’, 'Zlaten Medal', 'Byala Shipka’ , 'Sivriya', 'Yolo Wonder’,'f.nigrum', 'decorate . form'; Soybean, Glycine max L. Merrill, cv. ‘ Beeson,. The extraction media used were:(1) 1, 2, 3, 4, 5, 6, 7 and 8 M urea in water - glycerol 2:1 (v/v) , (2).20% sucrose: (3) 0.05 M Tris-HCl buffer (pH 7.5) containing 6 mM ascorbic acid, 6 mM cysteinhydrochloride, 20% sucrose and 2 M urea (4) 0.05 M Tris-HCl buffer (pH 8.0) containing 2% sodium dodecyl sulfate (SDS), 10 mM 2-mercaptoethano (2-ME) and 5 M urea.

The analyst. was performed by vertical block polyacrylamide gel electrirophoresis with gel size 70/90/1 mm And 12 wells. Samples of 15 ml per well were applied. .The following systems of e1ectrophoetic separation were used: No.1. 7.5 % acid gel

(Reisfeld et al, 1962) containing 5M urea; No. 2. 7.5 % alkaline gel containing 5 M urea; No.3. SDS gel eletrophoresis in 10% gel (Laemmli, 1970) containing 5 M urea. All the gels used were without upper gel. The gels were stained with Coomassie Brilliant Blue R-250 - 0.2% in *12.5%* trichloracetic acid. . No distaining was needed.

RESULTS AND DISCUSSION

Separation on acidic gel is of considerably higher quality

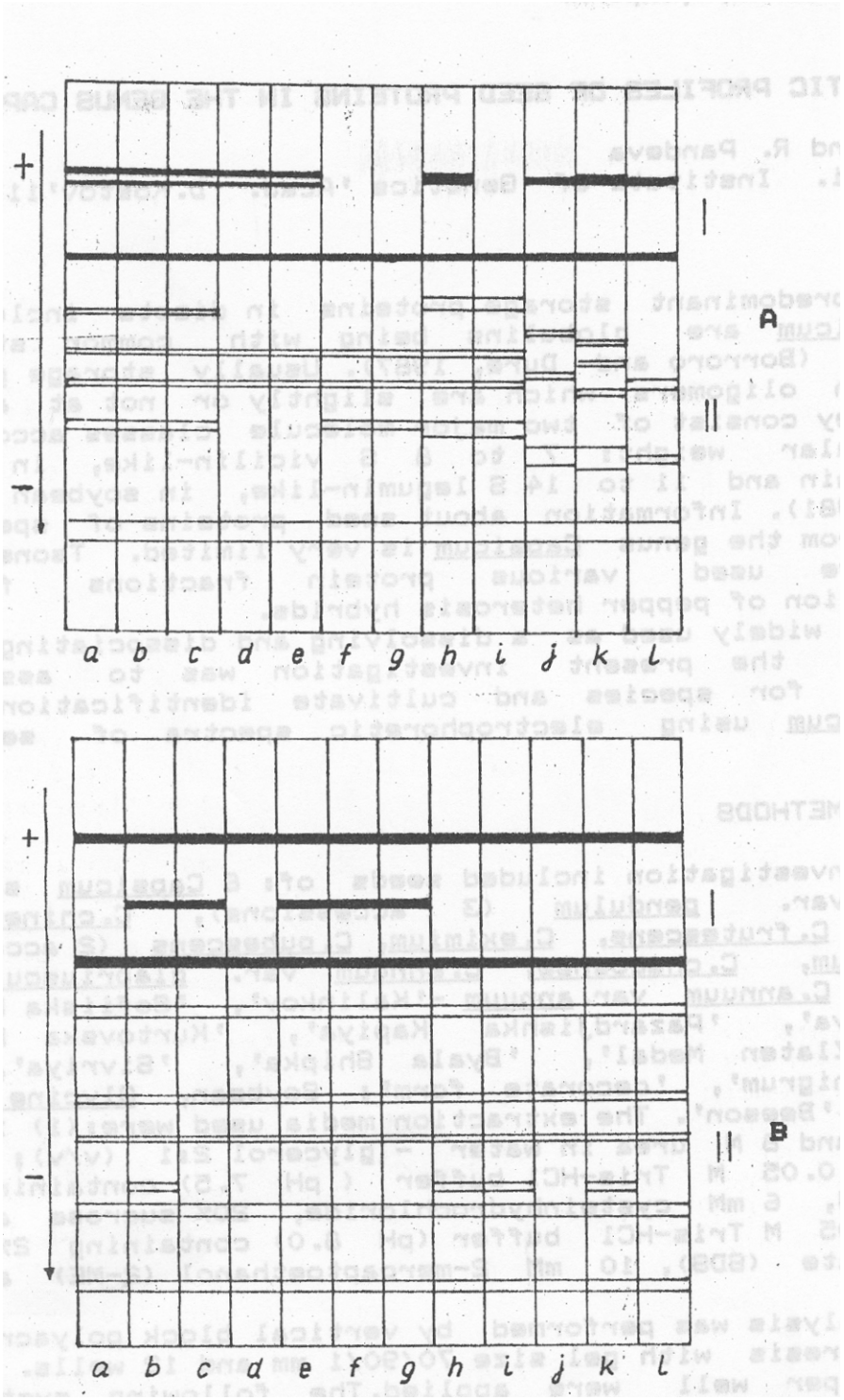

Fig1 (Aand B). Electrophoregrams of 7M extracted Capsicum seed proteins separated on 7.5% acid gel. A species investigated : C. baccatum var. pendulum – 3 accs. (abc); C.chinense – 2 accs. (d,e); C. frutescens (f); C.eximium (g); C. pubescens – 2accs. (h, I); C. praetermissum (j); C. chacoense (k) and C. annuum var. glabriusculum (1) B cultivars investigated; ‘ Kalinkov’ (a); ‘Sofiiska Kapiya’ (b); ‘ Byala Kapiya’ (c); Pazardjishka Kapiya’ (d) Kurtovska Kapiya (e); Albena (f) ‘ Zlaten Medal” (g); Byala Shipka (h) ; Sivriya (i) Yolo Wonder (j) ‘ F. nigrum (k) decorated form (l)

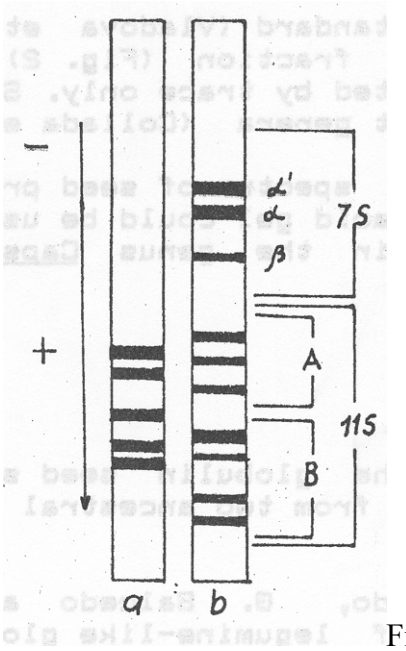

Fig. 2. Electrophoregrams of seed proteins extracted with 0.05 M Tris-HCl buffer ft containing 2% SDS, 10 mM 2-ME and 5 M urea and separated on 10 % SDS gel, containing 5 M urea. Capsicum annuum L- var. annuum cv.' Sivriya' (a); Glycine max. L Merrill, cv. Beeson (b). Soybean proteins are presented on the right-hand side: A acid subunits of glycinin, B - " basic subunits. than that on alkaline one. The seed protein spectrum in acidic gel could conditionally be separated in two parts : zone I including slow migrating components which are distinctly separated, and zone II including all remaining components characterized by a slightly expressed diffuse type. Components of zone I began to appear only at 5 M urea concentration in the extraction medium. They were absent in the spectra of proteins extracted with 20% sucrose and with 0.05 M Tris-HCl buffer, pH 7.5 as well. It could be assumed that proteins of zone I were dissociated products of oligomeric globulins.

Fig. 1 (A and B) shows the spectra of extracted with 7 M urea and sepatrated on acid gel seeq proteins from Capsicum species and cultivars. Differences between the individual species were clearly expressed in both zones. Spectra of the three C.gendulym accessions and of the two C.chinense accessions were almost undifferentiable from one another. However , differences existed between the two C. pubescense accessions which differ in their fruit colour (red and yellow) as well.

Spectra of the 12 cultivars were characterized by sharply separated slow migrating components. The first and last components of zone I were observed in the spectra of all cultivars studied. A certain variation was evident in respect to one intermediary situated component which was present only in the spectra of cvs. 'Sofiiska Kapiya', 'Byala Kapiya', 'Kurtovska Kapiya', 'Albena' and' Zlaten Medal'. Cultivate differences in the remaining part of the spectra were presented by the presence of a double fast moving component in the spectra of cvs. ' Sofiiska Kapiya', 'Byala Shipka', 'Sivriya' and 'f.nigrum.

Pepper storage proteins were characterized in greater detail on the basis of the common structural organization of storage globulins in dicotyledonous plants. The ptrotein spectrum of

soybean storage proteins was used as standard (Vladova et .1.). Pepper globulins were mainly of 11 S fraction (Fig. 2). The components of 7 S fractions were represented by trace only. Similar' picture was observed also in other plant genera (Collada et al., 1991)

In conclusion, the electrophoretic spectra of seed proteins extracted with 7M urea and separated on acid gel could be used for
species and cultivate identification in the genus Capsicum.

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PLANT REGENERATION IN TISSUE CULTURES OF PEPPER [Capsicum annuum L.] HYBRIDS AND VARIETIES.

G.J. Bahetee *, D.B. Dhumale+, P .D.Nerkar x
Biotech Research Centre, Punjabrao Agri. University, Akola - 444104, (M.S.) INDIA
+ Biotech Research Centre, Punjabrao Agri. University. Akola - 444104, (M.S.) INDIA
x Maharashtra State Seeds Corporation, Shioni, Akola, (M.S.) INDIA

ABSTRACT

. The shoot - tip and hypocotyl explants excised from aseptically grown 10 - day - old and 20 - day - old seedlings of two chilli (Capsicum annuum L.) hybrids viz., 'Agni' and' *Tej'* and two straight varieties of chilli viz., ' Jwala ' and 'G4' were utilized. In all the cultivars cultured 20 - day - old shoot - tip explant was found to be relatively more responsive to the initiation of multiple - shoots. Maximum multiple shoots were produced by the cultivar' Jwala' i.e. 14.8 (using MS + Kinetin 5 mg *II* + IAA 0.5 mg *II)* followed by'Agni" i.e. 12.44 (using MS + BAP 4 mg *II* + IAA 0.5 mg *II)* foliowed by 'G4' i.e. 9.68 (using MS t Bp.P,6 mg *II* + IAA 0.5 mg *II*) and' *Tej* , i.e. 9.44 (using MS + BAP 5 mg *II* + IAA 0.5 mg *II).* Multiple shoot - buds were induced within 24 - 27 days. The shoot - buds isolated after 30 - 35 days and kept for rooting produced profused roots and complete plantlets developed in 2 - 3 weeks. High percentage of survival of plantlets and increase in height was observed in mist chamber and not in open condition.

INTRODUCTION

The indispensable condiment of every Indian cuisine is chilli (Capsicum annuum L.). India is one of the leading producers and exporters of chillies in the world contributing about one fourth of the world's production with an average annual export of 8.5 million kg valued at Rs. 80 million (Thomas and Velappan, 1988). Though chilli has tremendous export potential, only about 3 % of the production Is being exported because the present level of production is able to meet the domestic consumption only and In the years of crop failure, even the domestic demand is not being met (Venkateshwarulee. 1988).

The chilli production in the country can be enhanced by using high yielding hybrid varieties. The three major constraints in the spread of F1 chilli hybrids are viz., non - availability of seed, exorbitant prices and high tech venture. The direct vegetative propagation of hybrid peppers for direct field planting is unlikely to be cost effective unless it is possible to devise less labour intensive in vitotechniques than shoot tip culture (Quereshi, 1990). An efficient method of micropropagation would be useful to produce virus - free, vigorous F1 chilli hybrid plantlets on large scale for commercial use. Large-scale production could curtail the cost of production of plantlets. The present research work was undertaken to standardize the media for micropropagation of high yielding chilli hybrids, to standardize the selection of suitable explants and exploitation of the most suitable explant for micropropagation of chilli hybrids.

MATERIALS AND METHODS

The shoot - tip and hypocotyl explants excised from aseptically grown 10 - day - old and 20 . day - old - seedlings of two chilli F1 hybrids viz., 'Agni' and , Tej' and two straight varieties of chilli viz.. 'Jwala' and 'G4' were used. These shoot. tip and hypocotyl explants were cultured on MS basal medium supplemented with different concentrations of BAP, Kinetin, IAA and IBA either alone or in combination with each other. In all the media 3 % sucrose was added and PH was adjusted to 5.8 and 0.8 % Bacto - Agar was added. The cultures were maintained in diffused light (Intensity 2000 lux) for 16 hours and dark period for 8 hours at 25 $\pm$ 2° C. The best treatment combinations are presented in the following table.

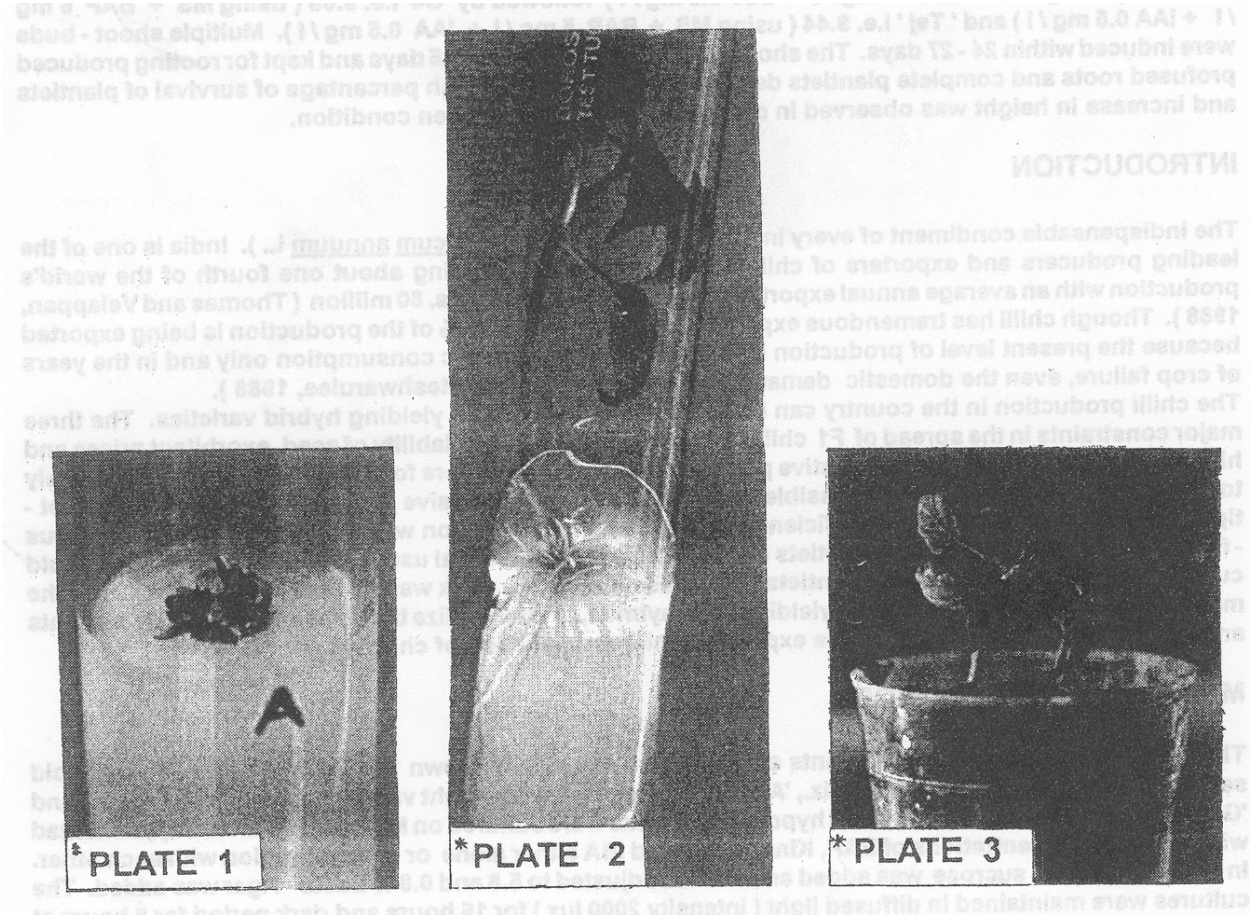
Results

The best response of 20 –day- old shoot explants culture on MS basal medium with different levels of different cytokinins and auxins in combinations to the initiation of multiple shoot

Ms (mg/l)	'Agni	'Jwala	Tej	'G4'
BAP(4) + IAA (0.5)	12.44+0.29	8.72+0.24	6.28+0.23	-
BAP(5) + IAA(0.5)	9.76+0.28	13.44+0.29	9.44+0.26	7.64+0.18
BAP(6) + IAA (0.5)	7.48+0.22	8.72+0.22	7.32+0.24	9.68+0.19
Kinetin(6) + IAA(0.5)	4.84+0.21	14.80+0.18	6.28+0.24	5.60+0.21

Obsevations recoreded after 24 days of incubation

Maximun multiple- shoot were produced by the cultivar Jwala (14.8) follwed by 'Agin (12.44) Plate1 G4 (9.69) Tej (9.44) . Multiple shoot buds were induced within 24-27 days. The shoot buds isolated agter 30-35 days and kept for rooting produed profused roots. The medium MS + IAA (0.5mg/I) and the medium MS + IBA (0.5mg/g) proved to be the best for inducing profused rooting and rooting was induced with elongation of shoot buds * PLATE 2 Complete plantlet were developed in 2-3 weeks Plate 3 Hight percentage of survical of plantlets and increase in height was observed in mist chamber and not in open conditions.



The results further revealed that in all the cultivars cultured;

, none of the hypocotyl explants from 10 - day - old seedlings produced multiple shoot - buds.
. none of the shoot. tip explants from 10- day -old seedling could produce much multiple - shoots as shoot - tip explants from 20 -day old seedling could.
- none of the hypocotyl explants from 20 - day - old seedling could produce as much multiple - shoots
as shoot - tip explants from 10 - day - old seedlings.
- shoot. tip explants from 20 - day - old seedlings produced maximum multiple. shoots while shoot -
tip explants from 10 - day - old seedlings produced less multiple shoots and hypocotyl explants from
20 - day - old seedlings produced least multiple shoots.
- shoot - tip explant was found to be more responsive than hypocotyl explant to the induction of multiple shoots.
- responses of all the explants to the initiation of multiple - shoots were better to the MS basal medium
. supplemented with cytokinins and auxins in combinations than to the MS basal medium supplemented with cytokinins alone.
- shoot - bud differentiation did not occur in a cytokinin free medium.
- BAP in combination with IAA proved to be better than in combination with IBA in all the cultivars tested.

BAP proved to be better than Kinetin for shoot - bud induction in the cultivars ' Agni ‘, ' Tej , and 'G4'
while Kinetin proved to be better than BAP for shoot - bud induction in the cultivar' Jwala '.

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EFFECT OF THE USE OF DROP (THIDIAZURON), OF GA3, AND OF MALTOSE IN THE INVITRO MULTIPLICATION OF CAPSICUM ANNUUM AND CAPSICUM BACCATUM FROM COTYLEDONS.

P. Arce Tudanca and B. Lopez Corzana Centro de Investigaciones Agrarias Apdo.1056,26080 LOGRONO

ABSTRACT
This paper is related to the obtention of plants of pepper using" cotyledons of two cultivars of Capsicum annuum, 'Pico' y 'Piquillo de Lodosa' and another one of Capsicum baccatum. The action of GA3 is evident both in the differenciation and formation of leaves and " the effect of the thidiazuron added by means of the commercial product DROP. The action of maltose is also emphasized as a source of carbohydrates.

INTRODUCTION

Pepper, for example, the economic importance of which ranks among the top ten in world production, has proven to be very difficult to regenerate, and consequently hardly any genetically transformede plants of this species have yet been obtained (winjbrandi and Both., 1993; in a special issue about transformation of horticultural crops). To the previous statement several other difficulties could be added. Difficulties found by those working in this field trying to find effective .methods to obtain a way of incorporation of resistance to diseases caused by fungi and virus.
We think that all which can contribute to progress in the line of multiplication of pepper by the invitro method, no matter how important it may be, is interesting and must be made know to the other researchers working in this field.
Our working material on improvement has been mainly based on two pepper cultivars, 'Piquillo de Lodosa' and 'pico' specially used in the canning industry and almost exclusively grown in the Mid-Ebro Valley.
In previous publications (Arce et al.1991 and Arce and Lopez 1993) results have been exposed referring to these two cultivars . This report goes in the same line adding an entry of Capsicum baccatum, C131 from Ramiro Gil Ortega

MATERIAL AND METHODS

Seeds of the previously mentioned varieties were superficially sterilized by their immersion in a solution of Domestos (a commercial bleach) to 10% for half an hour and later washing with sterile destillated water. The seeds so trated were placed in Petri dishes in MS medium (Murashige and Skoog, 1962) - without hormones and a pH of 5.7. We sistematically add the antibiotic Claforan in a concentration of 1 g/l, since sometimes we have had problems of bacterias in the successive steps of culture. The sown plates were paced in standard conditions

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his kind of works, 2,500 lux and photoperiod of 16 hours light and 8 hours night, in a constant temperature of 25 .8C.
For the obtention of plants we have parted from cotyledons. Usually, in the conditions above mentioned, they can be used after 15 or 20 days after sowing, although we have also obtained good results using plant lets with the two first leaves well differentiated, which allows us the use of the same plantlets for other kind of works.
The cotyledons are placed in the medium of culture in Petri dishes, but previously a series of incissions have been made on
them. These incissions have to be perpendicular to the axis making sure that the axillary bud is removed.
The medium of culture is formed by MS with addition of mes (Sigma) to prevent oxidations. For the others elements of the medium we have used different combinations of DROP,IAA and GA3, and three sources of carbohydrats: saccharose, mal tose and fructose at aconcentration of 30g/1.The DROP is a product of the Shering firm, recommended for the defoliation of the cotton plant and whos active matter is the Thidiazuron((N-fenil) N'-(1,2,3,-Tidiazol) 5-il Urea, C. Mok and al (1987).

RESULTS AND DISCUSSION

Ten days after the explants have been put in the media the differentiation and the appearance of the green areas in the cutting done in the cotyledons can be observed. Then a phase comes after in which a non-differenciated green mass is formed, and this is followed by the appearance of primordia and the later formation of leaves. From these structures we have taken two steps: either they have been placed in the medium of root induction or in another one which we named of proliferation that can be the same as the differentiation one and even better withouth GA3. Of the combination of Drop (TZ), IAA abd GA3 we have obtainned the best results with 2.5 mg/l, 0.1 mg/l and 2 mg/l respectivily and 30 g/l of maltose.The medium formed by 6mg/l of BAP, 0.1 mg/l of IAA and 30gr/l of sacharose is also good, Arce and Lopez (1993). With the addition of GA3 we have obtained differentiation to leaves in a 65% of the cotyledons and in one or several incissions. When going through the several media of proliferation the index of multiplication becomes higher as two to four new buds can be easily obtained.
The root induction is attained in several media described by Fari and Czako (1981), praga et al.,(1987) and Sadhana et al.(1989), all of then based on combination of IAB and NAA. We have used Fari's, 0.1 NAA mg/l and 0.05 mg/l IAB which have given us good results in works with hypocotyl in pepper.
The elongation, stem-formation, is attained either in the root medium or in a substratum of peat. There is a great difference between the cultivars of capsicum baccatum an the two cultivars of Capsicum annuum. Whilst in the first one this elongation can take place at the same time as the appearance of leaves, in the other it goes associated with the preliminary formation of leaves and roots.

The addition of thidiazuron (DROP) to the medium has similar effects to the addition of BA, fact which has already been confirmed by several authors in other works on different, species,Borkowska and Litwinczk (1993).

The utilization of the thidiazuron under the form of agricultural use makes the treatment cheaper. The action of GA3 has the same effects as that in the combination with BAP, a spectacular growth of the surface of the cotyledons and the systematic appearance of leaves. This last fact takes place only sporadically without its presence. with Capsicum baccatum , although the addition of GA3 has very positive effects, we have also obtained good results withough adding it to the medium. This seems to confirm what Wijbrandi and both (1993) say in their writing: "The best results are obtained with wild relatives or the little domesticated hot pepper"

The action of lactose is negative and in its presence we have observed that a necrosis in the area of cuttings takes place. The maltose has a similar effect as the saccharose in the media with GA3, but in media with 6mg/ of BA or 5gr/1 of Drop and 0.1 mg/l of IAA a higher index of differentiation and appearance of leaves than with the saccharose are observed.

Although both the cultivars 'pico' and 'piquillo' have similar behaviour this doesn't mean that the protocol is good for the rest of the cultivars and we agree with Ochoa-Alejo and IretaMoreno (1991) who finds different responses working on different varieties of Capsicum annuum placed in the same medium of culture.

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MICROSPORE CULTURE OF CAPSICUM ANNUUM

F. Regnet
Institute for Applied Microbiology, University for Agriculture and Foresty 1190 Vienna, NuBdorfer Lande 11, Austria

Despite the fact that there exists a protocol for androgenesis of pepper I tried to establish a method to regenerate haploid plants derived from microspores. As a transformation protocol of pepper is still missing this technique should offer a took for gen transfer approaches. Isolated microspores could function as a target by particle bombardement as soon as the recalcitrance of the globular embryos and embryo like structures by cultivating microspores on a modified R1 medium solidified by seaplaque agarose and by the use of precultured anthers.

As a first step anther culture (1) with the genotype 'Lamuyo' (kindly provided from the INRA in Montfavet) was established. Futhermore the economical most important hybrid of Austria ' Wanas F1' results in a similar percentage (2) of embryo- forming anthers.
Subsequently microspore culture of these genotype was started. The stage of late uninucleate pollen correlated with the appearance of slightly blue anthocyaned ends of the etamins. Isolation was performed in bulk and in single bud preparations from greenhouse plants. Surface sterilization was done with 2% NaOCl for 10 min, 96% ethanol for 1 min and several washing steps with sterile water. Suspension of microspores were filtered , washed in culture medium, counted and fially plated on 3cm petri dishes. Viability of the microspores was measured with FDA and the developmental stage was controlled by DAPI stain of the nuclei. Viability differs in a wide range from 0 – 90% even by the use of buds from the dame plant. Best results could be obtained by cultivating microspores consisting of 20- 50% at the binucleate stage. Then viability of the microspores was more stable and decreased in a slower way.
1.) Culture in liquid NLN 13% medium as used for Barassica Napus (3) or liquid version of CP and R medium as used failed to produce embryos or related structures. Viability was decreased at the second day of cultivation to 20% and this tendency couldn't be stopped by medium changes even each day. Division of the microspores stopped at a four or eight nuclei stage. But nevertheless sporophytical development was registered at different induction temperature. The nucleus divided after a different induction temperature. The nucleus divided after a 4oC, 25oC and 35oC induction phase of 48 hours in the dark. Cultures were incubated in the dark at 25oC. Development of the microspores from colder induction conditions was delayed but the progress of the cultures resembled to the structural and

x current address: HBLVA Klosterneuburg, 2103 Langenzersdorf, Rehgraben 2.

Sporophytical character of the microspores incubated at 35oC. I observed no gamtophytical (4) development during incubation as mentioned by Barrica napus.

2.) Futhermore cultuivation of purified microspores on a bilayer 6% or CP 6% and the liquid layer consisted in a different approaches of NLN 6%, NLN 9 %, NLN 13%; CP 6%, CP 13%. Liquid medium was changed one time each week. Sporophytical development stopped soon after incubation start at a four or eight nucleistage. In one experiment I used precultured anthers for micospore isolation. Best results were obtained by cultivating the anther 4-6 days under induction conditions before the isolation of microspores was performed. ELS (embryo like structures) were observed after 3-4 weeks of incubation in CP 6% medium.

3.) Cultivation on solid medium only was performed in two different ways. A) the microspores were suspened with a tight amount of liquid and were distributed on a nylon net (mesh size < 10 um) and trasfered by the net from the induction to the incubation medium. Sporophytical development stated well but the growing structures were defoed, got brown and deteriorated later on. B) Microspores were applied to the solid medium for induction and incubation condition. The liquid used to purify the microspored was CP 6% and the solid medium was a R1 medium with a higher amount of BA (1mg/1). This procedure has resulted after two months ELS only on Agar (0.8 %) medium and globular embryos on seaplaque agarose 0.7 % But these structures failed to develop to plants.

Media:	NLN(3)	CP(1)	R(1)
Micro-elements	NLN	SNGM	SNGM
Microelements	MS	Micro 2	Micro R
Vitamins	NN69	Morel and F witamins (50:50)	
		B12	
Growth regulators		2,4 –D 0,01	Kinetin 0,1
		Kinetin 0, 01	
Amino acids	gluthatione		
	L glutamin		
	L serin		

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ANTHER CULTURE OF HOT AND SWEET PEPPER (Capsicum annuum L.): INFLUENCE OF GENOTYPE AND PLANT GROWTH TEMPERATURE:

A. Ltifi and G. Wenzel
Institute for Resistance Genetics
Graf-Seinsheim-Str. 23, D-85461 GrOnbach, Germany 'J'

Introduction

Haploidy is of great importance in pepper breeding programmes and genetic studies. It is an efficient method for the production of homozygous lines. However, numerous factors including donor plant environment have been reported to affect anther culture and microspore embryogenesis (Foroughi-Wehr and Wenzel, 1983). Plant - growth temperature and plant age have been found to influence pepper anther culture which was unaffected by the photoperiod (Kristiansen et ale 1993). Interaction between genotype and donor plant environment have been documented (Wenzel and Foroughi-Wehr, 1994).
The purpose of the present investigation was to study the effects of genotype and plant growing temperature on anther culture of pepper.

Material and methods

The plant material included: 'Yolo Wonder', 'Marconi', 'Wir' three sweet pepper cultivars, 'Beldi', 'Wafer', 'Zlaten medal', 'COO02' and 'PBC204' five hot pepper varieties. All plant material was obtained from Experimental station of Manouba (SAM), Tunisia except for 'COO02' and 'PBC204' which were obtained from Dr. J.M. Poulos from Asian Vegetable Research and Development Center (AVRCD).
Seeds were germinated at a temperature of 25 :t: 2°C and seedlings were transferred to pots with 12 cm of diameter after five weeks. Seven plants of each variety were grown in the green house at a temperature of 20 + 2°C to study the genotype effect on anther culture response. Only 'Yolo Wonder', 'Marconi' and 'Beldi' were used to test the temperature effect on androgenesis and seven plants of each variety were grown in the green house at a temperature of 25 ± 2°C and 10 + 2°C.
A mixture of sand, clay and peat (2:1:2) was used as substrate for plants. The plants were watered with tap water as necessary to maintain optimum plant growth. Each pot was fertilized with 5 g of nutrient fertilizer (8-14-14) after transplanting and at the beginning of the flowering stage.

Flower buds were collected when microspores were at the late uninucleate stage, equivalent to a bud size where sepals and petals are of equal length (Dumas de Vaulx, et al., 1981). Bud size and developmental stage were checked during the experiment. Anthers were sterilized and cultured according to Dumas de Vaulx et ale (1981). After six weeks of incubation the number of normal, globular and total embryos per 100 anthers were recorded

Results

Genotype response on pepper androgenesis

Embryo emergence was observed after approximately four weeks of culture in pollen sacs. Between the 5th and 8th week a part of these embryos transformed to plants. The overall percentage of total embryos per 100 anthers was 15.56% with 6.97% normal embryos and 8.59% globular embryos. The highest embryo frequency per 100 anthers cultured (37.39%) was obtained with 'Marconi' with more globular than normal embryos. 'Beldi' demonstrated a high percentage of embryos per 100 anthers cultured (31.45%) with equal rates of normal and globular embryos (Tab.1). 'Wir' and 'Zlaten medal' demonstrated also high frequency of total embryos per 100 anthers, but their normal embryos are more important than globular embryos. 'Yolo Wonder' and 'PBC204' showed high rates of embryos per 100 anthers cultured (13.98% and 12.24% respectively). The lowest frequency of total embryos per 100 anthers was obtained from 'Wafer' and 'COO02' (3.54% and 0.85% respectively) .

Table 1: Anther response of eight sweet and hot pepper varieties (Capsicum annuum L.).

Variety	No. of anthers	No. of normal embryos *	No. of globular embryos *	No. of total embryos *	No. of plants *
Yolo Wonder	844	6.51	7.46	13.98	4.38
Beldi	213	5.96	15.49	31.45	3.75
Wir	61	19.67	3.28	22.95	14.75
Marconi	230	3.91	33.48	37.39	2.17
Zlaten medal	162	11.11	6.17	17.28	1.23
Wafer	113	1.77	1.77	3.54	0.00
COO02	117	0.85	0.00	0.85	0.00
PBC 204	49	10.20	2.04	12.24	6.12
Total	1834	85.93	69.69	155.62	32.40
Means		8.59	6.97	15.56	3.49

*: per 100 anthers.

An overall frequency of 3.49 plants per 100 cultured anthers was obtained. Although only 61 anthers of tWirl were cultured, 9 plants were regenerated. This corresponds to 14.75 plants per 100 cultured anthers. No plants were obtained from 'Wafer' and 'COO02' (Tab.1).

Effect of temperature on androgenesis

'Yolo Wonder' and 'Marconi' two sweet pepper varieties and 'Beldi' a hot pepper cultivar were grown under different temperatures and anthers of these cultivars were cultured as described previously. The frequency of normal, globular and total embryos are presented in Table 2. The influence of temperature on androgenesis is evident. Low

Table 2: Freqency of embryos from donor plants of three pepper varieties (Capsicum annuum L.) grown under two temperatures.

Variety	No. of anthers	No. of normal embryos *	No. of globular embryos *	No. of total embryos *
Yolo Wonder	25°C 566	5.65	7.24	12.89
	10°C 200	5.00	5.00	10.00
Beldi	25°C 37	10.81	8.10	18.91
	10°C 93	1.07	3.22	4.29
Marconi	25°C 157	3.82	10.38	14.56
	10°C 161	5.59	43.48	49.06

*: per 100 anthers.

temperature reduced total embryos per 100 cultured anthers from twirl and 'Beldi'. However, the number of globular embryos of 'Marconi' was increased when the donor plants had been exposed to low temperature.
This is a clear demonstration of a genotype - environment inter-
action.

Discussion

The influence of genotype on anther culture response and embryo formation had been indicated for sweet pepper Capsicum annuum L. (Dumas de Vaulx et al., 1981). In the present study it seems to be the case also for hot pepper. Similar results were obtained with other Solanaceae like potato (Foroughi-Wehr et al., 1977) and eggplant (Isouard et al., 1979).
The effect of plant growth temperature on androgenesis was reported in many species. High rate of embryogenesis was obtained with plants grown at low temperature in Brassica napus L. (Keller et al., 1987) and Triticum aestivum L. (Simmonds, 1989). However, in this study the embryogenesis, which was reduced when the varieties 'Yolo Wonder' and 'Beldi' were grown at low temperature, was increased with 'Marconi' at the same conditions. These results
suggest that the interactions genotype - temperature are involved in pepper androgenesis. The optimum level of growing temperature of donor plants varies with the cultivar. Other environmental factors (illumination, humidity and fertilization) influence the physiological condition of the donor plant from which anthers are cultured.
The donor plants must be maintained under optimum level of each factor.

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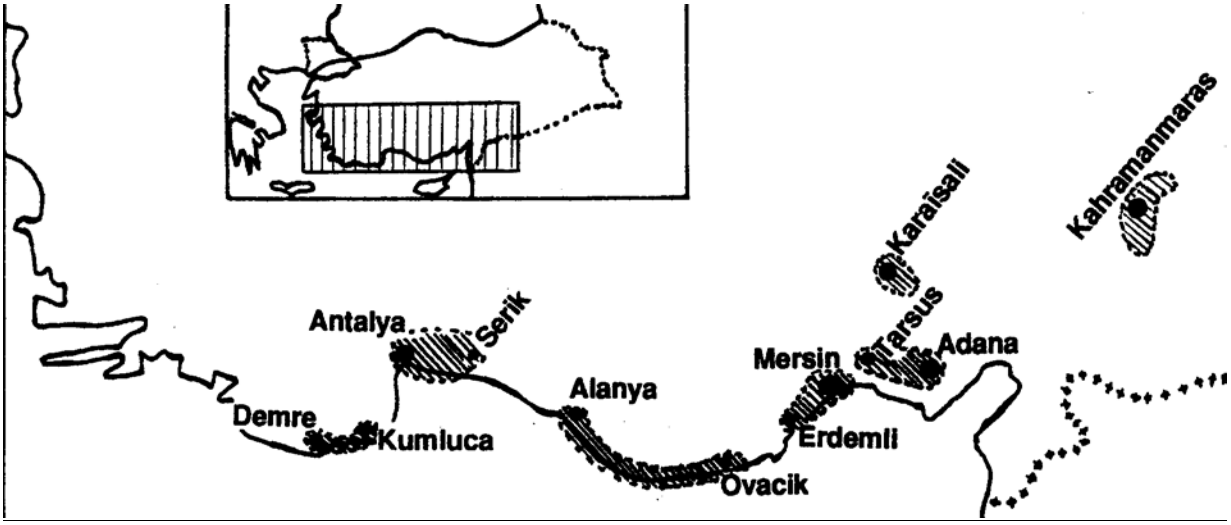
SURVEY OF PEPPER DISEASES AFFECTING THE MAIN PRODUCTION REGIONS OF TURKEY WITH SPECIAL INTEREST IN VIRUSES AND POTYVIRUS PATHOTYPES

A. Palloix 1, K. Abak2, A.M. Daubeze 1, M. Guldur3 and K. Gebre Selassie4
1 Vegetable Breeding Station, 4Plant Pathology Station, INRA, BP 94, 84143 Montfavet Cedex, France. 2Dept. of Horticulture, 3Dept. of Plant Pathology, 01330 Adana, University of Cukurova, Turkey.

Pepper production overpasses 900.103 t in Turkey, making this country the most important pepper producer of the mediterranean bassin (Anonymous 1993). Up to now, most of the cultivated varieties were local populations (land races) multiplied by farmers, but regional Institutes and Universities recently Q developped breeding programs to release inbred lines or hybrids in the locally cultivated types. Seed companies also exhibit a recent interest for the turkish market. Starting up breeding programs requires a precise knowledge of the cultivation contraints, including the pathological ones.
Among the parasites of pepper, *Phytophthora capsici* has been reported as one of the most damaging in Turkey (Abak and Pochard 1982). Virus diseases involving tobacco etch virus (Yilmaz et at 1983), tobacco mosaic virus (TMV), cucumber ,mosaic virus (CMV) (Yilmaz and Davis 1985) and potato virus Y (PVY) (Erkan 1986) have been identified in vegetable cultivations along the mediterranean coast. The relative frequency and the distribution of those viruses in pepper, as well as their pathogenicity remain to be surveyed. This paper presents a survey of the diseases encountered in the main production regions of pepper in Turkey and an identification of the prevalent viruses and potyvirus pathotypes, suggesting the effective resistance sources for breeding programs.
Figure 1 : Pepper production regions of Turkey surveyed for diseases incidence in automn 1992 and 1993. ?



Material and methods

Observations and sample collection were made in september 1992 and october 1993, the automn corresponding to the end of the harvesting period in open field cultivation and the beginning of the growing period under glasshouses and plastic tunnels. The production regions visited are indicated in fig. 1. From Demre to Kahramanmaras, these regions produce one third of the national pepper production. It includes traditionnal cultivations in open field for dried pepper powder (Kahramanmaras) or for pepper paste (Karaisali) and glasshouse or plastic tunnel cultivations along the mediterranean coast from Demre to Adana for fresh pepper production ('Sivri', 'Carliston' and 'Dolma' types)

Incidence of the different diseases was firstly evaluated by estimating the percentage of plants showing characteristic symptoms in each plot. Leaves were sampled from the plants showing mosaic symptoms probably due to viral diseases for further analysis.

Samples from the same plot and showing similar symptoms were mixed together and 65 final samples were analysed (8 to 16 per region). Virus content was firstly analysed by DAS.ELlSA serological method essentially as described by Clark and Adams (1977) to survey for TMV, PVY, TEV, CMV, pepper mild mottle virus (PMMV) and tomato spotted wilt virus (TSWV). In some instances, ELISA was coupled with dip-electron microscopy and host reactions. Pure isolates of TMV, PMMV, PVY and TEV purified in *Datura stramonium* were reinoculated to pepper differencial varieties to determine their pathotypes (i.e. their reaction toward the resistance genes of known pepper cultivars). Virus was extracted by grinding 19 of fresh leaves in 4 ml of phosphate buffer (0.02M, pH 7.2) added with *2.0%* DIECA, 300mg active charcoal, 80mg carburundum and mechanically inoculated on the cotyledons of the plantlets. Virus pathotypes were determined after visual observation of symptoms in the differencial pepper varieties and ELISA control of the plants.

Results

Incidence of the different diseases in the visited regions.

Results of this survey are summarized in table 1. Virus diseases were frequently observed in most of the visited regions, particularly in open fields and home gardens that often show 100% of infected plants at the end of the harvesting period. Only the Kahramanmaras region escaped these heavy virus infections in open fields. Under glasshouse and plastic tunnels, peppers were more recently planted (1 to 2 months ago) and virus incidence was lower, particularly in the Demre-Kumluca region where all the visited plots were free of virus symptoms. *Phytophthora capsici* caused heavy root rot damages in furrow irrrigated fields of Kahramanmaras and Karaisali. In the coastal regions, *P. capsici* was also present but the irrigation method used allows to isolate small plots of 10 to 12 plants individually branched to the main furrow, decreasing the inoculum spread in the whole field. Otherwise, in drip-irrigated glasshouses, root rot damages were much lower. Powdery mildew due to *Leveillula taurica* also caused important defoliations, infecting up to 100% of the plants in the fields and gardens of the coastal regions and of Karaisali.

More sporadic damages were also observed: mite infection due to *Tarsonemus sp.* infected some fields of the coastal regions, and soil problems, involving salinity and nematodes *Meloiaogyne sp.* together with *P. capsici,* may affect drastically some glasshouses in the Demre-Kumluca region.

Table 1 : Main diseases affecting peppers in automn 1992 and 1993 in different production regions of Turkey

	Demre - Kumluca	Antalya - Serik -	Alanya Ovacik	Erdemli - Mersin -	Tarsus Adana	Kara.isali	Kahraman- -maras
Mosaic symptoms	**-**	++	+++	+++	+++	+++	+
(virus complexes)							
P. capsici	+	-	-	+	+	++	+++
L. taurica	-	+	++	++	+++	+++	+
Meloiaogyne sp.	+	-	-	-	-	-	-
Tarsonemus sp.	-	+	-	+	+	-	-

-: no symptom observed in the different plots

+ : only some of the visited plots infested, with an incidence< 5%

++ : most of the visited plots infested, with an incidence from 5% to 50% +++ : all the visited plots infested, with an incidence up to 1 00%

Virus identification.

Results of the virus identification using ELISA serological method and host reactions are synthesized in table 2. CMV was the most frequent virus, encountered in all the production regions whatever the mode of cultivation. PVY also frequently formed a virus complex with CMV and was present in almost all the visited regions. TEV, another aphid transmitted virus was also detected in pepper samples and isolated in *Datura stramonium* plants. This potyvirus was less frequently isolated than PVY and CMV but it was dispersed in the main production regions of the mediterranean coast.

Tobamoviruses were also detected in some young plants sampled in glasshouses from Mersin and Alanya regions (TMV) and from the Antalya region (PMMV). Although we took a special care for Thrips transmitted viruses (TSWV), we never detected it in any of the visited plots.

Table 2 : Viruses identified in the samples removed from plants showing viral symptoms in the different regions of Turkey.

	Antalya - Serik	Alanya - Ovacik	Erdemli - Mersin	Tarsus -Adana	Karalsali	Kahraman--maras	Total positive samples
CMV	8*	6	12	11	7	6	50
PVY	4	9	7	1	6	6	33
TEV	2	0	1	1	0	-	4
TMV	0	3	4	0	0	0	7
PMMV	3	0	0	0	0	0	3
TSWV	0	0	0	0	0	0	-
Total samples per region:	8	9	16	15	9	8	65

number of positive samples (DAS-ELISA and / or biological detection) untested

Pathotype detennination of tobamoviruses and potyviruses

Tobamovirus pathotypes were determined by observing the reactions of pepper differencial varieties for the *L* locus: 'Lamu' *(L+L+),* Yolo Wonder *(L'L'),* C. *chinense'Miscucho' (L3L3)* , and C. *chacoense* PI 260429 *(L 4L* 4). These alleles confer the hypersensitive resistance to the different tobamovirus pathotypes (Boukema 1980, Rast 1988). The 2 TMV isolates induced mosaic symptoms in 'Lamu' and hypersensitive response in the other varieties (pathotype 0). The 3 PMMV isolates induced hypersensitive (resistant) response only in 'Miscucho' and PI 260429 (pathotype 0-1 or 0-1-2). *L* 1 and *L* 3 confer effective resistance to those seed transmitted TMV and PMMV respectively.

Nine of the PVY isolates were examined for their reactions on the following varieties: 'Yolo Wonder', Yolo Y', 'Florida VR2', and 'CM 334'. Five of these isolates infected systemically 'Yolo Wonder' but not the other varieties and 4 isolates infected systemically 'Yolo Wonder' and 'Yolo Y' but not 'Florida VR2' nor 'CM 334'. According to Gebre et al (1985), the first 5 isolates were classified as pathotypes 0 (virulent on *vy+* from 'Yolo Wonder' but not *vy1* from 'Yolo Y') and the 4 other isolates as pathotype 0-1 (virulent on *vy+, vy1,* but not vy2from 'Florida VR2')

The 4 TEV isolates were inoculated 'Yolo Wonder', Yolo Y', 'Florida VR2', 'Avelar' and C. *chinense* PI 152225. Only 'Yolo Wonder' and 'Yolo Y' were systemically infected. 'Florida VR2' and the other varieties remained resistant to these TEV isolates that were classified as common pathotypes according to Greenleaf (1986). The resistance from 'Florida VR2' due to the recessive *vy2* allele *(era* according to :- Greenleaf 1986) proved to be effective against these isolates.

Conclusion.

The results from this two-year survey underline the severe damages due to *P. capsici* and viruses in pepper cultivations. Production of pepper powder from dried fruits in the south-east part of Turkey is endangered by this fungus and the traditionnal pepper paste production from Karaisali also suffers heavy

losses from *L. taurica* and virus complexes. Modem glasshouse cultivations along the mediterranean coast were less affected by parasites, probably due to the drip-irrigation systems decreasing *Phytophthora* spread and to a more efficient protection of plant nurseries against the aphids that transmit the CMV, PVY and TEV. Presence of TEV in Turkey has to be underlined: this virus was previously known to be confined to Americas and Caribeans. It was reported only once In the coastal regions of Turkey by Yllmez et al (1983), and it is still not commonly known in the other countries of the mediterranean bassin. Presently, the recessive resistance from 'Florida VR2' is effective against both the PVY and TEV isolated strains but additionnal resistance sources have to be considered against these potyviruses known for their large variability and against CMV (Palloix 1992).

Most of the varieties and landraces observed were found to be slightly tolerant or susceptible to the above mentionned diseases. Further epidemiological studies should complete the present survey, but integrated protection development and breeding programs directed toward disease resistance are urgently needed to maintain traditionnal production areas and to promote modem cultivations.

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THE EFFECT OF VIRUS INFECTION ON THE PIGMENT CONTENT OF SPICE PEEPER (Capsicum annuum L_)

T. Huszka+- E. F. Kisso
+Szegedi Paprika Co.; Szeged Szovetkezeti u 1, H-6725
oPlant Health and Soil Protection Station, Hodmezovasarhely Rarosi u 102, H-6801

In Hungary cucumber mosaic virus (CMV), tobacco mosaic " virus (TMV), alfalfa mosaic virus (AMV) and potato virus Y (PVY) are the most important viruses in spice pepper (Capsicum annuum L_) growing. They can cause loss of 40 - 60 % of the total yield, depending on the annual virus infection (Kiss et al. 1983). But there is very few information about the effect of virus infection on quality, especially on pigment content of spice pepper.
In our investigation artificial infection (CMV, TMV, PVY, AMV) was carried out in 1992-93. Plants of the variety and candidates of Szegedi Paprika Co. ('Mihalyteleki',"Bibor', 'Napfeny','Fesztival','Viktoria' (Huszka,1992» and 'Szegedi 20' were transplanted in early June and infected at the state of 14 leaves. Degree of resistance was determined in September. The yield was harvested at the end of September. After a six week storage (postripening period) the pigment content of the pericarp of the fruits was measured.
The results showed, that 'Szegedi 20' was the most sensetive against virus infection (degree of resistance (Rd): 17.0), while our variety and candidates had higher level of, resisteance ('Mihalyteleki','Bibor','Napfeny','Fesztival' Rd: 42.5 - 51.0;'Viktoria' Rd: 72.0). After storage three groups of the fruits could be formed in each variety and candidate: 1, small, deformed fruits (symptoms of serious virus infection) and fungi infection (Alternaria sp, Asperaillus sp, Penicillium sp), lost red colour; 2, slight deformation and small spots with colour loss; 3, healthy fruits without any damage. The pigment content of the fruits in the groups were very different: in the 1st 46 %, in the 2nd 5 % of the pigment content was lost compared to the 3rd. Though these groups could be found in each variety and candidate, the ratio of them were different, e.g.:'Szegedi 20' 1st 50 %, 3rd 23 %; 'Viktoria' 1st 12 %, 3rd 49 %. Of course, the loss of the pigment content of the total yield (both groups together) was much higher in 'Szegedi 20' (40 %), than in our variety and candidates (15-5 %).
These data show the importance of breeding for virus resistance and growing varieties with high degree of resistance.

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BIOLOGICAL AND SEROLOGICAL CHARACTERIZATION OF TSWV ISOLATES

C. Jorda1, P. Viser, M.J. Dier, S. Rosell62, F. Nuer, A. Lacasa3, J. Costa4
1 Plant Protection Dept., Pathology, Polytechnical University, 46020 Valencia, Spain.
2 Biotechnology Dept., Polytechnical University, 46020 Valencia, Spain.
3 Plant Protection Dept., CRIA, La Alberca, Murcia.
4 Horticulture Dept., CRIA, La Alberca, Murcia.

The economic impact of TSWV is enormous. This is due, mainly, to its wide-spread . geographic distribution, the wide range of host plants, together with its devastating effects on the plants it infects. In the Spanish Mediterranean region damage has lead to important crop loss in tomato, pepper and lettuce, as well as considerable losses in other crops (Jorda et al., 1992).

The existence of a high variability of this virus was stated by Norris (1946), Best and Gallus (1953) and Best (1968). Nevertheless, up to now, no study of any depth has been made to find out the variability of pathotypes present in our fields, despite its importance in terms of finding materials which are genetically resistant to this virus.

In order to carry out this study, isolates were collected systematically from different crops and areas, at different times (Table 1). A serological test was carried out beforehand using the ELISA serological technique, by means of antiserum of the serogroups I, II-I and II-II of the TSWV and Impatiens Necrotic Spot Virus, which was considered to be related to the TSWV until recently.

Table 1. Isolates.

ISOLATE	ORIGIN	HOST ORIGIN	SEROLOGY I	II-1	II-II	INSV
L-93940	Murcia	Lactuca sativa	+	-	-	-
L-93947	Benicarlo	actuca sativa	+	-	+	-
T -93950	Benicarlo	LvcODersicon esculentum	+	-	-	-
T -93958	Benicarlo	vcooersicon esculentum	+	-	-	-
C-93968	Alboraya	Aoium sxaveolens	+	-	-	-
J-93971	Benicarlo	Capsicum annuum	+	-	-	-
P-93970	Benicarlo	Phaseolus vull!aris	+	-	-	-
H-93955	Pilar de la Horadada	Vicia faba	+	-	-	-
E-91758	Benifayo	Cichorium endivia	+	-	-	-
L-91672	Benifayo	Lactuca sativa	+	-	-	-
T -91525	Alginet	Lvcopersicon esculentum	+	-	-	-
P-91675	Benicarlo	Capsicum annuum	+	-	-	-

The different isolates collected were innoculated on the host plants, choosing those that gave a different responses.

The isolates which had been choosen for the study, were innoculated on a series of pepper plants belonging to C. annuum, C. chinense, as well as the compounds 74B and 207B which belong to the complex annuum-frutescens-chinense, in order to study their biological behaviour. The pepper plant were innoculated when they were at the three-four true leaf stage. A weak later they were studied for possible local lesions, as necrotic lesion which appear around the area where the virus penetrated. At approximately 14 days after innoculation, systemic symptoms became visible, normally in the form of necrotic points or spots on the leaves and stem, apical bud bronzing, general wilt and yellowing, etc. In all cases ELISA serological test was carried out. The results are given in table 2.

Table 2. Symptoms observed on the host plants

HOST PLANT

Isolaters	Type of Lesions	C.annuum *Settebello	Cannuum *Agridulce Tietar	C annuum 6135A	C.Chinense P!-152225	C. Chinense PI 15	C. chinense CB32A	C.Tri coloer chinese	Complejo 74B	Comlejo 207B
L-93940	L S	+ +	- +	- +	- -	+-	-+	+ -	- +	++
L 93947	L S	- +	- +	- +	- -	- -	+ +	+ +	- *	- +
T-93950	L S	+ +	- -	- +	+ -	+ -	+ +	- +	+ +	+ +
T 93958	L S	+ -	- -	+ +	- *	- -	- +	- +	- +	+ +
C93968	L S	+ +	+ -	- +	- -	+ -	+ +	+ +	+ +	+ +
J93970	L S	U U	+ +	+ +	+ +	+ +	+ +	+ +	+ +	+ +
P93971	L S	U U	+ +	+ +	+ -	+ -	+ +	+ +	+ +	+ +
H93955	L S	U U	- +	+ +	+ +	+ +	+ +	+ +	+ +	+ +
E91758	L S	+ +	- +	- -	- -	+ -	- ±	- -	- ±	- +
L91672	L S	+ +	- +	- +	- -	+ -	- +	- -	- +	- +
T 91525	L S	+ +	- +	- +	- -	+ -	+ +	- +	+ +	- +
P 91675	L S	+ +	- +	- +	- -	+ -	- -	- -	- +	- +

The symptoms observed varied qualitatively with respect to the season in which the test was carried out. We observed that isolates belonging to the same species and place, such as T -93950 and T -93958, collected during the same season, demonstrated different behaviour in some species such as C. annuum 'Settebello' and 6135A, C. chinense PI-152225, PI-15 and CB-32;. A, as well as the compound 74B. In many of the host plans tested, the isolate T -93958 did not" produce local lesions, however, systemic symptoms were to be found. One may conclude, therefore, that they are biologically different. J-93979, P-93971 and H-93955, which come from, different origin and different crops, including green bean, pepper and brod bean, are extraordinarily similar to eachother.

These results, together with previous ones (Jorda et al., 1993), lead us to the conclusion that we are dealing with an extraordinarily variable virus, existing isolates which demonstrate different biological behaviour under similar agroclimatic conditions. This knowledge is of utmost importance in the search for genetic resistence.

ACKNOWLEDGEMENTS

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GENETIC RESISTANCE TO TSWV (Tomato Spotted wilt Virus) IN Cagsicum sgg.

F. Nuez1., M.J. Diez1., S. Rosello1., A. Lacasa2, C. Jorda3, M. Martin3 J. Costa.

1. Biotechnology Dept, Poly technical University, 46020 Valencia, Spain.

2 Plant Protection Dept., CRIA, La Alberca, Murcia, Spain. Pathology, Poly technical University, 46020 valencia, Spain.

3 Plant Protection Dept., Pathology, Poly technical University, 46020 Valencia, Spain.

. Horticulture Dept., La Alberca, Murcia, Spain.

Accessions belonging to C. annuum, C. frutescens, C. chinense y " C. gubescens species were evaluated by mechanical transmission for resistance to TSWV in previous trials (Diez et al., 1993). " No accesions resistant of C. annuum species were found in these assays. Nevertheless, some of them belonging to C. chinense, frutescens, and C. gubescens did not show systemic symptoms when they were inoculated mechanically with various isolates of TSWV (Table 1).

Tabla 1. Resistant genotypes.

GENOTYPE	LESION TYPE	ISOLATES			
		T-91525	P-91675	L-91672	E-91758
C.chinense PI-15	L	+	+	+	+
	S	-	-	-	-
C.chinense PI-152225	L	-	-	-	-
	S	-	-	-	-
C.frutescens 7204	L	+	+	+	+
	S	-	-	-	-
C.pubescens 53-P	L	-	-	ND	ND
	S	-	-	ND	ND

L: local lesion S: systemic lesion ND: no determinate

Two isolates which were collected later, J-93971 and H-93955 have overcame the resistance of PI-15 and PI-152225 (Jorda et al., 1994). Mechanical inoculations of these two accessions were carried out in the greenhouse. All fully expanded leaves previously dusted with 600-mesh Carborundum were inoculated at 3-4 developed leaves stage. The plants were observed at 7 days to identifiying possible local lesions and again 14 days later to study characteristic systemic symptoms.

C. frutescens 7204 and C. pubescens 53-P were tested by thrips transmission. Plants of these accessions were exposed to

viruliferous F. occidentalis thrips in a semiclimatic room at 22- 24gC, 45 to 50% relative humidity and a photoperiod of 14 hours of light. Plants were kept in the room from the 4-6 developed leaves stage and remained there for enough time for systemic lesions to appear. Both accessions showed susceptibility.

After these experiments we argue that the possible utilization of C. chinense as a source of resistance of agronomic value to TSWV, at least with the isolates currently in our vegetable growing areas. Nevertheless, we think it is necessary to test PI-

15 and PI-152225 accesions with isolates J-93971 and H-93955 in field conditions. One dominant gene is reported to give resistance to C. chinense PI-152225 (Black et al ., 1991). Under certain environmental conditions a phenomenon of desestabilization of resistance has been observed in C.chinese. Young plants grown at about 30QC shown a slow reaction of hipersensibility. Small necrotic lesions progress, reach and injure veins, leaves, stem and bud, giving rise to the death of the plant. A similar process of desestabilization of hipersensibility has been observed in other viruses, such as PMMV (Boukema et aI, 1980; Boukema, 1982), BCMV in green bean (Walkey & Innes, 1979) and ToMV in tomato (Laterrot, 1973). In order to obtain a more stable source of resistance nine accesions belonging to C. chacoense have been inoculated mecanically with L-93940. Three of them are resistant to this Y isolate. Nevertheless, these are preliminary results that we have to prove with more isolates and by further thrips transmission.

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SHOULD HYPERSENSITIVITY RESISTANCE TO TOMATO SPOTTED WILT VIRUS (TSWV) BE USED IN BREEDING PROGRAMS?

R. Oil Ortega and M. Luis Arteaga
Servicio de Investigacion Agraria -.
Apartado 727, E50080 Zaragoza, Spain

Since 1991, when BLACK *et al.* reported resistance to Tomato Spotted Wilt Virus (TSWV) in *Capsicum chinense* 'PI 152225' and 'PI 159236' accessions, several researchers have pointed out resistance to TSWV in these and other accessions.. In Brazil, 'PI 159236' was considered resistant to TSWV (BOITEUX *et al.,* 1993). PALLOIX *et ale* (1993) have confirmed the resistance of both accessions in France. In Spain, DIEZ *et ale* (1993) have reported resistance in these two C. *chinense* accessions, in two other C. *chinense* lines ('P15' and 'PIS'), in *Capsicum frutescens* '7204' accession and in an unnamed accession belonging to *Capsicum pubescens.* Our own results allow us to confirm the resistance detected in 'PI 152225' and 'PI 159236'. Nevertheless, the responses to three different mechanical inoculations we made on these materials with a TSWV isolate obtained from pepper in Spain, showed to be no uniform. In our trials we found four *Capsicum baccatilm* accessions that showed a TSWV resistance similar or higher to that of C. *chinense* 'PI 152225' and 'PI 159236' accessions. The resistance was always of the hypersensitivity type as concentric local lesions developed on inoculated leaves while the foliage above the inoculated leaves remained symptomless and TSWV was not recovered by back inoculations on test plants. Nevertheless, as observed by BLACK *et al.* (1991) on one C. *chinense* plant, in our experiments we found some plants that showed necrotic local lesions and both systemic necrotic spots and necrosis. This phenomenon was observed on all previous resistant C. *chinense* and C. *baccatum* accessions but with different rates depending on experiments. When resistant accessions were ranked by the rate of plants showing systemic necrosis, no similar ranking was obtained in the three experiments. Our conclusion is that there are probably other factors that affect the resistance. Plant age, climatic conditions, inoculum concentration, etc., have to be considered among those factors. Isolate effect could also be added to the list as BOITEUX and NAGATA (1993) have' recently reported breakdowns of 'PI 159236' resistance both after artificial inoculation with some TSWV isolates and in field conditions in Brazil.

The easy breakdowns of TSWV hypersensitivity resistance, at least in some C. *chinense* and C. *baccaum* accessions, suggest us to consider with many reserves the introduction of this type of resistance into *Capsicum annuum,* cultivars. In fact, it is widely accepted that hypersensitivity resistance loses their effectiveness rapidly. Besides, more basic research on *TSWV-Capsicum interaction* is needed. Related to this AVILA *et al.* (1993) have proposed new members of the Tospovirus that could cause on peppers the same symptoms as TSWV. This suggests that the variability present within the Tospovirus should also be considered before a breeding programme aiming to introduce resistance to TSWV in peppers is started.

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POSSIBILITIES OF RESISTANCE TO NEW BACTERIAL DISEASE IN PEPPER

(Pseudomonas syringae pV. syringae) H.D. Led61 and M. Hevesi2

Plant Breeding Center, Vetomsg Trading House CO. LTD.

Szentes, P.D.B. 41. 6601 HUNGARY

2University of Horticulture and Food Industry, Department of Plant Pathology, Budapest 112, P.O.B. 53 1502 HUNGARY

Beside the bacterial spot caused by Xanthomonas campestris pv. vesicatoria, new bacterial disease has appeared since 1981 on pepper in Hungary. The pathogen was determinated as Pseudomonas syringae pv. syringae (van Hall 1902) (HEVESI, 1986).

In the case of humid, chilly weather this pathogen causes considerable damage in direct sowing red pepper production. The symptoms of the disease can be characterized as follows:

the young leaves become yellow and deformed, the shoot tips get brown and dried, the buds and little pods become brown and mumificated (HEVESI,1986).

Different susceptibility was noticed among red pepper cultivars to this disease (HEVESI-KAPELLER, 1987).

In 1993 six pepper lines derived from Southern Regional Plant Introduction Station as Xanthomonas - resistant materials and two Hungarian tomato - shaped pepper cultivars were evaluated.

Four-six leaves old plants were sprayed with the inoculum of 5-108 cfu/ml

of the bacteria and were placed into moist chamber at 20-250C for two days. The symptoms were evaluated seven (a) and fourteen (b) days after the inocl.11ation with two kinds of indices at the same time:

1. infection index (fi) - percentage of infection of whole leaf area,
2. defoliation index (di) - percentage of leaves abcissed.

Among six pepper lines PI 271322 high resistance, PI 163192 good resistance while PI 246331 moderate resistance had shown to P.s.pv. syringae

Figure 1. In previous works pepper line - PI 163192 was evaluated as highly resistant to X.c.pv. vesicatoria race 1, used spraying inoculation method (LEDO-HEVE5I,1992).

The fourth line (XVR-3-25) were moderatly susceptible to P.s.pv. syringae while in the case of infiltration of the suspension of X.c.pv.vesicatoria race 1 to its leaves, hypersensitive reactions were noticed. Pepper lines PI 183441 and PI 322719 were susceptible to this pathogen, in spite of that they had shown moderate resistance to bacterial spot.

The two Hungarian pepper cultivars were measured highly susceptible to both bacterial diseases (LEDO-HEVESI, 1992).

. Resistance features exist to new bacterial disease caused by Pseudomonas syringae pv. syringae in the case of pepper introductions - PI 271322 and PI 163192, which were investigated by spraying inoculation method. To explore the genetic background of this resistance and its probable connections with Xanthomonas resistance genes necessary to carry out genetical tests in various subseqent generations (Fl' F2' BC).

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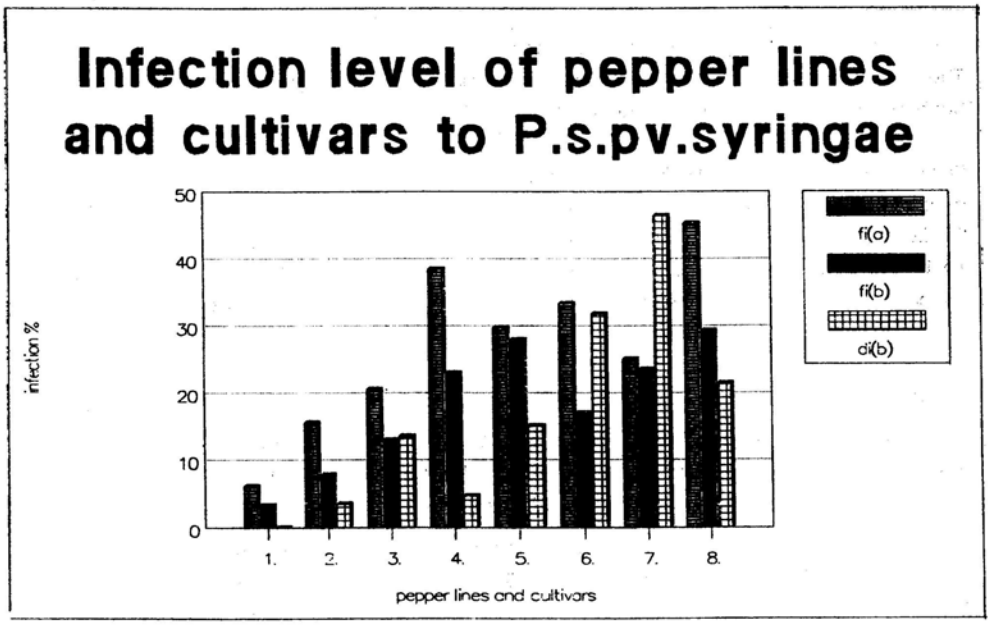
Figure 1



Pepper lines:

1. PI 271322
2. PI 163192
3. PI 246331
4. XVR-3-25
5. PI 183441
6. PI 322719
7. Paradicsom alakú zöld Szentesi
8. Greygó

92

Capsicum and Eggplant Newsletter. 13 (1994): 93-96.

Phytophthora nicotianae var. parasitica resistance ability of some pepper varieties

M. Bechir ALLAGUI
INRA T rue Hedi Karray 2080 Ariana Tunisia

1. Introduction ; Pepper wilting disease is rife in many tunisian regions where the pepper *"Capsicum annuum"* is cultivated. It attacks the plants in the fields as well as in greenhouses. The economic incidences are important due to the high elevated death-rate mainly in producing adult plants. The susceptible varieties manifest a delimited brown root and collar rot leading plants to rapid wilting. These symptoms are not caused by *P. capsici* which is well known as parasite on pepper (Leon, 1922). However, our isolations, identification and artificial inoculations of healthy plants have demonstrated that the pathogen agent, constantly observed in relation with the above mentioned symtoms, is *P. nicotianae var. parasitica* sensu Stamps and al. (1990).

The objective of the study was to test the reaction of six pepper varieties, proceeding from diverse origins, to the tunisian pepper wilting agent, *P. nicotianae var. parasitica.*

2. Material and methods

2.1. Vegetal material

It is chosen to ensure a better behaviour diversity, composed by the following varieties:

*Beldi = local variety susceptible to the *Phytophthora* species.
*HV2, HVI2 and HV13 : Haplodiploid issued from the Fl hybrid between a sensible line 'Vania' and another 'H3' resistant to *L . taurica* (Daubeze and aI., 1989; Allagui , 1993).
*PM 681 and PM 687: genotypes known *resistant to L. taurica*

The seeds, after gemination into Petri dishes, are directly sown in pots filled with sterilized loam, be made up of: 1 V manure: 1 V earth : IV clay: 1 V sand: 1V perl it.

2.2 Inoculation methods

The zoospores necessary to the plant inoculation are produced by growing the fungus during 10 days in PDA culture and bits of the latter are moved in sterile distilled water where they stay 3 days at 20-25°C. It make up then many sporangia which break out quickly under the effect of the temperature elevation, releasing the zoospores. The zoospore concentration is estimated by the haemocytometer and adjusted to the requested concentration.

The plants are inoculated at the 9-12 leave stage by the N° 1 isolate belonging to *P. nicotianae var .parasitica,* that have displayed during a preliminary test his pathogenicity on the local variety Heidi. The contamination take place at the plant collar by depositing 25 ml from a suspension of 10 000 zoospores per ml, the plant irrigation is made each 2 to 3 days.

In the greenhouse where the trials are conducted, the day temperature is keeped up at a maximum of 25° C, but at night, it can fall under 15°C.

2.3. Disease assessment and data analysis
Disease symptoms were recorded 10 days after inoculation, i.e when the first wilting symptoms become visible, and go on at 3 to 4 days intervals. It was stopped when all varieties didn't manifest any new mortality during a month..

The notation scale used to evaluate the inoculated plant health rate, inspired from Ristaino (1990) is the following: 0 = no symptom 1 = wilting without lesions on the " stem, 2 = wilting with lesions on the stem, 3 = girdled plant stem by lesions, 4 = dead
plant.

The experiment was conducted on a randomized complete block design where each plant is considered as repetition. The comparison of the variety ability for *P. nicotianae var. parasitica* resistance is carried out using the area under the disease progress curve, A UD P C (Shaner and al., 1977; Ristaino, 1990). AUDPC is calculated first for each plant and then the average for each variety.

Data are tested for homogeneity of variance before analysis of variance. Means from significant treatment effects are separed with Duncan's multiple range test.

3. Results and discussions The results of the plant mortality of all tested varieties, according to time after inoculation with N° 1 isolate of *P. nicotianae var. parasitica,* are shown in Fig. 1. The N°l isolate have exercised an evident parasitical action on all varieties. The reaction to infection is different from one variety to another (Fig.1). The PM 681 variety is the most resistant, showing plant mortality starting only 42 days after inoculation. The total mortality rate determined in the latter at the end of the trial is relatively we~ not exceeding 15% , i.e from the 19 tested plants only 3 dead after wilting. On the other hand, for the other varieties, the mortality produced after wilting bigin early, 17 - 24 days after inoculation and the total mortality rate registered is more than 60%.

For better discern the relative susceptibility of each variety, especially for the group having more than 60% mortality rate, we calculate for each variety the AUDPC (Table. 1.). HV2, HV13 and Beldi are the most susceptible. HV12 is as susceptible as
HVI3 and Beldi. However, PM687 is more resistant than HV2, HVI3 and Beldi and as susceptible as HVI2. While PM 681 stand out from the others expressing good Resistance

In this study, PM 681 respond to infection only late. We inoculate it a second time to make certain from the contamination, and yet save few plants which manifest their susceptibility. We think that PM 681 can be interessant for showing up resistance source. Nevertheless, the local variety Beldi is found susceptible. This confirm its behaviour in open air and greenhouse cultivation.

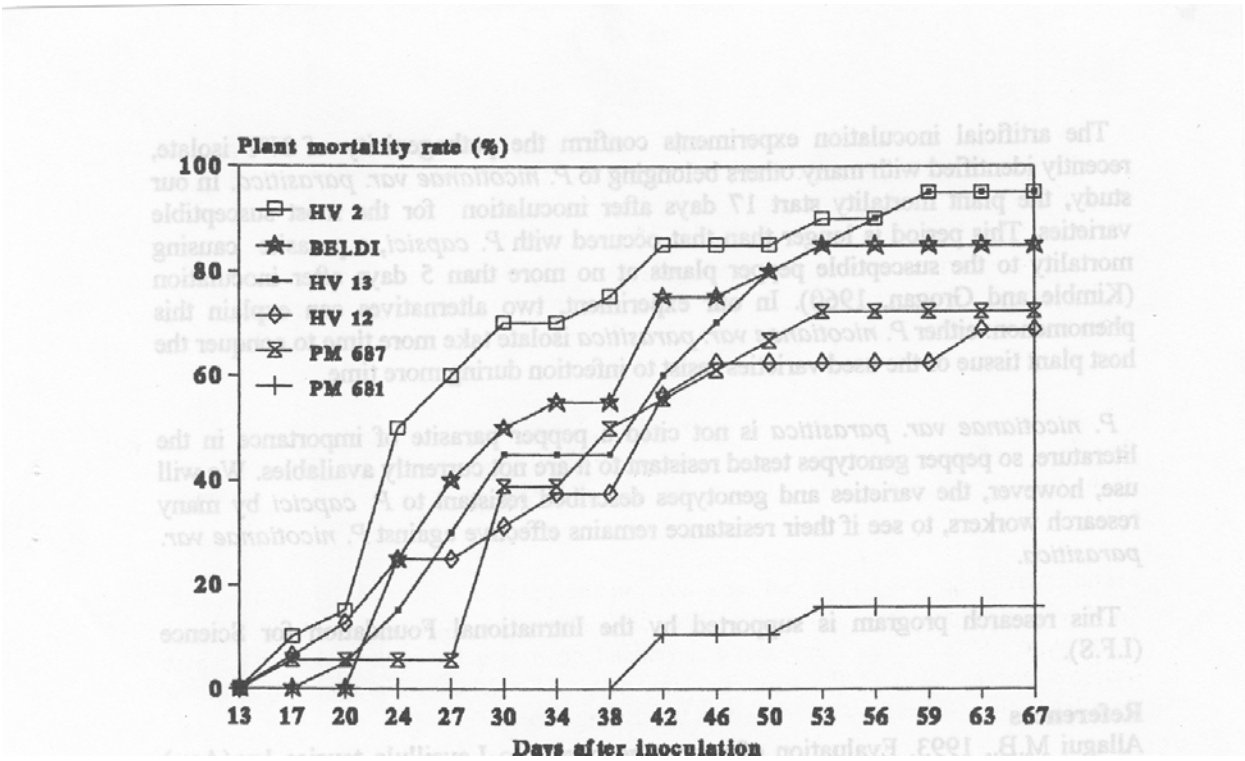


Fig. 1. Plant mortality of *six* pepper varieties according to time (days) after inoculation with NO 1 isolate of *P. nicotianae* var. *parasitica* from local Cultivated pepper.

Table 1. Mean areas under the disease progress curve (AUDRC) on diverse pepper varieties inoculated with *P. nicotianae* var. *parasitica* . (*)

Table 1. Mean areas under the disease progress curve (AUDPC) on diverse pepper varieties inoculated with *P. nicotianae var. parasitica.* (*)

Varieties	Number of tested plants/variety	Mean $(AUDPC + 0.5)^{\frac{1}{2}}$ (**)
HV 2	20	11.2 a
HV 13	20	10.3 ab
Beldi	20	10.2 ab
HV 12	16	8.3 bc
PM 687	18	7.8 c
PM 681	19	2.6 d

(*) : The artificial inoculation is made with the isolate N°1 obtained by isolation from infected local variety pepper onto selective medium (Ponchet et al., 1972).

(**): AUDPC is calculated as $\sum_{i=1}^{n} [(Yi + Yi+1)/2][ti+1 - ti]$, where Yi= disease severity at the i^{th} observation, ti= time (days) at the i^{th} observation and $(AUDPC + 0.5)^{\frac{1}{2}}$ is used for homogeneity of variance. Means separations according to Duncan test, level 5%.

The artificial inoculation experiments confirm the pathogenicity of N° 1 isolate, recently identified with many others belonging to *P. nicotianae var. parasitica.* In our study, the plant mortality start 17 days after inoculation for the most susceptible varieties. This period is longer than that occurred with *P. capsici,* a parasite causing mortality to the susceptible pepper plants at no more than 5 days after inoculation (Kimble and Grogan, 1960). In our experiment, two alternatives can explain this phenomenon: either *P. nicotianae var. parasitica* isolate take more time to conquer the host plant tissue or the used varieties resist to infection during more time.

P. nicotianae var. parasitica is not cited a pepper parasite of importance in the literature, so pepper genotypes tested resistant to it are not currently available. We will use, however, the varieties and genotypes described resistant to *P. capcici* by many research workers, to see if their resistance remains effective against *P. nicotianae var. - parasitica.*

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EFFECT OF PLANTING DISTANCE AND DIRECTION ON NATURAL CROSS POLLINATION AND THEIR ROLE IN SEED PRODUCTION OF PEPPER
(Capsicum annuum)

Nazeer Ahmed and Tanki, M. I.

Division of Olericulture, S. K. University of Agricultural Sciences and Technology, Shalimar, Srinagar -191 121, India.

Introduction

Natural crossing in pepper at different parts of the world varied from 7 to 68 per cent (Odland and Porter, 1941; Murthy and Murthy, 1962; Singh et al 1973; Moor, 1983 and Ahmed et al. 1992) confirming that pepper has a high rate of allogamy. Because of this high out crossing rate pepper varieties are now fast deteriorating after their release and thus posing great problems to seed growers. Therefore standardization of proper isolation distance between varieties and direction of planting in this regard will be helpful in maintaining genetic purity of the pepper varieties.

Materials and Methods

Present study on effect of direction and planting distance was carried out during Kharief 1990-91 at Vegetable Experimentat Farm, S. K. University of Agricultural Sciences and Technology.. Srinagar, India. The material consists of two varieties namely SPE-1 (dorninant, purple genetic marker as pollen parent) and PusaJwala (recessive, green seed parent). During Kr.arief 1990 thc seed parent was .planted at distance 5m, 25m, 50m, 100m , 200m, 400m and 600m away from pollen parent at two opposite directions i.e. towards east and west of pollen parent when no other crop was in blooming in between seed and pollen parent. There were 12 rows of pollen parent planted at centre of the experimental plot and at every planting distance there were six rows of seed parent. In each row there were 1 0 plants which were planted at a spacing 45 cm x 45 cm. Care was also taken in respect of synchronization of flowering in seed and pollen parent. From each planting distance and direction the red ripe fruits of seed parent were harvested separately, seeds extracted and stored. During Kharief 1991, the seeds of each planting/ isolation distance and direction were soon in nursery and counted number of purple dominant seedlings from recessive green seed parent and percentage cross pollination was worked out. During flowering and fruit set, observations on major insect pollinators was also recorded.

Results and Discussion.

Results presented in Table - 1 revealed that natural crossing irrespective of planting distance at two directions whether it was towards east or west from pollen parent showed no much variation indicating that direction of planting has less influence on out crossing rate. But on the *contrary* planting distance showed significant effect on natural cross pollination percentage. At closer planting/isolation distance of 5m to 100m the natural cross pollination percentage was highest irrespective of directions. Beyond 200m isolation

Table-1 percentage natural crossing at different isolation distance and directions

Isolation

Distance (meter) Direction

Towards west from pollen partent Toward east from pollen partent

	TotalNo. Of plants observed	No. of purple domainat in green population	Percentage cross pollination	Total N. of plants observed	No. of purple domainats in green population	Percentage cross pollination	Mean Pecentage cross pollination
5m	610	59	9.67	535	46	8.59	9.13
25m	453	32	7.06	560	37	6.60	6.83
50m	704	36	5.11	728	32	4.39	4.57
100m	620	24	3.87	689	31	4.49	4.18
200m	582	8	1.37	491	5	1.01	1.19
400m	355	1	0.28	460	0	0.00	0.14
600m	631	0	0.00	399	0	0.00	0.00
Mean	-	-	3.90	-	-	3.58	-

distance in both the directions the natural crossing was almost nil. Similar results have been reported earlier Singh (1973) under Punjab conditions. Therefore results clearly indicated that although pepper belongs to plants with strong self pollination mechanism however, out crossing rate belong fairly -high suggested for modification of present standards of the isolation distances required for commercial seed production of pepper varieties.

Odland and Porter as early as 1941 and Ahmed et al. (1992) have already reported importance of natural crosspollination as one of the factor responsible for deterioration of pepper varieties. Therefore to maintain genetic purity one must follow proper isolation between varieties during their seed production. As per the above results, it was therefore suggested that for production of foundation/certified seeds one must maintain a - minimum isolation distance of 400m between two varieties while for production of breeders seed the minimum isolation distance should be at least 600m.

Among insect pollinators around 58 per cent were bees followed flies (13%) ants (8%) wasps (5%) and others (16%). Bees visited more frequently and their activity was maximum between 8 a.m. to 12.30 p.m.

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EVALUATION, CHARACTERIZATION AND FRUIT PRODUCTION PATTERN OF EGG PLANT , GERMPLASM

A.O. Olufolaji+ and M.J. Makinde+
National Horticultural Research Institute, P.M.B. 5432, Ibadan, Nigeria.

Introduction

The genus - Solanum comprises of more than one thousand described species among which are S.melongena, S. incanum and S marginatum (Sakata, 1992). Solanum melongen is a perennial, errect branching herb of about 0.5 - 1.5 meters tall, most often grown as an annual (Purseglove, 1968). Solanum species is a warm climate vegetable, which needs abundant sunshine for good plant grovnh, flower bud differentiation and maximum fruit bearing capacity. It is non-tolerant to excessive moisture and drought, (Chang, LieuChun., 1972). A number of wild Solanum melongena, So. Macroncarpon and S. gilo species are grown to a limited extent in Africa for their leaves which are used as pot herbs and their immature fruits which are cooked as vegetables and for seasoning other foods (Kogbe, 1981; Lester, 1990). The cooked fruit provide a useful vegetable in many parts of the tropics. They may be boiled, fried or stuffed. The unripe fruits are sometimes used as curries (Purseglove, 1968).

Like other vegetables, eggplants supplement the starchy foods and also provide essential nutrients like minerals, vitamins and to a lesser extent proteins (Oyenuga and Fetuga, 1975).

In view of the dietary importance of egg-plant, it is important to seriously encourage massive collection, evaluation and characterization of the wild, local and exotic types. The experiments reported herein were carried out to evaluate the different accessions *in* terms of morphological characters, components of yield and yield of egg-plants.

Materials and Methods

EXPERIMENT I: The first experiment was carried out during the dry season of October, 1989 and *it* involves evaluation of thirteen accessions of egg- plants, each on a 1 x 5m plot at 50 x 50cm spacing in three replicates.

Plants were left until maturity for morphological and yield attributes evaluation (Table 1).

EXPER1MENT 2: second experiment a.1so involved evaluation of the fruit production pattern of (Solanum gilo 'Yalo') one of the most common and high yielding accessions in Nigeria. Six weeks old seedlings were transplanted on 1 x 2m beds at 50 x 50cm spacing in four replicates during the raining season of April, 1990**.**

Both experiments were of randomized complete block design. Plants were also irrigated when due, and were sprayed with 4 cypermethrine at the rate of 50g hectare-1 throughout the growth of the crops. The second experiment involved three treatments of *(i)* Daily flower counting and removal (ii) Daily fruit set counting and removal and *(iii)* Immature fruit counting and harvesting.

Harvesting of (immature) edible fruits was carried out twice weekly from 14 weeks up till 18 weeks, weekly up till 26 weeks and four weekly up till 34 weeks. I

Data collation involved a cumulative addition of harvests on four weekly basis and statistical analysis involved a two-way analysis of variance in which the least significant difference at 5% level was calculated.

Results

Most accessions are tall growing except S. melongena 'Long purple' and 'Black beauty' which are medium growing and S. macrocarpon which has a short and bushy growth habit (Table 1). Days to 50% flowering of the thirteen accessions range from 60 to 86 days. While the number of mature fruits per plant ranges between 1 and 20. Average fruit weight ranges between 9.1 and 183.2g. 'Black beauty', 'Long purple', 'Igbo', JB 81/02 I 'Yalo' and JD 88/03 are very seedy with 500g fruit producing 19 of seeds while between 1,000 - 2,000g fruit of the other fleshy accessions produced I 19 of seed. The mature fruit of OL 86/16, OL 86/11, OL 86/45, JB 81/02 and 'Yalo' are Red while the remaining accessions have yellow mature fruit colour. 'Black beauty', 'Lo purple' and 'Yalo' have fewer (6,5 and 1) fruits per plant but heavier (183, 143 and 126g) fruit weight respectively; while 'JD 88/03' has the highest (20) fruits per plant but gave a very low yield of 10.9g per fruit.

Studies of the number of flowers produced, number of fruits set and I number of edible fruits harvested per plant increased with age up till 22 I weeks after which there was a decline (Table 2). Based on a scale of hundred, out of one hundred percent flowers produced, 40% of such flowers set fruits while only 1% of total flowers produced finally developed into edible fruits.

At the peak of production (22 weeks after sowing) an average of 50 fruits m-2 were produced with an average weight of 31g per immature but edible fruit. However, fruit production declined considerably at 30 weeks to an average of 11 fruits m-2 and an average of 6g per fruit.

With adequate irrigation and plant protection measures under which the second experiment was carried out, the cumulative yield of 'Yalo' was 1.9 million fruits ha-1 which gave a corresponding yield of 37.3 metric tonnes per hectare.

Discussion

This study shows clear differences in morphological and yield. Attributes among the accessions tested. It can be stated that while absence of nutrient and moisture stress can maximize fruit size and number per plant (Kogbe, 1983), these characters appear basically genetically controlled.

Finally, in terms of efficiency of fruit production, S. 'Yalo' does not seem to suffer from flower abscission but rather the problem lies with fruit dropping since 40% of flowers produced set fruit while as low as 17% of total fruit set developed into edible fruits.

Future studies would examine ways of reducing fruit drop with attendant increase in fruit yield.

Table 1: Morphological and Yield attributes of egg- plant accessions

		Pubescence							
Accession	Name	Stem	Leaf	Fruit shape	Immature fruit colour	Days to 50% flowering	No. of Fruit per plant	Average fruit weight	Fruit weight g-1 seed yeild
'OL86/16'	S.incanum	S	H	Spherical	Green	72	7	67.7	2897
OL 86/17	"	H	H	Oval	Yellow	72	10	9.1	1147
OL 86/45	"	S	S	"	Green	67	12	26.7	2062
JD 87/02	"	S	S	Spherical	White	86	8	47.8	252
Garden-eggYalo	S.gilo	H	H	"	Light green	72	7	126.0	301
JD 87/03	"	S	S	"	Yellow	86	13	24.3	2841
JD 88/03	"	S	H	oval	green	86	20	10.9	547
JD 88/12	"	S	S	Sperical	White	60	9	43.0	1107
JD 88/21	"	S	S	Oval	Green	74	16	15.3	2801
OL 86/18	"	S	H	"	"	57	7	22.4	1167
Igbo	S. Macrocarpon	S	S	Spherical	"	86	8	46.9	191
Egg Plant Long Purple	S. melongina	H	H	Oval and elongated	Pruple	86	5	142.6	135
Egg-plant Black	S.meongina	H	H	Oval	Dark puple	86	6	183.2	38
LSD (0.05)						4.50	2.82	12.94	258.32

Key S: Smooth H hairy

Table 2: Fruit production pattern of egg- plant (Solanum gilo)

Weeks after sowing	Number of Flowers	Numberof fruit set	Number of edible fruit	Weight of fruits	Average fruit weight	Fruit yield tones ha-1
		Metre-2				
14	254	70	35	526	15.0	5.3
18	447	261	35	884	25.3	8.8
22	804	317	50	1557	31.1	15.6
26	943	290	44	623	18.3	4.2
30	61	64	17	103	6.1	2.0
34	36	18	6	37	6.2	1.4
Total	2545	1020	187	3730	-	37.3
LSD (p=0.05)	276.2	39.2	13.8	207.7	-	-
Percent yield	100	40.1	7.3			

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YIELD PERFORMANCE OF EGGPLANT LINES RESISTANT TO BACTERIAL WILT

A.T. Sadashiva, K.Madhavi Reddy, A.A. Deshpande and Roopali Singh

Indian Institute of Horticultural Research,Hessarghatta,Bangalore-560089,
India

ABSTRACT

Seven eggplant lines resistant to bacterial wilt were evaluated for their yield performance along with three susceptible checks in wilt sick soil followed by artificial inoculation. Among the several resistant lines evaluated, four lines viz.,
IHR 124-2, West coast green round, Rampur local and Mattu gulla'showed 100 per cent survival, whereas, all the three susceptible checks succumed to bacterial wilt. Ramput local (1.65kg/ pt) was the highest yielder followed by West coast green round (1.37 kg/pi),IHR 124-2 (1.30 kg/pt) and' Mattu gulla1 (1.26 kg/pt).

INTRODUCTION

Bacterial wilt caused by Pseudomonas solanacearum E.F. Smith is a serious disease in eggplant causing losses between 75 and 81 per cent in India (Rao,1976). Screening germplasm lines against bacterial wilt help in identifying new sources *of* resistance to this disease. Sadashiva et al (1993) reported that four eggplant lines viz., IHR 85, THR180, IHR 181 and
IHR 182 showed high levels *of* resistance to bacterial wilt when tested under wilt sick soil.

Title present study was undertaken to estimate the yield potential *of* collections *of* eggplant lines resistant to bacterial
wilt.

MATERIALS AND METHODS

Seven's eggplant lines namely IHR 85 (EC No.164453),IHR 124- 2,IHR 124-3,IHR 171 (West coast green round), IHR 180 (Rampur 10c.'al),IHR 181 (Mattu gulla) arId IHR 182 (Nalli badarle) resistant to bacterial wilt were evaluated along with three susceptible checks viz.,IHR 106 (Arka Shirish), IHR 108 (Arka Kusumakar) and IHR 228 (Manjarigota) during 1992 in wilt sick soil followed by artificial inoculation at Indian Institute *of* Horticultural Research .Station,Hessaraghatta.

Forty day old seedlings were planted at spacing *of* 90x40cm in wilt sick soil (bacterial - concentration 10 c.f.u/g) and fertilized with 120 kg N: 80 kg P: 50 kg K per hectare. Experiment was laid out following RBD with three replications. Each
seedling was artificially inoculated with bacterial suspension (at 0.7 0.0) after 20 days of transplanting by employing puncturing method as suggested by Winstead and Kelmarl (1952).

The data on plant survival (120 days after planting),yield per plant ,average fruit weight and number of fruits per plant were recorded and analysed. Susceptibility to bacterial wilt was confirmed by ooze tests.

RESULTS AND DISCUSSION

Results on title performance of eggplant lines revealed that little per cent survival in IHR 124-2,IHR 171 (West coast green
round), IHR 180 (Rampur local) and IHR 181 (Mattu gulla) was 100 per cent even after 120 days of planting, whereas it was 67,84 and 96 per cent in IHR 182 (Nalli badane),IHR 85 (EC No.164453) and IHR 124-3 respectively (Table 1).

All the three susceptible checks viz.,IHR 106 (Arka Shirish), IHR 108 (Arka KLlsumakar) and IHR 228 (Manjarigota) succumbed to will (100% death). Resistallt eggplant lines viz.,'Rampur local (1.65 kg/pt),West coast green round (1.37 kg/pt),IHR 1,24-2 (1.30 kg/Pt) and'Mattu gulla\ (1.26 kg/pt) were also
top yielders (Table 1).

'Rampur local also had the highest average fruit weight (439g) at marketable stage followed by 'West coast green round' (395g) and Mattu gulla (242 g).

From the analysis of the above results it is evident that Rampur local, Mattu gulla, West coast green round and IHR 124- 2 with high levels of resistance to bacterial wilt and high yield potential could serve as new resistant sources in egg plant improvement programme.

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Table 1: Performance of eggplant lines

Line	%survival (120 days after planting)	Yield/ plant (kg)	Average fruit weight (g)	No.of fruits/ plant	Remarks
IHR 228	0	0.02	25	0.27	'Manjarigota'
IHR 106	0	0.05	36	0.47	'Arka Shirish'
IHR 85	84	0.90	106	8.73	Collection from USA, pink long fruits. EC No.164453.
IHR 124-2	100	1.30	78	17.47	Selection from segregating material from Kerala, fruits light green, oval.
IHR 108	0	0.06	39	0.97	'Arka Kusumakar'
IHR 171	100	1.37	395	4.50	'West coast green round' Local collection from coastal Karnataka. Fruits round, green with creamy patches at stylar end.
IHR 180	100	1.65	439	3.73	'Rampur local' Local collection from Bellary dist.Karnataka. Fruits large, green round.
IHR 181	100	1.26	242	5.13	'Mattugulla' Local collection from Mattu village near Udupi(Coastal Karnataka). Fruits round, green with creamy patches at stylar end, spines on stem pedicel callics and mid-rib.
IHR 124-3	96	0.84	69	11.13	Selection from segregating material from Kerala. Fruits green oval.
IHR 182	67	1.29	87	13.63	'Nallibadane' Local collection from coastal Karnataka. Fruits green long, Calyx thorny.
SEm(±)	3.39	0.16	15.44	1.05	
C D @ 5%	10.06	0.47	45.88	3.12	
C D @ 1%	13.79	0.65	62.85	4.27	

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NEW BACTERIAL WILT RESISTANT F1 HYBRIDS OF EGG PLANT -:,

Solanum melongena L.)

P.A. Fugro, J.C. Rajput, V.H. Patil and D. Jadhav.

Central Experiment Station, Wakawali, Konkan Agricultural University, Dapoli - 415 712, M.S.(India)

Bacterial wilt caused by Pseudomonas solanacearum smith. is a very severe disease of egg plant in Konkan region of Maharashtra State in India. Yield losses up to 65 percent have been reported on account of thus disease (Das and chattopadhyay, 1955). Some of the varieties like 'IHR - 12 'IHR 21 'IHR - 54 SM - 6 Bandhtiware West Coast Green 'BB - 1 and 'BB - 7 are reported to be resistant to bacterial wilt (Rajput et al, 1993). However, these cultivars do not satisfy the consumers' requirements of cosmopolitan and local markets. In view of this, the above resistant sources along with excellent quality fruited cultivars but susceptible to bacterial wilt namely, 'Manjari Gota' ,and, 'Kali Rawai' ware involved for development of new bacterial wilt resistant F1 hybrids.

The seedlings were transplanted at 60 X 60 cm. spacing in a bacterial wilt sick plot for field screening. The seedlings of susceptible cultivars were transplanted at every tenth row so as to have the uniform spread of disease in the field. Similarly,
the same sets of seedlings were transplanted in the pots containing sterilized soil. The recommended package of practices was followed to raise the healthy crop.

The mortality of the seedlings due to bacterial wilt was recorded at an interval of 15 days after transplanting (DAT) and continued upto 135 days. The pathogenicity was confirmed by inoculating the potted seedlings 15 DAT with 24 hour old bacterial culture (4 X 108 CFU/ml) in the axil of the first two leaves by the standard pin prick method. The disease intensity was graded as highly resistant (HR), resistant (R), moderately resistant (MR), susceptible (S), and highly susceptible (HS) with 0 - 1, 2 - 10, 11 - 20, 21 - 50 and 51 - 100 percent mortality, respectively.

Out of 24 F1 hybrids, 16 were resistant, 4 susceptible and 4 hybrids were found highly susceptible to bacterial wilt. The trend of mortality was almost similar in susceptible parents 'and hybrids. It is interesting to note that the susceptible hybrids had one of the parents susceptible to bacterial wilt. This warrants that the disease is mainly governed by recessive genes. All the 16 resistant bybrids had both the parents resistant to bacterial wilt. However, resistance displayed by the hybrids was either slightly higher or lower than their parents. This might be the effect of additive genes.

Five of the hybrids viz. 'IHR - 54 X IHR - 21: 'IHR - 12 X IHR - 21: 'BB - 1 X IHR - 21: 'BB - 1 X 'BB - 7' and 'BB - 1 X WCG' had higher resistance than either of their parents and produced higher yield with acceptable quality fruits. These hybrids may be recommended for cultivation in bacterial wilt endemic pockets of Konkan region in Maharashtra (India).

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Table: Percent mortality in parents and hybrids due to bacterial wilt.

Parents/ hybrids	Days after transplanting							Reaction to bacterial wilt.
	45	60	75	90	105	120	135	
Parents								
IHR-12	-	-	-	-	-	2.5	3.5	R
IHR-54	-	-	-	-	-	-	3.3	R
BB-1	-	-	-	-	-	-	-	HR
SM-6	-	-	-	-	-	-	-	HR
Manjari Gota(MG)	35.5	66.7	100	-	-	-	-	HS
Kali Rawai(KR)	-	55.5	66.7	100	-	-	-	HS
West Coast Green (WCG)	-	-	-	-	-	3.5	6.7	R
IHR-21	-	-	-	-	-	3.3	3.3	R
BB-7	-	-	-	-	-	-	-	HR
Bandhtiware(BT)	-	-	-	-	-	-	-	HR
Hybrids								
IHR-12 X MG	-	27.7	44.4	55.5	66.7	68.8	68.8	HS
IHR-12 X KR	-	20.0	53.4	68.8	77.7	77.7	77.7	HS
IHR-12 X WCG	-	-	-	-	-	3.3	3.3	R
IHR-12 X IHR-21	-	-	-	-	-	-	2.0	R
IHR-12 X BB-7	-	-	-	-	-	-	3.5	R
IHR-12 X BT	-	-	-	-	2.0	3.3	3.3	R
IHR-54 X MG	-	6.7	20.0	33.3	33.3	33.3	33.3	S
IHR-54 X KR	-	24.4	44.4	57.7	62.2	62.2	62.2	HS
IHR-54 X WCG	-	-	-	-	3.5	7.5	7.5	R
IHR-54 X IHR-21	-	-	-	-	-	-	2.0	R
IHR-54 X BB-7	-	-	-	-	-	3.5	3.5	R
IHR-54 X BT	-	-	-	-	-	-	3.3	R
BB-1 X MG	-	26.7	51.1	64.4	75.5	77.7	77.7	HS
BB-1 X KR	-	8.9	22.2	35.5	42.2	48.2	48.2	S
BB-1 X WCG	-	-	-	3.3	3.3	3.3	3.3	R
BB-1 X IHR-21	-	-	-	-	-	-	2.0	R
BB-1 X BB-7	-	-	-	-	-	-	2.0	R
BB-1 X BT	-	-	-	-	-	-	3.3	R
SM-6 X MG	-	13.3	31.9	35.5	35.5	35.5	35.5	S
SM-6 X KR	-	13.3	22.2	31.1	37.7	37.7	37.7	S
SM-6 X WCG	-	-	-	-	-	-	2.0	R
SM-6 X IHR-21	-	-	-	-	-	2.0	3.3	R
SM-6 X BB-7	-	-	-	-	-	-	2.0	R
SM-6 X BT	-	-	-	-	-	-	2.0	R

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ELECTRLYTE LEAKAGE AS A POTENTIAL METHOD FOR MEASURING OF EGGPLANT RESITANCE AND VERTICILLIUM DAHLIAE VIRULENCE

Cristinzio G. and ScalaF.
Institute of Plant Pathology, University of Naples "Federico II" Via Universita 100,80055 Portici, Napoli, ITALY.

Introduction

Verticillium wilt caused by Verticillium dahliae Kleb. is one of the most serious diseases of eggplant. The identification of sources of resistance seems to be the most effective means for, controlling this disease. Evaluation of resistance in a germplasm is usually carried out under - field conditions by inoculating with the fungus and observing the appearance of disease symptoms. This method is time-consuming and often depends on where and how the " inoculation is performed (Notbmann and Ben-Yephet 1979; O'Brien 1983). Therefore, rapid and reliable alternative methods have been sought. An assay based on the leakage of electrolytes from plant tissues challenged with fungal culture filtrates or toxins has been used to differentiate between susceptible and resistant plants. Leakage from leaf discs of three elm species, induced by culture filtrates of an aggressive isolate of Qphiostoma ulmi, was correlated to the susceptibility of plants to the disease (Mezzetti 1988). The aim of this paper was to investigate whether leakage of electrolytes from calli of Solanum spp. caused by culture filtrates of Y.dahliae may be a potential system for in vitro screening of resistance to Verticillium wilt and for evaluating the virulence of isolates of the fungus.

MATERIALS ANDMETHODS

The cultures of Y.dahliae used in this study and listed in Table 1, were from the Culture Collection of our Institute.
Plants used were: the cultivar 'Lunga violetta' (LV) of Solanum melongena and an accession of S.torvum (ST).The accession ST from Prof. Monti (Department of Agronomy and Plant Genetics, University of Naples) was resistant to Y.dahliae, while the cultivar LV was very susceptible.
Seedlings of about 30 days grown on sterilized soil were removed and the roots were washed in tap water. Ten seedlings were placed for 1 min in a suspension of 5 x 106 conidia /ml of each isolate and then replanted in 12 cm diameter single pots filled with sterilized soil. Five seedlings were dipped in uninoculated broth and used as control. Wilt symptoms were recorded at 60 days after inoculation using a disease scale ranging from 0 (no symptoms) to 4 (plant dead).
For the production of culture filtrates, 11 flasks containing 300 m1 of the medium described by Nachmias (1982) were inoculated with 1 m1 of a conidial suspension of 107 spores / ml of each isolate and incubated in a rotary shaker (150 rev/min) at 26°C for 18 days. Cultures were then filtered through filter paper (Whatman n.4), centrifuged at 10.000 r.p.m. for 20 min and filtered again through a Nalgene filter 0.2 *um.* The final supernatants were stored in aliquots at -2Q°C until used. . For calli production the cultivar LV and the accession ST were grown on solid MSG medium at - 26°C with a photoperiod of 16day light. Calli were initiated by placing hypocotyl pieces of about 1 cm, cut from 14 days old plants, on MSmel medium (4.4 g MSG, 0.01 mg biotin, 1 mg , calcium pantothenate, 2 mg glycine, 0.1 mg 1AA, 1 mg BAP, 0.5 mg zeatin, 20 g sucrose and 6.5 g agar/l). After 10 days of growth at the same temperature and photoperiod as for plants, explants were eliminated and calli transferred to new MSmel medium. Calli were transferred two more times at 10 day intervals and then used in experiments to assay leakage of electrolytes.
Samples of calli of 1g from each of the two genotypes were washed with 6 m1 of sterile distilled water and placed in 20 m1 of both 5 and 10% culture filtrate solutions at 25°C with magnetic

stirring. Distilled water and growth medium were the controls. Conductance in solutions was measured at 1h intervals by using a conductimeter Crison mod.525 with 20 electrodes (range 20-2,000 mS/cm; K=1.0) connected to an Epson PX-16 computer. Each determination was the mean of five replications. The increase in conductance due to the release of electrolytes in solution, was measured at each time as the difference to the initial value that was assumed as 0.

RESULTS

In glasshouse tests, isolates 122, 128,424,871 and 1192 were virulent on the cultivar LV and caused death of plants or severe wilt symptoms. Isolate 167 and 809, were avirulent and did not cause any damage after two months from inoculation (Table I). On ST all the seven isolates were avirulent and no disease symptoms were observed during the experiments.

Table 1. Isolates of y. dahliae and their virulence on eggplant, cultivar 'Lunga violetta'.

Isolate	Host	Virulence
122	Capsicum annuum	4
128	Capsicum annuum	3
167	Lycopersicon esculentum	0
424	Solanum melongena	4
809	Capsicum annuum	0
871	Solanum melongena	3
1192	Capsicum annuum	4

On calli from the cultivar LV all culture filtrates of y.dahliae, as well as growth medium, caused a release of electrolytes that increased with incubation time. The electrolyte loss caused by 5% filtrate solutions of three out of the five virulent isolates (122, 128, and 871), of the two avirulent isolates (167 and 809) and of the growth medium was not statistically different (Fig. I). With 10% filtrate solutions, all the virulent isolates induced a loss of electrolytes significantly higher than that caused by the avirulent ones (Fig. 1).

On the resistant genotype ST no statistically significant differences were observed in electrolyte leakage caused by all isolates. In Fig.2 the values of conductivity in 10% solutions of one avirulent isolate (809) and one virulent isolate (1192) assayed with calli of both genotypes, are compared. Significant differences in loss of electrolytes from susceptible and resistant genotypes were only detected with the virulent isolate.

These preliminary results show that electrolyte leakage may be used to distinguish between virulent and non virulent isolates of y.dahliae and between susceptible and resistant cultivars of eggplant. More isolates of the fungus and a larger number of eggplant genotypes will be tested to confirm the reliability of the method.

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(Research sopported by National Research Council of Italy; Special project RAlSA, subpr. 2)

Fig.1. Electrolyte losses from calli of the susceptible cultivar 'Lunga violetta' of S.melongena induced by the growth medium (NAC) and culture filtrates (5 and 10% concentrations) of virulent and non virulent isolates of V.dahliae at different times. Conductance values expressed in microsiemens (μS) are average of 5 replications. Different letters indicate significantly differences at P=0.05.

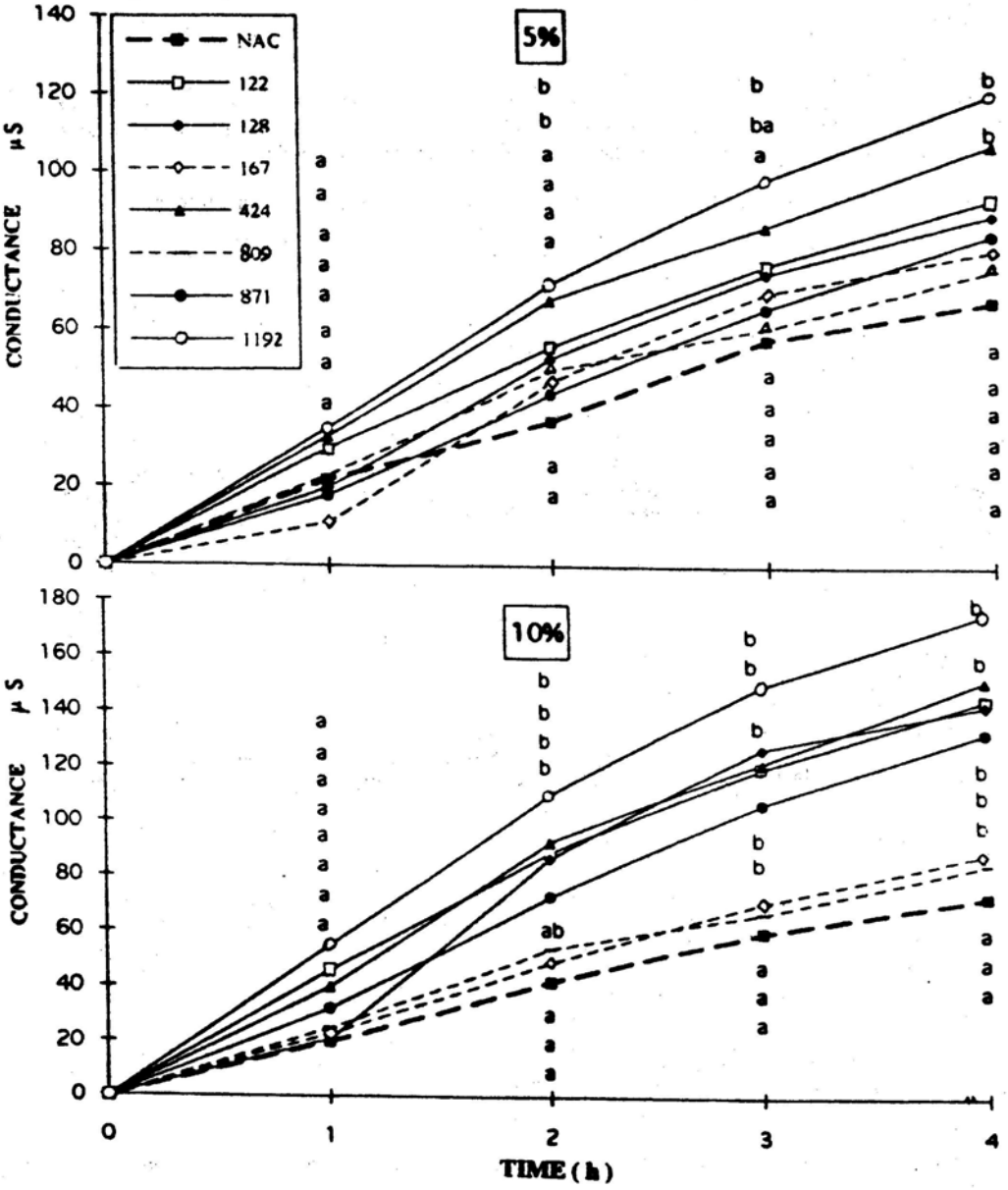

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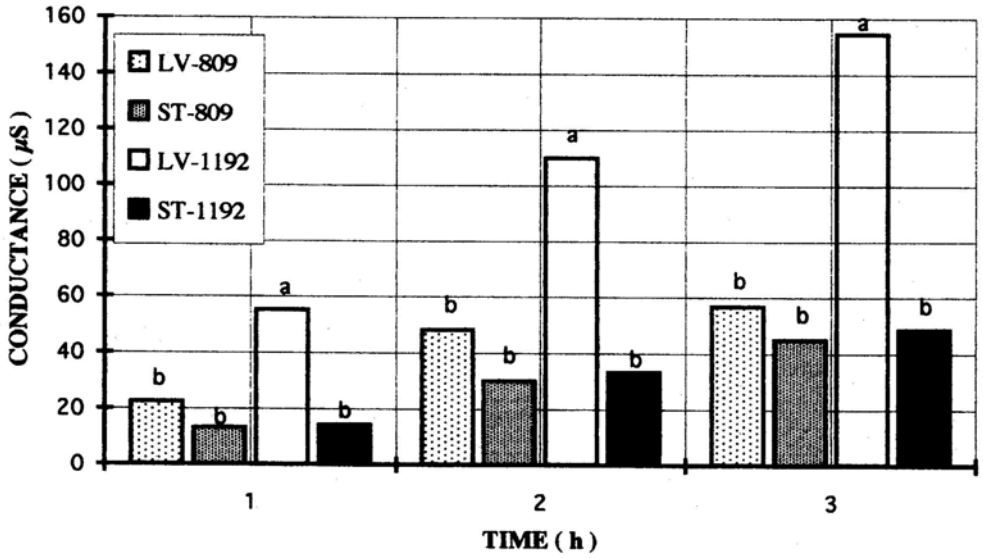
Fig.2. Effect of 10% culture filtrates of the virulent isolate 1192 and the non virulent isolate 809 of V.dahliae on calli of the susceptible cultivar 'Lunga violetta' (LV) and of the resistant accession of S.torvum (ST). Conductance values expressed in microsiemens (μS) are average of 5 replications. Different letters indicate significantly differences at P=0.05.



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CROATIA
Faculty of Agriculture, 41000 ZAGREB Podravka, 43300 COPRIVNICA
Povrtlarski Center Zagreb, 41000 ZAGREB
. **CUBA**
Centro de I.nformacion y Documentacion Agropecuario, LA HABANA 4
Dept. de Proteccion de Plantas, INIFAT, calle 1 esquina 2, CIUDAD DE LA HABANA
Horticulturallnst. Liliana Dimitrova, Ministry of Agriculture, Research Network, LA SALUD-LA HABANA

Inst. de Investigaciones Fundamentales en Agricultura Tropical, Ministry of Agriculture, Research Network, CIUDAD HABANA
IRTA, HAVANA
Universidad de Matanzas "Cienfuegos", Dir. de Informacion Cientifico Tecnica, Seleccion, Adquisicion y Canje, MATANZAS
CYPRUS
Agricultural Research Institute, Ministry of Agriculture and Natural Resources, A THALASSA, NICOSIA
CZECH REPUBLIC
Academy of Sciences of the Czech Republic, 111 42 PRAHA 1
Dept. of Genetic Resources, Div. of Genetics and Plant Breeding, Inst. of Plant Production, 161 06 PRAGUE 6 Inst. of Experimental Botany, Academy of Science of the Czech Republic, 77200 OLOMUC Research Inst. of Vegetable Growing and Breeding, 772 36 OLOMOUC 7
DOMINICAN REPUBLIC
Instituto Superior de Agricultura, SANTIAGO
ECUADOR
Instituto Nacional de Investigaciones Agropecuarias, QUITO, PICHINCHA
EGYPT
Faculty of Agriculture, KAFR-EL-SHEIKH
Faculty of Agriculture, University of Mansoura, SHARIA EL-GOMHOURIA, MANSOURA
Horticultural Research Institute, Agricultural Research Center (ARC), Ministry of Agriculture and Food Security, GIZA,
ORMAN, CAIRO
ELSALVADOR
Centro Nacional de Technologia Agropecuaria, SAN SALVADOR
Centro Nacional de Technologia Agropecuaria, SAN ANDRES-LA LIBERTAD Universidad de EI Salvador, Ciudad Universitaria, SAN SALVADOR
ETHIOPIA

Bako Agricultural Research Center, BAKO SHOA
FAO Representative in Ethiopia for ETH/87/001, ADDIS ABABA
Institute of Agricoltural Research (IAR), Nazareth Research Station, NAZARETH Institute of Agricultural Research, Horticultural Department, ADDIS ABEBA Plant Genetic Resources Center, ADDIS ABEBA
FIJI
Sigatoka Research Station, SIGATOKA
FRANCE
CIRAD-IRAT, Documentation, B.P.5035, Av.Val de Montferrand, 34032 MONTPELLIER
Clause Semences Professionnelles, Dr. C. Basterreix-Vergez, Mas St. Pierre, 13210 ST. REMY DE PROVENCE Ecole Nat. Sup. d'Horticulture, 78009 VERSAILLES
Ets Asgrow-France B.P. n.5, 37270 MONTLOUtS-SUR-LOIRE
Ets Vilmorin, Division Recherche, 49250 BEAUFORT EN VALEE . Graines GAUTIER, 13630 EYRAGUES
Griffaton Seeds, Centre de Recherches, Dr. C.Robledo, 30510 GENERAC INRA, Station d'Amelioration des Plantes Maraicheres - Bibliotheque, 84143 MONTFAVET -CEDEX ~ INRA,

Station d'Amelioration des Plantes Maraicheres - Anne Marie DAUBElE, 84143 MONTFAVET -CEDEX
INRA, Station d'Amelioration des Plantes Maraicheres - Daniel CHAMBONNET, 84143 MONTFAVET-CEDEX
INRA, Station de Pathologie Vegetale, Domaine Saint-Maurice, 84143 MONTFAVET -CEDEX
INRA-GEVES, Domaine d'Oionne, BP 1, Les Vigneres, 84300 CAVAILLON
Institut de Biologie Moleculaire des Plantes du CNRS, Bibliotheque, 67084 STRASBOURG CEDEX Institut de Recherches Vilmorin, Dr. Jean W. Hennart, Centre de la COstiere, 30210 REMOULINS
Laboratoire de Phytomorphologie, Experimentale Universite de Provence, 13331 MARSEILLE CEDEX 3
Laboratoire du Phytotron, C.N.R.S., 91190 GIF-SUR-YVETTE
MINISTERE de l'AGRICUL TURE, Groupe d'Etudes des Varietes et Semences, Domaine d'Oionne, CAVAILLON 84300 ORSTOM, 2051 Av. du Val de Mont Ferrand, 34032 MONTPELLIER
PALLOIX A., INRA, Station d'Amelioration des Plantes Maraicheres, 84143 MONTFAVET-CEDEX
Royal Sluis France, Research Department, 30900 NIMES
S & G Semences s.a., Centre de Recherche, J.L.Nicolet, 84260 SARRIANS
Societe Clause, 91220 BRETIGNY-SUR-ORGE
Station d'Amelioration des Plantes I.N.R.A.-C.N.R.A., 78000 VERSAILLES
TAKII Recherche France, Dr. Jacques Hallard, 13160 CHATEAURENARD
TEllER, Centre de Recerche, Documentation (Christine Rascle), Domaine de Maninet, 26000 VALENCE
GABON
Centre d'inttoducion, d'Amelioration et de Multiplication (ClAM), Ministere de I'Agriculture, LIBREVILLE
GERMANY
Fedral Center for Breeding Research on Cultivated Plants, Institute for Resistance Genetics, 85461 GRUNBACH Inst. fur Obst und Gemusebau (370), Universitat Hohenheim Peregrasweg, 17100 STUTTGART 70
Institut fur Pflanzengenetik und Kulturpflanzenforschung, Wissenschaftliche Bibliothek, 06466 GATERSLEBEN Karin Breun, Galgenhofer Str. 39, W-8522 HERZOGENAURACH
Plant Physiology Inst., Technical University of Munich, 8050 FREISING-WEIHENSTEPHAN
Universitat Bonn, lentralbibliothek-Landbauwissensch. leitschriften lugangstelle, 53014 BONN
GHANA
A.A. Opoku, KUMASI
University of Ghana, Faculty of Agriculture, Department of Crop Science, LEGaN
GREAT BRITAIN
Acquisitions Unit (DSC-AO), British Library Boston Spa, WETHERBY - W YORKS LS23 7BQ
C.A.B., International Plant Breeding Abstract, Wallingdorf, OXON OX10 8DE
Dept. of Agricultural Botany, Plant Sciences Laboratories, University of Reading, READING RG6 2AS
Horticulture Research International, WARWICK CV35 9EF.
Institute of Horticultural Research, Worthing Road, West Sussex BN17 6LP

Library and Information Services, Section N.R.I., KENT ME4 4TB ";' Schering Agrochemicals Ltd., SALLRON WALDEN-Essex CB10 1XL
School of Biological Sciences, Birmingham University, BIRMINGHAM B15 211 1
Scottish Crop Research Inst., Invergowrie, DUNDEE 002 5DA

GREECE
Costas Lepeniotis, P.O.Box 10637,54110 THESSALONIKI
Greek Gene Bank, 57001 THESSALONIKI
Inst. of Vegetable Crops, HERAKLION-CRETE 711 1 0
GRENADA
C.A.R.D.I., ST. GEORGES
GUADELOUPE (FRENCH W. INDIES)
INRA-CRAAG, 97184 POINTE-A-PITRE
GUAM
College of Agriculture, University of Guam, 96923 MANGILAO
GUATEMALA
Academia de Ciencias Medicas, Fisicas y Naturales de Guatemala, Apartado Postal 569, GUATEMALA CITY ICTA, Ave. La Reforma P-60, Zona 9, GUATEMALA
La Facultad de Agronomia de la Universidad Rafael Landivar
La Facultad de Ciencias Medicas de la Universidad de San Carlos, SAN CARLOS
Universidad de S. Carlos de Guatemala, Centro de Documentacion e Informacion Agricola, GUATEMALA ...

GUINEA BISSAU
Centre Pilote des Actions MaraTcheres (CEPAM), Ministere de I'Agriculture, DALABA Service Agricole Autonome de Bissau (SMB), Ministere de I'Agriculture, BISSAU
GUYANA
C.A.R.D.I., 44 Brickdam, GEORGETOWN
Guyana School of Agriculture, EAST COAST DEMERARA IICA, Antilles Zone, QUEENSTOWN, GEORGETOWN
HAITI
Ferme experimentale "Damien", Ministere de I'Agriculture, PORT-AU-PRINCE \
HONDURAS
Escuela Agricola Panamericana, TEGUCICALPA
Federacion de Productores y Esportadors Agropecuarios y Agroindustriales de Honduras - FPX, SAN PEDRO SULA Fundaci6n Hondurena de Investigaci6n Agricola, SAN PEDRO SULA, CORT~S
HUNGARY
Agricultural Biotechnology Center, 2101 GODOLLO
Agricultural Research Inst. of the Hungarian Academy of Sciences, 2462 MARTONVASAR
ANDRASFALVY A., Agricultural Biotechnology Center Institute for Plant Sciences, H-2101 GODOLLO CSILLERY Gabor, Budakert Ltd., H -1114 BUDAPEST
Enterprise for Extension and Research in Fruit Growing and Ornamentals, Dept. Ornamentals, H-1223 BUDAPEST Institute for Fruit and Ornamental Growing, FERTOD H-9431

Institute of Vegetable Growing, University of Horticulture, 1118 BUDAPEST Library, Seed Production and Trading Company, 6601 SZENTES Library, Vegetable Crops Research Institute, 6001 KECSKEMET
National Institute for Agricultural Quality Control, 1024 BUDAPEST
Plant Breeding Center, Vetomag, Trading House Co. Ltd., 6601 SZENTES Plant Healths and Soil Protection Station, HODMEZOVASARHEL Y
Plant Protection Institute, Hungarian Academy of Sciences, 1525 BUDAPEST Research Centre for Agrobotany, N.I.A.V.I.T., 2766 TAPIOSZELE
Research Station of Agricultural University, 4014 PALLAG-DEBRECEN
Szegedi Paprika Food processing and Trading Company, 6725 SZEGED
University of Agricultural Sciences, Faculty of Agricultural Sciences, Institute for Plant Protection, 8361 KESZTHEL Y
University of Horticulture and Food Industry, Department of Plant Pathology, 1118 BUDAPEST
Vegetable Crops Research Institute, Research Station Budapest, 1724 BUDAPEST
Vegetable Crops Research Institute, Research Station Kalocsa, KALOCSA 6300 .I VETOMAG Seed Growing and Trading Enterprise, J.Malik, 1364 BUDAPEST
ILE DE LA REUNION
IRA T --CIRAD-Reunion, REUNION
INDIA
Ankur Agric. Research Laboratories, NAGPUR 440 018 GRAM
AVT Research Foundation, Dr. D.C. Sastri, P.B.No 1685, PERUMANOOR P.O.-COCHIN 682 015
Biotechnology Research Center, Department of Agricultural Botany, Punjabrao Agricultural University, AKOLA 444 104 - MAHARASHTRA ST.

Burdwan University, BURDWAN 713 104
Central Experimental Station, DAPOLl415 711 (Dist.Ratnagiri-Maharashtra)
CHES HINOO HOUSE, RANCHI - Biharstate .,
Chillies Export House Ltd., VIRUDHUNAGAR - 626001 .
College of Agriculture, Orissa University of.Agriculture and Technology, ORISSA *i;*.
Cotton Research Units, CRS, Punjabrao Krishi Vidyapeeth, AKOLA - 444 104 (Maharashtra)
Dept. of Botany, Dharmpeth Science College, NAGPUR 440010
Dept. of Botany, Cytogenetics Laboratory, Nagarjuna University, Guntur Dist. (A.P.) Dept.. of Botany, Kakatiya University, Mutation Breeding, WARANGAL 506 009 A.P. Dept. of Botany, University of Rajasthan, JAIPUR - 302 004
Dept. of Horticulture, Banaras Indu University, VARANASI 221 005
Dept. of Horticulture, College of Agriculture, HYDERABAD 500 030 A.P.
Dept. of Plant Pathology, J.N.Agricultural University, Zonal Agric. Research Station, CHHINDWARA 480002 (MP) Dept. of Plant Pathology, Punjab Agricultural University, LUDHIANA Punjab 141 004
Dept. of Vegetable Crops Landscaping and Floriculture, Punjab Agricultural University, LUDHIANA - 141 004 ::
Dept. of Vegetable Science, College of Agriculture, Himachal Pradesh, PALAMPUR - 176 062
Div. of Mycology and Plant Pathology, I.A.R.I., NEW DELHI 110 012
Div. of Plant Genetic Resources, Indian Inst. of Hortic. Res., 255 Upper Palace Orchards, BANGALORE 560 080 ~ (Kamataka)

Div. of Vegetable Crops, Indian Inst. of Horticultural Res., BANGALORE 560 089
Haryana Agricultural University, Department of Plant Pathology, Prof. Narayan Rishi, HISAR - 125004 I.A.R.t. Library, NEW DEHLI-110 012 I.C.A.R., NEW DELHI 110 001
Indian Agricultural Research Institute, KATRAIN - Kullu Valley - HP 175 129
Indo-American Hybrid Seeds, Research and Development, 214 Palika Bhavan R.K Puram, NEW DELHI-110 066 Kerala Agricultural University, Dept. of Olericulture, College of Horticulture, THRISSUR - KERALA Library, MAHATMA PHULE Agricultural University, Dist.Ahmednagar [M.S} Library, Punjabrao Krishi Vidyapeeth, AKOLA - 444 104 (Maharashtra)
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Regional Fruit Research Station, ANANTHARAJUPET 516105
Self Employment Training Inst., Pudupudur S..R.K.V. Post, COIMBATORE 641 020 (Tamil Nadu)
Sher-e-Kashmir, University of Agricultural Sciences and Technology, Division of Olericulture and Floriculture, SRINAGAR KASHMIR 191121
Tamil Nadu Agricultural Univ., Agricultural Research Station, TAMILNADU - PALUR 607113
Tamil Nadu Agricultural Univ., Horticultural Research Station, UDHAGAMANDALAM 643 001 V. Ramsundar, 7 Karia Kara Vilai, NAGERCOIL 629001

INDONESIA

Central Research Inst. for Horticulture (CRIH), Head office, PASAR MINGGU, JAKARTA
LEHRI, library Project ATA, 395 Kotak Pos 1427, BANDUNG 40 014
LERIH, Research Institute for Horticulture, Jln. Tangkuban Perahu 517, WEST JAVA
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IRAN

College of Agriculture, KARAJ - TEHRAN

IRAQ .. College of Agriculture, University of Baghdad, JADIRIY A - BAGHDAD .

ISRAEL

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Hazera Seed Company, Research Division, 79570 SDE GAT SHIFRISS Chen, The Volcani Center, BET DAGAN 50250

ITALY

AGROTEC, 00192 ROMA RM
Azienda Agricola MFN di Mario Faraone Mennella & C., 80100 NAPOLI NA
Biblioteca, Istituto Agronomia Generale, 40126 BOLOGNA BO
Cattedra di Miglioramento Genetico, Facotta di Agraria. 80055 PORTICI NA
CLAUSE IT ALIA, 10078 VENARIA REALE TO
Consorzio VITROCOOP, Centrale ortofrutticola, 47027 CESENA FO
DI.VAP.R.A., Plant Breeding and Seed Production, 10126 TORINO TO
DI.VA.P.R.A" Pathology, 10126 TORINO TO
Dipartimento di Agronomia e Genetica Vegetale, Facolta di Agraria, 80055 PORTICI NA .
Dipartimentodi Agronomia Selvicoltura e Gestione del Territorio, 10126 TORINO TO
Dipartimento di Biologia, Sezione Genetica e Microbiologia, 20133 MILANO MI
Dipartimento di Genetica e di Microbiologia, Universita, 27100 PAVIA PV
Dr. Jean M. Poulos, ASGROW ltalia, 04014 PONTINIA l T ENEA Casaccia, Dipartimento FARE, 00100 ROMA RM
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FAO/IPGRI, Plant Production and Protection Division C 706,00100 ROMA RM
Istituto del Germoplasma, 70126 BARI BA
Istituto di Agronomia, 07100 SASSARI SS
Istituto di Agronomia, 20133 MILANO MI
Istituto di Agronomia, 35100 PADOVA PO
Istituto di Agronomia, 50144 FIRENZE FI
Istituto di Agronomia, 70126 BARI BA
Istituto di Agronomia Generale e Coltivazioni Erbacee, Facolta di Agraria, 40126 BOLOGNA BO
Istituto di Allevamento Vegetale, 06100 PERUGIA PG
Istituto di Botanica Agraria e Genetica, Facolta di Agraria, Universita Cattolica, 29100 PIACENZA PC . ,
Istituto di Coltivazioni Arboree, 50144 FIRENZE FI
Istituto di Genetica, 40126 BOLOGNA BO
Istituto di Miglioramento Genetico, Facolta di Agraria, Universita Tuscia, 01100 VITERBO VT
Istituto di Nematologia Agr. Appl., C.N.R., 70126 BARI BA
Istituto di Orticoltura e Floricoltura, 56100 PISA PI
Istituto di Orticoltura e Floricoltura, 90122 PALERMO PA
Istituto di Orticoltura e Floricoltura, 95123 CATANIA CT
Istituto di Patologia Vegetate, 40126 BOLOGNA BO
Istituto di Patologia Vegetale, Facolta di Agraria, 80055 PORTICI NA
Istltuto di Patologia Vegetale, Facolta di Agraria. Prof. M.Marte, 06100 PERUGIA PG
Istituto Ricerche Orto-Floro-Frutticoltura, 22070 MINOPRIO CO
Istituto Sperimentale per l'Orticoltura, Sezione Operativa, 20075 MONTANASO LOMBARDO - MI
Istituto Sperimentale per rOrticoltura, Sezione Operativa, 63030 MONSAMPOLO D. TRONTO AP
Istltuto Sperimentale per l'Orticoltura, Dr. V. Magnifico, 84098 PONTECAGNANO SA

Istituto Sperimentale Valorizzazione Tecnologica Prodotti Agricoli, 20133 MILANO MI
Laboratolio Fitovirologia Applicata,C.N.R" 10135 TORINO TO
Laboratorio Valorizzazione Colture Industrial,i ENEA-CASACCIA, 00060 S. MARIA 01
GALERIA ROMA Metapontum Agrobios, 75011 MET APONTO MT
NUNHEMS SEMENTI s.r.i., 40019 SANTAGATA BOLOGNESE BO OlTER
Sementi,14100ASTI AT
ORIS, Dr. F.Vecchio, 20090 SAlERANO SUl LAMBRO MI
PETO ITAlIANA s.r.i., Centro Ricerche, 04010 BORGO SABOTINO LT
S.A.I.S. S.p.A., Centro Ricerche e Miglioramento Genetico, 47023 CESENA FO SEMENCOOP S.c.r.i., 47020 MARTORANO 01 CESENA FO
Stazione Sperimentale Industrie e Conserve AJimentari, 84012 ANGRI SA

IVORY COAST

Compagnie lvoirinne pour Ie Developpement des Cultures Vivrieres (CIDV), BOUAKE Faculty of Science, ABIDJAN 04
Institut des Savanes, Department des Cultures Vivrieres, BOUAKE

JAMAICA

Bodies Agricultural Research Station, ST. CATHERINE
National Agriculture Research Institute, Ministry of Agriculture, KINGSTOM

JAPAN

Academy Kita-Osaka Co. Ltd., Yonezawa Bldg. Dai.6 Esaka 3F, Suita OSAKA 564 Agriculture Forestry and Fisheries Research Council, TOKYO Aoki Yosho Ltd., 1.58-14 Matsubara, TOKYO 156

Dept. *of* Breeding, Vegetable & Ornamental Crops Research Station, KUSAVA - AGE - MIE 514-23 Dept. *of* Greenhouse Cultivation, V.O.C.R., TAKETOYO -CHISTA - AICHI Faculty *of* Agriculture, Kagawa University, 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
Japan International Research Center *of* Agricultural Sciences, TSUKUBA 305 IBARAKI Kihara Inst. for Biological Res., Yokohama City Univ., YOKOHAMA~SHI
Kimio ITO, Vegetable Breeding Nagano, Chushin Agricultural, Shiojiri - NAGANO 399-64
Laboratory of Vegetable and Ornamental Horticulture, Faculty *of* Agriculture - Kyoto University, KYOTO 606 Morioka Branch, V.O.C.R.S., MORIOKA 020-01
Nationallnst. *of* Agrobiological Resources, YATABE IBARAKI
National Research Inst. *of* Veget. Ornamental, Plants and Tea, Lab. *of* Breeding Soian. Vegetables, ANO AGE-GUN MIE 514-23
Nihon Horticultural Production Institute, 207 Kamishiki, MATSUDO-SHI CHIBA-KEN 271 ~
NIPPON DEL MONTE Corp., Research and Development, NUMATA, GUMMA 378 OHTA Yasuo, TSUKUBA - SHI 305
SAKATA SEED Corp., Kakegawa Breeding Station, Dr. K. Miyoshi, KAKEGAWA - SHIZUOKA 436-01 ~
Sakata Seed Corp., Plant Biotechnology Center, Toshio Shiga, SODEGAURA, CHIBA, 299-02 ~
Shizuoka Agricultural Experimental Station, SHIZUOKA
The Nippon Shinyaku, Institute for Botanical Research, Oyake Sakanotsuji-cho 39, KYOTO 607
YUKURA Yasuo 46.7 3-Chome, TOKYO

JORDAN
Department *of* Agricultural and Scientific Research and Extension, AMMAN
Ministry *of* Agriculture, National Centre for Agricultural Research and Technology Transfer, BAQA'A 19381
KENYA , National Horticultural Research Station, THIKA
Department of Crop Science, University *of* Nairobi, NAIROBI
KIRIBATI
Agricultural Division, P.O.Box 267, TARAWA
KOREA DEMOCRATIC REPUBLIC
Pilot Greenhose Farm, PYONGYANG
Pyongyang Vegetable Research Center, PYONGYANG
KOREA, **REPUBLIC OF**
Choong Ang Seed Co. Ltd., Dr II-Woong Yu, CHEONAN CITY - CHOONG NAM 330-170
Department *of* Agricultural Biology, College *of* Agriculture and Life Sciences, Seoul National University, SUWON 441- 744
Department *of* Horticulture, College *of* Agriculture Seoul National University, SUWEON 170
Dept. of Horticulture, College of Agriculture, Kyungpook National University, TAEGU 702-701
Div. *of* Vegetable Breeding, Horticultural Experiment Station, SUWON 441-440 Horticultural Experiment Station, PUSAN 57111
HUNGNONG Seed Co., Joongbu Breeding Research Station, SEOUL
NONG-WOO SEEDS, Plant Breeding Research Institute, 387-2 Sasa-2Ri, HWASONG 445-820
OSAN, Breeding Institute, Choong-Ang Seeds Co. Ltd., HWASUNG KYOUNGGI445-810
SEOUL SEED International Co. Ltd., Chongill *BID* 736-17 Yeoksam-dong, SEOUL
KUWAIT
Agricultural Experimental Station, c/o Ministry *of* Public Works, SAFAT
LEBANON Plant Breeding Dept., Agricultural Research Inst., TRIPOLI ..
Faculty *of* Agricultural and Food Sciences, BEIRUT .
Institut de Recherche Agronomique du Liban (IRAL)
LESOTHO
Lesotho Agricultural College, MASERU 100
LIBERIA
CARl, Central Agricultural Research Institute, GBARNGA-BONG COUNTY CARl, Central Agricultural Research Institute, MONROVIA, SUAKOKO

LIBYA
Agricultural Research Station, TRIPOLI nI:~ National Bureau for Agricultural Consultations and Studies, TRIPOLI

MADAGASCAR
Centre National de la Recherche Appliquee au Development Rural, ANTANANARIVO (101)
MALAWI
Bunda College of Agriculture, University of Malawi, LILONGWE Bvumbwe Agricultural Research Station, LIMBE

The Officer-in-Charge, Chitedze Agricultural Research Station, LILONGWE The Principal Natural Resources College, LILONGWE

MALAYSIA
Dept. of Agronomy and Horticulture, University of Agriculture Malaysia, SERDANG - SELANGOR Dept. of Genetics & Cellular Biology, University of Malaya, KUALA LUMPUR 22-11 MARDI, KUALA LUMPUR
MARDI, Research Station JALAN KEBUN, SERDANG-SELANGOR MARDI, Tanah Rata 39007, Cameron Highlands - PAHANG
MALI
Institut d'Economie Rurale, Ministere de I'Agriculture, BAMAKO
MALTA
Department of Science, University of Malta, University Campus, MSIDA
MARTINIQUE , I.R.A.T.-C.I.R.A.D., FORT DE FRANCE
MAURITANIA
Centre Nat. de Recherche Agronomique et de D~veloppement de I'Agriculture, Ministere de I'Agriculture, Dept. de I'Horticulture, NOUAKCHOn
MAURITIUS
Ministry of Agriculture and Natural Resources, Agricultural Service, PORT LOUIS
MEXICO
Centro de Botanica, Colegio de Postgraduados, 56230 CHAPINGO-Estado de Mexico
Centro de Investigaciones Agricolas del Nord, INIA-SARH, 3300 CD. DELICIAS - CHIH.
Experimental Station Celaya, INIFAP, CELAYA-GTO 38000
Genetic Center, College of Postgraduate, 56230 MONTECILLO
IBPGR, Oficina para Latinoamerica, c/o CIMMYT, MEXICO 06600 D.F.
Instituto Nacional de Investigaciones Forestales y Agropecuarias (INIFAP), Dr. Juan Hernandez Hernandez, 93400 PAPANTLA-VERACRUZ
Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias (INIFAP), MEXICO CITY Instituto Nacional de. Investigaciones Agricolas, Apartado Postal C-1, TAMPICO Jose A. Laborde, CELAYA-GTO. 38040
Library, C.I.F.A.P., Campo Exper. del Sur de Tamaulipas Apartado Postal C-1, TAMPICO
MOROCCO
Complexe Horticole, Institut Agronomique et Veterinaire, Hassan I" AGADIR
Direction de la Production Vegetate, Ministere de I'Agrlculture et de la Reforme Agranre, RABAT
Division de la Documentation et de I'lnformation, Direction de /a Pianification et des Affaires Economiq., RABAT - DiVision de Recherches et Experimentations Foresters, Bibliotheque, RABAT - AGDAL
Ecole Nationale d'Agriculture, MEKNES
Ecole Nationale Forestiere des Ingenieurs, SALE Institut de Technoiogie Horticole, MEKNES
Institut National de la Recherche Agronomique, INRA, RABAT Societe du Developpement Agricole (SODEA), RABAT
MOZAMBIQUE
Facultad de Agricultura, Universidade Eduardo Mondlane, MAPUTO
MYANMAR
Institute of Agriculture, University of Yangon, University Estate, YANGON

NEPAL
National Agricultural Research and Servic Centre, Department of Agricultural Development Ministry of Agriculture, KATHMANDU
NEW ZELAND
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NICARAGUA
Istituto Superior Ciencias Agropecuarias, REGEN, MANAGUA
NIGER
Institut National de la Recherche Agronomique au Niger, (INRAN), NIAMEY

NIGERIA
Dept. of Agronomy, Inst. for Agricultural Research, Ahmadu Bello University, SAMARU - ZARIA
Dept of Crop Science, University of Nigeria, NSUKKA
National Horticultural Research Inst, Idi-lshin Jericho Reservation Area, IBADAN
NORWAY
Dept of Vegetable Crops, the Agricultural University of Norway, 1432 AA8-NLH I¥;
PAKISTAN
Pakistan Agricultural Research Council, ISLAMABAD
Vegetable Research Institute, FAISALABAD 38950
PAPUA NEW GUINEA
Department of Agriculture and Livestock, Headquarters, Sprint Garden Road, KONEDOBU
Department of Agriculture, Food Management Branch, Food Processing Preservat. Unit, LAE, MOROBE PROIVINCE
PERU
Dept. de Ciencias Agropecuarias, Universidad Nacional de San Agustin, AREQUIPA
Dept de Horticultura, Universidad Nacional Agraria, LA MOLINA-LIMA
Experiment Station LA MOLINA, LA MOLINA -LIMA HOLLE Miguel, LIMA 18
Instituto Nacional de Investigaci6n, Promoci6n Agropecuaria (INIPA), Sinchi Roca 2727 - Lince, LIMA 14
Julio A. QUEA, T ACNA
PHILIPPINES
College of Agriculture, Inst of Plant Breeding, Univ. of the Philippines at Los Banos, LAGUNA
3720 EAST-WEST SEED Company Inc., MAKATI (Manila)
POLAND
Academy of Agriculture, Inst of Genetics and Plant Breeding, 60-625 POZNAN Department of Plant Genetics, Breeding and Biotechnology, 02766 WARSAWA
Dept of Genetics and Plant Breeding, University of Agriculture, 60-198 POZNAN
Dept of Genetics, A. Mickiewicz University, 60-594 POZNAN
Inst of Plant Genetics, Polish Academy of Sciences, 60-479 POZNAN
POlAN Krakowska Hodowta, I Nasiennictwo Ogrodnicze, 30-130 KRAKOW Research Institute of Vegetable Crops, 96-100 SKIERNIEWICE
PORTUGAL
I.N.IA, Estacao Agronomica Nacional, OEIRAS

PUERTO RICO
Univ. de Puerto Rico, Rec. de Mayaguez, Colegio de Ciencias Agricolas, Estacion Exp. Agr. Subest de Isabela, ISABELA 00662
University of Puerto Rico, College of Agricultural Sciences, MAY AGUEZ 00708
ROMANIA
Research Inst for Vegetable and Flower Growth, 8268 VIORA JUD. GIURGIU
RUSSIA
All-Russian Research Institute of Vegetable Breeding and Seed Production, 143080 MOSKOV REGION
Boishoy Haritoniewsky, MOSKVA 8-78 Dept. of International Book Exchange, Central Scientific Agricultural Library, 107804 GSP-MOSCOW B-139 Majkop Research Station of Vavilov Institute of Plant Industry, 352772 MAJKOP REGION - SUNTUK N.I.Vavilon All Union, Inst. of Plant Industry, 190000 S. PIETROBOURG
Research Inst. on Vegetable Crop Breeding and Seed Production, 143080 ODINTSOV district

RWANDA
Institut des Sciencies Agronomiques du Rwanda (ISAR), BUTARE

SAMOA
Department of Agriculture, Ministry of Agriculture, APIA
SAO TOME AND PRINCIPE
Ministerio da Agricultura, Estacao Experimental, SAD TOME

SAUDI ARABIA
Department of Horticulture, Ministry of Agriculture, RIYADH

SENEGAL
Centre pour Ie Development de "Horticulture (ISRA), DAKAR
CORAF, Vegetable Research Network Attn. Alain Mbaye, DAKAR

SEYCHELLES
Direction Generale de la Production Agricole, Ministere de "Agriculture, GRAND'ANSE, MAHE Grand'Anse Experimental Centre GRAND'ANSE, MAHE

SLOVAK REPUBLIC

Research and Breeding Inst. for Vegetable and Special Plants, 94701 HURBANOVO Research and Breeding Institute for Vegetable and Special Plants, 94001 NOVE ZEMKY Research Breeding Station, Novofruct s.e., 94043 NOVE ZAMKY Slachttitelska Stanica, CRALOVA PRI SENCI
Vyskumnya slaschtitelsky ustav zeleniny-VRBANOVO, 93041 KVETOSLAVOV

SLOVENIA
Agricultural Institute of Slovenia, Dr. Mihaela Cerne, 61109 LJUBLJANA

SOLOMON ISLANDS
Dodo Creek Research Station, HONIARA

SOUTH AFRICA
Division of Plant and Seed Control, PRETORIA 0001

SPAIN

C.S.I.C., Estacion Experimental La Mayora, ALGARROBO-COSTA MALAGACentro de Investigaciones Agrarias, 26080 LOGRONO Clause Iberica S.A., PATERNA (Valencia)

Departamento de Bioquimica y Biologia Molecular, Universidad de Almeria, 04120 LA CANADA DE SAN URBANO Dept. de Biologia Animal y Vegetal, F. Merino de Caceres, Universidad de La Coruna, 15701 LA CORUI'JA Diputacion General de Aragon, Servicio de Investigacion Agraria, Seccion Documentacion y Bibliotheca, 50080 ZARAGOZA
Escuela de Capacitaci6n Agraria, DON BENITO (Badajoz) GIL ORTEGA R., D.G.A. - S.I.A., 50080 ZARAGOZA Horticulture Department, C.R.I.A., MURCIA
I.N.I.A., Dr.F.Ponz, 28080 MADRID
Instituto Nacionallnvestigaciones Agrarias., Cit. Centro Inv. y Tecn. Biblioteca, 28040 MADRID :-, Plant Protection Department, C.R.I.A., MURCIA
Polytechnical University of Valencia, Biotechnology Department, Dr. F. Nuez, 46020 VALENCIA Polytechnical University of Valencia, Plant Protection Department Pathology, 46020 VALENCIA Semi lias Fit6, BELLPUIG (Lerida)
Semillas Pioneer S.A., J. Riado Abad, 04710 EL EJIDO (ALMERIA) SEMILLAS RAMIRO ARNEDO, CALAHORRA-LOGRONO Sluis & Groot Semi lias, EL EJIDO-ALMERIA

SRI LANKA
Agricultural Research Station, MAHAILLUPPALLAMA

Central Agricultural Research Institute, GANNORUVA, PERADENIYA
Food Technology Section, Ceylon Inst. of Scientific and Industrial Research, COLOMBO
Government's Department of Agriculture, PERADENIYA
ST. LUCIA
C.A.R.D.I., CASTRIES
SUDAN
Agricultural Research Corporation, Horticulture Germplasm Unit, WAD MEDANI
Department of Horticulture, Faculty of Agriculture, University of Khartoum, SHAM BAT, KHARTOUM University of Gesira, Faculty of Agricultural Sciences, Dept. of Horticulture, WAD MEDANI
SUISSE
Nestec S.A, CH-1800 VEVEY "

SURINAM

Surinam Agricultural Experiment Station, Cultuurtuinlaan, PARAMARIBO '.

SWAZILAND
Agricultural Research Division, MALKERNS University of Swaziland, KWALUSENI

SYRIA
Faculty of Agriculture, Damascus University, DAMASCUS Faculty of Agriculture, University of Aleppo, ALEPPO

TAIWAN
RO.C. DAIS, T AINAN
Dept. of Horticulture, Nat. Chung Hsing Univ., TAICHUNG 40227 Dept. of Horticulture, Nat. Taiwan University, TAIPEI
Dr. Jan-Fen Wang, The Asian Vegetable and Research Development Center, SHANHUA - TAl NAN
Fengshan Tropical Hort. Exp. Stat., Fengshan - KAOHSIUNG
Information and Documentation, The Asian Vegetable Research and Development Center, SHANHUA TAl NAN 74199 Library, Taiwan Agric. Research Inst., WAN-FENG WU-FENG TAICHUNG
Lowell L. Black, The Asian Vegetable Research and Development Center, SHANHUA, TAINAN 741 National Chiayi, Inst. of Agriculture, CHIAYI
Taiwan Seed Improvement and Propagation Station, TAICHUNG
TANZANIA
Horticultural Training and Research Institute, Tengeru, ARUSHA Sokoine University of Agriculture, OAR ES SALAM
THAILAND
APTA, Phaya Thai Court, BANGKOK 10400
AVRDC, Thailand Outreach Program, Kasetsart University, (Kasetsart) BANGKOK 10903
CHIA TAl Company Limited, BANGKOK 10100
Div. of Horticulture, Dept. of Agriculture, Bagkhen - BANGKOK
EAST-WEST Seed Co. Ltd., Mr. S. J. de Joop, CHIANG MAl 50290 Faculty of Agriculture, Chiang Mai University, CHIANG MAl 50002
Horticulture Research Institute, Headquarters, Dept. of Agriculture, Ministry of Agriculture and Cooperatives,
BANGKOK 10900 *r* Thep Watana Seed Co. Ltd., BANGKOK 10500

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Bruinsma Seed b.v., Jurko Leij, 2670 AA NAALDWIJK
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De Ruiter Seed, 2665 BLEISWIJK
DE RUITER ZONEN, Dr. D. Vreugdenhil, 2691 RA 'S GRAVENZANDE
Enza laden, De Enkhuizer Zaadkandel b.v,. R.Kuijsten, 1600 AA ENKHUIZEN 78
EUCARPIA Secretariat, 6700 AH WAGENINGEN
Gebr. Bakker Zaadteelt Zaadhandel, 1723 LM NOORDSCHARWOUDE
Glasshouse Crops Research and Experiment Station, 2670 AA NAALDWIJK
Institute of Horticultural Plant Breeding, 6700 AA WAGENINGEN

Keygene NV, 8700 AE WAGENINGEN
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Rijk Zwaan Zaadteelt en Zaadhandel B.V., 2678 ZG DE LlER Royal Sluis, 1600 AA ENKHUIZEN

S & G Seeds, J. van Deursen, 2678 LV DE LlER
SAKATA SEED EUROPE B. V., Dr. Y. Kobayashi, 1435 DD RIJSENHOUT Scientia Horticulturae, AMSTERDAM
Sluis en Groot Seeds B. V., 2678 LW DE LlER
Swets & Zeitlinger B.V., Backsets Department, 2160 SZ LlSSE .. Van der Zaden B. V., Beethovenstraat 42, 5102 XB DONGEN

TOGO

Department de l'Agriculture, Ministere de I'Agriculture, YAOUNDE

TRANSNISTRIA MOLDAVIAN REPUBLIK

Inst. of Ecological Genetics of the Academy of Sciences, KISHINEV-277018
Transnistria Institute of Agriculture, Olga O. Timina, 278000 TIRASPOL

TRINIDAD AND TOBAGO

Caribbean Agricultural Research and Development Institute (CARDI), University Campus, ST. AUGUSTINE GCP/RLA/108/ITA, FAO, Chaguaramas, c/o FAO Representative's Office, PORT OF SPAIN

TUNISIA

Department of Biological Sciences, Faculty of Sciences, Library Research II, 1060 TUNIS '
Ecole Superieure d'Horticulture, CHOTT -MARIEM-SOUSSE
INRAT, Inst. National Recherche Agronomique de Tunisie, 2080 ARIANA INRAT, Laboratoire de Cryptogamie, 2080 ARIANA
Inst. National Agronomique de Tunisie, Lab. Cultures Maraicheres et Florales, 1002- TUNIS BELVEDERE Station d'Appui de la Medjerda, 2010 MANOUBA

TURKEY

Aegean Regional, Agricultural Research Inst., MENEMEN-IZMIR
Ankara University, Faculty of Agriculture, Department of Horticulture, ANKARA-Diskapi
Atatork Horticultural Research, Yalova Inst., ISTAMBUL
Department of Horticulture, Fac. Agriculture, Univ. Of Cukurova, 01330 ADANA
Department of Plant Pathology, Fac. Agriculture, Univ. Of Cukurova, 01330 ADANA Ege Universitesi, Ziraat FakOltesi Bitki Koruma B610mO, BORNOVA 35100-IZMIR Uludag Univ., Faculty of Agric., Dept. of Horticulture, BURSA Vegetable Research Institute, 07110 ANTALYA

U.S.A.

ASGROW E.P.G., KALAMAZOO - Michigan 49001
ASGROW SEED Company, Dr.R.Heisey, SAN JUAN BAUTISTA- CA 95045 Chili-Queen, TUCSON - ARIZONA 85704
College of Agricultural Sciences, University of Delaware, Department of Plant Sciences, NEWARK - Detaware 19717. Cornell University, Albert R. Mann, Library Acquisition Division, ITHACA - New York 14853 DE MARS Lawrence, MINNEAPOLIS-Minn 55410
Dept. of Agr. Engineering, Michigan State University, EAST LANSING -Michigan 48824-1323 ., 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, GENEVA-New York ~ Dept. of Horticulture, Louisiana Agricultural Exp. Stat., BATON ROUGE - LA 70803-2120 Dept. of Horticulture, Michigan State University, EAST LANSING - Michigan 48824

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, ITHACA - N.Y. 14853-1902
Dept. Plant Pathol. And Crop Physiol., Louisiana State University, BATON ROUGE - Louisiana 70803 Desert Botanical Garden, Richter Library, PHOENIX - ARIZONA 85008 Dr. Bradley Boese, SAGINAW - MICHIGAN 48601 Dr. Jean ANDREWS, AUSTIN - TX 78703
Extension-Research Center, ATTAPULGUS-Georgia 31715
Genetics Department, North Carolina State University, RALEIGH-NC 27695
Hortinnova Research Inc., Joseph Stem, SAN JUAN BAUTISTA -California 95045
FAS, University of Florida, Agric. Research and Education Center, FORT PIERCE - Florida 33454 IFAS, University of Florida, Agronomy Department, GAINESVILLE - Florida 32611-0621 IFAS, University of Florida, ARES BELLE GLADE - Florida 33430 IFAS, University of Florida, DELRAY BEACH-Florida 33444
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Petoseed Florida Research, Dr. Dale S. Kammerlohr, FELDA - FLORIDA 33930-0249
Rogers Food Co., Chili Products, Dr. P.A. Gniffke, 39502 Cypress Ave., GREENFIELD-CA 93927 ..
ROGERS SEED Co., Steven J. Czaplewski, BOISE -IDAHO 83711-4188 -"- Suburban Experiment Station, University of Massachussets, WAL THAM-Ma 02254
Texas Agr. Exp. Station, The Texas University, WESLACO - Texas 78596-8399.
The Pepper Gal National Hot Pepper Association, Dr. Elisabeth A. Payton, FORT LAUDERDALE - FL 33311 The Pillsbury Company, Technology Center, Att. Bonnie Moore, MINNEAPOLIS - MN 55414-2198
USDA, Agr. Mark. Serv., Plant Variety Protection Office, NAL Bldg.-Room 500, BELTSVILLE - Maryland 20705-2351
USDA, National Agricultural Library, Current Serial Records Rm 002, BELTSVILLE - Maryland 20705 USDA-ARS Southern Regional, Plant Introduction Station, EXPERIMENT-Georgia 30212 USDA-ARS-SM, Gilbert R.Lovell, GRIFFIN-GA 30223-1797
UGANDA
Library, Kawanda Agricultural Research Station, KAMPALA

UNITED ARAB EMIRATES
Agricultural Research Centre Digdaga, RAS AL KHAIMAH
URUGUAY
Centro de Investigaciones Agricolas "Alberto Boerger" (CIMB), LA ESTANZUELA, COLONIA

Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICYT), Reconquista 535 p 7, MONTEVIDEO
VENEZUELA
FUSAGRI, 2122 ARAGUA
Universidad de Oriente, ESTADO MONAGAS
VIETNAM
Vietnam Institute of Agricultural Science and Technology, HANOI
YEMEN
Hits Yemen (Cal Poly), SANA'A Y.A.R.
YUGOSLAVIA
Vegetable Research Institute, Palanka, 11420 SMEDEREVSKA PALANKA VITAMIN, Spice Pepper Breeding Station, 24420 HORGOS
ZAIRE
Institut National pour l'Etude et la Recherche Agronomique (INERA), KISANGANI
ZAMBIA
University of Zambia, LUSAKA
ZIMBABWE ..
Department of Agricultural, Technical and Extension Services (AGRITEX), Ministry of Lands, Agriculture and Rural Resettlement, HARARE
Department of Research and Specialist Services (R & SS), Ministry of Lands, Agriculture and Rural Resettlement, HARARE