

REPORT
of the
TOMATO GENETICS COOPERATIVE

Number 1 March 1951

Division of Truck Crops
University of California
Davis, California

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FOREWARD

The Tomato Genetics Cooperative is a group of workers who have a common interest in tomato genetics, and who are organized informally for the purpose of exchanging information and stocks. Participation is voluntary, and costs of activities are met by assessments to members. The first activity of the Cooperative has materialized in the issuing of this Report.

The number of workers who have expressed an interest by stating their desire to join the group and the number of research articles contributed on relatively short notice leaves little doubt that interest in this Cooperative is strong and that it might prove useful in stimulating greater cooperation among workers and in otherwise advancing research in tomato genetics.

The possibility that articles in the TGC Records might be cited as references raises several important and related questions. Since the reports will have a limited distribution, should articles in them be cited? If they can be cited and if permission for citations is usually granted, are permission and the caution against the use of articles really necessary? How widely should the report be distributed? Correspondence with several members has helped in clarifying the nature of some of these problems. It seems unlikely that all of the problems will be settled to everyone's satisfaction. At least we hope that the service that the Report might render will favorably overbalance problems that it might create. The policy that is finally adopted should be based on the majority desire of the members gleaned through correspondence. Ideas will always be welcome, and the call for articles (probably in October) for the next issue will invite more discussion.

Since a policy of some sort had to be stated in this first Report, the following was arbitrarily adopted. This Report is issued primarily for the use of the members of the Tomato Genetics Cooperative. None of the information in the Report may be used in publications without the consent of the respective authors.

Although it is felt that most of the interested workers at present will receive the reports, others might need to refer to them in the future. In an attempt to meet the problem of distribution, many extra copies have been mimeographed and will be stored with the stencils at Davis for future needs. Librarian R. R. Shaw has kindly consented to file two copies in the U. S. Department of Agriculture Library from which photoprints can be secured. The same arrangement will be made with the Agriculture Library of the University of California (Berkeley).

The help of many people in preparing the Report is gratefully acknowledged. Mrs. Mildred Stearns typed the stencils. Dora Hunt, Martha Rick, and Shigeyoshi Hayashi helped in other phases of the work.

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PART I RESEARCH NOTESBarham, W. S. and Ellis, D. E.

Sources of resistance to late blight and southern bacterial wilt.

In testing for resistance to S.B.W. all the P. I. lines were inoculated in the seedling stage in the greenhouse; some 200 lines survived this inoculation.

Seeds of these 200 lines were again planted and the plants were inoculated in the seedling stage; lines having 50% or more of their plants survive this inoculation were set in a field in which almost 100% of the check (uninoculated susceptible) plants became infected with S.B.W. Twenty-six of these P. I. lines had plants showing no external symptoms or internal discoloration and have been listed as possessing resistance.

Plants of all these lines were set at Transou, N. C. at an elevation of over 3000 feet. Normally tomatoes in this area are killed by Late Blight; this year was no exception - lines with little or no resistance were wiped out early in the season. Lines having plants that had little infection were classified as being resistant. There were only 28 of the 909 P. I. lines that were classified as possessing some resistance.

Lines Resistant to Late Blight

<u>North Carolina</u> <u>line</u>	<u>P. I.</u> <u>Number</u>	<u>North Carolina</u> <u>line</u>	<u>P. I.</u> <u>Number</u>	<u>North Carolina</u> <u>line</u>	<u>P. I.</u> <u>Number</u>
1950-8-1	91,913	1950-153-N	117,898	1950-351-N	127,809
26-1	92,865	179-1	118,790	395-1	128,236
30-1	95,584	227-N	123,538	432-N	128,277
32-1	95,586	234-N	124,132	449-N	128,445
84-N	110,597	251-N	126,408	521-N	128,990
86-N	110,946	287-N	126,907	566-N	129,065
96-N	114,038	294-N	126,914	755-N	146,129
99-1	114,492	305-1	126,925	757-1	146,609
99-N	"	330-N	126,951	767-1	153,168
104-N	114,967	331-1	126,952		

Lines Resistant to Southern Bacterial Wilt

<u>North Carolina</u> <u>line</u>	<u>P. I.</u> <u>Number</u>	<u>North Carolina</u> <u>line</u>	<u>P. I.</u> <u>Number</u>	<u>North Carolina</u> <u>line</u>	<u>P. I.</u> <u>Number</u>
1950-76-1	109,833	1950-126-3	115,218	1950-340-1	127,798
91-1	112,215	-4	"	344-1	127,802
97-1	114,490	-5	"	344-2	127,802
97-2	114,490	-6	"	344-3	127,802
98-1	114,491	-7	"	357-2	127,817
98-2	"	137-1	115,951	358-1	127,818
107-1	115,194	226-1	123,438	-2	"
108-1	115,195	251-1	126,408	364-1	127,824
112-1	115,200	283-1	126,820	400-1	128,241
112-2	115,200	286-1	126,906	552-1	129,051
120-1	115,210	290-1	126,910	557-1	129,056
120-2	"	337-1	127,795	-2	"
126-1	115,218	337-2	127,795	571-1	129,070
-2	"	339-1	127,797		

The degree of resistance has not been fully determined; therefore, no percentage designation is attempted.

Barton, D. W. Cytological studies.

Mapping of the pachytene chromosomes of the tomato (Barton, Amer. J. Bot. 37 (7): in press 1950) has made possible cytologi-

cal studies not previously adaptable to this plant. Several lines of cytogenetic research are now in progress.

1. Translocations. A series of translocations have been selected from F_1 progeny from X-ray treated pollen. All translocations identified thus far have caused about 30% pollen abortion in the heterozygote. Pachytene configurations are as expected and synapsis is quite good in most translocations. Rings, chains, pairs and univalents are found at diakinesis, and the proportion of these configurations can be used to identify the translocation at diakinesis. Table 1 indicates the percentage of the associations at diakinesis for some translocations.

Table 1

Translocation	Ring IV	Chain IV	12 _{II}	10 _{II} plus 1 _I	1 _{III} plus 1 _I	11 _{II} plus 2 _I
T 2-12*	--	63	33	3.3	0.7	
T 9-12	36	58	4	2	--	
T 3-8	21	75	3	1	--	
T 5-7	30	54	10	6	--	
T 7-9	4	84	--	12	--	
T 1-9	2	68	30	--	--	

*Prometaphase data

2. Deficiencies. Plants deficient for chromosome segments in the heterozygous condition have (thus far) had accompanying changes evident in plant morphology. Physiological upset ranges from extreme to slight. Work is in progress to determine the degree of transmission of these deficiencies through the pollen and ovules. Pollen abortion is over 50%.

3. Species. The pachytene morphology of several *Lycopersicon* species has been mapped. Despite previous evidence that chiasma frequency at diakinesis (and presumably pairing at pachytene) are only slightly reduced in species hybrids, the pachytene morphology of other species deviates markedly from that of *esculentum*. *L. pimpinellifolium* and *L. cerasiforme*, which cross so easily with *esculentum*, have chromosome morphology similar to *esculentum*. On the other hand, *L. peruvianum* var. *dentatum*, *L. peruvianum* var. *humifusum*, and *L. hirsutum* chromosomes are much less similar, although certain chromosomes may be recognized as being homologous those of *esculentum*.

Bohn, G. W. Fertility relations in *L. hirsutum* and its hybrids with *L. esculentum*.

while working with tomato species crosses at Cheyenne, Wyoming several years ago, I did some work with *L. hirsutum* that I have not yet published. The *L. hirsutum*

plants used were unfruitful in the field and greenhouse, but eventually set some seeded fruits on plants about 2 years old in the greenhouse. The plants failed to set seeded fruits from flowers treated with *L. esculentum* pollen, but their pollen functioned perfectly in the reciprocal cross. The F_1 hybrids were self-sterile and cross-sterile with *L. hirsutum*. They set seedless fruits from flowers treated with *L. esculentum* pollen, but their pollen functioned perfectly in the reciprocal cross. These results are similar to those obtained by other investigators.

In addition to the diploid material, numerous amphidiploids were obtained from F_1 hybrids treated with colchicine. About half of the amphidiploids exhibited leaf necrosis progressing from the base of the plant upward. The others were apparently normal; they were large and vigorous and retained their green color very well. They were more fruitful than the diploid F_1 hybrids and set seedless fruits following self- and cross-pollinations.

Meiosis in diploid and amphidiploid hybrids was comparable with meiosis in diploids and autotetraploids of the parental species.

These studies suggested that L. hirsutum is basically cross-fertile with L. esculentum at the diploid level. Unfruitfulness of diploid hybrids may be like unfruitfulness encountered in many collections of L. hirsutum and may not indicate cross-sterility with L. esculentum. It would be interesting to determine whether all or part of this unfruitfulness results from self-sterility observed in the green-fruited species of Lycopersicon by Rick and his students.

Burdick, A. B. Behavior of diploid lines derived from haploids.

I originally had four haploids in my collection, the two listed, Hap. D-y and Hap. pimpinellifolium, as well as a very old Hap. d₁ and a recent Hap. San

Marzano ms. The Hap. d₁ and Hap. SM ms were lost in my collection but I believe Dr. J. B. Griffing at Iowa State still has Hap. d₁ and Dr. J. A. Jenkins at the University of California, Berkeley, has Hap. SM ms. I have diploid progeny from each of these except the San Marzano haploid.

In 1945 I took 12 cuttings of Dr. E. W. Lindstrom's Hap. D-y and decapitated them in order to get callus growth. When shoots appeared I pruned off all but one on each of the 12 and allowed it to go on and set fruit. Eight of the twelve produced seed and these are numbered 001 through 008 in my stock list.

In 1948 a few plants of each of these eight stocks were set out in the field. The following data were obtained:

<u>Stock No.</u>	<u>No. Plants</u>	<u>Fruit Skin Color (No. of Plants)</u>	
		<u>Yellow (Y-)</u>	<u>Colorless (yy)</u>
001	26		26
002	1		1
003	2	1	1
004	1		1
005	3	3	
006	2 (lost)		
007	4		4
008	7		7

Recalling that the original haploid was y, colorless skin, it is hard to explain the appearance of yellow skinned fruits in these doubled haploids. Other plant characters gave some indication of segregation also.

This apparent segregation from doubled haploids has led to further investigation with such lines. The pimpinellifolium haploid was doubled in 1949 and chromosome counts were taken on 100 randomly selected shoots. About half of these shoots were haploid, 24 were diploid, and the rest included periclinal chimaeras of 12-24, 24-48, and 12-48 chromosome numbers, three 13 chromosome haploids, four tetraploids, and one octaploid. Attempts are now being made to determine what morphological differences, if any, exist within and between these "homozygous" pimpinellifolium diploids.

Burcick, A. B. Polygenetics of heterosis.

Data are being gathered on the extent and causes of heterosis in the tomato. A method similar to Griffing's constant parent regression analysis has been developed. Green weight of plant probably manifests the greatest heterosis, with several "earliness" traits also showing considerable heterosis.

Butler, L. Linkage groups V, X, XI, and XII.

The character broad leaf (b or e) is independent of the characters in the known linkage groups. This has been tested by growing F_2 's of from 500-7000 plants. The recombination values and their errors derived from these data show no significant departures from 50%. The character broad leaf is therefore proposed as a marker for group eleven.

By similar tests macrocalyx has been found to be independent of all known groups and also shows no linkage with broad leaf. It is therefore proposed that macrocalyx (mc) be used as a marker for linkage group twelve.

The tenth chromosome character wilted foliage (wt) is linked with leafy inflorescence (lf) and jointless pedicel (j) in the fifth chromosome. Limited data indicates that it is on the opposite side of jointless to the locus of green stem (a₁). Backcross material is being prepared to confirm these locations. Nipple-tip (n) has been shown to be linked with wt but there is little data concerning its linkage relations with group five genes. The distance between j and wt is so great that if n is on the distal side of wt the linkage would be hard to detect. It is proposed that wt and n both be taken out of group ten and put in group five. It is further proposed that narrow cotyledon (nc) which so far has proved independent of other groups, be tentatively used as a marker for group ten.

Butler, L. Narrow cotyledon (nc)

In MacArthur's 1929 X-ray experiments with Earliana seed the mutant 263M was characterized by extremely slow growth and smaller cotyledons and leaves. After being selfed for several generations and selected for vigour the plant lost its slow-growing character and only retained the narrow cotyledons. Plants with this character have been crossed with a number of different P_1 's and the F_1 is perfectly normal while the F_2 gives good 3 to 1 ratios. A typical ratio for a repulsion cross with lutescent being Nc L 547 : Nc l 226 : nc L 191 : nc l 75 which gives a monohybrid Chi-square of 0.2 for narrow cotyledon.

A typical plant has cotyledons of normal length but only half as wide as normal. Since cotyledon size varies with the age and ancestry of the seed no single set of measurements would satisfactorily characterize nc, but it can be classified with certainty except in F_2 's segregating for dwarf. The thick broad cotyledons of dwarf plants are not as strongly modified and some d₁nc plants are apt to be classified as Nc.

Frazier, W. A. A stock with wide calyx base and resistance to cracking.

Thick calyx base and lobes. Protects stem end scar unusually well. Good resistance to cracking indicated in the field at Corvallis, 1950. Selected in Hawaii from a complex lineage involving two species - Lycopersicon hirsutum and L. esculentum. Backcrossed to L. esculentum in Hawaii, and further selected for wide calyx. Vine very bushy, fruits about 1½" diameter, quality poor. Inheritance of wide calyx character not known - being worked on at Oregon State College by graduate student, Lysle Parsons. Definitely different character from macrocalyx. Seed available from Oregon State College or University of Hawaii - preferably Hawaii's HES4402, or Oregon's OSC12.

Frazier, W. A. A variety with unusual ability to set fruit at low temperatures.

Mean minimum temperatures throughout the summer in the Willamette Valley are below 55°F. Observation of a large number of varieties in 1950 revealed, not unexpectedly, that varieties from England, Germany, Sweden were superior in their ability to set fruit at low temperatures. One of the most interesting was the variety Puck, received from Dr. M. B. Crane, John Innes Hort. Inst., Hertford, Herts, England. It is a determinate, very small vined, with medium size fruit, and unusual fruit setting ability.

Gilbert, J. C. Control of secondary organisms in root knot inoculum.

In an effort to determine the relationship between minor symptoms of nematode galling sometimes observed in the seedling readings and subsequent behavior of such plants

a series of twenty-five tile beds were planted with individual plants which showed either swollen root tips or tiny side galls but no heavy galling at the time seedling readings were made on month-old plants which had been heavily inoculated when sown. In each tile bed susceptible seedlings which had been started in sterilized soil were used as controls. Each tile bed was inoculated with galled tomato roots with subsequent heavy galling of all the controls. The resistant plants which had shown these "minor symptoms" in the seedling tests were completely free from anything which could be called real galling in every case when mature plant readings were made two and a half months after planting in the tile beds. A few very small side galls were found in a small percentage of the plants. These minor galls were so small that it is difficult to see how such plants could be classed as susceptible in view of the very complete, heavy galling of the controls. Seedlings from thirty individual plant selections were represented in this test.

The classification of seedling tomatoes segregating for resistance or susceptibility to nematode root knot has been complicated here in some of our tests by the appearance of numerous individuals with swollen root tips but no severe galling such as observed in the true susceptibles. In some cases the rootlets would present a stubby appearance due to first swelling of the tips and then abrupt termination of their growth. These symptoms in otherwise resistant seedlings appeared to be related to the presence of damping-off fungi and possibly other organisms in some of the old infested tomato roots used as nematode inoculum. In experiments with the control of damping-off organisms in partly rotted tomato root knot material it was found that a yellow cuprocide suspension (50 gr. CuO per 500 ml. water) gave fair control if the chopped roots were immersed for 24 hours and then drained and allowed to stand with the copper residue on the material for two or three days longer. If the condition of the root knot inoculum was quite bad with respect to decay of the galls and danger of seedling losses from damping-off, it was found that the yellow cuprocide was less effective than a heat treatment in making the inoculum safe. This heat treatment consisted of a 4-hour immersion of the inoculum in water at 38°C. or a longer period at the same temperature if the chopped roots are held under humid conditions but not in a water bath.

Further experiments with this heat treatment of old galled roots are now under way but the evidence to date indicates the existence of a wide enough margin between the heat tolerance of our locally more dangerous damping-off fungi and of the more resistant stages of the life cycle of Heterodera marioni to allow good control of damping-off in badly infested root knot inoculum without killing all the nematodes present. Susceptible seedlings exposed to such heat treated inoculum showed uniform but delayed galling with no damping-off and no swollen root tip symptoms. Controls showed heavy damping-off losses with greatly reduced growth in surviving plants. An instant dip in the yellow cuprocide suspension gave poor control of damping-off fungi in the inoculum compared with longer dips or with a combination cuprocide dip and heat treatment run simultaneously.

Griffing, B. The nature of gene action determining fruit yield and its components.

A rather critical examination has been completed of the relationships existing among the three variables, yield of tomatoes, and components of yield, total number of fruits per plant, and fruit weight.

The resolution of a complex variable into component parts allows at least two objectives: (1) an examination of the relationships existing among the components; a determination of the relative importance of these components and how they fit together into different patterns in the synthesis of the more complex variable such as yield, and, (2) a clarification of the genetic system in which gene models may be developed for the components and then combined to give a gene model for yield.

The experimental material involves six inbred lines and all possible F_1 's from these lines. The parents collectively exhibited tremendous ranges of expression for all characteristics. At the two extremes were the parents, *L. pimpinellifolium* having an average of 1287 fruits of .5 gms each, and, Matchless, a variety of *L. esculentum*, with an average of 16 fruits each of 142.6 gms.

The first problem was that of describing as exactly as possible in linear form the relationships existing between the three variables. Beginning with the arithmetic data which exhibited curvilinear, non-distinct relationships, the first improvement was made by choosing a scale of measurement by which the relationships were linear. Various scales were tried including forms of the logit, but the simple logarithmic scale gave the best results. Linear relationships were obtained with this scale between all variables and involving all parental and F_1 data grouped together.

The next step was to organize the experimental material into more homogeneous sub-groups. The first grouping isolated the parents as one set, and all the F_1 's as another. This accomplished two objectives. First it allowed the exact relationships of the parents to become evident. The exceedingly high correlations coefficients of $r_{12} = -.989$, $r_{13} = +.994$, and $r_{23} = -.999$ demonstrated how accurately a linear description was possible with the logarithmic transformation. These statistics also demonstrated that for these lines $\log(\text{fruit weight})$ is relatively more important in determining $\log(\text{yield})$ than $\log(\text{number of fruits})$. The second objective was that it allowed a contrast of the F_1 relationships with those of the parents. The differences found were obviously due to non-additively genetic effects generated by the heterozygous F_1 condition. The partitioning of the F_1 values into additively and nonadditively genetic components was accomplished and it was possible to demonstrate exactly the relative contribution of these two different types of genetic effects to the F_1 phenotypic statistics.

The last step in attempting to obtain as exact relationships among the F_1 's as possible was to group the F_1 's into constant parent groups (all F_1 's having one parent in common were put into a group labeled by the particular constant parent). With this procedure distinct relationships among the F_1 's were found which approached the exactness found among the parents. In these analyses it was discovered that each constant parent group of F_1 's yielded statistics different from those of the parents, and, again, these differences were due to the non-additively genetic effects. For example, the relative importance of $\log(\text{fruit weight})$ in determining $\log(\text{yield})$ changed radically but consistently through all constant parent groups from constant parent group (1) to (6). (Where c.p.g. (1) had the smallest fruited parent as common parent and c.p.g. (6) had the largest fruited parent as common parent).

By the above techniques yield in tomatoes was broken down into two simpler components, and the relationships leading to an integrated gene system were developed. Much of the puzzling behavior of non-additively genetic effects, whose relationships were quite different from those of the additively genetic effects, was clarified and made interpretable with the gene models which were developed in connection with the problem of describing the relationships existing among the variables.

Jenkins, J. A. Inheritance of
size and shape of fruit.

While this subject has occupied tomato geneticists for several decades, progress has been very slow. In the main this is due to the lack of satisfactory methods for dealing with multiple-gene-determined characters. However, in part, the slow progress has been due to the haphazard choice of material for hybridization studies. It would seem logical to begin a study of size and shape inheritance by surveying the distribution of tomato varieties throughout the world.

Only a beginning has been made in such a survey (Jenkins, 1948). Nevertheless a number of important facts have emerged. Probably the most important of these is that in areas of ancient cultivation (Mexico, Peru and the intervening countries), there are two main trends in the evolution of fruit size and shape. In the first of these, beginning with a small two-loculed berry of one gram or less in weight, there has been a gradual increase in locule size resulting in berries weighing up to 100 grams. Together with this increase in locule size, there has been an increase in the size of the seeds, the size of the placenta and most conspicuously an increase in thickness of the outer wall of the locules. Accompanying the increase in locule size there has been a gradual change in shape from spherical to oval (i.e. with a greater polar diameter). Present evidence indicates that the increase in locule size has been due to the accumulation of many gene mutations, the bulk of which are recessive. The basic oval shape of the larger two-loculed fruits may be further modified by additional mutant genes resulting in pear-shaped and nipple-tipped tomatoes.

The second main trend in the evolution of the tomato fruit has been an increase in the number of locules. This multiplication of locules has resulted in an increase in the equatorial diameter until ultimately the fruit becomes kidney-shaped. In contrast to the increase in size of locules, the increase in number of locules seems to have a simpler genetic basis. In some crosses the increase in locule number seems to be due largely to a single recessive mutation, in other crosses there are evidences of numerous modifying genes. The fact that there are multiflocular types with all sizes of locules indicates that there may have been several independent mutations to the multiflocular condition.

In contrast to the areas of primitive cultivation, where the multi-locular types have their locules radiating from a fibrous, central placenta there has been a third evolutionary trend, which is largely confined to the tomatoes of the United States. In this third type the locules are irregular in shape and scattered throughout a soft central placental region.

Crosses involving a representative sample of the different types are now under study and will be reported in greater detail at a later date.

Larson, R. E. and Pollack, B. L.
Green Stripe (gs) - A new
characteristic

During the summer of 1948, a local gardener brought samples of an unusual fruit-striping mutation of a single plant occurring in his garden. Seed was saved and plants grown in 1949. All plants bred true for the characteristic. Unfortunately the variety from which this mutant was obtained is unknown but it is believed to have been derived from Gulf State Market. The type of striping differs from that reported by Young and MacArthur (Texas Ag. Exp. Sta. Bul. 698. 1947) and is thought to be a new characteristic. It appears to be caused by irregular pigmentation of the inner epidermis. The affected layer has a high chlorophyll content as evidenced by the dark green stripes or blotches in the immature fruits of either the UU or uu type. In the maturation process the stripes or blotches maintain their green color for a longer period of time than on the remainder of the fruit. The pigmentation of the inner epidermis is sufficient to prevent the expression of the flesh color through the skin, although the characteristic does not affect the flesh color per se.

In the mature fruit of the R Y types the stripe appears gold in color. The R y segregates produce a beige colored stripe in contrast to the pink appearance of the remainder of the fruit. The exterior color of the r y fruits is a light translucent yellow in the normal and an opaque golden yellow in the presence of the affected layer.

The characteristic appears to be inherited as a monorecessive, as shown in the table, and has been given the gene symbol gs. It is highly probable the complete recessive promotes a high rate of mutation in the somatic cells of the inner epidermis, whereas the heterozygous or homozygous dominant prevents this expression. On the basis of preliminary studies, from F_2 data, there appears to be no association of gs with the characteristics d, r, c, a, and l.

Segregation in the F_2 generation for normal
and green stripe fruit types

Population No.	Normal		Mutant		P from χ^2 for 3 : 1
	Obs.	Calc.	Obs.	Calc.	
1	85	89.25	34	29.75	0.50 - 0.20
2	91	88.50	27	29.50	0.95 - 0.50
17	162	172.50	68	57.50	0.20 - 0.10
Total					0.50 - 0.20
Deviation	338	350.25	129	116.75	0.20 - 0.10
Heterogeneity					0.50 - 0.20

Lesley, J. W. and Lesley, Margaret M. Cabbage (cb), a simple recessive mutant that is conspicuously pleiotropic.

A new simple recessive gene mutant of the common tomato named "cabbage" with the symbol cb occurred spontaneously in our cultures. The number and variety of differences from normal sibs is exceptionally great. Cabbage has larger, darker

green leaves, inconspicuous inflorescences, and fewer and smaller fruits. It has fewer flowers per inflorescence and fewer loculi per ovary. Unilocular ovaries are more frequent in cabbage. Fertility is greatly reduced. Cabbage has typically the diploid number of chromosomes. Its unfruitfulness appears to be due to general physiological causes rather than to chromosome abnormality. The cells of the sporogenous tissue of the small and often shrunk anthers vary greatly in size. This size difference is continued throughout meiosis. In the large diploid pollen mother cells of cabbage, the nuclei and nucleoli are larger than in the smaller diploid cells. Apparently the primary cause of increased nucleus and nucleolus size is cell size rather than increase in chromosome number or in satellite size. During the last somatic division preceding meiosis there is a strong tendency toward total or partial failure of cytokinesis in the mutant. This may give rise to large pollen mother cells with two diploid prophase nuclei. In such cells reduction proceeds simultaneously in the two nuclei so that eight haploid microspores are usually formed. But three diploid and two haploid nuclei were found in one cell, indicating that restitution nuclei are sometimes formed at AI or thereafter. Tetraploid pollen mother cells occur in the mutant from the fusion of the two prophase nuclei of binucleate cells. In a cell with two diploid nuclei non-reduction may occur in both. In one case non-reduction appears to have occurred in a tetraploid pollen mother cell. Occasional tetraploid or binucleate pollen mother cells have been found in normally fruitful sibs of cabbage. These are believed to be due to incomplete dominance of the normal allele.

With some single gene mutants of the tomato have only one known effect, others are pleiotropic, using the term in the etymological sense of "in many ways or modes". The d₁, or dwarf mutation affects numerous organs of the plant and was formerly known as a subspecies. The mutant cabbage is even more remarkable for the number and variety of differences from the normal. This diversity of effects suggests that the pleiotropy of cabbage may be "genuine" or "gene-active", using the terms proposed by Grunsberg (Symposium on growth and differentiation, Soc. Exp. Biol. Oxford, England, 1948) and by Adorn (Soc. Exp. Biol. No. 2, 177-195, 1948).

The occurrence of a single gene - single effect relation in *Neurospora* is evidence against the existence of gene-active pleiotropy but perhaps there has been a tendency to select mutants with single effects or to overlook secondary effects in this organism. In the case of cabbage and of dwarf no evidence suggesting that the pleiotropy is due to several closely linked genes has been found. Cabbage appears to be a single gene mutant of somewhat reduced viability. The locus is in chromosome III, about 28 crossover units from y, the mutant gene for non-yellow skin color of the fruit.

McGuire, D. C. Self-incompatibility in *L. peruvianum* and its hybrids with *L. esculentum* (Summary of a Ph.D. thesis).

Self-incompatibility has been discovered in *Lycopersicon peruvianum* and established in six separate collections of the species type, nine of the variety *L. p. dentatum* and one of *L. p. humifusum*. *L. hirsutum* and *L. glandulosum* are also self-incom-

patible. *L. hirsutum* var. *glabratum* is self-fertile. *L. cheesmanii*, the only other known species of the section *Eriopersicon*, was not available for investigation.

In *L. peruvianum* progenies from controlled crosses can be divided into

two or four intra-sterile, inter-fertile groups. These compatibility reactions and the reactions between the fertility groups and their parents and grandparents agree in all respects with the Nicotiana scheme of oppositional factors.

Fruits and seeds are set rarely after incompatible matings. Pseudo-fertility seems to occur in plants that are slightly weakened by lack of mineral nutrients.

Compatibility relations of L. esculentum, L. peruvianum, and their F_1 and F_2 hybrids were studied. The self-incompatibility of the F_1 is identical in intensity and apparently in nature with that of L. peruvianum. The observed relations can be explained by assuming that the S alleles of L. peruvianum prevent the functioning of identical S alleles and also the allele from L. esculentum. In order to explain the fact that pollen of the F_1 and most of the F_2 segregates will not function on styles of unrelated plants of L. peruvianum, an independent action--possibly by a dominant gene from L. esculentum--must also be assumed. In contrast to the action of the S genes, the second effect in the pollen is sporophytically determined.

According to cytological examination of incompatibly pollinated styles and stigmas, pollen germinates normally but the tubes always swell or burst at their tips. Incompatible tubes rarely reach the base of the style; most grow less than $\frac{1}{4}$ the length of the style. The greater inhibition of esculentum pollen on peruvianum styles might be related to the independent, sporophytically-determined incompatibility.

An understanding of self-incompatibility sheds light on the phylogeny of the species of Lycopersicon. It also has a significant bearing on the use of L. peruvianum in the improvement of commercial tomatoes. A method to utilize self-incompatibility in large-scale production of F_1 hybrid tomatoes is suggested.

McGuire, D. C. Storage life
of tomato pollen.

As part of a program of hybrid tomato seed production at the University of California College of Agriculture at Davis, the long-

evity of tomato pollen was tested under various storage conditions. Pollen was collected by means of a buzzer device similar to that described by Cottrell-Dormer (1945). In a few minutes this collector can collect enough pollen to supply a worker all day. The question naturally arose whether pollen could be safely used all day, or perhaps longer.

A preliminary test using the parents involved in the hybrid cross Pearson (ms₂) x Pennheart was made.

It was found that pollen stored in an open vial in the full midsummer sun still set a few fruits on the third afternoon after the morning of collection. No fruit was set later by this pollen.

Other lots of pollen, stored under various conditions, produced fruit a much longer period. That stored over CaCl_2 in a refrigerator produced fruit on 50% of flowers pollinated (five out of ten flowers) 35 days after collection.

A more careful test was made the following year, using as female plants San Marzano (ms₉) and as pollen parents a doubled-haploid line of San Marzano (2.72).

A quantity of pollen was collected three months before the start of the test, in order to lengthen the effective time span of the experiment. Each of the subsequent batches of pollen was collected on a single morning and thoroughly mixed before dividing into storage lots. Three such collections were made, six days apart, the collections being kept separate in storage. This was done to reduce the effect of random fluctuations of weather by summing results of each storage condition at given pollen ages.

Storage temperatures were 0° , 10° and 20°C . At each temperature one lot

of pollen was stored in a loosely-capped vial, another in a sealed vial containing CaCl_2 . Control pollinations with fresh pollen were made each time any experimental pollinations were made. Precautions were taken to reduce the effect of variation between female plants.

Pollen viability was measured as per cent of flowers that set fruit, and as number of seed per fruit. It may here be noted that this is an absolute measure of the effectiveness of pollen, not achievable in germination tests in vitro. Ten flowers were pollinated at each treatment with each lot of pollen. Pollinations were at three-day intervals for a month, then weekly for two months, then monthly until the oldest pollen was a year old.

At each temperature pollen stored in low humidity (over CaCl_2) produced fruit and seed long after that in high humidity (loosely capped vial). The lower the temperature of storage, the longer the life of the pollen. All samples retained their ability to stain in acetocarmine regardless of their capacity to produce fruit.

Decline of ability of a given sample to set fruit and seed seemed parallel, though many samples set a few parthenocarpic fruits before complete failure.

Pollen collected during a period of unfavorable weather (hot and dry wind) had a much reduced viability both initially and in storage life, which was comparatively short. Ovules (or ovaries) also showed reduced fertility during unfavorable weather.

Pollen stored under the best conditions of the experiment (0°C . and low humidity) produced fruit after a year in storage but the practical limit for seed production appears to be six months.

Using these conditions onion pollen has been viable after two months, and pollen of Lycopersicon peruvianum over three months.

Poole, C. F. Application of the convergent improvement method to ascorbic acid content.

In breeding for high ascorbic acid we are using a plan of procedure similar to the convergent improvement, or double back-cross, technique of Richey and Sprague.

Two divergent series of selections have been established by backcrossing to both parents from F_1 of the cross 2958 x P6 (high weight low ascorbic, 3-way disease resistant x low weight high ascorbic disease susceptible--obtained from Yeager). Between the F_1 (first convergence) and the secondary F_1 (second convergence) the best judged single plant in each divergent selection was self-pollinated for two successive generations. Second convergence was made in a greenhouse where multiple cross pollination was made between those plants in each of the two series which performed best with the characters of the non-recurrent parent.

Since it is possible to raise almost three tomato crops annually, and seasonal variation in fruit size and ascorbic acid content is high, it is difficult to know exactly how much progress is being made on the different convergences. However, the two parents to the original cross are planted with each test and when comparison is made between the performances of the derivative lines with the parents from step to step, it is apparent that considerable progress is being made in the direction of combining commercial size with disease resistance and increased yield of ascorbic acid concentration. Trends observed between the second and third convergences are indicated in the table attached.

Yield at second convergence (January 1950)			Yield from progenies backcrossed to the two divergent parents. (August 1950)				
Weight grams per fruit	Ascorbic acid mg 100 gm.	Nature of backcross	Total Yield (grams)	Fruit per plant	Wt. per fruit (gms.)	Ascorbic acid mg 100 gm.	
15	1 45.0	35.6	5-1 x T ₆ plant #116	1317	37	35.6	48.6
			$\bar{x} = 1010$	32	31.7	36.6	
			5-1 x 2958 (lost)				
			10-7 x P ₆ plant #20	1384	49	28.2	48.6
X10	7 38.7	40.2	plant #25	1372	35	39.2	48.2
			plant #178	1440	49	29.4	46.4
	\bar{x} 35.9	34.6	$\bar{x} = 889$	29	30.4	39.3	
			10-7 x 2958				
			plant #83	2744	36	76.2	33.4
			plant #84	4741	53	89.4	35.8
			$\bar{x} = 1361$	24	56.4	29.1	
P ₆	27.4	40.0	P ₆ -2-n	$\bar{x} = 1185$	46	25.8	43.4
2958	61.9	26.9	2958-10-n	$\bar{x} = 1383$	21	65.9	26.1

x designates selected plant

\bar{x} designates mean value of population

Rick, C. M. Linkage relations of j and lf (linkage group V)

Part of the tomato breeding program at Davis is concerned with the problem of shattering and subsequent loss of fruit.

It has been suggested that the j gene, which eliminates the pedicel joint and easy abscission of the fruit, might be incorporated to advantage. In checking available varieties and stocks, however, it was found that all those that carry j also carry lf, which causes extreme prelfiferation of shoots and is otherwise undesirable. A search for j lf individuals was then conducted in BC and F₂ generations segregating for these genes with the following results:

Generation	<u>J</u> <u>Lf</u>	<u>J</u> <u>lf</u>	<u>j</u> <u>Lf</u>	<u>j</u> <u>lf</u>	Total
Backcross	145	0	0	137	282
F ₂	716	11	0	222	939

(All in coupling phase)

The first point of interest is the very short linkage distance between j and lf. According to BC there is no crossingover, according to F₂, about 1%, the difference between the two probably not being significant. But the amount of c.o. is much less than the value indicated by Young and MacArthur (Texas A.E.S. Bul. 698, 1947), which according to linear map distance is about 10%.

The second point deals with the absence of j Lf crossovers, the phenotype especially sought here. Since a special effort was made to find this recombination, it is very doubtful whether any such individuals would have been

overlooked. If they are equally as viable as $J \underline{lf}$ -- and there is no apparent reason why they should not be -- one would expect about 6 per 1,000 in the F_2 . The probability that none would be found in a population of 939 is $0.994^{939} = 0.0035$. This discrepancy might be explained in several ways involving lethals, although each requires several rather unlikely assumptions.

In recent correspondence, Dr. L. Butler has kindly transmitted his figures for j and \underline{lf} . They also indicate a low crossover figure, but include some $j \underline{lf}$ individuals. At the same time, $J \underline{lf}$ is about three times as frequent as $j \underline{lf}$, a difference that is probably significant because large numbers are involved. Although $j \underline{lf}$ thus seems to be viable, its reduced frequency is nevertheless unusual.

The writer would be very grateful to have seed of any stocks that are known or suspected to be $j \underline{lf}$.

Rick, C. M. Trisomic analysis of linkage groups VI and VIII.

The primary trisomics of the tomato are being studied in several aspects. They are being classified according to morphological type, in which they differ extensively. They are being identified with their corresponding linkage group by appropriate breeding tests. Dr. D. W. Barton is collaborating in the program by identifying in pachytene the extra chromosome of each primary trisomic type. After these three phases are completed, an attempt will be made to evaluate individual chromosomes for their contribution to quantitative economic characters. Up to the present time, the genetic analysis has been completed with eight trisomic types and nine linkage groups, and seven trisomics have been identified cytologically.

Until the trisomic types have been described, a complete progress report of the other work here would not be very meaningful. It is appropriate, however, to call attention to data that seem to indicate a condensation of linkage groups VI and VIII into a single group. Lutescent (\underline{l}) was used as a marker for group VI and the anthocyanin deficiency \underline{a}_2 for VIII. The trisomic concerned here carries the morphological type number "3".

In the F_2 of type 3 homozygous for \underline{l} x diploid \underline{l} , the segregation was $92+ : 10 \underline{l}$, lutescent comprising $9.9 \pm 3.1\%$ of the family. In other families grown under the same conditions segregation for \underline{l} was $479+ : 135 \underline{l}$ ($22.0 \pm 1.7\%$ lutescent). In the same F_2 none of the 38 plants that were trisomic type 3 were lutescent, whereas for other genes segregating in the same family, $11/38$ trisomics were \underline{d} ; $10/38$ were \underline{c} ; $8/38$ were \underline{r} ; and $7/38$ were \underline{y} . Type 3 is therefore trisomic for the chromosome that bears linkage group VI.

The evidence for group X is as follows. Since \underline{a}_2 cannot be scored in the field at Davis, the analysis was limited to seedling segregations. The F_2 of type 3 homozygous for \underline{a}_2 x diploid \underline{a}_2 included $153+$ and $34 \underline{a}_2$, the latter comprising $18.2 \pm 2.8\%$ of the family. In families not descending from type 3 the segregation was $390+ : 154 \underline{a}_2$ ($28.3 \pm 1.9\% \underline{a}_2$). A χ^2 test of all families indicates the following: the heterogeneity χ^2 for all families taken together is significant at the 0.02 level, whereas for all families excepting the one involving type 3 it corresponds to a P of 0.2. The F_2 for type 3 disturbs the homogeneity of all other families segregating for \underline{a}_2 and differs significantly from them. The deviation, furthermore, is in the direction of a trisomic segregation, but is not so marked as might be expected. The evidence is not so conclusive as for \underline{l} , yet it strongly suggests that trisomic type 3 corresponds also to linkage group X. Further tests are in progress.

Trisomic analysis can further tomato genetics in several ways, but especially by providing an absolute separation of the linkage groups. It is worthwhile to determine as soon as possible whether any additional gene groups established by absence of linkage with other groups need to be consolidated.

Rick, C. M. and Robinson, Jeanette
Six new mutants affecting flower
structure and fruitfulness.

During 1950 work was completed on the inheritance, morphology, functioning of pollen and gynoecia, and other tests conducted in an attempt to ascertain the causes of unfruitfulness of these mutants. Under field conditions each is highly unfruitful. All have the normal diploid chromosome number, and with the exception of Cl₁ each behaves as if determined by a single recessive gene. ap (apetalous) 43L16-9 Var. Early Santa Clara. Corolla segments are variably, but usually greatly reduced. Since anthers are also reduced, pollen is scarce and nonfunctional, this mutant is generatively male-sterile.

Cl₁ (cleistogamous) 44L50-84 Var. San Marzano. Incomplete dominant. Corolla segments of Cl₁Cl₁ do not separate from each other either in late bud stage or at anthesis and are significantly smaller than normal. The complete unfruitfulness of this homozygote can be explained by (1) lack of hormonal stimulation adequate to prevent premature abscission of flowers and (2) failure of anthers to shed pollen. Corolla segments of the heterozygote usually separate slightly and the plants usually bear a few fruits. Expression of the floral character is more intense in the winter greenhouse than in the field. Although the possibility that anthers fail to shed pollen has not been entirely ruled out, the cause of unfruitfulness of the heterozygote has not been clearly demonstrated.

cl₂ (cleistogamous) 47L2-185 Var. San Marzano. In respect to its partial opening of flowers cl₂cl₂ resembles Cl₁+, but differs in being completely recessive, having leaves of modified shape, darker green color and shorter internodes. Flowers appear nearly normal in the greenhouse but vegetative characters remain distinct. This mutant is potentially fertile, but since anthers usually fail to shed pollen it is mechanically male-sterile. It offers some promise as a male sterile for mass hybridization.

ex (exserted) 47L2-191 Var. San Marzano. The only apparent deviations of this mutant are the greatly elongated style and consequently exserted stigma and high ovule sterility. In about 30% of the flowers stigmas do not emerge and styles are twisted and curled within the anther tube. The projection of the stigma tends to prevent self-pollination of the exserted flowers and can account for the observed unfruitfulness. This mutant seems to differ from the one described by Currence (Proc. Amer. Soc. Hort. Sci. 44:403-406. 1944) in the variable expression and the determination by a single gene of the former.

pi (pistillate) 44L50-137 Var. San Marzano. The flower is modified in many ways. Stamens, except for occasional rudiments are absent. Corolla and calyx segments are attenuate. Pistil is usually distorted and often adnate to adjacent organs. Inflorescences resemble lf in always continuing growth as a vegetative shoot.

vg (vegetative) 46L2-171 Var. San Marzano. All parts of the flower are reduced in size and number and are usually so greatly modified that they are scarcely recognized as flowers. Although potentially fertile, this mutant is highly unfruitful because the flowers are too greatly deformed to permit normal self-pollination.

(a complete account has been submitted to the American Journal of Botany)

Roever, W. E. Hybridizing tomatoes With the thought that pollen in tomato outcrosses might show a greater vigor than in selfings, outcrosses were made on the variety Red Jacket without emasculation. This variety is potato-leaved and long-styled. The Red Jacket planting was isolated by at least 500 feet.

A line of John Baer was used as male parent. Pollen of this male parent was used in hand pollinations on Red Jacket. Each flower was pollinated twice at an approximately 24-hour interval. Flowers were pollinated between 8:00 and 10:00 A. M. In all instances the first pollen application was made on

freshly opened flowers as indicated by the pale yellow, turgid, open corolla. Natural pollination^{was} relied upon for the selfing and sibbing that occurred.

Seed from crossed fruits was planted. Hybrids were easily determined in the early seedling stage since the potato-leaf character is recessive to the normal. A random count of 1739 seedlings showed that 542 or slightly over thirty-one per cent were hybrids.

This limited trial suggests that it would be practical to produce hybrid seed without emasculation if a marker character such as potato leaf or green stem is utilized and if the female parent has a stigma that protrudes above the anther tube or is at least flush with it.

The male line used in this test was not a vigorous parent. It may well be that a more vigorous male parent particularly one with strong pollen tube growth would yield a higher percentage of hybrid seedlings by a tendency to be prepotent.

Sen, N. K. A time and space saving method of greenhouse culture. (part of a Ph. D. thesis)

Forty-eight seeds are sown in each wooden flat (15 x 10 x 3 inches) containing well manured soil with a thin layer of sand on top. Ten days after sowing, the soil over the ungerminated seeds is gently disturbed, which helps some of them to germinate. Seed coats of a few weak seedling may have to be removed by dissection, otherwise these seedlings die, being unable to shed their seed coat. Three or four weeks after sowing, the seedlings are transplanted to three inch pots, which are then placed in wooden flats containing sand, ten pots per flat. The sand holds additional water, which keeps the pots moist. About half a teaspoonful of Gaviota fertilizer is added to each pot after transplantation, and repeated twice at intervals of about a month, once before flowering and again after fruit setting. Two teaspoonfuls of fertilizer are sprinkled over the sand in the wooden flats. Often the roots emerge through the hole at the bottom of the pots and spread within the sand to obtain more nutrient. The plants can be kept erect by tying them to small bamboo stakes fixed within the pots. The flowers should be shaken with a buzzer, as soon as they open to insure self pollination.

As soon as the first fruit is set, the stem apex beyond the inflorescence is pinched off. Only two fruits are allowed to grow on each plant. All side branches are removed as they appear. Diseased plants are transplanted to six inch pots, to keep infection from spreading, and to provide them with better survival conditions. About five to ten per cent of plants in different cultures grew slowly and in a few plants the first inflorescence did not set fruit. These plants were removed with their pots to new flats, placing only six pots in each to provide more space.

Sen, N. K. Chromosome aberrations. (part of Ph. D. thesis in preparation for publication)

Two isochromosomes were found at the diploid level: one following formalin treatment (curly-leaf mutant) and the other following ammonia treatment (dark-green mutant). The two arms of the isochromosomes paired with each other or one of the arms paired with the homologous arm of the normal chromosome to varying lengths. Unpaired segments of both chromosomes either remained single or showed some non-homologous pairing in the chromatic zones. At diakinesis the isochromosome appeared ring-shaped if a chiasma occurred between its two arms, and in half the cells the chromosomes of the heteromorphic pair were present as univalents.

According to Barton's map of the pachytene chromosomes, the isochromosome of the curly-leaf mutant was composed of the two long arms of chromosome 9, and that of the dark-green mutant of the long arms of 8.

The curly-leaf mutant was characterized by its slow growth, curling of

leaves, light-green color, thin stem, small fruits with dark-green radiating bands and pollen abortion. The dark-green mutant had dark-green leaves with few hairs and greater pollen sterility. The curly-leaf disomic mutant produced (i) normal plants, (ii) curly-leaf secondary trisomes and (iii) curly-leaf disomes, the last in an extremely small percentage.

The curly-leaf trisome had comparatively thicker leaves than the disomic mutant, semi-compound inflorescence and smaller fruits. It produced (i) normal plants, (ii) secondary trisomes and (iii) primary trisomes.

Another morphological mutant appeared following ether treatment, characterized by its slow growth, thin stem, long internodes, elongated rachis, grayish-green color and pollen abortion. Lagging chromosomes were occasionally seen at meiotic anaphases. The elongate-leaf character was inherited at a low rate with production of trisomes. The elongate-leaf trisome had 2-3 loculed, oval, nipple-tipped fruit.

A study of inheritance of one of the several morphologically and cytologically indistinguishable semi-sterile plants showed that pollen sterility factor was transmitted at a low rate. These plants may have either a small deficiency or a haplo-lethal mutant gene.

Sen, N. K. Chemical mutagenesis. Pollen which had been moistened in any way (part of a Ph.D. thesis) failed to function on the stigma. Consequently it was treated with the vapor of

some chemicals which have an appreciably high pressure at room temperature. Formalin, ammonia, acetic acid, ethyl alcohol, amyl alcohol, ether and chloroform were selected to include protein coagulants, acids, bases and fat solvents. Some of these chemicals have been claimed to be mutagenic. Later, nitrogen mustard was included.

For the vapor treatment, the pollen grains were obtained on a clean dry slide by shaking flowers with a buzzer, collecting from at least three to four flowers of different plants. The glass slide was then held on an inclined plane, and lightly tapped to spread the pollen uniformly in a single layer. An aqueous solution of the chemical was used for the treatment. In the case of fat solvents like ether, chloroform and amyl alcohol, an emulsion was made by churning the mixture in an electric mixer immediately before a treatment. The slide was kept above the level of the liquid by setting it on small glass rods. The inner rim of the petri-dish was smeared with vaseline to prevent diffusion of chemical vapor. The petri-dish was kept at 25°C. five minutes before starting the treatment, so that the air inside would be saturated with chemical vapor. The slide with the pollen was then placed inside the petri-dish by raising the upper lid from one side. Duration of exposure was varied, so that the chemical could penetrate the pollen to different degrees. Several concentrations of each chemical were tried. The effect of exposing the pollen grains to chemical vapor was observed by germinating them in acidified sugar, agar and gelatin medium (8 gms. of sucrose, 4 gms. agar and 4 gms. of gelatin in 100 cc. of water - Darlington and LeCour 1947). The medium was acidified with tartaric acid to 0.005 normal acidity, which was found to help germination of tomato pollen.

All the chemicals tested were found to inhibit pollen germination when treated in high dosages. The cause of such inhibition might be due either to formation of lethal genes or due to too drastic changes in the chemical composition of the cytoplasm. A sublethal dose, where about ten per cent of the treated pollen germinated, was found to vary within a narrow range for the different concentrations of a chemical. The exposure time for the sublethal dose of a chemical varied with the concentration.

Fruits were obtained when pollen treated at the sublethal doses was applied to emasculated flower buds. Pollen treated at doses that inhibited germination on the artificial medium, produced fruit in most cases. So the sublethal doses for fruit setting were determined directly by pollinating many

flowers with the different concentrations of each chemical. This indicates that pollen which failed to germinate in artificial medium, did so on a more suitable medium of stigmatic fluid.

Methyl bis (B-chloroethyl) amine hydrochloride was used for the nitrogen mustard treatment. Ten milligrams of the compound was dissolved either in five or in ten milliliters of distilled water and taken up in a hypodermic syringe. Sodium hydroxide was put in petri-dishes, one set having 5.5 cc. solution of 0.005 N., and the other set had 5.5 cc. of 0.01 N. alkali. The glass slide containing the pollen grains was placed within the petri-dish as described above and then 5 cc. of the solution was injected into the alkali from the hypodermic syringe. One of the set thus received 5 mgm. of the compound and the other 10 mgm., in 10.5 cc. of solution. The petri-dish was shaken for some time to increase reaction between the salt and the alkali, to form the active volatile amine. The pollen grains treated for a definite period were applied to emasculated buds of the tester stock. Enough pollen was applied to ensure fruit setting, since fruit setting was found to be very irregular even in lower doses when limited quantity of pollen was used.

Mutagenic effects of the agents were measured by determination of haplo-lethal segregations in the F_1 . Only nitrogen mustard was significantly effective in producing haplo-lethal F_1 plants at the rate of about 8 per 100. Of the other chemicals tested formalin and ammonia may prove to be mutagenic. Pollination with limited pollen seems to give an increase in mutation frequency. If the limited pollination technique is combined with study of populations larger than those used (2 to 400) it may be possible to obtain significant statistics for formalin and ammonia.

Walker, D. Lycopersicon-Cyphomandra In the course of a study of the trans-grafts in relation to increase in fruit size in the tomato. mission of tomato canker (Phytophthora michiganensis (E.F.S.) Bergey et. al) Prof. P. A. Ark of the Division of Plant Pathology, University of California at Berkeley made reciprocal grafts between Lycopersicon pimpinellifolium (Jusl.) Mill. and Cyphomandra betacea Sendt. In one case, in which L. pimpinellifolium was used as stock, an adventitious shoot of the stock produced fruit about twice as large as ungrafted sister plants. This increased fruit size was retained through several seed generations.

Three possibilities suggest themselves as explanations for the origin of the large fruited line: (1) the Cyphomandra scion caused a mutation in the tomato stock which was expressed somatically and was transmissible; (2) such a mutation occurred in the tomato stock independently of the graft; or (3) the original seed of the tomato culture contained both large and small fruited genotypes.

Two kinds of experiments were started to determine which possibility is most likely. First, an attempt was made to induce an increase in fruit size by grafting between tomato and Cyphomandra. A large number of reciprocal grafts using both pimpinellifolium and an esculentum variety with Cyphomandra were made. To date there is no evidence that Cyphomandra has any influence on fruit size of the grafted tomatoes or on their progeny.

Secondly, an investigation of the genetic differences between the large and small pimpinellifolium lines was begun. Reciprocal crosses were made and the F_1 which had the large fruited line as female parent was backcrossed to both parents and was also grown to give F_2 seed. In 1950 a field planting was made which included both parents, both F_1 's, F_2 and the two backcrosses.

A preliminary study of the 1950 field data shows that the parent lines differ by many genes, each with a small effect, as there is no evidence of segregation into discontinuous classes even in the backcross generations. The mean fruit weight of F_1 is somewhat less than the midparental value and the other generations have means below that expected on the basis of strictly ad-

ditive gene action. In other words, potency is in the direction of small fruit size which indicates that at least many of the genes for large fruit size are recessive. It is therefore extremely unlikely that such a large number of recessive mutations could have arisen in the adventitious shoot either as a result of the graft or spontaneously. It is even more unlikely that the original shoot from the stock could have been homozygous for such mutated loci.

Since the history of the original pimpinellifolium seed lot is somewhat obscure, it could and very probably did contain some seed of a large fruited pimpinellifolium line from Peru. Thus, all the evidence is consistent with the assumption that the seedling used in the original graft was genotypically large fruited.

PART II DIRECTORY OF MEMBERS

Andes, J. O., Agric. Expt. Sta., University of Tennessee,
Knoxville 16, Tennessee.

Projects: Breeding for resistance to Fusarium wilt, various leafspots, fruit rots, late blight, and Verticillium.

Andrus, C. F., U. S. Regional Vegetable Breeding Laboratory, Box 177,
St. Andrews Branch, Charleston, South Carolina.

Projects: (With M. W. Hills and Margaret S. Kanapaux) 1. Breeding for resistance to Alternaria, Cladosporium, Fusarium, Phytophthora, Septoria, and Stemphylium; multiple resistance. Also assemble stocks with resistance to other diseases for use of collaborators.

2. Breeding for improvement in higher productivity, maximum smoothness combined with large size and multilocular structure, superior color, particularly of the locular jelly, high ascorbic acid and high solids and % dry matter.

3. Genetic investigation of: Green stem (seedling), green jelly, pigmented seed, linkage between Fusarium wilt immunity and resistance to collar rot and Leafmold.

Barham, Warren S. with Ellis, D. E., Department of Horticulture, University of North Carolina, Raleigh, N. C.

Projects: (1) to develop late blight resistant tomato varieties that are suitable for growth in the higher elevations of western North Carolina where late blight is so destructive almost every year; and (2) to develop southern bacterial wilt resistant varieties that are suitable for growth in central and eastern North Carolina. Along with the breeding program, the inheritance of resistance to these two diseases will be studied.

Barton, Donald W. 103 Genetics Building, University of Missouri
Columbia, Missouri.

Projects: (1) Cytogenetic effects of X-ray and Ultraviolet irradiation; (2) cytological identification of tomato trisomics; (3) linkage studies.

Bohn, G. W. United States Horticultural Field Station, Box 150,
La Jolla, California.

Projects: (1) Selection for fertility and fruit size in 4N L. esculentum and 4N L. esculentum x L. pimpinellifolium; (2) selection for cold tolerance and other characters in 2N material. (3) The transfer of germ plasma from L. hirsutum and L. peruvianum into L. esculentum.

Eoswell, Victor R., United States Department of Agriculture, Plant Industry Station, Beltsville, Maryland.

Bowers, John L., Department of Horticulture, Mississippi State College,
State College, Mississippi.

Projects: Selection and Breeding Tomatoes and a Study of the Effect of Different Cultural Methods on Yield and Quality of Fruit .

Brock, R. D., Division of Plant Industry, P. O. Box 109, City,
Canberra Australia.

Projects: (1) Breeding for resistance to Fusarium Wilt. (2) Breeding for resistance to Root-knot nematode.

Brown, Ralph T., Plaquemines Parish Experiment Station,
Diamond, Louisiana

Projects: Breeding to combine the resistance to such diseases as Early Blight, Late Blight and Gray Leaf Spot with high production and earliness of other varieties.

Brown, S. W., Genetics Division, University of California,
Berkeley, California

Projects: (1) Attempts are made to grow recessive lethals under sterile conditions by nutritional supplements to Hoagland's solution. Techniques have been worked out for growing seedlings on liquid medium in tubes a third filled with glass beads, topped by a thin layer of glass wool. Illumination is provided in the laboratory by fluorescent lights. In the greenhouse, the cotyledons of the mutants turn yellow-green and the seedlings persist for many days with little or no growth. In the tubes, growth proceeds somewhat beyond the cotyledon stage and the mutants become necrotic and die rapidly. (2) F_2 progenies from irradiated pollen are grown for seedling mutants. Lethals produced are saved for nutritional tests. Other types are being used for linkage studies in the hope of building up stocks with good markers expressed in early development, as well as enlarging the linkage maps. (3) Cytological studies are being made of the origin and nature of the chromocenter in tapetal nuclei in the hope of getting better understanding of the heterochromatin-like function of the chromatic zones.

Brown, Walter N., Department of Horticulture, University of Illinois,
Urbana, Illinois.

Projects: (Collaborating on projects with W. A. Huelsen.)

Bullard, E. T., Branch Experiment Station, University of Idaho,
Parna, Idaho.

Burdick Allan B., Department of Agronomy, University of Arkansas,
Fayetteville, Arkansas.

Projects: (1) Behavior of diploids derived from haploids. (2) Polygenetics of heterosis. (See article on page 5)

Butler, L., Department of Zoology, University of Toronto,
Toronto 5, Canada.

Projects: (1) The inheritance of fruit size. Data are being worked over and seeds accumulated for a critical test to find out whether the apparent linkages between size genes and certain qualitative characters are valid linkages or merely pleiotropic effects. (2) Gene action. Preliminary experiments are being carried out with the two types of green stem a_1 and a_2 to study their effects in grafts and chimeras. (3) Linkage relations.

Cannon, Orson S., (in collaboration with V. Maddoups)
United States Department of Agriculture, Utah Agricultural
Experiment Station, Logan, Utah.

Projects: (1) The development of curly top resistant tomatoes, and (2) the development of Verticillium resistant tomatoes.

Chanasyk, Victor, Department of Agriculture, Experimental Station
Beaverlodge, Alta., Canada.

Projects: To develop an early variety with the ability to set fruit and mature under low temperatures in approximately sixty days from planting in the field.

Currence, T. M., Division of Horticulture, University of Minnesota,
Department of Agriculture, University Farm, St. Paul 1, Minn.

Projects: Activities at present are mainly devoted to problems that relate to commercial use of heterosis. Combining ability of varieties, transfer of sterility to certain varieties and use of the F_2 generation are being studied. We are also making and testing numerous crosses.

Dempsey, Wesley H., (Graduate Student) Division of Truck Crops,
University of California, Davis, California.

Denby, L. G., Vegetable Department, Department of Agriculture,
Experimental Station, Summerland, B. C., Canada.

Projects: (1) To develop varieties of extreme earliness and high quality, adapted to shipping as mature greens or semi-ripes. (2) To breed mid-season varieties, characterized by heavy yields of high quality fruit suitable for canning, but even in this case, earliness is at present an important factor, for the growers prefer to ship their early fruit to the fresh market, and the later fruit to the cannery.

Emmert, E. M., Department of Horticulture, University of Kentucky,
Lexington 29, Ky.

Project: Testing of varieties, particularly those of Ponderosa type that will set well under summer conditions.

Epps, James M., West Tennessee Experiment Station,
Jackson, Tennessee.

Project: Resistance to Fusarium wilt, leaf diseases and fruit cracking.

Fineman, Zola M., 1105 Washburn Ave. N.,
Minneapolis, Minnesota

Finlay, Keith W., Institute of Agriculture, University of Western
Australia, Nedlands, Australia.

Projects: (1) Resistance to spotted wilt and Fusarium wilt. (2) Hybrid vigour and its commercial utilization.

Flory, W. S., The Blandy Experimental Farm, University of Virginia,
Boyce, Virginia.

Frazier, W. A., Oregon State College Experiment Station,
Corvallis, Oregon.

Projects: Breeding for (a) fruit setting ability, (b) earliness, (c) quality, and (d) disease resistance. The latter category is very ill-defined at the moment.

Gilbert, J. C., University of Hawaii, College of Agriculture,
Honolulu 14, Hawaii.

Project: Breeding (See also D. C. McGuire) for resistance to nematode root knot.

Graham, T. O., Department of Horticulture, Ontario Agricultural College,
Guelph, Canada.

Project: Improved methods utilizing heterosis.

Griffing, Bruce, Department of Genetics, Iowa State College,
Ames, Iowa.

Project: Inheritance of quantitative characters. (see page 7).

Hardin, M., Geary, Oklahoma

Project: Breeding for wind, drought, heat, disease resistance and early maturity.

Hargrave, P. D., Department of Agriculture, Provincial Horticultural Station, Brooks, Alberta, Canada.

Projects: (1) The production of a determinate tomato earlier in maturity than Bounty, with the same shape and relative size, but of better colour. Also attempting to catalogue seedling characteristics of the parental material so that hybridity can be determined shortly after germination. (2) Search for male-sterile plants in large blocks of selected parental material.

Harrison, A. L., Plant Disease Laboratory, Texas Agricultural Experiment Station, Route 3, Yoakum, Texas.

Project: Breeding for resistance to: (1) Fusarium wilt, (2) Collar rot, (3) Root-knot, (4) Grey spot, (5) Blossom-end rot, (6) Puffing. (Listed in order of importance with reference to amount of work being conducted on them).

Helsel, Paul E., Associated Seed Growers, Inc., Franklin, Indiana.

Holmes, F. O., The Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York 21, N. Y.

Project: Resistance to viral diseases.

Hornby, C. A., Department of Horticulture, The University of British Columbia, Vancouver, Canada.

Huelsen, W. A., University of Illinois, Agricultural Experiment Station, Urbana, Illinois.

Projects: Production of varieties with high resistance to Fusarium wilt. (2) The adaptation of strains to prairie conditions. The first needs no explanation, but the second does. Ordinarily varieties during dry, hot years tend to run almost entirely to vine with very little fruit. This seems to be due to a combination of hot nights and relatively high nitrogen in the soil. Varieties have been isolated which produce well under these conditions. (3) Crossing and selection for quality factors.

Isbit, Arthur, Department of Horticulture, Michigan State College, East Lansing, Michigan.

Jenkins, J. A., Division of Genetics, University of California, Berkeley, California.

Project: Genetics and Evolution of the Cultivated Tomato with special interest in the (a) inheritance of size and shape differences, (b) inheritance of carotenoid differences.

Johnstone, Jr., Francis E., Department of Horticulture, The University of Georgia, Athens, Georgia.

Kerr, E. A., (Collaborating with D. L. Bailey and L. Butler), Horticultural Experiment Station, Vineland Station, Ontario, Canada.

Project: Isolation of the various genes for resistance to and immunity from the various races of Cladosporium fulvum.

Kihara, H., Laboratory of Genetics, Kyoto University,
Kyoto, Japan.

Larson, R. E., Department of Horticulture, The Pennsylvania State College,
State College, Pennsylvania.

Projects: (1) Use of steriles in production of hybrid seed. (2) Embryo size and its relationship to hybrid vigor in segregating generations. (3) Combining ability in tomato lines. (4) Inheritance of qualitative and quantitative characteristics.

Lesley, J. W., University of California, Citrus Experiment Station,
Riverside, California.

Projects: (1) (with R. K. Soost) Genetics of interspecific hybrids of L. esculentum x L. peruvianum var. dentatum. Special attention is being paid to the behavior of some of the recessive mutants of esculentum when introduced into dentatum. (2) (with J. T. Middleton) Verticillium resistance in hybrids of L. esculentum x L. peruvianum var. dentatum and L. e. x L. hirsutum. (3) (with Margaret M. Lesley) Cytology of tomato races differing in satellite size, and cytology of several meiotic irregularities in races of L. esculentum and L. peruvianum.

Lewis, D., John Innes Horticultural Institution, Bayfordbury,
Hertford, Herts., England.

Projects: (1) Investigation of the "Rogue" or "Jack" character. (2) Induction of male sterile plants for their use in hybrid production. (3) The inheritance and selection of inflorescence size.

Locke, L. F., United States Department of Agriculture, Southern Great
Plains Field Station, Woodward, Oklahoma.

McGuire, Donald C. (with J. Gilbert), University of Hawaii, College of
Agriculture, Honolulu 14, Hawaii.

Projects: (1) Breeding for resistance to tobacco mosaic virus. (2) Combining disease resistance - Two methods are being followed: The production of F_1 hybrids, combining of commercial or near-commercial lines carrying desired resistances; and combining lines homozygous for resistances early, then breeding up to commercial value. (3) Breeding for Bacterial Wilt resistance. (4) Producing F_1 hybrids - a field survey of hybrids of various commercial lines.

Magruder, Roy, United States Department of Agriculture, Agricultural
Research Administration, Washington 25, D. C.

Mariota-Trias, F., University of Puerto Rico, Agricultural Experiment
Station, Rio Piedras, P. R.

Project: To develop by breeding and selection varieties of tomatoes suitable for local and export markets; and especially adapted for growing during the late spring and summer months.

Mikell, John (with J. C. Miller), Horticultural Research Department,
Louisiana State University, Baton Rouge 3, Louisiana.

Mohr, Hubert C., Department of Horticulture, Agricultural and Mechanical
College of Texas, College Station, Texas.

Projects: (1) Development of a variety resistant to southern blight from a cross involving a line of Lyconersicon pimpinellifolium which shows good resistance to this disease. (2) Inheritance of fruitfulness under high temperatures.

Morrison, Gordon, Burgess Seed and Plant Co.,
Galesburg, Michigan.

Projects: (1) Breeding new varieties. (2) Improvement of existing varieties by selection. (3) Utilization of hybrid vigor.

Munger, H. M., Department of Plant Breeding, Cornell University,
Ithaca, New York.

Projects: (1) To develop a tomato variety with the earliness of Earliana and the more desirable fruit characteristics of later varieties. (2) To develop varieties with resistance to cracking, desirable fruit size and color, and maturity with Stokesdale or earlier. (3) To develop market varieties with greater firmness of fruit which will permit handling of fruit which has been allowed to become more mature than it is harvested at present.

Nonnecke, I. L., Department of Agriculture, Experimental Station,
Lethbridge, Alta., Canada.

Project: Breeding for adapted canning tomatoes of determinate type.

Odland, Martin L., Department of Horticulture, The Pennsylvania State
College, State College, Pennsylvania.

Gunsforth, L. F., Department of Agriculture, Experimental Station,
Harrow, Ontario, Canada.

Project: Breeding of a variety or varieties as early as or earlier than the Bounty and particularly suited to the district.

Perry, Bruce A., Winter Garden Experiment Station, Texas Agricultural
Experiment Station, Winter Haven, Texas.

Projects: (1) Breeding of large-fruited lines for summer production. (2) Development of a variety or varieties with multiple resistance (especially to Fusarium collar rot, and gray leafspot), for spring and fall and for both canning and shipping.

Paddock, Elton F., Botany Department, Ohio State University,
Columbus 10, Ohio.

Flaisted, Robert L., Division of Truck Crops, University of California,
Davis, California (Graduate Student).

Poole, C. F., University of Hawaii, College of Agriculture,
Honolulu 14, Hawaii.

Project: Improvement of ascorbic acid content.

Pound, Glenn S., Department of Plant Pathology, The University of Wisconsin,
College of Agriculture, Madison 6, Wisconsin.

Projects: (1) Breeding for an early maturing canning variety. (2) Environmental factors related to defoliation diseases.

Powers, LeRoy, United States Department of Agriculture, Horticultural
Field Station, Cheyenne, Wyoming.

Projects: (1) Breeding for earliness, yield, and quality. (2) Inheritance of earliness of maturity and size of fruit.

Richardson, R. W., Division of Horticulture, University of Minnesota,
Department of Agriculture, University Farm, St. Paul 1, Minnesota.

Project: Differential pollen tube growth. (Ph. D. thesis problem).

Rick, C. M., Division of Truck Crops, University of California,
Davis, California.

Projects: (1) (with D. W. Barton) Morphology, genetics, and cytology of the primary trisomics. (See Research Note on page). (2) Cytogenetic relations between *Lycopersicon* species, especially the nature of the sterility barrier between *L. esculentum* and *L. peruvianum*. (3) Techniques to facilitate the production of F_1 hybrid seed and (to a limited extent) testing performance of several F_1 hybrid combinations.

Roever, W. E., West Tennessee Experiment Station,
Jackson, Tennessee.

Projects: (1) (Major) - Development of greenwrap types for the Tennessee deal. (2) (Minor) - Development of better commercial early types. (3) (Minor) - Development of types that tend to hold mature fruit off the ground.

Samson, R. W., Department of Botany and Plant Pathology, Purdue University
Lafayette, Indiana.

Projects: (1) Breeding for disease resistance. (2) Breeding for increased vitamin content, especially vitamin C and beta-carotene. (3) Genetic determination of carotene and other flesh pigments.

Schermerhorn, Lyman G., Department of Horticulture, Rutgers University,
New Brunswick, New Jersey.

Schultz, J. H., Department of Horticulture, North Dakota Agricultural
College, Fargo, North Dakota.

Project: (Purnell 153) Breeding for earliness, yield, size, quality, ascorbic acid content and disease resistance.

Scott, G. W., Associated Seed Growers, Inc.,
Milpitas, California.

Projects: Breeding new varieties. Improvement of existing varieties.

Sen, Nirad K., 1/6 Golan Rd. Road (first floor), Kalighat,
Calcutta 26, India.

Projects: (1) Cytology of chromosomal aberrations. (2) Chemical mutagenesis. (See part 1.)

Skirm, George W., F. H. Woodruff & Sons,
Milford, Connecticut.

Project: Evaluation and maintenance of commercial stocks of tomatoes.

Smith, P. G., Division of Truck Crops, University of California,
Davis, California

Projects: Breeding for resistance to Fusarium wilt, root-knot nematode, and spotted wilt.

Soost, Robert K., Citrus Experiment Station, University of California,
Riverside, California.

Projects: (1) Incorporation of fusarium resistance into early market tomatoes for the desert-valley areas. (2) Dosage effects of Wo in trisomics, triploids, and tetraploids. (3) Inheritance of fruit color and incompatibility in backcrosses of *L. esculentum* x *L. glandulosum*.

Stair, Edw. C., Purdue University, School of Agriculture,
Lafayette, Indiana.

Projects: (1) Breeding (in both greenhouse and field tomatoes) for better yields, color, and uniformity of size, better foliage for protection from the sun, and disease resistance especially for fusarium wilt and cladosporium. (2) Development of a number of hybrids.

Stark, Francis C., Department of Horticulture, University of Maryland,
College Park, Maryland.

Stevenson, E. C., Department of Horticulture, Purdue University,
Lafayette, Indiana.

Project: Hybrid tomatoes and improved varieties for early market and canning.

Tezier, C., Tezier Freres,
Valence-Sur-Rhone, France.

Projects: (1) Breeding for earliness (especially in first 3 clusters) and for improved shipping quality. (2) Breeding for resistance to disease: especially mildew (Chytophthora infestans), virus diseases, drought and shoulder cracking.

Tomes, M. L., Department Botany and Plant Pathology, Purdue University,
Lafayette, Indiana.

Projects: Collaborating on projects with R. W. Samson.

Walker, Darrell, Division Genetics, University of California,
Berkeley 4, California.

Projects: (1) Stock-scion influence on fruit size. (2) Variation in diploids derived from haploids. (Ph. D. Thesis).

Walter, James M., Box 678, Manatee Station, University of Florida,
Bradenton, Florida.

Project: To combine as quickly as possible all of the disease resistances available in a few varieties of tomato meeting the high horticultural requirements of our Florida green wrap market.

Whaley, W. Gordon, The Plant Research Institute, The University of Texas,
Austin 12, Texas.

Projects: (1) An extensive morphological, anatomical, and physiological survey of the growth and development of one inbred line of tomato. (2) Genetic differences in the responses of tomato roots to thiamin, pyridoxine, and niacin and other substances in culture. (3) (In collaboration with W. V. Brown, Charles Heinsch, G. S. Rabideau, and A. E. Lee) The preparation of a summary of some selected data having to do with various aspects of the growth and development of the tomato plant.

Wortman, Sterling, The Rockefeller Foundation,
Londres 45, Mexico 6, D. F., Mexico.

Project: Emphasis on adaptability to local growing conditions in tomato production areas, tolerance to high and low temperatures and drought and disease resistance.

Yeager, A. F., Agricultural Experiment Station, University of New Hampshire,
Durham, New Hampshire.

Project: Breeding for extreme earliness, blight resistance and high ascorbic acid content.

York, Thomas L., Department of Plant Breeding, Cornell University,
Ithaca, New York

Young, P. A., Tomato Disease Laboratory, Route 4,
Jacksonville, Texas.

Projects: (1) To develop commercial tomatoes with resistance to Sclerotium rolfsii causing southern blight. (2) To improve tomato selections (recent hybrids) with I-allele for resistance to Fusarium wilt. (3) To develop green-wrap tomatoes with resistance to cracking. (4) To develop green-wrap tomatoes with resistance to catfacing. (5) To test inheritance of new genetic characters of tomatoes.

Young, Robert E., University of Massachusetts, Agricultural Experiment
Station, Field Station., Waltham 54, Massachusetts.

Projects: (1) Breeding tomatoes for use on the trellis as is practiced in this section with a particular interest in resistance to cracking and the use of hybrids. (2) Breeding of greenhouse tomatoes.

Downes, Jr., John D., Department of Horticulture, West Virginia University,
Morgantown, West Virginia.

Project: (with M. Gallegly) Breeding for resistance to Phytophthora infestans consistent with retention of desirable horticultural features. No lines of L. esculentum or species hybrids tested have shown resistance.

Huskins, C. Leonard, (with John Woodard), Birge Hall, Department of Botany,
The University of Wisconsin, Madison 6, Wisconsin.

Project: The effects of sodium nucleate on tomatoes.

Gabelman, Warren H., Department of Horticulture, University of Wisconsin,
Madison 6, Wisconsin.

PART III LIST OF AVAILABLE OR DESIRED STOCKSSTOCKS AVAILABLE

<u>Source</u>	<u>No. of Stock</u>	<u>Description</u>
Andrus, C. F.	2508A-1-1	Dark pigmented seed
	2512A-1-2-B	Dark pigmented seed
	GS5	Green seedling
Barton, D. W.	Translocation stocks (seed of selfed heterozygotes): T2-12; T ₁ 9-12; T3-8; T7-9; T5-7; T ₂ 9-12.	
Bohn, G. W.	2N and 4N stocks of <u>L. peruvianum</u> , <u>L. pimpinellifolium</u> , and the Danmark and Waltham Forcing varieties of <u>L.</u> <u>esculentum</u> .	
	F ₁ (4N <u>L. esculentum</u> x several collections of 2N <u>L. peruvianum</u>)(viability uncertain).	
	Genetic marker stocks and progenies from 6-8 repeated backcrosses to Danmark, Uniform Globe, Oxheart, and Ponderosa following crosses of these varieties with fusarium resistant <u>L. pimpinellifolium</u> .	
	(Seed in storage at Cheyenne, Wyoming. Probably viable).	
Bowers, J. L.	M54	Resistant to <u>Sclerotium rolfsii</u> ; derived from VBL42-23 (<u>L. pimpinellifolium</u> x <u>L. esculentum</u>)
Burdick, A. B.		Haploid D-y
		Haploid <u>pimpinellifolium</u>
	038	Agadir
	179	San Marzano aa ?
	001	2n Ex-Haploid D-y
	002	2n Ex-Haploid D-y
	003	2n Ex-Haploid D-y
	004	2n Ex-Haploid D-y
	005	2n Ex-Haploid D-y
	006	2n Ex-Haploid d ₁
	007	2n Ex-Haploid D-y
	008	2n Ex-Haploid D-y
		ca. 15 years old 1947
		4 gm. Fruit, semi- wild, from Morocco, F. A.
		Probably a ₁ a ₁ mutant
		Seed from original doubled shoot, i.e. DBL ₁ 1 DBL ₂ also.
		DBL ₂
		DBL ₂
		DBL ₂
		DBL ₂
		DBL ₆ ? Lindstrom, 1940
		DBL ₂ (DBL ₁ highly sterile)
		DBL ₂ (DBL ₁ highly sterile)

The following list of stocks are all DBL₁ generation (seed from the original callus shoot) from the Haploid pimpinellifolium. Somatic meristems were examined for the chromosome number given under remarks. Cases where two chromosome numbers are given were probably periclinal chimaeras. The cause of seed production on 12 and 13 chromosome haploids has not been determined.

<u>Stock Number</u>	<u>Description</u>	<u>Chromosome number</u>
180	DA I-1	12-24
181	DA I-2	24
182	DA I-3	24
183	DA I-4	24
184	DA I-6	24
189	DA II-1	24
190	DA II-2	24
191	DA II-3	24
192	DA II-4	24
193	DA II-5	13
201	DE I-1	12-24
204	DE II-1	24
205	DE II-2	24
206	DE II-3	24
209	EC I-1	24
210	EC I-3	24
212	EC I-7	12
213	EC I-8	12-24
214	EC II-1	12-48
215	EC II-2	24
216	EC II-3	48
217	EC II-6	24
218	EC II-7	24
222	EC III-1	24
227	DE I-1	13
228	DE I-2	24
230	DE I-4	12
232	DE II-1	24
233	DE II-3	24
236	DJ I-2	12
237	DK I-1	48

- Butler, L. Genetic stocks developed in collaboration with the late J. W. MacArthur, including the following genes in many but not all combinations: a or a₁, al or a₂, br, bk, lu, e, d, d₂ or dm, e or b, f, H, j, l, lf, m, mc, n, nc, o, p, r, s, sd, u, w, wf, wo, wt, Xa, and y.
- Cannon, C. S. Most of the stocks collected by H. L. Blood in South America. Stocks of special merit are those which are resistant to Verticillium albo-atrum and those which are resistant to the curly top virus.
- Currence, T. M. Many stocks and numerous crosses.
- Frazier, W. A. HES 4402 or OSC 12 Wide calyx and resistance to cracking (see article on page 5).
- Hoover, Max M. Extensive tomato accessions of the Division of Plant Exploration and Introduction are maintained. A list of available tomato stocks is published.
Plant Introduction Station
Iowa State College
Ames, Iowa

Jenkins, J. A.

170 $\underline{d}_1 - \underline{r} - \underline{y} - \underline{c} - \underline{a}_1 - \underline{l}$
 171 $\underline{c}_1 - \underline{f} - \underline{j} - \underline{lf} - \underline{H} - \underline{a}_2 - \underline{d}_2 - \underline{wt}$
 234 $\underline{c}_1 - \underline{c} - \underline{l} - \underline{u} - \underline{H} - \underline{d}_2$
 378 $\underline{c}_1 - \underline{p} - \underline{o} - \underline{s} - \underline{r} - \underline{f}$
 767 $\underline{br} - \underline{c} - \underline{j} - \underline{lf}$

Kerr, E. A.

Vetomold \underline{Cf}_{p1}
 V121 \underline{Cf}_{p2}
 Stirling Castle \underline{Cf}_{sc}
 Vulcan $\underline{Cf}_{p1} - \underline{Cf}_{sc}$
 V-469 $\underline{Cf}_{p1} - \underline{Cf}_{p2}$
 F101 $\underline{Cf}_{p1} - \underline{Cf}_{p2} - \underline{Cf}_{sc}$

Larson, R. E.

1025 - 1 - 50, Gh28-2 $\underline{d}_1 - \underline{a}_1 - \underline{c} - \underline{l} - \underline{y} - \underline{u} - \underline{gs}$
 1025 - 1 - 50, No. 4-29 $\underline{r} - \underline{c} - \underline{a}_1 - \underline{l} - \underline{u} - \underline{ps}$
 Functionally
 sterile Pennred $\underline{u} - \underline{wt} - \underline{j} - \underline{lf} - \underline{mc} - \underline{ps}$
 1025 - 1 - 50, No. 17-168 $\underline{d} - \underline{r} - \underline{y} - \underline{c} - \underline{l} - \underline{gs}$
 1025 - 1 - 50, No. 4-85 $\underline{d} - \underline{c} - \underline{ps}$
 Functionally sterile (ps ps) lines of Rutgers,
 Stokesdale, and Indiana Baltimore

Lewis, D.

L. pimpinellifolium (red-fruit)
 " " (yellow fruit)
 Genetic stock $\underline{d} - \underline{p} - \underline{s} - \underline{o} - \underline{r} - \underline{y}$
 Several English varieties
 Inbred strains of Ailsa Craig

Rick, C. M.

LA94 L. hirsutum (seed from plants in wild at Canta,
 Peru)
 LA102 L. peruvianum (seed from plants in wild at
 Rio Supe, Peru)
 LA118 L. glandulosum (seed from plants in wild at Canta,
 Peru)
 LA125 L. pimpinellifolium (seed from plants in wild at
 Trujillo, Peru)

2-72 San Marzano pure line derived from haploid by
 colchicine treatment

2-31 Male-sterile Pearson (ms₂)
 2-121 Male-sterile San Marzano (ms₉)
 2-132 Male-sterile San Marzano (ms₁₀)
 2-165 Male-sterile San Marzano (ms₁₃)
 2-175 Male-sterile Earliana (ms₁₄)

2-69 Dialytic (dl)

2-171 Vegetative (vg) (description on page 15)
 2-191 Exserted (ex) (" " " 15)

Schultz, J. H.

Foundation seed of 15 or more varieties developed at
 the N. D. Station. Also a considerable number of
 breeding lines of value in general objectives in the
 station breeding projects

Skirm, G. W.

Stocks of commercial varieties

Stair, E. C.

High-yielding stock of Indiana Baltimore strain characterized by gigantism, low fruitfulness, and dense foliage

Tezier, C.

Small-fruited varieties: Ailsa Craig, Rebrige, Stonor, Woodward's Sensation, Export Danemark, Roi Humbert, San Marzano, Cerise, Paire, Groseille
Medium-fruited varieties: Perpignan, Marmande, Perdrigeon, Merveille des marches, Reine des hatives, Alice Roosevelt, Pierrette
Varieties with large fruits: Rouge grosse, Rouge grosse maraichere, Larglobe, Break-o-day, Trophy, Perfection, Mikado ecarlate, Ponderosa, Blanche native grosse lisse

Yeager, A. F.

Genetic stocks : $\underline{d} - \underline{a} - \underline{c} - \underline{l} - \underline{r} - \underline{y}$
 $\underline{d} - \underline{p} - \underline{o} - \underline{s} - \underline{r} - \underline{y}$

Young, P. A.

Many of the genetic stocks described in Texas A.E.S. Bul. 698

STOCKS DESIRED

Rick, C. M.

Any line that is jointless but not leafy (j-Lf)
(see note on page 13)

PART IV. BIBLIOGRAPHY OF PAPERS ON TOMATO GENETICS ANDBREEDING PUBLISHED IN 1949.

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- Bahl, A. N., Sadano, J. C. and Ahmod, B., 1949. Carotenoid pigments of different cross-breeds of cultivated and wild varieties of tomatoes and the effect of further inter-varietal crossing on the carotenoid content. Indian Jour. Med. Res. 37:182-192.
- Brabec, Fr., 1949. Zytologische Untersuchungen an den Burdonen Solanum nigrum lycopersicum. Planta 37:57-95.
- Brown, S. W., 1949. The structure and meiotic behavior of the differentiated chromosomes of tomato. Genetics 34:437-461.
- , 1949. Endomitosis in the tapetum of tomato. Amer. Jour. Bot. 36:703--716.
- Carncross, J. W., 1949. American Tomato Yearbook. C. S. MacFarland Pub. 40 pp. (Includes statistics of the U. S. tomato industry, a buyers guide, and a bibliography of tomato breeding).
- Crane, M. E., and Silva, S. S., 1949. The influence of some genetic and environmental factors on the concentration of L-ascorbic acid in the tomato fruit. Jour. Hort. Sci. 25:36-49.
- Frazier, W. A., and Dennett, R. K., 1949. Isolation of Lycopersicon esculentum-type tomato lines essentially homozygous resistant to root knot. Proc. Amer. Soc. Hort. Sci. 54:225-236.
- , 1949. Tomato lines of Lycopersicon esculentum resistant to tobacco mosaic virus. Proc. Amer. Soc. Hort. Sci. 54:265-271.
- Gyrcff, B., 1949. The inheritance of the ascorbic acid content of paprika and tomato. Proc. Eighth Int. Congr. Genetics Stockholm 585-586 (Abstract).
- Hendrix, J. W., and Frazier, W. A., 1949. Studies on the inheritance of Stemphyllium resistance in tomatoes. Hawaii A.E.S. Tech. Bul. 8:1-24.
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