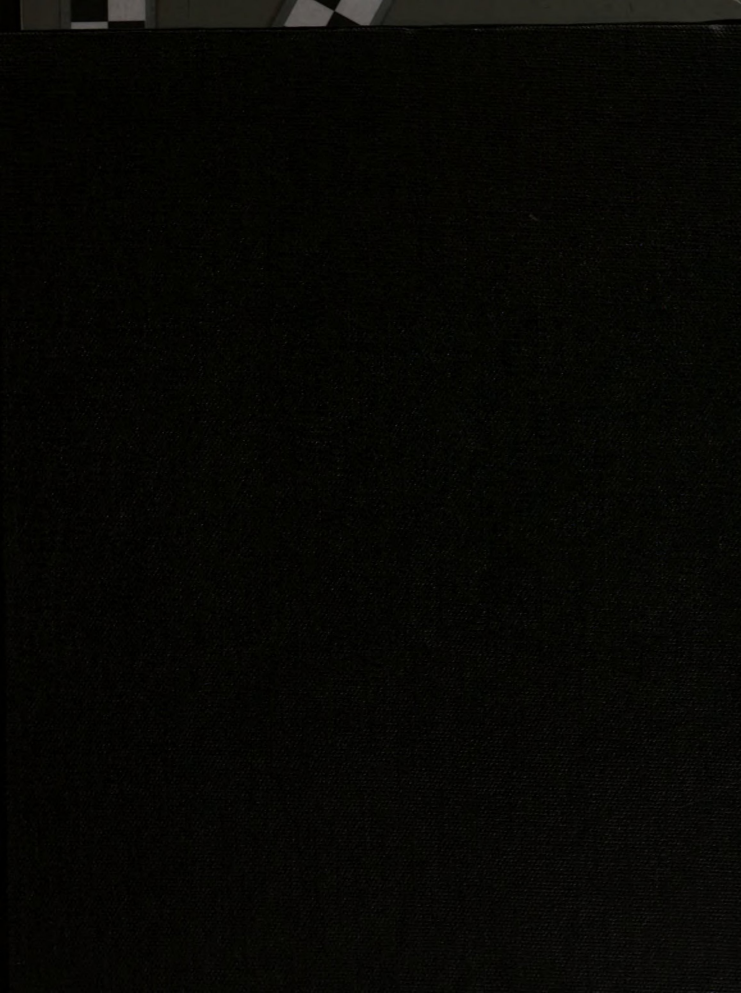




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***** A THESIS. *****
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*****Correlation of the Tree Characters of Apples*****
=====

Submitted by

Ray Gordon Voorhorst.

To the Michigan Agricultural College

as part requirement for the

Master of Science Degree.

***** June 1917. *****

*****A THESIS*****

*****Correlation of the Tree Characters of Michigan

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THESIS

*****Foreword*****

The author takes this opportunity to acknowledge his indebtedness to those who have aided so materially in the preparation of this paper: To the Horticultural Department of the Michigan Agricultural College for material used and for valuable suggestions; to Mr. F. A. Spragg, Instructor in Plant Crops, Michigan Agricultural College, for assistance and for suggestions; to Mrs. F. G. Voorhees and to Mrs. John Sims, who have helped in the checking^{of} data and in the preparation of this paper.

INTRODUCTION.

The fruit characters of the apple have been much more extensively studied and more fully described than have the tree characters. Perhaps this has been so because the fruit is more accessible at all times. Especially was this the method practiced by the earlier pomologists. A few notes sufficed to describe the tree and then a lengthy description of the fruit followed. But, at present, one sees a marked tendency to devote more time to a description of the tree characters. This is a forward step in the identification of varieties. The tree characters may constitute a part of the identity of the variety just as truly as do the fruit characters. However, it is commonly understood that the vegetative characters are more affected by environmental factors, than are the reproductive parts. The question then naturally arises, "Can the tree characters be depended upon in the identification of a variety?"

SCOPE OF THE EXPERIMENT.

The object of this investigation has been to determine: (1) Whether there is any correlation between similar characters of trees of the same variety; (2) Whether there is any correlation between similar characters of trees which have been supposed to be of the same pomological group; and, (3) Whether the correlations have been due to external factors rather than to internal factors. That is, "Is environment sufficiently strong to overcome heredity in the vegetative parts of the plant, or does heredity manifest itself?"

MATERIALS AND METHODS.

This investigation was conducted in the Grand apple orchard of the Michigan Agricultural College, East Lansing, Michigan. Some thirty-eight varieties of apples grow in this orchard. Originally each variety was represented by three trees. But through death and removal many varieties are represented now by one or two trees only. About two-thirds of the trees are of Paradise roots, the remainder are of Fennish roots. Material for this investigation came from both of these sources. In the data, location will always

be made of the surface of the material, whether it be Paradise or Pervin. The Paradise trees stood ten feet apart while the Pervin trees were planted fifteen feet apart.

The trees are approximately ten years old. A portion of them are thrifty; others, mention of which is to follow, are decidedly *Unthrifty*. The soil is a heavy clay loam. The writer thinks that it is due to the condition of a part of this soil that some of the trees are in so unthrifty a condition. An irregular circular area some four or five rods in diameter, which forms the highest point in the orchard— although the whole orchard does not vary more than two feet in elevation— seems to be overlaid with an impervious subsoil. While the orchard has been almost continuously in sod, no considerable extent of sod grows at this point, the ground being sparsely covered with small weed growth, mostly dandelion at this time.

Of the material used in this investigation, the varieties, Winter Banana and Mother were almost certainly affected and perhaps the varieties Sutton and Jonathan were also affected by this poor soil area. Owing to the poor growth made on this area it was sometimes difficult for the writer to obtain from the tree even the small amount of material with which he worked.

The varieties selected were eleven in number, namely: Esopus Spitzenburg, Jonathan, Mother, and Red Canada representing the Jonathan Group; Fall Pippin, Maiden Blush, and Winter Banana representing the Fall Pippin Group; Fameuse and McIntosh representing the Fameuse Group; and, Hubbardston and Sutton * representing the King Group.

In addition to these eleven varieties representing four pomological groups the writer also studied some twenty other varieties for purposes of comparison and may include the data therefrom at times.

*The writer is aware that in placing Sutton with Hubbardston he is not following the arrangement of groups given by Hedrick in Bulletin 275 N.Y. State Station, which has been his guide. But Beach, in the "Apples of New York," states that some believe Sutton to be a seedling of Hubbardston.

The material studied consisted: (1) in the new growth of shoots, the measurements being taken from a point on the southwest side of the tree and continuing around to the east until the desired number of twigs had been measured. In some cases this included practically all the twigs, the tree having but few more than twenty-five, the number of twigs used; and, (2) in the leaves. The limitations of time prevented the consideration of other characters.

The method followed in studying the new growth was as follows: Measurement was made of the distance from the last annual ring to the tip of the shoot. The measurement was made in inches with a yard-stick reading to the nearest half-inch. The inches were changed into their equivalents in millimeters before the computations were made. The diameter of the twig or shoot was measured at a distance of two inches above the last annual ring, the vernier calipers being used and measurements reading to the nearest tenth of a millimeter. This is the method Shaw followed in measuring diameters.

In measuring the leaf two methods were used. (1) The length and the greatest transverse diameter of the blade were measured. (2) The length of the blade and the length of the petiole were measured. In these measurements the millimeter scale was used.

The leaves were taken from a point near or just below the middle of the current season's growth, as suggested by Shaw.¹

The methods used for the determination of the different constants are those used by the Farm Crops Department of the Michigan Agricultural College. The formulas for these procedures are:-

$$\text{Correction } (C) = \frac{\sum f (V - G)}{N}$$

$$\text{Mean } (M) = G \pm C$$

$$\text{Standard Deviation } (\sigma) = \sqrt{\frac{\sum f (V - G)^2}{N-1} - G \sum (V - G)}$$

$$\text{Probable Error of Mean } (E_M) = \pm .6745 \frac{\sigma}{\sqrt{N}}$$

$$\text{Probable Error of Standard Deviation } (E_\sigma) = \pm .6745 \frac{\sigma}{\sqrt{2N}}$$

$$\text{Coefficient of Correlation } (r) = \frac{\frac{\sum P}{N} - G_1 G_2}{\sigma_1 \sigma_2}$$

$$\text{Probable Error of Coefficient of Correlation } (E_r) =$$

$$\pm \frac{.6745 (1 - r^2)}{\sqrt{N}}$$

The symbols used are those used by Bailey and Gilbert².
n = number, v = value, M = Mean, G = guess at mean, o = M - G,
 Σ = sum of, σ = standard deviation, f = frequency,
E = probable error.

The calculations were all checked by another person than the one who made them.

PRESENTATION OF DATA.

Owing to a scarcity of material at the time the collection of data was made, the number of individuals in each case is extremely small,-- too small, in fact, to admit of any degree of accuracy in results. Twenty-five shoots from each tree were used and the number of leaves from each variety ranges from sixteen to twenty-four.

The following characters were studied: length of new growths (shoots), diameter of new growth, length of leaf blade (not including tip), greatest transverse diameter of leaf blade, and length of petiole of leaf.

Before presenting the data on correlations it has been thought that it might make for clearness to present the

twelve classes. Variation in the character is not great. It is to be noticed that the number of nodes in the remaining of the bodies without a consideration of a typical chart. The trees of a single variety are shown side by side. The size of a class was 50 millimeters.

Length of Branches.

Esopus--- One tree only was studied. The range in classes was from 500 to 675 millimeters. The constants for this character were as shown in Table 1.

Table 1. Showing Variations in Length of New Growth of Esopus.

One unit = one millimeter.

	Tree No. 1.	Tree No. 2.	Tree No. 3.
Number	25	-----	-----
Mode	760	-----	-----
Mean	744	-----	-----
P.T. of Mean	± 14.61644	-----	-----
Standard Deviation	108.33081	-----	-----
P.T. of Stand. Dev.	± 10.83355	-----	-----
Coefficient of Var.	14.57133	-----	-----
P.T. of Coef. of Var.	$\pm .66487$	-----	-----
	-----	-----	-----

Jehathan---Two trees were studied. The range in classes was 570 - 610 millimeters, and 500 - 550 millimeters in trees 1 and 2 respectively. The constants for this character were as shown in Table 2.

Table 2. Showing Variations in Length of New Growth of Jehathan.

One unit = one millimeter.

	Tree No. 1.	Tree No. 2.	Tree No. 3.
Number	25	----	25
Mode	550	----	570
Mean	490	----	510
P.T. of Mean	± 17.60604	----	± 17.64143
Standard Deviation	150.51101	----	127.11001

U.F. of Mean	± 14.11001	-----	± 14.11001
Stann. Dev.	57.1201	-----	57.1201
U.F. of Stann. Dev.	± 1.00000	-----	± 1.00000
	=====	=====	=====

In this case an increase in the mean was accompanied by a decrease in the standard deviation and in the coefficient of variability.

Lotter--- Three trees were studied. The range in diameter was: 170 - 550 mm., 300 - 750 mm., and 300 - 600 mm. in trees 1, 2, and 3 respectively. The constants for the character of growth are shown in Table 4.

Table 4. Growth Variations in Diameter of New Growth of Lotter.

One unit = one millimeter.

Tree No. 1. Tree No. 2. Tree No. 3.

Number	25	25	25
Range	380	450	330
Mean	325	508	450
U.F. of mean	± 7.71201	± 14.96400	± 10.11300
Stann. Dev.	57.6777	110.11407	101.01000
U.F. of Stann. Dev.	± 1.01100	± 10.10000	± 10.11170
Coef. of Var.	20.6000	20.7000	20.7220
U.F. of Coef. of Var.	± 1.00000	± 1.00000	± 1.00000
	=====	=====	=====

We can see that the increase in mean diameter of the other trees is accompanied by an increase in standard deviation in both these trees over the first tree. But when the other two trees are themselves compared we find that the standard deviation increases with the increase of the mean. The tree making the greatest increase in the mean has the lowest coefficient of variability. The tree having the shallowest mean is second in variability, and the tree making second increase in mean is highest in variability.

Tree Canada. (Dorset Stool)--- Three trees were studied. The range in diameter was: 300 - 1050 mm., 450 - 1100 mm.,

400-500 mm. in rows 1, 2, and 3 respectively. The constants for the standard deviation are shown in Table 4.

Table 4. Showing Variations in Row 1 of New Growth of Tree Farina.

One unit = one millimeter.

Tree No. 1. Tree No. 2. Tree No. 3.

Number	15	15	15
Mean	650	700	610
Mean	700	710	671
D.F. of Row	± 11.93145	± 10.04107	± 10.91711
Standard Deviation	24.2361	100.01.77	120.10711
D.F. of Stand. Dev.	± 10.73000	± 10.80410	± 10.73000
Coeff. of Var.	10.7307	10.0107	10.0107
D.F. of Coef. of Var.	± 1.11170	± 1.01170	± 1.01170
=====	=====	=====	=====

The tree having the lowest mean and mean has also the lowest standard deviation and lowest coefficient of variability. The tree having highest mean and mean is highest in standard deviation and highest in coefficient of variability. The tree having highest in mean and mean is intermediate in standard deviation and coefficient of variability.

Tree No. 1--- Three trees were studied. The row 1 or classes was 400 - 500 mm., 400 - 500 mm., and 400 - 500 mm. in rows 1, 2, and 3 respectively. The constants for the standard deviation are shown in Table 5.

Table 5. Showing Variations in Row 1 of New Growth of Tree No. 1.

One unit = one millimeter.

Tree No. 1. Tree No. 2. Tree No. 3.

Number	15	15	15
Mean	700	700	610
Mean	600	610	610

P.E. of Mean	± 10.7116	± 11.41016	± 13.83321
Standard Deviation	161.6045	167.64636	186.82337
P.E. of Stan. Dev.	$\pm .018845$	$\pm .11730$	$\pm .18433$
Coef. of Var.	15.1816	17.5481	20.8137
P.E. of Coef. of Var.	± 1.11337	± 1.1062	± 1.01661
	=====	=====	=====

The tree lowest in mean is lowest in standard deviation and intermediate in variability. The second in mean is intermediate in standard deviation and lowest in variability. The tree highest in mean is highest in standard deviation and in coefficient of variability.

Naider Plush (Porein Steel)---Three trees were studied. The range in diameter was: 450-750 m.m., 450-850m.m., and 450 - 850m.m. in trees 1, 2, and 3 respectively. The constants for this character are shown in Table 3.

Table 3. Showing Variation in Length of New Growth of Naider Plush.

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	25	25	25
Mean	666	700	750
Mean.	678	672	672
P.E. of Mean	± 10.07324	± 10.07438	± 17.20753
Standard Deviation	93.81681	100.83773	127.54684
P.E. of Stan. Dev.	± 9.84417	± 10.70259	± 12.13701
Coef. of Var.	13.7336	20.5072	19.1763
P.E. of Coef. of Var.	± 1.00000	± 1.00000	± 1.00000
	=====	=====	=====

The tree lowest in mean is lowest in standard deviation, and also lowest in coefficient of variability. The second in mean is highest in standard deviation and highest in variability. The tree highest in mean is intermediate in both standard deviation and in variability.

Winter Parana---Three trees were analyzed. The range in classes was: 171-176mm., and 180-186mm. in trees 1 and 2 respectively. The constants for the character of length are shown in Table 7.

Table 7. Showing Variations in Length of Nov. Growth of Winter Parana.

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	15	27	-----
Mode	811	736	-----
Mean	738	873	-----
P.T. of mean	± 32.78621	± 17.04664	-----
Standard Deviation	128.40027	128.04178	-----
P.T. of Stand. Dev.	$\pm .16214$	$\pm .16240$	-----
Coef. of Var.	17.2615	14.5569	-----
P.T. of Coef. of Var.	± 1.56014	± 1.16200	-----
	=====	=====	=====

The tree 1 was in 1st year in lowest in standard deviation and in coefficient of variability.

Parana (Forest School)---Three trees were analyzed. The range in classes was: 461-506mm., 501-556mm., and 416-476mm. in trees 1, 2, or 3 respectively. The constants for the character of length are shown in Table 8.

Table 8. Showing Variations in Length of Nov. Growth of Parana.

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	17	27	27
Mode	550	550	600
Mean	608	583	581
P.T. of mean	± 17.74300	± 13.81800	± 17.41300
Standard Dev.	115.01710	120.02700	146.02517

P.E. of Stark. lev.	± 16.11601	± 15.75176	± 15.61211
Coef. of Var.	17.2011	22.1001	15.7176
P.E. of Coef. of Var.	± 1.66612	± 1.71336	± 1.21661
	=====	=====	=====

The tree lowest in mean and mean is intermediate in standard deviation and highest in coefficient of variability. The tree second in mean is lowest in both standard deviation and in the coefficient of variability. The tree highest in mean was also highest in standard deviation but intermediate in coefficient of variation.

McIntosh. (Golden Steel)-----Three trees were studied. The range in classes was: 850-1050 mm., 550-850 mm., and 350-550 mm. in trees 1, 2, and 3 respectively. The constants for the character of length are shown in Table 9.

Table 9. Showing Variation in Length of New Growth of McIntosh.

In unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	27	27	23
Mode	800	650	700
Mean	800	690	620
P.E. of Mean	± 26.55309	± 21.38218	± 21.51787
Stand. lev.	108.27019	161.31338	140.42805
P.E. of Stand. lev.	$\pm .17917$	$\pm .14710$	$\pm .14140$
Coef. of Var.	28.3500	29.3117	33.1004
P.E. of Coef. of Var.	± 1.677770	± 1.54300	± 1.77131
	=====	=====	=====

Now we find the tree lowest in mean to be lowest in standard deviation and intermediate in coefficient of variability. The tree second in mean was highest in both standard deviation and in coefficient of variability. The tree highest in mean was intermediate in standard deviation and lowest in coefficient of variability.

Hubbardston. Two trees were studied. The range in classes was: 500-700 mm. and 350-500 mm. in trees 1 and 2 respectively. The constants for the character of length are shown in Table 10.

Table 10. Showing Variations in Length of New Growth of Theobroma.

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	-----	27	27
Note	-----	300	510
Mean	-----	730	740
P.T. of Mean	-----	± 17.00613	± 17.00613
Standa. Dev.	-----	100.01014	100.07110
P.T. of Standa. Dev.	-----	± 13.21741	± 13.27101
Coef. of Var.	-----	24.2217	13.5113
P.T. of Coef. of Var.	-----	± 1.31220	± 1.31207
	=====	=====	=====

The tree lowest in mean was lowest in standard deviation and in last in coefficient of variability.

Discussion. The tree was chosen. The range in circles was: 401-500 mm. in the top piece. The constants for the character of length are shown in Table 11.

Table 11. Showing Variations in Length of New Growth of Sutton,

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	----	----	27
Note	----	----	300
Mean	----	----	334
P.T. of Mean	----	----	± 14.27116
Standa. Dev.	----	----	105.79037
P.T. of Standa. Dev.	----	----	± 10.01120
Coef. of Var.	----	----	13.3603
P.T. of Coef. of Var.	----	----	± 1.01107
	=====	=====	=====

The tree stands out for comparison. However we might say that the tree has a high mean and a low standard deviation, and a low coefficient of variability when compared with other varieties.

As previously explained, the measurements for this character were taken at the end of the growth cycle - the last annual ring. The next eleven letters will deal with this character. The size of a class was .5 mm. or less.

Eucalyptus. ---One tree only was studied. The range in classes was 4.0 - 8.0 millimeters for this tree. The constants for the character of diameter are shown in Table 12.

Table 12. Showing Variations in Diameter of New Growth of Eucalyptus.
One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	57	-----	----
Mean	5.5	-----	----
Mean	5.1	-----	----
P.E. of Mean	$\pm .12730$	-----	----
Standard Deviation	.64648	-----	----
P.E. of Stdev. of Var.	$\pm .15563$	-----	----
Coef. of Var.	15.5134	-----	----
P.E. of Coef. of Var.	$\pm .66080$	-----	----
	=====	=====	=====

While the mean is rather high here the standard deviation is not great and the coefficient of variation is low.

Jonathan. Two trees were studied. The range in classes was: 5.0-6.0 mm. and 5.5-7.0 mm. in trees 1 and 2 respectively. The constants for the character of diameter are shown in Table 13.

Table 13. Showing Variations in Diameter of New Growth of Jonathan.

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	25	-----	25
Mean	4.0	-----	5.0
Mean	4.6	-----	4.81

P.F. of Mean	$\pm .101175$	-----	$\pm .11013$
Stand. Dev.	.7700	-----	.83370
P.F. of Stand. Dev.	$\pm .07171$	-----	$\pm .06171$
Coeff. of Var.	17.8171	-----	18.4381
P.F. of Coef. of Var.	± 1.17343	-----	± 1.17133
	=====	=====	=====

We see in this case, that, with an increase in the mode and mean, we likewise have an increase in the standard deviation and in the coefficient of variability.

Notker. ---Three trees were studied. The range of classes was: 3.5-4.5 mm., 4.5-5.5 mm., and 5.5-6.5 mm. in trees 1, 2, and 3 respectively. The constants of the character of diameter are shown in Table 14.

Table 14. Showing Variations in Diameter of New Growth of Notker.

One mm. = one millimeter.

	Tree No. 1.	Tree No. 2.	Tree No. 3.
Number	28	25	25
Mode	4.0	5.5	5.5
Mean	4.13	5.24	5.10
P.F. of mean	$\pm .077103$	$\pm .08048$	$\pm .12033$
Stand. Dev.	.57135	.63833	1.11803
P.F. of Stand. Dev.	$\pm .07453$	$\pm .08337$	$\pm .10834$
Coeff. of Var.	12.9710	12.8701	18.3803
P.F. of Coef. of Var.	$\pm .79370$	$\pm .77890$	± 1.10310
	=====	=====	=====

Here we find as the mode and the mean increase, the standard deviation likewise increases. But there is a very slight decrease in the coefficient of variability of the tree intermediate in mean. It is somewhat lower than the tree having the lowest mean. The tree having the highest mean has also the highest standard deviation and the highest coefficient of variability.

Red Canada (Forsin Stock)--- Three trees were studied.

The range in classes was: 4.0-5.0 mm., 5.0-6.0 mm., and 6.0-7.0 mm. in trees 1, 2, and 3 respectively.

The constants for the character of diameter are shown in Table 12, Table 13, and the Variation in Diameter of New Growth of Red Gum.

One unit = one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	25	25	25
Range	5.6-7.6	7.0	7.0
Mean	5.83	7.3	7.15
P.T. of Mean	$\pm .12117$	$\pm .12737$	$\pm .12216$
Stand. Dev.	1.13237	1.73133	.92733
P.T. of Stand. Dev.	$\pm .10711$	$\pm .13807$	$\pm .09446$
Coef. of Var.	19.1313	23.1334	13.0347
P.T. of Coef. of Var.	± 1.21364	± 1.23134	$\pm .63334$
	=====	=====	=====

The tree having the lowest mean and mean here ranks intermediate in standard deviation and in coefficient of variability. The tree which has the intermediate mean ranks lowest in standard deviation and in coefficient of variability, as well. The tree which has the highest standard deviation and highest mean also has the highest coefficient of variability.

Fall Pippin. -----Three trees were studied. The range in classes was:4.5-8.5 mm., 5.0- 10.5 mm.,and 5.0-10.0 mm. in trees 1,2, and 3 respectively. The constants for the character of diameter are shown in Table 13.

Table 13. Showing Variation in Diameter of New Growth of Fall Pippin.

One unit= one millimeter.

	Tree No.1.	Tree No.2.	Tree No.3.
Number	25	25	25
Range	6.0	8.0	8.0
Mean	6.72	6.60	6.72
P.T. of Mean	$\pm .12311$	$\pm .13313$	$\pm .12110$
Stand. Dev.	1.10133	1.23333	1.40771
P.T. of Stand. Dev.	$\pm .09343$	$\pm .11733$	$\pm .13411$
Coef. of Var.	15.8721	18.1333	20.3333
P.T. of Coef. of Var.	$\pm .67377$	± 1.13333	± 1.33333
	=====	=====	=====

The tree lowest in mean is lowest in standard deviation, and in coefficient of variability. The tree intermediate in mean is highest in standard deviation and in coefficient of variability. The tree highest in mean is intermediate in standard deviation and in coefficient of variability.

Summer Flush (Palm Springs)--- Three trees were studied. The range in classes was: 3.7-5.0 mm., 4.0-5.5 mm., and 5.7-7.5 mm. in trees 1, 2, and 3 respectively. The characters for the character of diameter are shown in Table 17.

Table 17. Character Variation in Diameter of New Growth of Summer Flush.

One inch = one millimeter.

	Tree No. 1.	Tree No. 2.	Tree No. 3.
Number	15	15	15
Mode	5.0	5.0	5.0
Mean	4.66	5.33	5.74
P.T. of mean	$\pm .00101$	$\pm .00073$	$\pm .00072$
Stand. dev.	.68136	.64511	1.12666
P.T. of Stand. Dev	$\pm .00101$	$\pm .00073$	$\pm .00072$
Coeff. of Var.	14.632	12.0207	19.6114
P.T. of Coef. of Var.	$\pm .00101$	$\pm .00073$	$\pm .00072$

We find here perfect agreement. As the mean diameter is accompanied by an increase in standard deviation and in coefficient of variability.

Winter Flush--- Two trees were studied. The range in classes was: 4.7-5.0 mm., and 4.0-5.0 mm. in trees 1 and 2 respectively. The characters for the character of diameter are shown in Table 18.

Table 18. Character Variation in Diameter of New Growth of Winter Flush.

One inch = one millimeter.

	Tree No. 1.	Tree No. 2.	Tree No. 3.
Number	15	15	----
Mode	5.0	5.0	----
Mean	5.34	5.13	----

P.E. of Mean	$\pm .10382$	$\pm .11000$	-----
Stand. Dev.	1.47517	1.40091	-----
P.E. of Stand. Dev.	$\pm .10111$	$\pm .10916$	-----
Coef. of Var.	23.3746	21.1111	-----
P.E. of Coef. of Var.	± 1.74714	± 1.57801	-----
=====			

These two trees have almost identical means, standard deviations, and coefficients of variability. The standard deviations increase with the increase in mean, but there is a slight decrease in the coefficient of variability with an increase in mean.

Famorse (Main Stock)---- Three are 3 were studied. The range of classes was: 4.5-7.0 mm., 4.0 - 6.5 mm., and 4.5-6.5 mm. in trees 1, 2, and 3 respectively. The constants for the character of diameter are shown in Table 18.

Table 18. Showing Variations in Diameter of Non Growth of Famorse.

One unit = one millimeter.

	Tree No. 1.	Tree No. 2.	Tree No. 3.
Number	25	25	25
Code	5.0	5.5	5.0
Mean	5.73	5.68	5.63
P.E. of Mean	$\pm .08107$	$\pm .06403$	$\pm .14813$
Stand. Dev.	.68191	.60702	1.03810
P.E. of Stand. Dev.	$\pm .08704$	$\pm .03141$	$\pm .10474$
Coef. of Var.	12.2346	13.7751	18.6377
P.E. of Coef. of Var.	$\pm .78318$	$\pm .87340$	± 1.30494
=====			

There is a lack of uniformity in this case. The tree having lowest in mean is intermediate in standard deviation and in coefficient of variability. The tree which is intermediate in mean is lowest in standard deviation and in coefficient of variability. The tree having the highest mean also has the highest standard deviation and the highest coefficient of variability.

Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains.

$\frac{d}{dt} \left(\frac{1}{t} \right) = -\frac{1}{t^2}$

Age Group	1990	2000	2010	2020
0-14	15.0%	14.0%	13.0%	12.0%
15-24	12.0%	11.0%	10.0%	9.0%
25-34	10.0%	9.0%	8.0%	7.0%
35-44	8.0%	7.0%	6.0%	5.0%
45-54	6.0%	5.0%	4.0%	3.0%
55-64	4.0%	3.0%	2.0%	1.0%
65-74	2.0%	3.0%	4.0%	5.0%
75+	1.0%	2.0%	3.0%	4.0%

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1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

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Figure 1. The effect of the concentration of the *Agrobacterium* strain on the transformation efficiency of *Agrobacterium* strain 1024. The *Agrobacterium* strain 1024 was cultured in the YEA medium for 24 h at 28 °C. The cell concentration was adjusted to 10⁸ cells/ml. The cell suspension was mixed with the plant extract and the mixture was incubated for 24 h at 28 °C. The mixture was then transformed into the *Agrobacterium* strain 1024. The transformation efficiency was determined by the number of transformants per 10⁸ cells. The data are the mean ± SD of three independent experiments.

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$\frac{1}{60}$ • $\frac{59}{60}$ • $\frac{1}{61}$ • $\frac{60}{61}$ • $\frac{1}{62}$ • $\frac{61}{62}$ • $\frac{1}{63}$ • $\frac{62}{63}$ • $\frac{1}{64}$ • $\frac{63}{64}$ • $\frac{1}{65}$ • $\frac{64}{65}$ • $\frac{1}{66}$ • $\frac{65}{66}$ • $\frac{1}{67}$ • $\frac{66}{67}$ • $\frac{1}{68}$ • $\frac{67}{68}$ • $\frac{1}{69}$ • $\frac{68}{69}$ • $\frac{1}{70}$ • $\frac{69}{70}$ • $\frac{1}{71}$ • $\frac{70}{71}$ • $\frac{1}{72}$ • $\frac{71}{72}$ • $\frac{1}{73}$ • $\frac{72}{73}$ • $\frac{1}{74}$ • $\frac{73}{74}$ • $\frac{1}{75}$ • $\frac{74}{75}$ • $\frac{1}{76}$ • $\frac{75}{76}$ • $\frac{1}{77}$ • $\frac{76}{77}$ • $\frac{1}{78}$ • $\frac{77}{78}$ • $\frac{1}{79}$ • $\frac{78}{79}$ • $\frac{1}{80}$ • $\frac{79}{80}$ • $\frac{1}{81}$ • $\frac{80}{81}$ • $\frac{1}{82}$ • $\frac{81}{82}$ • $\frac{1}{83}$ • $\frac{82}{83}$ • $\frac{1}{84}$ • $\frac{83}{84}$ • $\frac{1}{85}$ • $\frac{84}{85}$ • $\frac{1}{86}$ • $\frac{85}{86}$ • $\frac{1}{87}$ • $\frac{86}{87}$ • $\frac{1}{88}$ • 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$\frac{114}{115}$ • $\frac{1}{116}$ • $\frac{115}{116}$ • $\frac{1}{117}$ • $\frac{116}{117}$ • $\frac{1}{118}$ • $\frac{117}{118}$ • $\frac{1}{119}$ • $\frac{118}{119}$ • $\frac{1}{120}$ • $\frac{119}{120}$ • $\frac{1}{121}$ • $\frac{120}{121}$ • $\frac{1}{122}$ • $\frac{121}{122}$ • $\frac{1}{123}$ • $\frac{122}{123}$ • $\frac{1}{124}$ • $\frac{123}{124}$ • $\frac{1}{125}$ • $\frac{124}{125}$ • $\frac{1}{126}$ • $\frac{125}{126}$ • $\frac{1}{127}$ • $\frac{126}{127}$ • $\frac{1}{128}$ • $\frac{127}{128}$ • $\frac{1}{129}$ • $\frac{128}{129}$ • $\frac{1}{130}$ • $\frac{129}{130}$ • $\frac{1}{131}$ • $\frac{130}{131}$ • $\frac{1}{132}$ • $\frac{131}{132}$ • $\frac{1}{133}$ • $\frac{132}{133}$ • $\frac{1}{134}$ • $\frac{133}{134}$ • $\frac{1}{135}$ • $\frac{134}{135}$ • $\frac{1}{136}$ • $\frac{135}{136}$ • $\frac{1}{137}$ • $\frac{136}{137}$ • $\frac{1}{138}$ • $\frac{137}{138}$ • $\frac{1}{139}$ • $\frac{138}{139}$ • $\frac{1}{140}$ • $\frac{139}{140}$ • $\frac{1}{141}$ • $\frac{140}{141}$ • $\frac{1}{142}$ • $\frac{141}{142}$ • $\frac{1}{143}$ • $\frac{142}{143}$ • $\frac{1}{144}$ • $\frac{143}{144}$ • $\frac{1}{145}$ • $\frac{144}{145}$ • $\frac{1}{146}$ • $\frac{145}{146}$ • $\frac{1}{147}$ • $\frac{146}{147}$ • $\frac{1}{148}$ • $\frac{147}{148}$ • $\frac{1}{149}$ • <

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1. *Journal of the American Medical Association*, 1990; 263: 1025-1028.

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NoIntosh. (Yellow Birch)----- Three trees were studied.

The range in classes was: 4.5 - 11.0 mm., 4.0 - 6.0 mm., and 4.0 - 10.5 mm. in trees 1, 2, and 3 respectively. The constants of the character of diameter are shown in Table 20.

Table 20. Showing Variation of Diameter of New Growth of NoIntosh.

One unit = one millimeter.

| | Tree No.1. | Tree No.2. | Tree No.3. |
|-----------------------|---------------|---------------|---------------|
| Number | 25 | 25 | 25 |
| Mode | 7.0 | 7.0 | 7.0 |
| Mean | 7.06 | 6.9 | 6.36 |
| P.F. of Mean | $\pm .12006$ | $\pm .12275$ | $\pm .10000$ |
| Stand. Dev. | 1.37213 | 1.42227 | 1.40772 |
| P.F. of Stand. Dev. | $\pm .17215$ | $\pm .13330$ | $\pm .10420$ |
| Coef. of Var. | 23.6020 | 20.7168 | 22.4373 |
| P.F. of Coef. of Var. | ± 1.91044 | ± 1.38316 | ± 1.47325 |
| | ===== | ===== | ===== |

In this case we find an increase in mean accompanied by an increase in standard deviation. But the tree having lowest in mean is intermediate in coefficient of variability. The tree having the highest mean has also the highest standard deviation and the highest coefficient of variability.

Hubbardston ----- Two trees were studied. The range in classes was: 5.0 - 8.5 mm., and 5.0 - 7.5 mm. respectively in trees 2 and 3. The constants for the character studied are shown in Table 21.

Table 21. Showing Variation of in Diameter of New Growth of Hubbardston.

One unit = one millimeter.

| | Tree No.1. | Tree No.2. | Tree No.3. |
|--------------|------------|--------------|--------------|
| Number | ----- | 25 | 25 |
| Mode | ----- | 4.5 | 5.0 |
| Mean | ----- | 4.72 | 5.02 |
| P.F. of Mean | ----- | $\pm .08279$ | $\pm .10000$ |
| Stand. Dev. | ----- | .21070 | .19100 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|-----|------|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 | 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 | 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 | 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 | 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 | 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 | 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 | 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 | 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 | 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 | 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 | 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 | 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 | 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 | 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 | 1001 | 1002 | 1003 | 1004 | 1005 | 1006 | 1007 | 1008 | 1009 | 1010 | 1011 | 1012 | 1013 | 1014 | 1015 | 1016 | 1017 | 1018 | 1019 | 1020 | 1021 | 1022 | 1023 | 1024 | 1025 | 1026 | 1027 | 1028 | 1029 | 1030 | 1031 | 1032 | 1033 | 1034 | 1035 | 1036 | 1037 | 1038 | 1039 | 1040 | 1041 | 1042 | 1043 | 1044 | 1045 | 1046 | 1047 | 1048 | 1049 | 1050 | 1051 | 1052 | 1053 | 1054 | 1055 | 1056 | 1057 | 1058 | 1059 | 1060 | 1061 | 1062 | 1063 | 1064 | 1065 | 1066 | 1067 | 1068 | 1069 | 1070 | 1071 | 1072 | 1073 | 1074 | 1075 | 1076 | 1077 | 1078 | 1079 | 1080 | 1081 | 1082 | 1083 | 1084 | 1085 | 1086 | 1087 | 1088 | 1089 | 1090 | 1091 | 1092 | 1093 | 1094 | 1095 | 1096 | 1097 | 1098 | 1099 | 1100 | 1101 | 1102 | 1103 | 1104 | 1105 | 1106 | 1107 | 1108 | 1109 | 1110 | 1111 | 1112 | 1113 | 1114 | 1115 | 1116 | 1117 | 1118 | 1119 | 1120 | 1121 | 1122 | 1123 | 1124 | 1125 | 1126 | 1127 | 1128 | 1129 | 1130 | 1131 | 1132 | 1133 | 1134 | 1135 | 1136 | 1137 | 1138 | 1139 | 1140 | 1141 | 1142 | 1143 | 1144 | 1145 | 1146 | 1147 | 1148 | 1149 | 1150 | 1151 | 1152 | 1153 | 1154 | 1155 | 1156 | 1157 | 1158 | 1159 | 1160 | 1161 | 1162 | 1163 | 1164 | 1165 | 1166 | 1167 | 1168 | 1169 | 1170 | 1171 | 1172 | 1173 | 1174 | 1175 | 1176 | 1177 | 1178 | 1179 | 1180 | 1181 | 1182 | 1183 | 1184 | 1185 | 1186 | 1187 | 1188 | 1189 | 1190 | 1191 | 1192 | 1193 | 1194 | 1195 | 1196 | 1197 | 1198 | 1199 | 1200 | 1201 | 1202 | 1203 | 1204 | 1205 | 1206 | 1207 | 1208 | 1209 | 1210 | 1211 | 1212 | 1213 | 1214 | 1215 | 1216 | 1217 | 1218 | 1219 | 1220 | 1221 | 1222 | 1223 | 1224 | 1225 | 1226 | 1227 | 1228 | 1229 | 1230 | 1231 | 1232 | 1233 | 1234 | 1235 | 1236 | 1237 | 1238 | 1239 | 1240 | 1241 | 1242 | 1243 | 1244 | 1245 | 1246 | 1247 | 1248 | 1249 | 1250 | 1251 | 1252 | 1253 | 1254 | 1255 | 1256 | 1257 | 1258 | 1259 | 1260 | 1261 | 1262 | 1263 | 1264 | 1265 | 1266 | 1267 | 1268 | 1269 | 1270 | 1271 | 1272 | 1273 | 1274 | 1275 | 1276 | 1277 | 1278 | 1279 | 1280 | 1281 | 1282 | 1283 | 1284 | 1285 | 1286 | 1287 | 1288 | 1289 | 1290 | 1291 | 1292 | 1293 | 1294 | 1295 | 1296 | 1297 | 1298 | 1299 | 1300 | 1301 | 1302 | 1303 | 1304 | 1305 | 1306 | 1307 | 1308 | 1309 | 1310 | 1311 | 1312 | 1313 | 1314 | 1315 | 1316 | 1317 | 1318 | 1319 | 1320 | 1321 | 1322 | 1323 | 1324 | 1325 | 1326 | 1327 | 1328 | 1329 | 1330 | 1331 | 1332 | 1333 | 1334 | 1335 | 1336 | 1337 | 1338 | 1339 | 1340 | 1341 | 1342 | 1343 | 1344 | 1345 | 1346 | 1347 | 1348 | 1349 | 1350 | 1351 | 1352 | 1353 | 1354 | 1355 | 1356 | 1357 | 1358 | 1359 | 1360 | 1361 | 1362 | 1363 | 1364 | 1365 | 1366 | 1367 | 1368 | 1369 | 1370 | 1371 | 1372 | 1373 | 1374 | 1375 | 1376 | 1377 | 1378 | 1379 | 1380 | 1381 | 1382 | 1383 | 1384 | 1385 | 1386 | 1387 | 1388 | 1389 | 1390 | 1391 | 1392 | 1393 | 1394 | 1395 | 1396 | 1397 | 1398 | 1399 | 1400 | 1401 | 1402 | 1403 | 1404 | 1405 | 1406 | 1407 | 1408 | 1409 | 1410 | 1411 | 1412 | 1413 | 1414 | 1415 | 1416 | 1417 | 1418 | 1419 | 1420 | 1421 | 1422 | 1423 | 1424 | 1425 | 1426 | 1427 | 1428 | 1429 | 1430 | 1431 | 1432 | 1433 | 1434 | 1435 | 1436 | 1437 | 1438 | 1439 | 1440 | 1441 | 1442 | 1443 | 1444 | 1445 | 1446 | 1447 | 1448 | 1449 | 1450 | 1451 | 1452 | 1453 | 1454 | 1455 | 1456 | 1457 | 1458 | 1459 | 1460 | 1461 | 1462 | 1463 | 1464 | 1465 | 1466 | 1467 | 1468 | 1469 | 1470 | 1471 | 1472 | 1473 | 1474 | 1475 | 1476 | 1477 | 1478 | 1479 | 1480 | 1481 | 1482 | 1483 | 1484 | 1485 | 1486 | 1487 | 1488 | 1489 | 1490 | 1491 | 1492 | 1493 | 1494 | 1495 | 14 |
|---|---|---|---|---|---|---|---|---|-----|------|----|

| | | | |
|-----------------------|---------|--------------|--------------|
| T.T. of Stand. Dev. | 4.00000 | $\pm$.00004 | $\pm$.00001 |
| Coef. of Var. | ----- | 10.0000 | 10.0000 |
| P.T. of Coef. of Var. | ----- | $\pm$.00000 | $\pm$.00000 |

Understand to know in these trees. An increase in size and mean is accompanied by an increase in standard deviation and in coefficient of variability.

Figure. ----One tree only was studied. The range in classes was: 4.0 - 8.0 mm. for this tree. The statistics for the diameter of diameter are shown in Table 23.

Table 23. Showing Variation in Diameter of New Growth of Figure.

One unit = one millimeter.

| | Tree No. 1. | Tree No. 2. | Tree No. 3. |
|-----------------------|-------------|-------------|--------------|
| Number | ---- | ---- | 25 |
| Mode | ----- | ----- | 6.0 |
| Mean | ----- | ----- | 6.36 |
| T.T. of Mean | ----- | ----- | $\pm$.17083 |
| Stand. Dev. | ----- | ----- | 1.03616 |
| P.T. of Stand. Dev. | ----- | ----- | $\pm$.10000 |
| Coef. of Var. | ----- | ----- | 16.2641 |
| P.T. of Coef. of Var. | ----- | ----- | $\pm$.00000 |

All that can be said here is that this tree has a high mean, a high standard deviation and a high coefficient of variability.

Discussion of the Variation in Length and in Diameter of the New Growth of All of the Varieties.

In studying the mean, the standard deviation and the coefficient of variability we learn these facts: The general summation for length is, that out of the one hundred highest mean, we find five highest standard deviation, three intermediate and one the had the lowest standard deviation among the highest mean. Of the six trees having intermediate mean length

of the nine trees having the highest mean length, the first eight having the highest standard deviation and one last intermediate in this constant. Of the six trees having intermediate mean diameters, the first three intermediate, the lowest and the highest in standard deviation. Of the six trees having lowest diameters, the first lower having the lowest, and the intermediate standard deviations. Then the coefficient of variation is the character studied as such character. Of the nine trees having the highest mean, seven had the highest, one the intermediate and one the lowest coefficient of variation. Of the six trees intermediate in mean diameter, one was highest, one was intermediate, and three were lowest in coefficient of variation. Of the nine trees having the lowest mean diameter, four were lowest, two were intermediate and one was highest in coefficient of variation.

Now we consider the diameters, of the circular, we have these results: Of the nine trees having the highest mean, the first eight having the highest standard deviation and one last intermediate in this constant. Of the six trees having intermediate mean diameters, the first three intermediate, the lowest and the highest in standard deviation. Of the six trees having lowest diameters, the first lower having the lowest, and the intermediate standard deviations. Then the coefficient of variation is the character studied as such character. Of the nine trees having the highest mean, seven had the highest, one the intermediate and one the lowest coefficient of variation. Of the six trees intermediate in mean diameter, one was highest, one was intermediate, and three were lowest in coefficient of variation. Of the nine trees having the lowest mean diameter, four were lowest, two were intermediate and one was highest in coefficient of variation.

If we take the statement of Huxley⁶, as quoted by Tever⁷, that, "The coefficient of variability is not of great importance to students in biology, he, (Huxley) being of the opinion that the coefficient of variability were not an index of actual facts of growth by as much as the standard deviation," and pursue our conclusions thereby- we find, that in general, the tree highest in mean length of new growth and in mean diameter of new growth is also highest in standard deviation; and that the tree lowest in these characters is also lowest in standard deviation.

Having considered the variations in the length and in the diameter of the leaf blade, we will now proceed to a study of the variations in the length and transverse diameter of the leaf blades and of the variations in the length of the petioles of the leaves. It was unfortunate that the leaves were taken collectively by 20 or all the trees of a variety instead of having taken into the study individual trees. This, on the one hand, the material was not so numerous, it was the material of the leaves of one variety with another, without the possibility of comparing the individuals within the variety. We should have wished that these comparisons of the leaves of a tree of a variety with those of another tree, or even of the same variety, could not have been made for it would have been of assistance to us in our comparison of the trees included within a variety. As the matter stands the comparison of one individual tree with another of the same variety has been confined wholly to a study of the characters of length and diameter of the new growth of shoots. Comparisons will be made, however, between the leaves of one variety and those of other varieties. Our first study will be a comparison of the length of the leaf blades and the transverse (broadish) diameter of the leaf blades. Later, we will study the variations in blade length and petiole length.

In the study of blade length and transverse diameter of the blade, the size of the class is five millimeters. The mid-classes are multiples of five (5). Leaf, or blade, length and diameter our first study, most advantageously in the same table, the secondizing space. The table which follows shows the variations in length and transverse diameter of leaf.

ESQUBUS.

Sixteen individuals were studied. The range of the classes for length was: 10-70 millimeters; for diameter, 40-55 millimeters. The constants for these characters are shown in Table 23.

Table 23. Showing Variations in Length and in Transverse Diameter of the Leaf Blade of Esqubus.

One unit = one millimeter.

| | Length | Diameter. |
|--------|--------|-----------|
| Number | 13 | 13 |
| Mode | 30 | 45 |

| | Length | Diameter |
|-----------------------|--------------|--------------|
| Mean | 61.6127 | 47.4131 |
| S.D. of Mean | $\pm .84173$ | $\pm .76113$ |
| Standard Deviation | 4.63117 | 4.31831 |
| S.D. of Stand. Dev. | $\pm .76114$ | $\pm .76113$ |
| Coeff. of Var. | 0.2726 | 0.2178 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

JONATHAN.

Twenty-two individuals were examined. The range in classes was: for length, 45 - 75 mm., for diameter, 30 - 50 millimeters. The constants for these characters are shown in Table 24.

Table 24. Standard Deviations in Length and in Transverse Diameter of the Head Blade of Jonathan.

One unit = one millimeter.

| | Length | Diameter |
|-----------------------|------------|------------|
| Number | 22 | 22 |
| Range | 30 | 41 |
| Mean | 61.6 | 47.41 |
| S.D. of Mean | $\pm .841$ | $\pm .763$ |
| Stand. Dev. | 4.632 | 4.318 |
| S. D. of Stand. Dev. | $\pm .814$ | $\pm .761$ |
| Coeff. of Var. | 0.2726 | 0.2178 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

NORMA.

Seventeen individuals were studied. The range in classes was: for length, 30-35 millimeters; for diameter, 30-35 millimeters. The constants for these characters are shown in Table 25.

Table 25. Standard Deviations in Length and in Transverse Diameter of the Head Blade of Norma.

One unit = one millimeter.

| | Length | Diameter |
|-----------------------|------------|------------|
| Number | 17 | 17 |
| Range | 73 | 53 |
| Mean | 70.000 | 57.000 |
| S.D. of Mean | $\pm .000$ | $\pm .000$ |
| Standa. Dev. | 5.000 | 7.000 |
| S.D. of Standa. Dev. | $\pm .000$ | $\pm .000$ |
| Coeff. of Var. | 7.000 | 12.278 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

ESE CHINA.

Twenty-five individuals were obtained. The range in diameter was; for length, 50-70 millimeters; for diameter, 40-60 millimeters. The constants for these elements are shown in Table 25.

Table 25. Relative Variations in Length and in Transverse Diameter of the Leaf Blade of ESE China.

One unit = one millimeter.

| | Length | Diameter |
|-----------------------|------------|------------|
| Number | 25 | 25 |
| Range | 65 | 30 |
| Mean | 61.000 | 52.000 |
| S.D. of Mean | $\pm .000$ | $\pm .000$ |
| Standa. Dev. | 5.000 | 6.000 |
| S.D. of Standa. Dev. | $\pm .000$ | $\pm .000$ |
| Coeff. of Var. | 8.197 | 11.538 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

Fall Tipin-Cay.

ESE CHINA.

Twenty-five individuals were obtained. The range in diameter was; for length, 70-100 millimeters; for diameter, 50-65 mm. The constants for these elements are shown in Table 27.

Table 27. Relative Variations in Length and in Transverse Diameter of the Leaf Blade of Fall Tipin-Cay.

One unit = one millimeter.

• $\frac{1}{2}$
• $\frac{1}{3}$
• $\frac{1}{4}$

• $\frac{1}{2}$
• $\frac{1}{3}$
• $\frac{1}{4}$

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• $\frac{1}{2}$

• $\frac{1}{2}$

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• $\frac{1}{2}$

• $\frac{1}{2}$

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| | Length | Transverse |
|-----------------------|-------------|-------------|
| Number | 10 | 10 |
| Mean | 61.667 | 57.137 |
| S.D. of Mean | ± 1.170 | ± 1.110 |
| Stand. Dev. | 3.870 | 3.464 |
| S.D. of Stand. Dev. | $\pm .001$ | $\pm .017$ |
| Coeff. of Var. | 10.160 | 11.377 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

PAIDEN FLUSH. (Green Creek)

Eighteen individuals were examined. The age of the class was: for length, 30-50 millimeters; for diameter, 10-25 millimeters. The characters for these characters are shown in Table 18.

One star = one millimeter.

Table 18. Showing Variations in the Length and Transverse Diameter of the Head Third of Paiden Flush.

| | Length | Transverse |
|-----------------------|-------------|------------|
| Number | 18 | 18 |
| Mean | 31 | 30 |
| Mean | 31 | 27.137 |
| S.D. of Mean | ± 1.170 | $\pm .600$ |
| Stand. Dev. | 3.870 | 3.464 |
| S.D. of Stand. Dev. | $\pm .010$ | $\pm .017$ |
| Coeff. of Var. | 11.333 | 11.111 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

PAIDEN FLUSH.

Eighteen individuals were examined. The age of the class was: for length, 30-50 millimeters; for diameter, 10-25 millimeters. The characters for these characters are shown in Table 19.

Table 19. Showing Variations in the Length and Transverse Diameter of the Head Third of Paiden Flush.

One star = one millimeter.

| | Length | Transverse |
|-----------------------|-------------|-------------|
| Number | 10 | 10 |
| Range | 80 | 80 |
| Mean | 75.610 | 77.820 |
| P.E. of Mean | ± 1.135 | ± 1.014 |
| Stand. Dev. | 7.520 | 8.034 |
| P.E. of Stand. Dev. | $\pm .654$ | $\pm .626$ |
| Coeff. of Var. | 0.031 | 0.040 |
| P.E. of Coef. of Var. | ---- | ---- |
| | ===== | ===== |

Female Group.

EXPERIMENTAL (Female Group) Twenty-four individuals were studied.

The range in classes was: for length, 80 - 85 millimeters; for diameter, 45 - 50 millimeters. The constants for these characters are shown in Table 30.

Table 30. Showing Variations in the Length and in the Transverse Diameter of the Head of Female.

Constant = one millimeter.

| | Length | Transverse |
|-----------------------|-------------|------------|
| Number | 24 | 24 |
| Range | 75 - 80 | 45 |
| Mean | 75.500 | 76.125 |
| P.E. of Mean | ± 1.114 | $\pm .900$ |
| Stand. Dev. | 8.000 | 8.000 |
| P.E. of Stand. Dev. | $\pm .778$ | $\pm .600$ |
| Coeff. of Var. | 0.034 | 0.034 |
| P.E. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

EXPERIMENTAL.

Twenty-four individuals were studied. The range in classes was: for length, 75-80 millimeters; for diameter, 40-50 mm. The constants for these characters are shown in Table 31.

Table 31. Showing Variations in the Length and in the Transverse Diameter of the Head of Male.

Constant = one millimeter.

| | Length. | Diameter. |
|-----------------------|-------------|-------------|
| Number | 25 | 25 |
| Node | 50, 60, 67. | 47, 50. |
| Mean | 57.160 | 52.180 |
| P.E. of Mean | ± 1.847 | ± 1.871 |
| Stand. Dev. | 6.100 | 6.034 |
| P.E. of Stand. Dev. | $\pm .914$ | $\pm .860$ |
| Coef. of Var. | 10.670 | 11.571 |
| P.E. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

Vine Group.

HUBBARDSTON.---Thirty-two individuals were studied. The range in classes was: for length, 55 - 70 millimeters; for diameter, 40-70 millimeters. The constants for the characters are shown in Table 32.

Table 32. Showing Variations in the Length and Transverse Diameter of the Leaf Blade of Hubbardston.

One unit = one millimeter.

| | Length | Diameter. |
|-----------------------|-------------|-------------|
| Number | 32 | 32 |
| Node | 60 | 50 and 57 |
| Mean | 72.938 | 53.813 |
| P.E. of Mean | ± 1.146 | ± 1.021 |
| Stand. Dev. | 7.937 | 7.103 |
| P.E. of Stand. Dev. | $\pm .732$ | $\pm .761$ |
| Coef. of Var. | 10.880 | 11.903 |
| P.E. of Coef. of Var. | ===== | ===== |
| | ===== | ===== |

SUTTON.---Sixteen individuals were studied. The range in classes was: for length, 60 - 85 millimeters; for diameter, 45 - 65 mm. The constants for these characters are shown in Table 33.

Table 33. Showing Variation in the Length and in the Transverse Diameter of the Leaf Blade of Sutton.

One unit = one millimeter.

| | Length | Diameter |
|-----------------------|-------------|-------------|
| Number | 16 | 16 |
| No. 13 | 77.446 | 54.032 |
| Mean | 77.5 | 54.032 |
| S.D. of mean | ± 1.506 | ± 1.076 |
| Stand. Dev. | 7.746 | 6.101 |
| S.D. of Stand. Dev. | $\pm .601$ | $\pm .761$ |
| Coeff. of Var. | 10.846 | 11.065 |
| S.D. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

Discussion of the Variation in the Length or in the Diameter of the Leaf Blade.

Going to the point that the leaves were rather un-
wisely chosen from all the trees representing the variety,
no comparison of the above mentioned characters between trees
of the same variety could be made. Our efforts will therefore
be confined to a discussion of the variation found in trees
representing a geographical group.

In the Jonathan Group, we study Wapug, Jonathan, Nathan,
and Tom Canada.--The first named having grown on Tomin Stock
whereas the others grew on Paradise Stock, might be thought to
differ in its leaf characters from the others. A study of the
tables however, fails to verify this belief. For purpose of
comparison we have concluded it best to compare the various
constants, one at a time. For the length character we learn
these facts: The mean for the varieties Wapug, Jonathan, Tom

Canada, and Mother represent the Jon than Group, are; 55 mm., 60mm., 57 mm., and 71 mm. respectively. Attention is called to the fact that the three first are very much closer to each other than the last shows a much higher value. The means for length of leaves in these trees in the group named are; 50.5125 mm., 51.0 mm., 51.50 mm., and 73.50 mm. respectively. Of course we would expect the means to resemble, somewhat, the means and they do.

For the standard deviation for length we find these results: For the trees in the group named; 4.6665 mm., 5.822 mm., 5.007 mm., and 5.533 mm. respectively. The standard deviation for the last named variety, namely; Mother, is low when its mean length is considered. When the coefficient of variability is considered, we find these results: 9.3738, 11.035, 8.782, and 7.014 respectively. We find the leaves of the variety "Mother" to be the least variable.

In conclusion we may say that in the constants for the length character of the leaf blade, the varieties Popus, Jonathan and Red Canada stand close together while Mother is quite alone in these characters.

In considering the same constants for diameter in the varieties of this same group, we find results as follows: None; 45 mm., 45 mm., 60 mm., and 55 mm. respectively for Popus, Jonathan, Red Canada, and Mother.

Red Canada in this case, shows a greater divergence from the

first two than does Mother. Of course, it is expected the means to be quite similar. The means were 47.518 mm., 47.44 mm., 50.373 mm., and 47.353 mm. respectively. Red Canada again joins its group and Mother moves further away. The standard deviations were: 4.6435 mm., 5.345 mm., 6.811 mm., and 5.037 mm. respectively. Red Canada shows the greatest deviation and Teopus the least for this character. But the coefficient of variability may tell another story.

The coefficients of variability were: 10.2478, 11.715, 14.373, and 8.703 respectively. This is as we expected. Teopus, Jonathan, and Red Canada are more variable than Mother. A characteristic of Mother has been to consistently hold to a low coefficient of variability. Teopus, Jonathan, and Red Canada show a close resemblance to each other while Mother, while placed in this group, has never shown so close a resemblance. Especially do Teopus and Jonathan resemble each other. Red Canada, being on Toudin roots, may be altered somewhat.

A discussion of the Fall Pippin Group.

Of this group, Maiden Blush was on Toudin roots, while Winter Banana was probably modified somewhat by its poor habitat. As in the preceding case, the constants for the length and for the diameter will be taken up in order, for Fall Pippin, Maiden Blush, and Winter Banana.

But when we consider that one of the traits showing a variability in branches similar to this variability in leaf diameter we may yet find an explanation for this behavior.

The coefficients of variability are: 11.877, 9.012, and 14.443 respectively. Maiden Blush consistently holds a low place in all the constants. Fall Pippin is rather consistent, but the radical departure in standard deviation of diameter has raised its coefficient of variability considerably.

Discussion of the Flaccus Group, represented by Flaccus and McIntosh. The nodes for length were: (75 and 80) mm., and (50-55-65 mm.). The means for length were: 75.728 mm. and 59.166 mm. The standard deviations were: 8.645 mm. and 9.418 mm. Flaccus with a much larger mean ~~has~~^s a lower standard deviation consequently McIntosh has a larger coefficient of variability, that for Flaccus being 10.844 and for McIntosh 13.675.

The constants for diameter of leaf blade in this group were: Nodes 75 and (45 and 60); Means, 52.125 and 41.166 mm. standard deviation 5; 3.165 and 3.334 mm. The coefficients of variability were 11.648 and 10.811.

The constants for length in these two varieties are widely separated, but the constants for diameter more nearly resemble one another.

Discussion of the Vine Group, represented by Rubenasten and Sutton. The constants for length of blade were: Means 80 and (75 and 86) mm., Means 72.867 mm. and 72.5 mm. mm., coefficient of variability, 18.216 and 11.616 and for standard deviations; 7.637 mm. and 7.546 mm. respectively.

The constants for length of blade were: Means (75 and 86) and 75 mm. respectively. Means were 75.368 mm. and 74.682 mm., Standard deviations, 7.155 mm. and 6.345 mm. ^{the} coefficients of variability being 11.885 and 11.967. To take this opportunity to call attention to the very close resemblance in both length and diameter characters of the leaf to found in these two varieties. We are firmly of the belief that these two varieties belong to the same zoological group. Later (in the discussion of blade and petiole lengths) we shall find this assumption strengthened by the results shown there.

... ..

... ..

For the sake of brevity, the

... ..

...

The

Table 31.--

... ..

| | ... | ... |
|-----|------------|------------|
| ... | 18 | 18 |
| ... | 20 | 18.1-22.5 |
| ... | 22.4-27 | 20.7 |
| ... | $\pm .54$ | $\pm .002$ |
| ... | $\pm .125$ | 2.711 |
| ... | $\pm .003$ | $\pm .016$ |
| ... | 7.000 | 0.721 |
| ... | ----- | ----- |
| | ----- | ----- |

... ..

Table 27. Growth Variations in Length of Plant and in Length of Petiole of Fall Ragwort.

| | | |
|-----------------------|-------------------------|------------|
| | 1 cm. = one millimeter. | |
| | Plant | Petiole |
| Number | 13 | 13 |
| Mode | 37 | 18.7 |
| Mean | 35.77 | 18.51 |
| P.T. of mean | $\pm .241$ | $\pm .246$ |
| Standa. Dev. | 1.874 | 1.756 |
| P.T. of stand. Dev. | $\pm .433$ | $\pm .311$ |
| Coeff. of Var. | 5.603 | 5.741 |
| P.T. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

Fall Ragwort Group.

FALL RAGWORT. The range in classes was: for length of plant, 30 - 40 millimeters; for petiole length, 10.7 - 24.8 millimeters. The constants for these characters are shown in Table 27.

Table 28. Growth Variations in Length of Plant and in Length of Petiole of Fall Ragwort.

1 cm. = one millimeter.

| | | |
|-----------------------|-------------|------------|
| | Plant | Petiole |
| Number | 13 | 13 |
| Mode | 31 | 22.5 |
| Mean | 35.075 | 18.153 |
| P.T. of mean | ± 1.511 | $\pm .346$ |
| Standa. Dev. | 0.936 | 1.5 |
| P.T. of stand. Dev. | ± 1.071 | $\pm .181$ |
| Coeff. of Var. | 10.631 | 8.710 |
| P.T. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

MAINTENANCE. (Newspaper Stock)

The range in classes was: for length of plant, 30-41 mm. for petiole length, 10.5-21.7 millimeters. The constants for these characters are shown in Table 28.

TABLE 39. Showing Variations in Length of Tarsal Bone and Length of Middle Toe of Parrot Finch.

Sample = 375 individuals.

| | Flank | Female |
|-----------------------|-------------|------------|
| Number | 16 | 16 |
| Mean | 31 | 28.5 |
| Mean | 71.23 | 10.873 |
| P.E. of Mean | ± 1.050 | $\pm .101$ |
| Stand. Dev. | 6.050 | .937 |
| P.E. of Stand. Dev. | $\pm .751$ | $\pm .114$ |
| Coeff. of Var. | 6.401 | 1.017 |
| P.E. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

REMARKS:--- The age in classes was: for length of Flank, 60-64 millimeters; for middle toe, 20.7-22.7 mm. The constants for these characters are shown in Table 40.

Table 40. Showing Variations in the Length of Flank and in the Length of Middle Toe of Parrot Finch.

Sample = 375 individuals.

| | Flank | Female |
|-----------------------|-------------|------------|
| Number | 16 | 16 |
| Mean | 77.062 | 28.5 |
| Mean | 77.062 | 28.573 |
| P.E. of mean | ± 1.050 | $\pm .101$ |
| Stand. Dev. | 6.123 | .937 |
| P.E. of Stand. Dev. | $\pm .751$ | $\pm .114$ |
| Coeff. of Var. | 6.006 | 10.123 |
| P.E. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

PARROT GROUP.

PARROT. (Parrot Finch) The range in classes was: for length of Flank, 60-64 millimeters; for middle toe, 20.7-22.7 mm.

The constants for these characters are shown in Table 41.

Table 41. Showing Variations in Length of Flank and in Length of Middle Toe of Parrot Finch. Sample = 375 individuals.

| | Plants | Petioles |
|-----------------------|-------------|------------|
| Number | 13 | 13 |
| Mode | 61-70-70 | 20.5 |
| Mean | 73.143 | 18.23 |
| P.T. of Mean | ± 1.117 | $\pm .707$ |
| Stand. Dev. | 3.912 | 1.604 |
| P.T. of Stand. Dev. | ± 1.050 | $\pm .878$ |
| Coeff. of Var. | 11.578 | 11.615 |
| P.T. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

MOINTAH (puain stock)

The range in classes was: for length of plant, 4-64 millimeters; for petiole length, 15.5-23.5 millimeters. The constants for these characters are shown in Table 42.

Table 42. Showing Variations in Length of Plant and in Length of Petiole of MOINTAH.

One unit = one millimeter.

| | Plants | Petioles |
|-----------------------|-------------|------------|
| Number | 13 | 13 |
| Mode | 77 | 24.5 |
| Mean | 83.373 | 21.173 |
| P.T. of Mean | ± 1.071 | $\pm .840$ |
| Stand. Dev. | 3.790 | 1.513 |
| P.T. of Stand. Dev. | ± 1.137 | $\pm .864$ |
| Coeff. of Var. | 13.870 | 11.160 |
| P.T. of Coef. of Var. | ----- | ----- |
| | ===== | ===== |

King Group/.

HUMPHREYSON. The range in classes was: for length of plant, 30-87 millimeters; for length of petiole, 16. - 23.5 mm. The constants for these characters are shown in Table 43.

Table 43. Showing Variations in Length of Plant and in Length of Petiole of HUMPHREYSON.

One unit = one millimeter.

very close correlation.

In the Tule River Group, the petioles have means of 16.36 and 14.677 millimeters for Tanneke and McIntosh, respectively. These are considered as their correlations.

The River Group shows means of 14.171 and 14.677 millimeters for McIntosh and Tanneke, respectively. A close correlation we would say.

In conclusion, it seems that there is a fair degree of correlation in these characters of the apple leaf. It seems to be even later in this paper will, we believe however, more accurately determine the degree of correlation in all characters, both branches and leaves.

-----Correlation of the new growth and leaf characters-----

In order to be able to tell how closely one character is associated with another it is very necessary that we resort to the use of correlation tables. We will now proceed to this study, taking up in order, the characters of length and diameter of the new growth; length and diameter of the leaf blades; and leaf blade and petiole lengths.

We will now take up the new growth correlations. Without further mention the leaf blade characters and petiole characters will follow in order at the conclusion of this part.

TSCORUS. Tree No. 1.

| V | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | F |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| 100 | | | | | | | | | | | | | | |
| 200 | | | | | | | | | | | | | | |
| 300 | | | | | | | | | | | | | | |
| 400 | | | | | | | | | | | | | | |
| 500 | | | | | | | | | | | | | | |
| 600 | | | | | | | | | | | | | | |
| 700 | | | | | | | | | | | | | | |
| 800 | | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | | |
| 1000 | | | | | | | | | | | | | | |
| 1100 | | | | | | | | | | | | | | |
| 1200 | | | | | | | | | | | | | | |
| 1300 | | | | | | | | | | | | | | |
| 1400 | | | | | | | | | | | | | | |
| 1500 | | | | | | | | | | | | | | |
| 1600 | | | | | | | | | | | | | | |
| 1700 | | | | | | | | | | | | | | |
| 1800 | | | | | | | | | | | | | | |
| 1900 | | | | | | | | | | | | | | |
| 2000 | | | | | | | | | | | | | | |
| 2100 | | | | | | | | | | | | | | |
| 2200 | | | | | | | | | | | | | | |
| 2300 | | | | | | | | | | | | | | |
| 2400 | | | | | | | | | | | | | | |
| 2500 | | | | | | | | | | | | | | |
| 2600 | | | | | | | | | | | | | | |
| 2700 | | | | | | | | | | | | | | |
| 2800 | | | | | | | | | | | | | | |
| 2900 | | | | | | | | | | | | | | |
| 3000 | | | | | | | | | | | | | | |
| 3100 | | | | | | | | | | | | | | |
| 3200 | | | | | | | | | | | | | | |
| 3300 | | | | | | | | | | | | | | |
| 3400 | | | | | | | | | | | | | | |
| 3500 | | | | | | | | | | | | | | |
| 3600 | | | | | | | | | | | | | | |
| 3700 | | | | | | | | | | | | | | |
| 3800 | | | | | | | | | | | | | | |
| 3900 | | | | | | | | | | | | | | |
| 4000 | | | | | | | | | | | | | | |
| 4100 | | | | | | | | | | | | | | |
| 4200 | | | | | | | | | | | | | | |
| 4300 | | | | | | | | | | | | | | |
| 4400 | | | | | | | | | | | | | | |
| 4500 | | | | | | | | | | | | | | |
| 4600 | | | | | | | | | | | | | | |
| 4700 | | | | | | | | | | | | | | |
| 4800 | | | | | | | | | | | | | | |
| 4900 | | | | | | | | | | | | | | |
| 5000 | | | | | | | | | | | | | | |
| 5100 | | | | | | | | | | | | | | |
| 5200 | | | | | | | | | | | | | | |
| 5300 | | | | | | | | | | | | | | |
| 5400 | | | | | | | | | | | | | | |
| 5500 | | | | | | | | | | | | | | |
| 5600 | | | | | | | | | | | | | | |
| 5700 | | | | | | | | | | | | | | |
| 5800 | | | | | | | | | | | | | | |
| 5900 | | | | | | | | | | | | | | |
| 6000 | | | | | | | | | | | | | | |
| 6100 | | | | | | | | | | | | | | |
| 6200 | | | | | | | | | | | | | | |
| 6300 | | | | | | | | | | | | | | |
| 6400 | | | | | | | | | | | | | | |
| 6500 | | | | | | | | | | | | | | |
| 6600 | | | | | | | | | | | | | | |
| 6700 | | | | | | | | | | | | | | |
| 6800 | | | | | | | | | | | | | | |
| 6900 | | | | | | | | | | | | | | |
| 7000 | | | | | | | | | | | | | | |
| 7100 | | | | | | | | | | | | | | |
| 7200 | | | | | | | | | | | | | | |
| 7300 | | | | | | | | | | | | | | |
| 7400 | | | | | | | | | | | | | | |
| 7500 | | | | | | | | | | | | | | |
| 7600 | | | | | | | | | | | | | | |
| 7700 | | | | | | | | | | | | | | |
| 7800 | | | | | | | | | | | | | | |
| 7900 | | | | | | | | | | | | | | |
| 8000 | | | | | | | | | | | | | | |
| 8100 | | | | | | | | | | | | | | |
| 8200 | | | | | | | | | | | | | | |
| 8300 | | | | | | | | | | | | | | |
| 8400 | | | | | | | | | | | | | | |
| 8500 | | | | | | | | | | | | | | |
| 8600 | | | | | | | | | | | | | | |
| 8700 | | | | | | | | | | | | | | |
| 8800 | | | | | | | | | | | | | | |
| 8900 | | | | | | | | | | | | | | |
| 9000 | | | | | | | | | | | | | | |
| 9100 | | | | | | | | | | | | | | |
| 9200 | | | | | | | | | | | | | | |
| 9300 | | | | | | | | | | | | | | |
| 9400 | | | | | | | | | | | | | | |
| 9500 | | | | | | | | | | | | | | |
| 9600 | | | | | | | | | | | | | | |
| 9700 | | | | | | | | | | | | | | |
| 9800 | | | | | | | | | | | | | | |
| 9900 | | | | | | | | | | | | | | |
| 10000 | | | | | | | | | | | | | | |

FIG. 1.---Correlation between length and diameter of new growth of Tscorus, Tree No. 1. Length in percent, diameter relative; $r = .808 \pm .0787$.

Identification of new growth---For the characters studied, there is only a fair correlation. In 1934-35 of the tables showing variation in length and in diameter of this tree to be the lowest (14.6) of all the trees in the coefficient of variability for the length character, while the coefficient of variability for diameter is (15.5) is near the average for all the trees. (See Tables 1 and 10.)

JONATHAN, Tree No.1.

| V | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | f |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 250 | | | | | | | | | | | | | | |
| 300 | | | | | | | | | | | | | | |
| 350 | 1 | | | | | | | | | | | | | 1 |
| 400 | | 1 | | | | | | | | | | | | 1 |
| 450 | 1 | 3 | 1 | | | | | | | | | | | 4 |
| 500 | | 2 | 2 | | | | | | | | | | | 4 |
| 550 | | 1 | 1 | | | | | | | | | | | 2 |
| 600 | | | 2 | 1 | 1 | | | | | | | | | 4 |
| 650 | | | | | 4 | | | | | | | | | 4 |
| 700 | | | | 1 | | | | | | | | | | 2 |
| 750 | | | | 1 | | | | | | | | | | 1 |
| 800 | | | | | 1 | | | | | | | | | 1 |
| 850 | | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | | |
| | 2 | 6 | 6 | 4 | 6 | | 1 | | | | | | | 25 |

FIG. 2.--- Correlation between length and diameter of new growth of Jonathan, Tree No.1. Length subject, diameter relative, $r = .8077 \pm .0462$

Length and diameter of new growth--- This is a very good correlation. From the tables of variation we learn that this tree has a high coefficient of variability for length (27.2) and a over the average coefficient of variability for diameter (17.1) (see Tables 2 and 10).

JERATHAN Tree No.2.

| V | 31 | 35 | 41 | 45 | 51 | 55 | 61 | 65 | 71 | 75 | 81 | 85 | 91 | 95 | F |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 250 | | | | | | | | | | | | | | | |
| 300 | | | | | | | | | | | | | | | |
| 350 | | | | | | | | | | | | | | | |
| 400 | 1 | | | | | | | | | | | | | | 1 |
| 450 | 3 | | | | | | | | | | | | | | 3 |
| 500 | | | | | | | | | | | | | | | |
| 550 | | | 1 | 1 | | | | | | | | | | | 2 |
| 600 | | | 5 | 1 | | | | | | | | | | | 6 |
| 650 | | | | 1 | | | | | | | | | | | 1 |
| 700 | | | | 1 | | | | | | | | | | | 1 |
| 750 | | | | | 1 | | | | | | | | | | 1 |
| 800 | | | | | | 1 | | | | | | | | | 1 |
| 850 | | | | | | | 1 | | | | | | | | 1 |
| 900 | | | | | | | | 1 | 1 | | | | | | 2 |
| 950 | | | | | | | | | | | | | | | |
| | 3 | 6 | 4 | 3 | 2 | | | 1 | 1 | | | | | | 25 |

FIG.3.---- Correlation between length and diameter of new growth of Jerathan, Tree No.2. Is an subject, diameter relative; $r = .1700 \pm .050$

Length and diameter of new growth--- This coefficient of correlation is exposed by only one other in all the studies of the characters of the tree. From the variation tables we find that, too, that the coefficient of variability for length (17.1) is a very high one for that character and the coefficient of variability for diameter (16.8) is also one of the highest. See Tables 2 and 10.

TABLE 7.10.7.2.

| V | 31 | 37 | 40 | 47 | 50 | 57 | 67 | 70 | 71 | 80 | 87 | 90 | F |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 150 | | | | | | | | | | | | | |
| 200 | | | | | | | | | | | | | |
| 250 | | | | | | | | | | | | | |
| 300 | | | | 1 | | | | | | | | | 1 |
| 350 | | | | | | | | | | | | | |
| 400 | | | 3 | | 1 | | | | | | | | 3 |
| 450 | | | | | 1 | | | | | | | | 1 |
| 500 | | | | 1 | 1 | 1 | | | | | | | 3 |
| 550 | | | | | 2 | 3 | | | | | | | 5 |
| 600 | | | | | 2 | 2 | | | | | | | 4 |
| 650 | | | | | | 1 | 1 | 1 | | | | | 3 |
| 700 | | | | | | | | | | | | | |
| 750 | | | | | | | | 2 | | | | | 2 |
| 800 | | | | | | | | | | | | | |
| 850 | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | |
| | | | 2 | 2 | 10 | 7 | 1 | 3 | | | | | 25 |

FIG. 5.----Correlation between length and diameter of new growth of Mother, Tree No. 10, for 1st subject, diameter relative; $r = .7322 \pm .0042$

Length and diameter of new growth--- The correlation here is a little below the average for these characters. We find that the tree has a high coefficient of variability for length (20.6) but that it is low in the coefficient of variability for diameter (13.7) Since length is variable and diameter is more constant we would expect a poorer correlation. See Tables 3 and 14.

| V | 3.0 | 4.0 | 4.5 | 4.7 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | f |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 150 | | | | | | | | | | | | | | 1 |
| 200 | | | | | | | | | | | | | | 2 |
| 250 | | | | | | | | | | | | | | 4 |
| 300 | | | | 1 | | | | | | | | | | 3 |
| 350 | | | 1 | | 1 | | | | | | | | | 4 |
| 400 | | | | 1 | 3 | | | | | | | | | 4 |
| 450 | | | | 1 | | | 2 | | | | | | | 3 |
| 500 | | | | 1 | 1 | | 1 | | | | | | | 4 |
| 550 | | | | | 3 | | 1 | | | | | | | 1 |
| 600 | | | | | | | 1 | | | | | | | 1 |
| 650 | | | | | | | | 1 | | | | | | 1 |
| 700 | | | | | | | | 1 | 1 | 1 | | | | 3 |
| 750 | | | | | | | | | 1 | | | | | 2 |
| 800 | | | | | | | | | | | | 1 | | 1 |
| 850 | | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | | |
| | | | | 1 | 4 | 8 | 4 | 1 | 3 | 3 | 1 | | 1 | 25 |

FIG. 6. Correlation between length and diameter of new growth of Mother, Tree No. 3. Length subject, diameter relative; $r = .9570 \pm .0083$

Length and diameter of new growth.-----This, again, is a very good correlation being among the highest obtained. Our variation tables show us that this tree made practically as good growth in length as the tree of the same variety making the least growth, 333 millimeters compared to 303 millimeters; that the coefficient of variability for length was very high (23.7) and that the new growth diameter was the greater of the three trees, (4.42, 5.24, and 6.10 millimeters, respectively). The coefficient of variability of diameter was high, being 18.0%.

See Tables 3 and 14.

FNU CANADA, Tree No.1.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | F |
|------|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|------------------|
| 450 | | | | | | | | | | | | | | | | | 2.11000220001111 |
| 500 | 1 | 1 | | | | | | | | | | | | | | | |
| 550 | | 1 | | | | | | | | | | | | | | | |
| 600 | | | 1 | | | | | | | | | | | | | | |
| 650 | | 1 | 5 | | | | | | | | | | | | | | |
| 700 | | 1 | | 1 | | | | | | | | | | | | | |
| 750 | | | 1 | | | 1 | | | | | | | | | | | |
| 800 | | | | 1 | 1 | 5 | | | | | | | | | | | |
| 850 | | | 1 | | 1 | | 1 | | | | | | | | | | |
| 900 | | | | | | | 1 | | | | | | | | | | |
| 950 | | | | | | 1 | | | | | | | | | | | |
| 1000 | | | | | | | | 1 | | | | | | | | | 1.110001111 |
| 1050 | | | | | | | | | 1 | | | | | | | | |
| 1100 | | | | | | | | | | 1 | | | | | | | |
| 1150 | | | | | | | | | | | 1 | | | | | | |
| 1200 | | | | | | | | | | | | 1 | | | | | |
| 1250 | | | | | | | | | | | | | 1 | | | | |
| | 1 | 4 | 5 | 2 | 2 | 4 | 4 | 1 | 1 | | | | | | | | 25 |

FIG. 7.---- Correlation between the length and diameter of new growth of Fnu Canada, Tree No.1. Length subject, diameter relative; $r = .8837 \pm .0465$.

Length and diameter of new growth.----Here we have a good correlation. The mean length of new growth in this tree was 738 millimeters, the greatest for any of the three trees, the other 2 being 718 and 678 millimeters respectively. But the variability was not as great as it was for another tree, (Tree No.2.); being (10.6) for this tree and (5.2) for Tree No.2. The mean diameter of new growth was the least in this tree and its coefficient of variability was not as great as for tree No.2. (See Tables 2 and 18.

FIG. 5.--CORRELATION TABLE NO. 2.

| V | 52 | 41 | 41 | 71 | 71 | 81 | 87 | 73 | 73 | 73 | 67 | 67 | 67 | 100 | 105 | 110 | 111 | 2 |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|---|
| 450 | | | | 1 | 1 | | | | | | | | | | | | | 2 |
| 500 | | | | | 1 | | | | | | | | | | | | | 1 |
| 570 | | | | | | | | 1 | | | | | | | | | | 4 |
| 600 | | | | | | 1 | | | | | | | | | | | | 1 |
| 630 | | | | | | | | 1 | 1 | | | | | | | | | 3 |
| 700 | | | | | | | | | 1 | | 1 | 1 | | | | | | 3 |
| 750 | | | | | 1 | | 2 | | | | | | | | | | | 5 |
| 800 | | | | | | | | 1 | | 2 | | | | | | | | 3 |
| 870 | | | | | | | | | | | | | | | | | | 1 |
| 900 | | | | | | | | | | | | | | | | | | 1 |
| 950 | | | | | | | | | | | | | 1 | | | | | 1 |
| 1010 | | | | | | | | | | | | | | | | | | 1 |
| 1070 | | | | | | | | | | | | | | | | 1 | | 1 |
| 1100 | | | | | | | | | | | | | | | | | 1 | 1 |
| 1150 | | | | | | | | | | | | | | | | | | 1 |
| 1200 | | | | | | | | | | | | | | | | | | 1 |
| | | | 1 | 2 | 3 | 2 | 1 | 3 | 4 | 1 | 2 | | | | 1 | 2 | | 1 |

FIG. 5.--Correlation between length and diameter of new growth of Tree Canada, Tree No. 2, from 10 to 12 feet, diameter relative $r = .9708 \pm .0010$.

Length and diameter given in the table represents the best correlation of all the trees in the new growth class to 2. It is not the case that gave the correct mean diameter growth, falling 30 millimeters short of Tree No. 1. in this respect. But the coefficient of variability for length was far above any of the others of the variety, and was among the highest of any of the varieties studied, being 20.6%. The new had the greatest diameter of new growth for the variety and the coefficient of variability for diameter of new growth was 20.2, the highest for the variety. See Tables 4 and 15.

TABLE 4. (continued) Tree No. 5.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 | 325 | 330 | 335 | 340 | 345 | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 | 395 | 400 | 405 | 410 | 415 | 420 | 425 | 430 | 435 | 440 | 445 | 450 | 455 | 460 | 465 | 470 | 475 | 480 | 485 | 490 | 495 | 500 | 505 | 510 | 515 | 520 | 525 | 530 | 535 | 540 | 545 | 550 | 555 | 560 | 565 | 570 | 575 | 580 | 585 | 590 | 595 | 600 | 605 | 610 | 615 | 620 | 625 | 630 | 635 | 640 | 645 | 650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720 | 725 | 730 | 735 | 740 | 745 | 750 | 755 | 760 | 765 | 770 | 775 | 780 | 785 | 790 | 795 | 800 | 805 | 810 | 815 | 820 | 825 | 830 | 835 | 840 | 845 | 850 | 855 | 860 | 865 | 870 | 875 | 880 | 885 | 890 | 895 | 900 | 905 | 910 | 915 | 920 | 925 | 930 | 935 | 940 | 945 | 950 | 955 | 960 | 965 | 970 | 975 | 980 | 985 | 990 | 995 | 1000 | 1005 | 1010 | 1015 | 1020 | 1025 | 1030 | 1035 | 1040 | 1045 | 1050 | 1055 | 1060 | 1065 | 1070 | 1075 | 1080 | 1085 | 1090 | 1095 | 1100 | 1105 | 1110 | 1115 | 1120 | 1125 | 1130 | 1135 | 1140 | 1145 | 1150 | 1155 | 1160 | 1165 | 1170 | 1175 | 1180 | 1185 | 1190 | 1195 | 1200 | 1205 | 1210 | 1215 | 1220 | 1225 | 1230 | 1235 | 1240 | 1245 | 1250 | 1255 | 1260 | 1265 | 1270 | 1275 | 1280 | 1285 | 1290 | 1295 | 1300 | 1305 | 1310 | 1315 | 1320 | 1325 | 1330 | 1335 | 1340 | 1345 | 1350 | 1355 | 1360 | 1365 | 1370 | 1375 | 1380 | 1385 | 1390 | 1395 | 1400 | 1405 | 1410 | 1415 | 1420 | 1425 | 1430 | 1435 | 1440 | 1445 | 1450 | 1455 | 1460 | 1465 | 1470 | 1475 | 1480 | 1485 | 1490 | 1495 | 1500 | 1505 | 1510 | 1515 | 1520 | 1525 | 1530 | 1535 | 1540 | 1545 | 1550 | 1555 | 1560 | 1565 | 1570 | 1575 | 1580 | 1585 | 1590 | 1595 | 1600 | 1605 | 1610 | 1615 | 1620 | 1625 | 1630 | 1635 | 1640 | 1645 | 1650 | 1655 | 1660 | 1665 | 1670 | 1675 | 1680 | 1685 | 1690 | 1695 | 1700 | 1705 | 1710 | 1715 | 1720 | 1725 | 1730 | 1735 | 1740 | 1745 | 1750 | 1755 | 1760 | 1765 | 1770 | 1775 | 1780 | 1785 | 1790 | 1795 | 1800 | 1805 | 1810 | 1815 | 1820 | 1825 | 1830 | 1835 | 1840 | 1845 | 1850 | 1855 | 1860 | 1865 | 1870 | 1875 | 1880 | 1885 | 1890 | 1895 | 1900 | 1905 | 1910 | 1915 | 1920 | 1925 | 1930 | 1935 | 1940 | 1945 | 1950 | 1955 | 1960 | 1965 | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 | 2105 | 2110 | 2115 | 2120 | 2125 | 2130 | 2135 | 2140 | 2145 | 2150 | 2155 | 2160 | 2165 | 2170 | 2175 | 2180 | 2185 | 2190 | 2195 | 2200 | 2205 | 2210 | 2215 | 2220 | 2225 | 2230 | 2235 | 2240 | 2245 | 2250 | 2255 | 2260 | 2265 | 2270 | 2275 | 2280 | 2285 | 2290 | 2295 | 2300 | 2305 | 2310 | 2315 | 2320 | 2325 | 2330 | 2335 | 2340 | 2345 | 2350 | 2355 | 2360 | 2365 | 2370 | 2375 | 2380 | 2385 | 2390 | 2395 | 2400 | 2405 | 2410 | 2415 | 2420 | 2425 | 2430 | 2435 | 2440 | 2445 | 2450 | 2455 | 2460 | 2465 | 2470 | 2475 | 2480 | 2485 | 2490 | 2495 | 2500 | 2505 | 2510 | 2515 | 2520 | 2525 | 2530 | 2535 | 2540 | 2545 | 2550 | 2555 | 2560 | 2565 | 2570 | 2575 | 2580 | 2585 | 2590 | 2595 | 2600 | 2605 | 2610 | 2615 | 2620 | 2625 | 2630 | 2635 | 2640 | 2645 | 2650 | 2655 | 2660 | 2665 | 2670 | 2675 | 2680 | 2685 | 2690 | 2695 | 2700 | 2705 | 2710 | 2715 | 2720 | 2725 | 2730 | 2735 | 2740 | 2745 | 2750 | 2755 | 2760 | 2765 | 2770 | 2775 | 2780 | 2785 | 2790 | 2795 | 2800 | 2805 | 2810 | 2815 | 2820 | 2825 | 2830 | 2835 | 2840 | 2845 | 2850 | 2855 | 2860 | 2865 | 2870 | 2875 | 2880 | 2885 | 2890 | 2895 | 2900 | 2905 | 2910 | 2915 | 2920 | 2925 | 2930 | 2935 | 2940 | 2945 | 2950 | 2955 | 2960 | 2965 | 2970 | 2975 | 2980 | 2985 | 2990 | 2995 | 3000 | 3005 | 3010 | 3015 | 3020 | 3025 | 3030 | 3035 | 3040 | 3045 | 3050 | 3055 | 3060 | 3065 | 3070 | 3075 | 3080 | 3085 | 3090 | 3095 | 3100 | 3105 | 3110 | 3115 | 3120 | 3125 | 3130 | 3135 | 3140 | 3145 | 3150 | 3155 | 3160 | 3165 | 3170 | 3175 | 3180 | 3185 | 3190 | 3195 | 3200 | 3205 | 3210 | 3215 | 3220 | 3225 | 3230 | 3235 | 3240 | 3245 | 3250 | 3255 | 3260 | 3265 | 3270 | 3275 | 3280 | 3285 | 3290 | 3295 | 3300 | 3305 | 3310 | 3315 | 3320 | 3325 | 3330 | 3335 | 3340 | 3345 | 3350 | 3355 | 3360 | 3365 | 3370 | 3375 | 3380 | 3385 | 3390 | 3395 | 3400 | 3405 | 3410 | 3415 | 3420 | 3425 | 3430 | 3435 | 3440 | 3445 | 3450 | 3455 | 3460 | 3465 | 3470 | 3475 | 3480 | 3485 | 3490 | 3495 | 3500 | 3505 | 3510 | 3515 | 3520 | 3525 | 3530 | 3535 | 3540 | 3545 | 3550 | 3555 | 3560 | 3565 | 3570 | 3575 | 3580 | 3585 | 3590 | 3595 | 3600 | 3605 | 3610 | 3615 | 3620 | 3625 | 3630 | 3635 | 3640 | 3645 | 3650 | 3655 | 3660 | 3665 | 3670 | 3675 | 3680 | 3685 | 3690 | 3695 | 3700 | 3705 | 3710 | 3715 | 3720 | 3725 | 3730 | 3735 | 3740 | 3745 | 3750 | 3755 | 3760 | 3765 | 3770 | 3775 | 3780 | 3785 | 3790 | 3795 | 3800 | 3805 | 3810 | 3815 | 3820 | 3825 | 3830 | 3835 | 3840 | 3845 | 3850 | 3855 | 3860 | 3865 | 3870 | 3875 | 3880 | 3885 | 3890 | 3895 | 3900 | 3905 | 3910 | 3915 | 3920 | 3925 | 3930 | 3935 | 3940 | 3945 | 3950 | 3955 | 3960 | 3965 | 3970 | 3975 | 3980 | 3985 | 3990 | 3995 | 4000 | 4005 | 4010 | 4015 | 4020 | 4025 | 4030 | 4035 | 4040 | 4045 | 4050 | 4055 | 4060 | 4065 | 4070 | 4075 | 4080 | 4085 | 4090 | 4095 | 4100 | 4105 | 4110 | 4115 | 4120 | 4125 | 4130 | 4135 | 4140 | 4145 | 4150 | 4155 | 4160 | 4165 | 4170 | 4175 | 4180 | 4185 | 4190 | 4195 | 4200 | 4205 | 4210 | 4215 | 4220 | 4225 | 4230 | 4235 | 4240 | 4245 | 4250 | 4255 | 4260 | 4265 | 4270 | 4275 | 4280 | 4285 | 4290 | 4295 | 4300 | 4305 | 4310 | 4315 | 4320 | 4325 | 4330 | 4335 | 4340 | 4345 | 4350 | 4355 | 4360 | 4365 | 4370 | 4375 | 4380 | 4385 | 4390 | 4395 | 4400 | 4405 | 4410 | 4415 | 4420 | 4425 | 4430 | 4435 | 4440 | 4445 | 4450 | 4455 | 4460 | 4465 | 4470 | 4475 | 4480 | 4485 | 4490 | 4495 | 4500 | 4505 | 4510 | 4515 | 4520 | 4525 | 4530 | 4535 | 4540 | 4545 | 4550 | 4555 | 4560 | 4565 | 4570 | 4575 | 4580 | 4585 | 4590 | 4595 | 4600 | 4605 | 4610 | 4615 | 4620 | 4625 | 4630 | 4635 | 4640 | 4645 | 4650 | 4655 | 4660 | 4665 | 4670 | 4675 | 4680 | 4685 | 4690 | 4695 | 4700 | 4705 | 4710 | 4715 | 4720 | 4725 | 4730 | 4735 | 4740 | 4745 | 4750 | 4755 | 4760 | 4765 | 4770 | 4775 | 4780 | 4785 | 4790 | 4795 | 4800 | 4805 | 4810 | 4815 | 4820 | 4825 | 4830 | 4835 | 4840 | 4845 | 4850 | 4855 | 4860 | 4865 | 4870 | 4875 | 4880 | 4885 | 4890 | 4895 | 4900 | 4905 | 4910 | 4915 | 4920 | 4925 | 4930 | 4935 | 4940 | 4945 | 4950 | 4955 | 4960 | 4965 | 4970 | 4975 | 4980 | 4985 | 4990 | 4995 | 5000 | 5005 | 5010 | 5015 | 5020 | 5025 | 5030 | 5035 | 5040 | 5045 | 5050 | 5055 | 5060 | 5065 | 5070 | 5075 | 5080 | 5085 | 5090 | 5095 | 5100 | 5105 | 5110 | 5115 | 5120 | 5125 | 5130 | 5135 | 5140 | 5145 | 5150 | 5155 | 5160 | 5165 | 5170 | 5175 | 5180 | 5185 | 5190 | 5195 | 5200 | 5205 | 5210 | 5215 | 5220 | 5225 | 5230 | 5235 | 5240 | 5245 | 5250 | 5255 | 5260 | 5265 | 5270 | 5275 | 5280 | 5285 | 5290 | 5295 | 5300 | 5305 | 5310 | 5315 | 5320 | 5325 | 5330 | 5335 | 5340 | 5345 | 5350 | 5355 | 5360 | 5365 | 5370 | 5375 | 5380 | 5385 | 5390 | 5395 | 5400 | 5405 | 5410 | 5415 | 5420 | 5425 | 5430 | 5435 | 5440 | 5445 | 5450 | 5455 | 5460 | 5465 | 5470 | 5475 | 5480 | 5485 | 5490 | 5495 | 5500 | 5505 | 5510 | 5515 | 5520 | 5525 | 5530 | 5535 | 5540 | 5545 | 5550 | 5555 | 5560 | 5565 | 5570 | 5575 | 5580 | 5585 | 5590 | 5595 | 5600 | 5605 | 5610 | 5615 | 5620 | 5625 | 5630 | 5635 | 5640 | 5645 | 5650 | 5655 | 5660 | 5665 | 5670 | 5675 | 5680 | 5685 | 5690 | 5695 | 5700 | 5705 | 5710 | 5715 | 5720 | 5725 | 5730 | 5735 | 5740 | 5745 | 5750 | 5755 | 5760 | 5765 | 5770 | 5775 | 5780 | 5785 | 5790 | 5795 | 5800 | 5805 | 5810 | 5815 | 5820 | 5825 | 5830 | 5835 | 5840 | 5845 | 5850 | 5855 | 5860 | 5865 | 5870 | 5875 | 5880 | 5885 | 5890 | 5895 | 5900 | 5905 | 5910 | 5915 | 5920 | 5925 | 5930 | 5935 | 5940 | 5945 | 5950 | 5955 | 5960 | 5965 | 5970 | 5975 | 5980 | 5985 | 5990 | 5995 | 6000 | 6005 | 6010 | 6015 | 6020 | 6025 | 6030 | 6035 | 6040 | 6045 | 6050 | 6055 | 6060 | 6065 | 6070 | 6075 | 6080 | 6085 | 6090 | 6095 | 6100 | 6105 | 6110 | 6115 | 6120 | 6125 | 6130 | 6135 | 6140 | 6145 | 6150 | 6155 | 6160 | 6165 | 6170 | 6175 | 6180 | 6185 | 6190 | 6195 | 6200 | 6205 | 6210 | 6215 | 6220 | 6225 | 6230 | 6235 | 6240 | 6245 | 6250 | 6255 | 6260 | 6265 | 6270 | 6275 | 6280 | 6285 | 6290 | 6295 | 6300 | 6305 | 6310 | 6315 | 6320 | 6325 | 6330 | 6335 | 6340 | 6345 | 6350 | 6355 | 6360 | 6365 | 6370 | 6375 | 6380 | 6385 | 6390 | 6395 | 6400 | 6405 | 6410 | 6415 | 6420 | 6425 | 6430 | 6435 | 6440 | 6445 | 6450 | 6455 | 6460 | 6465 | 6470 | 6475 | 6480 | 6485 | 6490 | 6495 | 6500 | 6505 | 6510 | 6515 | 6520 | 6525 | 6530 | 6535 | 6540 | 6545 | 6550 | 6555 | 6560 | 6565 | 6570 | 6575 | 6580 | 6585 | 6590 | 6595 | 6600 | 6605 | 6610 | 6615 | 6620 | 6625 | 6630 | 6635 | 6640 | 6645 | 6650 | 6655 | 6660 | 6665 | 6670 | 6675 | 6680 | 6685 | 6690 | 6695 | 6700 | 6705 | 6710 | 6715 | 6720 | 6725 | 6730 | 6735 | 6740 | 6745 | 6750 | 6755 | 6760 | 6765 | 6770 | 6775 | 6780 | 6785 | 6790 | 6795 | 6800 | 6805 | 6810 | 6815 | 6820 | 6825 | 6830 | 6835 | 6840 | 6845 | 6850 | 6855 | 6860 | 6865 | 6870 | 6875 | 6880 | 6885 | 6890 | 6895 | 6900 | 6905 | 6910 | 6915 | 6920 | 6925 | 6930 | 6935 | 6940 | 6945 | 6950 | 6955 | 6960 |
|---|----|----|----|----|----|----|----|----|----|----|----|----|------|------|
|---|----|----|----|----|----|----|----|----|----|----|----|----|------|------|

| V | 45 | 48 | 47 | 46 | 47 | 50 | 51 | 71 | 71 | 61 | 65 | 61 | 63 | 66 | 67 | F |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 350 | | | | | | | | | | | | | | | | |
| 400 | | | | | | | | | | | | | | | | |
| 450 | | | 1 | 1 | | | | | | | | | | | | 2 |
| 500 | | | | | 3 | 2 | 3 | | | | | | | | | 6 |
| 550 | | | | 1 | 1 | | | | | | | | | | | 2 |
| 600 | | | | | 1 | 1 | | 1 | | | | | | | | 3 |
| 650 | | | | | | 1 | | 1 | 1 | 1 | | | | | | 4 |
| 700 | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | 5 |
| 750 | | | | | | | | 1 | 1 | | | | | | | 2 |
| 800 | | | | | | | | | | | | | | | | |
| 850 | | | | | | | | | | | | | | 1 | | 1 |
| | | | 1 | 1 | 3 | 4 | 3 | 4 | 3 | 1 | | | | 1 | | 23 |

FIG. 11.--Correlation between length and diameter of new growth of Fall Tilly, Tree No. 2. For 21 subject, diameter relative; $r = .8165 \pm .0480$

Length and diameter of new growth--- This tree is intermediate in its coefficient of correlation, the coefficient being very good. The new length (610mm.) is the same as for the tree highest in coefficient of correlation within the variety. The coefficient of variability for length (17.3) is the lowest of any tree within the variety. The mean diameter (630) is the highest but the coefficient of variability (10.1) for this character is only intermediate in value.

See Tables 8 and 16.

| V | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | F |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|----|
| 350 | 1 | | | | | | | | | | | | | | | 1 |
| 400 | | | 1 | | | | | | | | | | | | | 1 |
| 450 | | | | | | 1 | | | | | | | | | | 1 |
| 500 | | | | | | 1 | | 1 | | | | | | | | 2 |
| 550 | | | | | 1 | 2 | | 1 | | | | | | | | 4 |
| 600 | | | | 2 | 2 | 3 | | | | | | | | | | 7 |
| 650 | | | | | | 1 | 1 | | | | | | | | | 2 |
| 700 | | | | | | | | 1 | 1 | | | | | | | 2 |
| 750 | | | | | | | | 1 | | | | | | 1 | | 2 |
| 800 | | | | | | | | 1 | | 1 | | | | | | 3 |
| 850 | | | | | | | | | | | | | 1 | | | 1 |
| 900 | | | | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | | | | |
| | 1 | 0 | 1 | 0 | 0 | 4 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | | | 25 |

FIG. 15.---Correlation between length and diameter of new growth of Full Tillin, Tree No. 3. Length subject, diameter relative; $r = .6667 \pm .0100$.

Length and diameter of new growth.--- The correlation coefficient here is the highest for the variety and is a very good correlation when compared with any variety. The mean length (610 mm.) is the same as that for tree No. 3, but the coefficient (.667) for this character is the highest found in the 100 trials, as is the coefficient of variability 20.9 diameter (20.9) the mean diameter being 6.74 mm. even though which is a little lower than that for tree No. 3.

See Figures 7 and 13.

TABLE IV. VARIETY No. 1.

| V | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.5 | N |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|----|
| 350 | 1 | | | | | | | | | | | | | | | 1 |
| 400 | | | | | | | | | | | | | | | | 1 |
| 450 | | 1 | 1 | | | | | | | | | | | | | 2 |
| 500 | | 2 | 1 | 3 | | | | | | | | | | | | 6 |
| 550 | | 1 | | | | | | | | | | | | | | 1 |
| 600 | | | 3 | 4 | 1 | | | | | | | | | | | 8 |
| 650 | | | | 1 | 1 | | | | | | | | | | | 2 |
| 700 | | | | | 1 | 1 | | | | | | | | | | 4 |
| 750 | | | | | 1 | | | | | | | | | | | 1 |
| 800 | | | | | | | | | | | | | | | | |
| 850 | | | | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | | | | |
| | 1 | 4 | 5 | 8 | 4 | 3 | | | | | | | | | | 27 |

FIG. 13---Correlation between length and diameter of stem growth of Madison Birch, Tree No. 1. Normal subject, diameter relative; $r = .7773 \pm .0784$.

Length and diameter relative together--The correlation we have here is fair but is the lowest within the variety. The mean length (579mm.) is intermediate but near the lowest length (573 mm) and ^{is} lowest in coefficient of variability (13.6) for this character when comparison, with the other trees of the variety, is made. The mean diameter (4.61mm.) is the lowest for the variety as is also the coefficient of variability (14.0) for this character. See Table 6 on p. 17.

| V | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | F |
|-----|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| 370 | | | | | | | | | | | | | | | 1 |
| 400 | | | | | | | | | | | | | | | |
| 450 | | 1 | | | | | | | | | | | | | |
| 500 | | | 1 | | | | | | | | | | | | |
| 550 | | | | 1 | | | | | | | | | | | |
| 600 | | 1 | 1 | 1 | | | | | | | | | | | |
| 650 | | | 2 | | 1 | | | | | | | | | | 2 |
| 700 | | | | 2 | | | | | | | | | | | |
| 750 | | | | | 1 | | | | | | | | | | |
| 800 | | | | | | 1 | | | | | | | | | |
| 850 | | | | | | | 1 | | | | | | | | |
| 900 | | | | | | | | 1 | | | | | | | |
| 950 | | | | | | | | | 1 | | | | | | |
| | 3 | 3 | 3 | 4 | 5 | 2 | 1 | | | | | | | | 25 |

FIG. 14.---Correlation between size of tree and stem and new growth of Mahua Flush. Tree No.3. Type III object, diameter relative; $r = .9334 \pm .0420$.

Interpretation and statistical analysis---The above correlation is intermediate for the variety. The mean length (695 mm.) and the mean diameter (5.52 mm.) are also intermediate for the variety. The coefficient of variability for the length character is 20.3, the highest for the variety, the others being 18.3 and 16.4, respectively. The coefficient of variability for diameter is 16 which is intermediate as regards the other two.

See Tables 6 and 17.

Fumusee (Pawnee Stock) Tree No. 1.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | f |
|------|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|----|
| 300 | | | | | | | | | | | | | | | | |
| 350 | | | | | | | | | | | | | | | | |
| 400 | | 1 | | | | | | | | | | | | | | 1 |
| 450 | | 1 | | | | | | | | | | | | | | 1 |
| 500 | | | | | | | | | | | | | | | | |
| 550 | | | 2 | | | | | | | | | | | | | 2 |
| 600 | | | 3 | 1 | | | | | | | | | | | | 4 |
| 650 | | | 3 | | | 3 | | | | | | | | | | 6 |
| 700 | | | 1 | 1 | | 2 | 1 | | | | | | | | | 5 |
| 750 | | | | | | 1 | | | | | | | | | | 1 |
| 800 | | | | | | 3 | | | | | | | | | | 3 |
| 850 | | | | | | 1 | | | | | | | | | | 1 |
| 900 | | | | | | | 1 | | | | | | | | | 1 |
| 950 | | | | | | | | | | | | | | | | |
| 1000 | | | | | | | | | | | | | | | | |
| | 2 | 9 | 2 | 10 | 2 | | | | | | | | | | | 25 |

FIG. 18.----Correlation between length and diameter of new growth of Fumusee, Tree No. 1. Length subject, diameter relative; $r = .7787 \pm .0613$.

Length and diameter of new growth-----A fairly good correlation is found in this case. One tree of the Fumusee variety falls much lower in correlation coefficient, while the third tree is considerably higher. The mean for length is intermediate, being 686 mm. as against 635 mm. and 613 mm. for the other two trees. The mean diameter is likewise intermediate being 5.56 mm. as against 5.06 mm. and 5.82 mm. The coefficients of variability for each character are found to be the lowest found in the three trees. They are 17.3 for length and 12.0 for diameter. See Tables 8 and 19.

FAMNUS (Round Stock) Tree No.2.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | f |
|------|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|----|
| 300 | | | 1 | | | | | | | | | | | | | 1 |
| 350 | | 1 | 1 | | | | | | | | | | | | | 2 |
| 400 | 1 | 1 | | | | | | | | | | | | | | 2 |
| 450 | | 2 | 1 | | | | | | | | | | | | | 3 |
| 500 | 1 | | 1 | | | | | | | | | | | | | 2 |
| 550 | 1 | 2 | 1 | | 1 | | | | | | | | | | | 6 |
| 600 | | | | | 3 | | | | | | | | | | | 3 |
| 650 | | | 1 | | 2 | | | | | | | | | | | 3 |
| 700 | | | | | 1 | | 1 | | | | | | | | | 2 |
| 750 | | | | | | | | | | | | | | | | |
| 800 | | | | | 1 | | | | | | | | | | | 1 |
| 850 | | | | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | | | | |
| 1000 | | | | | | | | | | | | | | | | |
| | 3 | 6 | 6 | 7 | 1 | 2 | | | | | | | | | | 25 |

FIG. 19. Correlation between length and diameter of new growth of Famnus, Tree No.2. Length subject, diameter relative; $r = .5701 \pm .0611$.

Length and diameter of new growth---This is the poorest correlation we have found in our study of new growth characters. Mean length and mean diameter (536 mm and 5.06 mm respectively) are far below the same means in the two other trees, these being 663 mm. and 668 mm. for length; and 5.56 mm. and 5.82 mm. for diameter. The coefficient of variability is highest for length and very low in diameter. This makes a poor correlation. See Tables 6 and 18.

FW 7417. (Pekin Stock) Tree No. 3.

| V | 43 | 47 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | f |
|------|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|----|
| 300 | | | | | | | | | | | | | | | | |
| 350 | | | | | | | | | | | | | | | | |
| 400 | | | | | | | | | | | | | | | | |
| 450 | | | 1 | | | | | | | | | | | | | 1 |
| 500 | | | | | | | | | | | | | | | | |
| 550 | | 1 | 2 | | | | | | | | | | | | | 3 |
| 600 | | 2 | 3 | 2 | 1 | | | | | | | | | | | 8 |
| 650 | | | | | 1 | | | | | | | | | | | 1 |
| 700 | 1 | | | | | | | | | | | | | | | 1 |
| 750 | | | 1 | 2 | 2 | | | | | | | | | | | 5 |
| 800 | | | | | | 1 | | | | | | | | | | 1 |
| 850 | | | | | 1 | 2 | | | | | | | | | | 3 |
| 900 | | | | | | | | 1 | | | | | | | | 1 |
| 950 | | | | | | | | | 1 | | | | | | | 1 |
| 1000 | | | | | | | | | | 1 | | | | | | |
| | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 1 | 1 | | | | | | | 25 |

FIG. 20.---Correlation between length and diameter of new growth of Tamarac, Tree No. 3. Length subject, diameter relative; $r = .8279 \pm .0450$.

Length and diameter of new growth--- Once again we have a very good correlation in these characters. Inspection of the tables shows us that the new growth of this tree is highest in mean length and in mean diameter. The coefficients of variability for mean length (12.8) and for mean diameter (12.9) are seen to be nearly equal. We are surprised that the correlation is not greater than it is, such being the case.

See Tables 2 and 19.

MoIntosh (Forsyth Street) Tree No.1.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | f |
|------|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|----|
| 300 | | | | | | | | | | | | | | | | 1 |
| 350 | | 1 | 1 | | | | | | | | | | | | | 1 |
| 400 | | | 1 | | | | | | | | | | | | | 1 |
| 450 | | | 1 | | | | | | | | | | | | | 1 |
| 500 | | | | | | | | | | | | | | | | |
| 550 | | 1 | | 1 | 1 | | 1 | | | | | | | | | 4 |
| 600 | | | | 1 | 1 | | | | | | | | | | | 2 |
| 650 | | | | | | | 1 | | | | | | | | | 1 |
| 700 | | | | | | | 1 | 2 | | | | | | | | 3 |
| 750 | | | | | | 1 | | | | | | | | | | 1 |
| 800 | | | | 1 | | | 1 | 1 | 2 | | | | | | | 5 |
| 850 | | | | | | | | 1 | | | | | | | | 1 |
| 900 | | | | | | | | | | | | 1 | | | | 1 |
| 950 | | | | | | | | | | | | | | 1 | | 1 |
| 1000 | | | | | | | | | | | | | | | | |
| 1050 | | | | | | | | | | | | 1 | 1 | | | 2 |
| | | 2 | 3 | 2 | 3 | 1 | 4 | 3 | 1 | 3 | | 2 | 2 | 1 | | 25 |

FIG. 31.--Correlation between length and diameter of new growth of MoIntosh Tree No.1. Length subject, diameter relative; $r = .8700 \pm .0033$.

Length and diameter of new growth---In this case we find one of our highest correlations again. The mean length is practically as high as for the tree highest in this respect being 800 mm. against 812 mm. In mean diameter (7.03 mm. against 6.80 mm. and 6.93 mm.); in coefficient of variability for length (23.5 against 25.4 and 26.1) as well as in coefficient of variability for diameter (23.8 against 25.7 and 26.5) we find it to be first in order. See Tables 6 and 20.

| V | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | F | |
|------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|----------------------|----------------------|
| 300 | | | | | | | | | | | | | 10 10 10 10 10 10 10 | |
| 350 | 1 | | | | | | | | | | | | | |
| 400 | | | | | 1 | | | | | | | | | |
| 450 | 1 | | 1 | | | | | | | | | | | |
| 500 | | | | | | | | | | | | | | |
| 550 | | | | | | | | | | | | | | |
| 600 | | | | | | 2 | | | | | | | | |
| 650 | | | | | | | 1 | | | | | | 10 10 10 10 10 10 10 | |
| 700 | | | | | | | | | | | | | | |
| 750 | | | | | | | | | | | | | | |
| 800 | | | | | | | | | | | | | | |
| 850 | | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | | |
| 950 | | | | | | | | | | | | | | 10 10 10 10 10 10 10 |
| 1000 | | | | | | | | | | | | | | |
| 1050 | | | | | | | | | | | | | | |
| | 2 | 0 | 2 | 1 | 3 | 0 | 2 | 0 | 2 | | | | 25 | |

| V | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | P |
|------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|----|
| 300 | | | | | | | | | | | | | 1 |
| 350 | | 1 | | | | | | | | | | | |
| 400 | | 1 | 1 | | | | | | | | | | |
| 450 | | 1 | 1 | | | | | | | | | | |
| 500 | | | 1 | 1 | | | | | | | | | |
| 550 | | | 1 | 1 | 1 | | | | | | | | 4 |
| 600 | | | | | | | | | | | | | |
| 650 | | | | 1 | 1 | 1 | | | | | | | |
| 700 | | | | | 1 | 1 | 1 | | | | | | |
| 750 | | | | | 1 | 1 | 1 | | | | | | |
| 800 | | | | | | 1 | | | | | | | 1 |
| 850 | | | | | | | | | | | | | |
| 900 | | | | | | | | | | | | | |
| 950 | | | | | | | 1 | | | | | | |
| 1000 | | | | | | | | | | 1 | | | |
| 1050 | | | | | | | | | | | | | 2 |
| | | | | | | | | | | | | | |
| | 3 | 3 | 3 | 2 | 1 | 6 | 3 | 1 | | | 1 | | 25 |

FIG. 23. ---Correlation between length and diameter of new growth of McIntosh, Feb. No. 3. Height 10 feet, and stem relative; $r = .8773 \pm .0073$.

Length and diameter of new growth--- To find here a close agreement with Tree No. 1 of this variety. The correlation coefficient for No. 1 was $.8536 \pm .0073$ as compared to $.8773 \pm .0073$. The mean length and mean diameter (6.10 mm. against 6.10 mm., and 7.00 mm. against 6.23 mm.) for these standards, will be found to be a close proportion. Again the coefficients of variability for length and for diameter are in good proportion. e.g. 25.5 : 23.6 :: 23.1 : 22.5.

Fig. 24 100 C and 10.

| V | 3.5 | 4.5 | 5.5 | 6.5 | 7.5 | 8.5 | 9.5 | 10.5 | 11.5 | 12.5 | 13.5 | 14.5 | 15.5 | 16.5 | 17.5 | 18.5 | 19.5 | 20.5 | F |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|----|
| 300 | 1 | 2 | | | | | | | | | | | | | | | | | 3 |
| 350 | | 1 | | | | | | | | | | | | | | | | | 2 |
| 400 | | | | | | | | | | | | | | | | | | | |
| 450 | | | | 2 | | | | | | | | | | | | | | | 2 |
| 500 | | 1 | | | 2 | | | | | | | | | | | | | | 3 |
| 550 | | | 4 | | | | | | | | | | | | | | | | 4 |
| 600 | | | 1 | | 2 | 3 | | | | | | | | | | | | | 5 |
| 650 | | | 1 | | | 3 | | | | | | | | | | | | | 3 |
| 700 | | | | | | 5 | | | | | | | | | | | | | 5 |
| 750 | | | | | | | | | | | | | | | | | | | |
| 800 | | | | | | | | | | | | | | | | | | | |
| | 1 | 5 | 8 | 4 | 7 | | | | | | | | | | | | | | 25 |

FIG. 21. Correlation of larval length and character of re-growth of *H. arcton*, Table No. 1. Fourth or fifth, relative; $r = .9072 \pm .0471$.

Independent character of larval length--There is a good correlation exists here. To this I have added the fact which says the longer growth having the better correlation. This has been a rare exception to the rule and only found that relative growth has been to be accompanied by greater coefficient of correlation. There too, we find a other unusual result. That is, with a same coefficient of correlation of variation between length and character (11.2 and 10.) we normally find a good correlation. See Tables 10 and 11.

| V | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 | 325 | 330 | 335 | 340 | 345 | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 | 395 | 400 | 405 | 410 | 415 | 420 | 425 | 430 | 435 | 440 | 445 | 450 | 455 | 460 | 465 | 470 | 475 | 480 | 485 | 490 | 495 | 500 | 505 | 510 | 515 | 520 | 525 | 530 | 535 | 540 | 545 | 550 | 555 | 560 | 565 | 570 | 575 | 580 | 585 | 590 | 595 | 600 | 605 | 610 | 615 | 620 | 625 | 630 | 635 | 640 | 645 | 650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720 | 725 | 730 | 735 | 740 | 745 | 750 | 755 | 760 | 765 | 770 | 775 | 780 | 785 | 790 | 795 | 800 | 805 | 810 | 815 | 820 | 825 | 830 | 835 | 840 | 845 | 850 | 855 | 860 | 865 | 870 | 875 | 880 | 885 | 890 | 895 | 900 | 905 | 910 | 915 | 920 | 925 | 930 | 935 | 940 | 945 | 950 | 955 | 960 | 965 | 970 | 975 | 980 | 985 | 990 | 995 | 1000 | 1005 | 1010 | 1015 | 1020 | 1025 | 1030 | 1035 | 1040 | 1045 | 1050 | 1055 | 1060 | 1065 | 1070 | 1075 | 1080 | 1085 | 1090 | 1095 | 1100 | 1105 | 1110 | 1115 | 1120 | 1125 | 1130 | 1135 | 1140 | 1145 | 1150 | 1155 | 1160 | 1165 | 1170 | 1175 | 1180 | 1185 | 1190 | 1195 | 1200 | 1205 | 1210 | 1215 | 1220 | 1225 | 1230 | 1235 | 1240 | 1245 | 1250 | 1255 | 1260 | 1265 | 1270 | 1275 | 1280 | 1285 | 1290 | 1295 | 1300 | 1305 | 1310 | 1315 | 1320 | 1325 | 1330 | 1335 | 1340 | 1345 | 1350 | 1355 | 1360 | 1365 | 1370 | 1375 | 1380 | 1385 | 1390 | 1395 | 1400 | 1405 | 1410 | 1415 | 1420 | 1425 | 1430 | 1435 | 1440 | 1445 | 1450 | 1455 | 1460 | 1465 | 1470 | 1475 | 1480 | 1485 | 1490 | 1495 | 1500 | 1505 | 1510 | 1515 | 1520 | 1525 | 1530 | 1535 | 1540 | 1545 | 1550 | 1555 | 1560 | 1565 | 1570 | 1575 | 1580 | 1585 | 1590 | 1595 | 1600 | 1605 | 1610 | 1615 | 1620 | 1625 | 1630 | 1635 | 1640 | 1645 | 1650 | 1655 | 1660 | 1665 | 1670 | 1675 | 1680 | 1685 | 1690 | 1695 | 1700 | 1705 | 1710 | 1715 | 1720 | 1725 | 1730 | 1735 | 1740 | 1745 | 1750 | 1755 | 1760 | 1765 | 1770 | 1775 | 1780 | 1785 | 1790 | 1795 | 1800 | 1805 | 1810 | 1815 | 1820 | 1825 | 1830 | 1835 | 1840 | 1845 | 1850 | 1855 | 1860 | 1865 | 1870 | 1875 | 1880 | 1885 | 1890 | 1895 | 1900 | 1905 | 1910 | 1915 | 1920 | 1925 | 1930 | 1935 | 1940 | 1945 | 1950 | 1955 | 1960 | 1965 | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 | 2065 | 2070 | 2075 | 2080 | 2085 | 2090 | 2095 | 2100 | 2105 | 2110 | 2115 | 2120 | 2125 | 2130 | 2135 | 2140 | 2145 | 2150 | 2155 | 2160 | 2165 | 2170 | 2175 | 2180 | 2185 | 2190 | 2195 | 2200 | 2205 | 2210 | 2215 | 2220 | 2225 | 2230 | 2235 | 2240 | 2245 | 2250 | 2255 | 2260 | 2265 | 2270 | 2275 | 2280 | 2285 | 2290 | 2295 | 2300 | 2305 | 2310 | 2315 | 2320 | 2325 | 2330 | 2335 | 2340 | 2345 | 2350 | 2355 | 2360 | 2365 | 2370 | 2375 | 2380 | 2385 | 2390 | 2395 | 2400 | 2405 | 2410 | 2415 | 2420 | 2425 | 2430 | 2435 | 2440 | 2445 | 2450 | 2455 | 2460 | 2465 | 2470 | 2475 | 2480 | 2485 | 2490 | 2495 | 2500 | 2505 | 2510 | 2515 | 2520 | 2525 | 2530 | 2535 | 2540 | 2545 | 2550 | 2555 | 2560 | 2565 | 2570 | 2575 | 2580 | 2585 | 2590 | 2595 | 2600 | 2605 | 2610 | 2615 | 2620 | 2625 | 2630 | 2635 | 2640 | 2645 | 2650 | 2655 | 2660 | 2665 | 2670 | 2675 | 2680 | 2685 | 2690 | 2695 | 2700 | 2705 | 2710 | 2715 | 2720 | 2725 | 2730 | 2735 | 2740 | 2745 | 2750 | 2755 | 2760 | 2765 | 2770 | 2775 | 2780 | 2785 | 2790 | 2795 | 2800 | 2805 | 2810 | 2815 | 2820 | 2825 | 2830 | 2835 | 2840 | 2845 | 2850 | 2855 | 2860 | 2865 | 2870 | 2875 | 2880 | 2885 | 2890 | 2895 | 2900 | 2905 | 2910 | 2915 | 2920 | 2925 | 2930 | 2935 | 2940 | 2945 | 2950 | 2955 | 2960 | 2965 | 2970 | 2975 | 2980 | 2985 | 2990 | 2995 | 3000 | 3005 | 3010 | 3015 | 3020 | 3025 | 3030 | 3035 | 3040 | 3045 | 3050 | 3055 | 3060 | 3065 | 3070 | 3075 | 3080 | 3085 | 3090 | 3095 | 3100 | 3105 | 3110 | 3115 | 3120 | 3125 | 3130 | 3135 | 3140 | 3145 | 3150 | 3155 | 3160 | 3165 | 3170 | 3175 | 3180 | 3185 | 3190 | 3195 | 3200 | 3205 | 3210 | 3215 | 3220 | 3225 | 3230 | 3235 | 3240 | 3245 | 3250 | 3255 | 3260 | 3265 | 3270 | 3275 | 3280 | 3285 | 3290 | 3295 | 3300 | 3305 | 3310 | 3315 | 3320 | 3325 | 3330 | 3335 | 3340 | 3345 | 3350 | 3355 | 3360 | 3365 | 3370 | 3375 | 3380 | 3385 | 3390 | 3395 | 3400 | 3405 | 3410 | 3415 | 3420 | 3425 | 3430 | 3435 | 3440 | 3445 | 3450 | 3455 | 3460 | 3465 | 3470 | 3475 | 3480 | 3485 | 3490 | 3495 | 3500 | 3505 | 3510 | 3515 | 3520 | 3525 | 3530 | 3535 | 3540 | 3545 | 3550 | 3555 | 3560 | 3565 | 3570 | 3575 | 3580 | 3585 | 3590 | 3595 | 3600 | 3605 | 3610 | 3615 | 3620 | 3625 | 3630 | 3635 | 3640 | 3645 | 3650 | 3655 | 3660 | 3665 | 3670 | 3675 | 3680 | 3685 | 3690 | 3695 | 3700 | 3705 | 3710 | 3715 | 3720 | 3725 | 3730 | 3735 | 3740 | 3745 | 3750 | 3755 | 3760 | 3765 | 3770 | 3775 | 3780 | 3785 | 3790 | 3795 | 3800 | 3805 | 3810 | 3815 | 3820 | 3825 | 3830 | 3835 | 3840 | 3845 | 3850 | 3855 | 3860 | 3865 | 3870 | 3875 | 3880 | 3885 | 3890 | 3895 | 3900 | 3905 | 3910 | 3915 | 3920 | 3925 | 3930 | 3935 | 3940 | 3945 | 3950 | 3955 | 3960 | 3965 | 3970 | 3975 | 3980 | 3985 | 3990 | 3995 | 4000 | 4005 | 4010 | 4015 | 4020 | 4025 | 4030 | 4035 | 4040 | 4045 | 4050 | 4055 | 4060 | 4065 | 4070 | 4075 | 4080 | 4085 | 4090 | 4095 | 4100 | 4105 | 4110 | 4115 | 4120 | 4125 | 4130 | 4135 | 4140 | 4145 | 4150 | 4155 | 4160 | 4165 | 4170 | 4175 | 4180 | 4185 | 4190 | 4195 | 4200 | 4205 | 4210 | 4215 | 4220 | 4225 | 4230 | 4235 | 4240 | 4245 | 4250 | 4255 | 4260 | 4265 | 4270 | 4275 | 4280 | 4285 | 4290 | 4295 | 4300 | 4305 | 4310 | 4315 | 4320 | 4325 | 4330 | 4335 | 4340 | 4345 | 4350 | 4355 | 4360 | 4365 | 4370 | 4375 | 4380 | 4385 | 4390 | 4395 | 4400 | 4405 | 4410 | 4415 | 4420 | 4425 | 4430 | 4435 | 4440 | 4445 | 4450 | 4455 | 4460 | 4465 | 4470 | 4475 | 4480 | 4485 | 4490 | 4495 | 4500 | 4505 | 4510 | 4515 | 4520 | 4525 | 4530 | 4535 | 4540 | 4545 | 4550 | 4555 | 4560 | 4565 | 4570 | 4575 | 4580 | 4585 | 4590 | 4595 | 4600 | 4605 | 4610 | 4615 | 4620 | 4625 | 4630 | 4635 | 4640 | 4645 | 4650 | 4655 | 4660 | 4665 | 4670 | 4675 | 4680 | 4685 | 4690 | 4695 | 4700 | 4705 | 4710 | 4715 | 4720 | 4725 | 4730 | 4735 | 4740 | 4745 | 4750 | 4755 | 4760 | 4765 | 4770 | 4775 | 4780 | 4785 | 4790 | 4795 | 4800 | 4805 | 4810 | 4815 | 4820 | 4825 | 4830 | 4835 | 4840 | 4845 | 4850 | 4855 | 4860 | 4865 | 4870 | 4875 | 4880 | 4885 | 4890 | 4895 | 4900 | 4905 | 4910 | 4915 | 4920 | 4925 | 4930 | 4935 | 4940 | 4945 | 4950 | 4955 | 4960 | 4965 | 4970 | 4975 | 4980 | 4985 | 4990 | 4995 | 5000 | 5005 | 5010 | 5015 | 5020 | 5025 | 5030 | 5035 | 5040 | 5045 | 5050 | 5055 | 5060 | 5065 | 5070 | 5075 | 5080 | 5085 | 5090 | 5095 | 5100 | 5105 | 5110 | 5115 | 5120 | 5125 | 5130 | 5135 | 5140 | 5145 | 5150 | 5155 | 5160 | 5165 | 5170 | 5175 | 5180 | 5185 | 5190 | 5195 | 5200 | 5205 | 5210 | 5215 | 5220 | 5225 | 5230 | 5235 | 5240 | 5245 | 5250 | 5255 | 5260 | 5265 | 5270 | 5275 | 5280 | 5285 | 5290 | 5295 | 5300 | 5305 | 5310 | 5315 | 5320 | 5325 | 5330 | 5335 | 5340 | 5345 | 5350 | 5355 | 5360 | 5365 | 5370 | 5375 | 5380 | 5385 | 5390 | 5395 | 5400 | 5405 | 5410 | 5415 | 5420 | 5425 | 5430 | 5435 | 5440 | 5445 | 5450 | 5455 | 5460 | 5465 | 5470 | 5475 | 5480 | 5485 | 5490 | 5495 | 5500 | 5505 | 5510 | 5515 | 5520 | 5525 | 5530 | 5535 | 5540 | 5545 | 5550 | 5555 | 5560 | 5565 | 5570 | 5575 | 5580 | 5585 | 5590 | 5595 | 5600 | 5605 | 5610 | 5615 | 5620 | 5625 | 5630 | 5635 | 5640 | 5645 | 5650 | 5655 | 5660 | 5665 | 5670 | 5675 | 5680 | 5685 | 5690 | 5695 | 5700 | 5705 | 5710 | 5715 | 5720 | 5725 | 5730 | 5735 | 5740 | 5745 | 5750 | 5755 | 5760 | 5765 | 5770 | 5775 | 5780 | 5785 | 5790 | 5795 | 5800 | 5805 | 5810 | 5815 | 5820 | 5825 | 5830 | 5835 | 5840 | 5845 | 5850 | 5855 | 5860 | 5865 | 5870 | 5875 | 5880 | 5885 | 5890 | 5895 | 5900 | 5905 | 5910 | 5915 | 5920 | 5925 | 5930 | 5935 | 5940 | 5945 | 5950 | 5955 | 5960 | 5965 | 5970 | 5975 | 5980 | 5985 | 5990 | 5995 | 6000 | 6005 | 6010 | 6015 | 6020 | 6025 | 6030 | 6035 | 6040 | 6045 | 6050 | 6055 | 6060 | 6065 | 6070 | 6075 | 6080 | 6085 | 6090 | 6095 | 6100 | 6105 | 6110 | 6115 | 6120 | 6125 | 6130 | 6135 | 6140 | 6145 | 6150 | 6155 | 6160 | 6165 | 6170 | 6175 | 6180 | 6185 | 6190 | 6195 | 6200 | 6205 | 6210 | 6215 | 6220 | 6225 | 6230 | 6235 | 6240 | 6245 | 6250 | 6255 | 6260 | 6265 | 6270 | 6275 | 6280 | 6285 | 6290 | 6295 | 6300 | 6305 | 6310 | 6315 | 6320 | 6325 | 6330 | 6335 | 6340 | 6345 | 6350 | 6355 | 6360 | 6365 | 6370 | 6375 | 6380 | 6385 | 6390 | 6395 | 6400 | 6405 | 6410 | 6415 | 6420 | 6425 | 6430 | 6435 | 6440 | 6445 | 6450 | 6455 | 6460 | 6465 | 6470 | 6475 | 6480 | 6485 | 6490 | 6495 | 6500 | 6505 | 6510 | 6515 | 6520 | 6525 | 6530 | 6535 | 6540 | 6545 | 6550 | 6555 | 6560 | 6565 | 6570 | 6575 | 6580 | 6585 | 6590 | 6595 | 6600 | 6605 | 6610 | 6615 | 6620 | 6625 | 6630 | 6635 | 6640 | 6645 | 6650 | 6655 | 6660 | 6665 | 6670 | 6675 | 6680 | 6685 | 6690 | 6695 | 6700 | 6705 | 6710 | 6715 | 6720 | 6725 | 6730 | 6735 | 6740 | 6745 | 6750 | 6755 | 6760 | 6765 | 6770 | 6775 | 6780 | 6785 | 6790 | 6795 | 6800 | 6805 | 6810 | 6815 | 6820 | 6825 | 6830 | 6835 | 6840 | 6845 | 6850 | 6855 | 6860 | 6865 | 6870 | 6875 | 6880 | 6885 | 6890 | 6895 | 6900 | 6905 | 6910 | 6915 | 6920 | 6925 | 6930 | 6935 | 6940 | 6945 | 6950 | |
|---|----|----|----|----|----|----|----|----|----|----|----|----|----|------|--|
|---|----|----|----|----|----|----|----|----|----|----|----|----|----|------|--|

| V | 27 | 42 | 47 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | F |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 300 | | | | | | | | | | | | | | |
| 350 | | | | | | | | | | | | | | |
| 400 | | | 1 | | | | | | | | | | | 1 |
| 450 | | | | | | | | | | | | | | |
| 500 | | 1 | | | | 1 | | | | | | | | 2 |
| 550 | | | 1 | 1 | 2 | | | | | | | | | 4 |
| 600 | | | | 3 | 1 | | 1 | | | | | | | 5 |
| 650 | | | | | 2 | | 1 | | | | | | | 3 |
| 700 | | | | | | | 1 | 2 | 1 | | | 1 | | 3 |
| 750 | | | | | 1 | | 1 | 1 | | 1 | | | | 4 |
| 800 | | | | | | | | 1 | | | | | | 1 |
| | | 1 | 1 | 1 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 25 |

FIG. 23.-- Correlation between length and mid ear of new growth of Witten, Tree No. 3. Length subject, diameter relative; $r = .7177 \pm .0377$.

Length and mid ear of new growth of Witten--- This is but a fair correlation when considering these characters in these trees. It is difficult to draw any conclusions and because this is considered to be a relationship which is, therefore, fair, previous studies where other trees were used, that the low correlation is due to the low coefficient of variability for length. Look a correlation study grows as such an effect. See Figures 21 and 22.

JONATHAN.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 |
|----|----|----|----|----|----|----|----|----|----|
| 45 | 1 | | | | | | | | 1 |
| 50 | | 1 | | | | | | | 1 |
| 55 | | 1 | 1 | | | | | | 2 |
| 60 | | 1 | 7 | | | | | | 8 |
| 65 | | | 3 | 3 | | | | | 6 |
| 70 | | | 1 | | 2 | | | | 3 |
| 75 | | | | 1 | | | | | 1 |
| 80 | | | | | | | | | |
| 85 | | | | | | | | | |
| | 1 | 3 | 13 | 4 | 2 | | | | 12 |

FIG. 10.--- Correlation between length and volume of heart of Jonathan. Based on 10 fish, all the fish were; $r = .7016 \pm .0736$.

Correlation in the fish was--- The above correlation is a very low one. There is no correlation, too, Jonathan showed any correlation. The same holds true; the length of lake 21.6122 mm. for the age 45, 19.7 mm. The standard deviations are high, being 6.6412 mm. for length and 3.6450 mm. for volume. But the ^{are} variances of length and volume are high, consequently the cross correlation of variance, that for length is 19.6052 and for volume being 13.710. This being the case we do not expect to find a good correlation in the other two fish. (See Table 11.)

| V | 5 | 37 | 40 | 47 | 50 | 57 | 64 | 65 | F |
|----|---|----|----|----|----|----|----|----|----|
| 65 | | | | | | | | | |
| 66 | | | | | | | | | |
| 67 | | | | | | | | | |
| 68 | | | | 1 | | | | | 1 |
| 69 | | | | | | | | | |
| 70 | | | | 1 | 3 | 1 | | | 5 |
| 75 | | | | | 3 | 4 | 2 | | 9 |
| 80 | | | | | | | 1 | | 1 |
| 85 | | | | 1 | | | | | 1 |
| | | | | 2 | 6 | 5 | 3 | | 17 |

FIG. 20---Correlation of length and diameter of the leaves of Mother. Length subject, diameter variable;

$$r = .0012 \pm .0001.$$

Length of variability of leaves---The coefficient of correlation in this case has been found to be .0012. It is a little irregular and is put in the results here shown. Attention is called to the fact that we have here only seven individuals. However this variance has been "erratic" in the behavior of all the characters studied. None theless our previous assumption, that, where we find low coefficient of variability we invariably find a low coefficient of correlation, is again sustained.

The coefficient of variability for length is 7.664 and for diameter it is 9.7618; also the coefficient for length is lower than that for diameter, which condition usually indicates a low coefficient of correlation. See Table 25.

| V | CC | CV | LC | LC | LC | LC | P |
|----|----|----|----|----|----|----|----|
| 45 | | | | | | | |
| 50 | | | 1 | | | | 1 |
| 55 | | | 1 | 3 | 1 | | 3 |
| 60 | | | | 1 | | 1 | 3 |
| 65 | | | | 1 | 1 | 4 | 3 |
| 70 | | | | | | 1 | 3 |
| 75 | | | | | | | |
| 80 | | | | | | | |
| 85 | | | | | | | |
| | | | 1 | 6 | 3 | 6 | 16 |

FIG. 30.-- Correlation between length and diameter of the leaves of Red Canada. Length subject, diameter relative;
 $r = .7278 \pm .0376$.

Length and diameter of leaves--- This is a fair degree of correlation for the leaf characters. The diameter (32.2727 mm.) has a greater standard deviation (3.5107 millimeters) than has the length (61.5019 millimeters) whose deviation is only 5.6455 mm. Such being the case, the coefficient of variability for length is comparatively low(9.166) as against the higher coefficient (13.073) for diameter and, as usual, we find a reduced coefficient of correlation. See Table 23.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|-----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | |
| 80 | | | | | | | | | | | | |
| 85 | | | | | | | | | | | | |
| 90 | | | | | | | | | | | | |
| 95 | | | | | | | | | | | | |
| 100 | | | | | | | | | | | | |
| | | | | | | | | | | | | |

FIG. 11.--The six dimensional length and number of leaves of Tail Tipin. Length segment, dimension relative; $r = .8611 \pm .0463$.

Length and number of leaves.-- Tail Tipin shows here, as it did in the new growth characters, a very good correlation in the above characters. The standard deviations for these characters are high -- 1.46, 1.00, and the coefficients of variability being 10.10 and 11.677 for length and leaves respectively, the two coefficients of variability being high and close together and thus a good correlation.

Table 10. 27.

| V | 45 | 5 | 55 | 65 | 75 | 85 | 95 | F |
|-----|----|---|----|----|----|----|----|----|
| 60 | 2 | | | | | | | 2 |
| 65 | 2 | 1 | 2 | | | | | 5 |
| 70 | | 1 | 1 | 1 | | | | 3 |
| 75 | | 1 | 1 | 1 | | | | 3 |
| 80 | | | 3 | | | | | 3 |
| 85 | | | | | | | | |
| 90 | | | | | | | | |
| 95 | | | | | | | | |
| 100 | | | | | | | | |
| | 4 | 3 | 7 | 3 | | | | 16 |

FIG. 32.—Correlation of length and diameter of leaves of *Manis Flus*. Length (mm.), diameter (mm.). $r = .5788 \pm .1187$.

Length and diameter of leaves. ---The correlation in this case might be called fairly good or quite low. The standard deviations (3.8516 mm. and 1.1534 mm.) are proportional to the mean length (70 mm.) and mean diameter (37.107 mm.) but the coefficients of variability, while close to unity, are low being 5.778 for length and 3.133 for diameter. The results bear us out in our contention that low coefficients of variability give us a low coefficient of correlation. See Table 33.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | f |
|-----|----|----|----|----|----|----|----|----|----|----|
| 60 | 1 | | | | | | | | | 1 |
| 65 | | 1 | | | | | | | | 1 |
| 70 | 1 | | 1 | 1 | | | | | | 3 |
| 75 | | 3 | | 1 | | | | | | 4 |
| 80 | | | 3 | 2 | | 1 | | | | 3 |
| 85 | | | | 1 | 3 | 1 | | | | 4 |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 3 | 4 | 3 | 5 | 3 | 1 | 1 | | | 16 |

FIG. 33.—Correlation between length and diameter of leaves of Winter Panama. Length subject, diameter relative; $r = .6896 \pm .0850$.

Length and Diameter of leaves—In this variety the correlation is fairly good. The relation between the mean for length (75.933 mm.) and its standard deviation (7.6364 mm.) has for the ± 1 deviation (2.3344) giving it a coefficient of variability of 14.44 as against 9.8% for length. The great difference in these coefficients is reflected in the correlation coefficient. See Table 26.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | F |
|-----|----|----|----|----|----|----|----|----|----|
| 45 | | | | | | | | | |
| 50 | | | | | | | | | |
| 55 | | | | | | | | | |
| 60 | | | | | | | | | |
| 65 | | 1 | | | | | | | |
| 70 | | | 3 | | | | | | |
| 75 | | | | 1 | | | | | |
| 80 | | | 1 | | 1 | | | | |
| 85 | | | | 1 | 2 | | | | |
| 90 | | | | | | | | | |
| 95 | | | | | | | | | |
| 100 | | | | | | | 1 | | |
| | | 3 | 10 | 7 | 3 | | 1 | | 24 |

FIG. 34.---Correlation between length and diameter of leaves of *Fimbristylis*. Length centimetres, diameter relative; $r = .8215 \pm .0448$.

Length and diameter of leaves of *Fimbristylis* shows a very good correlation in these characters. The standard deviation for length and for diameter are proportional to the means for these characters. The coefficients of variability are high and close together; 10.81 for length and 11.00 for diameter. This gives us a good correlation. The number of individuals used (24) being greater than in some other cases may have affected the result. See Table 36.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | f |
|-----|----|----|----|----|----|----|----|----|----|----|
| 45 | 1 | 1 | | | | | | | | 2 |
| 50 | 2 | 3 | | | | | | | | 5 |
| 55 | | 3 | 1 | | | | | | | 3 |
| 60 | | 1 | 4 | | | | | | | 5 |
| 65 | | | 3 | 3 | | | | | | 5 |
| 70 | | | | | | | | | | |
| 75 | | | | 1 | | 1 | | | | 2 |
| 80 | | | | | 1 | | | | | 1 |
| 85 | | | | | | | | | | |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 3 | 7 | 7 | 4 | 1 | 1 | | | | 23 |

FIG. 35. ---Correlation between length and diameter of leaves of McIntosh. Length subject, diameter relative;

$$r = .8751 \pm .0078.$$

Length of McIntosh leaves--- We find no higher coefficient of correlation for the leaf diameter, than that shown here now. The standard deviation is not in doubt the same with respect to each other as are the means of length and diameter. With this report, the deviation for length being proportionally a little the higher. Each, however, is high and the coefficients of variability are as a consequence high, length being 13.05 per cent. diameter being 10.6.

Highest variabilities here give highest coefficient of correlation. See Table 31.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | f |
|----|----|----|----|----|----|----|----|----|
| 55 | | 1 | | | | | | 1 |
| 60 | 1 | | | | | | | 1 |
| 65 | | 2 | 1 | | | | | 3 |
| 70 | | | 3 | 2 | | | | 5 |
| 75 | | | 3 | 2 | 1 | | | 6 |
| 80 | | | | 2 | 3 | 1 | | 6 |
| 85 | | | | | | | | |
| 90 | | | | | | | 1 | 1 |
| | 1 | 3 | 6 | 6 | 4 | 1 | 1 | 22 |

FIG. 38.--- Correlation between length and width of level 2 Nubb station. Length subject, diameter relative; $r = .8141 \pm .1457$.

Length and diameter of *la. yagui*.--- These figures show another very high correlation. The mean length has a small deviation but the diameter is a more variable giving us a greater standard deviation for the diameter. The coefficients of variability are 11.62 for length and 15.34 for diameter. A greater number of individuals being used here, again seems to give us a better correlation. (See Table 32.)

| V | 45 | 47 | 50 | 53 | 56 | 59 | 62 | f |
|----|----|----|----|----|----|----|----|----|
| 55 | | | | | | | | |
| 60 | | 2 | | | | | | 2 |
| 65 | | 1 | 1 | | | | | 2 |
| 70 | | | 1 | 3 | | | | 4 |
| 75 | | | 1 | 2 | 1 | | | 4 |
| 80 | | | | 1 | 1 | | | 2 |
| 85 | | | | | | 3 | | 1 |
| | | 3 | 3 | 6 | 2 | 2 | | 16 |

FIG. 37.—Correlation between length and diameter of leaves of Cotton. Length subject, diameter relative;
 $r = .9873 \pm .0717$.

Length and diameter of leaves---- In this case we have a small number of individuals (16) but find a very good correlation of the characters studied. The standard deviations of length and diameter are proportional to their length and mean diameter. The coefficients of variability stand close together being 26.66 for length and 22.6 for diameter. We now call attention to the close resemblance in every respect, of Cotton and Wolf muston when leaf characters are considered.

See Tables 52 and 53.

JONATHAN.

| V | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | F |
|----|----|----|----|----|----|----|----|----|----|
| 45 | 1 | | | | | | | | 1 |
| 50 | | 1 | | | | | | | 1 |
| 55 | | 1 | 1 | | | | | | 2 |
| 60 | | 1 | 7 | | | | | | 8 |
| 65 | | | | 3 | 3 | | | | 6 |
| 70 | | | | 1 | | 2 | | | 3 |
| 75 | | | | | 1 | | | | 1 |
| 80 | | | | | | | | | |
| 85 | | | | | | | | | |
| | 1 | 5 | 12 | 4 | 6 | | | | 19 |

FIG. 16.-- Correlation of size and length of larvae of the larvae of Jonathan. Total length, in tenths of an inch; size, in tenths of an inch. $r = .6786$.

Length and size of larvae.-- The larvae of Jonathan are a very common form. In the early stages, size, Jonathan shows a very good correlation. The larvae have a length of 11.0122 mm. for a size of 45. 11.057 mm. for a size of 50. 11.0122 mm. for a size of 55. 11.057 mm. for a size of 60. 11.0122 mm. for a size of 65. 11.057 mm. for a size of 70. 11.0122 mm. for a size of 75. 11.057 mm. for a size of 80. 11.0122 mm. for a size of 85. But the correlation of size and length ^{are} fairly high, consequently we can expect a high correlation of size and length. The correlation of size and length is 11.057 mm. for a size of 45. 11.0122 mm. for a size of 50. 11.057 mm. for a size of 55. 11.0122 mm. for a size of 60. 11.057 mm. for a size of 65. 11.0122 mm. for a size of 70. 11.057 mm. for a size of 75. 11.0122 mm. for a size of 80. 11.057 mm. for a size of 85. This is not the case we did not expect a high correlation in the characters of size and length. (See Table 1.)

| V | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | F |
|----|----|----|----|----|----|----|----|----|----|
| 45 | | | | | | | | | 1 |
| 50 | | | 1 | | | | | | 1 |
| 55 | | | 1 | 0 | 1 | | | | 3 |
| 60 | | | | 1 | | 1 | | | 2 |
| 65 | | | | 1 | 1 | 4 | 0 | | 6 |
| 70 | | | | | | | 0 | | 1 |
| 75 | | | | | | | | | |
| 80 | | | | | | | | | |
| 85 | | | | | | | | | |
| | | 1 | 6 | 3 | 8 | 5 | | | 16 |

FIG. 30.--- Correlation between length and diameter of the leaves of Red Canada. Length subject, diameter relative;
 $r = .7378 \pm .0376$.

Length and diameter of leaves--- This is a fair degree of correlation for the leaf characters. The diameter (52.2727 mm.) has a greater standard deviation (3.5167 millimeters) than has the length (61.5019 millimeters) whose deviation is only 5.6457 mm. Such being the case, the coefficient of variability for length is comparatively low(9.166) as against the higher coefficient (13.672) for diameter and, as usual, we find a reduced coefficient of correlation. See Table 23.

| Y | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|-----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 50 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | 1 | 1 | 1 | | | | | | | |
| 65 | | | | | 1 | 1 | | | | | | |
| 70 | | | | | 2 | 2 | 1 | | | | | |
| 75 | | | | | | 2 | 3 | | | | | |
| 80 | | | | | | | 4 | | | | | |
| 85 | | | | | | | | 1 | | | | |
| 90 | | | | | | | | | 1 | | | |
| 95 | | | | | | | | | | 1 | | |
| 100 | | | | | | | | | | | 1 | |
| | 1 | 1 | 3 | 5 | 5 | 4 | | 1 | | | | 1 |

FIG. 12.--Frequency in terms of length and diameter of leaves of Tall Flippin. For all 50 pairs, diameter relative; $r = .8641 \pm .0403$.

TABLE 27. (Cont.) Tall Flippin shows here, as is also in the other growth characters, a very good correlation in the above characters. The standard deviations for these characters are high and low, too, and the coefficients of variability being 18.176 and 11.977 for length and diameter respectively, the two coefficients of variability being high and close together and to give a good correlation.

See Table 27.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | f |
|-----|----|----|----|----|----|----|----|----|----|----|
| 60 | 2 | | | | | | | | | 2 |
| 65 | 2 | 1 | 2 | | | | | | | 5 |
| 70 | | 1 | 1 | 1 | | | | | | 3 |
| 75 | | 1 | 1 | 1 | | | | | | 3 |
| 80 | | | 3 | | | | | | | 3 |
| 85 | | | | | | | | | | |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 4 | 3 | 7 | 2 | | | | | | 16 |

FIG. 33.4. Correlation between length and diameter of leaves of *Yucca elata*. Length subject, diameter relative; $r = .5726 \pm .1137$.

TABLE 33.4. COEFFICIENTS OF VARIATION --- The correlation in this case might be said to be fair but it is quite low. The standard deviations (6.8511 mm. and 5.1556 mm.) are proportional to the mean length (70 mm.) and mean diameter (37.107 mm.) but the coefficients of variability, while close together, are low being 9.776 for length and 9.612 for diameter. The results bear us out in our assertion that low coefficients of variability give us a low coefficient of correlation. See Table 33.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | f |
|-----|----|----|----|----|----|----|----|----|----|----|
| 30 | 1 | | | | | | | | | 1 |
| 35 | | 1 | | | | | | | | 1 |
| 70 | 1 | | 1 | 1 | | | | | | 3 |
| 75 | | 3 | | 1 | | | | | | 4 |
| 80 | | | 2 | 2 | | 1 | | | | 3 |
| 85 | | | | 1 | 1 | 1 | | | | 4 |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 2 | 4 | 3 | 5 | 3 | 1 | 1 | | | 16 |

FIG. 33.—Correlation between length and diameter of leaves of Winter Danana. Length subject, diameter relative; $r = .6803 \pm .0850$.

Length and diameter of leaves—In this variety the correlation is fairly good. The relation between the mean for length (75.933 mm.) and its standard deviation (7.9264 mm.) has for the t a deviation (3.9341) giving it a coefficient of variability of 14.44 as against 9.821 for length. The great difference in these two coefficients is reflected in the correlation coefficient. See Table 26.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | f |
|-----|----|----|----|----|----|----|----|----|----|
| 45 | | | | | | | | | |
| 50 | | | | | | | | | |
| 55 | | | | | | | | | |
| 60 | | | | | | | | | |
| 65 | | 1 | | | | | | | 1 |
| 70 | | 1 | 3 | | | | | | 10 |
| 75 | | | 2 | 3 | | | | | 4 |
| 80 | | | | 1 | 3 | 1 | | | 4 |
| 85 | | | | | 1 | 2 | | | 3 |
| 90 | | | | | | | | | |
| 95 | | | | | | | | | |
| 100 | | | | | | | 1 | | 1 |
| | | 3 | 10 | 7 | 3 | | 1 | | 24 |

FIG. 24.---Correlation between length and diameter of leaves of *Ficus*. Length object, diameter relative; $r = .8415 \pm .0448$.

Length and diameter of leaves of *Ficus* shows a very good correlation in these characters. The standard deviation for length and for diameter are proportional to the means for these characters. The coefficients of variability are high and close together; 10.84 for length and 11.00 for diameter. This gives us a good correlation. The number of individuals used (24) being greater than in some other cases may have affected the result. See Table 25.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | F |
|-----|----|----|----|----|----|----|----|----|----|----|
| 45 | 1 | 1 | | | | | | | | 2 |
| 50 | 2 | 3 | | | | | | | | 5 |
| 55 | | 3 | 1 | | | | | | | 4 |
| 60 | | 1 | 4 | | | | | | | 5 |
| 65 | | | 3 | 3 | | | | | | 6 |
| 70 | | | | | | | | | | |
| 75 | | | | 1 | | 1 | | | | 2 |
| 80 | | | | | 1 | | | | | 1 |
| 85 | | | | | | | | | | |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 3 | 7 | 7 | 4 | 1 | 1 | | | | 23 |

FIG. 35. ---Correlation between length and diameter of leaves of MoIntosh. Length subject, diameter relative;

$$r = .8751 \pm .0378.$$

Length and diameter of leaves---As shown in the coefficient of correlation for the leaf characters, than that shown here now. The standard deviation is about the same for both characters as for the leaves of length and diameter which they represent, the deviation for length being proportionally a little the higher. Each, however, is high and the coefficients of validity are as a consequence high, length being .86.05 and diameter being .84.0. Highest variabilities here give highest coefficient of correlation. See Table 31.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | f |
|----|----|----|----|----|----|----|----|----|
| 55 | 1 | | | | | | | 1 |
| 60 | 1 | | | | | | | 1 |
| 65 | | 2 | 1 | | | | | 3 |
| 70 | | | 3 | 2 | | | | 5 |
| 75 | | | 2 | 2 | 1 | | | 6 |
| 80 | | | | 2 | 3 | 1 | | 6 |
| 85 | | | | | | | | |
| 90 | | | | | | | 1 | 1 |
| | 1 | 3 | 6 | 6 | 4 | 1 | 1 | 22 |

FIG. 36.--- Correlation between length and diameter of leaves of *H. wrightii*. Length subject, diameter relative; $r = .8944 \pm .0437$.

Length and diameter of leaves.--- These figures show another very good correlation. The mean length has a small deviation but the diameter is more variable giving us a greater standard deviation for diameter. The coefficients of variability are 10.62 for length and 13.34 for diameter. A greater number of individuals being used here, again seems to give us a better correlation. (See Table 33.)

| V | 45 | 47 | 50 | 53 | 56 | 57 | 70 | f |
|----|----|----|----|----|----|----|----|----|
| 55 | | | | | | | | |
| 60 | | 3 | | | | | | 2 |
| 65 | | 1 | 1 | | | | | 2 |
| 70 | | | 1 | 3 | | | | 4 |
| 75 | | | 1 | 2 | 1 | | | 4 |
| 80 | | | | 1 | 1 | | | 2 |
| 85 | | | | | | 2 | | 1 |
| | | 3 | 3 | 6 | 2 | 2 | | 16 |

FIG. 37.—Correlation between length and diameter of leaves of Gutten. Length arbitrary, diameter relative; $r = .6873 \pm .1767$.

Length and diameter of leaves— In this case we have a small number of individuals (16) but find a very good correlation of the characters studied. The standard deviations in growth are proportional to leaf length and leaf diameter. The coefficients of variability stem also: growth being 20.66 for length and 11.8 for diameter. We now call attention to the close resemblance in every respect, of Gutten and Willow when 10-13 characters are considered.

(See Tables 53 and 55.)

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | P |
|-----|----|----|----|----|----|----|----|----|----|----|
| 50 | | | | | | | | | | |
| 55 | | | | | | | | | | |
| 60 | | 1 | 1 | 1 | | | | | | 4 |
| 65 | | | | 1 | 1 | | | | | 3 |
| 70 | | | | 2 | 2 | 1 | | | | 6 |
| 75 | | | | | 2 | 5 | | | | 9 |
| 80 | | | | | | 4 | | | | 4 |
| 85 | | | | | | | | 1 | | 1 |
| 90 | | | | | | 1 | | | | 1 |
| 95 | | | | | | | | | | 1 |
| 100 | | | | | | | | | | 1 |
| | | 1 | 1 | 3 | 5 | 5 | 4 | 1 | | 28 |

FIG. 21.--The relation between length and diameter of leaves of Tall Fescue. Length square, diameter relative; $r = .9341 \pm .0403$.

In Table 27, the correlation coefficient for Tall Fescue shows here, as it did in the two growth characters, a very good correlation in the above characters. The standard deviations for these characters are high and so, too, are the coefficients of variability being 10.111 and 11.977 for length and diameter respectively, the two coefficients of variability being high and close together and so indicating a good correlation.

See Table 27.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | F |
|-----|----|----|----|----|----|----|----|----|----|----|
| 50 | | 2 | | | | | | | | 2 |
| 65 | | 2 | 1 | 2 | | | | | | 5 |
| 70 | | | 1 | 1 | 1 | | | | | 3 |
| 75 | | | 1 | 1 | 1 | | | | | 3 |
| 80 | | | | 3 | | | | | | 3 |
| 85 | | | | | | | | | | |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 4 | 3 | 7 | 4 | | | | | | 16 |

FIG. 32.— Correlation between length and diameter of leaves of *Nerium Oleaceum*. Length (mm.), diameter (mm.); $r = .5770 \pm .1107$.

Regression line given in Figure 44.—The correlation in this case might be called fair but it is quite low. The standard deviations (3.8513 mm. and 0.1551 mm.) are proportional to the mean length (70 mm.) and mean diameter (37.187 mm.) but the coefficients of variability, while close together, are low being 5.770 for length and 0.042 for diameter. The results bear us out in our assertion that low coefficients of variability give us a low coefficient of correlation. See Table 23.

| V | 47 | 50 | 57 | 64 | 67 | 70 | 77 | 80 | 87 | f |
|-----|----|----|----|----|----|----|----|----|----|----|
| 50 | 1 | | | | | | | | | 1 |
| 55 | | 1 | | | | | | | | 1 |
| 70 | 1 | | 1 | 1 | | | | | | 3 |
| 75 | | 3 | | 1 | | | | | | 4 |
| 80 | | | 2 | 2 | | 1 | | | | 3 |
| 85 | | | | 1 | 1 | 1 | | | | 4 |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 2 | 4 | 3 | 5 | 3 | 1 | 1 | | | 16 |

FIG. 25.—Correlation between length and diameter of leaves of Winter Panama. Length subject, diameter relative; $r = .9896 \pm .0050$.

Length and diameter of leaves.—In this variety the correlation is fairly weak. The relation between the mean for length (73.033 mm.) and its standard deviation (7.8264 mm.) has the exact deviation (6.0346) giving it a coefficient of variability of 14.44 as against 6.831 for length. The great difference in these coefficients is reflected in the correlation coefficient. See Table 25.

| V | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | F |
|-----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| 45 | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | |
| 65 | | | 2 | | | | | | | | | | 2 |
| 70 | | | 1 | 3 | | 3 | | | | | | | 10 |
| 75 | | | | 3 | | 1 | | | | | | | 4 |
| 80 | | | | 1 | | 2 | 1 | | | | | | 4 |
| 85 | | | | | | 1 | 2 | | | | | | 3 |
| 90 | | | | | | | | | | | | | |
| 95 | | | | | | | | | | | | | |
| 100 | | | | | | | | | | 1 | | | 1 |
| | | 3 | 10 | 7 | 3 | | | 1 | | | | | 34 |

FIG. 34.---Correlation for between length and diameter of leaves of *Fireweed*. Length subject, diameter relative, $r = .8417 \pm .0448$.

Length and diameter of leaves of *Fireweed* afford us a very good correlation in these characters. The standard deviation for length and for diameter are proportional to the means for these characters. The coefficients of variability are high and close together; 10.84 for length and 11.00 for diameter. This gives us a good correlation. The number of individuals used (34) being greater than in any other case may have affected the result. See Table 35.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | f |
|-----|----|----|----|----|----|----|----|----|----|----|
| 45 | 1 | 1 | | | | | | | | 2 |
| 50 | 2 | 3 | | | | | | | | 5 |
| 55 | | 2 | 1 | | | | | | | 3 |
| 60 | | 1 | 4 | | | | | | | 5 |
| 65 | | | 2 | 3 | | | | | | 5 |
| 70 | | | | | | | | | | |
| 75 | | | | 1 | | 1 | | | | 2 |
| 80 | | | | | 1 | | | | | 1 |
| 85 | | | | | | | | | | |
| 90 | | | | | | | | | | |
| 95 | | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 3 | 7 | 7 | 4 | 1 | 1 | | | | 23 |

FIG. 33. ---Correlation between length and diameter of leaves of McIntosh. length subject, diameter relative; $r = .8751 \pm .0072$.

Length and diameter of leaves--- We find no higher coefficient of correlation for the leaf characters, than that shown here now. The standard deviation is about the same for both characters as are the means of length and diameter which they represent, the deviation for length being proportionally a little the higher. Each, however, is high and the coefficients of variability are as a consequence high, length being 16.65 per cent. and diameter being 18.6. Highest variabilities have give highest coefficient of correlation. See Table 31.

| V | 40 | 45 | 50 | 55 | 60 | 65 | 70 | f |
|----|----|----|----|----|----|----|----|----|
| 55 | 1 | | | | | | | 1 |
| 60 | 1 | | | | | | | 1 |
| 65 | | 2 | 1 | | | | | 3 |
| 70 | | | 3 | 2 | | | | 5 |
| 75 | | | 2 | 2 | 1 | | | 5 |
| 80 | | | | 2 | 3 | 1 | | 6 |
| 85 | | | | | | | | |
| 90 | | | | | | | 1 | 1 |
| | 1 | 3 | 6 | 6 | 4 | 1 | 1 | 22 |

FIG. 28.-- Correlation between length and diameter of 1 level of Huttersten. Length subject, diameter relative; $r = .8949 \pm .0437$.

Length and diameter of level----- These figures show a rather very good correlation. The mean length has a small deviation but the diameter is more variable giving us a greater standard deviation for this class even. The coefficients of variability are 10.60 for length and 13.34 for diameter. A greater number of individuals being used here, again seems to give us a better correlation. See Table 28.

| V | 45 | 47 | 50 | 55 | 60 | 65 | 70 | f |
|----|----|----|----|----|----|----|----|----|
| 55 | | | | | | | | |
| 60 | | 2 | | | | | | 2 |
| 65 | | 1 | 1 | | | | | 2 |
| 70 | | | 1 | 3 | | | | 4 |
| 75 | | | | 1 | 2 | 1 | | 4 |
| 80 | | | | | 1 | 1 | | 2 |
| 85 | | | | | | | 2 | 1 |
| | | 3 | 3 | 6 | 2 | 2 | | 16 |

FIG. 37.—Correlation between length and diameter of leaves of Cotton. Length subject, diameter relative;
 $r = .9876 \pm .070$.

Length and diameter of leaves---- In this case we have a small number of individuals (16) but find a very good correlation of the characters studied. The standard deviations of length and diameter are proportional to their length and mean diameter. The coefficients of variability stand close together being 10.66 for length and 11.6 for diameter. We now call attention to the close resemblance in every respect, of Cotton and Wolf musters when 10 of characters are considered.

(cf. Tables 52 and 53.

| V | 11.5 | 12.5 | 13.5 | 14.5 | 15.5 | 16.5 | 17.5 | 18.5 | 19.5 | 2 |
|----|------|------|------|------|------|------|------|------|------|----|
| 51 | | | 1 | | | | | | | 1 |
| 57 | | | 0 | | 1 | | | | | 2 |
| 60 | | | | 2 | | | | | | 1 |
| 65 | | | 0 | 0 | 1 | | | | | 2 |
| 68 | | | | | 0 | | | | | 0 |
| 69 | | | | 1 | 1 | | | | | 2 |
| 71 | | | | | | | | | | |
| 75 | | | | | | | | | | |
| 79 | | | | | | | | | | |
| 81 | | | | | | | | | | |
| 84 | | | | | | | | | | |
| 87 | | | | | | | | | | |
| | | | 3 | 4 | 3 | | | | | 13 |

FIG. 12---Correlation between crown length and petiole length of leaves of *Euphorbia*. Plot length against petiole length columns; $r = .1753 \pm .0015$.

Interpretation of the correlation coefficient---We have here a correlation of these characters. We believe that this correlation is not significant because in each of the other 4 varieties was small and the coefficient of variability for each mean is low, being 7.63% for length and 6.72% for diameter. Because of the fact that the coefficient of correlation is not significant it is great as its probable error, no significance can be placed on these figures.---Follett and Gilbert.~

| V | 14.5 | 16.7 | 18.5 | 20.5 | 22.7 | 24.5 | 26.5 | 28.5 | F |
|----|------|------|------|------|------|------|------|------|----|
| 54 | | | | | | | | | |
| 57 | | | | | | | | | |
| 60 | | | | | | | | | |
| 63 | | | | | | | | | |
| 66 | | 1 | | | | | | | 1 |
| 69 | 1 | 1 | | | | | | | 2 |
| 72 | | | 2 | | | | | | 3 |
| 75 | | 1 | 2 | | | | | | 3 |
| 78 | | | 1 | 1 | | | | | 2 |
| 81 | 1 | 1 | | 2 | | | | | 4 |
| 84 | | | | | | | | | |
| 87 | 1 | | | | | | | | 1 |
| | 5 | 4 | 6 | 3 | | | | | 16 |

FIG. 40. ----Correlation between blade length and petiole length of leaves of Mother. Blade length subject, petiole diameter relative. $r = .4023 \pm .1071$.

Figure of Merit for Correlation of Petiole ---- The above is a fair correlation but no dependence can be placed on it. The blade length is again so nearly constant, that the deviation is low being 5.6351 mm. for a mean length of 75.75 mm. The petiole length is more variable, the standard deviation being 3 mm. for a mean petiole length of 18 mm. The coefficients of variability are: for blade length, 7.431; for petiole length 11.11. The blade length coefficient being low and the difference between them great, we look for a poor correlation. See Table 43.

| V | 14.5 | 18.5 | 18.5 | 20.5 | 20.5 | 24.7 | 13.5 | 28.5 | f |
|----|------|------|------|------|------|------|------|------|----|
| 54 | | | | | | | | | |
| 57 | | | | 1 | 1 | | | | 2 |
| 60 | | | | | 2 | | | | 2 |
| 63 | | | 3 | | 1 | | | | 4 |
| 66 | | | 4 | 3 | | | | | 7 |
| 69 | | | | | | | | | |
| 72 | | | | | 1 | | | | 1 |
| 75 | | | | | | | | | |
| 78 | | | | | | | | | |
| 81 | | | | | | | | | |
| 84 | | | | | | | | | |
| 87 | | | | | | | | | |
| | | | 7 | 4 | 5 | | | | 16 |

FIG. 41---Correlation between blade length and petiole length of leaves of Fee Canada. Blade length subject, petiole length relative; $r = .2461 \pm .1524$.

Length of blade and petiole length---Such a correlation coefficient as the one above would seem to indicate that here we find little relation between blade length and petiole length. However, we must remember that the number of individuals was very small and consequently our results in this study of little significance. Because of so little variation in leaf length we got this low correlation since the standard deviation for diameter is more nearly normal. The coefficient of variability for length is 3.023 and for diameter 8.741. but no dependence can be placed on these. See Table 37.

| V | 18.5 | 20.5 | 22.5 | 24.5 | 26.5 | 28.5 | 30.5 | 32.5 | f |
|----|------|------|------|------|------|------|------|------|----|
| 63 | | | | | | | | | |
| 66 | | | | | | | | | |
| 68 | | 1 | | | | | | | 1 |
| 72 | | 1 | 1 | | | | | | 2 |
| 75 | | 1 | | | | | | | 1 |
| 78 | | 1 | 1 | | | | | | 2 |
| 81 | | 1 | 2 | | | | | | 3 |
| 84 | | 1 | | | | | | | 1 |
| 87 | | | 1 | | | | | | 1 |
| 90 | | | 1 | 1 | | | | | 2 |
| 93 | | | 1 | | | | | | 1 |
| 96 | | | | 1 | | | | | 1 |
| 99 | | | | 1 | | | | | 1 |
| | | 6 | 7 | 3 | | | | | 16 |

FIG. 4B.-- Correlation between length of blade and petiole length of Fall Filpin. Blade length Subject, Petiole length relative; $r = .86416 \pm .0874$.

Length of blade and length of petiole-- Considering the fact that the characters now being studied have shown so little uniformity, the above correlation is a very good one. An examination of the tables shows us that the standard deviation for blade length (8.9568 for a blade length of 8.2375) is here about normal. (Normal ratio has been about 1:10) The petiole length and standard deviation are: length 22.125 standard deviation 1.5-- Not so good as the other. See Table 13.

| V | 28.5 | 30.5 | 32.5 | 34.5 | 36.5 | 38.5 | 40.5 | 42.5 | F |
|----|------|------|------|------|------|------|------|------|----|
| 65 | | 1 | | | | | | | 1 |
| 66 | 3 | 3 | | | | | | | 6 |
| 67 | 1 | | | | | | | | 1 |
| 72 | | 2 | | | | | | | 2 |
| 75 | | 2 | | | | | | | 2 |
| 78 | 2 | 1 | | | | | | | 3 |
| 81 | | 2 | | | | | | | 2 |
| 84 | | | | | | | | | |
| 87 | | | | | | | | | |
| 90 | | | | | | | | | |
| 93 | | | | | | | | | |
| 96 | | | | | | | | | |
| 99 | | | | | | | | | |
| | 5 | 11 | | | | | | | 13 |

FIG. 42.--Correlation between blade length and petiole length of leaves of Madder Fluch. Blade length subject, petiole length relative; $r = .9442 \pm .1587$.

Length of petiole relative to blade length---Here again, we have a very poor correlation between blade length and petiole length. However in this case, we find a normal deviation for blade length, namely; 6.0463 mm. for mean blade length of 71.57. Rather it is due here to the lesser deviation for petiole length this being .6574 mm. for a mean petiole length of 16.875 mm.

The coefficient of blade length is normal or a little above but the constant for petiole length is much reduced being 4.817. The result is a poor correlation but no dependence can be placed on these figures. See Table 36.

| V | 13.5 | 21.5 | 23.5 | 24.5 | 25.5 | 28.5 | 30.5 | 32.5 | f |
|----|------|------|------|------|------|------|------|------|----|
| 66 | 1 | | | | | | | | 1 |
| 68 | | | | | | | | | |
| 69 | | | 1 | | | | | | 1 |
| 72 | | | 3 | | | | | | 3 |
| 75 | | | 1 | 2 | | 1 | | | 4 |
| 78 | | | | | | 1 | | | 1 |
| 81 | | | 1 | 2 | | | | | 3 |
| 84 | | | | 1 | | 2 | | 1 | 4 |
| 87 | | | | | | | | | |
| 90 | | | | | | | | | |
| 93 | | | | | | | | | |
| 96 | | | | | | | | | |
| 99 | | | | | | | | | |
| | 1 | | 5 | 5 | | 4 | | 1 | 16 |

FIG. 34.--- Correlation between blade length and petiole length of leaves of Winter Panana. Blade length subject, petiole length relative; $r = .3713 \pm .0075$.

Length of petiole, length of blade.--- This is the highest coefficient of correlation that has been found, for three characters now being considered. The ratio of mean length of leaf blade to its standard deviation, in other words its coefficient of variability is about 1:12 being somewhat of this being a little low for making the best correlation. The relation existing between the mean petiole length and its standard deviation is more nearly normal giving us a coefficient of variability, here, of 10.18%. See Table 40.

| V. | 16.5 | 18.5 | 20.5 | 21.5 | 21.5 | 22.5 | f |
|----|------|------|------|------|------|------|----|
| 45 | | | | | | | |
| 46 | | | | | | | |
| 51 | | | | | | | |
| 54 | | | | | | | |
| 57 | | | | | | | |
| 60 | | | | | | | |
| 63 | | 1 | | | | | 1 |
| 66 | 2 | | 1 | | | | 3 |
| 70 | 1 | 1 | | 1 | | | 3 |
| 75 | | | 1 | | | | 1 |
| 78 | | 1 | 2 | | | | 3 |
| 81 | | | | | | | |
| 84 | | 1 | | | | 1 | 2 |
| 87 | | | | | 1 | | 1 |
| 90 | | | | | | | |
| 93 | | | | | | | |
| 96 | | | | | 1 | | 1 |
| | 5 | 1 | 5 | 1 | 2 | 1 | 16 |

FIG. 17.-- Correlation between length and period of length of leaves of *Pinus*. $r = .6027 \pm .1000$.

Length of leaf and period of leaf growth. For the character before considered the leaf is a fairly good correlation. The difference in variability in the period of growth from the same length elements for the same leaf is about 0.1 mm. (about 1/10 of the width of the leaf). Coefficient of variability for leaf length is 11.67 per cent and for period of growth is 11.61 per cent.

| V | 12.5 | 12.7 | 12.9 | 13.1 | 13.3 | 13.5 | F |
|----|------|------|------|------|------|------|----|
| 45 | | | 1 | | | | 1 |
| 48 | | | | | | | |
| 51 | | | | | | | |
| 54 | | | | | 1 | | 1 |
| 57 | | 2 | 2 | | | | 4 |
| 60 | | | | 1 | 1 | | 2 |
| 63 | | | | 1 | | | 1 |
| 66 | | | | 1 | 2 | | 3 |
| 69 | | | | | 1 | | 1 |
| 72 | | | | | | | |
| 75 | | | | | 1 | | 1 |
| 78 | | | | | | 1 | 1 |
| 81 | | | | | | | |
| 84 | | | | | | 1 | 1 |
| 87 | | | | | | | |
| 90 | | | | | | | |
| 93 | | | | | | | |
| 96 | | | | | | | |
| 99 | | | | | | | |
| | 3 | 2 | 3 | 6 | 2 | | 16 |

FIG. 46. Correlation between blade length and petiole length of leaves of McIntosh. Blade length subject, petiole length relative; $r = .3416 \pm .0468$.

Length of blade and length of petiole are also correlated in ⁸ found in this case. The standard deviations are about normal in each case and the coefficients of variability are high and close to each other, being 15.87 for blade length and 11.13 for petiole length. (See Table 42.)

| V. | 20.5 | 22.5 | 24.5 | 26.5 | f |
|----|------|------|------|------|----|
| 60 | 1 | | | | 1 |
| 63 | 1 | | | | 1 |
| 66 | | 1 | | | 1 |
| 69 | | 1 | | | 1 |
| 72 | | | | | |
| 75 | 1 | 2 | 1 | | 4 |
| 78 | | 1 | | | 1 |
| 81 | 1 | 1 | 2 | 1 | 5 |
| 84 | | | 1 | | 1 |
| 87 | | | 1 | | 1 |
| | 4 | 6 | 5 | 1 | 16 |

FIG. 47. Correlation between blade length and petiole length of leaves of *Hybanthus*. Blade length object, petiole length relative; $r = .5377 \pm .1146$.

Level of correlation of petiole length --- This is a fair correlation for these characters. The deviation of the blade length from the mean was greater than was the petiole deviation from its mean length. Differences in deviation give us a slight superiority in the coefficients of variability (10.17 for blade length and 7.681 for petiole length) resulting in a lower degree of correlation. See Table 48.

| V | 40.5 | 41.5 | 54.5 | 63.5 | P |
|----|------|------|------|------|----|
| 60 | | | | | |
| 63 | | 1 | | | 1 |
| 66 | | | | | |
| 69 | 1 | 2 | 3 | | 6 |
| 73 | | | 1 | | 1 |
| 75 | 1 | | 1 | | 2 |
| 78 | | | | | |
| 81 | 1 | 2 | | 1 | 4 |
| 84 | | | | | |
| 87 | | | 1 | 1 | 2 |
| | 5 | 5 | 6 | 2 | 16 |

FIG. 18. ---Calculation of the number of fish caught by length of fishes of Station. Value of χ^2 coefficient, $\chi^2 = 10.71$; $P = .010 \pm .001$.

Length and Number of Fishes of Station--- The coefficient of correlation has not been given from River to the river as great as the probable error one can obtain is dependent upon the coefficient.

This statement is given by Bailey and Gilbert in their Fish and Fishing Book, page 416.

High Correlation of the Correlation Coefficient

It was found that, in general, the results obtained from the new growth studies and from the diameter studies are similar and showing fair to very good correlations in practically all cases. In two instances only, was there a weakly poor correlation and that of the variety Nether, the other, one of the Turner trees. This last case was explained as being, in all probability, due to a high degree of variability in new growth length with but very little variability in new growth diameter.

The results obtained in our study of blade length and blade diameter of the leaves, were fairly good but not as accurate as the study of the new growth.

In our study of the correlation between blade length and blade diameter the results obtained were very inconsistent as to the writer. He thinks that the explanation for these varying results may be found in the small number of individuals used, this being evident in all cases.

-----GENERAL SUMMARY.-----

The results of the foregoing data may be summarized in the following paragraphs.

-1- Data have been given for the variations and correlations in the new growth (shoots) and in the leaves of leaves variation of shape, illustrating the following points.

-2- It would be hard to find any direct link between those of the same variety whose root growth and the character coincided, but, in general, the varieties usually show a reasonably close correlation of characters.

-3- It has been found, in the majority of cases, that an increase in length or in diameter in diameter is accompanied by a decrease in coefficient of variability.

-4- However, when a study of the correlation between length and diameter characters was made it was found that a high coefficient of variability for one character is generally accompanied by a correspondingly high coefficient of variability in the other characters, the result being a high correlation between the two characters.

-5- The present work, however, proves that external factors (environment) do influence the degree of correlation, for the trees within a variety were not all equally vigorous and these differences in vigor were reflected in the coefficients of correlation. In this connection Wilkinson⁶ says, "The trees in each block differ in every organ and function of which note could be taken. The uniformity of the trees in the stalling was in striking contrast. The effects of place, age or condition of variety, one of trees, or cultural treatment and also of whether the trees are dwarf or standard stocks. Features of their skeleton root system, dwarf trees are even more liable to

injury from frost than standards."

-6- From the results obtained, the writer is led to believe that there is a correlation existing between varieties within a group, as is shown in the case of Rogers, Jonathan, and Ten Green within the Jonathan Group, and of Hubbardston and Green within the King Group, but that the varieties have a distinct tendency to segregate in the group as in the case of the variety "Mother" which has but little resemblance to the other varieties in the Jonathan Group.

-7- From the results obtained, the author believes that there is, in general, a very noticeable correlation between all of the same variety; that varieties within the group often, or usually, show greater resemblance to each other, and further, that the vigor of the plant does influence the correlation of its parts. Study of the individual parts of a variety show us this almost conclusively.

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| | |
|--------------|-------|
| Variety | |
| Beopus | { 741 |
| | { 480 |
| Jonathan | { 510 |
| | { 502 |
| Mother | { 503 |
| | { 505 |
| | { 528 |
| Red Canada | { 710 |
| | { 579 |
| | { 58 |
| Full Pippin | { 510 |
| | { 510 |
| | { 572 |
| Maiden Blush | { 570 |
| | { 575 |
| | { 700 |
| Winter | { 500 |
| Banana | { 500 |
| | { 503 |
| Faneuse | { 506 |
| | { 512 |
| | { 500 |
| McIntosh | { 500 |
| | { 510 |
| | { 500 |
| Hubbardston | { 546 |
| | { 546 |
| Gutton | { 504 |

CHART 16. MEAN LENGTHS FOR LENGTH OF FISHES

| Variety. | $\bar{L}$ | σ_L | C_L | r |
|-----------------|--------------------|-------------------|--------|-----|
| Boopis | 85.8117 $\pm$.941 | 4.8117 $\pm$.040 | 8.2501 | |
| Jonathan | 81.8 $\pm$.081 | 8.180 $\pm$.084 | 11.007 | |
| Notus | 73.05 $\pm$.053 | 5.050 $\pm$.053 | 7.001 | |
| Red Canada | 81.00 $\pm$.010 | 5.007 $\pm$.008 | 6.700 | |
| Red Flippin | 81.00 $\pm$ 1.153 | 6.000 $\pm$.801 | 10.100 | |
| Reddish Flippin | 70.00 $\pm$ 1.153 | 6.001 $\pm$.010 | 11.000 | |
| White Flippin | 73.000 $\pm$ 1.153 | 7.003 $\pm$.004 | 8.001 | |
| Yellow | 73.000 $\pm$ 1.100 | 6.000 $\pm$.771 | 10.000 | |
| McIntosh | 50.13 $\pm$ 1.000 | 6.400 $\pm$.044 | 13.000 | |
| McIntosh | 73.000 $\pm$ 1.100 | 7.007 $\pm$.700 | 10.100 | |
| Notus | 71.8 $\pm$ 1.000 | 7.700 $\pm$.100 | 10.000 | |

CHART 17. MEAN LENGTHS FOR LENGTH OF FISHES

| Variety. | $\bar{L}$ | σ_L | C_L | r |
|-----------------|--------------------|-------------------|--------|-----|
| Boopis | 85.807 $\pm$.711 | 4.800 $\pm$.003 | 7.000 | |
| Jonathan | 81.010 $\pm$.000 | 8.000 $\pm$.100 | 6.000 | |
| Notus | 73.75 $\pm$.001 | 5.000 $\pm$.000 | 7.001 | |
| Red Canada | 80.75 $\pm$.000 | 5.000 $\pm$.100 | 6.000 | |
| Red Flippin | 80.000 $\pm$ 1.000 | 6.000 $\pm$ 1.000 | 10.000 | |
| Reddish Flippin | 71.00 $\pm$ 1.000 | 6.000 $\pm$.700 | 6.000 | |
| White Flippin | 77.000 $\pm$ 1.000 | 6.100 $\pm$.700 | 8.000 | |
| Yellow | 73.100 $\pm$ 1.417 | 6.000 $\pm$ 1.000 | 11.000 | |
| McIntosh | 63.000 $\pm$ 1.000 | 6.700 $\pm$ 1.100 | 13.000 | |
| McIntosh | 73.75 $\pm$ 1.000 | 7.700 $\pm$.010 | 10.174 | |
| Notus | 74.010 $\pm$ 1.000 | 7.000 $\pm$.001 | 6.700 | |

Notation:- $\bar{L}$ = Mean for Length.

σ_L = standard deviation for Length.

C_L = Coefficient of Variability for Length.

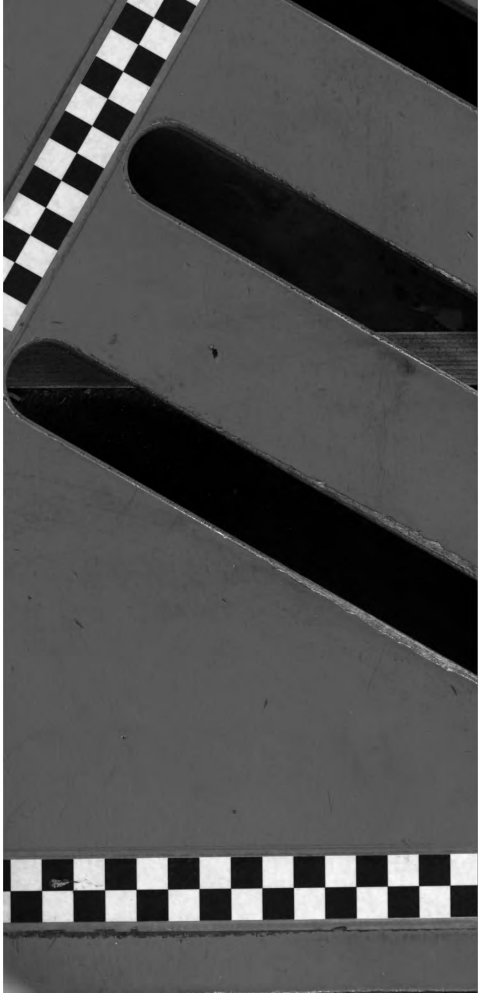
r = Coefficient of Correlation.

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