INTROGRESSIVE HYBRIDIZATION IN A NATURAL POPULATION OF TRADESCANTIA

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INTRODUCTION

Detailed analyses of populations containing natural hybrids have been reported recently. Anderson (1936) has suggested a method for expressing quantitatively the extent of hybridity of a population and for comparing various populations, and this method has been applied to various genera such as Tradescantia (Anderson 1936), Solidago (Goodwin 1937), and Iris (Riley 1938, 1939). The present paper reports a morphological and cytological study of a population of Tradescantia growing along a railroad right-of-way about fifteen miles east of the center of New Orleans, Louisiana. This population was more complex than most of the populations of that genus reported by Anderson and Hubricht (1938) for it involved three species of which two were tetraploids and the third a diploid.

MATERIALS AND METHODS

The plants used for this investigation were growing along the side of the railroad track at the intersection of the Louisville and Nashville R. R. and the Chef Menteur highway (U.S. route 90) at Michaud, Louisiana, near signal tower number 7934. During the spring of 1936, the author (Riley 1937) made a preliminary survey of the region, examining 52 plants, and this study was continued in 1937 using 93 plants and several additional characters. Ten characters were recorded for most of the plants, but on some it was not possible to get a chromosome count, on others no fertility records could be obtained, and on a few both kinds of data were unrecorded. Plants upon which information was incomplete were marked and the missing data were obtained when they bloomed again in the spring of 1938. Herbarium specimens were made for all 93 plants.

A more exact picture of the location of these plants and of their spatial relationships to one another can be obtained from figure 1. The railroad embankment begins to slope downward about two meters from the track. A number of plants were located just at the upper edge of this embankment and most of the rest were found on the slope. Plant 29 was growing near the tracks and plants 9 through 15 were in the level ground at the

1 Contribution from Newcomb College, Tulane University, New Orleans, Louisiana. This study was aided in part by a grant from the New Orleans Academy of Science.
Figure 1.—(See opposite page for legend.)
bottom of the embankment. About 20 meters from the railroad track, the
land rises again into a fairly dense woods and there is a path to the woods
from the railroad embankment starting at the location of plants 43 and 49.
These details of the topography of the region are important as they affect
the distribution of the plants. During the spring, the location is a sunny
one and the plants are at their peak from March through May, but by
late June most of their leaves have disappeared and the flower stalks are
well advanced; as the summer progresses, other plants grow up and shade
the Tradescantias which are at that time located only with great difficulty.

As has been stated previously, the plants at this right-of-way appear to
exhibit characters of three species. These are \textit{Tradescantia canaliculata}
Raf. (= \textit{T. reflexa} Raf.), \textit{T. hirsutiflora} Bush and \textit{T. paludosa} Anders. and
Woods. The type locality of \textit{T. paludosa} is near the Gentilly section of
New Orleans and the author has collected it in a number of places in
southeastern Louisiana where it is ubiquitous. The other two species are
known from several places in southeastern Louisiana but uncontaminated
specimens were not found in the immediate vicinity of the population
studied at Michaud. In all cases where the author has found specimens of
\textit{T. hirsutiflora} and \textit{T. canaliculata} in southeastern Louisiana they showed
signs in having intercrossed and probably none represented a pure species.
Therefore, local plants could not be relied upon with safety as standards of
those two species, and the author depended chiefly upon herbarium speci-
mens which were supplied to him by Dr. Edgar Anderson who had
collected them in localities where they were not intercrossing, and upon
descriptions from Anderson's and Woodson's (1935) monograph. The
ten characters which were selected for study and their appearance in the
three species are as follows:

<table>
<thead>
<tr>
<th>Character</th>
<th>\textit{T. canaliculata}</th>
<th>\textit{T. hirsutiflora}</th>
<th>\textit{T. paludosa}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of stomata</td>
<td>about equal on upper and lower surfaces</td>
<td>somewhat more numerous on lower surface</td>
<td>very few on upper surface</td>
</tr>
<tr>
<td>Shape of leaf</td>
<td>long and narrow</td>
<td>short and broad</td>
<td>short; not so broad; more or less subpetiolar base</td>
</tr>
<tr>
<td>Shape of stomata</td>
<td>large with conspicuous cells at ends</td>
<td>large; generally without cells at ends</td>
<td>small</td>
</tr>
</tbody>
</table>

\textbf{Figure 1.}—Map of the area discussed in this paper, showing the Louisville and Nashville railroad track at Michaud, Louisiana, the Chef Menteur highway where it crosses the track, part of the embankment and general land at the side of the railroad track, and the location of the 93 plants which were examined. The general contour can be determined from the cross-section profile.
Character | $T. \text{canaliculata}$ | $T. \text{hirsutiflora}$ | $T. \text{paludosa}$
---|---|---|---
Number of nodes | 7–8; smaller | 2–5; largest | 5–7 | above | above | strongly flexed at nodes |
Straightness of stem | straight or nearly so | straight | slender; almost delicate above |
Stoutness of stem | stout | somewhat stout | |
Size of buds | large | large | small |
Color on pedicels | slight purple flush | deep purple | green |
Hairiness of pedicels | glabrous | generally hairy | glabrous |
Hairiness of sepals | glabrous except for tuft at tip of sepals | hairy | glabrous |

OBSERVATIONS

The 93 plants which were studied in this investigation can be divided into the following four groups and as each group presents different problems, they will be discussed separately:

- Tetraploids $T. \text{canaliculata} \times T. \text{hirsutiflora}$
- Diploids $T. \text{paludosa}$
- Triploids All three species
- Tetraploids All three species

Tetraploids—$T. \text{canaliculata} \times T. \text{hirsutiflora}$

Seventy-five of the 93 plants were tetraploids ($n = 12$), and 54 of these showed no indication of hybridization with $T. \text{paludosa}$. It is probable that all 54 plants represent some degree of hybridity between $T. \text{canaliculata}$ and $T. \text{hirsutiflora}$ although two plants (nos. 29 and 82) appeared to resemble $T. \text{hirsutiflora}$ in all ten of the characters which were studied. In straightness of stem and size of buds, $T. \text{canaliculata}$ and $T. \text{hirsutiflora}$ do not differ from one another to any measurable extent. They differ, however, in the other eight characters, and each of these eight characters may resemble either of the two species or may be intermediate between them. There are three possibilities for each of the eight characters; if the chance of each possibility can be assumed to be equal to that of any other possibility, and if each character is determined independently of all the other characters, there would be $6^{8} = 6561$ possible types of tetraploids not involving $T. \text{paludosa}$. Of the $T. \text{canaliculata} \times T. \text{hirsutiflora}$ tetraploids which were examined, only two were alike; there are 53 different recombinations represented in these 54 plants. The number of plants with eight, seven, six, etc. characters like $T. \text{hirsutiflora}$ were tabulated and plotted in figure 2. While this histogram shows a fairly symmetrical distribution of $hirsutiflora$.
flora-like and non-hirsutiflora-like characters, it must be remembered that of the latter class some are like *T. canaliculata* and others are intermediate. If characters which resemble *T. hirsutiflora* are given the value 2, those like *T. canaliculata* are scored 0, and intermediates are given the value 1, and if the total index values of the plants are plotted (figure 3), it is seen that the curve is shifted towards *T. hirsutiflora*. This would appear to indicate that when non-paludosa plants of this population originated, there were more specimens of *T. hirsutiflora* than of *T. canaliculata* in the region of hybridization, so that the hybrid types show an introgression of *T. canaliculata* into *T. hirsutiflora*.

These tetraploids ranged in pollen fertility from 47.9 to 97.1 percent. Figure 4 is a scatter diagram in which X represents the percent of fertile pollen and Y the index values of these non-paludosa tetraploids. If there is correlation, it should show a curvilinear and not a straight line relationship since plants with high index values and also those with low index values should be more highly fertile than the intermediates. No such correlation appears from the diagram. The value of $\eta_{xy}$ is 0.4186 and that of $\eta_{yx}$ is 0.4382. There is no doubt that these plants were all tetraploids. Figure 5 illustrates a first meiotic metaphase of a typical plant showing bivalent and quadrivalent configurations and the normal tetraploid number of 24 chromosomes. Figures 6 and 7 represent metaphases of the haploid microspore division of two other plants and show their tetraploid nature; in addition to the twelve normal chromosomes the plant in figure 7 also shows one small fragment.
Diploids of *T. paludosa*

Fifteen of the 93 plants resembled *T. paludosa* in most respects and were diploids \((n=6)\). Four were pure *T. paludosa*, but the others seemed to show some influence of *T. hirsutiflora* in that their pedicels took on some of the purplish color of the latter species. Two plants showed some influence of both tetraploid species. All 15 plants very closely resembled *T. paludosa*; those that showed influence of either or both tetraploid species showed just a trace of influence as if one of the *paludosa* chromosomes which normally had the constitution \(p-p-p-p-p-p-p-p-p-p-p-p\) had acquired a gene or two from the tetraploids and was now \(p-p-p-p-h-p-p-p-p-p-p-p\) or

![Figure 4](image-url)

*Figure 4.* Scatter diagram of *canaliculata × hirsutiflora* tetraploid hybrids. Percent of fertile pollen is plotted on the X axis and index value on the Y axis.
perhaps \( p-p-h-p-p-p-c-p-p-p-p-p-p \). In pollen fertility, these plants ranged from 66.7 to 98.9 percent fertile with nine plants over 90 percent fertile and 13 of the 15 over 80 percent. The average is higher than in the case of \( canaliculata \times hirsutiflora \) hybrids.

Chromosome behavior in these diploids shows a number of irregularities of different kinds. Plant 68 was typical of \( T. paludosa \) in every respect, had six pairs of chromosomes and was 95.42 percent fertile. Figure 8 illustrates a metaphase of the first meiotic division in which two ring bivalents are interlocked similar to some of those described by SAX and ANDERSON (1934) in \( T. edwardsiana \) and which can be found in varying percentages in plants of a number of species of Tradescantia. Out of 114 cells in the first meiotic metaphase of plant 68, 33 (28.95 percent) showed one or more interlocked figures; of these, 25 cells had one pair of interlocked ring bivalents, three had one ring bivalent interlocked with a rod bivalent, one cell had three ring bivalents interlocked together, one cell had two ring bivalents and two rod bivalents all interlocked, two cells had two pairs of interlocked ring bivalents, and one cell had one pair of interlocked ring bivalents and one interlocked ring and rod. None of the ring bivalents had two internodes, so apparently all the interlocking in these cells is proximal, which is in accord with SAX and ANDERSON'S (1934) observations for \( T. edwardsiana \). The chiasma frequency was 1.97 per bivalent for the cells that did not include interlocked configurations nor rings of four chromosomes and was 1.96 for the 33 cells with interlocking; this agrees with SAX and ANDERSON’s observations that chromosome interlocking does not decrease the chiasma frequency per bivalent. At anaphase of the first meiotic mitosis, lagging of chromosomes, chromatid bridges and non-disjunction were observed. Figure 9 illustrates an anaphase in which five pairs of homologues have separated while the sixth is just beginning to separate and figures 10 and 11 show chromatid bridges at late anaphase and telophase. Of 75 cells in the anaphase of the first meiotic division, five (6.67 percent) showed chromatid bridges and nine (12 percent) showed non-disjunction with a 5-7 distribution of the chromosomes. MCCLINTOCK (1933, 1938) and SAX (1937) showed that chromatid bridges could be caused by a single crossover within an inversion, and MCCLINTOCK pointed out that cells which contain single bridges at the first division should also have one fragment which did not include an attachment region. However, in SAX’S results no such fragment was detected and many cells of plant 68 that had chromatid bridges did not contain a fragment. That a chromatid bridge interferes with the normal timing of meiosis can be observed from figure 11, where two telophase nuclei have formed except for the homologues which are still connected by the bridge. Metaphase and anaphase of the first division of the haploid microspore nucleus were for the most part
Camera lucida drawings of aceto-carmine smears of meiotic and microspore divisions of various diploids, triploids and tetraploids of Tradescantia. A Bausch and Lomb microscope was used with a 100X fluorite objective, N. A. 1.30 and a 12.5X ocular, drawn at table level. Magnification $\times 1725$ before reduction; reduced approximately two-thirds.

**Figure 5.**—Metaphase of the first meiotic mitosis of plant 8. This shows the normal tetraploid number of chromosomes with characteristic bivalent and quadrivalent configurations.

**Figure 6.**—Metaphase of the microspore division of the tetraploid plant 77, with the typical number of 12 chromosomes.
normal, but there were some tetraploid microspores among the majority of normal diploid spores. Figure 12 illustrates a normal diploid microspore (n=6) and figure 13 one of the tetraploids (n=12) from the same bud. Out of 172 cells at metaphase, 25 (14.5 percent) were tetraploid and at anaphase 13 cells (10.7 percent) out of 122 were giants. Of 2166 microspores in all stages, including one- and two-nucleate resting cells, 174 (8.03 percent) appeared abnormally large and can be presumed to be tetraploids.

At metaphase of the first meiotic division of plant 48, five cells with interlocked ring bivalents were observed out of fifty. In one, a ring bivalent with two chiasmata was interlocked proximally with another that had three chiasmata and two internodes. In figure 14, four pairs of anaphase chromosomes have almost reached the poles; a fifth pair has barely begun to separate and the sixth bivalent is still in the metaphase condition. A typical chromatid bridge from plant 48 is illustrated in figure 15. Too few figures were observed at anaphase to be of much significance, but they showed that cells with bridges and non-disjunction were not numerous.

No detailed study was made of chromosomal fragments but they were

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**Figure 7.**—Metaphase of the microspore division of the tetraploid plant 34. In addition to the normal number of 12 chromosomes, a fragment is present.

**Figure 8.**—First meiotic metaphase of plant 68. This is a diploid, *T. paludosa*, with six bivalents and shows two interlocked rings.

**Figure 9.**—First meiotic anaphase of plant 68, showing one pair of chromosomes slower to separate than the other five pairs.

**Figure 10.**—Late anaphase of the first meiotic division of plant 68. Five pairs of chromosomes have passed to the poles while in the sixth, both members are tied together by a chromatid bridge.

**Figure 11.**—Telophase of the first meiotic division of plant 68. The members of one pair of chromosomes are connected by a chromatid bridge and have not yet separated. This pair of chromosomes is indicated in black, while the telophase nuclei are shown in outline only.

**Figure 12.**—A normal microspore of the diploid plant 68 with six chromosomes in metaphase.

**Figure 13.**—Metaphase of the microspore division of a tetraploid microspore from the diploid plant 68. This figure shows 12 chromosomes in contrast to the normal microspore shown in figure 12.

**Figure 14.**—The first meiotic division of the diploid plant 48. Four pairs of chromosomes have already reached the poles; one pair is in the process of passing to the poles and has the appearance of the anaphase chromosomes, while the sixth pair is in the metaphase condition.

**Figure 15.**—Late anaphase of the first meiotic division of plant 48 illustrating a typical chromatid bridge.

**Figure 16.**—A normal late anaphase of the second meiotic division of the diploid plant 48.

**Figure 17.**—A normal metaphase of the first meiotic division of the triploid plant 15 with seven rod bivalents and two ring bivalents.

**Figure 18.**—First anaphase of the same triploid as in figure 17, showing an irregular distribution of the chromosomes with seven at one pole and eleven at the other. A fragment can also be seen at one pole.

**Figure 19.**—Anaphase of the microspore division of plant 15. This is from a microspore with nine chromosomes.
observed in over a dozen plants; in other plants no fragments were found although a large number of cells were carefully studied. The observations which were made can be summarized as follows, the numbers representing the individual plants which were observed:

<table>
<thead>
<tr>
<th>Plants With Fractures</th>
<th>Plants With No Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploids:</td>
<td></td>
</tr>
<tr>
<td>Meiosis</td>
<td>68</td>
</tr>
<tr>
<td>Microspore division</td>
<td>68</td>
</tr>
<tr>
<td>Diploids:</td>
<td>44, 70</td>
</tr>
<tr>
<td>Tetraploids (canal. hirsut.):</td>
<td>20, 37, 73, 80</td>
</tr>
<tr>
<td>Meiosis</td>
<td>27, 29, 35, 45, 53, 54, 63</td>
</tr>
<tr>
<td>Microspore division</td>
<td>43, 55, 57, 58, 62, 64</td>
</tr>
<tr>
<td>Tetraploids (three species):</td>
<td>21</td>
</tr>
<tr>
<td>Meiosis</td>
<td>19, 21, 38, 50, 56, 66, 67</td>
</tr>
<tr>
<td>Microspore division</td>
<td>25, 33, 41, 60, 61, 65</td>
</tr>
</tbody>
</table>

It was especially noted that in some plants some cells contained a fragment (occasionally two) but that other cells did not.

Summing up the diploids, it can be said that they appear, with the exception of a few genes, to be typical plants of *T. paludosa* and that a small percent of various abnormalities appears during microsporogenesis. Diploids which show a few traits of *T. canaliculata* and *T. hirsutiflora*, such as plants 3 and 36, might have had an origin as pictured in figure 20a.

### Triploids

Three of the 93 plants had a haploid chromosome number of nine. Plant 15 resembled the diploid species in distribution of stomata, stomatal shape, stoutness of stem, and size of bud, was like *T. canaliculata* in leaf shape and resembled *T. hirsutiflora* in pedicel color and pubescence. Plant 15 had six nodes which is characteristic of both *T. paludosa* and of intermediates between the two tetraploid species, and it had fewer hairs on the sepals than do typical plants of *T. hirsutiflora*. Further, it had a straight stem as do plants of both tetraploid species. While this plant was unusually fertile for a triploid, since about 13.5 percent of its pollen grains appeared to be viable, it was unmistakably a triploid. Figure 17 illustrates a perfectly normal metaphase of the first meiotic division showing two ring bivalents and seven rod bivalents. An anaphase is shown in figure 18 with apparently seven chromosomes at one pole and eleven at the other along with a fragment, while a normal microspore anaphase is seen in figure 19.
Plants 24 and 83 also had a haploid number of nine chromosomes. They differed from each other and also from plant 15 in their morphological characters, but all three show definite traits of *T. paludosa* and of one or both tetraploids. Plant 24 resembled the diploid species in distribution of stomata, shape of leaf, stoutness of stem and hairiness of pedicels. In stomatal shape, it was like *T. hirsutiflora* and the number of nodes was 7, which is characteristic of *T. canaliculata*. The buds of this plant were intermediate between the small size of buds of *T. paludosa* and the larger ones of the tetraploids. The purple on the pedicels and the pubescence of the sepals were intermediate between the extreme condition of *T. hirsutiflora* and the absence of these features as in the other species; the stem was straight as in both tetraploids. The third triploid, plant 83, resembled *T. hirsutiflora* only in shape of leaf, but had an intermediate number of nodes and an intermediate quantity of purple pigment; the stem was straight as in both tetraploids, but in the other characters, that is, distribution of stomata, shape of stomata, stoutness of the stem, size of bud, and pubescence of pedicels and sepals, this plant was identical with *T. paludosa*. Plant 24 had less than four percent good pollen while plant 83 was only 0.1 percent fertile. Cells in the metaphase of the first meiotic mitosis of plant 24 showed an occasional ring and rod trivalent and numerous univalents. Since plant 15 shows traits of all three species, and since it is a triploid, one might suppose that it had an origin somewhat as diagrammed in figure 20b. This assumes that the two tetraploid species had intercrossed.

**FIGURE 20a.**—A diagram showing the possible origin of plants 3 and 36. These were diploids but showed some influence of both tetraploid species, and probably arose by a cross of a tetraploid hybrid with *T. paludosa* to produce a triploid which was then crossed back to *T. paludosa*; a diploid segregate of this cross probably crossed with the normal diploid species to produce plants 3 and 36.

**FIGURE 20b.**—A similar diagram showing the possible origin of the triploid plant 15. This probably arose directly from a cross between the diploid and tetraploid plants.
at some time in the past and had produced a tetraploid with characters of
both species; if this hybrid was then crossed with a diploid *T. paludosa*, a
triploid would have been produced which might have resembled plant 15.

**Tetraploids of all three species**

Twenty-one plants were tetraploids but showed evidences of contamina-
tion with the diploid species to a greater or lesser extent. These plants were
relatively easy to score for stomatal distribution, leaf shape, shape of
stomata, and stoutness of stem. With respect to straightness of stem and
size of buds, the two tetraploids are essentially alike and both are very
different from *T. paludosa*; therefore, these characters were scored as
merely tetraploid-like or *paludosa*-like for these 21 plants and were dis-
regarded when describing the tetraploids which did not show contamina-
tion with *T. paludosa*. With respect to purple color on the pedicels and
pubescence of pedicels and sepals, plants of *T. canaliculata* and of *T.
paludosa* are essentially alike, so these characters were disregarded for this
analysis. Since many plants of *T. paludosa* have node numbers interme-
diate between those of the two tetraploids, this character was also disre-
garded.

![Figure 21](image)

**Figure 21.**—Distribution of the tetraploids which had traits of all three species, according
to their index values, the determination of which is discussed in the text.

The method of index values can be readily used for comparing these
plants. In applying this method, any character resembling either of the
tetraploid species was given the value 2; characters resembling *T. paludosa*
were scored 0 and intermediates were assigned the value 1. On this basis a
tetraploid with traits of *T. canaliculata* and *T. hirsutiflora* only would have
an index value of 12 while a plant like *T. paludosa* in every respect would
have an index value of 0. Figure 21 shows graphically that eight plants
had values of 11, four were 10, four had an index of 9, one had an index of
8, three were 7, and that one plant was nearer the diploid and had an index
value of 4. This distribution shows clearly that this group of 21 tetraploids is much closer to the two tetraploid species morphologically than it is to the diploid. Of the 126 characters examined on the 21 plants, 27 resembled *T. canaliculata* and 32 resembled *T. hirsutijora*; six characters were intermediate between these two tetraploids and 21 were like both (in straightness of stem and size of bud the two tetraploid species are alike). In contrast to these 86 tetraploid characters, only 15 characters on all 21 plants resembled the diploid species, and 25 characters could be interpreted as somewhat intermediate between *T. paludosa* and a tetraploid, and therefore as showing some influence of the former species.

In fertility of pollen, these tetraploids ranged from 33.8 to 95.5 percent. When a scatter diagram is made (figure 22) with percent of fertile pollen as the X axis and index value as the Y axis, their correlation may be compared with that of similar features of the population of non-*paludosa* tetraploids. In figure 4, no correlation is indicated for the *T. canaliculata* ×
T. hirsutiflora hybrids, but figure 22 indicates correlation in the case of tetraploids which show traits of T. paludosa. This correlation is curvilinear, showing that plants with either high or low index values are generally more highly fertile than those of an intermediate value. For these T. paludosa-tetraploid hybrids, $\eta_{xy} = 0.4231$ and $\eta_{yx} = 0.6152$. This difference between tetraploids involving T. canaliculata and T. hirsutiflora only and those which show an influence of T. paludosa is interesting. It may be due to the fact that chromosomal segments of T. paludosa when present in plants which are largely made up of chromosome material of T. canaliculata and T. hirsutiflora form a poorly balanced combination which exhibits more sterility than plants made up of the last two species only. On the other hand, it may mean that hybridization between T. canaliculata and T. hirsutiflora is much older than that which includes T. paludosa. In the case of Iris hybrids, the author (Riley 1939 and unpublished data) found that plants of I. fulva and I. hexagona var. giganticaerulea were more highly fertile than hybrids of very recent origin (ten years or less). These hybrids had had little time to intercross and to backcross and differences in sterility had not been eliminated. Hybridization between Tradescantia canaliculata and T. hirsutiflora is much older and relatively common. These species are ruderals (Anderson 1939) and are very much at home in the gravelly soil of a railroad embankment where they frequently come close together and intercross; wherever the author has seen these species in southeastern Louisiana, they have been in such areas and have shown many evidences of hybridization. Even though the hybrids which were first produced may have been decidedly more sterile than the original species, there was enough time for frequent intercrossing; this resulted in plants with a wide range of index values and eliminated any original correlation between index values and sterility that may have existed. The tetraploids that show characters of the diploid, T. paludosa, are less widespread in Louisiana and are probably of more recent origin. There has been less intermingling and backcrossing and, as a result, any original correlation which may have existed between index value and sterility has not been so completely eliminated and the intermediates tend to be more sterile than plants whose index values are higher or lower.

DISCUSSION AND CONCLUSIONS

Interesting features of this population are the chromosomal and ecological barriers to hybridization and the double introgression of T. canaliculata into T. hirsutiflora and of T. paludosa into the tetraploids. Tradescantia paludosa is very abundant in southeastern Louisiana and hundreds of plants were found in the woods near the track at Michaud. The tetraploids are more frequent in the northern part of the state and in adjoining
states and when found in southeastern Louisiana are usually limited to railroad rights-of-way and are invariably hybridizing.

In establishing the particular population reported in this paper, the sequence of events may have been somewhat as follows: a few seeds of both *T. canaliculata* and *T. hirsutiflora* or more probably of hybrids between them were carried to this embankment from a distance and became established in the region near the track; these then intercrossed and formed a large population of tetraploids which exhibited an introgression of *T. canaliculata* into *T. hirsutiflora*. Seeds of *T. paludosa* were transported to the same region from the adjacent woods and became established on the lower part of the slope and in the land below the slope. A superficial examination of the unrecorded plants of the area disclosed many plants of *T. paludosa* in the flat land at the foot of the slope and especially in and along both sides of the path; these plants were not examined in detail and serve merely to supplement the original 93 and to afford a somewhat more inclusive picture of the area as a whole. When these diploids became established on the embankment in close proximity to the tetraploids, they crossed with the tetraploids forming a few triploids which then crossed back to both the diploids and tetraploids. This backcrossing accounts for the diploids with a few tetraploid characters and for the tetraploids which have some indication of *T. paludosa* in their ancestry.

A similar instance of intensive hybridization between *T. canaliculata* and *T. hirsutiflora* was observed along the tracks of another railroad within a few miles of the crossing at Michaud, but *T. paludosa* was not involved in that population. A suggestion that hybridization in southeastern Louisiana involving these three species has occurred frequently is indicated by occasional abnormalities in meiotic behavior of the chromosomes in the tetraploids and in plants of *T. paludosa*, for many plants of this diploid species show a small percentage of abnormalities such as chromatid bridges, non-disjunction and fragments. Such hybridization, however, was probably a remote one for immediate instances, as reported in this paper, have been observed in only a few rather restricted areas. The writer's studies of both Iris and Tradescantia have indicated that natural hybridization appears to be fairly common in southeastern Louisiana. Whether hybridization is more common there than elsewhere cannot be stated without a more thorough study of that and other localities, but the recent geological formation of that part of the continent would suggest that, while hybridization might not be more common then than it had formerly been in other localities, it is and has been more common recently and its evidences have not been obliterated by time. The formation of a new area would open the possibility of invasion and colonization by species from elsewhere. Such species could intercross and produce many more
hybrids than are found in land of greater age. Growing deltas may very probably be regions where active hybridization is much more frequent than it is in most areas of the world.

The writer wishes to thank Professor Edgar Anderson and Professor Karl Sax for criticizing the manuscript and for helpful suggestions.

**SUMMARY**

1. A population of Tradescantia growing on a railroad right-of-way at Michaud crossing just outside New Orleans, Louisiana, was studied morphologically and cytologically. Ninety-three plants were examined for characters of *T. canaliculata* Raf., *T. hirsutiflora* Bush and *T. paludosa* Anders. and Woods., for fertility of pollen and for number of chromosomes.

2. Fifty-four plants were tetraploids and had some characters which resembled *T. canaliculata*, some which resembled *T. hirsutiflora* and some which were intermediate between these two species. Each of eight characters was recorded as resembling either species or as intermediate. There were 53 different combinations in these 54 plants. All the plants were tetraploids and the chromosome behavior was regular. Pollen fertility varied from 47.9 to 97.1 percent and there was no correlation between pollen fertility and morphological characters.

3. Fifteen plants were diploids. Four were apparently pure *T. paludosa* but the other eleven showed a slight influence of *T. hirsutiflora* or of *T. canaliculata*. Fertility of pollen ranged from 66.7 to 98.9 percent with most plants highly fertile. Meiotic divisions showed some interlocked chromosomes, lagging, chromatid bridges, and non-disjunction; in some plants a small percent of tetraploid microspores was observed.

4. Three triploids were found in the population. All three showed morphological characters of both diploid and tetraploid species and all were highly sterile and exhibited characteristic irregularities in the behavior of their chromosomes.

5. Twenty-one plants were tetraploids but showed some traits of the diploid species. Those which were intermediate morphologically between *T. paludosa* and the tetraploids tended to be less highly fertile than those that more nearly resembled either the diploid or the tetraploids.

6. A mode of origin of this population is suggested.

7. The meiotic abnormalities in the diploids suggest that while these plants are morphologically inseparable from *T. paludosa*, they are subject to introgression from the tetraploid species.

8. It is suggested that hybridization may occur more frequently in actively growing deltas (such as that of the Mississippi River) than in older areas.
LITERATURE CITED


