On a Mutant found in the Descendants of *Tradescantia canaliculata*, Bombed at Horoshima, With Special Reference to the Deficiency of the Sexual Organs. II.

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Tradescantia canaliculata which were gathered by N. Suita. a member of the Committee for the Investigation of the Effects of the Atomic Bomb, in the autumn of 1945 at an area 1 KM distant from the center of the atomic bombing on Aug. 9 in Hiroshima, were subsequently cultivated in the greenhouse, Botanical Institute, Faculty of Science, University of Tokyo, and some of them have been put under the care of this writer.

In 1946 five seeds from a capsule of an individual among the plants mentioned above were sown and five seedlings raised from them. Two of them were twins raised from one seed.

In the end of April, 1947, one of them, not of the twins, bloomed and it is this one (the cultivation No. 88, 14, 1, now abridged as 14, 1 in this paper) on which this writer is going to report in the following pages.

1. Description

As no seeds were produced on this plant, the propagation was done by cutting of the root-stocks rarely of shoots, and now more than the pods are being cultivated in the green house in Ochanomizu University, Tokyo.

The plant (14, 1) is smooth, slender and pale green; the leaves have a pale mauve colour at the margin and in the epidermal layer of the dorsal surface of the basal part parallel with the running of the vains.

The first flower bloomed on April 21, 1947, under long-day treatment in the greenhouse, but without heating. Since then the first flower has always bloomed earlier then those of the sister plants, as well as of the different stocks of the same species under the same condition.

The calyx is composed of three sepals, rarely two of them coalescing, green having mauve colour on the tip, not hairy. The number of the petals of the first flower was three, but the next flower had four. It was also three in the first flower in this year, as is shown in Figs. 1 and 2, and one of three flowers that bloomed next day had four (Fig. 3). And now, at the end of April 1955, most flowers have four petals, but some have more. Irregularities appear often in the shape of the petals, especially when the number is increased.

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The average length of the petals is 23.25 mm., the breath 21.00 mm. and the rate of breath/length 91.2% (the figures for those of the sister plants being 20.00 mm., 15.67 mm. and 78.0%). The petal are roundish in shape, having somewhat fringed margins, light lavender violet in colour.

The number of the stamens is six when the number of the petals is three, while it is generally eight when the latter is four, but often irregularities appear not only in the number but also in the structure; often one or two of them are petal-shaped, each having incomplete anther attached on its tip.

The pistil is generally so small that it can not be detected from the outside, as we see in Figs. 2 and 3; it is concealed under the thick hairs of the filaments. The style is very short and the stigma generally dried up when the flower opens due to the degeneration of the hairy nourishing cells.

The loculi in the carpels are generally empty or not apparent, but in very rare case (only two cases were found in more than hundred flowers this year), one ovule developed in each loculus of three carpels and it was found that only one ovule among them had a degenerating embryosac. The pistil of the normal flower has three carpels, each having one loculus containing two ovules in it.

These characteristics of the pistils show us that this specimen, (14, 1), is to be considered as a male plant, if not as an incomplete hermaphrodite having a deficient female organ or a steril pistil. The latter naturally result the non-fruiting which induces the development of the secondary floral shoots on the stem and also the growth of the root stocks, resembling the results of my experiments for the prolongation of the floral season on the same species (Yasui, 1938). The vigorous secondary floral shoot appeared penetrating the sheath of the leaf on the node is seen in Fig. 4 at *c*.

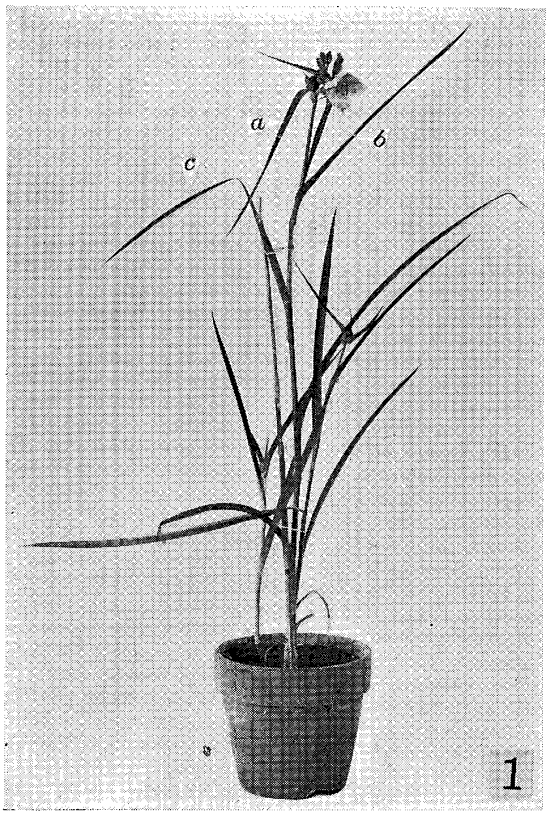
In some cases the peduncles are fasciated, having a cluster of flowers on them. Such a peculiarity, with the earlier blooming, large flowers, failure of the development of the pistils, appearance of the secondary floral shoots and the peculiarity of the budding distinguishes this plant from others.

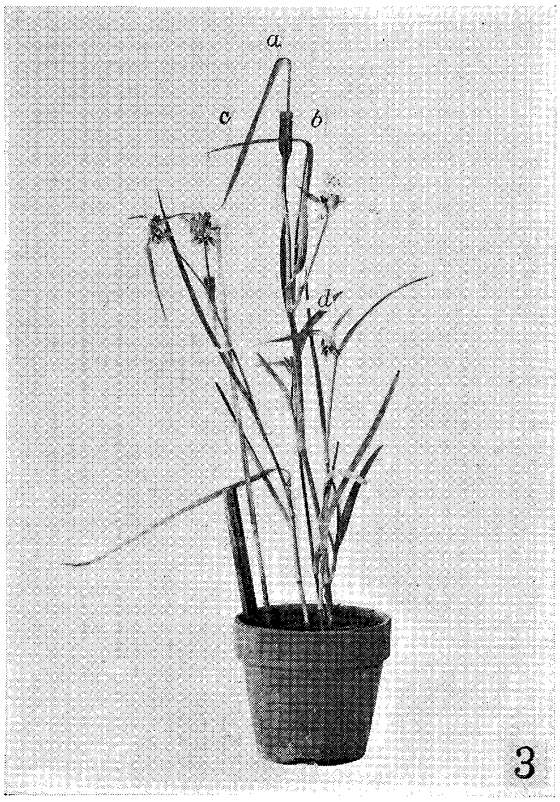
The number of the chromosomes counted in the PMCs is 24 and 2 fragments. The chromosome configurations in the first meiotic phase in the different PMCs are different even in one and the same pollen sac, as we see in the following examples and the figures :

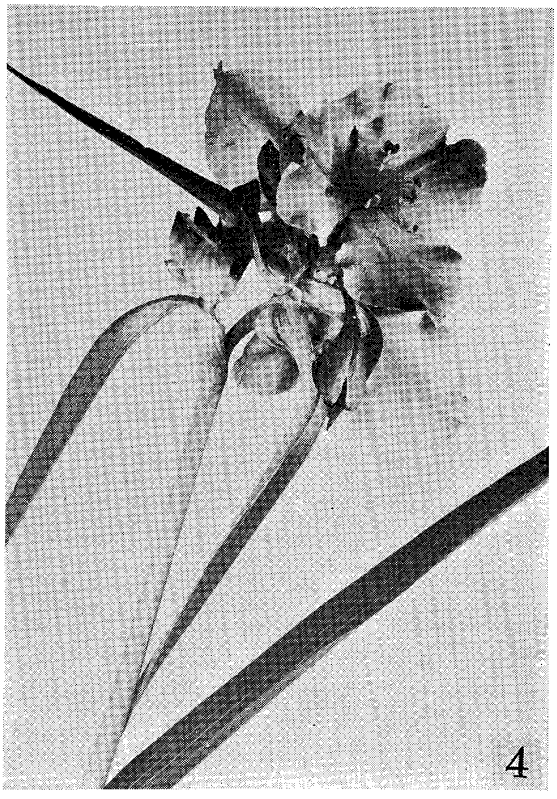
1. 1_{VI}(chain)+3_{IV}(rings)+1_{IV}(chain)+1_{II}(parallel)+1_{II}(frags.), (Fig. 5, A).
2. 1_{VI}(chain)+2_{IV}(rings)+1_{IV}(chain)+3_{II}(rings)+1_{II}(frags.), (Fig. 5, B).
3. 1_{VI}(chain)+1_{IV}(ring)+1_{IV}(chain)+3_{II}(rings)+2_{II}(chain)+2_{I}(frags.).
4. 1_{IV}(ring)+2_{IV}(chains)+4_{II}(rings)+2_{II}(chains)+1_{II}(frags.)

Two fragments generally pair, but sometimes separate from each other. When they pair they behave like the gemini of the ordinary chromosomes in

plant, phto on May 24, 1956, having the secondary floral shoots; the primary floral buds were taken off; each *a*, *b*, and *c* in Fig. 1 and 3 shows the same leaves; *d* in Fig. 3 shows the point where the secondary floral shoot (*f*) came out penetrating the sheath of the leaf (*c*); flowers in Figs. 2 and 3, having no detectable pistils shown.







Figs. 1-4. *Tradescansia canaliculata* (No. 88, 14, 1). **1**. Plant with the first flower, 1955, photo on April 12, 1955; **2**. Upper part of the plant in Fig. 1. ca. 1/1; **3**. The same part with that in Fig. 2, photo on next day, flower having 4 petals seen; **4**. The same

the Ist metaphase, while when separated they behave as univalent chromosomes.

Due to the irregular behaviour of the chromosomes in the first meiotic division, many extranuclear chromosomes or fragments, sometimes even ten (Fig. 5, *e*), appear in the interkinesis and more than 50 per cent of the pollen grains are empty when the pollen sac opens. Moreover, in the normal-looking pollen grains there are many in which abnormal mitotic phases take place. Consequently the fertility of the pollen grains is very low.

The two sister plants are hermaphrodites, one of the twins and the rest died before the flowers came out.

2. Heredity of the deficiency of the pistil

The flower of the sister plants of No. 14, 1 and several other individuals belonging to other strains were pollinated with the pollen grains of No. 14, 1. As the rate of the fertility in *Tradescantia* (4x) is not very high, and especially their self-fertility is very low, sometimes zero, the flower of the F_1 plant, hermaphrodite, were back-crossed with the pollen grains of the male parent. The number of the back-crossed F_2 plants that have already bloomed is very small, but in one case whose mother plant was one of the sister plants of No. 14, 1, two sister plants produced flowers and one of them had flowers resembled that of the male parent, namely the flowers had the deficient pistils confirming the character is heritable, though the rate in the F_2 plants is not certain due to the sample is quite small in number.

3. Conclusion

The present writer has found a plant having a deficient female organ and some other remarkable characters such as earlier blooming, larger flowers, complete sterility, prolongation of the floral season due to the development of the secondary floral shoots and peculier habit of the budding, among the descendants of a plant which was growing 1 KM away from the center of the atomic bombing in Hiroshima on Aug. 9, 1945.

We have no direct evidence which proves that the deficiency was caused by the influence of the bombing, nor any witness that we had not such a deficient plant there before the bombing. However, our No. 14, 1 has many remarkable characteristics among the strains of *Tradescantia*, namely the earier blooming, the larger flower, the irregularities of the number of the floral organs as well as in the structure and the prolongation of the floral season and the peculier habit of the secondary budding due to the complete sterility. It seems to the writer that these characteristics are enough to attract the attention of the specialists who study *Tradescantia* in the garden, the plant genetists and also those cytologists, to whom this plant has been giving important materials for their study since more than hundred years ago. Notwithstanding that we have no report on the presence of such a plant from the botanist in Hiroshima before the bombing. The present data, with those

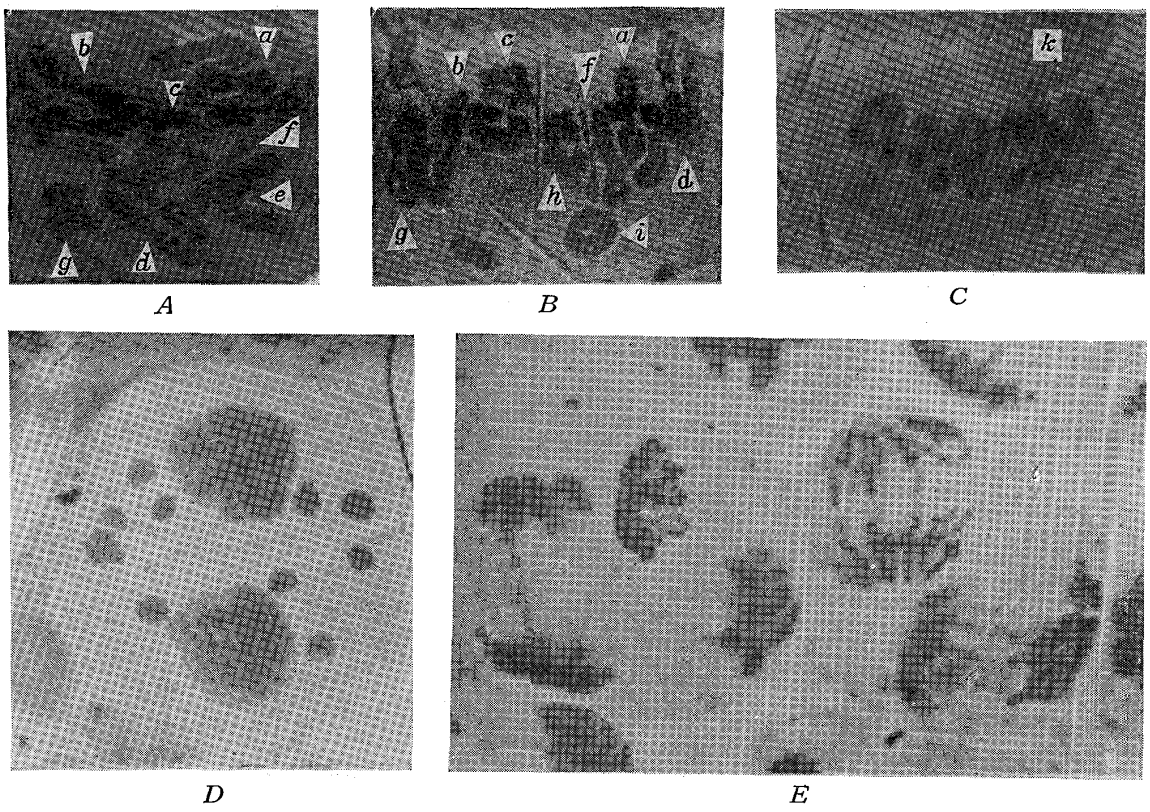


Fig. 5. Meiotic phases in the PMCs of No. 14, 1. *A*, Chromosome configuration in the nucleus of a PMC; *B*, Chromosomes in I-metaphase; *C*, Chromosomes in early anaphase in I-M; *D*, PMC in inter phase; *E*, PMCs in the later anaphase in II-M. *a*, hexavalent chromosome; *b*, quadrivalent (chain); *c*, quadrivalent (ring); *d*, quadrivalent (parallel); *e*, quadrivalent (ring); *f*, fragments (paired); *g*, bivalent; *h*, *i*, bivalents which are the composer of quadrivalent (*e*) in *A*.

remarkable irregular behaviours of the chromosomes in the meiotic phases as the deficiency in the chroloplasts, e. g. the albinism and the virescent which appeare in the descendants of No. 14, 1 of which this writer has had no example during more than 20 years of her studies on *Tradescantia*, lead her to consider that they may have been caused by the influence of the atomic bomb, in agreement with Suita's conclusion (Suita, 1953) of his studies on the bombed *Tradescantia*.

Reference

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