

Teratology in *Trillium grandiflorum*'s Floral Organs

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Introduction

Certain variations in *Trillium grandiflorum* (Michx.) Salisb. may prove important for the investigation of several fundamental biological problems. Some of these variations have been studied for several years by the writer and I shall present some preliminary observations concerning their significance.

Occasionally, in natural populations of *Trillium grandiflorum* there are found large numbers of "mutants" which were lumped together and named *Trillium grandiflorum* var. *variegatum* Smith. Since Smith (1) noted these unusual forms, they have been reported again and again, particularly from Michigan, southwestern Ontario, the Don Valley, Ontario, and the vicinity of Buffalo and Syracuse, New York. Numerous reports of these mutant forms made prior to 1917 have been summarized by Gates (2); later reports by Farwell (3), P. Louis-Marie (4), P. Louis-Marie and R. Giroux (5) indicate the variety of freaks and their persistence in the habitats where they are found. The evidence suggests that these freaks are mostly sterile and should be considered a teratological assemblage deserving no nomenclatural status whatsoever.

These mutants may be roughly grouped into five categories:

1. plants with more or fewer numbers of parts, both reproductive and vegetative, than the usual three per part (whorl);
2. plants with white petals streaked with more or less green tissue (leaf-like petals), with long-petioled leaves or normal leaves;
3. plants with green petals usually with petioled leaves or sometimes no leaves;
4. plants with pink flowers (opening pink) streaked with green tissue and having either petioled or normal leaves;
5. plants with pink flowers (opening pink) mottled or streaked with white and having normal leaves.

In appearance these mutants suggest the condition found in Parrot-tulips where the abnormal behavior in morphology is the result of virus transmission in propagules.

The distribution of the mutants suggests a possibility of virus infection. In southern Michigan they occur in woods of the northern type—in cold woods—beech-maple, white pine, hemlock, yew, wintergreen, etc. They occur again in similar habitats far to the north, e.g., in Leelanau County, Michigan. For this reason it was suspected that the development of mutant patterns may be the result of virus production on a differential basis, since it is well known that cold temperatures (northern climates) favor the production of virus protein in infected organisms creating competition in protein synthesis which affects the production of normal protein and results in an upset in the normal metabolism of the organism. It is thought that *Trillium grandiflorum* normals and abnormal should be

studied and compared, and the factors responsible for the production of the mutants should be determined.

Certain species and even genera of higher plants are considered to be of rather labile constitution and these often contain numerous teratological forms. The nature of the protoplasm of labile species should be studied and understood. Several species of the genus *Trillium*, particularly *T. grandiflorum*, demonstrate this liability. In most cultivated plants teratology is common not only because man selects the unusual but because hybridization, which permits unfamiliar gene combinations, is so universal. The relative precision of homeostatic control is surely weakened under these pressures. Historical relationships between *Trillium* and its relatives *Medeola* and *Paris* may prove most interesting in relation to the teratology in *Trillium* species. The present study was an attempt to discover an agent, a virus, which might be responsible for these teratological variations, while at the same time the proteins of normal and teratological leaves and petals were analyzed.

Normal and teratological plants were collected and kept cold to prevent the denaturing of protein. Leaves and petals were chopped, homogenized, centrifuged at 5,000 r.p.m. for 1 hour. The protein complements were salted out at 0.3 saturated Ammonium Sulphate and 0.6 saturated Ammonium Sulphate. These precipitates were dialyzed, brought to equilibrium with external buffer, and then analyzed in Tiselius electrophoresis.

Electrophoresis photographs were taken at 30 minute and one hour intervals. These photographs show the following:

1. there are three major protein components, A, B, and C in both leaves and petals of normal and teratological plants,
2. the normal petals possess much more of component A relative to B and C than do leaves,
3. the leaves from teratological plants show the same protein components as leaves or normal plants,
4. the teratological petals possess much more of component A relative to B and C; they are almost identical to the leaf components; i.e. these petals are like leaves,
5. there is a suggestion that there may be two peaks at B in the teratological petals instead of one.

There is no clear evidence that the teratology is caused by virus and there is no sharp peak in the electrophoresis typical of viruses. It remains necessary to do further work to establish the presence or absence of virus. It is likely that virus is not involved since its presence would indicate unusual behavior for virus—the production of additional normal protein rather than a foreign virus protein as in the case of most viruses.

At any rate these data show that this teratology is brought about by the presence of leaf protein in greater amounts than normal for certain floral parts in *Trillium*. Additional chloroplast proteins may have considerable determinative effects in changing the morphology of the floral organs. How these additional proteins are elaborated remains to be determined. At least this teratology does not appear to be transmitted through seed; it has no genetic significance, and does not deserve taxonomic status.

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