

that its poisonous principle is a substance free from proteid or only secondarily combined with it."

No local effects were observed at the point of injection of Gila monster venom, and no curare-like action was noted. No marked changes in the clotting time of the blood of animals under the influence of *Heloderma* poison were found.

These studies confirm, in the main, the investigations of Van Denburgh and Wight. Perhaps the principal difference in the two series of observations is regarding changes in the clotting time of the blood. The present investigators report no observed change in clotting time, while Van Denburgh, in pigeons subjected to *Heloderma* venom, found the blood firmly clotted in the auricles while the heart was still beating, and Van Denburgh and Wight observed that a primary shortening in the clotting-time was often followed by a complete loss of coagulability.

The results set forth in this volume by Leo Loeb and his collaborators constitute a valuable addition to our knowledge of reptile poisons. One can not but feel, however, that these results would be more readily available if given in much less extended form, nor need one be an emotionalist to doubt whether these results justify the experimental injection of venom into "more than 360 warm-blooded animals" in addition to many cold-blooded ones.

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#### SPECIAL ARTICLES

##### ANATOMY AS A MEANS OF DIAGNOSIS OF SPONTANEOUS PLANT HYBRIDS

IN the genetical studies, which have assumed so large and justly prominent a position in biological work during the past few years, external characters have been investigated almost exclusively. It has in fact been quite generally assumed that plants which resemble one another externally either belong to the same species or are at best only varieties of the same species. Nevertheless it is true that the

geneticist has often found it necessary, in his work, to secure by continued cultivation, "pure lines" of the plants he uses in his breeding investigations.

The intention of the present communication is to indicate that spontaneous hybrids are of extremely common occurrence either identical in appearance with recognized species or varying so slightly and constantly over wide areas from the norm, that they are recognized as merely varietal modifications of recognized species. They can often nevertheless be clearly diagnosed as hybrids by the investigation of their internal anatomy both vegetative and reproductive. The full data of these observations, accompanied by the necessary illustrations, will be published elsewhere.

It will be convenient to consider first the case of identical external structure covering profound differences in internal organization. In the course of anatomical experimental investigations, carried on in the laboratories of plant morphology of Harvard University, on some of the lower amentaceous Dicotyledons, specially directed towards the elucidation of the hitherto unrecognized but highly important relation of wood rays to genetical and phylogenetic sequence, material of *Betula pumila*, from the Arnold Arboretum of Harvard University, diagnosed as such both by the Arnold Arboretum and the Gray Herbarium, showed profound differences in organization from wild material of the same species, secured from widely separated localities in the eastern United States and Canada. Vegetatively the Arnold Arboretum specimens presented striking aggregations of wood rays in segments of the woody cylinder, such as are characteristic of the more primitive birches and alders, and in this respect presented a marked contrast to normal *B. pumila*, where rays of this type can not be said to occur. These peculiarities suggested its hybrid origin and the reproductive structures of the abnormal material were investigated for evidence for or against this hypothesis. Male cones examined early in March showed in the sporogenous regions of the anthers large areas of abortive spore-mother cells. Late in April it

was further observed that even in the case of the functional mother cells, that the tetrads frequently produced but one normal pollen grain, the other three persisting as mere vestiges, attached to the germination pores of the completely formed grains. In normal *B. pumila* abnormalities of this nature were not found. Another interesting feature of the development of the microsporangium in the material from the Arnold Arboretum was the abortion of the mechanical or fibroid layer of the anther wall, which in normally developed spore sacks is responsible for the dehiscence of the anthers. Both these features of the stamens of the specimens under discussion, viz., the abortive pollen and the degenerate anther wall, point unmistakably to their hybrid origin.

Professor Jack has been good enough to supply the history of the plants of *B. pumila*, growing in the Arnold Arboretum. They were derived from seed obtained from plants propagated at the Arboretum from wild seed of the species, secured by Professor Sargent in Vermont. A few of the group of individuals thus obtained were clearly hybrids between *B. pumila* and near growing large trees of *B. lenta*. The peculiarities of ray-structure referred to above, namely the aggregation phenomena, are found in neither *B. pumila* nor *B. lenta*, and are doubtless the result of the increased vigor of heterozygosis, as has been noted by Professor East and others. It appears quite obvious, from the various data described here, that the plants of *B. pumila* at the Arboretum, although resembling that species absolutely in external form, are in reality hybrids, as inferred from their more important anatomical features.

The next illustration of the value of anatomical data in the diagnosis of hybrids is taken from the genus *Equisetum*. The species of this genus known as *E. littorale* has long been recognized in Europe and this continent as a hybrid between *E. arvense* and *E. limosum*. It presents transitional features in its external form and internal anatomy between these two species and moreover is characterized by the production of large numbers

of abortive spores, which are generally without the "elaters" attached to normal *Equisetum* spores. The genus *Equisetum* is characterized both in this continent and in Europe by the large number of varieties of its species, which occur spontaneously (these would probably be designated by mutationists of the De Vriesian school as "elementary species"). One of these numerous varieties is here taken as an illustration of the value of anatomy in genetical work. Professor Jeffrey observed in material of *E. variegatum* var. *Jesupi*, gathered on Toronto island, that a large number of the spores were abortive and without elaters. A detailed anatomical investigation of this material and of other specimens, including the type, kindly supplied for this purpose by the Gray Herbarium of Harvard University, showed that not only are the spores largely abortive in *E. variegatum* var. *Jesupi*, but that the sporangium wall is also degenerate, lacking the mechanical or fibrous layer. The aerial and subterranean stem further showed a condition of organization intermediate between that found in *E. hiemale* and *E. variegatum*. *E. variegatum* var. *Jesupi*, is consequently not to be regarded at all as a variety or "elementary species," but as a clear hybrid, in all probability between *E. hiemale* and *E. variegatum*. The writer hopes later to publish extended observations on a number of the "varieties" of species of *Equisetum*.

In conclusion it may be pointed out that the investigation of the anatomy of recognized or cryptohybrids is likely to be of great value from the genetical standpoint and will in all probability lay bare the real foundation in fact of the so-called mutation hypothesis of De Vries.

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#### THE OHIO ACADEMY OF SCIENCE

THE twenty-third annual meeting of the Ohio Academy of Science was held at Oberlin College, Oberlin, Ohio, on November 27, 28 and 29, under the presidency of Professor L. B. Walton, of Kenyon College.