sey and southern Ohio have unusual interest in respect to the climatic boundary under consideration. The snow-covered northward slopes are effectively microthermal as regards snow cover and the southward slopes are mesothermal. Thus, from the geomorphological standpoint, in the vicinity of the isotherm of January 32° F., we find an ideal expression of climatic borderline conditions, innumerable islands of one climate within the realm of another. Whereas climatic contrasts may take place within comparatively short distances in areas of considerable relief, it is unusual to find them so strikingly displayed in such comparatively flat regions as those under discussion and hence of all the greater significance.

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CHLORATES AS HERBICIDES

THE persistent spread of the more noxious perennial weeds has recently focused the attention of many experimental workers on the problem of a cheap, safe and effective chemical method for the eradication of these plants. Sodium chlorate has proved in many trials to be the most generally effective herbicide now in use. With proper methods, such weeds as Canada thistle (*Cirsium arvense*), European bindweed (*Convolvulus arvensis*), quack grass (*Agropyron repens*) and similar plants can be controlled with one or more applications of this chemical. The cost ranges from twenty-five to one hundred dollars an acre and the fire hazard may be very serious with the usual methods of application in which a chlorate spray is applied to a heavy growth of foliage.

A three-year study of the herbicidal action of sodium chlorate in the botany department of the Iowa State College indicates that this compound may be more effective when applied to the roots rather than to the aerial portions of the plant, and suggests that under humid conditions the elimination of perennial plants by spraying with chlorates is dependent upon a portion of the spray residue reaching the soil. By applying the chemical, either crystalline or in solution, directly to the moist soil it is possible to reduce the quantities applied, and if the top growth of the plants is removed before treating, the principal fire hazard is eliminated. The apparently unchanged chlorate salt persists in the soil for a period varying with the conditions from a few weeks to two or more years. The herbicidal action consists of both a direct killing of the underground portions of the plants and of translocation to and slow killing of any new sprouts which may be formed. The importance of the two effects probably varies with the plant and the conditions. Quack grass or Canada thistle rhizomes and roots may be killed in the dormant stage, so that the effects of ultra-violet light are not required for the toxic action of chlorates. We have been unable to obtain any appreciable translocation of the toxin except in the transpiration stream, and any generalized action seems to be dependent upon the ability of the salt to persist in the soil solution, where, as stated, it may either penetrate and kill the roots and rhizomes, or be absorbed and translocated to transpiring regions of the top. The continued killing of the tops adds starvation to the direct action on the underground organs and explains the effectiveness of the treatment.

The tendency of the chlorate to persist in the soil may become seriously objectionable under some conditions. In our field tests we find that heavy applications which result in a large quantity of the salt reaching the sub-soil are particularly persistent. Temperature and leaching seem to be the most important factors concerned in the disappearance of chlorates. At temperatures of 25 to 30° C. treated soil loses its toxic properties in a few weeks, while in the sub-soils mentioned (three to five feet) the chlorate concentration is still too high to permit crop growth nearly two years after the initial application. The surface foot of these same plots which received chlorate at the rate of 1,000 pounds per acre is normal. The use of lighter applications under more favorable conditions should reduce the deep penetration and persistence of chlorates.

The recognition of the fact that chlorates are effective when used as root absorption poisons will permit the use of the sodium salt instead of the more expensive calcium chlorate. It will make it possible to eliminate the fire danger, now a very serious factor, avoid the destruction of chlorates exposed on the leaves of sprayed plants and help to reduce the aftereffects of chlorate applications by avoiding excessive applications in cool soils not subject to leaching.

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THE CAUSATIVE ORGANISM OF A PAPULAR TYPE OF APPLE MEASLES[1]

THE disease known as apple measles, reported first by Hewitt and Truax[2] in 1912 as an obscure apple disease, has recently attracted especial attention in certain sections. This disease has been reported under various names which include "measles," "pimple

[1] Approved by the director of the West Virginia Agricultural Experiment Station, as Scientific Paper No. 97.

[2] J. L. Hewitt and H. E. Truax, "An Unknown Apple Tree Disease," Arkansas Agric. Exp. Sta. Bull. 112: 481–491, 14 figs, 1912.

canker," and "scurfy canker." Previous investigators have considered it to be of a non-parasitic nature and of minor importance. It has been stated that it does not cause the death of the trees affected. This opinion, however, has been considerably modified as a result of recent investigations. The writer's studies seem to indicate that the various forms of measles hitherto described are not all manifestations of the same causative agent but are distinct diseases. One of these types of measles, a papular form, briefly reported here, has been proven to be caused by a parasitic fungus.

The disease first came to the attention of the writer in 1915, in the course of the application of an orchard dusting program in the Kanawha Valley, north of Charleston, West Virginia. Measles at that time was confined to a few Red Astrachan trees. The trunks and larger limbs presented a peculiar scurfy appearance while the younger twigs, especially the water sprouts, were covered with small, well-defined papules. Attempts to isolate an organism from these papules always resulted in sterile plates. Subsequent attempts in later years yielded the same results.

Frequent visits to this orchard each season, since the disease was first observed, have enabled the writer to observe its spread from the Astrachans, which constitute only a very small percentage of the planting, to Rome, the predominating variety. Interplantings of Gano, Transparent, Chenango, Pound Royal and Summer Queen, remained free from measles. Two years ago the orchard was abandoned because the disease had practically killed 16,000 trees. In the meantime numerous specimens of apple twigs affected with this type of measles have been obtained from adjoining counties in central and southern West Virginia.

In 1929, an active study of the disease was undertaken at this station. The work was conducted in the Kanawha orchard, where the papular type of measles was most prevalent. Small Red Astrachan and Stark's Delicious trees were planted near large Red Astrachan trees infected with measles. Both varieties became heavily infected with the papular form the first season. Attempts to isolate the causal organism again ended in failure. In 1930, the writer was stationed in the orchard throughout the growing season in order to keep the development of the disease under close and constant observation. However, due to the unprecedented drought very little infection took place. A few rains occurred late in the summer and a total of only 44 papules of new infection were located in the entire orchard, all on Red Astrachan, which seems to be the variety most susceptible to this form of measles. *Thirty-four of these yielded pure cultures of a peculiar, slow-growing fungus.* Sporulation of this fungus can be obtained by growing it on oatmeal or malt-extract agar.

Successful artificial inoculations were obtained on young Red Astrachan trees in the greenhouse during the past winter and the fungus was readily reisolated from the lesions produced. Diseased apple twigs collected in the Kanawha orchard on June 20, 1931, were placed in a moist chamber for 24 hours. Spores were obtained by scraping the surface of the older lesions. By studying free-hand sections of the diseased spots it was found that the fungus is a *Hyphomycete* and apparently belongs to the genus *Clasterosporium,* the species being yet undetermined.

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BIOLOGICAL ABSTRACTS—A DISCUSSION

THE value of such a comprehensive abstracting system as Biological Abstracts is well recognized by all workers in biological sciences, and is very well summarized in several articles published recently in SCIENCE.[1] In spite of the value of such a journal to subscribers, there are certain admitted drawbacks to it among which are the delay in publication, the cost of such an undertaking, and the time consumed by 6,000 abstractors and one hundred or more editors. If this were a temporary matter we might all be willing to help by personal effort or subscription, but it is a perpetual matter and as already shown will demand more time, effort and money as the years go by. It would therefore appear worthwhile to see if some method could not be devised to simplify this enormous undertaking.

As I understand the present system used by Biological Abstracts, an editorial and clerical staff first reviews the entire biological literature of 55,000 articles (yearly), and then decides who should abstract each of these articles (55,000 decisions). The well-known yellow abstract requests must then be mailed, asking for abstracts (55,000 letters). Many of these need second requests, inquiries, change of abstractor, etc. After this 6,000 men and women abstract these 55,000 articles which if done conscientiously is a difficult and tedious matter; many of us have seen young men struggling over an article in a foreign language which they very imperfectly understand. After these abstracts are made they are mailed to Biological Abstracts, who then collect, and remail to section editors, who in turn edit these collected abstracts in their field and return to Biological Abstracts where they are finally printed. Such a procedure is

[1] W. C. Curtis, SCIENCE 73: 1898, 509, 1931; J. R. Schramm, SCIENCE 73: 1898, 512, 1931; C. E. McClung, SCIENCE 73: 1898, 517, 1931; F. R. Lillie, SCIENCE 73: 1899, 560, 1931.