giving this blow is by striking any one of the regular keys. To prevent injury to the type on the typebar thus actuated, for example, bar D in the diagrams, the special bar is provided with a projection H so placed that it will be struck by the blank space between the two characters, L, on D. Exact alignment is provided by the projection I that moves between the regular guides C.

A block of wood with holes in it, properly labeled, serves to store the bars. It may seem offhand that the selection of the proper bar, its insertion in the pillar, the depression of the "shift" key if necessary, the striking of the blow, and the replacement of the bar in the block of wood, consume too much time. Actual experience shows that the entire process requires less time than does the insertion of special characters by hand. The device will make several carbon copies and will, of course, also cut neat stencils.

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# SPECIAL ARTICLES

## CELERY MOSAIC CONTROL IN FLORIDA BY ERADICATION OF THE WILD HOST COMMELINA NUDIFLORA

A MOSAIC disease of celery (*Apium graveolens*), mentioned by Foster and Weber,[1] has been troubling growers in the Sanford, Florida, district. Doolittle[2] stated that the malady was of virus nature, transmitted by *Aphis gossypii,* and affected a weed, *Commelina nudiflora.* The disease, according to a preliminary report by Wellman,[3] can be controlled by eradication of weeds, mainly Commelina, from about celery fields. As further stated by Doolittle (*loc. cit.*), celery and Commelina are affected by cucurbit mosaic, but subsequent studies by the present writer have shown that the mosaics of celery and cucurbits, though similar, are probably distinct.

Several insects were studied as carriers of celery mosaic. Grasshoppers, crickets, cutworms and other moth larvae, flea beetles, lantern flies, leaf-hoppers and two other species of aphids were used in addition to *Aphis gossypii. A. gossypii* (known as the "celery aphid" in the Sanford region) is the only insect which was found to carry the disease. Both winged and wingless adults were about equally capable of its dissemination, and nymphal stages were less effective.

Celery mosaic is readily transferred from celery to celery by mechanical means. Plants growing close together in the row may bruise each other when pushed over during spraying and cultivation practices, such injury serving to spread the disease without aphid intervention. The disease, as it has occurred in Florida, is not seed-borne in celery.

Commelina, known as "wild wandering-jew" by celery farmers, is found on the banks of drainage canals and in partly shaded areas. The weed is perennial, is propagated by seeds as well as bits of stem and is commonly affected by celery mosaic virus in nature. The disease is not carried in Commelina seeds, but lives from season to season in the growing plants. Careful search disclosed that the celery aphid occurred in small numbers on healthy and diseased Commelina plants. First occurrence of celery mosaic in the field was usually on the edge next to beds of mosaic-affected Commelina. At the outset spread was slow, but as the season progressed it was more rapid. It soon escaped from areas at the edges of the fields, and appeared in numerous isolated spots at some distance from points of origin. This suggestion of aphid flight was verified by subsequent observations. Later, these areas enlarged in all directions, irrespective of prevailing winds or orientation of rows of plants. In the beginning, winged forms of *Aphis gossypii* were the most important factors of distribution. From then on both winged and wingless forms served to spread the malady.

Spraying and dusting experiments to eliminate aphids were conducted by C. B. Wisecup, U. S. Department of Agriculture, Bureau of Entomology, but did not give commercially satisfactory disease control. Successful control of celery mosaic by weed eradication around celery fields has been reported.[4] This work was started in the fall of 1930 and continued until the summer of 1932.

During the winter seasons of 1930–1931 and 1931–1932, four fields were selected and systematic study made from the time of transplanting to harvest. The experimental fields were on farms in the heart of the badly diseased area in the Sanford celery-growing district. In the winter of 1927–1928, on parts of these farms around 70 per cent. of the crop was lost, due to mosaic. In the 1928–1929 season, the losses averaged around 75 to 80 per cent. and in the next season were about 60 per cent. Because of low temperature during the first season of weed eradication, 1930–1931, loss from celery mosaic at harvest on the farm on which no weeds were removed amounted to about 26

[1] A. C. Foster and G. F. Weber, "Celery Diseases in Florida," *Florida Agr. Exp. Sta. Bull.,* 173: 23–77, illus., 1924.

[2] S. P. Doolittle, "*Commelina nudiflora,* a Monocotyledonous Host of Celery Mosaic," *Phytopath.,* 21: 114–115, (abstr.), 1931.

[3] F. L. Wellman, "Control of Celery Mosaic by Eradicating Wild Hosts," *Phytopath.,* 22: 30, (abstr.), 1932.

[4] F. L. Wellman, *loc. cit.*

per cent. Across the road from this farm, where a 60 per cent. loss had been sustained in 1929–1930, weed eradication was practiced, and only 6 per cent. of the celery was thrown away on account of mosaic. In another field where eradication measures had been practiced, only 4 per cent. of the crop was lost. Weed eradication was not started around these two fields until ten days after the crop was transplanted. In another field weed eradication measures were put into effect two months after transplanting; and at harvest time the loss from mosaic, 25 per cent., was practically as severe as where no weeds had been removed.

Detailed laboratory and greenhouse studies, made during and following the winter of 1930–1931, showed that Commelina was probably the only important wild host and that the celery aphid was probably the only important insect carrier of the trouble. In 1931–1932 weed eradication was started before celery was transplanted and continued during the winter. Commelina was the only weed removed from about experimental plots. This winter was unusually warm and mosaic spread much more rapidly and widely than during the previous season.

Commelina was not removed from around one field during the winter of 1931–1932. At harvest a small number of plants still remained healthy, but the grower considered it too small to be worth harvesting. In two near-by fields around which Commelina had been removed, one showed that less than one per cent. of the crop was lost due to mosaic, and in the other the loss amounted to a little more than one and a half per cent.

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## THE EFFECT OF THE ELECTROPURE PROCESS OF TREATING MILK UPON BACTERIAL ENDOSPORES[1]

IN a recent paper[2] the Electropure process was described, and it was concluded that the process operating at 71° C. on an experimental basis was very effective in destroying resistant bacterial endospores. The results of these experiments indicated that another factor, in addition to heat developed in the milk, might be partially responsible for the endospore destruction. There seemed to be a strong indication that, in the case of endospores, the destruction might be partially caused within the cells. It is a known fact that the more concentrated an electrolytic solution becomes, the less resistance it offers to an alternating current and the greater the amount of heat produced in consequence. The cytoplasm in the bacterial endospores becomes more concentrated due to loss of water, and consequently the electrolytic substances in solution within the cells offer less resistance to the electric current than does the surrounding medium (milk). As a result, an instantaneous and marked increase in temperature within the cells themselves is effected. The heat thus created is probably sufficiently intense to cause the destruction of the spores.

The idea brought out in the above statement has been demonstrated in the laboratory by immersing an artificial cell, consisting of a parchment sac, filled with a 1.8 per cent. NaCl solution, between two carbon electrodes in a vessel containing a 0.9 per cent. salt solution. A sensitive thermometer was suspended in each solution, respectively, and, when the current was applied (110 v, A. C.) the temperature of the solution in the outer vessel at the end of 0, 10, 20, 30, 40, 50 and 60 seconds was, respectively, 21°, 26°, 31°, 39°, 57°, 76° and 86° C.; while in the parchment sac it was 21°, 28°, 37°, 48°, 62°, 80° and 88° C. The medium in the parchment sac contained the greater amount of free ions and, therefore, offered the least resistance to the current, and as a result more current flowed through the cell, and consequently more heat was generated.

A similar experiment was conducted in which the salt solutions both in the suspended cell and the surrounding medium were of equal concentration (0.9 per cent. NaCl), and a very heavy suspension of *Bacillus megatherium* spores was added to the inner or suspended cell. The temperature in the outer vessel at the end of 0, 10, 20, 30, 40, 50 and 60 seconds was, respectively, 21°, 25°, 31°, 37°, 48°, 62° and 78° C.; while in the parchment sac, containing spores in addition to the salt solution, it was 21°, 25°, 31°, 39°, 59°, 80° and 98° C. The data given from the above two experiments are representative of repeated tests.

The results of the first experiment showed that though the rise in temperature in the suspended cell was much more rapid than in the surrounding medium, the temperatures in both liquids quickly tended to become equal, and both reached the boiling point at about the same time. This was probably due to the fact that diffusion through the type of sac used was very rapid. The results obtained with the spores, however, showed that though the temperature rise was practically equal in both the inner and outer liquids for the first 30 seconds, the rate of increase became

[1] Journal Article No. 118 (M.S.) from the Michigan Agricultural Experiment Station.

[2] A. J. Galpi, Jr., and E. D. Devereux, "Effect of the Electropure Process and of the Holding Method of Treating Milk upon Bacterial Endospores," *Jour. Dairy Science*, 13, 368–371. 1930.