transplanted to plates or slants. Small circular, smooth, grayish white colonies appear in 72 hours from new cultures. When growth is established, the colonies are large, moist, and convex, with yellow pigment. The rough types are large white umbonated, leathery colonies with irregular margins that become powdery white on top in 48 hours and show no tendency to spread with age. Gelatin stab: Slight growth, no liquefaction. Potato: Good growth with yellow pigment. Loeffler's blood serum: Small, circular, colorless colonies, with slow liquefaction. Serum enhances growth of organism. Litmus milk: Unchanged. Kligler agar: Negative to slight hydrogen sulphide production. Indol test: No production in tryptophane broth. Nitrates: No reduction. Fermentation with cresol red and bromthymol blue, used as indicators: Acid produced in galactose, dextrose, levulose, maltose, sucrose, and salicin. Arabinose variable. Alkaline reaction produced in adonitol, dextrin, inulin, lactose, mannitol, raffinose, and xylose. Aerobic, facultative. Optimum hydrogen ion concentration of media: Ph. 7.6. Optimum temperature: 37° C.

Habitat: Isolated from liver, spleen, and heart blood of infected birds. Pathogenic for quail and grouse with the formation of intestinal ulcers when given per os.

The organism quickly loses its virulence following isolation, and ordinarily most of the strains become non-virulent when growth is established on culture media. The symptoms, the sudden death and the character of the lesions associated with acute cases of the disease indicate that the organism produces a potent toxin, but thus far we have been unable to demonstrate toxin production.

Under conditions on game farms there is usually a sudden onset of an epizootic with a large percentage of the birds succumbing in a short time. The disease may entirely subside or it may be followed by an occasional case of chronic infection. It is as a rule difficult to transmit the disease with infective material from a chronically affected individual. Repeated transmission of the disease from one bird to another, under laboratory environment in every instance, has tended to decrease rather than increase the virulence of the infection. All attempts to increase the virulence under natural conditions have failed.

L. C. MORLEY
P. W. WETMORE
BUREAU OF BIOLOGICAL SURVEY
U. S. DEPARTMENT OF AGRICULTURE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

VINEGAR AS A SOIL DISINFECTANT

ACETIC acid, like formaldehyde, is for some purposes an effective soil disinfectant.[1] Neither remains in the soil long enough to prevent all reinfestation of soil and resulting late infection of plants by fungi, but either is useful in protecting seedlings, of all but slowly germinating species, against damping-off. Applied to soil in too large amounts and not a long enough time before seeding, either may be toxic to plants. Any delay between soil treatment and seeding is considered objectionable by plantsmen, and the relatively general use of formaldehyde dust is due as much to the fact that it may be safely applied to soil immediately before seeding as to its effectiveness.

An acetic acid dust, containing about 23 per cent. of acetic acid in a carrier of powdered wood charcoal, is apparently no less effective in controlling damping-off of seedlings caused by species of Pythium and Rhizoctonia and no less safe to plants. This has been applied to and thoroughly mixed with sandy soils, at the rate of 42 grams per square foot of soil surface. With seeds sowed immediately after this treatment of the soil, and with soil well watered at the time of seeding, acetic acid dust has had no harmful effect on growth of seedlings of *Centaurea Cyanus, Bellis perennis, Cerastium Biebersteinii, Lupinus polyphyllus,* Zinnia, China aster, *Laburnum alpinum,* cress (*Lepidium sativum*), beet and five species of Rhododendron.

Neither acetic acid nor formaldehyde is always at hand when needed by the plantsman, and this is one principal reason why seeds are often sowed without any protection against soil fungi, for convenience or the lack of it is an important consideration in practice.

Cider vinegar, as usually sold, contains 4 to 5 per cent. acetic acid or not far above the minimum required by law. There are few substances more readily available or more generally at hand than vinegar, and the writer has found it reasonably effective in the protection of seedlings against some of the damping-off fungi and at the same time relatively or quite harmless to plants, even when applied to soil immediately before seeding.

Four brands of cider vinegar have been used. Although their acetic acid contents varied from 4.1 to 5.2 per cent., with an average of 4.3 per cent., they have not differed significantly in effectiveness.

Vinegar, without dilution, was applied to and thoroughly mixed with somewhat dry and definitely sandy soils. Soils used were either naturally infested with species of Pythium and Rhizoctonia or were, some days before treatment, inoculated with these fungi. Seeds were sowed immediately or within a few hours after soil treatment and the soils were then well watered.

The degrees of protection resulting from this treat-

[1] *Jour. Agr. Res.*, 44: 571–578, 1932.

ment were in some cases a little less complete than those which followed the use of formaldehyde or acetic acid dust, but germination of seeds was usually markedly improved, by the elimination of much pre-germination damping-off, and post-germination damping-off was on the whole very well controlled by 200 to 250 cc of vinegar per square foot. The quantity of vinegar necessary for satisfactory control of these diseases was apparently affected by the degree of infestation of the soil by the fungi, naturally contaminated soil being a less severe test than is soil autoclaved and artificially inoculated.

One-half pint (about 237 cc) of vinegar per square foot of soil, 3 inches deep, was usually enough for satisfactory, sometimes complete protection, with the number of living plants often increased many fold. Seedlings were weighed at that stage of growth at which they are usually transplanted for the first time, and this quantity of vinegar in the soils used had no retarding effect on growth of seedlings of *Calendula officinalis, Dianthus arenarius, Centaurea Cyanus, Lupinus polyphyllus, Iberis umbellata, Cheiranthus Allioni, Verbena hortensis, Dimorphotheca aurantiaca, Mesembryanthemum criniflorum,* China aster, beet, cabbage, lettuce and tomato.

WILLIAM L. DORAN

MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION
AMHERST

A METHOD FOR THE MEASUREMENT OF ACTIVITY OF SMALL ANIMALS

WHILE the running wheel has proved satisfactory for the study of the quantitative aspects of the activity of rats, the usual method of recording activity of other small animals by a vertically moving kymograph lever connected with the activity cage has not permitted adequate quantitative description. The apparatus described combines the method used by Skinner[1] in obtaining a distance-time graph of the activity of a rat in a running wheel and that of Szymanski,[2] which employs a cage suspended by a spring.

A cage (A) 1 ft. square on the bottom constructed of ⅛″ wire mesh is suspended by a spring (S) of the type used for small bird cages. The arm of a physiological work adder (W) (Harvard Apparatus Co., Boston) is connected by a string with the center of the cage bottom, so that any movement of the cage will cause a turning of the ratchet wheel of the adder. Rotation of the adder winds a string connected with a reducing gear (G), which in turn causes an upward movement of a pen (P) recording on a kymograph drum. (K) (A pulley wheel of 1¼″ diameter on a ¼″ axle served satisfactorily as a reducing gear.)

[1] *J. Gen. Psychol.*, 9: 3–24, 1933.
[2] *Pflüger's Arch.*, 171: 363–373, 1918.

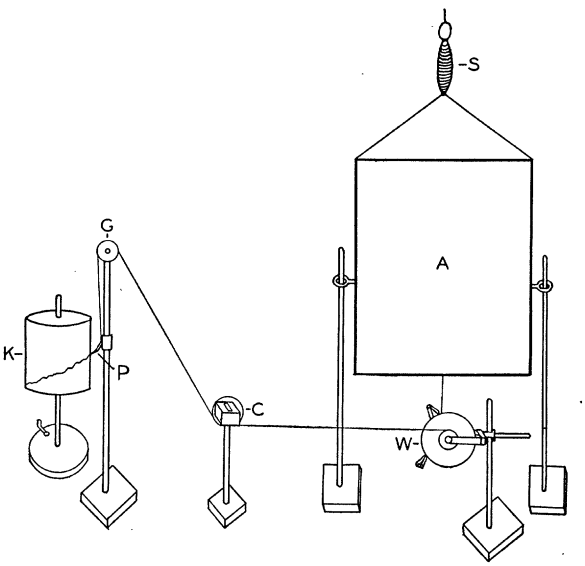

FIG. 1

This type of record differs from the usual one, which records each movement as a vertical rise and fall in that the graph rises during activity and moves horizontally during rest. The result is a cumulative vertically rising graph. It will be evident that the more violent the activity the more rapid will be the rise of the curve; and the height of the curve at any point will be proportional to the total activity up to that time. Mr. Herman Von Dach of this laboratory suggested the use of the Veeder counter as another means of measuring the total activity. This can be operated by the thread connecting the adder with the reducing gear looped around a pulley wheel placed on the shaft of the counter (C). When a kymograph record is not desired the writing unit can be disconnected and the counter attached to the adder by a pulley.

The specifications given have been found satisfactory for the study of activity of chicks. Modifications in cage construction, strength of spring and gear ratio make the method adaptable to animals of larger or smaller size.

KARL M. WILBUR

OHIO STATE UNIVERSITY

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