women who have the ability to generalize, the power to think and the initiative to find a way to do and invent new things. In short, they have the genius to create that which makes life pleasant.

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TOXICITY OF SELENIUM-CONTAINING PLANTS TO APHIDS

IN the course of studies[1] of the effects of selenium on wheat it was noted that aphids, *Rhopalosiphum prunifoliae* (Fitch), did not attack plants injured by selenium in solution cultures or soils. Since both rats and larger animals are able to detect the presence of selenium in their food and are reluctant to eat it,[2] the question arose as to whether the aphids found the selenium absorbed by the plants distasteful and migrated, or whether they died as the result of sucking the selenium-containing juice. The following experiments were accordingly designed to determine their behavior under conditions of artificial infestation.

Nutrient solutions, in 600 cc flasks, were made to contain various concentrations of sodium selenate ranging from amounts so small as to supply but 1 p.p.m. of selenium to concentrations as high as 12 p.p.m. Known numbers of aphids were placed on wheat plants growing in these solutions, and records of survival made daily. By placing each flask in the center of a large saucer of water it was possible to prevent migration and to account for the aphids that dropped from the plants.

Aphids placed on 2-months-old plants supplied with concentrations of selenium greater than 3 p.p.m. all died within a few days, while those with lower concentrations lived for as long as a week, although without reproducing actively. Similar results were observed with the red spider, *Tetranychus telarius* (L.). The plants were stunted by concentrations greater than 3 p.p.m. selenium.

The experiment was repeated with younger plants one month old. Comparatively few aphids survived on the plants grown with but 1 p.p.m. selenium, although some reproduction did take place. No damage to the plants themselves was apparent at this concentration. A few aphids survived for several days on plants supplied with 3 and 4 p.p.m., but did not reproduce. As the selenium concentration increased, it was necessary to add more aphids daily in an attempt to keep the plants infested with living aphids. Only on the control plants without selenium did the insects live and multiply normally.

The aphids were evidently sensitive to concentrations of selenium in the plant too low to visibly affect the plant itself. This was also obvious in some experiments with wheat, rye, oats and barley grown in soil treated with sodium selenate at a rate of 10 p.p.m. selenium, a concentration having little effect on the plants but almost completely inhibiting aphid infestation. For some reason more of the aphids persisted on the rye plants than on the others, although here also the number was greatly reduced. Adjacent control plants without selenium were all severely infested.

It is concluded that this species of aphid is killed by selenium taken up by plants from small amounts in the substratum. Evidently concentrations even lower than 10 p.p.m. in the soil would prevent serious attack. Whether or not this sensitiveness can be utilized as a means of insect control, with non-food crops or ornamentals, is problematical in view of the extreme toxicity of selenium to both plants and animals. Certainly the utility of the more readily absorbed selenium salts, such as the sodium selenate used in the experiments reported in the present paper, would seem limited to cases where the land is not to be utilized for food crops or where rapid leaching or irrigation insures complete removal of any residual toxicity.

The toxicity of selenium-containing plants to aphids is in accordance with their singular toxicity to higher animals. Selenium absorbed by vegetation on virgin soils has been shown to be the cause of a sometimes fatal disease of live stock.[3] White rats are injured by concentrations as low as 6 p.p.m. in a diet containing seleniferous grain.[4] The toxicity of selenium has led to various recommendations for its use in insecticides. It has been found especially effective in combatting red spiders,[5] although caution in its use has been urged.[6] It is not recommended by the Department of Agriculture because of the danger of contaminating foodstuffs, and because of a question as to possible injury to the persons making the applications.

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THE RÔLE OF CERTAIN INORGANIC ELEMENTS IN THE CAUSE AND PREVENTION OF PEROSIS

IN carrying on experiments on the cause and prevention of perosis, an anatomical deformity of the

[1] A. M. Hurd-Karrer, *Jour. Agr. Res.*, 49: 343–357, 1934.

[2] K. W. Franke and V. R. Potter, SCIENCE, 83: 330–332, 1936.

[3] K. W. Franke, T. D. Rice, A. G. Johnson and H. W. Schoening, *U. S. Dept. Agr. Circ.* 320, 1934.

[4] H. E. Munsell, G. M. DeVaney and M. H. Kennedy, *U. S. Dept. Agr. Tech. Bull.* (In preparation.)

[5] C. B. Gnadinger, *Ind. Eng. Chem.*, 25: 633–637, 1933.

[6] E. M. Nelson, A. M. Hurd-Karrer and W. O. Robinson, SCIENCE, 78: 124, 1933.

tibial-metatarsal joint of young chickens, it was found that the common c. p. grade of calcium carbonate, hydroxide and chloride as well as of mono-, di- and tri-calcium phosphates and of mono-sodium phosphate aggravated the occurrence of this disorder to about the same extent as steamed bone meal.

On the other hand, a technical grade of mono-calcium phosphate actually possessed a preventive rather than a causative effect. A spectroscopic examination of this salt showed the presence of considerable manganese and traces of iron. A qualitative analysis indicated the presence of aluminum as well. The subsequent addition of an equivalent amount of manganese, 0.0025 per cent., to a basal diet containing 0.0010 per cent. demonstrated that this element was responsible for the preventive action of this salt. This amount of manganese was found to be quite effective in preventing perosis at levels of 1.0 and 1.2 per cent. of calcium and at levels of 0.8 and 1.2 per cent. of phosphorus. The addition of a mixture containing 0.0025 per cent. each of manganese, aluminum and iron was entirely preventive at the lower calcium and phosphorus levels and had a slight beneficial effect on growth. Further results showed that aluminum and zinc had a similar but less effective preventive action. The perosis preventing property of common feed stuffs was roughly in proportion to their manganese content.

It is concluded that perosis is due to the lack of certain inorganic elements, of which manganese is notable, and that its occurrence is aggravated by an excess of calcium and probably of phosphorus.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

RETENTION OF PLANT COLORS

THE writer has for some months been experimenting with a new method of mounting plant material, which holds promise of considerable value, not only to botanists, but to entomologists, plant pathologists and perhaps others.

Every economic entomologist needs to keep a small herbarium of well-mounted, properly determined plants, to be associated with his insects collected, as positive proofs of his host records. The relationships between insects and plants are so intimate that accuracy in host records is imperative.

It was from the standpoint of an entomologist that I began my work. I have never liked the bulky botanical mounts, for my own purposes; nor are envelopes a proper way to put away record host plants. I have long felt that there must be some way to mount a flower and preserve its natural color, and yet when I look at great herbaria I am astonished at the ugly brown specimens of what were beautiful plants.

There came to me a thought in the late summer of 1935 which has been very productive. For a few months I had been using the adhesive cellulose tape known as Scotch cellulose tape, for mounting my plant specimens, so that not even the part covered by the strips was hidden. It was unquestionably a better way of mounting plants than the old white paper strip method.

Just as a hit-and-miss proposition I took a petunia blossom, of a rich purple color, and mounted it while fresh directly under the tape, with the lips flared open; another specimen from side view; and a third cut open down one side to show the floral organ arrangement. The sheet on which these were mounted was pressed. This was on September 1, 1935. On the following day, to my amazement, the cut-open flower had lost almost all its color, except where there was overlap, but there was only one change in the other two. The veins in the petals had become lightened and very distinct. These specimens have at present writing held color for eleven months.

The next trial was of a very blue new species of Commelina, a most difficult flower to press or hold colors in. Mounted on September 27, 1935, the blue color has held perfectly for over ten months.

Since that time numerous flowers of as many colors as I could find have been mounted, with varying results.

The essential point in holding the color is cutting off the air. If the mount is too thick, there is likely to be more or less loss of color.

Outstanding successes in color holding have been obtained with the delicate pink of the cranberry; the even more delicate pink of *Drosera filiformis;* the delicate blue of toad flax, *Linaria canadensis;* the rose red of *Kalmia angustifolia;* the green leaves and yellow flowers of *Baptisia tinctoria;* the yellow of the dandelion; the white of Spirea; the creamy yellow of Lonicera, bush honeysuckle; the yellow of an iris with short standards; the yellow of *Oxalis filipes;* yellow of Coreopsis and Calliopsis; purplish blue of Delphinium; purplish red of bergamot; orange of *Cynthia virginica;* the creamy pink of *Azalea viscosa;* yellow of *Hieracium venosum;* creamy white of mock orange; brilliant yellow of Oenothera; white of *Sabatia lanceolata;* and other yellow flowers.

Results not quite so perfect and yet very encourag-