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-

ing, which would probably be improved by the next method to be mentioned, were obtained with the beautiful pink *Limnodorum tuberosum;* the rich purplish rose of *Rhexia virginica;* the delicate pink of *Pogonia ophioglossoides;* the orange of *Hemerocallis fulva;* the rose pink of *Cydonia japonica;* pink Weigela; purple of Siberian iris; scarlet and pink roses; various colors of Dianthus; a purplish red Azalea; light blue violet.

All the above results were obtained by simply covering the flower on a plain cardboard, 4 × 6 inch, with overlapping strips of Scotch cellulose tape pressed smoothly and tightly. They were dried by placing between blotting papers in a pack of cards and pressed merely by rubber bands. This makes the method available to any field man, for he can carry all his equipment in a small collecting bag, or his pockets.

The botanist desiring a larger herbarium specimen can also make up in the field a card of fresh specimens for color holding, and also for showing permanently the internal plant organs. A dissected flower or two mounted on the card does away forever with the necessity of relaxing and dissecting the herbarium specimens. Flowers mounted this way have the petals and floral organs spread out more or less perfectly and will not shrivel. The greens of the leaves are holding splendidly in the oldest mounts.

Some flowers apparently contain chemicals which react to the rubber glue on the tape. The African violet in a few minutes becomes perfectly colorless transparent, and shows all the veins in the petals. *Sisyrynchium graminoides* also reacts immediately and becomes colorless. So also does the yellow Portulaca, except for the brighter orange center. I decided therefore to try another method, and covered the flower with a square of plain Cellophane, and sealed this down with the adhesive tape. The African violet, when not touched by the fingers, and the yellow portulaca then gave very successful results.

It is well known that *Baptisia tinctoria* turns black, but if the card is first covered with Dennison's transparent tape, and the flowers then mounted under the Scotch cellulose tape, and no pressing whatever administered, the color is held.

Now the method is also available to the entomologist for mounting leaf mines, and for extra evidence a miner larva, extracted and gently pressed, will be preserved beside its work.

Likewise, he can mount specimens of leaves showing typical injuries, and these cards mounted in a notebook can go into the library. In fact, my whole herbarium is in small notebooks, looseleaf, ten-cent binders.

In cases of aphids, scales, red spiders, lace-bugs, etc., the insect should be left right on the leaf where it did its injury and the adhesive prevents its moving, so that it dies in position. The color of the injury and cause are present as permanent records, easily studied under a binocular.

To the economic entomologist the method carries peculiar advantage. In spraying operations it is often desirable to have a permanent record of the nature of the coverage of the poison. If this is visible on the leaf when mounted under the adhesive tape, it will always be there for proof. In this way standards of coverage could be worked out and a field man could carry a sample set of standard cards, to match up with field behavior.

The plant pathologist will find that the brilliant colors of diseased leaves hold color splendidly. He can take a flower head with smut and lay it gently on a card and seal it under the tape for a permanent specimen that will not endanger anything else. I have found no fungous growth under tightly sealed, quickly dried specimens. When the plant material is full of moisture it is of advantage to dry upside down under a lamp.

The criminologist may also find use for the system. Having in his pocket a pack of 4 × 6 cards and a few rolls of adhesive tape he can lay down on a card fragments of dust, ash, pieces of leaf, hairs, many other delicate little evidences and seal them for permanent evidence, always available for study under the microscope. Such materials mounted on the spot and attested on the spot by a second witness should have added value in court.

The method is also available for mounting of insect wings.

There are various thicknesses of Cellophane, and many specimens could be mounted under the tape on Cellophane cards and be available for study on both sides.

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BOOKS RECEIVED

GALDSTON, IAGO, Editor. *Medicine and Mankind.* Lectures to the laity delivered at the New York Academy of Medicine. Pp. vi + 217. Appleton-Century. $2.00.

IMPATIEFF, VLADIMIR N. *Catalytic Reactions at High Pressures and Temperatures.* Pp. xxii + 786. 56 figures. Macmillan. $7.50.

MUIR, JOHN M. *Geology of the Tampico Region, Mexico.* Pp. xix + 280. 40 figures. 15 plates. American Association of Petroleum Geologists, Tulsa, Okla. $3.50 to members and associates. To others, $4.50.

PARSONS, WINIFRED. *The Circulation of the Blood.* Pp. xi + 204. 30 figures. Macmillan. $1.75.

SMITH, DAVID E. *Portraits of Eminent Mathematicians, Portfolio I.* Scripta Mathematica, New York. $3.00.

WILSON, DOUGLAS P. *Life of the Shore and Shallow Sea.* Pp. 150. 150 photographs. 1 colored plate. Ivor, Nicholson and Watson, London.