

(0.003 per cent.)," *i. e.*, of magnesium sulphate (anhydrous, 0.00147 per cent.).

4. It is a well-known fact that many compounds that act poisonously at a certain concentration can act in very high dilution as stimulants of growth.

Miss Burlingham said nothing to the contrary. She found nothing in opposition to it. There is nothing in her abstract to warrant the inference that she was not aware of this "well-known fact."

5. It is erroneous to attribute this stimulating action to any nutritive quality of the poison.

Miss Burlingham did not "attribute this stimulating action to any nutritive quality of the poison." She said her results "show conclusively that magnesium sulphate in proper dilution is *beneficial* to the growth of seedlings." She did not offer any explanation of her preliminary results, merely stated them.

It is ridiculous for Professor Loew to assume that Miss Burlingham exhibited prejudice in her abstract, for neither she nor I had any preconceived notions to establish, nor any theories to maintain. Her conclusions were drawn impartially from her results.

Professor Loew concluded his letter with the following unbiased allusion:

6. The unprejudiced reader who desires some information as to the nutritive rôle of magnesium salts in plants and to the conditions under which this function can be performed, is kindly requested to consult Bulletin No. 45 of the Bureau of Plant Industry, "The Physiological Rôle of Mineral Nutrients in Plants," Washington, 1903.

I cheerfully commend "Bulletin No. 45," of which Professor Loew is the author, to the attention of any one wishing "information as to the nutritive rôle of magnesium salts in plants and to the conditions under which this function can be performed." The said bulletin is the most valuable single contribution to our knowledge of the questions discussed in it, and reflects brightly the flood of light that Professor Loew has thrown upon the subject since he undertook its investigation. Nevertheless the "unprejudiced reader" of it will certainly conclude, after studying "Bulletin No. 45," that there is probably very much

more for all of us, including Professor Loew, to learn about the "nutritive rôle of magnesium salts in plants" and "on the conditions under which this function can be performed." The "unprejudiced reader" will also surely welcome such earnest attempts as Miss Burlingham's to extend our information on details of the subject.

Miss Burlingham's preliminary paper appeared in the July number of the Journal of the American Chemical Society. It gives the data upon which were based the remarks in her abstract that Professor Loew has misinterpreted for the "unprejudiced reader." It makes further comment here unnecessary.

WILLIAM J. GIES

NEW YORK BOTANICAL GARDEN

A NOTE ON CERTAIN WIDELY DISTRIBUTED LEAFHOPPERS (HEMIPTERA)

CERTAIN leafhoppers have more or less recently become notorious for the damage they occasion to various cereals, such as sugar-cane and sorghum. *Perkinsiella saccharicida* (Kirkaldy) has done much damage in Hawaii, having been introduced from Queensland, where, however, it is not native. It is to be found wherever sugar-cane is grown in Australia and Hawaii, and I have recently received it from Java. *Peregrinus maidis* (Ashmead) was described from maize in Florida and is now widely distributed over the southern United States; it has an even wider range now than *Perkinsiella saccharicida*, for it is all through eastern Australia, Hawaii, Viti and, I think, Java, while Mr. Distant has recently redescribed it as *Pundaluoya simplicia* from Ceylon.

G. W. KIRKALDY

SPECIAL ARTICLES

COLOR INHERITANCE AND SEX INHERITANCE IN CERTAIN APHIDS

THE color changes that occur in the sexual generation of certain aphids, and the correlation of a definite color with each sex, have suggested that these insects may furnish favorable material for testing the possibility

that the male and female sex characters form an allelomorphic pair and undergo segregation in gametogenesis.

In one of the goldenrod aphids all of the parthenogenetic individuals are a deep reddish brown, the males are green and the females brown, both males and females being produced by the same mother. Assuming that sex may be regarded as an inheritable character, the indications are that the parthenogenetic individual is both a sex-hybrid and a color-hybrid, green color and male sex being recessive. In the sexual generation green color becomes dominant with the male sex, brown with the female. Here correlation of color with sex, and selective fertilization, *i. e.*, only gametes containing opposite sex characters forming fertile unions, would account for the conditions observed.

In another aphid found on the star cucumber, the parthenogenetic generations consist of green and red individuals. Both red males and green females are produced by the same parthenogenetic mother which may be either green or red. Here again it appears that all of the parthenogenetic individuals must be both sex-hybrids and color-hybrids, but either color may be dominant during the parthenogenetic generations with no evident determining factor.

In an aphid which is abundant on the flower clusters and upper leaves of *Oenothera biennis*, we find more complicated conditions. In the parthenogenetic generations there are two colors, a dark red and a bright green. In autumn certain red-winged mothers produce red apterous females, and other apterous red individuals produce greenish-brown males, while red females and green males come from the green mothers. The winged males are produced only by apterous mothers, the apterous females only by winged mothers. In this case all may or may not be sex-hybrids and color-hybrids.

In November, 1905, I placed sexual forms of these *Oenothera* aphids on *Oenothera* rosettes in the greenhouse and an abundance of eggs were laid. The eggs hatched early in March, giving both red and green young. Individuals of the two colors were isolated on

Oenothera plants protected with fine tarlatan, and the several families were kept under observation in the greenhouse until June 14, about three months from hatching. All of the members of each family remained true to the color of their egg-ancestor. The plants with the aphids were then taken to Cold Spring Harbor and planted out under tarlatan screens. Syrphid larvæ killed many of the aphids. The last of the green ones disappeared in August, while some of the red ones lived until the last of September. In no case did any individual of any one of the families deviate in color from its egg-ancestor. Sexual forms did not appear before I left Cold Spring Harbor on September 28. After returning to Bryn Mawr, about October 1, I collected both green and red parthenogenetic aphids from wild *Oenotheras* and raised the males and females of the sexual generation from these. The males of green parentage are bright green like their mothers, while the females are pale green when born and gradually grow more and more reddish until, when mature, they are a bright red, not quite so deep a red, however, as that of the red females from red mothers. The males of red parentage are red when born, but change gradually to a greenish brown, while the females are deep red like the mothers, the red being a little brighter at maturity than that of the parthenogenetic generations, but easily distinguishable from the brighter and more transparent red of the females of green parentage.

It will thus be seen that the color which comes from the winter egg holds for all of the parthenogenetic descendants, but when the sexual forms appear the males are green or greenish brown, and the females red, indicating some relation between color dominance and sex. That this relation can not be associated with different metabolic conditions in the two sexes is shown by the fact that in the star cucumber aphid, where there are both green and red parthenogenetic strains, the color conditions in the sexual generation are reversed,—the males are red and the females green.

A few preliminary experiments were made in November, 1906, in mating males and

females raised from isolated mothers in the greenhouse. The matings and results were as follows, the letters showing the color characters which were visible:

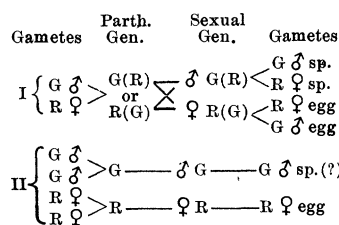
1. ♀ R (red par.) × ♂ RG (red par.) $\left\{ \begin{array}{l} a. \text{ All red.} \\ b. \text{ Red and green.} \end{array} \right.$
2. ♀ GR (green par.) × ♂ G (green par.) $\left\{ \begin{array}{l} \text{All green.} \end{array} \right.$
3. ♀ R (red par.) × ♂ G (green par.) $\left\{ \begin{array}{l} \text{No eggs hatched.} \end{array} \right.$
4. ♀ GR (green par.) × ♂ RG (red par.) $\left\{ \begin{array}{l} a. \text{ One red.} \\ b. \text{ Several green.} \end{array} \right.$

Only a small proportion of the eggs hatched, but the results, though meager, indicate the possibility that color inheritance may here be Mendelian, and that a further study of it may throw light on the problem of sex inheritance.

The coloration of the sexual generation, however, shows that either one or the other of two conditions must probably exist: (1) All of the egg-ancestors and therefore all of the parthenogenetic individuals, as well as the males and females, are sex-hybrids as well as color-hybrids, and the factors which determine sex dominance also determine color dominance, possibly by virtue of some structural correlation of the two characters. (2) There are green hybrid strains which produce red females and red hybrid strains which produce greenish-brown males, while the red strains which produce red females may be pure reds and the green strains which produce green males may be pure greens.

The first of these suppositions, which alone could account for the conditions found in the star cucumber aphid, where parthenogenetic mothers of either color produce both red males and green females, and in the goldenrod aphid where the brown parthenogenetic mothers produce both green males and brown females, seems much more likely to be true for all.

In the following table the possibilities for the star cucumber aphid are shown under I., and those for the *Onothera* aphid under I. and II. combined. (The color scheme must be reversed for the star cucumber aphid, G♀, R♂.) In both, the dominance of sometimes one color, sometimes the other in the parthenogenetic generations is a subject for investigation. It may be conditioned by the immediate ancestry of the gametes.



In the goldenrod aphid, if we consider the parthenogenetic forms as essentially female, correlation of color with sex (B♀ and G♂), and selective fertilization would account for the observed relation of color to sex.

The second, and less likely but nevertheless interesting, possibility for the *Onothera* aphid involves the question whether a zygote can be pure as to the sex character, or unisexual. The chief point to be investigated by experiment, in addition to the study of color inheritance in cross-breeding, is whether in this aphid both males and females come from the parthenogenetic progeny of each egg-ancestor, or in some cases (G♂) only males, and in others (R♀) only females. To test this possibility it would be necessary to carry many families through from the egg to the following sexual generation, and very likely to repeat the experiment several times.

A large series of experiments in cross-breeding to test the color inheritance has been planned by the author for next year, and this note is published in the hope that some one may be interested to undertake experiments along the same line.

N. M. STEVENS

BRYN MAWR COLLEGE,

BRYN MAWR, PA.,

June 8, 1907

A COLOR SPORT AMONG THE LOCUSTIDÆ

THERE are various sports among animals that are so rarely observed and so little understood as to seem to render it desirable that every occurrence should be recorded. One of these is the occasional substitution of pink for green color among the Locustidæ, which has been recorded perhaps a dozen times. It is to be hoped that repeated notices of their capture may call the attention of physiologists to them, and in time elicit a satisfactory explanation of the phenomenon. A specimen of