

contestable evidence that it was the intention to produce in this something which, with sovereign disdain for all that now exists, was to flow forth from the Royal Society's well of wisdom. But the Royal Society has not thereby erected a *monumentum aere perennius*, for if the plan should actually be carried out—from which sad result may the good fates spare science—it is unquestionable that in a very short time the whole scheme, together with numbers and everything else, will have to be changed. However thankfully the news might be received that a body like the Royal Society—to whose esteemed position in the scientific world so general a participation in this plan is to be attributed—finds itself impelled to continue the plan of a bibliographic repertory conceived by the 'Office international bibliographique de Bruxelles,' still the question must be raised: Does the uncertain and precarious condition of this undertaking, calculated entirely upon English conditions, warrant the granting of the great cost of its cumbersome organization from the public means?

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SOME COMMON SOURCES OF ERROR IN RECENT WORK ON COCCIDÆ.

No group of insects has excited more interest nor attracted more new students perhaps in the last few years than the scale insects, or Coccidæ. Entomological magazines, and, in fact, journals of all sorts and descriptions, and in the most unexpected and unusual quarters, have been heavily charged with literature of new species, sub-species, etc. The great number of such new species has struck the attention even of non-workers in this group, and particularly has the designation of an astonishing percentage of sub-species, physiological species, varieties, etc., been calculated to arouse the gravest suspicion as to the re-

liability of the work done and the validity of the forms characterized, especially when the characters on which the new species, sub-species, etc., are based are at all carefully investigated. That with all the enthusiasm manifested in working up new material and describing new forms many good species are found and characterized cannot be doubted, and it is, therefore, the more to be regretted that the authors responsible for much good work have been led by a surplus of zeal to be guilty also of much that must be a positive detriment to the knowledge of this group of insects. For the benefit of future students, and with the intention merely to bring about, if possible, a much needed reform in the interest of the scientific value of the work done, it may not be out of place to call attention to some of the common sources of error and questionable work. The criticisms to follow apply more particularly to the scale insects belonging to the Diaspinæ, with which the writer is most familiar, and especially to the genus *Aspidiotus* in its old and broader sense.

In the first place, it does not seem to have been sufficiently impressed on most writers that the scale covering, though an important adjunct of the insect, is not the insect itself, and still less the extraneous matter, such as sooty mold, epidermis of bark or leaf, etc., with which the scale may be covered. Many of the Diaspinæ—in fact, almost any of them—at times may assume a slight or marked so-called 'mining' habit. In other words, the female insect in revolving from side to side in the formation of the covering scale, and in making additions to it, is very apt, with her flat chitinous lobes, to cut under the superficial and more or less loosened layers of the bark, with its covering of mold or other extraneous matter, and this loosened material slides up over the scale and adheres closely to it, much modifying and changing its color and

appearance. This mining habit varies, of course, with the plant, being less on perfectly smooth bark, and much more prominent on bark that is rough or fibrous, or on older wood. The same mining habit is exhibited in scales occurring on leaves where the epidermal growth or any sooty mold, or other foreign matter, is lifted and covers the scale in the same way. Several species or sub-species of scale insects have been established on accidental variations of this character, as, for example, *Chionaspis furfurus*, var. *fulvus* King. Examples of the type of this species sent to the Department of Agriculture exhibit many scales which show none of the epidermal coverings, while others, owing to the character of the adjacent bark, are covered more or less completely by the outer layer of the bark of the plant. On this basis any scale insect almost may be split up into two or three species or varieties. The careful study of the scale in its relation to its situation on bark or leaf made by the writer has shown that the majority of the species in the Diaspinæ occasionally or frequently present epidermal or extraneous coverings.

The scale varies also in shape as influenced by the nature of its surrounding conditions. The exuviae is often shifted, or apparently so, by obstructions, such as veins or inequalities of the surface or the proximity of other scale insects. A convex scale becomes flattened when the insect occurs beneath the sheaths of the leaves, as on palms or bananas.

Color also varies very notably, being influenced undoubtedly by climatic conditions, dryness or humidity, the presence of mold or other fungi. The food of the insect on different plants undoubtedly also affects the character of the excrements. The effect of weather and age in bleaching or otherwise changing the appearance of the scale is often notable. The characteristic appearance of the scale varies im-

mensely in proportion as it has free room for growth or is crowded or massed together densely on the bark or leaves. The San José scale, growing in scattered numbers here and there on the terminal twigs, bears no resemblance whatever to the crowded masses on old, badly infested wood. The same is true of almost any other scale insect.

The covering scale, therefore, cannot be taken as a criterion of very great value in the separation of species, and by itself is almost without value. The specific characters must be found in the insect itself, the scale covering furnishing indications only of a rough sort. The describer of new species who fails to notice the importance of these sources of error, and sees a species, a sub-species, a physiological species or a variety, in every such accidental difference, greatly retards rather than advances the knowledge of this group of insects. It would be just as legitimate to describe as a new species an insect found on the under side of a leaf, as opposed to an insect found on the upper side, as to designate as new a species because a little extraneous matter is adhering to its scale covering, or to describe men as distinct species because they wear different colored coats.

When the insect itself comes to be examined, other sources of error present themselves. For example, the question of the maturity or adulthood of the specimens under study arises, and also the problem of individual variation. In the determination of material it is, as a rule, absolutely necessary to have the adult female insect. In the Diaspinæ, for example, the full grown second stage of the female is often nearly as large as the third or last stage, if not larger in some instances, and yet the difference in the structural characters of the two stages is very great. As an example of a description of a new species from a failure to recognize the maturity of the specimens, Cockerell's so-called variety

lateralis of Newstead's *diffinis* may be cited, *lateralis* merely representing the immature stage of Comstock's *cydonice*.

In the matter of individual variation this is just as notable in scale insects as in man or other animals. The two halves of the anal plate of a female Diaspine are never exactly alike, and often vary within quite wide limits. In different individuals from the same colony such variations are still greater. Fortunately, however, the characters of real value in this group of insects are much more constant than one who had not studied the subject would suppose, even in the case of material representing the same species from widely separated quarters of the world, and on totally dissimilar food plants. In the Diaspinæ, perhaps more markedly than in most other groups of insect, the specific characters are sharply and satisfactorily defined, and, hence, the less excuse for the cumbering and befogging of the literature which has resulted from careless, hasty and thoughtless work.

Minute differences in the pores or glands and appendages, or in the lengths of the joints of antennæ or legs, are usually individual and would often make two species of the same specimen if the latter were cut in half in the line of the main axis of the body. To return to an illustration already employed, one might as well describe men as distinct because they have Roman or Greek noses or short or long chins.

In other groups than the Diaspinæ I cannot speak from careful personal study, but I have the gravest doubts of the value of descriptions based on slight variation in the lengths of the joints of legs and antennæ, all of which must be subject, within specific limits, to variation with the age of the specimens and with its condition as to abundance or scarcity of nourishment. In this connection I cannot do better than quote the views expressed relative to the group Lecaninæ, by Mr. Theo. Pergande,

in a recent letter to a correspondent, views in which I heartily concur. He says:

"With regard to the difference in length of one or the other of the antennal joints, * * * * * I will say that it is simply individual variation; even in the same specimens the comparative length of either of the joints of both antennæ varies frequently, more or less. There is generally, also, a more or less perceptible variation in size, color and shape, in the same species, dependent in a measure on the food plant on which it may have established itself, and also on the locality. Old specimens, which have attained their full growth and have died a natural death, are generally darker, if prepared for the microscope, than younger individuals of the same stage, and with all the pores of the derm much more distinct. As to the shape of the individual scales and their sculpturing I find in our material of typical specimens of *Lec. armeniacum* the same variations as those mentioned * * * * * To consider every slight variation of specific value would lead to endless species which nobody would be able to recognize, and which would cause endless trouble in the study of this most difficult group of scale insects."

The writer trusts that the foregoing criticisms will be taken in the kindest spirit, as they are intended, and he does not wish it to be thought, for an instant, that he fails to recognize the learning and enthusiasm shown by the prominent workers in the Coccidæ, by no means all of whom have been equally guilty, and whose work in the main has been most excellent, and commands the heartiest approval, but, having experienced the great difficulty and labor necessary to discover and correct errors arising from the conditions criticised, the need of calling attention to them seems imperative.

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