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Recollections of a Naturalist, VI. Scale Insects and Mealy Bugs

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IN 1891, when I went out to Jamaica as Curator of the Public Museum, I began to make a card catalogue of the fauna of the West Indies, terrestrial and marine. Lists of fishes and marine shells were published, but it was soon evident that the information about many groups of animals was very inadequate, while the assembled data, such as they were, stood urgently in need of revision. That was nearly half a century ago, but in spite of the many discoveries made in the interval, there is still very much to do. Forty-five years ago, seeing that critical or revisional work would have to begin on some particular group, I chose the Coccidae for special attention. They were excessively abundant in Jamaica, and of economic importance. The literature at that time was not very extensive, and it was possible to remember more or less clearly the principal characters of all the known species. By February, 1892, I had thirty-four species recorded from Jamaica; many more I believe, than had previously been reported from the entire West Indies. At first, following the ideas of Signoret and other early writers, I imagined that each kind of plant must have its special scales. Some of my earliest descriptions, fortunately never published, reflect this point of view, and my friend Mr. E. E. Green recently found some specimens bearing my manuscript names in an old European collection. It was a mistake to attach such names before the subject had been sufficiently studied. Names should only be given to supposed new forms when the descriptions have been drawn up for publication, and even then it is best not to circulate them unless it is assured that publication will not be long delayed. Very soon, several interesting species, really new, were discovered. At the Hope Botanical Gardens, on June 9, 1892, I found on a tropical orchid (native of Madagascar), the singular new genus *Conchaspis*, so named because the white scales reminded me of the marine shell *Calyptraea*. It has since been regarded as the type of a distinct family, Conchaspidae. On another occasion, I was a very incompetent member of a judging committee at a flower show, but I had developed a little judgment of Coccids, and collected on the leaves of cultivated orchids the new species *Chrysomphalus biformis*. This insect is now well-known, and has been made, with apparently good reason, the type of a genus *Furcaspis*. It was a fact that nearly all the coccids found were on cultivated plants, and no search was made in the

wild forest or other places where the endemic species were likely to occur. Undoubtedly, the West Indian coccid fauna, as we know it today, is largely derived from other countries, the native habitat of most of the species being still unknown. It still remains for workers on the ground to find the truly indigenous species, which will rarely be conspicuous or of any economic importance.

The mealy-bugs illustrate what may be called the Unearned Increment in science. When a genus or species is described, or any fact made known, it is usually impossible to foresee what importance it will have in later times. Sometimes it happens that the apparently unimportant item becomes, as it were, the corner-stone of a vast edifice. When, in Jamaica, I found mealy-bugs in the "eyes" of pine-apples, and described the species as *Dactylopius brevipes*, I could not guess that this insect (now called *Pseudococcus brevipes*) would eventually be discussed in innumerable articles, and would prove to be of first-class importance as a pest, and equally notable as illustrating biological phenomena. In the first place, it was not really new; it has in fact been referred to by Adam Taylor as early as 1769. All I had done was to supply what appears to be the first valid name for the species, with a description and a small figure. It is found on pineapples apparently wherever they are grown, and formerly attracted no particular attention. But in comparatively recent years it was discovered that it communicates the virus of pineapple wilt, in some cases exterminating certain varieties. Certain kinds, as the Cheese Pine, were comparatively resistant. It also produces green spotting of pineapple in the Hawaiian Islands, and this is associated with the presence of a bacillus-like symbiont in the mealy-bug. The study of these curious phenomena has opened up a new field, and studies of internal symbionts, and of virus diseases, have now formed the basis of an extensive literature dealing with many species of insects and plants. Thus the poor little animal is given a star part in the biological drama. Because of the interest attaching to these matters, much has been done to elucidate the life-history of *P. brevipes*, its distribution and its parasites. The latest remarkable discovery (set forth by Carter, 1937) is that a parasite called *Hambletonia pseudococcina*, described by Compere from Brazil, has two biological forms, structurally alike so far as inspection shows. One of these is bi-sexual, and will not reproduce on *P. brevipes*, the other parthenogenetic, and an effective parasite of the pineapple mealy-bug.

Two other mealy-bugs, described in the same paper, have also had a "distinguished career". One is *Pseudococcus virgatus* (since made by Fullaway the type of a genus *Ferrisia*) and the other *P. filamentosus*. The *P. virgatus*, first found in Jamaica, is a pest on tea in the Malay Peninsula, on cotton in Formosa, on coffee in the Belgian Congo, on many different plants in Brazil, and in fact nearly everywhere in the tropics.

Where it originated, we do not know. Its parasites and predatory enemies have been found to be very numerous, so that it is the center of a biological complex which has attracted the attention of many workers. *P. filamentosus* was discovered by Doctor Strachan in 1892 in the Bahamas, but it is a pest in South Africa, Madagascar, Egypt, China, Formosa and many other localities. In the Hawaiian Islands it has been controlled by a minute Hymenopterous parasite, *Anagyrus dactylopii* of Howard, which was introduced from Hongkong.

Two other mealy bugs, which I described at other times, deserve some comment. One is *Trionymus sacchari*, which lives on sugar-cane. Hall reported it as a serious pest in Egypt, but in several countries, although present, it does little harm. It is subject to "biological control", and has been extensively studied from this point of view. The other species, much discussed, is *P. lilacinus*, described in 1905 from the Philippines. It proves to be widely spread throughout the oriental tropics, where it is comparatively harmless. Indeed Dammerman (1929) says of it in the Malay Archipelago that it is "mostly harmless, and in Java it must even be reckoned among the useful insects, as it attracts the black cocoa ant (*Dolichoderus*) which in turn is used against *Helopeltis*". In Africa, however, *P. lilacinus* was reported as a major pest, said in Kenya to have caused a loss of a hundred thousand pounds to coffee growers in the first six months of 1927. This was very extraordinary, but Le Pelley (1935) made minute comparisons of specimens found about Nairobi with the oriental insect and detected small differences which led him to describe a new species, *P. kenya*. He was good enough to show me his material, and to demonstrate it to me in detail, and I am convinced that he is right, although the characters relied upon are such as we should formerly have considered quite unimportant. It now remains to ascertain whether all the African supposed *P. lilacinus* is really *P. kenya*, or whether (as seems most likely) both species occur. At all events, these studies have again opened up a new line of investigation, into the minute characters of species which behave differently and are biologically different entities, but which have eluded the taxonomist.

I formerly paid a good deal of attention to the cochineal insects found on cacti. One of these which I described from Mexico, is known as *Dactylopius opuntiae*. Instead of being regarded as a pest, it has proved a blessing in certain countries where it has been introduced. It was reported to have cleared about 40,000 square miles of prickly-pear in Madras. It was being sent to different part of India, with the expectation of similar results. It was very successful in Ceylon, and also in Mauritius. In Australia (Queensland), Dodd (1936) now says it is on practically every prickly-pear plant, but it is only moderately efficient.

As I think of these matters, I cannot help regretting that circumstances have made it impossible (or rather inadvisable) for me to continue the study of the Coccidae. When we describe a species and give it a name, we say that it is "known". It is obvious that it has merely been introduced, and most of the facts concerning it are still to be ascertained. Every species of insect which has been intensively studied has yielded data of general biological interest, and it may fairly be said that the Coccidae are especially valuable in this regard. The careful study, by many workers, of a few species of economic importance, has lifted a corner of the veil, and shown in some degree what is waiting for the industrious and competent student. We have also learned that it would pay, from an economic standpoint, to study critically the characters and the life history (including, of course, the natural enemies) of all the Coccidae, wherever found. Work of this kind is now being made comparatively easy and reliable by the splendid illustrations issued by Professor Ferris of Stanford University. These include figures of the types of the various genera, and of the species found in North America down to Panama.

When I moved from Jamaica to New Mexico, I went by sea to Vera Cruz, and thence by rail to Las Cruces. Passing through a country new to me, I was keen to find coccidae, though the opportunities were few. As the train stopped at a station near the foot of Mount Orizaba, I jumped out and hastily examined the leaves of some trees along the platform. In this way I obtained the new *Chrysomphalus scutiformis*, now known to infest Citrus, and to occur in Texas, Brazil, and Argentina. At Vera Cruz, we put up at a hotel overlooking the plaza, where the band played in the evening, and the people walked around in circles, the men walking one way, the women the other. This arrangement permitted a sort of continuous flirtation, carried on without speaking, each man continually passing a different woman. I did not take part in this entertainment, but instead examined the shrubbery, and found a very wonderful coccid with a bright yellow egg-sac. I described it as *Lichtensia lutea*. It has been found since, but seems to be very rare.

Arriving in New Mexico, where I lived for many years, I found a country rich in Coccidae, nearly all the species being new. In the West Indies, I had been working almost entirely on the species infesting cultivated plants, and for the most part of unknown origin. In New Mexico, I had a native fauna on the indigenous plants of that dry region, and with few exceptions of no economic importance. They appeared to be subject to continual decimation by parasites and predatory enemies, but when a colony was thus destroyed, it was possible for the species to get a new start somewhere else, the larvae carried by the wind or by birds. Thus it happened that certain shrubs, such as the mesquite and the creosote bush, which abounded over hundreds of miles of country, were by no

means uniformly populated by their characteristic scales. Here and there colonies might be found, and it did not pay to assume that there was nothing to be had because hundreds of bushes had been examined with negative results.

I had one curious experience, in reality no more than a coincidence. I was on the way to the Agricultural College, riding my old grey horse, when I saw a clump of *Lycium* in the middle of a field. Now the *Lycium* (related to the matrimony vine of our gardens) was very abundant everywhere, but I developed a sort of premonition that there was a coccid on this particular clump. So, tying my horse to the fence, I climbed through, and there indeed was an abundance of a large new species, with white ovisac, which I called *Lichtensia lycii*. Steinweden (1929) has lately proposed to transfer it to the genus *Ctenochiton*, but I am not at all convinced that this is correct. Possibly it should form a new genus.

After a time, people began to send me scale-insects from many parts of the world, South America, Africa, Japan, The Philippine Islands, etc. I thus came to know many diverse genera and species, but I never felt that my knowledge approached completeness. Today, in spite of tremendous advances, it may still be said that we are beginners in relation to what will be known in the future. When we look at the current literature of economic entomology, it is very noticeable that the species of coccids mentioned are comparatively few. The same species is discussed over and over again, while the other members of its genus may be quite ignored. One who studies the known pests, easily comes to the conclusion that most of the coccids were described long ago. But there are, I suppose, thousands of species hidden away on native plants, awaiting zealous and keen-sighted students. Once in a while, one of these comes out from its seclusion and, spreading to some plant of value to man, becomes a first-class pest.

One of the most important works on coccidae is the great "Catalogue of the Coccidae of the World," published by the Massachusetts Agricultural College in 1903. It was written by Mrs. Maria E. Fernald, wife of the Professor of Entomology. Mrs. Fernald was not at all a specialist in Coccidae, but for over a quarter of a century she labored at this bibliography, which is remarkably complete and accurate. An Italian writer, seeing on the title page Maria E. Fernald, and perhaps unwilling to believe that a woman could do all this work single-handed, took the E. to mean "and" and so cited Mrs. Maria and Fernald.

A very dear colleague and friend in the study of Coccidae, throughout the years, has been E. Ernest Green of Surrey in England. He published a beautiful work on the Coccidae of Ceylon, illustrated in colors. I have often cited to my students his methods when beginning his studies. Living in Ceylon, and far from scientific libraries and collections, he wished to study the Coccidae, which he saw everywhere, some of them major

pests. Many men would have failed to accomplish anything, making the excuse that they did not have the literature. Not so with Green. He went to work on the insects themselves, drawing and describing them as if nothing had been done before. In this way he came to have an excellent knowledge of the species, and when he eventually took his materials to England, and looked up the species in the literature and museums, he found that his insects were for the most part actually undescribed. The saying "study nature, not books," should not be interpreted to mean that books are to be ignored, but it is wise counsel for the beginning student who should learn to see things and to know their characters, instead of merely following what has been written. It may be actually detrimental to a young student to have his insects all named for him by experts. He is thereby excused from studying their characters, and unless he has a good deal of originality and initiative he may lose the chance of becoming competent. On the other hand, of course, if he lacks those qualities, he is likely to quit altogether when he runs into difficulties, and this may not always be a misfortune to science.