

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

OPERATIONS OF THE DEPARTMENT

FOR THE

YEAR 1876.



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1877.

# REPORT OF THE ENTOMOLOGIST AND CURATOR OF THE MUSEUM.

---

SIR: As the Economic Museum, connected with this Department, is a branch of the Entomological Division, it has been principally engaged for the past year—and for several months previous—in the collection, preparation, and arrangement of the series of exhibits illustrating the workings of this branch of the Department at the Centennial Exhibition in Philadelphia. To my assistant, Mr. Charles R. Dodge, was given the supervision of the museum work, and the whole labor of both branches has been performed without the aid of additional force, with the exception that Mr. F. G. Sanborn was employed six months to assist in preparation of the exhibit of entomology.

The report of Mr. Dodge on that portion of the work referring to the Centennial, together with my own report on the *Homoptera*, is respectfully submitted.

TOWNEND GLOVER.

HON. FREDK. WATTS,  
*Commissioner.*

---

DEPARTMENT OF AGRICULTURE,  
*February 1, 1877.*

SIR: Upon learning your wishes in regard to the manner in which the museum should be represented at the International Exhibition in Philadelphia, three circulars were prepared, and were early sent out to a carefully-selected list of regular correspondents of the Department, in from three to six localities in different portions of the various grain, wool, or cotton growing States, for representative specimens of these products. Each circular so sent was accompanied with bags, labels, and directions for the shipment of specimens, so that no mistakes could occur, and the specimens themselves would not be liable to injury by careless packing. As fast as the samples were received at the Department, they were catalogued and numbered, the accompanying labels carefully filed, and the specimens prepared for exhibition, making, when complete, a collection of over 800 samples of wheat, barley, rye, oats, buckwheat, maize, &c.; 500 specimens of wool, many of the exhibition-jars containing series from different animals of the same flock; and 200 specimens of cotton, both seed and lint.

From the regular collection of the museum and other sources a full series of flax, jute, hemp, ramie, silk, and miscellaneous fibers, including paper-stock, were obtained, to complete the fiber exhibit. A large collection of tobacco was also made, representing a score of States, to which were added about a dozen specimens from the museum, and these, for the sake of uniformity, were pressed into boxes measuring 5 by 15 inches and 2½ inches deep; in all, nearly one hundred.

In addition to the above direct products of the soil and in connection with them, samples of their various manufactures were obtained and exhibited side by side, showing, in the case of the grains, the flours, starches, and fancy food products; with the wools and other fibers, the

fabrics manufactured from them, that any one at a glance might see the particular grade of wool or cotton entering into the composition of the fabric, and with the tobacco-samples the product in its prepared state.

The valuable collection of fruit and vegetable models, to which large additions were made, were renamed and mounted on blocks or standards that they could be better seen and examined. They were then transferred to Philadelphia, where the same plan of arrangement hitherto existing in the museum was followed out, showing the fruit as grown in various States, and illustrating their adaptability to given localities.

The large and valuable series of etchings on copper, comprising upwards of three hundred plates, prepared by yourself in leisure hours during the last twenty years, were transferred from the entomological rooms of the Department to Philadelphia as a portion of the exhibit in entomology, having been renamed up to the latest date from recent check-lists or works of specialists. In this series is illustrated not only the common and well-known forms of our noxious and beneficial insects, but many of the rare and little-known species from the far West, in public and private collections, in all many thousand species. Many of these are figured in all stages, from the egg to the perfect insect, with both sexes, and, in the *Lepidoptera*, with the upper and lower surfaces of the wings. Manuscript notes on the species were placed near at hand for those wishing to make references or desiring to learn more than the simple name of a given insect.

In the collection of economic entomology the usual plan of arrangement (according to classification) was dispensed with, and a plan adopted that was thought to be more purely agricultural and more in the interest of the farmer or fruit-grower. This collection, filling twenty-four cases or drawers, and numbering over 1,100 specimens, comprises the most common forms of injurious and beneficial insects in the United States. The collection is by no means complete, but serves to illustrate the plan of arrangement, which is especially adapted to cabinets of agricultural colleges, State museums, and similar institutions. The cases measure 16 by 21 inches and 2½ inches deep, outside measurement. They are made of whitewood or poplar, ¾ inch thick, dovetailed at the corners with the bottom rabbeted in. The sides are made of two pieces, forming the box proper, about 1½ inches high, and a cover 1 inch, which is grooved on the inner surface near the top (about ½ inch) for the reception of a plate of glass fastened in, when the box is made, with putty. The cover and box, where they fit together, are tongued and grooved, and are held together by brass hooks and eyes on either side.

The plan of arrangement is to show in one group the insect foes of a particular food-plant in the four stages of egg, larva, pupa, and insect, accompanied by specimens exhibiting the mode of injury, and classified according to the portion of the plant injured, as root, stalk, foliage, or fruit, to be followed by the beneficial insects known to destroy a particular species; in short, the idea of such a collection is to be able to show at a glance the entire history of any insect or group of insects affecting any of our food-crops.

In visiting such a collection, we will suppose the farmer, or fruit-grower, or student should desire to see the Colorado potato-beetle. The case devoted to the potato is opened, and he sees a dried specimen of potato-leaf, fastened upon a card-label, covered with little patches of the yellow, golden eggs of this insect; next he observes the larvæ, of various sizes, either in alcohol or prepared by "blowing;" then the pupa is shown to him; and, to complete the story, the male and female of the perfect insect are displayed, some in a state of rest, some with wings expanded, and others in various positions, to show marked portions of

the body. Then, if it were possible, a denuded potato-stalk should be shown, to exhibit the method in which they carry on their work of destruction; and, lastly, the army of parasites that help to check their ravages, with samples of chemicals and artificial contrivances in use by man to accomplish the same end, would close the short but instructive lesson. Each card should be labeled with the scientific and common names of the specimen, or with any information necessary to complete the history of the insects.

Should he desire to know what other species are destructive to the potato, in like manner he will learn the history of *Lema trilineata*, *Bari-dius trinotatus*, and other species. When an insect is a general feeder, it may be shown in the case devoted to two or three only of the plants it is most destructive to, though on the card-label the other plants it feeds upon should be named, or, if found on vegetation generally, the word "omnivorous" explains the fact.

The design of arrangement has not been as fully carried out as could be desired, chiefly for want of specimens, particularly those illustrating the early stages of the insects. The present collection, though, is a commencement, forming the nucleus of what may some day be the full realization of a complete cabinet of economic entomology. In colleges and other institutions, however—as is the case in our own cabinet—such a collection should be accompanied by a working collection, arranged according to families, tribes, genera, and species, in order that the student may familiarize himself with classification while studying the habits of insects in relation to our farm-products.

The groups exhibited in the twenty-four cases exhibited at the Centennial are as follows:

Case A.—Thirty-nine species of insects, destroying, either directly or indirectly, the root, stalk, foliage, or fruit (in the field and in the granary) of Indian corn or maize.

Case B.—Insects destroying (or proving injurious to) wheat, rye, oats, and other cereal crops. Twenty-two species.

Case C.—Insects destroying or injuring cotton. Thirty-three species.

Case D.—Insects destroying or injuring the potato, (*Solanum tuberosum*.) Sixteen species.

Case E.—Insects proving destructive to cucurbitaceous plants, as squashes, melons, &c. Seven species. Insects destroying milkweed. Twenty-five species.

Case F.—Insects destroying cabbage, turnips, &c., or the plants of the kitchen-garden. Twenty-eight species.

Case G.—Insects injuring the grape-vine or its fruit. Thirty-one species.

Case H.—Insects injurious to fruit, fruit-trees, &c. Twenty-six species.

Case I.—Insects destroying or proving injurious to the apple. Twenty-nine species.

Case J.—Insects that annoy the housewife, commonly called "household pests." Forty-one species.

Case K.—Insects aiding in the destruction of forest-trees. Thirty-seven species.

Case L.—Insects destroying the pine. Thirty-nine species.

Case M.—Insects destroying shade-trees. Twenty species.

Case N.—Insects injurious to man, by injuring or destroying the wood of various plants. Twenty-eight species.

Case O.—Gall-insects on oak. Twenty-seven species.

Case P.—Gall-insects of other plants. Forty-four species.

Case Q.—Insects destroying the eggs or young of fishes. Fourteen

species. Insects injurious or annoying to bees, to cattle, and to mankind. Thirty species.

*Case R.*—Objects of insect architecture, with the species employed producing them. Forty-eight specimens.

*Cases S and T.*—In these two cases are shown seventy species of the most common forms of our beneficial insects. (These should have been placed in the general collection, after the insects they are known to destroy, but it was decided to group them together for the present.)

*Case U.*—Thirty-one species of insects beneficial as scavengers by moving filth and carrion.

*Cases V and W.*—These two cases are devoted to silk-producing insects, and contain about thirty specimens illustrating this industry.

*Case X.*—In this case are gathered together a few insecticides, so called, and traps or devices for destroying insects.

The birds beneficial and injurious to American agriculture were shown in a case by themselves, labeled, as in the museum, with scientific and common name, and brief facts regarding benefit or injury, as well as suitable marks of distinction on the end of each perch, black to show the evil habits of the bird, and white to show the proportion of good by their destruction of noxious insects. With many of the specimens the contents of the stomach was exhibited to verify the statements upon the label.

The collection of domestic poultry was made almost complete by the purchase of 80 specimens of fowls, ducks, and pigeons, which were compared and exhibited with a careful selection from the collection already existing in the museum of the Department, and these, labeled with the name of breeds, formed an interesting exhibit for the farmer or poultry fancier.

The collections were arranged in sixteen walnut cases, built with the special object of transferment to the gallery of the museum when completed, in order that their great expense should not be lost to the Department, and were allotted a space of 40 by 60 feet. The arrangement of the grand whole is in an ascending series, beginning with the products of the earth, as grains, fruits, tobacco, cotton, wool, and other fibers; next, the insects which prey upon them and blast the hopes of patient labor; and, third, the birds which restore the balance, and render successful production possible by limiting the depredations of the countless hordes of insect spoilers.

Before leaving this subject, it may not be out of place to state that the Department is under obligations to many individuals and firms for aid in making collections for the museum, or for valuable donations of samples which could be procured in no other way, prominent among which may be mentioned:

The Lowell Manufacturing Company, series of samples illustrating manufacture of carpets; the Washington Mills, Lawrence, Massachusetts, a similar series illustrating the manufacture of woollen piece goods; Chas. A. Stevens & Co., Ware, opera flannels, wool, and manufacture; Amoskeag and Stark Mills, Manchester, N. H., through Mr. Reuben Dodge, samples illustrating cotton and flax manufacture. Various samples of paper-making materials and manufactured paper, E. Morrison & Co., Washington, D. C.; Holyoke Paper Company, Haverley Falls, Mass.; Askell & Smiths, Canajoharie, N. Y.; Dobler, Mudge & Chapman, and John A. Dushane & Co., Baltimore, Md.; Republic Mills, Springfield, Ohio, and others.

The thanks of the Department are also due to many of its regular correspondents, who aided materially in the success of the exhibition by their prompt response to the call for samples of grains and fibers.

While the Department was enabled by means of the Centennial Exhibition to add largely to its collections of native products of agriculture, far greater benefit was derived from it by the opportunity it presented for the acquisition of rare and not easily-obtained collections of the varied products of the agriculture of foreign countries. Through the earnest endeavors of Professor Baird, of the Smithsonian Institution, and by co-operation with him, the Museum Division has taken advantage of the opportunity presented, which has resulted in the securing of full collections of the products of the soil—direct and indirect—from various portions of the world; many from remote countries, curious and interesting, as illustrating the habits of the people, while exhibiting their agriculture, and all of such value and in such generous quantities, with few exceptions, that, when they are finally classified and arranged in the museum-hall, the display will be most complete.

For the most part the material is given as a donation to the United States for exhibition in its museums, although it is understood that the Department shall reciprocate by sending collections of grains and fibers of our own country, if such collections are desired. Some of the exhibits were presented in their entirety, without condition; from others the Department was allowed to select such specimens as were desirable in quantities sufficient for museum purposes, while with a few the specimens were secured by promise of exchange when the Department is enabled to secure the American collections for the purpose.

From the interesting exhibits of the Australian colonies a full series of grains and fibers were obtained. From Victoria, in addition to grain and wool samples, including thirty-two samples of the fine-wool collection of Hastings, Cunningham & Co., the Department was fortunate in securing a collection of miscellaneous fibers from over forty different species of fiber-producing plants, prepared by William R. Guilefoyle, director of the botanic gardens, Melbourne. This collection also includes fifty specimens of paper prepared from as many species of plants, nearly all of which are represented in the fiber-collection. Among the Victoria wheats secured, one variety weighed 68 pounds to the bushel, and not a few were up to 64 and 67 pounds. In all, several hundred specimens were obtained.

Samples of the remarkable wool exhibits from Queensland were secured, with about forty specimens of miscellaneous fibers, all of different species, with the exception of half a dozen samples of cotton and silk in the raw state. A fine series of sugars was also obtained, with a few samples of grain and tobacco.

The New South Wales donation consisted of a large series of wools, and some few miscellaneous fibers, including silk-cocoons; about twenty specimens of sugar, fifty specimens of grain, arrowroot, starch, flour, &c., and a series of preserved tropical fruits; tobacco, and other miscellaneous products. The South Australian and Tasmanian collections were very similar, numbering about one hundred specimens each.

From New Zealand, the valuable collection of one hundred and nine specimens of New Zealand flax, *Phormium tenax*, was received complete. It illustrates the textile in all stages of manufacture—even as rudely prepared by the natives, who strip the fiber with a shell—and includes articles showing the various uses to which it may be employed, as the manufacture of twine for making nets, coarse twine, small and large ropes, cables, halters, mats, matting, and even a fair quality of coarse flax cloth. A series of fine grains was also received, with about a dozen wool samples, native gum, starch, and miscellaneous products.

The Japanese donation includes one hundred and fifteen specimens of tea in bottles; specimens of tobacco, gums, varnishes, dye-stuffs, flour,

starches, and farinaceous products; and a valuable series of preserved fruits in alcohol, among them several varieties of the seedless persimmon, which is used for making wine and for preserving as a delicacy. A few bottles of sauces and wines were also presented. The most valuable acquisition, however, is the complete exhibit illustrating the silk industry of the country, as carried on by the natives, which was given without condition, and includes not only the silk of *Bombyx mori*, but *yama-mai* and other large silk-producing insects. In addition to about thirty samples of raw and spun silk, cocoons, &c., the collection is accompanied by all the implements, baskets, frames, cases, &c., used in feeding and caring for the worms and in preparing the silk; colored plates, with descriptions of each process, accompany each article, which make it not only an interesting but an instructive exhibit. The remainder of the fiber-collection of Japan given to the Department is contained in half a dozen large cases, and consists mainly of cotton and ramie, in various stages of preparation, with a few miscellaneous fibers.

The donations from Egypt include about two hundred varieties of cereals, seeds, &c., and a full series of Egyptian cotton samples. The Orange Free State also presented samples of its grains, as wheat, corn, millet, &c.

The Russian collection is very full and complete. The entire grain exhibit was turned over to the Department, there being in many cases a bushel of a given variety. Wheat, rye, oats, barley, linseed, cotton seed, grass-seed, beans, pease, &c., are embraced in this collection besides samples of nuts and other seeds not enumerated. In the dozen or fifteen varieties of vegetable oils presented are poppy, sunflower, and mustard oil. Twelve samples of beet-root sugar were secured from their fine display, and a few preserved fruits and liquors. The fiber-collection consists of samples of flax, raw and prepared, cotton, silk cocoons, and spun silk, and twenty samples of wools sent in the fleece. In addition to these specimens, two large ornamental cases of merino wool probably two hundred samples, were given entire.

Norway and Sweden presented their complete exhibit of grains and cereals, the latter country also giving about sixty samples of flour and food preparations, including the bread used by the peasants. This bread is made once a year, and is a large, round, flat cake some 10 inches across, made of rye or of wheat flour, and is quite palatable.

The Netherlands presented, without condition, the entire exhibit of the Zeeland Agricultural Society, with a number of miscellaneous exhibits of individual products, as chiccory, liquors, and oils from maize and other grain, medicinal preparations, &c. In addition to these collections, the large exhibit of the Holland Agricultural Society was secured by purchase, the Netherlands Commission offering to become responsible for two-thirds of the amount asked by the society if the Department would pay in cash the remainder, or \$50. The collection includes grains, cereals, seeds, fibers, and other products of the soil, and a series of dairy products, and the implements used in the native manufacture of cheese.

From Great Britain the Department received a very full classified collection of over three hundred varieties of wool from all parts of the world, arranged on a portable stand or table, in eight large glass-covered cases, and exhibited by J. L. Bowes & Brother, Liverpool. This collection was in reality presented to the Smithsonian Institution, and is deposited in the museum of the Department by it. Another remarkably fine collection of wool in the fleece was presented by Mr. Odeys, on condition that samples be preserved under glass.

Spain and Portugal each presented several hundred specimens of

grains, seeds, nuts, and various agricultural products, together with a small series of fibers, a portion of them from Philippine Isles.

Many of the South American exhibits were given almost unconditionally, and in two or three instances the Department was fortunate in securing the entire exhibit as it stood.

Brazil donated samples of all of its seeds and grains, some nuts, &c., with samples of flour, starch, *mandioca*, *tapioca*, and other native food products; native fibers, many of them curious and interesting, flax, cotton, silk in raw state, &c.; *maté*, cocoa, coffee, sugar, and tobacco—many kinds peculiar to the country—in the leaf and manufactured; wax, gums, oils, dyes, and a large collection of medicinal oils and other preparations, and *materia medica*, principally dried roots, leaves, barks, &c., of medicinal plants.

The agricultural display of Venezuela included thirty varieties of coffee, half as many of cocoa, specimens of grains, seeds, beans, pease, &c.; samples of native miscellaneous fibers, with a few of their manufactures; oils, liquors, and *materia medica*; also a series of fruits preserved in alcohol, in all, several hundred specimens.

A similar collection was also received from the Argentine Republic, much more valuable, however, in regard to its fibers, as it included a full exhibit of the wools of the country in the fleece.

The Chilean collection embraced a representative collection of the cereals and seeds of the country, with some minor products of agriculture; and a like collection from Peru includes, in addition, about forty samples of native wines and liquors.

Coming nearer home, Mexico presents samples of her agricultural products, and these, with a few small collections obtained from exhibits from our own country, complete the list of donations received from the exhibition, at its close, to be placed in our own museum.

In conclusion, I have only to say that when the gallery in contemplation shall have been erected in our Museum Hall, giving an additional space of 3,000 square feet, or 8,000 in all, and when appropriation shall have been made for the proper preparation and display of this valuable mass of material, the work will be commenced at once and pushed to completion.

Much time and labor, however, will have to be expended on the collection in classifying, arranging, and labeling, as samples in duplicate must be prepared from many of the countries for donations to other institutions; a condition required of the Department when the collections were presented. The Smithsonian Institution also desires a small series from each country represented, for exhibition in the Ethnological Hall of its Museum, when the whole shall have been examined and our own series displayed.

As to the advantages accruing to the Department in the possession of the material it has been so fortunate in securing, it is speaking within bounds to say that in fibers alone, in the number of specimens and value of the collection, the Museum is far ahead of any other Museum in this country, and is a rival of the Museums of the Old World, and that an appropriation of \$100,000 at any other time would hardly have proved sufficient for bringing together a similar general collection to the one now in the possession of the Department, which has been secured by very limited exchange, and by the simple cost of transportation to Washington.

I am, respectfully,

CHAS. R. DODGE,  
Assistant Entomologist.

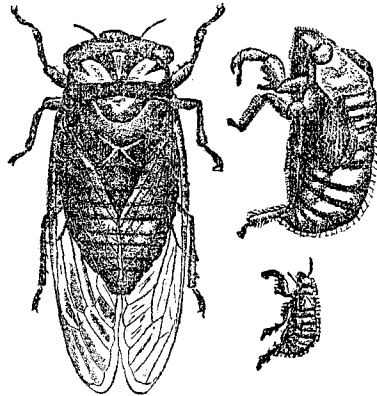
TOWNEND GLOVER,  
Entomologist.

## HOMOPTERA.

The suborder *Homoptera* of the order *Hemiptera* consists of insects having four membranous deflexed wings, usually lying over the back like the roof of a house, when the insect is at rest. The anterior pair of wings are usually larger than the posterior pair, generally transparent and net-veined. The mouth consists of a beak or sucker, which is used to pierce the outer cuticle of plants they frequent, and to suck out the sap in three of the stages of their existence. As larvæ, pupæ, and perfect insect, they are equally active and do much damage, feeding almost entirely upon vegetable substances, and when very numerous, as in the case of the *Aphides* or plant-lice, they do much injury to vegetation by sucking out the sap, thereby weakening the plants, shrubs or trees they frequent. As no recent reliable catalogue of the *Homoptera* has been published in this country, and only such old works as Amyot and Serville, &c., can be referred to, it has been thought best not to arrange these insects scientifically in this paper, but merely to allude to some of those best known to our farmers, or to such as are particularly distinguished by their destructive habits or singularity of form. This suborder has been very much neglected by our entomologists, who usually take more interest in the study and collection of the *Coleoptera*, (or beetles), and *Lepidoptera*, (butterflies, moths, &c.) in preference to the smaller and more inconspicuous insects, although the *Homoptera* contain some of the most grotesque and singularly-formed insects we usually meet with, such as *Entilia*, *Telamona*, *Ceresa*, and many others, which will be found described and figured in a later part of this report. We will therefore commence with the *Cicadidae*, or harvest-flies, incorrectly known in this neighborhood and elsewhere as locusts; the real locust being an orthopterous insect, very closely allied to our common grasshopper.

The harvest-flies are large insects, having a broad, short, transverse head, with large prominent eyes, and broad thorax. The upper wings are rather narrow, membranous, and deflexed over the sides of the body like the roof of a house. Our most common species in this neighborhood

No. 1.



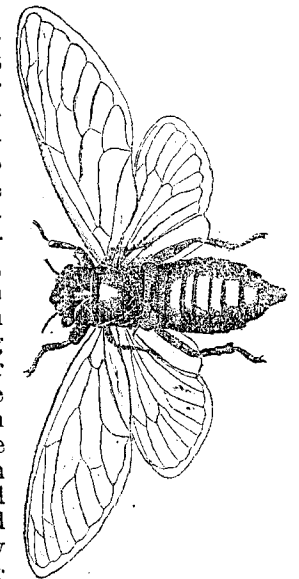
is the *Cicada pruinosa*, which may be heard in summer and autumn at almost any time making its peculiar trilling noise in the shade and forest trees in the grounds of the Smithsonian Institution. These insects are quite large in size, some of them measuring 2 inches or more from the front of the head to the tip of the closed wings. The males alone are musical, hence an old cynical writer observes: "Happy the cicadas' lives, since they all have voiceless wives." The musical apparatus producing the peculiar prolonged trilling chirp or cry made by the male is situated on the under side of the body, on the basal

ring of the abdomen, and consists of a pair of large plates, largely covering the anterior part of the body, which, acting like a drum, at the will of the insect produces the prolonged tremulous sound we hear so often in the tops of the trees they inhabit; if the tree on which

the insect is trilling be slightly struck by the hand, it will stop its musical serenade instantly and remain mute for some time. The perfect insect appears in May and June, and lasts until late in autumn; it is of a green color, shaded with brown. The outer edge of the wings is also green, and when the cicada is young and vigorous, it appears to be covered with a whitish dust or powder, which gradually disappears as the insect grows older. The female deposits her eggs in slits or incisions made in trees or plants, which she cuts with her ovipositor. The eggs remain in these longitudinal incisions for some time, according to the warmth of the season; when hatched by the heat of the sun, the young larvæ drop to the ground, and immediately bury themselves in the soil, feeding upon tender subterranean roots, which they pierce with their beak and then suck out the sap. It is a popular but erroneous idea that the females of this cicada are capable of piercing the skin of mankind and then ejecting a poisonous fluid into the wound, producing violent inflammation and pain. The insect itself is frequently carried off by a large burrowing wasp or hornet, (*Stirus speciosus*), which forms deep holes or burrows in the earth, where it deposits its egg or eggs in a half-killed cicada, which is intended to form a supply of fresh food for the larva until it changes into the pupa state, when it ceases altogether to feed until it emerges as a perfect wasp or hornet. Last season many specimens of this *stirus* were brought to the Department, having been caught in the very act of carrying still living harvest-flies to their burrows. The manna of druggists is said to be the concrete juice of a species of *Fraxinus*, or ash, in flakes, which is produced by a species of cicada, or, most probably, some other insect of the suborder *Homoptera*. The insects themselves are destroyed in great numbers by hogs, poultry, and various small animals; but as they never appear in such immense numbers as their relatives, the seventeen-year locust, they do very little, if any, damage to the farmer.

*Cicada septendecim*, or the seventeen-year locust, derives its specific name from the fact that it makes its appearance in certain districts at stated intervals of seventeen years in immense numbers, when the millions of them, swarming on the forest and fruit trees, almost deafen the observer with their trilling calls to the females, and form an abundant feast to the swine, fowls, &c., and wild animals on the land, and, if near a river or lake, to the fishes in the water. They sometimes injure fruit and forest trees by making their longitudinal slits or incisions in the young branches or terminal twigs, in which to deposit their eggs, many of the branches thus injured dying down as far as the injury, and afterward being broken off by high winds and literally almost covering the ground. The perfect insects make their appearance the last of May or beginning of June in immense swarms, and the earth in certain localities is literally honey-combed with the round holes which are made by the insects when issuing from the earth, these holes being bored sometimes through the hardest ground, and sometimes even through well-traveled country roads. After pairing, the females deposit their eggs, from ten to twenty or more, in longitudinal slits, made in pairs,

No. 2.



and penetrating to the pith in the terminal shoots and small branches of oak, apple, and other deciduous trees. These slits are made by the ovipositor of the female. The young larvæ hatch out in about six weeks, fall to the ground, and immediately bury themselves under the earth, where they are said to remain nearly seventeen years in the larval state, feeding on succulent roots of trees and shrubs. When about to change into pupæ, the larvæ work their way to the surface of the ground, shed their outer skins, and assume the pupa state, somewhat resembling the perfect insect, but having thick and strong fossorial digging fore legs, with only wing-cases, and utterly incapable of flight. This pupa state is said to last only a few days, during which the pupa remains near the orifice of its subterranean tunnel. Mr. Rathvon, however, states that in localities which are low and flat, and the drainage imperfect, they construct galleries of earth, 4 to 6 inches above ground, leaving an orifice for egress even with the surface, in the upper end of which the pupa would be found waiting their appointed time of change. They would then back down below the level of the earth and undergo their transformations in the usual manner. But in all the cases observed when these locusts or harvest-flies abounded near the agricultural college in Maryland, the pupæ were found in somewhat cylindrical holes or burrows, some of them having even burrowed upward through hard gravel roads, as before stated. When ready to change into perfect insects, they crawled out of these holes, made their way as best they could up the neighboring trees, stone fences, and rails, and attached themselves by the strong claws of their feet to some solid rough substance; the skins of the pupæ, hardened, split open down the back and thorax, and the perfect harvest-fly emerged into the open air from the dry old skin, after waiting some time to dry its yet damp wings, it eventually flew away to join its noisy companions on the neighboring trees. In these cases, however, no gallery whatever was made by any of the larvæ observed, but the insects emerged from simple holes in the ground. The situation was high, the soil gravelly, with no swamps in the immediate vicinity. For weeks afterward the trees and fences were literally covered with the dried-up and split skins of the pupæ still clinging to them by means of their strongly-hooked claws, appearing to the casual observer as if they were still alive and in the act of ascending the trees. At the end of the season many of these insects were observed flying about the Maryland woods with only about two-thirds of the abdomen remaining, and that portion perfectly dry and hollow, as if the end had been bitten off by domestic fowls or other birds or broken off by accident; sometimes, however, the hollow portion was partially filled with a brownish powder. On this subject Dr. Leidy, in the Proceedings of the Academy of Natural Sciences in Philadelphia, states that the cicada is liable to be attacked by a peculiar fungus, the posterior portion of the abdomen of the male insects being filled with a green fungus. The abdomen of the infected males was usually inflated, brittle, and totally dead while the insect was yet flying about; when, upon breaking off the hind part of the abdomen, the dust-like spores would fly as if from a small puff-ball. Mr. R. W. Ward, of Ohio, in the American Entomologist, (vol. 1, p. 117,) states that this mold or fungus seems to be a drying up of the membranes of the abdomen, and it is generally of a brown color, dry and brittle. He thinks, likewise, that these males in copulation break off one or more of the posterior joints of the abdomen, and that this "dry-rot" may be the result of the broken membranes. He adds, also, that he never found a perfect male thus affected in the early part of the season. Some naturalists assert that there are two, if not more, varieties of this insect: one appearing

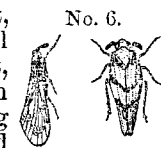
at intervals of seventeen years, while another comes every thirteen years. These insects are frequently carried off by the digger-wasps as food for their young, in the same manner as the *Cicada pruinosus* before-mentioned. Madam Meriam states that one species of cicada is very destructive to the coffee-plants in Surinam, but our species do not appear to do much permanent injury, excepting when exceedingly numerous, and then only to the terminal shoots and branches, where the eggs are deposited. The general color of the seventeen-year cicada is of a rich yellow or orange-brown, varied with a darker color; the outside edges of the wings are of a light rich buff or orange brown, by which alone it can be distinguished from its relative *Cicada pruinosus*, which is of a green color, with the edges of its wings also green. It is also much smaller, the figure of the insect No. 2 being taken from an extra large specimen.

*Otiocerus coquebertii* is a small insect of a somewhat elongated form and having a small projection in front, resembling the lantern No. 3. of the true fulgora or lantern fly of Surinam, but on a very diminutive scale; it feeds on the wild grape, beech, and oak; it is 0.35 to 0.42 in length, and of a yellowish-white color, with a bright carmine red stripe running longitudinally along each side of its wing, and which stripe is usually forked at its hinder end. This insect is 0.42 in length; it was quite rare near the Maryland college, and was taken by beating among the bushes with a common insect-net. The genus *Otiocerus* is remarkable for possessing long slender cylindrical appendages attached to the base of the antennæ. Another insect of the same genus, *Otiocerus amyottii*, is found on hickory and walnut. As these small insects, however, do very little injury to the farmer, we will not propose remedies, but refer to the remedies for *Tettigonia*, *Erythro-neura*, and *Aphis*, which will answer equally well for most of the tree-hoppers should they become very numerous and troublesome.

A small *Fulgora*—*Scolops (Fulgora) Sayi sulcipes*—is a most singularly-formed insect; the front part of its head being much prolonged, and projecting upward like a thin curved horn. When dried in a cabinet it is of a light-drab color, and is found among brambles and weeds in meadows. It is not very rare in the neighborhood of the Maryland Agricultural College in July and September, and may readily be taken in a sweep-net; but as it is very active and leaps well, it frequently escapes capture; in length, to the tip of its horn-like prolongation, it measures 0.40.

A small homopterous insect, *Phylloscelis atra* (var. *pallidescens*) is No. 5. not uncommon among the brambles and weeds in meadows in Maryland; it is of a singular round or broad oval shape, being about 0.20 in length by 0.13 in breadth; the fore thighs are much thickened, and the hind tibiae or shanks are quite long and spiny on their outer edges, and are fitted for leaping; it is very active. The color of this insect is black, having two orange-brown stripes on the thorax, two longitudinal stripes of the same color on the outer wings and on the border of the scutel. There is another variety, entirely black, found in the same situations, and the two varieties are frequently taken at the same time when sweeping for other insects.

The genus *Delphax* is here represented by a small insect, *Delphax carinata*, in form somewhat resembling a very small cicada, having wings sloping like a roof, almost transparent, and veined, and bearing three oblique bars of a brown color, meeting at the ridge. It was taken when beating in grass and meadows; length, 0.20; it is likewise found





among young pine trees. Dr. Packard states that another insect of this genus, *Delphax arvensis* of Fitch, is an insect of a pale yellow color with elytra and wings nearly pellucid, and that it is common in wheat fields early in June, but he does not state what it feeds upon, or whether it injures the wheat.

*Oliarius*, n. sp., is a small insect about 0.35 in length, with transparent wings, having a dark spot about two-thirds of the way down the outer margin. The body is dark green, or almost black, with rings of abdomen tinged with reddish. It was taken among high weeds and brambles, on blackberries, in a meadow near the Maryland Agricultural College, and as its natural history and food are not known, and the insect itself is somewhat rare, it has been figured here, in order to induce young naturalists to observe its habits and make them known to the public.



No. 8. *Amphiscepa (Flata) bivittata* is a small insect, 0.30 in length, having its upper wings somewhat broad and rounded, like the wing of the common white butterfly. They are somewhat veined, and rise abruptly from its sides at an acute angle or wedge-form, resembling a very steep roof. There is a broad, lateral, dark-reddish or brown stripe running down the middle of its back. Its general color is pale green, and, when resting on a blade of grass or green leaf, it is scarcely to be distinguished from the substance on which it rests. It is not uncommon in Maryland in grass-meadows and where brambles are abundant.



*Ormenis (Poeciloptera) septentrionalis* resembles *Amphiscepa bivittata*. No. 9. very much in both form and color, but is much larger, being 0.40 in length to end of wing-covers, and is found in the same situations, being frequently taken with it in the same sweep-net. It also frequents the May-apple (*Podophyllum*) and grape.



No. 10. *Ormenis (Poeciloptera and Flata) pruinosa*, the mealy flata or frosted tree-hopper, in general form and appearance, resembles the other insects of the genus *flata* before mentioned, being strongly compressed and wedge-shaped. It is about 0.35 in length to edge of wing-covers. Its height is pretty near double its width. It feeds from July to September on the sap of leaves and succulent shoots of various plants, among which may be enumerated rhubarb, gooseberry, plum, privet, grape, &c. The color of the insect itself is plumbeous or dusky bluish, and when young it is covered with white meal-like powder, giving it a hoary appearance. It is very common in Maryland among grass and rank herbage, but does not appear to do any damage to the plants above mentioned.

We will now proceed to insects related to the genus *Membracis*, some of which present most extraordinary and grotesque forms, and which, when resting on small branches or twigs, resemble thorns or excrescences so much that they are frequently passed by unnoticed. We will therefore give some figures to exemplify the singularity of their appearance.

*Enchenopa (Membracis) binotata*, or the two-spotted leaf-hopper, is a No. 11. most singularly-formed insect, its thorax having a compressed horn in front extending above the head; when perched upon a dry stalk it has somewhat the appearance of a miniature bird with a long arched neck. It is 0.45 in length to the tip of horn; of a brown or blackish color, and has two pale yellow spots on the edge



of its back. This insect punctures the leaves and extracts the sap from the butternut, hop-tree, and locust; it also is found on weeds. In Maryland it is common on locust, and may sometimes be seen in great numbers arranged in a line on a twig or branch near the body of the tree busily employed in sucking out the sap, which attracts myriads of ants, in the same manner as the so-called honey-dew produced from the anal tubercles of plant-lice.

*Tetamona ampelopsidis* is a curious tree-hopper, about 0.50 in length to the tips of its wings, of a brownish-gray color when dead and dried, and a large and somewhat square hump projecting from its back, which slopes or leans slightly toward the hinder part of its body. As its specific name implies, it is found on the *Ampelopsis*, or Virginia creeper, but also frequents grape-vines, and is rare in Maryland.

No. 12.



*Entilia (Membracis) concava* is a very small tree-hopper, 0.15 to 0.18 in length, with the ridge of the back somewhat elevated in front so as to form a slight concavity in the middle, or rather before the middle part of the back; the body is marked with dilated punctures. It is of a dark color, and quite inconspicuous in appearance; it is taken on weeds.

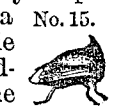
No. 13.



Another species, *Entilia (Membracis) carinata*, has the ridge of its back or keel deeply scooped out in a complete semi-circle, so as to make a kind of protuberance in front, separated from a square leaning hump on the ridge of its back by the aforesaid scooped out semi-circle; it is 0.20 in length, and of a brown color, and has been taken on potato-plants, but is quite rare in Maryland.



*Ceresa bubalus*, or the buffalo tree-hopper, is a very singularly-shaped insect, being broadest in front and shaped something like a beech-nut anteriorly, with a short sharp point at each side jutting out horizontally like the short horns of a bull, and ending also in a sharp point; it forms a kind of triangle on the front part of the insect, and presents a very singular appearance, especially as when viewed from the back; it grows narrower until it ends in a sharp angle at the ends of the wings. The insect is about 0.30 to 0.40 in length, of a green color, and has transparent wings sloping like the roof of a house. This insect is common on a variety of trees in Maryland, apple, peach, grape, and willow, and, when on the locust, generally stations itself in an angle where the leaf-stalk arises from a branch, and where it is almost hidden away. The eggs are deposited in a short curved row, in a series of punctures made by the ovipositor of the female in the bark and sapwood. The larvæ are shaped something like the perfect insects, but are somewhat spiny; as perfect tree-hoppers they are very active, and leap with great agility on being disturbed, and feed on sap of apple and peach trees, willow and grape-vines, and have been accused of injuring the stems of grape-vines by the punctures they make in which to deposit their eggs. The color of the insect being green, it is not very readily distinguished from the leaf itself when in a state of rest.



*Ceresa diceros* resembles *C. bubalus* very much in outward appearance, but appears to be somewhat smaller, and differs also in being marked with three or more dark brown spots on its upper wings; it is frequently swept up in the same net when beating for other insects on low bushes and in tall herbage or grass. In Maryland it is tolerably common.

No. 16.



*Thelia bimaculata*, or two-spotted tree-hopper, is 0.45 to 0.50 in length;



No. 17. it is a brownish triangular insect, shaped like beech-nut, with a long horn running obliquely forward and upward overhanging the head, compressed and rounded at the end; it has a large, bright yellow or dull gray colored spot on each side. The male differs from the female in the shape and size of its dorsal horn as in the fig. 18, and has been known as another species under the name of *T. acuminata* it has been taken on locust.

*Smilia (Membracis) inornata*, or the unadorned tree-hopper, resembles *Ceresa bubalus* in size and color, but has no horn-like projections on each side and is uniformly rounded in front and on the back, giving it the appearance of being hump-backed; it is shaped somewhat like a beech-nut, and of a light green color, fading to a light yellow in some specimens; the wings are hyaline or glassy, and deflexed at the sides like a roof; it is 0.35 in length, and found on oak and chesnut in late summer and autumn.

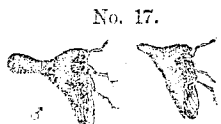
*Stictoccephala (Smilia) inermis*, or the unarmed tree-hopper, resembles No. 19. *Smilia inornata* in general form, but is more rounded on the back. These insects in late summer and autumn make short straight incisions in the bark of small limbs and twigs of pear and chestnut; the eggs are then deposited in these incisions and hatch out in spring, when the larvæ, pupæ, and perfect insects suck out the sap and thus weaken the trees. The insect is about 0.28 in length, of a uniform pale green color, fading to dirty yellow; when dried the wings are hyaline, and when disturbed it leaps with great agility; it is not uncommon in Maryland, and is frequently taken when sweeping with a net for other insects among grass and weeds and brambles; it has been taken likewise on chinquapin bushes.

*Smilia (Membracis) vau*, or the V-marked tree-hopper, is found on No. 20. walnut, hickory, and oak, where it punctures the young branches with its beak, or sucks and drains them of their sap. These insects are about 0.25 in length, with thorax not greatly elevated, but rounded in front, and acutely carinate from before the middle to the posterior tip. These insects are very variable in color, but in dried specimens they are of a dirty yellow, with V-like marks on the back. The thorax forms a high arched crest over the body. The figure is magnified somewhat.

*Archasia galeata (Fab.) (Smilia auriculata* of Fitch) is a very singularly-shaped tree-hopper, about 0.35 in length, having a very high rounded back ending posteriorly in a sharp point; its color when dried was of a brownish-yellow and evidently very much faded; it has been taken on prairie *Eupatorium* and *Verbena hastata*.

*Hoplophora quadrivittata* is a short, thick-set tree-hopper, about 0.35 in No. 22. length; dried specimens of this insect are of a grayish color, having two short and two longer longitudinal lines of a pinkish color on its back anteriorly; it was taken with a sweep-net among weeds and bushes, and is rare, but frequents oak.

*Cercopis bicincta* is a very pretty insect, with body sanguineous, (Say,) No. 23. thorax blackish, a rufous band on the middle wings, or hemelytra blackish, with two yellow or orange bands running across them; it was taken very sparingly when beating with a sweep-net among weeds, grass, and brambles; the insect is about 0.45 in length. Some of the *Cercopidae* are said to secrete a saccharine substance which is devoured by ants.



*Aphrophora (Cercopis) quadrangularis* is a small, broad, quadrangular insect of a light brownish-drab color dried, having a square or rather diamond brown linear mark on its back, and is about 0.35 in length. This insect is also known as the frog or cuckoo spittle-insect, as its larva lives in a kind of foam or froth formed on various plants, shrubs, and trees by the larva sucking the sap from the plant by means of its piercer or sucker, and then ejecting the said sap and discharging it through its body, forming small bubbles like froth or foam, and effectually concealing the larva from its enemies; it lives in security until ready to change into the perfect insect. In Maryland the negroes believe that the small forest horse-flies, so numerous in the woods, are produced from these spots of foam, and it is almost impossible to convince them to the contrary. In Vermont these insects are accused of injuring the crops of hay; it is also found on brambles. The larva of a species of *Aphrophora* and the frothy substance produced by it on rag-weed is figured here to show the appearance of the foam as it is formed on the plants.

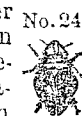
The larva of *Aphrophora (Membracis) parallela* in June and July forms a spot of white froth upon the bark near the end of the branches of white pine; the perfect insect is 0.50 in length, of a flattened and somewhat oval form, and has its wing-covers deflexed like the roof of a house; it is of a brown color, with blackish punctures on a pale ground, with a smooth whitish line along the back, and a small, smooth whitish spot in the center of each wing-cover; it frequents pine woods, and is very plentiful in Maryland.

The larva of *Aphrophora (Membracis) quadrinotata*, or the four-spotted spittle-insect, is frequently to be found enveloped in a spot of foam on the branches of the grape-vine; this insect is 0.33 to 0.35 in length, of a flattened form and brownish color; it has a blackish spot or mark near the tip of its wing, another on the outer margin, and a third at the base of the upper wing-covers; as it is found so plentifully sometimes on grape-vines, in all probability it deposits its eggs on or in the branches, which, when hatched out into young larvæ, suck the sap and weaken the growth of the vine. Insects of the genus *Aphrophora* are carried off by a hymenopterous insect, *Gorytis*, to provision its nest and serve as food for its young.

*Clastoptera (Cercopis) proteus* is a small insect, very prettily marked with yellow and black, but is somewhat variable in its ornamentalations; it is only 0.15 in length, and is found in cranberry and blueberry fields; no special complaints of its noxious habits have been received by the Agricultural Department, although various agricultural papers say it is a great pest to Eastern cranberry-growers, injurious to the cranberry culture. Flooding the fields for a couple of days would effectually remove them. The figure is considerably magnified.

*Clastoptera (Cercopis) obtusa*, the obtuse or blunt *Clastoptera* is a small, short, broad, and blunt insect, nearly circular in form; it is 0.25 in length, and of a grayish-brown color in dried specimens, which, when strongly marked, are described as having three brown bands anteriorly and a dark spot near the tip; in the large specimen figured these spots are not shown; it is found on the black alder.

*Proconia undata* is a tree-hopper, of a brown or blackish color, hav-



No. 30. ing the head, thorax, and posterior extremity of a lighter and brighter brown color; the head is broad, and blunted in front, and the insect itself is of an elongated form, 0.50 to 0.55 in length, and when young is covered with a bluish powder, which, however, in old insects appears to have been rubbed off. These insects are injurious to the grape-vine, as they are said to puncture the stems of the bunches of grapes, thus causing them to wither and drop off. It also sucks the sap from the branches and deposits its eggs in slits made in the stems in single rows. In certain localities this insect is quite common, and may be taken by sweeping with insect-nets the weeds and bushes in the immediate neighborhood of grape-vines or among weeds and bushes. In the woods they probably frequent the wild grape-vine, and are very common in Maryland on blackberry-bushes.



*Celidea (Jassus) sub-bifasciata* is a tree or leaf hopper, about 0.35 in length, having brownish transparent wings, with two (or more?) broad brown stripes across the wing-covers. It is very active and difficult to capture, except in long sweeping nets brushed through grass and weeds in meadows, but is found on black alder and brambles.



*Aulacizus (Tettigonia) mollipes* is a long and somewhat narrow leaf No. 32. hopper, with a very long triangular head. It is of a green color, and is about 0.35 in length. It is very active, and leaps, like the rest of the genus *Tettigonia*, with great agility, it was taken among weeds and brambles, in meadows, grass, and cypress.



The leaf-hoppers *Tettigonia*, *Erythroneura*, &c., are small leaping insects, very destructive to plants, and especially to the grape-vine, whence they are commonly but erroneously called thrips, which is quite a different insect, and will be found figured under the *Orthoptera*. These insects swarm upon certain plants, and in all their states, as larva, pupa and imago or perfect insect, are very active and destructive, as they pierce the outer skin of the leaf or bark. They suck the sap until the foliage turns yellow or brown, gradually withering away and dying, leaving the cast-off coats of both larva and pupa adhering to the surface of leaf, (generally on the under side,) resembling small white specks of semi-transparent skin.

*Erythroneura (Tettigonia) vitis*, or the vine-hopper, is a pretty fair specimen of all the leaf-hoppers; we will, therefore, give a condensed history of their habits and natural history. These insects are supposed to pass the winter in the perfect state, hibernating among fallen leaves and other rubbish. Some naturalists, however, deny this, and say that the eggs for the spring brood are laid during the preceding autumn. However this may be, the young larvæ appear in June, from eggs laid by the females which have survived the winter. The larvæ differ from the parent insects chiefly in not possessing wings, but they are able to leap with great agility when disturbed, and are equally as destructive as the perfect insect, as from the time they are hatched they suck the sap from the leaf and injure the vitality of the plant. In general, they frequent the under side of the leaves, and sometimes appear in such numbers as to be a great annoyance to casual passers by, and so injure the vines as to cause the foliage to turn yellow or brown, and finally to become dry, stiff, and brittle, and fall off. These insects, as before stated, are generally, but erroneously, known to our farmers as thrips. They cast their skins at least three times, leaving their old cast skins like white specks on the leaf, and are very lively, hopping away like fleas when disturbed. They attain maturity in June and July, fresh broods appearing throughout summer and autumn until the end of the season.

When fully grown, the larvæ acquire perfect wings, and are able to fly from vine to vine, where they lay fresh eggs for future generations. The real *Erythroneura vitis*, or grape-leaf hopper, is described as of a pale yellow color, with two blood-red bands and a third dusky band at the apex. The anterior band occupies the base of the thorax, wing-covers, and scutellum; the middle band ends in a much narrower, nearly square, spot on the middle of the outer side of the wing-covers; it is 0.13 in length. For the destruction of this insect syringing with strong tobacco-water has been recommended, also dusting with lime, sulphur, hellebore and red pepper, and fumigation with tobacco. Syringing with very dilute carbolic acid and water have also been recommended, but are said not to be of much utility unless applied almost every day. Carrying a lighted torch through the vineyard at night is said to destroy multitudes, as, attracted by the fire, they fly into the flame and are burnt. This should be repeated at short intervals. Spading up the ground in the immediate vicinity of the vines late in the autumn and early in the spring would probably expose the perfect insects to the frost and cold, if it hibernates as before stated. In a green-house or grapery, a large, somewhat shallow vessel, similar to a washing-tub, partially filled with water, might be placed, and a small quantity of oil poured over it so as to form a slight film upon the surface, and a brick placed in the middle of the tub with one end above the level of the water and oil, on which to place a candlestick or lantern, so that at night the candle or lantern might be lighted, and the vines disturbed, when many of the insects, naturally flying around the light, would fall into the tub, and the oil clogging their wings, they could not escape.

*Erythroneura (Tettigonia) basalis* is the most numerous species in this vicinity, and differs very much in ornamentation, some of them being very much spotted with red, while others have almost spotless wings and a mere reddish tinge here and there. It is very small, and about 0.05 in length.

No. 33. *Dicrocephala (Tettigonia) quadrivittata* is a very pretty insect, 0.35 in length, and is of a light-green color, with four distinct longitudinal stripes, meeting on apex or edge of the wings. We have taken these insects near grape-vines, but they appear to be more numerous in meadows and amid rank herbage and blackberry-bushes. These figures are magnified.



The *Psyllidæ* are small insects, very much like the *Cicada*, or harvest-fly in miniature, having the wings of both sexes deflexed at the sides of the body. As larvæ, pupæ, and perfect insects, they subsist on the juices of plants; the larvæ are flat. A very pretty species, *Psylla rhois*, having deflexed black wings and an orange-yellow thorax, is very common near the Maryland Agricultural College in July and August on the common sumach; it is very small, being only about 0.10 in length. The figure is magnified.

*Psylla pyri*, or the pear-tree flea-louse, is very injurious to the pear-trees. It is also found on apple-trees, and we have taken them in New York as late as the middle of December sucking out the sap. The pupæ of *Psylla pyri* are very small, of a flat form; the wing-cases are black; the abdomen and body are yellow, barred with black, and the thorax is also yellow, or brownish, spotted or ornamented with black. The perfect insect is about 0.20 to 0.25 in length, and has four transparent wings, which, when the insect is at rest, form an angle over the body like the roof of a house. These wings are hyaline, veined with black veins, and



having a blackish spot or mark on the lower side of the upper pair. The larvæ, pupæ, and perfect insects appear to prefer the side of a branch just above a bud or in the axils of the leaf-stalk, and the heads are generally hidden under the bud. These insects appear to be gregarious, and fond of herding together in groups of two or more. They elaborate and void a sweet clammy substance like honey-dew, derived from the sap of the tree, which, falling on the leaves and limbs below, gather all the dust and dirt, causing the tree to have a very filthy appearance. This so-called honey-dew is generally found on the upper surface of the leaves and branches, and evidently comes from insects feeding directly over or above the clammy places. As it is voided it falls on the leaves below, and is eagerly sought after by ants, which, when a tree is much infested by *Psylla*, may be seen in swarms running up and down the trunk.

The same remedies may be recommended for these insects as are mentioned for plant-lice and leaf-hoppers. They are also probably destroyed by chickadees and golden-crested wrens, as we have seen these little birds hanging head downward on a particularly-infested tree in November and even in dead of winter, busily employed in searching every hole and corner for hidden insects. The figure is magnified.

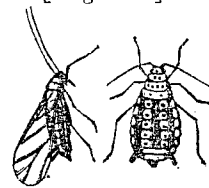
The *Aphides*, or plant-lice, are exceedingly injurious to horticulture, inserting their long beaks into the tender shoots and leaves of plants and then sucking out their sap. These insects are generally of very small size, having antennæ of 5 to 7 joints and a long three-jointed beak, or proboscis, for puncturing plants, and then sucking out the sap. Their bodies are soft, rounded or flask-shaped, and apparently only consist of a skin filled with a liquid; their legs are long and very slender, and many of them have two upright processes or tubercles on the hind part of the abdomen, from which a sweet gummy substance is occasionally ejected, which is eagerly sought for by ants and other small insects. The wings are generally transparent, and the upper pair are much larger than the lower, and are furnished with strong nervous veins, which pass outward from the costal or outer marginal vein; the wings are very much deflexed at the side of the body when the insect is at rest. Dr. Burnet states that in early autumn the colonies of plant-lice are composed of both males and females; the female after pairing deposits her eggs and dies. Early in the spring the eggs are hatched, and the young plant-lice puncture the plant, suck the sap, and increase in size, the whole brood consisting of individuals capable of reproducing their species without any connection with a male by species of gemmation or budding forth. These summer broods are wingless. The second generation and several others pursue the same course, being sexless, or at least without the trace of a male among them, and so on indefinitely until the autumn, when winged individuals are produced, which lay eggs for the spring brood of sexual individuals. Bonnet obtained nine generations and Daubigny seven by this process of gemmation in one season, and Packard states that *Aphis dianthi*, the plant-louse of the pink, continued to propagate by gemmation without any males for four years, in a constantly-heated room. It has been supposed that the final autumnal set of plant-lice were males and females alone, but Dr. Burnet states that on examining the internal organs of the winged individuals many of them were not female proper, but simply the ordinary gemmiferous or summer form. As there are peculiar plant-lice infesting different plants, the number of species must necessarily be very great.



As before stated, ants are very fond of the sweet gummy substance mis-called honey-dew, which is ejected from the anal tubes of plant-lice, and it has been repeatedly stated on good authority that the ants capture the plant-lice, carry them to their nests, and keep them there, like milch-cows, for the sake of having a good supply of their favorite food near at hand. Dr. Walsh states that *Aphides* feeding on annual plants hibernate in the imago or perfect-insect state. To show the injury done in England by these minute insects, Kirby and Spence long ago stated that their damage to hops alone made the difference of the duty often as much as £200,000 (or in the neighborhood of \$1,000,000) per annum, more or less, in proportion as the fly prevailed or otherwise. Happily, however, plant-lice are subject to a great many enemies which materially diminish their numbers. Almost all the lady-birds (*Coccinellidae*) feed upon them in both larva and perfect state. Minute hymenopterous insects, such as *Aphidius*, &c., lay their eggs in the body of the plant-louse, which, hatching into little grubs, eat out their interior and thus destroy them. (See *Hymenoptera*.) Several plant-bugs, *Nabis ferus*, *Phymata crosa*, *Reduvius raptorius* and *multispinosus*, pierce them with their beak, and suck out their juices. (See *Heteroptera*.) *Syrphus* and *Leucopis*, two-winged flies, also destroy them, (see *Diptera*;) *Chrysopa*, or the lace-wing fly, and *Agrion*, a dragon-fly, (see *Neuroptera*;) feed upon them, and many others, too numerous to mention here, all join in this indiscriminate war upon the helpless but noxious plant-lice. If any person interested in grape-culture will take a single leaf of a grape-vine infested with plant-lice and observe it closely, he will see several individuals differing from the rest, being much swollen and of a grayish-brown color, instead of the usual green, and each having a round hole in the abdomen. This is done by a small hymenopterous or four-winged fly, which deposits its eggs in the body of the doomed plant-louse, which, hatching into a minute grub, devours the inside of its victim, and after changing into a pupa inside the body of the aphid and finally into the perfect fly, cuts its way out into the open air, and emerges through this circular hole in the skin to lay the foundation of new broods of aphid-destroying flies, leaving the empty hard gray skin of its victim still clinging convulsively to the leaf. The number of these empty skins with holes in them on some of the vine leaves will testify how much good this little insect does to the grape-culturist by destroying his enemies. *Aphides* are likewise destroyed by other hymenoptera, *Passalæus mandibularis*, which stores them up in its cell or nest as food for its young. *Trypoxylon*, *Allotria*, and many of the *Chalcididae* and other *Hymenoptera* are also benefactors by destroying multitudes of these troublesome plant-lice.

*Aphis mali*, apple plant-louse. The females deposit their eggs, which are small, oval, and black, on twigs and bark in the autumn; the insect is hatched out the next spring, and feeds upon the sap of the tree. The first broods are all females, which in a short time, without any intercourse with the males, give birth to living young by the process of gemmation, as before described. These also produce other young ones, which are all females as long as the summer lasts, and it is only in the autumn that males are produced, which, uniting with the females, become the parents of the eggs for the following spring brood, thus bearing living young all the summer, and laying eggs which can withstand the frosts of the winter in autumn for the following spring season, while the parent insects in winter are de-

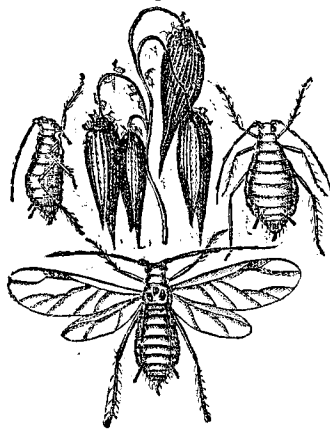
No. 37.  
[Magnified.]



stroyed by the wet and cold weather and alternate freezing and thawing. These insects, as larva, pupa, and perfect insect, are found generally on terminal shoots and on the under side of leaves, which become distorted and unhealthy from their repeated attacks. The male is winged, and has a blackish thorax, and is 0.05 to 0.08 in length to the end of abdomen. The female is green, with a row of black marks down each side, and has no wings, and is rather larger than the male. The insects eject a species of honey-dew, or sweet, sticky substance, from two projecting horns or tubercles on each side of the hinder part of the abdomen, which is greedily eaten by ants and other small insects.

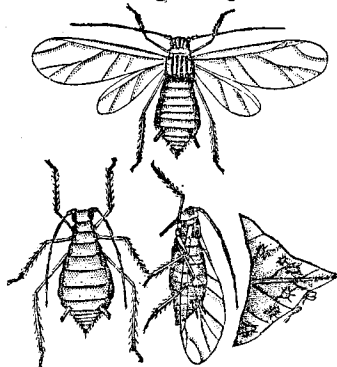
*Aphis avenae*, grain or oat-plant louse, does much injury to grain, especially to oats, but is also found on wheat, rye, and other cereals. Their habits are much the same as the before-mentioned plant-lice, excepting that it is said that although their honey-tubes are well developed, these insects emit no honey, and in consequence, are not followed by ants. It is also stated that they freeze on the stalks in winter and revive in the spring. The colors of some specimens sent for examination to the Department varied considerably, some of them being of a livid or dull green, while others were of a decidedly brown color. The feet and knees are generally of a darker or nearly black color; length, 0.05.

No. 33.  
[Magnified.]



then they are more liable to succumb to the attacks of these insects

No. 39.  
[Magnified.]



as by sucking out the sap they distort the stems, and in fact frequently kill the plants before they have attained sufficient maturity and strength to withstand their repeated attacks. Their habits are much the same as the rest of the *Aphides*, and their colors vary from green to a decided yellow, striped with black on the upper side of the thorax. A more full description of them may be found in the Patent-Office Agricultural Report for 1855.

*Aphis persicae* is destructive to the peach-tree. Harris says that larvæ, pupæ, and perfect insects live together in crowds under the leaves, causing them by their punctures to become thickened and curled, forming hollows with corresponding crispy and reddish swellings above, and finally to fall to the ground. But may not this so-called curl be caused by a fungoid growth or by a sudden change of temperature, as sometimes the *Aphides* are not seen until long after the curl has been observed and frequently not a single plant-louse is to be found in or on the badly curled and deformed leaves? We have, moreover, often observed that this so-called curl appeared almost immediately after very cold nights and warm days in the spring, and the leaves were yet very young and tender. These deformed leaves frequently fall off and are replaced by

others before the end of the season, but it must necessarily very much injure and weaken the tree to lose its leaves before its natural season for shedding them. Winged individuals of the Harris peach-tree plant-louse are described as black, with the under sides of abdomen dull green; shanks and bases of thighs dull brownish, and the horns or honey-tubes as long as the abdomen. Dr. Fitch considers it different from the peach aphid of England. Colonel Wilkins, of Riverside, near Chestertown, Md., a very extensive peach-grower, last spring wrote to the Department of Agriculture that an aphid or plant-louse similar to those infesting his peach-tree leaves was at work on the roots also, and was killing them by hundreds. Prof. P. R. Uhler, of the Peabody Library in Baltimore, to whom Colonel Wilkins applied, visited the infested peach-orchards, and found the statement to be perfectly correct, and that an underground aphid or plant-louse, not differing from those on the leaves, was doing immense injury to the young trees by sucking out the sap. Professor Uhler also stated that both insects are different from the *Aphis persicae* above mentioned, and probably is a new species, closely allied to, if not identical with, the *Aphis chrysanthemi* of Europe. The insects on both roots and leaves were about 0.08 in length, with the contour of a broad Florence flask, of a blackish-brown color, and the two varieties could not be distinguished from each other when placed side by side. If these peach plant-lice work under ground on the roots, would it not be advisable to saturate the earth around the trees with hot whale-oil, or soft-soap suds, or dilute carbolic acid? Tobacco or lime water poured around the roots in spring as soon as the frost is out of the ground might destroy the first broods and thus diminish their numbers. Quassia chips, soaked in boiling water, have also been recommended, and perhaps boiling water poured over the roots in the spring might destroy them, but might also injure the tree, although many farmers who have tried the boiling-water process, as recommended for the peach-tree borer, (*Algeria exilis*), a lepidopterous insect, have reported that the insects were destroyed, while the trees remained uninjured. These experiments, however, were tried in winter, when the trees were torpid. When in greenhouses, plant-lice may be destroyed by tobacco smoke. Syringing the plants with whale-oil, or soft-soap suds strong enough to kill the lice, but not strong enough to injure the plants, is also recommended. Lime-dust sprinkled over the plants in gardens is said to be beneficial; a solution of sal soda is also said to have been used with good effect, and Dr. Packard recommends 30 parts of unrectified cheap petroleum mixed with 100 parts of water to be sprinkled over the plants. As almost every kind of plant has its own peculiar plant-louse—indeed, many species of plant-lice are said to inhabit the same tree, and it is likewise said that if these lice are transplanted to other kinds of plants they will refuse to take nourishment and will die—it will be useless to enumerate more than we have already mentioned, excepting to observe that almost all plant-lice have very much the same habits, sucking the sap from plants, shrubs, and trees, and living either above or under ground, and the number of species cannot be known until a catalogue is made of this genus alone.

*Lachnus caryæ*, or hickory aphid, is a large aphid found in clusters on the under side of limbs of hickory, oak, and basswood and walnut, July and August, puncturing the bark and sucking the sap. The insect is 0.25 in length; to tips of the wing, 0.40; and across the wings, 0.72. It is of a black color, coated with a bluish-white powder. The thighs are of a clear tawny red, and the wings are transparent. Dr. Walsh observed on the same tree numerous apterous females, which

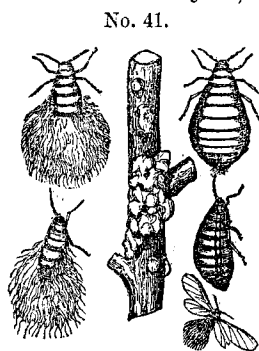
No. 40.



lived many days, and laid their eggs in confinement, but died without assuming wings.

Another species, *Lachnus strobi*, or the white-pine aphid, is found on white pine, and sometimes gives the bark of the trees a peculiar black appearance. The eggs are oval-elongate, shining black in color, and are attached in regular rows of from five to twenty, but usually in regular rows of eight, to the thread-like leaves of the white pine in September. The females are wingless.

*Eriosoma lanigera*, or the woolly apple-tree blight. These insects are



appropriate for their generic name two Greek words signifying wool and body, the insect being partially enveloped in a cottony or wool-like secretion, furnished from its own body. The eggs are deposited in crotches or cracks of the branches or bark, often at or near the surface of the ground, or on new shoots springing from the parent tree. They are mostly enveloped in a cotton-like substance, the young insects in a fine down, and are hatched out in the spring. A larva, pupa, or perfect insect they are equally injurious, sucking the sap, and, when numerous, do much injury to the trees. These insects are 0.10 to 0.12 in length, and are gregarious, feeding in societies, which, when seen from a short distance, resemble small bunches of cotton adhering to the trunk or branches of the tree. The insect, when denuded of its cottony covering, is egg-shaped, and of a dull reddish-brown color, with blackish head and feet; when undisturbed and feeding on the tree, it has a tuft of white down on the hind part of the body, which is very easily detached when roughly handled. These woolly plant-lice also produce warts or excrescences with their powerful beaks, and, when in great numbers on a young tree, cause the leaves to turn yellow, wither, and fall. The young ones are produced alive in summer, but in the fall the females lay eggs which are able to withstand the cold of winter and hatch out into young lice the following spring. Dr. Verrill states that, in Connecticut, in the middle of October, among the wingless neuters, a large number of males and females appear, having well-formed and rather large wings, in other respects closely resembling the rest, and having but little down on their bodies, very plump and of a black color, the winged females of which are able to fly from tree to tree to deposit the eggs to be hatched out next spring. When the downy covering of these insects is removed by wind or rain, another supply is readily produced, and they are said to be able to withstand a very considerable degree of cold without perishing. These insects have no honey-tubes, but frequently eject drops of a sticky substance from the extremity of their bodies. In order to destroy these pests, it has been recommended to have the insects well scrubbed off with a stiff brush and the infested parts of the tree immediately afterward well covered with a varnish of shellac. Painting the injured places with a thick coating of whitewash, well mixed with soft soap or weak glue water will also destroy the insects, and has been highly recommended. *Eriosoma mali* of Europe is said by C. H. Sorsby, F. R. S., in the Quarterly Journal of Microscopical Science, in an article on the coloring-matter of some of the *Aphides*, to produce a red coloring-matter between cochineal and the hæmoglobin of vertebrate animals.

*Eriosoma (Pemphigus) pyri*, or the apple-tree root-louse, sometimes does much injury to apple-trees, &c., by forming galls on the roots, like

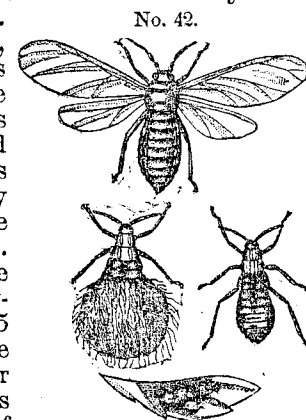
small potatoes, 2 or 3 inches in diameter, just beneath the ground. Walsh does not think this insect identical with that which is doing so much damage in Europe, either from description or habits. Pouring boiling water over the roots has been recommended as a remedy, but some of our correspondents have complained of their trees being injured by its application. However, it is said that water heated from 120° to 150° will kill the lice without injuring the tree. This remedy may serve among young trees, but large old apple-trees would probably not be benefited by this application. These root-lice are destroyed by several parasites, among which are reported *Ercophilus mali*, a Chalcid, (see *Hymenoptera*;) *Pipiria radicum*, a two-winged fly, (see *Diptera*,) &c.

An insect closely allied to *Eriosoma imbricata* is found very abundantly on birch in Maryland in October. These insects cluster together on the twigs, and have the appearance of down or masses of cotton; when disturbed, they present the very singular appearance of many small spots of snow-like wool or down moving up and down by jerks, the hinder parts of the insects being covered with this downy secretion. They are gregarious, and cluster together as close as they can crowd on the ends of the twigs. In the autumn the winged insects appear; the wingless individuals are of a pale or yellow-green color, veined with brown, and are 0.05 to 0.06 in length. This insect, as before stated, resembles the *Eriosoma imbricata*, or beech-tree blight, which is described as "woolly lice infesting the terminal twigs of the beech, and which in the wingless state have the habit of continually wagging their tails up and down." The figures are magnified.

*Eriosoma tessellata* was found on birch in Maryland, in clusters near the ends of twigs, in the autumn. It is of a black color, with white spots on the fore part of its body, and is covered with a snow white down or wool on its hinder part, like those before described. With its woolly covering, the wingless females measure about 0.15 to 0.20 in length.

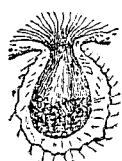
A species of *Rhizobius*, or underground plant-louse, was one season very destructive to the cultivated verbenas in the gardens of the Department of Agriculture, Washington, D. C., clustering in masses on the roots underground, and sucking the sap from the plants, and thereby so weakening them that many died. Most probably, however, had a strong mixture of tobacco and water, or soap-suds, been applied in time to the roots, many of the plants might have been saved; but the cause of the injury being hidden underground, nothing could be seen to indicate that the plant was not in perfect health, until suddenly the leaves turned yellow and the plant died. These insects were about 0.10 to 0.13 in length, of a swollen round form, and apparently bloated almost to bursting. They were of a brown color, and covered with a whitish powder or bloom; no winged individuals were observed among them at any time.

*Pemphigus vitifoliae* of Fitch, 1856, (*Dactylosphaera*, Schimer, 1867,) is





No. 45.



grape-vine-leaf gall-louse. The insect forms galls on the under side of the grape-vine leaves, and although they appear to do comparatively little injury to the vine, they are extremely interesting to vine-growers, as having been said by Professor Riley and other entomologists to be another form of the *Phylloxera vastatrix* or the grape-vine-root gall-louse so destructive to the vineyards in France and elsewhere. The female of the grape-vine-leaf gall-louse, after fixing herself on the upper side of a leaf, by constant suction and the irritation produced by continued puncture, causes a gall to swell irregularly on the under side, while the upper side gradually becomes downy or hairy and partially closes, forming a little bag on the under side with a small opening on the upper surface, surrounded with hair-like filaments. In this bag or gall the female lives, and deposits from fifty to some hundreds of small yellow eggs. Dr. Shimer states that there are 500 eggs in one gall, which is doubted by Walsh, who estimates that probably two hundred eggs will be the average number laid by one female. The figure is magnified.

*Phylloxera vastatrix*, or the grape-vine-root gall-louse, is by many entomologists supposed to be another form of the *Pemphigus vitifoliae* above mentioned, but that, instead of living above ground

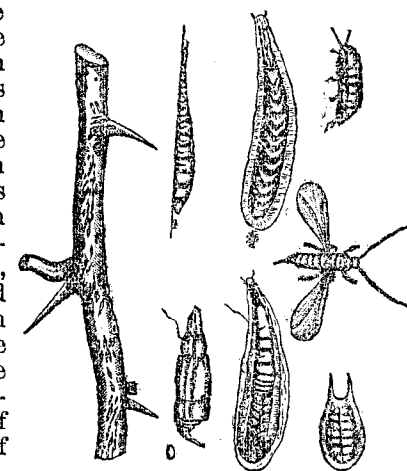


and forming hollow bag-like galls on the leaves, it lives underground on the roots, upon which it forms knotty swellings or galls. Mr. Riley, who has paid more attention to the natural history and habits of this insect than any other entomologist in this country, is of the above opinion. The young of the root-inhabiting type (*Phylloxera vastatrix*) are absolutely undistinguishable from those hatched in the leaf-galls, (*Pemphigus vitifoliae* of Fitch.) and the gravid apterous female differs in no respect from the mother gall-louse. There is, however, a different egg-producing form, which, as it molts, becomes tubercled and more elongate or pear-shaped. Some of these tubercled individuals remain without wings, while others acquire wings. The insect is found on the roots in all stages during the summer months, and in spring, when the sap begins to circulate, eggs are deposited, and the young lice by sucking produce the swellings produced on the roots. The winged lice begin to emerge from the earth as early as July, and the female has only two or three large eggs in her body; and Professor Riley says that her whole duty in life is to fly off and consign her two or three eggs to some grape-vine or bud, and that the lice hatching from these eggs constitute the first gall-producing mothers that form the excrescences on the leaves and have a great number of eggs. These insects attack both leaves and roots in the summer at the same time, but the roots appear to be less infested when the leaf-galls are abundant, and may be extremely abundant on the roots when no galls whatever are seen on the leaf. In order to prove the identity of the leaf-gall louse with the root-gall louse of the grape-vine, it is stated that very young gall-lice hatched from the leaf-galls have been transferred to the roots, and by successfully feeding them on roots the smooth-skinned gall-inhabiting type gave birth to the tubercled root-inhabiting type. In our own experience, however, as an experiment, several small vines were placed in a kind of Wardian case, having the roots covered with the swellings and the root-inhabiting type, (*Phylloxera vastatrix*.) Other healthy vines were also potted and placed in juxtaposition to the infested specimens, in order to see if the gall-inhabiting type would make their appearance in the spring on the leaves. The vines wintered safely, and in the spring and summer produced large healthy leaves on which no galls whatever made their ap-

pearance. In the Departmental greenhouse a few of the grape-vines were so much infested with the leaf-gall lice that they had to be cut down; still the other vines in the same house were never troubled with the root-inhabiting insect; and when many dozens of vines, both under glass and under common cultivation in the open air, were closely searched by M. Planchon to prove the existence of the root-louse among the vines, only half a dozen specimens could be procured. We ourselves will not express an opinion on the subject of the identity of the two insects, as we have no opportunity to watch the root-lice in our neighborhood, but will merely state that, although the leaf-gall louse was very plentiful in our gardens one year, not a single root-louse could be found either the same season or the next, and, although much wanted for experiment, not one could be procured excepting by sending to the other States where they were said to abound. The remedies for this root-louse of the grape, recommended by various authorities, are too numerous for a short report like this; but watering the roots with hot soap-suds or tobacco-water has been highly spoken of. Carbolic acid added to the water at the rate of one-half of 1 per cent., poured into holes made with a crow-bar, will permeate the ground and destroy the lice. Sulphuret of calcium dug in around the roots of the vine has also been recommended. M. Gachez, in a recent number of *Comptes Rendus*, states that by planting rows of red maize between the rows of grape-vines the vines are shielded from the ravages of the *Phylloxera*, the insects abandoning the vine-roots for the roots of the maize. Another experimenter reports that he found an effectual remedy in digging a trench four inches deep around his infested vines and throwing in 500 grammes (a little over a pound) of slaked lime, and then whitewashing the vine after having removed the bark; the remedies proposed in the European journals to destroy this insect, however, are too numerous to quote in this report, and as every writer thinks his own remedy the best, and reports it as infallible, nothing can be relied upon until it has been tested by competent persons in this country. Soot, salt, sulpho-cyanide of potassium, lime, and wood-ashes are said to be useful, if applied in proper quantities either above or under ground around the roots of the vines.

*Aspidiotus (Coccus) gloverii*, or the mussel-shell orange-scale insect, is found on the orange in Florida, where it does much injury to the orange-trees, sometimes killing whole orange-groves; it is found also on citron and lemon trees, and was found sparingly on a camelia grown under an orange-tree. The female scale (c) is from 0.06 to 0.08 in length by 0.02 in breadth, and resembles the upper half of a miniature brown mussel-shell with its flat side downward on the leaf. These scales, when placed singly and not crowded together, are generally straight in form, but when in clusters, they are curved to suit the inequality of the surface or contiguity of the neighboring scales, (c.) The insect itself is sheltered under the scale, and is of a soft consistence, resembling a grub, having the body gradually tapering from near the tail to the anterior part,

No. 47.



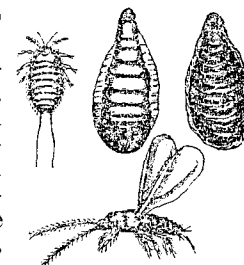


which ends somewhat obtusely. The insect, before it has laid its eggs is of a rosy pinkish color, and often of a creamy yellowish. From the under side of its breast proceeds a sucker, or trunk, by means of which it extracts the sap which constitutes its food. The female deposits the eggs, which are of a pinkish color, to the number of 20 to 30, in parallel rows, under the scale or outer shell, and decreasing in size gradually as the eggs are deposited, she finally dies and dries up at the small end of the scale. The eggs hatch out in a few days in the same order in which they have been laid, those near the obtuse end of the scale hatching first, when the young escape from under the scale at the posterior rounded end, which at that part is slightly elevated from the leaf in order to afford a means of escape from the parent scale of the young coccus. When very young these insects resemble small mites, for which they frequently have been mistaken. They have six legs, two antennæ, and are devoid of any shield-like covering; they run about for a day or two with rapidity in search of some unoccupied or favorable spot on the leaf or branch in which to insert their suckers to extract the sap from the tree, and it is at this time that they can most readily be destroyed, as, being without any scale or shield-like covering their tender bodies can readily be reached by any liquid solution which, when the insect is older and protected by its waxy scale, would otherwise run off without affecting the grub beneath it. After the place is selected the beak is inserted and the insect settled for life, a slight film is formed over its back, (b,) and the soft-bodied insect is hidden from view, when it gradually increases in size, assumes a brown color, and grows until it reaches maturity, when, after impregnation by the small midge-like two-winged male, the eggs are fertilized and hatch out into the small mite-like insects before described. The scale covering the male coccus is much smaller than that of the female, and the perfect insect, instead of remaining like the female a soft-bodied grub all its life, finally appears as a very minute fly, having two perfect wings which it uses to fly abroad and visit the females on neighboring trees. These males are only 0.01 in length and of a pinkish color, have black eyes, and their anal extremity is furnished with a long curved bristle-like appendage. A more full account of this insect may be found in the Patent-Office Agricultural Report for 1850, p. 256. They are destroyed by minute parasitic insects, *Chalcididae*, (see *Hymenoptera*,) lady-birds, *Coccinellidae*, (*Coleoptera*,) and several heteropterous insects or plant-bugs, &c. The best method of destroying these insects was found to be by syringing the trees both from above and below with whale-oil or soft-soap suds mixed with a small quantity of Peruvian guano, every three or four days, as soon as the young insects had hatched and were running about on the leaves unprotected by the waxy scale or covering which they acquire as soon as they fix their beaks in the leaf to settle down for life, and which protects the older ones from the liquid. The guano also, dropping from the leaves on to the ground beneath, fertilizes it, and causes a healthy growth, which is favorable to throwing off the old or dead scales. Many planters who have complained of the inefficacy of this remedy, upon questioning, have acknowledged that they syringed their trees only occasionally, and not at regular intervals of two or three days, thus giving the young naked insects time to form the protecting scale or shield between the syringings and lay the eggs for fresh colonies. Others state that they have carefully followed the directions, and yet see no diminution of the number of scales on the tree. This, however, is because the old dead female scales remain, adhering to the bark and leaves until thrown off by a new and vigorous growth. If such scale

be examined they will mostly be found empty. If, however, new small scales should appear, it is because some of the first brood have escaped between the days of applying the remedy, and the syringing should be continued until no young scales appear on the tree.

Another scale-insect, *Aspidiotus citricola*, (affinis,) was found on imported lemons in Jacksonville, Fla., 1857. This insect is said to be allied to *Aspidiotus* (*Coccus*) *citricola* of Boisduval, which has been very injurious to the orange in the maritime Alps in Northern Italy. It is much broader than *A. gloverii*, and more of the shape and color of an oyster-shell than of a mussel. It is mentioned merely to apprise orange-growers of its existence, and to warn them to examine all imported fruit well before introducing it on their plantations. It is said to be destroyed by a hymenopterous insect, *Coccophagus*. The figure is magnified.

No. 48.



*Aspidiotus conchiformis*, or the oyster-scale insect of the apple, is exceedingly injurious to the apple and many other fruit-trees—apricot, cherry, crab, currant, pear, plum; it occurs also on lilac. The female lays from 12 to 100 white eggs under the scale. The young, which appear in June, are at first reddish and resemble mites; they run over the twigs and leaves, and, like the orange mussel-shell coccus, in two or three days they fix themselves to one spot and settle for life, and suck the sap of the tree. Harris supposes the shell-like covering is secreted from the surface of the body, and is identical with the flocculent matter which exudes from certain *Aphides*. Dr. Shimer, however, considers the scale to consist of cast skins of larvæ cemented together. The insect under this scale is of a soft consistence, and injures the tree by sucking the sap. The scale itself is oblong, about 0.10 to 0.15 in length, of a brown color, and irregularly ovoid-shaped, like an oyster. These scales are sometimes so much crowded together as to cover the whole surface and cause the bark to appear rough; they are frequently bent in the middle and curved at the smaller end, which is pointed. Mr. Riley, in his report of 1873, has renamed this insect *Mytilaspis pinicorticis*, and given his reasons for so doing. This insect is destroyed by many parasites, among which is a mite, *Acarus malus* of Shimer, (a hymenopterous insect,) *Aphelinus mytilaspides* of Riley, several lady-birds, *Coccinellidae*, &c. It is found on many fruit-trees, such as the apple, crab, pear, plum, cherry, apricot, &c. The remedy recommended is to scrub the bark with a stiff brush and soap-suds a few days after the trees blossom, as the young are then hatched. Several other remedies have been recommended, such as carbolic acid and water, &c., but none appear to be as effectual as the soap. The figure is magnified.

No. 49.



*Aspidiotus Harrisii*, or the American bark-louse, is indigenous, and does not injure the trees as badly as the *A. conchiformis*, or the imported scale-louse. The scale is about 0.06 to 0.08 in length, of a broad oval form, and pure white in color; the eggs, which are laid under it, are of a red color; it is found on apple, mountain-ash, and pear. The figure is magnified.

No. 50.



*Aspidiotus pinifoliae*, or the pine-leaf scale-insect, fixes itself upon the leaves or needles of the white pine, and is abundant on the pine leaves in some parts of Maryland, in the form of minute white elongate

scales adhering to the dark-green needle-like leaves; these scales are sometimes crowded together, but usually they are disposed in a row. The scale appears externally to be composed of three different oval scales, with their rounded ends overlapping each other. The first scale is very small, and brown in color; the second is about three times the size of the first, and of a lighter color, while the third and last scale is quite large and white. It is 0.10 in length, and the female lays from 28 to 32 oval eggs with rounded ends in the case. These eggs are pinkish in color and crowded together under the scale. When the female has laid all her eggs, she dies and dries up at the smaller end of the case. We have seen the lady-birds (*Coccinella*, in *Coleoptera*) in March and

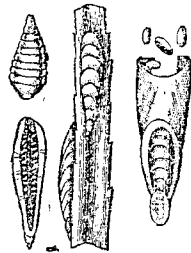
April busily employed in making holes in the cases in order to get at the eggs, which they eagerly devour, besides which, when the trees are agitated by the wind, almost all the unhatched eggs are shaken out of the opening made by the lady-bird and fall on the ground, where they perish. Some persons have supposed this insect to be the adult state of the *Coccus pinicortis*, another insect which appears as a downy patch on the bark of the same tree. The figure is magnified.

*Lecanium hesperidum* is another scale-insect, found upon the orange and lemon trees in Florida, but not in as great numbers as the mussel-shell scale-insect first mentioned. It is also not crowded so closely together, but is scattered more sparsely over the leaves. It is shaped like an oval oyster-shell, with a broad flat margin all around the convex part. Anteriorly, it has an indentation on each side, two similar indentations marking the thorax, and one deep notch the posterior portion of the scale. These indentations cross the flattened margin of the scale, and reach the convex and darker part. The very young insects are soft-bodied and yellowish, with six legs and two antennae. The posterior part is notched, and terminates with two hairs or bristles, which soon disappear. Should this insect increase so as to be injurious, the same remedies can be used as for the other species. The adult scale is about 0.06 to 0.08 in length; color brownish. The figures are magnified.

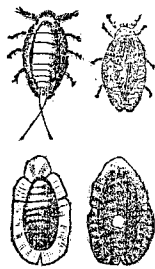
*Lecanium aceris* (Fitch, 1859, p. 776.) Maple-bark scale-insect. This insect was found on a silver-maple in the Smithsonian grounds in Washington, and is also found on other maples in the neighborhood. It is very conspicuous from its great size and the snow-white cottony appearance on the twigs and branches. The scale, when mature, is of a brown color and partially covers a mass of snow-white cottony down, which protects the eggs and young bark-lice which are under it. The young insects wander away from the parent scale, and afterward fix themselves to the bark. The males are probably two-winged, somewhat resembling the *Lecanium juglandifex*, as described by Dr. Fitch. *Lecanium acericola*, on maple, and *Lecanium maclurae*, on the osage-orange, are probably only varieties of the same insect. These insects, however, do very little injury, as they are not very abundant.

*Coccus pinicortis*, or the pine-blight, is sometimes very abundant in the pine woods of Maryland. They frequent the smooth bark around and especially below the axils where the limbs are given out from the main trunk. The injury appears like patches of white flocculent down, which covers minute bark-lice, of a broad, oval, nearly hemispherical, form, about

No. 51.



No. 52.



No. 53.



0.01 in length, soft-bodied, blackish in color, and coated over with a mealy powder. This insect was once erroneously supposed to be the preparatory state of the *Aspidiotus pinifoliae* before mentioned.

*Aleurodes* (?) is a minute four-winged insect, one-sixteenth of an inch in length, of a dull white color, and is sometimes found on the apple and crab. *Aleurodes vaporarium*, mentioned by Dr. Packard in the Massachusetts agricultural report for 1870, is 0.04 in

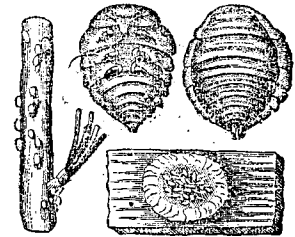


length, yellowish-white in color, with snow-white wings. It infests green-houses, and was found also out of doors on tomato-leaves, and is not uncommon at the Agricultural College of Massachusetts on strawberry-plants. The figure is taken from Westwood. A species of *Aleurodes* has been taken on Cornus.

*Dorthesia* (?) *cataphracta*, a European species figured in Westwood. The males only are provided with wings. The antennae are long, and nine-jointed, and the abdomen is ovoid, ending in a bushy mass of threads. The female is covered with elongated flakes of a waxy secretion, which, in some species are nearly an inch long. The male insect is terminated by a thick pencil of delicate white setae. Dr. Fitch mentions a species, *Dorthesia celastri*, which is found on the celastrus. The *Pediculidae*, or lice, are said by Professor Verrill to be low, degraded *Hemiptera*, destitute of wings, &c. Dr. Packard places them likewise in the *Hemiptera*. Leunis places them after *Coccus* in the *Homoptera*, and therefore we have placed them provisionally at the end of the *Homoptera* until a better place is found for them. They are blood-suckers, and live on mankind and animals, and on mankind certain species attack only certain parts of the body. The figure is magnified.

*Pediculus (humanus) capitis*, or the human head-lice, is always found on the head among the hair. The males are smaller than the females; the latter lay about 50 eggs, which adhere to the hair. These insects, after 14 days, are said to be able to propagate their species. They do not attack the smooth and hairless parts of the body, but generally confine themselves to the human head. Another species, *Pediculus vestimenti*, the clothes or body louse, confines itself to the smoother, hairless parts of the body, and hide themselves in dirty garments. They deposit their eggs near the body, in the clothes and in the creases of the linen. There is a third species of louse, *Pediculus pubis*, the crab-louse, or gray-back, which is a much broader square form than the other two species, that has been a great scourge to soldiers in time of war. This insect has been named the crab-louse from its broad crab-like appearance. It is of a grayish color; the head is small, and appears to be united with the broad body without any thorax; it inhabits the hairy part of the body, under the arms or shoulders, in the beard, &c., but appears to avoid the head. These insects pierce deeply into the skin of mankind, and produce an intolerable itching. Mercurial ointment was formerly used to eradicate these pests, but if not rubbed off, or even washed off, as soon as it has effected its purpose, or, if the patient is exposed to the cold and wet, or

No. 54.



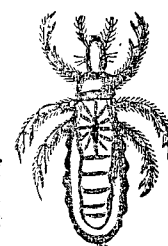
No. 56.



No. 57.



No. 58.



the ointment remains on the skin too long, the mercury is apt to be absorbed into the system, and will, in many cases, produce salivation.



No. 59. The essential oil of bergamot, or any other essential oil, rubbed into the skin, is said to be an effective remedy, and not to have any injurious effect whatever, excepting a little smarting when first applied. The seeds of a larkspur, *Delphinium*, sometimes called "slave's-acre," are said to be an effectual remedy for head-lice; but cleanliness is the most effectual preventive, and all the clothes should be scalded before putting on again, as most of these lice frequently hide themselves in the folds of the linen, and are thus carried from one person to another. These figures are magnified.

## REPORT OF THE CHEMIST.

SIR: The unfinished investigations mentioned in my last report have been completed, and have afforded results of great value, but the analytical work relating to new investigations has been materially interfered with by the preparation and care of the collection in the late International Exhibition in Philadelphia, and I have, therefore, but little to report.

The investigations that have been completed are as follows:

1. On the extent, composition, and value of certain deposits of bat guano in the Southern States.
2. On the proportion of tannic acid in American tanning materials.
3. On the composition of wines from some new varieties of American grapes.
4. On the presence and amount of oxalic acid in *Mesembryanthemum crystallinum*, and composition of the ash of the same.
5. On the composition of the ash of *Sueda californica*.
6. Analysis of a green sand marl from Maryland.

The collection prepared for the International Exhibition by the division under my charge consisted of specimens of soils, marls, and fertilizers, and of those agricultural and horticultural products the value of which depends upon their chemical composition, and the utilization of which involves chemical processes. It contained not only raw materials, but also specimens from the different stages of the processes of manufacture involved in their utilization, and were so arranged as to illustrate as far as they would the processes in question. The classification of the collection was mentioned in my general report to you, and it is therefore unnecessary to detail it here. The list of the materials will be published in a special catalogue, but I deem it of considerable interest and value to incorporate here a sketch of the American methods of manufacture of cheese, with analyses of the materials and products exhibited, prepared by Prof. G. C. Caldwell, of Cornell University, Ithaca, New York.

The collection for the illustration of the manufacture of the products of the dairy prepared and analyzed at the laboratory of agricultural chemistry in Cornell University at the request of the Department of Agriculture, and placed in its exhibit at the Centennial, consists of samples obtained directly from dealers in dairy supplies, or from factories or private manufacturers of butter or cheese.

It begins naturally with salt, rennet, and annatto—the first being universally used in the manufacture of both butter and cheese, the second always in the manufacture

of cheese, and the last-mentioned substance being very commonly used in coloring both butter and cheese.

In regard to the samples of salt, four of which are of English manufacture and one of American, the chemical analysis serves the useful purpose of showing that the difference between them is very slight, and in practice would appear to amount to nothing at all; and it also shows that the best American is fully equal to the best English product.

	Pure salt calc. from the chlor- ine.	Lime.	Sulphuric acid.
Syracuse salt.....	97.74	0.4	0.62
Liverpool salt.....	97.71	0.59	0.9
Ashton's.....	97.65	0.55	0.74
Worthington's.....	97.99	0.47	0.72
Marshall's.....	97.77	0.52	0.91
Dean Brothers.....			

Of the annatto, the seed itself, from which the coloring matter is obtained, is shown; this is used by some dairymen directly for the preparation of their coloring matter; then comes the so-called basket annatto, the usual form in which the coloring matter, extracted from the seeds by water, comes to market; there are exhibited also two preparations of annatto made in this country, the annattoine and the golden extract of annatto, both of which are quite free from any injurious ingredient; their use is preferred by many to that of the crude article. As there is no satisfactory method of determining the proportion of coloring matter in this substance, the results of the chemical analysis of its various forms in use among dairymen have little practical value; they do show, however, a very great difference between the three grades of basket-annatto, for that which is richest in organic matter is probably richest in coloring matter.

	Water.	Ash.	Organic matter.
Basket annatto.....	32.64	10.73	56.53
No. 1.....	22.96	28.83	48.21
No. 2.....	44.18	8.34	47.48
No. 3.....	9.13	4.66	86.21
Annattoine.....			

Of rennet, two samples are shown, the domestic and the foreign. There being no known means of estimating with any accuracy the proportion of the coagulating principle of the rennet, no analysis was made of these samples.

While in Europe there is a great number of methods of making cheese, with as great variety in the character of the products, our American dairymen confine themselves to a few methods; in fact, three different types will represent the main bulk of the manufacture at the cheese-factories of this country.

Concerning the most common mode of manufacture, that which yields the so-called whole-milk cheese, made from the whole of the milk, without any skimming, the main details of the process are familiar to all who are interested in the subject. Therefore we simply give below the results of the chemical analysis of several samples obtained from different parts of the country, and represented in the collection:

	Water.	Ash.	Fat.	Caseine, sugar, &c.
New York factory-cheese.....	31.41	3.53	37.88	27.18
No. 1.....	35.66	3.69	35.15	25.57
No. 2.....	35.24	3.23	35.68	25.85
No. 3.....	33.73	4.05	25.57	26.65
No. 4.....	34.18	3.02	33.92	28.88
Massachusetts factory-cheese.....	33.5	3.73	31.19	26.58
Maine factory-cheese, Jersey milk.....	28.11	2.71	41.02	28.15
Wisconsin factory-cheese.....	35.49	3.34	34.05	26.12

Of the second method of manufacture, that by which the ordinary skim-cheese is produced, the usual proportion of cream being taken from the milk for the manufacture of butter, two varieties are presented. By the one method, and that which is in most common practice, the skimmed milk alone is used for manufacture into cheese;