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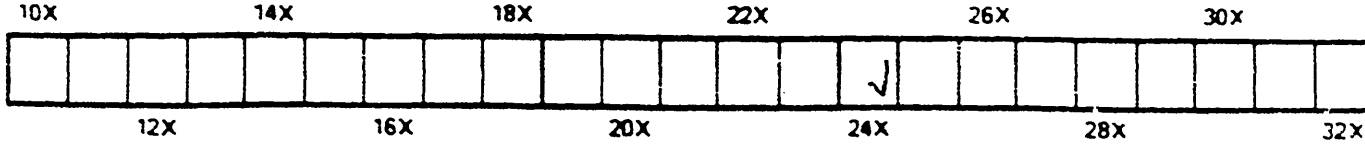

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SOME NOTES ON INSECT ENEMIES OF TREES.

BY A. D. HOPKINS, WEST VIRGINIA AGRICULTURAL EXPERIMENT STATION.

The study of forest and shade tree insects is a line of entomological work demanding especial attention in the State of West Virginia. During the past two years I have carried out quite an elaborate line of investigations and experiments on this subject. The *first* object was to conduct investigations with reference to the forest conditions, the distribution of forest trees, and the relation of certain kinds of forest growth to the occurrence and range of the several life zones, and minor divisions of the same in the State. *Second*, to ascertain as far as possible the principal insect enemies of forest growth and their habits, as well as to study the climatic and other conditions that might be favourable or unfavourable for their multiplication; or the extension of their depredations. *Third*, to determine by experiments and otherwise some improved and practical method of preventing the losses that are occasioned by the more destructive kinds, especially those caused by bark and wood infesting insects.

Sufficient evidence has been obtained in the first object to enable me to prepare a preliminary map of the forest divisions of the State and the probable range of the life zones. Considerable information has also been added with reference to the habits of some of the more destructive insects, and some results have been obtained towards successful methods of preventing serious losses from their attacks on felled timber.

The studies with reference to preventives and remedies include a line of experiments which has already given good results and promises better ones in the future. The experiments include the cutting of different kinds of trees twice a month, year after year, until sufficient evidence is obtained to enable me to arrive at some definite conclusions with reference to the proper times to cut timber to secure the least possible damage from insect attack.

This line of experiments has been carried on regularly in different sections of the State since April, 1895. Observations are made from

time to time during the year, and the condition of the wood and bark is noted, together with the kinds of insects occurring in the same, the character of injury, etc.

It was found necessary to have some convenient method of ascertaining what insects bred in the wood and bark of trees cut in each month. Therefore an insectary was planned and built with this end in view. At present it consists of a room 12 feet long by 9 feet wide and 9 feet high. It is divided into four compartments or rooms, each 3 feet wide and 9 feet long, with 12 breeding cages or boxes, 18 x 12 x 18 inches, in one end. A door opens into each room, and a window 12 x 12 inches above the suite of breeding boxes, near the ceiling, gives the necessary light. The breeding boxes are arranged like drawers, in a case with doors in each opening into the room, and with a 2-inch round window in the back, opposite to a correspondingly small window in the wall. The object of the small windows in the boxes and in the ends of the rooms is to attract the insects to the light when they emerge so that they can be easily collected. Each room is devoted to one kind of wood,—as pine, oak, and hickory. Pieces of the trunk and branches of an infested tree are placed on shelves on one side of the room, and as the insects emerge they fly to the window, where they are collected in a cyanide bottle provided for each room. A shelf is attached just beneath each window and is covered with white paper, so that if any of the smaller insects die, they fall on it and are easily found.

The twelve boxes in the end of each room are used to breed insects from the wood and bark of trees cut in each month of the year. This arrangement of rooms and boxes is proving quite successful. Hundreds of specimens have been obtained, representing many species which would have been difficult to obtain in any other way, and in addition, many important facts have been learned with reference to the food habits of certain species.

One of the most interesting results that has been obtained is from hickory and oak, cut in the winter and summer of 1894. That cut in the winter months is being converted into a powder by *Lyctus striatus*, while that cut during the summer months is but slightly damaged.

I have also found from the cuttings in the forest that the wood of certain species of trees felled during the winter months, as well as of those felled in the late fall and early spring, are seriously damaged by wood-boring insects, while those cut in July and August are either entirely exempt, or but slightly damaged.

FIRE WOUNDS THE PRIME CAUSE OF SERIOUS LOSS OF TIMBER.

In studying the forest conditions and the influences that contribute to the destruction of timber, I have found that a slight injury to the base of a tree by fire offers favourable conditions for the attack of insects, which result in the final destruction of the valuable wood of the tree. The fire burns and kills the bark at one side of the base of the tree, which in itself might not be a serious matter, since subsequent growth would heal it over, but it was found that these slight wounds are subsequently infested by Ptinid, Scolytid and Calandrid beetles and their larvæ; also by Cerambycid, Buprestid and Lepidopterous larvæ, which by their boring either convert the inner dead wood into a dry powder, or their mines give entrance to a "dry rot" fungus*, so that another forest fire finds in these extended wounds the conditions most favourable for a still further extension of the injury. Thus, frequent fires in the same forest may, by this process, burn entirely through the trunk of a large tree.

It was also found that these fire wounds are almost invariably followed by a decayed condition of the heartwood, which results finally in a hollow trunk. Previous observations led me to believe that insects were largely to blame for the destruction of the heartwood of living trees injured by fire and other causes. I therefore had a number of wounded trees felled on November 9th, 1895, and the trunks split open so that I could examine the causes and effects.

I found in nearly every tree thus examined that the rapid extension of the decay was due largely to Cerambycid, Lymexylon and Brenthid larvæ which had entered from eggs deposited in the edges of the fire wounds, and that brood after brood of these larvæ, aided by wood-infesting ants, had completely honeycombed the heartwood for a great distance above the wound. Thus the valuable heartwood was completely destroyed or rendered worthless. By persistent search I was fortunate enough to find in the heart of a chestnut tree the imago of one of the Cerambycid borers, where it had recently transformed within its pupa case. It was located near the heart of the tree, and about four feet and a half above the upper edge of the wound, and three feet above any decayed wood. This beetle was identified for me through the kindness of Mr. Howard, of the Division of Entomology, as *Centrodera bicolor*.

On May 19th, 1896, I cut another example of this species from a tulip log, at Pickens, W. Va., where I had previously discovered (June

* *Merulius lacrimans.*

20th, 1894) a Cerambycid larva, that was found to be exceedingly destructive to the heartwood of large tulip trees, as mentioned in a former paper (Insect Life, Vol. VII., p. 150). Subsequent observations lead me to conclude that this is one of the most destructive wood-boring insects that infests the wood of living trees, and that the destruction of valuable timber by it results largely from primary injuries by fire.

The cocoons of a parasite (*Gymnosetis americanus*, C.) were found in larval mines, evidently of this species, in the same tulip log previously mentioned, which may be of some service in keeping this pest in check. It evidently attacks the larvæ at the time they are forming the exit gallery for the adult, since at other times the larvæ are so deep in the heartwood of the tree that they could not be reached by the ovipositor of the parasite.

On July 7th of the present year (1896), I found a female example of the large and beautiful *Leptura emarginata* ovipositing in the dead wood of a wound in a living beech tree, and numerous large holes were observed in the same wood, from which the beetles had evidently emerged, thus indicating that this species may also be classed among the destructive heartwood borers.

There are probably several other Cerambycid and Buprestid species that contribute to this class of injury to living trees, and, since the results of their work are practically the same, they may be designated as *Destructive Heartwood Borers*.

Destructive Bark Borers.

With the exception of certain Scolytidæ, notably *Dendroctonus frontalis*, the most destructive and dangerous class of insects that attack living trees belongs to the genus Agrilus, since their habit of ovipositing in the bark of healthy trees in which it is possible for the larvæ to develop makes it possible for them to effect a terrible destruction of timber should they ever occur in sufficient numbers to take the character of an invasion.

Agrilus bilineatus is already to blame, either directly or indirectly, for the death of a great quantity of oak and chestnut timber, not alone in West Virginia, but in different sections of the country between here and the Mississippi River. Until last fall the dying of trees with which this insect was intimately associated was decidedly on the increase.

The beech, the dogwood *(Cornus florida)*, the hickories, the hornbeam, willows and poplars are suffering more or less from the attacks of this class of bark-borers. These insects are, however, attacked by Braconid and other enemies that may tend to keep them in check; yet, notwithstanding this fact, they must be considered as among the most dangerous enemies of trees.

Sassafras and Sumac Twig Girdlers.—The injury to twigs and branches of sassafras and sumac by Cerambycid twig-girdlers has been on the increase for some years in our State, as is a similar trouble affecting the dogwood. I was fortunate enough to find the beetle that is to blame for the interesting double girdles so common on sassafras, which proved to be *Oberea ruficollis.*

Brenthid Injuries to Rock-Oak Logs.—An interesting observation was made with reference to injuries by *Eupsalis minuta* to rock-oak (*Quercus prinus*) logs. from which the bark had been removed for tanbark. It was found that the logs bearing the mark of the axe, where they were girdled in the process of removing the bark, were infested with this destructive pin-hole borer, the eggs having been deposited in the axe wounds. Logs that were not injured by the axe were not infested. Since the peeled logs are often left in the forest for a year or more before they are converted into lumber, it is quite important that the sapwood should be injured as little as possible during the process of removing the bark. If the logs are not thus injured they may remain sound and make good lumber for several years after the tree is felled, but if injured as mentioned, the wood may be literally ruined by the Brenthid within one or two years after the bark is removed.

A Brenthid larva that appears to be quite different from that of *E. minuta* was recently found boring in the heartwood of a hickory tree, and the characteristic mines of Brenthid larvæ have also been observed in the heartwood of wild cherry (*Prunus serotina*) and other trees.

Hickory Nut Phylloxera.—On December 15th, 1895, I found a large hickory tree which presented quite a striking appearance. The nuts, of which it was very full, had not fallen, and upon closer examination it was noticed that they had assumed a curious abnormal growth, which was found to be the work of a Phylloxera. This is probably the work of *Phylloxera caryæcaulis* or a nearly allied species (mentioned in Illinois Agr. Report, 1878, page 160).

A Maple Twig Borer (——— ———) was one of the commonest shade tree pests in West Virginia during the past spring. It attracted general attention in all parts of the State, and was the cause of extensive correspondence in answer to inquiries. It is the larva of a moth that bores in the tips of the young, growing twigs of all species of Acer. So common was the injury by it that large trees presented the appearance, in June, of having suffered from a severe frost. It occurred in all the life zones of the State, from the Upper Austral to the Canadian. It makes its appearance soon after the leaves appear in the spring, and continues operations until about the middle of May, the moth emerging in June.

Oyster-Shell Bark-Louse on Pennsylvania Maple.—In May, 1896, I observed, while in the Canadian Zone of the State, that some of the small trees, and twigs on other trees of this maple, were out in leaf far in advance of other examples of the same species, the former being in fruit, while the latter had just commenced to flower. This was found to be due to the influence of the Oyster-Shell Bark-Louse, which occurred on all of the early fruiting twigs in great numbers.

The Locust Leaf Beetle (Odontota dorsalis).—This beetle is again common and destructive to the yellow or black locust leaves over the greater part of the State, it being destructive this year in localities which heretofore have been exempt. This beetle has been observed by me feeding on the leaves of white oak, beech, birch, hawthorn, and apple, thus indicating the possibility of its changing its normal habits and becoming destructive to the foliage of other trees, including the more valuable fruit trees.

A Remarkable Injury to the Leaves of Forest Trees by an Unknown Insect.—Last fall, while collecting in and near the western border of the Transition Life Zone, or what is known as Laurel Hill and Cheat Mountain, I observed that the leaves of all kinds of forest trees were literally riddled with holes of various sizes, as if they had been caused by hail when the leaves were young. This condition extended for a distance of four or five miles along the summit of the mountain and down the western slope to what appears to be the line separating the Upper Austral and Transition Life Zones. No trace or evidence could be found at the time to indicate what insect was to blame for this remarkable condition. The region has been frequently visited this spring and summer, and while the

same condition occurs this year as was noted last, and a large number of insects of various kinds have been observed feeding on the leaves, none of those I found were common enough, at any one time, to indicate that they were to blame for the trouble.

I am inclined to think now that it is the work of some nocturnal insect, possibly a Scarabæid.

Xyleborus celsus in Hickory.—On Dec. 1st, 1895, I discovered a number of colonies of a Scolytid in a hickory stump, which revealed numerous males of the species, as well as some good examples of the galleries. The interesting features of the discovery were presented to the W. Va. Academy of Science in a paper read at a meeting held on Dec. 3rd. Attention was called to the rarity of the male, and that this was probably the first time it had been found in company with the female. But one male was found in each colony of 40 to 50 females, and it was usually located at the farther end of one of the galleries, where it was imprisoned by the females, which were closely crowded in the galleries in Indian file, with their heads towards the inner end. One female guarded the single entrance to the suite of galleries from all intruding enemies by stationing herself just within the entrance and presenting her armoured elytral declivity as an impenetrable barrier to the would-be intruders. This habit and method of guarding the entrance to the brood-galleries is common with most Scolytidæ, and possibly serves in part to explain the object of the peculiar form of the elytral declivity in *Platypus*, *Xyleborus*, *Tomicus*, *Scolytus*, and other genera.

Some of the females of the bark-infesting species, after they have fulfilled their mission of forming the egg-galleries and depositing eggs, station themselves at the entrance, where they die at their maternal post of duty, their dead bodies forming as effectual a barrier against the entrance of certain enemies as if living.

The male *Xyleborus celsus* is evidently identical with Leconte's *X. biographus*, as was thought probable by Eichoff.

The Willow Leaf Beetle, Lina lapponica, was exceedingly common during the early part of the season, completely defoliating all kinds of willows in some sections of the State, and often doing serious damage to the foliage of certain cultivated poplars. Spraying with Paris green was recommended for the protection of cultivated willows and poplars.

Pines Exempt from the Attack of D. frontalis.—I have not, as yet, been able to find a single living example of *Dendroctonus frontalis* in the State since the fall of 1892. Thus, no opportunity has been offered to continue the experiment with the imported *Clerus formicarius* as an enemy of this species, as was intended. The sudden and apparently utter disappearance of *D. frontalis* over an area of some ten to fifteen thousand square miles, where it had occurred in such enormous and destructive numbers, is yet somewhat of a puzzle to me. What little evidence I have been able to obtain, however, points to a contagious disease, producing a widespread epidemic, as the only logical explanation of the phenomenon.

Last spring I received some pine bark from North Carolina, which had been taken from one of many pine trees that had recently died. This bark bore the unmistakable evidence of the work of *D. frontalis*, and an example of the species was found in the bark. The fact that the species is living in that section of the great pine belt would indicate that it is only a matter of time when another invasion may be expected.

Diseases of Forest Tree Insects.—On Dec. 25th, 1895, while cutting in a decaying beech log in search of the larva and imago of a large Buprestid, *Chalcophora campestris* (?), I found that large numbers of the larvæ and pupæ had been attacked and were completely enveloped by a white, fluffy fungous growth, resembling closely the description of Prof. Lugger's *Isaria tomicii.* It was also found that this fungus had attacked and killed other insects that infested the log, including larvæ, pupæ and adults of the common Tenebrionid, *Nyctobates pennsylvanica*, and imagoes of the Scolytid, *Platypus compositus.* Apparently the same fungus was also found in the entrance to the brood-galleries of *Xyleborus celsus*, in hickory, which were filled with a brood of living beetles. The fungus had apparently crowded back the guarding female into the secondary galleries, where it, with other examples of the brood, appeared to be hopelessly imprisoned, since they did not appear to be able to emerge through the leather-like substance of the fungus.

PTEROPHORIDÆ.—Prof. C. H. Fernald, of the Agricultural College, Amherst, Mass., who recently published a valuable monograph upon the Crambidæ of North America, is now engaged upon a similar work on the Pterophoridæ, and would like to obtain materials from all quarters. He prefers that specimens should be sent to him pinned and spread, not in papers.

SOME NEW NEMATIDS.

BY C. L. MARLATT, U. S. DEPT. AGRIC., WASHINGTON, D. C.

The following descriptions of sawflies belonging to the subfamily Nematinæ include, with one exception, a number of species which have been reared from the larvæ by Mr. H. G. Dyar. Mr. Dyar is anxious to publish the descriptions of the larvæ, and the technical descriptions of the species presented herewith are made to enable him to assign his larvæ to described species and avoid the difficulties which would arise from the description of larvæ before the adult insects have been characterized. The very valuable work which Mr. Dyar is doing in rearing larvæ is resulting in the clearing up of some puzzles in the classification of insects, and has no more interesting outcome than the fact that many of his rearings, at least in the line of sawflies, prove to be of species hitherto undescribed, showing how little we really know of the insects of this group in this country. The adults of most sawflies rarely leave their food-plants, and live but a few days, and hence it is not at all to be wondered at that so many species occurring on common plants have not been taken by collectors. The collected species, in fact, are usually only those which happen to frequent flowers and those taken by random beating, which, with insects of quick flight, like many sawflies, is not a very successful method of collecting. A vast deal of work will have to be done on the lines followed by Mr. Dyar before anything like an adequate knowledge of our insects in this family will have been gained. These species are additions to the recent revision of the Nematinæ, published by the Department of Agriculture, as Technical Bulletin No. 3 of th Division of Entomology, and are described in conjunction with the tables and descriptions therein contained, so that the affinities of these additional species may be easily recognized.

Camponiscus americanus, n. sp.

Female.—Length, 6 mm.; a short, robust species; head broad, as wide or wider than thorax; clypeus deeply circularly emarginate; lobes broad, rounded; walls about ocellar basin sharply defined; frontal ridge strong, bulbous, unbroken; fovea broad, deep; antennæ short, tapering, smooth; joints three and four subequal, or three slightly longer than four; venation normal for genus; third cubital cell of left wing divided by a cross vein; claws bifid; teeth not very long, stout; sheath obliquely tapering on lower margin, fringed with short hairs; cerci long, strongly tapering. Colour reddish-yellow; antennæ dark brown above,

except at tip; small spot, including ocelli, tip of scutellum, meso-post-scutellum, and central area of metathorax, hind coxæ and base of abdomen beneath, dark brown; more or less of meso-epimera, femora, especially hind pairs, and tips of hind tibiæ and hind tarsi, brownish or infuscated; veins light brown, with yellowish hyaline portions, especially towards base of wings; stigma very broad, yellowish hyaline.

Male.—Length, 5 mm.; much more slender than female; antennæ more robust, compressed, not relatively much longer than antennæ of female; third cubital cell of anterior wings subject to much variation, bordering cross lines sometimes almost touching each other. Colour reddish-yellow and black; upper edge of antennæ, including all of two basal joints, large spot surrounding ocelli, lateral lobes of mesonotum, scutellum, metathorax, and abdomen, for the most part dorsally, together with spot on pectus and base of abdomen ventrally, with bases of posterior coxæ, brownish-black; legs uniformly reddish-yellow; hind tarsi slightly infuscated; veins little darker than in female; stigma yellow hyaline or very slightly infuscated about margin.

Described from two specimens, male and female, reared by H. G. Dyar, from larvæ on poplar, taken at Jefferson, N. H. This species is the first representative of the genus Camponiscus found in America. It seems to be distinct from any European species, and is a very interesting addition to our insect fauna.

A female of this species was also received for identification from Mr. Alex. McGillivray, collected at Franconia, N. Y. This specimen measures 8 mm., and presents a rudiment of a marginal cross nerve. The metathorax and the venter of the abdomen basally, as also the hind tibiæ and tarsi, are unicolorous with the body.

Pteronus ostryæ, n. sp.

Female.—Length, 6 mm.; moderately robust; clypeus very broadly circularly emarginate, lobes small; pentagonal area with distinctly elevated limiting walls; crest unbroken; fovea deep, triangular; antennæ long, tapering, third and fourth joints subequal; sheath short, rather robust, regularly tapering; claws deeply and evenly cleft; venation about normal; upper discal cell of hind wings considerably exceeding lower; stigma broad, regularly rounded on lower margin. Colour for the most part light greenish-yellow; antennæ, compound eyes, large spot, including ocelli and extending back over occiput, lobes of mesonotum and metanotum and base of dorsal sclerites of abdomen centrally, apex of

sheath, apex of hind femora, distinctly defined apical two-thirds of hind tibiæ, hind tarsi and large spot on upper angle of meso-epimera, black or dark brown; wings hyaline; veins, except costal, brown; stigma brown.

Described from a specimen reared by H. G. Dyar, from a green larva (edge eater?) supposed to have come from hornbeam *(Ostrya americana)* taken in New Jersey. This species is closely allied to *P. odoratus*, Dyar.

Pontania terminalis, n. sp.

Female.—Length, 4 mm.; not very robust; shining; clypeus very shallowly, broadly emarginate; vertex with scarcely distinguishable pentagonal area, smooth or with ridges rounded, subobsolete; fovea shallow; antennæ with third joint slightly longer than fourth; venation about normal; outer veins of discal cells of hind wings interstitial; stigma not very broad, tapering regularly to tip; claws large, deeply cleft; sheath narrow, regularly tapering, or slightly emarginate on lower edge; cerci short. Colour black, shining; apex of clypeus, other mouth-parts, angles of pronotum, tegulæ and legs, for the most part, light yellow; extreme bases of coxæ and hind tibiæ and tarsi brownish-black; wings hyaline or nearly so; veins, including all of stigma, strongly infuscated.

Male.—Length, 3.5 mm; much more slender than female; structure as in female; antennæ slightly more robust and with shorter joints; colour as in female, except venter, which is reddish-yellow, more or less infuscated, especially on the lateral area.

Described from three females and two males reared by H. G. Dyar, from imperfect galls in the partly-rolled terminals of willow leaves. Specimens collected near New York City. Types in Coll. U. S. Nat. Mus., and collection of H. G. Dyar.

This species is somewhat closely allied to *Pontania hyalina*, but differs in important characters and distinctly in the habit of the larva in partly rolling the leaf and formation of imperfect gall.

Pontania populi, n. sp.

Female.—Length, 5 mm.; robust; shining; clypeus deeply emarginate; lobes somewhat pointed; labrum with rather long yellowish hairs; ridges about ocellar basin sharply defined; frontal crest stout, unbroken; fovea oval; antennæ short, moderately robust, third joint a little longer than fourth; venation normal, except that the second recurrent is very near the second transverse cubital, and the outer veins of the discal cells of hind wings are interstitial or nearly so; claws deeply and

evenly cleft; sheath elongate, narrow, regularly tapering; cerci very slender and elongate. Colour black, shining; apical half of clypeus and other mouth-parts, broad outer angles of pronotum, tegulæ, and legs, for the most-part, light yellow; posterior tarsi slightly infuscated; extreme base of coxæ, especially posterior pair, brownish-black; venter of abdomen yellowish, strongly infuscated; wings hyaline; veins, including all of stigma, dark brown.

Described from a single female, reared by H. G. Dyar, from larva collected in New York. This species is related to *Californica*.

The larva is practically the same in habit as *P. terminalis*, except that it is a different colour and lives on *Populus grandidentata*.

Amauronematus azaleæ, n. sp.

Female.—Length, 7 mm.; rather slender; clypeus very broadly and shallowly emarginate; frontal crest very strongly raised, bulbous, unbroken; walls about ocellar basin distinctly defined, not very prominent; fovea shallow, elongate, oval; antennæ short, tapering, fourth and fifth joints longer than third; claws deeply cleft, rays subequal; sheath pointed, with distinct scopa near tip; cerci long, slender, nearly filiform; venation normal; stigma narrow, strongly acuminate. Colour dull black and pallid white, the latter restricted to face below antennæ, orbits, pronotum, tegulæ, and entire venter except meso-epimera and sheath, more or less of the margins of some of the basal dorsal sclerites and lateral edge of all of dorsum of abdomen, including the sides of the large clasping terminal arc, also pallid; legs slightly infuscated on upper and lower edges of femora, tibiæ and tarsi; hind tarsi altogether infuscated; wings hyaline, veins dark brown, including all of stigma.

Male.—Length, 5.5 mm.; slender; structurally about as female. Colour the same, except that the abdomen is black above and the lateral area of the ventral sclerites is strongly infuscated; the pronotum is also more or less black near the anterior edge, and the extreme base of coxæ, especially the hind pair, is more noticeably infuscated.

Described from two specimens, male and female, reared by H. G. Dyar, from larvæ collected at Jefferson, N. H., on Azalea. The female of the species is very near *oregonensis* in colour, but differs in the darker stigma and wing veins, and in the infuscated terminal dorsal arc of the abdomen.

Amauronematus similis, n. sp.

Female.—Length, 9 mm.; rather slender, graceful; surface of head and thorax finely punctured, opaque; abdomen smooth, shining; insect clothed with very short fine whitish pubescence; clypeus narrowly, rather deeply, emarginate; lateral walls about ocellar basin rounded; frontal crest deeply broken by backward extension of deep elongate antennal fovea; antennæ short, tapering, third joint shorter than fourth or fifth; claws evenly and deeply notched; sheath elongate, slightly tapering, rounded at tip; cerci filiform, nearly as long as metatarsal joint of hind foot. Colour black; triangle beneath antennæ, clypeus, labrum, cheeks, base of mandibles and wide angles of pronotum, yellowish-white; labium and palpi greatly protruding, black; anterior faces of fore legs, from the middle of femora downwards, yellowish infuscated; venter of abdomen, except apex, yellowish, especially on lateral margin, with base of segments strongly infuscated and all very much obscured with brownish-black; wings hyaline or very slightly clouded near veins; veins and stigma black.

Described from a single female reared by H. G. Dyar, from larvæ on willow, collected at Jefferson, N. H.

This species is closely allied in general appearance to my *A. Comstocki* and *A. gracilis*, but differs in important colorational characters, and seems intermediate between the two. It may be that ultimate rearings will show that all three of these species, now apparently distinctly differentiated, are merely varieties or indicate wide seasonal or local variations.

Amauronematus Dyari, n. sp.

Female.—Length, 6 mm.; robust; head and thorax opaque; clypeus shallowly emarginate; walls of ocellar basin wide, rounded, frontal crest distinctly broken; antennal fovea circular, with branches extending over base of antennæ; antennæ short, moderately robust, joints not at all nodose at tips, 3–5 subequal; venation about normal; stigma rounded on lower margin, not tapering; sheath tapering, obtusely pointed, clothed with short and rather dense hairs; claws deeply and evenly cleft. Colour resinous-yellow, with the thorax and head reddish; antennæ, narrow ring about each ocellus, meso-postscutellum, black; meso-scutum and more or less of centre of basal plates brownish; tips of posterior tibiæ and their tarsi slightly infuscated; wings hyaline, veins light brown, stigma and costa yellowish hyaline.

Male.—Length, 5 mm.; not robust, approaching slender; clypeus much more distinctly emarginate than in female; character of vertex and antennæ about as in female; procidentia very short and broad, more than twice as wide as long: venation and claws as in female. Head, for most part, and thorax and abdomen above, black; face below antennæ white; most of pronotum, the tegulæ and the venter, with legs, resinous-yellow; pro-episterna, and base of meso-epimera, brown; abdomen slightly smoky beneath; posterior tibiæ and their tarsi slightly infuscated, wings hyaline, veins brown, stigma and costa hyaline, former darker basally.

Described from two bred females and two bred males in Coll. of H. G. Dyar. This species is closely allied to *brunneus*, and was briefly described by Mr. H. G. Dyar (including a careful description of the larvæ), from six males and four females under Norton's species, *Nematus monochroma*, from which, however, it is unquestionably distinct. The larvæ are gregarious edge-feeders on poplar, somewhat resembling the larvæ of the common willow sawfly (*Pteronus ventralis*) in appearance and habit [see CAN. ENT., XXVI., page 187, 1894].

Pachynematus gregarius, n. sp.

Female.—Length, 4.5 mm.; not robust, surface shining; head distinctly narrowing back of compound eyes; clypeus broadly and shallowly emarginate; pentagonal area depressed, limiting ridges low, rounded; frontal crest unbroken, not prominent; antennal fovea shallow; antennæ short, slender, scarcely tapering, third joint distinctly longer than fourth; sheath short, obliquely truncate, pointed at tip; first transverse cubital hyaline or subobsolete; upper middle cell of hind wings considerably exceeding lower; stigma broad, rounded on lower margin, not tapering; claws with inner tooth remote from apex. Colour brownish-black and resinous-yellow; antennæ, head and dorsum of thorax and abdomen for the most part, sheath and upper half of meso-epimera, dark brown; mouth-parts, tegulæ, outer one-half of pronotum, legs and venter, together with lateral margin of dorsum of abdomen and terminal dorsal sclerites, yellow; light area of epimera and pronotum slightly infuscated; wings hyaline, stigma and nervures light brown.

Male.—Length, 4 mm.; structurally as in female, except that the ridges about ocellar basin are more sharply defined; procidentia narrow, tapering, pointed at tip; antennæ, large spot on vertex about ocelli and extending over occiput, thorax above except pronotum and tegulæ, and central dorsal area of abdomen (paling towards tip), brownish-black:

balance of insect resinous-yellow, except slight dark spot beneath wings.

Described from one female and one male bred by Mr. H. G. Dyar, from larvæ taken on willow in New Hampshire and New Jersey. The larvæ are described as resting flatly on the surface of the leaves, which they skeletonize, and as being gregarious and, in appearance, shining like a slug.

Types in Coll. U. S. Nat. Mus.

Pachynematus pubescens, Marlatt.

Male.—Length, 8 mm.; elongate, slender; head and thorax densely clothed with long sordid yellowish hairs; clypeus shallowly emarginate, strongly transversely keeled; ridges about ocellar basin distinct, but slight; crest not prominent, unbroken; fovea oval; antennæ very long and slender, joints nodose at tips, fourth and fifth longer than third; third cubital and second recurrent, and outer veins of discal cell of hind wings interstitial; third cubital cell large, divaricating apically; stigma long, narrow, tapering; procidentia wide, tapering, truncate at tip; inner tooth of claw very minute. Colour black, shining, including all of head, with mouth-parts, pronotum and tegulæ; apical half of hypopygium, apices of femora, and the tibiæ and tarsi, reddish-yellow, infuscated; genitalia pallid; wings hyaline, veins brown, stigma yellowish, usually with a brownish tinge, much darker than stigma of *apicalis*.

Described from six specimens from Cornell University, collected on Mount Washington, at an elevation of 5,500–6,000 feet, July 9th, 1891. In structural and colorational characters the male of this species is very close to the male of *extensicornis*, but is readily distinguished by the remarkable hirsute clothing of the head and thorax.

The female of this species was described in my Revision of the Nematinæ of North America. (Tech. Ser. No. 3, U. S. Dept. Agric., Div. Ento., 1896, p. 100.)

Hemichroa laricis, n. sp.

Female.—Length, 5.5 mm; robust; shining; clypeus broadly, shallowly, emarginate, and with strong transverse ridge near base; pentagonal area distinctly defined; ridges somewhat rounded; fovea shallow, circular; antennæ very slender, filiform, fourth joint much longer than third; sheath short, rounded at tip; cerci short; claws simple, without inner tooth; venation normal. Colour black; mouth-parts scarcely paler than the general body colour, or very slightly reddish; tegulæ and legs

pallid, strongly infuscated; coxæ black; wings slightly infuscated; veins brown, stigma pale centrally.

Described from a single female reared by H. G. Dyar, from larva collected on larch.

Mr. Dyar states that this is identical with the larva referred to in the Fifth Report of the U. S. Entomological Commission, as No. 26 of larch insects, Selandria sp.?, page 901. Mr. Dyar's specimens were collected at Jefferson, N. H.

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

EIGHTH ANNUAL MEETING, BUFFALO, N. Y., AUGUST 21–22, 1896.

The Association was convened in the Lecture Hall of the Library Building, Buffalo, N.Y., and its meetings were attended by some nineteen active members, including the following officers: President, C. H. Fernald; Vice-president, F. M. Webster; and Secretary, C. L. Marlatt. The Entomological Society of Ontario was represented by the Rev. C. J. S. Bethune and Dr. James Fletcher. A number of entomologists not members of the Association were also present, with other zoologists, the number of persons present at the meetings averaging about thirty.

The following new active members were elected :—

W. G. Johnson, College Station, Md.
E. E. Bogue, Stillwater, Okla. Ter.
James S. Hine, Wooster, Ohio.
C. W. Mally, Wooster, Ohio.
H. L. Frost, Boston, Mass.
M. F. Adams, Buffalo, N. Y.
Lewis Collins, Brooklyn, N. Y.
W. E. Rumsey, Morgantown, W. Va.

The following new foreign members were elected :—

Chas. P. Lounsbury, Department of Agriculture, Cape Town, Cape of Good Hope.
Fred. Enock, 21 Manor Gardens, Holloway, London, England.
Dr. Enzio Reuter, Fredriksgatan, 45 Helsingfors, Finland, Russia.
Frederick B. Theobald, Wyecourt, Kent County, England.
Dr. Antonio Berlese, R. Scuola Superiore de Agricoltura, Portici, Italy.
Dr. Paul Marchal, 16 Rue Claude Bernard, Paris, France.
W. C. Grasby, Parkside, Adelaide, South Australia.

The active membership of the Association now numbers eighty-six, and includes practically all the leading workers in economic entomology in the United States and Canada. The foreign membership numbers twenty-nine, and comprises the leading official economic entomologists of the world.

A number of resolutions were passed; among others, the following: Resolutions (1) relating to the death of Dr. C. V. Riley, the originator and first president of the Association; (2) urging the publication by the U.S. Department of Agriculture of a general index to the seven volumes of Insect Life; and (3) recognizing the importance of the work being done by the State of Massachusetts in the control of the gypsy moth, urging the continuance by the State of work in this direction and expressing the greatest confidence in the officers now charged with it.

The annual address of the President, Mr. C. R. Fernald, Professor of Entomology, Massachusetts State Agricultural College, Amherst, Mass., was entitled "The Evolution of Economic Entomology," and was devoted to a historical resumé of the progress in the practical control of insects from the earliest times to the present. The following papers were read and discussed:—

"Some Temperature Effects on Household Insects."

"On the Futility of Trunk and Crown Washes for Elm Leaf Beetle."

"Remarks on Steam Spraying Machines."

By Dr. L. O. Howard, Chief of Division of Entomology, U.S. Department of Agriculture, Washington, D.C.

"Three Years' Study of an Outbreak of the Chinch Bug in Ohio."

"Insects of the Year in Ohio."

By Prof. F. M. Webster, Entomologist to the Ohio Agricultural Experiment Station, Wooster, Ohio.

"A New Insecticide."

By A. H. Kirkland, Assistant to the Gypsy Moth Committee, Malden, Mass.

"Comparative Tests with New and Old Arsenicals on Foliage and with Larvæ."

"Insecticide Soaps."

By C. L. Marlatt, First Assistant, Division of Entomology, U.S. Department of Agriculture, Washington, D.C.

"Enemies of the San José Scale in California."

By Dr. J. B. Smith, Entomologist to the New Jersey Agricultural Experiment Station, New Brunswick, N.J.

"Insect Enemies of Forest Trees."

"Notes on Some Observations in West Virginia."

By Prof. A. D. Hopkins, Entomologist to the West Virginia Agricultural Experiment Station, Morgantown, W. Va.

"Notes on Insect Attacks of the Year."

By Dr. J. A. Lintner, State Entomologist, Albany, N.Y.

"Entomological Notes from Maryland."

By W. G. Johnson, State Entomologist, College Station, Md.

The following papers, the authors of which were not present, were read by title, but, it is expected, will be included in the published proceedings of the Association:—

"The Grasshopper Disease in Colorado."

By C. P. Gillette, Professor of Zoology in the State Agricultural College, Fort Collins, Colo.

"The Development of the Mediterranean Flour Moth."

By F. H. Chittenden, Assistant in Division of Entomology, U. S. Department of Agriculture, Washington, D.C.

"Notes on the San José Scale."

By W. B. Alwood, Vice-director of the Virginia Agricultural Experiment Station, Blacksburg, Va.

"A New Garden Smynthurid."

By F. L. Harvey, Professor of Entomology in the Maine State College, Orono, Maine.

"A Simple Device for the Preparation of Oil Emulsions."

By H. A. Morgan, Professor of Entomology in the Louisiana State University, Baton Rouge, La.

The following officers were elected for the ensuing year: President, F. M. Webster; first Vice-president, Herbert Osborn; second Vice-president, Lawrence Bruner; Secretary, C. L. Marlatt.

In accordance with the established custom, the next session will be held on the two days preceding the general sessions of the American Association for the Advancement of Science, Detroit, Mich., August 6–7, 1897.

C. L. MARLATT,
Secretary.

NOTES ON COLEOPTERA—No. XII.

BY JOHN HAMILTON, M.D., ALLEGHENY, PA.

Liparocephalus cordicollis, Lec.—This species does not differ in any way from *L. brevipennis*, Mæk., except in its pale colour, and the two forms must be united, as intimated in a former paper (CAN. ENT., XXIV., 158). Since the publication of that paper more than thirty examples of *brevipennis* and several of *cordicollis* have been examined and compared. Apart from colour, not a single character of general applicability has been observed by which to separate them into species. The synoptic characters given by Capt. Casey (Ann. N. Y. Acad. Sci., VII., 354) are without value otherwise than as descriptions of those of some individuals. When a sufficient number of each form is present, all the elements, without exception, tabulated by him to differentiate *cordicollis* exist in examples of *brevipennis*, and the reverse.

L. brevipennis is very variable in most of its structural parts (length of antennæ, width of head, form of thorax, etc.), for which due allowance must be made, or about four species created.

It may be observed that Dr. Leconte described *cordicollis*. He had seen only one example from the sea coast of California, and one of *brevipennis* from Unalaschka, both of which, from his remarks, were evidently extremes, such as now exist. The pale colour of *cordicollis* may be from immaturity, just as in other dark *Staphylinidæ*, or it may be permanent, as occurs in variations of *Cryptobium bicolor*, *Belonuchus formosus*, etc. Rev. J. H. Keene, Massett, Queen Charlotte Islands, to whom I am indebted for such ample material, writes that he takes both forms together on the beach under rubbish in early spring, while later the pale form is not so often seen.

Tachinus Schwartzi, Horn, is by no means a common insect, and is mentioned here to record its occurrence in the mountainous parts of Western Pennsylvania. I took several examples recently in Forest County, in the pine region, from a decaying boletus growing on a pine log. It may readily be known by its black colour, elytra longer than wide and with distinct traces of sulci; the last joint of the antennæ, the four basal, and the legs, rufous; the sixth ventral segment of the male is deeply and widely emarginate, and in front of the emargination concave to the base and finely punctate, but without granulations. It was described from examples taken near Detroit, Michigan, and is known from Canada.

Trogoderma tarsale, Mels.—The larva of this species is unfavourably known as an occasional museum pest, and is generally supposed to live solely on animal matter, which it undoubtedly prefers; but it can likewise live on vegetable food as well, as the following demonstrates: A few packed figs were placed in a paper sack and securely tied and placed in a trunk while in Florida, in May, which was not opened till May of the next year, when the figs were found infested by the larvæ and pupæ of this species, while over sixty recently disclosed beetles were taken from the sack. Possibly in this instance the parent beetle may have accidentally been inclosed with the figs, and may not have from choice selected them as suitable food for her offspring, but it is in demonstration that this species can propagate itself on either animal or vegetable products.

The larvæ are more readily distinguishable from those of *T. ornatum* than are the beetles themselves; those of the latter have the last three abdominal segments dark; in the former some have the last three dark, with a spot on each side of the preceding two; some with the last and a spot on each side of the preceding two, dark, while one is occasionally seen entirely pallid. Both species pupate within the larval skin wherever it may be convenient.

Corymbites elongaticollis, Ham.—I find that this species is placed in some collections as *caricinus*, Germ., to which it bears considerable resemblance. It has been, as yet, taken but rarely in Western Pennsylvania, but appears to be more common in Canada, where I have likewise taken it. I have not seen an example of the true *caricinus* from the region eastward from the Mississippi, and I strongly doubt its existence there. Any comparison between the two species must be made with *caricinus* from the Pacific Coast. Several obvious differences will be observed: in *caricinus* the front is prolonged and much depressed at middle like in *Asaphes*, the depressed portion being smooth and with a few coarse punctures; in *elongaticollis* the front is distinctly and uniformly elevated, more or less transversely concave and densely punctate; in the former the thorax is less depressed, uniformly rather densely and coarsely punctured, the punctuation of the latter being comparatively fine, sparse on the middle, denser on the sides; in *caricinus* the elytral intervals are less convex and therefore apparently wider. Many other differences exist—difficult to make plain in print to such as have not both forms, useless to such as have. No one having both would for a moment proclaim them the same species. Whoever united *umbricola*, Germ., with *caricinus*

could not have had good material of both forms before him or such a bad mistake would not have likely occurred. I have good material of the former from Vancouver and from Queen Charlotte Islands, and of the latter from Queen Charlotte Islands, and their union cannot be entertained when compared.

Agrilus macer, Lec., seems to be rare. It was described from Texas (Eagle Pass); one male occurred here five years ago, but it has not been taken since. If Dr. Horn's and Dr. Leconte's examples were ornamented with pubescence, it is not clearly set forth; in that taken here, on each side of the thorax above is a broad marginal band of white pubescence; the sternal side pieces, the vertical portion of the ventral segments, and a large spot on each side of each of the ventral segments, white, as in *difficilis*, from which it may at once be known by the furcate or emarginate projecting carina of the pygidium. In this sex the elytra are acute at tip as well as rounded and serrate, just as in *difficilis*. I have observed no other record of distribution than the above, but quite likely it is mixed in collections with *difficilis*.

Phyllodecta vitellinæ, Linn.—This species is recorded from Canada, Michigan and New Hampshire. No American examples have been seen, and there is strong presumptive evidence that *vulgatissima*, Linn., is the species so determined by Kirby; in his time, in Britain, the latter species was placed as a synonym of *vitellinæ*, and of course he would give the same name to the American examples. *Vulgatissima* is common in the regions mentioned, but no example of the other species is known. The two species are difficult to separate, even with the insects in hand, and it is more so to make an intelligible description of their differences. In both species the colour of the upper surface is equally variable—green, violet, purple or bronze; the surface of the thorax is a little uneven, sparsely irregularly finely punctured on the disc, more densely toward the sides; the elytra are serially punctured in undulating rows of fine, close-set punctures; these rows are usully much confused before the apex and at the sides; the intervals are usually impunctate. The differences at first sight are not very evident, the chief being the more elongated form of *vulgatissima* and the carination of the lateral elytral interval; *vulgatissima* is .19 inch. in length; *vitellinæ* .17 inch., with the width of the former and a little more convexity, which gives it a more robust appearance. The carination of the lateral elytral interval used by European authors to divide the genus into sections is not a very evident character;

by a careful examination may be seen a row of fine punctures next the margin, separated from the general surface of the elytron by a more or less sharp line, while in *vitellinæ* this row of punctures is more or less obsolete and not sharply separated from the confused punctuation of the contiguous surface. A little faith is sometimes required to see these differences. It would be useless to enter into more minute details, as anyone who cannot identify his insects by those given would probably fail with both species in hand. If *vitellinæ* occurs in North America, the above may be sufficient to cause its recognition.

P. interstitialis, Mann.—This species was described from the Yukon, from a single example, and is usually set down by American writers as a synonym of *vulgatissima*, the type being considered as perhaps deformed. The description seems, however, to forbid such an assignment, as, in addition to the usual strial arrangement, the whole of the elytral surface is represented as deeply and coarsely punctured. I have examined many specimens of the American and European *vulgatissima*, and likewise of the European *vitellinæ* and *cavifrons*, in all of which the intervals are practically impunctate, and show no tendency to become punctured in any degree. *Interstitialis* by description is a valid species.

Amblyderus (Anthicus) pallens, Lec., was described from examples taken on the shores of Lake Superior; a form taken on the sea coast of New Jersey, and southward, by others as well as myself, seemed from description to be the same, but it is only recently that I have been able to be assured of their identity by direct comparison of specimens. Mr. Wickham has kindly sent four examples from the southern shore of Lake Superior, between which and those from the Atlantic Coast there are seemingly no differences except those of individuality. Of those sent by Mr. Wickham, one is entirely pallid throughout, one has the abdomen partly fuscous, another entirely so, and the fourth has in addition the elytra pale livid, indicating that there may be a melanotic form. Of six sea-shore forms, two are entirely pallid, the other four have the abdomen infuscate and one of them also the elytra slightly. Inasmuch as the original description is out of print, its reproduction may be useful on account of the redescription by Capt. Casey in his recent revision of the *Anthicidæ* being so seriously defective as to be misleading, describing the entirely pale and exceptional form not mentioned by Dr. Leconte, but giving no hint of the common form with the fuscous abdomen—Leconte's species.

"Testaceous, convex, pubescence white, eyes black; head triangular, base emarginate with the angles acute, a smooth longitudinal line, moderately punctate; thorax not narrower than the head, shorter than wide, obovate, obsoletely canaliculate, rather densely punctate; elytra very finely punctate, apex subtruncate; abdomen dark fuscous *(nigro-fusco)*. Length, .11 inch."—[TR.] Agassiz, Lake Superior, p. 231. Supplementary characters were added (Proc. Acad. Nat. Sci., Phil., 1852, p. 103): "Head sparingly granulato-punctate, thorax very strongly narrowed posteriorly; elytra convex, truncate at base; antennæ slender and long, terminal spurs of tibiæ very distinct, those of anterior tibiæ very unequal, the anterior tibiæ of the male slightly sinuate internally and the terminal spine more prominent." The elytra do not cover the abdomen. The pallid examples occur on the coast among the hills of white sand immediately fronting the ocean, and I took one on the beach of Anastasia Island, Florida; those with dark abdomens, a little further back at the ase of those bordering on the salt meadows.

Under the name *A. arenarius*, Capt. Casey has described from a unique taken at Newport, Rhode Island, what seems to be the form of *pallens* with the fuscous abdomen, as described by Dr. Leconte.

MISCELLANEOUS NOTES.

Stagmomantis carolina, Linn.

In his index to the Mantidæ of North America (CAN. ENT., August, 1896, 211), Mr. Scudder gives the range of this species as "Florida to Arizona. . . . . north to Maryland, Southern Illinois, Missouri, Kansas, and Utah."

He might also have included the southern half of Indiana, since it is common in the counties bordering on the Ohio River, and is occasionally taken as far north as the City of Indianapolis; specimens taken here (females, brown form) having been brought to me on Sept. 23rd and 26th, 1895, and Sept. 4th, 1896. I have also a green female from Mitchell, Lawrence Co. Mr. S. G. Evans, of Evansville, Ind., in a personal letter, says: "The Mantids are found here of all sizes and colours, the eggs and young being almost as common as mosquitoes. I have on several occasions placed male and female together in a glass jar, and the female always devoured the male, and generally while in the act of copulating, the bodies remaining together until the male was almost consumed."

Gonatista grisea, Fabr.

The specimen from Indiana mentioned by Mr. Scudder (*loc. cit.*)

was taken by Mr. Evans, at Evansville. As he thought it to be a short-bodied form of *S. carolina*, he has no recollection of the exact date or place in which it was found.

Acanthosoma cruciata, Say.

Mention of this handsome member of the family Pentatomidæ occurs in but few of the published lists of Heteroptera. This is probably not so much due to its scarcity as to an ignorance of its food-plant and habitat. In Indiana I have found it in abundance on several occasions, but always on the leaves and stems of Spikenard (*Aralia racemosa*, L.), growing on the sides of deep damp ravines. The mature insect may be taken during August and September.

Trichopepla semivittata, Say.

This is another uncommon Pentatomid, which appears to have a special food-plant. I have taken it but once, Sept. 9th, 1894, in Vigo Co., Ind., where I found it very common in all stages, on the heads, and in the angles of the leaves, of the plant known as Rattlesnake-Master, or Button Snake-root (*Eryngium yuccæfolium*, Michx.). The insect will probably be found wherever this plant abounds.

Libythea Bachmani, Kirtland.

This little butterfly, so readily known by its long, beaklike palpi and angled fore wings, is usually of rare occurrence in Indiana. This season, however, it has been very common, and has been noted in a number of localities in the State. On June 14th, eighteen specimens were secured from the flowers of some basswood trees (*Tilia americana*, L.), which stand in front of my residence, in a thickly settled portion of the City of Indianapolis.

Papilio philenor, L.

This butterfly is very common in Indiana, and for a long time I was puzzled as to its food-plant, the ones commonly mentioned in the books, *Aristolochia serpentaria*, L., and *A. sipho*, L'Her, being very rare in the State. The problem was solved one day, however, when I found the larvæ of *philenor* feeding upon the leaves of the wild ginger (*Asarum Canadense*, L.), a common plant along the rich hillsides of Central and Southern Indiana, and one which belongs to the same family as the different species of *Aristolochia*.

Indianapolis, Ind. W. S. BLATCHLEY.

BOOK NOTICES.

THE GYPSY MOTH.—A report of the work of destroying the insect in the Commonwealth of Massachusetts, together with an account of its history and habits both in Massachusetts and Europe. By E. H. Forbush and C. H. Fernald.

This report, a handsome volume of nearly 600 pages, well printed and most copiously illustrated with chromolithographs, photogravures, and wood cuts, gives a full account of the introduction of the now notorious "Gypsy moth" into America by Leopold Trouvelot in 1868 or 1869, traces its history, and records the efforts which have been made to exterminate it by the State of Massachusetts up to the end of 1895. The spread of this insect for the first ten years was remarkably slow, in the light of what we now know of its capabilities for harm. During that period it was not noticed by anyone but the introducer. The first extensive outbreak was in 1889, but for ten years before that it had given great annoyance to the people living in the part of the town of Medford where it was first introduced. It had also spread and had gained a foothold in thirty townships without attracting public attention. Since that time its history is well known. In 1890 the first Gypsy Moth Commission was appointed and the work of fighting the pest was inaugurated. In February of the next year this commission was removed and another one substituted. On 12th of March, Mr. E. H. Forbush, the present very efficient Director of Field Work, was appointed, and on 18th June Prof. C. H. Fernald began his labours as Entomological Advisor. Since that time the work has been pushed on with great energy, and the present valuable report is an outcome of the combined efforts of a practical, energetic manager and a careful scientific entomologist. The two parts of this report, prepared by the above-named officers, are quite distinct and form together a very complete treatise, not only upon the Gypsy moth, but upon the general principles which it is necessary to study when combatting any injurious insect. This carefully-prepared report, therefore, cannot but be for a long time an indispensable book of reference for economic entomologists.

There are in this volume many things which will attract the attention of entomologists. Indeed, it is so full and there are so many different subjects treated of, that even to give the titles would take more space than is at my disposal. The first thing which will be noticed is the adoption of the generic name *Porthetria*. Articles of particular note deal with

the studies made as to the methods of distribution of the Gypsy moth, and the measures practised for the destruction of the insect in its different stages; spraying apparatus; and particularly the care of spraying machinery; methods of pruning; and some charming observations upon insect-eating birds.

The scientific work contained in Professor Fernald's report is of great value and contains a record of most painstaking and patient work. Probably one of the most interesting sections is that which deals with Natural Enemies, in which most excellent work has been done. Prof. Fernald has been aided in this work by efficient assistants, and the whole information so gained has been pieced together by a master hand.

With regard to spraying, some surprising results have been obtained. In the first place, the caterpillar of the Gypsy moth seems to be little affected by applications of Paris green when applied of the strength ordinarily used for other mandibulate insects. Mr. Forbush says: "It became evident before the end of the season of 1891, that spraying, while reducing the numbers of the moth, could not be relied upon as a means of extermination, for many caterpillars survived its effects."

The following conclusion, on page 139, will show entomologists that the matter of controlling mandibulate insects, by means of active poisons, is still a fertile field for careful work, in which useful and laurel-bearing results are still to be reaped:—

"Every effort was made during the spraying season to determine why the results of spraying were not uniform and satisfactory. The feeding caterpillars were watched day and night by many observers. The spraying was most carefully superintended, and the conclusion finally arrived at was that, under ordinary conditions, spraying with Paris green for the Gypsy moth was ineffective and unsatisfactory."

Paris green was on the whole the most fatal insecticide, and when used in the proportion of one pound to 150 gallons of water, did not burn foliage; but with larger proportions, did considerable harm. The injury developed so rapidly that within a short time the leaves were all killed and the surviving larvæ had to go elsewhere to feed. "Therefore, a strong Paris green mixture had little better effect than a weak one. Lime was then used with the Paris green, with a view of neutralizing the burning; but considerable injury to the foliage still continued."

Probably one of the most remarkable facts discovered by the entomologists is related by Prof. Fernald, on page 476, where he says: "One

interesting result obtained from the analyses of the different stages of the Gypsy moth made in 1893 and 1894 is that pupæ and imagoes from caterpillars which have been reared on leaves sprayed with Paris green or arsenate of lead may contain arsenic in recognizable quantities. Several pupæ and a few female imagoes obtained under these conditions, when subjected to chemical analysis, gave ample evidence of the presence of arsenic in their bodies. This shows that the presence of arsenic in the pupa may not materially interfere with the processes involved in the development of the imago. Since, as has been repeatedly demonstrated, moths reared from poisoned larvæ are capable of reproduction, it is also evident that the arsenic contained in their bodies does not injure the reproductive function." With reference to the amount of arsenic which could be consumed by some of these caterpillars, and yet leave them "normally active and healthy," it was found that some of them had in their bodies, in proportion to their weight, an amount equivalent to 12½ times the fatal dose for an adult human being, in proportion to the weight of the latter.

The work of the Gypsy Moth Committee has been criticised, examined and studied by practical men who were entomologists and others who were not. As far as I can learn, the general verdict is that excellent work, and, under the circumstances, remarkably so, has been done. The insect is not exterminated, it is true; but there seems every reason to hope, judging from what has been done and the behaviour of the species in other countries where it was once alarmingly abundant, that this is possible if money be supplied and if it be given at the time when it can be made use of to the best advantage. On pages 38 to 93 of the report will be found an instructive account of the constant efforts of the committee to get funds to carry on the work properly, and year after year it was the same story of reduced, and what was almost worse, delayed, appropriations, resulting in the necessity of modifying the whole plan of work arranged for the year; so that instead of making vigorous efforts for the extermination of the insect, and fighting it at the time this could be most effectively done—early in the season when the caterpillars were small—all that could be done was to try and prevent the further spread of the enemy from the localities known to be infested. The appropriations which have been made for this work are considerable, about $525,000 up to the present time, and this amount would certainly have produced far better results could the committee have obtained the grants

at the time they required them, so that they could have begun the work early in the season and continued employing, from year to year, those assistants who had been taught, at an expense of much time and trouble, what was required of them.

J. FLETCHER.

Mittheilungen aus dem Roemer-Museum, Hildesheim. No. 6.—Juni, 1896. DIE SATURNIIDEN (Nachtpfauenaugen), von A. Radcliffe Grote, A. M.

This paper of 28 pages is illustrated by three plates and eighteen cuts. The illustrations are from photographs of living moths and are remarkably fine. The author defines the superfamily Saturniides and gives a table separating the families and a number of genera. The value of this table is unfortunately vitiated by the curious spacing, which renders it practically impossible to follow it.

The Saturniides are divided into two families, and each of these into three subfamilies. The Endromidæ, Bombycidæ, and Lacosomidæ are shown not to belong to the group, principally on larval characters. The relations of the Sphingidæ are also briefly discussed. Following are remarks on parthenogenesis and hybridization in the group, a discussion of the subfamilies adopted, geographical distribution, nomenclature, certain corrections to the author's previous paper on the Apatelidæ, and a list of European and North American Saturnians.

No fault is to be found with the classification which the author has worked out, regarded as an artificial grouping. A certain character of venation is selected (position of vein IV_2 on primaries) and the groups referred strictly by this character. A natural classification, which should combine several such special ones, is not attempted. As compared with the reviewer's classification on larval characters, the position of the groups represented by Hemileuca and Aglia are transposed. Mr. Grote must, therefore, suppose that the larva of Aglia is derived from a Citheronia type independently of the Saturnia branch. The larva should have re-acquired the pair of anal tubercles which are already entirely lost in Citheronia, and lost the unpaired tubercle on joint 13. He must also suppose that the stinging spines have been twice separately evolved in the group. On the other hand, to reconcile his grouping with mine it is only necessary to suppose that vein IV_2 has moved toward IV_1 in Hemileuca separately from the types of Attacus and Saturnia, where this process is congenital.

HARRISON G. DYAR.

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