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ON A NEW LIBRARY PEST.*

BY DR. H. A. HAGEN.

Everybody now-a-days has books, even if he never reads them. It has become an acknowledged fashion—the more books the larger the wisdom, the finer the culture. The climax is reached in France, where you can buy as decoration for fine rooms large libraries, where all the prominent classic authors are represented only by the handsomely lettered backs of the volumes, stored in cabinets with glass doors. The key of the cabinets is invariably mislaid; in fact, the cabinets do not open at all. But even where book-cases contain real volumes, it is interesting to observe which authors are never taken out. In German private libraries, the binding of Klopstok's masterpiece, the Messiah, is almost invariably as fresh as possible, and in England and here I have often seen Paradise Lost in a very fine condition. As an instance of the contrary, when I was a young man, an older prominent naturalist singled out a volume from my library in a condition best to be described by book and binding in tatters, and then exclaimed, "That is just how I like to see books." It was on bugs, and my scientific digestive organs were at that time in excellent condition. Later I was always interested in picking out books in similar condition in libraries, in order to have an idea of the taste and favorite studies of the patrons. I should state that the first prize could be given to a copy of Pepy's Memoirs, in the truest Billingsgate condition, greasy as candles. It was in a library intended for the culture of the young.

Let that be as it is; but certainly no owner of books likes to have his property destroyed except by himself. I had believed until recently that the most obnoxious enemies of books were my special friends, the insects. But I see now that I was decidedly wrong. A most interesting publication, "The Enemies of Books," by William Blades, in London, which

* Read before the Boston Thursday Club, January, 1886.

has gone through three editions during the past five years, shows conclusively that men are far greater enemies of books, at least in old England. Mr. Blades describes everything injuring books—fire, water, gas, heat, dust, neglect, and ignorance. Then come two short chapters on the book worm and other vermin, followed by chapters on bookbinders and collectors. The small volume contains facts which will be read with virtuous astonishment and disgust. A rich shoemaker, John Bagford, one of the founders of the Antiquarian Society, in the beginning of the last century, went from library to library, tearing away title pages from rare books of all sizes. These he sorted out according to nationalities and towns, and so formed over a hundred folio volumes now preserved in the British-Museum. Others collect initials on vellum, all rich in gold and colors, floral decorations ranging from the 12th to the 15th century, all nicely mounted on stout cardboard. A Mr. Proeme collects only title pages, to follow a senseless kind of classification. One of his volumes contains coarse or quaint titles, showing how idiotic or conceited some authors have been: "Bowels Opened in Diverse Sermons," "Die and be Damned," and many others too coarse to be quoted. Certainly it is sure that the poor bugs cannot compete with such rivals, except some more enterprising ones, apparently bound west, and going straight through 30 folios of patristic works, making them look like a spy-glass, in a fashion never dreamed of by Chrysostomus and his partners.

Nearly six years ago I was invited to make a communication about library pests, at the meeting of the librarians in Boston. After a review of the literature then at my command, I came to the conclusion that only two insects were to be considered very dangerous and obnoxious in North America, the Anobium and the White Ants. The Anobium is a small beetle, which is also very destructive to old furniture and old picture-frames. All who have the infirmity to indulge in the love for old furniture, will have often observed with disgust small round openings in their treasures, out of which a fine mealy dust falls in little heaps on the floor. I observed myself such a case long ago, when I was a boy, but I confess that the remembrance of this case is always accompanied by a strong itching of my right ear. A lady cousin of mine who was a lover and lucky owner of such old jewels, had decided to take care of them herself. I had been naughty enough to write the date in these dust heaps with my fingers. When I impudently ventured to show to her about a fortnight

later the date I had written still undisturbed, the only acknowledgment of my service came forth with admirable dexterity.

Use every man after his desert, and who should 'scape whipping?

Nevertheless I gave up forever this kind of chronological record.

Three additions to my communication before the librarians have been published, but they contain only isolated cases, certainly nothing of general importance. Of course the insects mentioned had injured books, and as everybody likes to have his own little pest, the new comers were chronicled with some emphasis. Nevertheless I have followed up the matter carefully during these six years, and would be able to give a nice list of names of more or less queer composition. Six years ago a part of the publications on book pests was not to be found here. But in the meantime I have been able to get some of them, the most important ones through the splendid custom of the public library of ordering books wanted by scientists for their study.

There is, in fact, no end of obnoxious creatures. "Misery acquaints a man with strange bedfellows." Perhaps the word obnoxious is not exactly in the right place, as probably those bedfellows may consider the intruding stranger decidedly obnoxious. Nevertheless, as such philosophical views would destroy every legitimate Museum's business, we are bound to our accustomed impoliteness towards all intruders.

One morning Mr. R. T. Jackson, assistant in Geology in the Museum, asked my advice and help against a new pest in his department. The stones and petrefacts were left untouched, but all the new labels, written during the past year, were more or less injured, or nearly destroyed. Of course this is a serious danger for a collection, as the specimens lose their value if the locality or the scientific name is lost. A new form of labels had been chosen last year printed on excellent card paper. The stones are kept in small square open boxes, the label is folded in the middle; upon the lower half the stone is laid, to keep the label in place; upon the upturned half the locality and the name are written in order to afford an easy view of the contents of the collection. Now, since last winter this upper half has appeared to be scraped on both sides in such a manner that the writing is injured and in some cases has disappeared. The lower half of the label was similarly injured, so far as not covered by the stone; the under side of the lower half proved never to be injured, and was apparently protected by the bottom of the box, to which it was pressed

by the weight of the stone. The damage is a considerable one, as the whole collection is again to be provided with new labels. A careful research led to the discovery of an insect belonging to the genus *Lepisma*, which lived in the boxes and cabinets. The old labels of common writing paper were never attacked, therefore it was to be presumed that the finish of the new labels was the attraction to the insects. Indeed, Professor C. L. Jackson found the new labels finished on both sides with starch, and without doubt the starch covering attracted the *Lepisma*. I was rather puzzled by this fact. It has been known for more than a century that the greatest library pest, *Anobium*, does not like starch. Therefore it was recommended to use in binding books only such paste as was made of pure starch without meal, of course also with the addition of several drugs of the most vicious odor; and now a new customer proves to prefer starch to other things. It is, by the way, a queer but very common association of ideas that substances with an unpleasant scent to man should also be unpleasant to insects. But the virtuous hater of Rockfort or Limbourg cheese would directly be disabused by discovering with a common hand lens a lively carnival of bugs in those disgusting dainties.

The *Lepisma* destructive to the labels is a true American insect, described by Professor Packard as *L. domestica*. It belongs to a small group of insects with the euphonious name *Thysanoura*, and there are half a dozen species known in the United States. The principal one found in Europe is the *L. saccharina*, better known as the Small Blue Silver-fish. This little insect is found in dark places or corners near provisions, running very fast, and being so soft that it is crushed by the lightest touch. In Europe it has always been considered, but without proof, as imported from America. It has been known there for more than 200 years, but its existence cannot be traced before the discovery of America. The whole body of the insect is covered with very fine iridescent scales, which have been used as a delicate test object for microscopes, and are the cause of its vulgar name, Silver-fish.

The earliest notice of the small European species is in R. Hooke's *Micrographia*, a folio, London, 1665. It was printed at the expense of the Royal Society, and is an account of innumerable things examined by the microscope. The book is still respected for the accuracy of the author's observations. Mr. Blades calls it most amazing for its equally frequent blunders. I have reason to suppose that the absurd blundering

is more on Mr. Blades' side. R. Hooke calls it Book-worm, and states that it corrodes and eats holes through the leaves and covers of books. The figure is for the time tolerably good and recognizable. On Mr. Hooke's authority, *Lepisma* was reported as obnoxious to books. As Mr. Hooke has apparently mixed up the destructions done by *Anobium* with those of *Lepisma*, of which in the following hundred years no damages were observed, the whole observation was doubted, and Prof. Herman, in Strasbourg, in his prize essay on library pests, declared (1774) that *Lepisma* was erroneously recorded as obnoxious. This was the reason that I did not mention *Lepisma* in my communication to the librarians, the more so as in the past hundred years no new observations had again been recorded. I did not mention other remarkable facts, as the Jehthio-Bibliophage, a codfish which had swallowed three Puritanical treatises of John Frith, the Protestant martyr. No wonder, after such a meal, the fish was soon caught and became famous in the annals of literature. This is the title of a little book issued upon the occasion: "Vox Piscis, or the Book-fish, containing three treatises which were found in the belly of a Codfish in Cambridge Market, one midsummer eve, 1626;" great was the consternation at Cambridge upon the publication of this work.

Nevertheless, just after the delivery of my communication, new proofs of the depravity of *Lepisma* came forward.

"God made him, and therefore let him pass for a man."

Prof. Westwood, of Oxford, showed to the Naturalists' Association in 1879, a framed and glazed print of which the plain paper was eaten by *Lepisma*, while the parts covered by the printing ink were untouched. I accept this as a sufficient proof of obnoxiousness, the more so as the white paper is often the best part of a print. Prof. Westwood mentioned that the same fact had been observed in India, where some of the Government records had been injured in the same manner.

Patrick Brown states in his Natural History of Jamaica, that *Lepisma saccharina* is very common there, and extremely destructive to books and all manner of woollen clothing. This notice had been reproduced by Linnæus, but was later considered as not reliable.

Mr. De Rossi writes in 1882 as follows: *Lepisma saccharina* likes damp places and destroys in my house paper hangings from inwards entirely. Muslin curtains were perforated and the living animals found near fresh holes. Probably the curtains were starched, though it is not

stated. Also, insect boxes and the wings of butterflies have been damaged.

Prof. Liversidge, in Sidney, reports the same year *L. saccharina* as very common in New South Wales. It does not do so much harm to books, as it cannot well get in between the closely pressed leaves of a book, but it injures loose papers, maps and labels; the loose edges of piles or bundles of letters suffer more than the central portion. Writing paper, too, probably contains more attractive matter in the way of size. The labels were written only 15 months ago, and some hundreds have been rendered totally worthless.

The same calamity is reported by Mr. H. Lucas, assistant in the Museum of the Jardin des Plantes, in Paris. *L. saccharina* destroys labels of white paper, but the parts printed with oil and minium remain untouched. The labels on starched paper were very much injured, but only the white parts. When leaving for the country in 1862, he put in a drawer various articles of clothing, all starched, collars, cuffs and bonnets, and returning after six weeks, he found numerous holes, round or oval, in a bonnet, and *Lepisma* near by. On the labels of Polyyps, Madreporas and others in the Museum, the writing was in a great part destroyed. Dr. Aube, in Paris, says that the black part of the backs of bound books was nearly destroyed, probably by *Lepisma*.

Mr. Samuel Henshaw, Assistant of the Society of Nat. Hist. in Boston, enclosed purposely living *Lepisma* with soft paper, part of a newspaper, in a glass jar, and ascertained that the insects had eaten large holes in the paper.

The well-known antiquary, Mr. Quaritch, in London, had complained, 1870, of the ravages done to books; and Mr. Lewis, in London, after careful examination, stated that by eating parts of the bindings the books were caused to fall to pieces; yet he considered it impossible for *Lepisma* to bore holes in the books, which were probably made by *Anobium*. Prof. Packard, in his Guide, reports of silk and silken tapestry eaten by *Lepisma*, which also devour the paste, making holes in the leaves of books. Also, Mr. Horne, in London, alluded to the damages done to silk garments in India by *Lepisma*. The insect evidently attacks the silk on account of the stiffening matter in it, but nevertheless makes holes in the fabric. Finally, Mr. Adkin showed a species of *Lepisma* which damaged account books kept in the iron safe of an office in London.

After all these reliable facts, there is of course no doubt that *Lepisma*,

when left undisturbed, may become very obnoxious. The question, Why has that not been observed long ago? may be answered by the well known "I awoke one morning and found myself famous!" I think there is a very simple explanation. There are so many rogues who work in the same way, that the swiftest one to disappear is often easily overlooked. Many times I have been told by ladies that their silk dresses, always black ones, had been destroyed by carpet bugs, and have always answered that the carpet bugs only attack wool. Indeed, I confess that I have only recently learned that these aristocratic desires belong to the Silver-fish.

If we tabulate all the facts, we find directly that all damages, except those to paper and its combinations, have been inflicted on silks, clothing and muslin curtains which were invariably starched or finished with some stiffening size, making them more easily eaten or eroded. Secondly, the backs of books have been more or less seriously injured. But just here paste had been used in quantity. The gold lettering of the backs is commonly done by putting the gold on paste and burning the hot brass letters into the back. I have been assured that in one case only the gold of the lettering had disappeared. There is no wonder that silken and paper tapestry has been eaten; but it is to be hoped that the industry now common of making paper hangings solely of arsenic may induce *Lepisma* to emigrate to more hospitable quarters.

That labels in collections have been destroyed, is observed here, in France and in N. S. Wales. All those labels were starched. Prints have been destroyed in England; letters, when lying loose or in heaps, and government records in England, in N. South Wales and in Boston. I think many gentlemen present will find the most rascally instance of destruction is the making erasures in account books in the safe.

After all these facts, there is no doubt that maps, engravings, collections of photographs, herbariums, even label catalogues, are in evident danger. But if we look more closely at the injuries reported, we find directly that all such papers, when pressed firmly together, were not reached by *Lepisma*, and in this way a large number of accidents may be avoided. Engravings and maps, which would suffer if pressed too hard, will be perfectly safe in simple pasteboard boxes, provided that they are made to close perfectly, so that it is impossible for *Lepisma* to find an entrance. Insect powder sprinkled in the nooks and corners where *Lepisma* is often observed—in Cambridge, behind the kitchen stove or

range—kills directly all reached by the powder, and I should recommend the same for silk dresses or the closets and drawers in which they are stored. Concerning valuable engravings, I would cover the backs of those framed with common paper fastened on with a paste mixed with insect powder or tincture. I consider, therefore, *Lepisma* as not dangerous *when proper care is taken to prevent the danger.*

The most dangerous enemies to papers and books are the white ants, the Termites, because they destroy everything and avoid the daylight, when they work. As I had before this the pleasure of delivering a communication on this subject, I will give only some additional facts which have come to my knowledge during late years. The common white ants of the United States are to be found everywhere, from Manitoba down to the Gulf of Mexico, and from the Atlantic to the Pacific. In the mountains in Colorado, Washington Terr. and Nevada, they ascend to 5000, and even above 7000 feet. It is of course not possible to exterminate them, but they must behave if they intend to live together with man. Their depredations should not exceed certain limits allowed to them. Everybody is accustomed not to forget for one moment the precautions necessary to protect his property against destruction by fire, and if the same precautions were taken and not for one moment forgotten, against the destruction by white ants, I think all that men are able to do would have been done. Of course, very valuable property we are accustomed to shield by fire-proof buildings, and similar caution will be necessary to protect very valuable property, i. e., libraries, against white ants. Buildings should be stone or brick, and all stumps or roots of trees taken out of the bottom of the cellars to a depth of six feet before the cellar floor is carefully cemented. Outside the building should be surrounded by a deep open area; no flower beds, shrubs, ivy, as the necessary manure is the greatest attraction for white ants.

Large cities are certainly in less danger, at least some parts of them. I am sure that all that is called Back-bay in Boston, will be free from white ants, if they are not brought in by nice parks and similar fineries. The older parts of Boston are by no means free from the pest, but for palpable reasons the owners of infected property do not like to speak of such things. Their presence in the State House, in the so-called Dungeon, was noted in the papers four years ago. As nothing has been done to prevent the pest from entering other parts of the building, it is very pro-

bable that they have spread further. The note in the newspapers about the sudden break down of the wooden stand supporting the ensigns and standards, looks very suspicious. Perhaps white ants may know more about it. In the Dungeon only the taxation papers of the State were stored, and the white ants, when I saw it, had arrived at the twentieth year of this century. According to another notice in a newspaper (I cannot say if it is true), the archives of the Board of Health have been placed in the Dungeon—as the notice stated—for preservation. As the State House was built on a place that was formerly a beautiful garden, it is very possible that stumps not taken out may be the cause of the presence of the pest. To find out where the white ants came into the Dungeon, and to follow their gangs outside the building, would be the first and most important step to take. Indeed, two years ago a bill asking for a paltry sum for this purpose was brought before the Legislature, but laid upon the table. In a boarding house in France, infested by white ants, the floor of the dining room suddenly came down two flights, together with the table boarders. It is gratifying to learn that nobody was hurt, and as it is stated, they lost only their appetites for one day. So we may hope that if the Legislature should come down in a similar soft manner, they may lose only their appetites for one day, and that this *argumentum a posteriori* may be followed by an enlightenment about the pest. Indeed, the State House is not the only place infested by white ants in those parts of the city. A few months ago an old bachelor, in a house very near Mt. Vernon Street, had to take out all the injured lumber supporting the walls and to replace it by new. When told by one relation that it was rather dangerous, he answered that he felt very comfortable, as it was only every ten years he had to meet this expense. In the neighborhood of the State House, in small courts, are some sickly looking old trees, probably dear old pets of the owners. They have decidedly the appearance of knowing something about white ants. That may be as it is, but I believe that no library here is more in danger than that in the State House, and I am told that it contains very rare books, difficult or impossible to be replaced. The Athenæum, situated near the State House and on one side bordering on an old churchyard, seems at first in a rather dangerous situation. But the very substantial building, with high, and, I believe, vaulted basements, makes danger to the library appear very improbable. Nevertheless, it would be reasonable to always have the pest in mind, and to

often make a revision of those parts of the library which are little or rarely used. The Public Library does not seem in danger, but I know the surroundings only imperfectly. After all these gloomy predictions, I may assert that nobody would be happier than I if they were forever unfounded, and the librarian might say, What's Hecuba to him, or he to Hecuba!

ON THE GEOGRAPHICAL DISTRIBUTION OF NORTH AMERICAN LEPIDOPTERA.

BY AUG. R. GROTE, A. M.

(Concluded.)

The following tables contain a partial resumé of the species common to Europe and North America, and also of what are technically known as representative species. I have intended to include only species which I have myself examined and which are with some certainty accurately compared. But the term "representative" species is in itself perfectly elastic, as I have elsewhere shown; in the present case the species compared are believed to have had a common ancestor in the Tertiary. With regard to the introduced species no historical data are accessible to me, and I doubt if any exist; it is a case for the operation of reasonable surmise. I think these tables are of preliminary interest and value; I first commenced to publish similar observations in the Bulletin of the Buffalo Society of Natural Sciences. In a comparison of European and American species we are chiefly indebted to M. Guenée and Dr. Speyer.

FIRST CATEGORY OF ORIGIN OF THE NORTH AMERICAN FAUNA.

I. Species of Moths Common to North America and Europe, probably not Introduced by Commerce, and thus Unchanged Descendants of a Tertiary Fauna.

<i>Europe.</i>	<i>N. America.</i>
Euprepia caja (Linn.)	Grote, Check List, p. 15.
Agrotis C-nigrum (Linn.)	Guenée, Noct. I., 328.
pecta (Linn.)	Guenée, Noct. I., 326.
fennica (Tausch.)	Guenée, Noct. I., 270.

<i>Agrotis conflua</i> <i>Treits.</i>	<i>Grote</i> , 6th Ann. Rep. Peab. Ac. Sci., 29.
<i>sauucia</i> <i>Hüb.</i>	<i>Agrotis inermis</i> <i>Harris.</i>
<i>psilon</i> (<i>Hufn.</i>)	<i>Agrotis telifera</i> <i>Harris.</i>
<i>Eurois occulta</i> <i>Hüb.</i>	<i>Grote</i> , Can. Ent., vi., 13.
<i>prasina</i> (<i>Fabr.</i>)	<i>Gueneè</i> , Noct., II., 5.
<i>Mamestra trifolii</i> (<i>Rott.</i>)	<i>Speyer</i> , St. Ent. Zeit., 137.
<i>Dipterygia pinastri</i> (<i>Linn.</i>)	<i>Grote</i> , Proc. Ent. Soc. Phil., I., 218.
<i>Euplexia lucipara</i> (<i>Linn.</i>)	<i>Gueneè</i> , Noct. II., 65.
<i>Apamea nictitans</i> (<i>Bhk.</i>)	<i>Gueneè</i> , Noct. I., 126.
<i>Heliophila pallens</i> (<i>Linn.</i>)	<i>Gueneè</i> , Noct. I., 95.
<i>Pyrophila tragopogonis</i> (<i>Linn.</i>)	<i>Bethune</i> , Can. Ent., II., 73.
<i>Xanthia togata</i> (<i>Esper.</i>)	<i>Walker</i> , C. B. M. Noct., 461.
<i>Scoliopteryx libatrix</i> (<i>Linn.</i>)	<i>Walker</i> , C. B. M. Noct., 1011.
(?) <i>Heliothis armiger</i> <i>Hüb.*</i>	<i>Grote</i> , in Proc. Ent. S. Phil.
<i>Anarta melanopa</i> <i>Thunb.</i>	<i>Anarta nigrolunata</i> <i>Pack.</i>
<i>myrtilli</i> (<i>Linn.</i>)	<i>acadiensis</i> <i>Beth.</i>
<i>cordigera</i> (<i>Thunb.</i>)	<i>luteola</i> <i>G. & R.</i>
<i>Orgyia antiqua</i> (<i>Linn.</i>)	<i>Orgyia badia</i> <i>Hy. Edw.</i> , Papilio, iii. 39.
<i>Prionia lacertinaria</i> (<i>Linn.</i>)	<i>Prionia bilineata</i> <i>Pack.</i>
<i>Ennomos alniaria</i> (<i>Linn.</i>)	<i>Ennomos magnaria</i> <i>Guen.</i>
<i>Metrocampa margaritata</i> (<i>Linn.</i>)	<i>Metrocampa perlata</i> <i>Guen.</i>
<i>Boarmia crepuscularia</i> (<i>Treits.</i>)	<i>Boarmia occiduaria</i> <i>Guen.</i>
<i>Asopia costalis</i> <i>Fabr.</i>	<i>Grote</i> , in U. S. Geol. Reports.
<i>Scoparia centuriella</i> <i>W. V.</i>	<i>Grote</i> , Check List, 52.
<i>Botis octomaculata</i> (<i>L.</i>)	<i>Botis glomerata</i> <i>Walk.</i>
<i>Nomophila noctuella</i> <i>W. V.</i>	<i>Grote</i> , Check List, 53.
<i>Salebria fusca</i> <i>Haw.</i>	<i>Grote</i> , in U. S. Geol. Survey.
<i>Pyrrhia umbra</i> <i>Hufn.†</i>	<i>Pyrrhia exprimens</i> <i>Walk.</i>

* Of this species I have described the large, pale greenish form, apparently not found in Europe, as *H. Umbrosus*; the dirty ochrey typical form is apparently common to both hemispheres. But the species of *Heliothis* may have been introduced by commerce, and I do not refer to them here any further on this account.

† This species (= *marginata* *Fabr.*) is the same apparently on both continents, but some authors erroneously regard *angulata* as a form of it. Now the varieties of a species seem always to follow the type form, and as *angulata* does not occur in Europe, it is not likely that it is a variety of *umbra*. I have figured both forms in the Buffalo Bulletin, while Dr. Speyer has been at some pains to point out the differences between

II. *Species of Moths Common to Europe and North America, probably Introduced by Commerce.*

Europe.

- Trochilium apiforme (L.)
 Sesia tipuliformis (L.)
 asiliformis (Rott.)
 Heliothis dipsaceus (Linn.)*
 var. maritima Grasl.
 scutosus W. V.
 Plusia ni Hubn.†
 Asopia farinalis (Linn.)
 Galleria melonella (Linn.)
 Carpocapsa pomonella (Linn.)
 Tinea and Tineola.
 Dakruma convolutella Hubn.

N. America.

- Grote, Check List, 11.
 Harris, Ins. Inj. Veg., 234.
 Grote, Check List, 12.
 Heliothis phlogophagus G. & R.
 var. luteitinctus Gr.
 nuchalis Gr.
 Plusia brassicæ Riley.
 The Meal Moth.
 The Bee Moth.
 The Codling Moth.
 The Clothes and Carpet Moths (three species).
 Dakruma grossulariæ Pack.

the two, although his material from America of *angulata* was incorrectly named for him "exprimens." Surely Dr. Speyer must be good authority that in Europe no variety of *umbra* corresponding to *angulata* exists! That another species of *Pyrrhia* exists in America is proved by *stilla*, which is perfectly and undoubtedly a distinct species from any of the others, and handsomer in colors.

* I incline to believe in the possibility that the species of *Heliothis* and *Pyrrhia umbra* have been imported by commerce; in this case the other two American species of *Pyrrhia* may be held as descended from a common ancestor in the Tertiary. This is at the best conjecture. But I am tolerably confident that our two species, *angulata* and *stilla*, are perfectly valid and distinct.

† This species is regarded as distinct and representative by some writers, but I cannot agree with them; the lateral abdominal tufts are the remarkable specific feature common to both forms; the larva feeds on cabbage, and I think it has been brought over like the Cabbage Butterfly. The Heliothians may have been brought with plants, but I do not feel confident of this with regard to *dipsaccus* and *armiger*; it is more likely, perhaps, with regard to *scutosus*, the larva of which feeds in Europe on *Artemisia campestris*. Probably specimens of the European *Zeuzera Aesculi* have occurred in New York, brought by the importation of trees or in wood, but the species has not spread. The Clear-wings above noted have probably been imported. There is a purposed importation of European insects, with a view to acclimatization, going on, conducted by collectors acting from unscientific motives. Prof. Fernald has given us a very careful paper on *Tinea* and *Tineola*.

III. *Species which have very close Allies, and which have accordingly Undergone a Slight (Specific) Change since the Separation of the European and North American Faunæ in the Tertiary.**

<i>Europe.</i>	<i>North America.</i>
Hemaris fuciformis (L.) .	Hemaris diffinis <i>Boisd.</i>
Deilephila galii (L.)	Deilephila chamænerii <i>Harris.</i>
Habrosyne derasa (L.)	Habrosyne scripta <i>Gosse.</i>
Triæna Psi (L.)	Triæna occidentalis <i>G. & R.</i>
Jocheaera alni (L.)	Jocheaera funeralis <i>G. & R.</i>
Arsilonche albovenosa (G.)	Arsilonche Henrici <i>Grote.</i>
Agrotis baja (W. V.)	Agrotis Normaniana <i>Grote.</i>
augur (<i>Fabr.</i>)	haruspica <i>Grote.</i>
Copimamestra brassicæ (<i>Linn.</i>)	Copimamestra occidenta <i>Grote.</i>
Dianthoecia cucubali (<i>Bkh.</i>)	Dianthoecia bella <i>Grote.</i>
Hyppa rectilinea (<i>Esp.</i>)	Hyppa xylinoides <i>Guen.</i>
Helotropha fibrosa (<i>Hubn.</i>)	Helotropha reniformis <i>Grote.</i>
Oncocnemis campicola (<i>Ev.</i>)	Oncocnemis pernotata <i>Grote.</i>
confusa (<i>Ev.</i>)	Behrensii <i>Grote.</i>
Caradrina lepigone (<i>Moeschl.</i>)	Caradrina miranda <i>Grote.</i>
Pyrophila pyramidea (<i>Linn.</i>)	Pyrophila pyramidoides <i>Guen</i>
Orthosia ferruginea (<i>Esp.</i>)	Orthosia ferrugineoides <i>Guen.</i>
Cosmia paleacea (<i>Esp.</i>)†	Cosmia infumata <i>Grote.</i>
Lithophane lambda (<i>Esp.</i>)	Lithophane Thaxteri <i>Grote.</i>
ingrica <i>G.†</i>	pexata <i>Grote.</i>
Lithomia solidaginis <i>Hubn.†</i>	Lithomia germana <i>Morr.</i>
Calocampa vetusta (<i>Hubn.</i>)†	Calocampa nupera <i>Lintn.</i>
Calpe thalictri (<i>Bkh.</i>)†	Calpe canadensis <i>Beth.</i>
Rivula sericealis (<i>Scop.</i>)	Rivula propinqualis <i>Guen.</i>
Cidaria populata (<i>Linn.</i>)	Cidaria Packardata <i>Lintn.</i>
Triphosa dubitata (<i>Linn.</i>)	Triphosa indubitata <i>Grote.</i>
Glaucopteryx caesiata (L.)	Glaucopteryx inventaria <i>Grote.</i>

* This category may be in so far almost indefinitely extended since I have shown that *all* grades of similarity exist, from undoubtedly different, but congeneric, to undoubtedly identical species. I have only included forms which run very close, about some of which perhaps naturalists are not clear whether they are the same or different. In the discussion of these it is to be regretted that much unscientific temper has been displayed, but that is the fault of that amateurism which Dr. Packard so deprecates,

† These are probably identical species.

SECOND CATEGORY OF ORIGIN OF THE NORTH AMERICAN FAUNA.

I. *Species which are probably Descended from North American Tertiary Ancestors, Occupying Comparatively the Same Territory.**

- Thyreus Abbotii Swainson.*
Deidamia inscripta Harris.
Cressonia juglandis Abbot & Smith.
Dolba Hylaenus Drury.
Phemonoe quinquecaudata Ridings.
Alypia octomaculata Fabr., etc.
Hypoprepia fucosa Hübner.
Leucarctia acraea Drury.
Packardia fusca Packard, etc.
Lacosoma chiridota Grote.
Hyparpax aurora Abbot & Smith.
Heterocampa Astarte Doubleday, etc.
Platysamia cecropia (Linn.), etc.
Prionoxystus Robiniaë Peck.
Leptina dormitans Guen., etc.
Eutlype Rolandi Grote.
Copipanolis cubilis Grote.
Harrisimemna trisignata Walk.
Arzama obliquata G. & R., etc.
Ufeus satyricus Grote, etc.
Marasmalus ventilator Grote, etc.

THIRD CATEGORY OF ORIGIN OF THE NORTH AMERICAN FAUNA.

I. *Species which have been long Domiciled and probably Originally of South American Origin.†*

- Philampelus Pandorus Hübner.*
Citheronia regalis Fabr.
Eacles imperialis Drury.
Cosmosoma omphale Hübner.

* These are mere selections from a host of species which belong by descent to the North American fauna *per se*.

† This list is also extremely partial; at some time in the past there has probably commenced a movement from South to North which resulted in the settlement of the ancestors of these forms within the territory of North America.

Gnophaela vermiculata *Grote.*
 Lycomorpha pholus *Drury.*
 Ecpantheria Scribonia *Stoll.*
 Empretia stimulea *Clem.*
 Oiketicus Abbotii *Grote.*
 Apatelodes torrefacta *Abbot & Smith.*
 Hyperchiria Io *Fabr.*
 Scolecocampa Liburna *Geyer.*
 Remigia latipes *Guen., etc.*
 Panopoda carneicosta *Guen., etc.*
 Homoptera edusa *Drury, etc.*
 Lagoa opercularis *Abbot & Smith, etc.*
 Carama cretata *Grote.*
 Anticarsia gemmatalis *Hübner.*
 Antiblemma canalis *Grote.*
 Selenis monotropa *Grote.*
 Homopyralis tactus *Grote, etc.*

II. *Species which are Partially Domiciled, not probably Continuously Breeding in the Middle States and to the Northward, where they are Winter-killed.*

Enyo lugubris *Linn.*
 Aellopos Titan *Cramer.*
 Dilophonota Ello *Linn., etc.*
 Philampelus Linnei *G. & R.*
 Anomis erosa *Hubn., etc.*
 Aletia argillacea *Hubn.*
 Euthisanotia timais *Cramer.*
 Hyblaea puera *Fabr.*
 (?) Hypocala Hillii *Lintner.*
 Erebus odora *Linn.*
 Plusia egena *Guen.*

III. *Species which form part of the West Indian Colony in the Florida Peninsula.*

Spragueia pardalis *Grote.*
 Cautethia Grotei *Hy. Edwards.*
 Amphonyx Antaeus *Drury.*

Pachylia Ficus Linn.
Didasys Belæ Grote.
Lymire Edwardsii Grote.
Eupseudosoma floridum Grote.
Euhalisidota longa Grote.
Byssodes obrussata Grote.
Urapteryx floridata Grote.
Mecoceras Peninsularia Grote.
Almodes rivularia Grote.

These last eight species are presumed to be distinct from closely allied species inhabiting the West Indies. They have been colonized from thence and in part have undergone some local modification which is presumed to have progressed far enough to warrant a distinct title. It is in the same case with the first category; there will probably be found all grades of relationship in these Florida species, and we shall have to express as best we may the *amount* of these differences in our nomenclature. A sufficiently difficult task! And the "lumpers" will have to be fought against until all the life histories are known and have been quietly compared.

IV. Species which are probably mere Summer Birds of Passage from the West Indies and South America, following the Gulf Stream or Aided by Prevailing Winds.

Diludia Brontes Drury.
Argeus Labruscæ Linn.
Thysania zenobia Cramer.
Noctua agrippina Cramer.
Brotis vulneraria Hübner.
Sylectra Erycata Cramer.

These tables will rather show of what material our fauna is made up, what its relationships are, than any attempt to classify with precision a part of our genera and species according to their probable origin and distribution. But very little has been yet published, so that full lists cannot be compiled; the foregoing are mainly drawn up from my own experience and work.

I believe that these conclusions as to the origin of our genera may be properly criticized from a better knowledge of the facts, but I also believe

that these general ideas as to the origin of our fauna will more and more come to be regarded as probably true, and that I have given them a proper scientific basis.

As we go southward, the Canadian fauna gradually absorbs southern elements in its character. Certain genera, which are plentifully represented in the West Indies, appear in single species; as, for instance, the brightly colored, clear spotted, arctic form, *Zygaenidæ*. Occasionally, at least, *Cosmosoma omphale* occurs in New Jersey; it is not rare in South Carolina; I have taken it, flying in the daytime, in Alabama. Again the larger species of *Ceratocampinæ*, such as *Citheronia* and *Sphingicampa*, become more plentiful in individuals in the Middle and Southern States. There is a change in the character of the *Noctuidæ*; certain genera of the *Nonfasciatæ*, such as *Orthosia* and allies, *Lithophane*, etc., gradually disappear, and the genera of the *Fasciatæ*, such as *Homoptera*, *Pleonectyptera*, *Poaphila*, *Remigia*, *Homopyralis*, etc., become more plentiful. Again, as we go westward, the Heliothians appear in more numerous forms of genera and species. and, in Colorado and California, are quite important components of the *Noctuidæ*. But, as a whole, we have a fauna of moths homogenous in general character until, on the Atlantic side, we strike the tropical colony in Florida, and, on the west, we meet the Mexican fauna in Texas and the South-west Territories. Labradorian and Arctic forms we meet again on the summits of the White Mountains in the east, and on the Rocky Mountains and parallel ranges in the west. The local lists which have appeared of late, and the compilation of which is most laudable work for entomologists in all parts of the country, bear out this general view. The replacement and change of species is a very gradual one; striking differences will be called out by the comparison of localities separated by mountain ranges. If the student will bear in mind the different elements which go to make up our fauna, and which are here superficially discussed and indicated, he will arrive at some comprehension of the relationship which our fauna bears to that of Europe, Northern Asia and South America, and, in time, its true distinguishing features can be fully grasped. My own principal satisfaction, during late years, has arisen from a slightly increased apprehension of the importance of the problems of geographical distribution, and how they may have been influenced and brought about. All this will come clearly to light when large collections shall have been brought together from all principal points

within our territory, while the study of the West Indian, Mexican and South American faunæ is one to which the North American student of our moths must sooner or later betake himself, if for no better reason than that it is necessary for a better knowledge of his own particular fauna, which stands in close relationship to these and takes no note of political boundaries. Already I hear of one good student, Mr. Wm. Schaus, working away in Mexico!

Very instructive tables may be prepared of the different expression of European and American genera of moths. We have, for instance, more than double the number of species found in Europe of the genera *Apatela*, *Oncocnemis*, *Catocala*, etc. In fact, going parallel with our larger territory, all the principal genera of Moths represented on either side of the Atlantic contain a larger number of American than of European forms; and this with but few exceptions, such as *Eupethecia*, where the American species are probably but indifferently known. Certain genera, very largely represented in Europe in the Moths just as in the Butterflies, are totally wanting in America, as, for instance, *Zygaena*. I am speaking now of peculiar genera which give a determinative expression to the faunæ, leaving out of sight the innumerable cases of nearly allied genera replacing each other on the two hemispheres. The time for the institution of such comparisons will not fully come until our Western faunæ are well known. So important an European genus as *Hypopta* has only been recently discovered in Arizona, and undoubtedly we have yet much to learn before we really know what forms our territory harbors. Quite unexpectedly Prof. Snow found in New Mexico a species, *Halisidota trigona* Grote, which has an exceedingly close ally in South America, figured by Dr. Herrich-Schaeffer. But what was to me a most surprising fact was the discovery, by Mr. W. W. Hill, of Albany, N. Y., of *Hepialus auratus* Grote in the North Woods. This species belongs to the genus or subgenus *Plusiodes* of Herrich-Schaeffer, and our species has a near ally in Brazil as illustrated by this authority. That such a genus as *Hepialus* should be so widely distributed, considering its life history, structure and habits, is a proof of the great age of this type of the Moths. Other Bombycidæ might easily spread themselves, but the Ghost Moths would seem by their weak structure, somewhat unwieldy flight and nocturnal habit, not to be of this number. *H. auratus* has patches of dead gold scales principally about the cell of primaries at base, while three bright, gilded, tri-

angular, superposed, brown-edged spots form part of the subterminal band opposite the cell. The hind wings are pinkish fuscous; both wings have the short fringes shaded with orange. Almost all the *Hepialinae* are thinly scaled, sub-transparent, and the peculiar fact that the secondaries are also 12-veined render them anomalous among Moths. I notice that the Rev. Mr. Cramer records the fact that he captured some twenty specimens of the "Graceful Ghost," *Hepialus gracilis* Grote (the tautology of the English name is better than its equivalence), sitting against the trunks of trees in a cemetery (appropriate spot!) at St. Johns, New Brunswick. I wonder he did not run away from them, with their ill-omened name, conferred, I believe, from the ghostly appearance of the European *Hepialus Humuli* when flying, the male of this species being silvery white above and brownish gray beneath, and, in its vacillating flight, exposing now the white and then the dark surface, presents an uncanny appearance in the dusk of evening. A large species, *Hepialus argenteomaculatus* of Dr. Harris, inhabits the Catskill Mountains, as also various localities in the Eastern States. Dr. Harris originally in his Report describes this species, which has dusky fuscous bands and is of a dull obscure tint, as compared with a second larger silver-spotted species, having a salmon pink tinge and figured by me in the Proceedings of the Philadelphia Entomological Society many years since under the name of *Hepialus quadriguttatus*. The silvery spots are smaller as compared with Dr. Harris' species; but, strange to say, in Agassiz' "Lake Superior," now a rare book, Harris figures my larger species, which inhabits the Lake Superior Region and Canada, as identical with his *argenteomaculatus*. I have also a suspicion that my *quadriguttatus* has been re-named by Mr. Strecker, but I am not certain of this synonym as I am of so many others which might have been avoided by only a little more care as to what has been published. If students would only study our own periodical literature covering the last twenty years or so before putting pen to paper! I know of so many instances where this obvious duty has been neglected. And then if they would always have surely the right name of the species they discuss. I have known a great deal of argument wasted on a wrong determination.

In concluding this somewhat discursive, but I hope not on this account less readable paper, I cannot but pay my tribute to the CANADIAN ENTOMOLOGIST and its contributors for important contributions to the development of our knowledge. Speaking with the experience of more than a

quarter of a century of active scientific work behind me, I may be excused if I acknowledge how much I myself, at any rate, have profited by this regularly appearing publication, which, alone by its constancy, gives one courage to persist. A host of facts have been painstakingly recorded in its pages, year by year, and an article on our Insects written without a knowledge of what the CANADIAN ENTOMOLOGIST contains, would be a comparatively valueless contribution. The Canadian Entomologists themselves are a body of careful, if conservative, workers, filled with the proper spirit of devotion to their pursuit, and, above all, courteous and kind as correspondents. I am myself so much indebted to their many favors that what little I have been able to accomplish takes much of its value from their assistance; while the impartial editorship of their journal has led me to entrust my manuscripts freely for publication, thankful for the opportunity of recording my modest discoveries upon its friendly page.

PRESENTATION.

It affords us much pleasure to announce that our esteemed friend and valued contributor, Mr. AUG. R. GROTE—now residing at Bremen in Germany—has been presented by His Highness the Duke of Saxe Coburg-Gotha (brother-in-law of Her Majesty the Queen), with the large Silver Medal, *Princeps Musarum Sacerdos*, for Art and Science. The award was accompanied by a very friendly letter, alluding in warm terms to Mr. Grote's literary and scientific talents, and was entirely unexpected by its recipient. We beg to offer Mr. Grote our hearty congratulations on this pleasing recognition of his work and attainments.

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