

[FROM THE FORTY-FOURTH REPORT OF THE NEW YORK STATE MUSEUM.]

SEVENTH REPORT

ON THE

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK,

Made to the Regents of the University, Pursuant to
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TABLE OF CONTENTS.

| | PAGE. |
|--|-------|
| INTRODUCTORY | 215 |
| No serious insect attacks, or importation of insect pests during the year, 215. Abundance of the apple-tree tent-caterpillar, 215. The neglected orchards of the State, 215. The failure of the fruit crop of the State ascribable largely to seasonal conditions and fungoid attacks, 215. Exemption from the usual injury from the white-marked tussock-moth caterpillars, 216. Injuries to corn from the corn-worm, 216. Increasing depredations from the bud-worm, 216. Spread of the apple-leaf Bucculatrix in Western New York, 216. A New York locality for <i>Chloropisca prolifica</i> , and probable discovery of its breeding grounds, 216. Unusual abundance on Long Island of the northern lady-bird, and the 12-spotted Diabrotica, 217. Continued northern progress of the elm-leaf beetle, 217. Studies of the bean-weevil, 217. Prevalence of the grain aphis in rye fields in Eastern New York, 217. Unlooked for, and inexplicable appearance of the 17-year Cicada on the Hudson river, 218. Collection of insects made in Keene valley, in the several orders, with notice of the more interesting forms, 219. The contributions to the department, 220. A collection purchased, containing rarities, 220. Need of assistance in field work and in office duties, 221. Contents of the Appendix, 221. Courtesies acknowledged, 222. | |
| INJURIOUS INSECTS | 223 |
| AULACOMERUS LUTESCENS, the Poplar saw-fly | 223 |
| May prove to be identical with <i>Cladius viminalis</i> of Europe, 223. Comparison of the two made by Mr. J. G. Jack, 223. The male of the European species needed to determine the question, 224. Variation in the venation of the Tenthredinidæ, 224. The larval habits of <i>viminalis</i> as given by Dr. Jacobs, differ from those of <i>lutescens</i> , 224. Note, establishing the identity of the two, 224. | |

| | PAGE. |
|---|-------|
| PYRRHARCTIA ISABELLA, the Black-and-red Woolly-Bear | 225 |
| Bibliography of the species, 225. Not a serious insect pest, 225. Information of the caterpillars asked, 225. Traveling habit of the caterpillar, 226. Figures of the insect, 226. Description of the caterpillar, 226. Its means of defense, 227. Its hibernation, 227. An unusual number of moltings, 227. Transformations of the insect, 227. Description of the moth, 227. Food of the caterpillar, 228. Its natural enemies, 228. | |
| HELOPHILUS LATIFRONS — one of the Syrphus flies..... | 228 |
| Its bibliography, 228. Appearance and mode of flight of the Syrphidae, 229. Mimicry of other insects, 229. Little known of their early stages, 229. Dr. Williston's monograph of the family, 229. Correction of an erroneous specific determination, 230. Difference between <i>H. similis</i> and <i>H. latifrons</i> , 230. The "rat-tail" larvæ of <i>H. latifrons</i> found in a water-tank, 230. The mature larvæ, 231. Their pupation, 231. Account by Dr. Morey of their habitat, movements in the water, and place of pupation, 231. Erroneous habits ascribed to the larvæ, 232. The perfect insect, 233. Its distribution, 233. Apparently rare in New York, 233. Not an injurious species, 233. The Syrphidæ, except a few, are not harmful, 233. The corn-feeding Syrphus fly one of the exceptions, 233. | |
| CHLOROPISCA PROLIFICA, the Prolific Chlorops..... | 234 |
| Reference to notices of it, 234. Entering dwelling-houses for hibernation, 234. Where first observed, 234. Remarkable gatherings of allied species recorded in Europe, 235. Interest excited by these gatherings, 235. Speculations concerning them, 235. Only three known localities for the fly in the United States, 235. Recently appearing at Ausable Forks, N. Y., 235. Its first appearance as described by Mrs. Graves, 236. Observed within doors, 236. Not controllable by Pyrethrum powder, 236. Their immense number, 236. Seeking new quarters, 236. Some of their annoying habits, 236. They arrive in three companies, 237. Effort to destroy them, 237. No other house visited by them, 237. Manner of arrival in summer and departure in spring, 237. Features of special interest in the fly, 238. Where does the insect breed? 238. Surroundings of the infested house, 238. Probability that the breeding | |

| | |
|--|-----|
| ground is in the extended lawns of the infested localities, 239. | |
| The flies found abundantly upon the grass, 239. Could not be secured coming from the ground, 239. Do both sexes hibernate? 240. | |
| Observations that apparently confirm the presence of both sexes, 240. General features of the fly, for its detection, if observed elsewhere, 240. Its reappearance the present year at Franklin, N. H., where it was first observed, 241. Reappearance, in diminished numbers, at Alfred Center, N. Y., the second place of its occurrence, 241. The halteres of the fly, 241. | |
| PHYTOOMYZA CHRYSANTHEMI, the Chrysanthemum Fly..... | 242 |
| Synonymy and references, 242. Its notice in a former Report as identical with an European species, 242. The error detected, and the fly described under the above name, 242. Its description by Mr. Kowarz, 243. Observations and figures of the insect by Mr. Jack, 244. Differences in the larval mines appear to indicate two species, 245. The flies produced from the different mines found to be identical, 245. Comparison of this with allied species, 245. A Phytoomyza mining the leaves of Aquilegia, 246. Remedy for the chrysanthemum insect, 246. | |
| DYNASTES TITYUS, the Rhinoceros Beetle..... | 246 |
| Bibliography, in addition to that in a former Report, 246. No publication of the early stages of the insect, 247. A detailed description and figures of the larva furnished by Dr. Riley, 247. The same of the pupa, 249. Illustration of a Mexican species of Dynastes described by Dr. Dugès, 250. Method of feeding of <i>D. Tityus</i> on the inner bark of ash, 251. Another method ascribed to it, 252. The beetle attracted by the odor of bruised ash twigs, 252. Variations in color, 252. A rare insect in Say's time, 253. Dr. Rathvon's early recollections of it, and of its supposed larva, 253. The first authentic account of its occurrence in New York, 254. The beetle said to fly into the chimneys of cabins, 254. Is the attraction thither the same as that which draws, as reported, the larval hellgrammite? 254. | |
| BRUCHUS OBSOLETUS, the Bean-Weevil..... | 255 |
| Bibliography, 255-6. A comparatively recent insect pest, 256. Probably an introduced species, 257. The large number of Bruchidæ, 257. They all infest leguminous plants, 257. The insect under | |

two names, 257. Thought, by some, to be distinct species, 257. First noticed in Rhode Island in 1860, 257. Later observations of it, 257. Its rapid spread and distribution, 258. Not yet known in Canada, 258. Is mainly distributed through infested beans, 258. Precautions that would limit its spread, 258. Its occurrence in imported beans at the Centennial Exposition, 259. May be identical with the South African bean-seed weevil, 259. Its occurrence in Europe, Asia, Africa, and South America, according to Fauvel, 260. General features of the beetle and illustration of it and its early stages, 260. Compared with the pea-weevil, 261. Say's description of the beetle quoted, 261. Riley's description of *fabeæ* referred to, with his comparison of it with *obsoletus*, 261. Ticketed in collections as *B. fabeæ* Fabr., 261. Explanation of this name, in MS. notes and a publication found of Dr. Fitch, 262. The MS. in possession of the Boston Society of Natural History, 262. A copy of the same furnished for present publication, 262. *B. fabeæ* described by Dr. Fitch and published in 1861, in the Transactions of a Rhode Island Society, and in separate slips, 262. Dr. Fitch's description of the bean-weevil, 262-3. *B. fabeæ* Fb. had been changed inadvertently to *B. fabeæ* Fb. 264. Severe injuries, and rapid multiplication of the bean-weevil, 264. Its destructiveness as reported by Prof. Popenoe, 265. Instance of its multiplication, 265. Infested beans should not be planted, 265. Not sufficient to destroy the inclosed beetles, 265. Prof. Goff's experiments on impaired germination of weevil-eaten seed, 266. The same by Professor Beal, 266. The same by Professor Popenoe, 266. These experiments contradict former belief, and show that the germ is destroyed or much injured, 266. This is at variance with the old European authorities, quoted, 267. Experiments, in Europe, in testing vitality and productiveness of weevil-eaten seed, 267. With germination hardly impaired, productiveness is seriously injured, 268. Infested beans unfit for food, 268. Epitome of life-history of the bean-weevil, 269. A brood of dwarfed bean-weevils from Waterbury, Conn., 269. Why they were dwarfed, 270. They suggested successive broods in the same beans, 270. Mr. Schwarz on consecutive generations, 270. Professor Popenoe on the question, 270. The fact of continued breeding established, 271. Oviposition, 271. The larvæ entering the beans, 271. The third or fourth brood of the insect, 272. Oviposition on infested seed, 272. Transformation to the final stage, 272.

| | |
|---|-----|
| Contents of an infested bean, 273. Conclusion of the history of the brood, 273. A dwarfed beetle from insufficient food, 273. There may be four or five broods a year, 273. How the larva enters the bean, 273. How the beetle is released from the bean, 274. The construction of the lid, for exit, 274. The lid is not cut by the larva, but by the beetle, 274. Remedies, 275. Keeping over until the second year is no remedy, 275. No preventive of egg-deposit known, 275. The insect should be killed upon the gathering of the crop, 275. May be done by heat, 275. By kerosene, 276. Bisulphide of carbon, 276. The Tracy house for treating infested or suspected beans, 277. What should be the insect's name? 277. Reasons why it should be known as <i>B. fabae</i> Fitch instead of <i>B. obsoletus</i> Say, 277-8. Why the latter name is retained in the present paper, 278. Possibility that both may fall before an older name, 279. | |
| BRUCHUS RUFIMANUS, the European Bean-Weevil | 279 |
| Bibliography, 279. A common European insect, 280. Illustration of its stages, 280. Its destructiveness to pease and beans, 280. Introduced into the United States many years ago, 281. Not yet naturalized, 281. The authentic records of its occurrence, 281. Imported in New Jersey from Switzerland, 281. Observed in Canada, 281. Dr. Packard's identification of it erroneous, 281. Wrongly reported from Tennessee, 281. Its ascribed parasite was from <i>B. scutellaris</i> , 282. The confusion in the synonymy of the insect, 282. Curtis' figures of it, 282. Miss Ormerod on its synonymy, 283. Authenticated examples received from Europe, 284. Mr. Janson and Dr. Hamilton quoted on it, 284. Its synonymy not yet entirely settled, 284. Its distribution, 284. Remedies, 285. | |
| BRUCHUS LENTIS, the Lentil Weevil | 285 |
| Bibliography, 285. Observed at Buffalo, N. Y., 285. Associated with another species, 285. Compared with <i>B. rufimanus</i> Bohem., 286. Identified in Europe, 286. Description by Baudi, 287. Of not much economic importance, 287. The sale of lentils, 287. Their cultivation not a success in Canada, 288. What the lentil is, 288. Grown as a field-crop in Wisconsin, 288. | |
| CONOTRACHELUS NENUPHAR, the Plum curculio | 288 |
| Reference to the more important publications on the insect, 288. Its abundant literature, 289. The many remedies proposed for it, | |

| | |
|---|-----|
| 289. Two only regarded as valuable, 290. Arsenical spraying, 290. How it reaches the curculio, 290. When to spray, 290. May honey-bees be poisoned by the spraying ? 290. London purple or Paris green ? 291. Dr. Weed's experiments with London purple, 291. Proper strength of the mixture, 291. How Paris green may be mixed, 292. Suitable spraying pumps, 292. Beneficial results of spraying reported by Dr. Lugger, 293. Jarring for the cur- culio, 294. How to arrange for jarring, 294. The curculio catcher, 294. Oviposition of the cureulio, 295. Not correctly described by Harris, Fitch, Walsh, and others, 295. Riley's correct account of it, 295. The egg not placed in the crescent cut, 295. Mr. Haywood's observations on the mode of oviposition, 296. Time required for oviposition, 296. | |
| CICADA SEPTENDECIM, the Periodical Cicada..... | 296 |
| Bibliography, 296. Its unexpected appearance at Tivoli, N. Y., 297. The insect illustrated, 297. Number of broods in the State of New York, 297. The year 1890 not a locust year for this State, 297. Examples taken by Mr. Clarkson, 298. Visit to Tivoli for their observation, 298. Information obtained in regard to its presence, 298. The insect not abundant, 298. Its song described, 299. At first supposed to be an advance of the 1894 brood, 299. Reported, also, from Saratoga county, 299. If confirmed, would show them to belong to the "Hudson river Brood," 299. Dr. Riley on precursors of the regular broods, 299. The Tivoli insects not referable to Brood viii, 300. Are they the remnant of an unrecorded brood ? 300. Dr. Riley on the broods to which they may possibly pertain, 300. The "Galway Cicadæ" (Saratoga county), a newspaper story, 301. An undecided question, perhaps to be settled hereafter, 301. Is there a New York thirteen-year brood to which the Tivoli examples may belong ? 301. Mr. Clarkson's views upon the present occurrence of the insect, 301.. | |
| BRIEF NOTES ON VARIOUS INSECTS | 302 |
| OCNERIA DISPAR, the Gypsy Moth..... | 302 |
| Criticism on figures of the moth, 302. Its possible introduction in New York through railroads, 302. The New York World on its | |

| | |
|---|-----|
| appearance in Massachusetts, and the excessive alarm occasioned by it, 303. Professor Fernald and Dr. Hagen quoted, 303. Its destructiveness probably overstated, 303. Why it should not become a very serious pest, 303. Effort should be made to exterminate it in its present limited location, 304. How this may best be done, 304. Reference to notices of the insect, 304. Its parasitic enemies, 304. Notes on its transformations, 304. | |
| SPILOSOMA VIRGINICA, the Yellow Woolly Bear | 304 |
| Its reported injuries, 304. Its omnivorous habits, 305. How it should be destroyed, 305. Features of the moth. 305. Transformations of the insect, 305. Illustration of its stages, 305. | |
| THYRIDOPTERYX EPHEMERÆFORMIS, the Bag-worm | 306 |
| Hundreds of cases of the insect on quince trees in Sargeantville, N. J., 306. The caterpillar defoliating quince trees in Georgetown, O., 306. Should be classed among the insects injurious to the quince, 306. Comparatively few quince insects, 306. | |
| EREBUS ODORA | 306 |
| Record of the captures of this moth in the State of New York, as given in a preceding Report, 306. Its capture, at sugar, at Jamaica, L. I., 306. Extended time of appearance of the moth, 306. | |
| TMETOCERA OCCELLANA, the Eye-spotted Bud-moth | 306 |
| Characters of the caterpillar and of the moth, 306. Operations of the caterpillar in the blossom buds, 306. Transformation of the insect, 307. The second brood less injurious, 307. A favorable year for its multiplication, 307. May be destroyed by early arsenical spraying, 307. | |
| CECIDOMYIA BALSAMICOLA, the Balsam Cecidomyia | 307 |
| Probably occurs in North Carolina, 307. Galls apparently identical with its gall taken from <i>Abies Fraseri</i> , 307. A possible parasite associated with the galls when received, 307. Mr. Howard's views upon it, 307. | |
| CECIDOMYIA sp ? within a Jumping Gall | 308 |
| A jumping gall, from a bough of May blossom, in England, submitted for information, 308. Dr. Riley's views upon it, 308. Is | |

| | |
|--|--|
| possibly <i>Cecidomyia crataegi</i> , 308. Professor Trail's description of this Cecid gall, 308. A description from <i>Science Gossip</i> of what is probably identical with the English gall, 309. A "jumping seed" on oaks in the western States, and their peculiar motions described, 309. Mr. Ashmead's <i>Andricus saltatus</i> , occurring in Florida, 309. A jumping gall from Fort Edward, N. Y., undetermined, 310. The "Mexican jumping seed," containing <i>Carpocapsa pomonella</i> , 310. | |
| EPILACHNA BOREALIS, the Northern Lady-bird 310 | |
| One of the few species of <i>Coccinellidae</i> that injures vegetation, 310. Its destructiveness at Dosoris, L. I., 310. Had never before been so abundant, 310. Feeds on any of the <i>Cucurbitaceæ</i> , 310. Its fondness for melons, 301. Seeking quarters for hibernation, 311. The beetle described and figured, 311. Description of its larva, 311. How it may be ordinarily controlled, 311. | |
| SITODREPA PANICEA, as a Leather Beetle 310 | |
| Mr. Fuller's identification of the insect as the cause of serious injury to the leather-work of carriages, 310. Account from the manufacturers of the operations of the insect, 311. Two insects observed within the carriage cushions, one of which is probably the larva of <i>Scenopinus fenestralis</i> , 312. The <i>Sitodrepa</i> is believed to feed upon the paste used in the leather-work, 312. Cooking the paste a possible remedy, 312. | |
| APHODIUS FIMETARIUS, a Dung Beetle 312 | |
| The beetle attacked by a parasite, 312. The same which often infests the Colorado potato-beetle, 312. Proposal to cultivate the parasite for distribution, 312. Professor Fernald upon the abundance of the beetle, 312. Associated with <i>A. prodromus</i> , 312. Occurs abundantly in the Adirondack Region, 313. | |
| SAPERDA CANDIDA, the Round-headed Apple-tree Borer 313 | |
| Mr. Strong's method of protecting from this borer, 313. The oviposition of the beetle on the trunk should be prevented, 313. How the trunk may be protected by a wrapping of paper, 313. Other purposes served by the wrapper, 314. Protection of quince trees from the borer by grafting on other stock, 314. Two varieties of the English hawthorn found to be borer-proof, 314. Late | |

| | |
|---|-----|
| observations show that the insect does not confine its operations to the base of the trunk, 314. Old methods of prevention not sufficient, 314. | |
| DIABROTICA 12-PUNCTATA, the 12-spotted Diabrotica | 315 |
| The beetle destructive to Chrysanthemums and Dahlias on Long Island, 315. Occurs in such abundance as apparently to defy all remedies, 315. Pyrethrum water suggested for it, 315. Reported from Mississippi, as injurious to peach foliage and the cabbage, 315. | |
| PHYTONOMUS PUNCTATUS: the Fungus infesting it..... | 315 |
| The fungus killing the larva of this weevil, the clover-leaf beetle, at Geneva, N. Y., was named by Dr. Arthur as <i>Entomophthora Phytonomi</i> , 315. Subsequently referred by Dr. Thacher to <i>E. sphærosperma</i> , 315. Infests a large number of insects, 316. Some of them are mentioned, 316. The fungus may become epidemic, 316. The clover-leaf beetle also attacked and killed by a fungus in New Jersey, 316. | |
| MONARTHROPHYLAX MALLI, the Apple-tree Bark Beetle | 316 |
| The larval burrows in an apple tree described, 316. A beetle from a burrow identified as this species, 316. The burrows differently described by Mr. Schwarz, 317. The identified example may have been associated with a more abundant species to which the burrows are referable, 317. | |
| APHIS BRASSICÆ, the Cabbage Aphis | 317 |
| Abundance at Buffalo, N. Y., in 1890, 317. Its insect enemies, 317. Its abundance in New Jersey, 317. Professor Smith on its antennal structure, 317. Its extraordinary multiplication in Dakota in 1889, 318. Reference to descriptions of the sexed individuals, 318. Remedies available against it, 318. | |
| MYRMELEON? IMMACULATUS: a Strange Habitat for the Larva | 318 |
| Found beneath a carpet, at Coeymans, N. Y., 318. Differs in appearance and habits from larvæ previously seen, 318. Does not construct a pit-fall, 318. Its identification as <i>Myrmeleon immaculatus</i> , 319. Its life and habits while in confinement, 319. Its hibernation, 319. Could it have been an <i>Ascalaphus</i> ? 319. Structural peculiarities, 319. | |

| | PAGE. |
|---|-------|
| DENDROLEON OBSOLETUM; a Climbing Ant-Lion | 319 |
| Its occurrence in New York, 319. Synonymy as given by Dr. Hagen, 319. The larva lives on trees, 320. Its distribution, 320. Reference to its description, 320. | |
| INJURIOUS ARTHROPODS..... | 321 |
| BRYOBIA PRATENSIS, the Clover Mite | 321 |
| Bibliography, 321. Its frequent occurrence in recent years, 321. A great annoyance in infesting dwelling-houses, 321. Figure of the larval form, 322. Studied by the Entomological Division at Washington, 322. Illustration of its structure, fig. 38. Its distribution across the continent, 322. Food-plants and trees on which its eggs have been observed, 322. Frequently attacks grasses and clover, 322. Its recent occurrence at Schodack, N. Y., 322. Found in a watering trough, 322. Its place in classification, 323. Dr. Morey's observations on it, 323. Observed on the stone walls of a church at Ausable Forks, N. Y., 324. | |
| CERMATIA FORCEPS—a Household Centipede..... | 324 |
| Bibliography, in addition to a former Report, 324. Illustration, 325. Observations of Dr. Rathvon on it, 325. Observed in Pennsylvania in 1849, 325. Probably brought from the south in express packages, 325. Obtains the name of the "cockroach-killer," 325. Its combats with the roach described, 325. Its habits on a study table, 326. Preys, also, on the croton-bug, and how the capture is made, 326. Its northward progress, 326. Feeds greedily on the house-fly, 326. Is it a desirable guest? 326. Its occurrence in Missouri, 326. Found in a bed, and inflicts a poisonous bite, 327. Death of a child, reported, from it, 327. Effects of a bite from stepping barefooted upon it, 327. Another instance of its bite reported from Albany, 327. | |
| APPENDIX. | |
| (A) ENTOMOLOGICAL CONTRIBUTIONS..... | 331 |
| THE INSECTS OF THE PAST YEAR AND PROGRESS IN INSECT STUDIES | 331 |
| The more important insect attacks, and absence of ordinary ones will be noticed, 331. Omission of several, named, which were given in the preceding report, 331. The chinch-bug, | |

BLISSUS LEUCOPTERUS, in Western New York, as reported by Mr. Van Duzee, 331. Increasing injuries from the grape-vine flea-beetle, HALTICA CHALYBEA, 332. How to meet it, 332. The cow-horn fly, HÆMATOBIA SERRATA, in New Jersey and Pennsylvania, 332. May soon be expected in New York, 332. Is native to the south of France, 332. Its popular names, 333. Nature and effects of its bite, 333. The amount of harm caused by it, 333. How its eggs may be destroyed, 333. Introduction of a saw fly, CEPHUS PYGMEUS, from Europe, 334. Its European name of the "corn saw-fly," inapplicable to it here, 334. Observed at Ithaca, N. Y., infesting wheat, 334. Professor Comstock's studies of it, 334. Operations within the wheat stalk, 334. Transformations, 334. Its injuries not, thus far, severe, 334. Its bad reputation, 335. Observed, also at Buffalo, and in Canada, 335. The Gypsy moth, OCNERIA DISPAR, introduced in Massachusetts, 335. Date of introduction of several of our insect pests, 335. The Ocneria a notorious European pest, 336. When and how brought to this country, 336. Its present multiplication, 336. Confined to a limited locality, 336. Its ravages therein, 336. Importance of its immediate extermination, if possible, 336. A State appropriation made for the purpose, 337. Means by which it is thought possible to control it, 336. PROGRESS BEING MADE IN INSECT STUDIES, 337. Encouraging prospect for the future, 337. Great advance made in the preceding year, 337. Resulting largely from the establishment of the Agricultural Experiment Stations, 337. Number of entomologists employed in the Stations, 337. Admirable work done at the Minnesota Station in controlling the Rocky Mountain locust, CALOPTENUS SPRETUS, 338. Crops of Otter Tail county threatened by a colony of the locust, 338. Dr. Lugger commissioned to examine and report upon the situation, 338. His report accepted, and the aid asked for, from the State, granted, 338. "Hopper-dozers" for catching and killing the locusts, constructed, 338. The number caught by them, 338. A bounty offered, 338. Operation of the "balloon hopper-catcher," 339. Enthusiasm shown in "hopper-catching, 339. The privilege strictly guarded, 339. The hopper crop a lucrative one, 339. Fourteen thousand bushels of locusts caught, 339. The cost to the State, 339. The farm crops saved from destruction, 339. Infested lands plowed to kill the eggs, 339. How the plowing was done, 339. A complete success and at

what cost, 339. The final result, 340. The fearful losses in other States inflicted by the locust, 340. Its complete destruction in Minnesota, a triumph for economic entomology, 340. THE WORK OF THE ENTOMOLOGICAL DIVISION OF THE U. S. DEPT. OF AGRICULTURE, 340. Introduction from Australia of the natural enemies of the Icerya scale insect, 340. How the ICERYA PURCHASI was brought to California, 340. Its subsequent increase, 340. Its destructiveness to orange trees, 340. Orange culture in the State apparently doomed, 340. Proposition to import its parasites and other enemies, 341. Appropriation made from the general government for the purpose, 341. Agents sent to Australia for their collection, 341. The number obtained and forwarded to California for propagation and distribution, 341. Their progeny now number many millions, 341. The wonderful success attending their distribution in the orange orchards, 341. The pernicious Icerya scale seems doomed to a speedy extermination, 341. CULTIVATION OF INSECT DISEASES, 341. Distribution of insects attacked with contagious diseases, 341. The chinch-bug utilized for spreading a fungus attack, 341. The experiment a pronounced success, 342. Economic entomology prepared to aid largely in the promotion of the agricultural industry, 342.

LATE EXPERIENCES WITH INSECTS INJURIOUS TO THE ORCHARD AND GARDEN 342

The rapid progress being made in economic entomology, 342. The impetus received from the Agricultural Experiment Stations, 342. The new "Association of Economic Entomologists," 342. Experiences in spraying operations, 343. The necessity in fruit culture, of arsenical spraying, 343. What experiments have taught in the past year, 343. The dilution of the arsenite to be used, 344. Susceptibility of different fruit-trees, 344. Beneficial results from spraying with cold water, 344. Mr. Howard's account of his method and success, 344. Insects that may be killed by this means, 344. Advantages from combining fungicides with insecticides, 345. Formula for the Bordeaux mixture, 345. Carbolized plaster preventive of eurculio attack, 346. Study of the rose-bug, 347. What has been learned of its breeding grounds, 346. Detection of a COLEOPHORA operating in young pears, 347. How it affects the fruit, 347. Is the cause of many of the scars and deformations of apples and pears, 347. The pear-blight beetle XYLEBORUS DISPAR, 348. Its ravages in a Niagara

county pear orchard, 348. Its operations observed by Mr. Pomroy, 348. Rearing the beetle from infested stock, 349. Its burrows and their white lining, 349. The young feed on the white substance, 350. Comparative rarity of the male, 350. *X. obesus* confounded with it, 350. The identity of *X. pyri* with *X. dispar* recently established, 349. The eggs of the beetle, 351. A new depredator on quince blossoms found in *LIMONIUS CONFUSUS*, one of the snapping beetles, 351. Its numbers and their injuries, 351. The peach bark-borer, *PHLEOTRIBUS LIMITARIS*, 351. Formerly supposed to cause the "yellows," 352. Not an elm-boring insect, 352. The bark-boring Scolytids difficult to control, 352. Hope of reaching them with kerosene, 352. The cherry-tree slug, *ERIOCAMPUS CERASI*, 352. Prevalent and injurious at West Farms, N. Y., 352. Easily controllable by hellebore in water, 352. The currant-stem girdler, 352. Its operations described, 352. The insect not yet detected, 353. The grapevine flea-beetle, *HALTICA CHALYBEA*, 353. Means for its control, 353. A plant-bug, *Podisus modestus* preys upon it, 353. A new rose pest observed in Ausable Forks, N. Y., 354. The insect unknown, but believed to be the larva of a saw-fly, 354. It burrows downward into the twigs, 354. Unsuccessful efforts to rear it, 354. VARIOUS ATTACKS OF FRUIT-INSECTS noticed, 354. The apple-leaf Bucculatrix in Western and Central New York, 354. The apple-leaf miner, *Tischeria malifoliella*, in Albany county, 354. The hickory tussock-caterpillar, *Halisidota caryæ*, in Dutchess county, on a cherry tree, 355. The oblique-banded leaf-roller, *Cacæcia rosaceana*, destroying pear buds at Seneca Falls, N. Y., 355. The remedy for this common fruit-tree pest, 355. The eye-spotted bud-moth, *Tmetocera ocellana*, burrowing into the new growth of plum twigs, at Geneva, N. Y., 355. The V-shaped Tortrix, *Cacæcia argyrospila*, eating into young pears, at Rochester, 355. A new enemy of the currant-worm found in the plant-bug, *Podisus cynicus*, 356. The importation of the currant-worm charged upon a prominent member of the W. N. Y. Horticultural Society, 356.

(B) LIST OF PUBLICATIONS OF THE ENTOMOLOGIST 357

Gypsy Moth in Medford, Mass.: Insect Pests of the State of New York: Mites Infesting Smoked Meats: Useful Insects, 357. A Singular Fly: Fighting the Insect Pests: Late Experiences with

Insects Injurious to the Orchard and Garden: Spraying for the Curculio, 358. Apple-tree Insects: Poisoning Insects: The Fly Chloropisca prolifica: The Voracity of the Silk Worm: Spraying for Fruit tree Insects, 359. Eggs in Plum Twig: The Australian Lady-bug: The Eye-spotted Bud-moth: Wire-worms on Cabbage: Insect Strawberry Pests: Grain Aphis, 360. A New Enemy of the Currant Worm: Coleophora sp.—A New Pear Insect: The Pear blight Beetle: Quince Blossoms Beetle: The Peach Bark Borer: The Grape vine Flea-Beetle: Seventeen-year Locusts make their Appearance, 361. A Grain Weevil Distributed: Sheep Scab: The Grain Aphis: Insects Killed by Electric Lights: Rose-Leaf Hopper and Rose-Slug, 362. Sweet Potato Beetles: A New Bug: The [Corn] Cut Worm: Locust Tree Borer: Syrphus Fly: Elm Tree Beetle, 363. Collections in Keene Valley, N. Y.: Insect Parasites: The Carpet Beetle: Severe Bite of a Horse-fly: A Curious Jumping Gall: The Midge or Punky of the Adirondacks, 364. Mites infesting a Water-trough: Spittle Insects: A Mite Parasitic on the House Fly: The Pear-leaf Blister: Weevils in Rye: Report of the State Entomologist to the Regents of the University of the State of New York, for the year 1889, 365. Snails—Slugs: Diseased Austrian Pines: A Manual of Injurious Insects, 366. A Guest to be Welcomed in our Homes: Bean Weevil: The Larch Saw-Fly: Bot-Fly of the Hare: Insects Infesting Maple Trees: The Striped Cucumber Beetle, 367. The Woolly-Bear Caterpillar: Apple-Leaf Bucculatrix: A Mite Infesting Dwellings: The Hessian Fly: An Aquatic Worm, 368. Grain Aphis: Insect for Name: Insects for Name: The Raspberry Cane Borer: Two Beetles: Insects for Name: The Peach-Twig Moth, 369. A Grape Vine Coccus: Insects in Illinois: Apple-Bark and Pear-Blight Beetles: The Cockscomb Elm-Gall: An Apple Tree Insect: Maple Bark Scale Insect—*Lecanium acericorticis*, 370. Preface and Notes to the Genera of the Hesperiæ of the European Faunal-region: Phylloxera: Burrowing Beetle—*Cebrio bicolor*: An Ugly Bee-Slayer: A Squash-Vine Borer: Phylloxera, 371. The New Carpet Beetle: Annual Address of the President of the Entomological Club of the American Association for the Advancement of Science at St. Louis, Mo., August 20, 1878: The Turnip Flea Beetle: The Carpet Beetle: The Harlequin Cabbage-bug: The Cabbage Aphis, 372. Economic Entomology during the year 1877: Contribution to the Economical

PAGE.

| | |
|---|-----|
| Entomology of the year 1876: Report on the Insect and other Animal Forms of Caledonia Creek, N. Y.: Description of a New Species of <i>Anisota</i> , 373. The Clover-seed Fly, a new Insect Pest: The Peach Tree Borer: The Clover-seed Fly, a new Insect Pest: <i>Poduridæ</i> (Spring Tails) in a Cistern: Entomological Contributions — No. IV, 374. Two-spotted Lady-bug: Strawberry-Borers, 375. The Golden Tortoise Beetle: Grapevine Galls: The Army Worm — <i>Leucania unipuneta Haw</i> : The Corn Curelio — <i>Spheno-phorus Zeæ Walsh</i> : The Clover-seed Fly: The Grapevine-Bark Louse — <i>Lecanium vitis Linn.</i> : The Striped Blister Beetle, 376. Inquiries about Ants and Beetles: On <i>Cecidomyia leguminicola</i> : The Stalk Borer — <i>Gortyna nitela Guenée</i> : Two Carpet Bugs: The Wheat-Stem Maggot — <i>Meromyza Americana Fitch</i> : The Carpet Beetle, 377. The Earth-worm — <i>Lumbrieus Terrestris Linn.</i> : Annual Address of the President of the Entomological Club of the American Association for the Advancement of Science, at Saratoga, N. Y., August 26, 1879: Two Pests of the Clover Plant: Apple Tree Insect, 378. <i>Coccus</i> on Peach Trees: A Grape Insect: A Dung Beetle: The Five-Spotted Sphinx: Apple Tree Insects: A Grape Insect — <i>Proeris Americana Boisd.</i> , 379. <i>Coccus</i> on Peach Trees — <i>Lecanium Persicæ</i> : The Fitch Biological Collection of the N. Y. State Agricultural Society, 380. | |
| (C) CONTRIBUTIONS TO THE DEPARTMENT | 381 |
| GENERAL INDEX..... | 385 |
| 28 | |

R E P O R T.

OFFICE OF THE STATE ENTOMOLOGIST, }
ALBANY, November 30, 1890. }

To the Regents of the University of the State of New York:

GENTLEMEN.—I have the honor of presenting to your board my Seventh Report on the Injurious and other Insects of the State of New York, embracing results of studies and observations made during the year 1890.

The year has not been signalized by any wide-spread and particularly injurious insect attack upon the agricultural products of the state, or by the introduction from abroad of insect pests of special economic importance, yet a large number of important subjects of study have presented themselves, most of which have received the attention due them, while of several the investigation has not advanced sufficiently far to authorize their presentation at the present time.

May I briefly refer, as in former reports, to some of the more interesting insect occurrences of the year, and to a few that seem to call for their simple record while awaiting the fuller notice to be given them hereafter.

The apple-tree tent-caterpillar, *Clisiocampa Americana* Harris, which has been noticed in the two preceding reports for its excessive abundance and injury to the foliage of apple trees, has again been destructive over a large portion of the state, but in a somewhat diminished degree. Its ravages are being more extensively met by its destruction in its early stages, and by spraying operations later. Our orchardists are slowly awakening to the absolute necessity of preserving the foliage of their trees from insect pests and fungoid diseases, if fruit-growing hereafter is to be conducted with profit. In this connection it may be proper to mention that the almost entire loss of the fruit crop the past year over a large part of the state is not attributable to insect injuries, but to a concurrence of unfavorable seasonal conditions which resulted in, or contributed largely to, various fungus attacks and unknown maladies, from the effects of which blossoms blighted or the young

fruit was cast, and the diseased foliage either fell to the ground or served no vital purpose on the tree.

This year has been the second one of exemption from the usual defoliation of elms, horse-chestnuts, plum trees, etc., by the tussock caterpillar of *Orgyia leucostigma* (Sm. Abb.). The caterpillar has been seldom seen: hardly any of the cocoons of the female bearing the conspicuous egg-deposit have been observed; and no measures have been necessary for the prevention of its ordinary injuries.

The boll-worm or corn-worm of the southern states, *Heliothis armiger* Hübn., which occasionally occurs in southern New York, through the flight hither, it is supposed, and oviposition of one of the later broods of moths, has been reported from Westchester county as seriously damaging sweet corn, in September—nearly every ear in a garden, in one instance, having been ruined by it.

A minute caterpillar having the pernicious habit of eating into the buds and blossoms of the apple tree when they first appear, or later, of burrowing into the terminal twigs, or spinning together and consuming the tender leaves, has been destructive in some of the orchards of the western part of the state. It is known, locally as the bud-worm, and scientifically as the larva of *Tmetocera ocellana* (Schiff.). Its injuries are preventable by early spraying—in advance of the time for blossoming.

From the unusual number of inquiries received from orchardists of the apple-leaf *Bucculatrix*, *Bucculatrix pomifoliella* Clemens, it is apparent that this insect is rapidly multiplying within our borders, and that effort should be made to check its increase before it shall have become generally distributed. It is not difficult to control by methods that have been already pointed out.

Another of the interesting assemblages within dwelling-houses of a small fly, named and described in a former report as *Chloropisca prolifica* Osten Sacken, has been brought to my notice and been given careful study. It is but the third record of the kind for the United States—the two others being at Franklin, N. H., and Alfred Centre, N. Y. In Europe, a number of similar gatherings for winter abode of an allied species have been observed and recorded within the last sixty years. The source and food-plants of the insect have been an enigma to European scientists, but the prevalent belief has been that it breeds in some of the grain-fields. From observations made the past season, it seems probable that it will soon be ascertained beyond question that the breeding-place of the fly is in the lawn grasses that surround the dwellings.

Two species of plant-eating beetles have appeared on Long Island in such remarkable and unwonted numbers, that it seemed

useless to resort to any measures for their destruction. The one was a member of the family of *Coccinellidae*, the species of which are justly regarded as highly beneficial to the agriculturist from their feeding almost exclusively upon Aphides or plant-lice. But unfortunately this species, *Epilachna borealis* (Fabr.), has won for itself an exceptionally bad reputation, and was for a long time quoted as the only leaf-eating member of a carnivorous family. A few other species—eight or ten—have since been found to be partly vegetarian in their habits, but of these about one-half the number have only been detected feeding on the spores of fungi or other vegetable growths of no economic value. At Glen Cove, L. I., *Epilachna borealis* was particularly injurious to the melon and squash, while it fed readily on any of the *Cucurbitaceæ*.

Associated with the above, in almost equal number, was a common Chrysomelid beetle, *Diabrotica 12-punctata* (Oliv.), of broad distribution throughout the United States, and hitherto reported as injurious to corn, particularly in some of the western states where its larvae have infested the roots of the young plants to such an extent as to impair the crop fully 75 per cent. It proved a great annoyance at Glen Cove in infesting the greenhouses and feeding on chrysanthemums and other flowers.

The elm-leaf beetle, *Galeruca xanthomelana* (Schrank), whose steady progress northward has been noticed in former reports, and which was announced in my Fifth Report, for the year 1887, as having made its appearance at Poughkeepsie—midway between New York and Albany, has during this year (or more probable a year or two earlier) extended its range forty miles farther north, being now found at Hudson—117 miles from New York and within thirty of Albany. It is already so injurious to the elms in Hudson, that its citizens have become alarmed, and in several instances have resorted to spraying with arsenites for the arrest of the threatened destruction of their shade trees.

Studies of interest and of considerable economic importance have been made upon the bean-weevil, *Bruchus obsoletus*, which, in the disclosure of unlooked-for phases in its life-history and unsuspected powers for harm, have shown the need of resort to means by which the insect may be killed as soon as the crop is gathered. Far more active and earnest measures against it than have hitherto been deemed necessary, should be undertaken.

The grain aphid, *Siphonophora avenae* (Fabr.), which was reported last year as destructive in adjoining, and some of the western, states, while New York was apparently free from its presence, has appeared the present season in portions of our state, particularly

in its south-eastern counties, and has inflicted serious injury to grain crops. During the last weeks of June numerous inquiries were received of means by which its injury to rye could be arrested. Several of these came from Columbia county, where the attack was apparently more severe than elsewhere. Complaint was also made of its presence on rye in Rensselaer county. At Canaseraga, Allegany county, it was reported as attacking oats and barley as soon as they were out of the ground in the spring. At Glen Cove, Queens county, it appeared upon the wheat after it had headed. The aggregate of injury caused by the insect was not large, for in most of the localities the aphis, after passing to the heads of the grain, was attacked by the minute parasites that persistently follow it and insert their eggs within the body of the aphis, thereby insuring its speedy death. Almost every head of grain submitted to me for examination contained the brown and distended bodies of the aphides, indicating their parasitized condition and the probable arrest within a short time, and without much further harm, of the aphis attack.

The appearance in June last, at Tivoli, N. Y., of the periodical Cicada, *Cicada septendecim*, although in limited numbers, and so far as known not elsewhere observed, was an event of unusual interest to entomologists. It was thought that all the broods that belong to the more densely populated portions of the United States were definitely known and their limits accurately defined. Of these, six pertain to the state of New York, no one of which was due the present year. The Tivoli appearance was therefore unannounced and unexpected. It could not be regarded as a residual of the brood of 1889, for this only occurs within the state on portions of Long Island, nor as an advance of the well-known Hudson river brood, due in 1894. At the present, it remains as an entomological enigma. Subsequent examinations of records may show it to be the remnant of an unrecognized brood, which in several of its recurrences may have been dwindling in numbers until it is now on the verge of extinction—a result which would naturally follow the clearing up of forest land, and the removal of the natural food of the adolescent insect—the roots of trees and shrubs.

The field collections of the year, with a few exceptions, were made at Keene Valley, in the Adirondack mountains, during the month of July and part of August. The season was not abundant in insect life. The usual profitable method of night collecting by the aid of a lantern, known as "sugaring," which in former years had yielded such large and valuable returns, gave nothing of particular value,

and indeed but little beyond a few common forms of the smaller moths. A favorable and conveniently located maple grove was selected, but after devoting a number of evenings to successive fruitless rounds to the baited trees, this method was abandoned for the more remunerative one of collecting with lights at the windows. Why this should have been more productive, no reason can be given.

The field collections were quite successful, and enabled me to secure for the state collection, many more specimens than in any preceding year. Above 1,500 specimens were mounted, and labeled with locality and date of capture. In addition, there were several hundred examples of alcoholic and biological material. The Hymenoptera, for some unknown reason, were less abundant than usual, comparatively few of the order being largely represented, except the Apidæ and Andrenidæ. Of the Lepidoptera, *Papilio Turnus* was remarkably common upon moist ground in early July. *Limenitis Arthemis* was not rare. *Pieris oleracea* was seen frequently, flying with *Pieris rapæ*. The Argynnids were abundant in some wet meadows, among which *Argynnис Atlantis* was common. A single example of *Melitea Phaëton* was taken. The Graptas were rare. Of the Theclas, seldom observed by me in this region, two species were taken, viz., *Thecla strigosa* and *T. Titus*. *Feniseca Tarquinius* was not uncommon: its larvae were also collected. Of the Bombycidæ, *Arctia virgo* was frequently taken within doors attracted to lights; *Cullimorpha confusa* was in several instances driven up from the grass in meadows, about the first of August; and the larvae of *Orgyia nova* were found in a number of examples on low willows by the river-side.

In the Diptera, the *Tipulidæ* were unusually abundant, as were also the *Tabanidæ*. Only a few species of *Syrphidæ* were collected, and it was a surprise that more were not abroad, although a month later would no doubt have given much larger representation.

Of the Coleoptera, *Cicindela repanda* occurred in large numbers in the roadway. From a sandy ditch beside the road, it could be driven up in flocks and gathered into the net; other species of the genus were only seen in occasional examples. *Lina scripta* was quite abundant in its larval and pupal stages, and later in its perfect form, upon willows bordering the Ausable river. I had not previously taken it in the Adirondack region. Through most of July, the large number of the light-giving *Lampyridæ* that were abroad — their leisurely flights often marked in trails of light — was an attractive feature of the evening hours.

The Odonata were not numerous in species or in individuals, with the exception of *Diplax rubicundula*, of which any desired number might have been secured, and of some of the smaller Agrioninæ. Of the Calopterygina, a few examples of *Calopteryx amata* Hagen, were seen, momentarily resting on a branch beside, or flitting over, the water.

In the other orders, the collections were comparatively small, as but few species that were new or of special interest or value were observed.

The Contributions to the Department have been from fewer individuals during the year than in some of the preceding ones. But among them is one of particular value, from the large number of specimens and the beauty of most of them. The donor, Mr. Erastus Corning, Jr., of Albany, in these successive additions (see preceding reports) to the Zoölogical Department of the State Museum, has shown a generosity and an appreciation of the educational value of the Museum, which is deserving of more than the grateful acknowledgment herewith made. The present contribution consists of one hundred and ninety-five specimens of butterflies, mainly from South America, and four hundred and seven of native butterflies and moths, largely native to the state. They have not been catalogued for the present report, as the literature for the authentic determination of the South American forms is not contained in our State Library. Whenever arrangements can be made by which the collection may be placed on exhibition, without subjecting it to the injury that would follow its exposure to continual light, it will be displayed, and form an attractive feature in the Museum.

A beautifully arranged collection of American and foreign Lepidoptera, which the owner was desirous of disposing of at a moderate price, has been purchased for the state and is now in the office of the entomologist. It consists of ten hundred and thirty-four specimens, arranged in a cabinet of eighteen drawers, of twenty-one by twenty-three inches. Among other things of special value in it, is a bisexual example of *Clisiocampa Americana*, in which the right-hand half is male, and the left-hand, female. This is shown in the pectinations of the antennæ, the disparity in size of the wings, and in the modified form of the abdomen — notably in the difference in contour of its two sides. Such examples are rarities in collections and always of great interest, and are highly valued. There is also in one of the drawers, a pair, in perfect condition, of *Cossus querciperda* Fitch, of which, it is believed, not over a half-dozen could be found in the cabinets of the world.

I regret that the pressure and confinement of office work allows me but little opportunity for field observations and studies. Could a reasonable amount of field work be done, either by myself or an efficient assistant, and so distributed over the year as to cover the period of insect activity, it would, beyond question, add materially to the value of the service that this department may render to the state. The Entomological Division of the United States Department of Agriculture, at Washington, while equipped with an office corps of a chief and eight skilled assistants, draughtsman, typewriter, and clerks, has also the aid of seven field assistants, located in six of the States. The entomologists of our state agricultural colleges and agricultural experiment stations, have, in several instances, a trained assistant, or a class of advanced students, at their command, who are rendering excellent service. The value of the work now being done in applied entomology, hardly needs to be referred to. Its results are apparent to all and have obtained the highest recognition. The agriculturist, in this time of widespread agricultural depression, appreciates as never before the aid that it is prepared to offer him, and gladly avails himself of the proffered assistance. The measure of what the state may do in this direction will be in proportion to the amount of study that it shall authorize. The field is so broad and the objects that it embraces so innumerable, that it can never be exhausted, or even an approach made to a complete garnering of its stores. The insect world, existing largely upon cultivated products which are essential to the life or well-being of man, is brought into such intimate relations in its state of continual antagonism to him, that it may be safely asserted that of no other branch of the animal kingdom is the study of equal utilitarian value.

With direct reference to my own official work: there is no doubt but that its value to the state could be more than doubled by the assignment to the Office, of a skilled assistant or one who might soon be trained to serve in that capacity. It is neither economical nor just to the department, that the entomologist should be obliged to devote so large a portion of his time to simple clerical duties, while there remain important studies to complete and arrange for presentation in such form that they may accomplish the purpose for which they were undertaken, and others, that he is desirous of entering upon at the earliest opportunity.

In the Appendix, will be found a paper read by the Entomologist before the Western New York Horticultural Society at its January

meeting, which, in part, supplements the necessarily hurried report presented to your board for the preceding year (1889).

A list of publications by the Entomologist during the year (sixty-one in number), most of which were contributed to agricultural journals in response to inquiries made of injurious insects submitted, is also contained in the Appendix, together with a similar list for the years 1878 and 1879. A list of contributions to the department for the year 1890 is also given.

In conclusion: I desire to offer my grateful acknowledgments to your honorable board for the aid and many courtesies extended to me through your Secretary, in conveniences for office work, in facilities for consulting the literature of my department contained in the State Library, and for the addition to the library of a number of volumes needed in my studies.

Respectfully submitted.

J. A. LINTNER.

INJURIOUS INSECTS.

Aulacomerus lutescens (Lintn.).

The Poplar Saw-fly.

(Ord. HYMENOPTERA : Fam. TENTHREDINIDÆ.)

LINTNER: Fourth Report on the Insects of New York, 1888, pp 44-46, figs. 20-22.

In the description of the larva, its habits, the winged insect, and oviposition of this poplar saw-fly which had occurred in numbers at Albany, N. Y., it was given name as a new species upon information received from Mr. E. T. Cresson, to whom it had been submitted, that it was probably undescribed and was referable to the genus *Aulacomerus* (see page 46, *loc. cit.*).

Examples of it were subsequently sent to Mr. John G. Jack, of the Arnold Arboretum, of Harvard University, Boston. From a comparison that he was able to make with European specimens in the collection of the Cambridge Museum, and the examination of literature consulted, it seems not improbable that this saw-fly will have to assume an older European name, and add one more to our extended list of insect pests introduced from the Old World.

Mr. Jack has written to me as follows :

The other day, in looking over some specimens of European saw-flies in Dr. Hagen's Collection, I was struck by the similarity of the manner of oviposition between your *Aulacomerus* and that of one of the specimens in the cabinet. My interest was aroused to look further into the matter, and after pretty careful comparisons of your specimens and description with those of *Cladius viminalis* Fallen, of Europe, I confess that I can make out but little difference, if any.

The European description and figures as given by Vollenhoven (vol. i [1858], p. 176, pl. 10, *Tijdschr. v. Entomol.*), and by Cameron (*Monog. Brit. Phyt. Hymenop.*, vol. ii, p. 29, and vol. i, pl. v and xv), seem to agree with your specimens, and I can detect no essential differences between them and Brischke's specimens in the Museum Collection. Food-plants, eggs, larvæ, and imagoes all agree well.

Upon requesting Mr. Jack to compare the nervulation of the *viminalis* and *lutescens* particularly in the position of the recurrent nervules, he reports an exact agreement in the two. Unfortunately there is no

male example of *C. viminalis* in the Cambridge collection. If the male should show the peculiar structure ascribed to *Cladius* in its diagnosis as given by Cresson, viz., "basal joints of flagellum produced or branched beneath" (as appears conspicuously in our *Cladius isomera* Harris), then *A. lutescens* is assuredly distinct, for no approach to such structure is presented in its antennæ.

Mr. Jack has pointed out a discrepancy in the description and figure of *Cladius* given by Cameron, in that the former calls for four submarginal cells, while his figures of the male show but three. This, however, is but of little importance, since the nervulation in the *Tenthredinidae* is known to vary to so great extent that it seems hardly to afford a sufficient basis for separating genera. *Aulacomerus* is one of the several genera which are based on comparatively slight differences in venation. The family certainly needs a thorough study and revision with the aid of a knowledge of the European species, with which a number of ours, will in all probability prove identical.

I have not been able to compare the life-history of *C. viminalis* with that of *A. lutescens*, but the following note of the European species has just come under observation:

In M. le Dr. Jacobs' "Tenthredines, Céphides & Siricides des Environs de Bruxelles," contained in *Comptes-Rendus des Séances de la Société Entomologique de Belgique*, 1884, xvi–xxiv, is this (p. xix) :

*Trichiocampus** *viminalis* Fallen. The larva lives in August and September, on the willow and poplar, of which it eats the under side of the leaves; the perfect insect appears in June.

Compared with the above, and essentially differing — *A. lutescens* larva feeds in June and August, resting on the upper side of the leaf and consuming all but the stronger ribs; the perfect insect appears at about the middle of July.

NOTE.—Just as the above is being printed, the identity of *Aulacomerus lutescens* with *Cladius viminalis* of Europe, has been determined by Mr. Peter Cameron, of Sale, Cheshire, England — an authority in European *Tenthredinidae*. Examples of our species, in both sexes, were submitted to him, and he has returned answer that they are certainly *C. viminalis*. He also states that *Aulacomerus* has nothing to do with *Cladius* so far as can be made out from the description and rough figure. Mr. Cameron has also kindly sent colored figures of the European larvæ, which agree with ours.

* A genus of Hartig, separated from *Cladius* of Illiger.

Pyrrharctia isabella (Sm.-Abb.).*The Black-and-red Woolly-Bear.*

(Ord. LEPIDOPTERA: Fam. BOMBYCIDÆ.)

SMITH-ABBOTT: Nat. Hist. Lep. Ins. Geo., ii, 1797, pl. 66; as *Phalaena*.HÜBNER: Verz. bekann. Schmett., 1816, p. 184; as *Estigmene*.HARRIS: Cat. Ins. Mass., 1833, p. 591; Rept. Ins. Mass., 1841, p. 59; Ins. Inj. Veg., 1862, p. 355, f. 170; as *Arctia*.

GOSSE: in Canad. Nat., 1840, pp. 78, 308.

EMMONS: Nat. Hist. N. York—Agricul., v, 1854, p. 229 (description and habits; as *Arctia*).WALKER: Cat. Br. Mus.—Lep. Heteroc., iii, 1855, p. 611; as *Spilosoma*.CLEMENS: in Proc. Acad. Nat. Sci. Phila., xii, 1860, p. 531; Appen. to Morris Synop. Lep., 1862, p. 352; as *Spilosoma*.MORRIS: Synop. Lep. N. Amer., 1862, p. 340; as *Arctia*.SAUNDERS: Synop. Canad. Arct., 1863, p. 16; in Canad. Journ., viii, 1863, p. 361; in Canad. Ent., i, 1869, p. 26; id., v, pp. 75-77, f. 14; as *Spilosoma*; in Rept. Ent. Soc. Ont. for 1873, p. 22; f. 15; as *Pyrrharctia*.PACKARD: in Proc. Ent. Soc. Phila., iii, 1864, p. 121; as *Pyrrharctia isabella* and *P. Californica*; in 4th Rept. Peab. Acad. Sci. 1872, p. 86; as *P. Californica*.RILEY: in Amer. Entomol., i, 1870, p. 48; id., ii, p. 182, f. 112; 4th Rept. Ins. Mo., 1872, p. 143, f. 65; in Amer. Entomol.—Bot., iii, p. 133, f. 51 (life-history); as *Arctia*; Gen. Ind. Mo. Repts., 1881, p. 55; as *Pyrrharctia*.EDWARDS H.: in Proc. Cal. Acad. Sci., v, 1873, pp. 187, 370; as *Pyrrharctia*.MOESCHLER: in Stett. Ent. Zeit., 1876, pp. 37, 297; as *Pyrrharctia*.

FRENCH: in Trans. Dept. Agricul. Ill., xv, 1877, p. 182.

MANN: in Psyche, ii, 1878, p. 270; as *Spilosoma*.

MARTEN: in Trans. Dept. Agricul. Ill., xviii, Appen. 1880, p. 115.

COLEMAN: in Papilio, ii, 1882, p. 18; as *Pyrrharctia*.WEED: in Papilio, iii, 1883, p. 84; as *Pyrrharctia*.BEAN: in Canad. Ent., xvi, 1884, p. 67; as *Spilosoma*.SMITH: in Amer. Entomol., ii, 1886, p. 79; in Canad. Entomol., xxii, p. 103 (bibliography); as *Pyrrharctia*.DIMMOCK, A. K.: in Psyche, iv, 1888, p. 281; as *Spilosoma*.

LINTNER: in Count. Gent., iv, 1890, p. 941 (general notice).

DYAR: in Psyche, v, 1890, p. 422 (number of stages).

This insect, as the result doubtless, of the perils attendant upon its exposure to its many enemies during its not closely-hidden winter's sleep, is never multiplied to such an extent as to give it rank among our serious insect pests; yet the caterpillar is frequently encountered in the latter months of the year, and often excites curiosity, as may appear from the following inquiry:

Could you kindly give myself and others some information about the caterpillars sent herewith? Just now they are crawling in all directions, apparently seeking warm quarters for the winter, as they all appear to be wending their way towards buildings of some sort.

Everybody walks over them, but few, I think, stop to inquire about their life-history or habits, or whether they are harmful or otherwise. I notice chickens eye them curiously, but will not devour them, presumably on account of their hirsute covering. J. H. C.

MORETON FARM, N. Y., October 15.

To the above the following reply (some additions thereto are inclosed in brackets) was made, through the *Country Gentleman*, of November 27th of the present year:

Traveling Habit of the Caterpillar.

The caterpillars sent are the common red-and-black "woolly-bears," known to science as *Pyrrharctia isabella*. It is very seldom that it occurs in such numbers as reported above, but it may be seen almost every year during the autumn months, traveling over roadways and along foot-paths, en route to some suitable place for its winter quarters. Its remarkably rapid gait would indicate extreme haste to find the desired shelter, but if followed, it would be seen to consume hours of time in unnecessary travel, as if in obedience to some requirement in its economy, or simply for the pleasure that the exercise may afford.

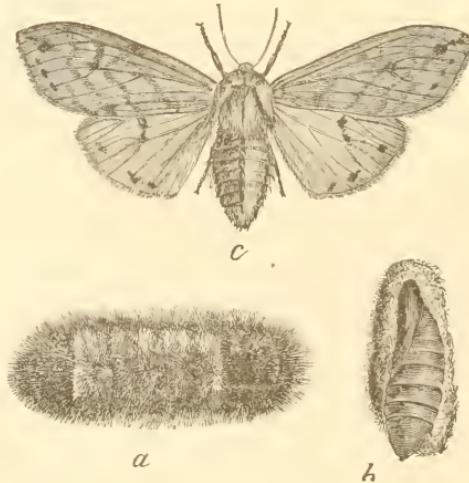


FIG. 1.—The Isabella tiger-moth, PYRRHARCTIA ISABELLA: *a*, its larva; *b*, its cocoon opened to show the pupa.

The Caterpillar Described.

Nearly all who have had the privilege of passing their childhood in the country — where nature may be so conveniently studied and ever appeals to the inquiring eye — are familiar with the class of caterpillars known from their thick-set, hirsute clothing as "woolly-bears." This particular one is the most common of all throughout the eastern part of the United States. When full-grown it measures an inch and

one-half in length. Its black body is thickly covered with long, stiff, barbed, spine-like hairs, which are of even length like close-cut bristles of a brush. The first four segments (of the twelve in which the body of caterpillars are divided) are black, as are also the last two, while the intermediate ones are red or chestnut-brown. If taken in the hand or arrested in its journeyings with a stick or the foot, it rolls itself up in a ring, almost as tightly as the armadillo is reported to do, and for the same purpose—to protect itself from harm, or possibly only as an inherited instinctive act. From this habit it has been given the name by which it is known in some of the western states, of "the hedge-hog caterpillar." It is represented in Fig. 1, at *a*.

Transformations of the Insect.

At this season of the year (autumn) the caterpillar is not fully matured. It therefore retires, upon the approach of freezing weather, to some concealed place, as in an old stone wall, within a wood-pile, or under a board, where, rolled in a ring or doubled up like a bear, it may pass the winter in a semi-torpid state. Here it remains, unless a succession of warm days should draw it temporarily from its retreat, until the warmth of spring arouses it again into activity.

It comes abroad and feeds for a while on almost any garden or other succulent plant that it finds conveniently at hand. It is soon full-fed and in readiness in April or May for its transformations.* Again it retires to shelter, when it incloses itself within a dark-colored oval cocoon, consisting of a silken thread that it spins into a firm web about it, interwoven with the hairs rubbed or plucked from its body. The cocoon torn open, showing the pupa within, is represented in the above figure, at *b*.

Within the cocoon it throws off its caterpillar skin and becomes a shining black, blunt-ended pupa. When ready for its final change the pupal case is rent by the movements of the imprisoned insect, and the moth emerges. Within a half-hour, with expanded and dried wings, it has become a perfect creature, prepared for flight, and for seeking the companionship of its mate. This last stage usually occurs during the months of June or July.

The Moth Described.

The moth is not conspicuous in coloring. Its wings are dull yellow or a yellow-buff, with a few black dots and two or three indistinct brownish lines crossing the outer half of the front pair. The hinder

[* Mr. H. G. Dyar reports, as the result of his observations upon this insect, that the larva undergoes nine moltings before pupation—the largest number in twenty-eight species of *Bombycidae* of which he has recorded the stages—five being the usual number.]

pair of wings are sometimes tinged with red. The body is darker yellow, and is marked with a row of six black spots above and a similar row on each side, and two rows of smaller dots underneath. The moths measure about two inches in spread of wings.

Food of the Caterpillar.

Although the caterpillar feeds on a large number of plants, and is somewhat common, yet from its habit of keeping near the ground and confining itself principally to the lower leaves, it is far less injurious than is another of the woolly-bears, with long, uneven, yellow hairs, named *Spilosoma virginica*.

[Perhaps a rather unusual diet for it is that of feeding on other insects, but in one instance, at least, it is known to have displayed a cannibalistic taste and to have devoured the pupæ of a butterfly, *Pyrameis cardui*, which had transformed in a box in which some caterpillars of both species had been confined together. When the box was opened one of the isabellas was discovered feeding on a pupa which it had half consumed. Two had previously been eaten. An abundance of vegetable food was in the box.]

Its Natural Enemies.

It is not known to have many natural enemies ; chickens and other poultry would not dare to eat it. It is occasionally parasitized by some of the ichneumon flies when its rolled-up position opens its barricade of hairs sufficiently to admit of the insertion of an egg within or upon its body. [Of these, four species have been recorded by Professor Riley, viz., *Ophion macrurum* (Linn.), *Ichneumon caeruleus* Cress., *Ichneumon signatipes* Cress., and *Trogus obsidianator* Brullé (*American Entomologist*, iii, 1880, p. 134). *Ophion arcticæ* Riley MS., has also been bred from it (*Insect Life*, iii. 1890, p. 155).]

Helophilus latifrons (Loew).

(Ord. DIPTERA: Fam. SYRPHIDÆ.)

LOEW: Diptera Americae Septentrionalis indig., Century iv, 1863, p. 73.

WALSH: in Amer. Entomol., ii. 1870, p. 142, f. 94.

GLOVER: MS. Notes Journ.—Dipt., 1874, p. 25, pl. 9, f. 21.

OSTEN SACKEN: West. Dipt., in Bull. U. S. G.-G. Surv., iii, 1877, pp. 321, 337; in Bull. Buf. Soc. Nat. Sci., iii, 1877, p. 57; Cat. Dipt. N. A., 1878, p. 134.

WILLISTON: in Proc. Amer. Philosoph. Soc., xx, 1882, p. 324; Synop. N. A. Syrph., in Bull. 31. U. S. Nat. Mus., 1886, p. 188 (detailed description).

LINTNER: Rept. St. Entomol. for 1885, in 39th Rept. N. Y. St. Mus. Nat. Hist., 1887, p. 102-3 (as *H. similis*).

SMITH: Catalogue Ins. N. J., 1890, p. 386.

The Family of Syrphidæ.

The family of flies known as *Syrphidæ*, from one of its principal genera, *Syrphus*, is one of the largest among the Diptera,* and consists largely of gayly colored and prettily ornamented flies, which from their habit of frequenting the sweet-scented flowers of the golden-rods, asters, the Canada thistle, etc., are popularly known as "flower flies." They are often to be seen in the bright sunshine of July and August poised on rapidly vibrating wings, like the hawk moths and humming birds, over or near the blossoms that they frequent, and like them, suddenly darting away, if alarmed. From their peculiar motion, some of the English writers discourse of them under the appropriate name of "hover-flies." A prominent color among them is a brilliant yellow, displayed in conspicuous bands and spots and lines. Some of the species show a striking resemblance to bees, wasps, and hornets, and are doubtless often mistaken for them. Any one not an entomologist, upon being shown a specimen of *Volucella erecta* Walker, or of *Eristalis flavipes* Walker, would, without hesitation, pronounce it a bumble-bee. *Temnostoma alternans* Loew, might easily at a little distance, even by one familiar with insects, be confounded with the irascible little "yellow-jacket," *Vespa diabolica* Sauss. I have seldom taken the large and beautiful *Spilomyia fusca* Loew from the blossoms of the Clematis without looking closely to see whether it were not the white-faced hornet, *Vespa maculata*. The rare *Ceria abbreviatella* Loew has been brought to me from the trunks of the balsam poplar, as a prettily marked wasp showing a peculiar running habit: its resemblance to *Odynerus Philadelphicus* Sauss., is strikingly marked in its two yellow abdominal bands, the yellow lateral spots of the thorax, the yellow-spotted scutellum, the length of the antennæ, and in size. *Eristalis tenax* (Linn.), so closely mimics the drone of the honey-bee that in Europe it is known as the "honey-bee fly."

Although so large and attractive a family, very little has been learned of the larvæ of these flies and their early history. A wonderful range of diversity prevails in their appearance, habitat, food, transformations, and habits, which will afford an ample and interesting field for study. In consideration of the excellent monograph of the *Syrphidæ* recently prepared by Dr. Williston, at the request of the Smithsonian Institution and published by the Department of the Interior, we may expect that increased attention will henceforth be given to this interesting family.

*About two thousand species are catalogued from the whole world, of which over three hundred are from North America north of Mexico.

The following is offered as a slight contribution to the natural history of *Helophilus latifrons*.

A Correction.

This insect was noticed in the Report of the Entomologist for the year 1885, *loc. cit. sup.*, under the name of *Helophilus similis* Macquart—the result of erroneous determination of the specimens in my cabinet.



FIG. 2.—HELOPHILUS LATIFRONS,
enlarged.

tional. A ready means of separating the species is offered in the form of the lateral black stripes of the thorax, which are less heavy in *latifrons*, and terminate in a point on the anterior and posterior margins, while in *similis* they appear to be continued broadly over them. The last-named species is also a stouter form, having a comparatively broader thorax and abdomen. *H. latifrons* is represented in figure 2, and *H. similis* in figure 3.

Habitat of the Larva.

Examples of the larvae of *H. latifrons* were received in 1885, from Dr. R. H. Morey, of Old Chatham, N. Y., who, attracted by the singular appearance of their rat-tail like appendage, had taken them from a water-tank in Nassau, N. Y. They were numerous at the time, July fourth, but when a week later additional examples were asked for, only a half dozen could be found—all but these having left the water and gone elsewhere for pupation.

The Mature Larvæ.

The larvæ were placed in a glass of water with an inch of ground and dead vegetable matter at the bottom. They hid themselves in the ground, with their tails extended upward to the surface for respiration, to an extent of two inches, except when disturbed, when the respiratory tube would be quickly withdrawn from the surface and partly contracted.



FIG. 3.—HELOPHILUS SIMILIS, enlarged.

The two species bear so close a resemblance to one another that prior to the detailed and comparative descriptions given by Dr. Williston, examples in collections were often incorrectly named. The principal structural difference is to be found in the comparative breadth of the front in the males; the other differences as indicated by Baron Osten Sacken, are mainly colora-

Within the following week, some of the larvæ were found floating upon the surface of the water. As this condition was believed to indicate approaching pupation, they were transferred to a box of dampened saw-dust, into which they buried themselves.



FIG. 4.—Larva of *HELOPHILUS LATIFRONS*, enlarged.

At this time they presented the following features: The body was subcylindrical, narrowing somewhat anteriorly, and one-half of an inch in length by one-eighth of an inch broad; beneath, whitish, pale brown above, becoming darker toward the tail; the several segments show six divisions (as wrinkles or folds) above, of which the front one is the broadest; on segments two to seven apparently (the posterior ones not being separable) are six pairs of tubercle-like feet, which, when protruded, show each a short black spine. The head bears anteriorly two brown, slender, blunt projections, so short as to be barely visible without a magnifier. The first two joints of the dark brown tail are corrugated, and measure seven-tenths of an inch in length, with the terminal black-tipped extensile joint projecting from them one-fourth of an inch.

Other larvæ were transferred for pupation July sixteenth, eighteenth and the last on the twenty-fifth.

Pupation.

The transformation of the larva into the pupa and imago occurred within the material given it for the purpose. On the eighteenth of July, the first fly emerged; on the twenty-fifth the second appeared, and two others followed later, the dates of which were not noted. It appears from the above that the pupal stage is a brief one—of about ten days continuance.

Habits of the Larva.

My attention having recently been newly drawn to these rat-tail larvæ, request was made of Dr. Morey for such information as he might be able to give of the mode of occurrence and conduct of the company that had come under his notice in 1885. To his kindness, and habit of careful observation of animal forms which is so often associated with the advanced study and practice of medicine, we are indebted for the following interesting and valuable contribution to the history of these strange forms:

The water-tank from which the larvæ sent to you were taken, was a road-side one on the farm of my father, in the town of Nassau. It was the half of an old molasses cask or hogshead, which was fed by water running for about six rods through the old-fashioned wooden

pipe (logs), a portion of which had been there for from fifty to seventy years. The water stood in it usually at a depth of two feet. At the bottom was a sediment of light mud covered over with confervæ which also grew upon and around the sides of the tank, in all stages of growth and decay. Of the "rat-tails"—some were swimming about in the water at the depth of a foot or more below the surface; some were creeping slowly, or more often remaining quiet on the sides of the tank, also below the surface; others (perhaps a fifth part or less) were floating along with expanded end of tail at the surface, but a sudden jar would at once send them downward. They were able to remain underneath without coming up for respiration for a much longer time than the larval mosquito. They were very sluggish in all their movements. Of those resting on the sides of the tank, some were at just the height to reach the surface with the tip of their tails. A few were observed on the outside of the tub, on the shady or moist side, apparently working their way to the ground, where they burrowed into the soft, wet soil, and into some decaying portions of a willow log. It did not appear that any buried into the mud at the bottom of the tub, although it was an inch or more in depth; indeed they were seldom seen on the bottom except as they might be hanging downward from the side. It seemed to me, although I could not determine the fact, that the larvæ were feeding on the decaying confervæ in the water. The tub was partially overhung and shaded for most of the day by a willow tree standing on the opposite side of the highway.

I endeavored to procure more of the larvæ for you in 1886, but they did not make their appearance. The year following my father removed the water-tank in consequence of a diminished water supply from the old pipes, and since then, although I have kept them in mind at their usual time of coming, I have not been able to find them elsewhere.

Erroneous Larval Habits Reported.

In the *American Entomologist*, ii, 1870, pp. 141, 142, Mrs. Mary Treat in a paper entitled "Plant-lice and their Enemies," has given an account of the habit of some Syrphus-fly larvæ which she had reared, as minutely detailed, from eggs deposited by the parent flies among some plant-lice infesting Chrysanthemum slips while under glass. In an extended note upon the article, appended by the editor, C. V. Riley, he remarks as follows: "At our request Mrs. Treat has sent us some of the bred flies mentioned in this article, and among them are three species of the genus *Syrphus*, and one of *Helophilus*. The latter is the *H. latifrons* of Loew (Fig. 94)." The species, was evidently correctly identified and illustrated by Professor Riley (it is given in Fig. 5 from an electro-type furnished) but there is clearly some mistake in the matter. *Helophilus latifrons* could not have been reared from larvæ feeding on plant-lice. Its larva is aquatic only, and wholly incapable of living in the manner stated. Some error probably occurred in the examples sent by Mrs. Treat.



FIG. 5.—*HELOPHILUS LATIFRONS*, natural size.
(After Riley.)

The text describes a discrepancy between Mrs. Treat's account and the illustration provided by Professor Riley. The illustration shows a fly, identified as *Helophilus latifrons*, which is aquatic and cannot live on plant-lice. The text notes that some error likely occurred in the examples sent by Mrs. Treat.

The Fly.

The fly is among the handsomest of its family. Its principal features are the three black thoracic stripes on a dull yellow ground; four large yellow spots on the sides of the abdomen above, nearly meeting on the middle of the back; and a narrow yellow band on the segment following the spots. The face is yellowish, covered with a light pile. The legs are yellow and black. The wings are hyaline. Its length is from five to six-tenths of an inch. For a detailed description the student may refer to Dr. Willeston's monograph as cited.

Distribution of the Species.

H. latifrons would appear to be more particularly a western species, Baron Osten Sacken having observed it abundantly in the environs of San Francisco, Cal., and having received it from the Red River of the North. Dr. Loew's type specimens came from Nebraska. Professor Comstock has received a number of examples from Montana. Dr. Williston has examined many from the Rocky mountains and Pacific regions, while he also finds it in its eastern extension, to be the most common species of its genus in New England. I have only taken a single example of it in New York — at Keene Valley, Adirondacks, on August thirtieth — owing, perhaps, to my seldom making field collections during the late summer, when it may be of more frequent occurrence. Of its closely allied species, *H. similis* Macquart, twenty-four specimens (13 males and 11 females), were taken by me at Piseco lake, Hamilton county (Adirondack region), on the 30th and 31st of August, 1889, from the flowers of a low-growing golden rod (*Solidago*) overspreading a pasture.

Not an Injurious Species — The Syrphidæ not Harmful.

From the preceding statement of larval habits, it will be seen that the species is not an injurious one, unless the fly, in its visits to flowers, should be found justly chargeable with the injury that is suspected of *Eristalis tenax* — of soiling the petals of some delicately colored flowers.

None of the species of the *Syrphidæ* are known to be positively injurious, while many of them in their larval stage render most excellent service to the agriculturist and florist in the myriads of the destructive family of plant-lice (*Aphididæ*) that they devour, and upon which they exclusively live.

One of the species, however, *Mesograpta polita* Say, although belonging to an aphid-eating tribe, has recently won for itself the name of "the corn-feeding Syrphus-fly," from its having been found to feed as a larva, on corn. It has been detected in New Jersey, feeding, in

large numbers, on the pollen of corn; while in Florida it has been discovered in great abundance, engaged in puncturing the saccharine cells of the leaves at their base and also of the stalks, and sucking up the exuding juice. Thus far, no serious injury has been seen to result from its operations.*

***Chloropisca prolifica* (Osten Sacken).**

The Prolific Chlorops.

(Ord. DIPTERA: Fam. OSCINIDÆ.)

LINTNER: Fourth Rept. Ins. N. Y., 1888, pp. 67-72, f. 30; in (and from) 41st Rept. N. Y. St. Mus. Nat. Hist., 1888, pp. 187-192, f. 30; in New York Times of April 14, 1890; in Albany Daily Press and Knick., for April 15, 1890; in Plattsburgh (N. Y.) Morning Telegram, for April 23, 1890; in Country Gentleman, for May 1, 1890, iv, p. 349.

In the "Fourth Report on the Insects of New York (41st Rept. on the New York State Museum of Natural History) for the Year 1887," as above cited, an account is given of a fly that had been brought to my notice during the year, as hibernating in immense numbers in a dwelling-house, in Franklin, N. H. It was found to be an undescribed species of the *Oscinidae*, and was accordingly given the name of *Chloropisca prolifica* Osten Sacken. Figure 6, representing it, is from a drawing made by Mr. J. Bridgman, greatly enlarged — the cross-lines beside it giving the natural size.†

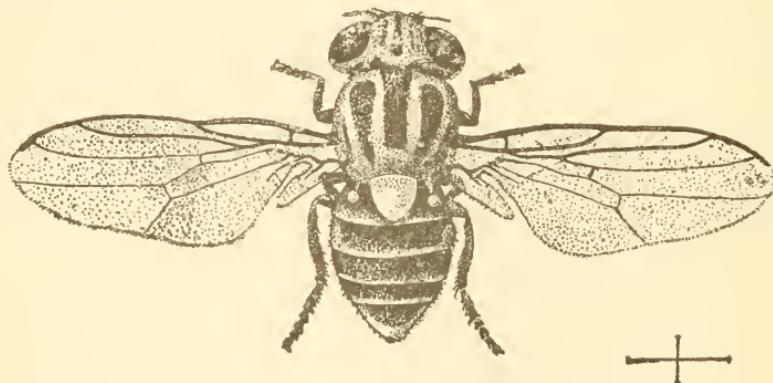


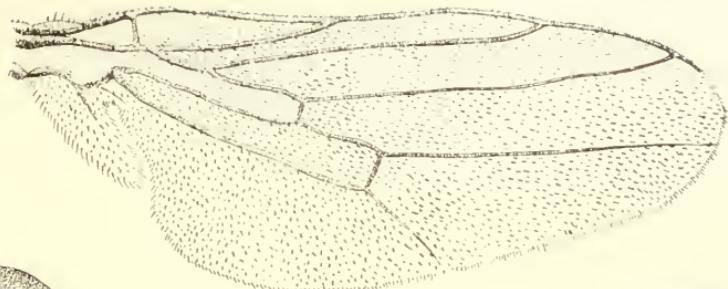
FIG. 6.—The Prolific Chlorops, *CHLOROPISCA PROLIFICA*, enlarged.

Remarkable Gatherings of the Fly.

Examination showed it to be closely allied to other species of *Oscinidae*, which, under the generic name of *Chlorops* had been

* *Insect Life*, i, 1888, pp. 6, 7.

† The cross-lines show twice the natural size of the fly, the photo-engraver having reproduced the figure in full size of drawing, instead of reducing it to one-half, as directed.



J Bridgman.

FIG. 7.—Details of structure in different degrees of enlargement, of *CHLOROPISCA PROLIFICA*.

described and recorded as occurring in immense assemblies for their hibernation within buildings in different countries of Europe, as in England, France, Switzerland, Germany, and Russia. The flies had usually assembled during the month of September, and collected in a particular room or limited portion of a building where they passed the winter for the most part in a torpid state and in concealment, and departed in the early spring (March) for their unknown breeding grounds.

These gatherings had been deemed of such interest, from their immense numbers, amounting to many millions, the unusual features displayed in their hibernation, and the inability to trace them to their source in any of the cereal crops in which they were believed to breed, that, whenever brought to the notice of scientific men, they have always been deemed worthy of attention, and of record sometimes quite detailed.

Three Known Localities in the United States.

Another late summer gathering and winter hibernation of the same fly, in addition to the New Hampshire locality, was reported during the same year, at Alfred Center, N. Y., which is also noticed in the report above cited.

The present year, a third of these interesting occurrences, scientifically viewed, has been brought to light, which is also of the same insect, *Chloropisca prolifica*. As these three are the only ones of the kind recorded from the United States in our literature, it seems not improbable that future studies will show the fly to be a comparatively recent introduction, and identical with some of those that have long been known in Europe as possessing similar habits, but of which, although some have been referred to *Chlorops* and given specific designation, their identifications, according to Baron Osten Sacken, were not made by competent persons, and are therefore of no value whatever.

The third locality is at Ausable Forks, in northern New York, where a large company of the fly has, for the last few years, been making an annual visit to, and finding winter quarters in, the residence of Mr. H. D. Graves. For the interesting account which I am able to present of the visits of this insect, I am indebted to the kindness and courtesy of Mrs. Graves, as shown in her readiness to give me any desired information, and to extend aid in endeavoring to discover the source of her intrusive and unwelcome guests.

The following account is compiled from the several letters received from her upon the subject.

Mrs. Graves' Account of the Fly.

Its first notice.—The first appearance of the fly was in the last of July or early part of August in 1882 or 1883, on the brick wall of the northeast side of the house, under a veranda. After that, they came each summer at about the same time upon the veranda, when the annoyance of their humming [probably in slow flight] would compel the family to leave their seats and find shelter within doors during the middle of the day. This would continue for about three weeks, when they would disappear as suddenly as they came. Occasionally one would be seen within doors during the winter months.

Observed within doors.—Three years ago, in February, “swarms” of the fly were discovered in the north-east corner room of the first floor (the house is a double one, steam-heated, and the occupied rooms are mainly on the south side). Since then they have increased in number each year, and at their last coming, they have been exceedingly numerous, and have “swarmed on the windows all winter.” With the exception of stray individuals they are confined to this one apartment.

In the sleeping rooms, a few — three or four — were occasionally found concealed beneath pillows, stand-covers, etc. When routed out from their retreats, they would depart with an “angry buzz.”

Not controllable by Pyrethrum powder.—Attempt was made to destroy them with pyrethrum. All that were seen could be killed by this means, but the following day they would be found as numerous as before, while the source of the new-comers could not be ascertained. It was thought that they were hidden in the wall between the brick and the lath-and-plaster.

New quarters.—The past winter, the front vestibule had been for the first time infested with them, and during the spring, they were observed on a veranda on the second floor, over the porte-cochère. When the nights were cold, those seen on the outside of the house, found shelter between the window frames and the brick: those in the inside were observed creeping into the openings in the frames in which the window-cords ran.

Some annoying habits.—Except by their innumerable presence, at the time of their advent and departure, they were not seriously annoying to the person. The servants of the house declared that they were bitten or stung by them, but this must have been wholly imaginary. They would often alight on the hands and face, over which they would creep unpleasantly, and at times become entangled in the hair, when their peculiar “buzz” would be given. Their

wings were seldom used except when they were disturbed. A light introduced in a warm room arouses them at first, but after investigating it, they show a disposition to hide away.

Three companies of the flies.—For the last two seasons, two companies of the flies have been observed. The last comers took possession of the northwest end of the veranda and kept entirely separate from those on the northeast end. The veranda is forty feet in length, and between the two there was a stretch of brick wall of ten or twelve feet in extent, upon which a few scattering individuals only could be seen. The hose was occasionally turned upon the wall to drive them away, but as soon as it was free from drip, they returned again, and each company to its own quarters. The present summer, in early September, a third company made its appearance and swarmed on the front porch which faces the east and receives the sunshine nearly the entire day.

No other house visited.—The flies, so far as could be learned, were not found in any other house at Ausable Forks, nor in any of the other buildings upon the same grounds. Not a single one had been seen in either the conservatory or grapery. A notice of the fly and its interesting peculiarities was published in the county papers, with the request for notification if it had been observed elsewhere in the vicinity, but no response was received.

Arrival and departure.—The flies have not been observed either in their approach to the house or in their departure from it, and it is, therefore, suspected that their flights are made during the night or under cover of darkness. An advance guard seems to signalize the coming of the main body. Some morning, in the latter part of August, a few are to be seen on the wall or screens, when the announcement is made by some member of the family—"those horrid flies are coming again!" Perhaps a week thereafter, or the first hot day following, upon going out after breakfast, the Chloropiscas are found in such force, that the veranda is surrendered to them. They continue to abound on the veranda for about two weeks longer, when they begin to show a rapid diminution in number, through having crept into crevices and holes for their winter retreat. In a short time, all have disappeared. This year, on the twentieth of September, none were to be seen.

When the time of their departure approaches, during the month of April, they are to be seen buzzing actively about, both inside and outside of the house. The window panes, especially, abound with them on both sides. This is a favorable time to apply pyrethrum to them,

and hosts are killed in this manner.* By this means and by unobserved flight, their number continues to decrease toward the latter part of the month, and by the first of May, the last of the invaders has disappeared.

Interesting Features in *Chloropisca*.

In the above recital, several points of interest in the history and economy of the fly may be noticed, the chief of which are these: Leaving its food-plant each season in the month of August (heat of summer), and speedily taking possession of quarters where it is to pass the autumn and winter in inactivity and hibernation; its occupancy each year of the same room in a house on its north or northerly side; its awakening into activity in early spring and appearance in myriads; its gathering on the outer wall of the house and disappearance therefrom during the month of April; its flight to its unknown food-plant; and lastly, its occurrence in so few localities. How mysterious the instinct, or the principle of heredity that can guide each year the new brood upon their emerging from the plants within which they were developed, to the particular house and to the identical room which their parents had occupied for their hibernation. This, without parental guidance or direction, for as throughout the insect world, with few exceptions, the parents die before their offspring come into existence,† so in this instance, the *Chloropisca* dies soon after it has done all that it can do for its progeny in depositing its eggs upon the plants which will nourish and carry them to maturity.

Where Does *Chloropisca* Breed?

In the hope that some clue to the source of the *Chloropisca* visitations and to its selection of hibernating quarters might be obtained, request was made of Mrs. Graves for some account of her house, and its immediate surroundings. From her satisfactory reply, we extract the following :

The house is brick, three stories and an attic. It faces nearly east, is on a corner lot, 140 feet from the street in front, and 120 feet from the street on the north side. The lot, all of which is in lawn, except a plot of about a hundred square feet reserved for flowers, is 200 feet on the east side and 280 feet deep on the north side: then comes the flower garden, and back of that again more grass, old orchard, and small fruits, ending at the foot of a steep hill covered on the north side from street to top with a dense growth of pine trees, with a few

* Mrs. Graves had swept up and burned over a half pint of the flies in the second week of April.

† Exceptions are found in the ants, bees, and termites, and according to Kirby and Spence, in certain species among the *Sphecidae*, *Tenthredinidae*, *Scolytidae*, *Pentatomidae*, and *Forficulidae*.

birch, beech, locust, and hemlock. The stables, hen-house, and vegetable gardens are on the opposite side of the street on the north.

At Franklin, N. H., where the flies occurred, perhaps, in greater abundance than at Ausable Forks (see Fourth Report), the infested dwelling-house of Mr. Daniell "was surrounded by a broad lawn, and in front was fine green grass for 200 feet or more. Across the road was a hill arising to a height, perhaps, of a hundred feet, extending for an eighth of a mile, and covered with a growth of oak, pine and locust trees."

A comparison of the surroundings of the two dwellings show a striking resemblance, in which the feature in common, of an extended and encircling lawn, is suggestive: That of a neighboring eminence clothed with forest trees, among which are the pine and locust, is interesting, but would hardly need consideration in this connection. No grain fields, in which the fly has hitherto been thought to breed, are in the vicinity of either; at Franklin, "but little grain is grown within many miles;" at Ausable Forks, "no farms are within three miles."

The Fly Probably Breeds in Grass.

When informed under date of August twenty-seventh that the flies had made their appearance the day before, I was unable to visit Ausable Forks for the investigation which I had purposed to make at this time. Believing that they would be found coming out of the grasses of the lawn, and availing myself of the generous offer of Mrs. Graves to give me any assistance in her power, I wrote requesting her to cover patches of the lawn in different portions of it, with some thin muslin weighted down at the borders, that it might catch and hold any flies that might emerge.

The first attempts with thin muslin and lace were unsuccessful, as they allowed all of the small insects to escape before they could be identified. A second experiment with thicker muslin, secured a number of small flies, but *Chloropisca* was not positively identified. Later, under date of September 2d, Mrs. Graves wrote: "I went out again this morning, and after stirring up the grass with my hands, I kept perfectly still for the cloud of flying things to settle. I felt like shouting *Eureka!* when I saw *Chloropisca* in numbers on my dress and hands. Those that settled on the chamois gloves that I had on, gave me the opportunity of making sure of their identity. Of course, I can not say from this that the pest is in the grass, but it certainly is on the grass abundantly."

On receipt of the above, the further suggestion was made, to ensure, if possible, beyond all question, the source of the flies, that a

number of tight glass-covered boxes of as large a size as could be conveniently obtained, be distributed over the lawn, and set in *close contact* at the bottom with the soil, after driving away whatever of insect life might have previously settled on the grass. Arrangements for so doing were made, but heavy rains and cold weather ensued, and continued until too late to give any success.

Do Both Sexes Hibernate?

The concluding line appended to Baron Osten Sacken's description of this species (4th Report, page 71), which reads : "I have about thirty unpinned specimens before me; they seem to be all females," suggests the possibility that, as in some other of the orders, so in this species, it is only the female that lives through the winter. The above specimens, which had been sent by me to Baron Osten Sacken, were selected indiscriminately from a large number that had been taken in spring.

A necessarily hurried examination of a few of a small sending from Ausable Forks this summer, showed no distinguishable sexual features, nor were eggs found present in those that were opened. The search for them, however, was not of sufficient thoroughness to give assurance of their absence at the time.

Inquiring of my correspondent if any observations made showed the presence of the two sexes, answer was returned that in looking through the window pane as the flies were resting on its opposite side, a marked difference in shape was noticeable. Some were slim, and longer in the body than others, while in some the body was nearly round, rather short, and the end of the abdomen very much distended and nearly white.

The above described conspicuous difference in the shape of the abdomen, seen under the most favorable circumstances possible, seems to indicate, without much doubt, the presence of both sexes.

General Features of the Fly.

It would be strange indeed if other localities for this insect were not discovered. It should be easily recognized from its peculiar habits, as given — unlike those of any other fly known, and from the detailed accompanying drawings. Characteristic features by which it may also be known, are, its small size, only about one-tenth of an inch long; a somewhat flattened head, broader than the thorax; the thorax marked by three black stripes, of which the two outer ones are narrower and elongate wedge-shaped; two black triangular spots beneath, between the middle pair of legs; a dark brown abdo-

men, the segments of which are yellowish on their hind margin; the balancers or halteres with a yellow-white knob; the wings iridescent and considerably longer than the body.

In the accompanying Figure 7 the following enlargements of parts of the fly are shown: *a*, the wing;* *b*, head from in front; *c*, halter from below; *d*, halter from outside;† *e*, ocelli from above; *f*, ocelli from behind; *g*, a middle leg; *h*, side view of the fly; *i*, antenna, side view; *j*, antenna, front view; *k*, antenna bristle.

Its Reappearance at Franklin, N. H., in 1890.

Mrs. W. F. Daniell reports, under date of May 12th, a great diminution in its numbers the present year, as the result, no doubt, of the efforts made to rid themselves of the pest, in their spring appearance in 1887, 1888, and 1889, by the persistent use of pyrethrum freely applied with a powder-bellows. In addition to this, hot water was also thrown into the cracks and crevices about the windows and piazza where they had entered for hibernation, or for shelter during the cold days of spring.

They came from their retreats with their usual regularity this year about the first of April, and in their accustomed places, in the front rooms of the second story on the north side of the house and around the front door; but they were promptly met with pyrethrum, which killed all that were seen, and a second application was not required.

Reappearance at Alfred Center, N. Y.

Dr. H. C. Coon, of the Alfred University, in reply to an inquiry made, writing under date of November 15, 1889, stated that the flies had not been observed on the windows that they had previously occupied, but that they had been found on some papers over canned fruit in the cellar, near a north window, but in far less abundance than in preceding years. These were destroyed with pyrethrum powder. They were not observed during the following month of April.

The unusual locality given above for the fly, and its association with canned fruits, leads us to question whether examples of the pickled-fruit fly, *Drosophila ampelophila* Loew, might not have been mistaken for the Chloropisca, as the two are of about the same size and form.

* In the description of the wing of the fly, in the *Fourth Report on the Insects of New York*, the first vein was inadvertently referred to as the auxiliary vein. In *Chloropisca* the auxiliary vein is wanting—it being coalescent with the first.

† The halteres are beautiful microscopic objects, being covered with a pubescence of very fine white hairs, giving them the appearance of velvet—not representable in a figure.

Phytomyza chrysanthemi n. sp. Kowarz.*The Chrysanthemum Fly.*

(Ord. DIPTERA: Fam. PHYTOMYZIDÆ.)

Phytomyza lateralis. LINTNER: 4th Rept. Ins. N. Y., 1888, pp. 73-79, figs. 31, 32.
Not *Phytomyza lateralis* of FALLÉN, MEIGEN, CURTIS, et al.

Phytomyza aqfinis. FALCONER: in Amer. Florist, ii, 1887, p. 297.

Phytomyza chrysanthemi KOWARZ MS. JACK: in Garden and Forest, iii, 1890, p. 440, figs. 55 f. f. g.

Phytomyza ?nigricornis. WESTWOOD: in Gardeners' Chronicle, May 12, 1883, p. 593.

A somewhat extended notice of the destructive leaf-miner of Chrysanthemums, Eupatoriums, Cinerarias, etc., the injurious character of which has drawn considerable attention to it during recent years, was given in the *Fourth Report on the Insects of New York*, 1888, under the name of the Marguerite Fly — *Phytomyza lateralis* Fallén, it having been identified with the European species of that name by Baron Osten Sacken, to whom examples had been sent.

The Marguerite Fly not Phytomyza lateralis.

Subsequently, other examples of a *Phytomyza* found mining Chrysanthemums and other plants in the vicinity of Boston by Mr. J. G. Jack, and believed by him to be the *P. nigricorris* of Macquart, were submitted to Baron Osten Sacken for his determination. Early in the present year, Baron Osten Sacken informed me of the sending and reception of the above, and that their examination showed them to be, in all probability, of the same species received from me a few years ago, and which he had identified for me as *Phytomyza lateralis* Fallén. He further stated: "I am very sorry to acknowledge that I must have misled you in this case by a wrong determination. I do not remember now under what circumstances I committed that blunder and what prevented me from sending the specimens to Kowarz. Both species are very much alike, and the Entomologist Boie committed the same mistake (see Schiner, Fauna, ii, p. 316, foot-note). But I should have noticed that the one was bred from the heads of *Composite* and the other from the leaves. No wonder that I found some of the statements of Curtis misleading."

A wrong determination by the distinguished European dipterist is of so rare occurrence that, without awaiting his permission, we publish the above explanation, relying upon his well-known readiness to acknowledge and correct any error accidentally made.

It Proves to be an Undescribed Species.

The examples from Mr. Jack were submitted by Baron Osten Sacken to Mr. Kowarz,* who returned answer that they are most closely allied to *Phytomyza affinis* Fallén (non Meig. or Macq.), and must be considered as a new species. In compliance with requests made, Mr. Kowarz prepared a description of the fly, of which Baron Osten Sacken has made the following translation, and kindly sent copies of it to Mr. Jack and myself. With Mr. Jack's permission, it is herewith given:[†]

Its Description as *Phytomyza Chrysanthemi*.

Phytomyza Chrysanthemi n. sp. *Ph. affinis* Fall. simillima, setulis acrostichalibus in dorso thoracis vix ullis ♂ ♀, et terebra distinete breviore (♀) diversa. Fronte et epistomate flavis, antennis totis nigris, thorace cum scutello cinereis, aut unicoloribus, aut liueola pallida ante alas in thoracis lateribus parum perspicua, pedibus nigris, geniculis tantum pallidis, abdomine nigro, margine postico segmentorum anteriorum angustissime, segmenti ultimi latiore flavo.—Long. corp. 2 mm.

This species is strikingly like *P. affinis* Fall., and differs from it only in the absence of the acrostichal bristles (at least on the front part of the thoracic dorsum), and in the shorter ovipositor.

Front and face yellow, occiput gray, antennæ altogether black, suctorial flaps of the proboscis yellow, tip of the palpi generally dark, oral bristles distinct, genæ narrow, hardly equal to one-third of the height of the eye. Thorax and scutellum uniformly gray, sometimes the former with a pale-yellow lateral stripe in front of the root of the wings; thoracic dorsum usually with four pairs of dorsal macrochetae, but without the intermediate acrostichal bristles;[‡] seldom a few in the vicinity of the scutellum; scutellum with four macrochetae on the edge. Wings almost hyaline; veins blackish, yellowish near the root; the costal vein reaches the tip of the third vein only, which tip is rather far distant from the tip of the wing; the first, second, and third veins are distinct, the other longitudinal veins are thin, especially the fourth, which ends in the tip of the wing; the sixth vein is incomplete; the posterior crossvein is wanting; tegulae and halteres pale yellow. Legs black, only the knees pale-yellow; sometimes also the trochanters of the forelegs yellow. Abdomen black, but little shining, the ventral sides more or less distinctly pale-yellow; the posterior edge of the anterior segments with an exceedingly narrow pale-yellow margin; on the last segment this margin is more distinct. Genitals black, those of the male of moderate size; the ovipositor of the female hardly as long as the last abdominal segment. Twenty specimens.

* "Mr. Ferdinand Kowarz, in Franzensbad, Bohemia, I consider as the entomologist who, at present, possesses the most extensive knowledge and experience of European Diptera, especially so far as the discrimination of species is concerned."—(Baron Osten Sacken, in *Insect Life*, ii, 1889, p. 191.)

† Mr. Kowarz in referring, *in lit.*, to his observations on this insect, asks that reference may be made to the descriptions of *Phytomyza diminuta* Wlk. and *P. solita* Wlk., in the *Transactions of the [London] Entomological Society*, New Series, iv, p. 232, v, p. 232,

‡ [May also be called; the inner row of the dorso-central bristles.—O. S.]

Operations: and Figures of the Insect.

Mr. Jack has kindly given me permission to use the figures illustrating the insect which accompanied a brief notice of it in a late number of the *Garden and Forest* (*loc. cit.*). The figure of the fly in my Fourth Report was not from nature but from Curtis' *Phytomyza lateralis*, with which ours had been pronounced identical.



FIG. 8.—The Chrysanthemum fly, *PHYTOMYZA CHRYSANTHEMI*, with its larva, and its mines in a chrysanthemum leaf.

Mr. Jack has also informed me that the insect had been troublesome in the vicinity of Boston during the past three or four years, but had only come under his observation about a year ago. It had

been found there, as a miner in the leaves of Chrysanthemums, Eupatoriums and Cinerarias in greenhouses. The mines are irregular, and are often so abundant that the upper and lower epidermis of the leaf alone remain, and these, of course, soon shrivel and dry.

Differences Shown in the Mines.

The leaf figured above is that of the large Japanese Chrysanthemum, in which the operations of the larva are rather rare. Upon comparing the figure with the leaf represented in my Fourth Report, a great difference will be seen in the direction of the mines in the two. In the latter — in the large number of the leaves sent me, in every one the mine was almost wholly *confined to the margin*, following closely each division and tooth of the leaf, and *in no instance crossing itself*; while in that figured by Mr. Jack its course is quite irregular, tortuous, *frequently crossing, and only in two places touching the margin*, as if by accident. This great variance would seem to be quite in excess of what might be expected from the dissimilarity — marked as it is — in the size and shape of the leaves of the two chrysanthemums.

Do the Differing Mines Indicate Distinct Species?

A difference so marked suggested the possibility that the flies submitted to Mr. Kowarz may not have been identical with those that had been placed in Baron Osten Sacken's hands. It did not appear that there had been direct comparison of the two lots of specimens, nor had an exchange been made between Mr. Jack and myself. To set the question at rest, a number of those reared by me in 1887 from the Long Island larvae, was sent this autumn to Mr. Kowarz, with the request that he would compare them with those in his possession received from Mr. Jack.

Shown by Comparison to be Identical.

In a letter promptly returned the undoubted identity of the two was declared: the last sending was *Ph. chrysanthemi* in litt. In addition thereto, Mr. Kowarz has kindly made comparison of the species with *Ph. affinis* and with *Ph. lateralis*, which we gladly transcribe as of interest and value to the student.

Compared with Other Species.

This species is the nearest of all to *Ph. affinis* Fall., Zett., Schin. It is very similar, but is distinguishable from this by the lack of the acrostichal bristlets, and by the relatively shorter and weaker ovipositor of the female: unfortunately I could not compare it with the male *affinis*. *Ph. chrysanthemi* has sometimes a row of acrostichal

bristlets, but always in so insignificant number that they could almost be left out of consideration in comparison with *P. affinis*.

Ph. chrysanthemi is certainly not identical with *Ph. lateralis* Fall., Zett., Schin., which, on account of the venation, Haliday has placed in a distinct genus—*Napomyza*. It appears also, extraordinarily like that in color and size, but lacks the posterior transverse vein. *N. lateralis* lives in the base of the flowers of a few *Compositæ*, while *Ph. affinis* and *Ph. chrysanthemi* are true leaf-miners. So far as known to me, *Ph. affinis* confines itself to the leaves of a few *Ranunculaceæ*, while *Ph. chrysanthemi* mines in the leaves of *Compositæ*.

I have not identified *Ph. chrysanthemi* with *Ph. affinis*, because I believe that from the absence of the bristlets and from the features of the ovipositor, the claim of the former to be a distinct species could be established.

The illustration in your Report for 1887, copied from Curtis' *British Entomology*, p. 393, is the true *Napomyza lateralis* Fallén.

It would be quite interesting to learn to what *Phytomyza* the one belongs which burrows in the leaves of *Aquilegia*, as figured on page 79 of your Report; perhaps it is the *Ph. affinis* Fall.

Remedy for the Insect.

In the former notice of this insect (*4th Rept. Ins., N. Y.*, p. 76), it was recognized as a pest not to be controlled by ordinary remedies or preventives, and it was, therefore, recommended that, until some other more successful method could be found, the plants should be examined at brief intervals after the first recognition of the attack, and every infested leaf picked off and burned.

This method seems to have been quite effective in the greenhouses of Mr. Dana, at Dosoris, L. I., where the insect was first noticed, as appears from a note of Mr. W. Falconer, written January 31, 1888, stating: "Although the cool months of the year—October to May—are the favorite times for the appearance of the larvæ, our greenhouses at the present time are almost free from them; and this, not from any remedy employed, but from watching diligently for the first indication of their operations, and plucking and destroying every infested leaf."

Dynastes Tityus (Linn.).

The Spotted Horn-bug, or the Rhinoceros Beetle.

(Ord. COLEOPTERA: Fam. SCARABEIDÆ.)

PAL. DE BEAUVOIS: *Ins. recueil. en. Afr. et Amer.*, 1805, p. 138 (as *Scarabaeus Tityus*).

LATREILLE: *Encyc. Method. Hist. Nat. Entomol.*, x, 1825, p. 347 (mention), pl. 137, f. 7 (as *Scarabaeus Tityus*).

WALSH-RILEY: in *Amer. Entomol.*, i, 1869, p. 168 (identified from Miss.).

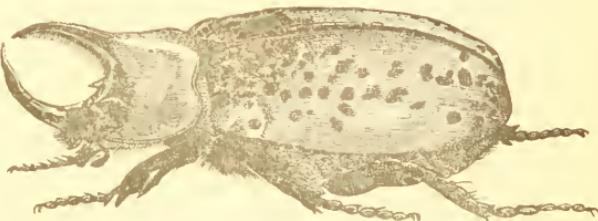
- RULEY: in Amer. Entomol.-Bot., ii, 1870, p. 276 (features).
 SMITH: in Ent. Amer., ii, 1886, p. 163; in Proc. Ent. Soc. Wash., i, p. 54;
 in Pop. Sci. Monthly, xxx, 1887, pp. 409, 410 (a public nuisance).
 LUGGER: in Ent. Amer., ii, 1886, p. 163 (fondness for the ash); in Proc. Ent.
 Soc. Wash., ii, 1888, p. 54 (food-plant).
 SCHWARZ: in Proc. Ent. Soc. Wash., i, 1886, p. 55 (odor of pupa).
 HOWARD: in Proc. Ent. Soc. Wash., i, 1886, p. 56 (offensive in Raleigh,
 N. C.).
 HAMILTON: in Canad. Entomol., xviii, 1886, p. 112 (change in color and
 noises made).
 LINTNER: 5th Rept. Ins. N. Y., 1889, pp. 227-231, figs. 26, 27 (general account).
 LEAVELL: in Insect Life, iii, 1891, p. 395 (dug up under a woodshed in Va.);
 ib., RILEY-HOWARD (identification of the same and breeding habit).

(The above are additional to the references given in the 5th Rept. Ins. N. Y.)

In the notice of this insect in the *Fifth Report on the Insects of New York*, incidental reference only is made to its larva. My attention having recently been drawn to some of the peculiar habits of the beetle, it became desirable to learn something of its early life, but nothing descriptive of its larva or pupa could be found in our publications.

On inquiry of Dr.

FIG. 9.—Side view of the Rhinoceros beetle.



Riley if he could assist me in the matter, he has most kindly given me for publication the careful and extended descriptions which follow, of these two stages, taken from the MS. notes on Undescribed Coleopterous Larvæ, upon which, in connection with Mr. E. A. Schwarz, he has been for a long time engaged. Figures illustrative thereof were also made, to accompany the descriptions, electrotypes from which have been furnished me, with permission for their use—for which privilege grateful acknowledgment is rendered.

Description of the Larva.

Length, 13 centimetres. Of the normal Lamellicorn form, enlarging but little posteriorly. Color, dirty yellowish-white, head reddish-brown, mandibles piceous or black, other mouth-parts and legs pale reddish-brown. Head slightly wider than long, convex above, coarsely rugose-punctate over the whole surface, the punctations often umbilicate, the narrow interstices shining; a few long setæ are scattered over the surface; epistomatal line almost entirely obliterated and difficult to trace, space inclosed by it distinctly wider than high; clypeus about four times wider than long, trapezoidal, coarsely, not densely punctate, slightly convex longitudinally; no trace of ocelli; antennæ shorter than head, consisting of four joints and a large, trans-

verse basal tubercle; joints 1-3 clavate; joint 1 about twice as long as its width at tip; joint 2 one-fourth longer than joint 1; joint 3 as long as joint 1, slightly and obliquely produced at its lower apical angle; joint 4 somewhat shorter than joint 3, acuminate at tip; labrum a little longer than the clypeus, slightly narrowing anteriorly, sides rounded, anterior margin truncate and armed with long stiff bristles; upper surface rugosely punctate. Mandibles nearly as long as the width of the clypeus, outer surface near base coarsely ciliate and furnished with two longitudinal carinae, the sloping inner surface and tip smooth; edge of scissorial part with three obtuse teeth, the terminal one large and triangular, the middle one smaller but also triangular, the basal one rectangular, the three teeth as well as the manducatorial tooth larger on the left than on the right mandible; left manducatorial tooth quite prominent at the anterior edge and forming a right angle

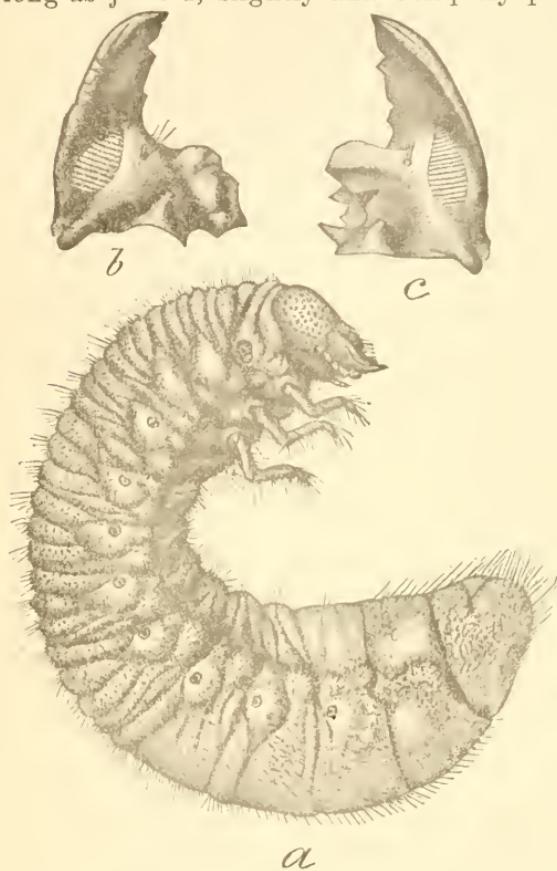


FIG. 10.—Larva of the Rhinoceros beetle, *DYNASTES TITUS*, in natural size, with its mandibles enlarged

with its anterior edge not prominent, under surface of scissorial part opaque at tip, smooth and shining toward the base; stridulatorial surface about three and one-half times longer than wide at middle, the ridges becoming finer and shorter towards the apex. Lobes of maxillæ connate on the under (outer) side, except that there is a shallow, smooth dividing furrow at tip; on the upper (inner) side the dividing suture is distinct throughout; both lobes are on either side covered with long yellow spines arising from little tubercles; the outer lobe terminates in a stout thorn, inner lobe at tip with three closely set triangular teeth; stridulating teeth on inner surface not placed on a distinct ridge and consisting of six larger and two or three very small and indistinct teeth; maxillary palpus decidedly longer than the outer lobe, three-jointed, first joint distinctly clavate and twice as long as its width at base, second joint as long as the first and very slightly clavate, third joint narrower but one-fifth longer than the second, subacuminate at tip. Mentum and lingua on

the under side smooth and shining, opaque and spinulose on the upper surface; palpi of the usual form.

Prothoracic joint, when viewed from the side, slightly longer than the other two thoracic joints. Dorsally the three thoracic and the first six abdominal joints are essentially alike in length and sculpture; they are triplicate in the usual manner and covered with rather sparse, small, shining tubercles, each giving rise to a stiff, moderately long, blackish spine, directed backwardly; there is also on each joint a more or less regular transverse row of long brownish setæ. The last four abdominal joints are much longer, not sulcate and much smoother; the anal joint longer but much narrower than the pre-anal, transversely convex and evenly rounded at tip, its surface is sparsely beset with irregular long setæ more densely so at tip. On its under surface and not visible from above, the terminal joint has a transverse slit which causes it to appear divided in two parts. Spiracles large, the abdominal ones regularly short-oval in outline, the break in the peritremia very narrow; prothoracic spiracle decidedly larger, more oblong and less regular in outline.

Legs stout, covered with long but rather sparse setæ; second pair thicker and slightly longer than the first; third pair again longer than the second; the claw is short, robust, and subulate at tip.

Under surface of abdomen more shining, more sparsely tubercled and less spiny than the upper surface.

The description is made from an alcoholic larva found in a rotten stump at Wilkesboro, N. C., in the month of June.

Attention is called to the fact that Dr. Eugène Dugès in describing the larva of the Mexican *Dynastes Hyllus*,* says, that the larva is distinguished from that of *Strategus julianus* only by the sculpture of the body and the form of the last abdominal joints. In the former species the abdominal joints and the two posterior thoracic joints are said to be furnished with numerous *longitudinal* folds (*plis*), and the terminal joint flattened above so that when viewed from above it appears to be triangular in outline. Referring to DeHaan's figure of *Dynastes hercules*,† I find the general sculpture and the form of the last abdominal segment to correspond with those of our *D. Tityus*, and as I know of no Lamellicorn larva having longitudinal folds except from contraction, I half suspect that those in Dugès' specimen were unnatural.

Description of the Pupa.

Pupa of male.—Covered with a very fine velvety pruinosity and therefore opaque. Where the pruinosity is abraded the body appears to be somewhat shining. No distinct sculpture is visible; horns on head and prothorax much thicker and stouter than in the imago, and faintly ringed transversely. Mesonotum and metanotum with a very fine faintly impressed median line. The sutures between the first six abdominal joints are deeply and suddenly depressed, the joints themselves appearing to be very short and somewhat gibbous. Base of the first joint as well as the anterior and posterior margin of the four following joints and the anterior margin of the sixth, furnished on

* Ann. Soc. Ent. Belgique. xxxi, 1887, p. 137.

† Nouv. Ann. Mus. d'Hist. Nat., iv, 1835, pl. 11, fig. 1.

each side of the middle with two transverse, slightly impressed areas surrounded by sharply defined shining ridges. The posterior margin of the sixth joint is slightly lobed at middle, but without transverse impressions; anterior margin of seventh joint in the middle with two small stigma-like impressions, and on each side with two large, transverse, and shining areas. The cerci when viewed from below, represent two large irregularly-oval lobes which are contiguous at tip and thence diverging. Pleuræ very indistinctly limited by a shallow furrow above and beneath. The four anterior pairs of abdominal spiracles are strictly

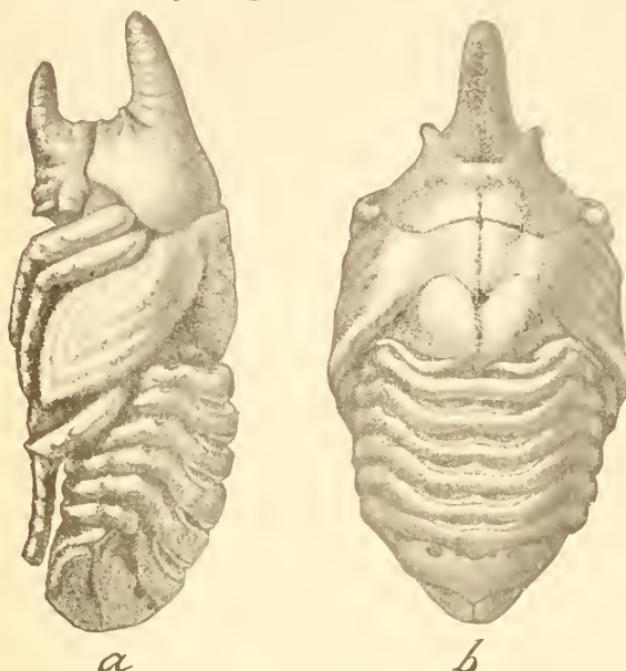


FIG. 11.—Pupa of the Rhinoceros beetle, *DYNASTES TITYUS*:
a, side view; b, dorsal view. In natural size.

dorsal, very large, oblong and transversely placed; the posterior pairs of spiracles can not be seen in the specimens before me: they are probably smaller than the anterior ones.

Described from two specimens, both dried up and injured.

The peculiarities of the genus in the adolescent states, as for instance, the rotten-wood feeding habit of the larva, the strong, peculiar odor of the larva and pupa lasting even after death, and the stridulation of the imago, [*] are all recorded by authors.

A Mexican Species of *Dynastes*.

In the above, Dr. Riley has referred to the description of the Mexican *Dynastes Hyllus* Chevr., by Dr. Eugène Dugès, of Guanajuato, Mexico. For comparison with the early stages of *D. Tityus*, Dr. Dugès' figures of *D. Hyllus* are herewith given, copied from his notice of the species in the place above cited.

* There is no record of the stridulation of the larva having been heard. Dr. Hamilton (*loc. cit.*) has remarked of the imago: "While no stridulating organs are present, they have the power to produce a sound that may answer the same purpose, somewhat resembling that of an angry goose. The pygidium and part of the last ventral surface are very hairy, and by withdrawing the abdomen from the elytra so as to admit air and then suddenly forcing it out through the hair by a sudden extension, a noise is produced that is rather alarming to one unacquainted with their harmlessness."

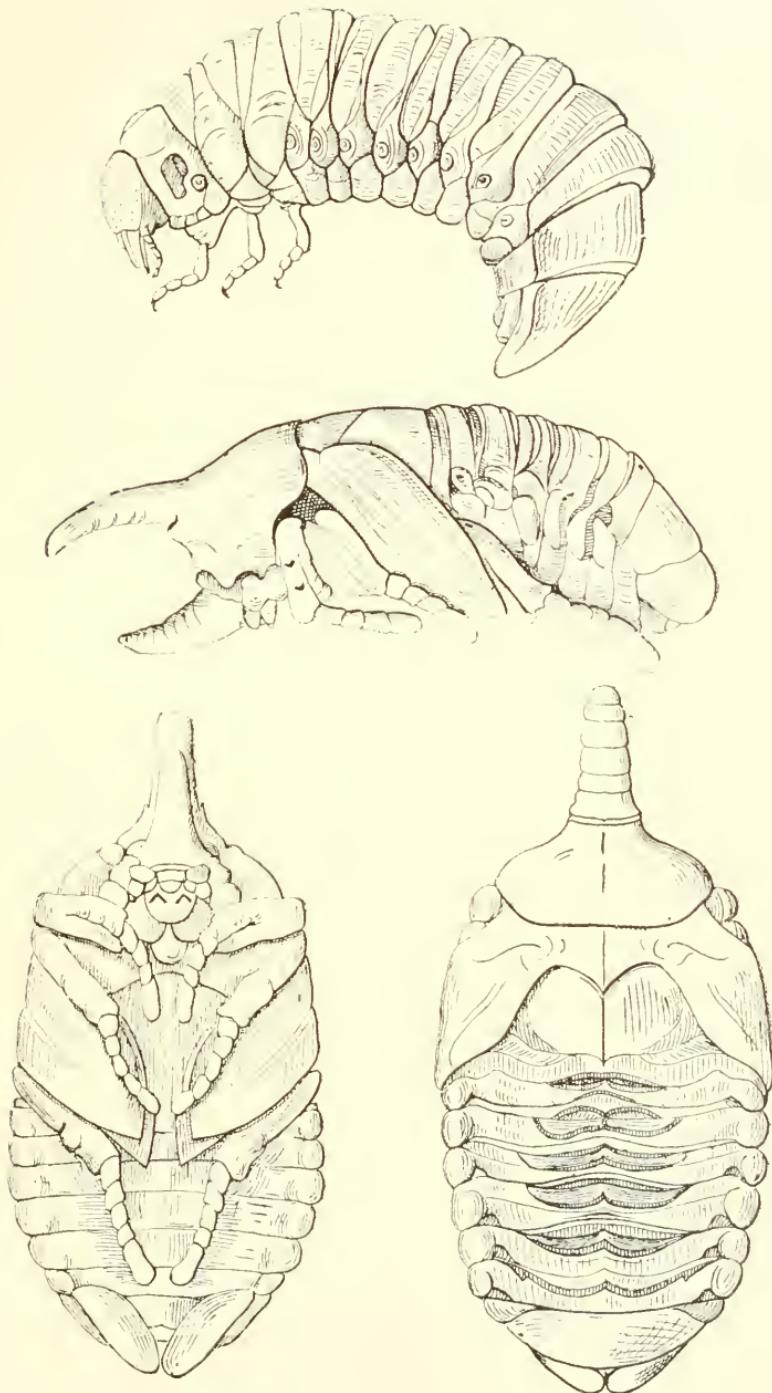


FIG. 12.—The larva of *DYNASTES HYLLUS*. FIGS. 13, 14, 15, the pupa of the same in lateral ventral, and dorsal views.

The larva, Fig. 12, with others, was found within an opening in the trunk of an oak, in the midst of a mass of woody debris. One having transformed to the pupa, gave out the imago in about a month. Later, in enlarging the opening, two pupæ of males (Figs. 13, 14 and 15) were found, inclosed in a large (une énorme) cocoon formed of the detritus in which the larvæ had lived, smooth on the interior, and of a thickness not less than a centimetre.*

In the same oak, and associated with the above, were thirty or thirty-five larvæ of the closely allied *Strategus*, and several of *Mallodon angustatum*.

Feeding Habits of the Beetle.

In the notice of this insect in the *Fifth Report on the Insects of New York*, referring to its feeding habits, Mr. G. E. Murrell is quoted as stating :

When feeding on the ash, they place themselves longitudinally on a smooth limb, and, rising to the full extent of their legs, move their entire body backward and forward like a plane, using several chisel-like projections on the under side of the head for cutting — stopping the motion as soon as the alburnum is reached.

In comment upon the above, it was intimated that further information was desirable as to whether the beetle preferred the bark to the leaves, and if it consumed, harmlessly, only the outer bark, or injuriously, also the alburnum beneath.

This information has been supplied in a subsequent communication from Mr. Murrell, in which he has written as follows :

I inclose you portions of an ash limb, *planed* by the beetles, from which you can see that they feed on the alburnum, and the size of the shaving that they take at a stroke. They do not eat the leaves, but attack limbs from three inches in diameter down to the smallest twigs.

I can give no information as to habits below ground, but in the autumn the ground beneath the trees will be covered with the adult dead, and the ground perforated with holes next to the tree-trunk.†

From specimens of the wood sent, the "shavings" cut by the beetles appear to be from one and one-half inch to two inches in length. From Mr. Murrell's statement it may be inferred that the outer bark is first planed or scraped off and rejected, exposing the alburnum or sap-

* A correspondent of Dr. Hamilton has represented these cocoons as "oblong cases about three to four inches long and three inches in diameter, composed of the rotted wood in which they were imbedded."

† Mr. B. D. Walsh believed that such "holes around the roots of young ash trees" on Long Island, N. Y., were made by the large black Rhinoceros beetle, *Xyloryctes Satyrus* Fabr., which were found near them, the larvæ of which live underground and feed on the roots (*American Entomologist*, i, 1868, p. 60).

wood, which is then eaten. More than the tender cambium layer has been apparently removed — possibly all of the exposed alburnum, as in the pieces received, the bottom of the wound shows patches of black and dead wood, overgrown at their margins by the new growth that had taken place since the injury was inflicted.

Another quite different habit of obtaining food has been ascribed to *Dynastes* by some writer whom we can not now refer to, nor would it, probably, authenticate the statement or give it any claim to consideration, if it could be found. The beetle is said to attach itself to a small branch by grasping it between its horns, and twirling its body round and round by a rapid movement of its wings, so tears the bark as to give it the food desired — either the inner bark or, as some suppose, the sap that flows from the laceration.

Possibly the beetles may be both bark-eaters and sap-suckers. Mr. J. Doll records* of a species of *Dynastes* observed by him, and of which he "captured over one hundred examples, some fully four inches in length," in Hell's Canon, Arizona, that "they are always found near the tips of branches, where, by means of their projecting thoracic horns, they scrape through the soft bark to cause a flow of sap, which is very sweet, and of this consists their food."†

In further remark upon the feeding habits of the beetle, Mr. Lugger may be quoted, in giving the water-ash [black ash] *Fraxinus sambucifolia* as its favorite food-plant. On the shore of eastern Maryland he had attracted the beetle by bruising ash-twigs — a friend from Mexico having informed him that in that country they were so taken (*Ent. Amer., loc. cit.*). The bruised leaves of this species of ash are well known for the peculiar odor that they give forth; Dr. Asa Gray has compared it to the scent of elder.

Variations in Color.

The different colors occasionally presented in individuals of this species, particularly in the female, has often been remarked upon. In my preceding notice of the insect it is stated: "One example in my collection has the thorax black, while in another both the thorax and the wing-covers are very dark brown. A male before me has the thorax of the normal color, while the elytra are dark brown, slightly mottled with paler brown."

Some have thought these darker colors to be the result of "greasing," but Dr. Hamilton seems to have found the proper explanation.

* *Bulletin of the Brooklyn Entomological Society*, vii, 1885, p. 121.

† This species is thought by Dr. Horn to be *Dynastes Grantii*, described by him in *Trans. Amer. Entomolog. Soc.*, iii, 1870, p. 78, as a variety of *D. Tityus*: it is so cited in the *Fifth Rept. Ins. N. Y.*, 1889, p. 227, but is now regarded as a valid species.

Of two specimens taken early in December from a cavity in a poplar in Clairborne county, Tenn., he has written :

When received, about three weeks after being taken [from their cases when they were "soft and white"], the male was assuming the greenish hue, and in three weeks more was normally colored. The female was entirely brown, and in four weeks had changed to nearly black; the black then began to fade, and in about four weeks more the beetle had taken on the greenish tint, with the usual brown maculae. No further change in color has occurred till the present, April 6th. It may be possible that the brown males and females mentioned by writers are immature individuals, as it would appear from the above that it requires from two to three months to perfect the colors.

Early Observations on the Insect in Pennsylvania.

Say, in his description of the beetle in 1824, remarks that "it is so extremely rare in Pennsylvania, that the late Rev. F. V. Melsheimer, the parent of entomology in this country and a very industrious collector, found but two individuals in eighteen years."

Dr. S. S. Rathvon, a veteran entomologist, whose name, although not now frequently quoted, should long be held in grateful remembrance for the service that he rendered to entomological science in its earlier days, and who is still living at the advanced age of nearly eighty years, at Lancaster, Pa., although withdrawn from active labors through the heavy burden of serious bodily infirmities resting upon him*—has kindly given me in a recent communication some recollections of his first acquaintance with *Dynastes Tityus* in Pennsylvania, from which I extract :

"The Rhinoceros beetle," *Dynastes Tityus!* How far back my memory runs in connection with that gigantic subject of Coleopterous realms.

The first specimen I ever saw (a female) was in the possession of the late Judge Libhart of Marietta, Pa., in 1839, and was captured near Wrightsville, York county, Pa. Twenty years later, I received a male specimen that was captured in the same county opposite Marietta, which is about three miles above Wrightsville. In the meantime I had received a male and female from Kentucky, and a male from Virginia.

In 1859 or 1860 a large willow tree was blown down by a storm, at the village of Safe-Harbor, in the county of Lancaster. The trunk, inside, was much decayed, and in it were found about twenty specimens, and a number of larvae. I did not learn of this for a week or ten days thereafter, and was only able to secure a single pair, from a person in Lancaster city who obtained them on the spot. Perhaps half a dozen were secured and the others permitted to escape. I sub-

* Dr. Rathvon died at Lancaster, Pa., on March 19, 1891.

sequently came in possession of a female which had been captured near New Holland, about ten miles east of Lancaster. The largest specimen that I have ever seen from this state, was taken within our city limits in 1870. This one, a male, I kept alive in a wire cage for several days, but he eventually forced some of the wires apart and made his escape and was never recovered.

In 1873, in a wood about three miles northwest of Lancaster city, just where one tree had fallen across another—both much decayed—under the bark in the rotten wood, I secured three very large specimens of larvæ, which I believed to belong to *Dynastes*. Not being otherwise prepared, I put them in the outside pocket of a skeleton summer coat, filling it with the debris. When I reached home, two hours or more later, I found a hole cut through the pocket and the larvæ had escaped, nor were they to be found in the vehicle. As the skirt of the coat hung outside of the seat, they had doubtless fallen to the ground somewhere on the road. I feel pretty sure that they were not the larvæ of *Copris*, *Osmoderma*, or any species of *Lachnosterna*, nor yet *Passalus*. They were the largest Lamellicorn larvæ I had ever seen; too large, also, I think, for *Lucanus*.

Its Occurrence in New York.

In my previous notice of this insect, its occurrence in this state was inferred from Dr. Fitch having given it place in his *Third Report on the Insects of New York*, among the insects of the cherry tree. But upon referring to what he had written of it, this appears: "I have specimens of it from Pennsylvania, but know not of its ever having been found in New York."

For my first knowledge of its occurrence within our state, I am indebted to Mr. Berthold Fernow, who has informed me, that one evening in the latter part of July, 1889—the precise date was not noted—as he was sitting by an open window, at Kingston, a large female *Dynastes* flew in and alighted on his table. It was captured, and a few minutes thereafter, a male entered through the window, evidently drawn by the presence of the female, of which it may have been in pursuit.

There is no record of *Dynastes Tityus* being attracted to light and entering houses, but Mr. Lugger has mentioned as a singular habit of the beetle, that "the males had a fashion of flying into the chimneys of cabins. He had found remains of as many as fifty in a single deserted cabin." Where this occurred, was not stated.

Query : What can be the attraction of chimneys to the *Dynastes*? Possibly it is the same with that which sometimes, according to "Walsh and Riley," leads the larvæ of the Hellgrammite fly, *Corydalis cornutus* (the Dobson, of fisherman) to leave the water and the bank of the stream and wander some distance away that it may "crawl up the

wall and on the roof of a low one story frame building [clapboarded?] and then [after climbing the chimney] tumble accidentally [?] down the chimney, to the great dismay of the good woman of the house!" (*American Entomologist*, i, 1869, p. 62.)

Bruchus obsoletus Say.

The Bean-Weevil.

(Ord. COLEOPTERA: Fam. BRUCHIDÆ.)

SAY: Descriptions of North American Curculionides, July, 1831, p. 2 (orig. descrip.); the same, in Comp. Writ., Lec. Edit., 1883, i, p. 261; as *B. obiectus*, pp. 1 and 259 of same publications.

FITCH: in Trans. Soc. Encour. Domes. Ind., 1861, p. 62 (as *B. fabæ*).

RATHVON: in Amer. Entomol., ii, 1870, p. 118 (occur. in Penn., discus. of name, remedy).

RILEY: in Amer. Entomol., ii, 1870, p. 119 (compared with other sp.), p. 125 (ident. from West Farms, N. Y.), p. 182 (do. from Ill.), p. 307 (do. from N. J.), p. 374 (do. from Pa.); in Trans. Kans. St. Hort. Soc. for 1872, 1873, p. 110 (in Kansas).

ANGUS: in Amer. Entomol., ii, 1870, p. 125 (abundance in West Farms).

FULLER: in Amer. Entomol., ii, 1870, p. 302 (abundance in stored beans).

PACKARD: Inj. Ins. New and Little Known, 1870, pp. 19-21 (habits and descrip. of diff. stages, as *B. granaria*); 1st Rept. Ins. Mass., 1871, p. 22 (= *B. varicornis* Lec. MS.); in 9th Rept. U. S. Geolog.-Geograph. Surv. Terr., 1877, p. 767 (as *B. fabæ*); Guide Stud. Ins., 1878, pp. 484, 711, pl. 14, figs. 8, 8a (as *B. varicornis*); Entomol. for Beginners, 1888, p. 104 (mention as *B. obsoletus*), p. 207 (mention of *B. fabæ* Riley).

GLOVER: in Rept. Commis. Agricul. for 1870, 1871, p. 72; id. for 1871, 1872, p. 375 (brief mention, as *B. fabæ*).

RILEY: as *B. fabæ*: 3d Rept. Ins. Mo., 1871, pp. 52-56, f. 19 (distrib., habits, injuries, description, etc.); in Trans. Acad. Sci. St. Louis, iii, 1877, p. 220 (imported); in N. Y. Tribune, Feb. 20, 1878 (habits and distrib.); Ind.-Supp. Repts. Ins. Mo., 1881, pp. 67-71 (descrip. and comp. with "*B. obsoletus*" et al.); in Rural N. Yorker, Dec. 9, 1882, xli, p. 835 (habits and preventives).

HORN: in Trans. Amer. Ent. Soc., iv, 1873, p. 337 (description, and *B. fabæ* a synonym).

CROTCH: Check List Coleop. Amer., 1873, p. 93, No. 5498 (= *fabæ*).

LE BARON: 4th Ann. Rept. Ins. Ill., 1874, p. 129 (brief reference).

LECONTE-HORN-LEIDY: in Proc. Acad. Nat. Sci. Phil., 1876, p. 270; in Rept. Ent. Soc. Ont. for 1876, 1877, p. 22 (from various countries).

THOMAS: 6th Rept. Ins. Ill. [1877], p. 128 (brief description).

POPENOE: in Trans. Kans. Acad. Sci., v, 1877, p. 34 (local in Kansas); in Industrialist, Feb. 8, 1890 (injuries in K. and remedies); in 2d Ann. Rept. Kans. Agricul. Exper. St. for 1889, 1890, pp. 206-210, pl. 9, figs. 1, 2, 3, 4 (history, bibliography, operations, description).

- HARRINGTON: in 7th Rept. Ent. Soc. Ont. for 1880, 1881, p. 50, f. 33 (mention).
 DWIGHT: in Trans. Vass. Bros. Inst., i, 1881, pp. 80-87 (appearance at Poughkeepsie).
 LINTNER: in Count. Gent., xlvi, 1881, p. 7 (distribution and remedies, as *B. fabae*), p. 795 (general account, as *B. obsoletus*); id., xlviii, 1883, p. 317 (remedies, as *B. fabae*); 2d Rept. Ins. N. Y., 1885, p. 49 (distrib. and remedies); in New Eng. Homestead, Dec. 21, 1889, p. 425 (remedies); 6th Rept. Ins. N. Y. 1890, pp. 178, 185 (ref. to notices); in Count. Gent. iv., 1890, p. 898 (life-history, breeds in old beans, remedy).
 LAZENBY: in 1st Ann. Rept. O. Agricul. Exper. St., 1883, p. 80 (mention, as *B. fabae*).
 DIMMOCK: in Cassino's Stand. Nat. Hist., ii, 1884, p. 335 (brief reference).
 DORAN: Rept. Econom. Ent. Tennessee, 1886, pp. 204-206 (injuries in Tennessee, etc.).
 BETHUNE: in 17th Rept. Ent. Soc. Ont., 1887, p. 60, f. 36 (remedies).
 RILEY-HOWARD: in Insect Life, i, 1889, p. 316 (introduction in California).
 WEED: in 7th Ann. Rept. O. Agricul. Exper. St. for 1888, 1889, p. 163, f. 7 (heat for killing); in id., for 1889, 1890, p. lii (continuation of injuries).
 HAMILTON: in Trans. Amer. Ent. Soc., xvi, 1889, p. 150 (distribution, etc.); in Psyche, vi, 1891, p. 148 (on a synonym).
 FAUVEL: in Revue d'Entomologie, viii, 1889, p. 153 (gives synonymy as follows; *B. obtectus* Say, *obsoletus* Say, *fabae* Riley, *irresectus* Fahr., *pallidipes* Fahr., *subellipticus* Woll., *Breweri* Crotch.).
 JANSON: in Ormerod's Injur. Farm-Fruit Ins. So. Africa, 1889, pp. 22-28, f. 13 (in So. Africa, descrip. and remedies as *B. ? subarmatus*).
 COCKERELL: in Insect Life, ii, 1890, p. 332 (in Colorado).
 COOK: in Grange Visitor [Paw Paw, Mich.] for Oct. 1, 1890, p. 1, c. 4-5 (brief life-history).
 REITTER: in Cat. Coleop. Eur., Cauc., Armen. Ross., 1891, p. 332 (as *Mylabris irresecta* Fahr.).

A Comparatively Recent Insect Pest.

The bean-weevil, *Bruchus obsoletus* has been added to our list of insect pests within a comparatively recent time. No mention is made of it in the published writings of Dr. Harris or Dr. Fitch, although Dr. Harris deemed it desirable to devote four pages of his *Treatise on the Insects of New England* to its intimate associate (of later days) in the garden and field — *Bruchus pisorum* (Linn.).* In earlier years, like many of the insect pests of the agriculturist, it undoubtedly fed on some one or more of the many wild plants of the pulse or bean family. Its first recognition and description by Thomas Say, nearly sixty years ago, was from western specimens obtained by him from the seeds of an *Astralagus* — a genus of leguminous plants. For nearly thirty years following, it does not appear to have assumed any economic importance.

* *Curculio pisorum* Linnæus. *Amoen. Acad.*, tom. 3, 1756, p. 347.

Probably an Introduced Insect.

It has for a long time been accepted as a native species, but from its having been found in recent years, in importations from other countries, and also from some late synonymous references of it by European authors, as will be noticed hereafter, it seems quite probable that it has been introduced in the United States through commerce from the Old World, and possibly from Asia.

Known Under Two Names.

The differences separating some of the species of the *Bruchidae* are very slight as would naturally be expected in so large a family (about four hundred species are known), and all possessing the habit in common of feeding on, and undergoing their transformations within, the seeds of plants, mainly those of the *Leguminosæ*.*

To this close resemblance it is owing that the species under present consideration appears in our entomological literature under the two names of *Bruchus obsoletus* and *Bruchus fabæ*—Prof. Riley having found in some examples received from Pennsylvania, in 1870, features which seemed to him to warrant the designation of another species, and accordingly gave them minute description under the latter name. Dr. Horn, our conceded authority in the Coleoptera, not being able to recognize in them differences of specific value, has referred them to *B. obsoletus*. In a late Washington publication, edited by Dr. Riley,† we find the form referred to as *Bruchus obsoletus* var. *fabæ* Riley, and this will perhaps be accepted as a proper settlement of a disputed name.

Earliest Attack on Cultivated Beans.

The earliest notice of its operating upon cultivated beans, is that given by Dr. Fitch, in 1860, he having received a small parcel of infested beans from Providence, R. I. Next in order, Mr. James Angus, of West Farms, N. Y., writing in 1869, *loc. cit. sup.*, states that he had seen five or six years previous, a heap of beans lying on a barn floor, nearly all of which were infested with the beetle—one-half, at least, quite badly.‡ Some of the beans contained as many as fourteen of the larvæ or grubs.

Mr. S. S. Rathvon, of Lancaster, Pa., writing the same year (1869), reports the beetle as having been discovered infesting ripe seed beans in Lancaster, within the preceding five years.

* They infest the plants of this order in the tropics. Kirby and Spence state: "In tropical climates the seeds of almost every pod-bearing plant, as of the genera *Gleditsia*, *Theobroma*, *Mimosa*, *Robinia*, etc., are eaten by some species of *Bruchus*." See also, J. G. Jack, in "Weevils in Leguminous Tree-seeds," in *Garden and Forest*, iv, 1891, pp. 280, 281, fig. 49.

† *Insect Life*, v. ii, 1890, p. 332.

‡ *American Entomologist*, v. ii, 1869, p. 125.

Beans infested with weevil (presumably this species) were common in the supplies furnished to the army in South Carolina, in 1863, to the extent that the soldiers were in the habit of soaking them and afterwards laying them out to dry in order to allow the beetles to escape.*

Its Rapid Spread and its Distribution.

The rapidity with which the attack of this insect spread over the country, was somewhat remarkable. The ten years following its earliest notice seems to have carried it over a large part of the United States. When Prof. Riley wrote of it in 1870, it had already become quite common in the State of New York; had appeared in several of the New England States; it was known in New Jersey, and it was distributed throughout Pennsylvania; it must also have been carried with the army into several of the Southern States. Westward, it had obtained a firm footing in Illinois in 1865; in 1869, it made its first appearance in Missouri, in a locality near St. Louis; and in 1872, it was detected in Kansas. Subsequently, it has continued its westward progress, and in 1889 we have it reported from the Pacific Coast, California, where it is believed to have been introduced during the year 1887, in some "Golden wax" beans brought into the Carpenteria valley.† In the present year, it made its appearance in Colorado (Cockerel, *loc. cit.*).

It would be strange and unaccountable if it has not yet invaded Canada, but no notice of its presence there is known to me, and upon inquiry of Mr. Fletcher, Entomologist of the Experimental Farms, he informs me that he has no knowledge of its occurrence in the Dominion, nor has Mr. Saunders.

As the beetle is of sluggish habits, and not addicted to flight, it is believed that its distribution throughout the country is mainly by means of infested beans. This is the explanation of its being so often reported to us from various portions of the United States, as a new pest of the bean, never before known in that particular locality. Its distribution would doubtless be very materially limited if all dealers would carefully examine each purchase of beans made from other places, and at once subject infested stock to proper treatment.

Its Occurrence in Other Countries.

In a Report entitled "Report on Insects Introduced by Means of the International Exhibition," made by Dr. J. L. LeConte, Dr. Geo. H.

* Riley: in *Third Report on the Insects of Missouri*, 1871, p. 52, and Fitch MS.

† *Insect Life*, v. i, 1889. p. 316.

Horn, and Dr. Joseph Leidy, in behalf of the Committee appointed by the Academy of Natural Sciences of Philadelphia, Oct. 10th, 1876, "to investigate and report upon the introduction of new species of insects and plants through the medium of foreign exhibits at the Centennial Exhibition"—among twenty-eight species of insects mentioned (no less than eight are species of *Bruchus*—four undetermined), *Bruchus obsoletus* is named as found "in beans from various countries of both continents." As this bean-weevil had been generally accepted as a native species, it would have been of interest if the several countries in whose exhibits it was discovered had been specified, so that some intelligent opinion could have been formed as to whether it was native to any of those countries, or had, through commerce, been carried thither from our shores.

Dr. Hamilton (*loc. cit.*), in referring to this Report, says: "It was found in beans from various European countries in the Centennial Building at Philadelphia, but I have not observed the name on any European catalogue."

In Prof. Riley's Report on the "Centennial Insects," published in the *Transactions of the St. Louis Academy of Science*, the occurrence of *B. obsoletus* in beans from Jamaica, West Indies, is mentioned.

Just as this Report is about to be submitted for publication, happening to refer to the description by Mr. O. E. Janson, of the "South-African Bean-seed Beetle," which had been submitted to him by Miss Ormerod, and which he had identified, *with doubt*, as *B. subarmatus* Gyll. (see "Notes and Descriptions of a few Injurious Farm and Fruit Insects of South Africa," by Eleanor A. Ormerod, London, 1889, 116 pp.), I am struck with the close agreement of the description of the South African insect with that given by Dr. Horn, of *B. obsoletus*. In arranging the two in parallel columns every item in that of "*? subarmatus*" agrees exactly with the corresponding one of *obsoletus*, except in thoracic punctures, which in the former are given as *close* and in the latter *sparse*; also, the sizes assigned are 4 mm, as against 2.5 to 3.5 mm.

Examples of *obsoletus* will be sent to Miss Ormerod for comparison with "*? subarmatus*."

That the two will prove identical seems the more probable from the extended distribution assigned to *B. obsoletus* by M. A. Fauvel, in accordance with the synonymy of the species (*B. obtectus* given priority) recently given by him (in *loc. cit.*), and which has just been brought to my notice through Dr. Hamilton, viz.:

"Central and South America, Madeira, Canaries, Azores, Mediterra-

nean Basin, Persia, etc. Carried by commerce, it is probably cosmopolite." (See foot-note.)

General Features of the Beetle.

The bean-weevil, when found infesting, or in association with injured beans, may be recognized by the following features, many of which are in common with other members of the same family:

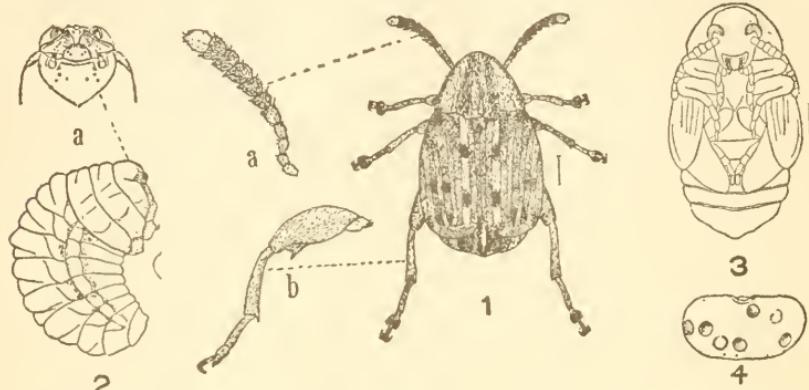


FIG. 16.—The bean-weevil, *BRUCHUS OBSOLETUS*: 1, the beetle; 1a, the antenna greatly enlarged; 1b, a hind leg enlarged to show the femoral teeth; 2, the larva; 2a, larval head enlarged to show mouth-parts; 3, the pupa; 4, a bean burrowed by the insect.

It is a hard-shelled beetle, one-tenth of an inch long, of an oval form, having its head bent downward and more or less concealed as seen from above, and prolonged in a short, squarely cut snout or beak. Its antennæ are distinctly jointed and enlarged at the tip; the first four joints and the terminal one are reddish or yellowish. The thorax and abdomen at their junction are about of equal width. The wing-covers (elytra) are marked by ten impressed and punctured lines in flattened ribs, which are clothed with a short pubescence arranged in yellowish, black, and whitish spots and lines—the white lines more distinct on the third rib or interval. The grayish tip of the abdomen extends nearly one-half the length of the wing-covers beyond them, and is faintly marked with a central whitish line. The legs are short, of a reddish color; the thighs (femora) of the hind pair are quite thick.

The above figures, for the use of which I am indebted to the courtesy of Professor Poponoe, of the Kansas State Agricultural College, should insure its recognition, and will also serve to illustrate its early stages.

NOTE.—The comparison of the two has since been made by Mr. Janson, and they are unhesitatingly pronounced identical.

In the light of our increasing knowledge of the distribution of this insect through commerce in the four quarters of the globe, there can hardly remain any reason for longer regarding it as native to the United States of America.

Compared with the much better known pea-weevil, shown in Fig. 17, *obsoletus* is not one-half so large, is more soberly colored, having less white on the wing-covers, and is without the white spot on the middle of the hinder part of the thorax and the two oval blackish spots which so conspicuously mark the exposed tip of the abdomen of *Bruchus pisorum*. In the latter the whitish hairs of the wing-covers form an oblique, interrupted, bent band behind the middle.

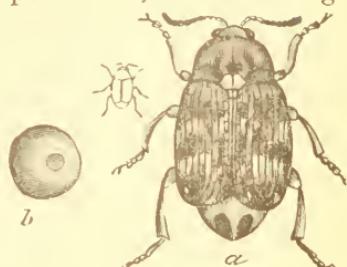


FIG. 17.—The pea-weevil, *BRUCHUS PISORUM*, natural size and enlarged; *b*, a pea containing the weevil.

Description of the Beetle.

Say's description (*loc. cit. sup.*) of *Bruchus obsoletus* may be consulted for more positive determination. It is as follows:

Body blackish cinereous with a slight tinge of brown; antennæ not deeply serrate; thorax much narrowed before, cinereous each side, a slight impressed dorsal line; base with the edge almost angulated, central lobe almost truncate; scutel quadrate, whitish, longitudinally divided by a dusky line; elytra with the interstitial lines having a slight appearance of alternating whitish and dusky; on the middle of the third interstitial line is a more abbreviated whitish line; posterior thighs with a black spine and two smaller ones.

Length over one-tenth of an inch.

The whitish or cinereous markings are not very striking; on the elytra they may sometimes be traced into two obsolete macular bands.

I obtained many specimens from the seeds of an *Astragalus* in August.

Prof. Riley has given in his *Third Report on the Insects of Missouri*, a detailed description of *B. fabae*, which may also be referred to. The features upon which he separates it from *B. obsoletus* of Say are these: We give them that by their aid, *B. fabae*, if it proves to be a permanent variety, may be identified from the comparison.

B. obsoletus is a smaller species, dark gray, with the antennæ all dark, the pygidium not rufous, the thorax with a perceptibly darker dorsal shade so that the sides appear more cinereous, a white scutel, and each interstitial line of the elytra with a slight appearance of alternating whitish and dusky along its whole length.

The *Bruchus fabae* of Prof. Riley.

Following the description of *B. fabae*, to which reference is made above, the description being too extended to give it place here, Prof. Riley has written as follows:

This insect has been for several years ticketed in some of the Eastern collections by the name of *B. fabae*, or else what is worse, the corruption of it, *fabi*. * * * * * The name was credited to

Fabricius, but I can find no notice in any of the works that I possess of any European *Bruchus fabæ*, and several of my eastern correspondents who have access to large libraries have been unable to find any description or allusion to a species by that name. Dr. LeConte has given it the MS. name of *varicornis*, but as his description will not appear perhaps for years to come and as no comprehensive description has yet been published, I have deemed it advisable to dispel in a measure the confusion that surrounds the nomenclature of this species. There is need of a description of so injurious a species, and as *fabæ* is not preoccupied, I adopt the name because it is entirely appropriate, and because it is more easily rendered into terse popular language than *varicornis*.

The *Bruchus fabæ* of Dr. Fitch.

The origin of the name "*B. fabæ*" attached to the insect "in Eastern collections," for which Professor Riley was unable to account, finds full explanation in the two following MS. notes, and a long-time overlooked published letter of Dr. Fitch. The notes are extracted from one of the many manuscript volumes left by Dr. Fitch, which subsequently came into the possession of Dr. A. E. Foote, of Philadelphia. Not long ago they were purchased by Mr. S. H. Scudder, and by him presented to the Boston Society of Natural History. The notes have kindly been transcribed for me for present use by Mr. Samuel Henshaw, of the Boston Society, from whom I also received some months ago a copy of the letter referred to in the first note, printed in slip form (10x28 cm.), several copies of which were found among the MSS.

In his notes on *Bruchus fabæ*, Dr. Fitch had written as follows :

In August, 1860, I received from W. R. Staples, Secretary of the R. I. Society for the Encouragement of Domestic Industry, a small parcel of beans infested by insects, the result of my examination of which I communicated to him in the following letter, which was published in the Transactions of the Society for that year, page 62, this volume having been issued in February, 1861. He stated in the accompanying communication that the stored beans in the city of Providence were quite generally preyed upon by this insect. I subsequently learned that it was common in and around the city of New York and other places along the seaboard. And from the complaints made by prisoners in the late civil war of the wormy beans furnished them for food and which were so loathsome to them, I infer this insect to be common through the southern states. Mr. Riley having received specimens from Massachusetts ticketed as being the *Bruchus Fabæ* of Fab., and finding no such name in the works of Fab., describes it as a new species under this name in his 3d Report, p. 52.

The letter above referred to, and printed in the Transactions cited, and as a separate slip, is the following :

THE BEAN-WEEVIL.

W. R. STAPLES, *Secretary of the Rhode Island Society for the Encouragement of Domestic Industry*:

DEAR SIR.—Whoever inspects beans infested with the insect which you send me, will at once infer that this depredator is closely akin to

the well-known Pea-bug, or Pea-weevil, as it might better be called—the *Bruchus Pisi* of Linnaeus—the beans being perforated with large round holes, similar to those in the pea, where the insect has escaped, or presenting a discolored spot, under which is a round cavity, in which the creature is still lying: the only important difference being, that as the bean is a much larger fruit, several holes, usually as many as six and sometimes twelve, are bored in it, instead of the single hole which we see in peas.

And on inspecting this insect, I find it to be a weevil so similar in its general appearance to that of the pea, that persons who have not made this class of animals a special study, would probably infer it to be the very same insect, somewhat modified in consequence of its being reared upon slightly different food. But on a close inspection, it will be found to differ essentially from that insect, in many points of its structure and colors.

From the examination I am at present able to make, I do not recognize this as a species that has been heretofore described. I infer it has but recently been noticed in your vicinity, and it would hence appear to have been introduced, probably, from some foreign country. It, however, is unlike the *Bruchus rufimanus* and *granarius*, common insects in Southern Europe, which prey upon beans in this same manner. In addition to these, I see a Brazilian species has been named *B. Phaseoli* by M. Chevrolat, a name implying it to subsist on the bean; but I have not the work of this author at hand. Upon a kind of wild bean growing in Indiana, Mr. Say met with a beetle which he names *B. obscurus*, which appears to approach nearer to this insect than does any other species to which I can refer.

Under the circumstances, the best service I can render, will be, to present a name for this insect, with such a description of it as will serve to plainly distinguish it, and thus open the way for future researches to determine whether it really is a species which has lurked unnoticed in the world until the present time.

I would therefore name it the Bean-weevil—*Bruchus Fabæ*. It is slightly smaller than our Pea-weevil, its length being from 13 to 15-100ths of an inch. It is of a black color, more or less densely coated over with tarnished yellowish gray pubescence, and is particularly distinguished from other species by having the four first and last joints of its antennæ, and all its legs, of a rusty or pale dull yellowish color, with only the under side of the hind thighs black. Along the middle of its thorax is a faint whitish stripe, which has an impressed line at its hind end. Its wing-covers have impressed lines or striæ, the interstices between which are alternately of a faint whitish color, this color being most clear and distinct along the middle of the third interstice between two faint blackish spots, which are placed on this interstice, a few other blackish spots being also perceptible here and there, outside of this. The abdomen or hind body is pale dull yellow, with a black band on the fore-part of each joint, and its flattened tip, beyond the ends of the wing-covers, is obscure grayish, with a faint whitish stripe along its middle. On the under side of the hind thighs, near their end, is a little projecting spine, like the point of a thorn, with a similar very minute one at its hind base, followed by a more minute, blunt-pointed one.

The habits and transformations of this insect will probably be found to vary but little from those of the Pea-weevil; and the same remedies doubtless will be as efficacious against the one as the other. It is generally known that the Pea-weevil rarely injures the embryo or germ of the future sprout, and that "buggy peas" may consequently be used for seed; though the plants from them will probably be puny and feeble during the first stages of their growth. This Bean-weevil is a more inveterate enemy, for in most instances I find the germ is devoured, rendering the beans as worthless for seed as they are for food.

Yours respectfully,

ASA FITCH.

Following the above, after a short note about "Southern Beans fed to Prisoners of War," Dr. Fitch wrote:

Specimens were sent from Rhode Island in 1862 to the Boston entomologist, Mr. Sanborn, probably ticketed as "Bruch. Fabæ Fh." The abbreviation was no doubt misread "Fb." And thus this has become in the collections a Fabrician species. Mr. Riley finding that Fabricius had described no species under this name gives it as a new species in his 3d Report, p. 55. What is here presented will clear this matter of the misapprehensions which have been so widely prevalent.

A comparison of the descriptions of Dr. Fitch and Professor Riley, will show, as is also claimed by Dr. Fitch, that the same insect was described by each. It is worthy of notice in this connection, that Dr. Fitch was unable to refer his Bruchus to the description of *B. obsoletus* of Say (its comparison with "*B. obscurus*" Say is obviously a clerical error), although it is now claimed by our best authorities that they are but one and the same species.

Injuries of the Weevil.

A field attack of this insect, if allowed to continue without effort to check its progress, ordinarily results, within a few years, in the worthlessness of the crop, or its entire destruction. The insect multiplies with great rapidity, for unlike the pea-weevil of which but one larva occupies a pea, a score or more of this may be developed within a single bean. It appears to feed upon all the varieties of beans, none, so far as known, being weevil-proof. Professor Popenoe, in writing the present year of its operations in Kansas, states: "It has proved very troublesome here [in Manhattan] during the season just closed, and an examination of our stock of beans of about eighty sorts [in the Agricultural College] shows a destruction of the product varying in amount, according to the sort, from 2 to 60 per cent, the Broad Windsor and the Lima being alone exempt from attack." From other published accounts from different localities, it

would appear that the Lima is nearly as liable to attack as other varieties.

In regard to the amount of injury to the individual bean, Professor Popenoe has written:

The full-grown larvæ are often literally crowded together in the bean. This crowding often results in the entire destruction of the seed except the outer skin, which remains unbroken, thus often totally misleading the observer who sees no external injury except a very few minute white scattered punctures where the insect first entered the bean [?]. In the Dutch case-knife bean the larvæ were abundant, a single seed containing by actual count in one instance, as many as twenty-eight, while in other varieties the actual number was only less because the beans were too small to contain so many.

A package of the small baking bean (Marrowfat), averaging a half-inch in length, received from Mr. H. H. Morrell, of New London, N. Y., and now in the State collection, the weevils from which emerged in my office on the 11th of January, show burrowing to the extent that nearly the entire interior was destroyed, and leaving within the rind only a packed mass of yellowish fecal matter. Many of them—perhaps most—show from twenty to twenty-five weevil cells.

In further illustration of the possible multiplication of the insect when it has been left unmolested, the instance may be cited where, from two quarts of beans which had been hung up for seed, over a teacupful of beetles, as reported, were taken when they were opened for planting in the early part of June.

Infested Beans Should not be Planted.

It is hardly necessary to remark that beans containing the living insects should not be planted, as they would quite as readily give out the beetle as if left above ground; and, moreover, the beetle would thus be given every needed facility for reaching the plants as soon as they are in readiness for the reception of the eggs. Nor should weevil-eaten beans be used for seed; they can not produce healthful plants. This fact has been overlooked by a number of writers upon the bean-weevil, who have thought it sufficient to urge that care should be taken that all the beetles have left the seed, or been killed within it, before planting. It was for a long time believed that the presence of the pea-weevil in the seed rarely interfered with its germination. Thus Latrèille had written of it many years ago : "If the summer has been hot, the beetles are disclosed the following autumn, and the seeds will grow notwithstanding their inhabitants, which spare, owing to a wonderful instinct, the vital germ of the pea." Professor Westwood entertained nearly the same belief, for he also represents the larva as having "the curious instinct to leave the most vital parts of

the seed until the last" (*Introduc. Class. Ins.*, i, 1839, p. 330). Dr. Fitch had stated (see page 264): "It is generally known that the pea-weevil rarely injures the embryo or germ of the future sprout, and that 'buggy peas' may consequently be used for seed." But even if the germination was not seriously affected, the subsequent growth of the plant is an equally important (and until lately overlooked) consideration.

Experiments in Germination of Weevil-eaten Seed.

Professor Goff, formerly of the N. Y. State Agricultural Experiment Station at Geneva, has made valuable experiments in this direction, of which he has written:—"Our experiments showed that although peas that have been inhabited by the weevil will frequently germinate, they rarely make strong and productive plants. In one lot of fifteen seeds only two vegetated, and *but one made a vigorous plant*. In an experiment in germination with a larger number, 57.2 per cent of 'buggy' peas germinated."

A still more disastrous result from insect injury is reported by Professor Beal in the *Country Gentleman* for August 14, 1879, xliv, p. 519. Of 500 weevil-eaten peas planted, only 26 per cent (130) germinated, while of the same number of apparently sound peas, only four failed to germinate.

The pea containing but a single weevil, and the bean several—the number, at times, being only limited by its capacity—it would naturally be expected that the operations of the bean-weevil in interfering with germination and subsequent growth would be the more disastrous of the two. This, in part (so far as germination alone is considered), is clearly shown by recent observations reported by Professor Popenoe, as having been made in 1889, at the Kansas State Agricultural Experiment Station, as follows:

A large number of infested beans of different varieties were carefully examined, and the proportion of cases noted where the vital part of the seed had suffered material injury. This examination showed many cases where the plumule was entirely cut through at different points, and others again where the radicle was partially or totally eaten up, and the cotyledons eaten from their attachments. In the greater number of such cases, the injury was sufficient to preclude healthy germination.

Experiments Contradict Former Belief.

The statement—apparently quite at variance with the above observations—made by Professor Riley in his third *Report on the Insects of Missouri*, in 1871, that he had "always found the germ either untouched

* *First Annual Report of the New York State Agricultural Experiment Station*, 1883, p. 142

or but partially devoured even in the worst infested beans," may require this explanation: at the time of writing, the bean-weevil had only been known in Missouri for a year or two, and had not as yet become abundant. If Curtis, in his "Farm Insects," in commenting on Latrèille's remark that by a wonderful instinct of the weevil "the vital germ of the pea is spared," was correct in stating, "this is the case with the beans also," and again on page 361 *loc. cit.*, "as the beetles [*Bruchus granarius*] generally leave the germ uninjured, the vitality of the infested seeds is not destroyed"—then certainly the bean-weevils of Europe must be less injurious in their feeding operations than is our species. Dr. Fitch—always accepted as a careful observer—has distinctly stated (as already quoted), "in most instances I find the germ is devoured." My own examinations of infested beans are in accord with this, for in no case have I found a bean of the ordinary size used for baking, which has nurtured more than five larvae, in which the germ has remained intact.

Experiment in Testing Vitality and Productiveness.

But beyond the question of germination, there is still another quite as important—the vitality and productiveness of the plant after its stalk and leaf development. Where a full crop is desired, and when is it not, beans *even but slightly injured should not be used for seed*. This is proven beyond all question by the careful experiments made and reported by an eminent English entomologist, Mr. Theodore Wood.

For the purpose of ascertaining the precise degree of injury caused by *Bruchus rufimanus* in beans, twenty were selected from a large lot of infested material, three of which had been perforated by three weevils each, five by two, and twelve by one only. They were sown under the most favorable conditions for insuring uniformity in growth and general welfare.

The young plants showed strong and vigorous growth, and were apparently none the worse for the injury that the seed had received. But when the time for fruiting came, a great change was evident. The blossoms were few and small; the foliage faded and withered; and several of the plants died without producing a single pod. Mr. Wood further states:

Of the first three plants, raised from seed pierced by *three* weevils, one was altogether barren, while the remaining two bore but three pods between them, none of which arrived at perfection. The next five grown from seed tenanted by *two* beetles only, were slightly more fruitful, bearing in all six pods, of which five reached their full growth; two of these five plants, however, were barren. Upon the remaining twelve, the seed of which had but one perforation, I

counted twenty-three pods, not more than ten of which arrived at maturity. Only one plant of this latter was entirely unfruitful. It will thus be seen that the twenty plants bore among them but thirty-two pods in all, of which less than one-half came to perfection. The bean in question, I should mention, was not one of the most freely-bearing varieties, six pods being the average yield of each plant. (*Entomologist's Monthly Magazine*, xxii, 1885, p. 114.)

A comparison of the above yield with that sown at the same time from uninjured beans, warranted Mr. Wood in claiming, as "proved beyond all question, that the presence of the beetle [to the extent above stated] is highly prejudicial, not to the germinating qualities of the seed, which appear to be uninjured, but to the reproductive capabilities of the adult plant."

That Mr. Wood might with propriety have been even more emphatic in his conclusions, will appear when the result of his experiment is presented in the following form : Beans averaging only one and one-half weevil perforations, produced less than 27 per cent of the average number of pods, and not exceeding 13 per cent of an average matured crop.

It should be stated, however, that a somewhat greater injury might be expected to accrue from presence of *B. rufimanus* than from that of *B. obsoletus*—ours being about one-fourth less in size, or in the proportion of 0.12 inch average length to 0.15 inch in the European species.

Infested Beans Unfit for Food.

While beans that had been infested with the weevil would not be given place on the table, their value for feeding to stock would not be materially impaired ; but so long as they contain the beetle, and it is not always very easy to determine this condition without opening them for examination, it might be hazardous, to say the least, to feed them to our domestic animals.

Curtis relates :* "An alarm was spread in some parts of France, in 1780, that people had been poisoned by eating worm-eaten pease, and they were forbidden by authority to be exposed in the market." The pease were given scientific examination, and the insect found to be the pea-weevil *Bruchus pisorum*.

A small lot of beans was submitted to Dr. Curtis, in 1845, for examination, by the Secretary of the Royal Polytechnic Institute, which had been sent from Sicily by a cabriolet proprietor whose horses had become much deranged in their health by feeding on them. Less than one-half of the beans were found to contain from one to four Bruchids, to which the name of *Bruchus flavimanus* was given by Schönher.

* *Farm Insects*, 1860, p. 362.

Epitome of Life-History of the Bean-weevil.

I do not know that the eggs of the beetle have been observed on the growing plant, but its oviposition is presumably similar to that of the pea-weevil, as stated by Dr. Harris:

After the pea-vines have flowered, and while the pods are young and tender, and the peas within them are just beginning to swell, the beetles gather upon them and deposit their tiny eggs singly in the punctures or wounds which they make on the surface of the pods.

Professor Riley's account varies somewhat from the above in the matter of placing the egg, in that "the beetles deposit their eggs on any part whatever of the surface without attempting to insert the egg within the pod." He describes the eggs, which "are fastened to the pod by some viscid fluid which dries white and glistens like silk."

The egg of the bean-weevil hatches in from eight to ten days, and the larva, penetrating the pod, enters the young and growing bean. When, as is usual, several occur in a single bean, each one occupies a distinct cavity where it feeds and attains its growth. When in readiness for pupation it shapes for itself a broadly oval cell with firmly compacted white walls, within which it transforms to a pupa and finally into the beetle. The larva, under normal conditions, reaches maturity in the late summer, and pupates in the autumn. The length of time ordinarily passed in its pupal stage is unknown, if we may judge from the absence of record of it.

As in most cases, the circular covering of the cell (the lid) has been eaten away upon its inner surface, its faint translucency in colorless beans indicates to careful inspection the presence of the insect within; this is more conspicuous when the maturity of the beetle permits its darker colors to be indistinctly seen. The emergence is by pushing off the circular cap. The time when this takes place is irregular. It may be in the late autumn, at any time during the winter months in a warmed apartment, or not until the spring when not exposed to artificial warmth. For some reason the perfect beetle frequently remains within its cell for months before it comes abroad, and is often found dead, without apparent cause, within the bean. I have at times found the beetle head downward in an open cell, as if it had crept within it for the purpose of feeding.

A Brood of Dwarfed Bean-weevils.

Examples of this beetle were received March 11th, for name, with the statement that they were present in countless numbers in a dwelling-house in Waterbury, Conn., occurring most abundantly in the kitchen. The gentleman was surprised at the appearance of such a display of insect life during the winter, and was inclined to ascribe

its source to the fuel which was being used for the kitchen fires, which consisted largely of the timber from a livery stable that had been torn down during the preceding summer.

In answer, the name was given and the assurance that they could not have had their origin in the source supposed, as that would be incompatible with their well-known habits, but that in all probability, if search was made, some overlooked bag or package of beans would be found from which they had escaped. A few days later, a letter was received, announcing that a paper bag of beans had been brought to light still swarming with the beetles and perforated with innumerable holes through which they had escaped.

The specimens of which there were many, were uniformly at least one-half smaller in size than the examples that had previously come under my observation—the difference being so marked that I was unwilling to trust my identification of the species until it was confirmed by Dr. Horn. In all probability the larvae had been dwarfed in size from an insufficient food-supply, from the oviposition having been unusually abundant, or possibly, from a second brood having been produced from the same lot of beans. The "countless numbers" in which the beetles appeared would seem to lend color to the latter supposition, although I could find no record of such an occurrence, nor had I previously deemed it possible, believing that ripened and dried beans could not serve as food for the tender larvae. I was not able to learn how long the bag of beans had been kept in the house.

Are There Successive Broods Within Stored Beans?

Addressing an inquiry to Mr. E. A. Schwarz, of the Entomological Division of the Agricultural Department at Washington, who is perhaps our best authority on the early stages of the Coleoptera, if he had any knowledge, either personal or from record, of the bean-weevil undergoing all its changes within ripened and stored beans—with his usual kindness, the following reply was sent:

Although I can not refer you offhand to any special publication, I am positive that there have been observations published showing that *Bruchus obsoletus* is able to breed for at least two consecutive generations in the same lot of beans, so that the second generation oviposits on, and the larvae develop within, the dry beans. In the Cow-pea Bruchus (*B. scutellaris*) this fact is well known and the beetle seems to be able to live for an indefinite number of generations in the same lot of beans. I also know that the Gleditchia Bruchus (*Spermophagus robiniae*) has been bred in at least two consecutive generations from the same lot of seeds.

Professor Popenoe has recently expressed his belief that he has found evidence that the beetles continue to breed and develop in

dried beans, in that some early matured varieties that had been placed in bottles with loose corks early in September, when again examined in January, 1890, were found to contain "larvæ of all sizes, pupæ, and adult weevils, as well as the empty cells whence adults had escaped earlier."*

The Fact of Successive Broods Established.

The question raised as above, of the ability of the bean-weevil to produce, not only a second generation from the beans in which the first was developed, but also successive broods limited only by the food-supply, has been satisfactorily determined in the affirmative from observations made by me during the past summer.

Oviposition.—A number of the beetles were sent to me September 4th by Dr. H. C. Coon, of Alfred University, Alfred Centre, N. Y., for name, etc. When received they were alive and active, and had deposited a number of eggs upon the side of the phial in which they were inclosed. The following day, for better observation, the beetles were removed to a jar, and furnished with some sound and uninjured beans. It was thought that they might perhaps eat into them for oviposition, but no attempt of the kind was made. Examining them with a magnifier on the 10th of September, quite a number of eggs were found on their surface, sometimes placed singly, but oftener in clusters of three, four, or five. They were white, smooth, narrower at one end (the lower, when attached at an angle), and with a length nearly three times that of their greatest breadth (as 10 to 29 on a scale). Larvæ from them were observed on the 17th, traveling incessantly over the smooth surface of the beans.

The egg-laying was continued — upon the beans only — for a few days longer, and by the 23d the last of the beetles had died.

The larvæ entering the bean.—The larvæ were carefully watched with a strong glass, but no effort seemed to be made by them to burrow into the bean. The earliest hatched by degrees became more quiet, then ceasing their travel and dying — their bodies adhering to the surface and assuming a pale yellow hue. As an experiment, the rind of the upper surface of two beans was pierced in several places (six in the one and ten in the other) by revolving upon it the fine point of a knife-blade. The punctures were very soon discovered by the larvæ, and they at once commenced to burrow into them. By the following day each puncture had been appropriated by a larva which was actively engaged in boring its way slowly into the hard substance — about a day being required to remove itself entirely from sight. The

* In *Second Ann. Report of the Kansas State Agricultural Experiment Station* for 1889-1890, pp. 208-9.

material excavated was thrown out in a powdery, adherent, irregular mass, presenting a flocculent appearance. Two smaller punctures made with the point of a needle, were also entered by larvæ.

At about the same time, two larvæ were observed entering the bean where no puncture had been made to aid them.

It is possible that they may have been guided and aided by some minute opening, but no fracture or other injury adjacent was discoverable even under a high magnifying power. With the locality known, the points where they had entered could be barely detected with a glass.

The egg-shells which remain in place are transparent, and entire with the exception of being irregularly broken at the larger end from which the larva escaped.

The third or fourth brood of the insect.—It was subsequently learned from Dr. Coon that the beans had been in his house for two or three years: from this fact, it is evident that the beetles received were at least the third or fourth brood* that had been produced therefrom. It is probable that but a small portion of the year is required for a generation when the larvæ are permitted to feed and develop within doors during the winter months, and this would explain why the beetle is frequently sent to us for name at other seasons than at the time of its normal appearance.

Oviposition on infested seed.—From the readiness with which the beetles oviposited, as above narrated, the inference may be drawn that it is their habit when confined with the beans, to mate and at once proceed to lay their eggs. Even if the eggs should not be placed within the holes from which the beetles had emerged, the young would enter them and find no difficulty in penetrating from thence into the solid interior.

Transformation to the final stage.—Much to my surprise, not long after writing the above (which is allowed to stand as written, although perhaps needing modifications in a few particulars), the completion of the life-cycle, the early stages of which are above noted, was observed by me in season for embodying in the present report.

Happening to look at the beans early in November, indications were apparent of the recently microscopic larvæ having been transformed into the mature insect. The lids of numerous cells were defined and their rims cut in readiness for removal. Raising one of them, on November 6th, a fully matured beetle was drawn from beneath it. Eggs deposited between September 5th and 10th, had given the

* See remarks beyond on the possible number of broods.

perfect insect *two months thereafter*. Two or three days later the beetles began to emerge. One of the beans was then dissected, giving the following as its contents:

No larvæ; three pupæ, entirely white except the dusky crescent of the eye; one pupa or beetle* (?semi-pupa), with dusky eyes and faint gray color to the wings which lie on the ventral surface; one imago with brown beak, antennæ and crumpled wings blackish, elytra yellowish and carried over to the side, darker basally, and showing characteristic markings; one imago with the elytra on the back, the wings fully extended from beneath them, thorax and legs yellowish-brown; four imagoes of nearly normal colors above, wings still extended, segments of abdomen beneath dark brown anteriorly and pale over the incisures; one imago, with wings folded beneath the elytra, and perfect in every respect and creeping out of its cell when opened—in all, eleven individuals, which have been preserved in alcohol.

Fifty-four beetles have emerged up to the time of present writing (November 28th) from the eleven beans inclosed in the box where oviposition took place. One of the beans was intact; the others gave respectively 1, 3, 5, 8, 10, 13, and 14 beetles. A few of the cells still contain the insect.

To conclude the history of this brood: Eggs were observed from them on November 20th, and at the present time they are freely ovipositing.† The successive broods, of which this may be the tenth, allowing two and a half months for a brood, would doubtless all have occurred within the beans where they originated, had they been retained there and their food-supply continuing sufficient for them.

As showing the extent to which the insect may be dwarfed through insufficient food-supply, it may be stated, that from the most largely infested bean (fourteen beetles emerged and five still inclosed) and from a portion where the cells were more closely clustered, a beetle was withdrawn of only about one-third the average size; the lid covering it was almost in miniature.

How the larva enters the bean.—As may be seen from what has been written, the larva, as it leaves the egg, is able to burrow through the

* From my lack of knowledge of the transformations of the *Bruchidae* (which may possibly be peculiar) I know of no other indication of the final stage than the appearance of the wings from beneath the elytra. This occurs while the elytra lie upon the ventral surface, whence, with deepening coloration, they are by degrees carried over to the sides and upon the back.

† The brood from this oviposition commenced appearing early in February, 1891, and the 14th of the month some of the eggs were placed in a small bottle with beans. From these eggs beetles were obtained on May 2d, 1891. These again ovipositing in a large jar of beans, the jar was found to be swarming with beetles on July 3d, some of which must have been out for several days.

testa (shell) of the ripened and dried bean without the need of a fracture, or puncture such as was made for it in the present instance. But that this may be done—if we may judge from the number of dead larvæ observed, and on the supposition that they were from eggs deposited upon the sides of the box—it is highly probable that the aid given the larva by the walls of the egg-shell while still within it, in concentrating, guiding, and sustaining its muscular efforts, or that afforded by some surface in contact, as of an adjoining bean or the inclosing bag or jar, is essential to its effecting an entrance. That the punctures made in two of the beans, as previously stated, were utilized by the traveling larvæ, appears from the fact that they contained the largest number of beetles, viz., eighteen and nineteen, as against an average of five in the others.

The lid, cut by the beetle for its release.—The exit of the Bruchus through a circular or oval neatly-cut lid, evincing so much design in its construction, has been stated by numerous writers. Over a century ago the distinguished French entomologist, Olivier, had represented the larva as cutting a channel to the outer covering of the seed, and leaving it so thin that the slightest effort suffices to open it. Dr. Harris repeats the statement. Dr. Packard, more recently, has written: "The insect escapes through a thin orbicular almost transparent lid, previously gnawn by the larva, which falls when the beetle emerges."

That the lid is made by the larva seems to have been accepted by all who have written of it. It is, however, not formed at this stage of the insect's life, but later, by the beetle. The larva, guided by instinct, carries its burrow outwardly quite to, and partly within, the shell, where a semi-transparent irregular spot in which the burrow terminates locates the proper place for the pupal cell. Here the cell is made and pupation follows. When the final transformation has taken place the beetle commences to feed at the ruptured end of its cell, and eats into the shell—not at the semi-transparent spot above-mentioned, but removed a little way therefrom, perhaps slightly more than the cell's length.

The first indication of the construction of the lid is a small translucent crescent, rather sharply defined on its convex side. The crescent continues to grow in size and to extend the measure of its limb and the translucent portion within, paralleling the increase of the growing moon, until, like that, it becomes full-orbed. The few adhering grains of the body of the shell are next dissected away, and finally, when the time for emergence has nearly come, a cutting is made into the lid around its entire circumference, leaving it attached by hardly more than a film. This, of course, is done by the man-

dibles of the beetle, and the cutting is after this manner: an incision being first made, its extension is continued as the beetle slowly rotates for the purpose within its cell—one revolution completing it—its outline being defined by the position of the beak.

¶ Two or three dark-colored excremental rods may be left within the cell (together with the cast and flattened mass of exuvia), as the result of the feeding that has taken place therein.

Remedies.

¶ After this perhaps too extended discussion of a minute insect, if aught relating to the history and habits of any of our insect pests can be in excess, it yet remains to consider the remedies available against the bean-weevil.

It follows from what has been written, that one of the popular remedies oftentimes presented for its control, viz., keeping over the beans until a second year, by which time the beetles will have emerged and died, leaving the seed safe for planting, must henceforth be discarded, as of no value whatever.

As yet we know of no preventive of the deposit of the eggs upon the young plant. If the season for oviposition of the parent beetle were quite limited, which unfortunately it is not, the entrance of the newly hatched larva into the pod might perhaps be prevented by the same means used for the destruction of the young caterpillar of the codling-moth—giving it, by spraying, an arseniated surface through which to penetrate.

The best remedies are undoubtedly to be found in the destruction of the insect, as soon as may be, after the ingathering of the crop. This may be accomplished in a number of ways, among which are these:

Heat.—The beans may be thrown into hot water for nearly a minute. It is stated, but we do not know if as the result of careful experiment, that they will bear immersion in water at the boiling point for one minute without injury to the germ. We would prefer recommending hot water below the boiling point for about a half-minute. Examination would show if this was sufficient. If not, testing the germination of small lots would indicate if a higher temperature or longer exposure were safe. Will not some of our experiment stations make careful tests of the different varieties, the more and less hardy, and report authoritatively.

Mr. Weed, of the Ohio Agricultural Experiment Station, reports that exposure to a temperature of 145° Fahr. continued for one hour, killed the grubs of the pea-weevil contained in newly-ripened pease,

about the middle of July, at which time the insect was but about half-grown. In the experiment a gasoline stove-oven, heated by a kerosene lamp placed underneath, was used. It is thought that the same means would be effective with infested newly ripened beans, but probably a somewhat higher temperature would be required. (*Seventh Rept. O. Agr. Exp. St., loc. cit.*)

Kerosene.—A communication to the *Country Gentleman*, of April 5, 1883 (page 277), from a lady in Virginia, states, that in a fit of desperation over a bag of badly infested beans kept for seed, she poured kerosene over them until they were saturated, and laid them aside in the seed drawer for further developments. When they were examined in the spring, a quantity of dead beetles were in the bag which had doubtless been killed by the kerosene, and all of those that remained within the beans were also dead. A test of the beans for germination showed in their vigorous growth that they had not been injured by the application. The writer concludes with: "I shall never plant beans again from any source without first applying coal oil, and if all our neighbors will do the same, we may entirely drive the weevil out of the country." This remedy could not be recommended where beans are kept for food.

Bisulphide of Carbon.—Exposure to the vapor of this volatile liquid, is an infallible means of killing our bean and pea weevils. The infested beans may be put in some tight vessel, box, or bin, with a cup containing bisulphide of carbon upon them, covering up closely, and leaving them for a day or two. The heavy vapor (about two and one-half times heavier than common air) given off will descend and kill all the animal life present, without injury to the germ, or impairment for use as food after suitable exposure to the air. This valuable insecticide—available against a large number of our insect enemies—may be purchased at drug-stores, at the moderate price, by the pound, of about thirty cents. A small quantity of it will suffice. It has been found, in experiments on a large scale made in India for killing the weevils that there infest stored grain quite seriously, that one pound and a half is amply sufficient for use in a ton of grain, provided that the grain is inclosed in tight vessels. As the vapor is quite inflammable, precaution should always be taken not to bring a light in contact with it.

The sooner that the remedy is applied to the infested beans after their ripening and gathering, the greater will be their value for food. As at that early time, the presence of the insect within is not so readily detected, it would be wise, if in all localities where it has obtained a foothold, that examination be made before storing, either

by careful inspection of the surface, or, what would be preferable, opening a number and examining their interior.

It is evident, in the light that we now have, that this pest may not be exterminated from a locality by the refraining, by common consent, for a year or two, from the culture of the bean, as we have previously recommended, for the insect may be safely "tided over" during that time by continued generation within the stored crops, or in the house-wife's bag of beans carefully laid aside and protected in some bye and forgotten drawer.

The Tracy house.—Perhaps in no way could as much be accomplished toward arresting the spread of this insect, as in the use, by all extensive bean-growers, of the "Tracy house," or "bug-house," which, according to Professor A. J. Cook, was largely used by the pea-growers of northern New York for the arrest of the ravages of the pea-weevil, when not long ago the pea interest was threatened with destruction. Professor Cook has given the following description of the house and the manner in which the bisulphide of carbon is used in it:*

"The house is made air-tight; even the door is made very close-fitting; and is made still closer by pasting paper over the edges upon closing it, after filling the house with sacks of peas. An air-tight flue at one end opens at the very top into the building, and at the bottom out of doors. A sort of shoot with an adjustable air-tight valve is arranged for the turning in of the liquid. The liquid is turned in till the odor shows that the vapor is pouring out at the bottom of the flue. Then, of course, the air has all been forced out by the vapor, when the valve is closed. It is left closed for three days; then the doors are opened that the vapor may escape, when all the weevils will be dead."

What Should be the Insect's Name?

During the preparation of this paper, I have been led to question the propriety of retaining for it, Say's name. There is certainly reason for doubting its being the species which he has briefly and insufficiently described as having been bred by him from the seeds of *Astragalus* in Indiana. I offer the following considerations:

1. For many years after its discovery at Providence, R. I., it was only observed along, or not far from, the Atlantic seaboard—quite remote from "Indiana" and "Louisiana."† Its westward distribution seems to have been quite gradual, in later years.

2. No one has since bred the Bruchus from *Astragalus*. As a rule, the *Bruchidae* confine themselves to a single food-plant. Dr. Horn, in

* Bulletin No. 58, Michigan Agricultural Experiment Station, St. Agricul. Coll., April 1890. Insecticides. (Bisulphide of Carbon, pp. 8-12.)

† Say gives Louisiana as the habitat of *B. obtectus*.

his Monograph of the Bruchidæ of the United States, has stated: "each species appears to prefer a special plant, or at most, restricts its attacks to the species of one genus." In Dr. Gray's arrangement of the Leguminosæ, *Phaseolus* is separated from *Astralagus* by *Wistaria* and other genera. Is it not probable that whenever the *Astralagus* *Bruchus* shall again be bred, that it will show itself to be quite distinct from the "obsoletus" of Dr. Horn?

3. Say's description is so indefinite and general, that our bean-weevil can not be positively referred to it. The type, unfortunately, is not in existence, and therefore the insect that Say had before him can only be reached through conjecture and probabilities. Dr. Horn, while he expresses his confidence of his interpretation of the species, can only claim that Say's description "fits the bean-weevil fairly well."

4. Dr. Fitch had no thought of the Rhode Island beetles being the *obsoletus* of Say: it appeared to approach nearer to it than did any other species to which he could refer. Dr. LeConte was equally unable to identify it with *obsoletus* Say, and had therefore described and named it in MS. as *Bruchus varicornis*. Dr. Riley also felt assured of its being an undescribed species, and therefore designated it, with careful description, as *B. fabæ*, indicating several important features in which it differed from *B. obsoletus*. Subsequent study has not led him to change his views.

5. If it was deemed necessary to fit Bruchids into Say's names, why was it not thought proper first to supply the hiatus of "obtectus," which precedes that of "obsoletus" in description, and is regarded as identical with it by Dr. Horn? In this we have the peculiarly colored antennæ of the bean-weevil described (so marked a character that Dr. LeConte selected it as a specific designation), the omission of reference to which is strikingly apparent in "obsoletus," and a strong argument against our present employment of the name.

It would better accord with custom and the rules of nomenclature if, instead of clinging pertinaciously to Say's name, in the belief that we know the insect to which it was applied, that it be rejected on the ground of its having been accompanied with merely a definition—without description such as leaves no room for reasonable doubt. Such rejection has been repeatedly made, as notably with scores of Walker's "species." In that event—as the description of Dr. Fitch unmistakably indicates our bean-weevil, and as it has priority of, and fully accords with, the "varicornis" of LeConte, the *fabæ* of Riley, and the *obsoletus* of Horn—"obsoletus Say" would give place to *fabæ* Fitch.

I have retained (under protest) the name of *Bruchus obsoletus* in this paper for present convenience, and not desiring to be the first to depart from the nomenclature presented in Dr. Horn's *Monograph of*

the *Bruchidæ*—a work which we have gladly accepted as a standard for our species.

NOTE.*—It is not improbable that the question above discussed of the respective claims of the two names for recognition and acceptance may ere long be set at rest through supersedence of one or both by some earlier name. Recent studies in Europe have brought to light several other names and descriptions (see in the bibliographical list given herewith), of which Reitter in his *Catalogus Coleopterorum Europeæ, Caucasi et Armeniæ Rossicæ*, 1891,† claims priority for *irresectus* Fahraeus. It seems that *irresectus* was first named and described by Fahraeus in Schoenherr's *Genera et species Curculionidum*, vol. v, 1839, page 18, (Habitat in Asia). If its identity, claimed by Reitter, with our "obsoletus" shall be hereafter satisfactorily established, the name would at least have priority over *fabeæ* Fitch, and perhaps obtain acceptance, if "obsoletus" is abandoned, or transferred to the *Astralagus* weevil, when found.

Bruchus rufimanus (Bohemian).

The European Bean Bruchus.

(Ord. COLEOPTERA: Fam. BRUCHIDÆ.)

Bruchus rufimanus BOHEMAN: in Schoenherr's *Gen. et Spec. Cureul.*, i, 1833, p. 58.

Bruchus granarius Linn. WESTWOOD: in *Mag. Nat. Hist.*, for 1834, p. 257; *Introdue. Class. Ins.*, i, 1839, p. 330, f. 40. 1-6 of p. 324.

Bruchus rufimanus. STEPHENS: *Manual Brit. Coleop.*, 1839, p. 265.

Bruchus granarius. HAGEN: in *Landwirth. Jahrb. aus Ostpreus.*, xi, 1859, pp. 161-162.

Bruchus granarius Linn. CURTIS: *Farm Insects*, 1860, p. 358, f. 53, 5-10 (description, habits, etc.).

Bruchus granarius Linn. RILEY: in *Amer. Entomol.*, ii, 1870, p. 126-7, f. 85 a, e, f (identified from Switzerland); 3d Rept. Ins. Mo., 1871, pp. 50-52, f. 18 (description and habits from Curtis), p. 56 (erroneous reference).

Bruchus rufimanus. RATHVON: in *Amer. Entomol.*, ii, 1870, p. 119 (quotes description from Stephens' Manual).

Bruchus rufimanus. WOOD: *Insects at Home*, 1872, also 1887, p. 162, pl. xvi, f. 4.

Bruchus granarius Linn. LE BARON: 4th Rept. Ins. Ill., 1874, p. 129 (imported in U. S.).

Bruchus granarius Linn. THOMAS: 6th Rept. Ins. Ill. [1877], p. 129 (characters and brief notice as imported from Europe).

Bruchus granarius Linn. ORMEROD: *Manual Inj. Ins.* [1881], pp. 8-11, f. 1-8; 9th Rept. Inj. Ins., 1886, pp. 6-8, figs. 1-8 (history, injury, remedies).

* This note is appended, November, 1891.

† See notice by Dr. John Hamilton in *Psyche*, vi, 1891, p. 147.

- Bruchus granarius* and *B. rufimanus*. DIMMOCK: in Cassino's Stand. Nat. Hist., 1884, ii, pp. 334, 335, fig. 375, b, c (mention).
- Bruchus granarius* Linn. WHITEHEAD: Rept. Ins. Inj. Gr. Britain, 1885, pp. 57-58, f. xvii, 1, 2 (brief notice).
- Bruchus rufimanus* Boh. WOOD: in Entomol. Month. Mag., xxii, 1885, p. 114; in Trans. Ent. Soc. Lond., Oct., 1886, Part III, pp. 375-380 (productiveness of infested beans).
- Mylabris rufimana* Bohm. BAUDI: in Deuts. Entomologische Zeits., Heft ii, 1886, p. 404, no. 20 (description and distribution).
- Bruchus granarius* L. FLETCHER: in Rept. Min. Agricul. Canada, for 1888, p. 55 (imported in beans from Europe).
- Bruchus rufimanus* Schön. WHITEHEAD: 2d Ann. Rept. Agr. Adv., 1888, pp. 49-51, f. 17 (injuries, transformations, prevention).
- Bruchus rufimanus* Sch. HAMILTON: in Trans. Amer. Ent. Soc., xvi, 1889, p. 150; in Entomolog. Amer., vi, 1890, p. 43 ("*B. rufimanus* Bohm. should be dropped"—? from our lists).
- Bruchus granarius* Curtis; *Bruchus rufimanus* Boh. ORMEROD: 12th Rept. Inj. Ins., 1889, pp. 19-24, figs. 1-8; Manual Inj. Ins., 2d Edit., 1890, pp. 5-9, f. 1-8 (description, prevention and remedies).
- Bruchus rufimanus* Schönh. RITZEMA Bos: Tierische Schädlinge und Nutzlinge, 1891, p. 293, f. 162.

A Common European Insect.

Bruchus rufimanus is the common bean-weevil of England, where it fills the place that is held in this country by *B. obsoletus* in its injuries to beans, while at the same time covering a broader field, as it infests

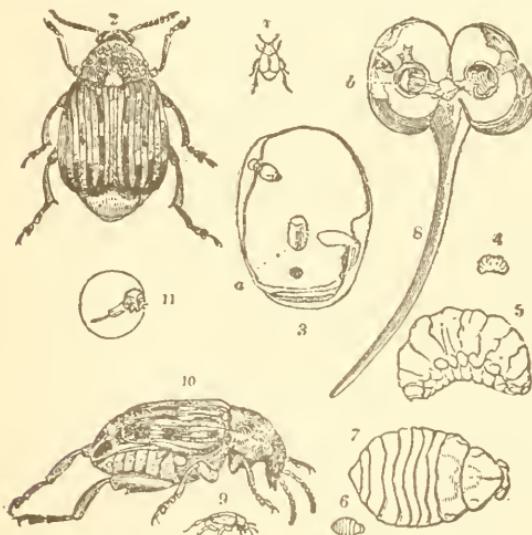


FIG. 18.—The European bean-weevil, *BRUCHUS RUFIMANUS*: 1 and 2, in natural size and enlarged; 3, infested bean; 4 and 5, larva in natural size and enlarged; 6 and 7, pupa ditto; 8, an infested bean showing subsequent vegetation. Nos. 9, 10 and 11 are of *BRUCHUS PISORUM*. (After Curtis.)

pease largely and also feeds in other of the *Leguminosæ*. From this range of food it has come to be known as the "grain beetle" and the "seed beetle," and until recently has borne the scientific name of *Bruchus granarius*—erroneously given it, as will be seen hereafter. Fig. 18 (part) represents it in its transformations and bean infestation.

It is both a common and destructive species in England, as appears from many writers. Curtis states of it: "This species, which is everywhere abundant early in February on the furze

[? *Ulex Europæus*] when it is in bloom, inhabiting also the flowers of

various other plants in the beetle state, as the rhubarb, meadow-sweet (*Spiraea ulmaria*), &c., is a most destructive insect in our pea and bean fields, the larvæ feeding in the seeds and sometimes destroying more than half the crop. They are exceedingly abundant in some parts of Kent, where they often swarm at the end of May, and are occasionally found as late as August." (*Farm Insects*, 1860, p. 361.)

Not Naturalized in the United States.

It is strange that this weevil has never become naturalized in this country, as it was introduced many years ago, and no special effort so far as known was made to stay its spread. The only authoritative published records of its occurrence in the United States are these, each referring to the same event:

Its Occurrence in New Jersey and Canada.

Professor Riley, in 1870 (*loc. cit.*), identified as *Bruchus granarius* examples received by him from Mr. A. S. Fuller, of Ridgewood, N. J., who had discovered them in some pods presented to the "Farmers' Club," which the donor had gathered from a tree in Switzerland, thought by Professor Riley to be a species of *Liburnum*. Dr. Horn, in his *Revision of the Bruchidae of the United States*, 1873, adds to his description of *Bruchus rufimanus* Schön.: "This species was sent me by Mr. C. V. Riley, of St. Louis, as having been reared from pea-pods imported from Switzerland." Dr. Hamilton, in the *Transactions of the American Entomological Society* for 1889 (*loc. cit.*), quotes the same introduction.

Other writers, as Le Baron, Thomas, etc., have made simple mention of its having been introduced into the United States in recent years.

It has also been imported into Canada. Mr. Fletcher, in his Report as Entomologist and Botanist of the Department of Agriculture of Canada, for the year 1888, states that some infested seed of the large Windsor bean, which had been imported from Europe, had been sent to him for examination, and was found to contain living examples of the weevil (noticed as *B. granarius* L.), many of the beans containing from two to three each.

The identification by Dr. Packard, in *Injurious Insects, New and Little Known*, 1870, of bean-weevils received by him from the vicinity of New York City as the European *Bruchus granarius* [*B. rufimanus*], was in error, as appears from the appended description and the correction made by himself the following year in his *First Annual Report on the Insects of Massachusetts*.

Erroneously Reported from Tennessee.

Mr. E. W. Doran, formerly Assistant Entomologist to the Bureau of Agriculture of Tennessee, in his *Report on the Economic Entomology of*

Tennessee, 1886, in noticing *Bruchus granarius* Linn., states: "This is a European insect, but was imported into this country many years ago.

* * * * * It has not been considered injurious in this country. I have seen no account of any injuries caused by it, yet I am able to report it as being *very injurious* in this state." Following, an account of its abundance in pease offered for sale in the London market, is given. The differences between it and *Bruchus pisi* [*pisorum*] and *B. obsoletus* Say are pointed out, and it is therefore evident that the species had been identified with the one now known as *B. rufimanus*. Dr. Doran, in compliance with my request for information of the occurrence of the insect in Tennessee, has kindly sent me a number of examples collected at the time of his report upon it.* They proved to be *Bruchus scutellaris* Fabr., or, as recently pointed out by Dr. Hamilton, *B. Chinensis* Linn. It is a common species in pease throughout the southern states. A notice of it is contained in my 6th Report, which please see and correct the statements made in "Its Probable Life-history" respecting oviposition, inability of the larva to enter ripened seed, and the time for emergence of the imago—as subsequent observations (recorded in preceding pages) have shown them to be erroneous.

The Confused Synonymy of this Insect.

To the above brief notice of the European bean-weevil, it may not be ill-timed to add a few words in relation to its mixed synonymy, which has long been an embarrassment to me, and, doubtless, the same to many others.

Referring to Curtis' admirable volume on *Farm Insects*, London, 1860, on page 358, we find figure 53 illustrative of *Bruchus pisi* and *Bruchus granarius* (given on pages 359 and 360), each credited to Linnaeus; on page 363, *Bruchus flavimanus* is described and credited to Schönherr, *Genera et Species Curculionidum*, vol. i, page 59.† Figure 53 is presumably among those of which Mr. Curtis in his Introduction to the above volume states: "Nearly all the drawings have been made by myself from nature, and were engraved under my own inspection."

The above figure has been repeatedly copied by subsequent writers. Miss Ormerod, in her Ninth Report for 1885, continues for the "Bean Beetle; Seed Beetle," the name of *Bruchus granarius* Linn. In her

* A parasite bred by Dr. Doran from the London infested pease, as noticed in his Report cited, was sent with the above. It was in poor condition, and the last one remaining in his possession. Mr. L. O. Howard thinks it may be an undescribed species of Mr. Ashmead's new genus, *Bruchophagus* (*Insect Life*, iv, 1891, page 49).

† This species is mentioned incidentally here, it being a British species (see page 284), to correct an erroneous reference of it to *B. rufimanus* in Riley's 3d Report on the Insects of Missouri, page 56.

Twelfth Report, for 1889, and in the second edition of her *Manual of Injurious Insects*, it appears as "*Bruchus granarius*, Curtis; *Bruchus rufimanus*, Boh." Professor Riley, in the *American Entomologist*, ii, 1870, and in his Third Missouri Report, 1871, gives it place as *B. granarius*; in the Index to his writings in the *Bibliography of American Economic Entomology*, Pts. i-iii, 1890, which passed under his revision, no correction of synonymy is attached to the reference to *granarius*.

To solve the existing confusion and doubt, appeal was made to Miss Ormerod for aid, requesting her to tell me what their bean-weevil really was, and to send me examples that they might be compared with the "*rufimanus* Schön." of the Horn Monograph. In explanation of the apparent discrepancy in her reports, the following statement was made :

The *Bruchus* consideration is a very involved one. In the first edition of my Manual I was not aware of this, and accordingly took Curtis' description as being (as he gives it) of the *Bruchus granarius* Linn. Since then I became aware of the difficulty, and have tried to meet it in my second edition by giving *B. granarius* as of Curtis, with the now accepted specific name of *B. rufimanus* Boh.

I venture to quote still farther from Miss Ormerod's letter, as showing additional synonymy, and the confusion existing in the names of the European species.

You will prefer to have our English views on this subject from a more authoritative Coleopterist than myself, so I venture to lay before you some information sent me in reply to my inquiries, by Mr. Oliver E. Janson — who I always find most trustworthy in running up specialisms which I have not all the works on, nor yet the access to specimens, which he can command. Mr. Janson wrote me:

"You are quite correct in your supposition regarding the *Bruchus granarius* of Curtis: it is the same as that now known under the name of *rufimanus* Boh. It was in error that Curtis, Stephens, and Marsham, identified our British species as the *granarius* of Linn."

* * * * *

I see that SHARP'S Catalogue gives only *rufimanus* Boh., without synonymy. WATERHOUSE catalogues *rufimanus* Schön. as *granarius* of Marsham and Stephens; and further, *seminarius* Linn., as the *granarius* of PAYK., OLIV., GERM., SCHÖNH., but not Linn. RYE gives nothing of *granarius* in his list of British Beetles, but has *rufimanus* Schön. PASCOE has *rufimanus* Boh. COX, in his Handbook, has *rufimanus* Boh.

* * * * *

Regarding the question of priority or superior claims of Schönher or Boheman to the name *rufimanus*, I found that many of the descriptions in Schönher's *Gen. et Spec. Curcul.*, were written by Boheman, and the description of *B. rufimanus*, is one of these.

To present the above in a somewhat clearer form, and incorporating some additional notes from Dr. Hamilton — too extended to present in full, it appears that —

Bruchus granarius of Curtis, Stephens, and Marsham, is *B. rufimanus* of Schönerr and Boheman—the first-named (Schön.) given priority in most of the European catalogues.

Bruchus granarius Linn. is *B. atomarius* Linn.—not British.

Bruchus granarius Fahr. is *B. seminarius* Linn. and is British.

Bruchus granarius Payk., Oliv., Germ., and Schön., is *B. seminarius* Linn.

Bruchus flavimanus Bohem. is *B. affinis* Froelich, found in Germany, France, Italy, and Caucassia; occurring also in Britain (auct. Hamilton).

Authenticated Examples Received from Europe.

Miss Ormerod kindly sent me several examples of their *Bruchus rufimanus* Boheman, received from Mr. Janson. Later, fearing that each and every specimen had not been given critical examination, and that, in their unmounted condition they may have been rubbed in transit, Mr. Janson most kindly forwarded to me through Miss Ormerod other examples beautifully displayed on cardboard, and retaining their pubescence and markings quite in contrast with the condition in which it is ordinarily found.

Referring to Dr. Horn's description of *B. rufimanus* in his "Revision" cited, Mr. Janson, in his letter accompanying the specimens, wrote:

I find the description of *rufimanus* to agree very well with our specimens except as regards the piceous color of the anterior tarsi and tip of the tibia; he also says that the hind tibiæ are sub-truncate, with the inner spine not prolonged, whilst in our *rufimanus* it is the outer spine that is not prolonged, the inner one being unusually long and acute. This would of course be an important difference, but I am inclined to think it a slip on the part of Dr. Horn, for I would be rather surprised if they really prove to be distinct species.

Dr. Hamilton has written me of the European specimens:

They agree very well with the figure given in Wood's *Insects at Home*, and with his letter press; also with the synopsis and description of F. Baudi (Monograph, 1883). I am not quite satisfied, however, that it is the true *rufimanus* of Schönerr.

It will be seen from the above that the synonymy of *Bruchus rufimanus* is not entirely settled, and that there still remains some work to be done upon it by those who have a special fondness for unraveling perplexing synonyms. But we now know the insect that is accepted by the best European authorities, as *rufimanus*, and in that, the more important consideration has been attained.

Distribution.

According to Baudi, the species ranges throughout Central and Southern Europe, Syria, Egypt, and all of Northern Africa, and also occurs in Montevideo, South America.

Remedies.

The remedies for it would be the same as for the preceding species. In addition to those, a very simple one is mentioned in Miss Ormerod's 12th Report, viz.: "In experimenting on infested beans, I found that if placed for a short time to soak [in cold water presumably], the water passed through the thin film of coating of the bean at the end of the gallery, and soddened the powdery dust and rubbish within, and thus choked the breathing pores of the beetle lying within, and killed it." If this will accomplish the purpose, it will be decidedly preferable to the risk of the hot-water application.

Bruchus lentis* Boheman.The Lentil Weevil.*

(Ord. COLEOPTERA: Fam. BRUCHIDÆ.)

Bruchus lentis BOHEMAN: in Schoenherr's Gen. et Spec. Cureulionidum, i, 1833, p. 70.

Bruchus lentis Koyi. DEJEAN: Cat. Coléop. Coll. Comte Dejean., Edit. III, 1837, p. 254 (hab. in Italy).

Bruchus lentis Koy. Schh. GAUBIL: Cat. Syn. Coléop. d'Eur. et d'Alg., 1849, p. 175.

Bruchus rufimanus Sch. HORN: in Trans. Am. Ent. Soc., iv, 1873, p. 315 (description).

Mylabris rufimanus Sch. REINECKE-ZESCH: List Coleop. Vicin. Buff., 1880, p. 10.

Bruchus lentis: BAUDI: in Deutsche Entomologische Zeitschrift, xxx, 1886, Hept ii, p. 395.

Bruchus lentis Koyi. RITZEMA Bos: Tierische Schädlinge und Nutzlinge, 1891, p. 294 f. 163.

Observed at Buffalo, N. Y.

This species of weevil is an European insect which, so far as known, has only occurred within the United States, at Buffalo, N. Y., where it was taken abundantly in a provision store. It has since been learned that lentils (*Lens esculenta*),* the food-plant of the insect, were kept for sale in the store, but whether they were imported from Europe is not known; they are not grown in the vicinity of Buffalo. From the number obtained, Mr. Reinecke made free distribution through his exchanges, under the name of *B. rufimanus* to which, from its general resemblance to that species, or difference from *B. obsoletus*, he referred it.† During the recent study given to the European bean-weevil, which, through the aid of our English friends, has resulted in its positive identification on this side of the Atlantic, and an understanding of its confused synonymy, it became evident that the Buffalo

* So recorded in Gray's *School and Field-Book of Botany*. 1869 (page 111), and in Wood's *New American Botanist and Florist*, 1889, part iv, page 100: the *Errum lens* or *Vicia lens* of many botanists.

† Of four of the examples sent to Dr. Hamilton under this name, two proved to be the lentil species and the others the common *Bruchus mimus* Say.

specimens were quite different in features, and even belonged to another group from that of *rufimanus*, viz., to that of *pisorum*. In all probability, examples of it had served Dr. Horn for his description of *B. rufimanus*, in his Monograph of the Genus, and accordingly, a specimen submitted to him was referred to that species, as possibly a climatic variety, in consideration of some differences to which his attention was called.

Compared with *B. rufimanus*.

The principal points of difference, by the aid of which *B. lentis* is readily separable from *B. rufimanus*, have been succinctly noted in a letter from Dr. Hamilton; they are these:

1. In the eyes. In the European insect [*rufimanus*], besides the emargination, there is on the upper or inner side an inscribed line that nearly separates the lobe in two parts; in the Buffalo insect no such line exists or it is merely traceable. 2. The very obvious differences in the form of the thorax — the American short and transverse, the European longer and narrowed anteriorly. 3. The tooth at the side of the thorax in both sexes of the American; that of the European (sexes not observed) can scarcely be called a tooth, but is rather an undulation in the side of the thorax. (The purpose of this unevenness in the thoracic margin, whether tooth or undulation, is for the reception of the femoro-tibial articulation of the anterior legs while the insect is in the seed.) 4. The tooth of the posterior femur in the American seems acute, as in *pisorum*, while in the other it is rather a lamination. (The examination was made with a lens; the insects should have been relaxed and then observed under a microscope. This, of itself if sustained, would alone be specific.) 5. There is a row on each side of the ventral segments of dense cinereous pubescence in the American — not observed in the others. 6. Part of the middle legs of the American is rufous, but color would not be specific. 7. The general sculpture of the European is much coarser; the striae of the elytra are deeper, the intervals wider, and the transverse rugæ are wider. 8. The American form is one-half smaller (this alone would not be specific).

Identified in Europe.

As it seemed probable that the insect was an introduction from Europe, an example was sent; through Miss Ormerod to Mr. O. E. Janson, of London, for comparison with European forms. The following very satisfactory answer, giving the result of the critical comparisons, was returned:

Not being able satisfactorily to identify the *Bruchus*, I forwarded it to my friend Dr. Sharp, who has quite recently worked at the group and published a monograph of the Central American species. He writes me that he thinks that there can be no doubt that it is the *Bruchus lentis* Bohem., and that he can see no difference between the specimen and European examples. Upon comparing it myself with Boheman's description, I found that it possessed denticles at the sides of the thorax, which Boheman says do not exist in *lentis*. I therefore pointed this out to Dr. Sharp, and he writes me in reply:

"Baudi, the best and the most recent writer on the genus, places *lentis* in the division with denticulate sides to the thorax. c. f. *Deutsche Ent. Zeit.*, vol. xxx, specimens so named by Kraatz when he worked out the genus and others named by Schaum, Wolliston, etc., have the denticle."

Description.

Perhaps the best published description of *B. lentis* is that given by F. Baudi (above quoted) in his recent Monograph of the Bruchidæ. As the work in which it is published is inaccessible to most students, and the original might not be of service to all if attainable, Dr. Hamilton has kindly supplied the following translation from the Latin, contained in *Deutsche Entomologische Zeitschrift*, xxx, 1886, Heft ii, p. 395.

BRUCHUS LENTIS Boh.

Conspectus.—Thorax with a tooth on each side, behind which it is more or less emarginate * * * Posterior femora armed with a more or less strong tooth before the apex * * * Thorax armed at the middle with an inconspicuous tooth * * * Anterior feet testaceous, simple in both sexes; * * * Anterior feet of the male nearly always testaceous; of the female with the femora black at base * * * The intermediate feet black, with the tibiae and tarsi rufous.

Description.—Oblong-ovate, black, with grayish-brown or ochraceous pubescence; thorax nearly truncate at apex, obsoletely dentate on each side at middle and scarcely emarginate behind the tooth; elytra ornamented with longitudinal, narrow, whitish lines, alternating with brownish spots often confusedly, there being larger brownish spots near the base on the thorax, and also on the base of the elytra; pygidium pubescent with cinereous or fulvescence, broadly infuscate on each side near apex, and occasionally almost uniformly fulvo-pubescent; three white spots at base, or rarely wholly griseo-pubescent; antennæ nearly as long as the head and thorax, suddenly thickened after the third joint and more gradually so to apex, black, first five joints rufo-testaceous; the anterior feet are rufo-testaceous, the femora in the female are frequently infuscate at base, the middle have the femora black, occasionally rufous at the knees, tibiae and tarsi rufo-testaceous; the posterior femora armed with a medium sized acute tooth.

Male.—Middle tibiæ slightly arecate, armed at the apex with a very fine black spine; the fifth ventral segment perceptibly emarginate at the middle of the hind border.

Hab. Central and Southern Europe, Syria; Italy, most frequently in lentils. Varies by both sexes having rarely the femora of the anterior feet black or pieaceous. Southern France.

Its Economic Importance.

Having received this insect only from Buffalo, N. Y., we do not know of its having become established in the United States. Its economic importance, however, could not be of particular moment, as lentils are not grown to any great extent in this country, but are in the main imported by a half-dozen or more large wholesale dealers in New York city. From one of these an Albany house procures its supply for the Albany market, which usually amounts to about fifty bags annually, of one hundred and fifty pounds each.* Their sale is limited to the German population, who use it prepared as a soup and also as a vegetable eaten with vinegar.

According to Mr. Daniel Batchelor, of Utica, N. Y., lentils are rarely grown in England as the climate is too moist for the seed to mature

* This dealer informs me that when his stock has been kept over the winter, it is often pierced with small holes by a worm, which, from his description, should be the lentil weevil.

without moulding. They are extensively grown in the south of Europe. French catalogues advertise *lentillon de printemps* and *lentillon d'hiver*, and in German catalogues they are designated as the large, and the small, lentil.

Mr. J. Fletcher, Entomologist of the Dominion of Canada, informs me: "The lentil is not grown as a crop in Canada. Two or three varieties are raised in small quantities at the Hungarian and the Bohemian settlements north of Whitewood in our Northwest Territories, but the seed is not quoted in any of our seed catalogues, which is a good criterion as to the demand. Experiments in cultivating lentils in this district a few years ago were a failure, as the crop obtained did not prove remunerative."*

The imported lentil, *Lens esculenta*, as found in the Albany market, is a small, yellowish or brownish seed, flattened to the shape of a double-convex lens, averaging less than one-fourth of an inch in diameter and with a maximum thickness of one-eighth of an inch; it grows in a small, broad, two-seeded pod. The seed would seem almost too small to contain the *Bruchus lentis*, as its shortest diameter is less than the length of the weevil. But this seeming difficulty is obviated by the position of the pupal cell of the *Bruchus*, which is always inclined to the surface of the seed, as may be seen in the bean-weevil, so that the beetle, lying within its cell, may give to its beak the sweep required for cutting the circular lid for its escape.

Possibly the "large lentil" of the German catalogues is the one used for feeding to animals in Europe, and not imported here, and the variety more liable to *Bruchus* attack. Baudi, in his description of the insect, does not give the scientific name of the lentil, but merely states—"frequens in lente."

Conotrachelus nenuphar (Herbst).

The Plum Curculio.

(Ord. COLEOPTERA: Fam. CURCULIONIDÆ.)

Curculio nenuphar. HERBST: Natursyst. bekann. in- und ausländ. Insecten, vii, 1797, p. 29.

Conotrachelus nenuphar. HARRIS: Ins. New Engl., 1852, pp. 65-71; Ins. Inj. Veg., 1862, pp. 75-82, figs. 39, 40.

Conotrachelus nenuphar. WALSH: in Practical Entomologist, ii, 1867, pp. 75-79 (natural history and remedies).—RILEY: 1st Rept. Ins. Mo., 1869, pp. 50-62 (nat. hist. rem., &c.)—SAUNDERS: Insects Injurious to Fruits, 1883 and 1889, pp. 180-187, figs. 192-200 (nat. hist., rem., nat. enemies, &c.)—RILEY-HOWARD: in Rept. Commis. Agricul. for 1888, pp. 57-79, plate I and XII.

*I have since learned, through Professor E. S. Goff, of Madison, Wisconsin, that lentils, in two kinds, are grown as a market crop, in Manitowoc county, Wisc., and more extensively in Kewaunee county. They are a good crop and sell, at present, at \$2.25 per 60 lbs. They are not infested with the weevil.

This notorious pest of the fruit-grower, represented in Figure 19, has not been noticed at any length in these reports. In the admirable series of fourteen annual reports by Dr. Fitch, my predecessor, in which are given extended accounts of the larger number of our more injurious insect enemies, it was simply named and characterized among the insects infesting the plum tree—the reader being referred, for further information upon it, to the writings of Dr. Harris. It has, however, been so frequently written of and figured in agricultural journals, and discussed in the meetings of farmers' clubs and horticultural societies, that the present reference to it is simply for the purpose of noticing and putting in the hands of the fruit-growers of New York the two best measures, so far as known, for its control. Above are noted a few of the principal publications relating to the insect, which will give all needed information of its life-history, habits, food-plants, etc., to those who may desire the knowledge. The last named publication, by Dr. Riley and Mr. L. O. Howard, is quite full, covering not only all that is of special moment in the other writings named, but about all that is known of the insect and of the best approved methods of dealing with it, up to the present time. It treats at length of the geographical distribution of the species, its food-plants, habits and natural history (four pages), its natural enemies, remedies (twelve pages), and experiments in rearing the insect. This valuable paper forms a portion of Dr. Riley's Entomological Report for the year 1888, and is contained in the Annual Report of the Department of Agriculture for that year. From the very large edition of this report annually printed by order of Congress, copies may doubtless be obtained, gratuitously, by making proper request of the Secretary of Agriculture, at Washington.

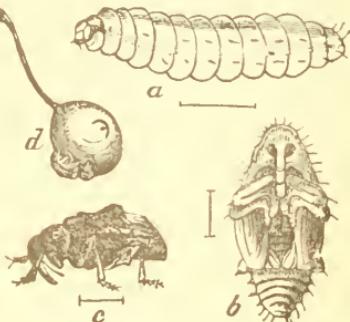


FIG. 19.—The plum curculio, *CONTRACHELUS NENUPHAR*: a, the larva; b, the pupa; c, the beetle; d, a plum with the crescent cut.

The Remedies for Curculio Attack.

The remedies and preventives that have been recommended for this insect in the various writings upon it would aggregate several volumes. Among them, to cite a few, are the following: dusting the foliage with air-slaked lime; sprinkling with lime-wash; jarring the beetles from the tree; trapping by chips or pieces of wood or bark distributed beneath the tree; attracting to bottles of sweetened water hung among the branches; repelling by strongly odorous substances placed

in the tree; repelling by burning gas-tar; spraying with coal-tar water; spraying with whale-oil soap solution; inclosing pigs and poultry in the orchard to feed upon the fallen infested fruit; planting the trees over ponds or water-courses; paving or flagging beneath the trees, and poisoning the beetles with arsenic.

Of the above, while some of them would undoubtedly serve as palliatives of attack, only two are now regarded as reliable for the protection of an exposed crop: these are, jarring the insects from the trees, and spraying with an arsenical mixture.

Arsenical Spraying.

The last named method has but recently been brought into notice, but the success that has attended the experiments made, has shown conclusively that when properly done, a good crop of plums may be insured (so far as it may depend upon exemption from curculio injury) at a moderate cost and with comparatively little labor. The value of this method is based largely upon the fact which has been lately discovered, that the beetle feeds to a considerable extent on the foliage of the plum tree as well as on the fruit, and is therefore exposed to the poison of which it partakes with its food.

A spraying "properly done," implies a knowledge of, and attention to, a suitable apparatus, the strength of the arsenical mixture, its uniform strength while being distributed, and the time or times that will give the best results. The comparative merits of Paris green and London purple are also to be considered.

All of these points are referred to in a communication made by me to the *Country Gentleman* of April 24th, in reply to an inquiry of the best time for spraying the different fruit trees (including the apricot) and the strength of the "London purple" mixture required for protection from curculio attack; it is essentially given below:

When to Spray.

"The spraying should be done just as soon as the blossoms fall. Although it would be effective (and therefore desirable) earlier than this, or upon the first appearance of the curculio abroad and its feeding on the young leaves, there is a strong opposition to the application of arsenical poisons to fruit blossoms, for fear of its killing the honey bees that visit them."

It is by no means certain, however, that bees would be poisoned by this means. I do not know of any positive evidence that they have thus been killed, and I question the general statements made of its having occurred. In consideration of the importance of early spraying—in advance, and during the time, of blossoming—for several of our insect pests, it would be well, before we continue to put this limi-

tation upon the proper time for arsenical spraying, that the danger to bees from visiting the blossoms should be positively determined. The possibility of their being poisoned in this manner, or collecting poison that may be communicated to the honey, is questioned by some of our best botanists. Will not some of our Agricultural Experiment Stations make a study in this direction the coming season?

London Purple, or Paris Green?

"The seasonal conditions of last year [1889] were such that the foliage was badly affected in many instances after having been sprayed with London purple. Although most of the injury observed was doubtless chargeable upon one or more of the fungous diseases that were unusually prevalent, it is at the same time possible that the foliage was more susceptible to injury from London purple than in ordinary years.

"After the experience of last year several of our fruit-growers, who have been in the habit of using the purple, will, the present year, abandon it for Paris green. Whenever this arsenite is used care should be taken that the liquid be kept in continual agitation, so as not to permit it to become of unequal strength through its speedy settling. The purple is much more easily held in suspension, being a lighter powder.

"In favor of London purple, it may be stated that Entomologist Weed of the Ohio Agricultural Experiment Station, has used, without injury to the foliage, one pound of the purple to one hundred gallons of water, in protecting cherry trees from *cerculio* attack, saving thereby 75 per cent of the fruit liable to injury. The same result was obtained by spraying two or three times with the weaker mixture of one pound to one hundred and sixty gallons of water.

"Although methods of spraying are not yet perfected, and each season's experiments are giving us important information regarding it, the success attending it at the present is so marked and so great that no fruit-grower can afford to dispense with arsenical spraying."

Strength of Mixture.

Replying to the question, how strong a mixture should be used : "One pound of Paris green to two hundred gallons of water may safely be used on apple and cherry trees; one pound to two hundred and fifty gallons for the pear and plum, which are more sensitive, and one pound to three hundred gallons for the apricot, presuming it (in the absence of any direct experiments) to be almost as readily affected as the peach.

"If experiments shall satisfactorily prove that our fruit trees will, in general, bear a stronger liquid than the above—in this event, for

killing the curculio, it should be used as strong as the foliage will bear, as in this case, we have to poison the adult insect. For preventing codling-moth injury, one pound of Paris green to two hundred and fifty or two hundred and sixty gallons of water has proved sufficient, as an almost infinitesimal quantity of the arsenite will kill the young caterpillar just as it is hatched from the egg. In spraying for the curculio, it should be repeated for two or three times at intervals of ten days (or if rain intervenes, then after every rain), as the curculio continues its egg-laying and feeding on the fruit for a longer time than the duration of the flight of the codling-moth."

How to Mix Paris green.

Another correspondent, from Penn Yan, N. Y., submits the following : "I would like information with regard to mixing Paris green in spraying operations. Will the pumps that discharge a part of the liquid in the tanks mix it effectually, or in what way can it be done?" Answer was made through the *Country Gentleman*, for May 1, 1890, as follows :

"Paris green mixes readily with water, and only needs to be stirred into it, or to have the water poured upon it and then stirred. The spraying pumps that are furnished with a return hose for dis-



FIG. 20.—The Field Force Pump Co.'s
"Perfection Spraying Outfit."



FIG. 21.—The Goulds' Manufacturing
Co.'s Double-Acting Spraying Pump.

charging into the barrel or tank at its bottom—such as are sold by the Field Force Pump Company (their "perfection spraying outfit," see Figure 20), by the Goulds' Manufacturing Company (Figure 21), and I presume by other manufacturers—keep the mixture sufficiently and properly stirred. Indeed it is difficult by any other known method to maintain a proper diffusion of the Paris green throughout the

water. Constant agitation is very important in using this arsenite—far more so than with the lighter powder of London purple. From an experiment just made by me, it was found that a mixture of one pound of the Paris green uniformly distributed by stirring in two hundred gallons of water and then permitted to rest, would in thirty seconds give a mixture drawn from the bottom through the spraying pipe of a strength of about one pound to sixty gallons of water—far too strong for most foliage. London purple should first be mixed with a little water into a paste-like consistency, and then washed through a fine wire sieve into the tank that such impurities may be removed as might otherwise clog the finer spraying nozzles."

In using smaller pumps, such as may be placed in a pail or open vessel, as the Combination Force Pump of P. C. Lewis, Catskill, N. Y.,

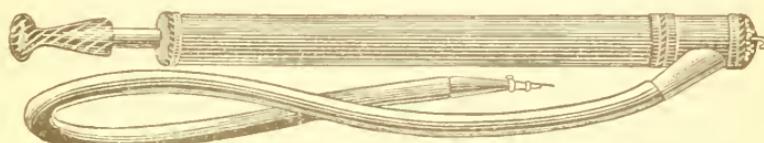


FIG. 22.—The Lewis Combination Force Pump, in one of its forms.

one of the forms of which is shown in Figure 22, the required mixture of the Paris green may be accomplished by withdrawing the hose from the tree at short intervals, and directing its nozzle into the vessel for two or three seconds while the pumping is continued.

Beneficial Results of Spraying.

As illustrating the benefits resulting from arsenical spraying for prevention of curculio injury, we may refer to the experiments made by Dr. Otto Lugger, Entomologist of the Minnesota Agricultural Experiment Station, in spraying native plums, which are often spoken of as being curculio proof.*

The first work of the curculio was noticed on June 4th; on the next day two trees each, of from ten to twelve feet in height, of three different varieties, were sprayed by the aid of a common garden syringe with one spoonful of London purple to two gallons of water, just after the blossoms had fallen, and twice thereafter at intervals of a week.

As the result, the ripe fruit on the sprayed trees was almost entirely free from blemishes, was of unusually large size, well colored and of high flavor. The unsprayed trees used as checks, contained hardly a plum that was not injured by the curculio or by the plum-gouger, while the fruit ripened prematurely and was of smaller size and inferior flavor. The foliage of the syringed trees was uninjured.

* Bulletin No. 10, March, 1890, Minnesota Agricultural Experiment Station.

Jarring for the Plum Curculio.

Some of our orchardists and fruit-growers still find it profitable, even in connection with spraying, to collect the curculio by jarring from the trees. Mr. J. M. Randall, of Dey's Landing, Seneca county, N. Y., has written to me as follows, under date of May 23d, of his crusade against the insect :

We have been fighting the plum curculio since the 18th of this month. We found none the day before, but on that morning, following a warm night, killed one hundred and thirteen. The next morning we killed forty-nine, and the following morning the same number. Rain fell on the 20th, and since the 21st we have caught none, owing to the wet weather. The above record is for an orchard of 525 four-year-old plum trees, which is surrounded on the north and south by apple orchards, on the east by quinces, and on the west by a vineyard. We catch more of the curculios next to the apple orchards and down through the middle of the plum orchard. More are found when the nights are warm and with an east wind.

Although the best method of jarring for the curculio has often been published in our agricultural journals, it may be well to give it here :

Rod iron of about three-eighths of an inch in diameter, is cut in pieces three inches long. With a brace-bit of the same diameter bore a hole of an inch and a half in depth, at convenient reach, in each of the principal limbs of the tree (if it be a large one) and drive in the iron. A sharp blow with a hammer upon the head of the iron, which should be flat, will at once bring all the curculios down upon the sheet spread for them beneath, or upon the curculio-catcher held in the hand, if one has been prepared.

An excellent apparatus for the purpose, convenient for orchards of moderate size, is the following: Take a square of two yards white muslin, or if a larger size is needed for larger trees, make a piece by

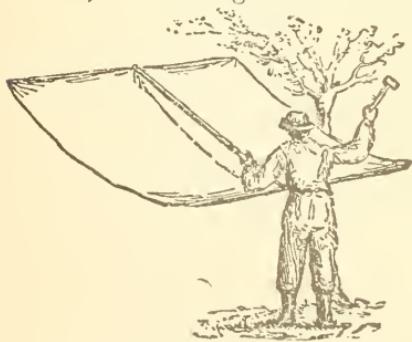


FIG. 23.—CURCULIO-CATCHER.

sewing together two by three yards, or larger. Stiffen it with light rods across the ends, and with one rod at the middle to keep them apart and to serve as a handle, as shown in the figure. Let it be a little slack, so as to give a slightly concave form to the sheet. Iron plugs having previously been inserted in the tree, or into each main branch,

the operator holds this sheet in his left hand under one side of the tree, and strikes the plug with a heavy hammer in his right hand. The curculios caught upon the sheet may be turned into a pan of

water and kerosene. Oil-cloth might be substituted for the muslin, as it would not wet with the dew when used in the morning, and as affording a smoother rolling surface for the beetles. (*Country Gentleman*, xlvi, 1881, p. 259.)

Oviposition of the Plum Curculio.

So apt are we to accept as truth statements apparently made of the result of personal observation, that for a long time the egg-laying of the curculio was believed to be after the manner described by Dr. Harris, viz.: that the beetle first makes a small crescent-shaped incision with its snout in the skin of the plum, and then turning round inserts an egg into the wound.

Dr. Fitch has apparently copied from Dr. Harris when he represents the beetle as "making a small crescent-shaped incision upon the side of the young fruit and dropping an egg therein." (*First Rept. Ins. New York*, 1856, p. 47.)

Mr. Walsh, in 1867, entertained the belief that the egg was deposited within the crescent cut. He has described the attendant operations as follows: "Alighting upon a plum, she then, with the minute jaws placed at the tip of her snout, proceeds to make the singular crescent-shaped slit in the skin of the fruit, which is characteristic of the species, and to which the popular name of "little Turk" refers. In this slit she excavates with the same instruments a hole such as a pin would make, to as great a depth as the length of her snout will allow, widening and enlarging it a little at the bottom so as to make it somewhat gourd-shaped. Depositing in the slit a single egg, she next proceeds to crowd it down with her snout to the bottom of the hole where the cavity is sufficiently large enough to avoid all danger of the flesh of the injured plum growing in upon and crushing the egg." (*Practical Entomologist*, ii, 1867, p. 76.)

The true method of oviposition was first pointed out by Professor Riley in his *First Report on the Insects of Missouri*, in 1869. The egg is not deposited within the crescent. The beetle first makes a cut with her jaws through the skin of the fruit; she then inserts her curved beak beneath the skin, making a hole sufficiently large to receive the egg which is then dropped at the mouth of the opening. Turning around and using her beak, the egg is crowded to the end of the hole. This being done, the crescent cut is next made in front of the egg, undermining it and leaving it in a sort of flap.

In confirmation of the above, the same method of oviposition coupled with a somewhat more delicate manipulation, has been described to me in a communication from Mr. T. E. Hayward, of

Pittsford, N. Y., as having been observed by him on different occasions.

After selecting a spot, the beetle very carefully turns up a thin piece of skin exposing a place of the size of the thickness of an ordinary pin. It then with its beak makes a hole for the reception of the egg, which is deposited and carefully arranged therein. The bit of skin is then turned down over it and worked at until it is accurately fitted and seemingly air-tight. The semicircular or crescent cut is then made near it for the purpose of checking the growth of the skin so that the egg may not be disturbed by the future growth. The general opinion, I know, is that the crescent cut is first made and the egg placed underneath it — a small mistake, but how it detracts from the instinctive skill displayed in the more elaborate operation above given. I have never timed a beetle in its act of oviposition, but I judge that it occupies from fifteen to twenty minutes in laying a single egg.

That our correspondent has correctly described as an "elaborate operation," the preparation of the hole for the reception of the egg and its closure after oviposition, would seem to find support in the statement of Riley and Howard that "the first cutting of the cylindrical hole occupied *five minutes*," while all the subsequent procedure — the deposit of the egg, its packing in, and the cutting of the crescent required only from five to eight minutes of time.

Cicada septendecim Linn.

The Periodical Cicada.

(Ord. HEMIPTERA: Subord. HOMOPTERA: Fam. CICADIDÆ.)

WALSH-RILEY: in Amer. Entomol., i, 1869, pp. 63-72, figs. 58-64 (broods designated, a 13-year for n, etc.).

CHAMBERS: in Amer. Entomol., iii, 1880, p. 77 (occurrence in Colorado in 1876).

UHLER: in Cassino's Stand. Nat. Hist., ii, 1884, p. 227, f. 304, pupa (nat. hist. and distribution).

DAVIS: in Entomolog. Amer., i, 1885, p. 91 (on Long Island).

RILEY: in Harper's Magazine, for June 6, 1885, xxix, p. 363 (of broods vii and xxii); in Science, for June 25, 1885, v, pp. 518-521 (food, transf., voice, etc.); Bull. No. 8, Divis. of Ent.—Dept. Agricul., 1885, 46 pp., 8 figs. (general account); in Rept. Commis. Agricul. for 1885, pp. 233-258, plates i and iv, f. 1, pl. 6 (general account); in Entomolog. Amer., 1885, p. 91 (transfer of eggs, north and south).

LINTNER: 2d Rept. Ins. N. Y., 1885, pp. 167-179, figs. 43-47 (general account); 5th Rept. do., 1889, p. 276 (experiment with); in Albany Morning Express, for June 13, 1890, p. 2, c. 5 (occurrence at Tivoli, N. Y.).

HOWARD: in Proc. Ent. Soc. Wash., i, 1885, p. 29 (edibility of).

BUTLER: in Bull. No. 12, Divis. of Ent.—Dept. Agricul., 1886, pp. 24-31 (occurrences in S. E. Indiana, habits, nat. enemies, etc.).

SCHWARZ: in Proc. Ent. Soc. Wash., i, 1886, p. 52 (voice of, at Fortress Monroe, and of what brood?).

RILEY-HOWARD: in Insect Life, i, 1888, p. 31 (of broods v and x in 1888), p. 298 (distribution of brood viii in 1889), p. 324 (precursors of brood viii).

MCNEAL: in Insect Life, i, 1888, p. 50 (precursors in 1888 of brood v).

MURTFELDT: in Rept. Commis. Agricul. for 1888, p. 135 (trees killed in Illinois).

BARLOW: in Insect Life, ii, 1889, p. 342 (larva in its gallery).

MARCH: in Rept. Commis. Agricul. for 1889, p. 218 (food, injuries, enemies).

WEBSTER: in Insect Life, ii, 1889, p. 161 (brood ?viii in the 17th century).

SCHWARZ: in Proc. Ent. Soc. Wash., 1889, pp. 230, 248 (of brood viii near Washington).

(The above are additional to the references given in the 2d Rept. Ins. N. Y., 1883.)

The regular appearance of the successive broods of this remarkable insect at the long intervals of seventeen years—the longest life-period of any known species—has been fully established, and the limits of the twenty-two broods that occur throughout the United States have been approximately ascertained and mapped. Of these, six only

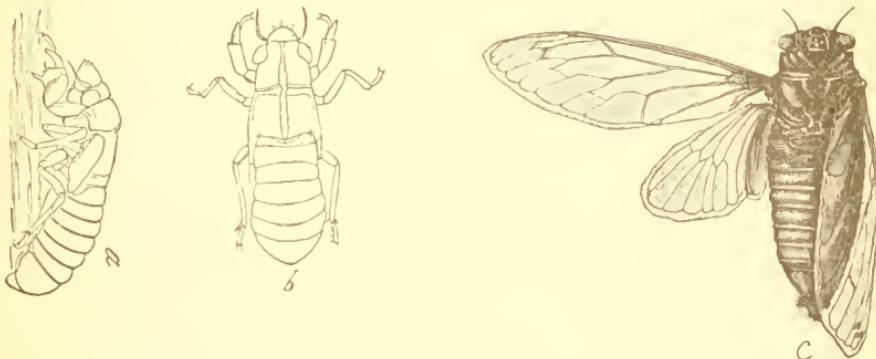


FIG. 24.—The seventeen-year Cicada—*CICADA SEPTENDECIM*: a, the pupa; b, the pupa case; c, the mature insect.

are recognized as occupying some part of the territory of the State of New York. The years of their appearance are so well known to entomologists, and by them usually announced in advance through the public press, that the event is always looked forward to with no little interest.

The Periodical Cicada at Tivoli, N. Y., in 1890.

The present year, 1890, is not one of the New York "cicada years." When, therefore, the announcement was made of the appearance of the insect at a locality on the Hudson river, where it was not due until 1894, it could hardly be credited, and it was naturally questioned if some other species had not been mistaken for it, notwithstanding the authoritative source from which the information came.

Mr. Frederick Clarkson, of New York city, wrote me on June 7th, from Tivoli-on-Hudson, that he had that day captured on the piazza

of the place formerly known as "Clermont," the residence of Chancellor Livingston, examples, in both sexes, of *Cicada septendecim*, and that at the time of writing (noon) the hum of the insects was quite loud. He had also taken the puparia from the trunks of trees.

That I might personally verify the occurrence of the insect, procure some specimens, and note its abundance, I visited Tivoli on June 11th. A search within the woods near the station gave no indication of its presence, either to the eye or ear. Driving to Clermont, three miles distant, I was equally unsuccessful in finding the insect. Mr. Clarkson, to my regret, had returned to New York, and taken his captures with him. The heavy rain that was falling prevented any extended search through the grounds and adjoining woods, and had silenced the cicada's song. Mr. Clermont Livingston, the present owner and occupant of the manor, kindly gave me all the information in his power in relation to the visitation. He had heard the song during the morning before my arrival, as also on several preceding days, during the warmer and brighter hours — the louder when the sun was shining brightly at mid-day, when there was a continual hum. He recognized it as the same in character with that which had attended the appearance in 1860 and 1877 of the "Hudson river brood." Not, however, expecting the recurrence of the brood until 1894 — when the notes were first heard, some days before Mr. Clarkson's coming, he had ascribed them to tree-toads.

A few days later Mr. Clarkson again visited the Livingston manor, but was unable to find any more examples. Those that he had taken had become injured and were thrown away, having already many in his cabinet which he had obtained in 1877 at the same locality. Under date of June 17th he wrote :

I did not succeed in obtaining either the imago, larva, or puparium, and am therefore led to believe that the insects are not numerous; but that a few are in this neighborhood is conclusive from the fact that their music was heard on every clear warm day during my visit, which — with the interruption of a few days — extended from the 3d to the 16th inst. The capture of a male and female made by me on the piazza of the residence referred to, on the 4th inst., the day after my arrival, and which I greatly regret I did not keep, fully believing at that time that I could supply any number if desired, I have no hesitation in saying are identical with those taken by me on the upper portion of the same manor at "Oak Hill" in 1877, and which, in their various stages of development are represented in my cabinet ; their marked characteristic being orange-red eyes, legs, and nerves of wings. The sound produced by the insects this year is well described by the

lettering as given by Dr. Fitch, and which is perfectly familiar to me through the experience of the visitations of 1860 and 1877, viz., "tsh—e—e—E—E—E—e—ou."

Mr. Clarkson was inclined, at the first, to regard this as the advance guard of the host that is expected in 1894, and suggested as a possibility that the extraordinary wet of the past year may have caused an earlier development of such larvæ as may have been the more directly exposed to its influence.

The Insect Reported at Galway, N. Y.

By a strange coincidence, just before the discovery of the cicada at Tivoli, my attention was called to an item in the *Albany Evening Journal* to the following effect—I quote from memory, as the slip has been mislaid :

A farmer at Galway, while plowing in his field a day or two ago, turned up with his plow a mass of compacted earth filled with small holes. It excited his curiosity, and it was carried to his house and laid aside. A couple of days afterward when happening to look at it again, it was found to be swarming with seventeen-year locusts. It will be remembered that this is "locust year."

The above-named locality is in the south-western part of the county of Saratoga, and lies within the limits of the territory occupied by the "Hudson river brood" (the 1st as defined by Dr. Fitch, brood viii of Walsh-Riley, and brood xii of Riley), as does, also Tivoli, in Dutchess county.

The simultaneous appearance of the insect at these two localities, could have but one interpretation, viz., that they belonged to the brood above-mentioned, but which was not due until 1894. But in no recorded instance had any portion of a brood shown itself for more than one year in advance—never for two—while three would be entirely at variance with our knowledge of the insect's life-history.

Precursors of a Regular Brood.

Addressing an inquiry to Dr. Riley, who has made special study of the species, if he had knowledge of its occurrence for more than a year before its appointed time, and stating what I had learned of its appearance at Tivoli, the following reply was returned, under date of June 16th :

Yours of the 12th has just come. You will note from my account in Bulletin No. 8 of the Division (page 8) the statement that the Periodical Cicada frequently appears in small numbers, and more rarely in larger numbers, a year before or a year after its proper period. I know of no positive evidence (which it would, in fact, be difficult to obtain) of the appearance two years in advance, though I

can see no reason why there should not be even that amount of irregularity among straggling members of a brood, but the evidence would have to be quite strong to justify such conclusion. The specimens you refer to might perhaps be more justifiably considered as retarded individuals of Brood VIII. I shall be glad to hear from you when you receive specimens.

P. S.—If they turn out to be true *septendecim*, I will give the matter more careful consideration in the light of other unpublished data, but I would like first positive evidence that we are not after a "will-o'-the-wisp," from wrong identification.

The Tivoli Insects not Referable to Brood VIII.

Brood viii, above referred to, appeared in 1889. Its range is the extreme south-eastern part of Massachusetts, across Long Island, along the Atlantic coast to Chesapeake Bay, and up the Susquehanna as far as to Carlisle, in Pennsylvania.

As members of this brood have never been observed within the State of New York, except on Long Island, there would seem to be no reason for its consideration in connection with the Tivoli visitation. Tivoli is one hundred miles north of New York city, and above two hundred miles north-east of Carlisle, Pa.

Are they the Remnant of an Unrecorded Brood?

The letter from Mr. Clarkson, given above, having been submitted to Dr. Riley for perusal, the following response was made:

From Mr. Clarkson's letter which you inclose, I think there can be no doubt that he has found this year the genuine *Cicada septendecim*, and his account seems to be confirmed by the reported appearance of the Cicada at Galway. I agree with you that the Tivoli Cicadæ can not be referred to Brood VIII, and if they were numerous enough to be called a brood they would form one hitherto unrecorded. Referring to my unpublished Cicada records I find under the heading "New or doubtful broods," a record of a seventeen-year brood 1839-'56, in Halifax Co., N. C. To be sure this record is a little doubtful since I obtained no further evidence in 1873 or in 1890, but, taken in connection with the appearance of specimens near Washington, D. C., in 1890, and with those reported by you, it is possible that we have to do with the scattered remnants of a formerly widely distributed and numerous brood. Two other records mention the appearance of Cicada in 1873, in Scott Co., Mo., Alexander Co., Ill. and Holmes Co., Miss. Finally, I have a report from reliable authority (the late Mr. W. S. Robertson) of a brood in 1839 at Muscogee, Indian Territory. But these western localities have not been corroborated subsequently and, moreover, we can not tell whether they belong to a 17 or 13 year brood.

It is safe to say that we know now pretty accurately all the large broods of the Periodical Cicada, but it is more than probable that in many places a few and scattered specimens will appear in off years which cannot be referred as precursors or belated specimens to any

of the established broods, and which can not properly be called a "Brood."

The "Galway Cicadæ," a Newspaper Story.

After many efforts made to ascertain the name of the "farmer in Galway," who had unearthed the cicada mass, a letter was received from the enterprising reporter who had communicated (in his own hand-writing, as was subsequently learned) the item to the *Albany Evening Journal*, expressing his regret that he was unable, after diligent inquiry, to trace the report to its source, and that "the first intimation that he had of the nest of locusts was what appeared in the *Journal!*"

This blots out the Galway appearance, and with it, forerunners of the Hudson river brood three years in advance of time.

An Undecided Question.

I have no opinion of my own, or even suggestion, to offer, as to the reference that should be made of the Tivoli cicadæ—whether to any of the unrecorded broods, or to one hitherto unrecognized. The possibilities have apparently been covered in the careful consideration and examination of records by Dr. Riley, and in the views advanced by Mr. Frederick Clarkson, in the portion of a letter given below. Future observations, or the discovery of overlooked records, may possibly enable us to reach a definite conclusion.

Is there a New York Thirteen-year Brood?

I thank you very kindly for your letter of June 30th, and return to you herewith the correspondence which you have permitted me the pleasure of reading. I shall be most happy to furnish you with any facts that may reach me with regard to this extraordinary visitation.

If the definition as given by Dr. Riley is strictly correct as to what constitutes a brood, then I think the conclusion which he has reached is a possible solution of this year's visitation, but in the absence of more essential data, it occurs to me that the captures made this year may be a thirteen-year brood, which may have occurred simultaneously with the extraordinary seventeen-year brood of 1877, and possibly formed a part, if not the whole, of the very limited number seen at Westchester by Mr. Angus in 1864. If it is satisfactorily established that the puparia discovered on Staten Island by Mr. Davis in 1881 was of the red-eyed Cicada, it would demonstrate the fact that in that year it was the seventeen-year brood, but does this admission, in view of present findings, exclude the conjecture that the thirteen and seventeen-year broods may have appeared together in 1864. Does it not rather look, in view of the fact that we have rather accurate knowledge of all the large broods, that these limited numbers may represent broods in the decadence, and becoming more and more exhausted at each periodical appearance? However, these are merely suggestions to doctors learned in the lore of the Cicadæ.

BRIEF NOTES ON VARIOUS INSECTS.

Ocneria dispar (Linn.).

The Gypsy Moth.

The Gypsy moth, which at the present time is exciting so much interest in Massachusetts, in efforts for its extermination, or at least

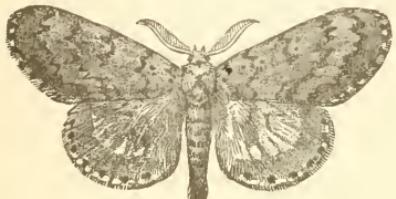


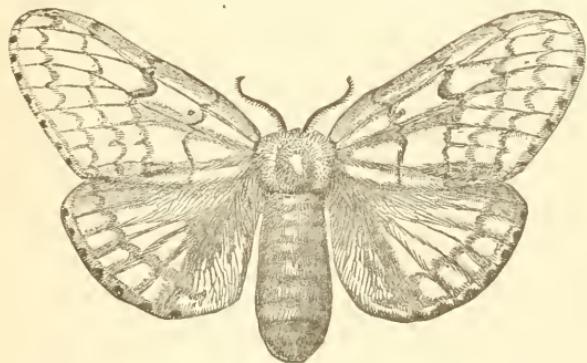
FIG. 25.—The male Gypsy moth,
OCNERIA DISPAR.

to prevent its spread, and to which further notice is given on page 335, is represented in Figures 25 and 26. These figures, copied from European authors, and reproduced from *Insect Life* for 1890, are stated to be of natural size, but they exceed by at least one-fourth the largest American

or European examples that have come under my observation. The largest examples that have been reared by me, measure respectively in expanse of wings, 1.60 inch, and 2.25 inches.

While the insect is still confined to three or four townships in the eastern extremity of Massachusetts, and therefore at such a distance

that in a natural distribution it would require many years ere it made its appearance in New York, still it is liable to be introduced in some of its stages, within our state at any time through railroad transportation. Attention is therefore invited to the



above figures of the moth, that it may be recognized, and promptly destroyed, in any locality where it might chance to be brought.

The following communication, sent by me to the *Country Gentleman*, was the occasion of quoting me as not believing in, and as opposed to, the active measures which it was proposed, through the State aid solicited, to undertake against the insect for its extermination. It will be seen that such an inference could not properly be drawn from the communication.

EDS. COUNTRY GENTLEMAN.—My attention has been called to the following notice in the *New York World* of a recent issue, with the suggestion that an expression of my opinion upon it might be of interest:

[*From the New York World.*]

"Massachusetts farmers are filled with alarm over the reported ravages of a newly found insect pest which an Amherst College "bug sharp" says may become widespread through the country, and may cause more havoc than the celebrated Colorado potato beetle. This is the gypsy moth, known to entomologists as the *Ocneria dispar*. At present it is confined to the neighborhood of Medford, where it caused so much damage that Gov. Brackett, in his message the other day, saw fit to call the attention of agriculturists to the pest, and recommended its speedy extermination.

"The moth was introduced here twenty years ago by Dr. L. Trouvelot, who saw the eggs at the Paris Exposition, and put a few in his vest pocket. One day the little bunch of eggs was blown out of his window in Medford, and never heard from until last fall, when millions of the gypsy moths attacked shade and fruit trees and shrubbery, leaving nothing save stalks and twigs behind. The area thus devastated was an ellipse a mile and a half long, and half a mile wide.

"Prof. Fernald of the Amherst Agricultural College, says the moth is a terrible pest. The Harvard authority on bugs and millers, Professor Hagen, on the other hand, says his Amherst contemporary doesn't know what he is talking about. The Harvard expert asserts that the gypsy moth is not alarmingly destructive.

"'In my opinion,' says he, 'this talk about state aid, this ordering out the militia to shoot caterpillars, as it were, is entirely unnecessary. Let every man kill his own caterpillars.' The professor has some of them always on tap in his study."

The facts of the introduction into Medford, Mass., about twenty years ago of the gypsy moth, *Ocneria dispar*, and its subsequent multiplication and extension are, I believe, correctly given, but I doubt if, even in the limited area to which it is apparently confined, of "the trees and shrubbery" there were only left "the twigs and stalks." Nor do I believe that there is any danger, even if it shall become widespread, of its causing havoc even approximating to that of the Colorado potato beetle. I do not see any just cause for alarm on the part of farmers or others, over the introduction of this new pest. The caterpillar is "a general feeder"—represented as feeding, in Europe, "on every species of fruit and forest tree" (probably not absolutely true). But the general feeders, as a rule, are far less to be feared than those that concentrate their attack on a particular food-plant. This is also rather a local species. It is rarely injurious in England, and only occasionally so on the continent. It seems to prefer oak and other forest trees to fruit trees. Thus Professor Westwood has stated: "It

is occasionally exceedingly destructive in Germany to the forests, which they completely strip of their foliage."

While, therefore, there would seem to be no occasion for alarm, the insect is sufficiently injurious to move the people of Medford and the vicinity to prompt and energetic action to arrest its spread and exterminate it while in its present limited locality. It is believed that it can be done without severe labor or a large expenditure of money. How it may best be done has been pointed out in a special bulletin recently prepared by the able entomologist of the Massachusetts Agricultural College, Professor C. H. Fernald, and published by the Hatch Experiment Station, under date of November, 1889. This bulletin contains description and figure of the insect in its different stages, and narrates about all that is known of its appearance in this country, with directions how and when to fight it. Copies of it may probably be obtained by those interested by addressing the station at Amherst, Mass.—(*Country Gentleman*, of January 23, 1890.)

Several notices of this insect are contained in vols. ii and iii of *Insect Life*. In the former, pp. 208-211, may be found something of its European habits, the plants on which it is known to feed, and a list compiled by Mr. L. O. Howard, of twenty-four species of parasites which attack it. No detailed account of its observed habits and transformations in this country have been given us. Of a small colony reared by me on apple leaves in 1890, I have only the following memoranda: The first males emerged on July 26th and the last August 7th. The females were disclosed between August 1st and August 13th. From six larvae, the pupation of which took place on July 13th and 14th, two males and four females appeared on August 1st, giving a pupal period of eighteen and nineteen days.

From other larvae obtained in 1889, a male emerged a month earlier than the above, viz., on June 26th, and a female on July 17th.

Spilosoma Virginica (Fabr.).

The Yellow Woolly Bear.

I find a worm attacking my rhubarb, zinnias, calendulas, etc., on the under side of the leaf. It is from one inch to one inch and one-fourth in length, about one-eighth in diameter, and has long hairs on all sides of its body. Its color is a yellowish-white. It is easily captured, as it is slow in its movements, but is a rapid eater. It has eight feet on the under side of its body, about in the center; with these and with small points at the extremities it moves along.—[E. J. HUMES, Providence, R. I.]

Judging from the description given, the insect is the caterpillar of one of the "woolly bears" as they are commonly known from the long

hairs with which they are closely covered. This is doubtless the one that Dr. Harris has called the "yellow bear," as its hairs are usually of a pale yellow color, although in some examples they are brownish-yellow or a foxy-red. While most caterpillars have their particular food-plants, and some will feed only on a single species of plant, there are others to which hardly anything in our gardens comes amiss ; of the latter kind is the "yellow bear," whose omnivorous habits and remarkable voracity renders it at times a great garden pest. When it has about reached its maximum size of two inches in length, it is

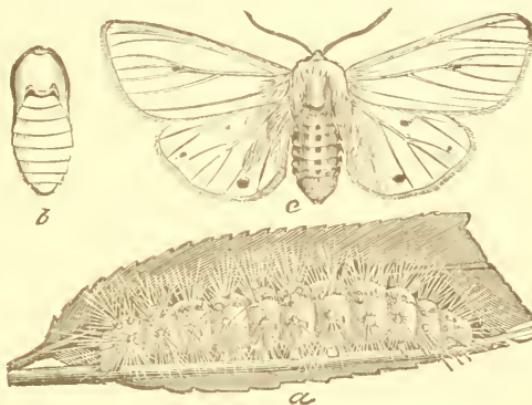


FIG. 27.—The caterpillar, pupa, and moth of *SPILOSOMA VIRGINICA*.

capable of destroying a plant of moderate size in an incredibly short space of time. As the caterpillars do not feed in company and are generally not numerous in any locality, they can not be fought with the ordinary methods. Their presence is usually betrayed by the eaten foliage, when the caterpillar, conspicuous from its color and size can readily be found, removed from the plant and crushed. The moth into which it transforms has for its scientific name, *Spilosoma Virginica*. It is familiarly known as the "white miller," from its white wings, devoid of any marking except one, two, or three small black spots on each wing. Its body has a row of conspicuous black spots on its back, a similar one on each side, and a dark yellow line intermediately. The caterpillars now feeding (July 5th) will soon spin up into their cocoons, within which they will change to pupæ, from which the moths will emerge during the last of this month or beginning of August, and lay their eggs for another brood in clusters upon the leaves of various plants.

Figure 27 represents the insect in its three stages of larva, pupa, and imago. Saunders says that the eggs are round and yellow and are deposited on the under side of the leaves in large clusters, and in a few days hatch into small hairy caterpillars.

Thyridopteryx ephemeraeformis* Haw.The Bag-Worm.*

The cases of this caterpillar which feeds on so large a number of our fruit, forest, and other trees (see 1st *Rept. Ins. N. Y.*, p. 84), have been sent to me from Sargeantville, N. J., taken from quince trees by Mr. Anderson Bray, who reports them as occurring by hundreds on these trees.

The species is not recorded in "Saunders' Fruit Insects" among the pests of the quince, nor is it often noticed thereon. In the *American Entomologist*, i, 1869, p. 250, it is identified by Mr. Walsh, in examples received from Georgetown, O., and represented as literally stripping many of the quince trees in an orchard, although the larvæ were at the time but about one-third grown.

These records would seem to be sufficient to give it place among the insects affecting the quince—the list of which is as yet comparatively small compared with those that attack other fruits.

***Erebus odora* (Linn.).**

In the *Fourth Report on the Insects of New York*, 1888, p. 138, a number of captures made of this comparatively rare Noctuid in the State of New York, are given. In addition to these, it may be recorded that a female, in fair condition, was taken at sugar, at Jamaica, L. I., on August 12, 1890, by Mr. J. V. D. Walker.

The time of appearance of this moth is extended over nearly one-half of the year—in June, August, September and November.

Tmetocera ocellana* (Schiff.).The Eye-Spotted Bud-moth.*

Inquiries are frequently received of a small caterpillar discovered on apple and other fruit trees, feeding among the opening leaves or burrowing into the green tips. It is of a dull-brown color, with its



FIG. 28.—The

eye-spotted bud-moth, *TMETOCERA OCELLANA*, and its caterpillar.

head and front part of its body black, and bearing a few short scattering hairs. When full grown, it is about half an inch long. In its perfect state it is a small moth known as the *Tmetocera ocellana* or eye-spotted bud-moth, from the eye-like markings on the front wings and its feeding habit. It feeds on pear, cherry, and plum buds, as well as on those of the apple. The caterpillar may be found during early May, boring into the base of the blossom buds, which it ties together

with its silken threads, and consumes one after another until only their blackened remains are left. Later in the month and extending into June, it spins together the young leaves and feeds upon them. It also bores into the blossom-bearing tips, eating the pith and causing their death. The moths usually appear abroad in July, although in rearing them I have had them emerge during the first week of June. Their eggs are deposited soon thereafter and the caterpillars come from them in about a week. This is the second brood, and as the leaves at this time are full-grown, their depredations are not serious, and have not attracted much attention. Large numbers of these caterpillars are sometimes found on a single tree, where their presence readily arrests attention, and their injuries become serious from the proportion of blossom buds destroyed. This pest is hardly known in the western states. The present season has presented conditions peculiarly favorable to their multiplication. The only way that promises success in their extermination is by spraying with Paris green or London purple about the time that the leaf-buds appear in April and ten days later, and at intervals until the blossoms have formed. The spraying, it will be observed, will have to be done earlier than for the codling-moth. This early operation will also destroy other species of leaf-rollers that make their attack simultaneously with the eye-spotted bud-moth.

Cecidomyia balsamicola Lintn.

The Balsam Cecidomyia.

Dr. Roland Thaxter, Mycologist of the Connecticut Agricultural Experiment Station, has sent me tips of Fraser's or the southern balsam, *Abies Fraseri*, taken by him from the summit of Roan Mt., N. C., in 1887, containing galls which are apparently identical with those of the above-named species occurring on *Abies balsamea* in the Adirondack Mountains of New York, and in New Hampshire (see *Fourth Report on the Insects of New York*, 1888, p. 60). The perfect insect of this species is not yet known.

Inclosed in the closely-folded paper containing the infested tip of *A. Fraseri*, a small Chalcid was found. Suspecting it to be a parasite of the *Cecidomyia*, it was sent to Mr. L. O. Howard for name. Answer was returned that as the specimen had lost its head and front legs it could only be referred to the *Pteromalinae*. In this group, the characters are chiefly derived from the front legs and head, and it could therefore not be placed generically. It apparently belonged to a

section of the sub-family in which the species are mostly parasitic upon wood-boring beetles, and from this general fact it was thought that the Abies had been infested by *Tomicus* or some other Scolytid, and that this Chalcid was parasitic upon one of these rather than on the Cecidomyiid.

Cecidomyia sp?

Within a Jumping Gall.

The following note, accompanied with a rather rude drawing, was submitted to me by Professor Ballard, President of the Agassiz Association, who had received it from a correspondent in England. The note and my reply, are herewith given, as published in the *Popular Science News*, for August, 1890:

We have found a most curious insect on a bough of May blossom. Both in form and color it is exactly like a large bud of the blossom just before it opens. The skin is just turning a shade creamy, and is of very fine, leathery texture. It makes frequent bounds or springs from the table to the height of nearly six inches. Were it not for this, one would pass it by as a May-bud. Can you enlighten us?

OATLANDS PARK, WEYBRIDGE, ENGLAND.

E. M. McD.

DEAR MR. BALLARD.—Thank you for permitting me to read the letter of E. M. McDowell, which has interested me much. You ask what the curious insect referred to therein, may be. It was something that I had never met with, nor read of, and I therefore sent the description given, to Dr. C. V. Riley, thinking that perhaps it might have come under his observation while in England, during his early life. He kindly returned me the following reply:

I was much interested in the account of the deformation of the May-bud, from my old boyhood tramping-ground, Oatlands, Weybridge. I regret to be unable to say positively what the deformation is. It must, however, be some kind of gall, and the movements are caused by the gall-maker; and as there is but one known to me, viz., the bedeguar of the hawthorn (*Cecidomyia crataegi* Winnertz), it is probably that species (see Kaltenbach), but I never heard of its jumping so.

I have not Kaltenbach at hand to refer to for a description of the gall, but in a publication on the "Gall-Making Diptera of Scotland," by Professor J. W. H. Trail,* I find on page 17: "*Cecidomyia crataegi*, Winn., often galls the terminal buds of the upper twigs of the hawthorn (*Crataegus oxyacantha*), producing a rosette of sessile deformed leaves, often covered with prickly hairs. The rosette may be an inch and a half across. Between the leaves lie several of the larvæ."

*A reprint from the *Scottish Naturalist*, 1888, pp. 281-88, 309-28, 373-82.

If we may accept the probable determination of Dr. Riley, the curious object observed must have been the gall of the fly, containing its nearly matured larva. Its remarkable bounds of nearly six inches in height (?) would be the result of the larva bending its body in an arched form and then by a strong muscular action suddenly throwing itself into a reverse position. It is quite probable that this gall is identical with that described in *Science Gossip* for December, 1867, in a communication from Ventnor, Isle of Wight, quoted by Mr. Charles R. Dodge in *Field and Forest*, ii, p. 55, as follows:

"The writer describes the 'jumping seed' as a 'small excrescence ; which had been taken from a hawthorn ; it was about the sixth of an inch in length, pear-shaped, and in size resembled a grape or raisin stone. The specimen had been seen to jerk or leap nearly an inch from a given point, though while in his possession it had not shown such activity, leaping only a third or a quarter of that distance. On opening the case, it was found to contain a whitish maggot, with a small, yellowish, scaly head, the body bent into a semicircle, and the tail-end slightly flattened. It had no legs, but the shining skin was deeply corrugated, or thrown into folds, which appeared to serve in some degree as limbs.'"

If the above description of the larva is approximately correct, it could not have been a *Cecidomyia*.

Quite a number of "jumping galls" and "jumping seeds" are known to science. Of the former, one of the most interesting is a species occurring as a small globular body of about the size of a mustard seed, formed on the under side of leaves of *Quercus obtusifolia*, *Q. macrocarpa*, and *Q. alba*, in California, Missouri, Illinois, Indiana, Michigan, and less frequently eastward. Sometimes a thousand of these galls are found on a single leaf. "The gall drops in large quantities to the ground, and the insect within can make it bound twenty times its own length, the ground under an infested tree being sometimes fairly alive with the mysterious moving bodies. The noise made by them often resembles the patterning of rain. The motion is imparted by the insect in the pupa, and not in the larva state." (Riley: *American Naturalist*, x., p. 218). The insect forming the above gall is known scientifically as *Neuroterus saltatorius* (H. Edwards).

Mr. Ashmead has published an account of another of these curious forms, which he has named *Andricus saltatus* (*Trans. Amer. Entomolog. Soc.*, xiv., 1887, p. 142). Two or three of the galls are formed on the bud-axils of the blue-jack oak (*Quercus cinerea*) in early spring, in Florida. "It appears the last of March, and when first taken from the tree and for several weeks thereafter, it has the power of jumping,

due to the contraction and sudden relaxation of the larva within: some of them will jump three-fourths of an inch from the table."

An interesting jumping gall was received by me last year, from a gentleman at Fort Edward, N. Y., which had been found beneath a tree leaping actively about, by his little daughter. Unfortunately, I was not able to obtain the insect from it and learn the particular species.

The most interesting of all these "jumpers" is, undoubtedly, the one popularly known as the "Mexican jumping seed," which is a large seed-vessel, of nearly half an inch in diameter, believed to be of a species of *Euphorbia*.^[*] Its peculiar leaps, jumps, and tumbles are occasioned by the movements of the caterpillar of a small moth confined within, known as *Carpocapsa saltitans* Westwood. The insect borrows additional interest from the fact that it is congeneric with our well-known and common codling-moth (*Carpocapsa pomonella*), which is responsible for the annoyance of the fruit-eater, and serious losses to the fruit-grower, from the defilement, disfigurement, and destruction of the "apple-worm."

In my fourth report on the insects of New York, figures, and a pretty full account of these jumping seeds have been given, and reference made to other literature on the subject.

I regret that I can not give a more satisfactory reply to your inquiry — one which would enable you to return a positive answer to your correspondent.

Epilachna borealis (Fabr.).

The Northern Lady-bird.

This lady-bird — one of the few *Coccinellidae* which are chargeable with injury to vegetation, has been sent to me from Mr. Wm. Falconer, as having been remarkably destructive in the gardens and conservatories of Mr. Charles A. Dana, at Dosoris, L. I., during the summer and autumn. It had never before appeared in such numbers. Last year a few occurred, but during the present year it has multiplied enormously, and seemed to abound "by the millions." It has not been particular in its food, for every member of the *Cucurbitaceæ* is apparently acceptable to it and eagerly devoured. It has shown a special fondness for eating into the rind of melons — Mr. Falconer having taken from seventy to eighty from a single melon. Writing in October — at that time, "every nook and cranny about the sheds,

[*The plant has lately been determined as belonging to the genus *Sebastiania*, the species being undescribed. (See Riley, in *Insect Life*, vol. iii, 1891, page 431.)]

wood-piles, and other convenient hiding-places, are full of them, searching for winter quarters."

The beetle is represented in Figure 29. It is of a luteous color; its eyes are black. The thorax is marked with four black spots, the largest of which is central near the hind margin. The wing-covers have seven black spots, two of which are common to the two covers.

It varies considerably in size — the largest measuring one-third of an inch in length.

The larva is described as yellow, with long, brown, branched spines, arranged in rows of six on each segment, except the first thoracic segment, which has only four. Its several stages, together with the egg, have been described by Professor G. H. French in the *Canadian Entomologist*, xv, 1883, pp. 189, 190.

In seasons of an ordinary abundance of this insect, it may be easily controlled by hand-picking, but in years of such an excessive multiplication as above recorded, it is almost a hopeless task to attempt to attain immunity from its depredations.



FIG. 29.—The northern ladybird, *EPILACHNA BOREALIS*. (After Emmons.)

Sitodrepa panicea (Linn.).

Referring to the notice of this insect as a leather pest, in Report iv pp. 88-92, Mr. A. S. Fuller, of Ridgewood, N. J., has called my attention to a communication made by him to "The Hub," of March (?), 1873, under the head of "A Pest of the Trimming Shop." A firm of carriage manufacturers, W. S. Bruce & Co., of Memphis, Tenn., reported serious injury to the curtains, falls, and cushions of their carriages, from the borings of a "worm," which, upon being submitted to Mr. Fuller, accompanied by the beetle into which it developed, was identified by him as the well-known pest, *Sitodrepa panicea*. The following are extracts from the letters of Bruce & Co.:

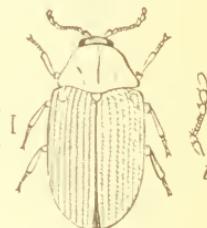


FIG. 30.—*SITODREPA PANICEA*.

We have been troubled during the last few years in our carriage rooms by a bug or worm, which not only destroys cloth linings, but also eats the leather in tops, cushions, and falls, more particularly when there is paste, as in the facings of the cushions and the falls. They bore little round holes through the leather on the outside, and in a little while it looks like a sieve, or the nozzle of a sprinkling can. They are worse in warm weather. On tearing apart cushion facings and falls, we have found in nests two kinds of white worms, one short and thick about three-sixteenths of an inch long, and the

other long and thin, from one inch to an inch and a quarter, which wiggles and runs like a snake. It is about the size of a large pin, and almost as sharp at the ends.

We have tried all remedies for this pest, such as are commonly used to destroy moths and other insects, but without any effect. They are very annoying and disastrous.

In a fall that we cut open, we found the worms in nests in the paste, between the leather and lining. We have about come to the conclusion that they are bred in the paste, * * * * for we never find them in any vehicles of our own make, the paste used in which we cook, which is not done in some Northern and Eastern States. The infested carriages were built up country.

The "two kinds of white worms" were not sent for identification to Mr. Fuller. The smaller one was undoubtedly the larva of *Sitodrepa panicea*; the larger was probably the larva of *Scenopinus fenestralis*, preying upon the larvæ of the clothes moths or some other insect infesting the cushions.

Aphodius fimetarius (Linn.).

A DUNG-BEETLE.

This little "dung-beetle" was sent to me, on May 6th, from the N. Y. State Agricultural Station at Geneva, infested with a large number of *Uropoda Americana* Riley—the mite that has several times been reported as attacking and killing the Colorado potato-beetle.*

Mr. G. W. Churchill, to whom I am indebted for the interesting specimen, informs me that it was found in a hot-bed of the Station, from which, last year, an example of the potato-beetle, similarly infested, was taken. It would seem from this, he thought, that they had a little parasite-farm at their command which might be utilized for infesting potato-beetles and other insect pests, and then turning them loose for the distribution and multiplication of the valuable parasite.

Professor Fernald, in a communication made to me, has expressed his surprise that mention was made in my "Third Report"† of Dr. Packard having observed this species in abundance on the carriage road of Mt. Washington, since "it is not only abundant on the White Mountains, but is common here [Amherst, Mass.] and also throughout Maine, where I have known of its abundance from my early childhood, and with it a species quite as abundant, viz., *Aphodius prodromus* Brahm."‡

* *Fifth Report on the Insects of New York*, 1889, pp. 289-291.

† *Report to the Regents of the University S. N. Y.* for 1886, p. 103.

‡ Although this species had long ago been introduced in this country from Europe, it had not, according to Professor Fernald, been recognized by coleopterists until a few years ago.

Although *A. fumetarius* is recognized as a quite common beetle in the Atlantic region, and in some other portions of the United States, it has rarely come under my observation in this portion of New York State. I have found it abundantly in the Adirondack mountains during the month of July — at Lake Pleasant, at Keene Valley, and elsewhere. Does it favor elevated localities?

Saperda candida Fabr.

The Round-headed Apple-tree Borer.

In an excellent article on "Insect and Fungus Enemies," contributed to the *Country Gentleman*, of March 20, 1890, by Mr. Woodbridge Strong, of Middlesex county, N. J., he has given in detail "a simple, ready, and complete protection" from this destructive borer,

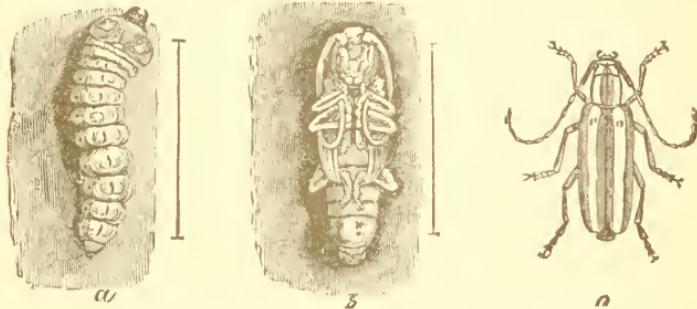


FIG. 31.—The round-headed apple-tree borer, SAPERDA CANDIDA; *a*, the grub or larva; *b*, the pupa; *c*, the imago or beetle.

which, although not entirely a new method, has never before been presented in so attractive a form, from its simplicity and assured effectiveness. The writer is evidently convinced that it is the best of all known methods of protection, and we are not disposed to question his conclusions, so far, at least, as employed for nurseries and young orchards. He has written as follows:

It is well known that the borer never gets into the stem, otherwise than as the result of an egg laid by the winged insect in a puncture made by her in the bark, at or just above the ground surface, usually in May or June. If that point is effectually covered against her at that time every season, of course the egg never gets there, nor the consequent boring worm. For this covering nothing is equal to a newspaper or some other soft paper.

Fold a newspaper into three or four thicknesses, remove the earth at the foot of the tree two or three inches deep, and wrap the paper from the bottom of the hole about the stem for at least a foot above the ground, crushing the paper tightly in so as to fit all depressions in the stock where the insect might creep under and down; tie all tightly with a string frail enough to break when the stem shall expand

in midsummer or later, and bring the earth back and tramp it at the foot of the tree. This simple plan I have followed for some six seasons, and no borer has ever entered a tree thus guarded.

The wrap should be put on early in May, and need never be touched thereafter, until the same time the ensuing spring, when the protection is renewed. On its removal, the healthy expansion and appearance of the trunk thus covered show the value of the bandage, also, as a shield against summer's sun and drying winds, * * * and as a protection in winter against the alternations between the low temperature of the night and the bright sunshine that often follows the next day. * * *

Every season I read in horticultural papers directions to wash the stems of trees with mixtures of soap, soda, and other substances, and to rub the trunks with offal or with bloody and greasy things to render the point of attack of borers, mice and rabbits too vile for even their mean work. Throw these all aside, and rely entirely on the paper wraps of any number of thicknesses you may choose, above two, and you will wonder why any other protection was ever thought of. But there must be no omission, and the work must be carefully done early in every May, against borers, or in November against mice and rabbits.

Mr. Strong also narrates in the same article with the above, the success that he has attained in immunity from the same borer in his quince trees, by setting out only such trees as have been worked upon stocks not attractive to it. After experimenting with the various varieties of the English hawthorn or *Crataegus oxyacantha* and finding that they were also subject to the attack of the borer, but that its ravages therein were less extensive, and better sustained, and more quickly repaired, he finally obtained better results with our native thorns, and particularly with *Crataegus crus-galli* and *C. coccinea*. From the many varieties of these two species — to use his own words — “after many years of trial, I have selected two so practically borer-proof, that while they have been left wholly exposed to their attacks, *I have never known one among many hundreds to be at all injured.*”

Professor J. B. Smith's recent observations of this insect, have clearly shown, what had before been reported, that its oviposition and borings, are not confined to the base of the tree, but that they also occur at various heights upon the trunk and extending upward even into the base of the main branches. It will therefore be seen that the application of washes or wraps to the base of the trunk, generally recommended, does not give complete protection from the injuries of this pernicious borer.

For an account of the oviposition of the beetle, reference may be made to my Fifth Report, 1889, pp. 127-129 (269-271 of the State Museum Report).

Diabrotica 12-punctata (Oliv.).*The twelve-spotted Diabrotica.*

The above-named well-known Chrysomelid, represented in Figure 32, has been received from Mr. Wm. Falconer as having been (in association with the *Epilachna* noticed in a preceding page) a great annoyance and very injurious during the summer and in October, as despoiling the Chrysanthemums and Dahlias, in eating and riddling the petals. According to Mr. Falconer, it appears to feed on almost everything, and is present in so great abundance that it seems useless to attempt any remedy. Sprinkling with pyrethrum water was suggested, but Mr. Falconer had but

little confidence in an application of this character, for a beetle so alert and active and which so readily takes wing when disturbed.

In addition to its large number of known food-plants, it has recently been reported as feeding to an injurious extent upon the foliage of the peach, and also on cabbage in southern Mississippi (S. F. Earles, in *Entomological News*, i, 1890, p. 152).



FIG. 32.—The twelve-spotted Diabrotica, DIABROTICA 12-PUNCTATA enlarged, with further enlargements of parts (After Emmons).

THE FUNGUS OF
Phytonomus punctatus (Fabr.).

The Clover-leaf Weevil.

The fungus that attacked and quickly killed the young larvae of *Phytonomus punctatus* at the farm of the N. Y. Agricultural Experiment Station, at Geneva, in the spring of 1885, was noticed in the *Fifth Report on the Insects of New York*, 1889, p. 272, as *Entomophthora Phytonomi* Arthur. At that time, the careful study made by Dr. Roland Thaxter on "The Entomophthoræ of the United States," as published in the *Memoirs of the Boston Society of Natural History*, vol. iv, No. vi, April, 1888, had not come under my observation. In this publication, Dr. Thaxter has referred the *E. Phytonomi* of Prof. Arthur, after about the examination of material from Geneva, N. Y., which had passed through my hands, to the *Entomophthora sphærosperma* of Fresenius, published in 1856.



FIG. 33.—Fungus-attacked larva of PHYTONOMUS PUNCTATUS coiled under the tip of a blade of grass.

This species of fungus, according to Dr. Thaxter, is peculiar from its infesting so many widely differing insects, distributed through all the orders except the Orthoptera. It has been found on a *Pieris* caterpillar; a *Colias Philodice* butterfly; several species of *Ichneumonidae* and a small bee; the common house-fly and several species of *Culicidae*, *Mycetophilidae*, *Tipulidae*, and other families of Diptera; one of the Lampyrid beetles; an aphis and on some of the leaf-hoppers (*Typhlocybe*); a *Limnophilus* among the Neuroptera; and upon *Thrips* sp. in the larva, pupa, and imago. In two instances it had been seen to prevail as an epidemic.

Professor J. B. Smith reports, that in the spring of 1890 and again in 1891, the clover-leaf beetle in New Jersey (locality not stated), when appearing in great number and threatening destruction, was attacked and were nearly all killed when about half-grown by a fungoid disease (*Insect Life*, iv, 1891, p. 43). In the absence of direct statement, it is to be presumed that the fungus was the *Entomophthora sphærosperma*.

Monarthrum mali (Fitch).

The Apple-tree Bark Beetle.

Mr. C. M. Hedges, of Charlottesville, Va., has reported the death of an apple tree, which he found "filled from the top to the bottom with a small white larva."

The bark from the piece received easily separated from the wood in comparatively thin sheets (in the more infested portions) which alone remained of it. Its inner portion had been consumed by the larvae which had also made part of their burrows in the wood underneath, after the manner of these bark-borers—half in the bark and half in the wood. The burrows curve and run in every direction but with rather a longitudinal tendency. In a few places are seen a different kind of burrow, running straight the length of the trunk for about an inch, with elevated margins of portions of uneaten bark: leading into these margins may be seen a row of minute punctures as if made by the point of a pin, as close almost as they could be made. These burrows are those of the parent beetles, and at each of the lateral holes a young larva had entered the bark after hatching from the egg—a row of eggs having been placed in little niches excavated for their reception on each side of the burrow. At the end of one of the straight burrows, a dead beetle (one of the parent beetles doubtless) was found on peeling off the bark above it, permitting the identification of the architect as *Monarthrum mali*.

As the young larva approach their pupation they sink their burrow within the wood until it is contained wholly therein, to a depth not exceeding one-eighth of an inch. A transverse section before me, of six-tenths of an inch diameter, shows nine of these burrows, in one of which, quite near the surface, the head of a pupa is seen.

This beetle is the *Tomicus mali*, of Dr. Fitch's Third Report, wherein the beetle is named and described, but with no mention of its burrows.

The above notes were made several years ago. On referring to the description by Mr. Schwarz, of the galleries and sub-galleries of *M. mali*, contained in the *Proceedings of the Entomological Society of Washington*, i, 1890, pp. 44, 48, it is found to disagree entirely with that of the burrows as above described. It would seem, therefore, that the example identified, as above, was not the infesting beetle of the apple-tree, but was only incidentally present in association with the more abundant species. What was this species?

Aphis brassicæ Linn.

The Cabbage Aphis.

Mr. E. P. Van Duzee, of Buffalo, N. Y., reports this insect as exceedingly abundant in many of the gardens of the city during the autumn of the present year. Its parasites and predaceous enemies seemed correspondingly abundant, and it was expected that their multiplication would tend to prevent the appearance of the pest in unusual numbers in the following year (*in lit.*).

A similar abundance of the species was noticed in New Jersey, by Professor John B. Smith, who states in Bulletin No. 72, of the New Jersey Agricultural College Experiment Station: "This insect has been unusually abundant during the year. The plants were sometimes so crowded with the lice that it was impossible to see the leaves, and the plants were so devitalized that they failed to grow."

In the above-named Bulletin, Professor Smith has illustrated the antennal structure of the species, showing the peculiar sensory pits which, in this family, afford good specific characters. The same is

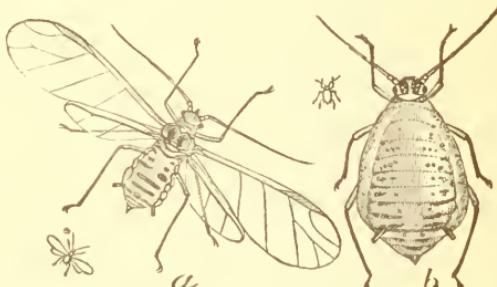


FIG. 34.—Winged and wingless females of the cabbage aphid, *APHIS BRASSICÆ*, enlarged.

given, in comparison with other species, in *Psyche*, v, 1890, p. 411. The beak structures are also shown.

The Entomologist of the Dakota Agricultural Experiment Station has reported of the excessive multiplication of the species in the preceding year (1889), in that state, as follows: "It often crowds the upper and under sides of the foliage in such numbers that the leaves become hidden by the living mass. Indeed, sometimes, weight for weight, there is more animal than vegetable substance present."

In *Insect Life*, iii, 1891, p. 289-90, Professor C. M. Weed, has described and illustrated the sexed forms of *A. brassicæ*. They had never before been given, although the insect has been known in both Europe and America for more than a century. Careful descriptions of the winged male, the oviparous female, and of the egg are contained in the notice.

Remedies.—This insect can be effectually controlled by spraying with a kerosene emulsion, or with one pound of whale oil soap dissolved in eight gallons of water. In order to reach the aphids when congregated on the under side of the leaves, it is desirable to use one of the knapsack sprayers furnished with a Vermoral nozzle.

Other remedies are named in the notice of this insect contained in the *Sixth Report on the Insects of New York* p. [52] 148.

? *Myrmeleon immaculatus* (De Geer).

A STRANGE HABITAT FOR THE LARVA.

An ant-lion, apparently about half-grown, was received June 3d, from Mrs. E. B. Smith, of Coeymans, N. Y., who had found it beneath a carpet in her house. It

differed so much in its colors and in structural features from the only species with which I am familiar, *M. immaculatus*, (often observed and collected by me beneath the overhanging limestone rocks of the Helderbergs, and reared in



FIG. 35.—The spotless ant-lion *MYRMELEON IMMACULATUS*. (After Emerton.)

a few instances) that I had no thought of its being, by any possibility, that species. Added to this, when placed upon the table it traveled both forward and backward with almost equal facility, and when laid on sand, it manifested no disposition to run a circular furrow or to construct a pitfall. Its habitat seemed also most remarkable for

an ant-lion. Finding no mention of similar habits pertaining to any of our species, the insect was sent to Dr. Hagen, of Cambridge, Mass., who has made special study of the *Myrmeleonidae*, for its determination. To my great surprise it came back to me as "probably *M. immaculatus*."

From that time to the present it has been kept in a jar with sand, in which it has partially buried, but has never made a pitfall. At first, most of its body was concealed beneath the sand, leaving its head exposed and jaws extended with which to seize any small insect placed within its reach. It was occasionally given young caterpillars, but most of its food has been the smaller flies taken from the windows. Later, it was content to have but a portion of its body in the sand—a few of the terminal segments. For perhaps a month past it has declined taking food, and has only occasionally changed its location. At the present time, November 15th, it shows but little vitality. As it may possibly be preparing for hibernation, in which state the larva has been known to pass the winter when in confinement, the box of sand containing it has been removed to a cold room where it may find winter quarters, if that is its purpose.

NOTE.—It survived the winter, and was still living when examined on May 7, 1891, but declined taking food, and died a few days thereafter. Could it possibly have been a species of *Ascalaphus*, of which the larvae do not make pitfalls or move backward? (see "Notes on the life-history of various species of the Neuropterous genus *Ascalaphus*," by J. O. Westwood, in *Transactions Entomological Society of London*, for 1888, part 1, pp. 1-12). It showed marked structural differences in the head, mandibles, etc., from specimens in the state collection, received from Annapolis, Md., taken from their sand pitfalls, and identified by me as those of *Myrmeleon immaculatus*.

Dendroleon obsoletum (Say).

A Climbing Ant-Lion.

The first winged example of this species that had occurred to me in New York was brought to me in September, 1883, by the lady, Mrs. E. B. Smith, of Coeymans, who has been so fortunate as to capture the larva of the preceding species. Dr. Hagen, to whom the specimen was submitted, states of it: "It is the same as *ocellatus* Burm. and *nigrocinctus* Ramb., Walker; very



FIG. 36.—DENDROLEON OBSOLETUM.

much like *M. pantherinus* Fabr. (*ocellatus* Borsch) from Europe. The larva lives on trees—described and raised by F. Brauer.

Another example of *D. obsoletum* was taken by a lady at Palenville, N. Y., Catskill mountains, on August 6th, 1884, and I have also received it, in two examples, from Mr. G. F. Pierce, taken by him at South Britain, Conn. It is figured by Dr. Packard, in his *Guide to the Study of Insects*, 1869, p. 612, fig. 604, who remarks of it: "Not rare in the warmer parts of the country, and has been found at Salem, Mass., by Dr. E. P. Colby."

Dr. Hagen has described the winged insect in his *Synopsis of the Neuroptera of North America*, 1861, p. 225-26, where he gives as its habitat. "United States, not rare (Say); New York; St. Louis, Mo.; Alabama; Maryland."

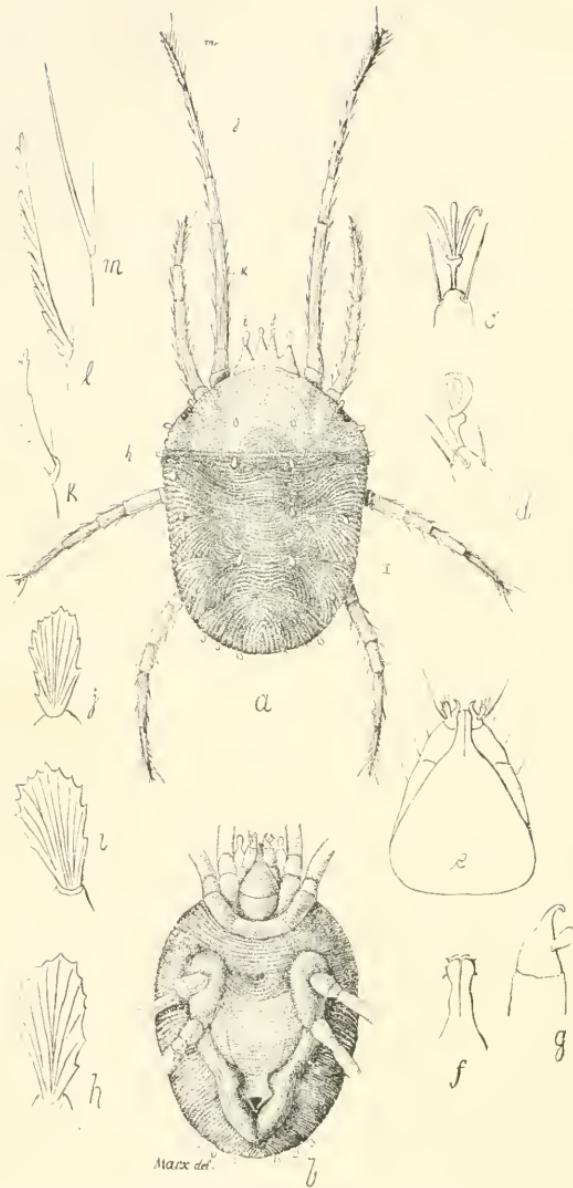


FIG. 38.—The clover mite, *BRYOBIA PRATENSIS*: *a*, female, from above; *b*, do, ventral view, with legs removed; *c* and *d*, tarsal claws; *e*, proboscis and palpi from below; *f*, proboscis enlarged; *g*, palpus enlarged; *h*, one of the body scales; *i*, scale from outer cephalic-thoracic projection; *j*, scale from inner cephalic-thoracic prominence; *k*, serrate hair from basal joint of leg; *l*, same from penultimate joint; *m*, spine of last joint; *a*, *b*, greatly enlarged; *c-m*, still more enlarged.

INJURIOUS ARTHROPODS.

Bryobia pratensis Garman.

The Clover Mite.

(Class ARACHNIDA : Ord. ACARINA : Fam. TROMBIDIIDÆ.)

— — — LINTNER: in Count. Gent., xlvi, 1881, p. 376 (infesting clothing).
Trombidium bicolor Herm. LINTNER: in Count. Gent., xvii, 1882, p. 395: the same, [3d] Rept. St. Ent. to Regents, for 1886, pp. 128-130 (on timothy).

Bryobia sp. RILEY: in Rept. Commis. Agricul. for 1884, 1885, p. 413 (infesting houses in Diamond Hill, R. Isl., and Waltham, Mass.).

— — — FORBES: 14th Rept. Ins. Ill., 1885, p. 73 (on clover and grass).
Bryobia pratensis GARMAN: in 14th Rept. Ins. Ill., 1885, p. 73, pl. 6, f. 7 (description); in Prairie Farmer, for June 26, 1886.

Bryobia pallida GARMAN: in 14th Rept. Ins. Ill., 1885, p. 74 (description of immature form).

— — — COOK: in Mich. Farmer, for Jan. 9, 1888 (in houses in Scotts, Mich.).

Bryobia sp. LINTNER: in Ohio Farmer, for April 13, 1889, p. 274; as *B. pratensis*, 6th Rept. Ins. N. Y., 1890, pp. 62-65 (occurrences of, habits, and remedies); in Albany Evening Journal, for Sept. 5, 1890, p. 5 (in a water-trough, etc.).

Bryobia sp. ? WEBSTER: in Insect Life, i, 1889, pp. 277-279 (infesting houses and timothy in Ind.).

— — — WISNER: in Insect Life, i, 1889, p. 252 (by roadside and in fields, in Mich.).

Near *Tetranychus*. RILEY-HOWARD: in Insect Life, i, 1889, p. 252 (refers to prec.).

Bryobia pratensis. RILEY-HOWARD: in Insect Life, ii, 1890, p. 279 (in houses in Wilmington, O.).

— — — ELLIS: ib., p. 278 (injury of the prec.).

Bryobia pratensis Garman. RILEY-MARLETT: in Insect Life, iii, 1890, pp. 45-52, figs. 4, 5 (history, distribution, life-history, remedies, description of stages).

This minute, spider-like red mite has, during the past ten years, as may be seen from its bibliography above given (all of which is believed to refer to it), been frequently brought to our notice from the immense number in which it has occurred in clover, timothy and other grass fields, and the serious annoyance which it has caused in its entrance in myriads in dwelling-houses. It was first given scientific

name and description by Professor Garman, in the year 1886. Recently, it has been studied at the Entomological Division of the

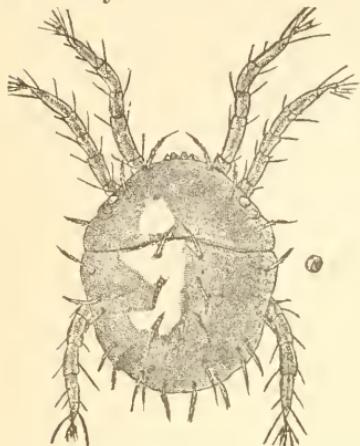


FIG. 37.—The larval clover mite,
BRYOBIA PRATENSIS.

wood, and almond trees, from several localities in California. It has also been observed in Oregon, Montana, and Utah, and to the eastward, in Iowa, Indiana, Illinois, Ohio, New York, Massachusetts, Rhode Island, and District of Columbia.

Food-plants.

The paper further represents it as being a very general feeder. "Many of the trees on which it has been found, however, evidently serve but to furnish winter-quarters, and are not especially attacked by the young and adults during the summer months."

"Of the forage plants, clover and timothy are especially attacked; the former being perhaps the ordinary food-plant of the mite. Of trees, the apple and arbor-vitæ are frequently infested with all stages during summer, and the occurrence of eggs and adults in autumn and winter on almond, plum, prune, poplar, elm, and other trees, would indicate that these are also attacked."

Occurrence at Schodack Center, N. Y.

In my Sixth Report, several appearances of the mite in New York and other States, are recorded. The following was brought to my notice during the month of August of the present year, in this inquiry, from a correspondent at Schodack Center:

Will you please answer the following in relation to the mite that has appeared the past week in a barn-yard here, and oblige many who are interested in it. The insect is so small that it would hardly be discernible to the naked eye, were it not for its color, which is a beau-

U. S. Department of Agriculture, and a valuable paper upon it has just been published by Dr. Riley and Assistant Marlett of the Division, to which the reader is referred for its life-history and all other needed information of it. The paper is illustrated by carefully executed figures, which, by permission of the Division, we are permitted to present herewith.

Distribution.

It appears from the above paper that the mite has been identified in its eggs occurring upon the apple, plum, cotton-

tiful carmine red. They infest the water-trough mostly. The water is brought to the yard from a spring about forty rods distant through a lead pipe, and has been there for fifty years. There are myriads of the mites, and they move very slowly. What they will do or where they will go is what we would like to know.

Answer was returned, as follows: The little creatures of which inquiry is made, are not true insects. They belong to the *Acarina*, not far removed from the spiders, in the order of *Arachnida*. They are true mites and doubtless pertain to the genus of *Bryobia*. Within a few years past we have had many accounts of these red mites (probably all are of the same species) occurring on grass, clover, and other vegetation, and entering dwellings at certain times and swarming over bedding, carpets, clothing, furniture, etc., to the great annoyance and disgust of the occupants.

The source of the mites in this instance may be either the ground and plants near the water-trough, or the spring. Examination would probably show whence they came. They would not harm the cattle or other animals that might be watered at the trough; and in all probability they will soon disappear, perhaps not to be seen again in years. We are glad to receive accounts of all such occurrences of these mites, and would like to have examples sent us that we might see if they belong to the species which has recently been named and described as *Bryobia pratensis*. Their study has been too long neglected in this country, for they are of considerable economic importance. Further information of their appearance at Schodack Center would be acceptable—of their continuance, their habits, their extent—if observed elsewhere than in the water-trough, some idea of their number, etc.

The following extract of a letter received from Dr. R. Morey, of Old Chatham, N. Y., narrates a similar occurrence of what was probably the same mite as the above:

I found this season [1889] in July some specimens in a watering-trough nearly covering its surface, of which I secured a number to send to you, but owing to illness I failed to do so. When afterward going for more they had disappeared—a heavy rain having intervened. They were small mite-like creatures, which could be better examined with a power of about fifty than with the unaided eye, but I was too ill to make the examination.

The place where these were seen must have been near to that of the Schodack Center occurrence—within the ride of Dr. Morey. It would be of interest could it be ascertained that both were at the same watering-trough, in consecutive years.

Occurrence at Ausable Forks, N. Y.

Mrs. H. D. Graves, of Ausable Forks, has written me of her observation of this same mite upon the walls of a church edifice near her residence.

The mites were seen five or six years ago, in March? ("during Lenten services"), as red spots upon a cement covered wall of the porch of a stone church at Ausable Forks. Some of the clusters in which they had gathered, as estimated, would have twice filled a tablespoon. They were of so bright a red color that they suggested blood to the observers. In appearance, when examined with a magnifier, they closely resembled the "red spider" of the green-house, except that they were two or three times as large. The cracks in the cement seemed full of them, so that they were smoked out with sulphur and then killed by applying kerosene. No plausible conjecture could be made as to their source. The church yard is in grass, with a small elm growing near the porch. The weather at the time of their observation was of a freezing temperature. They have not since reappeared.

Cermatia forceps (Raf.).*A Household Centipede.*

(Class MYRIAPODA: Ord. CHILOPODA: Fam. SCUTIGERID.E.)

WALSH: in Amer. Entomol., i, 1869, p. 252 (in Missouri, and harmless).

RILEY: in Amer. Entomol., ii, 1870, p. 182 (common in houses west).

CURTIS: in Amer. Naturalist, viii, 1874, p. 368 (poisonous bite).

LINTNER: Fourth Rept. Ins. N. Y., 1888, pp. 128-134, fig. 53 (general notice); Fifth Rept. do., 1889, pp. 295-6 (food).

DALL: in Insect Life, ii, 1890, p. 315 (at Washington, D. C., and inquiry of).

RILEY-HOWARD: in Insect Life, ii, 1890, p. 316 (habits).

FLETCHER: in Entomolog. News, i, 1890, p. 167; in Insect Life, iii, 1890, p. 85 (capture of Croton bugs).

HARGITT: in Insect Life, iii, 1890, p. 85 (numerous in Ohio, and habits).

For additional Bibliography, see Fourth Report Ins. N. Y., 1888.

Additional Notes.

Since my former notices of this Centipede, which has special interest to us, in consideration of its disposition to domesticate itself within our dwellings, some additional information in regard to its distribution, its habits, and the poisonous nature of its bite, has been obtained, which is deemed of sufficient interest to warrant its being given at the present.

In a letter recently received from Mr. S. S. Rathvon, of Lancaster, Pa., who apparently has an almost exhaustless store of untold observations upon insect lives and habits, he has given me the following account of his early acquaintance with the *Cermatia*, which is particularly valuable as antedating all the published records of the domestic habits of this strange creature.

Observed in Pennsylvania in 1849.

From the spring of 1841 until the close of 1848, my residence was in Marietta, Pa. During that period, I actively canvassed the townships of East and West Donegal, in Lancaster county, and Hallom and adjoining townships in the county of York — in fact it was the most active period in my life in field entomology. During all of the above time I never saw a single specimen of *Cermatia forceps*; but the first year after my removal to Lancaster I met them frequently, especially in the cellars of old buildings. My place of business was at No. 101 North Queen street, and my private residence at No. 506 on the same street, in an elevated location. At the former location they were large and of a bluish-green color. About the second or third year they began to appear in the cellar and also in the upper rooms of my residence, but not so large nor yet so highly colored — more of a drab color, except the feet, which were white.

A Cockroach-killer.

In the same building, with only a four-inch wall between us, lived a Mr. James G. Thackara, an agent of the Adams Express Company. His house was more infested than mine, and he frequently brought me fine specimens of them. He called them the "Cockroach-killers," and he related some of his observations in reference to them, as follows:

On two or three occasions he witnessed conflicts between them and the cockroach [*Periplanata orientalis* (Linn.)], which always ended in the death of the roach. The roach seemed to be conscious that he had engaged in conflict with his deadly enemy; he made no attempt to escape, but raised himself up as high as he could on his feet, and seemed to have his eye fixed upon his foe — both animals apparently reconnoitering and trying to get the vantage ground. This might continue for from ten to fifteen minutes, until the myriapod would seize the first opportunity to pounce upon the roach at an unprotected point and get him in his embrace, when after a very short time he would relinquish his prey and leave him dead upon the field. What

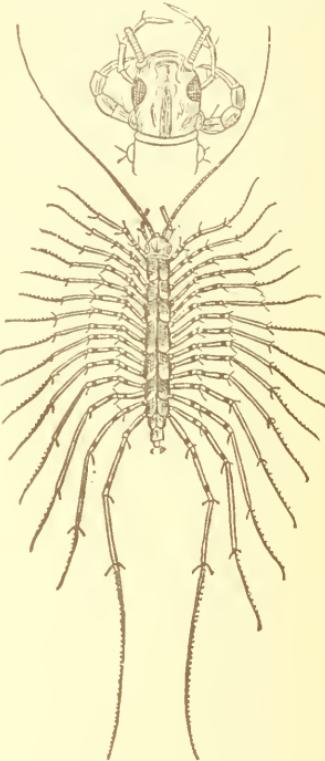


FIG. 39.—*CERMATIA FORCEPS.*

(After Wood.)

he would have done with the roach had he not been disturbed he could not say, for in attempting to secure the one the other ran away.

I have often noticed them on my desk while I was writing late at night, when they would remain fixed as a statue for twenty minutes or more, but would disappear as quick as lightning if I made the least movement toward them. They themselves may in turn be fed upon by spiders, as I have often found their dead bodies in spiders' webs in cellars and outhouses. I have, however, never witnessed such a contest as Mr. Thackara described.

Its Capture of the Croton-bug.

That the Cermatia found a portion of its food in the Croton-bug, *Ectobia Germanica* (Fabr.), has been suspected from its known food-habits. At the last meeting of the Entomological Club of the A. A. A. S., at Indianapolis, Ind., Mr. James Fletcher reported his having observed its capture of this insect at Washington, D. C., and described its method as springing upon its prey and encaging it between its many curved legs (*Entomological News*, i, 1890, p. 167).

Its Distribution Northward.

In my first notice of this myriapod, it was represented as a southern species gradually working its way northward (4th Report Insects New York, page 130), it having first been seen in New York city in the year 1867, and in Albany in 1870. The above reminiscence by Dr. Rathvon, locates it in Lancaster county, Pa. (southeastern portion of the state), many years previous to these dates, indicating quite a slow progress for a creature of such remarkable cursorial powers.

Is it a Desirable Guest?

In the same notice, it was intimated that Cermatia presence in dwelling-houses was for the purpose of feeding upon some of the smaller insects that commonly frequent them. In the succeeding report (Fifth, p. 296), it was shown as rendering some return for its disagreeable presence, by catching and greedily feeding upon flies. Now that it is presented in the role of a cockroach and Croton-bug killer, its companionship might even be invited in our houses, were it not that in further study of its habits, we have evidence that leads us to accept it as not only capable of inflicting a poisonous bite, but ready to do so under provocation.

Its Occurrence in Missouri.

A late communication from Mr. Gilbert Van Ingen, of Clinton, Mo., gives the following notes of its occurrence in localities in Missouri, where it has not been previously recorded:

At Higginsville, Lafayette county, Mo., I saw an individual running across the floor of the hall of the second story. At Osceola, Mo., I

found another between the sheets in my bed at the hotel. I have often found them under stones and logs in St. Clair county, Mo., and occasionally in the same habitats about Clinton, Mo.

Its Poisonous Bite.

Mr. Van Ingen also gives an account of a bite received by him, which without doubt was inflicted by the Cermatia:

It is poisonous, sometimes fatally so. The one at the hotel at Osceola bit me in two places on the body. The flesh around the bites became much inflamed and swollen, but did not fester. This condition continued for four or five days, after which the swelling and inflammation gradually subsided. Dr. J. H. Britts has told me that he knows of a case in which a child was bitten by a Cermatia and died from the effects. You state that there is no record of its bite having been inflicted upon a human being. I did not see the Cermatia bite, as from the circumstances it was impossible to do so, but I felt the pain, and getting up and lighting a lamp and making examination for the cause, I found the Cermatia between the sheets. In each of the wounds, the punctures made by the two mandibles were distinctly visible as small inflamed spots.

The poisonous nature of its bite had been recorded several years ago in a note to the *American Naturalist*, for June, 1874, which had been, until recently, overlooked by me. In it, Dr. Josiah Curtis, of Washington, D. C., wrote that a lady in the house with him had been bitten upon her foot, by stepping barefoot upon a Cermatia in the dark. She at first thought she had trodden on a carpet tack, but the sensation was quite different soon, being more like the effects of a coal of fire. On lighting the gas the creature wounded by her tread was found. The bite was followed by much swelling in the foot, but taking medical advice, it yielded to an application of ammonia and camphor. The swelling and pain continued for thirty-six hours, meantime keeping the lady awake for nearly an entire night.

In view of the above statements, where the fact of poisonous bites having been inflicted under provocation will not be questioned, the instance given in my 4th Report (page 134) of a supposed Cermatia bite, in the dormitory of a boarding-school [in Albany, N. Y.], will also be accepted as adding a third to the number of such occurrences.

A P P E N D I X

(A)

ENTOMOLOGICAL CONTRIBUTIONS.

The two following papers are published in this place, for convenience of reference, and as partly supplementing the brief report of the preceding year:

THE INSECTS OF THE PAST YEAR, AND PROGRESS IN INSECT STUDIES.

[Read before the N. Y. State Agricultural Society, at its Annual Meeting, Jan. 23, 1889.

GENTLEMEN.—Instead of asking your attention at this time to the consideration of some particular insect pest, as I have done on former occasions, it will, I am sure, be of more interest if I offer a brief review of the more important insect attacks of the past year within the State of New York, coupled with the absence of those that might have been expected to occur, and a few remarks on progress made in insect studies.

[Following were notices of the operations of the grain aphid, *Siphonophora avenae* (Fabr.); an attack, in July, of the hop aphid, *Phorodon humuli* (Schrank); abundance of the apple-tree tent-caterpillar, *Clisiocampa Americana* Harris, in connection with the neglected apple orchards of the state; a remarkable multiplication at Kingsbury of the forest tent-caterpillar, *Clisiocampa sylvatica*; absence of the usual injuries of the caterpillar of the white-marked tussock-moth, *Orgyia leuco-tigma* (Sm.-Abb.); and two weevils, *Otiorhynchus ovatus* (Linn.) and *Silvanus Surinamensis* (Linn.) infesting dwelling-houses. These are omitted, having been included in the introduction to the preceding (6th) Report of the Entomologist.]

THE CHINCH-BUG IN WESTERN NEW YORK.

In my Second Report, several pages were devoted to observations on the Chinch-bug, *Blissus leucopterus* (Say), in Jefferson county, in the year 1883, where so large an acreage of grass and clover was destroyed by it, as to occasion great alarm, and excite the fear that it was destined to become one of the permanent pests of our state, as it for a long time has been of several of the western states. Professor Forbes, State Entomologist of Illinois, has written of it:

"It is the most dangerous insect foe with which we have to deal. That it taxes them more heavily than all other such enemies combined, is burnt into the convictions of thousands of farmers by repeated heavy losses and bitter disappointment."

The following year, 1884, as the result of the thorough plowing, burning, and other active measures with which it was met, and no doubt, also, to seasonal conditions unfavorable to it, it did not reappear in northern New York, in injurious number. Since that time, I have had no knowledge of further injuries from it, until quite recently, a correspondent, Mr. Van Duzee, of Buffalo, who is making special study of the order of Hemiptera, to which the chinch-bug belongs, has written me of serious losses resulting from its presence, in Erie county, particularly in the central portion of the county, near Lancaster. He reports a field of three acres of timothy grass at Lancaster, which in 1888 yielded as fine a crop as was ever seen, the past year not worth the cutting, as the result of the operations of the bug. Fortunately the attack was arrested and kept from spreading as it gave every indication of doing, by the cold heavy rains that commenced on the 18th of May and continued for nearly a month, followed by the notable sharp frost on the 29th of May. Many of the farmers had complained to him of serious injuries to their hay crops in 1888 and 1889, "from the bug."

THE GRAPEVINE FLEA-BEETLE.

The grapevine flea-beetle, *Haltica chalybea* (Ill.), is apparently on the increase in western New York, and is becoming a pest of the grape-growers, if we may judge from the frequent inquiries received of its habits and how to deal with it. Its multiplication should not be permitted, but should be persistently fought by breaking up or removing in the autumn its usual places of hibernation, as loose bark and the refuse material of the vineyard, and by preventing the beetle eating out the heart of the buds in early spring. It is claimed that this form of injury can be prevented by spraying, in March, with a mixture of lime-wash made with brine, to which is added some London purple. The grapevine leaf-hoppers are also occasioning a great amount of harm. I purpose as soon as may be, to give them special study.

THE COW-HORN FLY.

A new insect pest has been exciting much interest in adjoining states—in New Jersey and Pennsylvania during the past year. As yet, it has not, to my knowledge appeared in the State of New York, but as it will in all probability soon extend its range hither as it is

rapidly spreading northward, a few words in relation to it may serve to give early knowledge of its presence, and thereby enable farmers to meet it promptly and check its increase.

The larger number of our most harmful insect pests have been brought to us, from Europe, and this is one of the latest additions to the extended list of much to be regretted importations that might be given. It is native to the south of France — was first noticed in Pennsylvania in 1886, and from its habit of collecting in masses on the horns of cattle so as completely to cover and blacken them toward their base, it has been given the common name of the "cow-horn fly." Other names that have been applied to it, are "cow-fly," "horn-fly," "Texan-fly," and "Buffalo-fly." Scientifically it is *Haematobia serrata* R. Desv. It is a small insect, not so large as the common house-fly but resembling it in general appearance, and is quite closely allied to the common biting fly, *Stomoxys calcitrans*, which often greatly annoys cattle and horses by inflicting its sharp bite, usually upon their legs. Unlike that, however, this confines its attack to cattle, not extending it to horses, mules, or man. Greatly exaggerated statements were at first made of the injury wrought by the fly. Common report represented it as depositing eggs at the base of the horn, the larvae hatching from which burrowed into the head, entering the brain, and often causing the death of the animal within twenty-four hours.

As soon as scientific study could be given the insect, it was found that the harm resulting from the presence of the fly was not so serious as to be the occasion of alarm. No deaths had resulted from it, and the cows were not dehorned by it. In the thinner-skinned and more sensitive animals, as the Jerseys, the bites, and bloodsucking and resulting inflammation might, perhaps, through rubbing, produce sore and bleeding spots. The amount of harm caused by the fly seems to be narrowing down to a falling off in the amount of milk and cream of infested herds, reported by some at one-third, and in one instance, in New Jersey, at one-half of the usual production.

The life-history of the fly has been studied out, and published, by the Division of Entomology at Washington,* and by Prof. J. B. Smith, of the State Agricultural College of New Jersey. Its eggs are deposited in the fresh droppings of the cattle. The larvae, feeding and maturing therein, may be destroyed by a daily sprinkling of the droppings with lime, or better still, as not liberating the ammonia, with plaster. Protection from the bite may be had by the application of oils to the body of the animals.

* *Insect Life*, ii, 1889, pp. 93-103, figs. 11-15; *Report U. S. Dept. Agriculture* for 1889, p. 346.

[For a more extended notice of this insect, see *Fifth Report on the Insects of New York*, 1889, pp. 78-85; pp. 220-227 of 42d St. Mus. Rept.]

A SAW-FLY BORER IN WHEAT.

Another introduced insect pest, long known in Europe for its injuries to wheat and rye, has been brought to notice the past year. It bears abroad the common name of the "corn saw-fly," which may not be used by us as it would be misleading, since with us "corn" is applied only to the maize or Indian corn, while in England it is used collectively for all of the cereals or farinaceous food-plants which grow in ears, viz., wheat, rye, barley, oats, and maize. Its scientific name is *Cephus pygmeus* (Linn.).

It was discovered two years ago (in 1887) infesting wheat on the Cornell University Farm, at Ithaca, where it has already become extremely abundant, but strangely, has not been observed, so far as known, elsewhere. Professor Comstock has made it the subject of a Special Bulletin—No. XI, November, 1889, in which a full account of the insect is given. The larva, hatching from the egg deposited in a slit made by the ovipositor of the female fly usually in the upper portion of the stalk, four to five days before its heading out, burrows within, working its way both upward and downward while feeding on the inner portion, and passing successively through all of the joints. Indications of its presence seldom appear before the first week in July, when it has penetrated to the first joint above the ground, at which time a discoloration beneath it may be noticed. When much of the inner portion of the straw has been eaten away, the stalk is liable to be broken and thrown to the ground by high winds that may prevail.

At the time of harvest, nearly all of the larvæ have burrowed downward to the surface of the ground, where a cell is excavated and closed at the top with borings, and a cocoon is spun of fine silk. Here, after the cutting of the grain, it remains within the stubble, hibernating in its larval stage, and not assuming its pupal form until the following spring—in March or April. Some time in May the winged insect emerges from the pupa, and appears abroad upon the wing.

Professor Comstock reports that somewhat under five per cent of the wheat straws have been found to contain the insect. He does not find its injury to be so great as reported by European writers. Careful weighing of the kernels of infested and uninfested heads, shows but a very moderate amount of difference in weight. Perhaps the rye crop might be more seriously affected by it. It is an insect that

comes to us with a bad reputation, and, therefore, effort should be made to arrest its spread. The Cornell University Station would accomplish a good work, if they would not permit us to hear of its operations beyond their own borders. The wheat stubble of their farm may, at the present time, entirely monopolize the living and unfledged material in this country.* It is thought that it may have been brought over from England in straw used for packing.

THE GYPSY MOTH.

It is of no little interest to the naturalist, when the date and locality of introduction from abroad of a species of injurious insect can be definitely ascertained, that its rate and lines of distribution may be more accurately determined, and change of habits under its new environments observed. The last half century, prior to which but little attention had been given to the study of insects in this country affords approximate data of the kind, for several of our notable insect pests. Thus, to cite a few of these: The elm-leaf beetle, *Galeruca xanthomelena* (Schr.) was first noticed in 1838, on elms in Baltimore and its vicinity; the grain aphid, *Siphonophora avenae* (Fabr.), probably about 1850, but not injurious until 1861; the cabbage butterfly, *Pieris rapæ* (Linn.), observed in 1858, at Quebec, Canada; the asparagus beetle, *Crioceris asparagi* (Linn.), introduced probably in 1856 or 1857, and first seen at Astoria, Long Island, in 1859; the hop-vine aphid, *Phorodon humuli* (Schrank), recorded for the first in 1862; the currant worm, *Nematus ribesii* Scop. (formerly known as *N. ventricosus* Klug), introduced about 1860, it is believed at Rochester, N. Y.; the carpet beetle, *Anthrenus scrophulariae* (Linn.), about 1870, in New York city and in California; the clover-root borer, *Hylesinus trifolii* (Müll.) [lately referred to *Hylastinus obscurus* Marsh.], about 1875, first observed in Yates county, N. Y., in 1878; the pear midge, *Diplosis pyrivora* Riley, in 1877 or 1878, at Meriden, Conn.; the larch saw-fly, *Nematus Ericksonii* (Hartig), first seen in 1880, on imported larches, at Brookline, Mass. To the above formidable list, a score of others introduced within the period embraced, might be added, the injurious character of several of which would entitle them to special mention. I will only add to the list, at this time, by mention of, and brief reference to, one which has been brought to our notice during the past year, and which is exciting so much interest in Massachusetts that the Governor of the state has deemed it

* Publication has since been made of the capture of a single example of the species, at Ottawa, Canada, in 1887, by Mr. Harrington, and of three examples by Mr. Van Duzee, at Buffalo, on the 9th and 11th of June, 1889, showing that it has already attained a somewhat extended distribution.—(*Canadian Entomologist* for February, 1890, xxii, p. 40.)

proper, in his late message, to call public attention to it, that, if possible, it may not be permitted to extend over the state, and other states of the Union. The insect is the *Ocneria dispar* of Linnaeus, popularly known in its winged stage, as the Gypsy moth. It is an old pest of European countries—more particularly perhaps in Germany than elsewhere, where at times its caterpillar has stripped the foliage from entire forests. It is one of the kind known as polyphagous or having a great number of food-plants. Hardly any shrub or tree, whether fruit or forest or ornamental is rejected, and garden vegetables and other products are also eaten by it. It is evidently adapted to a very broad distribution, occurring as it does, throughout Europe, Northern and Western Asia, and in Japan.

It was accidentally introduced in the United States in the year 1869, by an entomologist, Mr. L. Trouvelot, then living near Glenwood, Medford, Mass., who was engaged in experiments with the production of cocoons suitable for silk manufacture, from our native silk worms and a few foreign species. From some cocoons of the Gypsy moth, brought over by him, the winged insects emerged, and a few chanced to escape. Their progeny, adapting themselves to the conditions presented, have continued to increase from that time onward, until they have become thoroughly naturalized. Fortunately, the species is single-brooded; the female does not deposit many eggs, and its heavy abdomen disinclines it to extended flight. Hence it is, that although twenty years have passed since its colonization, the area of distribution which it has appropriated and now holds, is limited to an ellipse of about a mile and a half by a half-mile in extent, in Medford—a few miles northwardly of Boston. But within this area, it appears, from the report of Professor C. H. Fernald, Entomologist of the Massachusetts Agricultural College and of the Hatch Experiment Station, to have displayed a remarkable voracity. In the Special Bulletin of the Station for November, 1889, devoted to the insect, it is said to have "multiplied to such an extent as to cause the entire destruction of the fruit crop and also to defoliate the shade trees in the infested region"—that above named. That an insect capable of such destructiveness, and with such an European history attached to it, should be promptly met and exterminated while practicable in its present limited area of occupation, will be conceded by all. It is reported by the press, that an appropriation from the state legislature has been asked for the purpose. Professor Fernald expresses his confident belief that "if every tree and shrub in the infested region in Medford be thoroughly showered with Paris green in water, soon after the hatching of the eggs in the spring, the young

caterpillars will surely be destroyed ; and if any escape, it will be because of some neglect or ignorance in the use of the insecticide." He is not positive that the insects "can be exterminated in a single year, but entertains no doubt but that, if the work of showering be continued during the months of April and May for two or three years, under competent direction, that they may be entirely destroyed."*

PROGRESS IN INSECT STUDIES.

Passing now to another division of my paper, may I speak briefly of the progress being made in insect studies, particularly as they relate to the control of insect depredations.

After having been laboring for many years in a field of study in which the forms requiring investigation are far more numerous than all the other classes of the animal kingdom combined—with but few, perhaps ten or twelve, co-laborers throughout the United States, and with results not always meeting the demand from our agriculturists for aid in times of need—it affords me more gratification than I can express, to be able to report a progress in economic entomology, such as I had not dared to hope ever to see. Those of you who have had hard experiences in your gardens and elsewhere in fighting some of our most common insect pests, such as the wire-worm, the white-grub, the rose-bug, the cucumber-beetle, and the cabbage-worm, should also rejoice with me that these, together with many others of the kind, will in all probability, ere long, be brought under such control that serious injury from them can be prevented. Scores of enthusiastic workers are now engaged in earnest study of the successive stages in the lives of our more injurious insects, that their most vulnerable points may be learned, and in experiments which shall indicate the most simple, inexpensive, and efficient method of dealing with each insect pest. No preceding year has marked so great an advance in applied entomology as has the last.

ENTOMOLOGISTS OF THE AGRICULTURAL EXPERIMENT STATIONS.

This is the direct result of the beneficent provisions of what is commonly known as the "Hatch Act" of the 49th Congress, of 1887, for the establishment of an Agricultural Experiment Station in each of the United States, to embrace those departments of investigation and experiment which will bear most directly on the agricultural industry of the respective states. Thirty of these stations

* An appropriation of \$25,000 has since been made by the Massachusetts legislature for the extermination of the moth, and three commissioners have been appointed by the Governor who have already (in March) entered upon their work. Since the above was written the insect has spread over a considerably larger territory.

have already organized a department of entomology, or of entomology and botany united—the two studies being intimately connected in the interrelation of insect injuries and plant diseases. The valuable work accomplished by these entomologists has been shown in several publications, in bulletins of the stations, etc., which have been highly creditable, and, undeniably, contributions of much economic importance; and further, giving assurance of rich results to follow.

OPERATIONS AGAINST THE ROCKY MOUNTAIN LOCUST.

I can not refrain from referring, in illustration of the character and value of the work that is being done in insect warfare, by the experiment stations, to that recently conducted at the Minnesota Experiment Station, by its very able entomologist, Dr. Otto Lugger. It was an effort to save from destruction the crops of a section in Otter Tail county from the descendants of a few Rocky Mountain locusts, *Caloptenus spretus*, that had located there in 1884, and at the time that active operations against them were commenced (in 1888) had hatched in numbers sufficient, as estimated, not only to destroy the entire crops of that county but of a large portion of the state. The preceding year five thousand acres of wheat had been swept away. In this emergency appeal was made to the Governor of the state for aid. Dr. Lugger was commissioned by him to visit the locality and report upon the situation. Upon his report the Governor at once sent to the infested region the material that was asked for in sheet-iron for making large pans to contain tar and kerosene, and muslin for the construction of bags, in which to catch and kill the "hoppers." By means of these, fifty and more bushels of locusts (nearly all young and requiring, at the least, seven thousand individuals to make a bushel) were caught and killed daily near Perham during a week in June. By the 1st of July, from a low estimate, twenty-five hundred bushels had been killed. The labor required was paid for by the county commissioners, with the promise of being returned by the state, which was thereafter done. Later, it was determined to pay a bounty for catching and killing the hoppers, and one dollar a bushel was offered by the county commissioners. As the "hopper-dozers," the popular name for the ten-feet long sheet-iron pans which had proved so efficient, did not hold the insects that were swept into them, but allowed perhaps four-fifths of the number to jump from the oil to die thereafter on the ground, another device was resorted to. This was known as the "balloon hopper-catcher," and consisted of a frame of strips of wood, 18 feet long, to lie flat on the ground, and carrying upon it a large, loose bag of cheese-cloth, with a spout made of a sack

sewed into one corner. As this is drawn quickly over the ground by a horse, and the bag or balloon becomes inflated by the wind or draught, the "hoppers" are scooped up, or hop or fly into it. When the bag is filled, the insects are removed to other bags, in which they are tied up for convenient measurement. It worked admirably, and yielded golden returns. The fields were covered with hopper-catchers—men, women, and children—the latter using their aprons and shawls, and the women, table-cloths and sheets. The farmers gave up their usual work for this better remuneration. They would allow no one to share with them in the ingathering of this harvest, all intruders being warned away by such signs as these posted up in conspicuous places : "All hopper-catching forbidden on these premises," or "For the privilege of hopper-catching apply to —— ——." The crop was undoubtedly the best paying one that their lands had ever yielded. The number of bushels caught and measured in this manner, and paid for by the commissioners, was 14,357. The nearly \$15,000 required for the purpose was considered as money well expended. At the lowest estimate, the number of bushels of locusts killed in Otter Tail county, during the season, was thirty-five thousand. The total expenditures, under the different methods employed, was \$17,757 ; and, as the result, the crops of most of the farms were saved.

It having been found last spring (1889) that the eggs of the locusts had been mainly deposited in stubble-fields, and that in every case where such lands had been plowed, as the result of the deep burial of the eggs beneath the surface, hardly a locust had made its appearance, it was determined to plow all of the more badly infested fields, through the aid extended by the state, while continuing the use of the "hopper-dozers" on the less infested portions. All such fields as were found on examination to contain a large number of the eggs, if exceeding twenty-five acres (the smaller plots being left to the owners to plow), were condemned, and farmers living in the vicinity were invited to plow them within a given time. The plowing was to be properly done as supervised by the owner, to the depth of at least five inches, for which the laborer was entitled to draw his pay of \$1.25 per acre. This measure proved to be a complete success. No locusts hatched in the plowed fields. Where the young had emerged from the eggs, they were buried in the furrows and killed. The number of acres plowed as above, was 6,361—a trifle less than ten square miles. The entire expenditure for the season, including the "hopper-dozer" catching, burning over stubble and dead grass fields, poisoning with London purple, etc., was \$10,131.

As the result of the operations above narrated, the insect has been virtually destroyed throughout the infested districts. Comparatively few eggs were laid last year, and there is no apprehension of serious injury from the few survivors the coming season.

When you recall the fearful losses from this Rocky Mountain locust in some of the western states in former years that brought poverty and starvation to thousands of their people — estimated at two hundred millions of dollars in a single year (1874), in the four States of Missouri, Kansas, Nebraska, and Iowa, you can not but regard it as a triumph for economic entomology, that this great scourge, almost equaling in destructiveness, in years of its abundance the migratory locust of the old world, has been brought under control.

THE ENTOMOLOGICAL DIVISION OF THE U. S. DEPARTMENT OF AGRICULTURE.

I have on many former occasions felt it my duty and privilege to mention and commend the work being done by the Entomological Division of the Department of Agriculture at Washington. It well deserves the liberal support extended to it by our General Government, and the appreciation and encouragement which it is receiving from the present Secretary and Assistant Secretary of the Department. Its studies are thorough and of great practical value. Its publications are characterized by a merit that makes them eagerly sought for by entomologists throughout the world. Its collections—remarkably rich in biological material—its manuscript and other unworked matter relating to insect lives and habits, surprised me with their amount and richness when a short time ago I was able to look over a small portion of the accumulated store.

The Division has recently achieved a signal triumph, to which there is but time merely to refer, interesting as the recital of its story at some length would be.

INTRODUCTION OF PARASITIC INSECTS.

In 1868, a scale-insect, *Icerya Purchasi*, or, as it is popularly known from its peculiar appearance, "the cottony-cushion scale," chanced to be brought into California, on an Acacia from Australia. It multiplied, spread rapidly, attacked almost every kind of vegetation, but was especially destructive to orange trees. Its increase could not be prevented by any means resorted to, although aided by all the scientific skill that could be commanded. The orange trees were killed; entire orchards were taken up and devoted to other uses. The orange culture—so important an industry of the state—was apparently doomed.

It occurred to Dr. Riley, chief of the Entomological Division, that the ravages of the insect could be staid, if the natural parasites that had kept it from being a pest in its home in Australia, could be secured, brought to California, propagated in sufficient number, and then turned loose to seek their prey. After much labor and many disappointments, a small appropriation was obtained sufficing to defray the traveling expenses of two agents of the division. They were dispatched to Australia, where they were successful in procuring some of the parasites and predaceous enemies of the Icerya, and in sending them alive to this country. They were carefully cared for, propagated in confinement in large number, and then distributed throughout the infested districts. One of the imported species, belonging to the family of "lady-bugs" (*Coccinellidae*) has displayed wonderful powers of multiplication, and remarkable fitness for the work assigned it. From the 514 individuals imported last winter, in five different sendings, the present progeny may be numbered by the million.

The success of this measure has far exceeded the most sanguine expectations. It has been simply marvelous! The orange grower now points to orchards which were on the verge of ruin, where it is not easy to find a single living scale. The, perhaps, most pernicious scale-insect ever known to science, has been conquered, and seems doomed to a speedy extermination. The California fruit-growers are jubilant over the success of the first experiment of fighting an introduced pest by the importation of its natural enemies — often proposed but never before accomplished.

CULTIVATION OF INSECT DISEASES.

Considerable attention has been given by Professor Forbes and others to the contagious diseases of insects, to which some of our insect enemies have shown themselves to be quite liable. They have at times assumed an epidemic character, and have thereby proved highly beneficial in arresting serious and widespread ravages. It has been hoped that much might be accomplished by the distribution of insects infested with contagious disease to uninfested localities, and thus rapidly and greatly extend its sphere of operations. Experiments of this nature have been made the past year in Minnesota and in Kansas to utilize a fungus disease with which the chinch-bug has been recently attacked in some of the western states. In Kansas, numbers of the diseased bugs were collected, which being confined with apparently healthy ones, readily communicated their malady to them. When a sufficient quantity were obtained in this manner, distribution was made of them at various points along the railroads of

the state and other principal lines of travel. It is claimed that in almost every one of these localities the disease subsequently made its appearance, and it is believed that it was conveyed and quite largely extended through this distribution.

Lest I should weary you with details that may not be of general interest, I will not extend them, trusting that what I have already presented will suffice to show that economic entomology is not only a live science, but that it has attained a vigorous manhood, in which it is prepared to do its full share in the extension and promotion of the first and foremost of the great industries of our country—the agricultural.

LATE EXPERIENCES WITH INSECTS INJURIOUS TO THE ORCHARD AND GARDEN.

[From the Proceedings of the Western New York Horticultural Society, 1890. Read before the Society at its Annual Meeting, January 22, 1890.]

GENTLEMEN.— You will be glad to know that rapid progress is being made throughout the United States in the study of insects, particularly in that department of the science known as economic entomology, which has specially to do with our insect foes and insect friends, and how they are to be met. A great impetus has been given to the study through the establishment, in each one of the states of the Union, of an Agricultural Experiment Station, thirty of which, in consideration of the practical importance of investigation relating to insect pests, have enrolled an entomologist among their faculty. Some of these are among our most able entomologists. They have entered with ardor upon their work, and highly valuable results have been achieved. There is every prospect that within a few years nearly all of our most injurious insects will be brought under control.

The most promising feature in this "new departure" is the opportunity for experiment offered, whereby the value of any possible preventive or remedy may be tested, and any proposed remedy tried under the many modifications required by conditions of soil, climate, season, atmosphere, wet or drought, particular vegetation to be protected, etc. This recent large increase in the number of working entomologists, together with the favorable field for research and experiment presented in the farms connected with the Stations, has led to the organization during the year of an association known as the "Association of Economic Entomologists." Its title defines its membership. Its objects, essentially, are the insuring of such co-operation among its widely distributed members as shall result in the largest possible aggregate of benefit, through the discussion of best

methods of work, the announcement of proposed studies that unnecessary duplication may be avoided, and indication of special lines of desired investigation.

I have not dared to attempt, in the few hours that I have been able to devote to this paper, to give you what I would gladly have done had time permitted—a general summary of what has been accomplished by our entomologists during the past year in their studies of methods of dealing with the insects with which you are specially interested—those of the orchard and garden, which, by the way, embrace by far the larger number of our insect enemies. I can only refer to some of the results obtained through experiment, in several instances elaborately conducted, and mention some of the insect attacks of the year which may be of interest to you.

SPRAYING OPERATIONS.

Judging from present indications, the force-pump is destined, for the future, to play a prominent part in our operations against the insects of the orchard and garden—especially those of the former. It has assumed its present importance, from studies made within the last few years in insecticides, in simple methods through improved apparatus for their easy and thorough application, and the results that follow their use. The ease with which the codling-moth can be controlled, and apples grown of full size (the elements permitting), of perfect form, rich in color, of highest flavor, and of resistance to early decay, are a sufficient attestation to its value. When we add to this, that by its aid we hope soon to be able to bid defiance to the plum curculio, and control the ravages of almost every insect that feeds upon the foliage of our fruit trees, and of a large number of those that attack the products of our gardens, I feel justified in saying that no orchardist or horticulturist can afford to do without a force-pump; it would be costly neglect. Insecticidal spraying, compared with old methods of fighting insects, as pinching by hand or distributing poisons with a sprinkling-pot, is as the Gatling gun in comparison with the old flint-lock musket.

The experiments made at the Experiment Stations show conclusively that in spraying with the arsenical poisons, much stronger mixtures have been used than are necessary, and that in no case need they exceed the strength of one pound of the arsenite to 200 gallons of water. As the foliage of fruit trees has at times been injured to a greater or less extent by the insecticides employed, it is very desirable that the minimum amount of the arsenite should be used that will suffice for its purpose. Experiments for determining this will be a portion of the work for the present year. It would seem that the

arsenities are more liable to injure the foliage when it is more advanced than when it first puts forth. If this shall be established, later sprayings should be of reduced strength.

The different fruit trees show different degrees of susceptibility to the poisons. It appears that the apple and cherry are the least affected, the plum is more susceptible, and the peach the most readily injured. For plum trees one pound of the arsenite to 250 or 300 gallons of water should be used, while for the peach, a dilution to at least 300 gallons [for Paris green, and 400 gallons for London purple] is recommended. It is probable that further experiments will show that while Paris green is preferable for use on one or more of the fruit trees, London purple is less harmful to others, and the reverse.

Different results with reference to injury to foliage have been obtained through spraying at different hours of the day, and under different atmospheric conditions.

Although there has been some conflicting testimony, it would seem that white arsenic may not be used with safety, and certainly not when it has been dissolved by boiling or otherwise.

SPRAYING WITH WATER.

With merely mentioning, in passing, other principal insecticidal liquids that are employed in spraying, such as kerosene emulsions, alkaline solutions, pyrethrum water, tobacco water — each of which has certain adaptation to certain insect attacks, I will ask your attention to a method that has been brought to our notice within the past year as having proved efficient in arresting the injuries of one of the chief pests of rose-growers — the rose-slug, *Monostegia rosæ* (Harris). We are indebted for it to Mr. L. O. Howard, first assistant of the entomological division at Washington. I quote a communication recently made by him to *Orchard and Garden*.

I enjoyed fighting the rose-slugs in my garden last summer, particularly as they were so easy to kill. It was an old garden with many varieties of roses. During the early summer there was abundant rain and I did not bother myself one way or the other about the plants, as they bloomed plentifully and looked green. But when a dry spell came, the leaves turned brown at once, and an examination showed them to be covered with slugs of all stages of growth. I sprayed them with a tobacco-soap solution which killed them at once, but stained all the petals brown at the tips. I puffed on pyrethrum mixed with spoiled flour, which also killed them, but pyrethrum is rather expensive. I dusted them with sifted coal ashes, which also killed them, but it made the bushes look nasty. As the drought continued I brought out my hose, and discovered, to my delight, that a strong stream of water directed on the foliage each evening was the most efficacious and the neatest remedy that I had yet found. During the remainder

of the season the bushes were green and beautiful, and free from slugs. This strong stream of water I found was a most admirable thing. It blew the plant-lice off my currant bushes; it thoroughly discouraged the web-worm on my shade trees; it made the little ants which build their little mounds on my lawn and in the cracks of my brick wall, tired of life; and, best of all, it broke up the nests and completely disheartened the English sparrows which built in the ivy and over the windows of my house. Where it is available, therefore, pure water, "without trimmings," when thrown with a sufficient force, is a good insecticide.

I would heartily indorse the above communication of Mr. Howard. I have every confidence that a rather coarse spray of water thrown with force will serve to rid us of the injuries of many other pests than those above named. It will be efficient against the little white rose-leaf hopper—probably the *Tettigonia rosae* of Harris (which, as Mr. Uhler has informed me, belongs to the genus *Anomia*, and is distinct from the European *rosae*). It should also be equally efficient against the several species of small leaf-hoppers, *Erythroneura vitis*, and others, that infest the grapevine, particularly if employed against them in the early larval stages. It should be destructive to all of the plant-lice that can be directly reached by the spray. The efficiency of rains in arresting attacks of the apple-tree aphis and the hop-vine aphis has long been known. If these delicate insects can be knocked from their food-plant while their beak is inserted into it, the smallest portion of the tip of the beak left behind them in the plant would prevent further feeding and necessarily prove fatal to them.

FUNGICIDES AND INSECTICIDES COMBINED.

The multiplication and extension within a few years of plant diseases, which have been ascribed to high culture, large production, and extended areas devoted to special crops, have rendered it necessary that these, as well as insect ravages, should enlist the attention of, and be earnestly fought by, the horticulturist. Many of these diseases among those which are of a fungoid nature, promise to be controlled, if not conquered, by the use of the Bordeaux mixture.* If the fungi and the insects could be simultaneously controlled, it is evident that time, labor, and expense would be saved. The advantage resulting from combining London purple with Bordeaux mixture in killing the Colorado potato-bug and preventing the potato rot, has been shown in experiments made; and there is every reason to believe that other insects and other fungoid attacks may be similarly treated with great success.

* Of the different formulæ for this, perhaps the best is: Six pounds of sulphate of copper dissolved in 4 gallons of hot water; 4 pounds of lime dissolved in 4 gallons of cold water; mix and dilute with cold water to 22 gallons.

CARBOLIZED PLASTER PREVENTIVE.

Plaster of Paris has frequently been used to prevent insect depredation, but it is doubtful if it would be more efficacious for this purpose, when applied to fruit trees, than ashes or road dust. From some experiments in protecting plum trees from curculio attack, carbolized plaster, made by combining one pint of crude carbolic acid with fifty pounds of plaster, has shown such beneficial results that the method merits additional trials. It may prove a valuable preventive of the depredations of the rose-bug, *Macrodactylus subspinosus*, from which, as yet, we know of no satisfactory means of protection.

STUDY OF THE ROSE-BUG.

The recent working out of the life-history of this great pest of the fruit-grower and florist, by the Entomological Division at Washington, will, it is hoped, when published, aid materially in operations against it; but I have long thought that our best success in contending with it is to be found in the study of its particular breeding grounds. It is known to be a local insect, appearing suddenly in immense numbers, in particular localities only, and there is, therefore, reason to believe that it has its particular breeding grounds. In one instance, at least, such a source for it has been known and observed for many years. Mrs. Lucy G. Chrisman, of Chrisman, Va., with whom I have exchanged several letters on the subject, informs me that year after year the rose-bugs may be seen coming in myriads from a bush-covered, swampy or marshy soil, of sand that is always wet, and which had, evidently, in former years, been a bend in the river, now cut off by a change in the channel. They are annually true to their appointed time of appearance almost to a day, and true also to their line of flight, which she has kindly mapped out for me, and represents as being in a body about five hundred feet broad, moving up the old river bed the first day as far as a church indicated in her sketch, about a mile from the swamp, and flying quite low. The second day they rise higher in their continued flight, spreading somewhat, and reaching certain points beyond (indicated) in one, two and three days thereafter. I hope, later, to compile from Mrs. Chrisman's letters the interesting observations made by her and gathered from her friends, of the breeding ground, flight, limitation to sandy soil, feeding and other habits, which she has very kindly given to me. [*]

In the necessarily hurried preparation of my Annual Report for the last year, which was handed in for printing in December last,

[* An admirable study of the Rose-bug has since been made by Prof. Jno. B. Smith, of the New Jersey Agricultural College Experiment Station, which has been published as Bulletin No. 82, July, 1891, of that station: pp. 40, figs. 10.]

several of the insect attacks of the year, to which I had given attention, were not mentioned. May I briefly refer to a few of them here. They will be mainly of fruit insects.

COLEOPHORA SP.—A NEW PEAR INSECT.

On June 8, 1888, Mr. P. Barry reported to me that the newly-set pears of the Mount Hope Nurseries had been vigorously attacked by a new enemy, a queer-looking form, which was found with one end inserted into the fruit. Examples were subsequently sent, when the depredator was found to be the larvae of a small Tineid moth, of the group known as "case-bearers," from the small case which they construct for their covering while in the caterpillar and pupal stages—sometimes cylindrical, sometimes ellipsoidal with a smooth or ridged surface, in others horn-shaped, and indeed, assuming various forms. The case is never deserted by the larva, but is carried about upon its body, thrusting out its head to feed, and in this instance burying its head and front segments into the fruit, with the case projecting therefrom and appearing as if a small twig had been stuck into the pear.

Specimens of the fruit submitted showed that the operations of the caterpillar consisted in boring numerous round holes of about the diameter of its body (that of an ordinary pin) to the depth that it could protrude from its case. Withdrawing itself, it would remove a space and again burrow into the fruit. Many of these holes had been made in each pear. One of the pears received, of only one-half inch in diameter, showed, by count, forty-four of the borings. The necessary result of such an attack was the destruction of the fruit, it becoming with its growth gnarled and wholly unfit for use.

The detection of this attack is undoubtedly the explanation of many of the scars and unsightly deformations of apples and pears, which, from the entirely different character presented at a later stage of growth, had long been a perplexing mystery to me, not being able to refer it to any known insect. A month later, July 9, some Duchesse pears, of about an inch and one-fourth in diameter, were received from J. F. Rose, of South Byron, N. Y., which were sent as a sample of his crop, which had been rendered worthless from its scarred and gnarled condition. I recognized the injury as having been caused by the Coleophora. Some of the spots retained their original round form, while others had become elongated, triangular, lozenge-shaped, or of irregular forms, as the result of the growth of the fruit. The margins of the scars were blackened, elevated, and the somewhat enlarged interior contained pale, yellowish, granulated matter. From twenty to thirty

of the scars occurred on each pear, and several of the same character on the stems. [*]

It is quite probable that this Coleophora attack will prove to be widespread and the cause of injury frequently observed but not hitherto traced to its source from the early period at which it is made. The insect seems to belong to the genus *Coleophora*. The species has not yet been determined. From the half-dozen cases sent me, two of the insects were successfully carried to their perfect stage, and are now in the State collection. The larvae ceased feeding and fastened their cases on end to the bottom of the box containing them on June 13th. The first moth emerged twelve days thereafter, and the second on July 7th.

Should the insect appear in injurious numbers hereafter, it could be destroyed by spraying with an arsenite soon after the setting of the young fruit.

THE PEAR-BLIGHT BEETLE.

The "pear-blight beetle," *Xyleborus pyri* (Peck) appeared in great abundance in a pear orchard of Mr. Norman Pomroy, of Lockport, N. Y., in the spring of 1888, where its operations were so severe that the orchard consisting of young trees, was nearly ruined by it. The attack had assumed a different character from that usually ascribed to it, for instead of the burrows of the insect running upward or downward, in this they were mainly horizontal, and carried around the trunks or limbs of the young nursery stock so as to nearly girdle them and permit of their being easily broken off by hand. All of the trees attacked were killed, and were either pulled up when they were seen to be dying, or sawn off below the lowest burrows, which in many cases was near to the ground. These latter, subsequently made a vigorous and healthy growth. The injuries of this beetle have long been known, but thus far we have been without its life-history. Nothing, so far as I know, has been published of its early stages. As Mr. Pomroy who kindly sent me some of the infested material from Lockport, claims to have seen the insect in its egg and young stages, I extract portions of his letter, containing also, interesting notes of habit, that they may be compared with observations of others that will be made hereafter.

Writing under date of June 5th, 1888, he states: "I find by close inspection, the eggs as well as the young. By cutting carefully into the burrow the bottom of the hole is found to be full of eggs and young ones." Under date of June 13th, the following: "When the

[*]A portion of this injury, it was subsequently learned, was inflicted by one of the plant-bugs, *Lytta invictus* Say, as will be related in the Report of the Entomologist for the year 1891.]

trees were seen to be dying and I commenced to pull them up (presumably about the middle of May, when inquiry was first made of the insect), the ground beneath was noticed to be covered with sawdust, and examining for the cause I found the trees full of holes. Sitting down and watching the holes I saw the dust dropping out of them. I only saw one of the beetles out of the holes and that was walking around on the tree. At the bottom of the holes they have made a side-cut and lined it with a white substance for their young to eat. If you take your knife you will find this side-cut and the eggs, if they have not hatched; if they have, then the young will be there. Professor Lewis of the Union School examined a limb and found the side-cut full of eggs.

"I send a short piece of the body of a tree, that you may see that they like the trunk as well as the limbs.

"The tree leafed out, but in a few days the leaves wilted. I carried a couple of the trees to the Farmers' meeting at Cambria Center, which was held a day or two after I found the insects in them." (The meeting was on May 25th.)

I am sorry to have to state that pressing engagements prevented my examination of the infested material sent me, and the opportunity for examining the eggs, if present, and the young and their feeding habits was lost. There must, however, have been some error in the observations as reported to me, for instead of the young beetles occurring in association with the eggs, it should have been the larvae—or grubs, as generally known. Possibly the pupæ may have been mistaken for eggs.

In the latter part of September—26th—there were discovered upon the hearth-tiles of my office, where the bundle of infested branches had been placed at the time of its reception, a number of beetles that had emerged—ten males and ten females, most of which were alive. Cutting into a few of the burrows, some of them disclosed the peculiar white lining above referred to, but no living presence. A few words in reference to this white substance: It was of a yellowish-white color, solid, exceeding in thickness that of an ordinary sheet of writing paper, rather smooth when apparently undisturbed, but quite roughened where it had probably been more or less eaten. In a letter recently received from Miss Ormerod, the accomplished entomologist of the Royal Agricultural Society of England, in mentioning serious ravages on plum trees in England during the past year from *Xyleborus dispar*—possibly identical with our *X. pyri* [*]—Schmidberger is

[*It has since been ascertained that the two are identical, and the name of *pyri* will have to give way to the earlier one of *dispar*.]

quoted as of the opinion that the larvæ of this species feed on a whitish substance in the mother galleries. Miss Ormerod had observed the white linings in the tunnels of the *X. dispar*, but it seemed to her to be a mould, such as other observers have thought to have noticed in the galleries of Coleopterous larvæ allied to *dispar*, and on which they apparently fed. The limited observations that I have made, lead me to believe that further examination and study will show it to be a special secretion by the female or the parents, to serve as food for the young, and that it constitutes the only food of the larvæ, living as they do within chambers excavated for them, and not tunnelling separate galleries.

At the time above mentioned the burrowed branches were cut in pieces and inclosed in a case to secure such beetles as might thereafter emerge. On December 18th, following, I took from the case 33 male beetles and 293 female—all dead; December 24, ten females—one alive; February 11, 1889, 18 females—all dead and the last to emerge. The material is retained for further study of the burrows.

The above recital well illustrates how much there is still to be learned of our common insects, and may also serve as an apology for the entomologist's inability at times to offer remedies for their ravages. This "pear-blight beetle," destructive also at times to apple, plum, and apricot stock, was described and its operations observed as long ago as the year 1817, and has since been frequently written of; but up to the present day it has succeeded in concealing its early stages from us. Still more strangely, the male sex of the species had never been recognized or known to science until found by me among the large number of beetles reared from the Lockport pear trees.[*] Another species, *Xyleborus obesus* of LeConte, had been thought by Schwarz and others to be the male of *X. pyri*, but it now proves to be quite distinct. The two sexes differ so markedly that they may be separated at a glance without the chance of error. The abdomen of the male is only about one-half so long as that of the female, its thorax is less rounded and elevated, and the head is porrected (bent downward), at least after death, so as to form quite a curve with the body. Examples of the male have been contributed to the cabinet of our principal Coleopterists, and others will be sent to those who value them.

Since the above was penned, Mr. Pomroy has written me in reply to inquiries made, that the "young" to which he referred were the young grubs of the beetles. He commenced to find the grubs and the eggs

[*] This requires correction. *X. dispar* had been known in Europe for many years, in its early stages and in both sexes. The rarity of the male had often been stated.]

about the first of June. [Probably he did not look for them earlier.] The eggs were quite small, of a whitish color, standing on end side by side to the number of six to eight, in a side chamber. A magnifying glass was used in their discovery. As near as he could determine by the aid of the glass at his command, the grubs were feeding and living on the white substance lining the chambers.

A NEW DEPREDATOR ON QUINCE BLOSSOMS.

From Mr. A. H. Briggs, of Macedon, examples of a species of snapping-beetle were received on the 20th of May, 1889, which, during the preceding four years, had been so abundant and injurious to the blossoms of his quince trees that he had been obliged to go over the trees daily and knock the beetles into a pan of kerosene and water. "From three small bushes frequently a hundred would be taken, and often five or six would be working into the heart of one bud, and apparently fighting one another in their eagerness to enter it. Their attack usually began before the blossom-bud had opened, or immediately thereafter, and continued until it was destroyed." Until the present year, when the insect was less numerous than heretofore, he had been able to save but few buds from its attack. The same insect had made its demonstrations on the trees of Rev. Dr. Jacques, while four years previously residing at Macedon Center, and had been fought by him with Paris green mixed with flour.

My identification of the beetle as *Limonius confusus* LeConte, was subsequently confirmed by Dr. Horn; but the injury to the blossoms reported of it was questioned, and further examination asked for. Upon submitting the doubt to Mr. Briggs, answer was returned that there was no possibility of a mistake, as he had often watched their feeding, and that those sent me had been taken by him from the blossoms while eating the petals. Dr. Horn entertained the opinion that many of the Elaters (snapping beetles), were predaceous in their final winged stage, although vegetarians as larvae. While he had recorded *Limonius 4-maculatus* from the blossoms of *Aesculus*, he was not aware that they fed on the flowers—possibly on insects within them.*

THE PEACH-BARK BORER.

Some small bark-boring beetles were received October nineteenth from David Huntington, of Somerset, Niagara county, N. Y., taken from the bark of a peach tree affected with "the yellows," accompanied with the inquiry of name—if they caused the yellows, and

[* Prof. F. M. Webster has observed *Limonius auripilis* Say feeding upon ripe raspberries in the month of July. *Insect Life*, ii. 1889, p. 258.]

the remedy for their attack. Reply was made that they were a species of the Scolytid bark-borers, known as *Phlaeotribus liminaris* (Harris). In writings upon it, it has been given the common name of "the elm-bark beetle;" but it has been recently ascertained that it does not infest the elm, but that another form closely resembling it, viz., *Hylesinus opaculus* Lec., had been mistaken for it. It is a well-known pest of peach trees, and was formerly supposed to be the cause of "the yellows;" but its only connection with it is that it is frequently found in trees that have become weakened and sickly through the disease. All of these Scolytid bark-borers, from their concealment and habits, are difficult to reach and kill, and we know of no satisfactory methods at present of dealing with them. Whenever a tree has become badly infested, it should be promptly taken up and burned. I have requested of our State Station at Geneva that experiments be made in the application of kerosene to the trunks and limbs of trees, at different seasons of the year, to see if it may be done with safety. If it shall be found that kerosene—one of our most efficient insecticides—may be freely applied without harm to the tree, then I trust that we shall be able to kill the bark-borers in whatever stage they may be occurring within or beneath the bark.

This insect seems to be increasing in the State of New York. Some notes upon it, descriptive of its galleries, etc., may be found in the *Fourth Report on the Insects of New York*, 1888.

THE CHERRY-TREE SLUG.

The cherry-tree slug, *Eriocampa cerasi* (Peck), has, during the last year, and for several preceding years, been very prevalent and injurious at, and in the vicinity of, West Farms, N. Y. As reported by Mr. James Angus, the foliage has been so riddled by the feeding of the well-known brown, slimy, slug-like larva, that a perfect leaf could with difficulty be found. There is no need of injury such as the above, for the larva can be readily destroyed by spraying with hellebore in water—an ounce of the powder to two gallons of water—or by dusting the foliage with fresh air-slaked lime.

THE CurrANT-STEM GIRDLER.

The operations of this insect are recorded in my Fourth Report (page 47), as follows: "A short distance below one of the larger leaves of a tip, five or six sharp, somewhat curved cuts could be seen, encircling the stalk, and from their depth, nearly severing it, causing the tip to fall over and hang by only some small points of attachment. Later the tip breaks off and falls to the ground. The attack, while allied to that of the raspberry-stem girdler, is quite distinct."

I have not been able to find the author of this, apparently, new form of injury. Mr. A. H. Briggs, of Macedon, N. Y., has kindly sent me pieces of currant-stems thought to have been girdled by the insect and to contain the larva, but I was unable to find any living form within them.

THE GRAPEVINE FLEA-BEETLE.

An unusual number of inquiries have been received during the spring and summer of the grapevine flea-beetle, *Haltica chalybea* Illig. Either the conditions have been more favorable for it, or it is becoming a more formidable pest of our grape-growers. Wherever it makes its appearance effort should be made to destroy the beetles during their hibernation, by burning or removing their ordinary winter quarters, as in the rubbish of the vineyards or the loose bark of the posts. In the early spring, when they first make their attack on the buds to which they are so destructive, they should be knocked off daily into a pan of water and kerosene, or jarred to the ground and crushed, or a poisonous liquid applied to the buds. The ravages of the larvae, at a later period, may be controlled by Paris green. [In the accompanying figure, the larvae and the beetles are represented in their natural sizes, feeding upon a twig of grapevine.] Mr. George C. Snow, of Penn Yan, N. Y., has sent me an insect which he detected preying upon the larva by sucking its juices. They were Hemipterous, belonging to the plant bugs, of which so many are known to be valuable aids to us in the destruction of our insect foes. As I could not recognize it in its pupal stage in which it was received (June 26th), it was submitted to Mr. Uhler, and was referred by him to the genus *Podisus*, and probably of the species *modestus* (Dallas).



FIG. 40.—The larvae and the adults of the grapevine beetle *HALTICA CHALYBEA* operating on grapevine leaves.

A NEW ROSE PEST.

A destructive borer of the tips of rose bushes has made its appearance at Ausable Forks, N. Y., during the past summer, which has only been observed in its larval stage, and therefore can not be named at present. It apparently belongs to the *Tenthredinidae*, or saw-flies. Its form of injury is to commence at the extreme tip and burrow downward several inches, consuming the entire interior of the stem. Some of the infested tips were sent to me during the month of June, and were inserted in damp sand for maturing the larvae which they might contain. On June twenty-seventh, two had completed their growth and burrowed into the sand, where they have formed cocoons of the general shape of those of the currant-worm, and measuring four-tenths of an inch in length; but it is quite doubtful if they can be carried through to their perfect stage, as hibernating larvae of the saw-flies are difficult to rear.

The lady sending them has written: "About twenty years ago my garden roses were infested by this same borer. I fought them with knife and fire for four or five years, and rid myself of them entirely, and had never seen one since until this year. I have not been able to find a fly or a beetle on the bushes uncommon enough to think it the cause. As yet, tea and green-house roses in open ground are exempt."

Mention is made of the above, and of the other attacks, the authors of which are unknown, in the hope that whenever they may come under observation the opportunity will be embraced to give them such study as will lead to their identification and a knowledge of their entire history, that we may know how to deal with them.

VARIOUS ATTACKS OF FRUIT INSECTS.

Several other attacks have come to my knowledge during the past year, to which there is no time to refer at length, but which deserve to be put on record.

The Apple-leaf Bucculatrix.—This, at times, destructive insect, known to science as *Bucculatrix pomifoliella* Clemens (see *First Report on the Insects of New York*, 1882, pp. 157–167), which seems to display a partiality for the orchards of western and central New York, has attacked the trees of W. J. Strickland, of Albion, Orleans county, N. Y. Twigs infested with the cocoons were sent to me October twenty-fifth.

The Apple-leaf Miner.—The larvae of the apple-leaf miner, *Tischeria malifoliella* Clemens, actively engaged in running their curious mines within the leaves of apple-trees on the grounds of State Botanist

Peek, at Menands, Albany county, N. Y., were received on September tenth. By holding to the light, the little caterpillar was plainly to be seen actively mining within. The blotches made by them appeared of a brick-red color, on the upper side of the leaves.

The Hickory Tussock Caterpillar.—From Pawling, Dutchess county, N. Y., Mr. Ira W. Hoag sent a colony of the young larvæ of the hickory tussock, *Halisdota caryæ* (Harris), taken from a cherry tree. They also occurred on several of his apple and pear trees. From a small pear tree "nearly a pint" (many hundreds at their then small size) was taken. When disturbed they dropped by a thread and hung suspended. Shaken upon a sheet their quickness of motion made them difficult to kill. (They could easily have been destroyed by first saturating the sheet with kerosene.) This insect has not been recorded as a pest of fruit trees, having usually been confined to forest and shade trees, as walnut, butternut, elm, and ash.

The Oblique-banded Leaf-roller.—Serious injury was inflicted in a pear-block at Seneca Falls, N. Y., during the month of May, to certain varieties of pears, by a small caterpillar eating into and destroying the buds, and later, by spinning together, and feeding on, the young leaves. It had prevailed for a few years preceding. The larvæ sent to me were those of one of the Tortricid moths, and apparently that of *Caccacia rosaceana*, but I was not successful in obtaining the moth for positive identification. This species—"the oblique-banded leaf-roller"—is a common pest of our fruit trees, roses, strawberry, and a number of other trees, shrubs and plants. The remedy for it would be spraying with an arsenical liquid at its earliest attack upon the buds, before it conceals itself among the leaves.

The Eye-spotted Bud-moth.—Pieces of the new growth of plum trees were sent, June fourteenth, from the nurseries of T. C. Maxwell & Bros., at Geneva, burrowed into by a small caterpillar, which is believed to be that of *Tmetocera ocellana* (Schiff), although the larva may not properly be described as cylindrical, its head being about one-third the diameter of the body, and the central segments the broadest. In two of the tips examined the larva had burrowed just at the commencement of the new growth upward for about a half-inch, and in another, at the extreme tip from the terminal leaves downward for more than an inch. The lower burrows were filled with gum—the upper one with rounded pellets of excrementa.

The V-shaped Tortrix.—Young pears, into which large holes had been eaten, even extending into the seeds, and in some of the examples embracing nearly one-half of the pear, were received, together with the caterpillar feeding upon them, June thirteenth, from Mr. P. Barry,

of Rochester. The caterpillar changed to a pupa within the leaves of the pear, and on June twenty-fifth gave out the moth, which proved to be *Cacecia argyrosipa* (Walker)—the *Tortrix furvana* of some authors, and the *T. V-signata* of Packard, whence we have the common name above given. It is reported as having been bred from rose, apple, hickory, oak, maple, elm, and cherry. It has not been recorded previously from the pear.

A New Enemy of the Currant-worm.—A large plant-bug was discovered by Mr. Samuel G. Love, of Jamestown, N. Y., with its beak inserted into currant-worms *Nematus ventricosus*, sucking out their juices and killing numbers of them. When received by me, they were in their pupal form. They were fed on currant-worms until they transformed to the perfect stage, permitting of their identification as *Podisus cynicus* (Say), after which they were released to feed at large, in the hope that their progeny in coming years would inherit a special fondness for the food of their ancestors, and thus aid in the work of bringing under control that annoying garden pest, the introduction of which into this country from its native home in Europe, it is said, is chargeable upon a prominent member of the Western New York Horticultural Society. But this was in the infancy of your Society, and we trust that since then—during a term of years exceeding the average length of human life—you have accomplished sufficient good to atone, over and over again, for the commission of so great an evil—innocently done. Enterprise often leads us into danger and harm.

(C)

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST.

The following is a list of the principal publications of the Entomologist during the year 1890—sixty-one are named—giving title, place and time of publication, and a summary of contents. A similar list for the years 1878 and 1879 is appended:

Gypsy Moth in Medford, Mass.* (Country Gentleman, for January, 23, 1890, lv, p. 69, c. 2, 3—26 cm.)

As comment on a notice in the New York World on the introduction in Medford of the European gypsy moth, *Ocneria dispar*, and the alarm occasioned by it—opinion is expressed, that even if it should become widespread, it will not “cause more havoc than the Colorado potato-beetle,” based on reasons given. Prompt and energetic action should, however, be taken to arrest its spread, and exterminate it in its present limited locality, through measures recommended in a late Bulletin of the Hatch Experiment Station, by Professor Fernald.

[See pp. 302-304 of this Report.]

Insect Pests of the State [of New York]. (Albany Evening Journal, for January 23, 1890, xxxiv, p. 3, c. 4—12 cm.)

In an extract from an address before the Albany Farmers’ Institute, held the above date, the operations of the grain aphid, the hop aphid, fruit insects, shade tree defoliators, the grapevine flea-beetle, and other insect pests of the past year, are noticed.

Mites Infesting Smoked Meats. (Orange Judd Farmer, for January 25, 1890, vii, p. 63, c. 1, 2—20 cm.)

Mites infesting smoked hams in a provision house in New York city were identified as *Tyroglyphus siro*. The meat had probably become infested in a western packing-house whence they came. Dipping in a bath of one part of carbolic acid to one hundred parts of water, recommended for destroying the mites.

[See *Fifth Report on the Insects of New York*, 1889, pp. [149]–[151].]

Useful Insects. (Country Gentleman, for February 27, 1890, lv, p. 170, c. 3—8 cm.)

Insect eggs from Waverly Mills, S. C., “occurring in numbers on pear trees,” are those of the Carolina Mantis, also known as the praying

*The capitalizing of the *Country Gentleman* is retained herein, in the citation from it of titles of publication.

Mantis. Its eggs should not be destroyed, as the insect is carnivorous and consumes many injurious insects. A packet from a plum tree, also sent, is composed of the cocoons of a species of *Microgaster*, which is another useful insect.

A Singular Fly. (New York Times, for April 14, 1890, p. 5, c. 2—12 cm. Albany Daily Press and Knickerbocker, for April 15, 1890. Plattsburgh [N. Y.] Morning Telegram, for April 23, 1890.)

Examples of a small fly received from a lady [Mrs. H. D. Graves] in Ausable Forks, N. Y., are recognized as *Chloropisca prolifica* Osten Sacken. They entered the house in September, 1889, and are now appearing in one of the rooms by thousands. They were first observed eight years ago, and have annually appeared since then in August. This is the third known instance of the fly infesting dwelling-houses, the other two being at Franklin, N. H., and Alfred Center, N. Y. Reference is made to similar gatherings of allied species in European countries.

[See extended notice in pp. 234-241 of this Report.]

Fighting the Insect Pests. (Albany Evening Journal, for April 16, 1890—44 cm.)

Report of a paper read before the Albany Institute, April 15, 1890, noticing: hopeful progress in the study and work of economic entomology; the grain weevil and hop aphis; the chinch-bug; the gypsy-moth; the cow-horn fly; insecticides and the protection of crops; importation and propagation of insect parasites; an example of practical work; diffusion of insect diseases, etc.

Late Experiences with Insects Injurious to the Orchard and Garden. [Read before the Western New York Horticultural Society, at its Annual Meeting, January 22, 1890.] (Proceedings of the Western New York Horticultural Society, at its Thirty-fifth Annual Meeting, January 22, 23, 1890, pp. 16-35.) Also, in separates, pp. 20 [April 22, 1890].

Treats of: Spraying with arsenites, and with water only: Insecticides and Fungicides combined: Carbolized plaster preventive: Study of the rose-bug: Coleophora sp. as a new pear insect: the "pear-blight" beetle: a new depredator on quince blossoms: the peach-bark borer: the cherry-tree slug: the currant-stem girdler: the grapevine flea-beetle; and various attacks of other fruit insects.

[See pages 342-356 of the present Report.]

Spraying for the Curculio. (Country Gentleman, for April 24, 1890, lv, p. 329, c. 1-2—22 cm.)

Spraying would be effective even before the falling of the blossoms—on the first appearance of the insect abroad. London purple spraying last

year was often followed by badly affected foliage, owing in many cases to plant diseases and not to the arsenite. Paris green growing in popular favor. Importance of continual agitation of the Paris green mixture. Strength in which it may be used upon different trees.

[See pages 290-292 of this Report.]

Apple-Tree Insects. (Country Gentleman, for April 24, 1890, lv, p. 329, c. 2—12 cm.)

Cocoons of the apple-leaf Bucculatrix, *Bucculatrix pomifoliella* Clemens, containing the pupæ, are identified from [Canastota] Madison county, N. Y.; also the eggs of the apple-tree tent-caterpillar, *Clisiocampa Americana*, from which the caterpillars are hatching. The remedies for these two orchard pests are given.

Poisoning Insects. (Country Gentleman, for May 1, 1890, lv, p. 347—10 cm.)

Directions are given for mixing Paris green and London purple in water for spraying purposes, and strength in which they may be safely used. Importance of thorough mixture by constant agitation, as shown in experiment made with its rapidity of settling when at rest.

[See pages 292, 293 of this report.]

The Fly *Chloropisca Prolifica*. (Country Gentleman, for May 1, 1890, lv, p. 349, c. 2, 3—42 cm.)

Observations on the habits of the fly at Ausable Forks, N. Y., made by a correspondent [Mrs. H. D. Graves]. Effort being made to rear it on grass sod. Notices of its occurrence at Franklin, N. H., and at Alfred Center, N. Y. Its European gatherings and particularly in the Observatory at Warsaw, Russia. The chief points of interest in the insect. A brief description, that it may be recognized, if seen elsewhere.

The Voracity of the Silkworm. (Albany Times, for May 8, 1890, p. 2, c. 3—9 cm.)

In reply to inquiry made by the Times editor of the truth of a paragraph which is going the rounds of the press, to the effect that the silkworm when first hatched only weighs one-fourth of an ounce, yet during its life of thirty-five days consumes between 3,000 and 4,000 pounds of leaves!—a gross misstatement is shown, in that the silkworm just from the egg weighs but the *one-hundredth part of a grain*, and its entire food is less than a half-ounce of leaves.

Spraying for Fruit Tree Insects. (Country Gentleman, for May 22, 1890, lv, p. 407, c. 4—22 cm.)

Inquiry is made for an insecticide that may be used in a vegetable garden against the various fruit tree insects, where it is thought that the arsenites might not be safe. In reply: The arsenites may be used without danger if not in overstrength (1 to 250), and only in a sufficient

quantity; they alone, are efficient against the codling-moth worm; for many other insects, kerosene emulsion and pyrethrum water will answer. Remarks on use of cold water for spraying.

Eggs in Plum Twig. (Country Gentleman, for May 22, 1890, lv, p. 407, c. 4—6 cm.)

A deposit of eggs, received from Dey's Landing, N. Y., inserted in a row about a half-inch long, and disclosed to view by the splitting of the bark, are doubtless those of some "tree-hopper," allied to *Ceresa bubalus*, but are not recognized. No description of them is found. Have been tied to a plum tree in the hope that they may be reared. [They failed to develop.]

The Australian Lady Bug. (New York Times, for May 23, 1890.)

Examples of *Vedalia cardinalis*, the Icerya scale parasite, added to the State collection. Its extermination of the Icerya scale. Proposition to experiment with it for destroying the maple tree scale, so abundant in New York.

[The Eye-spotted Bud-moth.] (Albany Evening Journal, for May 28, 1890, p. 6, c. 2—6 cm.)

The caterpillars of this insect are occasioning much damage in the apple orchards of New York, and its injuries are apparently on the increase. The proper remedy is spraying with Paris green or London purple at the first appearance of the blossoms or earlier.

Wire-worms on Cabbage. (Country Gentleman, for June 5, 1890, lv, p. 450, c. 4—13 cm.)

The thirteen wire-worms taken from one cabbage at Metuchen, N. J., are probably of the genus *Melanotus*. For information of, and remedies for, these insects, reference is made to the Country Gentleman, for November 29, 1888, p. 893, where other references are given.

Insect Strawberry Pests. (New England Farmer, for June 4, 1890, p. 1, c. 1—11 cm.)

A beetle devouring the foliage of strawberry plants in localities in Massachusetts is identified as *Paria aterrima* Oliv. Its history, from its first public notice in 1873, is given—reference to its literature and brief description. Associated with the above was a snout beetle, identified as *Otiorhynchus ovatus* (Linn.), which may probably be added to the list of forty-two species of strawberry insects previously recorded.

Grain Aphis. (Country Gentleman, for June 12, 1890, lv, p. 470, c. 3—12 cm.)

Replying to inquiry of an insect on rye, at Ridgewood, N. Y., which is *Siphonophora avenae* (Fabr.), no method is known by which to arrest a serious grain attack. Prof. Smith's recommendation of spraying with kerosene emulsion is referred to. Its usual parasitic attack in June may check it, as would also heavy rains.

Coleophora sp.—A New Pear Insect. (Popular Gardening, for June, 1890, v. p. 198, c. 1, 2—7 cm.)

Young pears in the Mt. Hope Nurseries at Rochester, N. Y., are attacked by a small case-bearing caterpillar which eats numerous round holes of the diameter of the case into the fruit and badly injures it in its subsequent growth. Early arsenical spraying would doubtless prevent the injury.

[See page 347 of this Report.]

The Pear-blight beetle. (Popular Gardening, for June, 1890, v. p. 198, c. 2—6 cm.)

Notices the attack of *Xyleborus pyri* in a pear orchard at Lockport, N. Y., in the spring of 1888, and the injury inflicted.

[See page 348 of this Report.]

Quince Blossoms Beetle. (Popular Gardening, for June, 1890, v. p. 198, c. 2—4 cm.)

A snapping-beetle [*Limonius confusus*] proved quite destructive to quince blossoms in the spring of 1889, at Macedon, N. Y., and had been injurious for the preceding four years.

[See page 351 of this Report.]

The Peach Bark Borer. (Popular Gardening, for June, 1890, v. p. 198, c. 2—3 cm.)

No preventive of the attack of this Scolytid borer (*Phloeotribus liminaris*) is known. Infested trees should be taken up and burned. It is apparently increasing in number in the State of New York.

[See page 351 of this Report.]

The Grapevine Flea-Beetle. (Popular Gardening, for June, 1890, v. p. 198, c. 2—5 cm.)

The best methods of dealing with this insect [*Haltica chalybea*] are given. A hemipterous insect [*Podisus sp.*] has been detected preying upon it at Penn Yan, N. Y.

[See page 353 of this Report.]

A New Enemy of the Currant Worm. (Popular Gardening, for June, 1890, v. p. 198, c. 2—4 cm.)

One of the large plant-bugs, *Podisus cynicus*, has been taken at Jamestown, N. Y., feeding upon and destroying many currant worms.

[See 356 page of this Report.]

Seventeen-year Locusts make their appearance. (Albany Morning Express, for June 13, 1890, p. 2, c. 5—14 cm.)

Capture of examples of *Cicada septendecim* reported at Tivoli, N. Y. The only brood to which they can be referred is that due on the Hudson river in 1894. But this insect is not known ever to have anticipated its

regular time of appearance by more than one year. They could not have been belated individuals of the 1889 brood (one of the six occurring in New York), for that is not found on the Hudson river.

In connection with the above, is given a report of their appearance at Galway [Saratoga Co.], N. Y.

A Grain Weevil Distributed. (Country Gentleman, for June 19, 1890, lv, p. 489, c. 1—16 cm.)

A sample of seed corn, badly infested with *Calandra oryzae* Linn., is received from Coxsackie, N. Y. The infested corn had been purchased of a New York firm. Its sale, by a respectable firm, was highly culpable, as its condition could and should have been known. It should have been consigned to the mill for feeding purposes, instead of distributing the pest to localities free from it.

Sheep Scab. (Country Gentleman, for June 19, 1890, lv, p. 493, c. 2—12 cm.)

Replying to inquiries: Sheep may become infested from a pasture where scabby sheep had run the year before. The remarkable vitality of the sheep-scab *Psoroptes equi*, is shown in an account of its living for two years between plates of glass. Horses are also liable to the infection from an infested pasture. How to disinfect barns from the scab insect.

[The Grain Aphid.] (New England Homestead, for June 21, 1890, xxiv, p. 216, c. 6—5 cm.)

The grain aphid is quite prevalent in rye fields in New York and New Jersey. An apparent blight in oats is believed to be caused by the same insect [subsequently ascertained to be associated in every specimen examined, with bacterial presence (*Jour. Mycol.*, vi, 1890, p. 72)]. For arresting the injuries of the aphid we must depend, at present, upon parasitic attacks. How the parasite attacks it.

[Insects Killed by Electric Lights.] (Albany Evening Journal, for June 26, 1890, p. 5—9 cm.)

Estimate from a count, in part, of the contents of an arc globe, in Albany, of the number of insects killed by one light in a single night (100,000), and what the insects were.

Rose Leaf-Hopper and Rose-Slug. (Country Gentleman, for July 3, 1890, lv, p. 538, c. 1—22 cm.)

Inquiry from Abington, Mass., of insects destroying the foliage of rose bushes and blasting the buds, is replied to, in identifying the "*Tettigonia rosae*" of Dr. Harris (belonging to *Anomia* and not identical with the *rosae* of Europe), and the rose-slug, *Selandria* [*Monostegia*] *rosae* Harris. The features of these insects and their operations are described and remedies given.

Sweet Potato Beetles. (Country Gentleman, for July 3, 1890, lv, p. 538, c. 1, 2—10 cm.)

The beetles sent from Red Bank, N. J., as destructive to sweet potato vines, are *Cassida nigripes* and *Coptocycla aurichalcea*. They feed also on the morning-glory; their peculiar larval appearance with their excremental covering noticed. They are seldom so abundant as to necessitate the use of insecticides.

A New Bug. [A Destructive Apple-tree Insect.] (New England Homestead, for July 5, 1890, xxiv, p. 232, c. 4—13 em.)

A caterpillar boring into the pith of the new wood of apple trees at Watertown, N. Y., and committing serious injury, is identified as the eye-spotted bud-moth, *Tmetocera ocellana*. It is briefly described, food-plants given; its feeding habits and injurles; its increase in Eastern United States; many reports of it the present year; when the moths appear, and a second brood. Spray with arsenites to kill it, and when.

The [Corn] Cut Worm. (Country Gentleman, for July 24, 1890, lv, p. 590, c. 1, 2—12 cm.)

A grub reported from Areola, Ill., and boring into early corn and eating the kernels—each ear containing one or more—is the boll-worm or corn-worm of the Southern States, *Heliothis armiger*. Attracting the moths to plates of vinegar and molasses when they are abundant.

See Country Gentleman, xlvi. 1881, p. 759, or 1st Rept. Ins. N. Y., 1882, pp. 116-126.

Locust-Tree Borer. (Country Gentleman, for August 14, 1890, lv, p. 644, c. 1—6 cm.)

Preventives of *Cyllene robiniae* attack, are washing the trunk of the locust with soap solution and carbolic acid mixed, and cutting out the young larvæ. Remedy, cutting down and burning badly infested trees.

Syrphus Fly. (Country Gentleman, for August 14, 1890, lv, p. 644, c. 3—4 cm.)

The rat-tailed larva of a Syrphid fly, found in a cow-stable at Schoharie, N. Y., may be a species of *Eristalis*.

[From other examples subsequently sent and reared, it proved to be *Eristalix tenax* (Linn.)]

Elm-Tree Beetle. (Country Gentleman, for August 14, 1890, lv, p. 644, c. 3, 4—10 cm.)

In answer to request from Nyack, N. Y., for a remedy for this beetle, directions are given for spraying the foliage, and recommendation made of killing the larvæ when they descend the tree trunks for pupation.

[Collections in Keene Valley, N. Y.] (Albany Evening Journal, for August 16, 1890, p. 6—6 cm.)

Brief notice of collections made in the Adirondacks by the State Entomologist, during July and August, and of a reported disease of pine-trees near Keene Valley.

Insect Parasites. (Country Gentleman, for August 21, 1890, lv, p. 662, c. 1—5 cm.)

The green grapevine Sphinx received from Geneva, N. Y., has been parasitized by *Apanteles congregatus* (Say), the cocoons and matured insects of which were in the box when received. For particulars of this common attack, see Fifth Report Ins. N. Y., 1889, p. [35] 177.

The Carpet Beetle. (Country Gentleman, for August 21, 1890, lv, p. 662, c. 3—4 cm.)

Insects from Dorchester, Mass., the neighborhood of which is reported "full of them," are the *Anthrenus scrophulariae*. Remedies: use of kerosene or benzine; leave carpets unnailed and make frequent search beneath the border for the larvæ.

[Severe Bite of a Horse-fly.] (Albany Evening Journal, for August 28, 1890, p. 8, c. 3—4 cm.)

A horse before a wagon, standing by the sidewalk in Central avenue, pranced and threw himself to the ground, from the pain of a bite of a horse-fly [*Tabanus atrata*] fastened to him. The fly, which was secured, was unusually large, measuring two and one-fourth inches in expanse of wings.

A Curious Jumping Gall. (Popular Science News, for August, 1890, xxiv, p. 119, c. 1—3—47 cm.)

To an inquiry from Weybridge, England, of a curious insect on a bough of May bloom, resembling a bud, answer is made that it is probably the bedeguar of the hawthorn, *Cecidomyia crataegi* Winnertz: note from Dr. Riley thereon. Other jumping galls are mentioned.

[See pages 308—310 of this Report.]

[The Midge or Punky of the Adirondacks.] (Albany Evening Journal, for September 5, 1890, p. 5, c. 2—9 cm.)

In reply to inquiry made of the name of the above insect, it is stated: "Midge" or "gnat" is too general a name for it; punky would be preferable, and it will be given in the forthcoming Century Dictionary. "The little gray gnat" would be a good designation for it. It belongs to the genus *Ceratopogon*, but is without a specific name. There may be different species of it, as there are of the Adirondack black-fly.

[Mites Infesting a Water-trough.] (Albany Evening Journal, for September 5, 1890, p. 5, c. 2—16 cm.)

Mites occurring at Schodack Center, N. Y., in large numbers in a barn-yard water-trough, are a species of *Bryobia*, and probably *B. pratensis*. [See pages 322, 323 of this Report.]

Spittle Insects. (Country Gentleman, for September 25, 1890, lv, p. 759, c. 4—22 cm.)

In answer to inquiries from Northampton, Mass., "spittle insects" and the spittle-like mass in which the larva lives are characterized. The manner in which the spittle is produced is given in a translation from DeGeer's *Mémoires des Insectes*.

A Mite Parasitic on the House Fly. (Albany Evening Journal, for October 1, 1890, p. 6, c. 2.)

Some flies from Gouverneur, N.Y., sent for examination, were infested with a red mite which is identified with *Trombidium muscarum* (Riley). Many of the flies in that place were similarly attacked. Another mite infesting flies, noticed.

The Pear-leaf Blister. (Country Gentleman, for October 2, 1890, lv, p. 781, c. 3, 4—35 cm.)

Pear leaves from Charlotte, N. Y., show a severe attack of this blister, which is described as caused by the gall mite, *Phytoptus pyri*. Remarks on the galls produced by the *Phytoptidæ*, and features of the mites. Remedies are to be found in sulphur applications, burning all the infested leaves, and heavily pruning the trees in winter.

Weevils in Rye. (Country Gentleman, for October 2, 1890, lv, p. 782, c. 2—6 cm.)

The weevil reported as infesting last year's rye in Denville, N. J., is probably *Calandra granaria*. It may be killed by placing an open vessel of bisulphide of carbon upon the grain in a tightly covered bin. Quantity of the liquid to be used.

Report of the State Entomologist to the Regents of the University of the State of New York, for the Year 1889. (Forty-third Report of the New York State Museum of Natural History for the Year 1889, pp. 99–206, figs. 1–25.) Separate: Sixth Report on the Injurious and other Insects of the State of New York [October 2], 1890, pp. 110, figs. 25.

The contents are: INTRODUCTORY. NOTICES OF VARIOUS INSECTS: *Eumenes fraternus* Say—The Fraternal Potter-Wasp. *Hypoderma bovis* (DeGeer)—The Ox Warble-Fly. *Drosophila* sp.—A Flour-paste

Fly. *Adalia bipunctata* (*Linn.*)—The Two-spotted Lady-Bird. *Dermestes lardarius* *Linn.*—The Bacon Beetle. *Agrilus ruficollis* (*Fabr.*)—The Raspberry Gouty-gall Beetle. *Coptocycla aurichalcea* (*Fabr.*)—The Golden Tortoise Beetle. *Coptocycla clavata* (*Fabr.*)—The Clubbed Tortoise Beetle. *Bruchus scutellaris* *Fabr.*—A Pea Weevil. *Hymenorus obscurus* (*Say*)—A Bark Beetle. *Meloë angusticollis* *Say*—The Oil Beetle. *Epicauta vittata* (*Fabr.*)—The Striped Blister Beetle. *Epicauta cinerea* (*Forst.*)—The Margined Blister Beetle. *Epicauta Pennsylvanica* (*DeGeer*)—The Black Blister Beetle. *Pomphopoea Sayi LeConte*—Say's Blister Beetle. *Podisus spinosus* (*Dallas*)—The Spined Soldier Beetle. *Prionidus cristatus* (*Linn.*)—The Nine-pronged Wheelbug. *Pulvinaria innumerabilis* (*Rath.*)—The Maple-tree Scale-insect. *Aphis brassicæ* *Linn.*—The Cabbage Aphis. *Gryllotalpa borealis* *Burm.* The Mole Cricket. *Melanoplus femur-rubrum* (*DeGeer*)—The Red-legged Grasshopper. Some Apple Tree Insects. NOTICES OF ARACHNIDA. *Ixodes bovis* *Riley*—The Cattle Tick. *Bryobia pratensis* *Garman*. Infesting a Dwelling-house. APPENDIX: (A.) LISTS OF PUBLICATIONS OF THE ENTOMOLOGIST. (B.) CONTRIBUTIONS TO THE DEPARTMENT. INDEX.

Snails — — Slugs. (Country Gentleman, for October 16, 1890, lv, p. 819, c. 2—8 cm.)

A non-poisonous remedy is needed for injury by snails to a mushroom bed. Slugs (naked snails), that are so destructive to gardens in England, are there killed by sprinkling them with lime water. Nitrate of soda is also used. These would probably not affect the mushrooms injuriously. Salt will kill slugs in the ground.

[See C.—G., p. 879, for Mr. Falconer's method of trapping with pieces of dry rotten boards.]

Diseased Austrian Pines. (Country Gentleman, for October 16, 1890, lv, p. 820, c. 2, 3—42 cm.)

Twigs of Austrian and California pines are sent from Matteawan and Moriches, N. Y., for explanation of their unhealthy condition. Scales of *Chionaspis pinifoliae* (*Fitch*), a few black thrips, and some mites are present, but could not have caused the injury. It is probably owing to some unknown atmospheric or soil condition. Fertilizing to stimulate growth is recommended. A new disease, apparently, of the white pine, known locally as "ring-rot," is referred to. Abundance of the pine *Chionaspis* in Washington Park, Albany.

[In the *Eighth Report on the Insects of New York*, in MS.]

A Manual of Injurious Insects. (Country Gentleman, for October 16, 1890, lv, p. 822—3, c. 4—1—32 cm.)

Notice of a new edition of Miss E. A. Ormerod's Manual. Past labors and publications of the author in Economic Entomology: the new features in this edition: a volume which should be regarded as indispensable to all English agriculturists. Compared with Curtis' Farm Insects.

A Guest to be Welcomed in our Homes. (Amsterdam [N. Y.] Daily Democrat, for November 1, 1890, p. 2, c. 5.)

A worm-like creature reported, from Amsterdam, N. Y., as having eaten numerous holes in a felt lambrequin, is the larva of *Scenopinus fenestralis* (Linn.), which does not injure woolens or other fabrics, but feeds only, so far as known, on the larvae and pupae of the clothes-moth. Its adaptation to the purpose is pointed out, and its value as a clothes-moth destroyer stated.

Bean Weevil. (Country Gentleman, for November 13, 1890, iv, p. 898, c. 3, 4—12 cm.)

The cause and cure for weevil in beans is asked for, from Morgan county, Tenn. The life-history of *Bruchus obsoletus* is given, together with the fact that it is capable of breeding in old and dried beans. The remedy for it is exposing the infested beans to the vapor of bisulphide of carbon.

The Larch Saw-Fly. (Country Gentleman, for November 13, 1890, iv, p. 905, c. 4—16 cm.)

The ravages of *Nematus Erichsonii* Hartig, on Prince Edwards' Island, Canada, is given by a correspondent, who asks for means of arrest, if any. There is no remedy for it when large areas of the larch are attacked. The trees should be felled at once and promptly converted to use. Isolated trees may be protected by arsenical spraying.

[In *Eighth Report on the Insects of New York*, in MS.]

Bot-Fly of the Hare. (Country Gentleman, for November 13, 1890, iv, p. 905-6, cols. 4, 1—16 cm.)

A large brown grub found crawling on a bare patch of the skin of a hare shot in Gordonsville, Va., is probably from its mode of occurrence and an outline figure given, that of *Cuterabia cuniculi* (Fabr.). Habits of the *Estridæ*; reference to *Cuterabia emasculator* Fitch, and description of the imago of *C. cuniculi* as given by Macquart.

Insects Infesting Maple Trees. (New England Homestead, for November 15, 1890, xxiv, c. 4—4 cm.)

Insects living on the outer bark of maples, are too imperfectly described to permit of identification. They may be some species of plant-louse, and if so, spraying with kerosene emulsion or pyrethrum water would kill them.

[From additional information received, the insects were probably *Psyllidæ*.]

The Striped Cucumber Beetle. (Country Gentleman, for November 20, 1890, iv, p. 925-6, c. 4-1—30 cm.)

Inquiry from Hess Cross Road Station, N. Y., for the best remedy for this garden pest, *Diabrotica vittata* (Fabr.), is replied to, by citing

Prof. Weed's experiments with various substances as remedies and preventives, of which, excluding the insect from the plants, in manner stated, alone proved effective. But these experiments do not show that other repellants may not be found which will prove satisfactory. Dusting with ground bone has been reported successful, as also beans planted with the cucumbers or melons, as described.

The Woolly-Bear Caterpillar—*Pyrrharetia Isabella*. (Country Gentleman, for November 27, 1890, lv, p. 941, c. 2—34 cm.)

The insect is identified from Moreton Farm, N. Y.; the habits of the caterpillar are given, as also its description, mode of hibernation, transformations, its feeding habits, and reference to its natural enemies. The moth is also described.

[See pages 225-228 of this Report.]

Apple-Leaf Bucculatrix. (Country Gentleman, for December 4, 1890, lv, p. 962, c. 3—8 cm.)

Small white cocoons on apple-twigs from Ransomville, N. Y., are those of *Bucculatrix pomifoliella*. Reference to former notices of it in the C. G., and in 1st Rept. Ins. N. Y., 1883. It is rapidly increasing in New York, and should be promptly met by arsenical spraying.

A Mite Infesting Dwellings. (Ohio Farmer, for April 13, 1889, p. 274—42 cm.)*

To inquiries from Napoleon, O., and Bloomingdale, Mich., of a mite infesting dwellings, reply is made that it is probably a species of *Bryobia*; its occurrence elsewhere noticed; habits of the mites; why they enter dwelling-houses; remedies.

[Published, with additions in *Sixth Report on the Insects of New York*, 1890, pp. 62-65; pp. 158-161 of 43d St. Mus. Rept.]

PUBLICATIONS OF THE ENTOMOLOGIST DURING THE YEARS 1878 AND 1879

The Hessian Fly. (Country Gentleman, for January 24, 1878, xlivi, p. 55, cols. 3, 4—24 cm.)

Gives a general account of *Cecidomyia destructor* Say, its history, appearance, its life-history, remedies, etc.

An Aquatic Worm. (Country Gentleman, for January 31, 1878, xlivi, p. 72, c. 3—9 cm.)

"Animalculæ" sent from a well in Winsted, Conn., which could not be killed by lime or salt introduced, can not be identified. They bear a general resemblance to a leech in their motions when gliding over the bottom of the jar: when swimming freely, the anterior portion is shortened and extended laterally to a greater diameter than the connecting part of the body.

* Omitted from its proper place, in Report for 1889.

Grain Aphid. (Country Gentleman, for April 11, 1878, xlivi, p. 232, c. 2—5 cm.)

The common grain aphid, *Aphis [Siphonophora] avenae*, is identified from Bellbuckle, Tenn. It has not been an injurious species for late years.

Insect for Name. (Country Gentleman, for April 18, 1878, xlivi, p. 248, c. 2—7 cm.)

A piece of grapevine from Keswick Station, Va., containing supposed "grape-lice," has on it the flat, oval eggs, in two rows, of *Phylloptera [Amblycomorpha] oblongifolia*. Plants on which found.

Insects for Name. (Country Gentleman, for April 25, 1878, xlivi, p. 264, c. 2—7 cm.)

Beetles plowed up in hundreds from about three inches below the surface, on a farm in the suburbs of Albany, are the common June-bug, *Lachnostenus fusca* Frohl., and *Phyllophaga pilosicollis* Knoch [is *Lachnostenus tristis* (Fabr.)].

The Raspberry Cane-Borer. (Country Gentleman, for May 23, 1878, xlivi, p. 328, c. 1—8 cm.)

The girdling of raspberry canes at Great Bend, Pa., is referred to *Oberea tripunctata* (Fabr.) [*bimaculata* Oliv.], the operations of which are detailed.

Two Beetles. (Country Gentleman, for May 30, 1878, xlivi, p. 344, c. 2—9 cm.)

Chrysomela trimaculata (Fabr.) [*Doryphora clivicollis* Kirby], is characterized; it feeds on milk-weed, and is not regarded as injurious. *Coptocycla guttata* (Oliv.) is briefly described, its beauty referred to, as also its occasional injuries to potato leaves.

Insects for Name. (Country Gentleman, for June 13, 1878, xlivi, p. 376, c. 2—12 cm.)

Bibio albipennis, a harmless insect; *Dermestes lardarius*, its injuries to various animal substances; *Aphis [Siphonophora] avenae*, hundreds occurring on heads of wheat at Edgewood, Md.; an aphid on grapevines, undetermined.

The Peach-twig Moth. (Country Gentleman, for June 27, 1878, xlivi, p. 407, cols. 1-3, 44 cm.)

Insects received from Annapolis, Md., as destructive to the terminal branches of peach trees, are identified as *Anarsia lineatella* Zeller. Its synonymy is given, also Mr. Glover's account of the larva and its operations; Professor Comstock's observations upon it; Mr. Saunders' statement of its attack upon strawberry roots, and a parasite destroying it.

[Extended in *First Report on the Insects of New York*, pp. 151-156.]

A Grapevine Coccus. (Country Gentleman, for July 4, 1878, xlivi, p. 423, c. 3, 4 — 19 cm.)

A piece of grapevine from Cleveland, O., is covered with the scales of a Coccus, of which no description is found. The scale, in two forms and sizes, is described, together with the eggs beneath them. Under one scale were 1,054 eggs. Remedies for this and other *Coccidae* are given.

Insects in Illinois. (Country Gentleman, for July 4, 1878, xlivi, p. 425, c. 2, 3 — 15 cm.)

Insects sent from Champaign Co., Ill., as *Coccus hesperidum*, and occurring on soft maple, osage orange and black walnut (estimated, p. 421, c. 1, at more than 100,000 on each tree), are identified as *Lecanium acericola*, figured in *American Naturalist*, i, p. 14, and in Packard's Guide, p. 530. The twigs received are swarming with the active, newly-hatched lice; the scales are described, with their projecting cottony masses. It will probably not continue to be as abundant in future years. See notice of the same insect in issue of July 25 [proves to be *Pulvinaria innumerabilis* Rathvoni].

Apple-Bark and Pear-Blight Beetles. (Country Gentleman, for July 18, 1878, xlivi, p. 455, c. 1, 2 — 36 cm.)

Xyleborus pyri (Peck) [*dispar* Fabr.] and *Crypturgus (Monarthrum) mali* (Fitch) are found associated with pear-blight by a gentleman in Bradford county, Pa., supposed by him to be the cause of the blight. They are described with notice of their injuries, preventive measures, and their distribution.

The Cockscomb Elm-Gall. (Country Gentleman, for July 18, 1878, xlivi, p. 455, c. 2 — 16 cm.)

This gall, of which inquiry is made from Staunton, Va., occurs on the *Ulmus Americana*, and the insect producing it is the *Bryoscripta ulmicola* of Fitch, subsequently removed to the genus *Thelaxes* by Walsh, and to *Glyphina* and *Colopha* by later writers. No remedy is known against the attack of this insect.

[See *Rept. St. Entomol. to Regents Univ. S. N. Y.* for 1886 ("Third Report"), pp. 126-128.]

An Apple Tree Insect. (Country Gentleman, for July 25, 1878, xlivi, p. 471, c. 1 — 11 cm.)

Larvæ in crevices of a section of a limb—not in a burrow—varying in length from one-eighth to one-fourth of an inch, and apparently hymenopterous, can not be identified. They may be of parasitic origin.

The Maple Bark Scale Insect—*Lecanium acericorticis*. (Country Gentleman, for July 25, 1878, xlivi, p. 471, c. 1, 2 — 34 cm.)

Dr. Fitch's account of the operations of this insect upon maples in Albany, its naming, and remedies suggested for it—for a long time over-

looked — is republished. Some remarks on the synonymy of the species are appended. [It proves to be *Pulvinaria innumerabilis*.]

[Preface and notes to the Genera of the Hesperiadæ of the European faunal-Region, by Dr. Speyer.] (Canadian Entomologist, for July, August and September, 1878, x, pp. 121, 123, 124, 126, 146, 151, 163, 169.)

Introduction to above paper, p. 121, and notes, as follows: *Systasia* substituted for *Lintneria*, 122; the frenulum, 123; the tibial epyphysis, 124; on *Thymelicus*, 151; *Catodaulis* for *Daimia*, 163; tibial tufts on *Nisoniades*, 169.

Phylloxera. (Country Gentleman, for August 1, 1878, xliii, p. 488, c. 2—7 cm.)

Leaves from Milburn, N. J., are covered with the galls of *Phylloxera vastatrix*. The two forms in which it occurs on the leaves and roots.

Burrowing Beetle — *Cebrio Bicolor*. (Country Gentleman, for August 8, 1878, xliii, p. 507, c. 3, 4—19 cm.)

A beetle injurious to grass plats in Nashville, Tenn., by burrowing beneath the surface and throwing up little mounds of earth when it rains, is identified as *Cebrio bicolor*. The distribution of the family, habits of the species in burrowing and coupling, and remedies for their attack, are given.

[See *Report to the Regents for 1886* — “3d Report of the State Entomologist,” p. 100.]

An Ugly Bee-Slayer. (Country Gentleman, for August 29, 1878, xliii, p. 551, c. 1, 2—31 cm.)

Method employed by *Phymata erosa* in capturing butterflies, bees, etc.; appearance and habits of the insect; feeding upon plant-lice; notices of it by writers.

[See *Report to the Regents for 1886* — “Third Report of the State Entomologist,” pp. 107–110.]

A Squash-Vine Borer. (Country Gentleman, for August 29, 1878, xliii, p. 551, c. 1, 2—31 cm.)

Squash vines in Baltimore, Md., destroyed by the larvæ of *Melittia cucurbitæ* (Harris); life-history of the insect; description of the moth; pupation; means of protection from attack.

Phylloxera. (Country Gentleman, for August 29, 1878, xliii, p. 551, c. 3—4 cm.)

Galls on grape leaves, from Louisville, Ky., are identified as those of *Phylloxera vastatrix*. The galls on swamp maple, said to be similar to these, are distinct from the Phylloxera [and probably produced by a species of mite].

The New Carpet Beetle—*Anthrenus scrophulariae*. (Entomological Contributions, No. IV, June 1878, pp. 15-23, figure. American Naturalist, for August, 1878, xii, pp. 536-544. Thirtieth Annual Report of the New York State Museum of Natural History, 1878, pp. 117-254.)

Newspaper report of an unknown carpet pest; examples taken at Schenectady; its scientific identification; earlier history; its importation; illustration of stages; larva described; transformations; beetle described; habits, habitat, and injury; its prospective harm; its operation in a house at Cold Spring, N. Y.; preventives and remedies; distribution; necessity of combatting it; other imported insect pests; not injurious to carpets in Europe.

Annual Address of the President [of the Entomological Club of the American Association for the Advancement of Science, at St. Louis, Mo., August 20, 1878]. (Canadian Entomologist, for September, 1878, x, pp. 171-176.)

Review of progress during last half century; extended catalogues of insects; present knowledge of life-histories; number of working entomologists; entomological collections; serial literature; writings of specialists; government aid in investigation and publication; biological study commended.

The Turnip Flea Beetle. (Country Gentleman, for September 12, 1878, xlivi, p. 583, c. 2—12 cm.)

Larvæ destroying turnips at Chardon, O., of the appearance and after the manner described, are identified as those of *Haltica (Phyllotreta) striolata* Ill. [is *Phyllotreta vittata* (Fabr.)] The larva is described.

The Carpet Beetle. (Country Gentleman, for September 12, 1878, xlivi, p. 583, c. 2, 3—18 cm.)

Extracts from an article in the August *American Naturalist* relating to distribution, its food, appearance and habits of the larva, the beetle found in flowers, its description, and remedies for the insect.

The Harlequin Cabbage-bug. (Country Gentleman, for September 26, 1878, xlivi, p. 616, c. 1—9 cm.)

An insect destroying cabbages at Fort Union, Va., is *Murgantia histrionica* (Hahn). Its injuries in several of the States are referred to, together with preventions of its attack.

[See *First Report on the Insects of New York*, 1883, pp. 264-271.]

The Cabbage Aphis. (Country Gentleman, for November 14, 1878, xlivi, p. 727, c. 1, 2—14 cm.)

An Aphis attacking turnips in Laceystown, O., is the *Aphis brassicæ* of Linnæus, occurring in both Europe and America. Remedies are given, as the use of lime, soap-suds, and tobacco water.

The aphis on the apple-twigs is *Aphis mali*.

Economic Entomology during the year 1877. (Thirty-seventh Annual Report of the N. Y. State Agricultural Society, 1878, pp. 37-39.) (Transactions of the N. Y. State Agricultural Society, xxxiii, 1877-1882 : 1884, pp. 17-20.)

Importance of economic investigations as shown by the operations of the U. S. Entomological Commission; annual losses from insect injuries; necessity of their prevention; additions to the literature of economic entomology; notice of the operations of *Nephopteryx [Pinipestis] Zimmermani*, in pine, and of *Cossus Centerensis* in poplars near Albany.

Contribution to the Economical Entomology of the Year 1876. (Transactions of the N. Y. State Agricultural Society, xxxii, 1872-1876 : 1878, pp. 236-243.) [A paper presented at the Annual Meeting of the State Agricultural Society, January 17, 1877.] (Country Gentleman of May 31 and June 7, 1877.)

Notices the army-worm, *Leucania unipuncta*; the abundance of the Colorado potato-beetle, and measures for preventing its introduction into Europe; the grape-seed fly; the new carpet-beetle, *Anthrenus scrophulariae*; and the operations of an unknown potato insect tunneling potatoes.

Report on the Insects and other Animal Forms of Caledonia Creek, N. Y. (Tenth Annual Report of the New York Fishery Commission, for the year 1877 : 1878, pp. 12-36, plates 1 and 2. Also, separate, with title-page and cover, pp. 1-25, plates 1 and 2, August, 1878.)

Examination of the waters made in view of its supposed unusual abundance of animal life, in reference to the desirability of transporting its peculiar vegetation and associated insect and crustacean fauna, to other streams, as food for trout; the animal forms found in the mosses and other vegetation. The Fishes. Reptiles. Crustaceans—the abundant *Gammarus fasciatus* Say. Insects: Coleoptera; Diptera; Hemiptera; Neuroptera—Perlidae, Ephemeridae, Odonata, Phryganeidae (three subfamilies noticed). Vermes. Mollusca. The following considerations are presented: Crustaceans as food for Fishes, p. 14. Insects as food for Fishes, p. 17. Mollusca as food for Fishes, p. 18. Plants as food for Fishes, p. 18. The desirability of transplanting fish-food, p. 19. The practicability of transplanting fish-food, p. 21. The propagation of fish-food, p. 22.

Description of a New Species of Anisota. (Canadian Entomologist, for January, 1879, xi, pp. 10-12.)

Anisota bisecta is described from an example taken by Dr. P. R. Hoy, in Racine, Wisconsin.

The Clover-seed Fly—A New Insect Pest. (American Naturalist, for March, 1879, xiii, p. 190.)

Notice of a paper read before the N. Y. State Agricultural Society in January last, in which is described a larva infesting the blossom heads of the red clover, under the name of *Cecidomyia trifolii*. It occurs in western New York, and has caused in former years the failure of the seed crop which had been ascribed to imperfect fertilization.

The Peach-Tree Borer. (Country Gentleman, for March 27, 1879, xliv, p. 199, c. 2, 3—26 cm.)

Application of hot water for killing the borer, and mounding around the base of the tree for preventing egg deposit, is recommended. The plum curculio is sometimes found in the peach. The fungus occurring on the peach twigs submitted, is *Stereum complicatum*.

The Clover-seed Fly—A New Insect Pest. (Canadian Entomologist, for March, 1879, xi, pp. 44, 45. Annual Report of the Entomological Society of Ontario, for 1879, pp. 28–30.)

Account of the discovery of the larva in heads of *Trifolium pratense*. Its description as *Cecidomyia trifolii*, previously read to the State Agricultural Society. New localities reported.

Poduridae (Spring-Tails) in a Cistern. (Country Gentleman, for May 22, 1879, xliv, p. 327, c. 2—22 cm.)

Habits of the *Poduridae* and their systematic position. The species abounding in a cistern in Clifton Heights, O., is *Lipura fimetaria* (Linn.); was probably introduced from damp shingles of a roof. An allied species, observed at Center, N. Y., in a sandy roadway, may have been *Podura aquatica*.

[See the *Second Report on the Insects of New York*, 1885, pp. 208–210.]

Entomological Contributions—No. IV. (Thirtieth Report on the New York State Museum of Natural History, 1879, pp. 117–254. Separate, in advance of the Report, with title-page, table of contents, index, and cover, June, 1878, pp. 144.)

The contents are as follows:

1. On *Mermis acuminata* *Leidy*.
2. The New Carpet-bug—*Anthrenus scrophulariae* (*Linn.*).
3. *Isosoma vitis* *Saunders*—the Grape-seed Fly.
4. List of Lepidoptera, collected by W. W. Hill, in the Adirondack Region of New York.
5. Collections of Noctuidæ, at Schenectady, N. Y., in 1875.
6. On some Lepidoptera common to the United States and Patagonia.
7. On *Lycæna neglecta* *Edwards*.
8. Descriptions of two New Species of Californian Butterflies. [*Lycæna Lotis* and *Pamphila Osceola*.]

9. On some Species of Nisoniades [N. Pacuvius n. sp., N. funeralis Scudd.-Burg., N. Icelus Lintn., N. Brizo Boisd.-Lee., N. Martialis Scudd., N. Persius Scudd., N. Juvenalis Fabr.]
10. Transformations of Nisoniades Lucilius Lintn.
11. Description of Eudamus Epigena Butler.
12. Systematic Arrangement of the European and some American Hesperiidae.
13. Notes on Notodontia dictaea (Linn.).
14. On some New Species of Cerura [C. occidentalis, C. aquilonaris, and C. candida. Also of C. borealis (Boisd.)].
15. On Caradrina fiduciliaria (Morr.).
16. The Larva of Homohadena badistriga Grote.
17. Descriptions of two New Species of Xylina [X. lepida and X. unimoda].
18. Notes on Cucullia luctifica Lintn.
19. Notes on Catocala pretiosa Lintn.
20. On a New Species of Hypocala [H. Hilli].
21. On the Identity of Homoptera lunata and H. Edusa.
22. On the Identity of two forms of Hypenidæ [Tortricodes bifidalis and T. indivisalis].
23. Descriptions of two New Species of Phalaenidæ [Acidalia lacteola and Cidaria Paekardata].
24. A new Locality for Brephos infans Moesch.
25. Notes of Capture of Lepidoptera in 1876, rare to the Vicinity of Albany.
26. Notes on some Lepidoptera [Graptia Satyrus Edw., Lycaena Lucia Kirby and L. pseudargiolus Boisd.-Lee., Agrotis nigricans Linn. var. maizii Fitch. Agrotis perpolita Morr., Agrotis cupida Grote, Agrotis brunneicollis Grote, Cucullia intermedia Speyer, Xylina lambda (Fabr.) var. Thaxteri Grote, Hypena humuli Fitch, Depressaria LeContella Clem., et al.].
27. On some species of Cossus [Cossus reticulatus n. sp., C. undosus n. sp., C. plagiatus Walker, C. crepera Harris, C. querciperda Fitch].

Two-Spotted Lady-Bug. (Country Gentlemen, for June 26, 1879, xliv, p. 407, c. 1, 2—15 cm.)

A beetle found abundantly in dwellings in Poughkeepsie, N. Y., and thought to be the adult of the carpet-bug, is *Coccinella bimaculata* [*Adalia bipunctata* (Linn.)]—one of our friends to be protected. Its peculiar odor referred to.

[Extended in *Sixth Report on the Insects of New York*, 1890, pp. 21-23.]

Strawberry Borers. (Country Gentleman, for June 26, 1879, xliv, p. 407, c. 2—6 cm.)

“Worms” infesting strawberry roots in great numbers, in Muncey, Pa., are probably, judging from the description sent, the larvæ of the strawberry crown-borer, *Anarsia lineatella*.

The Golden Tortoise Beetle. (Country Gentleman, for June 26, 1879, xliv, p. 407, c. 2—6 cm.)

Beetles found in injurious numbers on potato vines in Philadelphia, Pa., are *Cassida [Coptocycla] aurichalcea* (Fabr.). Their usual food-plants, and Paris green for killing them.

Grapevine Galls. (Country Gentleman, for June 26, 1879, xliv, p. 407, c. 2—5 cm.)

Galls on grapevine, from Staatsburg, N. Y., are those of *Lasioptera vitis* Osten Sacken, from which the larvæ had emerged.

[See *Fourth Report on the Insects of New York*, 1888, pp. 63-67, f. 29.]

The Army Worm—*Leucania unipuncta* Haw. (Country Gentleman, for July 3, 1879, xliv, pp. 422, 423, cols. 4, 1—51 cm.)

Habits of the insect; early notice of it; its natural history; parasites in the examples received; instinct shown by *Exorista militaris* (Walsh) [*Nemoreæ leucaniae* Kirkpatrick] in its oviposition; descriptions of the larvæ and moth.

The Corn Curculio—*Sphenophorus Zeæ* Walsh. (Country Gentleman, for July 10, 1879, xliv, p. 439, c. 2—25 cm.)

Abundant and injurious at Bordentown, N. J. Its first notice; its habits, description, distribution, and injuries.

[Is *Sphenophorus sculptilis* Uhler: see *First Report on the Insects of New York*, 1882, pp. 253-263.]

The Clover-Seed Fly. (Country Gentleman, for July 17, 1879, xliv, p. 455, c. 1—16 cm.)

Description is given of the larva of this insect which was noticed at the meeting of the State Agricultural Society in January last, as *Cecidomyia trifolii* n. sp. The specific name selected being preoccupied, it is proposed to designate it as *C. leguminicola*.

The Grapevine Bark Louse—*Lecanium vitis* Linn. (Country Gentleman, for July 17, 1879, xliv, p. 455, c. 1, 2—25 cm.)

A scale-insect on the grapevine and its leaves, from Essex county, Mass., is identified as *Lecanium (Pulvinaria) vitis* of Linnæus. The scale and egg-covering, hatching, and distribution of the young are noticed. While the scales on the vine are brown, those on the leaves are green. [The insect is *Pulvinaria innumerabilis* (Rathvon)].

[See *Sixth Report on the Insects of New York*, 1890, pp. 45-51, f. 20.]

The Striped Blister Beetle. (Country Gentleman, for July 31, 1879, xliv, p. 487, cols. 1, 2—37 cm.)

Beetles from Prospectville, Pa., destructive to potato leaves, are *Epicauta vittata* (Fabr.). Description, and some account of it and of the

Meloideæ and their transformations are given. Reference to literature on it.

[See *Sixth Report on the Insects of New York*, 1890, pp. 36-38, f. 16.]

Inquiries about Ants and Beetles. (Country Gentleman, for July 31, 1879, xliv, p. 487, cols. 2, 3—13 cm.)

Identification of *Formica Norvegorensis* Fitch [is *Camponotus herculeanus* (Linn.)], and of *Coptocycla aurichalcea* (Fabr.), with the larval features of the latter; and of *Melanotus fissilis* Say, one of the "snapping beetles," with remarks on their habits.

On *Cecidomyia leguminicola*. (Canadian Entomologist, for July, 1879, xi, pp. 121-124.)

It having been learned that the name of *C. trifolii* pertains to an European species, that of *C. leguminicola* is substituted for it. Notice of the rearing of the imago, its description and its distribution.

The Stalk Borer—*Gortyna Nitela* Guenée. (Country Gentleman, for August 7, 1879, xliv, p. 503, cols. 2, 3—35 cm.)

The caterpillar is sent with inquiries from Monsey, N. Y., with account of its habits in boring potato stems and causing them to break down. In reply is given its food-plants, its description and that of the moth, life-history, and remedies.

[Extended in the *First Report on the Insects of New York*, 1882, pp. 110-116, f. 26.]

Two Carpet Bugs. (Country Gentleman, for August 7, 1879, xliv, p. 503, c. 4, 18 cm.)

Two larvae from beneath carpets in Poughkeepsie, N. Y., are *Anthrenus scrophulariae* (Linn.), and *Attagenus megatoma* (Fabr.) [is *A. piceus* Oliv.]. Distinguishing features of the two are given. Remarks upon the latter as a carpet pest [see *Second Report on the Insects of New York*, 1885, pp. 46-48.]

The Wheat-stem Maggot—*Meromyza Americana* Fitch. (Country Gentleman, for August 21, 1879, xliv, p. 535, cols. 3, 4—51 cm.)

Stalks of spring wheat from Scipioville, N. Y., contain the larva of this insect; its location in the stem; its description and that of the fly; literature of the species; its injuries; allied species in Europe; little is known of our *Oscinidae*; its popular name; is difficult to control.

[Extended in the *First Report on the Insects of New York*, 1882, pp. 221-227, figs. 66, 67.]

The Carpet Beetle. (Country Gentleman, for August 21, 1879, xliv, p. 535, c. 4—4 cm.)

The insect identified from Poughkeepsie, N. Y., as *Anthrenus scrophulariae*.

The Earth Worm—*Lumbricus Terrestris Linn.* (Country Gentleman, for September 4, 1879, xliv, p. 567, cols. 2, 3—20 cm.)

From eggs deposited in loose soil in July or August, the worms in their complete stage, are developed the following spring. The sexes are united in the same individual, but fertilization is a reciprocal action for which two unite. Their principal food is earth, from which they extract the animal and vegetable matter. They also feed on plants, drawing within them the tips of grass or leaves and extracting the juice. Little is known of their life-history. From their action in loosening the soil their benefits exceed their injuries.

Annual Address of the President [of the Entomological Club of the American Association for the Advancement of Science, at Saratoga, N. Y., August 26, 1879]. (Canadian Entomologist, for September, 1879, xi, pp. 163–175. Annual Report of the Entomological Society of Ontario, for 1879, pp. 11–18. American Entomologist, for January and February, 1888, iii, pp. 16–19, 30–34.)

Mainly a notice of the principal publications and investigations in Entomology during the preceding year, of which, among others, are these: Baron Osten Sacken's Catalogue of the Diptera of the U. S.; Dr. Loew's Dipterological labors; the entomological serials of the United States and Canada; special studies in the Noctuidæ, Tortricidæ, Tineidæ; local lists of species; life-history studies of W. H. Edwards; publications on the biology and in the anatomy of insects; biological collection of the Museum of Comparative Zoölogy at Cambridge, Mass., work of the U. S. Entomological Commission; studies on the pupation of butterflies; discovery of immense western beds of fossil insects.

Two Pests of the Clover Plant. (Country Gentleman, for October 2, 1879, xliv, p. 631, cols. 3, 4—32 cm.)

A correspondent from Bristol Springs, N. Y., describes an insect found in its three stages in and among the roots of clover, and its injuries to the plant; also another observed creeping from the head, resembling the wheat-midge larva. The former is identified as the clover-root borer, *Hylesinus* [*Hylastes*] *trifolii* Mull., first detected in this country the preceding year; its operations are stated. The latter has only been known and described the present year, as *Cecidomyia leguminicola* Lintn.; its present distribution is given.

Apple Tree Insect. (Country Gentleman, for October 9, 1879, xliv, p. 648, c. 1—9 cm.)

A coleopterous larva sent from Carrollton, Ky., can not be identified. It may belong to the *Carabidæ*, and if so, would not have caused the suspected injury to the tree. Its description is given.

Coccus on Peach Trees. (Country Gentleman, for October 23, 1879, xliv, p. 679, cols. 2, 3—10 cm.)

A peach-twigs from Chambersburgh, Pa., has on it a number of scale-insects which are not recognized. They apparently differ from the *Lecanium persicæ* Modeer, as described by Dr. Fitch. Remedies for it are given.

A Grape Insect. (Country Gentleman, for October 23, 1879, xliv, p. 679, c. 3—7 cm.)

A small caterpillar from Summerfield, Ill., sent as attacking and destroying the leaves of the Taylor's Bullitt grapes only, in a vineyard embracing many varieties, can not be identified. From a crushed pupa of one of the larvae it is thought that it may be a *Depressaria*.

A Dung Beetle. (Country Gentleman, for October 30, 1879, xliv, p. 695, c. 4—18 cm.)

A beetle occurring in great number at Annapolis, Md., greedily eaten by ducks, and called "the young tumbler-bug," is *Aphodius inquinatus* Herbst. The beetle is described with its habits and transformations. Reference to allied species—*A. fimetarius* (Linn.) and *A. fossor* (Linn.).

[Published in 40th *Rept. N. Y. State Museum Nat. Hist.*, 1887, pp. 102-103 = *Third Report Insects of New York*.]

The Five-Spotted Sphinx. (Country Gentleman, for October 30, 1879, xliv, p. 696, c. 1—7 cm.)

Sphinx quinquemaculata Haw. is identified, the larva of which—the tobacco-worm—often occurs abundantly on tomato and tobacco plants. Its transformations are given.

Apple Tree Insects. (Country Gentleman, for November 6, 1879, xliv, p. 711, c. 3, 4—30 cm.)

Larvae from Carrollton, Ky., taken from beneath bark, are apparently dipterous, but can not be identified. The "flat-headed borer" reported as infesting the end of the twigs, if a *Chrysobothris*, is probably not *femorata*. Several species, judging from the range of food-plants assigned, may be confounded under the name of *femorata*.

[See *Sixth Report on the Insects of New York*, 1890, pp. 57-59.]

A Grape Insect—*Procris Americana* Boisd. (Country Gentleman, for November 6, 1879, xliv, p. 711, c. 4—10 cm.)

The grapevine insects noticed in the Country Gentleman of October 23d, which could not be named, are identified by Mr. E. A. Schwarz as *Procris Americana* Boisd. The larvae are described, habits given, and the moth characterized. The larvae can easily be destroyed when feeding in company, by hand-picking and crushing.

Coccus on Peach Trees—*Lecanium Persicæ*. (Country Gentleman, for November 6, 1879, xliv, p. 711, c. 4—8 cm.)

The coccus insect noticed in the Country Gentleman of October 23d, is the above-named species, as determined by Mr. E. A. Schwarz, who also sends its synonymy. How the examples received differed from Dr. Fitch's description of *L. persicæ*.

The Fitch Biological Collection of the N. Y. State Agricultural Society. (*Psyche*, September—December, 1879, ii, pp. 275, 276.)

The collection, arranged in six table-cases, is as follows : Case 1. Insects infesting grain and other crops; Case 2. Grass insects; Case 3. Insects of the garden; Cases 4 and 5. Insects infesting fruit-trees; Case 6. Insects injurious to men and animals. The number of specimens in these cases is about sixteen hundred. The labeling is that of Dr. Fitch, except of a few specimens subsequently added. The larger biological specimens are in wall-cases on an upper floor of the Museum. Notice of a collection placed in the State Museum, and of the Homoptera contained therein which have alone escaped destruction.

(D)

CONTRIBUTIONS TO THE DEPARTMENT.

The following are the Contributions that have been made to the Department during the year (1890):

LEPIDOPTERA.

Six hundred and two specimens of butterflies and moths, from South America and the United States: see notice on page 220. Also, one hundred and one specimens, collected at Murray Bay, Province of Quebec, Canada, viz.: Hymenoptera, 7; Lepidoptera, 52; Diptera, 3; Coleoptera, 28; Hemiptera, 3; Neuroptera, 8. From ERASTUS CORNING, Jr., Albany, N. Y.

Larvæ of *Junonia Cœnia* (Boisd.-Lec.), September 3d, and the imago therefrom, October 2d. From J. V. D. WALKER, Jamaica, N. Y.

Larva of *Thyreus Abbotii* Swainson, July 15th. From J. SAGER, Naples, N. Y.

Parasitized examples of the grapevine sphinx, *Darapsa Myron* (Cramer), July 17th. From H. C. WILLIAMS, Knox, N. Y.

Parasitized examples of *Sphinx chersis* (Hübñ.). From Mrs. K. M. BUSICK, Wabash, Ind.

Eggs of *Orgyia nova* Fitch. From Rev. T. W. Fyles, South Quebec, Canada.

Larva of *Empretia stimulea* Clemens, August 30th. From Rev. CLEMENT G. MARTIN, Greenport, N. Y.

Larvæ of *Phobetron pithecium* (Sm.-Abb.), from apricot, August 16th. From Miss H. G. MYER, Port Ewen, N. Y.

Thyridopteryx ephemeraeformis (Haw.), in cases, from quince trees From ANDERSON BRAY, Sargeantsville, N. J.

Perophora Melsheimerii Harris, feeding on oak, September 30th. From Dr. Otto LUGGER, St. Anthony's Park, Minn.

Larvæ of *Datana perspicua* Gr.-Rob., feeding on sumach, August 23d. From H. G. DYAR, Rhinebeck, N. Y.

Larvæ of *Datana ministra* (Drury), in numerous examples, in different stages of growth. From W. C. BARRY, Rochester, N. Y.

Young larvæ of *Edemasia concinna* (Sm.-Abb.), parasitized by *Limneria fugitiva* (Say). From SAMUEL E. RUSK, Haines Falls, N. Y.

Agrotis tessellata Harris, from some cabbage cut-worms. From JEROME MABEE, New York.

Larvæ of *Heliothis armiger* Hübn., burrowing into tomatoes, and an imago therefrom August 26th. From E. J. LORD, Albany, N. Y.

Larvæ of *Tmetocera ocellana* (Schiff.) in apple-twigs, June 5th, giving the imago June 22d. From A. B. RATHBONE, Oakfield, N. Y.

Cocoons of *Bucculatrix pomifoliella* Clemens, in June, October and November. From J. W. W., Canastota, N. Y.; from WASHINGTON GARLOCK, Utica, N. Y.; from GEORGE H. ALLEN, Brockport, N. Y.; from W. T. MANN, Barkus, Niagara Co., N. Y.; from W. H. Ransom & Son, Ransomville, N. Y.

DIPTERA.

Galls in leaves of *Abies Frazeri* similar to those of *Cecidomyia leguminicola* Lintn. From Dr. ROLAND THAXTER, New Haven, Conn.

Galls of *Lasioptera vitis* Osten Sacken, on grapevine and leaves, June 6th. From George T. POWELL, Ghent, N. Y.

Larva of *Scenopinus fenestralis* (Linn.), about half-grown, June 21st. From E. P. VAN DUZEE, Buffalo, N. Y. The same about full-grown, October 7th, from CLARENCE VALENTINE, Albany, N. Y.

Pupæ of *Eristalis tenax* (Linn.), August 11th, giving the imago September 4th-12th. From CHARLES COUCH, Schoharie, N. Y.

Eristalis tenax (Linn.)—the fly, infesting cosmos and chrysanthemums in a green-house. From WM. FALCONER, Glen Cove, N. Y.

Larva of *Cuterabra ?cuniculi* Clark, from the skin of a hare, November 6th. From H. L. LEMPRIERE, Gordonsville, Va.

Chloropisca prolifica Osten Sacken, in many examples, April 10th, and the same, August 27th. From Mrs. H. D. GRAVES, Ausable Forks, N. Y.

COLEOPTERA.

Hippodamia convergens (Linn.), *Coccinella sanguinea* Linn., *Coccinella 9-notata* Hübn., *Lema trilineata* (Oliv.), *Coptocycla clavata* (Fabr.), and six other species of undetermined coleoptera, and thirty other specimens in the different orders. From Mrs. E. B. SMITH, Coeymans, N. Y.

The Australian lady-bird, *Vedalia cardinalis* M. From D. W. COQUILLET, Los Angeles, Cal.

Epilachna borealis (Fabr.) as injurious to Cucurbitaceæ, and *Diabrotica 12-punctata* (Oliv.) from dahlias and chrysanthemums, in October. From WM. FALCONER, Glen Cove, N. Y.

Attagenus piceus Oliv. From C. M. HOWARD, New York city.

The tumble-dung, *Canthon lœvis* (Drury), June 23d. From F. F. GOODWIN, Albany, N. Y.

Aphodius fimetarius (Linn.) infested with *Uropoda Americana* Riley, from a hot-bed of the Agricultural Experiment Station at Geneva, N. Y., May 6th. From G. W. CHURCHILL, Geneva, N. Y.

Disonycha triangularis (Say), from larvae feeding on beet leaves in July. From E. S. GOFF, Agricultural Experiment Station, Madison, Wis.

Haltica sp. infesting Ampelopsis, in September. From Dr. JAS. H. HOOSE, State Normal School, Cortland, N. Y.

Cassida nigripes Oliv., from sweet potato vines, June 23d. From W. W. STORM, Red Bank, N. J.

Bruchus obsoletus Say, from large numbers in a dwelling, March 10th. From H. T. BASSETT, Waterbury, Conn. The same species, ovipositing, Sept. 4th. From Dr. H. C. COON, Alfred Center, N. Y.

Bruchus rufimanus Bohem. and *Xyleborus dispar* (Fabr.). From Miss ELEANOR A. ORMEROD, St. Albans, Eng.

Bruchus scutellaris Fabr., collected at Loudon, Tenn. From Dr. E. W. DORAN, Pritchett Institute, Glasgow, Mo.

Larvae of *Balaninus caryatrypes* Boh. from chestnuts, October 18th and 22d. From BERTHOLD FERNOW, Albany, N. Y., and EDWARD W. SEWELL, Albany, N. Y.

Calandra oryzæ (Linn.) feeding on seed corn, June 3d. From H. VAN SLYKE, Coxsackie, N. Y.

Scolytus rugulosus (Ratz.), June 6th, from a cherry tree. From GEORGE T. POWELL, Ghent, N. Y.

HEMIPTERA.

Benacus griseus (Say), May 21st. From J. A. PAINE, Tarrytown, N. Y.

Belostoma Americanum Leidy, drawn to light, April 24th. From FRED SMITH, Albany, N. Y.

Larvae of spittle insects ?*Ptyelus lineatus* (Linn.), from grass, July 8th. From DAVID CROWE, Summit, N. Y.

The dog-day cicada, *Cicada tibicen* (Linn.), July 15th. From T. REED WOODBRIDGE, Port Henry, N. Y.

Unknown egg-deposit in a plum-twig of a ?Membracid, May 6th. From ANDREW S. LONG, Dey's Landing, Seneca Co., N. Y.

The grain Aphid, *Siphonophora avenae* (Fabr.), in June. From E. VAN ALSTYNE, Kinderhook, N. Y.; from WM. TOUGH, Hudson, N. Y.; from A. FORD WILLIAMS, Chatham Center, N. Y.; from FRANK N. RAEDER, Niverville, N. Y.; from JACOB W. TITUS, Glen Cove, N. Y.; from FRANKLIN DYE, Trenton, N. J.

Aleyrodes sp. in larva, pupa, and imago, on white oxalis, April 10th. From Mrs. E. B. SMITH, Coeymans, N. Y.

Mytilaspis pomorum Bouché, on lilac. From HARRISON G. DYAR, Rhinebeck, N. Y.

Diaspis rosae (Sandberg), infesting a climbing rose bush. From Miss H. D. LEEMING, Brooklyn, N. Y.

Chionaspis pinifoliae (Fitch) on the Austrian pine. From Miss A. H. WOOLSEY, Matteawan, N. Y.

Lecanium sp.? on Magnolia. From Professor CHARLES H. PECK, Albany, N. Y.

The maple scale-insect, *Pulvinaria innumerabilis* (Rathvon), June 23d, from Mrs. H. D. CRANE, Schenectady, N. Y.; and July 8th, from Dr. CHARLES L. HOGEBOOM, Lawrence, L. I.

Thrips sp. on diseased Austrian pines. From Miss A. H. WOOLSEY, Matteawan, N. Y.

Bird-lice—*Mallophaga*—from a chimney-swallow, *Chaetura pelagica* (Linn.). From Professor HARLAN H. BALLARD, Pittsfield, Mass.

Oecanthus niveus Harris; eggs in poplar twig. From W. C. BARRY, Rochester, N. Y.: the imago, from E. B. SMITH, Coeymans, N. Y.

Amblycomorpha rotundifolia Scudder—3 examples. Larva of *Myrmeleon immaculatus* DeGeer, from beneath a carpet, June 3d. From Mrs. E. B. SMITH, Coeymans, N. Y.

Trombidium muscarum Riley, parasitic on the house-fly, September 11th. From Miss SARAH PARKER, Gouverneur, N. Y.

Julus cœruleocinctus Wood, infested with *Uropoda Americana*—from a hot-bed. From GEORGE W. CHURCHILL, Geneva, N. Y.

GENERAL INDEX.

The author's work on this Report was necessarily suspended by severe indisposition, before the slips of the index had been entirely arranged for the printer. As he will not be able to read the proof sheets of the index, or place it in the hands of any one familiar with entomological terms, he fears that a large number of errors will creep in, for such all needed forbearance is asked.

A.

- Abbotii, Thyreas, 381.
abbreviatella, Ceria, 229.
Abies Fraseri, infested by a Cecidomyiid, 307, 382.
Acarina, 323.
acericorticis, Lecanium=Pulvinaria innumerabilis, 370.
Acidalia lacteola, 375.
acuminata, Mermis, 374.
Adalia bipunctata, 375.
Address before New York State Agricultural Society, 331-342.
before Western New York Horticultural Society, 342-356.
of President of Entomological Club of A. A. A. S. at Saratoga meeting, 378.
of President of Entomological Club of A. A. A. S. at St. Louis meeting, 372.
on Economic Entomology, 373.
Adirondack black-fly, 364.
gray gnat, 364.
midge, 364.
punk, 364.
Adirondack collections, 218.
Adirondack butterflies, 219.
Aesculus blossoms, Limonius in, 351.
affinis, Bruchus, 284.
Phytomyza, 242, 245, 246.
Agricultural experiment stations, 221.
Agrotis brunneicollis, 375.
 cupida, 375.
 nigricans v. maizii, 375.
 perpolita, 375.
 tessellata, 382.
Albany Daily Press cited, 234.
Evening Journal cited, 321, 357, 358, 360, 362, 364(3), 365(2).
Morning Express cited, 296, 361.
Press and Knickerbocker cited, 358.
Times cited, 359.
albipennis, Bibio, 369.
Aleyrodes sp. 383.
Akaline solution for insect attack, 344.
Allen, George H., insects from, 382.
alternans, Temnostoma, 229.
amata, Calopteryx, 220.
Amblycomorpha oblongifolia, 369,
 rotundifolia, 384.
Americana Clistocampa, 215, 220, 331, 359.
Meromyza, 377.
Procris, 379.
Uropoda, 312, 383, 384.
American Entomologist cited, 225(2), 228(2), 232, 246, 247, 251, 255(5), 257, 279(2), 283, 296(2), 306, 324(2).
American Naturalist cited, 309, 324, 327, 370, 372(2), 374.
Americanum, Belostoma, 383.
ampelophila, Drosophila, 241.
Ampelopsis, Haltica sp. on, 383.
Amsterdam Daily Democrat cited, 367.
Anarsia lineatella, 369, 375.
Andrenidae, 219.
Andricus saltatus, 309.
Angus (James) cited, 255, 257, 352.
angustatum, Mallodon, 251.
Anisota bisecta, 373.
Annales Société Entomologique de Belgique cited, 249.
Annual Report of the New York State Agricultural Society cited, 373.
Anomia? rosea, 345, 362.
Anthrenus scrophulariae, 335, 364, 372, 373, 374, 377(2).
Ant-lions, 318-320.
 ascalaphus species, 319.
 climbing species, 319.
 food of, 319.
 hibernation of, 319.
 localities for, 320.
 not making pitfalls, 319.
 strange habitat for, 318.
 tree inhabiting, 320.
Apanteles congregatus, 364.
Aphides, 217, 317.
Aphis brassicæ, 317, 372.
Aphodius flmetarius, 312, 379, 383.

- Aphodius fossor, 379.
inquilinus, 379.
prodromus, 312.
- Apidæ, 219.
- Apple-bark beetles, 370.
- Apple-leaf bucculatrix, 359.
- Apple-leaf miner, 354.
- Apple-tree aphis, 345.
- Apple-tree bark beetle, 316.
- Apple-tree tent-caterpillar, 215, 331, 359.
- Apple: Insects injurious to.
Bucculatrix pomifoliella, 216, 354, 368, 382.
Cacccia argyrosipa, 356.
Clisiocampa Americana, 215.
Halisdota caryæ, 355.
Monarthrum mall, 316, 370.
Oenoria dispar, 304.
Saperda candida, 313.
Tischeria malifoliella, 354.
Tmetocera ocellana, 216, 306, 360, 363, 382.
Xyleborus pyri, 350, 361, 370.
- Apricot, Phobetron pithecium on, 381.
Xyleborus pyri in, 350.
- aquatica, *Podura*, 374.
- Aquatic worm, 368.
- Aquilonaris, *Cerura*, 375.
- Arctiæ, *Ophion*, 228.
- Arctia Isabella, see *Pyrrhartia Isabella*, 225.
virgo, 219.
- Argynnis Atlantis, 219.
- Armiger, *Heliothis*, 216, 363, 382.
- Army-worm, 373, 376.
- Arsenical spraying:
 bees poisoned by it, 290.
 codling-moth mixture, 292.
 curculio killed by it, 290, 343.
 early spraying desirable, 290.
 fungus mistaken for arsenical injury, 291.
 how to mix Paris green, 292.
 how to mix London purple, 293.
 indispensable to fruit-growers, 291.
 London purple protection of cherry trees, 291.
 peach susceptible to injury, 291.
 Lugger's experiments in, 293.
 Paris green or London purple, 291.
 pumps adapted to, 292.
 stirring (constant) of Paris green, 291.
 strength of mixture for fruit trees, 291, 343, 344.
 when, for the curculio, 290, 292.
 results of, 343.
- Arsenical spraying for insects, 216, 307, 336, 353, 355, 360, 361, 363, 368.
- Arthemis, *Limenitis*, 219.
- Ascalaphus sp., 319.
- Ash: Insects injurious to.
Dynastes Tityus, 251.
Halisdota caryæ, 355.
Xyloryctes Satyrus, 251.
- Ashmead, W. H., cited, 282, 309.
- Asparagi, *Crioceris*, 335.
- Asparagus beetle, 335.
- Association of Economic Entomologists, 342.
- Asters visited by Syrphidae, 229.
- Astragalus, *Bruchus obsoletus* bred from, 256, 277.
- aterrima, *Paria*, 360.
- Atlantis, *Argynnис*, 219.
- atomarius, *Bruchus*, 284.
atrata, *Tabanus*, 364.
- Attagenus, *megatoma* = *piceus*, 377.
piceus, 382.
- Aulacomerus lutescens, 223, 224.
aurichalcea, *Coptocycla*, 363, 376, 377.
- Australian lady-bug, 360, 382.
 scale insect, 340.
- auripilis, *Limonius*, 351.
- avenæ, *Siphonophora*, 217, 331, 335, 360, 369(2), 383.
- B.
- badistriga, *Homohadena*, 375.
- Bag-worm, 306.
- Balaninus earyutrypes, 383.
- Ballard, Prof. H. H., gall received from, 308.
 Mallophaga from, 384.
- Balloon hopper-dozer, 336.
- balsamicola, *Cecidomyia*, 307.
- Balsam: insect injurious to *Ceeldomyia balsamicola*, 307.
- Balsam poplar visited by *Cerla*, 229.
- Barley: insect injurious to *Cephus pygmeus*, 334.
- grain aphis, 218
- Barlow [J. G.] cited, 297.
- Barry, P., insects from, 347, 355, 381, 384.
- Bassett, H. T., insects from, 383.
- Batchelor, Daniel, on lentils, 287.
- Baudi, F., cited, 280, 284(2), 287.
 description of *Bruchus lentis*, 287.
- Beal, Prof. W. J., on bean-weevil, 266.
- Beans: insects injurious to, *Bruchus obsoletus*, 217, 257.
Bruchus rufimanus, 280.
- Bean [T. E.] cited, 225.
- Bean-weevil, 217, 255-279, 367.
- Bedeguar of the hawthorn, 364.
- Bees affected by arsenical spraying of blossoms?, 290.
- Bees killed by *Phymata erosa*, 371.
- Bee-slayer, 371.
- Belostoma Americanum, 383.
- Benacus griseus, 383.
- Benzine, for insect attack, 364.
- Bethune [Rev. C. J. S.], cited, 256.
- Bibio albipennis, 369.
- Bibliography of American Economic Entomology, cited, 283.

Bibliography of *Bruchus latus*, 285.

- Bruchus obsoletus*, 255-6.
- Bruchus rufimanus*, 279.
- Bryobia pratensis*, 321.
- Cermatia forceps*, 324.
- Cicada septendecim*, 296.
- Dynastes Tityns*, 246.
- Helophilus lutifrons*, 228.
- Phytomyza chrysanthemi*, 242.
- Pyrrhocaria isabella*, 225.
- bicolor, *Cebrio*, 371.
- Trombicidium*, 321.
- bifidalis*, *Tortricodes*, 375.
- bimaculata*, *Oberea*, 369.
- Biological collection of the Museum of Comparative Zoölogy at Cambridge, Mass., 378.
- blipunctata*, *Adalia*, 375.
- Bird-lice, 384.
- bisecta, *Anisota*, 373.
- Bisexual *Clisiocampa Americana*, 220.
- Bisulphide of carbon for Insect attack, 276, 277, 365, 367.
- Bite of a horse-fly, 364.
- Black-and-red woolly-bear, 225-228.
- Black walnut, *Pulvinaria innumerabilis* on, 370.
- Blissus leucopterus*, 331.
- Blister-beetle, striped, 376.
- Blue-jack oak, galls on, 309.
- Boll-worm, 216, 368.
- Bombycidæ*, 225, 302, 304, 306.
- Bordeaux mixture, 345.
- borealis, *Cerura*, 375.
- Epilachna*, 217, 382.
- Bot-fly of the Hare, 367.
- brassicæ, *Aphis*, 317, 372.
- Bray, Anderson, insects from, 306, 381.
- Breeding-grounds of the rose-bug, 346.
- Brephos infans*, 375.
- Breweri, *Bruchus*, 256.
- Briggs, A. H., insects from, 351, 353.
- Brizo, *Nisomiades*, 375.
- Bruchidæ*, 255-288.
- Bruchophagus* sp.? 282.
- Bruchus affinis*, 284.
- atomarius, 284.
- Breweri = *obsoletus*, 256.
- Chinensis*, 282.
- fabæ, 255, 256, 257, 261, 262, 263, 278.
- fabi, 261.
- flavimanus*, 268, 282, 284.
- granarius*, 255, 263, 267, 279-284.
- irresectus* = *obsoletus*, 256, 279.
- lentis*, 285-288.
- mlmus*, 285.
- obscurus*, 263, 264.
- obsoletus*, 217, 255, 367, 383.
- obtectus*, 255, 278.
- pallidipes* = *obsoletus*, 256.
- phaseoli*, 263.
- pisi* = *pisorum*, 263, 268, 280, 286.

Bruchus affinis — (*Continued*):

- rufimanus*, 263, 267, 268, 279-285, 286, 383.
- scutellaris*, 282, 383.
- seminarius*, 283, 284.
- ?*subarmatus* = *obsoletus*, 256, 259.
- subellipticus* = *obsoletus*, 256.
- varicornis* = *obsoletus*, 255, 278.
- brunneicollis*, *Agrotis*, 375.
- Bryobia pallida* = *pratensis*, 321.
- pratensis*, 321, 324, 365.
- Bryoscripta ulmicola* = *Colopha ulmicola*, 370.
- bubalus*, *Ceresa*, 360.
- Buceulatrix pomifoliella*, 216, 354, 359, 368, 382.
- Bud-worm, 216.
- Buffalo-fly, 333.
- Bulletin of Brooklyn Entomological Society cited, 252.
- Buffalo Society of Natural Science cited, 228.
- Division of Entomology — U. S. Department of Agriculture cited, 296(2).
- Massachusetts Agricultural Experiment Station cited, 304, 337.
- Michigan Agricultural Experiment Station cited, 277.
- Minnesota Agricultural Experiment Station cited, 293.
- New Jersey Agricultural Experiment Station cited, 317, 346.
- U. S. Geological and Geographical Survey cited, 228.
- U. S. National Museum cited, 228.
- Bumble-bee, 299.
- Burning gas-tar to repel insects, 290.
- infested stock, 361, 363, 367.
- rubbish, 353, 365.
- stubble, 339.
- Burrowing beetle, 371.
- Busick, Mrs. K. M., insects from, 381.
- Butler [Amos W.] cited, 296.
- Butterflies killed by *Phymata erosa*, 371.
- Butternut, *Halidota caryæ* on, 355.

C.

- Cabbage *Aphis*, 317, 318, 372.
- abundance in Buffalo, 317.
- in Dakota, 318.
- in New Jersey, 317.
- antennal structure of, 317.
- parasites of, 317.
- remedies for, 318.
- sexed forms of, referred to, 318.
- Cabbage, insects injurious to:
- Agrotis tessellata*, 382.
- Aphis brassicæ*, 317, 372.
- Diabrotica 12-punctata*, 315.
- Melanotus* sp.? 360.
- Murgantia histrionica*, 372.
- Pieris rapæ*, 335.
- Cabbage-worm, 337.

- Cacecia rosacea, 355.
cæruleus, Ichneumon, 228.
 Calandra granaria, 365.
 oryzæ, 362, 383.
 calcitrans, Stomoxys, 333.
 Calendula, insect attacking; *Spilosoma Virginica*, 304.
 Callimorpha confusa, 219.
 Caloptenus spretus, 338.
 Calopterygina, 220.
 Calopteryx amata, 220.
 Cameron, Peter, on *Cladius viminalis*, 223.
 Camponotus herculeanus, 377.
 Canada thistle visited by Syrphidae, 229.
 Canadian Entomologist cited, 225(3), 311,
 335, 371, 372, 373, 374, 377, 378.
 Journal cited, 225.
 Naturalist cited, 225.
 candida, Cerura, 375.
 Saperda, 313, 314.
 Cannibalism of *Pyrrhactia isabella*, 228.
 Canthon laevis, 382.
 Caradrina fidicilaria, 375.
 Carbolic acid, for insect attack, 357.
 Carbolized plaster preventive, 346.
 cardinalis, Vedalla, 360, 382.
 cardui, Pyrameis, 228.
 Carolina Mantis, 357.
 Carpet beetle, 335, 364, 372(2), 373, 374, 376,
 377.
 Carpocapsa pomonella, 310.
 saltitans, 310.
 caryæ, Halisidota, 355.
 caryatipes, Balaninus, 383.
 Case-bearers, 347.
 Cassida (*Coptocycla*) aurichalcea, 376, 377.
 nigripes, 363, 383.
 Cassino's Standard Natural History cited,
 256, 280, 296.
 Catalogue des Coléoptères de la Collection
 du Comte Dejean cited, 285.
 Catalogue of Insects of New Jersey cited,
 228.
 Catocala pretiosa, 375.
 Catodaulis superseded by Daimia, 371.
 Cebrio bicolor, 371.
 Cecidomyia balsamicola, 307.
 eratægi, 308, 364.
 destructor, 368.
 leguminicola, 376, 377, 378.
 trifolii, 376, 377.
 Cecidomyia in a jumping gall, 308.
 Centerensis, Cossus, 373.
 Centipede, a household, 324.
 Cephas pygmeus, 334.
 cerasi, Eriocampa, 352.
 Ceratopogon sp. 384.
 Ceresa bubalus, 360.
 Ceria abbreviatella, 229.
 Cermatia forceps, 324-327.
 bibliography, 324.
 cockroach-killer, 325.
 Cermatia forceps—(*Continued*):
 croton-bug killer, 326.
 death reported from bite, 327.
 distribution northward, 326.
 earliest record of observation in Penn.,
 326.
 figure of, 325.
 habits, 325.
 occurs under stones and logs, 327.
 poisonous bites, 327.
 Rathvon's observations on, 325.
 Cerura aquilonaris, 375.
 borealis, 375.
 candida, 375.
 occidentalis, 375.
 Chaetura pelagica, bird-lice on, 384.
 Chalcid associated with a Cecidomyiid, 307.
 chalybea, Haltica, 332, 353, 361.
 cherry: insect injurious to
 Cacæcia argyrosipa, 356.
 Eriocampi cerasi, 352.
 Hallsidota caryaæ, 355.
 Scolytus rugulosus, 383.
 Tmetocera ocellana, 306.
 Cherry-tree slug, 352.
 chersis, Sphinx, 381.
 Chestnuts, *Balaninus caryatipes* from,
 383.
 Chilopoda, 324.
 Chinch-bug in Western New York, 331.
 Chinensis, Bruchus, 282.
 Chionaspis pinifoliae, 366, 384.
 Chloropisca prolifica, 216, 234-241, 358, 359,
 382.
 Chrisman, Mrs. L. G., on the rose-bug,
 346.
 chrysanthemi, Phytomyza, 242-246.
 Chrysanthemum fly, 242-246.
 Chrysanthemum: insects injurious to
 Diabrotica 12-punctata, 315.
 Eristalis tenax, 382.
 Phytomyza chrysanthemi, 242.
 Chrysobothris ?femorata, 379.
 Chrysomela trimaculata [=Doryphora
 clivicollis], 369.
 Churchill, G. W., insects from, 312, 383, 384.
 Cicada septendecim, 218, 296-301, 361.
 tibicen, 383.
 Cicindela rapanda, 219.
 Cidaria Packardata, 375.
 Cinerarias: insect attacking Phytomyza
 chrysanthemi, 242.
 Cladius isomera, 224.
 viminalis, 223, 224.
 clavata, *Coptocycla*, 382.
 Clarkson, Frederick, on Cicada septende-
 cim at Tivoli, N. Y., 297-299, 301.
 Clematis visited by Spilomyia fusca, 229.
 Climbing ant-lion, 319.
 Clislocampa Americana, 215, 220, 331, 359.
 sylvatica, 331.
 clivicollis, Doryphora, 369.

- Clover: insects injurious to
Blissus leucopterus, 331.
Ceclomyia trifolii [=leguminicola], 374.
leguminicola, 378.
Hylastes trifolii, 378.
- Clover-leaf weevil, 315.
- Clover mite, *Bryobia pratensis*, 321-324.
 Ausable Falls occurrence, 324.
 bibliography, 321.
 common occurrence, 321.
 distribution, 322.
 eggs on trees, 322.
 figure, 322.
 food plants, 322.
 in a water-trough, 323.
 in dwelling-houses, 321.
 Schodack Center occurrence, 322.
- Clover-root borer, 335.
- Clover-seed fly, 374(2), 376.
- Coal ashes for insect attack, 344.
- Coccidae, 370.
- Coccinella bimaculata*, =*Adalia bipunctata*, 375.
 9-notata, 382.
 sanguinea, 382.
- Coccinellidae*, 217, 310, 341.
- Coccus hesperidum* [=Lecanium hesperidum], 370.
- Cockerell [T. D. A.] cited, 256, 258.
- Cockroach-killer, 325.
- Cockscomb elm-gall, 370.
- Cocoon of red-and-black woolly-bear, 227.
- Cocoon of rhinoceros beetle, 251.
- Codling-moth, 307, 310, 343.
- Coenia*, *Junonia*, 381.
- ceruleocinctus*, *Julus*, 384.
- Cold water for insect attack, 285.
- Coleman [N.] cited, 225.
- Coleophora* sp., 347, 361.
- Colias Philodice* killed by a fungus, 316.
- Colorado potato-beetle mite, 312, 345, 373.
- Compositæ, 242.
- Comptes-Rendus des Séances de la Société Entomologique de Belgique cited, 224.
- Comstock [J. H.] cited, 233, 334, 369.
- concinna*, *Œdemasia*, 381.
- confusa*, *Callimorpha*, 219.
- confusus*, *Limonius*, 351, 361.
- congregatus*, *Apanteles*, 364.
- Conotrachelus nenuphar*, 288-290.
- Contagious diseases of insects, 341.
- couvergens*, *Hippodamia*, 382.
- Cook [Prof. A. J.] cited, 256, 277, 321.
- Coon, Dr. H. C., insects from, 271, 272, 283.
 on *Chloropisca prolifeca*, 241.
- Copris, 254.
- Coptocycla aurichalcea*, 363.
 clavata, 382.
 guttata, 389.
- Coquillett, D. W., insects from, 382.
- Corn: insect injurious to *Calandra oryzæ*, 362, 383.
- Corn — (*Continued*):
Diabrotica 12-punctata, 217.
Heliothis armiger, 216, 362.
Mesographa polita, 233.
Sphenophorus sculptilis, 376.
- Corning, Jr., Erastus, insects from, 220, 381.
- Corn saw-fly, 334.
- cornutus*, *Corydalus*, 254.
- Corn-worm, 216, 363.
- Cossus Centerensis*, 373.
 crepera, 375.
 plagiatus, 375.
 querciperda, 220, 375.
 reticulatus, 375.
 undosus, 375.
- Cottony-cushion scale, 340.
- Couch, Charles, insects from, 382.
- Country Gentleman cited, 225, 234, 256(2), 266, 290, 295, 302, 304, 313, 321(2), 357(2), 358, 359(4), 360(3), 362(3), 363(5), 364(2), 365(3), 366(3) 367(4), 368(4), 369(7), 370(6), 371(5), 372(4), 373, 374(2), 375(2), 376(7), 377(5), 378(3), 379(6), 380.
- Cow-horn fly, 332-334.
 confined to cattle, 333.
 eggs in fresh manure, 333.
- Injuries from, 333.
- Introduced from France, 333.
- northward spread, 333.
- popular names for, 333.
- preventives of bite, 333.
- reference to literature, 334.
- remedy for, 333.
- when first observed, 333.
- Cow-pea Bruchus, 270.
- Corydalus cornutus*, 254.
- Crane, Mrs. H. D., insects from, 384.
- crataegi*, *Cecidomyia*, 308, 364.
- Crataegus crus-galli*, borer proof, 314.
- Crataegus oxyacantha gall*, 308.
- crepera* [=robiniae] *Cossus*, 375.
- Cresson, E. T., cited, 223, 224.
- Crioceris asparagi*, 335.
- Crotch, Check List of Coleoptera cited, 255.
- Crotton bug, 326.
- Crotton-bug killer, 326.
- Crowe, David, insects from, 383.
- Crypturgus (Monarthrum) mali*, 370.
- Cucullia intermedia*, 375.
 lætipica, 375.
- Cucumber-beetle, 337, 367.
- Cucurbitaceæ, 217, 310, 382.
- cucurbitæ*, *Melittia*, 371.
- Culicidae attacked by a fungus, 315.
- cuniculi*, *Cuterabra*, 367, 382.
- cupida*, *Agrotis*, 375.
- Cureulio-catcher, 294.
- Cureulio nenuphar*, 288.
- pisorum* — see *Bruchus*, 256.
- Currant-stem girdler, 352.
- Currant-worm, 335, 361.
- Curtis' British Entomology cited, 249.
- Curtis, Dr. Josiah, cited, 327.

Curtis' Farm Insects cited, 267, 268, 279, 280,
282.
Cuterabra cuniculi, 367, 382.
 emasculator, 367.
Cutting out larvæ, 363.
Cut worm in corn, 363.
Cyllene robiniae, 363.
cynicus, Podisus, 356, 361.

D.

Dahlias injured by Diabrotica, 315, 382.
Daimia should supersede Catodaulis, 371.
Dall [Mrs. C. H.] cited, 324.
Daniell, Mrs. W. F., on Chloropisca pro-
lifera, 241.
Darapsa Myron, 381.
Datana ministra, 381.
 perspicua, 381.
Davis [Wm. T.] cited, 296, 301.
De Geer's Mémoires des Insectes cited,
365.
Dendroleon obsoletum, 319.
Depressaria LeContella, 375.
Depressaria? 379.
Dermestes lardarius, 369.
destructor, Cecidomyia, 368.
Deutsche Entomologische Zeitschrift cited,
285, 287.
diabolica, Vespa, 229.
Diabrotica 12-punctata, 217, 315, 382.
 vittata, 367.
Diaspis rosæ, 384.
dictæa, Notodontæ, 375.
diminuta, Phytomyza, 243.
Dimmock, A. K., cited, 225.
Dimmock [Dr. G.] cited, 256, 280.
Diplax rubicundula, 220.
Diplosis pyrivora, 335.
Diseased Austrian Pines, 366.
Disonycha triangularis, 383.
dispar, Ocneria, 302-304, 336, 357.
 Xyleborus, 349, 350, 370, 383.
Division of Entomology of U. S. Depart-
ment of Agriculture cited, 333, 340, 341, 346.
Dobson, the hellgrammite larva, 254.
Dodge, Charles R., cited, 309.
Dog-day Cicada, 383.
Doll, J., on Dynastes in Arizona, 252.
Doran [Dr. E. W.] cited, 256, 383.
 on Bruchus granarius, 282.
Doryphora clivicollis, 369.
Drosophila ampelophila, 241.
Dugès, Dr. Eugène, on Dynastes Hyllus,
249.
Dung-beetle, 312, 379.
Dyar, H. G., cited, 225, 227, 381, 384.
Dye, Franklin, insects from, 383.
Dynastes Grantii, 252.
 Hercules, 249.
Hyllus, 249, 250.
Tityus, 246, 255.

E.

Earies, S. F., cited, 315.
Earth-worm, 378.
Ectobia Germanica, 326.
Edusa, Homoptera, 375.
Eggs in plum twig, 360.
Eggs of
 Bean-weevil, 269, 271.
 Mantis, Carolina, 357.
 Spilosoma Virginica, 305.
 Xyleborus dispar, 348, 351.
Ellis [L. H.] cited, 321.
Elm-bark beetle, 352.
Elm: insects injurious to
 Cacœcia argyrospila, 356.
 Colopha ulmicola, 370.
 Galeruca xanthomelana, 217.
 Halisdioda caryæ, 355.
 Hylesinus opaculus, 352.
 Orgyia leucostigma, 216.
Elm-tree beetle, 217, 335, 363.
emasculator, Cuterabra, 367.
Emmons' Natural History of New York
cited, 225.
Empretia stimulea, 381.
English sparrow, 345.
Entomologica Americana cited, 247, 252,
280, 296(2).
Entomological Division U. S. Dept. Agri-
culture, 221.
Entomological News cited, 315, 324, 326.
 serials of the United States, 378.
Entomologists' Monthly Magazine cited,
268, 280.
Entomologists of Agricultural Experi-
ment Stations, 342.
 of Experiment Stations, 337.
Entomophthora phytonomi, 315.
 sphaerosperma, 315.
ephemeræformis, Thyridopteryx, 306, 381.
Epicauta vittata, 376.
Epidemic of fungus attack on insects, 36.
Epigena, Eudamus, 375.
Epilachna borealis, 217, 310, 311, 382.
 abundance at Dosoris, L. I., 310.
 figure of, 311.
 food of, 310.
 hibernation, 311.
 larva of, 311.
 remedies, 311.
equi, Psoroptes, 362.
Erebus odora, 306.
Erichsonii, Nematus, 335, 367.
Ericocampa cerasi, 352.
Eristalis flavipes, 229.
 tenax, 229, 233, 363, 382.
erosa, Phymata, 371.
Ervum lens eaten by Bruchus, 285.
Erythroneura vitis, 345.
Eudamus Epigena, 375.
Eupatoriums, insect attacking; Phytomyza
chrysanthemi, 242.

European bean *Bruchus*, 279-285.
Evecta, bolucella, 229.
Exorista militaris (*Nemoræa leucaniae*), 376.
 Eye-spotted bud-moth, 306, 355, 360, 363.

F.

Falcon (Wm.) cited, 242, 246, 310, 315, 366, 382.
fasciatus, *Gammarus*, 373.
 Fauvel, A., quoted on *Bruchus obsoletus* distribution, 259.
 Fauvel's *Revue d'Entomologie* cited, 256.
fenestralis, *Scenopinus*, 312, 367, 382.
Feniseca Tarquinius, 219.
 Fernald, Prof. C. H., cited, 303, 304, 312, 336, 357.
 Fernow, Berthold, insects from, 383.
 on the rhinoceros beetle, 254.
fidicularia, *Caradrina*, 375.
 Field and Forest cited, 309.
 Field Force Pump Co.'s Perfection Spraying Outfit, 292.
 Field collections in 1890, 219.
 Fighting insect pests, 358.

Figure of

ant-lions, 318, 319.
Aphis brassicæ, 317.
 bean-weevil, 260.
Bruchus obsoletus, 260.
Bruchus pisorum, 261.
Bruchus rufimanus, 280.
Bryobia pratensis, opp. p. 321.
 cabbage aphid, 317.
Cermatia forceps, 325.
Chloropisca prolifica, 234.
Chrysanthemum fly, 244.
Cleada septendecim, 297.
 clover-mite, opp. p. 234.
Conotrachelus nenuphar, 289.
 curculio-eatcher, 294.
Dendroleon obsoletum, 319.
Diabrotica 12-punctata, 315.
Dynastes Hyllus, opp. p. 250.
Dynastes Tityus, 247, 248, 250.
Epilachna borealis, 311,
 eye-spotted bud-moth, 306.
 European bean-weevil, 280.
 Field Force Pump, 292.
 fungus-attacked larva of clover-leaf weevil, 315.
 Goulds' double-acting spraying pump, 292.
 grapevine flea-beetle, 353.
 Gypsy-moth, 302.
Haltica chalybea, 353.
Helophilus latifrons, 230, 232.
Helophilus simillimus, 230.
Isabella tiger-moth, 226.
 larva of bean-weevil, 260.
 larva of clover mite, 322.
 larva of European bean-weevil, 280.
 larva of eye-spotted bud-moth, 306.

Figure of—(Continued):

larva of *Haltica chalybea*, 353.
 larva of plum curculio, 289.
 larva of rhinoceros beetle, 248.
 larva of *Saperda candida*, 313.
 larva of *Spilosoma Virginica*, 305.
 larva of *Syrphus* fly, 231.
 Lewis' Combination Force-pump, 293.
Myrmeleon immaculatus, 318.
 Northern lady-bird, 311.
Ocenera dispar, 302.
 pea-weevil, 261, 280.
Phytomyza chrysanthemi, 244.
Phytonomus larva killed by fungus, 315.
 plum-curculio, 289.
Prollie Chlorops, 234.
 pupa of bean-weevil, 260.
 pupa of *Cicada septendecim*, 297.
 pupa of *Dynastes Hyllus*, opp.
 pupa of plum curculio, 289.
 pupa of rhinoceros beetle, 250.
 pupa of *Saperda candida*, 313.
 pupa of *Spilosoma Virginica*, 305.
Pyrrharctia isabella, 226.
 rhinoceros beetle, 247.
 round-headed apple-tree borer, 383.
Saperda candida, 313.
 seventeen-year *Cicada*, 297.
Sitodrepa panicea, 311.
Spilosoma Virginica, 305.
Syrphus flies, 230, 232.
Tmetocera ocellana, 306.
 twelve-spotted *Diabrotica*, 315.
 yellow woolly-bear, 305.
flmetaria, *Lipura*, 374.
flmetarius, *Aphodius*, 312, 379, 383.
fissilis, *Melanotus*, 377.
 Fitch Biological collection of the N. Y. State Agricultural Society, 380.
 Fitch [Dr. A.] cited, 266, 289, 295, 299, 270, 380.
 on the bean weevil, 255, 257, 262-264, 267, 278.
 Reports on the insects of New York cited, 254, 295, 319.
 Five-spotted *Sphinx*, 379.
 Flat-headed apple-tree borer, 379.
flavimanus *Bruchus*, 268, 282, 284.
flavipes, *Eristalis*, 229.
 Fletcher, James, cited, 258, 280, 281, 288, 324, 326.
 Flies captured by *Cermatia*, 326.
 Flower flies, 229.
 Foote, Dr. A. E., referred to, 262.
 Forbes, Prof. S. A., cited, 321, 331, 341.
 forceps, *Cermatia*, 324-327.
Forficulidae, 238.
Formica Novaeboracensis = *Camponotus herculaneus*, 377.
fossor, *Aphodius*, 379.
Fraxinus sambucifolia, *Dynastes* feeding on, 252.
 French [G. H.] cited, 225, 311.

- fugitiva, *Limneria*, 381.
 Fuller, A. S.; *Bruchus*-infested pods from,
 281.
 cited, 255, 311.
funeralis, *Nisoniades*, 375.
Fungicides and insecticides combined, 345.
Fungus attack of peach twigs by
 Stereum complicatum, 374.
Fungus of chinch-bug, 341.
Fungus of clover-leaf weevil, 315, 316.
furvana, *Tortrix*, 356.
Furze, flowers visited by bean-weevil, 280.
fusca, *Lachnostenra*, 369.
fusca, *Spilomyia*, 229.
Fyles, Rev. T. W., insect eggs from, 381.
- G.**
- Galeruca xanthomelæna*, 217, 335.
Gall-mite, 365.
Galls on *Lasioptera vitis*, 376, 382.
Galls on *Abies Frazeri*, 382.
Galls on grapevine, 376, 382.
Gammarus fasciatus, 373.
Garden and Forest cited, 242, 244, 257.
Gardeners' Chronicle cited, 242.
Garlock, Washington, insects from, 382.
Garman, H., cited, 321(2).
Gaull's Catalogue des Coléoptères d'Europe et d'Algérie cited, 285.
Germanica, *Ectobia*, 326.
Gleditschia eaten by *Bruchus*, 257, 270.
Glover [T.] cited, 255, 369.
Glover's MS. notes of my Journal cited,
 228.
Glyphina ulmicola = *Colopha ulmicola*,
 370.
Goff, Prof. E. S., cited, 266.
 insects from, 383.
 on cultivation of lentils, 288.
Goldenrods visited by *Syrphidæ*, 229, 233.
Golden tortoise beetle, 376.
Goodwin, F. F., insects from, 382.
Gortyna nitela, 377.
Goulds' Manufacturing Company's double-acting spraying pump, 292.
Grain aphis, 217, 331, 335, 358, 360, 362, 369, 383.
 beetle, 280.
 weevil, 217, 362.
granarius, *Bruchus*, 255, 263, 267, 279-285.
granaria, *Calandra*, 365.
Grantii, *Dynastes*, 252.
Grape: insects injurious to.
 Aphis sp.? 369.
 Erythroneura vitis, 345.
 Darapsa Myron, 381.
 Haltica chalybea, 333, 353.
 Isosoma vitis, 374.
 Lasioptera vitis, 376, 382.
 Phylloxera vastatrix, 371.
 Procris Americana, 379.
 Pulvinaria innumerabilis, 376.
- Grape-seed fly, 373, 374.
Grapevine flea-beetle, 332, 353, 357, 361.
 Coccus, 370.
 Sphinx, 381.
Grapta Satyrus, 375.
Grass: insects injurious to.
 Blissus leucopterus, 331.
 Cebrio bicolor, 371.
 Chloropisca prolifica, 216.
 Ptyelus lineatus, 383.
Graves, Mr. H. D., cited, 358, 359.
 insects from, 382.
 on *Chloropisca prolifica*, 236-238, 239,
 240.
 on the clover mite, 324.
Gray, Dr. Asa, cited, 278.
Gray gnat, 364.
Gray's School and Field-Book of Botany
 cited, 285.
Green grapevine Sphinx, 364.
griseus, *Benacus*, 383.
guttata, *Coptocycla*, 369.
Gypsy moth, 302-304-335-337, 357.
 alarm caused by, 303.
 appropriation for its extermination,
 337.
 carriage by railroads, 302.
 distribution in Massachusetts, 302, 336,
 337.
 European habits, 303, 336.
 figures, 302.
 food-plants, 303, 336.
 Hagen, Dr. on, 393.
 how it may be controlled, 304, 336.
 injuries from, 303, 336.
 introduction in United States, 304, 336.
 legislation on, 336.
 parasites, 304.
 pupation, length of, 304.
 when the moths appear, 304.
- H.**
- Haematobia serrata*, 333.
Hagen, Dr. H. A., cited, 279, 303, 319, 320.
Halisidota caryæ, 355.
Haltica chalybea, 332, 353, 361.
 striolata = *Phyllotreta vittata*, 372.
 sp. undetermined on *Ampelopsis*, 338.
Hamilton, Dr. John, on bean and lentil
 weevils, 256, 259, 279, 280, 281, 283, 284, 285,
 286, 287.
 on change of color in *Dynastes*, 252.
 on rhinoceros beetle, 247, 251.
 on stridulation of the rhinoceros beetle,
 250.
Hand-picking insect pests, 246, 311, 379.
Harlequin cabbage-bug, 372.
Harrington [W. H.] cited, 256, 335.
Harris, Dr. T. W., cited, 225, 256, 305.
Harris' Insects of New England cited, 256,
 269, 288, 295.

- Hatch Act establishing Experiment stations, 337.
 Hawthorn galled by *Cecidomyia*, 308.
 Hayward, T. E., on oviposition of plum curculio, 296.
 Hedges, C. M., apple-bark beetle from, 316.
Heliothis armiger, 216, 363, 382.
 Hellebore powder, 352.
 Hellgrammite fly, 254.
Helophilus latifrons, 228.
similis, 228, 230, 233.
 Henshaw, Samuel, notes on bean-weevil from, 262.
herculeanus, *Camponotus*, 377.
 Hercules, *Dynastes*, 249.
Hesperidæ, Dr. Speyer on the genera of, 371.
?hesperidum, *Lecanium*, 370.
 Hessian fly, 368.
 Hibernation of *Chlorops* in Europe, 235.
 Hickory: Insects injurious to.
Caeocæcia argyrospiæa, 356.
Halisdota caryaæ, 355.
Hippodamia convergens, 382.
histrionica, *Murgantia*, 372.
 Hoag, Ira W., insects from, 355.
 Hogeboom, Dr. C. L., insects from, 384.
Homohadena badistriga, 375.
Homoptera Edusa, 375.
 Homoptera collection arranged by Dr. Fitch 380.
 Honey-bee fly, 229.
 Hoose, Dr. James H., insects from, 383.
 Hop-vine aphid, 331, 335, 345, 357.
 Horn, Dr. G. H., cited, 252, 351.
 on bean-weevils, 255(2), 257, 258, 278(3), 281, 284, 285, 286.
 Horn-fly, 332-334.
 Horse chestnut, *Orygia leucostigma* on, 216.
 Horses liable to sheep-scab, 362.
 Hot water for insect attack, 241, 374.
 House-fly infested by a fungus, 316.
 parasite, 384.
 Household pests:
Cermatia forceps, 324-327.
Chloropisca prolifica, 216.
 Hover-flies, 229.
 Howard, C. M., insects from.
 Howard [L. O.] cited, 247, 282, 296, 304, 307.
 on spraying with cold water, 344.
 Hoy, Dr. P. R., referred to, 373.
 Humuli, *Hypena*, 375.
Phorodon, 331, 335.
 Huntington, David, peach-bark borer from, 351.
Hylastinus obscurus, 335.
Hylesinus (Hylastes) trifolii, 335, 378.
opaculus, 352.
 Hylli, *Hypocacca*, 375.
Hyllus, *Dynastes*, 249.
Hypena humuli, 375.
Hypocala Hilli, 375.

- I.
- Icelus*, *Nisoniades*, 375.
Icerya Purchasi, 340.
Icerya scale, 360.
Ichneumon ceruleus, 228.
signatipes, 228.
Ichneumonidae infested by a fungus, 316.
immaculatus, *Myrmeleon*, 318, 384.
indivisalis, *Tortricodes*, 375.
infans, *Brephos*, 375.
innumerabilis, *Pulvinaria*, 370, 371, 376, 384.
Inquinatus, *Aphodius*, 379.
 Insecticides and fungicides combined, 345.
 Insect Life, cited, 228, 234, 243, 256, 257, 258, 297(4), 302, 304, 310, 316, 321(5), 324(4), 333.
 Insects attacked by a fungus, 316.
 Insects received from New York localities:
 Adirondacks, 364.
 Albany, 369, 382(3), 383(3), 384.
 Albion, 354.
 Alfred Center, 271, 383.
 Amsterdam, 367.
 Ausable Forks, 236, 354, 382.
 Bristol Springs, 378.
 Brockport, 382.
 Brooklyn, 384.
 Buffalo, 285, 382.
 Caledonia, 373.
 Canastota, 359.
 Charlotte, 365.
 Chatham Centre, 383.
Coeymans, 318, 319, 382, 384.
 Cortland, 383.
 Coxsackie, 362, 383.
Dey's Landing, 360, 383.
 Fort Edward, 310.
 Geneva, 312, 328, 364, 383, 384.
 Ghent, 382, 383.
 Glen Cove, 382(2), 383.
Gouverneur, 365, 384.
 Greenport, 381.
Haines Falls, 381.
 Hudson, 217, 383.
 Jamaica, 381.
 Jamestown, 356, 361.
 Keene Valley, 233, 364.
 Kinderhook, 383.
 Knox, 381.
 Laurence, 384.
 Lockport, 348, 361.
Macedon, 351, 353, 361.
Matteawan, 366, 384.
 Menands, 355.
 Monsey, 377.
 Moreton Farm, 226.
 Morches, 366.
 Naples, 381.
 Nassau, 230.
 New London, 265.
 New York, 382(2).
 Niagara Co., 382.
 Niverville, 383.

Insects received from New York localities—

(Continued):

- Oakfield, 382.
Palenville, 320.
Pawling, 355.
Penn Yan, 353, 361.
Piseco Lake, 233.
Port Ewen, 381.
Port Henry, 383.
Poughkeepsie, 375, 377(2).
Ransomville, 368, 382.
Rhinebeck, 384.
Ridgewood, 360.
Rochester, 347, 356, 361, 381, 384.
Schenectady, 372, 384.
Schoharie, 363, 382.
Scipioville, 377.
Somerset, 351.
South Byron, 347.
Staatsburg, 376.
Summit, 383.
Tarrytown, 383.
Utica, 382.
Watertown, 363.

Insects received from other localities:

- Abington, Mass., 362.
Annapolis, Md., 369, 379.
Arcola, Ill., 363.
Baltimore, Md., 371.
Bellbuckle, Tenn., 369.
Bordentown, N. J., 376.
Bradford Co., Pa., 370.
Carrollton, Ky., 378, 379.
Chambersburgh, Pa., 379.
Champaign, Ill., 370.
Chardon, O., 372.
Charlottesville, Va., 316.
Cleveland, O., 370.
Clifton Heights, O., 374.
Denville, N. J., 365.
Dorchester, Mass., 364.
Edgewood, Md., 369.
Essex Co., Mass., 376.
Fort Union, Va., 372.
Glasgow, Mo., 383.
Gordonsville, Va., 367, 382.
Great Bend, Pa., 369.
Keswick Station, Va., 369.
Laceyville, O., 372.
Los Angeles, Cal., 382.
Loudon, Tenn., 383.
Louisville, Ky., 371.
Madison, Wis., 383.
Metuchen, N. J., 360.
Millburn, N. J., 371.
Morgan Co., Tenn., 367.
Murray Bay, Canada, 381.
Nashville, Tenn., 371.
Northampton, Mass., 365.
Philadelphia, Pa., 376.
Pittsfield, Mass., 384.
Prospectville, Pa., 376.

Insects received from other localities—

(Continued):

- Providence, R. I., 304.
Racine, Wis., 373.
Red Bank, N. J., 363, 383.
Roan Mt., N. C., 307.
Sargeantville, N. J., 306, 381.
South America, 381.
South Britain, Conn., 320.
South Quebec, Can., 381.
St. Albans, Eng., 383.
St. Anthony's Park, Minn., 381.
Staunton, Va., 370.
Summerfield, Ill., 379.
Trenton, N. J., 383.
Wabash, Ind., 381.
Waterbury, Conn., 269, 383.
Waverly Mills, S. C., 357.
Weybridge, Eng., 364.
Winsted, Conn., 368.

Insects introduced from Europe and when:

- asparagus beetle, 336.
cabbage butterfly, 335.
carpet beetle, 336.
clover-root borer, 336.
corn [wheat] saw-fly, 334.
cottony-cushion scale, 340.
cow-horn fly, 333.
currant worm, 335.
elm-leaf beetle, 335.
grain aphid, 335.
gypsy moth, 336.
hop-vine aphid, 335.
larch saw-fly, 335.
pear midge, 335.

Insects killed by electric lights, 362.

intermedia, Curculia, 375.

Introduction of insect pests:

- Aanthrenus serophulariae*, 335.
Cephus pygmeus, 334.
Crioceris asparagi, 335.
Diplosis pyrivora, 335.
Galeruca xanthomelaena, 335.
Hæmetobia serrata, 333.
Hylastinus obscurus, 335.
Icerya Purchasi, 340.
Nematus Erichsonii, 335.
Nematus ribesii, 335.
Ocneria dispar, 335.
Phorodon humuli, 335.
Pleris rapæ, 335.
Siphonophora avenæ, 335.

Introduction of parasitic insects, 340.

invitus, *Lygus*, 348.*irresectus*, *Bruchus*, 256, 279.*isabella*, *Pyrrharctia*, 226, 228, 368.*isomera*, *Cladius*, 224.*Isosoma vitis*, 374.

J.

Jack [J. G.] cited, 242, 243, 244, 257.
on the poplar saw-fly, 223.

- Jacobs, Dr., cited, 224.
 Jansen [O. E.] on bean weevils, 256, 259, 260,
 283, 284, 286.
 Jarring for the curculio, directions, 294.
 Jarring insects from trees, 289, 294.
Journal of Mycology cited, 362.
Julianus, *Strategus*, 249.
Julus ceruleoocinctus, 384.
 Jumping galls from *Euphorbia*, 310.
 hawthorn, 309, 364.
 Oaks, 309.
 Sebastiania, 310.
 Jumping seeds, 309, 310.
 June-bug, 369.
Junonia Coenia, 381.
Juvenalis, *Nisoniades*, 375.
- K.**
- Keene Valley collections, 364.
 Kerosene emulsion, 318, 360 (2).
 Kerosene for insect attack, 276, 351, 352, 353,
 355, 364.
 Kirby and Spence cited, 257.
 Kowarz, F., on *Phytomyza chrysanthemi*,
 243, 245.
- L.**
- Lachnostenra*, 254, 369.
lacteola, *Acidalla*, 375.
laetifica, *Cucullia*, 375.
laevis, *Canthon*, 382.
lambda var *Thaxteri*, *Xylina*, 375.
Lampyridæ, 219.
 Lampyrid attacked by a fungus, 316.
Larch saw-fly, 335, 367.
lardarius, *Dermestes*, 369.
 Larva of
 ant-lion, 318, 319.
 bean-weevil, 271.
 black and red woolly-bear, 227.
 Helophilus latifrons, 231.
 poplar saw-fly, 224.
 rhinoceros beetle, 247, 249.
Lasioptera vitis, 376, 382.
lateralis, *Napomyza*, 246.
latifrons, *Helophilus*, 228.
 Lazenby [Wm. R.] cited, 256.
 Leaf-hoppers, 345.
 Leaf-roller, 355.
 Leather-eating beetle, 311.
 Leavell [J. M.] cited, 247.
 LeBaron [Dr. Wm.] cited, 255, 279, 281.
Lecanium acericola=*Pulvinaria innumerabilis*, 370.
Lecanium acericorticis=*Pulvinaria innumerabilis*, 371.
Lecanium sp.? on *Magnolia*, 384.
Lecanium Vitis=*Pulvinaria innumerabilis*, 376.
Lecanium Persicæ, 379, 380.
 LeConte [Dr. J. L.] cited, 255, 258, 278.
LeContella, *Depressaria*, 375.
 Leeming, Miss H. D., insects from, 384.
- leguminicola, *Cecidomyia*, 376, 378.
 Leguminosæ infested by *Bruchidæ*, 257.
 Leidy [Dr. J.] cited, 255, 259.
Lema trilineata, 382.
 Lens esculeuta eaten by *Bruchus lentis*,
 285, 287, 288.
 Lentil weevil, 285, 288.
lentis, *Bruchus*, 285, 288.
lepidia, *Xylina*, 375.
 Lepidoptera common to the United States
 and Patagonia, 374.
Leuconia unipuncta, 373, 376.
leucopterus, *Blissus*, 331.
leucostigma, *Orgyia*, 216, 331.
 Lewis Combination Force Pump, 293.
Liburnum? infested by *Bruchus*, 281.
 Life-history studies of W. H. Edwards, 378
Lilac, *Mytilaspis pomarum* on, 384.
 Lime, for insects, 333, 352, 372.
Limenitis Arthemis, 219.
liminaris, *Phycotribus*, 352, 361.
Limneria fugitiva, 381.
Limnophilus attacked by a fungus, 316.
Limonius auripilis, 361.
 confusus, 351, 361.
 4-maculatus, 351.
Lina scripta, 219.
lineatella, *Anarsia*, 369, 376.
lineatus, *Ptyelus*, 383.
Lintneria [Hesperid genus] changed to
Systasia, 371.
Lipura flmetaria, 374.
 List of Lepidoptera collected by W. W. Hill
 in the Adirondack Region of New York
 cited, 374.
 Livingston, Clermont, on Cicada's song,
 298.
 Locust insect, *Cyllene robiniae*, 363.
 Locust-tree borer, 363.
 Loew [Dr. H.] cited, 228.
 Loew, Dr., Dipterological labors of, 378.
 London purple and Bordeaux mixture, 345.
 London-purple poisoning, 339.
 Long, Andrew S., insect eggs from, 383.
 Lord, E. J., insect from, 382.
Lotis, *Lycæna*, 374.
 Love, S. G., insects from, 356.
Lucanus, 254.
Lucia, *Lycæna*, 375.
Lucilius, *Nisoniades*, 375.
 Lugger, Dr. O., insects from, 381.
 Lugger, Otto, cited, 247, 252, 254.
 Lugger, Otto, successful spraying for
 plum curculio, 293.
Lumbrieus terrestris, 378.
lunata, Homoptera, 375.
lutescens, *Aulacomerus*, 223, 224.
Lycæna Lucia, 375.
Lycæna Lotis, 374.
 neglecta, 374.
 pseudargiolus, 375.
 Lygus invitus on pear, 348.

M.

Mabee, Jerome, insects from, 382.
 Macrodactylus subspinosus, 345.
 macrurum, Ophion, 228.
 maculata, Vespa, 229.
 Magnolia, Lecanium sp.? on, 384.
 malifoliella, Tischeria, 354.
 mali, Monarthrum, 316, 370.
 Mallodon angustatum, 251.
 Mallophaga, 384.
 Mann [B. P.] cited, 225.
 Mann, W. T., insects from, 382.
 Maple insect, Cacocæcia argyrospila, 356.
 Maple insect, Pulvinaria innumerabilis, 370, 371.
 Maple scale insect, 384.
 Maple-tree scale, 360.
 Marguerite fly, 242.
 Marten [John] cited, 225.
 Martialis, Nisoniades, 375.
 Martin, Rev. C. G., Insects from, 381.
 Maxwell & Bros., insects from, 355.
 McDowell, E. M., gall received from, 308.
 McNeal [Jerome] cited, 297.
 Meadow-sweet, visited by bean-weevil, 280.
 megatoma, =pileus, Attagenus, 377.
 Melanotus fissilis, 377.
 Melanotus sp., 360.
 Melittæ Phaëton, 219.
 Melittia cucurbitæ, 371.
 Melon attacked by Epilachna borealis, 217, 310.
 Melsheimeri, Perophora, 381.
 Memoirs of Boston Society of Natural History cited, 315.
 Mermis acuminata, 374.
 Meromyza Americana, 377.
 Mesograpta polita, 233.
 Mexican jumping-seed, 310.
 Michigan Farmer cited, 321.
 Microgaster cocoons, 358.
 Midge, Adirondack, 364.
 Migratory locust of the Old World, 340.
 militaris, Exorista, 376.
 Milkweed: Doryphora clivicollis on, 369.
 Mimicry in Syrphidae, 229.
 Mimosa eaten by Bruchus, 257.
 mimus, Bruchus, 285.
 ministra, Datana, 381.
 Mite parasite on the house-fly, 865.
 Mites:
 Phytoptus pyri, 365.
 Tyroglyphus siro, 357.
 Bryobia pratensis, 368.
 Trombidium muscarum, 365.
 Mites on grass, clover, trees, etc., 322.
 Mites infesting smoked meats, 357.
 Mites in water trough, 355.
 modestus, Podisus, 353.
 Moeschler cited, 225.
 Moltings of Bombycidae, 227.
 Monarthrum mali, 316.

Monostegia rosæ, 344, 362.
 Morey, Dr. R. H., on mites in a water-tank, 328.
 Insects from, 230.
 on rat-tail larvæ of Helophilus, 231.
 Morning glory insects:
 Cassida nigripes, 363.
 Coptocycla, aurichalcea, 363.
 Morrell, H. H., insects from, 265.
 Morris [J. G.] cited, 225.
 Murgantia histrionica, 372.
 Murrell, G. E., on the feeding of the rhinoceros beetle, 251.
 Murtfeldt [Mary E.] cited, 297.
 muscarum, Trombidium, 365, 384.
 Mycotophilidæ attacked by a fungus, 316.
 Myer, Miss H. G., insects from, 381.
 Mylabris rufimana, 280.
 rufimanus, 285.
 Myriopoda, 324.
 Myrmeleon immaculatus, 318, 384.
 ocellatus, 319.
 nigrocinctus, 319.
 pantherinus, 320.
 Myron, Darapsa, 381.
 Mytelaspis pomorum, 384.

N.

Napomyza lateralis, 246.
 neglecta, Lycaena, 374.
 Nematus Erichsonii, 335, 367.
 Nematus ribesii, 335.
 Nematous ventricosus (=ribesii), 356.
 Nemorea leucanæ, 376.
 nenuphar, Conotrachelus, 288-290.
 Nephopteryx [Pinipestices] Zimmermanni, 373.
 Neuroterus saltatorius, 309.
 New enemy of the current-worm, 355.
 New England Farmer cited, 360.
 New England Homestead cited, 256, 362, 363
 367.
 New York Times cited, 234, 358, 360.
 New York Tribune cited, 255.
 New York World quoted, 303.
 nigricans, Agrotis, 375.
 nigripes, Cassida, 363, 383.
 nigrocinctus, Myrmeleon, 319.
 Nisoniades, tibial tufts in, 371.
 tibial epiphysis in, 371.
 Nisoniades Brizo, 375.
 funeralis, 375.
 Icelus, 375.
 Juvenalis, 375.
 lucilius, 375.
 Martialis, 375.
 Pucuvius, 375.
 Persius, 375.
 nitela, Gortyna, 377.
 nivius, Ecanthus, 384.
 Northern lady-bird, 310, 311.
 Notodonta dictæa, 375.

nova, *Orgyia*, 219, 381.
novem-notata, *Coccinella*, 382.
Number of known Syrphidae, 229.

O.

Oak insect, *Cacoccia argyrospila*, 356.
Oak insect, *Perophora Melsheimerii*, 381.
Oats injured by grain aphid, 218.
Oats, insect, *Cephus pygmeus*, 334.
Oberea tripunctata [=blimaculata], 369.
obesus, *Xyleborus*, 350.
Oblique-banded leaf-roller, 355.
oblongifolia, *Amblycomorpha*, 369.
obscurus, *Bruchus*, 263, 264.
obscurus, *Hylastinus*, 335.
obsidianator, *Trogus*, 228.
obsoletum, *Dendroleon*, 319.
obsoletus, *Bruchus*, 217, 255-279, 367, 383.
occidentalis, *Cerura*, 375.
ocellana, *Tmetocera*, 216, 306, 355, 363, 382.
ocellatus, *Myrmeleon*, 319.
Oeneria dispar, 302-304, 336, 357.
odora, *Erebis*, 306.
Odynerus Philadelphiae, 229.
Ecanthus niveus, 384.
(Edemasia concinna, 381.
(Estridae, 367.
Ohio Farmer, cited, 321, 368.
oleracea, *Pieris*, 219.
opaculus, *Hylesinus*, 352.
Opion arctiae, 228.
 macrurum , 228.
Orange Insect, *Icerya Purchasi*, 340.
Orange Judd Farmer cited, 357.
Orchard and Garden cited, 344.
Orgyia leucostigma, 216, 331.
Orgyia nova, 219, 381.
orientalis, *Periplanata*, 325.
Ormerod's Injurious Farm and Fruit
Insects of South Africa, cited, 256.
Ormerod's Manual of Injurious Insects
cited 279, 280, 282, 366.
 Reports on Injurious Insects cited, 279,
 280, 282, 285.
Ormerod, Miss E. A., cited, 259, 282, 284, 349.
 insects from, 383.
 quoted on bean weevil, 283.
 lentil weevil, 286.
oryzae, *Calandra*, 362, 383.
Osceola, *Pamphila*, 374.
Oscinidae, 234, 377.
Osmoderma, 254.
Osage orange, *Pulvinaria innumerabilis*
 on, 370.
Osten Sacken [Baron] cited, 228, 230, 233, 235,
 240, 242, 243, 378.
Otiorhynchus ovatus, 331, 360.
ovatus, *Otiorhynchus*, 331, 360.
Oviposition of *Saperda candida*, 314.
Oviposition of the plum curculio, 295, 296.
Oxalis, *Aleyrodes* on, 383.
Packardata, *Cidaria*, 375.

P.

Packard, Dr. A. S., cited, 225, 255, 281, 312,
 320, 370.
Pacuvius Nisonlades, 375.
Paine, J. A., insect from, 383.
pallida, *Bryobia*, 321.
pallidipes, *Bruchus*, 256.
Pamphila Osceola, 374.
panicea, *Slodrepa*, 311.
pantherinus, *Myrmeleon*, 320.
Papilio cited, 225.
Papilio Turnus, 219.
Parasitic insects introduced, 340.
Parasites:
 of *Aphodius flemetarius*, 312, 388.
 of army worm, 376.
 of *Bruchus scutellaris*, 282.
 of grapevine Sphinx, 364.
 of house-fly, 365, 384.
 of *Julus cœruleocinctus*, 384.
 of *(Edemasia concinna*, 381.
 of grain aphid, 218.
 of gypsy moth, 304.
 of *Icerya Purchasi*, 341.
 of *Pyrrharctia isabella*, 228.
Paria aterrima, 360.
Paris green and flour for beetles, 351.
Parker, Miss Sarah, insects from, 384.
Passalus, 254.
Peach-bark borer, 351, 361.
Peach-tree borer, 374.
Peach-twigs moth, 369.
Peach insects:
 Anarsia lineatella, 369.
 Diabrotica 12-punctata, 315.
 Lecanium Persicæ, 379, 380.
 Phloeotribus liminaris, 352.
 plum curculio, 374.
Pear-blight beetle, *Xyleborus pyri*, 348-351,
 361, 370.
 at Lockport, N. Y., 348.
 beetles reared, 349.
 burrows of, 348.
 disparity in sexes, 350.
 eggs in a side chamber, 351.
 fatal to trees, 348.
 food of larva, 350.
 fruit trees attacked, 350.
 identity with *dispar* of Europe, 349.
 males not numerous, 350.
 Pomroy, N., on, 348.
 white lining of burrows, 349.
Pear-leaf blister, 365.
Pear: insects attacking:
 Cacoccia argyrospila, 356.
 rosaceana, 355.
 Coleophora sp., 347, 361.
 Diplosis pyrivora, 335.
 Halisidota caryæ, 355.
 Lygus invitus, 348.
 Tmetocera ocellana, 306.
 Xyleborus dispar, 348.

- Pear midge, 935.
 Peas: insect attacking;
 Bruchus rufimanus, 281.
 scutellaris pisorum = *Chinensis*,
 282.
 Pea-weevil, 263, 264, 266, 267, 269, 280.
 Peck, Prof. C. H., insects from, 355, 384.
 Pentatomidae, 238.
 Periodical Cicada, 218, 296-301.
 Periplanata orientalis, 325.
 Perophora Melsheimerii, 381.
 perpolita, *Agrotis*, 375.
 Persicæ, *Lecanium*, 379, 380.
 Persius, *Nisoniades*, 375.
 persplicua, *Datana*, 381.
 Pest of the Carriage Trimming Shop, 311.
 Phaëton, *Melitaea*, 219.
 Phaseoli, *Bruchus*, 263.
 Philadelphiæ, *Odynerus*, 229.
 Phloœotribus liminaris, 352, 361.
 Phobetron pitheciun, 381.
 Phorodon humuli, 331, 335.
 Phyllophaga pilosicollis [= *Lachnostenra tristis*], 369.
 Phylloptera oblongifolia, 369.
 Phylloxera vastatrix, 371(2).
 Phymata erosa, 371.
 affinis, 242, 245, 246.
 Phytoomyza chrysanthemi, 242-246.
 dilminuta, 243.
 lateralis, 242, 244.
 nigricornis, 242.
 solita, 243.
 Phytomyzidae, 242.
 phytonomi, *Entomophthora*, 315.
 Phytonomus punctatus, 315.
 Phytoptus pyri, 365.
 pleus, *Attagenus*, 382.
 Pierce, G. F., insects from, 320.
 Pieris caterpillar killed by a fungus, 316.
 Pieris oleracea, 219.
 rapæ, 219, 335.
 Pigs for eating infected fruits, 290.
 Pine insect:
 Chionaspis pinifoliae, 366, 384.
 Pinipestis Zimmermani, 373.
 Thrips, sp., 384.
 pinifoliae, *Chionaspis*, 366, 384.
 pisi, *Bruchus* = *pisorum*, 263.
 pisorum, *Bruchus*, 268, 280, 286.
 pitheciun, *Phobetron*, 381.
 plagiatus, *Coccus*, 375.
 Plant-lice, 217, 345.
 Plant-lice killed by *Phymata erosa*, 371.
 Plaster of Paris for insect attack, 336.
 Pittsburgh Morning Telegram cited, 234, 358.
 Plowing under locusts, 339.
 Plum curculio, 288-290, 343, 374.
 Plum-gouger, 293.
 Plum: insect attacking;
 Conotrachelus nenuphar, 289.
- Plum: insect attacking, (*Continued*):
- Tmetocera ocellana, 306, 355.
 - Xyleborus dispar, 350.
 - Podisus cynicus, 356, 361.
 - Podisus modestus, 353.
 - Podisus sp., 361.
 - Podura aquatica, 374.
 - Poduridae in a cistern, 374.
 - Poisoning insects, 359.
 - Poisonous bite of Germatia, 327.
 - polita, *Mesograpta*, 233.
 - ponmfoliella, *Bucculatrix*, 216, 354, 359, 368, 387.
 - pomonella, *Carpocapsa*, 310.
 - Pomroy, Norman, on pear-blight beetle, 348.
 - Popenoe, Prof. E. A., on bean-weevil, 255, 260, 264, 265, 266, 270.
 - Poplar insect:
 - Cladius viminalis*, 223, 224.
 - Cossus Centerensis*, 373.
 - Cecanthus niveus*, 384. - Poplar saw-fly, 223.
 - Popular Gardening cited, 361(6).
 - Popular Science Monthly cited, 247.
 - Popular Science News cited, 304, 308.
 - Potato insect:
 - Coptocyclo aurichalcea*, 376.
 - Coptocyclo guttata*, 369.
 - Epicanta vittata*, 376.
 - Gortyna nitala*, 377. - Powell, George T., galls from, 382.
 insects from, 383.
 - Practical Entomologist cited, 288, 295.
 - Prairie Farmer cited, 321.
 - pratinensis, *Bryobia*, 321-324, 365.
 - Praying mantis, 357.
 - Precursors in Cicada broods, 299.
 - pretiosa, *Catocala*, 375.
 - Preventives of apple-tree borer, 313.
 chinch-bug, 332.
 cow-horn fly, 332.
 grapevine flea-beetle, 332.
 locust-tree borer, 363.
 peach-tree borer, 374.
 plumb curculio, 290, 346.
 striped cucumber beetle, 368.
 - Preventives of insect attack:
 breaking up hibernating quarters, 332.
 brine lime wash, 332.
 carbolized plaster, 346.
 dusting foliage, 289.
 excluding by netting, 368.
 gas-tar water, 290.
 ground bone dust, 368.
 heavy rains, 332.
 lime-dust, 289.
 lime-wash, 289, 332.
 mounding about base of trees, 374.
 oil application, 333.
 plaster of Paris, 346.
 soap and carbolic acid, 363.

- Preventives of insect attack—(Continued):
 strong odors, 289.
 wrapping tree-trunks, 313.
- Proceedings of Academy of Natural Sciences of Philadelphia, cited, 255.
- Proceedings of American Philosophical Society cited, 228.
- Proceedings of California Academy of Science cited, 225.
- Proceedings of American Entomological Society cited, 225.
- Proceedings of Entomological Society of Washington cited, 247(3), 296(2), 297, 317.
- Proceedings of Western New York Horticultural Society cited, 342, 358.
- Procris Americana, 379.
- prodromus, Aphodius, 312.
- Progress in economic entomology, 342.
- Progress in insect studies, 337.
- prolifica Chloropisca, 216, 234-241, 358, 359, 382.
- Prolific Chlorops, 234-241.
- Propagation of contagious diseases of insects, 341.
- pseudargiolus, Lycaena, 375.
- Psoroptes equi, 362.
- Psycho cited, 225(2), 256, 279, 318, 380.
- Psyllidae? infesting maples, 367.
- Ptyelus lineatus, 383.
- Pteromalinae, 307.
- Pulvinaria innumerabilis, 384.
- punctata, Diabrotica, 315.
- punctatus Phytonimus, 315.
- Punk of the Adirondacks, 364.
- Purchasi, Icerya, 340.
- pygmaeus. Cephus, 334.
- Pyrameis cardui eaten by Pyrrhactia isabella, 228.
- Pyrethrum powder, 236, 290.
- Pyrethrum water for insect attack, 315, 344, 360.
- pyri, Phytoptus, 365.
- pyri, Xyleborus, 348, 370.
- pyrivora, Diplosis, 335.
- Pyrrhactia Californica = isabella, 225-228, 368.
- Q.**
- querciperda, Cossus, 220, 375.
- Quince: insect feeding on:
 Thyridopteryx ephemeraeformis, 306.
 Limonius confusus, 351, 361.
 Saperda candida, 314.
- Quince on Crataegus stock proof against apple-tree borer, 314.
- quinquemaculata, Sphinx, 379.
- R.**
- Raeder, Frank N., insects from, 383.
- Randall, J. M., on jarring for eurelio, 294.
- Ransom & Son, W. H., insects from, 382.
- Ranunculaceæ mined by Phytomyza affinis, 246.
- rapae, Pieris, 219, 335.
- Raspberry cane-borer, 369.
- Raspberry insect
 Limonius auripilis, 351.
 Oberea bimaculata, 369.
- Rathbone, A. B., insects from, 382.
- Rathvon Dr. S. S., cited, 255, 257, 279,
 on Cermatia forceps, 325, 326.
 on the rhinoceros beetle, 253.
- Rat-tail larvæ, 363.
- Red mites, 323, 365.
- Red spider, 324.
- Reinecke (Ottomar) cited, 285.
- Reinecke and Zeseh's List of Coleoptera in the vicinity of Buffalo, cited, 285.
- Reitter's Catalogus Coleoptorum Europeæ, etc., cited, 256, 279.
- Remedies for insect attacks;
 alkallne solutions, 344.
 arsenical spraying, 216, 290-293, 307, 336, 353, 355, 360, 361, 363, 368.
 attracting to vinegar and molasses, 363.
 balloon hopper-dozer collecting, 336.
 benzine, 364.
 bisulphide of carbon, 276, 277, 365, 367.
 burning infested stock, 361, 363, 367.
 burning stubble, 339.
 burning rubbish, 353, 365.
 carbolic acid, 357.
 coal ashes, 344.
 cold water, 285.
 cold water spraying, 344, 360.
 crushing larvæ, 363, 364, 379.
 eurelio-catcher, 294.
 cutting out the larvæ, 363.
 hand-picking, 246, 311, 379.
 heat, 275.
 hellebore powder, 352.
 hopper-dozer collecting, 338.
 hot water, 241, 374.
 jarring from tree, 289, 294.
 kerosene, 276, 351, 352, 354, 355, 364.
 kerosene emulsion, 318, 360(2).
 lime, 333, 352, 372.
 lime-water, 366.
 London purple poisoning, 339.
 nitrate of soda for slugs, 366.
 Paris green and flour, 351.
 paving or flagging under trees, 290.
 pigs to eat infested fruit, 290.
 planting fruit trees over water, 290.
 plaster of Paris, 333.
 plowing under, 339.
 propagation of contagious diseases, 341.
 pyrethrum powder, 236, 290.
 pyrethrum water, 315, 344, 360.
 soap-suds, 372.
 sulphur, 365.
 sweetened water in bottles, 289.
 tobacco water, 344, 372.

- Remedies for insect attacks—(Continued):
 trapping, 366.
 whale-oil soap solution, 290, 318.
- Remedy for bean-weevil, 275–277, 285.
 boll-worm or corn-worm, 363.
 bud-moth, 216.
 cabbage aphis, 318, 372.
 carpet-beetle, 364.
 cherry-tree slug, 352.
 chinch-bug, 341.
Chloropisca *prolifica*, 241.
chrysanthemum fly, 246.
 cow-horn fly, 333.
Diabrotica 12-punctata, 315.
 elm-leaf beetle, 363.
Epilachna *borealis*, 311.
 eye-spotted bud-moth, 216, 307, 360, 363.
 golden tortoise beetle, 376.
 grain aphis, 360.
 grain weevil, 365.
 grapevine flea-beetle, 353.
 hickory tussock caterpillar, 355.
 locust-tree borer, 383.
 mites infesting meat, 357.
 oblique-banded leaf-roller, 355.
 peach-bark borer, 361.
 peach-tree borer, 374.
 pear-leaf blister, 365.
 plant-lice, 345.
 plum curculio, 289, 290.
Proteris Americana, 379.
 Rocky Mountain locust, 338, 339.
 rose-leaf hopper, 345.
 rose slug, 344.
 Scolytid bark-borers, 352.
 slugs and snails, 366.
 snapping-beetle on quince blossoms, 351.
- repanda*, *Cicindela*, 219.
- Report on the Insects and other Animal Forms of Caledonia creek, N. Y., 373.
- Report Kansas Agricultural Experiment Station cited, 255, 271.
- Report of N. Y. State Agricultural Experiment Station, 266.
- Report of Peabody Academy of Science cited, 225.
- Report of U. S. Geological and Geographical Survey cited, 255.
- Reports of Commissioner of Agriculture cited, 255, 288, 289, 296, 297(2), 321, 333.
- Reports Entomological Society of Ontario cited, 225, 255, 256(2), 371.
- Reports on Injurious and other Insects of New York, 234, 242, 247, 251, 252, 256, 296, 306, 307, 311, 312, 315, 318, 321, 324, 326, 331, 334, 352, 357, 364, 365, 369, 372, 374, 376, 377, 379.
- Reports of N. Y. State Museum of Natural History cited, 228, 234, 312, 365, 372, 374, 379.
- Reports on Noxious and Beneficial Insects of Illinois cited, 255(2), 279(2), 321(3).
- Reports of Ohio Agricultural Experiment Station cited, 256(2), 276.
- Reticulatus, *Coccus*, 375.
- Rhinoceros beetle, 246–255.
- Rhubard, flowers visited by bean-weevil, 280.
- Rhubarb: attacked by *Spilosoma Virginica*, 304.
- Ribesii, *Nematus*, 335.
- Riley, C. V., cited, 225, 228, 247, 296, 309, 321, 324, 341, 364.
 description and figures of early stages of *Dynastes Tityus*, 247–250.
 on bean-weevils, 255, 257, 258(2), 259, 261, 264, 269, 278, 279, 280.
 on Cicada at Tivoli, N. Y., 299, 300.
 on May-bud gall, 308.
- Riley's Insects of Missouri cited, 225, 255, 261, 266, 279, 282, 283, 288, 295.
- Riley-Howard cited, 247, 256, 288, 289, 296, 297, 321(2), 324.
- Riley-Marlett cited, 321, 322.
- Ring-rot of the pine, 366.
- Ritzema Bos cited, 280, 285.
- Ritzema Bos: *Tiersche Schädlinge und Nutzlinge* cited, 285.
- Roach killed by *Cermatia*, 325.
- Robinia eaten by *Bruchus*, 257.
- Robiniae, *Cyllene*, 363.
- Robiniae, *Spermophagus*, 270.
- Rocky Mountain locust in Minnesota, 338–340.
 acres of land plowed, 339.
 aggregate injuries in one year, 340.
 balloon hopper-catcher used, 338.
 bounty paid, 336.
 cost to the State for killing, 336, 339.
 eggs destroyed by plowing, 334.
 hopper-dozers used, 338.
 lucrative work of catching, 339.
 Lugger's work in Otter Tail Co., 338.
 losses in other States, 340.
 number of bushels destroyed, 339.
 plowing infested land, 339.
 privileges for catching sold, 339.
 result of operations against it, 340.
 wheat acreage destroyed, 338.
 young hoppers killed by plowing, 339.
- rosaceana*, *Cacoxcia*, 355.
- rosæ*, *Diaspis*, 384.
- rose*, *Monostegia*, 344, 362.
- rose*, *Tettigonia*, 345, 362.
- Rose-bug, 337, 346.
- Rose insects:
Cacoccia argyropila, 356.
Diaspis rosæ, 384.
Monostegia rosæ, 344, 362.
Tettigonia rosa, 362.
- Rose-leaf hopper, 345, 362.
- Rose: saw-fly — sp.?, 354.
- Rose-slug, 344, 362.
- Rose, J. F., insects from, 347.

rotundifolia, Amblycomorpha, 384.
 Round-headed apple-tree borer, 313.
rubicundula, *Diplax*, 220.
rufimana, *Mylabris*, 280.
rufimanus, *Mylabris*, 285.
rufimanus, *Bruchus*, 263, 267, 268, 279-285,
 286, 383.
rugulosus, *Scolytus*, 383.
 Rural New Yorker cited, 255.
 Rusk, S. E., insects from, 381.
 Rye injured by grain aphids, 218.
 Rye insect:
 Calandra granaria, 365.
 Cephus pygmeus, 384.
 Siphonophora avenæ, 360.

S.

Sager, J., insect from, 381.
saltatus, *Andricus*, 309.
saltatorius, *Neuroterus*, 309.
saltitans, *Carpocapsa*, 310.
sanguinea, *Coccinella*, 382.
Saperda candida, 313, 314.
Satyrus, *Grapta*, 375.
Satyrus, *Xyloryctes*, 251.
 Saunders' Insects Injurious to Fruits,
 cited, 288, 306.
 Saunders [William] cited, 225, 258, 305,
 369.
 Saw-fly borer in wheat, 334.
 Say [Thomas] cited, 258.
 Say's Complete Writings cited, 255.
 Say [Thomas] on bean weevil, 255, 261,
 278.
 Scale insects, 340.
Scarabæidæ, 246.
Scarabæus Tityus=*Dynastes Tityus*, 246.
Scenopinus fenestralis, 312, 367, 382.
 Schoenherr's Genera et species Curculionidum cited, 279, 282, 283, 285.
 Schwarz [E. A.] cited, 247, 297, 317, 350, 379,
 380.
 Schwarz, E. A., on bean-weevils, 270.
 Science Gossip cited, 309.
Scolytidæ, 238.
Scolytid bark-borers, 352.
Scolytus rugulosus, 383.
scripta, *Lina*, 219.
scrophulariæ, *Anthrenus*, 364, 372.
 Seudder, S. H., referred to, 262.
scutellaris, *Bruchus*, 383.
scutellatus, *Bruchus*, 282.
Scutigeridæ, 324.
 Seed beetle, 280, 282.
Selandria rosa, 362.
seminarius, *Bruchus*, 283, 284.
Sephonophora avenæ, 383.
septendecim, Cicada, 218, 296-301, 361.
serrata, *Hæmatobia*, 333.
 Seventeen-year Cicada, 296-301.

Seventeen-year Cicada—(Continued):
 at Galway, N. Y., erroneous report, 299,
 301.
 at Tivoli, N. Y., 297, 298.
 bibliography, 296.
 brood viii (of Riley) in New York, 300,
 Clarkson on Tivoli examples, 297-299,
 301.
 figures of, 297.
 Hudson river brood in 1860 and 1877, 298.
 New York broods, 297.
 possibly a 13-year brood in New York,
 301.
 precursors of regular broods, 299.
 Riley on Tivoli examples, 299, 300.
 song of, 298, 299.
 taken by Mr. Clarkson at Tivoli, 298.
 unrecorded broods?, 300.
 Seventeen-year locusts, 361.
 Sewell, E. W., insects from, 383.
 Sharp, Dr., on *Bruchus lentsis*, 287.
Sheep-scab, 362.
signatipes, *Ichneumon*, 228.
Silk worm, voracity of, 359.
Silvanus Surinamensis, 331.
similis, *Helophilus*, 228, 230, 233.
Siphonophora avenæ, 217, 331, 335, 360,
 369(2).
siro, *Tyroglyphus*, 357.
Sitodrepa panicea, 311.
 Slugs, 366.
 Smith, Fred., insect from, 383.
 Smith [Jno. B.] cited, 225, 228, 247, 314, 316,
 317, 333, 346, 360.
 Smith, Mrs. E. B., insects from, 318, 319, 382,
 383, 384.
 Snails, 366.
Snapping-beetles, 351, 377.
Snout-beetle, 360.
 Snow, George C., insects from, 353.
 Soap-suds for insect attack, 372.
solita, *Phytomyza*, 243.
 South American butterflies, 220.
Spermophagus robiniae, 270.
sphærosperma, *Entomophthora*, 315.
Sphecidæ, 238.
Spheñophorus Zeæ=*S. sculptilis*, 376.
Sphinx chersis, 381.
Sphinx quinquemaculata, 379.
Spilosoma Isabella, see *Pyrrharetia isabella*, 225.
Spilosoma Virginica, 228, 304, 305.
 description, 305.
 eggs of, 305.
 feeding-habits, 305.
 figures of, 305.
 plants eaten by, 304.
 transformations, 305.
Spilomyia fusca, 229.
 Spiraea visited by bean-weevil, 280.
 Spittle insects, 365, 383.

- Spotted horn-bug, 246, 255.
 Spraying for fruit-tree insects, 359.
 Spraying for the curculio, 358.
 Spraying operations, 343.
 Spraying with water, 344.
Spretus, *Caloptenus*, 338.
 Squash: insects attacking, 217.
 Squash: insect
 Melittia cucurbitæ, 371.
 Squash-vine borer, 371.
 Stalk-borer, 377.
Stereum complicatum on peach-twigs, 374.
Stimulea, *Empretia*, 381.
Stomoxys calcitrans, 338.
 Stephens' Manual of British Coleoptera cited, 279.
 Storm, W. W., insects from, 383.
 Strawberry insect:
 Anarsia lineatella, 367, 375.
 Otiorhynchus ovatus, 360.
 Paria aterrima, 360.
Strategus Julianus, 249.
 Strickland, W. J., insects from, 354.
 Stridulation of *Dynastes*, 250.
Strigosa, *Thecla*, 219.
Strioliata (=vittata) *Phyllotreta*, 372.
 Striped blister-beetle, 376.
 Striped cucumber-beetle, 367.
 Strong, Woodbridge, on *Saperda candida*, 313.
?subarmatus, *Bruchus*, 256, 259.
subellipticus, *Bruchus*, 256.
subspinosus, *Macroductylus*, 346.
 Sugaring for Lepidoptera, 218.
 Sulphur for mite attack, 365.
Sumach, *Datana perspicua* on, 381.
Surinamensis, *Silvanus*, 331.
 Sweet-potato Insect:
 Cassida nigripes, 363, 383.
 Coptocycla aurichalcea, 363.
 Sweetened water in bottles for insects, 289.
Sylvatica, *Clisiocampa*, 331.
Syrphide, 219, 228, 229.
Syrphus fly, 363.
 Systasia [Hesperid genus] substituted for *Lintneria*, 371.
- T.
- Tabanidæ*, 219.
Tabanus atrata, 364.
Tarquinius, *Feniseca*, 219.
Temnostoma alternans, 229.
tenax, *Eristalis*, 229, 233, 363, 382.
Tenthredinidæ, 223, 238, 354.
terrestris, *Lumbricus*, 378.
tessellata, *Agrotis*, 382.
Tettigonia rosæ, 345, 362.
Texas-fly, 333.
- Thaxter*, Dr. Roland, cited, 315.
 galls received from, 307, 382.
Thecla strigosa, 219.
Thecla Titus, 219.
Theilaxes ulmicola = *Colopha ulmicola*, 370.
Theobroma eaten by *Bruchus*, 257.
 Thirteen-year brood of *Cicada* in New York ? 301.
Thrips sp. attacked by a fungus, 316.
Thrips sp. 366.
Thrips sp. on Austrian pine, 384.
 Thomas [Dr. Cyrus] cited, 255, 279, 281.
Thyreus Abbotii, 381.
Thyridopteryx ephemeraeformis, 306, 381.
Thymelicus genus, 371.
tibicen, *Cicada*, 383.
Tipulidæ, 219.
Tipulidæ attacked by a fungus, 316.
Tischeria mallfoliella, 354.
Titus, Jacob W., insects from, 383.
Titus, *Thecla*, 219.
Tityus, *Dynastes*, 246-255.
Tivoli, N. Y., cicadas in 1890 not referable to any known broods, 300.
Tmetocera ocellana, 216, 306, 355, 363, 382.
 Tobacco water for insect pests, 344, 372.
 tobacco worm, 379.
 Tomato insect:
 Heliothis armiger, 382.
 tomato worm, 379.
Tomicus mali = *Monarthrum mali*, 317.
Tortricodes bifidalis, 375.
 indivialis, 375.
Tortrix furvana = *Cacoecia argyrosplla*, 356.
 Tough, Wm., insects from, 383.
 Trail, Prof. J. W. H., on *Oecidomyia crataegi*, 308.
 Transactions of Academy of Science of St. Louis cited, 253-259.
 American Entomological Society cited, 225, 252, 255, 256, 280, 309.
 Entomological Society of London, cited 243, 280, 319.
 Kansas State Horticultural Society cited, 255(2).
 New York State Agricultural Society cited, 373(2).
 Vassar Brothers' Institute cited, 256.
- Trapping insect pests, 366.
 Treat, Mrs. Mary, cited, 232.
 Tree-hopper, 360.
triangularis, *Disonycha*, 383.
Trichlocampus viminalis, 224.
trifolii, *Hylastes*, 378.
trifolii, *Hylesinus*, 335.
trifolii [=leguminicola], *Oecidomyia*, 374.
trilineata, *Lema*, 382.
trimaculata, *Chrysomela*, 369.

tristis, Lachnostenra, 369.
Trogus obsidianator, 228.
 Trombididae, 321.
Trombidium bicolor, 321.
 muscarum, 365, 384.
 Trouvelot, Dr. L., gypsy moth introduced by, 303, 336.
 Tumbler-bug, 379.
 Tumble-dung, 332.
 Turnip flea-beetle, 372.
 Turnip insect:
 Phyllotreta vittata, 372.
 Turnus, Papillo, 219.
 Tussock caterpillar, 216.
 twelve-spotted Diabrotica, 217.
 Two-spotted lady-bug, 375.
 Typhlocybe attacked by a fungus, 316.
 Tyroglyphus siro, 357.

U.

Uhler [P. R.] cited, 296, 345, 353.
Ulmicola, Colopha, 370.
Ulmus Americana, Colopha *ulmicola* on, 370.
unipuncta, Leucania, 373, 376.
unimoda, Xylina, 375.
Uropoda Americana, 312, 383, 384.

V.

Valentine, Clarence, 382.
 Van Alstyne, E., insects from, 383.
 Van Duzee, E. P., insect from, 382.
 cited, 317, 332, 333.
 Van Ingen, G., on Cermatia, 326, 327.
 Van Slyke, H., insects from, 383.
varicornis, Bruchus, 255, 278.
vastatrix, Phylloxera, 371(2).
Vedalia cardinalis, 360, 382.
ventricosus, Nematus, 335, 356.
Vespa diabolica, 229.
 maculata, 229.
Vicia lens eaten by Bruchus, 285.
viminalis, Cladius, 223, 224.
 Trichocampus, 224.
Virginica, Spilosoma, 228, 304.
virgo, Arctia, 219.
vitis, Erythroneura, 345.
 Icosoma, 374.
 Lasioptera, 376.
 Lecanum=*Pulvinaria inumerabilis*, 376.
vittata, Diabrotica, 367.
 Epicauta, 376.
 Phyllotreta, 372.
Volucella evecta, 229.
 Voracity of the silkworm, 359.
V-signata, Tortrix=*Cacoecia argyrosopila*, 356.
 V-shaped Tortrix, 355.

W.

Walker, F., cited, 225.
 Walker, J. V. D., *Erebus odora* taken by, 306.
 insects from, 381.
 Walnut: *Halisidota caryae* on, 355.
 Walsh, B. D., cited, 228, 306, 324.
 on burrows of *Xyloryctes Satyrus*, 251.
 Walsh, on oviposition of plum curculio, 295.
 Walsh-Riley cited, 246, 254, 296.
 Webster [Prof. F. M.] cited, 297, 321, 351.
 Web-worm, 345.
 Weed [C. M.] cited, 225, 256, 275, 318, 368.
 Weevils, 331.
 Weevils in rye, 365.
 Western beds of fossil insects, 378.
 Western N. Y. Horticultural Society referred to, 221, 356.
 Westwood [Prof. J. O.] cited, 242, 265, 279, 303, 319.
 Westwood's Introduction to Classification of Insects cited, 279.
 Whale-oil soap solution, 290, 318.
 Wheat insect:
 Cephus pygmaeus, 334.
 Caloptenus spretus, 338.
 Meromyza Americana, 377.
 Siphonophora avenae, 367.
 Wheat saw-fly, *Cephus pygmaeus*, 334, 335.
 amount of injury, 334.
 Comstock's study of, 334.
 "corn saw-fly" in Europe, 334.
 extends in Canada, 335.
 introduced from Europe, 334.
 larval operations, 334.
 occurrence at Ithaca, 334.
 transformations, 334.
 when first observed, 334.
 Wheat-stem maggot, 377.
 White-faced hornet, 229.
 White-grub, 337.
 Whitehead, Charles, cited, 280(2).
 White-marked tussock-moth, 331.
 Williams, A. Ford, insects from, 383.
 Williams, H. C., insects from, 381.
 Williston [S. W.] cited, 228, 229, 230, 233.
 Willow insects:
 Claudius viminalis, 221.
 Dynastes Tityus, 253.
 Lina scripta, 219.
 Wire worms, 337, 360.
 Wisner [A. B.] cited, 321.
 Woodbridge, T. Reed, insects from, 383.
 Wood's Insects at Home cited, 279, 284.
 Wood's New American Botanist and Florist cited, 285.1

Wood, Theodore, cited, 280.
on *Bruchus* infested beans, 267, 268.
Woolly-bears, 225, 228, 368.
Woolsey, Miss A. H., insects from, 384(2).
Work of the U. S. Entomological Commission, 378.

X.

Xanthomelæna, *Galeruea*, 217, 335.
Xyleborus pyri, 361.
pyri=dispar, 348, 370.
dispar, 333.
obesus, 350.
Xylina lambda var. *Thaxteri*, 375.
leptida, 375.

Xylina lambda--(*Continued*):
uninoda, 375.
Xyloryctes Satyrus, 251.

Y.

yellow bear, 305.
Yellow-jacket, 229.
Yellows in peach, 351.
Yellow woolly-bear, 304, 305.

Z.

Zææ, *Sphenophorus*, 376.
Zimmermani, *Pinipestis*, 373.
Zinnia: insect attacking *Spilosoma Virginica*, 305.

ERRATA IN INDEX.

- Page 385, read, Abbotii, Thyrens,
385, read, Americana, Clisiocampa,
386, read, aquilonaris, Cerura,
386, read, Arctia * * * Pyrrharetia
386, read, armiger, Heliothis,
386, read, Ascalaphus
386, read, asparagi, Crioceris,
386, read, Attagenus megatoma
386, read, Balaninus caryatrypes,
386, read, Barley * * *; Cephus
387, read, [Bibliography of] * * * Cicada
 septendecim,
387, read, Brizo, Nisoniades,
387, read, Bruchus — (*Continued*).
388, read, [Cecidomyia] leguminicola,
388, read, Cephus pygmensis,
388, read, Cicindela repanda,
388, read, Cinerarias: * * *; Phytonyma
389, read, Corn: * * *; Calandra
389, read, [Corn—] Mesograpta
389, read, [Cucullia] letifica,
390, read, (Elm:) * * * Colopha ulmicola,
391, read, erecta, Volucella,
391, read, Falconer Wm.
391, read, [Figure of] pupa of *Dynastes Hyllus*.
 opp. 250.
392, read, Graves, Mrs. H. D.
394, read, [Introduction of] * * * Haemato-
 tobia
395, read, Janson [O. E.]
395, read, Lentil weevil, 285-288.
395, read, lents, Bruchus, 285-288.
395, read, Leucania unipuncta,
396, read, [Morning glory insects:] Coptocycla
 aurichalcea,
396, read, muscarum, Trombidium (*without in-*
 dention).
396, read, Mytilaspis pomorum,
- Page 396, read, Nephopteryx [Pintpestis]
396, read, New enemy of currant-worm.
396, read, [Nisoniades] Lucilius,
396, read, [Nisoniades] Pacuvius,
396, read, niveus, Ecanthus,
397, read, Pacuvius, Nisoniades,
398, read, [Peas:] scutellaris, 282.
398, read, Pigs * * * infested fruits.
398, read, Pine insects:
398, read, Plant-lice * * * Phymata
398, read, Plum: insects attacking:
398, read, Poplar insects:
398, read, Potato insects:
398, read, Potato insects: Epicanta
398, read, Potato insects: Gortyna nitela,
398, read, [Preventives of] plum curculio,
399, read, prolific, Chloropsis,
399, read, punctatus, Phytonomus,
399, read, Quince: insects
399, read, Raspberry insects:
400, read, reticulatus, Cossus,
400, read, Rhubarb flowers
401, read, Rye insects:
401, read, serophilariae, Anthrenus. 335. 364.
 372, 373, 374, 377(2).
401, read, Siphonophora (in column 1).
401, indent, Hudson river brood.
402, read, spretus, Caloptenus,
402, read, stimpiea, Empretia,
402, read, Strawberry insects:
402, read, strigosa, Thecla,
402, read, striolata (= vittata)
402, read, Sweet potato insects:
402, read, sylvatica, Clisiocampa.
403, read, Wheat insects:
404, read, Xyloina unimoda, 375. (*for 1st and 2d*
 lines.)
404, read, Zinnia: insect attacking:

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ON THE
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OF THE
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Made to the Regents of the University, Pursuant to
Chapter 355 of the Laws of 1883.

BY J. A. LINTNER, Ph. D., STATE ENTOMOLOGIST.

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Second Report on the Injurious and Other Insects of the State of New York. Made to the Legislature, Pursuant to Chapter 377 of the Laws of 1881. Albany: Weed, Parsons and Company, Legislative Printers, 1885. Pages xiv, 265, figures 68.

[Reports of the State Entomologist to the Regents of the University of the State of New York, for the years 1884 and 1885, are published (only) in the 38th and 39th Annual Reports of the New York State Museum of Natural History, for the above-named years, pages 67-76, 77-125.]

[**Third Report of the State Entomologist.**] Report of the State Entomologist to the Regents of the University of the State of New York, for the Year 1886. Albany: The Argus Company, Printers, 1887. Published in the 40th Annual Report of the New York State Museum of Natural History, 1887, pages 79-154; also in 200 separates, with cover and title page.

Fourth Report on the Injurious and Other Insects of the State of New York. Made to the Regents of the University, Pursuant to Chapter 355 of the Laws of 1883. Albany: James B. Lyon, Printer. 1888. Pages 237, figures 68. Also as Report of the State Entomologist to the Regents of the University, for the Year 1887, in the 41st Annual Report of the State Museum of Natural History. 1888. Pages 123-358.

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