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FURTHER REMARKS ON COLLEMBOLA.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

A very remarkable feature of the Collembola is their amazingly wide distribution. They are found all over the world, and as Dr. Folsom remarks' "may be expected to occur wherever there is a soil that supports vegetation." The one condition fatal to them is dryness. Some of the scaled kinds are said to live in comparatively arid situations, but the vast majority can exist only in a decidedly moist atmosphere. Given a modicum of humidity, however, they can make themselves at home anywhere. You can collect them on cloud-capped mountains, under the dense shade of forests, over grassy plains, along the sea shore, or in your own wood-shed at home. They are perhaps most abundant among the moss, dead leaves, and rotten logs of woodlands, but they are common also in fields, gardens, and green-houses. They shelter under the bark of trees, (I have found them living at the top of a 75-ft. maple)—they are plentiful in long grass and damp soil, and certain over-ripe toadstools often swarm with them. They are counted among the unbidden guests in ants' nests, and one species is known in the United States as a household pest, though admittedly a very minor one. Many frequent caves,—some species occur nowhere else—others find their way deep down into mines, and one ghastly white Isotoma (*I. sepulcralis* Fols.) makes its hideous habitation with mouldering human bodies in the grave. Some occur along the sea shore, and may be submerged by the tide for hours every day without hurt. Others live on the banks of fresh-water streams, and many venture out on to the surface of ponds. A curious accident sometimes happens to these aquatic kinds. The "surface skin" of the water is for them a firm floor which they cannot break through, but occasionally an adventurer among them, by crawling down the stem of a water plant, penetrates beneath the surface. If he returns by the same road, good and well; but if he lets go of the plant, he at once floats up against the under side of the water film, and being as unable to break through from beneath as he was from above, he perishes miserably.

Quite as remarkable as this "sub-ubiquity" of the order is the exceedingly wide range of certain genera and species. The name of the springtails common to the whole Northern Hemisphere is legion; indeed no other order of animals is known to show such a large proportion of Holarctic species. *Isotoma palustris* Mull., to mention only one, abundant on water in this country, is domiciled also in California, Great Britain and Siberia. Other species range even farther. *Sminthurus hortensis* Fitch, which you are sure to find in your garden in May and June if you look for it, is a resident also of Scotland, Bohemia, Japan and Tierra del Fuego. *Achorutes armatus* Nic., plentiful everywhere in our woods, is recorded from Greenland, Spitzbergen, Great Britain, Switzerland, North

Africa, Brazil and Chile, Ceylon, Sumatra, and New Zealand. I once heard a shantyman describing the camp he worked in as being in such an out of the way place in the woods, that even the chickadees had not discovered it. If this man's tastes had been entomological, he would certainly have found that he was not beyond the range of *A. armatus*. The genus Isotoma, however, holds the distributional record. It is not only known all over the globe from the shores of the Arctic Ocean to the remote islands of the Antarctic, but one of its species, *Isotoma klovstadi* Carpenter, shares the honour with another Collembolan, *Gomphiocephalus hodgsoni* Carpenter, of constituting the entire land fauna of the great Antarctic continent. Excluding as essentially pelagic the sea-birds that visit those desolate shores merely to nest, these two tiny and primitive insects are, so far as known, the only indigenous form of terrestrial animal life on Antarctica.

How these delicate, wingless insects have reached such widely separated stations is an interesting question. They are feeble and uncertain travellers, and their dispersal by their own efforts must be very slow. They have, of course, been transported to a certain extent by man along trade routes, but Dr. Folsom regards running water as the chief means of their spread over land areas, and some may be carried for limited distances by ocean currents along coasts and to outlying islands. But this does not explain how they have managed to cross vast ocean spaces and reach far distant and isolated archipelagoes in the Indian Ocean and the Pacific. Their presence in the nests of gulls and puffins on detached rocks on the coast of Ireland, as noticed by Carpenter, indicates the possibility of their transfer in some instances by birds. But the fact, also recorded by Carpenter, that they are plentiful on the ancient granite-formed islands of the Seychelles while nearly absent from the more recent coral islands of the same group, would suggest that their spread by birds must be both slow and limited in extent. It seems most probable that in some cases they have travelled to their present stations by land connections that have since disappeared. It is significant, too, that only the Arthropleona, the more primitive of the two sub-orders, have been found on the Seychelles and Hawaii. Apparently these islands were cut off from the rest of the world before the more specialized Symphypleona had been evolved. The Collembola are of an ancient race, and were old settlers in the world even in the inconceivably far-off days of those strange continents that geologists tell us existed where the oceans are now, and which they map out to the bewilderment of plain people who have been brought up on Mercator's Projection.

Heat and moisture, in some degree, are absolutely essential to all forms of life, vegetable or animal. The Collembola evidently regard moisture as a prime necessity, but many of them are not so particular about heat, and low temperatures affect them less than any other hexapod. This is shown by the habit of numerous species in coming out on the snow—a practice which has earned for them the popular name of "snow-fleas." Like most popular names, the designation is inaccurate, for the Collembola are not in any way related to the true fleas (Siphonaptera) and the species that come out on the snow occur in the summer also. But as the term is convenient to distinguish the insects in their snow-frequenting phase, its use persists.

A considerable number of arthropod sare recorded as having been taken on the snow, including mites and spiders and members of almost every order of insects. The occurrence of a good many of these creatures, however, is purely accidental and involuntary, and is due to their having been evicted in some way from their winter shelters. On the other hand, others come out regularly and with intent, or, if you prefer, as the result of some tropism. But with the doubtful exception of *Isotoma saltans* Ag., reported from the glaciers of the Swiss Alps, no hexapod, so far as I know, makes its permanent habitat on the snow. There are some microscopic rotifers and some curious worms (Oligochæta) that seem actually to live and breed in the snow of glaciers, but the snow-frequenting hexapods merely emerge from the soil and surface detritus for a few hours, more or less, and those that do not perish on or in the snow, eventually retire again to their subnivean shelters. In this class may be mentioned in addition to the Collembola, the Mecopter genus Boreus, and some of the stone-flies, (Plecoptera). I have seen thousands of the latter coming out of the Madawaska River at Arnprior about noon on a fine day in March, and all setting off southwards in obedience to a positive heliotropism that headed them straight into the sunlight. But the best known and most regular frequenters of the snow are certain species of Collembola.

The term "snow-flea" is sometimes used as if it designated a single species. Doubtless the title was first applied to *Achorutes socialis* Uzel, by far the most frequent and abundant species on the snow. But it is necessary nowadays to widen the application of the name; for at least eight genera of Collembola including more than thirty species, have been recorded as appearing on the snow in Europe and North America. Here again, however, we must distinguish between mere chance appearances and regular occurrences. Authors generally have paid little or no attention to this point, but there is no doubt that a good many springtail species appear on the snow, not in the course of a normal life activity, but as the result of an accident. Of the eleven species I have collected on the snow in the vicinity of Arnprior, four had obviously fallen out of logs or been washed from the ground by the running water of a thaw, and the individuals were either dead or numb with cold, although at the same time, the hardier species were quite active on the surface. But even allowing this, the Collembola have still a far larger number of snow species, both actual and proportional, than any other order of insects.

It is remarkable that practically all the snow habitués among the springtails belong to the more primitive of the two sub-orders; the Arthropleona. The only record I can find of a Symphypleona on the snow is given by Schött, who speaks of *Sminthurus aureus* Lubb. as having so occurred in Sweden. But while he mentions no date, the context of his statement leads to the suspicion that the snow fall was an unseasonably early one, and that the creatures were there by accident.

It is also worth noting that, so far as my observations go, none of the white or light-coloured species ever come out in the winter. The snow frequenters are of various shades of blues, browns, yellows, reds, greens and purples, but the colours are all so dark that nearly all the insects look virtually black on the snow. The celebrated Count Rumford, giving practical effect to his studies

in heat and light, dressed in white in the winter, on the principle that, as he was a warm-blooded animal, this costume would reduce to a minimum the radiation of heat from his body. Conversely, the snow-flea being a cold-blooded animal, with no bodily heat to lose, finds its dark pigmentation advantageous in assisting it to absorb heat when it comes to the surface in winter.

A great many species of Collembola survive the northern winter, but the snow-frequenting habit is sharply confined to certain kinds, while other closely allied species never emerge while the snow is on the ground. Available North American and European records credit about one-half of all the snow appearance, accidental or intentional, to the genus Isotoma. The other genera represented are Entomobrya, Achorutes, Onychiurus, Anurophorus, Orchesella, Tomocerus and Sminthurus. My experience in this district also is that Isotoma can claim more species on the snow than any other genus, *Isotoma nigra* MacG. is the most abundant of the genus here, and it is sometimes found over many acres of open woodland or beaver meadow, with a frequency of one or two specimens to the square yard. *I. palustris* Mull., more local in its distribution, often reaches about the same frequency in swampy places. *I. macnamarai* Fols., which affects wet places also, is scarcer, and it usually takes some searching to collect a dozen or so specimens. *I. viridis* Bourl. var. *riparia* Nic. I have found only towards spring. Once I collected 25 or 30 specimens in April on the snow covering a rather dry pasture, but mostly they are found sparingly in woods. A couple of other Isotomas of undetermined species are represented by only a specimen or two, and the appearance of one at least was accidental. Also a few odd specimens of *Tomocerus* sp., *Orchesella* sp. and *Entomobrya* sp. had evidently not come out of their own accord where I found them. Among the real snow travellers, however, we must class *Achorutes armatus* Nic. It never emerges in very large numbers, but I have found it active on the snow in the vicinity of small streams from November to March.

Very seldom do any of the species mentioned so far ever appear on the snow in sufficient numbers to attract the attention of the casual wayfarer; no one but the entomologist who is looking for them is likely to notice them. This does not mean, however, that the insects occur only sparingly, for many people are extraordinarily insensible to phenomena that do not affect them directly, and even when in large numbers, snow-fleas are often passed by unnoticed. One morning, crouched on my snowshoes in a narrow pathway through a cedar swamp, I was picking up Isotomas with a small brush and dropping them into a vial, when I heard another snowshoer come crunching over the crust towards me. It was a labouring man of my acquaintance with his axe on his shoulder, taking a short cut to his work across the Ottawa River. He gave me a polite "good-day," but looked so curiously at my occupation, that in order to preserve at least the remnant of a reputation for sanity, I thought it well to explain to him what I was doing. He was greatly surprised to see the insects on the snow. They were plentiful that morning, and for some distance he had been crushing scores of them under his snowshoes at every step, but he had not noticed them until I pointed them out to him. "Well, by gosh!" he said, "I often heard tell of snow-fleas, but I never seen them before." A worthy man as I know, though imperfectly instructed in grammar.

But the most heedless passer-by cannot overlook *Achorutes socialis* Uzel when it makes up its mind to come out. The vast swarms literally blacken square yards of the snow around the principal foci from which they emerge. On level surfaces they may be as thick as 500 to the square foot, while in hollows and depressions in the snow—such as foot-prints—from which they cannot easily escape, they sometimes accumulate in solid masses that could be ladled out with a spoon. (I find the mark of a No. II shoe-pack an admirable snow-flea trap,—and to prevent unkind inferences I hasten to point out that in winter this footwear calls for at least four pairs of heavy socks.) Spreading out from these centres, the distribution becomes thinner, though for acres the insects often run from 10 to 50 to the square foot, and examination of a yard or so of the surface anywhere over miles of country is almost certain to show two or three specimens leaping and clambering among the snow particles.

Most writers speak of snow-fleas as occurring in the spring, and it is true that some species of them seem to come out only at that season, and in general they are most abundant towards the end of the winter. But it is the effect of the mild weather whenever it occurs and not the season that brings them out, for most of them can be found on the snow every month from November to April whenever the rising temperature approaches the freezing point. Those excellent field-naturalists, the Red Indians, noticed this. Among the native weather lore recorded by F. W. Waugh in his "Iroquois Foods," the snow-fleas are said to indicate mild weather, and the Onondagas, Mr. Waugh says, called them "soft weather fleas."

But it should be borne in mind that while the snow-flea tide rises in direct relation with the temperature, the soft weather is not the determining cause of the insects' emergence. The real factor is the amount of moisture in the atmosphere. In mild weather, the large quantity of water vapor released by the melting snow soon brings the humidity, both relative and absolute, to a high figure, and the snow-fleas, finding a more

(To be continued.)

NEW APHIDS FROM OAKS.

*BY W. M. DAVIDSON, U. S. BUREAU OF ENTOMOLOGY, SACRAMENTO, CALIFORNIA.

Vacuna californica, sp. nov.

Vacuna dryophila Schrank?. Davidson, Journal Econ. Ent., Vol. X, Apr., 1917.

In April, 1917, issue of the Journal of Economic Entomology, the writer referred this species doubtfully to *dryophila* Schrank of Europe, only a single winged individual having been taken up to the time the article (Little-known Western Plant-Lice II) was submitted for publication. Since that time more winged insects have been collected, and all prove to differ from the typical *dryophila* in the same manner as the first. It appears, therefore, that the Californian insect is worthy of specific rank.

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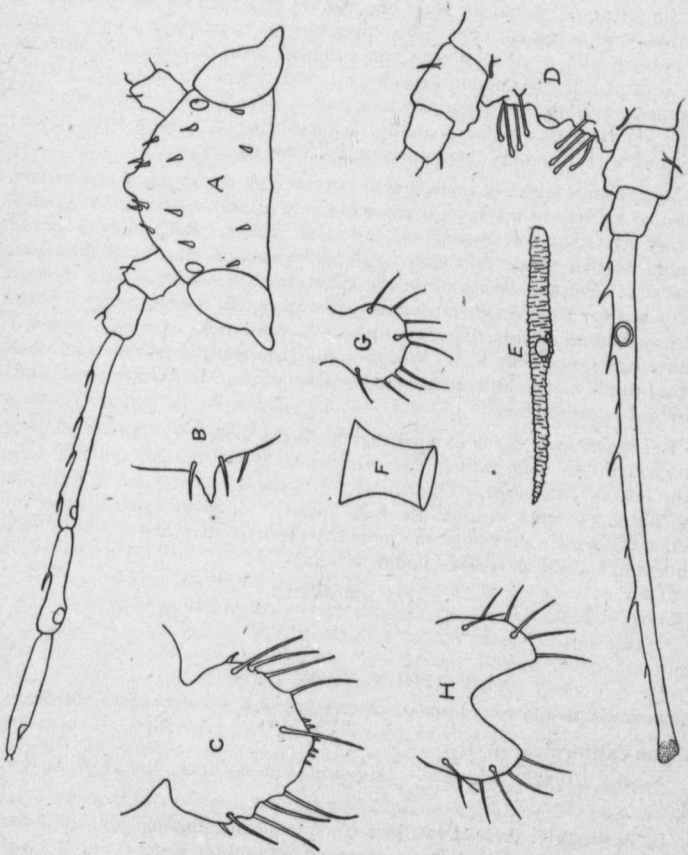

Fig. 32.—A-C, *Vacuna californica*, sp. nov.; A, head and left antenna; B, lateral tubercle of abdomen; C, cauda from above.
D-H, *Myzocallis quercifolii*, sp. nov.; D, head and left antenna (joints I to III); E, joint VI of antenna;
F, cornicle; G, cauda from above; H, anal plate from above.

The two species differ as follows:—

V. dryophila	*V. californica*
4 or 5 sensoria on antennal III.	Only the apical sensorium on antennal III.
About 9 long hairs on antennal III.	3 or 4 long hairs on antennal III.
Mesothorax appearing as single chitin plate.	Mesothorax appearing as partially divided into lobes.

Dates of collection of winged forms are as follows: May 16, 1915; April 29, 1916; May 8, 1916; *Quercus lobata* Nee, Walnut Creek, Cal., May 14, 1917; *Quercus macrocarpa* Michx., Sacramento, Cal.

Myzocallis quercifolii, sp. nov.

Alate viviparous female.

General colour light green; antennæ pale green with narrow brown annulations at apices of joints, filament of joint VI brownish; head and thoracic lobes olive green; wings hyaline, stigma very pale with dusky brown spots at base and apex; legs pale green, base of tibiæ with a brown ring, femora brownish near apex, tarsi and tibial apices brown; tubercles of thorax and abdomen paler than body colour; cornicles pale green; cauda and anal plate pale green; beak pale, extreme tip brown; venter light green.

Antennæ on short frontal tubercles, slender, longer than body, base and filament of joint VI subequal; joint III with one or two circular sensoria near the base; antennal spines rather stout; the forehead bears 8 stout prominent pale capitate spines, in length equal to half the width of the forehead. Prothorax and mesothorax each with a pair of tubercles on the dorsum. Abdomen narrow, with three pairs of conical tubercles on the dorsum and with three pairs of blunt tubercles on sides. Cornicles slightly longer than wide at base, somewhat constricted in centre. Cauda globular, spinose. Anal plate deeply cleft, spinose. Beak reaches to the second coxæ. Wings longer than body.

Measurements.—Length of body (mounted specimens) about 1.25 mm. Width of body about .45 mm. Antennæ, joint lengths: III .61 mm., IV .35 mm., V .32 mm., VI .28 mm. (.145 mm. plus .135 mm.). Length of wing 1.94 mm., of cornicles .085 mm., of cauda .08 mm., of beak .23 mm., of hind tibia 1.06 mm.

Described from 3 individuals collected on the leaves of Blue Oak (*Quercus douglasii* H. & A.) by Mr. F. B. Herbert, Los Gatos, Cal., June 4, 1917.

This species is closely related to *Myzocallis quercus* Kaltenbach, *M. pasaniæ* Davidson, *M. californicus* Baker, and *M. californicus* Baker var. *pallidus*, below described. The prominent capitate spines on the forehead will distinguish it from others.

The following key will separate the above species:

1. Cornicles partly black.....*Myzocallis quercus* Kalt.
   Cornicles pale throughout.....2.
2. Forehead of winged vivipara with prominent capitate spines.....*Myzocallis quercifolii*, sp. nov.
   Forehead of winged vivipara with spines non-capitate or indistinctly capitate.....3.

3. Distal antennal joint about .58 mm. in length ..... *Myzocallis pasaniæ* Davidson.
   Distal antennal joint about .34 mm. in length ..... 4.
4. Distal sensorium of antennal III at or beyond middle of joint ..... *Myzocallis californicus* Baker.
   Distal sensorium of antennal III hardly one-third of the length of the joint from base ..... *Myzocallis californicus* Baker var *pallidus* var nov.

Myzocallis californicus Baker var. **pallidus** var. nov.

This form differs from var *californicus* in the sensoriation of the third antennal joint, *pallidus* having 3 or 4 sensoria all in the basal third of the joint, whereas *californicus* has from 4 to 6 sensoria more widely distributed and occupying the basal half or more of the joint The structure of the body including the dorsal tubercles is very similar

Var *pallidus* is pale green in colour, smaller in body than *californicus;* it was collected January 5, 1918, on *Quercus dumosa* Nutt , an evergreen scrub oak, near Jacumba, Cal.

A NEW SPECIES OF THE GENUS TACHYDROMIA FROM ILLINOIS (DIPTERA, EMPIDIDÆ).

BY J. R. MALLOCH, URBANA, ILL.

The type series of the species described herein is deposited in the collection of the Illinois State Natural History Survey.

Tachydromia harti, sp. n.

Male and female.—Glossy dark brown. Head black; antennæ yellowish testaceous; palpi brown. Thorax brown, paler anteriorly; propleura with white pruinescence. Abdomen yellowish at base of venter. Legs yellowish testaceous, darker in female, hind femora and tibiæ except bases, mid tibiæ at bases, and apices of basal three and all of apical two joints of all tarsi in both sexes blackened; fore tibia in male with two deep black spots on the inner or anterior side, one, heart-shaped, beyond middle and the other, round, at apex. Wing with two broad, black fasciæ as in *schwarzi* Coquillett, but the apical fascia extending nearer to apex of wing. Knobs of halteres white.

Eyes distinctly separated in both sexes; third antennal joint not large than second; arista terminal. Dorsum of thorax nude; scutellum with two bristles. Ventral sclerite of abdomen in male in front of hypopygium with a number of curved bristles, apex of hypopygium with a few similar bristles. Fore femur much swollen; fore tibia of male very much dilated from base to apex. Venation as in *schwarzi.*

Length 1.5–2 mm.

Type—male, Havana, Ill., June 5, 1918, (J. R. Malloch). Allotype and paratypes topotypical. One male and three females.

This species is most closely allied to *schwarzi* Coquillett, but may be separated from it by the broadened fore tibia of the male and the very much closer approximation of the subapical fascia to the apex of the wing.

Named in honour of my late colleague, C. A. Hart, who did some of his best work in the locality where the species was taken.

November, 1919

NOTES ON COCCIDÆ—IV. (HEMIPTERA).*

BY G. F. FERRIS, STANFORD UNIVERSITY, CALIFORNIA.

In an earlier paper of this series I called attention to the artificial character of the genus *Sphaerococcus*, and began the process of transferring the included species to other genera. At that time specimens of the genotype, *S. casuarinæ* Maskell, were not available for examination, but since then (through the kindness of Professor Cockerell) I have been enabled to see specimens of this species. The suspicion that I then expressed to the effect that this species is merely an *Antonina* is nearly, if not quite, substantiated, for it is certainly of this type. However, there are certain points upon which the genus *Sphaerococcus* may, for the present, be maintained.

I am here redefining the genus. Also, I am removing from this genus three more species, one of which, *S. obscuratus* Maskell, I refer provisionally to the genus *Kuwanina*, another, *S. leptospermi* Maskell, which I refer to the genus *Amorphococcus*, and another, *S. pirogallis* Maskell, for which I name a new genus, *Eremococcus*. I may note here that *Sphaerococcus sylvestris* Ckll. and King, is probably nothing more than an immature stage of some species of *Kermes*.

Genus SPHAEROCOCCUS (Maskell).

Coccidæ referable to the subfamily Dactylopiinæ (of the Fernald Catalogue) and belonging to the *Pseudococcus* group, that is, possessing dorsal ostioles. Adult female resembling the female of *Antonina;* apodous; with the antennæ reduced to mere vestiges of three or four minute segments; with the posterior end of the abdomen invaginated to form a short tube at the inner end of which is the anal ring, this bearing six short setæ. Differing from *Antonina* (if at all) only in the fact that the legs are present in the penultimate stage of the female. First stage larva with six-segmented antennæ, with six hairs on the anal ring, with dorsal ostioles.

Type of the genus, *Sphaerococcus casuarinæ* Maskell. It is probable that none of the other species now referred to this genus are congeneric with the geno-type.

Notes.—As I have pointed out in the description given above, this is essentially an *Antonina*, differing only in the fact that the legs are retained in the penultimate stage. However, this point needs investigation. I would call attention to the fact that in one species now referred to *Antonina* (*A. parrotti* Ckll.) the anterior pair of legs alone are retained in what has been described as the adult. In specimens of *A. indica* Green, the legs are lacking in the penultimate stage.

Sphaerococcus casuarinae (Maskell).

Fig. 33.

There is little except detail to add to the description given by Maskell. The species resembles the various species of *Antonina* except that it is more nearly circular. The anal ring bears six short setæ and is not hairless, as asserted by Maskell. Beyond this the material examined does not permit me to go.

*Continued from Canadian Entomologist, vol. 50, p. 113, (1919).

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The first stage larva is quite as in *Antonina*. The antennæ are six-segmented. The anal lobes (Fig. 33) bear a single stout spine, a short seta and the usual long seta.

Material examined. From *Casuarina quadrivalvis*, Australia.

Genus AMORPHOCOCCUS Green.

But two species are at present referred to this genus, one *A. mesuæ* Green, from Ceylon and another *A. acaciæ* Brain, from South Africa. With these

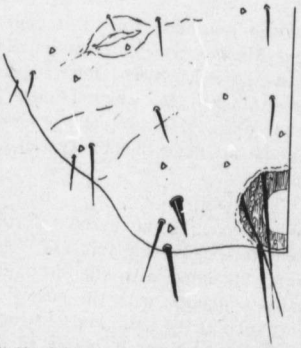

Fig. 33.—*Sphaerococcus casuarinæ* (Maskell); dorsal aspect of portion of caudal extremity of first larval stage.

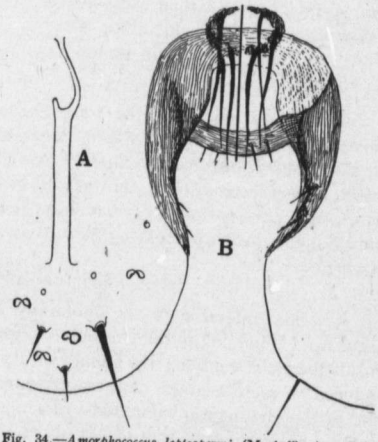

Fig. 34.—*Amorphococcus leptospermi* (Maskell); A, tubular duct; B, anal rings and surrounding structures, left half dorsal, right half ventral.

Sphaerococcus leptospermi Maskell appears to be strictly congeneric. All are gall makers, the galls appearing as twig swellings.

Amorphococcus leptospermi, (Maskell).

Fig. 34.

Habit.—Occurring in a twig gall, this gall being merely a swelling with a small, pore-like opening at the top.

Morphological characteristics.—Adult female apodous and with the antennæ reduced to mere vestiges, which show three or four minute segments. Derm membranous throughout. Pores of the 8-shaped type small and rather few, scattered over the body but most numerous in a narrow zone extending about the lateral margin of the body. Tubular ducts likewise relatively few, of the type shown in Fig. 34A. Anal lobes rather prominent, each bearing one moderately long and two much shorter setæ. Anal ring borne at the inner end of a quite deep cleft, apparently at the end of a short invagination, rather small, bearing six slender setæ. The mouth of the invagination (Fig. 34B) is surrounded by a narrow chitinous ring. From this ring a chitinized area extends posteriorly along each side of the cleft.

Immature stages not seen.

Material Examined.—Specimens from *Leptospermun* sp., Australia, determined by Froggatt at this species and agreeing in general with the original description.

Notes.—Assuming this determination to be correct (as it doubtless is) the original description is in error in the statement that the anal ring is hairless. Also the original description hints at the presence of abdominal spiracles, which are certainly lacking.

This species appears to differ from *A. mesuæ* and *A. acaciæ* in the much deeper anal cleft and the form of the chitinized areas about the anal opening.

Genus KUWANINA Cockerell.

Kuwanina obscurata (Maskell).

Fig. 35.

Habit.—Occurring in galls which are mere swellings of the bark.

Morphological characteristics.—Adult female (Fig. 3A) apodous and with the antennæ reduced to mere vestiges with three or four minute segments. Form broadly oval or subcircular. Derm everywhere heavily chitinized. Anal opening appearing on the ventral side, small, heavily chitinized and only slightly cellular, bearing six very small spines. The opening is covered by a small, cauda-like flap. Constrictions between the abdominal segments very

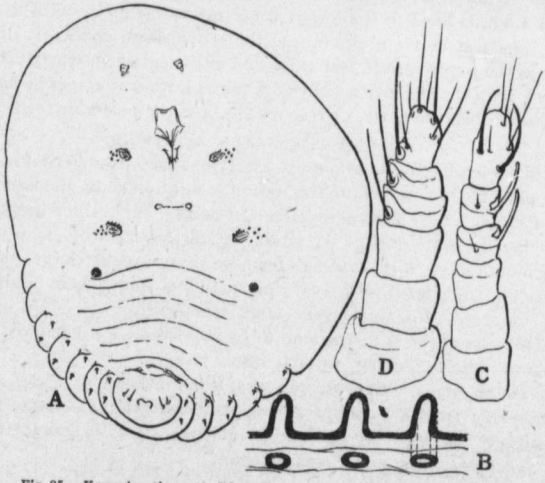

Fig. 35.—*Kuwanina obscurata* (Maskell); A, adult female, venteral aspect; B, pore-like structures of the intersegmental furrows; C, antenna of first stage; D, antenna of penultimate stage.

deep on the dorsal side and extending somewhat to the ventral side. In these constrictions there appear numerous pore-like openings which communicate with invaginations of the derm (Fig. 35B). These invaginations show no evidence of internal pores and are, therefore, hardly to be described as ducts. They are confined to the intersegmental furrows of the abdomen and are most numerous toward the posterior end, forming a continuous, transverse row on the last

four or five segments. Anterior to these segments they appear only toward the lateral margins. Abdomen with a few rather stout, conical spines arranged in transverse rows. Spiracles not unusually large, associated with a few very small, circular pores. Behind each of the posterior pair there is a small, cribriform plate or tubercle.

Penultimate stage.—In form resembling the adult but without the constrictions between the abdominal segments, without the pores in the intersegmental furrows and less heavily chitinized. Antennæ and legs present, the former (Fig. 35C) quite stout, six-segmented, the latter of ordinary character, the tibia somewhat shorter than the tarsus, the claw with a small tooth. Anal ring as in adult but at the tip of the abdomen. Body with a few, scattered conical spines and a very few, small, multilocular pores.

First Stage.—Antennæ (Fig. 35D) six-segmented, the last three segments each with one or two long, stout, curved spines. Anal ring with six slender setæ. Anal lobes each with a single slender seta and two short spines. Derm with a few small, stout spines and multilocular pores.

Specimens examined.—From *Eucalyptus*, New South Wales, Australia. Collected by Koebele and received by me from Mr. Ehrhorn. They agree in all respects with the original description.

Notes.—While it is possible that this species is not strictly congeneric with *K. parvus*, I am inclined to think that it belongs in the group with that species. It will at least rest better in *Kuwanina* than in *Sphaerococcus*. It differs from *K. parvus* in the nature of the first stage and in the entire absence of the tubular ducts which are a conspicuous feature of *K. parvus*, while it agrees in the presence of the pair of cribriform plates or tubercles behind the posterior spiracles.

Genus EREMOCOCCUS, new genus.

Coccidæ referable to the subfamily Dactylopiinæ (of the Fernald Catalogue) but of doubtful position within this group. Adult female apodous and with the antennæ reduced to mere unsegmented vestiges; anal orifice simple, minute, borne on the dorsum; dorsum of adult flat, heavily chitinous, venter membranous; mouth-parts with internal framework unusually large and heavily chitinized; first stage larva with anal ring small and simple as in adult, with the antennæ composed of a single very large segment (and possibly one or two minute basal segments), with the anal lobes obsolete and not marked by a long seta. Dorsal ostioles lacking; tubular ducts lacking.

Type of the genus, *Sphaerococcus pirogallis* Maskell.

Notes.—I am unable to throw any light on the relationships of this genus. I would suggest that possibly its nearest relatives are to be sought for in such forms as *Sphaerococcopsis* and *Pseudoripersia*.

Eremococcus pirogallis (Maskell).

Fig. 36.

Habit.—Enclosed within a small, pear-shaped gall which has a minute opening at one side near the base. The insect lies in a saucer-like elevation at the far end of the gall.

Morphological characteristics.—In addition to the characters given in the description of the genus I may add the following. The female of the early adult stage is entirely membranous but at maturity the dorsum becomes heavily

chitinized and the venter becomes much expanded (Fig. 36A). This dorsal, chitinized area is destitute of spines and pores except around its margin where there are numerous slender setæ and pores of the type shown in (Fig. 36B). There are also numerous setæ about the vaginal orifice. The antennæ (or what appear to be the antennæ) are a pair of small, tubular, wrinkled, chitinous structures, usually appearing behind the mouth-parts and presenting no traces of segmentation. The internal framework of the mouth-parts in unusually

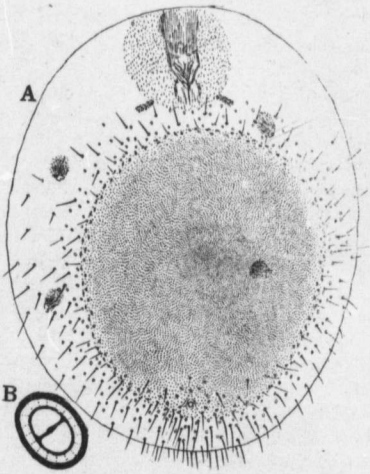

Fig. 36.—*Eremococcus pirogallis* (Maskell); A, adult female, from dorsal aspect; B, type of pore.

large, and the rostrum is borne upon a prominence, the derm of which presents a somewhat papillate appearance. I have been unable to detect any trace of tubular ducts.

The first stage larva is as described under the genus. My material is not in sufficientiy good condition to permit the presentation of figures.

Material examined.—Specimens from Froggatt and from Ehrhorn, determined as this species and agreeing with the original description.

WILSONIA—A CORRECTION.

A curious case of lapse of memory occurs in my article, Canadian Entomologist, Vol. LI, p. 212. Although I know several species of *Wilsonia* I used this name for a genus of Aphids. Both Dr. Cockerell and Mr. Criddle have called my attention to it. It is inexcusable. I herewith substitute the name *Dilachnus*.

A. C. BAKER.

A NEW OAK GALL FROM ARIZONA. (HYMEN., CYNIPIDÆ).

BY LEWIS H. WELD, EVANSTON, ILL.

Andricus splendens, n. sp.

Female.—Head a clear, dark red, finely shagreened, with whitish hairs on lower face and cheeks, slightly broadened behind the eyes, concave behind. Eyes black, bare, coarsely granulate. Antennæ 14-segmented, the third and fourth slender and equal, the last slightly longer than the next to last, distal half darker. Palpi 5- and 3-segmented. Mesonotum reddish with a median black area enclosing the two anterior parallel lines and a smooth, black area over base of each wing (but sometimes almost uniformly infuscated). It is one and a half times as long as the width of the head, its surface finely coriaceous (best seen in balsam mount) with scattered punctures bearing short whitish hairs. Scutellum is rugose behind with setigerous punctures, has a mediodorsal smoothish area behind the two distinct black polished shallow pits and a steep triangular impression on each side. Mesopleuræ polished, bare except for pubescent area above. Legs lighter in colour, yellowish, with middle and hind coxæ infuscated, hind femur normal, tarsal claws small but in balsam showing a distinct tooth. Wings hyaline with distinct brown veins, surface short brown pubescent and margin short ciliate. Median segment with two distinct outwardly curved ridges enclosing a smooth area which is narrowed at the top. Abdomen darker, smooth and polished, not compressed, as deep as long and with a pubescent area on each side at base. Ventral spine about three times as long as broad, slightly pubescent. Ovipositor (when dissected out) a little longer than length of antenna, eggs well developed, nearly globular with long pedicel. Using the width of head in widest part in balsam mount as a base the length of wing ratio is 4.61-4.78; length of antenna ratio 2.75-2.93; length of ovipositor 2.71–3.00.

Range in length of 350 dry specimens measured by optical methods to nearest tenth of a millimeter was 1.3–2.4mm. Other constants for the group were calculated. Mode 1.950 mm. Mean 1.926–0.007. Median 1.933–0.008. Standard deviation 0.181–0.005. Coefficient of variability 9.40%–0.24%. Average deviation from median 0.147 mm. Quartile deviation 0.127 mm.

Described from two balsam slides, 84 pinned specimens and others in vial dry.

Type and paratypes in U. S. N. M. Type No. 22328. Paratypes deposited also in N. Y. State, American, Cornell, Field and Harvard Museums, and with Wm. Beutenmuller and author.

Related to *Andricus rileyi* Ashm. (to which it runs in the Dalla Torre and Kieffer key in Das Tierreich) which is a larger species from east of the Rockies without a tooth on tarsal claw.

Type Locality.—Prescott, Ariz.

Host.—Quercus grisea Lieb.

Gall.—Single or scattered on the under side of leaf. Cylindrical with ends and middle slightly swollen, 2 mm. in diameter and 3–5 mm. high, covered with short stout blunt spines from which run faint decurrent ridges. Sessile, often lop-sided, spines more numerous on basal third. The rosy red colour with a straw yellow band around the middle and some yellow at either end, together

with its crystalline appearance make it a very beautiful object and suggest the name. The basal third is solid, then comes the thin-walled larval cell in the middle of the gall leaving the distal third or more tubular with the open end slightly flaring. The exit hole is made into the hollow portion. The gall was figured by Dr.E.P. Felt in his paper on "Gall Insects in their Relation to Plants" in Sci.Mo. 6:515, Fig. g (June,1918), and again in the Ottawa Naturalist 32:130, Fig. g, and was also characterized by him under the above manuscript name in his "Key to Am. Insect Galls" in Bull. N. Y. State Mus. 200:106.

Habitat.—The species was first brought to my attention by three specimens sent by Dr. Felt, collected by Messrs. Bethel and Hedgcock two miles S.W. of Prescott, Ariz., in the fall of 1917. These were cut open on Dec. 5, 1917, and gave three living adults, one of which was selected as the type. On Apr. 11, 1918, while collecting for the U. S. Bureau of Entomology, Division of Forest Insects, I took galls near Williams, Ariz., on a hillside N.W. of Supai siding, and flies began to emerge before Apr. 16. On Apr. 13, 1918, a lot more were taken near Prescott, and flies emerged by Apr. 20 and continued to come out until the last of May. The larvæ evidently transform to adults in the fall but remain in the galls all winter and emerge the next spring. An alternating sexual generation produced in an early summer gall is suspected but not known.

The U. S. National Museum possesses galls of this species, found on an unknown oak from Durengo, Mexico.

CATORAMA NIGRITULUM Lec.,[1] AND ITS FUNGUS HOST.

BY HARRY B. WEISS, NEW BRUNSWICK, N.J.

This member of the family Ptinidæ was recently found at Springfield and Monmouth Junction, N.J., breeding in the sporophore or fruiting body of *Fomes applanatus*.[2] Smith[3] records it only from Woodbury, July 7 (Brn.) and Blatchley[4] states that it is scarce in Vermillion and Lawrence counties, Indiana, May 24–June 13. Fall in his "Revision of the Ptinidæ of Boreal America"[5] records it as occurring in Mass., D.C., Va., W. Va., Ohio, Mich., Tenn., Miss., Indian Territory and Texas, and writes as follows about the genus Catorama,—"very little is known as yet concerning the life-habits of the species of this genus. Certain species are known to inhabit galls while others have been found in the seeds or stems of various plants."

At Springfield, N.J., on April 8, several specimens of the beetle were taken from the fungus *Fomes applanatus*. More than a month later, or on May 30, numerous adults, several pupæ and many larvæ of all sizes were found in another specimen of the same fungus at Monmouth Junction, N.J. Both the context and tubes of the fungus were bored by the insects, but most of the feeding appeared to have taken place in the tubes. The pupal cells also were found in the tubes.

Fomes applanatus (Pers.) Wallr., occurs on old logs and stumps of deciduous trees in various parts of New Jersey. Overholts in his "Polyporaceæ

1. Kindly identified by Mr. C. W. Leng.
2. Kindly identified by Mr. Erdman West.
3. Insects of New Jersey, N. J. State Museum Report, 1909, p. 307.
4. Coleoptera of Indiana, p. 880.
5. Tr. Am. Ent. Soc., XXXI, 1905, p. 97–296.

of the Middle-Western States"[6] records it from Mich., Ohio, Ky., Ind., Ill., Wis., Minn., Iowa, Mo., Kan., Neb., N. Dak. Heald[7] describes a disease of the cottonwood due to *Fomes applanatus*, but Von Schrenk and Spaulding[8] consider it as a saprophytic form.

Full-grown larva.—Length 2.5 mm. to 3 mm. Width 1 mm. Colour whitish or dirty white; body soft, curved, resembling a miniature white-grub, strongly convex above and flattened beneath, skin transversely wrinkled. Head whitish, mouth-parts dark. Body and head sparsely hairy. Median dorsal surface of thoracic segments elevated into a distinct ridge. This ridge not as pronounced in immature larvæ. Dorsal portion of abdominal segments supplied with transverse group of minute stiff hairs or spines. Fewer similar spines on dorsal surfaces of thoracic segments. Legs short and weak.

Pupa.—Length 2.2 mm. Width 1.4 mm. Suboval, white or yellowish white, smooth. Posterior end prolonged into a somewhat flattened blunt process armed at each posterior, lateral edge with a transverse leg-like appendage, each appendage terminated by a chitinous hook.

Adult.—Catorama nigritulum Lec., (Proc. Phil. Acad. Nat. Sci., 1865, 241). The following description is by Blatchley. "Elongate-oval, moderately robust, less than twice as long as wide, not narrowed behind. Black or piceous; pubescence sparse and very fine. Head and thorax finely, closely and evenly punctulate without intermixed coarser punctures. Elytra finely punctulate with scattered larger punctures. Eighth antennal joint broadly triangular. Length 1.7–2.4 mm."

A NEW SPECIES OF PHORIDÆ FROM ILLINOIS (DIPTERA).

BY J. R. MALLOCH, URBANA, ILL.

The species described herein was taken by me in 1918, and the type is deposited in the collection of the Illinois State Natural History Survey.

Beckerina luteola, sp. n.

Female.—Testaceous yellow, shining; third antennal joint orange yellow; frons brownish; dorsum of thorax with 3 faint reddish vittæ; pleura with a small, dark spot below base of wing; dorsum of abdomen except the anterior and posterior margins of each segment brown; apices of hind femora infuscated; wings clear, veins pale brown; halteres yellow.

Frons about 1.5 as broad as long, the surface with sparse, erect setulæ in addition to the strong bristles; preocellar series of bristles almost straight, second series following contour of anterior margin of frons, slightly curved; postantennals two in number, divergent, erect, moderately strong; third antennal joint rounded, about one-fourth as large as eye; arista longer than width of frons, pubescent; palpus larger than third antennal joint, with a few bristles along lower margin; proboscis short, stout, fleshy. Dorsum of thorax with dense, short, pale hairs; scutellum much broader than long, with two bristles; mesopleura bare. Abdomen with a few weak bristles on lateral margins of second and third dorsal segments. Legs stout; fore tarsi slender; all tibiæ

6. Wash. Univ. Studies, Vol. III, Part 1, No. 1.
7. Nebr. Agr. Sta. Rept. 19; p. 92–100, 1906.
8. U. S. Bur. Plant Industry, Bul. 149, p. 58.

rounded, without dorsal setulæ. Costa extending nearly to middle of wing, noticeably thickened from near base to apex, the setulæ rather close, not much longer than diameter of costa, first section slightly longer than 2+3, third about half as long as second; fourth vein arcuate, ending well in front of apex of wing; all thin veins evanescent at apices.

Length 2.25 mm.

Type.—Cobden, Ill., May 9, 1918. One specimen.

This species differs from the only described North American one, *orphnephiloides* Malloch, in being yellow instead of black, in the armature of the frons, and the much shorter costal vein.

A BUTTERFLY NEW TO KANSAS.

BY HORACE GUNTHROP, WASHBURN COLLEGE, TOPEKA, KANS.

The capture of a specimen of *Eresai texana* Edwards in the city of Topeka by Prof. W. A. Harshbarger on October 24, 1918, adds a new species to the list of Kansas butterflies. The specimen, a female, was caught on a hedge on West Sixth St., near the city limits.

According to Holland*, this species ranges from Texas into Mexico, so its presence as far north as Kansas must be looked upon as accidental rather than as an extension of its normal range. It is probable that the chrysalis was carried here upon some shipment of goods on the railroad, or by some other human agency.

PISCATORIAL ENTOMOLOGY.

Entomologists not familiar with the classification of insects more or less current among fly fishermen, may be interested in a brief review of the subject based chiefly on an American book. The classification rests essentially upon the works of various English fly-fishermen but has been applied to American insects, worked out and illustrated in the book to which we refer, namely, "American Trout-Stream Insects," by Louis Rhead (1916).

The names for insects orders which differ most from those in ordinary use among entomologists are: drakes for the may-flies, browns for the stone-flies, duns for the caddis-flies, and spinners for the crane-flies. The nomenclature of species is more or less fanciful, for instance: brown buzz, nobby spinner, yellow sally, black dose. However, names of this sort cannot be entirely ignored by entomologists for a. long them are some genuine vernacular terms, viz., redbug for *Aphodius fimetarius* in the Catskill region of New York. Since common names for insects are so rare, yet desirable, all those actually in use should be noted.

Fishermen are not to be severely criticized for inventing a classification and nomenclature especially adapted to their special needs, but it should rest upon accurate observation, and reasons urged for adopting it should be the real and perhaps justifiable ones, honestly stated, not unfounded allegations regarding the lack or unreliability of scientific system.

*W. J. Holland. The Butterfly Book. New York, 1904.

The author here reviewed commits all these errors, and his book would have been better without them. As examples of mistakes in observation, we may point out the following: April Insect Chart., Fig. 1. The figure is said to represent one of the Trichoptera, which it illustrates with a caudal appendage having two pairs of branches, something no North American insect of any order has. May Insect Chart, Fig. 14. A crane-fly is drawn with netted venation a character which the artist should have restricted to his browns, duns and drakes, August Insect Chart, Fig. 14. This "fluffy spinner," said to be one of the Diptera, but is drawn with only four legs (all insects having six). The original of this sketch probably was a *Pterophorid* moth. The author speaks a number of times of his faithful representations of the insects and especially of getting the colours true, but to those accustomed to good entomological illustrations, these are crude, and the colours, as reproduced unsatisfactory.

Now, as to reasons for not adopting the classification of scientists Mr. Rhead says: "European entomologists have divided insects into various orders; each season finds them making new classifications so conflicting as to bewilder the lay mind," (p. XVII). Taxonomy has had to bear many reproaches, but this is the first we recall, to the effect that the insect orders are changed each season. Other reasons given by the author for disregarding scientific classifications are expressed in the following sentences: "I was asked by an angling expert who was examining my drawings, "Why don't you give the proper Latin names to each fly?" My answer was, "I would do so, but no entomologist has yet made any effort to classify American trout insects into orders or divisions, families and species as has been done in France and England." (p. 102).

It appears, therefore, that the works of Hagen and of Banks, culminating in the latter's catalogue of the Neuropteroid Insects (1907), which includes all the browns, duns and drakes of Rhead, go for nothing, so far as this author is concerned. Similarly, the works of Osten-Sacken, and of Alexander and the Aldrich Catalogue of Diptera (1905) take care of all of his spinners and other flies, but he knows it not.

Our author makes the remarkable statement also that "Inquiries from various State entomologists failed to locate a single volume or treatise on trout-stream insects" (p. VII). He surely did not inquire of his own State entomologist, for the fact is, that New York State issued long before the date of Rhead's work two very valuable and well illustrated reports on this very subject. These are Needham and Betten's "Aquatic Insects in the Adirondacks" (1901), and "Aquatic Insects in New York State," by Needham, MacGillivray, Johannsen and Davis (1903). The shorter papers bearing more or less on trout stream insects, and publications on kindred topics are numerous.

Another work entitled "Fishing with floating flies" (S. G. Camp, 1913), varies somewhat from the book reviewed in nomenclature of insects, calling the May-flies duns and the caddis-flies sedges. It has the commendable feature, however, of quoting most of its entomological material from a standard work, namely Kellogg's "American Insects" (1905).—W. L. McAtee.

RECENT CANADIAN PUBLICATIONS.

CLASS BOOK OF ECONOMIC ENTOMOLOGY—By Wm. Lochhead, (P. Blakiston's Son & Co., Philadelphia).

This compact book of 436 pages, many of them in reduced type, covers a wider scope of Entomology than any text book we have seen.

Part I (65 pages) deals with the structure, growth and economics of insects, and is of special interest and value, not only because it describes in much more detail than usual the external and internal anatomy—especially the various types of mouth-parts—but also because it brings together in a clear and concise way much valuable data on such interesting subjects as beneficial insects, distribution of insects, insects and disease, and methods of studying insects.

Part II contains tables for the identification of insects injurious to farm, garden and orchard crops, separate tables being made for each host plant. Cross references are also given with each insect to the pages in the latter part of the book where such insect is described in more detail. This enables the student to verify his determinations. Tables of this nature though difficult to construct and seldom satisfactory would appear to be a valuable feature in a book of this nature.

Part III, the main part of the book (280 pages), deals with the classification, description and control of common insects. The old classification has been revised and brought up to date. Each order is treated in considerable detail and keys given not only to the families likely to be met with by the student, but also in many cases to the genera and in a few cases to the most common species. These keys should prove a boon to teacher and student.

Under each family the insects of economic importance are described and an account given of their life-history and the method of control. The total number of insects thus dealt with is large, possibly somewhat larger than necessary.

Towards the end of this part a few pages are assigned to the near relatives of insects, especially such pests as red spiders, sow-bugs, millipedes, slugs and eelworms. Control measures for these are also indicated.

Part IV discusses, in a general way, the control of injurious insects under such subjects as factors of control, cultural or preventive methods, artificial methods, insecticides, spraying, etc.

Although there are 257 illustrations, all of them good and valuable, more would have added to the merits of the book even though this meant an increase in size.

The compilation of a work of this nature, embracing so many aspects of Entomology, must have involved an enormous amount of labour and time, and the author is to be congratulated on the clear, concise way in which he has accomplished his task. The book has many merits and should be of great assistance in furthering the study of Entomology. Its chief defect so far as one can judge without having tested it in the class-room, would appear to be that an attempt has been made to include too many subjects, and while most of these have been well treated, the so-called strictly economic aspect of the work—the life-histories and control measures—have been somewhat sacrificed to the necessity for brevity.

L. CAESAR.

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF NOVA SCOTIA FOR 1918.—No. 4. February, 1919. 89 pp., 7 plates.

In this volume we again have proof of the vigorous condition of our Maritime Branch. It contains 13 papers, many of which are important contributions to Canadian Entomology. Six of these papers deal mainly with the life-histories of particular insects, four with general questions of natural and artificial control, while only one is strictly taxonomic.

The following is a list of these papers:—

A few notes on ant history and habits. By Rev. H. J. Fraser. Pp. 6–9.

The meaning of Natural Control. By John D. Tothill. Pp. 10–14. An analysis of the factors operating in the natural control of Lepidoptera, with special reference to the Forest Tent Caterpillar and the Fall Webworm in New Brunswick. Tables are given, showing the average history of an egg-mass of each of these species during certain years.

Further notes on the Apple Maggot (1918). By W. H. Brittain. Pp. 15–23. In this paper tables are given to show the dates of emergence of 640 adults during the season of 1918, with maximum and minimum temperatures and associated climatic conditions. The time of emergence in early spring is practically the same, whether the season is early or late. Two other tables give dates of emergence according to the variety of apples infested. Experiments were also made to determine the length of the pre-oviposition period, under conditions of control in cages and in the open. It is shown that in certain orchards formerly infested by the apple maggot, but which were rid of the pest by spraying, these insects are now increasing, owing to the orchards having been untreated for two years.

The Salt Marsh Caterpillar (Estigmene acraea Drury). By H. G. Payne. Pp. 24–31. A detailed account of the life-history of this "woolly-bear," with descriptions of all the stages and a table giving dates of hatching, lengths of instars and other data on the seasonal history. The paper is illustrated by an excellent half-tone from a photograph.

A Copper Dust. By G. E. Sanders and A. Kelsall. Pp. 32–37. Gives the results of experiments with a mixture of powdered dehydrated copper sulphate, arsenate of lime and hydrated lime, containing 5 per cent. of metallic copper and 2 per cent. of metallic arsenic. Methods of preparation, storage and cost are also discussed. According to laboratory tests this mixture does not decrease the killing value of arsenicals to the same extent as liquid Bordeaux. Late potato blight was effectively controlled by it.

Notes on the life-history and immature stages of three common Chrysomelids. By W. E. Whitehead. Pp. 38–50. The species discussed are *Disonycha 5-vittata, Chrysomela scalaris* and *Gastroidea polygoni*, all of which are illustrated on plates 2 and 3. Full data on the seasonal history of each is given in tabulated form.

A modified Bordeaux mixture for use in apple spraying. By G. E. Sanders and W. H. Brittain. Pp. 51–61. An extended discussion of the properties and actions of the various formulæ used in the preparation of Bordeaux mixture, particularly with reference to the proportion of lime in its effect on the mixture as a fungicide. Conclusions believed to be correct for Nova Scotian conditions are given on pp. 59–60.

Some notes on Olene vagans B. and McD. in Nova Scotia. By W. H. Brittain and H. G. Payne. Pp. 62–68. Gives a full description of the life-history of this little-known tussock moth, with tables giving duration of stages. These are well illustrated on plate 4, from a photograph.

Some miscellaneous observations on the origin and present use of some insecticides and fungicides. By G. E. Sanders and A. Kelsall. Pp. 69–75. A useful article dealing with the properties and uses of the more important insecticides and fungicides, with particular reference to Nova Scotian practices.

Notes on Lygus campestris Linn. in Nova Scotia. By W. H. Brittain. Pp. 76–81. Discusses the distribution, host plants, injurious habits, life-history and control of this Mirid. The stages are illustrated on plate 5.

Life-History and immature stages of Abbottana clemataria, Smith and Abbott. By H. G. Payne. Pp. 82–85. The various stages are shown on plate 6, from a photograph.

Key for determining the Crambinæ of Nova Scotia. By E. Chesley Allen. Pp. 86–88. The key is based chiefly on the colour-pattern, and the 20 species listed are all illustrated on plate 7 by life-sized figures.

A treehopper new to our list. By W. H. Brittain. P. 89. Gives notes on *Enchenopa binotata* Say, recorded from Nova Scotia for the first time.

THE APPLE BUD-MOTHS AND THEIR CONTROL IN NOVA SCOTIA. By G. E. Sanders and A. G. Dustan. Bull. 16, (Technical Series), Entomological Branch, Dept. of Agriculture. March 1, 1919. 39 pp., 14 figs. in text.

This is a very thorough account of the habits and methods of control of the four commonest and most injurious species of Bud-moths found in the apple orchards of Nova Scotia, viz., the Eye-spotted Bud-moth (*Tmetocera ocellana*), the Oblique-banded Leaf-roller (*Cacoecia rosaceana*), the Lesser Bud-moth (*Recurvaria nanella*) and the Green Bud-moth (*Argyroploce consanguinana*).

The bud-moths are the most serious orchard insects in Nova Scotia, probably causing more injury to apple orchards than all the other insect enemies combined. "It is estimated that in unsprayed or poorly sprayed orchards in Nova Scotia they reduce the crop about 30 per cent. About 75 per cent. of the bud-moths can be destroyed and the crops increased about 22.5 per cent. by two thorough applications of poisoned spray applied before the blossoms open, with a nozzle throwing a coarse driving spray."

"Open planting and thorough pruning help in the control of the bud-moths by allowing the wind to blow away and destroy many of the adults when they are on the wing in June and July."

The Eye-spotted Bud-moth is by far the most important of the four species, over 90 per cent. of the larvæ infesting buds being usually of this species.

Considerable difference exists in the susceptibility of different varieties of apple to bud-moth injury, the varieties having wrinkled twigs being almost invariably more heavily infested than those with smooth twigs, owing to the better hibernating quarters offered by the former to the half-grown larvæ.

Accurate data are given on the injuries to the buds and set of fruit, e. g., the exact reduction in the set as determined by counts of infested blossom clusters in the same variety of apple in the same orchard; the comparative size of the

apples from infested and uninfested clusters; the relation between spring and fall injury, etc.

The control of bud-moths is discussed at length, the measures recommended being based on a long series of experiments on different varieties of apple, using different sprays and nozzles.

The latter part of the paper is taken up with the detailed descriptions, life-history and habits of the four species discussed.

THE FRUIT WORMS OF THE APPLE IN NOVA SCOTIA. By G. E. Sanders and A. G. Dustan. Bull. 17 (Technical Series), Entomological Branch, Dept. of Agriculture. March 1, 1919. 28 pp., 9 figs. in text.

The fruit worms discussed in this report are the larvæ of a number of Noctuid moths belonging to the genera Graptolitha, Conistra and Xylena. They are important enemies of the apple in Nova Scotia, and the damage which they effect by eating into the young fruit or the set of the apples causes the dropping of about 72 per cent. of the injured fruit and the deforming of about 78 per cent. of the remainder. The commonest species is *Graptolitha bethunei*.

The life-history of the various species is so similar that a general account is given which applies to all. The moths appear in the autumn, hibernate and deposit their eggs on the twigs of the apple during May. "These eggs hatch about the time the apple buds are beginning to show pink. The larvæ feed for two first two weeks on apple leaves and blossoms, and drop to the ground very readily when disturbed. After the first two weeks the larvæ feed more on the fruit than the leaves, causing an immense amount of injury." Pupation takes place in the ground in early July.

Fruit worms are difficult insects to poison, and their control is largely mechanical. The authors find that an arsenical spray applied immediately before the blossoms is the most valuable, while that applied immediately after the blossoms comes next in importance. The pre-blossom spray should be applied at a high velocity in serious outbreaks.

The latter part of the report consists of descriptions of the earlier stages of the nine species of fruit worms discussed.

A CONTRIBUTION TO THE KNOWLEDGE OF THE BOT-FLIES, GASTROPHILUS INTESTINALIS, DEG., G. HAEMORRHOIDALIS, L., AND G. NASALIS, L. By S. Hadwen. D.V.S., (Dominion Pathologist, Health of Animals Branch) and A. E. Cameron, M.A., D. Sc., F.E.S. (Technical Assistant, Entomological Branch), Dept. of Agriculture, Ottawa. Bull. Ent. Research, Vol. IX, pt. 2, Sept., 1918.

An investigation into the life-histories and habits of the three species of horse bot-flies that occur in the western provinces. Detailed descriptions are given of the eggs and the manner of their deposition, the young larvæ and their method of entering the host. Experimental evidence is given to show that the eggs of *G. nasalis* and *G. haemorrhoidalis* are capable of hatching spontaneously, and that the larvæ probably penetrate directly into the integument of their host. The eggs of *G. intestinalis*, on the other hand, require moisture

and friction in order to hatch, and the larvæ experimented with failed to enter the skin but succeeded in entering the buccal mucosa.

The distribution of these flies in Canada, the habits of the adults and the period of activity is also discussed.

As a preventive measure against the attacks of *G. haemorrhoidalis* a nose fringe is recommended, consisting of a leather band around the nose and cut into strips long enough to cover the lips of the horse. An additional flap is attached to the band to protect the nose, and a piece of canvas, extending from the nose band to the throat, may be used to ward off attacks of *G. nasalis*.

SOME NEW SPECIES OF TACHINIDÆ FROM INDIA.—By John D. Tothill. Bull. Ent. Research, Vol. IX, pt. 1, May, 1918. Pp. 47–60, with 16 text figures.

This paper gives descriptions and figures of eight new species of Tachinid flies, which constitute the major part of a collection received from Dr. A. D. Imms. They belong to the genera Gymnochaeta, Servillia (2 species), Gonia, Paraphania, Chaetoplagia, Frontina and Lophosia.

SOME NOTES ON THE NATURAL CONTROL OF THE OYSTER-SHELL SCALE (LEPIDOSAPHES ULMI L.). By John D. Tothill. Bull. Ent. Research, Vol. IX, pt. 3, March, 1919. Pp. 183–196, 7 figs. in text.

This study is based on an examination of about 18,000 egg-masses collected between September, 1916, and April, 1917, from representative places throughout Canada.

It was found that the most important single factor in the control of this scale is the predaceous mite *Hemisarcoptes malus* Shimer, a species of European origin, which feeds upon both the eggs and the growing scales. In some localities, e. g., Moncton, N.B., where the scale has been very abundant, it has been almost exterminated by the mite. In British Columbia, on the other hand, it has not yet been found. "As hundreds of the mites can be sent through the mail on an apple twig it should be possible to colonize it in scale-infested places and countries where it may prove to be absent from the local fauna."

Other important factors in the control of the summer stages of the scale are overcrowding of the scales and the Hymenopterous parasite *Aphelinus mytilaspidis* LeBaron, which in one locality was found to have destroyed 75 per cent. of the scales.

E. M. W.

(To be continued.)

CORRECTION (*APHIDIDÆ*).

I am obliged to Dr. A. C. Baker for the information that *Heteroneura*, recently described by the writer in Canadian Entomologist, (1919, page 228) as a new genus to include *Aphis setariæ* Thos., is preoccupied. I am, therefore, proposing a new name, namely, *Hysteroneura*, as a substitute for *Heteroneura*.

JOHN J. DAVIS.

NOTES ON THE LARCH CASE BEARER (COLEOPHORA LARICELLA HBN.).

BY H. T. FERNALD, AMHERST, MASS.

During the present season (1919)the Larch Case Bearer has made its appearance in Northampton, Mass., apparently at the same place where it appeared in 1886, as recorded by Hagen (Can. Ent., XVIII, 125). A number of good-sized larches have been injured, the outer half of the leaf being thoroughly mined, causing the trees to look quite badly. By the middle of June all work was at an end and no moths could be found, and it is probable that at this time the insect was in the pupa stage.

On July 18th another examination was made, and eggs and newly-hatched larvæ were found in abundance. The egg is rather dome-shaped, its diameter at the base being about .3 mm., and its height the same or slightly less. It is of a grayish or brownish colour, apparently determined by the age of the embryo within, the more advanced eggs being darker. The centre of the top is irregularly roughened and about a dozen ridges diverge from this area toward the margin of the egg, the exact number of ridges varying somewhat in different examples. The surface between the ridges is minutely roughened, resembling the surface of an orange. The egg may be placed on either side of the leaf, but most frequently upon the upper one, and somewhere on its outer half.

The larva on hatching appears to enter the leaf, and forms its mine along one edge, working sometimes toward the tip, sometines in the other direction. At this [illegible] no trace of a thoracic shield could be found in any of the specimens examined, though quite high power lenses of a compound microscope were used, nor were any prolegs or spines on the body visible, except two or three of the latter on the head and prothorax, so small as to be extremely difficult to locate. The general colour of the larva was brown, but under the microscope appeared mottled with dark reddish. Unfortunately, it was not possible to carry the observations farther.

Mailed Novemober 20th, 1919