



FIGS. I, II, III and IV.



FIG. V.

MITES INFESTING HORN-FLY.

The Canadian Entomologist.

VOL. XLIII.

LONDON, MAY, 1911.

No. 5

OBSERVATIONS ON MITES INFESTING THE HORN FLY, *HEMATOBIA SERRATA* ROB. DESV.

BY DR. SEYMOUR HADWEN, OTTAWA, ONT.

The mites were first observed on July 3rd at Duncans, British Columbia. My attention was drawn to them by seeing several specimens of *Hematobia serrata* Rob. Desv., which appeared to have been powdered with brick-dust; on looking more closely I found that they were heavily infested with mites. Out of 118 flies captured I found 94 infested with mites, but as mites were seen travelling from one dead fly to another it was difficult to arrive at a positive determination. This estimate was made with the aid of a hand lens; the number found on each fly varied; some had 4, 5, others were covered.

Later I found the mites in other parts of British Columbia. This occurrence, coupled with the fact that *H. serrata* does not seem to have been such a serious pest during the past summer (1910), as it usually is, suggests to my mind that the mite may prove to be detrimental to the fly.

On one farm I visited frequently during the summer, who the owner had been spraying his cattle said that the spraying had diminished the number of flies. He was asked to stop spraying for a time, and no apparent increase was noted.

On communicating with Mr. N. Criddle, of Treesbank, Manitoba, I learned that *H. serrata* in that locality did not appear to be infested with mites.

Some living infested flies were shipped to Mr. Criddle, but arrived dried up and dead. No further attempt was made to try and infect clean flies in a new locality.

The introduction of *H. serrata* into British Columbia dates back some years. I find a record of a specimen taken by Miss Ricardo at Vernon in July, 1902.

According to Dr. Rutherford, the fly was first recorded as a serious pest in Ontario about twenty years ago, from whence it spread to other parts of the Dominion.

In reading Austen's British Blood-sucking Flies, 1906, I note the following: "In the British Isles this (*L. irritans* = *H. serrata*) seems to be an uncommon pest" (Lieut.-Colonel Yerbury). This statement appears to me to be significant, and I am convinced that it is worthy of further investigation.

In the course of the summer two other flies were found infested with mites, one a Sand Fly, *Ceratopogon* sp.?, the other I cannot name; it annoys cattle, however, by sucking up the serum which exudes from the wounds made by other flies. The Sand Fly has been scarce this summer, but as in the case of the Horn Fly, further evidence is needed to see if other influences rather than the mites were not the cause of their diminution in numbers.

I am indebted to Dr. J. G. Rutherford, C.M.G., Veterinary Director-General, for permission to publish this note.

EXPLANATION OF FIGURES ILLUSTRATING DR. HADWEN'S PAPER.

Figs. i, ii and iii.—*Pigmeophorus americanus* Banks.

Fig. iv.—Tyroglyphid Hypopus.

Fig. v.—*P. americanus* on *H. serrata*.

(Original photographs by S. H.)

Note on Dr. Seymour Hadwen's Paper.—The Horn Fly, *Hematobia serrata* Rob. Desv., was first recorded in Canada in the summer of 1892, when it caused considerable alarm in Ontario and Quebec. The species of mite infesting *H. serrata* has been kindly identified by Dr. Nathan Banks as *Pigmeophorus americanus* Banks. He informs me that this mite, which belongs to the family Tarsonemidæ, has been previously found in the Western U. S. on a fly of the family Platypezidæ. This species is illustrated in the accompanying figures i, ii and iii. Fig. iv, which was occasionally found, is the Hypopal stage of a Tyroglyphid mite, which is using the fly as a means of transportation. The relation of these mites to the flies upon which they are found is not always that of a parasite; sometimes they may feed, and in other instances the fly is merely acting as a disseminating agent. I have occasionally found certain Gamasisid mites, truly parasitic, on dipterous insects.—C. GORDON HEWITT.

FURTHER NOTES ON ALBERTA LEPIDOPTERA.

BY F. H. WOLLEY DOD, MILLARVILLE, ALBERTA.

(Continued from Vol. XL, p. 193, June, 1908.)

During the course of studies at my own and various other collections, I have paid far more attention to variation in colour and maculation than to structural characters upon which "Genera" are based. I am strongly of opinion that by far too little importance is usually attached to these characters in articles published on Lepidoptera on this Continent. I have no wish to under-rate the value of many structural characters in showing the relationship and phylogeny of forms. But though, theoretically, a tabulated key of genera should enable a student to identify an unknown species with far greater ease than where no such key exists, it is a deplorable fact that I have noticed some far worse mixtures of species, and often of very distinct genera, in collections owned or supervised by systematists, than in many of those of collectors who make no pretense of studying generic characters at all. It may be asked, "How can I prove it?" I can at present only offer the dried specimens themselves as evidence, it is true, and in the knowledge of many very variable species there can be no such thing as certainty, except by careful breeding from known parents. But in the case of little varying forms, there is such a thing as knowing a species by sight, and suggested errors have in very many instances been borne out by non-related, or at least admittedly disassociated points of structure.

This state of affairs is, it seems, due to several causes. Nowadays, unless a student classifies by structure and dissects, and publishes articles on these lines, his work is not considered of much value. It is too elementary! Systematic work unquestionably is of high value, but close attention to such limits the time necessary for familiarization with the species separated by its aid. Then again, most of these systematic workers direct their attentions to so many different families or orders that their knowledge becomes too general. And another reason, perhaps coincident with and resulting from both the foregoing, may be that, once their system is laid down, their work is too hasty.

Frequently in looking over other collections I have been struck by the small amount of material exposed for study, even where much more was really available. It is obvious that lack of both time and space has often been the reason for that, but it, nevertheless, suggests that variation is not studied as it might be. One notable exception was in the American

Museum of Natural History, where many and even little varying species are to be seen in long series, sometimes from one locality. Some may think that such is a waste of space, but there is this to be said in its favour, that whereas a long and picked series of one species, from one locality or many, may indicate to what extent it varies, a long series of another may indicate that that varies but little at all.

It has been admitted by many men of science that, at any rate, a very large number of so-called "genera" are purely conventional terms, for the mere convenience of the student. As an instance, let me go back twenty-one years and quote Prof. Smith's words in Bulletin No. 38,* U. S. N. M., page 6: "I had at one time the strong conviction that genera were natural assemblages, capable of strict limitation, and definite in extent. The study of a very large material since that time has convinced me that my first impression was erroneous, that genera as such are mere artificial divisions of convenience, useful for the purpose of identification, and for the expression of relationship, and that they were useful for that purpose just in proportion as they expressed clear and definite association of characters. . . . The limits to which generic division may be carried will depend entirely upon the tact and individual propensities of an author, and in a large part also upon the tendency of the time at which he is writing. After a period of wild generic creation, there comes usually a reaction, in which lumping is carried to an extreme, and this is true as to species as well as genera." Yes, and through it all the species remain the same. Like Br'er Rabbit, they "lie low and keep on sayin' nuffin'!" Yet generic division is apt to be looked upon as the acme of science, to say nothing of the designation of certain forms as "new species," without the least idea of the extent of their variation, or the character or sum of characters which, through their sundry phases of variation, may present evidence that they are alien from their allies, or at any rate from forms from which they are assumed to differ biologically. Too much is taken for granted. Too much is stated as fact that is really pure speculation, without evidence being brought forward in support of the hypothesis. It seems to me that he is just as true a student of nature who is constantly testing those facts and bringing all available evidence to bear upon them, not from one point of view alone, but from all the various sources from which it may be drawn.

*Revision of *Agrotis*.

The subject of basing specific distinctions upon slight differences of of genitalic structure, affords too wide a field to be dealt with by more than a brief remark in this article. There are many who claim, and probably few are in a position to dispute, that certain portions of the reproductive organs show greater stability than any other organs or characters in lepidoptera and other insects. Yet there are, I believe, none who will claim that they never vary at all in a species. Carefully prepared and figured organs may be, doubtless are, very highly valuable as evidence in support of or against suppositions as to unity or distinctness of species. But, admitting that they can and often do vary, why should their exponents expect others to take it for granted that differences shown do not intergrade, or to prove that they do intergrade, without themselves proffering evidence to support their hypothesis that they do not? This seems the more strange when the differences claimed to denote distinctness are between forms occurring, not side by side, but in different parts of the country, it may be on opposite sides of the continent. In other words, whilst the exponents of genitalia freely admit variation up to a certain point in one locality, and even show figures denoting such variation, why should they disallow that variation may exist to the point of differences shown between races inhabiting widely different regions? The regions intervening seem to be left out of account altogether.

In the following articles I have, to facilitate reference, adhered as far as possible to the order and generic names given in my original list, which first commenced on page 40, Vol. XXXIII.

95. *Hemaris diffinis* Bdv.—This appears to be the form described by Messrs. Barnes and McDunnough as *diffinis ariadne* in their "List of Sphingidæ of America north of Mexico" (*Psyche* xvii, 190-206, Nov., 1910). The description is made from fourteen specimens from Colorado, and Manitoba is given as another locality in the list on page 201. It agrees with Holland's figure and description of *thetis* in the "Moth Book," which the authors say "he seems to have confused with *ariadne*."

99. *Sphinx vancouverensis* Hy. Edw., and var. *albescens* Tepper.—I have two males, taken probably at the Calgary town lights, by Mr. C. G. Garrett, which have the dark dorsum to thorax, and are throughout nearly as dark as my only two males from Vancouver Island. I have a still darker specimen taken at High River by Mr. Baird. One of my Pine Creek specimens is almost a connecting link. The form is not seasonal, as pointed out in the paper in *Psyche*, above referred to.

101. *Smerinthus cerisyi* Kirby.—Rather common some years in June and July playing over water just before and after dark, in company with *geminatus*.
102. *Samia columbia* Smith, var. *nokomis* Brodie.—What I have listed as *columbia* is probably referable to var. *nokomis*, articles on which appeared in CAN. ENT., XL, pp. 350-354, and 373-376, Oct., 1908. The types of *nokomis* came from Carberry, Manitoba.
103. *Scepsis fulvicollis* Hbn.—Red Deer River, July 5th, 1905, at light. High River (Mr. Thomas Baird). It is probably not rare on the prairies.
105. *Hypoprepia miniata* Kirby.—Two more specimens from Pine Creek are dated July 22, 1906, and I have occasionally taken others.
106. *Celama cilicoides* Grt.—Sir George Hampson so named a specimen I sent him of the species I listed as *pustulata*, the type of which, and of *nigrofasciata*, are in the British Museum. He figures neither, but figures a female as *cilicoides* from the Grote collection, which seems browner and less marked than any of my specimens.
107. *Eubaphe immaculata* Reak., var. *trimaculosa* Reak., is the correct name for this form, according to Dr. Dyar. Specimens which I took at Windermere, B. C., in July, 1907, and which he called typical *immaculata*, have a pinkish tinge, and as a rule less of the fuscous border to secondaries, and sometimes lack the discal spot. One in my Calgary series lacks the border, but none completely lack the spot. In both series the border is sometimes broken into three blotches. A specimen from Stockton, Utah, is quite immaculate. Two from Chicago, sent by Mr. Kwiat, as *immaculata*, have discal spot, and one or two marginal blotches, but are ochreous rather than pinkish. Specimens received as *aurantiaca* from the same source are, in the male, more like the Calgary form in colour, but have narrower, darker and more even border, and are smaller. The females are of a more crimson red than the males, or than my only Calgary female. Four Chicago males which Mr. Kwiat sent as *rubicundaria*, are like his *aurantiaca* males, but immaculate. One is almost exactly like the Stockton specimen, but shorter in wing. The Calgary female and one male have whitish spots below the cell, as in Grote's *quinaria*, which is referred as a variety of *aurantiaca* in our lists. A series I saw in Mr. Baird's collection at High River were less maculate than the average of mine. I have met with no more females besides the one

previously mentioned in my list, but have one from Edmonton taken by Mr. F. S. Carr on 7, vii, 10, which is like it as to maculation, but has secondaries almost crimson, as in the Chicago specimens referred to as *aurantiaca*.

110. *Neoarctia beanii* Neum.—The larva has been described by Mr. Gibson, from Sulphur Mountain, Banff, found by Mr. Sanson. (CAN. ENT., XLI, 400, Nov., 1909). Mr. Bean had previously briefly described it in XXIII, 124, 1891. He also found a larva on Mt. St. Piran, Laggan, in the middle of July, 1893, which produced a moth on Aug. 20th. "St. Piran" is the correct name for the mountain I have sometimes referred to as "Piran," and which was at one time called "Niblock."

111. *N. yarrowi* Stretch.—Mrs. Nicholl took a specimen on a rock slide above Lake Louise, about July 20, 1904.

112. *Phragmatobia fuliginosa* Linn.—Occasionally met with since, but I have never found it common. May 5th, 1906 (in sunshine), and May 20th, 1907.

113. *Arctia caja* Schrank.—Mr. Baird takes the species rather commonly at High River, and sent me some labelled "var. *Wiskotti*," on whose authority I know not. The secondaries incline to pale orange rather than red, but I have seen nothing approaching what Holland figures as *Wiskotti*, from Colorado. Specimens from Vancouver have secondaries scarcely darker. I have seen specimens taken in Calgary, but have none of them in my collection.

114. The species is that figured by Holland as *Hyphoraia parthenos* Harr., and agrees with Hampson's description of *parthenos*, and not of *lapponica*.

115. *Apantesis virgo* Linn.—Another male at light here, July 27, 1907. Another taken by Mr. Hudson on July 20, 1906, also at light, is of the variety *citrinaria* N. & D., having pale straw yellow secondaries instead of red.

116. *A. virguncula* Kirby.—Occasionally taken since.

118. *A. parthenice* Kirby.—I have twenty-one males and three females in my series, carefully picked from a large number of specimens through a course of years. There is a tendency to melanism in a few examples. The inner transverse white line is either obsolete or defined merely by a spot on the costa. In one specimen only it is visible as a dot

in the cell. The second or middle line is obsolete in one, and reduced to a mere dot in the cell in three or four more. The third is occasionally broken, or very fine and reduced, and in one specimen almost obsolete. A male taken at light by Mr. Hudson on July 20th, 1906, has the secondaries yellow instead of red, slightly tinged with orange centrally. Dr. Fletcher referred it to this species. It is strange that this and the *citrinaria* above referred to should have been taken on the same night.

127. *Parasemia petrosa* Walk.—Had I studied Mr. Bean's article more closely, I should, as suggested by recent correspondence with him, have thus named my species rather than *plantaginis*, which does not seem to be properly referable to any known North American form. A form sent me by Dr. Fletcher from Nepigon, Ont., as *Selwynii* Hy. Edw. (= *Scudderi* Pack.) differs in some respects from anything yet taken in Alberta either by Mr. Bean or myself, and is, Mr. Bean tells me, claimed to be constant in its locality, and not unlikely distinct.

128. *Halisidota maculata* Harr.—I may add *Acer negundo* as a food-plant.

NOCTUIDÆ.

132. *Acronycta canadensis* Smith.—There is only one specimen now in my collection which I feel sure is the same species as the type. This is a female dated July 13th, 1899. It is the one previously referred to as labelled "like type" by Prof. Smith, and "*lepusculina* Gn." by Sir George Hampson. The latter determination would probably now be revoked, as he figures a female from Hudson's Bay under "*canadensis*" as a species. It may be the same as mine, but is not obviously so. The figure does not happen to be a very good one of the specimen. I have re-examined the type, but beyond suggesting that it shows affinities to both *felina* and *cretata*, I dare form no opinion at present as to its true status. Hampson claims that *insita* of Smith and Dyar's "Monograph" is *lepusculina* Gn., and renames their *lepusculina* as *chionochroa*, figuring a male from Iowa, but making no type. I mention this to explain the former reference of *canadensis* to *insita* by Smith, and to *lepusculina* by Hampson. *Insita* Walker appears to have preference over *denvera* Smith. I have reasons for doubting whether either *insita* or *lepusculina* of Smith and Dyar were pure.

133. *A. cretata* Smith.—I took a fine series of this species at treacle, between June 22nd and July 16th, 1909, and its distinctness from *canadensis* stands out quite clearly. It was described from one male and two

females from Garfield Co., Colo., 7,000 ft., and a female co-type is excellently figured by Hampson. The other pair stand as types in the Washington Museum, and both are figured in the Monograph. I have serious doubts whether these two types are one species. The male, as stated under the description, is a good deal smaller than its female, and lacks the contrasting sharp written black markings of the other two females, and of all my specimens. It seemed to me to agree very closely with one or two specimens standing, I thought correctly, under *populi*. But at any rate the name should probably stand for the female. The ground colour is the whitest of any North American *Acronycta* known to me. I once thought it was the western form of *populi*, but have abandoned that idea. I have a specimen from Winnipeg, and one from Montreal, from Mr. Winn. It is broader winged than *populi*, has less acute apices, whiter ground, and while the maculation is blacker and more contrasting, the powdering is less evenly distributed and seldom as heavy. The orbicular is very small, round or nearly so, and often reduced to a mere black point. There are numerous other differences. In fact, it is a closer ally of *leporina* Linn., of which I have a fine pair from Cartwright, Man. These have a slightly creamy ground, and much less of both the powdering and maculation. They differ in these respects somewhat sharply from the whole of my *cretata* series, but had I not *cretata* from Winnipeg I should have suspected the Cartwright specimens of being a local variation. I expect shortly to have European *leporina* to compare. Dr. Dyar, in his "Kootenai List," gives three names as probable varieties of *leporina* Linn., "*vulpina* Grote, Atlantic coast; *cretata* Smith, Colorado mountains, and *moesta* Dyar, eastern B. C." The type of *vulpina* I have not seen. If the pair I saw standing in the Washington collection are true *vulpina*, my Cartwright specimens are probably the same species, which seems likely to prove distinct from *cretata*, to which I have no hesitation in now referring *moesta* as a suffused form.

134. *A. manitoba* Smith.—One worn specimen on the Red D. River, N. E. of Gleichen, on July 6th. 1905. I have examined a large number of this species from Cartwright and other points in Manitoba, and have a good series. Its nearest ally seems to be *furcifera*, than which it has paler ground colour, is more strigate, and has all the dark shades blacker. My material in *furcifera* is, however, deficient, and I have none from Manitoba or westwards. Holland's figure under *furcifera* appears to me to be *manitoba*. It is a trifle too brown, which may be accounted for by the tint of the plate. The species I refer to as *furcifera* is that figured

by Holland as *hasta*. The *hasta* of Hampson's Catalogue is *pruni* of Smith and Dyar. I have seen types of neither *hasta* nor *furcifera*.

136. This should be *A. grisea* Walker, some Alberta specimens agreeing well with Walker's type from "Hudson's Bay." The anal dagger in my series varies somewhat in thickness, but is lacking from none, as it is from Hampson's figure of an Alberta specimen. In the Kootenai List, Dr. Dyar refers the Kaslo form to "*grisea*, var. *revellata*," and implies that Kaslo larvæ are like larvæ of eastern *grisea*. *Revellata* was described from Salida and Glenwood Springs, Colo., and is larger and a little darker than the average run of Calgary specimens, with the anal dagger rather heavier. The male type at Washington is somewhat fuscous and like Kaslo specimens. The female type is bluer and like Vancouver Island specimens in the same collection. A few of my Calgary examples, if mixed, could probably not be picked out from a Kaslo series, and I have no reason for considering the names to refer to two species. Dyar gives birch as the food-plant of both forms. I have not discovered its food-plant here, but know of no birch within two miles, though the moth is sometimes common.

138. *A. illita* Smith.—Specimens from Aweme, Cartwright and Miniota, Man.; Kaslo, B. C., and Duncans, Vanc. Is., are all much like my only Alberta specimen, and all are dark, somewhat suffused, but blue-gray, not brown as in Hampson's figure, which is poor. The species was described from Denver and Glenwood Springs, Colo. Dr. Dyar, in the Kootenai List, calls Kaslo specimens "*impleta*, var. *illita*." My *impleta*, from New Brighton, Pa., New York and Montreal, are paler and less contrastingly marked. I have no actual intergrades, nor did I notice any when at Washington, yet I can see nothing contrary to Dr. Dyar's opinion.

139. *A. emaculata* Smith.—The male type in Prof. Smith's collection is from Calgary, and I have a specimen labelled by myself as almost a dead mate to it. A Calgary specimen very like it is well figured by Sir George Hampson. The female type is in the Washington Museum, and is from Easton, Washington. It is very dark and uniform, with no contrasting shades. These two specimens form the whole of the type material. Hundreds of Calgary specimens have passed through my hands, and I have over forty picked specimens in my series now, but have seen none as evenly dark as the female type. But a Kaslo female in the Washington Museum is extremely like it, though having a trifle more contrast

in shades. I should say they are unquestionably the same species. Feeling very hazy about the distinctions between *impressa*, *emaculata* and *distans*, I submitted two pairs from Calgary to Dr. Dyar a few years ago for his opinion. He replied that none were *emaculata*, and returned two as *distans* and two as *impressa*. Those sent as *distans* are the darker, and have distinct submedian dark shading from the base to the anal angle almost unbroken. The others lack this shade almost entirely, and are pale, like my *impressa* from the east. These characters are used in separating the imagines in the monograph, and a pair are figured under each name in accordance, *distans* being shown to have also slightly narrower wings and more pointed apices. But following up these characters through my series, and using my two labelled pairs as leaders, I entirely failed to divide them into two series, nor could I do so by the help of any other characters, either then or on the many occasions upon which I have made the attempt since, after examining fresh material in the Washington collection, where there is a good series under both names from many localities.

At the British Museum in February and March, 1909, I was unable to follow out Sir George Hampson's separation of *distans*, *impressa* and *emaculata*. The types of *impressa* and *fasciata* Walker, from "Hudson's Bay," and Grote and Robinson's *verrillii*, from Cambridge, Mass., are pale blue-gray, and seemed to be one species, as catalogued. But other specimens associated with them and with *distans*, seems to me to fit *emaculata* equally well.

In the *distans* series I made careful notes on a male and three females, which seemed different from the rest of the group, and from any that I had seen before. Of these, one was the male type from Montreal, which appeared to be the one figured in plate cxxvi, 21, of the Catalogue. One female was from New York, and labelled "*brumosa*," presumably by Grote. The other two bore no locality labels, but I judge from the Catalogue that they were from the same localities. These four seemed to have creamier ground, and to be browner and more smoky than any of the rest, and to have wider space between the t. p. line and termen, with wider, larger pale spots constituting the s. t. line. These then are all typical *distans*. I spent a lot of time trying to persuade Sir George that some of the Calgary specimens belonged to these and others did not, though all differed in colour, none being brown or smoky, but rather blue-gray. A male under *impressa* marked "New York Garrison, Cockerell," also seemed to me to be *distans*. But on my return to Calgary my attempt

to make a satisfactory separation in my series on the above characters (eliminating the mere colour difference) proved abortive.

I marked a specimen in Mr. A. F. Winn's collection at Montreal as typical *distans*, and have two males from Mr. J. D. Evans, of Trenton, Ont., which seem to fill the bill. My notes on the Washington collection are: "Not one typical *distans* in the whole long series under this name, and a few seem undoubtedly *impressa*." And "several under *impressa* are typical *distans*, though others are typical *impressa*." I am of course making no claim to ability to define the limits of *distans*, nor always to recognize it when I see it, but am merely diagnosing the typical form. Granted that larval differences claimed by Dr. Dyar may signify the existence of two species, it has, I think, yet to be shown that they are *distans* and *impressa*. At any rate, the progeny of known females will have to be carefully compared before the limits of variation in each can be learnt. In Dr. Dyar's list it is signified that the larval descriptions given under the two names in the Monograph were reversed. Sir George Hampson associates them accordingly.

I have at present no reason whatever for supposing that *emaculata* male is a good species. It is more like the type of *impressa* than of *distans*, but beyond that I dare not venture at present. Mr. Heath claims that he can recognize two distinct forms at Cartwright, which appear at different dates, but I have not succeeded in dividing material received from him supposed to contain both. During 1909 I selected from treacleed posts about a hundred good specimens, ranging from about June 10th to July 14th, but though the variation is considerable, and includes forms like eastern *impressa*, I noted nothing in their dates, habits or appearance to help me in a separation.

I am inclined to consider *dolorosa* Dyar, from Kaslo, the same species as *emaculata* female type, and not distinct from the Kaslo female referred to under that name. The form seems to me to connect female *emaculata* with its male, and to be actually nearer the type of *impressa* than of *distans*.

141. *Hadenella tonsa* Grt.—In Dyar's list *subjuncta* Smith is referred as a synonym of *minuscule* Morr. Prof. Smith, in Trans. Am. Ent. Soc., xxix, 194, states that it has nothing in common with *minuscule*, but is a synonym of *tonsa* Grt., and that he had studied the types of all three. He so refers it in his Check List. In the Kootenai List Dr. Dyar accepts this change, recording *tonsa* from Kaslo, and stating that the specimens agree with *subjuncta* type. As to the lack of close relationship

to *minuscula*, I am willing to accept Prof. Smith's word. As to *tonsa*, I have seen the type in the British Museum, a female from Nevada, and am inclined to agree with Sir George Hampson in considering it distinct from the Calgary species which he figures as *subjuncta*, and which is the form that has for years stood in my collection as such, and was previously listed by me as *tonsa*. In the Washington Museum are male and female types *subjuncta* from Glenwood Springs, Colo., a female co-type "Colo.," and a pair of co-types from Calgary. The female type and the other Colo. female appeared to me to be *tonsa*. The variation puzzled me a bit, but I have come to the conclusion that the male type and Calgary male co-type, which are alike, must be *tonsa* also. There were also in the collection Kaslo specimens, and a female from Williams, Ariz., which agreed with the female type.

I possess as *tonsa*; females from Kaslo and Prescott, Ariz., from which latter locality there is one in the British Museum, agreeing with the type. This is dark gray, suffused, blackish centrally, with spots outlined in black, and claviform well defined, moderate in size. Kaslo and Arizona specimens differ principally only in being slightly brown-tinged. But, with one exception, all my Calgary series (*subjuncta* Hampson, probably on my authority) are very much paler, scarcely suffused, reddish-brown tinged, and the spots are not distinctly outlined in black. The claviform in none is distinctly outlined, is very small where discernible, but as often as not entirely lacking. Similar Calgary specimens are at Washington. They may grade through to *subjuncta* Smith, = *tonsa* Grote, but I was unable to decide. From my own material I should not suspect it. *Subjuncta* Hampson, which is also the *subjuncta* of Holland's figure, is very near *semicana* Walker, which is the species known in eastern collections as *hausta* Grote, of which I have not yet seen the type. Hampson places them next one another in the genus *Oligia* Hubn. *Semicana* is shorter-winged, and has them proportionately a little broader near the base. He separates them in the table by *subjuncta* having the terminal area darker than subterminal, as against "not darker" in *semicana*. This seemed correct, and I noticed that *semicana* had a more cream coloured ground. But this scarcely holds in my own series from New Brighton and Oak Station, Pa., in which the diffuse pale s. t. line is crowded closer up to the hind margin (termen) than in the Calgary form, though such margin as it leaves is dark. Barring that and the wing form, my two series are exactly alike. The locality of type *semicana* is known merely as "U. S. A."

143. This form is *Caradrina nitens* Dyar without a doubt. The seven types are all males. Four are from Kaslo, and the other three from Turtle Mountains, N. D., which according to my atlas are continued across the boundary into Manitoba. The average of Calgary specimens are a little larger, darker and narrower of wing than my series under *miranda*, from New Brighton and Pittsburg, Pa., Lawrence, Kan., and Chicago, Ill. But these differences are not constant. I can match Chicago and Calgary males, good fresh specimens too, in every detail. Unfortunately, out of a series of sixteen local specimens, only two are females. These do not differ in secondary structure from the males, having slender thorax, and long slender abdomen. Six of my *miranda* series are females, out of thirteen. These all have more robust thorax and abdomen, and the latter is also shorter, not exceeding the anal angle of the secondaries. This character may or may not denote a distinct species, but, not to commit myself further, I expect at any rate that *nitens* occurs at Chicago. There is no type of *miranda* in the British Museum, nor have I any note of the series there, but Sir George Hampson states that *nitens* has a white point in the reniform which *miranda* lacks. This does not hold in my series either, as the majority in both have white points. It looks to me as though Dr. Holland, on Plate xix, fig 20, had figured *miranda* female as "*Orthodes vecors*. male." The series under *miranda* at Washington, on the strength of which *nitens* was described, may prove to be a mixture, but in this I may be wrong, except as to the distinctness of a worn male from Kaslo, like which I have two fine specimens from the same locality, and have seen others. These are, as Dr. Dyar remarks in the Kootenai List, "large and grayish powdery," and have the t. a. and t. p. lines faintly indicated as broad, diffuse striae, with uniform, slightly smoky secondaries.

144. *C. punctivena* Smith.—The type is at Washington, and is a male labelled "Laggan Sta., N. W. T., Bean."

145. *Hillia senescens* Grt.

146. *H. vigilans* Grt.—As to the relationship of these two forms, I have been able to discover nothing more than I knew when I previously published. I have, however, compared specimens with both types, and the names are correct. The type of *senescens* is a female from Lewis Co., N. Y., and *vigilans* is also a female, from Orono, Maine. Sir George Hampson makes both synonymous with *iris* Zett., which was described from Lapland. About *crassis*, which he makes the first synonym and "ab. 1." of *iris*, I know only what I have read in catalogues. It was

described apparently from Europe, and Hampson's description reads like *senescens*, which is in accordance with Prof. Smith's diagnosis of the *crassis* of the Berlin Museum. Type *semisigna* Walk., a female, locality unknown, is a very badly rubbed *senescens*. I have no note that I have anywhere seen any intergrades. The black specimen referred to in my previous list as destroyed, was in all probability *maida* Dyar, which has recently been taken at Banff.

148. *Luperina niveivenosa* Grote.—This is prior to *vivalis* Grote, and Sir George Hampson places the species in Volume IV in his new genus *Protagrotis*. The type of *vivalis* is in the British Museum, and is a very badly rubbed male from Nebraska. The reference to *niveivenosa* was shown in the collection when I was there, though it had not been known when Vol. IV was published. The woodcut of *vivalis* is very poor, owing to the bad condition of the specimen. Prof. Smith in his Catalogue states that the type of *niveivenosa* is in the Graef collection. The description was made from a single good specimen from Colorado, and this, a female, is in the American Museum of Natural History, from the Henry Edwards collection. I saw no type in the Graef collection at Brooklyn. Grote described both as *Agrotis*. I examined the tibiae of neither type, but that of *vivalis* is stated to have a spine between the two pairs of hind tibial spurs. I find this in two out of six specimens that I have so far examined, and am not assured of its absence from the rest.

149. *Hadena passer* Guen.—I have seven Calgary specimens in my series at present, and have never taken many more. I am not sure as to the extent of variation in this species. The type, a male from Trenton Falls, New York, is in the British Museum, and is an even-coloured specimen, fairly well figured in the Catalogue, though the broad blackish t. p. line from the costa to opposite the reniform is a mistake of the artist. Type *loculata* Morr., from Evans Centre, is there also, and is like it but more even. Type *incallida* Walker, from Trenton Falls, is, my notes tell me, like my specimen previously listed as No. 155, wrongly as *morna*, though I had not this specimen with me to compare. My specimen is pale ochreous except on costa, termen and central band to just below the median vein. Hampson's "ab. 1. *conspicua*" is like this, but has the central band fairly complete. Type *conspicua* is stated to be in the Tepper collection. I am not quite confident that my supposed *incallida* specimen will not be found to belong to another allied species. Of this latter I have one male taken here on July 9th, 1907, and one from Mt. St. Hilaire,

Quebec, July 1st, 1899, through the kindness of Mr. Chagnon, who showed me a short series taken at the same time and place. This is apparently one of two species which I found standing wrongly in the Washington collection, in different drawers, as *morna* Strecker, and there were specimens of it from Wellington, B. C., Raleigh, N. C., and Silverton, Colo. I can identify it at present with no known name, and have given it one in my manuscript notes for my own convenience, but will not publish until I have had opportunities for further study. It shows stronger contrasts of colour than *passer*, having paler ground, and dark shades blacker, and mine have more whitish in the reniform.

NOTES ON ORTHOPTERA.

BY A. N. CAUDALL, WASHINGTON, D. C.

Mr. Chas. Schæffer, of the Brooklyn Museum, recently sent Mr. Banks a number of Neuroptera for identification. Among this material was one specimen labelled "*Mantispa* sp. Neuropt," which proves to be a male specimen of *Mantoida mays* S. & Z., a little Mantid very like, in general appearance, the members of the Neuropteroid genus *Mantispa*. The locality label was only "Florida," and, as the species was described from Northern Yucatan, it seemed doubtful if it was really from Florida. The specimen bore an accession label, so Mr. Banks wrote for further information regarding it. Mr. Schæffer replied, assuring him that the specimen was from Florida, probably from Kissimmee, and was from the collection of Charles Palm.

This is an interesting addition to the list of United States Orthoptera, being the only representative of its subfamily, the Eremiaphalinae, found in the nearctic fauna.

The genus *Parabacillus* of Schulthess¹ is preoccupied by the genus of the same spelling erected by the writer some years ago.²

The genus *Lophotettix* of Bruner³ is preoccupied by *Lophotettix* Hancock.⁴

Tettigidea australis Bruner⁵ is preoccupied by *Tettigidea australis* Hancock.⁶

1. Mitth. Schw. Ent. Ges., Vol. xii, p. 8 (1910).
2. Proc. U. S. Nat. Mus., Vol. xxvi, p. 865 (1903).
3. Ann. Carnegie Mus., Vol. vii, p. 137 (1910).
4. Trans. Ent. Soc. Lond., p. 388 (1909).
5. Ann. Carnegie Mus., Vol. vii., p. 132 (1910).
6. CAN. ENT., Vol. xxxii, p. 26 (1900).

May, 1911

STUDIES IN THE LIFE-HISTORIES OF CANADIAN
NOCTUIDÆ.—I.*

BY ARTHUR GIBSON, OTTAWA, ONT.

MONIMA REVICTA MORR.

Eggs of this species were received from Mr. Theo. Bryant, of Wellington, B. C., along with the captured ♀ which laid them. They were deposited on the 26th April, 1904, and hatched on the 9th May—duration of egg state 13 days.

Egg.—Spheroidal, the base flattened; pale yellowish; 0.8 mm. in diameter; about 44 ribs, cross-striæ distinct. Laid singly.

Stage I.—Length when hatched 2 mm.; pale lilac before feeding, after feeding pale green. Head 0.4 mm. wide; bilobed; testaceous, mouth-parts darker. Cervical shield concolorous with head. Body cylindrical, skin smooth and shiny. Tubercles black, shiny, single haired setæ black. Second day after hatching indistinct stripes are noticeable on the body. On the third day, under a lens, these are distinct; in colour dull reddish, and are as follows: a stripe between tubercles i and ii, another stripe, more distinct, almost midway between tubercles ii and iii, and still another stripe running through tubercle iii. There is also a sub-ventral stripe running through tubercle v. At this time the skin between tubercles iv and v is pale bluish. Feet darker than body, front two pairs of prolegs aborted. Larvæ loop when walking.

Stage II.—Length, 6 mm. Head 0.65 mm. wide, rounded; pale luteous, darker at vertex. Ground colour of body dark green, almost a bottle-green, still darker laterally, with a decided burnt-umber tinge. Dorsal stripe pale bluish; sub-dorsal stripe of same colour, just below tubercle ii; lateral stripe, just above tubercle iii, also of same colour, but not so wide or so conspicuous as the sub-dorsal stripe; stigmatal band very wide and conspicuous, extending along the whole side of the body and on to the anal prolegs. Tubercles small and black, each with a black, short hair. Spiracles black in front of tubercle iv. Feet concolorous with venter; prolegs darkened exteriorly. First pair of prolegs aborted, the larvæ still looping when walking. Later in the stage the colour of the skin laterally, just above and below the stigmatal band, becomes more of

*Contributions from the Division of Entomology, Ottawa.
May, 1911

a reddish-brown, as does also the whole dorsum of segment 13 and part of segment 12.

Stage III.—Length, 11.5 mm. In general appearance the larvæ are now dark purplish-black, with a conspicuous white stigmatal band. Head 1.0 to 1.1 mm. wide; honey colour, darkened at vertex. The larvæ in this stage are darker than Stage II, and the markings on body are more distinct. The dorsal stripe is wider and more apparent than the sub-dorsal and lateral stripes; all these stripes pale blue. The lateral stripe is the least conspicuous. Stigmatal band creamy-white and very distinct. Under a lens the colour of the skin of body above the sub-dorsal stripe is almost a bottle-green, with small, pale bluish and blackish mottlings. The dorsal stripe is narrowly margined on either side with black, as is also the upper edge of the sub-dorsal stripe. The colour of the skin between the sub-dorsal stripe and the stigmatal band is almost a clove-brown. Skin below spiracles dark brownish, becoming paler and of a bluish tinge towards centre of venter. Tubercles small, black. Spiracles round, black. Thoracic feet semi-translucent, dark at tips; prolegs sordid-white, darkened exteriorly towards base.

Stage IV.—Length, 18 mm.; Head 1.6 to 1.75 mm. wide; testaceous, reticulated with darker brown; ocelli black. Body purplish-black, the skin above the sub-dorsal stripe with a greenish tinge, throughout which are numerous streaks and dots of black. The stripes on the body are the same as in last stage. The creamy-white stigmatal band is even, wide and very conspicuous. The spiracles are black, elliptical in front of tubercle iv. Tubercles black, small and inconspicuous. Thoracic feet rather translucent, with a brownish tinge; prolegs pale, darker towards base. Venter slightly pruinose, more apparent in some specimens than in others. The larva is a beautiful creature with its dark body, pale bluish stripes and prominent stigmatal band.

Stage V.—Length, 22 mm. Head 2.3 to 2.5 mm. wide; reticulated with brown, as in last stage; an oblique, wide band of brown crosses upper portion of each cheek. The larvæ are now altogether different from previous stages. The colour of the dorsum from the sub-dorsal stripe on one side to the sub-dorsal stripe on opposite side is dark yellowish (yellowish-green in a few specimens), blotched with brown. The tubercles within this area are circled with white. This yellowish colour of dorsum

becomes more distinct as the stage advances. The skin below this, to the wide creamy-white stigmatal band, is rich brown with a purplish tinge. Spiracles black. Below stigmatal band the colour is seal-brown, dotted with white; the venter is slightly pruinose. In some specimens the distinct stigmatal band is edged within with pale (but bright) yellow. Dorsal, sub-dorsal and lateral stripes distinct, but broken in places.

Stage VI.—Length, 30 mm. Head 3.2 mm. wide; markings much heavier than in Stage V. The larvæ in this stage are much the same as in Stage V. The stripes above the spiracles have become less distinct. In some specimens the lateral stripe is almost obliterated. The stigmatal band is now not clear, as in former stages, but is blotched, particularly in the centre, with the same brownish colour of the skin of the body. In some specimens almost the whole of the stigmatal band bears these blotches. Spiracles black. Tubercles minute and inconspicuous. Body colour same as in last stage, below stigmatal band with a distinct purplish sheen. Thoracic feet pale brown; prolegs concolorous with venter.

Length of mature larva 42 mm. at rest, when extended 47 mm.

On June 2 the first larva to burrow entered the earth, and others followed soon afterwards. The oval earthen cocoon made by the larva is similar to that made by many other noctuid larvæ; no silk could be detected.

Pupa.—Length, 18 mm, width at widest part 6 mm., dark chestnut brown, shining; abdominal segments roughly pitted on anterior half; spiracles black. Cremaster blackish, rough, terminating in two long, excurved, stout spines, on either side of each of which there is a short thick spine, and in front of these latter two other spines, all, also, excurved; all the spines dark reddish brown.

The moths (7) emerged in a cool cellar during the latter half of March, and early in April of the following year. The specimens are remarkably alike in appearance, the general colour of the primaries of all being bluish-gray. They vary in expanse from 40 mm. to 44 mm. The moth is well illustrated in Hampson's Catalogue of the Lepidoptera Phalænæ in the British Museum, Vol. V, pl. xc, fig. 24.

Food-plant.—The larvæ were offered apple, willow, poplar and birch, but only ate willow and poplar, preferring the former. Latterly they were reared to maturity on willow.

THE LIFE-HISTORY OF *CHRYSOPHANUS DORCAS* KIRBY.

BY WILLIAM W. NEWCOMB, M.D., DETROIT, MICH.

Ever since I began to study *Chrysophanus dorcas* in the summer of 1908, I have especially desired to work out its life-history, but I have only accomplished this the past year (1910). During the first season in which I attempted to find the eggs* I met with considerable success, at least after three or four weeks' effort, and secured an abundant supply, mostly from caged females. I had not then discovered the best way of carrying the eggs over the winter (this was in 1908-1909), with the result that in the following spring they failed to hatch, except one lot, which had been found in the open. Unfortunately the latter, about 25 in number, had been overlooked at the time, and, when discovered, all but two or three of the caterpillars, which lived only a few hours, were dead.

It was not until the fall of 1909 that I had an opportunity to look for more eggs. On October 4th I paid another visit to the Bloomfield bog, and after three or four hours search on the leaves of the cut shoots of *Potentilla fruticosa* I found some 150 eggs, only a few of which were evidently unsound.

The method I employed in caring for the eggs during the winter (1909-1910) was as follows: I placed the leaflets with the attached eggs in small vials, to each of which was added two or three drops of water, which was repeated the following spring whenever the leaflets began to dry up. The tops of the vials were open to the air with a cover of gauze, and during the winter they were kept in an outside shed, so that the conditions might be nearer to those to which the eggs are subject in nature.

The winter, fortunately, was an evenly cold one. On March 19, 1910, fearing that the spring changes in temperature might affect the successful hatching of the eggs, I divided them into two lots, one of which was placed in an ice-box and the other lot returned to the shed. As it afterwards proved, this was unnecessary, for eggs of both lots hatched well, yielding healthy, vigorous caterpillars. I am now satisfied that my failure in getting the eggs to hatch upon the previous attempt was due in part to the changeable temperature of a warm winter, but, undoubtedly, more largely in not providing them with sufficient moisture.

The first eggs hatched on April 10, 1910. As soon as the eggs were found to be hatching, both lots were brought into the house and were, of course, under the same conditions, except, perhaps, as chance left the

*For information on the egg-laying habits and other observations on the biology of this species, see CAN. ENT., 41: 221-229.
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leaves in one vial slightly damper than those in another. The eggs continued to hatch until April 25th, when a total of 109 caterpillars had emerged. The majority came out on the 18th, 19th and 20th: 19, 31 and 15 caterpillars, respectively.

I think one observation indicates quite clearly the necessity of providing sufficient moisture for the eggs. Up to April 15th 24 eggs had given caterpillars from the lot that had been kept in the shed all the time. No more hatched from this lot until the 23rd, although in this interval a majority of all the caterpillars had come out of the eggs that had been kept for a period in an ice-box. On the morning of April 23rd I moistened the leaves in the vial, which had become dry and from which no eggs had hatched for the past eight days. At 10 p.m. on the same day three more caterpillars had hatched, thus showing quite conclusively, I think, the need of moisture, at least, during the period of hatching. This is what we should expect, as the fallen leaves lying beneath the cinquefoil bushes must become very wet in the spring from the melting snow and ice.

At first I did not know the best way of caring for the caterpillars, for they were so small. After a few days, however, I hit upon a plan which proved very successful.

For breeding cages I used a large number of tube or shell vials of two sizes, 25 x 60 mm. and 35 x 72 mm. In each of these was placed a layer of sand to the depth of about 15 mm., which was kept well moistened. To prevent the escape of the caterpillars, the top of each vial was covered with a thin piece of gauze, held in place by a rubber band. A tiny spray of cinquefoil stripped of its lower leaves, pushed into the wet sand, furnished food. To transfer the caterpillars I used a wooden match sharpened at one end.

For those caterpillars which I desired to keep under special observation, I used the smaller vials, a single specimen to a vial. In providing individual homes for them in this way I could readily keep track of each caterpillar, notwithstanding its small size, and, best of all, as the food-plant kept fresh and green, it was only necessary to disturb the caterpillars about once in four or five days until after the third ecdysis. Then, as they were eating more, food had to be supplied oftener. In the larger vials I kept several caterpillars, but I could not, of course, watch each individual one so closely. Fortunately, I had a good supply of *Potentilla fruticosa* in my garden, for the caterpillars preferred the tender opening leaflets to the fully-opened leaves.

In Southern Michigan the life-history of this species in brief is as follows: The eggs are laid during the latter part of July and the first part of August. They are placed on the under side of the leaflets, and drop with the leaves to the ground in the fall, where they remain, more or less covered by snow, until the following spring. I have not gathered the fallen leaves and searched them for the eggs, but that the eggs are there during the winter I can entertain no doubt, a point, however, which I shall hope sometime to demonstrate. The caterpillars emerge from the eggs during the middle of the following April. There are five instars, and the majority of the bred specimens reached the chrysalis between the 15th and the 20th of June, and the butterfly between the 26th of June and the 2nd of July. In the bog I believe these dates would be about two weeks later, as the conditions indoors were probably more favourable to rapid development than they would be outdoors, and this corresponds better so far as my observations have as yet gone with the dates of appearance of the butterflies in the field. This is further confirmed by the following: Of 14 caterpillars found in a bog near Ann Arbor, I raised 8 to maturity. These yielded butterflies from July 16th to 22nd, dates considerably later, but, on June 13th, 1910, when this lot was secured, all of these caterpillars, except one, were in the third instar, while on the same date nearly all of the egg-bred caterpillars reared within doors were in the fifth instar, many nearly ready for the chrysalis, and two had already changed. It will thus be seen that from the time the egg is laid to the death of the resulting butterfly about one full year is taken.

I kept records of the time passed in the different instars and chrysalis of as many examples as I could. The table below shows the average number of days passed in the different instars and chrysalis, and also the shortest and longest time spent in any instar or chrysalis.

Instar.	Number of specimens.	Average number of days.	Shortest time.	Longest time.
First	41	18.6	13	30
Second	28	12.3	9	16
Third	26	8	5.5	12
Fourth	26	10.7	8	13
Fifth	27	13.8	11	18
Chrysalis	32	10.1	8	15

I should rather have expected that the lengths of time spent in the different instars would have become successively shortened, but instead of

that we have a decrease to the third instar with an average of only 8 days, and an increase to 10.7 in the fourth and to 13.8 in the fifth. I hardly know how to account for this, as the weather was about the same during the entire period of growth of the caterpillars, particularly cloudy, gloomy and cold, conditions which were more or less reflected indoors, for the caterpillars were not kept near any artificial heat. Undoubtedly there must be many days in April and May, and even June, especially in such cold and rainy springs as the past two seasons have been in this vicinity, when the caterpillars in the open would become so chilled as to be unable to move about and feed.

There are some habits of the caterpillars which are worth noting :

(1.) In emerging the caterpillar eats an irregular hole in the top of the egg, but only large enough for it to crawl through, the greater portion of the egg being invariably left. (2.) The caterpillars are very active crawlers, a fact which I learned at first to my loss, and this would seem to be necessary in nature to enable them to reach tips of the shoots of the cinquefoil, where the tender opening leaflets are to be found. (3.) Almost always after moulting I would find the caterpillar turned around, head facing its exuvia. This it seldom ate, although the position taken would seem to indicate the opposite. One example which had recently passed the first ecdysis I watched for two hours, but no attempt at eating its exuvia was made. In one instance, however, after the second ecdysis, I caught the caterpillar in the act of feeding on its exuvia. Usually I never had any trouble in finding the latter. (4.) In selecting a place to pupate, the caterpillar most often chose the under surface of the gauze cover on the vial, only occasionally the under surface of a leaflet. In the open the latter is presumably the position most often chosen.

There are two or three very interesting features in the clothing of the caterpillar and chrysalis, a description of which follows, to which I desire to call attention. I would mention, especially, the long, backwardly-curved dorsal bristles of the newly-hatched caterpillar, the numerous egg-shaped processes of the caterpillar in the later instars and the very minute wine-glass-shaped processes of the chrysalis. The significance of these various structures is not readily apparent, but when someone is able to make a careful comparative study of *dorcas* with its congeners, especially *helleoides* and *epixanthe*, more light may be thrown upon the subject.

I can heartily recommend *Chrysophanus dorcas* to any one who desires to study the life-history of some Lycænid form. The fact that its eggs can be secured in numbers, with the assurance that a good proportion will

hatch and that the caterpillars can be easily reared, should appeal to teachers of zoology and insect life, especially when it is considered how readily the food-plant may be grown in the garden.

DESCRIPTION.

Egg.—Echinoid in type ; firmly attached to the leaflet by a flattened base, top flattened to a lesser extent, the centre being occupied by a moderately deep pit, at the bottom of which is a very fine network. Chalky-white when first laid, which colour is retained in those specimens kept unmoistened indoors, but is changed to a brownish in those moistened or exposed in the field. From this it would appear as if the change in colour is due to staining from the juices of the leaflet rather than anything inherent in the egg. The surface shows a raised network, the intersections of which are enlarged into blunt, thickened knobs, while the ridges between are thinner and lower. Near the base of the egg the network is finer, the spaces more numerous and the raised intersections less prominent. Two eggs gave the following diameters: Vertical, 0.45 mm.; equatorial, 0.7833 mm.; vertical, 0.46 mm.; equatorial, 0.7833 mm.

First Instar.—On emergence the caterpillar is nearly cylindrical, slightly broader in the thoracic region ; venter flat. As it grows the thorax becomes highest at the third thoracic segment, sloping gradually caudad and abruptly cephalad, and the first thoracic segment is now very large, and at least twice the cephalo-caudal diameter of the succeeding segment ; between the sutures highly arched.

Head small, rounded, dark brown, retractile ; at rest the thoracic segments are swung forward around a transverse axis, so that the head comes to lie directly underneath the first thoracic segment and is withdrawn into it.

Colour pale clay yellow or pale brown, but after feeding a few days changing to pale green ; lateral and dorsal surfaces, except for a very small central area on the dorsal surface of each segment, thickly studded with minute black dots.

Each half of the caterpillar bears six rows of prominent tubercles ; the two dorsal and the substigmatal rows give rise to colourless bristles, while the other three rows, dorso-lateral, lateral and sub-ventral, are without bristles ; the tubercles are slightly elevated above the surface, on each segment those of the inner dorsal row are placed cephalad of those in the outer dorsal row, and are at least twice the height of the tubercles of both the outer dorsal and substigmatal rows, which are very flat.

Besides the three rows of bristleless tubercles, there are four additional rows of very small tubercles: (1.) Each tubercle of the dorso-lateral row may be accompanied (but often is not) by a minute brown tubercle. (2.) Each tubercle of the lateral row is apparently always accompanied by a tubercle behind and above it. (3.) Between the lateral row of tubercles and the spiracles is a third row, while (4.) behind each spiracle is a tiny tubercle. Some of these tubercles bear tiny bristles.

The bristles of the inner dorsal row of tubercles are somewhat longer than the transverse diameter of the first thoracic segment at birth, and project in a curve that is upward, backward and a little outward; the bristles of the outer row are less than half the length of those of the inner row, are only slightly curved, and set so as to project upward, but more directly backward crossing the bristles of the inner row; on the seventh abdominal segment the bristle of the outer row is lacking.

The substigmatal row of outwardly directed bristles unites with the row of the opposite side in a continuous fringe around both cephalic and caudal extremities of the caterpillar; in length these bristles are somewhat shorter than those of the outer dorsal row; the number and relative lengths of the bristles in the row apparently are constant, excepting the first thoracic and last (ninth) abdominal segments. The number of bristles is as follows: second and third thoracic segments four each, first to eighth abdominal segments three each; not considering the cephalic bristle on the second and third thoracic segments. The relative lengths of these bristles on the second thoracic to eighth abdominal, inclusive, are: Middle bristle longest, caudal shortest, cephalic between these two, while the cephalic bristle on the second and third thoracic is slightly shorter than any of the others.

Each half of the first thoracic segment bears nine long bristles; these are placed in two irregular rows, the four bristles in the upper row being longer than the five of the lower row, except the most caudal one.

Each half of the ninth abdominal segment bears seven bristles, of which the uppermost dorsal bristle is longest, the others of shorter lengths.

The bristles of the dorsal and substigmatal rows are imbricated.

The prolegs are provided with tiny bristles.

Two small branched spines project caudad from the last segment, just below the anal opening.

Spiracles brown, which colour is retained throughout the instars.

The thoracic shield is triangular, base caudad, apex cephalad and truncated, pale brown, clearer within.

Length, 1.3 mm. to 1.5 mm.

Second Instar.—The shape is as in latter part of first instar.

Head, at first pale green, as the caterpillar gets older changing to brown; shining.

Colour blue-green. The minute black dots which studded the surface in the first instar have now entirely disappeared.

The bristle-bearing tubercles are much more numerous than in the first instar. The inner dorsal row of long, backwardly-curved bristles is conspicuous, the substigmatal fringe less so, because its bristles are somewhat shorter. Between these two series of bristles the surface is richly clothed with tubercles which bear short bristles, but the precise arrangement of these tubercles in rows, as in the first instar, is not evident.

Between the substigmatal fold, which appears as a white line, and the mid-dorsum are four faint lines interrupted at the sutures.

The thoracic shield is represented by a pit.

Mandibles brown, ocelli black, these remaining the same in succeeding instars.

Length, 2 mm. to 2.5 mm.

Third Instar.—Shape similar; the caterpillar now appears longer, however, in proportion to its width.

Head pale green.

Colour blue-green (in one example pale green), later in the instar becoming pale green.

The substigmatal fringe of bristles and dorsal row of backwardly-directed bristles are still present, the latter less curved, relatively shorter and less conspicuous; the region between these two series of bristles is well clothed with bristle-bearing tubercles, the bristles short; tubercles without bristles few. In this instar a new element in the clothing usually appears for the first time; this is an opaque, white, egg-shaped process borne by a short pedicel, the latter arising from a tubercle. These processes are few in number, irregularly placed and often found cephalad. In the examination of several caterpillars they varied in number from six to twenty-five, while in one example none at all could be discovered.

There are four faint, uneven white lines as before, the two upper ones being wider, and all becoming more distinct as the caterpillar approaches the end of the instar.

Length, 3 mm. to 4.5 mm. Average of 22 caterpillars, 3.7 mm.

Fourth Instar.—Shape as before; the arching of the segments between the sutures has gradually been reduced as the caterpillar has grown older.

Head and body colour as before.

The bristles of the dorsal rows have ceased to be a conspicuous feature of the ornamentation; they are now but slightly curved and only longer than the other bristles from the third to the eighth abdominal segments. The entire surface above the substigmatal line is thickly studded with short bristles and the egg-shaped processes which first appeared in the preceding instar. These processes are very generally scattered over the surface, and are in all respects the same as in the third instar.

The mid-dorsal area is dark green from the underlying blood-vessel. White lines as before, except that the two upper ones are fused into one band; all are faint.

The thoracic shield is a shallow, somewhat diamond-shaped pit.

Length, 5 mm. to 6.5 mm. Average of 27 caterpillars, 5.76 mm.

Fifth Instar.—The segments are only slightly arched.

The bristles of the dorsal rows are very slightly curved backwards, and are progressively longer proceeding caudad, from about the second to the seventh abdominal segments, where they extend a little beyond the other bristles. The longest bristles are in the frontal fringe and on the first thoracic segment between this fringe and the diamond-shaped pit of the thoracic shield. The egg-shaped processes are thickly scattered all over the surface, except on the venter.

The white lines are present now as two very faint bands, separated from each other and the substigmatal line by a faint, wavy, green line.

Length, 8 mm. to 10.5 mm. Average of 26 caterpillars, 8.9 mm.

Mature Caterpillar.—The shape and colour are very much as before.

The head is almost colourless, but it may assume a very faint brown shade.

Dorsal bristles as before. The longest bristles are on the first thoracic and the anal segments. The egg-shaped processes and short bristles thickly clothe the surface, as in the preceding instar.

The white bands are more plainly marked in some specimens than in others, and on very close examination are seen to be made up in reality of four white lines very slightly separated by the green.

The thoracic shield is a diamond-shaped pit, as before, but in addition there is a curved crease-like extension on each side; near each of the side angles of the pit is a tubercle bearing a fairly long slender tentacle-like process.

Length, 14.5 mm. to 16 mm. Average of 7 caterpillars, 15.14 mm.

Chrysalis.—Compact, fairly cylindrical, narrower cephalad; rounded, bluntly-tapering caudad. Truncated in the dorso-cephalic plane. Mesothorax with a low median dorsal prominence. Cremasteric area circular, provided with numerous minute hooklets, the latter with two curved prongs.

The chrysalis, except over wing, tongue, leg and eye-cases, is entirely covered with minute processes. Under magnification (55 diam.) these are seen to be wine-glass-shaped, the rims made up of tiny finger-like projections extending upwards and outwards in a circle. I could discover no hairs on the surface of the chrysalis, these processes evidently replacing them.

The colour is very variable, hardly any two alike; often some shade of green (nile, blue, pale or merely tinged), or over the green on wing-cases and dorsum there may be a slight sprinkling of black or brown atoms, which may increase until the whole chrysalis is well covered with atoms and blotches, or the green may be lacking, and the colour then is black or brown (Roman sepia), or even as in one case, a purple-madder. The substigmatal and the two lateral, wavy, white bands of the caterpillar can sometimes be traced in the chrysalis, varying in colour, of course, sometimes white (particularly with the green forms), again as rows of black or brown specks.

The spiracles are white, with a faint yellowish tinge; thoracic elongate-oval, abdominal oval.

Length, 8.5 mm. to 10.25 mm. Greatest width about 4 mm. at tips of wing-cases.

THE CHALCIDOID PARASITES OF THE COCCID *KERMES PUBESCENS* BOGUE, WITH DESCRIPTIONS OF TWO NEW GENERA AND THREE NEW SPECIES OF ENCYRTINÆ FROM ILLINOIS.

BY A. A. GIRAULT, URBANA, ILL.

From a single small lot of specimens of this common coccid of the oak—*Kermes pubescens* Bogue—gathered from the twigs of a single tree on the campus of the University of Illinois at Urbana, during the summer of 1908, the following chalcidoid parasites were reared, several of which appear to be undescribed. The oak was a species of the *alba* group. So far, I believe, but a single parasite of this coccid has been recorded in the literature; this paper adds at least three others, two representing new genera, and all belonging to a single subfamily, the Encyrtinæ.

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Associated with the three encyrtinines reared here in Illinois, however, were found certain chalcidoids of the family Pteromalidæ, tribe Pachyneurini, genus *Pachyneuron* Walker, and of the family Eulophidæ, subfamily Tetrastichinæ, genus *Gyrolasia* Foerster, which are perhaps secondary in their relations, or may have come from some syrphid larva in among the hosts. The first was *Pachyneuron micans* Howard, and the second an apparently undescribed species of the eulophid genus mentioned (but without long marginal fringes of the fore wings), allied with (*Syntomosphyrum*) *Gyrolasia esurus* (Riley), differing from that species in having more slender veins in the fore wings. For the present it is left undescribed. These two species are not listed below (Accession Nos. 44,226 and 44,227, Illinois State Laboratory of Natural History, Urbana, Illinois, two males, one female and two females respectively, all on tags, and a slide for each species).

For the authoritative identification of the host I am indebted to Professor T. D. A. Cockerell, University of Colorado, Boulder, Colorado.

Family ENCYRTIDÆ.

Subfamily ENCYRTINÆ.

Tribe *Ectiromini*.

Cristatithorax, genus novum.

Normal position.

Female.—Head lenticular, not quite as wide as the thorax at its widest point, the facial impression rather small, not prominent, its caudal margin acute, yet not sharply defined by an arched carina, the convexed discal portion with moderately large, scattered punctures, bearing setæ; scrobes short, forming a semicircle; face between the eyes and the vertex hexagonally sculptured or rugose, the eyes margined with a row of moderately large punctures, each puncture giving origin to a single grayish seta; impression of the face from cephalic aspect (natural position) elliptical, less than one-half the length of the head; face beneath the eyes glabrous; vertex rather narrow, the eyes somewhat convergent above, the lateral ocelli touching the eye margin, the ocelli in an acute-angled triangle; cheeks finely rugose; antennæ inserted at the clypeal border, compressed, clavate, with no sharp demarkation between the funicle and club, the flagellum gradually enlarging, the scape slightly dilated towards apex, the funicle 6-jointed, longer than the club, and with the first joint shorter than the pedicel; mesothorax finely reticulated, with a squamose appearance,

the scutum with some large punctures, which are scattered and inconspicuous, and clothed with short stiff prostrate gray or silvery hairs, which, however, are absent at the meson of the caudal three-fourths of the sclerite and along the caudal margin, some distance laterad from the meson; scutum and scutellum subequal in length, the latter slightly longer; axillæ cuneate, joining at base of scutellum; scutellum with a conspicuous tuft of black hairs at its dorsal apex. Abdomen conic-cylindric, equal to combined length of head and thorax, the hypopygium prominent, extending one-fifth the length of the abdomen beyond the anal extremity. Wings infuscated beyond the submarginal vein, with the extreme apex hyaline however; marginal vein slightly thickened, linear, thrice the length of the stigmal vein, which is nearly twice the length of the postmarginal vein, the latter distinct; a short V-shaped, hyaline, hairless marking present, its apex along the costal margin just beyond the postmarginal vein, one branch running slightly apico-caudad (normal position) across the truncate end of the stigmal vein, the other proximo-caudad, into the angle subtended by the junction of the stigmal and postmarginal veins; also an oblique (meso- or proximo-caudad) hairless line running from the stigma, but included within the coloured area of the fore wing, and hence somewhat obscured. Marginal cell of hind wings long. Wings extending beyond abdomen, and slightly beyond the hypopygium. Legs normal. Mandibles bidentate, the outer tooth shorter, obtuse, and one-third as broad as the inner, which is broadly truncate at apex.

Nearest to *Chrysopophagus* Ashmead, and separated from it by the slightly dilated scape, the longer pedicel, the less noticeable compression of the antennæ, and the differently shaped, more rounded head, and by mandibular characters, the mandibles in *Chrysopophagus* being distinctly 3-dentate, the two inner (mesal) teeth being equal and slightly smaller than the outer (lateral) one, and less acute. And liable to be confused with *Habrolepis* Foerster and *Eusemion* Dahlbom, of the tribe Mirini.

(Type: *C. pulcher*, species nova, described in following.)

1. *Cristatithorax pulcher*, species nova.

Normal position.

Female.—Length, 1.35 mm. Moderate for the tribe. Submetallic; varicoloured. General colour dark chrome-yellow. Cheeks bordering the eyes, face below the eyes, and a portion of the convex disk of the facial impression, mesoscutum, dorsum of the metathorax, the whole of the abdomen, excepting base of venter and the exerted portion of the hypopygium, which is white, caudal portions of the thoracic pleurum, dark

purplish, with a metallic lustre, especially at the dorsum of the abdomen. Eyes dark, prominent; ocelli ruby red, with some yellow.

Antennæ black, the middle or intermediate longitudinal portion of the sides of the scape silvery white, the white stripe reaching the margin at apex, at the dilation. Head, prothorax, scutellum, ventral base of abdomen, thoracic pleuræ and venter dark chrome-yellow, the axillæ still darker, the vertex and face with some traces of a purplish sheen. Legs dark yellowish, with some purplish above, the intermediate femora with a white annulus near the apex; tarsi yellowish, the posterior pair white, with two apical joints dusky. Distal two-thirds of the wing fuliginous, the extreme apex and the basal third hyaline; in reflected light wings purple; sooty colour more pronounced in a small triangular area between the indistinct oblique hairless line and the marginal vein, and less so in the portion of the wing included between the marginal vein and the posterior margin; a somewhat irregular longitudinal lighter area in the middle of the wing, near the posterior margin. Hind wings hyaline.

Antennæ 11-jointed; scape longer than the combined lengths of the pedicel and first two funicle joints; pedicel obconic, longer than the funicle joint 1; funicle gradually, regularly enlarging to club; funicle joints 1 and 2 subequal, 1 slightly narrower and longer; funicle joints 3 and 4 subequal, larger, 4 somewhat larger than 3; joints 4 and 5 of funicle subequal, 4 slightly smaller, both still larger than 3 and 4, and wider than long; club joints slightly wider than joints 5 and 6 of funicle, the basal joint subquadrate, the two apical joints narrow, much wider than long.

(From two specimens, two-thirds-inch objective, two-inch optic. Bausch and Lomb.)

Male.—Unknown.

This species is superficially like *Chrysopophagus compressicornis* Ashmead. Described from two tag-mounted females reared from *Kermes pubescens* Bogue, on oak, Urbana, Illinois, July 1, 1908.

Type: Accession No. 37.590, Illinois State Laboratory of Natural History, Urbana, Illinois, one female, tag mounted; head and antenna (1 slide) and antenna (1 slide), both in xylol-balsam.

Tribe *Mirini*.

Enasioidea, genus novum.

Normal position.

Female.—Length moderate for the tribe.

Head (cephalic aspect) rounded triangular, longer than wide, not lenticular, the facial impression weak, bounded by the antennal scrobes which form a rounded triangular impression, surrounding on two sides the raised cuneate disk of the facial impression; the apex of the scrobes obtuse, reaching to a point midway between the eyes (cephalic aspect); the whole of the cephalic aspect of the head and the vertex closely, but not very coarsely, punctured, the surface slightly less rough than the eye surface; ocelli in an almost equilateral triangle, the lateral ones slightly farther apart from each other than each is from the cephalic ocellus, and close to, but not touching, the eye margin, and still farther from the occipital margin; eyes large, round, prominent on the dorso-lateral aspect of the vertex, and prominent from both dorsal and cephalic aspects, somewhat convergent from dorsal aspect, and from lateral aspect not as long as the cheeks or malar space, regularly convex, lenticular, and reaching caudad to the convexed, acute occipital margin; from dorsal aspect vertex an inclined plane; the occipital foraminal depression almost acutely concave; face with some sparse grayish hairs; antennæ inserted far below the middle of the face, the scape with a large leaf-like dilation ventrad, the pedicel longer than the first funicle joint, the funicle 6-jointed, white, annulate with black at the first joint, cylindrical and slightly clavate, the club 3-jointed, white, ovate and distinctly wider than the funicle, but not more than one-half as long; flagellum on the whole cylindrical, subcapitate. Dorsal aspect of the surface of the thorax similar in sculpture to that of the head, the pro- and mesonotum with scattered, short, stiff, recumbent white hairs, hispid (Coddington lens, half-inch), the hairs apparently not arising from shallow, larger punctures; axillæ meeting at the meson, cuneate; along the median line scutellum somewhat longer than the mesoscutum, peltate, its cephalic margins oblique from the side to the meson, cephalo-mesad; caudal margin of the mesoscutum straight or very slightly convex; dorso-lateral aspect of the mesopostscutellum and the metanotum bare, that of the former finely, obliquely corrugated.

Abdomen short, only about two-thirds the length of the thorax, ovate, its dorsum concave and not clothed with stiff pubescence, the spiracle of the third segment dorsal, at the lateral margin prominent, fuscous, margined and guarded by about three long black setæ; hypopygium prominent, plowshare-shaped, extending distinctly beyond the abdomen. Legs normal, the middle tibial spur short and stout, not as long as the basal tarsal joint, which is by far the longest of the joints of the intermediate tarsi, the others relatively small; the bristles on the intermediate

tarsi ventrad, short, more numerous and stiffer than usual; the proximal tarsal joint of the caudal legs intermediate in size between those of the cephalic and intermediate legs, but all of the proximal tarsal joints longer than the other tarsal joints, excepting perhaps that of the cephalic legs, the apical tarsal joint next in length, the three others nearly subequal in length and shorter; caudal tibiæ with but a single short spur, the single spur of the cephalic tibiæ curved and slender, reaching nearly to the apex of the proximal tarsal joint.

Wings hyaline, both densely, closely ciliate in the disk, and the fore wings with a transverse, oblique, hairless streak, as in *Anagyrus* Howard, extending from the stigmal vein, proximo-caudad; marginal vein of fore wing punctiform, the postmarginal vein absent, the stigmal vein moderately long, straight, the submarginal vein long and slender, about five times the length of the stigmal vein, but not reaching to the middle of the costal margin. Costal cell of caudal wings extending to the hooklets. Wings relatively long. Body non-metallic, pallid ochraceous.

Mandibles 3-dentate, the outer (lateral) tooth shorter than the two inner (mesal) ones and obtuse, the two inner shallow and subequal, as if formed of a broad truncate tooth, with a concave emargination at the centre of its apical margin.

(Type: *A. latiscapus*, species nova, described beyond.)

Close to *Anasius* Walker, but differing in the smaller club, the antennæ being capitate, in the longer funicle, the absence of large thimble-like depressions on the head, and the different shape of the latter, the joined axillæ, in the absence of the postmarginal vein, the hyaline wings, and in the broader pronotum and longer mesoscutum. And agreeing in some respects with *Encyrtus* Ashmead in wing and antennal characters, but the scape of the antennæ is totally different, and the body non-metallic, besides differing in habitus. The genus is liable to confusion with *Anagyrus* Howard, of the tribe *Ectromini*, but besides the 3-dentate mandibles and other tribal characters, the more reduced venation will readily distinguish it.

2. *Anasioidea latiscapus*, species nova.

Normal position.

Female.—Length, 0.89 mm. General colour pallid yellowish, the head and mesonotum conspicuously light chrome-orange, the dorsal aspect of the mesopostscutellum and the metanotum, also the proximal segment of the abdomen, blackish, the pronotum dark, with a pruinose appearance, but pallid laterad; remainder of abdomen yellowish white; eyes very dark

reddish, margined dorsad, along the occipital margin, with yellowish; ocelli ruby-red, with some yellow; tegulæ pallid. Antennæ white, the dilation or exfoliation (only) of the scape, the base of the pedicel dorsad, and the first funicle joint black. Venation pallid yellowish. Legs white, with a tinge of yellowish, the apical tarsal joint darkened.

Mesopleurum slightly reticulated. Marginal cilia of fore wings short, those of the caudal margin of the caudal wings longer; stigmal vein capitate; area of the fore wing proximad of the oblique hairless line or streak densely ciliate, as in the larger portion of the wing apicad of the streak, excepting at the caudal margin, proximad; the oblique hairless streak does not extend quite to the caudal wing margin, and is broadest at its caudo-proximal end; spurious veins inconspicuous, not breaking the ciliation of the wing. Tegulæ longitudinally rugulose.

Scape as long as the pedicel, and the first three funicle joints combined; pedicel obconic, not quite twice as long as it is wide at apex, nearly as long as the combined length of the first two funicle joints, which are subequal and shortest of the antennal joints, and narrower than the apex of the pedicel; funicle gradually widening to the club; funicle joint 3 longest of the funicle joints, slightly shorter than the pedicel, wider than joint 2 and narrower than joint 4 of the funicle; the latter still longer than wide, shorter than the preceding joint but wider; funicle joints 5 and 6 subquadrate, shorter than joint 4, and distinctly narrower than the proximal club joint. Basal joint of the club longest of the three, the intermediate joint shorter but widest, and the apical joint shortest and narrowest, obtusely conical. Antennæ pubescent.

(From six specimens, two-thirds-inch objective, two-inch optic. Bausch and Lomb.)

Male.—Unknown.

Described from two tag-mounted and four slide-mounted females reared June 25th, 1908, from specimens of *Kermes pubescens* Bogue, on oak, Urbana, Illinois. Seven females reared.

Type: Accession No. 40,285, Illinois State Laboratory of Natural History, Urbana, Illinois, two females tag-mounted and four females in xylol-balsam (two slides).

Microterys Thomson.

3. *Microterys cincticornis* Ashmead.

Ashmead, 1900, p. 390. (Proc. U. S. National Mus., Washington, D. C., XXII.)

King, 1899, p. 139. (CANADIAN ENTOMOLOGIST, London, Ontario, XXXI.)

"2. *Microterys cincticornis* Ashmead, new species.

"This species probably represents a variety of the European *M. tessellatus* Dalman. It agrees with it in stature and in wing markings, except that the triangular white marginal spots are connected so as to form an additional band, while the head and thorax at sides, too, are quite differently coloured. The head, the pronotum, except above, the sides of the thorax and the legs are brownish-yellow, while the mesonotum is metallic-blue.

"*Type*: Cat. No. 4769, U. S. N. M. (Ashmead collection).

"*Habitat*: New Hampshire: Mount Washington. (Mrs. A. T. Slosson)."

George B. King, in 1899, recorded this parasite from *K. pubescens* in Massachusetts. I have not met with it in Illinois. Through the kindness of Mr. J. C. Crawford, Division of Insects, U. S. National Museum, Washington, D. C., I am able to offer the following descriptive notes on this species, taken from the type and in comparison with the two co-type females of *M. speciosissimus*, species nova, described just beyond: "*cincticornis* has the upper part of the head more reddish, the middle more yellowish; this yellowish colour shows on the back of the head and on the under parts of the insect; the scape is light—only the anterior margin is dark; the scutellum is very metallic—as much so as the mesonotum; legs all light; what I will call the middle band on the wing is dark and the apical band distinct, making the apical part of the wing darker than in your species; in your species the middle band is a series of dark spots, but in Ashmead's species these are so close together that they are hardly distinct from one another, being a band instead." (J. C. Crawford, *In litt.*, January 8, 1909.)

In *cincticornis* there is no tuft of hairs on the scutellum.

4. *Microterys speciosissimus*, species nova.

Normal position.

Female.—Length, 1.33 mm. Normal in size and shape; funicle annulate, scape greatly dilated, scutellum without a tuft of hairs at apex.

General colour ochraceous, the mesoscutum metallic dark blue, the axillæ and scutellum duller than the mesoscutum, purplish, the dorsum of the abdomen the same colour as the scutellum, with a little more blue, the abdominal ventum concolorous with the dorsum of abdomen, the cephalic and caudal margins of the pronotum nearly concolorous with the mesoscutum, leaving a narrow transverse intermediate portion ochraceous,

but which, however, widens at the lateral third, extending cephalad, laterad and caudad to the respective margins; metanotum concolorous with the scutellum, excepting dorso-laterally, where it is ochraceous; tegulae ochraceous, obscured in the disk with some bluish; clypeus conspicuously dark brown, from side to side; head between the vertex and front, between the eyes, variable, frequently tinged with lustrous purple, visible in certain lights only; legs ochraceous, the caudal femora and tibiae, however, flushed with bluish, the intermediate tibiae more delicately so, the apical tarsal joint dark; antennae black, the 5th and 6th funicle joints white; scape at the peduncle and extreme apex ochraceous, and the pedicel and first two funicle joints dusky, lighter ventrad; dilatation of the scape somewhat metallic and with some bluish. Fore wings fuliginous to end of the stigmal vein, the apical margin of the fuliginous area convex; from thence apicad, hyaline, but through the midst of this, nearer the fuliginous area than to the apex of the wing, runs transversely (cephalo-caudad) a broken band of fuliginous, consisting of four distinct portions, two subequal subquadrate spots leading caudo-apicad from the cephalic wing margin, a smaller rounder dot in the middle of the wing, further proximad, and then leading to the caudal margin, apico-caudad, a longer columnar area; if joined together the line formed would be ξ -shaped; venation brownish-black. Eyes dark; ocelli ruby-red.

Head slightly wider than long (cephalic aspect), sublenticular, as wide as the thorax at its widest point, from lateral apex deflexed, the facial impression normal and margined caudad, the scrobes forming a semicircle, the mesal portion of the impression carinated for a short distance along the median line near the caudal margin. Face between the eyes and the vertex as in *Cristatithorax pulcher* Girault. Eyes nearly circular, their mesal margin somewhat flattened, rather large and on the cephalo-lateral aspect of the head, their caudal margins invading the sharp occipital margin; ocelli not near the occipital margin, in a nearly equilateral triangle, the lateral ones oval and nearly touching the eye margins, and slightly nearer to each other than either is to the cephalic ocellus, which is circular. Occipital margin acute, convex. Pro- and mesonotum and the mesopleurum squamose, the two former with regularly scattered, obscure punctures, which are less conspicuous on the scutellum and axillae, each puncture giving origin to a reclinate, short, dull grayish seta; meso-scutum slightly shorter than the scutellum along the meson, its caudal margin regularly convex; axillae acutely cuneate, meeting at the meson, where they are subaccuminate; scutellum peltate, normal, without a tuf

of bristles, its cephalic margin angularly convex, subacute at the meson. Metanotum normal. Abdomen short and stout, subtriangular, not quite as long as the thorax, flat dorsad and not pubescent, shining, but with the squamose sculpture of the thorax, which, however, is more delicate on the abdomen. Sheaths of the ovipositor slightly exerted, ochraceous. Fore and hind wings densely ciliate in the disk; marginal vein of the fore wing short and thick, but slightly longer than wide, the stigmal vein nearly as long as the marginal and postmarginal veins combined; the latter slightly shorter than the marginal vein; fore wings extending for nearly one-half their length beyond the abdomen; a subcuneate hairless line with its apex just caudad of the stigmal vein runs from that vein cauda-proximad through the fuliginous area to the caudal wing margin, where it is widest; this hairless line is not conspicuous; joining it, or originating from it, near the caudal margin, is a narrow, curved white line, which runs apicad through the fuliginous area to its apical margin, where it splits into two; also, this line is not very conspicuous. There is also in the fore wing an inconspicuous, more deeply-coloured spot beneath the submarginal vein, just proximad of the oblique hairless line, and running somewhat parallel to it. Immediate base of fore wing naked.

Antennæ 11-jointed, inserted at the clypeal border; scape with a conspicuous, dorso-ventral, leaf-like dilatation or expansion, the dilatation appearing just beyond a short peduncle and extending to the apex, and of itself hemi-pyriform; scape longer than pedicel and joints 1 and 2 of funicle combined, the expansion with some punctures; flagellum normal, cylindrical and regularly clavate, and the club normal. Pedicel obconical, longer than any of the following joints, and slightly shorter than the combined lengths of joints 1 and 2 of the funicle; first funicle joint two-thirds the length of the pedicel, and slightly shorter and narrower than funicle joint 2; funicle joints 2 and 3 subequal, joint 3 slightly thicker, both longer than joint 1, and still more so than the three following joints; joints 4, 5, 6 of the funicle quadrate, subequal, one-third shorter and wider than joint 3; the club regularly conical, about the same length as the combined lengths of joints 4, 5 and 6 of the funicle, its basal joint one-third longer and slightly wider than funicle joint 6, and as long as, and much wider than, funicle joint 3; the intermediate joint is one-third shorter and slightly narrower than the basal joint, and narrows cephalad; the apical joint of the club conic, equal in length to the basal joint. Antennæ hispid.

Mandibles 3-dentate, the two inner (mesal) teeth, however, shallow, equal, and taken together like a single broad tooth notched at the centre of its apical margin; the outer (lateral) tooth acute, but very slightly longer.

(From eight specimens, two-thirds-inch objector, two-inch optic. Bausch and Lomb.)

Male.—Unknown.

This beautiful species was described from eight females reared June 23 (seven ♀s) and July 7th, 1908 (one ♀) from the same lot of *Kermes pubescens* Bogue.

Types: Accession Nos. 37,561 (five ♀s, tag-mounted) and 37,593 (♀ head and antenna, one slide, xylol-balsam), Illinois State Laboratory of Natural History, Urbana, Illinois. *Co-type*: No. 12,166, United States National Museum, Washington, D. C., two ♀s, tag-mounted.

A NEW ALASKAN MOSQUITO.

BY C. S. LUDLOW,

Army Medical Museum, Washington, D. C.

For several years there appeared in the collections of mosquitoes from Alaska what were evidently two distinct species, but in such bad condition that it was impossible to be sure just what the differences were. Now, after some four years of indcision, specimens have been received that allow of differentiation and description, and I give below the description of what seems to be a new species:

Culex borealis, n. sp.

Female.—Head very dark brown, covered with broad, curved ochraceous scales in a comparatively narrow median space from vertex to occiput, broad, flat ochraceous scales laterad and extending as lateral scales, a few fork scales, light and dark, at the nape; brown bristles projecting forward over and between the eyes; antennæ brown, verticels brown, pubescence light, basal joint testaceous, with flat pale ochraceous scales on the median aspect; palpi dark brown, with a very few light scales, mostly on the ventral side; proboscis very long (about seven times longer than the palpi), almost black; eyes reddish-brown; clypeus dark, and in some specimens the contiguous mouth-parts much distended, rather pouch-like on the ventral side.

Thorax: Prothoracic lobes dark, with pale ochraceous flat scales; mesothorax very dark, covered with large curved scales, a narrow median

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line of ochraceous scales with a very broad stripe of black ones on each side, extending from the nape to the "bare space," bordered laterally by ochraceous and black scales mixed, ochraceous scales predominating to the lateral margin of the mesothorax; near laterad of the "bare space" is often a short dark stripe, extending only a little way cephalad from the caudad margin of the mesonotum, but in some specimens this is lacking, or nearly so; scutellum covered with ochraceous broad curved scales; metanotum very dark; pleura very dark, mostly covered with flat pale ochraceous scales.

Abdomen covered with almost black scales and basal pale ochraceous bands, which vary greatly, being usually broad, somewhat widened laterally as "lateral spots," but sometimes these basal bands are narrow; the first segment has pale scales apically and mostly in the median portion, and sometimes the apical segment is mostly light-scaled; venter mostly with pale ochraceous scales, sometimes showing apical black bands, very narrow on the median part, broader laterally.

Legs: Coxæ and trochanters mostly light-scaled; femora all pale basally and ventrally, dorsally darker toward the apex, but speckled with ochraceous scales, light knee spot; tibiæ dark, but some light scales sprinkled through; 1st and 2nd tarsals also slightly speckled with ochraceous scales, the remainder of the legs usually entirely dark-scaled; ungues heavy, uniserrate.

Wings clear, brown-scaled, except at the very base, where the subcosta, at least, has, on many specimens, bright ochraceous scales. Cells large; 1st submarginal a little longer than 2nd posterior, and about $\frac{1}{3}$ longer than its petiole, the bases nearly on a line; root of the 3rd longitudinal vein about as long as the mid cross-vein which it meets nearly in a straight line; posterior cross-vein about the same length as the mid and its own length distant.

Length, 10 mm., of which 3.5 is proboscis.

Habitat.—Alaska. Taken June, July, August.

The dark submedian thoracic stripes are nearly black, and do not suggest in any way the brown markings of *Currei*, *latavittata* or *pretans* nor do they resemble the brown stripes of Felt's *absobrinus*, of which Dr. Felt kindly sent me specimens for comparison, and it seems likely it is a new species. It occurs in great numbers, sometimes with an apparently closely-related species, which, however, lacks thoracic markings, and is most likely *nigripes* (or *impiger*). So far this new species has never been sent in with *T. alaskaensis* Mihi, which has apparently a much more restricted distribution.

BOOK NOTICE.

"THE CODLING MOTH": L. Cæsar. Bulletin 187, Ontario Department of Agriculture. 40 pp., 21 figs. (Toronto, Ont., Jan., 1911.)

To say that this publication "fills a long felt want," if it has the disadvantage of echoing the words of hurriedly written notices and reviews of books, is only expressing our firm conviction. Every entomologist in Eastern Canada, we say "eastern" advisedly, has realized the need of a clearly written and practical bulletin on this insect, which is, of all insects attacking the apple, the most universally destructive. It has remained, however, for Mr. Cæsar to endeavour to supply that need, and he is to be congratulated on the successful manner in which he has accomplished his task. He has added to the increasing list of valuable publications written by members of the staff of the Ontario Agricultural College one which is second to no other in its manner of treatment, simplicity of expression, so important in these bulletins of an educational character, and in the description of the practical methods of control.

The account of the life-history of the moth, which succeeds the introduction, contains many original observations. These, together with the observations of other investigators, increase the utility of the bulletin to no small extent, as so many accounts are mere compilations, and inapplicable to local conditions, which must, of necessity, be studied. The author's experience of orchard conditions in Ontario, and his intimate acquaintance with the practical work of spraying, give the bulletin the impress of authority and a markedly increased value. We are pleased to note his insistence on thorough spraying. In view of the debated question as to the efficacy of the single-spraying for controlling the Codling Moth, the author's experience, in which this method resulted in an average of 90 per cent. worm-free fruit, is worthy of note. As we presume the author is not responsible for the inversion of Figure 4, we will not criticize the only one of twenty-one excellent illustrations to which reference might be made.

We hope that the free distribution of the bulletin by the Department of Agriculture for Ontario will result in a marked increase in the practice of judicious and thorough spraying, the beneficial effect of which will be incalculable.

C. G. H.

Mailed May 12th, 1911.