



ORTHOPTERA OF NORTHERN ONTARIO.

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WILLIAM H. EDWARDS.

We regret to record the death, at the ripe old age of eighty-seven years, of this eminent entomologist, which took place at Coalburgh, West Virginia, on the 4th of April. He was an honorary member of the Entomological Society of Ontario, and contributed a large number of papers to this magazine during a long series of years. His son, the Hon. William Seymour Edwards, of Charleston, W. Va., has promised to furnish us with a memoir of his father, which we hope to be able to publish in the July number.

ON THE ORTHOPTERA OF NORTHERN ONTARIO.

BY E. M. WALKER, TORONTO.

(Continued from p. 144.)

1. *Nomotettix borealis*, n. sp. (Pl. 7, fig. 1, 1a.)

Closely allied to *N. cristatus* Harr., from which it differs as follows: Median carina of vertex somewhat less prominent, projecting a shorter distance in advance of the front margin; vertex not projecting quite so far in front of the eyes, the angular excavation beneath it, seen in profile, shallower, the frontal costa gently sinuate. Antennæ (broken off in one specimen) 12-jointed, about one-fourth shorter than in *cristatus*. Median carina of pronotum less regularly arched, highest opposite the fore coxæ, the height thence diminishing somewhat more rapidly and irregularly than in *cristatus*. In the type specimen the mid-carina at its highest point is somewhat higher, in the other, which I have figured, about as high as in typical *cristatus*. Hind femora somewhat narrower and less ampliate at base than in the latter.

Length of body, 8.5 mm.; pronotum, 8 mm.; hind femur, 5-5.6 mm.

Two females, shore of Diamond Lake, Temagami District, Sept. 7, 1908.

Both specimens are of a dark rust-brown colour, the dorsum of the pronotum darker, with a grayish tinge and with two pairs of black spots, the posterior larger and somewhat triangular. A pale yellowish specimen was also seen, but not captured.

The specimen figured was examined by Prof. Morse, who wrote to me that it was new, perhaps a northern variety of *cristatus*. I am inclined to think that this is its proper status, but in any case, it seems worthy of a name.

The shore of Diamond Lake, where these specimens were taken, is a broad sandy beach about 100 yards in length, and the lake for some distance out from the shore very shallow and reedy. The beach is bounded behind by a narrow irregular ridge a few feet in height, which has apparently been pushed up by the ice in winter. This ridge supports a growth of Banksian pine, some of them quite large and spreading, with a very luxuriant undergrowth of Canada blueberries and other shrubs in less abundance. Back of the ridge is a large open sphagnum bog with a dense cover of Ericaceous shrubs, such as Dwarf Cassandra, Andromeda, *Kalmia angustifolia* and blueberry bushes. Between the ridge and the zone of heath shrubs is a strip of nearly dry sandy soil a few feet wide, with scattered blueberry bushes, etc. It was here that these Tettigians, along with one example of *Tetrix acadicus*, were found.

2. *Tetrix granulatus* Kirby.

Fort William, Aug. 27, 1907, 1 ♂, 1 ♀; Temagami, portage between Lakes Obabika and Temagami, Sept. 11, 1908, 1 ♀.

3. *Tetrix Brunneri* Bol.

Near Temagami Falls, Sept. 2, 1908, 1 ♂, macropterous, from a small opening on a portage through a forest of mixed white pine, spruce, balsam, canoe birch, etc. A very few *Melanoplus islandicus* and one *M. femur-rubrum* were the only other Orthoptera found here.

This specimen measures as follows: Length of body, 10 mm.; pronotum, 12.5 mm.; hind femur, 6 mm. It is pale yellowish-brown above, the pronotum marked with two large triangular velvet-black spots, followed by a pair of elongate black streaks.

This species was reported by the writer from Algonquin Park, somewhat doubtfully as *T. acadicus* (36th Ann. Rep. Ent. Soc. Ont., 1905, p. 66). The two Algonquin Park specimens, both males, are similar in size to the Temagami one, and one of them is nearly the same in colour pattern, but in both the pronotal process is much shorter, extending in the single specimen now in the writer's collection, less than 1 mm. beyond the tips of the hind femora, the wings projecting very slightly farther. In the Temagami specimen the pronotal process reaches 4 mm. beyond the hind femora, and the wings .75 mm. farther.

One of the Algonquin Park specimens was sent to Prof. Morse, who verified my determination.

4. *Tetrix acadicus* Scudd.

Fort William, Aug. 27, 1907, 1 ♀, macropterous, taken on the open plateau on Mt. McKay; Diamond Lake, Temagami District, Sept. 7, 1908, 1 ♀, taken on the edge of an open heath bog. (See under No. 1.)

The Fort William specimen is the only strikingly long-winged example I have seen, the pronotal process extending 2 mm. beyond the tips of the hind femora, and the wings about .75 mm. farther. It measures as follows: Length of body, 11 mm.; pronotum, 12.2 mm.; hind femur, 6 mm. In the Temagami specimen the pronotal process reaches only .75 mm. beyond the femora, and the wings the same distance. It measures as follows: Length of body, 9.5 mm.; pronotum, 9.6 mm.; hind femur, 6 mm.

The Fort William specimen is dull yellowish-gray, with no markings, except a few minute dots on the dorsum of the pronotum, a little behind the middle; but the Temagami specimen is brownish-gray, and the black dots are replaced by a pair of velvet-black triangular spots nearly meeting in the middle line and margined externally by a conspicuous yellow line. The inner borders of these spots, the top of the head and four spots on the dorsal surface of the hind femora are bright rust-red.

This species is also known from the Lake of the Woods District, which is the type locality.

The long-winged form, though hitherto unknown, is not, in the writer's opinion, worthy of a name. The use of trinomials for such variations is both cumbersome and misleading. Trinomials should be employed to designate races or subspecies—not mere individual variations, however great these may be. Until comparatively recently the significance of dimorphism in wing-length in the Orthoptera was not understood, and the practice of giving distinctive names to the long- and short-winged forms of the same species was excusable. We are now, however, practically sure that in many, if not all such dimorphic species, both forms must often occur in the same brood, and they are therefore, at most, simply cases of discontinuous variation.

5. *Tetrix Hancocki* Morse.

Summit of Mt. McKay, Aug. 27, 1907, 1 ♀, macropterous.

6. *Chloealtis abdominalis* Thomas.

Fort William, Aug. 26, 27, 1907; both macropterous and brachypterous forms fairly common, especially upon the plateau and summit of Mt. McKay. Also observed on the grassy plain on the west side of the Kaministiquia River. It was most numerous on the summit of the mountain, where it frequented the small openings in the scrubby woods. It also occurred at Nipigon.

The specimens, like those from the Severn River, Ont., are of larger size than those from the Prairie Provinces and Banff, Alberta.

Measurements: Length of body, ♂ 19 mm., ♀ 23-27 mm.; head + pronotum, ♂ 6.5-7 mm., ♀ 8-8.6 mm.; tegmen, ♂ 11 mm. (brach.), 18-19 mm. (macr.), ♀ 10 mm. (brach.), 21-22 mm. (macr.); hind femur, ♂ 12.5-13 mm., ♀ 13-16 mm.

7. *Chloealtis conspersa* Harris.

Moderately common at Fort William and Nipigon, but not observed at Temagami. Only a few specimens were collected, and no accurate data can be given as to the relative proportion of macropterous to brachypterous individuals. The latter certainly predominated at Nipigon, where the species was observed in some numbers on logs and rubbish near the edge of a wood in a bushy pasture.

Wing-length is quite variable in the brachypterous type, and it is not improbable that a more or less continuous series of intergrades may be found connecting the latter with the macropterous type. In a typical pair of this form the tegmina of the male measure 17.5 mm., reaching 3 mm. beyond the tips of the hind femora. Those of the female are 19.75 mm. long, likewise extending 3 mm. beyond the hind femora. The wings of such specimens are fully developed and ample, while in the brachypterous type, even in a male with tegmina reaching within 2 mm. of the tips of the hind femora, the wings are quite abortive, being in the latter example 6 mm. shorter than the tegmina.

8. *Stenobothrus curtipennis* Harris.

This species appeared in large numbers in open grassy places at Ft. William and Nipigon, but was not observed at Temagami. It exhibited its usual great variability in wing-length and colour-pattern.

9. *Mecostethus lineatus* Scudder.

Nipigon, Aug. 30, 1907, 1 ♂, 2 ♀ ♀; Temagami, marsh on Obabika Creek, Sept. 11, 1908, 1 ♂. A few others were observed here and at one or two similar places, but could not be captured.

The Nipigon specimens were taken from the open inundated marsh surrounding the island in the Nipigon River. It was not a favourable-looking spot, the swamp vegetation being chiefly *Equisetum*, *Caltha*, coarse sedges, etc., and the specimens taken were the only ones observed, although the ground was gone over thoroughly.

As in specimens from Anticosti, there is a dark brown subbasal ring on the hind tibiae, very distinct on the inner surface. This ring is absent in the Temagami specimen and generally in specimens from Middle and Southern Ontario, though sometimes indicated in the latter.

The pronotum in the females is somewhat more incrassate, and the fastigium of the vertex tends to be somewhat broader than in specimens from other parts of Ontario.

10. *Mecostethus gracilis* Scudder.

Very common in open grassy places at Fort William and Nipigon, where its presence can be readily detected by its peculiar stridulation. At Lake Simcoe and Go Home Bay, Georgian Bay, this species is strictly confined to open marshes, where it is often found in company with the preceding species; but in the north it enjoys a much wider range of habitat, though still inclined to occupy low grounds. *M. lineatus*, on the other hand, is strictly a marsh form throughout its known range.

Specimens of *M. gracilis* from Lake Simcoe agree perfectly with those from Fort William and Nipigon. Unfortunately no females were found, these being remarkably secretive. At Lake Simcoe great variation in wing-length is met with in the females. The tegmina in one individual in my collection measure 24.5 mm. in length, extending 2 mm. beyond the tips of the hind femora, while in another, only slightly smaller in size, they are only 15 mm. long, and fall 5.5 mm. short of the tips of the hind femora. It would be interesting to know if brachypterism is more marked here than in the north.

11. *Arphia pseudonietana* Thomas.

This insect has been recorded by Caulfield from Nipigon and Sudbury, but I have never met with it in Ontario. It will probably be found in the Rainy River District.

A. frigida Scudd. is also likely to be found there, as it is common from Manitoba to the Rocky Mountains.

12. *Camnula pellucida* Scudd.

Abundant at Fort William and Nipigon, and common in open rocky or sandy places in the Temagami District.

13. *Hippiscus tuberculatus* Pal. de Beauv.

Nipigon (Scudder); Sault Ste. Marie (Walker); shore of Diamond Lake, Temagami, Sept. 7, 1908, a few nymphs (stad. 3) taken on a dry bushy hillside. This spot was on a rough clearing on which a few trappers' huts stood. Although these were surrounded by a rank growth of grass, weeds and bushes, behind which lay a few acres of recently-tilled land, Orthoptera were by no means abundant, only a few common species, such as *Mel. atlanis*, *femur-rubrum*, *bivittatus* and *Camnula pellucida*, having been observed.

14. *Dissosteira Carolina* Linn.

This species was common on the clearings and roadsides on Bear Island, and was occasionally met with in dry open places on the portages. It was not observed either at Fort William or Nipigon, although it probably occurs at the former locality in limited numbers. I have also recorded it from Kenora (Rat Portage).

15. *Circotettix verruculatus* Kirby.

Generally distributed and abundant on all exposed rocky or otherwise barren surfaces of any considerable area, especially in burnt-over districts. It was very common at the foot of Mt. McKay. In the unburnt or uncleared parts of Temagami it was only occasionally met with, and generally in very small numbers.

The prevailing coloration in these districts is dark grayish-brown, somewhat obscurely mottled. Strongly-marked examples are seldom met with, although this type of coloration seems to be the prevailing one in Quebec and the New England States.

EXPLANATION OF PLATE 7.

Fig. 1. *Nomotettix borealis* n. sp.; 1a, head of same from above.

" 2. " *crispatus* Harr.; 2a, head of same from above.

Fig. 3. *Idionotus brevipes* Caud., brachypterous male; 3a, same, tegmen of macropterous male.

(To be continued.)

A LAST WORD TO MR. DISTANT.

BY G. W. KIRKALDY, HONOLULU, HAWAII.

In the course of describing a new genus of Gerrididae (1908, CAN. ENT., XL, 453), it was necessary to compare it with the apparently closely-allied *Chimarrhometra*, Bianchi, the type of which is a species of

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Mr. Distant's. It was necessary, incidentally, to point out that Mr. Distant had endowed it with an extra (fifth!) segment to its labium (*rostrum*), a condition which, if correct, certainly merited more than a passing mention; as a matter of fact, every Hemipterist knows that the labium is always composed of four segments, no more and no less, though sometimes one or more may be difficult to see.

In his reply (CAN. ENT., XLI, 96), Mr. Distant ignores this essential part of my observation, but impeaches my accuracy in a minor detail, although I may remark that if a species is placed in *Halobates*, even with a "?", and is said to be placed provisionally in it, then it *is in it*, at least I do not see where else it can be said to be!

His description of 1879 is reproduced verbatim in his work of 1903 (Faun. Ind. Rhynch. II, 190), yet he did not then recognize immediately the very well marked generic differences between *Halobates* and his new species.

Mr. Distant animadverts on the seriousness of my work, but what is to be thought of the seriousness of a Hemipterist who mistakes the nymph of a bug for the adult, and creates a new genus on it?¹

I am, I trust, always sufficiently humble under the criticisms of such Masters of Hemipterology as Reuter, Montandon or Horvath, the character of whose works gives them this privilege, while the capital errors of Mr. Distant's work make it impossible to range him among these. For example: *Eumenotes* is a Cimicid (Pentatomid), not (as Bergroth has shown) an Aradid. Mr. Distant has pleaded that he merely followed Bergroth's original disposition.

Curupira is a Myodochild (Lygæid), (and incidentally a synonym); it does not even agree with the characters given by Mr. Distant himself for the family in which he places it.

Rulandus is a Reduviid, not a Nabid. It has not the faintest resemblance nor is it structurally allied to any Nabid, except, of course, in so far as it belongs to the same superfamily.

The subfamily Machærotinæ "distinctly links the Membracidæ with the Cercopidæ" (1907 Faun. Ind. Rh., IV, 79), but the resemblance is entirely superficial and not phylogenetic. One has only to examine the form of the face and antennæ in each to recognize the "seriousness" of Mr. Distant's investigations.

1. As for example, "*Bucæus*" and "*Critobulus*" among the Myodochildæ (Lygæidæ), as well as the numerous Ectrichodiinæ corrected by Reuter and Bergroth.

It is thus with Mr. Distant, not the making of mistakes, as regards the placing in wrong genera, undue lumping or undue splitting of genera and species, or a failure to express in our descriptions the points we see, or think we see (lamentable as these failures are), but a *total ignorance of the fundamental principles governing taxonomy, and a perpetual confusion between Homology and Superficial Resemblance.*

In the Trans. Amer. Ent. Soc. (XXXII, 1906), I published a list of certain Heteropterous genera, with their types, etc. I prefaced this contribution with the following remarks (p. 117): "The object of this list is to enumerate the Heteroptera pagiopoda with their synonyms and type species. . . . It should be considered as a bibliographical contribution." In 1907 (Entom., XI., 2), Mr. Distant wrote: "It seems, therefore, a little surprising that Mr. Kirkaldy should have recently . . . proposed his own classification of the family." In the same publication and year (p. 58) I replied that "I did not, as Mr. Distant affirms, propose a new classification, but distinctly stated . . . that the object of my list was simply to enumerate the genera, genotypes, etc., and that it should be considered as a bibliographical contribution." In the face of these statements, Mr. Distant's repeated allusion to my "connection with a proposed revision of the Capsidae" is not in harmony with the facts.

Finally, I deny absolutely the slightest interest in persons, but I uphold my right to call attention to any errors or misapprehensions I detect, or think I detect, in the writings of any Hemipterist, in the same way that I welcome criticisms on my own work, provided that they deal with facts, and are not merely invalid reassertions, in another place, after their inaccuracy has been pointed out.⁶

6. Mr. Distant (p. 95) refers to my "misstatements" of his work made in the "Entomologist," and "Ann. Ent. Soc. Belg.," but omits to refer to the fact that I have replied in these journals, showing that my remarks were justified, and were not misstatements. Those who are interested will find both sides set forth in the following papers:

DISTANT: "Entomologist," 1906, pp. 274-5; 1907, pp. 2-3; 1908, pp. 15-6; 36-7; 147-8.

"Ann. Soc. Ent. Belg.," 1907, pp. 220-2.

KIRKALDY: "Entomologist," 1906, pp. 283-7; 1907, pp. 58-60; 61; 282-3; 1908, pp. 12-5; 123-4.

"Ann. Soc. Ent. Belg.," 1907, pp. 123-7; 300-2; 303-9.

In one of these papers Mr. Distant resented my impeachment of his inaccuracy in dates, etc. (1907, Entom., 2). I replied (op. cit., 58), giving several examples. In one of his most recent works (1907 Faun. Ind. Rh., IV, 201) Mr. Distant cites "*Tetigonia*, Geoffr. (Hist. abreg. des Ins., I, p. 429, 1798-99)."

INCISALIA (LEPIDOPTERA) FROM TEXAS.

BY JOHN H. COOK AND FRANK E. WATSON, ALBANY, N. Y.

Some years ago there came into our possession a number of butterflies of the genus *Incisalia*, which we recognized as belonging to an undescribed species, closely allied to *irus*. No data accompanied the specimens, but we have recently learned that the species is found in some abundance near Houston, Texas.

Incisalia hadros,* new species.—Wings above, ♂, brown; ♀, bright ferruginous, with a coppery lustre, slightly clouded near bases, apices and outer margins; fringe concolorous, except for a narrow edging of white near the apex. Wings beneath dark brown, the secondaries with a ruddy cast and a rather obscure overlay of dull griseous scales on the outer margin, broadening toward the anal angle and running up the inner margin about one-third of the way. Practically all the other elements of design (as found in *irus*) may be discerned in some specimens as vaguely lighter and darker markings almost obliterated by the tendency to uniformity in the coloration; but the only remnants visible throughout the series are the extramesial white line on primaries and a white dash occupying the costo-subcostal interspace in the middle of the front margin of the secondaries. In the types (♂ and ♀) and two paratypes (♂ and ♀), which will be sent to the U. S. National Museum, the black spot crowned by a rusty crescent occupying the first median interspace on the secondaries is in evidence. This mark is, however, obliterated in many individuals, especially among the males.

The types were selected to show the more usual form with variegation reduced to a minimum, the paratypes to show a somewhat brighter phase, in which the elements of design are visible, though obscure.

Expanse, ♂, 32 to 36 mm.; ♀, 35 to 38 mm.†

Incisalia Henrici, G. & R., new variety, *solatus*.‡—Differs from the usual northern form in that the difference in colour between the basal and limbal areas of the wings beneath is comparatively slight. The brighter yellows are, in the variety, replaced by yellow-brown, and the blackish-browns are lightened to faded chocolate. The hoary margin of the

*ἀόρος, well-grown.

†The expanse of *irus* varies in the male from 28 to 30 mm., and in the female from 30 to 32 mm. All measurements taken from apex to apex through mesonotum.

‡*Solatus*, sunburnt.

secondaries beneath is pale and lacking in brilliance, and the wings above show little or no tendency to ferruginous suffusion.

This is an interesting, though by no means striking example of the effects of environment in inducing a protective alteration in colour. The form is a good geographical variety, and merits a distinctive name.

Seventeen specimens from Blanco Co., Texas (Feb. and March).

SOME CURIOUS CALIFORNIAN LEAF-HOPPERS.

BY E. D. BALL, LOGAN, UTAH.

The Jassid fauna of the Western Coast of North America is strikingly different from that of the Mississippi Valley and the Rocky Mountain Region. The *Deltocephalinae* and *Athysaninae*, which contained the greater numbers of species in the eastern fauna, are almost wanting on the coast. In place of these groups we find representatives of a number of curious and aberrant genera, some of which are apparently restricted to this region, while others occur in the fauna of Northern Europe. Several of these genera have but a single representative in the European fauna, while in most cases a number of species have been found in the coast region.

Errhomenellus friscanus, n. sp.—Form of *montanus* nearly, but smaller and paler. Female green, male green with black markings. Length, ♀, 5.5 mm.; ♂, 4 mm.

Vertex acutely conically-pointed in the female, shorter and more angular with front in the male, longer than pronotum, ocelli placed closer to the margin than in *montanus*. Front broad, tumid, slightly convex in profile, ledge above antenna but slightly developed. Elytra reaching only to the apex of last dorsal segment in both sexes, exposing the pygofers, their apices rounding, venation faint and weak, under wings about half the length of the elytra.

Colour: Female bright green, slightly whitish pubescent from sparse white hairs; male pale, dirty straw-colour, with a pair of divergent black stripes arising just behind the apex of vertex and extending onto elytra from just outside the scutellum. Elytra smoky-black, with the nervures light. Pale examples have the stripes reduced to three pairs of spots, two pairs on vertex and an elongated pair on pronotum, and in this case the elytra are mostly pale.

Genitalia: Female segment moderately long, rounding posteriorly and weakly notched; male plates long, slender attingent.

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Described from eight examples from San Francisco, California, collected by the author. This is a much more fragile species than any before placed in this genus, and in some of its characters resembles an *Euacanthus*.

Errhomenellus aridus, n. sp.—Resembling *maculatus*, but smaller, with the elytra abbreviated in the male. Length, ♂, 4 mm.

Male vertex short, obtusely angulate, the margins slightly convex, scarcely as long as pronotum, over twice longer on middle than against either eye, scarcely as long as its basal width, anterior margin foliaceous against the eyes. Vertex acutely angled with the broad tumid front. Elytra abbreviated, roundly truncate, covering one-half the abdomen, venation obscure, abdomen appressed and upturned posteriorly. Male plates long, strap-shaped, with attingent upturned tips closely folded against pygofer.

Colour: Pale yellow, heavily and irregularly irrorate and reticulate with dark testaceous brown and fuscous, usually a pair of irregular stripes are outlined on scutellum and less definitely on pronotum, and there is always an oblique light dash near the outer angle of the elytron.

Described from four males collected at Reno, Nevada, by the author. Several nearly grown nymphs taken with them were apparently females, and showed about the same head characters as the adult male.

Paropulo²a friscana, n. sp.—Form and general appearance of *interrupta* nearly. Over twice as long, with a much shorter vertex. Length, 4.5 mm.

Vertex short, roundly angled in front, three times as wide as its median length, scarcely twice as long on the middle as against either eye. Elytra longer than the abdomen, coriaceous, the costa strongly convex, almost angled in front. Venation distinct, slightly irregular, usually two cross-nervures between the sectors.

Colour: Pale, dirty straw, coarsely irrorate with fuscous, the scutellar carinæ and the posterior tablet are usually light, while the scutellar margins of elytra, the veins of corium, an irregular common black spot on the claval areas, and a few spots on the apical nervures, dark fuscous. Face finely irrorate, a few short arcs and the sutures brown. Femora lined and tipped with fuscous.

Genitalia: Female segment short, almost truncate, slightly roundly excavated on the median third, exposing the base of the pygofer. Male valve very short and broad, almost parallel margined, plates broad,

together almost quadrangular, their apices individually rounding and exposing two stout curved hooks.

Described from eight examples from San Francisco, California. Collected by the author.

Paropulopa arborea, n. sp.—Resembling *Mexicana* in form and colour. Smaller and slenderer than *friscana*. Pale castaneous. Length, 3.5 mm.

Vertex very short, evenly rounding, margins parallel, nearly five times as broad as long. Pronotum convex, elevated behind. Elytra long, slender, the costa only weakly convex, venation distinct, usually two and often three transverse nervures between the sectors, in the latter case there are usually two complete sets of anteapical cells.

Colour pale castaneous, traces of three fuscous points on anterior margin of vertex, the apices of the claval nervures marked with light. Sometimes the apical portion of elytra is faintly mottled with milky.

Genitalia: Female segment short, slightly roundly excavated on the posterior margin, a pair of lateral plates appear beneath in one specimen. Male valve short, transverse, nearly parallel margined, plates long, almost parallel margined, longer than their combined width, their apices individually, roundly pointed.

Described from four examples from Colfax, California. Collected by the author.

Paropulopa Californica, n. sp.—Resembling *interrupta* in size and form, slightly longer and narrower and with more definite dark nervures. Length, 3 mm.

Vertex slightly shorter and more evenly rounding than in *interrupta*, especially in the female. The margin inclined to be thick, as in *Mexicana*. Pronotum not as strongly pitted or as much depressed anteriorly as in *interrupta*. Elytra moderately long and narrow. The costa only slightly curved, venation strong and distinct on apical portion of corium.

Colour: Pale straw, coarsely and irregularly irrorate with fuscous, the nervures on apical portion of elytra almost entirely fuscous, on anterior portion pale or milky.

Genitalia: Female segment long, the lateral margins straight, the posterior margin slightly roundly emarginate from the sharp lateral angles, the middle deeply notched. Male valve short, broad, posterior margin broadly rounding. Plates extremely large, longer than their combined width, their apices together broadly rounding.

Described from eight examples from Salinas, California. Collected by the author. The distinct genitalia of either sex will readily separate this species from the related forms.

Koebelia irrorata, n. sp.—Form of *Californica* nearly, slightly longer and with a longer and more pointed vertex. Head finely irrorate. Length, ♀, 7.5 mm.; ♂, 6 mm.

Vertex as long as its basal width, the lateral margins parallel before the eyes, then rounding evenly to a blunt point. Front narrower above than in *Californica*, the margins straight. Elytra longer and narrower than in that species, not quite covering the ovipositor in the female. Venation obscure, but more regular than in *Californica*. Female segment slightly produced on median third. Male plates triangular, with the apices attenuately produced.

Colour: Vertex, face and pronotum pale buff, finely and evenly irrorate with brown. Elytra powdery-white in fresh specimens, brownish-white in older ones.

Described from three females and three males from Williams, Ariz. Collected by Barber and Schwarz, and received from the U. S. National Museum.

Koebelia coronata, n. sp.—Resembling *irrorata*, but with a still longer vertex. Length, ♀, 7 mm.; ♂, 5 mm.

Vertex rather narrow and angled almost from the eyes to the roundly pointed apex in the female, parallel beyond the eyes, and then angled in the male. Elytra very short in the female, exposing the last abdominal segment, as well as the long pygofers and ovipositor, as long as the body in the male. Venation weak and obscure. Female segment short, with the posterior margin slightly produced; male plates long, triangular, their apices not produced.

Colour: Female pale ferruginous, male ferruginous-brown. A median line on vertex and pronotum and a crescent just back of the apex of vertex, light, more strongly marked in the male. Face ferruginous-brown, a light line from the eyes along the carinae to the ocelli, then across in about the curve of the vertex margin, except that it is strongly broken forward in the middle.

Described from a single pair from California in the collection of the author.

Koebelia grossa, n. sp.—Resembling *irrorata*, but larger and with a more nearly quadrangular vertex. Length, ♂, 6.5 mm.

Vertex very large, the lateral margins widening before the eyes for more than the length of the eye, then abruptly rounding to the obtusely angulate apex. Front very long and extremely narrow between the antennæ, slightly widening to the ocelli, the disc very flat, and sharply angled with vertex, entire margin back to ocelli thin and foliaceous. Elytra long and coriaceous, slightly exceeding the abdomen; venation obscure, the veins with large, sparse, black tubercles. Male valve semicircular, plates long, triangular, their apices slightly attenuate.

Colour: Vertex and pronotum soiled-white, irregularly irrorate with fine brown points, slightly heavier around the vertex margins. Traces of three orange stripes on vertex and some orange shading on anterior half of pronotum. Elytra pale, very finely and evenly irrorate with brown. The veins faintly milky-white and sparsely ornamented with shining black tubercles. Traces of powdery-white on the disc of corium. Face creamy, heavily irrorate with brown, omitting the usual line on the carinæ.

Described from a single male from Chico, California. Collected by the author.

Macropsis grandis, n. sp.—Form of *bisignata* nearly, much larger, green, the male heavily black marked. Length, ♀, 5.75 mm.; ♂, 5 mm.

Vertex strongly inflated, half longer on the middle than against the eye. Pronotum long, the disc convex and strongly wrinkled. Elytra broad, appressed posteriorly in the male, whole surface covered with fine hair. Venation obscure and rather weak, often a number of reticulate veins between the sectors and along costa.

Colour: Female uniformly light green in life, sometimes with a brownish tinge in old specimens. Male shining black above, except for the narrow lateral margins of the pronotum and the costal third of the elytra before the apical cells, pale green. Below pale green, the black extending down onto the face nearly to the antennal sockets on the side. Some of the males are much lighter, lacking most of the dark on the vertex and pronotum, and often on the apical third of claval areas.

Genitalia: Female segment moderately long, posterior margin truncate, with the median half cut out one-third the depth of the segment, the margins of the cut rectangular; male valve twice the length of the ultimate segment, the margins parallel, considerably exceeded by the long narrow pygofer.

Described from eight examples collected in Colorado and Utah by the author, and two females received from Arizona.

FURTHER NOTES ON THE RHOPALOCERA OF SANTA CLARA COUNTY, CALIFORNIA.

KARL R. COOLIDGE, MONTEREY, MONTEREY COUNTY, CALIF.

The following additions and corrections are supplementary to my list of the diurnal Lepidoptera of this county.* A few notes had been overlooked, and the additions to the skippers have been made through the naming of a small collection by Dr. Skinner. The hysterical state of confusion in the *Hesperidæ* makes it quite impossible for a western collector to name his specimens correctly unless he has a large collection and library.

Pieridæ.

Pontia occidentalis, Reakirt.—Mr. A. F. Porter (Entom. News, Oct., '08) records this species from Decorah, Iowa. I have gone over a number of specimens from this locality, and I can hardly see why it should be differentiated from *protodice*, Boisd., which also occurs here. I hope to be able to breed *protodice* this coming season, and ascertain the relationship between the two. The listing of *Zerene eurydice*, Boisd., from Iowa by Mr. Porter is a *lapsus calami*.

Euchloe sara, Boisd.—On page 425 I stated that it was quite probable that *sara* had, besides *Brassica*, another food-plant on which the larva feed in the higher hills, where mustard is not everywhere met with. Late last June, while on a collecting trip in the Santa Cruz Mountains, I found *sara* to be quite common, and after considerable searching I discovered many eggs and young larvæ on *Sisymbrium officinale*, the common hedge mustard, on which I later observed a female ovipositing.

Lycænidæ.

Cyaniris ladon piasus, Boisd.—I find I overlooked the fact that Mr. W. G. Wright, in the CAN. ENTOM., Vol. XX, p. 97, 1888, briefly recorded the life-history of *piasus*, the larva and pupa of which I recently described.† Mr. Wright gives as the food-plant at San Bernardino the flower buds of *Adenostoma fasciculatum* (*Rosaceæ*). Prof. Kellogg, illustrating the chapter on "Colour Patterns and their Uses," in his AMERICAN INSECTS, gives three figures in colour of the larva of *piasus* on its food-plant, *Æsculus Californicus*. The illustrations are given under the title of "*Larvæ of Lycæna sp.*," but in the later edition I find this is changed to "*Larvæ of Lycæna ladon piasus*, Boisd." The following is quoted from the text: "An interesting example of colour harmony, which may be

* CAN. ENT., November, 1908, Vol. XL, p. 425.

† CAN. ENT., October, 1908, Vol. XL, p. 347.

classified under the head of variable protective resemblance, that has come under my observation while writing this chapter, is the case of the larvæ of *Lycæna* sp., abundant on the flower-heads of the just-blossoming (May) California buckeye, *Æsculus Californicus*. The buds of the buckeye are green, or green and rose, or even all rose externally. The quiet slug-like Lycænid larvæ lie longitudinally along the buds and their short stems, and are either green, with faint rosy tinge, especially along the dorsi-meson, or are distinctly rosy all over, depending strictly on the colour-tone of the particular inflorescence serving as a habitat for the larva. The correspondence in shade of colour is strikingly exact; the utter invisibility, or rather indistinguishability, of the larvæ is something that needs to be experienced, as my artists, my students, and I have experienced in the last few weeks, to be fairly realized. We have watched the larvæ through their whole life, and all the time the safe position along the bud and the immobility are maintained." Several other corrections in the *Lepidoptera* have been made in the later edition of AMERICAN INSECTS. On plate XI the figure of *Synchlœ sara*, which was labelled as the eastern *genutia*, has been corrected, and also the figure of *Neophasia Terlootii*, Behr., which was masquerading under the name of *Archonias lyceas*. Will the troubles of *Neophasia Terlootii* ever end? The figures of *Papilio daunus*, Boisd., on page 447, which are figured as *rutulus*, have not been changed.

Hesperidæ.

Pamphila comma juba, Scudder. This large skipper appears to be quite common here, and is also well distributed throughout California.

Thanaos tristis, Boisd.—This species I listed under the name of *clitus*, Edw. What Wright (Butt. West Coast) figures as *tristis* (469) is *juvenalis*, Fabricius, ♂.

Thorybes Mexicana, Herrich-Schæffer.—A single specimen of this species was taken in the foothills on April 26. It is somewhat darker than specimens from the Sierra Nevadas. Wright's figure (No. 472) gives a poor representation of the markings of the primaries.

Hesperia cæspitalis, Boisd.—Finding this species flying abundantly about various flowers in the open spots along San Francisquito Creek last summer, I confined a number of females for ova. Of these but a single ♀ was kind enough to oviposit, and then but a single egg, which proved infertile.

Egg.—Hemispherical, ribbed longitudinally with numerous raised ridges, between which are finer cross-veinlets. Height and diameter about the same. Colour when first laid pale greenish, changing to light lemon-yellow. Diam. 5 mm.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 27.

THE HEPIALIDÆ, OR GHOST-MOTHS.

BY ALBERT F. WINN, WESTMOUNT, QUE.

The moths forming this family are not at all common in collections, are not strikingly beautiful, and are not particularly injurious to vegetation, but are so utterly unlike their relatives that a few general remarks may be of interest. The Hepialidæ are distributed through all parts of the world, most of the North American and European species being small or medium in size, expanding from a little over an inch to about four inches, the colours being mostly of various shades of browns, grays, yellow and white. In warmer lands, for example Australia and New Zealand, species are found of lovely colours, very large expanse of wings and heavy bodies. The male of one of the commonest European species, *H. humuli*, is of a pure white colour, and this, coupled with its odd habit of hovering in large numbers over the meadows, just at dusk, has caused it to be known as the Ghost-moth, and the family are often spoken of by this name, though also known as Swifts, on account of the rapid flight of some of the smaller species.

The scientific name is derived from the Greek *ῥπιαλος*, which means a shivering fit, a nightmare, a fever attended with violent shivering. Those who have hunted for these moths will appreciate the aptness of the name.

In North America there are a number of species, and in every Province of Canada one or more of them is to be found, but good series of specimens are in few collections, not because the moths are really rare in nature, but because their habits and life-histories are little understood. Unfortunately, also, the literature on the subject is meagre, and the question of which of the species on the lists are really distinct, and which are varieties or synonyms, is a very puzzling one.

The best known species in the East is probably Harris's Silver-spotted Ghost-moth, *H. argenteo-maculatus*, but as I am more familiar with the habits of our local species, *H. thule*, Strk., it will probably be best to select this. The Island of Montreal seems to be the headquarters of this moth, though its habitat extends to Ottawa in a westerly direction, probably north as far as the base of the Laurentian Mountains, but lack of entomologists to the east and south makes it, at present, impossible to limit the range in these directions. It is very regular in appearance,

about July 7th, seldom earlier, in backward seasons perhaps a week later, the flight lasting only about ten days. Having previously found a low-lying field, more or less swampy, with a good growth of scrub willows from four to ten feet high, the food of the larva, we set out after supper, allowing time to get on the ground a little before 8 o'clock. After getting the net and bottles ready, it is well to look over the field, selecting a spot, if possible, from which a good view over the bushes can be obtained, and one that is free from very treacherous or boggy places, as it is often necessary to move about rapidly. Cloudless evenings, with a light west wind, seem to be the most favourable; on cloudy nights the moths begin to fly a few minutes earlier, showing that they wait for a certain degree of darkness.

Five minutes past eight, and there is nothing flying, and nothing to indicate there ever will be, and we begin to get anxious as to whether there will be any sport, our eyes fixed on the air over the willows. The minutes pass—ten minutes past eight—now is the time. A shout comes from one of the party, "Look out, there's one," and flying quickly over the bushes, perhaps ten feet up, is seen a yellowish-white object, a moth expanding a little over three inches, with a long, thin body. There is no mistaking it for anything else, the position and shape of wings in flight is entirely unlike any other moth. We probably miss it as it passes by, but it turns, and comes back a little further in the swamp, suddenly arrests in its long flight, and begins to hover over a certain bush, dancing in the air, backwards and forward, as if it were the ball of a pendulum having a stroke of about two feet. Another moth of the same kind appears, apparently from nowhere, and joins the other in its mad gambol. Another, several more, till perhaps 12 or even 20 are all at it close together in the air. Sometimes they are provokingly just out of reach of the net, at other times it is easy to catch some of them. At the least touch of the net they close their wings and drop either into it or outside. If the former they are easily bottled, as they usually remain quiet for a short time, but it is well to be quick, for when they try to escape from the net the wings vibrate so rapidly that the specimens are ruined by the rubbing against the net. Those that fall to the ground or among the bushes are seldom to be found in the fast disappearing daylight, but they generally fly up again, sometimes to join the remainder of the dancers close by, sometimes to rush off elsewhere. These assemblages usually last only a few minutes;

I have never witnessed them after 8.30 p.m., the moths disappearing as quickly as they came. What do these gatherings mean? Why did they select one spot, hover over it for a while, and then disappear? The revellers were all males; on a willow twig below the swarm was the lady moth, whom they all sought. When a partner was selected, the others went off, perhaps to form other oscillating groups nearby, perhaps to hide till next evening (whether there is a corresponding flight in the morning twilight I know not), perhaps to be eaten up by the bats, which destroy quantities of the moths.

The females are seldom found flying till after the dance of the males is over. Their flight is altogether different, very swift, only a few feet from the ground, and usually in a great sweeping curve. As it is almost dark, it is difficult to make accurate observations on the habits of the females, but this style of flight is probably of importance to the moth in the disposition of her eggs. Most moths lay a comparatively small number of eggs, say 300 or 400, placing them on, or near, the plants on which the larvæ feed, but these Ghost-moths lay at least 2,000, and drop them broadcast as they fly about. There is a regular stream of eggs; it is like the discharge of bullets from a rapid firing Maxim gun. If a piece of paper be held beneath the moth, when flying, or when held by the wings, the eggs can be heard pattering on the paper as if fine sand were being sifted through the fingers over it. The eggs are exceedingly small for such a large insect, being smaller than those of our tiny blue butterflies.

When laid they are of a dirty white colour, turning black within a few hours. They are quite smooth, and do not adhere to the leaves or grass. One would think that eggs deposited in this haphazard manner would result in a very large percentage of deaths of the baby larvæ through not being able to find the proper food-plant, though possibly almost any tender roots may suffice for their first meals, or till they reached the proper kind.

The quick flight of the moth from one clump of bushes to another may tend to ensure the loss of the least possible number of eggs, and at the same time enable the female to deposit eggs over a much wider area. The larvæ feed on the roots, boring into them, but it seems impossible to breed them in confinement, and it is not yet known whether more than one year is spent in the larval stage.

Let us look at one of the moths which we have just caught, with its beautiful soft lemon-yellow wings, with brown costa, folded over the body

like a slanting roof. Perhaps the first things we notice are the antennæ, mere threads about three-sixteenths of an inch long. Then it is seen that the fore wings and hind wings are almost the same length and shape, reminding us of the dragon-flies. Looking at the under side, we notice the most important character of these moths, the manner in which the wings of each side are fastened together to assure their acting simultaneously. From near the base of the inner margin of the fore wings there projects a lobe, called the *jugum*, or yoke, which passes under the costa of the hind wings. In all other moths, except one small family of very minute species, the wings are connected by a bristle or bristles on the hind wings, or a large angle, extending under the primaries.

The legs of the males have very large tufts of hair, so the sexes can be separated at a glance. The venation is very peculiar, the front and hind wings being almost identical, while other moths have fewer veins in the secondaries, and from this and other characteristics, as well as their universal distribution, some entomologists are inclined to consider them a very ancient type of the Lepidoptera.

To look for the Silver-spotted Ghost-moth, *H. argenteo-maculatus*, instead of selecting a site where there is a growth of willows, we should search for alder bushes. The moths have similar habits, but they fly two or three weeks earlier in the season, and are found over a much larger territory.

Of these moths, the real treasure is the Golden Ghost, *H. auratus*, of which only one example has been recorded from Canada, the Rev. Dr. Fyles having been fortunate enough to take a specimen flying at dusk one July evening in 1865, in Brome Co., Que. The fore wings are decorated with pale brown markings and large patches of dull gold, on a dull lilac or pinkish-fuscous ground colour. The expanse of wings is about two inches. Nothing is known of its habits and life-history, and only a very few stray specimens have been found, but it seems to have a preference for mountain regions, as it has been taken in the Adirondacks, the Catskills, and the White Mountains.

A small species, now and then met with about Ottawa and through the Province of Quebec, but quite common in New Brunswick, Maine and New Hampshire, is called *H. mustelinus*. It expands only about an inch and a half, and is of varying shades of warm browns and grayish-browns, with darker brown bands and spots. The moths seem to frequent the pine

woods, and may often be found towards the end of July, or early in August, in the afternoons, resting on the pine-tree trunks from two to eight feet from the ground, their wings slantingly folded close over the body. At dusk they fly about in openings in the woods with exactly the same hovering flight as the larger species, but later in the evening are often attracted to lights in windows, sometimes in large numbers.

There are a number of other equally interesting species of these moths found in Canada, which space does not permit being even mentioned here, but it is hoped this article will serve to call attention to the group. In order to get accurate information about the distribution and variations of these little-known moths, it is desirable that the capture of any species should be placed on record, with the dates and localities. The writer is anxious to obtain, by exchange, specimens of all the North American species, from as many localities as possible, and will consider it a privilege to examine and return any specimens that may be sent for comparison.

SOME NEW SPECIES OF NORTH AMERICAN GEOMETRIDÆ.

BY JOHN A. GROSSBECK, NEW BRUNSWICK, N. J.

(Continued from page 157.)

Cleora agrestaria, new species.—Expanse, 27–30.5 mm. Head and palpi dark gray; front dark brown. Thorax and abdomen brownish-gray, the segments of the latter edged posteriorly with deep brown. Ground colour of wings whitish-gray, heavily overlaid with brownish-gray. Basal line absent. Intradiscal line blackish, contrasting, edged inwardly by an equally broad border of pale brown, commences on costa one-third out from base, and is directed outward toward centre of wing, but is lost a short distance below costa; begins again near discal spot, and extends slightly outcurved and obliquely inward to inner margin, ending quite close to root of wing. Extradiscal line blackish, faintly toothed outwardly on the veins, and edged externally below M_2 by a broad border of pale brown; begins on costa one-fourth in from apex, and appears only on the veins to M_1 , thence continuous to inner margin, being as a whole slightly outcurved from costa to middle of wing, then extends very obliquely inward, running almost parallel to intradiscal line. Subterminal line whitish, deeply scalloped, runs through centre of broad outer space; internally between M_1 to Cu_2 it is edged with a deep brown shade, and this joins with a subapical dash of the same colour. Terminal line black, scalloped,

well defined. Fringe whitish at base. Discal spot rather small, round, distinct. Secondaries with two median, quite broad, straight lines, extending from inner margin two-thirds across the wing toward costa. The outer one is bordered by a pale brown band. A basal line continuous with the intradiscal line of primaries. Subterminal line whitish, wavy, shaded inwardly with brown, running subparallel to outer margin. Terminal line black, irregularly scalloped. Fringe as in fore wings. Discal spot present. Beneath smoky, costæ with pale brownish cast; extradiscal line of primaries faintly showing; discal spots present.

Types: Male and co-types in the Brooklyn Institute Museum; female and co-types in the author's collection, and co-types with Mr. Geo. H. Field, of San Diego, California.

Habitat: California, Monterey Co. (Doce); San Diego Co., Bat., VI, 30; Thyce Camp, VII, 1; Jacumba, VII, 3; Pine Valley, VII, 5; Talley's, VII, 8 (Field).

In ornamentation the species is nearest to *Hulstina (Selidosema) formosata*, Hulst, but besides differing in structure is broader-winged, and the two median lines of the hind wings are straight, not parallel to the curved outer margin as in *H. formosata*.

This species was originally included in a paper published in the Jour. N. Y. Ent. Soc., March, 1908, but was excluded at the last moment on the discovery of its similarity to *Selidosema Wrightiaria*, Hulst. I have seen but one of four types of this later species, and while it does not exceed 28 mm., it is, I believe, one of the specimens from which the species was described. It is apparently as prevalent in Southern California as *Cleora agrestaria*, and it is possible that one or more specimens of this latter species were included in the description of *Wrightiaria*, hence the measurement, 28 mm.; but whether or not this is the case, I propose to hold Hulst's name on the type that is now in his collection.

Wrightiaria is a smaller species than *agrestaria*, and as here limited is a *Selidosema*. This arrangement does not interfere with the recent result of Mr. Pearsall, by which he refers *Chloroclystis inconspicua*, Hulst, as a synonym of *S. Wrightiaria*, for while *inconspicua* may equal *Wrightiaria*, it certainly is not *agrestaria*.

Cleora fragilaria, new species.—Expanse: ♂, 30-33 mm.; ♀, 37-38 mm. Body and wings in general whitish-gray, the female with an even scattering of brown scales, which gives to it a darker gray colour than

the male. Usually the space between the antennæ is occupied by a brown band, and the superior part of the front is also brownish. Posterior part of collar brownish, and a stripe across the first abdominal segment is of the same colour. Sometimes two dorsal spots are on each of the remaining abdominal segments, though these may be altogether absent. Cross-lines of primaries blackish, narrow; clearly delineated in the male, obscure in the female. Basal line originates on costa one-sixth out, in a black spot, extends outward to cell, then bends inward, and is twice sinuate to inner margin. Extradiscal line begins two-thirds out on costa, extends outwardly sinuate to below R_5 , then curves inward to Cu_1 , is outwardly scalloped between Cu_1 and Cu_2 , again scalloped slightly below this last vein, then deeply incurved to inner margin, terminating between the base of the wing and the anal angle. The median line is rather indistinct, begins on costa between the extra- and intradiscal lines, rounds outwardly the faint discal ringlet, of which it forms a part, and there runs close and subparallel to the extradiscal line to the inner margin. External to the extradiscal line is a brown-ochre shade, broad within the incurves of the extradiscal line, narrow or broken at the outcurves. Outer space with a patch of dark scales between veins R_4 and M_1 . Subterminal line white, scalloped between the veins and running parallel to the outer margin. Terminal line scalloped, and with a distinct black spot at the angles formed by the junction of the scallops. Secondaries with a sinuate intra- and extradiscal line, the former most distinct on inner margin, the latter with the sinuations sometimes angular, and with a distinct outward angle between M_2 and Cu_1 . The latter bordered externally with an ochreous shade. Subterminal line white, scalloped, bordered with a gray shade internally. Terminal line as in primaries, but the scallops much more pronounced. Beneath whitish in male, grayish in female, the primaries dusky subapically and the costa strigate with brown. Discal spots on all wings solid; large and conspicuous on primaries, smaller and faint on secondaries. Terminal line represented by the black points at the angle of the scallops on the upper side.

Types: Ten males and two females in the collection of Mr. Geo. H. Field, of California, and in the collection of the author.

Habitat: San Diego, Cal., June 12, July 17, Aug. 20, 30, Oct. 2, 19, 24, Nov. 2, 15. All taken by Mr. Field. I have the species also from Pasadena, Cal., taken Oct. 10, but these are in rather poor condition, and have not been made types.

The species is very nearly allied to *Cleora emasculatum*, Dyar, but is slighter in build, and the cross-lines, though clearly defined, are narrower and the shades are less conspicuous. Beneath the species lacks the yellowish cast often present in *emasculatum*, and does not show the anterior half of the extradiscal line of the primaries which the latter very pronouncedly does in all my specimens. It is the species referred to occasionally as the western *Selidosema humaria*, and is found in collections under that name.

Stenaspilates levisaria, new species.—Expanse, 30–33 mm. Entire insect pale yellowish-white, more or less profusely sprinkled with fine gray scales. Head and palpi with rather few gray scales; thorax with a very even distribution of the gray scales, while on the abdomen they are clustered into small blotches. Intradiscal line of primaries whitish, scarcely indicated or absent, begins less than one-third out on costa, extends outward toward centre of wing, then curves around and runs evenly inward to inner margin. Extradiscal line whitish, narrow, begins on costa one-third in from apex, and extends, outwardly scalloped between the veins, to the inner margin, the size of the scallops varying with the width of the spaces between the veins. The space from the base of the wing to the intradiscal line is covered with gray and brown scales, rather sparsely at the base, but becoming more dense and more brown outwardly, until at the extradiscal line little of the ground colour is visible except at the costa. Inner half of outer space even pale yellow in colour, or with scattered gray scales; outer half thickly covered with gray scales. Terminal line absent. Discal spot vaguely showing as a grayish spot. A brownish-gray spot in each of the marginal angles of the wing. Secondaries pale at base, becoming darker outwardly, and with a single, slightly scalloped extradiscal line continuous with and similar in colour to the extradiscal line of primaries. Grayish spots in the angles of the wing, and one to four small, defined, black spots near the anal angle. Beneath pale yellowish-white, profusely scattered over with grayish scales. The extradiscal line of both wings appearing as rather even whitish lines.

Types: Two males in the collection of Dr. Barnes and in my own collection.

Habitat: Santa Catalina Mts., Ariz., August 1–7 and September (Barnes).

LIST OF THE SIPHONAPTERA OF CALIFORNIA.

BY M. B. MITZMAIN, B. S., TECHNICAL ASSISTANT, LABORATORY FOR
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The wealth of fauna displayed in the list of mammals from California makes one wonder at the paucity of Siphonaptera recorded from the Golden State. The comparative ease with which specimens can be obtained, and the economic bearing of these parasites in the dissemination of epizootics of obscure origin, furnish an ample incentive for the collection and study of these insects. We are, nevertheless, aware of the repugnance assumed by certain entomologists toward the degenerate flea, and the disrepute in which Siphonapterologists are likely to be esteemed. This contempt, we observe, is not the brand which is bred through familiarity. We venture to surmise, a familiarity with the flea and its behaviour would indeed win many students for research in the Siphonaptera.

We may be presumptuous enough to maintain, that of all insects in California, the flea is probably the most popular; that is to say, it is "the most sought after." Then, too, the hunting season for the flea appears to be open throughout the year, though at some periods it proves a greater "craze" than at others. The present gigantic endeavours of the Surgeons of the U. S. Public Health and Marine Hospital Service in their efficient measures for the suppression of plague in California, are stirring up a popular interest in the flea and its notorious associations. One of the Surgeons in this Service, Dr. Carroll Fox, during the few months engaged in this work has contributed to the California Siphonaptera a greater number of species than any other entomologist.

The bibliographical references pertain only to the records of California workers.

Prior to 1905 the Siphonaptera recorded from California consisted of the following species:

- Anomiopsyllus Californicus, Baker.
- Ceratophyllus acutus, Baker.
- C. proximus, Baker.
- C. sexdentatus, Baker.
- C. Californicus, Baker.
- C. ciliatus, Baker.

The first of these was described in 1904, *Invert. Pacif.*, I, p. 39. The remainder were recorded from California in 1904, *Proc. U. S. N. M.*, XXVII.

In 1907 this list was supplemented by the following species taken from rats :

- Pulex irritans*, Linn.
- Loemopsylla* (*Pulex*) *cheopis*, Roth.
- Ctenocephalus canis* (Curt), Baker.
- Ceratophyllus fasciatus*, Bosc.
- Ctenopsyllus musculi* (Duges), Wagner.

These were first recorded as rat fleas in Bull. Cal. State Board of Health, 1907, III, No. 5, p. 39.

The list was augmented in 1908 by the species following :

- Argopsylla gallinacea* (Westwood), Enderlein.
- Hoplopsyllus anomalus*, Baker.
- Ceratophyllus ignotus*, Baker.

These three species were recorded in Entomological News, October, 1908, pp. 380-382.

The remaining species, with a few exceptions, were embodied in a report on the Species of the Siphonaptera found within the boundaries of the city and county of San Francisco, by Fox, Jan., 1909, Entomological News, pp. 10-11.

The following compilation constitutes a compendium of the species of fleas, with normal and occasional or accidental hosts. It may be of interest to note that the fleas recorded from rats had been identified after an examination of more than 200,000 rats of the common varieties found locally and taken from ships in the San Francisco harbour. The squirrel fleas were collected from several hundred California ground squirrels. Two species, *Ceratophyllus acutus* and *Hoplopsyllus anomalus*, seem fairly constant in the San Francisco Bay region and in the vicinity of Los Angeles.

Family RHYNCHOPRIONIDÆ, Baker.

Genus *Argopsylla*, Enderlein.

- 1.—*Argopsylla gallinacea* (Westwood), Enderlein.
1908.—Mitzmain, Entomological News, XIX, No. 8, p. 381.
Hosts.—Poultry and farm animals, occasionally man.
Region.—Central California.

Family PULICIDÆ.

Subfamily Anomiopsyllinæ, Baker.

Genus Anomiopsyllus, Baker.

2.—*Anomiopsyllus Californicus*, Baker.1904.—Baker, *Invert. Pacifica*, I, p. 39.Host.—Western spotted skunk (*Spilogale phenax*).

Region.—Southern California.

Subfamily Pulicinæ.

Genus Pulex, Linnæus.

3.—*Pulex irritans*, Linn.1907.—Mitzmain, *Bull. Cal. State Board of Health*, III, No. 5, p. 39.Hosts.—Man; domestic fowl, *Gallus domesticus*; brown rat, *Mus Norvegicus*; black rat, *Mus rattus*; dog, *Canis familiaris*; California skunk, *Mephitis occidentalis*.

Region.—Throughout California.

Genus Læmopsylla, Rothschild.

4.—*Læmopsylla (Pulex) cheopis*, Roth.1907.—P. pallidus, Tasch.; Mitzmain, *Bull. Cal. State Board of Health*, III, No. 5, p. 39.1908.—Cheopis, Mitzmain, *Entomological News*, XIX, No. 8, p. 381.Hosts.—House mouse, *Mus musculus*; brown rat, *Mus Norvegicus*; black rat, *Mus rattus*.

Region.—San Francisco Bay region.

Genus Ctenocephalus, Kolenati.

5.—*Ctenocephalus canis* (Curtis), Baker.1907.—Mitzmain, *Bull. Cal. State Board of Health*, III, p. 39.Hosts.—Dog, *Canis familiaris*; man; brown rat, *Mus Norvegicus*; black rat, *Mus rattus*.

Region.—San Francisco Bay region.

6.—*Ctenocephalus felis*, Bouché.1909.—Fox, *Entomological News*, XX, p. 11.Hosts.—Cat, *Felis domestica*; man; brown rat, *Mus Norvegicus*; California skunk, *Mephitis occidentalis*.

Region.—San Francisco Bay region.

Genus Hoplopsyllus, Baker.

7.—*Hoplopsyllus anomalus*, Baker.1908.—Mitzmain, *Entom. News*, XIX, p. 381.

Hosts.—California ground squirrel, *Citellus Beecheyi*; brown rat, *Mus Norvegicus*.

Regions.—Los Angeles and San Francisco Bay region.

8.—*Hoplopsyllus affinis*, Baker.

1909.—Fox. Not published heretofore. To appear in Entomological News.

Host.—Bachman brush hare, *Lepus Bachmani*.

Region.—San Francisco County.

Genus *Ceratophyllus*, Curtis.

9.—*Ceratophyllus acutus*, Baker.

1904.—Baker, Invert. Pacifica, I, p. 40.

Hosts.—*Spermophilus* sp.; California ground squirrel, *Citellus Beecheyi*; nest of wood rat, *Neotoma* sp.

Regions.—Los Angeles, Palo Alto, San Francisco Bay region.

10.—*Ceratophyllus ignotus* (Baker), Wagner.

1908.—Mitzmain, Entom. News, XIX, p. 382.

Hosts.—California pocket gopher, *Thomomys bottae*; California mole, *Scapanus Californicus*.

Region.—San Francisco Bay.

11.—*Ceratophyllus niger*, Fox.

1908.—Fox, Entom. News, XIX, p. 434.

1908.—Mitzmain, erroneously reported as *abantis*, *ibid* p. 382.

Hosts.—Domestic fowl, *Gallus domesticus*; nest of the sparrow, *Passer domesticus*; man; brown rat, *Mus Norvegicus*.

Region.—San Francisco Bay.

12.—*Ceratophyllus proximus*, Baker.

1904.—Proc. U. S. Nat. Mus., XXVII, pp. 412, 446.

Host.—Ground squirrel, *Citellus* sp.

Region.—Southern California.

13.—*Ceratophyllus sexdentatus*, Baker.

1904.—Baker, Proc. U. S. Nat. Mus., XXVII, pp. 403, 446.

Host.—Taken from the nest and from the wood rat, *Neotoma* sp.

Regions.—San Francisco County and Central California.

14.—*Ceratophyllus Californicus*, Baker.

1904.—Baker, Proc. U. S. Nat. Mus., XXVII, pp. 395, 440.

Host.—Field mouse, *Microtus Californicus*.

Region.—Central California.

- 15.—*Ceratophyllus ciliatus*, Baker.
1904.—Baker, Proc. U. S. Nat. Mus., XXVII, pp. 397, 441.
Host.—Chipmunk, *Eutamias* sp.
Region.—Central California.
- 16.—*Ceratophyllus fasciatus*, Bosc.
1907.—Mitzmain, Bull. Cal. State Board of Health, III, p. 39.
Hosts.—House mouse, *Mus musculus*; brown rat, *Mus Norvegicus*; black rat, *Mus rattus*; man; California skunk, *Mephitis occidentalis*; California pocket gopher, *Thomomys bottae*.
- 17.—*Ceratophyllus Londoniensis*, Roth.
1909.—Fox, Entom. News, XX, p. 11.
Host.—Black rat, *Mus rattus*.
Region.—San Francisco County.
- 18.—*Ceratophyllus telchinum*, Roth.
1909.—Fox, Entom. News, XX, p. 10.
Host.—Field mouse, *Microtus Californicus*.
Region.—San Francisco County.
- 19.—*Ceratophyllus multidentatus*, Fox.
1909.—Fox. Unpublished. To appear in early number of Entom. News.
Host.—Field mouse, *Microtus Californicus*.
Region.—San Francisco County.
- 20.—*Ceratophyllus*, spec. nov., Fox.
1909.—Fox. Unpublished. To appear shortly.
Host.—California weasel, *Putorius xanthogenys*.
Region.—San Francisco County.
- 21.—*Ceratophyllus Wagneri*, Baker.
1909.—Fox. Heretofore unrecorded.
Host.—Weasel, *Putorius xanthogenys*.
Region.—San Francisco County.
- 22.—*Ceratophyllus anisus*, Roth.
1909.—Fox. Reported in a private communication; has not appeared in American literature.
Host.—Brown rat, *Mus Norvegicus*.
Region.—San Francisco County.

Genus *Odontopsyllus*, Baker.

23.—*Odontopsyllus*, spec. nov., Fox.

1909.—Fox, Entom. News, XX, p. 11. Recorded as *Charlottensis*.

Rothschild pronounced it a new species.

Hosts.—Field mouse, *Microtus Californicus*; nest of wood rat, *Neotoma* sp.

Region.—San Francisco County.

24.—*Odontopsyllus Wymani*, Fox.

1909.—Fox. To be published in Ent. News.

Host.—California mouse, *Microtus Californicus*.

Region.—San Francisco County.

25.—*Corypsylla ornatus*, Fox.

1909.—Fox, Entom. News, XX, p. 11.

Host.—California mole, *Scapanus Californicus*.

Region.—San Francisco County.

Genus *Spilopsyllus*, Baker.

26.—*Spilopsyllus inæqualis*, Baker.

1909.—P. A. Surgeon Geo. W. McCoy. Hitherto unrecorded.

Host.—Bachman brush hare, *Lepus Bachmani*.

Family CTENOPSYLLIDÆ, Baker.

Genus *Ctenopsyllus*, Kolenati.

27.—*Ctenopsyllus musculi* (Duges), Wagner.

1908.—Mitzmain, Entom. News, XIX, p. 382.

Hosts.—House mouse, *Mus musculus*; black rat, *Mus rattus*; brown rat, *Mus Norvegicus*; field mouse, *Microtus Californicus*.

Region.—San Francisco Bay region.

Family HYSTRICHOPSYLLIDÆ, Baker.

Genus *Hystrichopsylla*, Taschenberg.

28.—*Hystrichopsylla dippiei*, Roth.

1909.—Fox, Entom. News, XX, p. 11. Recorded as a new species. Dr.

Fox sent specimens to Mr. Rothschild, who identified them.

Hosts.—California field mouse, *Microtus Californicus*; nest of wood rat, *Neotoma* sp.

Region.—San Francisco County.

29.—*Dolicopsyllus Bluei*, Fox.

1909.—Fox, Ent. News, XX, p. 195.

Host.—California weasel, *Putorius xanthogenys*.

Region.—San Francisco County.

HOST INDEX.

Including Normal and Temporary or Accidental Parasites.

<i>MAN</i> —	Pulex irritans, Linn. Ctenocephalus felis, Roth. Ctenocephalus canis (Curtis), Baker. Ceratophyllus niger, Fox. Ceratophyllus fasciatus, Bosc. Argopsylla gallinacea (Westw.), End.
<i>Canis familiaris</i> —	Ctenocephalus canis (Curtis), Baker. Pulex irritans, Linn.
<i>Felis domestica</i> —	Ctenocephalus felis, Roth.
<i>Spilogale phenax</i> —	Anomiopsyllus Californicus, Baker.
<i>Mephitis occidentalis</i> —	Ctenocephalus felis, Roth. Pulex irritans, Linn. Ceratophyllus fasciatus, Bosc.
<i>Putorius xanthogenys</i> —	Ceratophyllus ignotus, Baker. Ceratophyllus spec., Fox. Ceratophyllus Wagneri, Baker.
<i>Lepus Bachmani</i> —	Hoplopsyllus affinis, Baker. Spilopsyllus inæqualis, Baker.
<i>Thomomys botte</i> —	Ceratophyllus ignotus (Baker), Wagner. Ceratophyllus fasciatus, Bosc.
<i>Scapanus Californicus</i> —	Corypsylla ornatus, Fox. Ceratophyllus ignotus (Baker), Wagner. Ctenopsyllus musculi (Duges), Wagner.
<i>Eutamias sp.</i> —	Ceratophyllus ciliatus, Baker.
<i>Neotoma sp.</i> —	Hystrichopsylla dippiei, Roth. Odontopsyllus sp., Fox. Ceratophyllus sexdentatus, Baker. Ceratophyllus acutus, Baker.
<i>Microtus Californicus</i> —	Ceratophyllus Californicus, Baker. Hystrichopsylla dippiei, Roth. Ctenopsyllus musculi (Duges), Wagner. Odontopsyllus spec., Fox. Ceratophyllus multidentatus, Fox. Ceratophyllus telchinum, Roth.

<i>Mus musculus</i> —	Ctenopsyllus musculi (Duges), Wagner. Lœmopsylla cheopis, Roth. Ceratophyllus fasciatus, Bosc.
<i>Mus rattus</i> —	Ctenopsyllus musculi (Duges), Wagner. Lœmopsylla cheopis, Roth. Ceratophyllus fasciatus, Bosc. Pulex irritans, Linn. Ctenocephalus canis (Curtis), Baker. Ceratophyllus Londoniensis, Roth.
<i>Mus Norvegicus</i> —	Ceratophyllus fasciatus, Bosc. Lœmopsylla cheopis, Roth. Pulex irritans, Linn. Ctenopsyllus musculi (Duges), Wagner. Ctenocephalus canis (Curtis), Baker. Ctenocephalus felis, Roth. Ceratophyllus acutus, Baker. Ceratophyllus niger, Fox. Ceratophyllus anisus, Roth. Hoplopsyllus anomalus, Baker.
<i>Citellus Beecheyi</i> —	Ceratophyllus acutus, Baker. Hoplopsyllus anomalus, Baker.
<i>Citellus sp</i> —	Ceratophyllus proximus, Baker.
<i>Gallus domesticus</i> —	Argopsylla gallinacea (Westw.), End. Pulex irritans, Linn. Ceratophyllus niger, Fox.
<i>Passer domesticus</i> —	Ceratophyllus niger, Fox.

MR. C. T. BRUES, Curator of Invertebrate Zoology in the Public Museum of Milwaukee, has been appointed Instructor in Economic Entomology at Harvard University under Professor Wheeler; after Sept. 1st his address will be Bussey Institution, Forest Hills, Boston, Mass.

CORRIGENDA.

Page 157, lines 11 and 5 from the bottom, and page 158, lines 2, 9, 16 and 21 from the top, for *Solidago ceasia* read *Solidago caesia*.

Page 158, line 18 from the top, for *Pedisca ceasiella* read *Pedisca caesiella*.

Page 159, line 12 from the bottom, for "destructive" read "descriptive."

Mailed June 4th, 1909.