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# A LIST OF PERLIDÆ FROM BRITISH COLUMBIA AND ALBERTA.

BY NATHAN BANKS, EAST FALLS CHURCH, VA.

Recently Prof. Raymond Osburn, of Columbia University, New York, turned over to me a large collection of Perlidæ made in British Columbia and Alberta. He spent two summers in this region, but collected chiefly in British Columbia. As the lot contains at least a fair proportion of the Perlid fauna of that region, I have made it the basis of a paper. I have also received some Stoneflies of this region from the Rev. G. W. Taylor and Prof. Harvey. In 1903 Mr. R. P. Currie (with Dr. Dyar and Mr. Caudell) spent a season at Kaslo, B. C. He has kindly permitted me to examine his catch of Perlidæ (about 100 specimens), which is now in the National Museum; and I have added his localities to the species in this list. All uncredited localities are from the collection of Prof. Osburn.

As most of the genera are readily separated, I have prepared a key to enable the collector to recognize them. The identification of species is a more difficult matter, and must be made, at present, by a specialist. Undoubtedly there are other species to be found in this region, but the genera are probably all represented in the list.

Perlidæ, like Lepidoptera, should be spread, at least partly, before identification. The essential specific characters are in the genitalia, but the size and markings of head and pronotum are quite constant in each form.

Five of the species are new, the most interesting being the new *Pteronarcys*.

## KEY TO GENERA.

1. In the hind tarsi the apical joint is at least a little longer than the two other joints together; anal setæ always distinct; the anal cell of fore wings usually gives off at least two veins from below..... ..2.

   In the hind tarsi the apical joint is at least a little shorter than the two other joints taken together; setæ often absent; the anal cell of fore wings never gives off but one vein from below.....10.

2. Anterior coxæ approximate; a series of cross-veins in anal region of fore wings..... (Pteronarcini) *Pteronarcys*.

   Anterior coxæ widely separate; rarely a series of cross-veins in anal region of fore wings ..... ..... (Perlini) 3.

3. Many cross-veins between radius and radial sector, as well as between branches of radial sector..... ..... *Perlodes.*
Rarely more than one cross-vein between radius and radial sector, and not many between branches of radial sector.....4.
4. Several cross-veins in middle part of fore wing, between branches of radial sector..... ..... *Acroneuria.*
Few, if any, cross-veins in middle part of fore wing, between branches of the radial sector.....5.
5. Ocellar triangle more than twice as broad as long; usually one cross-vein between radius and radial sector near end of latter; a dark spot near pterostigma ..... *Isogenus.*
Ocellar triangle not twice as broad as long; only abnormally a cross-vein between radius and radial sector near tip of latter .....6.
6. But two ocelli, and setæ very short; the pronotum broader than head..... *Peltoperla.*
With three ocelli.....7.
7. From the anal cell of fore wings there extend below two simple veins, or one simple and one forked..... .....8.
From the anal cell of fore wings there extends below but one vein, which soon forks.....9.
8. Hind wings with but two cross-veins in the cubital area, one near base, one near tip; small greenish or yellowish species..... *Isoperla.*
Hind wings with a series of cross-veins in the cubital area; radial sector of fore wings usually twice forked ..... *Perla.*
9. A series of cross-veins in cubital area of hind wings; radial sector of fore wings forked twice ..... .....*Paraperla.*
No series of cross-veins in cubital area of hind wings, only one near base, and one near tip; small greenish or yellowish species ..... .....*Alloperla.*
10. Anal setæ obscure or absent; one branched vein from anal cell of fore wings; a series of cross-veins in median and cubital areas of fore wings..... .....(Nemourini) 11.
Anal setæ distinct; one simple vein from anal cell of fore wings; no series of cross-veins in median and cubital areas of fore wings .....(Capnini) 14.
11. Second joint of tarsi subequal to first; no oblique cross-vein beyond end of subcosta.. ..... *Tæniopteryx.*
Second joint of tarsi much shorter than first..... 12.

12. An oblique cross-vein beyond end of the subcosta ; wings not involute.... ..... ..... *Nemoura.*
No oblique cross-vein beyond end of subcosta..... 13.
13. Wings involute ; pronotum as broad as long ..... *Leuctra.*
Wings not involute ; pronotum longer than broad ..... *Perlomyia.*
14. The space beyond discal cell longer than discal cell..... *Arsapnia.*
The space beyond discal cell shorter than the discal cell .... *Capnia.*

LIST OF SPECIES.

*Pteronarcys Californica*, Newport. — A female from Vancouver (Harvey).

*Pteronarcys princeps*, n. sp.—Head dark brown or black above, pale around ocelli ; antennæ blackish-brown ; pronotum black ; a reddish-yellow spot in middle of front and hind margin, not distinctly connected ; rest of thorax blackish ; abdomen paler brown, blackish on pleura, base of venter paler. Legs dull blackish-brown ; wings rather smoky to quite dark, the apical third from just before the pterostigma outward is more infuscated, and there is a more distinct black cloud below the pterostigma; venation blackish-brown ; in the male the basal part of the abdomen is rather orange. The head is much narrowed in front ; the pronotum has all the angles acute, and the sides are slightly rugose ; the male tip of abdomen is much like *Pt. Californica*, but the scar each side is larger, and the area that separates them is narrower at tip than in that species. The ventral plate of the female (Fig. 16) has two very large hairy processes fully three times as long as in *Pt. Californica*.

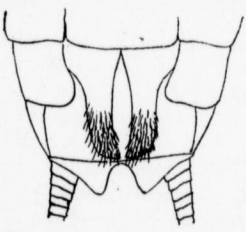

FIG. 16. — Ventral plate of female of Pteronarcys princeps.

Expanse, 70–75 mm.

One pair from Mission, B. C., April (Harvey).

*Perlodes signata*, Hagen.—Vancouver, 12th April (Harvey).

*Perlodes irregularis*, Banks.—Glacier, B. C., 21st August, and Laggan, Alta., 22nd July and 23rd August ; Kaslo, B. C., June (Currie, Dyar, Caudell) ; Ainsworth, 11th July (Currie).

*Isogenus frontalis*, Newman.—Vancouver, 19th May (Harvey) ; Kokanee Mt., B. C., 10th August, 9,000 ft., on snow (Currie).

*Acroneuria Quebecensis*, Provancher.—A pair from Laggan, Alberta, 22nd July.

The female has a notched ventral plate like a specimen in the Hagen coll. at the M. C. Z., labelled *A. Quebecensis*. It is a narrower and darker species than *A. pacifica*.

*Acroneuria pacifica*, Banks.—Nicolum River, Hope, B. C., 13th July (Harvey); Vancouver (Harvey).

*Perla sabulosa*, Banks.—Port Renfrew, B. C., 3rd July.

*Perla ebria*, Hagen.—Vancouver (Harvey); Glacier, B. C., 22nd August; Wellington, B. C., 9th August (Taylor); Laggan, Alta., 22nd July; Banff Sp., Alta., 16th August (Currie).

*Paraperla frontalis*, Banks.—Laggan, 23rd August.

*Isoperla decolorata*, Walker.—Described from Great Bear Lake. I have not seen it from British Columbia, but it occurs in Alaska and in Eastern Canada.

*Peltoperla brevis*, n. sp.—Head pale, with a large, ill-defined black cloud on the middle, not extending to the mouth; antennæ brown; pronotum brown, its margin paler; thorax dark brown or black; abdomen brown; legs pale yellowish; wings subhyaline, venation brown, costal veins yellowish. Structure similar to *P. arcuata*. Head broad, bent downward, two ocelli, about as close to each other as to eyes; antennæ slender, about as long as front legs, the joints rather nodiform; pronotum very broad, slightly angulate behind on the middle, its sides straight, surface quite strongly rugose; abdomen broad and short, setæ very short, scarcely one-half as long as width of abdomen; anal plate of female (Fig. 17) large, notched at middle behind. Wings rather short and broad, many central cross-veins, radial sector forked once beyond anastomosis; anal cell with two widely-separated branches behind.

Expanse, 18–20 mm.

From Glacier, 21st August, and Port Renfrew, 3rd July.

*Alloperla Coloradensis*, Banks. — Port Renfrew, 2nd July; Glacier, B. C., 20th July and 21st August; Laggan, Alta., 23rd August; Kaslo, B. C., 18th June (Currie); Ainsworth, B. C., 11th July (Currie); Kokanee Mt., B. C., 10th August, 8,000 ft. (Currie).

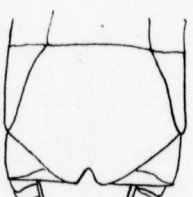

FIG. 17.—Ventral plate of female, Peltoperla brevis.

*Alloperla imbecilla*, Say.—Port Renfrew, B. C., 3rd July; Glacier, B. C., 20th July and 21st August; Bear Lake, B. C., 20th July (Currie); Ainsworth, 11th July (Currie).

*Alloperla pacifica*, Banks.—Port Renfrew, B. C., 3rd July.

*Alloperla borealis*, Banks.—Port Renfrew, 29th June; Banff, Alta., 17th June; Laggan, Alta., 22nd July and 23rd August.

*Tæniopteryx pacifica*, Banks.—Banff, Alta., 17th June; Kaslo, B. C., 18th June (Currie).

*Tæniopteryx occidentalis*, Banks.—Kaslo, B. C., 18th June (Currie). One specimen, the second I have seen.

*Nemoura cinctipes*, Banks.—Port Renfrew, 3rd July; Goldstream, B. C. (E. A. Anderson); Wellington, B. C., 29th February (Taylor); Laggan, Alta., 23rd July; Kaslo, B. C., 18th, 30th June, 16th August (Currie, Caudell).

*Nemoura depressa*, Banks.—Laggan, Alta., 21st August; Bear Lake, B. C., 20th July (Currie).

*Perlomyia collaris*, Banks.—Wellington, B. C., 26th April (Taylor).

*Arsapnia grandis*, n. sp.—Black; antennæ brownish; legs brownish; wings brownish, sometimes darker on the anastomosis; venation dark brown. Posterior ocelli about twice as far apart as from the eyes; pronotum about as long as broad, narrowed behind, slightly rugose each side; abdomen elongate, setæ nearly as long as the abdomen, their joints (beyond basal ones) very long and slender; hind tibiæ scarcely reaching to tip of abdomen. Wings large and elongate, three to seven costal cross-veins, also one beyond end of subcosta, apical cells longer than discal cell; in the median and cubital areas there is but one cross-vein, which is continuous.

Expanse, 22–26 mm.

Specimens from Wellington, February; Vancouver, April; and Banff, Alberta, 17th June.

*Arsapnia decepta*, Banks.—Banff, Alta., 17th June.

*Leuctra occidentalis*, n. sp.—Black; antennæ brownish; legs pale brown; dorsum of abdomen reddish; wings smoky, veins brown, costal area at extreme base brown. Head with some fine white hairs; pronotum broader than long, rather narrowed behind, its surface slightly rugose, with a broad median depression containing a median ridge. Wings rather short and broad, the radial sector forks before the upper

cross-vein, but beyond the lower cross-veins, about six cross veins in the median series, and in the cubital series there are two, rarely three, cross-veins beyond the last of the median series; in the hind wings the radial sector forks as in the fore wings, and there are five cross-veins in an irregular transverse row. The apical claw-like joint of the male claspers is jet black; before them there is an erect, slightly curved median tooth. (Figs. 18, 19.)

FIG. 18.—Ventral view of male genitalia, Leuctra occidentalis.

FIG. 19.—Side view of male genitalia, L. occidentalis.

Expanse, 12–14 mm.

From Laggan, Alta., 23rd August; Ainsworth, 11th July (Currie); Bear Lake, 29th July (Currie).

*Leuctra augustus*, n. sp.—Black; head with some short, fine white hairs; antennæ brownish-black; abdomen, beyond base, rather reddish; legs yellowish-brown, hind femora darker towards tip; wings rather fumose, venation yellowish-brown. Pronotum fully twice as long as broad, slightly rugose each side, a median depressed area with a central ridge; abdomen slender; legs very long, especially the hind pair, being plainly longer than the entire body Wings very slender, reaching fully one-half their length beyond the tip of the abdomen, the radial sector forks beyond the lower cross-vein, and before the upper one, about six cross-veins in the median series, and in the cubital series there are three or even four cross-veins beyond the last of the median series.

Expanse, 18 mm.

From Port Renfrew, 10th August.

## ON A FEW ORIENTAL GEOCORIDÆ [HEMIPTERA].

BY G. W. KIRKALDY, HONOLULU, H. I.

1. *Dieuches femoralis*, Dohrn.

*Hab.*—India, Kangra Valley, 4,500 feet (Oct., G. C. Dudgeon).

What I suppose to be a nymph of the 5th instar may be described as follows: Dull black; the narrowly laminate lateral margins of pronotum and of tegminal pads, some pleurital spots, coxæ, trochanters, base of femora of middle and hind femora, the fore and middle tibiæ (except apically), first segment of tarsi, pale yellowish, rest of hind tibiæ piceous. Second segment of antennæ fuscous, darkening apically, a pale ring near the base of the fourth. The pronotum is slightly impressed transversely near the base, and slightly impressed longitudinally inside the laminate lateral margins; there is a distinct collar, wider medially than at the sides. Fore femora only slightly incrassate and very feebly dentate.

*Aphanus Kangricus*, sp. nov.—Apparently belongs to Stal's subgenus *Xanthochilus*, and probably allied to *A. orientalis*, but the transverse impression on the pronotum is much more distinct. Dull blackish, with brownish hairs. Labium pale piceous; eyes reddish-brown, darkening outwardly; ocelli colourless. Laminate lateral margin of pronotum yellowish-brown, hind area pale castaneous, punctured with blackish. Scutellum apically fading a little, punctured with black. Ambulacra, trochanters, base of femora, first two segments of tarsi, hind margin of metasternum, etc, pale castaneous, rest of legs more or less piceous. Tegmina testaceous, subhyaline, with brown punctures; about the apical half brown-fuscous, with a large subtriangular pale yellow spot on the outer half of the middle; basal half of membrane smoky, except one pale, undulating vein and two spots; apical margin irregularly and faintly smoky.

Form apparently that of *A. orientalis*, but the pronotum is impressed transversely basad of the middle, the lateral margins of the pronotum laminately keeled. Antennæ as in *A. orientalis*. Labium reaching a little beyond the middle of the mesosternum. Clavus with three rows of punctures. Fore femora more strongly incrassate than in *A. orientalis*, and have two strong submedian spines and a few feeble ones; tarsi dilated at the apex. Hind femora not dentate. Length, 8½ mill.

*Hab.*—India, Kangra Valley, 4,500 ft. (June, G. C. Dudgeon).

*Bedunia*, Stal.

1. *B. taprobanes*, sp. nov.—Blackish. Ocelli red. Antennæ blackish-fuscous, second segment (except the apex) pale fuscous; basal half of 4th (except base) white. Labium yellowish-testaceous. Lateral margins of

hind lobe of pronotum yellowish-fuscous. Collar very short, ferruginous. Two ferruginous spots on the middle of the scutellum. Tegmina brownish-yellow; clavus and basal half of corium largely fuscoferruginous, with blackish-brown punctures; apical half of corium dark fuscous-brown, a large pale yellow spot subapically. Membrane dark fuliginous, marked slightly with yellow. Fore femora, apex of middle femora, apical third of hind femora, apices of tibiæ, fuscopiceous, rest yellowish. *Labium* reaching the middle coxæ, *first segment not nearly reaching the base of the head*, but about the hind margin of the eyes. Clavus rather irregularly punctured in four rows. Fore coxæ strongly spined. Length, 7½ mill.

*Hab.*—Ceylon, Pundaluoya (July).

This was sent to me about ten years ago by Mr. E. E. Green. It seems to be rare, as it is not described in the "Fauna of India." My example has unfortunately lost its abdomen, but it is otherwise perfect, and the species is distinct.

*Edulica*, Distant.

Distant places *Edulica* in the Clerardini. Apart from the general habits, which places it in his "Rhyparochromaria" perhaps, the labial structure at once removes it from the Clerardini; in *Edulica* the first segment alone is equal in length to the head, while the principal character of the *Clerardini* is that the first two segments together are about this length.

*Macropes*, Motsch.

1. *M. sinhalanus*, sp. nov.—Black (shining on head and pronotum), with sparse, very pale yellowish hairs; apex of tylus and the first and second antennal segments pale ochraceous, third and fourth dark fuscous. Clavus piceous, very narrowly margined with testaceous; rest of tegmina opaque milky-white, inner margin (very narrowly) of corium, and a broad suffused band across the middle (somewhat obliquely covering junction of corium and membrane) dark fuscous. Labium and legs more or less piceous, first two segments of tarsi brownish-testaceous, hind tibiæ dark piceous, antennæ 4, 10, 11, 20. Labium reaching to about the fore coxæ. Pronotum anteriorly and posteriorly punctured; a double, rather feeble line of punctures down the middle; roundly curved outwards laterally, sides of hind area parallel, posteriorly emarginate. Tegmina reaching to apical margin of third segment. Fore femora comparatively strongly spined. Length, 5¼ mill.

*Hab.*—Ceylon, Peradeniya. Mr. E. E. Green sent me this some ten years ago, and it has remained undescribed up till now.

# DIPLONYCHUS, LAPORTE (=HYDROCYRIUS, SPINOLA), AND ITS RELATION TO THE OTHER BELOSTOMATID GENERA.

BY J. R. DE LA TORRE BUENO, NEW YORK.

The genus *Hydrocyrius* was founded in 1850 by the Marquis Maximilian Spinola,[1] and since then it has figured under that name. It has been redescribed several times under different appellations. Stål called it *Ilyotrephes*;[2] A number of other authors[3] have treated it as a species of the old genus *Belostoma*, Auctt. (now *Amorgius*, Stål). But the question nevertheless arises, "Is this the true generic name, or have we another valid appellation for the genus?" In consulting a number of works and papers for material for these notes on the affinities of *Hydrocyrius*, Laporte de Castelnau's[4] definition of the genus *Diplonychus* attracted my attention. It reads thus: "Antennæ breves, sub oculos in excavatione insertæ, articulis 4; ultimis 3 subpectinatis. Rostrum breve, arcuatum, acuminatum. Tarsi articulis 2; ungulis 2.

"Faciès des Bélostomes; l'abdomen des femelles est terminé par deux longs filets.

"Ier Sous-genre. *Diplonychus*, Mihi.

"Corpus elongatum; tarsorum anticorum unguiculis elongatis. *Belostoma rustica*, FAB., 106, 3.

"Et plusieurs autres espèces exotiques.

"IIme Sous-genre. *Sphærodema*. Mihi, etc."

Further on in the same work (p. 83) he states: "C'est par erreur que j'ai indique (page 18) le *Belostoma rustica* de Fabricius, comme type du genre *Diplonichus* (!). Cet insecte est un *Sphærodema*."

Now, according to my understanding of Kirkaldy's views on the historical method of type fixation,[5] this leaves the subgenus without a type species. The fact that subsequent authors have raised the subgenus to full generic standing, and that under it they have grouped Belostomatids with two *short* claws, in no way invalidates the original description, which specifically indicates that in the typical subgenus *Diplonychus* the claws of the anterior tarsi are *elongate*. Moreover, the

1. 1850, Mem. Mat. Soc. Modena, xxv, 146.

2. 1856, Ofv. Vet. Ak. Förh, p. 358.

3. Dufour, Belostoma algeriense; Lucas, B. grande; Guérin, B. capitatum; Coinde, B. cosmopolitanum.

4. 1832, Essai d'une Class. Hém. p. 18 (of separate).

5. 1905, Proc. Ent. Soc. Wash., Vol. XII, pp. 27 to 28.

body is stated to be *elongate*. Now, no species of the genus or genera variously known as *Atomya*, Spinola; *Appasus*, Amyot and Serville; *Cyclodema*, Dufour; *Nervinops*, Dufour; *Sphærodema*, Auctt., and *Diplonychus*, Amyot and Serville, of those that I have seen (and my collection contains nearly all the known species which at one time or another have been ranged in these genera), is *elongate*. All are more or less ovate. This view was enunciated by Leon Dufour in his "Essai Monographique sur les Bélostomides,"[6] who then said under *Hydrocyrius*, Spin. (p. 385): "On a peut être mal interpreté le genre *Diplonychus* fondé en 1832, par M. de Laporte. Cet auteur dit positivement que les *Diplonychus* ont le faciès des *Belostoma;* que leur corps est *elongatum*, que les tarses antérieurs se terminent par deux ongles *elongati*. Je le demande aux esprits sérieux, ces traits sont-ils applicables aux *Diplonychus* des auteurs de l'epoque? Quant à moi qui ai etudié à fond cette question, j'ai l'intime conviction que le Diplonychus de M. de Laporte a du être primitivement, fondé sur un grand *Bélostome*, analogue à mon *Algeriense*."[7]

Prof. Montandon has discussed the synonymy of this genus in one of his able essays on Water-bugs,[8] and his conclusion is that *Diplonychus*, Lap., being unidentifiable, it is better dropped for the defined *Sphærodema*, Lap., although he suggests that Laporte may have had before him a nymphal Belostomatid (which is two-clawed) or a species of *Hydrocyrius*. In his discussion, however, it is evident that he is unfamiliar with Laporte's later note cited above, in which he removes *Belostoma rustica*, Fab., from the subgenus, and states that it is a *Sphærodema*. While it is true and proven that nymphal *Belostomatids* are two-clawed, none of those known to me have the so-called "filets abdominaux" or "caudal setæ." These are characteristic of the adult only, and are *not* sexual characters, but rather pertain to the respiratory apparatus, and are parts of the highly specialized and modified sixth abdominal segment. I am familiar with all but one of the described Belostomatid genera, and know about fifty species, but of these the only ones that have the "facies des Belostomes," and are at the same time two-clawed, are the two species of *Hydrocyrius* I possess.

6. 1863, Ann. Soc. Ent., Fr. (4), III.

7. =columbiæ, Spin. (Hydrocyrius).

8. 1900. Notes s. qqs. genres de la Fam. Belostomidæ—Bull. Soc. Sci. Buc. An. IX, No. 2 and 3, pp. 1 to 8 (of separate).

My friend Kirkaldy, in his recently-published list of genera,[9] rejects Montandon's work and adopts *Diplonychus*, Lap., as the true generic appellation of the *Sphærodema-Appasus-Nervinops-Cyclodema-Atomya* series, but in consideration of the facts I have here set forth, the correct synonymy, which may be intercalated in Kirkaldy's generic list, p. 151, is as follows :

Genus 5.—*Sphærodema*, Laporte, 1832, Essai Hem., 18 (type fig. in Fieber, etc.). The rest of the synonymy as in Kirkaldy, l. c .....Type *annulata*, Fabr.

Genus 7.—*Diplonychus*, Laporte, 1832, Essai, p. 18.
= *Hydrocyrius*, Spinola, 1850, etc. (The remainder of the synonymy as in Kirkaldy, l. c., p. 152.)

II.

What is the true systematic position of *Diplonychus*, Lap. (= *Hydrocyrius*, Spinola)? Kirkaldy in his work cited places *Hydrocyrius*, Spin. (recte *Diplonychus*, Lap.), between *Limnogeton*, Mayr, and *Nectocoris*, Mayr, this genus being placed last in the family. Going further back, Mayr[10] places it between *Benacus*, Stal, and *Limnogeton*, Mayr, and so does Stål.[11] Dufour,[12] however, seems to have been the only one of the older entomologists to have had the true conception of the affinities of *Diplonychus*, Laporte (= *Hydrocyrius*, Spinola). He places it between *Belostoma*, Auctt., nec Latr. (= *Amorgius*, Stål), and *Zaitha*, Am. & S. (= *Belostoma*, Latreille). Agreeing with Dufour, I believe the linear relationship of the Belostomatid genera is more nearly expressed by the following order :

1. *Benacus*, Stal.
2. *Amorgius*, Stal.
3. *Diplonychus* (Laporte), Bueno.
4. *Belostoma*, Latreille.
5. *Abedus*, Mayr.
6. *Limnogeton*, Mayr.
7. *Nectocoris*, Mayr.
8. *Sphærodema*, Laporte.

9. 1906, List of the Genera of the Pagiopodous Hemiptera, etc., Tr. Am. Ent. Soc., XXXII, No. 2, pp. 117 to 156 and 156a.

10. 1871, Die Belostomiden, Verh. Zool. bot. Geo. Wien., XXI.

11. 1865, Hem. Afr., III.

12. 1863, Ess. Mon. s. l. Belost., Ann. Soc. Ent. Fr. (A.) III.

These genera may be separated by the following table:

1. (2) Anterior femora not sulcate.....I, *Benacus*, Stal.
2. (1) Anterior femora sulcate.
3. (10) Anterior tarsi with two claws.
4. (9) Claws of anterior tarsi of equal length, minute.
5. (8) Anterior femora more or less incrassate, much larger than tibiæ.
6. (7) Species with two sulci between the eyes .VII, *Nectocoris*, Mayr.
7. (6) Without such sulci .....VIII, *Sphærodema*, Lap.
8. (5) Anterior tarsi scarcely incrassate, but little larger than tibiæ.....VI, *Limnogeton*, Mayr.
9. (4) Claws of anterior tarsi of equal or unequal length, elongate .....III, *Diplonychus*, Lap. (Bueno).
10. (3) Anterior tarsi with one claw.
11. (14) Head conically produced, rostrum long, thin.
12. (13) Membrane of hemelytra large.....IV, *Belostoma*, Latr.
13. (12) Membrane of hemelytra much reduced.....V, *Abedus*, Stal.
14. (11) Head not conically produced, rostrum short, stout.....II, *Amorgius*, Stal.

A brief study of the three genera, *Amorgius*, Stal; *Diplonychus*, Laporte (Bueno), and *Belostoma*, Latreille, is necessary in order to elucidate my position. The difference between the adults of the three genera will appear from the following comparisons:

The Head.—In *Amorgius* we have the front truncate, projecting but little beyond the eyes, which are in general longer than broad. The vertex also is not wider than one eye, and is more or less conical in shape, as is *Belostoma*. But in *Diplonychus* the vertex is not wider than the eye, while in *Belostoma* it is. In both the eyes are wider than long. The rostrum in *Amorgius* is quite short and stout, and in *Belostoma* very long and slender, whilst in *Diplonychus* it is moderately long, and as stout as in the first-named genus. The prothorax is trapezoidal in all three genera, but is much less narrowed anteriorly in *Diplonychus* than in the other two, which gives it a massive aspect. The scutellum also is apparently large, due to the more stout general build of this bug. The hemelytra are much the same in the three except for slight variations, which are no greater than those occurring in the different species of any one genus. *Diplonychus* agrees with *Amorgius* in the general outline, the sides being more or less parallel, whilst in *Belostoma* the body is more or less pointed oval posteriorly. We now come to the under side of the body and the legs. The

genital plate in *Diplonychus*, as in *Belostoma*, is entire, while in *Amorgius* it is deeply fissured medianly. In shape it is much the same throughout the family, although much shorter in *Belostoma* than in the other two genera. The tibiæ of the third pair of legs in *Amorgius* is flattened, more or less broad, heavily fringed with long hairs, and terminates in two long claws. *Belostoma* and *Diplonychus*, on the other hand, have prismatic posterior tibiæ, and the hairs are shorter. The form of the intermediate tibiæ is the same in each genus as the posteriors. It is in the anterior pedes that the most interesting features occur. The femora are incrassate in all three, but while in *Belostoma* they are only moderately so, in *Diplonychus* and *Amorgius* they are greatly so. All three genera have them deeply sulcate for the reception of the tibiæ, which are of similar shape in all. The tarsal joints are moderately long and equal in *Belostoma*. In *Amorgius* and *Diplonychus* they are small and unequal. The profound yet most significant character is contained in the anterior tarsal claws. These are single, long in *Amorgius*, and small in *Belostoma*. In *Diplonychus* they are *double* and *long*, though the outer is but half the length of the other in the two species known to me, while in one described by Mayr they are of equal length. The importance of this structural feature can be appreciated only from the study of the nymphs taken in conjunction with the changes that occur in the claws during development. As various authors[13] have from time to time pointed out, Belostomatid nymphs of the several genera are all two-clawed in the anterior tarsi throughout all, or in some of the earlier, instars. In general, the nymphs of *Amorgius* possess two elongate equal claws up to the last moult, one of which they lose at that ecdysis, and the adult has only one more or less long tarsal claw. In the several nymphs of *Belostoma*, as I have elsewhere noted,[14] some lose the one claw early, others by slow stages,[15] at some one of which the length of one claw bears the same relation to the other as the adult in *Diplonychus* known to me. In this last-named genus, however, the nymph in the last instar has the two long claws of equal length,[16] as in *Amorgius*. At the last moult in two species one of these claws is reduced to half the length of the other, while in the third, known to me only by description, the two equally long claws are preserved.

13. 1863, Dufour, op. c.; 1871, Mayr, op. c.; 1901, Howard, Ins. Bk., p. 279; 1906, Bueno, CAN. ENT., XXXVIII, p. 197; and others.

14. Op. c.

15. Cf. *B. fluminea*, op. c.

16. Duf., Ann. Soc. Ent. Fr. (A.)III, p. 386, description of nymph in last instar of *Hydrocyrius algeriensis*.

The egg-laying habits of *Diplonychus* are as in *Belostoma*,[17] in which genus (as well as in several others of the family) the female fastens the eggs on the back of the male. *Amorgius*, however, deposits its ova under a convenient log or plank in a damp spot at the water's edge, glued to it, which also appears to be the habit with *Benacus*.[18] To recapitulate: *Diplonychus*, Lap. (Bueno), approaches *Belostoma*, Latreille, in the shape of the eyes, the genital plate, the posterior and the intermediate tibiæ, and in the manner of oviposition. It is close to *Amorgius*, Stål, in the form of front and vertex, general shape, anterior femora, tibiæ and tarsal joints, and in the claws in the nymph. It is intermediate in the rostrum, which tends to the *Amorgius* side. It resembles both genera in the shape of the scutellum, in the membrane, of the hemelytra, and in most of the other features not dwelt upon. The differences are the general shape of the head, which is very broad, the shape of the prothorax, and, above all, in the possession of two long claws in the adult, of equal length in one known species, and unequal in the other two. From this last character, taken in conjunction with the nymphal structure of these appendages in the two allied genera, as well as in the others of the family, we may in fairness conclude: 1st. That *Diplonychus* is an intermediate form in the chain of development linking the Amorgioid forms to the Belostomoids; and 2nd. That it is in all likelihood the most primitive form of the Belostomatid series, from which arise the genera *Amorgius*, Stål, and *Benacus*, Stål, on the one hand, and *Belostoma*, Latr.; *Abedus*, Mayr; *Limnogeton*, Mayr; *Sphærodema*, Lap., and *Nectocoris*, Mayr, on the other.

To sum up, it would appear that *Diplonychus*, Laporte (Bueno), is nearly allied to both *Belostoma*, Latr., and *Amorgius*, Stål, with closer leanings to the latter, and that its systematic position is as given in the linear arrangement between these two genera.

III.

The species and distribution of *Diplonychus*, Lap. (Bueno), are moot questions. A great deal of confusion has arisen from the description and rediscription of what is said to be one species from several widely-separated localities. I recognize three species, but it is more than likely that some of those reduced to synonymy may be later revived as our knowledge of

17. 1906, Bueno, op. c. p.; 1900, Horvath in Lit., quoted by Mont. Bull. Soc. Sci. Buc. An. IX, No. 2 and 3, p. 8.

18. 1889, C. M. Weed, Studies in Pond Life, Bull. Ohio Agr. Exp. Sta., Tech. ser., I, No. 1; 1907, Needham, Ent. News, XVIII, pp. 113 to 116.

the genus and the group at large increases. They are *Diplonychus columbiæ*, Spinola; *D. punctatus*, Stål, and *D. rectus*, Mayr, the two first of which I am acquainted with in nature, and the latter by description. They may be separated as follows:

KEY TO THE SPECIES OF *Diplonychus*, Laporte.

1. (2) Anterior tarsi furnished with two claws of *equal* length.....III, *rectus*, Mayr.
2. (1) Anterior tarsi furnished with two claws of *unequal* length.
3. (4) Disk of prothorax punctate, with two pronounced round foveæ, hemelytra more or less punctate..... ... II, *punctatus*, Stål.
4. (3) Disk of prothorax slightly punctate, with two shallow foveæ and two sulci converging posteriorly toward the transverse sulcus, hemelytra impunctate.....I, *columbiæ*, Spinola.

I.—*Diplonychus columbiæ*, Spin.

*Hydrocyrius columbiæ.*

1850.—Spin, Mem. Nat. Soc. Modena, XXV, 146.
1863.—Duf., Ess. Mon. Bel., Ann. Soc. Ent. Fr. (4), III, 385.
1864.—Lucas, Ann. Soc. Ent. Fr., IV., 228.
—Signoret, op. c., 224.
1865.—Mayr, Reise der Novara, Hem., p. 183.
1871.—Ibid, Die Belostomiden, Verh. Zool.-bot. Ges. Wien, XXI, 429, part.
1886.—Uhler, Ch. List, p. 28.
1895.—Schmidt (Schwedt), S. B. Ges. Nat. Freunde Berlin, p. 38.
1900.—Montandon, Bull. Soc. Sci. Nat. Buc. An. IX, No. 2 and 3, p. 4.
1901.—Champion, Biol. Cent. Am., Het., II, 362.

*Belostoma grande.*

1849—Lucas, Hist. Nat. An. Art. Alg., III, 43.
1862.—Ibid, Ann. Soc. Ent. Fr., II, 404.
1864.—Ibid, op. c, IV, 227.

*Ilyotrephes herculeus.*

1853.—Stål, Öfv. Vet. Ak. Förh., V, 264.

*Hydrocyrius herculeus.*

1866.—Stål, Hem. Afr., III, 181.

*Belostoma algeriense.*

1855.—Duf., Mem. Soc. Ac. Sci. Liege, X, 187, pl. I, f. 1.
1862.—Lucas, Ann. Soc. Ent. Fr. II, 404.

*Belostoma capitatum.*

1856.—Guérin, in Sagra's Hist. Cuba, An. Art., VII, 420.

1865.—Mayr, Reise der Novara, Hem., p. 183.

*Belostoma cosmopolitanum.*

1863.—Coindé, Rev. Mag. Zool., 33.

1864.—Lucas, Ann. Soc. Ent. Fr., IV, 227.

Ever since this species was first described, it has been recorded from time to time from the most widely-separated places. The distribution, as given by Dufour and Mayr, is as follows:

*America.*—Mexico and Cuba.

*Africa.*—Algeria, Khartoum, Guinea, Caffraria and Madagascar. This distribution, however, seems to me too scattered to be real.

Mexico is given following Spinola, while under the supposition that *Belostoma capitatum*, Guér., is the same insect, the Cuban record comes into existence. Madagascar is given by Mayr, on the ground that *punctatus*, Stål, described from the Island, is merely a synonym of *columbiæ*, Spinola. This is not the case, however, as the former is readily distinguishable from the latter, as may be seen by the analytical table. The homogeneity, so to say, of the other localities, added to the fact that in Algeria at least the Hemipteron seems to have been fairly common, would appear to establish them as real beyond reasonable doubt. In addition, I have a specimen from German East Africa. It may, therefore, be safely stated that the bug is African, and that it is spread over the greater part of the continent. Its existence in America is problematical, to say the least, and although Champion refers to it in Biologia Centrali Americana, he does not list it, but states as his opinion that "In addition to the species enumerated here, two others have been recorded from Mexico, but further evidence is required before they can be included in our list; these are *Hydrocyrius columbiæ*, Spinola," etc. In confirmation of this, my personal endeavours to secure the bug, either from Cuba or Mexico, have thus far proven fruitless. It seems best, therefore, to ignore the American records, at least till they are absolutely confirmed or disproved.

II.—*Diplonychus punctatus*, Stål.

*Hydrocyrius punctatus.*

1865.—Stål, Hem. Afr., III, 182.

*H. columbiæ*, partim.

1871.—Mayr, Die Belostomiden, Verh. Zool.-bot. Ges. Wien, XXI, pp. 429, 430.

This bug was reduced by Mayr to synonymy, and evidently he did not consider it more than a local variety. In fact, he says so in so many words (op. c., p. 430). The species, however, is well marked. Stål recorded it from Madagascar originally, and it does not appear to have been mentioned since. I possess a specimen from that Island. It is apparently restricted to that territory.

III.—*Diplonychus rectus*, Mayr.

*Hydrocyrius rectus.*

1863.—Mayr, Verh Zool.-bot. Ges. Wien, p. 359.
1864.—Signoret, An. Soc. Ent., Fr. (4), IV, 224.
1871.—Mayr, Die Belostomiden Verh Zool.-bot. Ges. Wien, XXI, 430.

No other records are to be had of this well-defined species than that of the author, who gives Sierra Leone (West Africa) as its habitat. It is 10 mm. shorter than *punctatus*, Stal, from which the character given in the table at once separates it.

In conclusion, I wish to express my thanks to Mr. G. W. Kirkaldy, whose independent investigation when I called his attention to the generic emendation proposed, confirmed the conclusion I had already reached. He added in his letter other important synonymical matter, which it is to be hoped he will make public ere long.

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## PRACTICAL AND POPULAR ENTOMOLOGY.—No. 23.

### Fumigation with Hydrocyanic Acid Gas for Bedbugs.

BY GLENN W. HERRICK, AGRICULTURAL COLLEGE, MISS.

*Fumigation of a Large Building.*

For the past two years we have used hydrocyanic acid gas on an extensive scale with considerable success, and thinking that the experience gained might be of benefit to other workers who may be confronted with the same problem it seemed worth while to give an account of the work and method of procedure.

Our dormitory building, in which the work has been done, is a large 4-story structure in the form of an E, and contains, all told, 253 rooms of different sizes on the different floors. We use approximately the formula recommended by Dr. L. O. Howard in Circular 46, s.s., the only change

being that we consider 30 cc. as the equivalent of a fluidounce. It takes about 340 pounds of cyanide (98% pure) and the same quantity of sulphuric acid to give the building a single treatment, not including the halls, which are thoroughly scrubbed with lye and water.

Our first work was to measure the rooms and compute the cubic contents of each. With the exception of a few corner rooms, they are as follows :

| Floor. | Cu. Ft. | Cyanide. | Water. | Acid. |
|---|---|---|---|---|
| 4 ..... | 1960 | 1¼ lbs. | 1200 cc. | 600 cc. |
| 3 ..... | 2352 | 1½ lbs. | 1440 cc. | 720 cc. |
| 2 ..... | 2352 | 1½ lbs. | 1440 cc. | 720 cc. |
| 1 ..... | 2744 | 1¾ lbs. | 1680 cc. | 840 cc. |

In computing the amounts of cyanide, water and acid to be used, we always raise the cubic feet in any given room to the next even hundred. For example, the capacity of each room on the fourth floor, which is 1960 cubic feet, was considered to be 2000 cubic feet.

In the fumigation we attempted to treat one-fifth of the building each successive day. It is to be noted that there are three wings and a long front, twice as long as each wing. This affords a natural division of the building into five parts, each division containing an average of about 50 rooms. We begin on one wing by setting six men to caulking the windows and transoms with strips of newspaper about four inches wide and thoroughly soaked in water. The paper is first torn into strips and then placed in pans of water, where it is allowed to remain until thoroughly soaked. These wet strips are then quickly and effectually applied to the top, bottom and sides of each window and transom or other cracks that may be found in the room.

At the same time two men are placing ordinary china wash-bowls in each room with the proper amount of water and acid in each. Beside each bowl is also placed the proper amount of cyanide on a piece of newspaper spread flat on the floor.

We usually try to begin at such a time in the day that the rooms in one wing will be ready for fumigation at about 6 p.m. It takes the force

enumerated above about four or five hours to do this, so that we should begin about 1 p.m. As a matter of fact, the time varied considerably owing to unforeseen additional labour. When everything is ready two men go to the top floor, and beginning at one end of the hall, pass into opposite rooms, one man on each side of the hall, gather the edges of the newspaper in the fingers and pour the cyanide *directly* into the acid and water and walk quickly out of the room, closing the door after them. There is not the slightest danger, apparently, in pouring the cyanide directly into the acid and water if one does it coolly and quickly and holds the breath for a few seconds until the door is reached. Of course, the chemical reaction is very rapid and begins immediately, but by reaching the hand out over the bowl and turning the head a little away and holding the breath a few seconds we have never in all of our work—and we have always done it that way—experienced the slightest annoyance from the gas. By passing rapidly down the hall from room to room and floor to floor two men will set the whole 50 rooms off in ten or fifteen minutes.

Our success last year was very gratifying indeed, although we had some complaints of bedbugs in a few rooms late in the session. This, in most instances, could be traced to some old wooden bedsteads that had not been fumigated, and which I supposed were to be thrown out and destroyed, but which were used afterwards by students who, coming late in the session and finding these old bedsteads, utilized them instead of buying new ones. In a few cases I believe it was due to the large cracks around the doors, through which the gas dissipated itself into the halls. To obviate this difficulty, we tried a plan this year that seemed to work very well, and, I believe, will prove more effective.

Instead of caulking all the rooms in a division we simply caulked the rooms on the top floor of that division first and then fumigated them at once. As the fumigator would close the door of a room two men, who stood ready with water-soaked strips of paper, would quickly seal the cracks around the edges of the door and the keyhole. These two men would caulk a door in less than two minutes, and the rooms must have been made as tight as is possible under average conditions. All of the rooms on that floor were treated in this way, after which the force passed to the floors below in succession, treating each in the same manner.

Although it took about one hour to treat each floor, not the slightest inconvenience or annoyance was experienced by the men from the gas on the floor or floors above. There is also another advantage in this method: Where the sun shines in windows the strips of paper, although we use three thicknesses and soak them thoroughly, are apt to dry and curl away from the cracks if left too long. By treating a floor as soon as ready we obviate this difficulty and get the full effect of the gas.

*Some Results of the Use of This Gas Against Bedbugs Under Varying Conditions.*

Desiring to know the effect of hydrocyanic acid gas on bugs hidden away in mattresses, blankets, comfortables, etc., we tried the following experiments:

1. Three bugs were placed in a perforated pill box and then wrapped in excelsior, three inches all around, and this in turn in some domestic to imitate ticking.

2. Three bugs (one adult, one one-third grown and one very young) were placed in a similar box and then carefully wrapped in two folds of a thick comfortable.

3. Three bugs (two adults and one one-third grown) were placed in a similar box and carefully wrapped in cotton-batting to the depth of two inches.

4. Two bugs (one adult and one two-thirds grown) were placed in a similar box and wrapped in two folds of a thick woollen blanket.

5. Six bugs were put in a vial 3½ inches deep and one inch in diameter, and the latter stopped with an inch cork which had been punched twice with a pair of dissecting-forceps with curved points. The holes thus made had apparently closed up owing to the spongy nature of the cork, but I found afterwards that I could readily force air through them by placing the cork between my lips.

6. To serve as checks several bugs in perforated boxes were placed about the room at different heights from the floor.

In every box of bugs wrapped in different materials several new-laid eggs were placed to determine the effect of the gas upon the hatching of the same.

The room in which the fumigation was done measured 14 x 8 x 8, and contained 896 cubic feet. We used 10 ozs. of cyanide, 300 cc. of acid

and 600 cc. of water, allowing the room to remain closed 14 hours. We made a slight mistake in our computation, and used 1 oz. more of cyanide than our formula called for.

The results were surprising and very gratifying. Every bedbug in every case was killed.

The fumigation was done June 1, and as I write, June 12, none of the eggs have shown any signs of hatching. It is impossible for me to say whether they are fertile or not, but it is reasonable to suppose that they are. We obtained them by confining a dozen or more adult bugs in a large vial, and on the second day we found eggs in abundance. The eggs must have been formed in the females under natural conditions in the bedsteads from which they were taken, and very likely the bugs were fertilized there before we collected the females.

Acknowledgments are due to Mr. R. W. Harned for his aid in the execution of the fumigation done this season.

## SOME NEW SPECIES OF WESTERN GEOMETRIDÆ.

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

*Gymnocelis remorata*, new species.—Expanse, 16–17 mm. Head, thorax and abdomen pale creamy-white, the abdomen somewhat the darkest. Wings whitish, variegated with shades of small pale brown patches, which show up the ground colour in a series of transverse white lines. On the primaries the first of these white lines is near the base, inwardly edged with brown and outwardly fused with the ground colour. Intradiscal line geminate, begins at costa and extends outward to cell, then inwardly, dentate to inner margin. Median line geminate, originates at centre of costa and extends outwardly, the inner line bordering the discal spot outwardly, then runs obliquely dentate to centre of inner margin. Extradiscal line dentate, geminate, subparallel with median line. All these lines show up most prominently on the costal area of the wing; less so on the remainder of the wing, yet readily to be followed. Subterminal line single, finely dentate throughout its course. Terminal line brown, sometimes interrupted by white at the venules. The brown patches appear most plainly on the costa, especially between the intradiscal and median lines, immediately outward of the median line and between the extradiscal and submarginal lines. A rather prominent

blotch is near the outer margin between M1 and M3, and another less distinct is at the anal angle; through the centre of these blotches the subterminal line runs. Cu. is usually lined with dark brown scales on the basal half or centre, and the veins of the media are also slightly marked with a similar colour inwardly of the extradiscal line. Discal spot dark brown, longer than broad, very distinct. Fringe whitish, silky, pale brown at the veins. Secondaries with about four white lines on basal half of wing, beginning at inner edge and disappearing toward centre. A geminate sinuous white line crosses at outer two-thirds and corresponds to the extradiscal line of fore wings. Subterminal line white, wavy. Terminal line brown, sometimes interrupted, distinctly wavy at inner angle. Discal spot dark brown, elongate, distinct. Beneath silky, cream coloured, the delineations of upper side faintly showing on costa. Discal spots faint and rather small.

Described from a number of specimens, representing both sexes, in the Rutgers College collection.

Habitat: Yuma County, Arizona, April 11–20.

*Sciagraphia Yavapai*, new species.—Expanse, 26 mm. General colour leaden-gray, with a reddish-umber hue and with black atoms sparsely scattered over the body and wings. Costa of primaries flesh coloured, marked with small but distinct black flecks on basal third and larger ones on the centre. Intradiscal line ochre-brown, narrow, begins one-fourth out on costa, and is slightly outcurved to inner margin. Extradiscal line concolorous with the first, begins on costa over two-thirds out from base, extends outwardly to M1, then with a faint in-and-out curve to Cu. 1, and with a sharp inward semicircle to inner margin, ending two-thirds out from base. This line is marked on the costa by a distinct, rather large black spot, on the inner margin by a smaller one and by five dots on the veins from M1 to Cu. 2 inclusive. Terminal line a series of small intervenular spots. The basal and median areas are uniform in colouring, the outer area slightly darker and with a dark shade-spot in the centre bordering the extradiscal line. Discal spot an irregular elliptical ring with several ochre-brown scales at each end, indicating a median transverse line. Secondaries with numerous inconspicuous transverse dashes, giving the wing a finely-mottled appearance. A transverse ochre-

brown line extends from middle of wing to inner margin. Discal spot round, dusky. Beneath whitish-gray, the outer portion darker and all veins lined with ochreous; both wings profusely marked with minute transverse dashes that show up sharply on the light background. Discal spots distinct, rather large.

Type: One female in the collection of the writer.

Habitat: Yavapai County, Arizona, Aug. 20 (Hutson).

*Gonodontis ocellaria*, new species.—Expanse, 44–47 mm. at greatest width. Front, palpi and thorax bright buff, the abdomen pale buff. Primaries with apex acute, outer margin scalloped between the veins, extending outward from apex to $M_3$, then inward to rounded anal angle. Colour uniformly bright buff, washed with a faint grayish shade, most perceptible toward outer margin; costa with a number of slate-coloured specks, the largest at the beginning of the extradiscal line. Intradiscal line not strongly marked, whitish, bordered externally by a pale gray shade, beginning one-third out from base on costa, regularly outcurved to inner margin, where it almost disappears. Extradiscal line well defined, whitish, with a grayish border, internally originates on costa less than one-fourth in from apex, extends with an outward curve to Cu. 2, thence with a faint inward curve to inner margin. Distance between the two lines on costa double that on inner margin. Discal spot a clear white dot edged with brown. Marginal line deep orange; fringe pale yellow, marked with brown at the apices of the scallops. Secondaries brighter than primaries, more of a salmon colour, paler at base; outer margin evenly rounded and scalloped between the veins. A brown line crosses the centre, is broadest in the central portion, obsolete at the costa and faint at the inner margin. Beneath both wings pale buff, except at inner margins, where they are flesh-coloured. Costa of primaries and costal and basal areas of secondaries sparsely marked with brown specks. The transverse lines of upper surface, save intradiscal line of primaries, faintly reappear, and are marked with venular brown spots, which tend to join in the centre of the hind wing. Discal spots brown, small, present on all wings.

Types: Three males in Rutgers College and in the collection of the writer.

Habitat: Minnehaha, Arizona, Oct. 2 and 3 (Hutson).

This is the first American species that has scalloped wings like the type of the genus, *G. bidentata*, Clerck, of Europe. There is no other species in the genus with which it can be confused.

*Metanema brunneilinearia*, new species.—Expanse, 33 mm. at greatest width. Head, thorax and abdomen pale yellowish-white, sprinkled with gray scales, thickest on the abdomen. Apical border of abdominal segments destitute of gray scales, and appearing as pale rings to a grayish abdomen. Ground colour of both wings pale yellowish-white, rather profusely sprinkled with gray scales. Primaries with costa produced on basal third, apex acute, thence scarcely sinuous to prominent, acute angle at M3, thence even to rounded anal angle. Intradiscal line pale brunneous, rather narrow, begins on costa more than one-third out from base, extends outwardly to vein R, then turns at right angles and runs, gently sinuous, to inner margin, ending one-third out from base. Extradiscal line sinuous, concolorous with first, but slightly broader, originates on costa one-fourth in from apex, and runs almost parallel with intradiscal line to inner margin. Basal area profusely sprinkled with gray scales, fewer on the costa toward intradiscal line. Median area with a sparse scattering of gray scales; discal spot large, round, dark brown. Outer area heavily overlaid with gray scales, except at outer margin from apex to M3, and thickest in patches between the veins from M1 to anal vein bordering the extradiscal line. On the outer margin between R5 and M1, and M1 and M2, are two dark brunneous crescents with gray and flesh-coloured scales in the concavities. Fringe pale brunneous, checkered with brown at the veins. Secondaries with a single, almost straight pale brunneous line crossing the centre, both areas profusely overlaid with gray scales, less so centrally; discal spot in basal space large, brown, rather faint. Fringe pale brunneous, scarcely checkered with brown. Beneath, ground colour as above, the gray scales distributed as on upper surface, central space of both wings, the apex and veins bright ochreous.

Type: One female in Rutgers College collection.

Habitat: Verdi, Nevada.

Readily distinguished from its congeners by its rough-scaled appearance, suggesting *Eutrapela* rather than the smooth and evenly-clothed species of *Metanema*.

# CULICID CHARACTERS.

BY FREDERICK KNAB, WASHINGTON, D. C.

In the June number of the CANADIAN ENTOMOLOGIST Miss Mitchell takes Professor Williston to task for including the Corethrids in the family Culicidæ. In her article there are so many erroneous statements made that, in the interest of truth, they call for correction. Be it clearly understood that I do not accuse Miss Mitchell of falsification. Her errors are in large part due to fragmentary and insufficient knowledge, obtained in part at second hand.

At the very start it must be stated that the idea of separating the Corethrids from the other Culicidæ is by no means a new one. Twice within recent years the family Corethridæ has been proposed by independent workers—Dr. Dyar[1] in this country and Dr. Eysell[2] in Germany—both of them, by the way, "nondipterologists." Dr. Eysell has given a very comprehensive presentation of the case, and more than two years ago brought out, not only all the data offered by Miss Mitchell, but a great many others. Indeed, he outstrips Miss Mitchell in classificatory enterprise, and also elevates the Anophelines to family rank. This paper by Dr Eysell, which I expect to deal with in another place, contains a great deal that is interesting and suggestive. Unfortunately, not all the data given are correct. Both Dr. Eysell and Miss Mitcheli develop their ideas from a few familiar forms. Of the great mass of species, some of which contradict their generalizations, they know nothing.

In the following I will only deal with the statements of Miss Mitchell, without, however, attempting to take up every detail. The reader should therefore take note that the statements which remain unchallenged are not necessarily correct in every case.

Miss Mitchell claims that the pupæ of the Corethrids are not active like those of Culicids. The pupa of *Sayomyia* lives submerged, that of the Culicine forms floats at the surface; both become active when alarmed or disturbed, and for activity upon such occasions, the pupa of *Sayomyia* far surpasses anything in the Culicine group. This difference in the two pupæ is largely one of specific gravity. Most Culicine pupæ are so buoyant that they cannot go below the surface without a vigorous

1. H. G. Dyar: Our present knowledge of North American Corethrid larvæ. Proc. Ent. Soc. Wash., VII, 13, 1905.

2. A. Eysell: Sind die "Culiciden" eine Familie? Sbhandl in Bericht, XLIX, Ver. Naturkunde Cassel, 16–24, 1905.

effort, and when this ceases are immediately carried to the top. Dr. Dyar has pointed out to me that the pupæ of *Aëdes atropalpus* and *Stegomyia calopus* can remain below the surface at any depth without effort, and therefore, their specific gravity must be the same as that of the water. In the case of *Stegomyia calopus* this is obviously of great advantage, and even essential, to the preservation of the species. As is well known, this species breeds almost wholly in water in artificial receptacles, in the tropics primarily in the jars of drinking water kept in every house. When water is poured from the jar the pupæ go to the bottom, and remain there until the danger is over. The pupæ of other mosquitoes could not remain below, and would be poured out with the water. With reference to any classification by pupal characters, it must be further stated that the pupæ of *Corethra* and *Eucorethra* are unlike those of *Sayomyia*, and practically like those of Culicines, both in appearance and behaviour. Pupæ essentially similar occur also in the Chironomidæ, and the pupa of at least one species of *Dixa* that I have bred is in every respect like that of a Culicine. In the family Psychodidæ the pupæ are for the most part active. The pupa of an unidentified species of this group, sent to us from Florida, is free swimming and active, and greatly resembles that of a Culicine. In the Psychodid genus *Maruina*, on the contrary, the pupa is inactive, and attached to rocks in moist situations.

As to the eggs of the Corethrids, so far we know only the eggs of *Sayomyia*, and these are suspended in a mass of gelatinous substance. It is quite likely that those of the other genera of Corethrids are not deposited in this way. *Eucorethra* occurs so sparingly that the eggs must be laid singly. The indications are that *Corethra* hibernates in the egg, and if in a gelatinous mass the eggs would hardly be in a suitable condition to withstand freezing. A Culicine which Mr. August Busck has recently discovered on the Isthmus of Panama deposits its eggs in a gelatinous mass. According to Miss Mitchell's classification this mosquito would become a Corethrid! Turning to the Chironomidæ, we find that although many of the aquatic species deposit their eggs in a gelatinous secretion, there are others that do not. Should these latter be put in a separate family? Mr. Coquillett's unsatisfactory application, as a primary division, of the mode of egg-laying of the Culicidæ,[3] illustrates with what caution

3. D. W. Coquillett: On the breaking-up of the old genus Culex. Science, N. S., XXIII, 312-314, 1906.

such characters should be used. Such habits are purely adaptive, and may occur in widely-separated groups. Surely no one would think of associating the Sabethine *Joblotia nivipes* with *Culex* and *Culiseta* simply because it lays its eggs in a raft.

It would be unfair to criticize Mr. Thompson, whom Miss Mitchell quotes, before he has himself presented his facts and conclusions. Furthermore, it is impossible to discover from Miss Mitchell's wording just how much is to be credited to Mr. Thompson and how much to his spokesman. This much may be said, however: No safe conclusions as to relationships can be drawn from the examination of a few detached forms. Before formulating any theory of relationships some of the more aberrant Culicine forms, such as *Mansonia*, *Ædeomyia* and *Hæmagogus*, and at least one member of the Sabethine series, should be studied. Perhaps the Sabethines, like the Corethrids, will be found to have four instead of five malpighian tubes. I fancy that the Sabethines will be found to stand nearer the common ancestor than either the Culicines or the Corethrids, but I await further data. In a consideration of the relationships of the Culicidæ with the other families of Nemocera, the Psychodidæ, which seems to have been omitted by Mr. Thompson, should properly play an important part. That *Anopheles* is close to the other Culicine forms, closer than most students are willing to admit, has been the writer's belief for a long time. Miss Mitchell says "Culex may be derived from *Anopheles*." Never! The reverse might be true, for *Anopheles* is by far the more specialized form.

The statement is made that the Corethrid larvæ differ from those of the Culicids by the "place of attachment of antennæ" and "presence of air floats." Neither of these characters holds good for the group, as Miss Mitchell could have ascertained very easily, if material was unavailable, by reference to published descriptions and figures. In *Sayomyia* and *Corethrella* the antennæ are inserted close together at the front of the head; in *Corethra* and *Eucorethra*, however, the antennæ are inserted at the anterior angles of the head, just as in the Culicids. By "air floats" we understand Miss Mitchell to mean the dilations of the tracheal tubes. These reach their greatest development in the larva of *Sayomyia*, where they represent the respiratory system as four large detached air vesicles. In *Corethra* these air vesicles are likewise present, but only form parts of the main tracheal trunks. In the larvæ of *Eucorethra* and *Corethrella* these tracheal dilations are wholly absent; they would be superfluous in

these larvæ which live mostly at the water-surface. Air vesicles of this character occur in various degrees of development in Culicine larvæ. In the larvæ of *Mansonia signifer* and *M. fascipes* they represent a condition very similar to that in *Corethra*.

Miss Mitchell objects to the placing of *Dixa* with the Culicidæ, and one of her reasons is that "the antennæ of the adults are almost bare, and are quite similar in the two sexes." In another place I have already shown that Miss Mitchell's startlingly simple classification of the Culicidæ according to antennal characters[4] resulted from her ignorance of the facts.[5] It may be further pointed out that in the Chironomidæ the same conditions are found. In most of the genera the male antennæ are plumose, but in a few they are similar to those of the female. It does not appear that these conditions have anything to do with the grouping of the genera. The larval characters of *Dixa* enumerated by Miss Mitchell as of family value, cannot be conceded such importance. The segmentation of the thorax is fairly distinct in the Culicid larvæ. As to the prolegs, although I have no material at hand, I am strongly under the impression that their number differs in the different species, if, indeed, they may not be absent altogether. Miss Mitchell indicates them on the first and second abdominal segments. Meinert's figure of the larva of *Dixa* shows them on the fifth, sixth and seventh segments as well.[6] The characteristic proleg on the first thoracic segment of most Chironomidæ is familiar to all students. It is present in most genera of Chironomidæ, but there are some in which it is wholly absent. Are these to be excluded from the family? Moreover, a series of prolegs, similar to those of *Dixa*, occurs in the larva of the Chironomid *Psamathiomyia*. Miss Mitchell describes the pupa *Dixa* as "inactive, floating quietly on the surface," the implication being that they differ markedly from the Culicidæ. In a species which the writer bred the pupæ were just as "inactive" as those of Culicids, and, like them, when disturbed made rapidly for the bottom. In another species which the writer bred the larva leaves the water to pupate, and the pupa remains attached to a blade of grass and motionless, some distance above the water surface.

4. E. G. Mitchell: Validity of the Culicid subfamily Deinoceritinæ. Psyche, XIV, 11–13, 1907.

5. F. Knab: Deinocerites again. Journ. N. Y. Ent. Soc., XV, 121–123, 1907.

6. Fr. Meinert: De encephale Myggelarver, pl. IV, 1886.

In defence of her subfamily Psorophorinæ, Miss Mitchell states that it is based chiefly on characters of the early stages. Herewith I quote her characterization of the subfamily, adding after each item the genera or species that show the same characters. It may be stated that only a few promising forms have been drawn upon for comparison.

"PSOROPHORINÆ."

1. "LARVÆ insectivorous, their mouth-parts fitted for seizing and tearing."—*Psorophora, Anopheles Barberi, Megarhinus* (including *Ankylorhynchus* and *Toxorhynchites*), *Lutzia, Sabethes, Lesticocampa.*

2. "MOUTH-BRUSHES a few appressed plates, heavily pectinate along the entire inner margin, and directed obliquely backward beneath head or held out at right angles to it."—The units of the mouth-brushes of *Psorophora* can hardly be termed "a few"—there are fifty or more of them in each brush. In *Megarhinus*, which Miss Mitchell perhaps confused with *Psorophora*, there are from 9–12 units; *Lutzia* holds an intermediate position in this respect. All intergrades occur in the matter of pectination.

3. "MAXILLÆ trapezoidal, with many curved spines, a few short hairs."—*Psorophora, Lutzia, Limatus.*

4. "LATERAL COMB of mandible a few heavy, immovable spines, their base almost at right angles with top of mandible."—*Psorophora, Lutzia.*

5. "MARGINAL COMB of mandible absent."—*Psorophora* (in part!), *Anopheles Barberi, Lutzia, Megarhinus, Lesticocampa, Joblotia.*

6. "BITING part very large."—*Psorophora, Anopheles Barberi* and other species, *Megarhinus, Lutzia, Joblotia, Limatus.*

7. "ANTENNÆ near middle of sides of head, eyes near posterior margin."—These characters are present in a more or less pronounced degree in many mosquito larvæ.

8. "PUPÆ with anal flaps as broad as long."—This is incorrect. Measurement of a number of specimens shows them to be about one-third longer than broad.

9. "ADULTS with femora and tibiæ bearing many outstanding scales irregularly and thickly arranged around them, never a fringe. Wing-scales narrow."—The outstanding scales of the legs are evanescent or absent in certain species of *Psorophora*. Enough has already been said on the subject of wing-scales.

## A NEW BEE OF THE GENUS ANTHOPHORA.

BY T. D. A. COCKERELL, BOULDER, COLO.

Professor R. H. Forbes, of the University of Arizona, writes me under the date of Feb. 15, 1907: "While waiting for the train at Maricopa (Arizona) I became interested in a bee which was busy depositing honey in cells in the ground, leaving an egg in each cell. The workings of this bee were as deep as seven inches, often branched into two to five separate tunnels, and each branch had from one to three or four cells of honey, one above the other. When a set of cells was finished the bee would kick the loose dirt into the tunnel until full, then seal it with mud. I am sending you specimens of bees, grubs and honey cells containing eggs. What is the name of this most entertaining bee?"

Upon examination, it proves to be a new species of *Anthophora*.

*Anthophora Forbesi*, n. sp.

♀.—Length about 15 mm., width of abdomen a little over 6½, length of anterior wing 11. Black, with dull white or creamy-white hair; hair of front white, with a few black hairs intermixed, of vertex black, of occiput white, of cheeks white, of thorax above white with many black hairs intermixed; hair on inner side of anterior tarsi a sort of dull sepia; on inner side of middle and hind tibiæ and basitarsi black, contrasting with the creamy-white on the outer side; abdomen broad, not at all metallic; the hind margins of the segments rather broadly whitish, hyaline—not chalky, covered by quite dense white hair-bands; hair of surface between the bands erect, only conspicuous in side view, wholly white except a very little short black hair at basal middle of third; tufts of black hair above and on each side of the long narrow apical plate.

Superficially, the insect looks just like *A. Washingtoni*, Ckll., except that it is more robust. The third antennal joint is only a little longer than the following four together, being less long and slender than that of *Washingtoni*. The eyes are perfectly black, in *Washingtoni* they are green. *A. Washingtoni* also has conspicuous black hair on abdominal segments 3 to 5, wanting in *Forbesi*. The clypeus of *Forbesi* has a broad smooth shining median band, wanting in *Washingtoni*.

The earthen cells are 21 mm. long, and about 14½ broad, formed as usual in the genus. The drawing of the burrow, sent by Prof. Forbes, shows that it is vertical. There is no indication of the usual chimney-like structure.

October, 1907

## NOTES ON THE PREDACEOUS HABIT OF *POLISTES RUBIGINOSUS*, ST. FARGEAU.

BY A. A. GIRAULT, PARIS, TEXAS.

At 2.30 p.m., June 20, 1904, the day clear and warm, I was in a small cornfield near the outskirts of Paris, Texas, searching the ears for full-grown larvæ of the cotton boll-worm, *Heliothis obsoleta*, Fabricius. The infested ears were stripped back or husked, and the full-grown worms taken out, leaving the younger larvæ in their places.

While passing along one of the rows previously examined, a female *rubiginosus* was frightened and flew up from near the ground, from one of the husked ears attached to a prostrate corn-plant; she dropped a boll-worm in instar IV. Upon my remaining motionless she returned to the ground near the corn ear, and began to hunt for the larva which had been dropped; it was in full sight near the ear of corn, but the wasp did not succeed in finding it in the time allowed. In the meantime I had taken one of the full-grown larvæ from the box in my hand and placed it on the ear, which it began to attack, working its way down in between the rows of grain. The Polistes crawled over this larva several times in the course of its search for the first one, but without discovering it. Another full-grown larva was then placed on the corn-ear, and crawling up the side of the ear happened to meet the wasp coming from the other direction. The two met on the top of the ear of corn, both moving rapidly, and without the slightest apparent hesitation the wasp literally pounced upon the larva's back, and both rolled to the ground several inches below.

The boll-worm wriggled and squirmed its body violently, and bit at the wasp fiercely with its jaws, but the latter was more powerful and bit the larva more effectively, making several bad wounds in the ventum of the abdomen, through which a mass of viscera oozed. When thus injured the larva was practically defeated, but the wasp continued to inflict wounds with its jaws at various points on its body, until it had apparently succumbed.

The actions of the Polistes thus far indicated nothing more than that it was very hungry and had captured food, and its rapidly-working jaws heightened this effect. However, grasping the limp body of the boll-worm with its jaws and fore legs, and keeping the remaining pairs of legs well spread out for support, the wasp began to girdle the body of the larva by eating or biting (apparently the former) around one of the mid-body

segments. It was nervous the whole time and appeared to be very much excited, but as the two halves of the body were nearly severed it seemed to get almost frantic, biting and tugging desperately at the joining shreds of viscera until they parted.

The cephalic half of the larva's body was then grasped and worked with the jaws until it became round, and the wasp then made an attempt to carry it off, but without success.

It was then reduced in size, by severing with the jaws into halves again, the insect showing the same frantic movements as before.

The morsel reduced to a convenient size, the mother wasp climbed and reclimbed a nearby corn-plant, until it finally reached a point from which it could safely launch itself into the air. It arose heavily, flew in about eight concentric circles, with the morsel of meat grasped in its legs, then arose obliquely about twenty-five feet, and flew away in a straight south-westerly direction until lost from view.

When first attacking the caterpillar the sting was held in a threatening attitude, but was not used as far as could be seen. The younger larva dropped by the wasp bore a large wound in the second thoracic segment; it was not dead, but limp and helpless.

The predaceous habits of this species are well known, and they have often been recorded as active enemies of many of our injurious insects. Their nests are especially abundant in the corn and cotton fields of Texas, and they doubtless destroy many larvæ which feed exposed on the foliage, and any others which, though internal feeders, may become exposed during their lifetime, through chance or otherwise. Other females of this species of Polistes have been observed to catch boll-worm larvæ exposed as in the foregoing, and strip the integument from their bodies and then chew the whole into a roundish mass of meat and carry them off to their nests. These larvæ, however, were younger.

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THE ANNUAL MEETING of the Entomological Society of Ontario will be held in the Biological building at the Ont. Agricultural College, Guelph, on Thursday, Oct. 31, and Friday, Nov. 1. The sessions will begin on the afternoon of the former day, and be continued during the day following. The Wellington Field Naturalists' Club will hold its annual meeting on Saturday, Nov. 2, and hopes that all in attendance will remain over that day. Popular addresses under the auspices of both Societies will be given on the Thursday and Friday evenings. Members intending to be present will please notify the Secretary at their earliest convenience.

## THE BOSTON MEETING OF THE ENTOMOLOGICAL SOCIETY OF AMERICA.

Taking advantage of a time and place when many entomologists and other zoologists would be gathered together to attend the Seventh International Zoological Congress, and to supplement for those interested in entomology the very interesting session of that Congress, a meeting of the Entomological Society of America was held in Boston during the week commencing August 19th.

On Tuesday afternoon, August 20, about 50 members of the Society, as guests of Mr. A. H. Kirkland, were taken in special cars to Saugus, where they were shown the details of the campaign against the Gypsy and Brown-tail moths. The operations directed towards the control of these pests by means of the importation of parasites were of especial interest.

On the evening of the 22nd a meeting was held in the room of the Boston Society of Natural History, at which the following 53 persons were in attendance:

Members: Prof. John Barlow, Kingston, R. I.; Rev. Prof. C. J. S. Bethune, Guelph, Ont.; Mr. William Beutenmuller, N. Y. City; Mr. C. V. Blackburn, Stoneham, Mass.; Mr. J. C. Bradley, Ithaca, N. Y.; Mr. A. F. Burgess, Boston; Mr. Erich Daecke, Philadelphia, Pa.; Mr. N. S. Easton, Fall River, Mass.; Mr. J. H. Emerton, Boston; Mr. G. P. Englehardt, Brooklyn, N. Y.; Prof. C. H. Fernald and Prof. H. T. Fernald, Amherst, Mass.; Mr. W. L. W. Fielde, Boston; Mr. C. A. Frost, South Framingham, Mass.; Mr. F. Haimbach, Philadelphia, Pa.; Dr. J. Headlee, Durham, N. H.; Mr. E. F. Hitchings, Waterville, Me.; Dr. W. J. Holland, Pittsburg, Pa.; Mr. C. W. Johnson, Boston; Prof. V. T. Kellogg, Palo Alto, Cal.; Prof. Trevor Kincaid, Seattle, Wash.; Mr. F. E. Lutz, Cold Spring Harbor, N. Y.; Mr. H. H. Lyman, Montreal; Mr. B. P. Mann and Mr. C. T. Marlatt, Washington, D. C.; Prof. A. P. Morse, Wellesley, Mass.; Mr. H. H. Newcomb, Boston; Prof. Herbert Osborn, Columbus, O.: Prof. R. C. Osburn, New York; Miss Edith M. Patch, Orono, Me.; Dr. H. M. Russell, Winchendon, Mass.; Prof. E. D. Sanderson, Durham, N. H.; Dr. Henry Skinner, Philadelphia, Pa; Prof. J. B. Smith, New Brunswick, N. J.. Mr. F. M. Webster, Washington; Dr. Wm. M. Wheeler, New York.

Visitors: Dr. G. Horvath, Buda-Pesth; Prof. N. J. Kusnezov, St. Petersburg, Russia; Prof. G. A. Severin, Bruxelles; Dr. H. Heymons,

Berlin ; Mr. F. Bates; Prof. and Mrs. T. D. A. Cockerell, Boulder, Colo.; Mr. E. C. Cotton, Knoxville, Tenn.; Mr. W. F. Fiske, Washington ; Mr. J. Arthur Harris, St. Louis, Mo.; Mr. G. V. Pinder, New York ; Mr. L. R. Reynolds, Boston ; Mr. A. C. Sampson, Sharon, Mass.; Mr. L. W. Swett, Bedford, Mass.; Mr. A. G. Weeks, Boston ; Mr. R. K. Wolcott, Lincoln, Neb.; Mr. Chas. Zeleny, Bloomington, Ind.

The following were in Boston during the meetings : Dr. R. Blanchard, Paris, France, Mr. R. H. Johnson, Cheney, Wash.; Dr. H. G. Dyar, Washington, D. C.; Mr. J. Martin, New York State ; Dr. L. O. Howard, Washington, D. C.; Mr. J. E. Bates, Whitman, Mass.; Mr. E. H. Forbush, Malden, Mass.; Mr. H. C. Weeks, Gilman, N. Y.; Prof. A. F. Conradi, College Station, Texas ; Mr. A. H. Kirkland, Boston ; Mr. S. Henshaw, Cambridge, Mass.; E. A. Goeldi, Para, Brazil ; Mr. W. Wirtner, Penn. Station, Pa.

In the absence of Prof. Comstock, the President, and Dr. Fletcher, the First Vice-President, Dr. Skinner, the Second Vice-President, took the chair. In opening the session, he welcomed, on behalf of the Society, the foreign and other visitors who were present. Like all new movements, he said, the new Society had at first met with some opposition on the part of those who failed to see the advantages to be derived from it. But only by trying can we hope to ascertain its possibilities for good. He believed the Society was an expression of the steadily increasing interest in entomology, and felt that the number who had enrolled as members, now over 400, and the eagerness with which membership had been sought, was a very convincing proof of the demand for the organization. He believed firmly in its utility, and wished it great success and long continuance.

The Secretary announced that the following persons had been elected Honorary Fellows of the Society : Ezra Townsend Cresson, Philadelphia ; Samuel Hubbard Scudder, Cambridge ; William Harris Ashmead, Washington ; William Henry Edwards, Coalburg, W. Va.; Philip Reese Uhler, Baltimore ; Henry Christopher McCook and Henry Ulke, Philadelphia.

The Secretary further announced that the following had been elected Fellows of the Entomological Society of America : John Merton Aldrich, Moscow, Idaho ; Wm. Beutenmuller, New York ; Philip Powell Calvert, Philadelphia ; Daniel William Coquillett and Harrison Gray Dyar,

Washington; Jas. H. Emerton, Boston; Charles Henry Fernald, Amherst, Mass.; Stephen Alfred Forbes, Urbana, Ill.; Samuel Henshaw, Cambridge, Mass.; Andrew Delmar Hopkins and Leland Ossian Howard, Washington; Vernon Lyman Kellogg, Palo Alto, Cal.; Henry H. Lyman, Montreal; James George Needham, Ithaca; William Saunders, Ottawa, and Eugene A. Schwarz, Washington.

The original Fellows, elected at the first meeting, which was held in New York in December last, are: John Henry Comstock, Ithaca; James Fletcher, Ottawa; Henry Skinner, Philadelphia; Charles J. S. Bethune, Guelph; Charles Willison Johnson, Boston; Herbert Osborn, Columbus, Ohio; John B. Smith, New Brunswick, N. J.; Francis Marion Webster, Washington; William Morton Wheeler, New York.

The whole number of Fellows is thus 25, which is the limit laid down by the Executive Committee. Prof. Osborn, on behalf of the Publication Committee, announced that it did not seem desirable to take over any existing journal, to publish anything that would occupy the field of any existing journal, or to make any of the current periodicals the official organ of the Society. It might, however, prove desirable to undertake sooner or later a dignified series of publications in the form of "Annals" or "Memoirs," which would be distinctly creditable to American entomology.

The President invited the foreign entomologists who were present to address the meeting, calling upon Dr. Horvath, of Buda-Pesth; Prof. Kusnezov, St. Petersburg; Prof. Heymons, Berlin, and Prof. Severin, Bruxelles, each of whom responded with a few words of kindly greeting to the new Society.

Dr. Holland, who had been asked to bear the greetings of the Society to Dr. Scudder, gave an account of his interview with the venerated invalid, and told of the pleasure which his message of love and respect had afforded. Dr. Scudder desired him to "thank the Society from the fulness of his heart for having remembered an old man, now almost a shadow of his former self."

Dr. Bethune expressed the thanks of the Society to their entertainers in Boston, and especially the Cambridge Entomological Club.

Dr. J. B. Smith proposed that the thanks of the meeting should be given to Mr. Kirkland for the delightful opportunity he had afforded them for observing the experiments now being carried on at Saugus. The motion was very heartily concurred in.

Dr. J. B. Smith read a paper entitled "Some Unrecognized Sexual Characters of Noctuidæ." The males of many Noctuids have characteristic hair-tufts and hair pencils on the legs, and these reach their extreme development in the Deltoid series. Many other Noctuids have pencils, brushes and scale-tufts concealed in abdominal cavities, and of these little or nothing has heretofore been known. A few of the principal forms were shown on slides.

Mr. J. Chester Bradley read "A case of gregarious sleeping habits among Aculeate Hymenoptera." In the San Joaquin Valley in California a large number of sleeping Hymenoptera were observed gathered into clusters. But each cluster contained only a single species, and there were nine species represented in all.

Prof. F. M. Webster spoke on "Parasitism of Toxoptera." Drawings were exhibited, showing the movements of the larva when parasitizing, which caused the body of the host to assume a characteristic globose shape.

Mr. Bradley read "The Evolution of the Wings of Evaniidæ." The wings of this family portray in a remarkable manner the progress of evolution. From a relatively complex venation we find gradual steps through various degrees of atrophy, resulting in the almost complete loss of venation. The paper was discussed by Dr. Holland and Prof. Kellogg.

The meeting then adjourned to a very enjoyable smoker in the Grundman Studios, at which the Society and its visitors were the guests of the Cambridge Entomological Club.—J. CHESTER BRADLEY, Secretary-Treasurer.

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JAMAICAN HEMIPTERA.—In the Bulletin of the Buffalo Society of Natural Sciences (Vol. viii, No. 5, 1907, pp. 1–77), Mr. E. P. Van Duzee gives a report on a collection of Hemiptera that he made in Jamaica during a short visit in March and April, 1906. Though climatic and other difficulties were great, heavy rains and tropical heat alternating in rendering out-door work at times impossible, he was able to procure specimens of 236 species, of which 85 are new to science, and among them are representatives of no less than ten new genera; a large proportion of these forms are described in this paper. The Capsidæ collected were submitted to Dr. O. M. Reuter, of Helsingfors, who has described as new seven genera, 29 species and two varieties from the material submitted to him. Students of the order will welcome this valuable contribution to its literature, in which are to be found many critical notes on species already known, as well as the descriptions of new forms. The paper is rendered all the more interesting and acceptable by the excellent portrait of the author which forms its frontispiece.

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Mailed October 5th, 1907.