

**Bibliocephala kelloggi** Garrett.*Bibliocephala kelloggi*, Garrett, Insec. Ins. Menst. Vol. 10, p. 91, 1922.

Known only by the single male type specimen collected in 1921 at Cranbrook, B. C.

**Bibliocephala comstocki** Kellogg.*Bibliocephala comstocki*, Kellogg, Proc. Calif. Acad. Sc. (3), Vol. 3, p. 192, pls. 1903.

Known only from California.

**Agathon** von Röder.

The species belonging to this genus have the pleura bare, the posterior basal cell present and the second longitudinal vein branched.

## TABLE OF SPECIES

- |  |                              |
|--|------------------------------|
| 1. Eyes of both male and female bisected .....   | 2.                           |
| Eyes of male only, bisected; second branch of Radius very short simulating a crossvein and forming a triangle in which R <sub>2</sub> is shortest side | <i>doanei</i> Kell.          |
| 2. Second branch of Radius almost as short as in <i>doanei</i> but in triangle formed R <sub>2</sub> is not the shortest side .....                    | <i>elegantula</i> von Röder. |
| Second branch of Radius distinctly longer than in <i>elegantula</i> and <i>doanei</i> , not simulating a crossvein .....                               | <i>canadensis</i> Garrett.   |

**Agathon doanei** Kellogg.

Fig. 7.

*Liponeura doanei*, Kellogg, Psyche, Vol. 9, p. 39, 1900.*Bibliocephala doanei*, Kellogg, Proc. Calif. Acad. Sc. (3), Zool. Vol. 3, p. 194, pls. 1903.

Known only from California. Both sexes have been described.

**Agathon elegantula** von Röder.

Fig. 6.

*Agathon elegantula*, von Röder, Wien. Ent. Zeit. 10, 230, 1900.*Bibliocephala elegantulus*, Kellogg, Proc. Calif. Acad. Sci. (3), Zool. Vol. 3, p. 193, pls. 1903.

Recorded from Nevada, Idaho and Colorado. Both sexes have been taken.

**Agathon canadensis** Garrett.

Figs. 2, 5, 8.

*Bibliocephala canadensis*, Garrett, Insec. Ins. Menst. Vol. 10, p. 89, 1922.

This species has been recorded only from Canada. The following localities are represented: Wilson Creek, B.C. (5000 ft. elevation) Aug. 26 to Sept. 18, both sexes; Cheakamus, B. C. June 23, two female specimens; Ottawa, Ont. June 16, one female specimen.

## NOTES ON THE SPECIES OF THE GENUS HEXAGENIA WITH DESCRIPTION OF A NEW SPECIES (EPHEMEROPTERA).\*

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In a pamphlet entitled "Burrowing Mayflies of Our Larger Lakes and Streams," published in 1920 in the Bulletin United States Bureau of Fisheries, Vol. XXXVI, pp. 269-292, Professor Needham, discussing the species of the genus *Hexagenia*, makes the statement (op. cit. p. 279) that he is "unable to recognize more than two good and distinct species in the Eastern United States—a lowland species from lakes and rivers, *Hexagenia bilineata* Say, and an upland bog-stream species, *H. recurvata* Morg." He amplifies this statement in previous paragraphs (p. 278) by applying the name *bilineata* Say, "to all the variants of

\*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

the species that occupies the beds of our larger lakes and streams. The color differences appear to be only differences of degree. Even the differences of male genitalia—usually our ultimate criteria of species—are intergradient.”

With the above conclusions I must most emphatically disagree; from a study of a large number of dried specimens and further from personal observations on living material (both subimagos and imagos) during the annual “swarming” period at Sparrow Lake, Ont., in the latter half of June, 1925, I am convinced that there are a number of good species in this genus, closely related, it is true, but well separable, partially on male genital characters and also on color pattern of the abdomen, size of eyes, etc.; none of these features varies to any appreciable extent in any given species and Needham’s so-called intergradients are in reality good species.

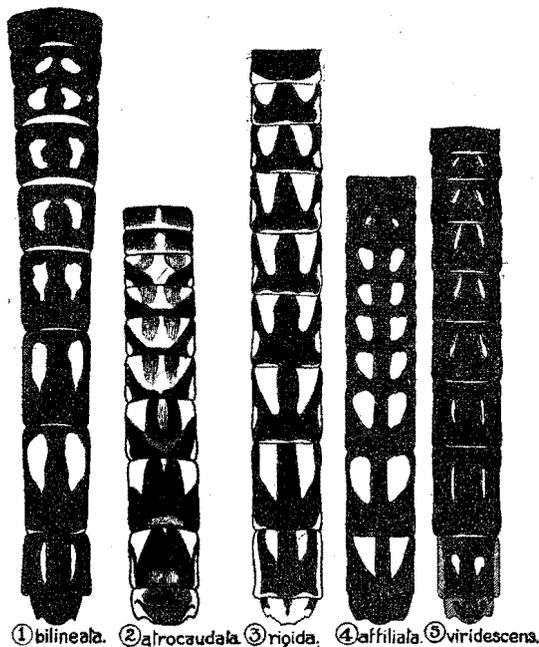


Fig. 1. Abdominal Pattern of Canadian Hexagenias.

The correct identity of *bilineata* Say has been ably established by Dr. Ulmer in 1921 (Archiv. f. Naturg. 87, Abt. A, pp. 233-9); Walsh’s identification of Say’s species has been confirmed and figures showing the distinctions between *bilineata* Say and *limbata* Guer., both in abdominal maculation (vide fig. 1) and in male genitalia, are given. I commented on this article in the Canadian Entomologist, 1924, p. 90 and might now add that fresh material from Rock Island, Illinois, received through the kindness of Dr. T. Frison of the Illinois State Natural History Survey has only served to strengthen my opinion as to the correctness of Ulmer’s identification. In his original description Say mentions “posterior edges of the segments white above,” a feature quite noticeable in these specimens and to my knowledge not nearly so evident in any other species. *Bilineata* seems confined to the Mississippi river and its tributaries and has not yet been captured in Canada. Needham’s figure (op. cit. Pl. LXXXI, 62), to which

he has applied the name *bilineata* form *falcata*, represents the genitalia of typical *bilineata*, and *falcata* Needham will therefore fall as a direct synonym of Say's species.

In 1924 (Canadian Entomologist, LVI, pp. 90-93) I described two further species in the genus as *rigida* and *atrocaudata*, based largely on genitalic characters in dried specimens; these species would correspond to Needham's *bilineata* form *bilineata* (fig. 61) (*err. det.*) and *bilineata* form *munda* Eaton (fig. 64), also an obvious misidentification, as the type male of *munda* at Cambridge, Mass. shows a hook-like penis, much as in *limbata* Guer. (vide Ulmer's figure and Needham's figure 63); Needham's fig. 65 as *bilineata* form *falcata* (subimago) should also be referred to *rigida* McDunnough. A study of more material of *atrocaudata* in fresh condition shows that, besides a remarkable constancy in the shape of the male genitalia (both in subimago and adult), there is also a very distinct abdominal pattern, best understood by a reference to the accompanying figure (fig. 2).

At Sparrow Lake, as I mentioned above, I was privileged to witness the emergence and flight of vast numbers of *Hexagenias*; the tree-trunks and buildings in the vicinity of the lake were covered with subimagos and a few days later swarms of adults filled the air toward sundown. I at first was under the impression that only a single species was represented but, after a careful study of the unlimited material at my disposal, came to the conclusion that at least three species could be distinguished by the abdominal maculation alone, and it only required a little practice to be able to pick these three species out quite readily, both in the subimagos and in the two sexes of the adult.

In one species which for the present I call "Species No. 1" the abdomen was a deep black-brown with narrow subdorsal pale dashes and the posterior margin of each segment similarly colored (vide fig. 5); the setae were largely brown, slightly ringed with yellowish on the anterior portion of each segment; the eyes of the ♂ were deep-brown above and decidedly larger than in the other two species and the forelegs were normally longer. There was a very decided brown border on the hind wing in both sexes.

"Species No. 2" was noticeable for the bright yellow character of the dorsal maculation which consisted of two elongate triangular subdorsal spots, based on the anterior margin of each segment, the posterior margin being usually narrowly yellowish (vide fig. 3); the setae were largely yellowish with narrow brown rings at the joints; the eyes of the ♂ were deep olive-brown above and smaller than in "Species 1." The brown border of the hind wings was narrowed and less noticeable than in the previous species. The females and even the subimagos showed the same bright, contrasted type of abdominal maculation.

"Species No. 3" possessed the same bright yellow character of maculation as "Species 2" but differed decidedly in the more irregular nature of the spots and the fact that they were not based on the anterior margin of the segment but entirely surrounded by the dark brown ground-color (vide fig. 4); yellow triangles, situated in the postero-lateral corners, were better developed than in "Species 2" especially in the females (not seen in the figure), and the posterior borders of the segments, in the males at least, were scarcely tinged with yellowish;

the setae were irregularly and broadly banded with brown and yellow, the eyes of the ♂ were of similar size to those of "Species 2" but with a slight greenish tinge and the dark border of the hind wings was lacking.

On closer examination it was found that the two latter species could further be separated by the structure of the ♂ genitalia; in "Species 2" the penis was rod-like whilst in "Species 3" it was hook-like; no intergradations were observed and even in the subimagos the two types were easily visible, although considerably smaller and less developed.

On returning to Ottawa "Species 2" was readily determined as *rigida* McD.; a few of the ♀ Paratypes of this species, examined in the light of my more accurate knowledge of this sex, proved to belong to the species which I called *limbata* at the time of description; the color of the longitudinal veins in the primaries which I mentioned then as diagnostic can hardly I think be considered of much value as a means of differentiation as it apparently varies according to the age of the specimen.

For Species 1 and 3 I could find no names available; the genitalia of both were of the *limbata* type, which eliminated *bilineata* Say from consideration: the abdominal maculation, however, forbade a reference of either species to *limbata*. As there were several of Walker's names in the synonymy of *limbata*, the identity of which had never been satisfactorily cleared up, I finally sent a considerable series of specimens to Mr. R. G. Blair of the British Museum, who kindly examined Walker's types in the light of my suggestions; as a result it was found that the name *viridescens* Wlk. based on a ♀ subimago from St. Martin's Falls, Albany River was applicable to Species No. 1; this name, therefore, must be reinstated as that of a good species.

As there appears to be no name available for Species 3 I propose the name *AFFILIATA*; the chief distinctive characters have already been given but in addition it might be mentioned that in the male sex on the ventral side of each abdominal segment, besides a medioventral brown line, there is a more or less semicircular brown patch, based on the posterior margin and occupying nearly the entire posterior half of the segment but *not attaining the anterior border*; on the rear segments the shape is roughly triangular rather than semicircular. These brown patches are only rarely present in the ♀ which generally merely show a broken medioventral dark line.

*Holotype*.—♂, Sparrow Lake, near Severn, Ont., June 16-21, (J. McDunnough); No. 2426 in the Canadian National Collection, Ottawa.

*Allotype*.—♀, same data.

*Paratypes*.—21 ♂, 8 ♀, same data.

Specimens of this species are also before me from the Ottawa region, Kingston and Algonquin Park, Ontario.

In conclusion it remains to discuss briefly one of our commonest Canadian species of *Hexagenia* to which I have formerly referred under the name *limbata* Guer. Typical *limbata* is evidently a pale yellow species with decided yellow abdominal maculation; it is doubtful if the typical form occurs in eastern Canada, its range being southern and western. I have examined a few specimens from central Illinois where it occurs along with *venusta* Eaton and have a long

series before me of almost typical specimens from various localities in southern British Columbia. Our eastern form, common throughout the Great Lakes and St. Lawrence regions and extending into Manitoba, lacks the clearly-cut yellow maculation, this being suffused to a greater or less degree in the males with pale ruddy-brown; even in the females this suffusion is present in a more moderate degree. Generally speaking the males have a dark border to the hind wings which, together with the suffused type of maculation, distinguishes the species from *affiliata*. As however this dark border does not appear to be entirely constant a further means of separation in the male sex is found in the ventral abdominal maculation; the semicircular brown patches of *affiliata* have become triangular patches with the apex of the triangle *attaining the anterior margin* of segment in the median line, thus leaving only an antero-lateral patch of the pale ground-color visible; at times almost the whole ventral surface is suffused with brown. Suffused males, especially when dried, are apt to be confused with *viridescens* Wlk. which has the same ventral abdominal markings and hook-like type of penis; the latter species, is however, larger and the diameter of the eye considerably greater.

I am still in doubt as to whether the species under discussion is a good species or merely a northern form of *limbata*; in any case the name *occulta* Wlk., with *angulata* Wlk. as a synonym, will apply to this form, according to Mr. R. G. Blair's comparisons and notes on Walker's types. Possibly when I have had opportunity to study the species during one of its swarming periods I may be able to discover points of specific distinction; for the present I shall refer to the form as *limbata* var. *occulta* Wlk.

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NOTES ON THE HIBERNATION OF THE SPRUCE BARK-BEETLE.  
*IPS PERTURBATUS* EICHH. IN NORTHERN ONTARIO.\*

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The location selected for hibernation by this bark-beetle has long been a mystery and it was believed at first that, in common with other members of the *Scolytidae*, these beetles did not depart from the usual custom of hibernating in their tunnels in the bark where they had matured from the egg.

In the Algoma District of Ontario, *Ips perturbatus* invariably passes the winter as a young adult beetle, the parent beetles dying in the summer after completing their tunnels. A partial emergence of beetles was noted late in the fall and it was assumed that these beetles were about to enter living or freshly-killed spruce preparatory to the excavation of egg-tunnels in the following spring. A close examination of windfall spruce and trees killed by *Dendroctonus piceaperda* earlier in the season failed to reveal any signs of *Ips perturbatus* and the species was not to be found at all until the following May when a few individuals were noted on the wing. Towards the end of the month, *Ips* was to be seen in numbers entering windfalls and the tops of spruce killed by *Dendroctonus* the previous year.

It has since been ascertained that the young adults of *Ips perturbatus* leave their tunnels in September and October and hibernate in the ground, emerg-

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\*—Contribution from Division of Forest Insects, Entomological Branch, Dept. Agriculture, Ottawa.