The following paper embraces the results of some observations made since the fourth paper in this series was published. (See Canadian Entomologist, 1910, vol. 42, p. 357; 1911, vol. 43, p. 399; 1912, vol. 44, p. 73; 309.)

1. Pyractomena borealis Randall. (*) The presence of this species in the neighbourhood of Washington, D.C., was established by Mr. W. S. Fisher, who found it pupating in large numbers in deep crevices in bark at Great Falls, on the Potomac River, about fifteen miles northwest of the U. S. Capitol at Washington. It is quite a large Lampyrid, and its flash appeared to the writer to be the brightest of any of the known local fireflies. When flying at a height of from eight to ten feet above the ground, its flash produced a distinct though faint illumination over an area perhaps ten feet in diameter on the ground.

The distribution of the luminous organ in this species is very similar to that in P. angulata and P. lucifera. In the male, the entire ventral surfaces of the two segments before the last show the yellow colour of the luminous tissue, while in the female this tissue area is restricted to two irregular patches on these segments. The male should, therefore, give distinctly the brighter light. The habit of the insects of pupating in crevices in bark several feet from the ground, as observed by Fisher, together with the known reluctance of many female lampyrids to fly, even when possessing wings, would make it seem probable that the females would be found on the bark of the trees where they emerged, or not very far away.

(*) In a former paper the writer adopted the late E. Olivier's name Lecontea for this genus. Olivier's reasons for the change, however, appear to be invalid, according to Rule 36 of the International Commission on Zoological Nomenclature. As a matter of interest it may be mentioned that Mr. H. S. Barber, of the U. S. National Museum, calls my attention to the fact that the name Pyractomena was originally applied by Dejean (1833) to a genus containing only manuscript names of species. Leconte, in 1850 applied this generic name to Lampyris borealis Randall, a described species, which therefore automatically became the type for this genus. This publication antedates that usually given, Leconte, 1852. The other species, lucifera and angulata, are correctly placed in this genus.

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The writer's observations on this species were made at Great Falls, over the same area where Fisher had found the species, and on the evening of May 3, 1916, several days after Fisher's observations. The insects did not appear until it was quite dark—about 8.00 p.m.—when numbers of them were seen along the top of the bluff, some forty or fifty feet high, which marks the former river bank at this point. On ascending this bluff, the insects were found to be flying around in the foliage, principally from ten to twenty feet above ground, flashing at intervals of five to ten seconds; they soon became very plentiful. At first their flight appeared to be entirely aimless, and even long and close watching failed to reveal any replies to the flashes from females on bark or twigs, but presently a fainter occasional flash was observed on a trunk about 8 feet above ground, where the brighter flashes of the males had already been observed. It soon appeared that the fainter flash emanated from a point between two males, each of the latter some six or eight inches from the faint flashes. An electric flashlight revealed an imago of this species on the bark, but just out of reach; it cannot be stated positively that this was a female, but the conduct of the faint flashes points strongly in that direction, as the fainter flash was several times observed to follow closely flashes from one of the two males; it did not follow all of these flashes, which may have been due to the irregularities in the bark hiding the flashes of the male at times. The males, as was found later, on alighting near a supposed female, run fairly rapidly over the area, apparently in search of her. In this case, the male lower down on the bark was captured and identified. They were still flying and flashing an hour after the first observation, apparently as thickly as at first, this conduct resembles Photurus more than Photinus—indeed, except that the light is not quite as green to the writer's eye, the flight of this species suggests that of Photurus.

The flash of the male is a single, rather short and intense flash, followed in many instances, though not in all, by a very faint, slow or "trailing" secondary flash. This secondary flash varied greatly with different individuals, being in some cases so distinct as to suggest the double flash of Photinus consanguineus, while in other specimens it was apparently absent. The males, when approaching a supposed female, usually, though not always, exhibit a faint,
continuous glow between flashes. The flash of the female—if this may be judged by the specimen seen on bark and assumed to be a female—is a much less intense and slower flash, given almost immediately after the flash of the male she is answering. Representing these in the manner used by the writer in his review of this subject (Zeitschrift für wissenschaftliche Insektenbiologie, 1914, Bd. 10, pp. 303-307), the flashes of this species would appear as shown in the sketch, Fig. 1.

Experiments with a pocket flashlight soon showed that the flying males would pay no attention to the unshielded light, when flashed immediately after their flashes (although the toads in the neighbourhood seemed greatly interested, and could be heard hopping toward the experimenter from several directions after each flash!) When, however, the fingers of the free hand were so disposed over the bulb as to completely prevent the escape of any direct light, the luminous surface being the portion of the finger tissue through which the light passed, it was found easy to attract flying males from a distance of as much as twenty-five feet, by flashing immediately after the flash of the male. The reaction was so definite as to leave no doubt of the matter; of ten males captured in perhaps fifteen minutes, nine were obtained as the result of attraction to the experimenter by means of the flash light. For instance, a male was observed to be flying in a direction about at right angles to the path which the experimenter was following, and about fifteen feet ahead and perhaps twenty feet in the air. Immediately after he flashed, the shielded lamp was flashed; the flying insect immediately turned, flying downward and along the line of the path, almost in a direct line for the experimenter's hand. Each time he flashed, the flash was answered, as he drew nearer, and when quite close, he swerved suddenly and alighted on the coat sleeve of the extended hand. One or two of those taken were caught in flight, but most of them were allowed to alight on the coat sleeve, and then captured; they usually landed at a distance not more than about eight inches from the light, running around rather rapidly after lighting, stopping occasionally and waving the antennae somewhat after the manner of Photinus pyralis when mating. It is interesting to note that the distinctly red colour of the light from the flash light after passing through the tissue of the experi-
menter's fingers, did not seem in the least to interfere with the phenomenon, although decidedly different from the colour—to the human eye—of the light of the female insect.

A flash of a flying Lampyrid, closely resembling that of the male of this species, was observed by the writer in the Soldier's Home Park, in Washington, D.C., about April 20, 1911, and was at that time ascribed by Mr. H. S. Barber, to some northern species not yet recorded from this locality. The distribution of *P. borealis* in the surrounding country has not been worked out, but it would appear possible that the flash seen in 1911 might have been due to a chance male of this species. The spring of that year was rather warmer than usual, possibly accounting for the early date.

Olivier (Accouplements anormaux chex les insects. Premier Cong. Internat. d’Entomologie, 1910, pp. 143–145; see also Gadeau de Kerville, Bull. Soc. Ent. France, 1896, No. 4, p. 85) has mentioned the comparative frequency with which two male lampyrids are found attempting to mate. During this investigation a number of live males of *Pyractomena borealis* were placed in a test-tube, and upon examining them about half an hour later it was found that two of them had coupled, the penis of the upper one being held between the mandibles of the other; they remained in this position at least two hours. The position of the terminal segments of the upper male were those of normal intromission. There was no evidence that one insect had attacked the other, nor did either appear to be injured.

It may be noted that the odor of this insect, while resembling that of *Photinus pyralis*, is still rather different from that of the latter species.

2. *Photuris pennsylvanica* DeGeer. This species was observed for the first time during the season of 1916, along the Conduit Road between Great Falls and Cabin John Bridge, on the evening of May 27. The insects first appeared as isolated, scattered specimens about 8.15 p.m., but by 9.00 o’clock there were thousands of them flashing in the trees and over the fields. As previously noted (Can. Ent., 1911, vol. 43, pp. 403–4) difficulty had been experienced in connecting the luminosity with the mating conduct in this species. Experiments with the use of the electric flash light
were begun on the above date, using both the naked bulb and the bulb covered with the hand, as just described for *Pyractomena borealis*, but no evidence of attraction toward the lamp was obtained. In view of the fact that the light of this species is rather more greenish than that of the other local Lampyridae which have been studied (Coblentz, Can. Ent., 1911, vol. 43, pp. 355-360, and previous papers by the present writer) the experiment was tried of covering the bulb of the lamp with a thin leaf. With this modification of the colour of the light, and by using a long flash, in imitation of that previously described as one of the methods of light-emission of this species, it was found comparatively easy to attract the males so that they would approach the flashed light, but unless the bulb were shaded more as they drew nearer, they appeared to recognize some difference in the light and would fly away again. The response was not entirely uniform, even in the early evening when but comparatively few were flying; later, when several hundred insects might be within the range of the flash, a definite response was decidedly the exception, unless a particular, isolated insect near the electric light responded.

Four distinct types of light-emission on the part of this species were observed, agreeing with those previously reported (Can. Ent., 1910, vol. 42, pp. 358-360). First noted was a series of usually three, though sometimes four or five rapidly repeated flashes of considerable intensity, followed by darkness for several seconds; the flashing thus was repeated at intervals of from not more than three seconds to as much as half a minute. The series of flashes is suggestive of that of the male of *Pyractomena lucifera*, except that ordinarily not as many separate flashes are given, that there is a distinct interval of darkness between succeeding flashes in the series, and that the flashes in any series appear to be of diminishing intensity, (see diagram, Fig. 6). The specimens which exhibited this type of flash, came to the lamp when given the long flash described, and were usually, though not always, found to be males.

The second type of lighting observed was that which the writer has previously described as "a faint glow rapidly increasing in brilliancy. . . . It then ends suddenly. . . ." The only correction to make on this earlier observation is that this flash,
when observed close at hand, is seen not to be a continuous steady flash, but a series of very rapid pulsations, or a flash of very rapid variations in intensity, such as may be observed in a moving mirror image of an arc-lamp operation on alternating current. (See diagram). As compared with the phenomenon of the alternating current arc-lamp, the “frequency” appeared to be about 50 per second, rather slower than the lamp (60 cycles). One insect flashing thus was caught on the evening of May 27, and found to be a female, but at this time, none could be attracted to the electric light, by imitating either this flash, or that described in the preceding
paragraph, for the male. Later, notably on the evening of June 17, along the Chesapeake and Potomac Canal, only a few hundred yards from where the first observations were made, females giving this long flash, repeatedly came to electric lights operated in the flashing manner of the male, when used both by the writer and by Mr. H. S. Barber, the bulbs in both cases being shielded by a leaf. The reverse attraction, as described in the foregoing paragraph, was also observed at this time, and had previously been observed by Mr. Barber and the writer, along the Canal on the evening of June 3. There were, however, some curious exceptions: for instance, on the evening of June 5, at the writer's residence, 1901 Jackson St., N.E., this city, an insect giving the long flash was attracted to a lamp giving the flashing light, and when captured proved to be a male; also on the evening of June 13, at the same place, using the electric lamp giving a long flash, two females and four males were attracted, caught and identified. It was not found necessary that either sex be flying to respond; insects at rest on leaves and fences repeatedly responded by flashing to stimulation with the electric lamp, and would sometimes leave their locations and fly to the light. Good results were never obtained unless the light was either shielded with a leaf, or the bulb coated with a solution of malachite green and chlorophyl in collodion.

The third method of lighting observed for this species was that already described as single, not very bright flashes, emitted at intervals of a second or two while the insect is flying through the air in almost any direction, dropping from a tree, or running around on the ground or on the grass. In every instance these insects were found to be females. Operating the electric light in imitation of this flash did not seem to cause attraction of either sex, but in one instance, when a male was observed on a fence rail, giving his usual triple flash, and responding to the electric light flashes in imitation of the usual long flash of the female, the change to the type of flash above described caused him immediately to cease to respond. Provisionally we may regard this as the flash of a pregnant (or hungry) female.

The fourth type of light-emission consists of a single, short, bright flash, repeated at intervals of about four seconds or more. This flash is the least common, and insects flashing thus were
found to be males, and did not respond satisfactorily to the electric light.

Only rarely was attraction between the sexes in this species noted, and as mentioned in a previous paper, it is very rarely that pairs in couple are seen or taken. On account of the great numbers of the insects, and their habit of flying quite high, it is very difficult to follow closely any particular individual or pair. On one occasion a male and female were confined in a tube for some time, hoping that mating would take place; the male flashed irregularly, in single flashes, and the female appeared to answer him, but although she ceased to light and became quiet whenever the male touched her or ran over her back, he appeared to pay no attention whatever to her, and no mating was observed.

Mr. Barber informs the writer that he has frequently noticed dim, fixed points of light in the woods at night, which on investigation, proved to come from the luminous organ of a small adult Photinus that was being devoured by an adult Photuris, the latter in each case appearing to be a female. In several cases where a male and female of Photuris were confined together to secure eggs, the male was found to have been devoured during the night. These appear to be natural habits of the insect, both of which the writer has been able to conform. Mr. Barber also states that he has been informed by Mr. Harry L. Parker, of Hagerstown, Md., who has observed the pupa of this species, that in addition to the anal lights, there is a constant light emitted from the pupal prothorax, which persists through the teneral adult stage, but disappears as the beetle hardens.

3. Pyractomena lucifera Melsheimer. Experiments on the evening of May 15, on the attraction of the males of this species to a flashed electric light, were entirely negative. A lamp shielded with a leaf was not used at this time, but was tried later, still with negative results.

4. Pyractomena angulata Say. A male of this species was captured at the writer's residence on the evening of June 13; when in flight it gave a series of short, dim flashes, not unlike those described for the pregnant or hungry female Photuris, but fainter and of a decidedly orange colour. (See fig. 6). No attraction to the flashed electric light was noted. A female of this species
was taken in flight in mid-day near the same locality on May 30; in fact all females of this species which the writer has taken, have been caught flying in daylight. This flash does not agree with that of the insect which the writer supposed to be a male of \( P. \text{angulata} \) in 1912.

5. \( P. \text{consanguineus} \) Lec. This species was observed at Plummer's Island, Md., on June 3, and along the Canal on June 17. The interval between the two flashes constituting the light-emission of the male, was found to be variable, sometimes as much as two seconds. No attraction of the male to the electric bulb could be secured.

6. \( P. \text{scintillans} \) Say. The previous observations on this species were plentifully confirmed, but no new facts brought forth.

During this season a flash was observed on two separate occasions, but in the same locality, which does not correspond with that of any known Lampyrids of this vicinity. It consisted of a series of quite rapid flashes, somewhat like that of the male of \( P. \text{Pyrrhactomena lucifera} \), but of a distinctly orange tone. Both observations were made long after the normal period of prevalence of the \( lucifera \). It was found impossible to capture the insect at this time, and the flash was not seen again, on later visits.

NEW NEARCTIC CRANE-FLIES (TIPULIDÆ DIPTERA).
PART II.

BY CHARLES P. ALEXANDER, ITHACA, N. Y.

(Continued from page 31.)

The following records also undoubtedly pertain to this species, but in the absence of the material are not included in the type series:

Fort Kent, Aroostook Co., Maine, August 19 (Johnson); White Cap Mt., Maine, August 17, 1905 (Jones); Dedham, Mass., Sept. 4, 1906 (Johnson); Brookline, Mass., Sept. 6, 1906 (Johnson); Cohasset, Mass., Oct. 1, (Bryant); Mt. Marcy, Essex Co., N. Y., July 30, 1913 (Young); Elm Lake, Hamilton Co., N. Y., August 2, 1912 (Young); Hazleton, Luzerne Co., Pa., August 20, 1909 (Dietz).

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