

THE STONEFLIES OF THE GENUS PELTOPERLA.

BY JAMES G. NEEDHAM AND LUCY W. SMITH, ITHACA, N. Y.

This obscure genus of stone-flies is of wide distribution in North America, and it includes a considerable number of species, only two of which have hitherto been made known. The type species *P. arcuata* was described by the senior author in 1899 in the *Proceedings of the Biological Society of Washington*. However, specimens of both adult and larva of this species had long reposed in the Cornell University collection. In 1907 Nathan Banks described a second species, *P. minor*, from British Columbia. In 1912, Professor H. Garman published an excellent figure of a nymph belonging in this genus in Bulletin No. 159 of the Kentucky Agricultural Experiment Station. This specimen was from a rill flowing into Straight Creek near Cary, Kentucky, and was labelled "An Undetermined Stonefly nymph, (No. 3)."

Meanwhile specimens for study have been coming into our hands from various quarters: from Ramapo, N. Y., contributed by Mr. William T. Davis; from Black Mts, N. Carolina, loaned by Mr. William Beutenmuller; from several localities in Georgia, collected by Dr. J. C. Bradley; from Nevada, loaned from the Museum of Comparative Zoology by the curator, Mr. Samuel Henshaw. There are also a few specimens bearing only general locality designation from unknown sources in the Cornell University collections, and along with these a few nymphs from British Columbia, from California, from Arizona, and from Washington, D. C. One species, described below as *P. maria*, from Pelham, Mass., has been collected and reared by the junior author. No good characters have as yet been discovered for distinguishing this nymph from that of *P. arcuata*, or from those of the other species which have not as yet been reared. This paper will therefore be limited to characterization of the adult forms.

Soft-bodied stoneflies such as these make very unsatisfactory pinned specimens. They shrivel like prunes in drying, and, as a rule, the best differential characters offered by the genitalia may be made out only by boiling and softening and expanding the specimens. The colours fade hopelessly, either pinned or in alcohol. Our descriptions of colour will therefore be useful only in so far

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as they indicate general distribution of the deeper pigmentation areas. What is described from pickled or mummified specimens as yellow may have been green in life.

This genus includes species varying from 10 mm. to 20 mm. in length, and from 18 mm. to 50 mm. in expanse of wings. It is characterized by the possession of but two ocelli, by having a broadly depressed body, short head retracted under the front of a wide prothorax, long antennæ, and very short caudal filaments that are often hardly longer than the abdomen is wide. The venation of the wings is characterized by numerous costal cross-veins, a short sub-costal vein, not reaching the level of the cord, and the branches of the vein Cu 1 appear to spring from its anterior side.

Nymphs of this genus, so far as observed hitherto, live in spring-fed rivulets under stones. About Ithaca, N. Y., they are not uncommon in such places, and they are abundant in a small southern tributary to Enfield Creek near the mouth of the gorge. The nymphs are unique in form, having a wide thorax, broadly rounded and covered with an appressed pubescence above. The abdomen is narrower and rather short. A few long tapering gill filaments protrude backward singly about the base of the legs, both dorsally and ventrally.

Nine species are here described, of which seven are believed to be new. Only the adults are characterized, and, unfortunately, but one sex is known as yet in the case of several of the species. The accompanying plate will doubtless serve better than the descriptions for distinguishing the species. The drawings of genitalia and of the disc of the prothorax have all been done on uniform scale. They are the work of the junior author.

Two very distinct types of male genitalia occur in this genus. One is represented only by a new species from Nevada, *Peltoperla thyra*. In this, the 9th abdominal segment is abbreviated almost to complete disappearance on the mid-dorsal line; the mid-ventral callosity is a mere crescentic transverse ridge at the base of a deep V-shaped suture, the supra-anal plate is remarkably hypertrophied, elevated, bent forward in the middle, and armed with a pair of lateral expansions beside its knobbed tip (Fig. 14). In the other group, represented by all the other species of which

males are known (Figs. 5, 8 and 11) the 9th abdominal segment is prolonged on the mid-dorsal line; its mid-ventral callosity is elevated on a clavate pedicel; the supra-anal is rudimentary, and the subanal plates are developed as a pair of upcurving hooks, whose tips meet the prolongation of the tergum of the 9th segment.

These differences are so remarkable that in any other order of insects they would doubtless be used to distinguish genera; but here they appear not to be accompanied by corresponding differences in other parts and we must agree with Enderlein that the remarkable differences in secondary sexual characters often found in a series of species of Plecoptera, otherwise uniform, are probably not of generic significance.

There are slight venational differences between species, in the number of cross-veins in certain areas, and in the number of terminal forks of veins Rs and Cu, but in absence of a considerable series of specimens, we have no means of knowing how constant are the apparent differences, and our experience with such characters in this order leave us little confidence in their reliability. *Pelto-perla brevis* appears, however, to be the only species in which the radial sector is but once forked beyond the cord. The differences in the form of the apex of the 8th ventral segment in the female is probably the most available criterion of the remaining species. *Pelto-perla anna* is the only species which shows no appreciable prolongation of the apex of this sternite: *P. dorothea*, *P. ada* and *P. arcuata* have it successively more prolonged and entire; *P. maria*, *P. cornelia* and *P. cora* have it successively prolonged and with a wide median notch.

The two species hitherto made known are not here redescribed but new figures of them are given in the accompanying plate.

DESCRIPTION OF NEW SPECIES.

***Pelto-perla maria*, n. sp.**

Length of female 16 mm.; expands 27 mm.

Colour brownish, darker on the sides of the thorax and apex of the abdomen. Head yellowish with a diffused brownish blotch on the disc in front of the ocelli. Antennae yellowish, paler for a distance beyond the two basal segments, which are thick and brownish. Wings yellow hyaline with brownish veins.

There are some 14 cross-veins in the costal space before the end of the subcosta, and seven beyond. The cross-veins in the median and cubital areas are 5 and 7 respectively. Legs yellowish brown, not distinctly bicoloured; 8th ventral segment of the female slightly produced and broadly emarginate in the middle by a shallow wide notch.

Type—A female in the Cornell University collection from Pelham, Mass., reared on the 20th of May, 1913, by the junior author.

***Peltoperla anna*, n. sp.**

Length of male 13 to 14 mm.; expands 23 mm. Length of female 20 mm.; expands 27 mm.

A yellowish species (possibly greenish in life), having inter-segmental darker areas about the bases of the legs and on the sides of the thorax. Head yellow. Antennæ yellowish, slightly darker on the pedicel and on the apical half. Prothorax with pale brown marks just before the middle of the disc and a transverse brownish crescent close to the rear margin. Legs yellow, with a knee-cap of brownish-yellow on the base of the tibia externally, and the tips of the tarsi also brownish. Abdomen yellow, with broad, half-rings of brown margining the ventral segments. A pair of large, brownish blotches almost covers the 9th segment ventrally and the tips of the subanal plates are suffused with brown. Wings yellowish hyaline, with the veins darker.

The 8th ventral segment of the female shows in this species no elongations. The plate is cut squarely across the margin, and scarcely differs in appearance from that of adjacent segments. At the base of the 9th ventral segment of the male, there is a chitinated knob supported upon a short pedicel directed backward. The apex of this segment is slightly produced upward in the rear and covers the bases of the enlarged subanal plates, which are pointed, and reach with their tips the level of the dorsum of the segment. Caudal appendages short, abruptly tapering; each of the segments beyond the 4th basal bears a single, stout, downwardly directed seta.

Types—Male and female, in the Cornell University collection were collected at Burton, Ga., (altitude 1800 feet), on May 21st, 1911, by Dr. J. Chester Bradley.

***Peltoperla cornelia*, n. sp.**

Length of female 18 mm.; expands 30 mm.

Colour brownish-yellow. Head yellow, except for an obscure brownish diffused spot before and between the ocelli. Disc of prothorax pale brownish, obscurely and coarsely rugose. Legs yellowish, with the sides of the femora brown. A dark basal knee-cap covers the tibiae, with apices of tibiae and all of the tarsi brown. Abdomen entirely yellow. Wings smoky-yellowish, the veins brown, costal cross-veins closely crowded, there being about 15 before the end of the subcosta and 8 beyond.

The 8th ventral segment of the femora, produced backward to cover about half of the 9th segment, broadly rounded on the sides and very broadly emarginate in the middle, and a wide notch that is hardly more than an undulation of the margin.

Type—A single female collected at Cornelia, Georgia, on the 5th of April, 1906 (possibly the 4th of May, the label bearing the designation, "5-4").

***Peltoperla dorothea* n. sp.**

Length of male 14 mm.; expands 21 to 28. Length of female 17 mm.; expands 28 to 30.

Colour, pale brownish. Head yellowish, except for a broadly diffused band between the eyes before and between the ocelli. The ocelli are somewhat nearer to the eyes than to each other. Antennae brownish and distinctly yellowish basally just beyond the 2nd segment. Prothorax, nearly straight across the front margin, with nearly parallel sides and very broadly rounded hind margin. Angles all obtuse. Rugosity upon the discs few, irregular, and somewhat paler. Thorax and abdomen brownish on the sides, yellow below. Wings smoky-hyaline, with brown veins. Setae yellow, slightly darker on the tip, densely clothed with yellowish hair and bearing beneath a line of long, stout spines, one on each segment.

The 9th ventral segment of the male bears a conspicuous knob upon a stalk that rises from the extreme base of the segment. The apical border is upturned, partly covering the bases of the sub-anal hooks, which are up-curved, parallel and sharp-pointed, and reach to the rear of the dorsal segment. The 8th ventral segment of the female is entire and moderately produced into a

broadly-rounded lobe which covers nearly the entire width of the 9th segment, but only the basal third of its length.

The male type is from Ramapo, New York, collected on the 31st of May by Mr. William T. Davis. The female type is in the American Museum of Natural History, and was collected by Mr. William Beutenmuller in the Black Mountains of North Carolina in May. There are several male and female co-types collected at the same time and place by Mr. Beutenmuller.

***Peltoperla ada*, n. sp.**

Length of female, 14 mm.; expands 24 mm.

A slender yellow species. Head wholly yellow. Antennæ yellow at the base, growing somewhat darker beyond the basal third. Prothorax yellow, with indistinct, embossed markings on the disc, shorter than usual, its length being about half its width. Front border nearly straight, sides converging posteriorly, a little border around hind margin. Legs pale yellowish, excepting the extreme tips of the tarsi, which are darker. Abdomen and setæ yellow. The 8th ventral segment of the female produced backward in a broadly rounded entire lobe, which covers two-thirds of the 9th segment.

Type—One female specimen in the Cornell University collection, collected at Black Rock Mountain, Ga., May 24, 1911, by Dr. J. Chester Bradley.

***Peltoperla cora*, n. sp.**

Length of female 28 mm., expands 50 mm.

Yellowish brown. Top of head wholly yellow. Distance between ocelli about one-half distance from ocellus to eye. Antennæ pale brown, base pale yellow. Prothorax concave in front, bulging at sides, slightly narrowed posteriorly with obtuse hind angles, hind border straight across middle, sloping backward at sides; length little more than one-half width; margins strongly flaring; disc concolorous, obscurely and sparsely rugose.

Legs mostly brown, tarsi wholly so; femora and tibiae paler on the sides with margins brown, darker externally.

Abdomen brownish, yellow below, excepting the immense ventral plate of the 8th segment, which almost covers the 9th segment. It is very broad, with wide and shallow apical emargina-

tion. Setæ brown, with yellowish bases, very short and abruptly tapering.

Type—A single female from Reno, Nevada, in the Museum of Comparative Zoology.

***Peltoperla thyra*, n. sp.**

Length of male 18 mm.; expands 30 mm.

Colour yellowish brown. Head obscure, but a little darker around the ocelli. Prothorax nearly uniform yellowish brown, faintly rugose, somewhat more squarely angled than in the other species, though like the others narrowed posteriorly and somewhat rounded behind. Legs yellow, with tips of tibiæ and tarsi darker. Wings yellowish-hyaline; veins amber-brown; abdomen yellowish, with the apical segments much darker. Setæ yellowish basally, darker towards the apex.

The 9th ventral segment is divided by a U-shaped suture, which separates off the upturned posterior lobe from the basal part of the segment, and just before the suture on the mid-ventral line there is a broad, chitinous callosity that is very different from the knob of the males of the other two species above described. It is not elevated upon a stalk, but merely caps the mid-ventral portion of the hind margin of this basal half of the sternum of the 9th segment. On the dorsal side the 9th segment is broadly excavated on its hind margin, a wide V-shaped notch almost dividing it in two in the median line. The edges of the V are upturned and chitinized. The 10th segment is not visible externally, reduced to a very narrow, thinly chitinized ring that is somewhat wider below. Supra-anal plate remarkably developed, broadened upward, and then recurved forward at its tip, knobbed at the end and bearing two thinner, wing-like appendages at its sides. The median terminal knob is beset with backwardly curved prickles.

The ventral callosity of the 9th segment is crescentic in outline when viewed from below. Within the apex of the 9th segment there are visible a pair of chitinized appendages, the nature of which is unknown. They are divergent basally, parallel and approximate at their tips, and possibly are in the nature of copulatory organs.

Type—Single male specimen from Nevada in the Cornell University collection.

EXPLANATIONS OF PLATE V.

Fig. 1. *Peltoperla arcuata* Needham.—End of abdomen of ♀ adult in ventral view.

Fig. 2. *Peltoperla arcuata* Needham.—Wings.

Fig. 3. *Peltoperla maria*, n. sp.—End of abdomen of ♀ in ventral view.

Fig. 4. *Peltoperla anna*, n. sp.—End of abdomen of ♀ in ventral view.

Fig. 5. *Peltoperla anna*, n. sp.—End of abdomen of ♂ in left lateral view.

Fig. 6. *Peltoperla cornelia*, n. sp.—End of abdomen of ♀ in ventral view.

Fig. 7. *Peltoperla dorothea*, n. sp.—End of abdomen of ♀ in ventral view.

Fig. 8. *Peltoperla dorothea*, n. sp.—End of abdomen of ♂ in left lateral view.

Fig. 9. *Peltoperla ada*, n. sp.—End of abdomen of ♀ in ventral view.

Fig. 10. *Peltoperla brevis* Banks.—End of abdomen of ♀ in ventral view.

Fig. 11a. *Peltoperla brevis* Banks.—End of abdomen of ♂ in left lateral view.

Fig. 11b. *Peltoperla brevis* Banks.—Ninth sternite of ♂ showing median callosity.

Fig. 12. *Peltoperla brevis* Banks.—Outline of prothorax.

Fig. 13. *Peltoperla arcuata* Needham.—Outline of prothorax.

Fig. 14a. *Peltoperla thyra* —End of abdomen of male in left lateral view.

Fig. 14b. *Peltoperla thyra*.—Extremity of supra-anal plate, viewed from behind.

Fig. 15. *Peltoperla thyra*.—Outline of prothorax.

Fig. 16. *Peltoperla ada*.—Outline of prothorax.

Fig. 17. *Peltoperla dorothea*.—Outline of prothorax.

Fig. 18. *Peltoperla maria*.—Outline of prothorax.

Fig. 19. *Peltoperla anna*.—Outline of prothorax.

Fig. 20. *Peltoperla cora*.—End of abdomen of female in ventral view.

Fig. 21. *Peltoperla cora*.—Outline of prothorax.

Fig. 22. *Peltoperla cornelia*.—Outline of prothorax.