

DISCOVERY OF THE FIRST MALES OF THE GENUS PSEUDOCLOEON (EPHEMEROPTERA) IN THE USSR

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The genus Pseudocloeon has been recorded from the Oriental-Australian, Ethiopian and Neotropical regions, and also from the Nearctic region. In the USSR it was first recorded from the Moscow River represented by the species P. inexpectatum Tshern., and slightly later from Romanian waters where P. hyalopterum Bogoescu was found. These species were described from adult females; the males and nymphs were unknown.

Nymphs of this genus were recorded for the Palearctic region by Imanishi (1940). In the case of the USSR they were first recorded by Zapekina-Dul'keyt and Dul'keyt (1961)* from the upper reaches of the Yenisey. They were later reported from the Angara Basin by Sukatskene (1962) and Kazlauskas (1963).

Pseudocloeon fenestratum Kazl. 1963.

Synonym: Baetiella "nx" Iman. (Imanishi, 1940).

Male imago (alcohol). Eyes orange, thorax dark-brownish, shiny, sometimes brownish with a reddish tinge; wings hyaline with a mat white spot in costal and radial fields; apex of costal field with 10 (Fig. 1a), in some specimens 7-8 (Fig. 1b) crossveins; femora of all legs light brown, tibiae and tarsi yellowish; fore tibia 1.7 times as long as femur; 1st segment of fore tarsus slightly longer than 2nd (1.2 times), 2nd 1.8 times longer than 3rd; 4th segment shortest, little more than half as long as 3rd; hind femur slightly shorter than tibia (by one-tenth); hind tarsus 3/5ths as long as tibia; 1st segment of hind tarsus 1.3 times as long as 2nd, 2nd segment 1.5 times as long as 3rd; 4th segment the longest, 2.5 times as long as 3rd (Figs. 2-4). Abdomen reddish brown above, sternites brownish yellow; forceps with a short stout first segment, its apical segment slender, fused with the preceding segment, separated only on the inner surface by a small notch (Fig. 5) and covered with delicate hairs; apical segment of forceps elongate, a little pointed at the end. Caudal setae yellowish.

Female adult (alcohol). Eyes black, thorax brownish above, whitish yellow below; mesothorax and metathorax with light goblet-shaped markings towards median line thorax and bases of wings with dark brown striae along sides; hind pair of wings wanting; wings hyaline; apex of costal field mat white; costal and subcostal veins yellow, remaining veins pale yellow; crossveins hyaline, slightly tinted (Fig. 6); fore legs light brown, middle and hind pairs yellow; fore tibiae 1.2 times as long as femur; 1st segment of fore tarsus as long as 2nd segment, which is 1.5 times as long as the 3rd; 4th segment the longest, 2.5 times as long as the 3rd; hind femur slightly longer than tibia (26:25); hind tarsus 3/5ths as long as tibia; 1st segment of hind tarsus 1.8 times as long as 2nd; 2nd segment 1.3 times as long as 3rd; 4th segment 3.3 times longer than 3rd (Figs. 7-10); subanal plate with small denticles (Fig. 11); caudal setae yellowish.

Measurements in mm

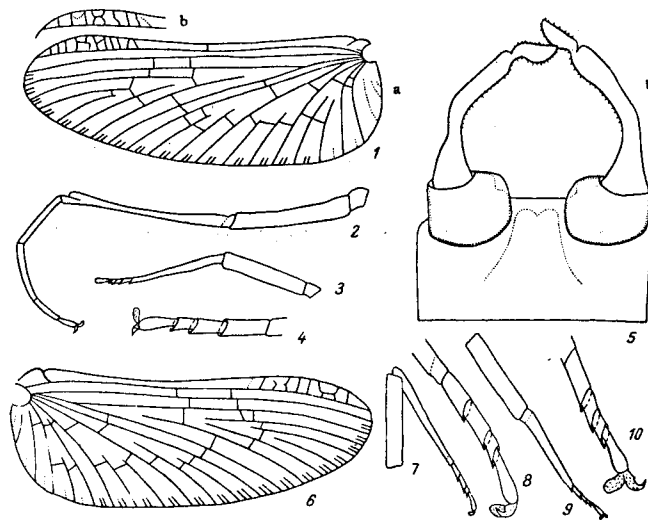
| | Male | Female |
|----------------------------------|---------|---------|
| Body length | 3.5-5.0 | 5.0-5.5 |
| Wing length | 4.0-5.0 | 5.5 |
| Length of caudal setae | 7.0 | 5.0 |

The female of P. fenestratum differs in the length ratio of the femur, tibia and tarsus from the Palearctic species known to the author, P. hyalopterum Bogoescu and P. inexpectatum Tshern., each described from the female imago. P. fenestratum females are very similar to P. exspectatum in the length proportions of the femur, tibia and tarsal segments. Thus, the length of the fore femur and tibia and of the 2nd and 3rd tarsal segments of the hind legs is practically the same in both species. The lengths of the 1st and 2nd tarsal segments of the fore legs, and the hind femur and the tibia are exactly the same.

Found along the middle reaches of the Amur: Bira River, 1 km below the Teplovka fish hatcheries, second bank, 19 July 1960, 1 ♂, 2 ♀♀ subimagines; same locality, 25 July 1960, 1 ♂ imago; same locality, Teplovka stream, mouth, 2 ♂♂ adults, 28 Aug. 1960, nymphs very plentiful in the Bira and Teplovka streams; Ussuri Basin; Khor River, Bol'shaya channel, July 1961, from traps used to estimate the amount of benthos carried away, 3 nymphs; Iman River, Sidopo and Tatibe channels, 12 Sept. 1959, 35 nymphs (collected by the author). Vitim Basin, Lake Oron, mouth of the Polovinka, 15 Aug. 1949, 2 nymphs from the gut of a grayling; same locality, mouth of the Belyy brook, 31 Aug. 1949, 10 nymphs (collected by Tomilov). Upper reaches of the Yenisey: Kaltat River, 1 km from the mouth, 18 May 1956, 1 nymph; same locality, head waters, 9 January 1957, 3 nymphs; same locality, 12 km from mouth, 24 Sept. 1957, 10 nymphs; Bazaika River, collected all along the bed, 10-12 July and 2 Aug. 1956, 18 mature nymphs; same locality, near Synzhul, 10 July 1957, 6 nymphs; same locality, 5 km above the mouth of the Namurt, 6 July 1957, 7 nymphs; same locality, at Inzhul, 18 Sept. 1957, 3 nymphs; same locality, 22 Oct. 1957, 4 mature nymphs; Namurt River, 5 km from mouth, 20 Aug. 1956, 2 nymphs; Plitnyazhnaya River, 4 km from mouth, 22 Aug. 1956, 3 nymphs; B. Inzhul River, 6 km from mouth, 5 nymphs; Kandalak River, 1 km from mouth, 8 Sept. 1956, 1 nymph; B. Synzhul River, 7-8 km from mouth, 19 Sept. 1957, 9 immature nymphs; Medvezhka River, 4 km from mouth 22 Sept. 1957, 5 nymphs; Rodstvennyy stream, 0.5 km from mouth, 3 nymphs (collected by Zapekina-Dul'keyt).

Not previously recorded in the literature from the Amur Basin. The present author identified nymphs for the first time in the USSR in waters of the upper reaches of the Yenisey (Zapekina-Dul'keyt and Dul'keyt, 1961). Known from the Angara Basin (Sukatskene, 1962; Kazlauskas, 1963), from which it was first described by R. S. Kazlauskas. In addition, nymphs of this species are recorded by Imanishi from the Korean Peninsula under the name Baetiella "hx" Iman (Imanishi, 1940).

*Our identifications.



Figs. 1-10. *Pseudocloeon fenestratum* Kazl.

1a) fore wing of male imago; 1b) part of fore wing of male imago; 2) fore leg of male imago; 3) hind leg of male imago; 4) hind tarsus of male imago; 5) genital appendages of male imago; 6) fore wing of female imago; 7) fore leg of female imago; 8) fore tarsus of female imago; 9) hind leg of female imago; 10) hind tarsus of female imago.

Pseudocloeon tuberculatum Kazl. 1963.

Synonym: *Baetiella japonica* "na" Iman. (Imanishi, 1940).

Male subimago (alcohol). Eyes orange, thorax light brown; wings opaque, fumose, marginated; anterior portion of costal field with 4 crossveins (Fig. 12); legs pale yellow; fore tibia 1.3 times as long as femur; 1st tarsal segment of fore legs 1.3 times the second; 2nd tarsal segment 1.5 times the 3rd; 4th tarsal segment the longest, 1.7 times the 3rd; hind femur less than half as long as tibia; hind tarsus 3/5ths of tibia; 1st segment of hind tarsus 1.3 times as long as 2nd; 2nd twice the 3rd; 4th segment longest, 5 times the 3rd (Figs. 13-16). Abdomen grayish yellow above with two paired small light spots on each tergite; abdominal sternites pale yellow; 10th sternite with a deep median incision (as in *Rhithrogena*) and its lateral portions protruding; genital forceps with small first and last segments (Fig. 17). Caudal setae mat white.

Female subimago (alcohol). Thorax brownish yellow; wings opaque, fumose, marginated; longitudinal veins grayish, crossveins pale gray; costal field with four crossveins, two branching (Fig. 18); legs pale yellow; fore tibia 1.3 times as long as femur; 1st segment of fore tarsus more than twice as long as 2nd; 2nd tarsal segment 1.2 times the 3rd; 4th tarsal segment the longest, 5 times the 3rd; hind tibia 1.4 times as long as femur; tarsus slightly more than half as long as tibia; 1st tarsal segment of hind legs 1.7 times as long as 2nd; 2nd 1.5 times as long as 3rd; 4th segment the longest, 10.6 times the 3rd (Figs. 19-20). Abdomen palish cinnamon-brown above with two light dots on each tergite; 3rd and 10th abdominal tergites light. Subanal plate with small teeth and with long hairs between these (Fig. 21). Abdominal sternites pale yellow; caudal setae light.

Measurements in mm

| | Male | Female |
|---------------------------------|------|--------|
| Body length. | 4.0 | 4.3 |
| Wing length. | 4.0 | 5.5 |
| Length of caudal setae. | 6.0 | 6.2 |

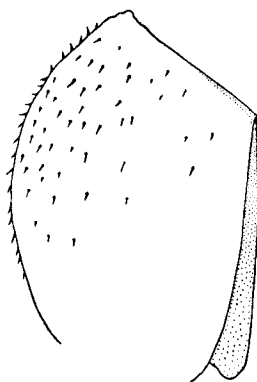
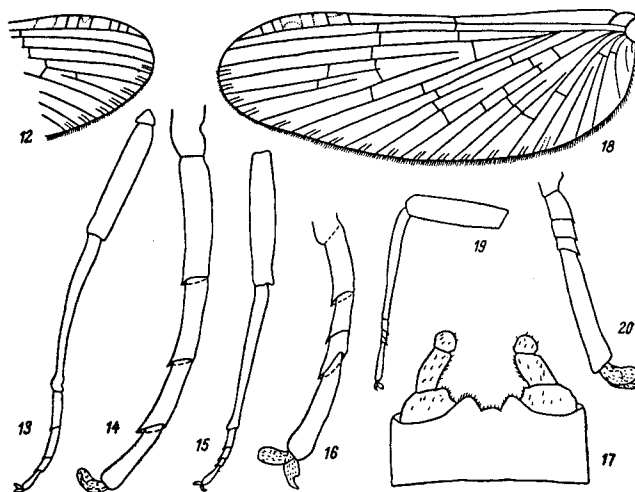


Fig. 11. *Pseudocloeon fenestratum* Kazl.
Subanal plate of female imago.

Found in the middle reaches of the Amur: Bira River, Staraya channel near a lock, 20 Aug. 1960 (1 ♂, 1 ♀ subimago reared); Bira River, middle of river, on sandbank, July-Aug. 1959-1960, 50 nymphs; Ussuri Basin: Birushka River near the mouth, 1952, 2 nymphs; Khor River, Bol'shaya channel, from traps used to estimate benthos carried away; Iman River, upper reaches, 35 nymphs on sandbank, Aug-Sept. 1959 (collected by the author). Southern Maritime Territory, Sudzukhe River, Sandagou channel (Primorybvod collections). Upper reaches of the Yenisey: Vynosnaya River, 50 km from the mouth, 30 Aug. 1956, 2 nymphs; B. Slizneva River, 3 km from mouth, 24 April 1957, 6 nymphs; Bazaika River, Dolgushi cordon, 12 July 1957, 3 nymphs; same locality, below the mouth of the Medvezhka River, 22 Sept. 1957, 6 nymphs before emergence; B. Synzhul River,



Figs. 12-20. *Pseudocloeon tuberculatum* Kazl.

12) part of fore wing of male subimago; 13) fore leg of male subimago; 14) fore tarsus of male subimago; 15) hind leg of male subimago; 16) hind tarsus of male subimago; 17) genital appendages of male subimago; 18) fore wing of female subimago; 19) hind leg of female subimago; 20) hind tarsus of female subimago.

2.5 km from mouth, 18 Sept. 1957, 2 nymphs; same locality, 8 km from mouth, 19 Sept. 1957, 14 nymphs (collected by Zapakina-Dul'keyt).

Recorded for the first time from the Amur Basin and the Southern Maritime Territory. Identified by us from waters along the upper reaches of the Yenisey (Zapakina-Dul'keyt and Dul'keyt, 1961). Known from the Angara basin (Sukatskene, 1962; Kazlauskas, 1963), from which it was first described by R. S. Kazlauskas. In addition, this species is recorded by Imanishi (1940) from the Korean Peninsula and Sakhalin under the name *Baetiella japonica* "na" Iman.

Biology. In the genus *Pseudocloeon* the nymphs transform to the winged stage on the surface of the water, which is not the case for other members of the family Baetididae. This is apparently related to the mode of life of the nymphs. Since *P. fenestratum* and *P. tuberculatum* nymphs live mainly on stones and rocks in banks and waterfalls; they are apparently incapable of crawling actively on to the stones along the bank before molting to the subimago as with nymphs of the families Ephemerellidae and Siphonuridae and almost all the families of the Heptageniidae.

We collected the largest number of nymphs of the last stage between 20 and 30 August 1959 and 1960 (Bira and Teplovka Rivers). Although these nymphs occur widely in these rivers, we have never seen nymphs crawling on to dry stones along the banks to molt; this has also been confirmed by our experiments. In cages for the rearing of rheophilous species the nymphs failed to emerge from the water onto the walls of the cage, but floated on the surface of the water and changed in a few seconds into the winged insects. According to our observations, subimagines that emerged from nymphs flew up into the air in isolated instances, but were mostly carried along by the strong current of the river.

Adults begin to emerge in the second half of July and continue to fly until the end of September. Emergence of the subimago from the nymph takes 2-3 seconds. The subimaginal stage lasts 10-15 hours, and the molt from the

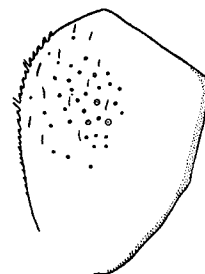


Fig. 21. *Pseudocloeon tuberculatum* Kazl.
Subanal plates of female subimago.

subimago to the imago takes 4-5 seconds. The winged insect lives for between 4 and 6 days.

P. fenestratum and *P. tuberculatum* nymphs live in fast-flowing water, mainly on banks and at waterfalls and rapids. Ecologically these species are similar to species of the genera *Iron*, *Cinygma* and *Cinygmula*. The nymphs are found mainly on stony bottoms and at a depth of from 0.1 to 1.5 meters; several nymphs were collected from logs and tree stumps and on banks in bottom-fed rivers in the Stolba reservation; water temperature in places where nymphs were collected in the summer ranged between 4 and 18°C; the optimum development temperature is 7-15°C.

The nymphs feed mainly on the diatoms *Fragilaria* sp., *Synedra* sp., *Achnanthes* sp., *Navicula* sp., *Amphora* sp., *Surirella* sp., *Tabellaria* sp., *Diatoma* sp., *Cocconeis* sp., *Ceratoneis* sp., *Cymbella* sp., *Gomphonema* sp., *Melosira* sp. and *Eunotia* sp. *Synedra* sp., *Navicula* sp., *Cocconeis* and *Ceratoneis* sp. are the diatoms of greatest importance in the food of the nymphs. Filamentous green algae (*Rhizoclonium* sp.) were also found in small quantities in the food

of nymphs of both species. There was scarcely any sand or ooze in the food mass.

CONCLUSIONS

Males of Pseudocloeon fenestratum Kazl. and P. tuberculatum Kazl. are described for the first time.

The nymphs feed mainly on diatoms. Metamorphosis of the nymphs to the winged stage occurs at the surface of the water.

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ENTOMOLOGICAL REVIEW

Vol. 47, Number 3

July-September 1968

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