

Ephemeroptera from Mongolia

By

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Abstract: Thirty-two species of mayflies collected during Dr. KASZAB's expeditions to Mongolia in 1964 - 1968 are listed and illustrated. *Cinygmula kaszabi* sp.n. (adult male and larva of *Baetopus asiaticus* are described and *Siphonurus alternatus*, *Baetis vernus*, *Cloeon simile*, *Ecdyonurus joernensis*, *Drunella submontana*, *Caenis jungi*, and *Ephemera strigata* are recorded from Mongolia for the first time. The species *Baetopus asiaticus*, *B. montanus*, and *Oligoneuriela mongolica* were described from the Dr. KASZAB's material earlier. Faunistical and biogeographical aspects of species investigated are discussed.

The mayfly fauna of Mongolia is relatively well known although most information concerning the species composition was obtained during several expeditions. IMANISHI (1940) first mentioned some species from this area but he left them mostly unnamed. TSHERNOVA (1952) described one species of *Baetis* from Eastern Mongolia (Chalchyn-gol). The results of the Mongolian-Soviet expedition to the Selenke river basin were published by BAYKOVA & VARYCHANOVA (1978). In all, they list 37 species from 9 families including a description of a new species of *Ecdyonurus*. The results of the Mongolian East German expeditions were elaborated by D. BRAASCH in series of papers (BRAASCH, 1977, 1979a, 1979b, 1980a, 1980b, 1982). He found 14 further species new to Mongolia and described 6 new species from the family Heptageniidae. Mongolian mayflies were also studied by SOLDÁN & LANDA (1977) and SOLDÁN (1978). These authors described 3 new species from the families Baetidae and Oligoneuriidae. Mayfly fauna of adjacent regions of (Central Asia, Siberia, Manchuria and Far East) was studied mainly by BRODSKY (1930), IMANISHI (1940), TSHERNOVA (1952, 1958), SOWA (1973), LEVANIDOVA (1982) and others.

We had the opportunity to study the material of the Hungarian-Mongolian expeditions collected by Dr. Z. KASZAB in 1964, 1965, 1966, and 1968. This material consists mostly of adults and subimagos collected at light traps so that our information concerning larval habitats, life cycles and larval habits are consequently, very restricted. This paper deals with the taxonomy and biogeography of the species investigated.

GENERAL FEATURES OF THE AREA INVESTIGATED

Mongolia's territory is situated in the centre of Asia exhibiting most of the physical features common for Central Asia as a whole. The natural conditions show a great variety of features (Fig. 1), prevailing biotopes can be classified as dry steppes of clean-cut continental type. Taking

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into account the average elevation above sea level (1580 m), this area belongs to the uppermost situated ones in the world. The average altitude of our localities is 1292 m a.s.l.

Mongolia's territory consists of two principal physiogeographical units defined by its morpho-structure, prevailing geomorphological processes, lithological particularities and hydrological conditions, climate, and vegetation. All these components affect the aquatic biotopes as well. As pointed out by several authors dealing with aquatic insects, the southern part of Mongolia belongs, according to its characters, to Central Asia, while the northern one to Eastern and Southern Siberia (see RAUŠER, 1968 for details). The localities investigated are evenly distributed throughout the Mongolian territory except for the waterless area of the Gobi desert (Fig. 1). Most localities are situated in the northern part of the Gobi area (A) in dry steppes of clean-cut continental type (14 localities) and in the desert of clean-cut continental type in the Intramontanious basin (Ab) (4 localities). Nine localities (see Fig. 1) are situated in the semideserts and steppe thin forests of the Altai Mts. (C) and Dzungaria (D). The remaining localities are situated in the Khangai Mts. (B) (8 localities) and in the Hind Baicalian Highlands (D). The last area is closely connected with Siberia from the physico-geographical point of view. Twenty-one localities are situated in the basins of three principal rivers: Selenke (Selenga, Baykal Lake or Yenisey basin), Tola and Kerulen (Amur basin). Further localities are situated in desert or semidesert areas with an extremely dry climate and there is no doubt that the mayfly larvae inhabit also periodic aquatic habitats at these localities. For further details concerning physico-geographic features and localities, see e.g. KASZAB (1965), RAUŠER (1968) and others.

There are 41 localities at which Ephemeroptera species were collected during Dr. KASZAB's expeditions. The localities are situated at altitudes of 585 - 1900 m. The material comes from various administrative districts (aymaks) as follows Archangai; Bajanchongor; Bayal Ölgii; Bulgan; Central; Chentel; Chovd; Chövsgöl; Coybalsan; Gobi Altai; Suchebaator; Uvs.

SYSTEMATIC PART

Siphonurus alternatus (Say) (Fig. 3)

Material examined: Archangai aymak, 24 km N of Somon Lun, 1520 m, July 1, 1964 (No. 238), 1 ♀; 8 km W of Somon Urdtamir, Khangai Mts, 1680 m, July 21-22, 1966 (No. 723, 724), 1 ♀.

This circumpolar species is recorded for the first time from Mongolia. Only females comprised our material. Subgenital plate of sternum VII is slightly more produced (Fig. 3) than that in European populations, but according to our opinion this variability does not exceed species range. BRODSKY (1930) records this species from Novosibirsk, BRAASCH (1982) from the vicinity of Khabarovsk. There is no doubt that occurrence of this species in Mongolia represents an arcto-alpine disjunction to Central Asia.

Siphonurus lacustris Eaton (Fig. 2)

Material examined: Chövsgöl aymak, Tesiin gol riv., Alag Mort, 42 km NE of Pass Chaldzan Sogotyn davaa, 1900 m, July 15, 1968, light trap (No. 1109, 1110), 1 ♀.

This species is recorded from Mongolia by BRAASCH (1982) and from the Far East (Amur basin) by TSHERNOVA. LEVANIDOVA (1982) found *S. lacustris* also in Chukotka and Kamchatka. Our female resembles that of *S. chankae* (this species is known from the Amur basin and the Muren gol riv. in Mongolia - TSHERNOVA, 1952; BAYKOVA & VARYCHANOVA, 1978) but is distinguished by smaller body size and different colour patterns.

BAETIDAE

Baetis fuscatus (Linnaeus)

Material examined: Chovd aymak, Bulgan gol riv., 10 km SSW of Somon Bulgan, 1200 m, July 4-5, 1966 (No. 628, 629), 1 ♂, 37 ♀; Gobi Altai aymak, Mongol els, 10 km SE of Somon Chechmort, 1600 m, July 13, 1966, light trap (No. 684), 1 ♂; Chövsgöl aymak, 6 km WNW of Somon Tosoncengel, 1400 m, June 18, 1968, light trap (No. 981), 1 ♀; Tesiin gol riv.,

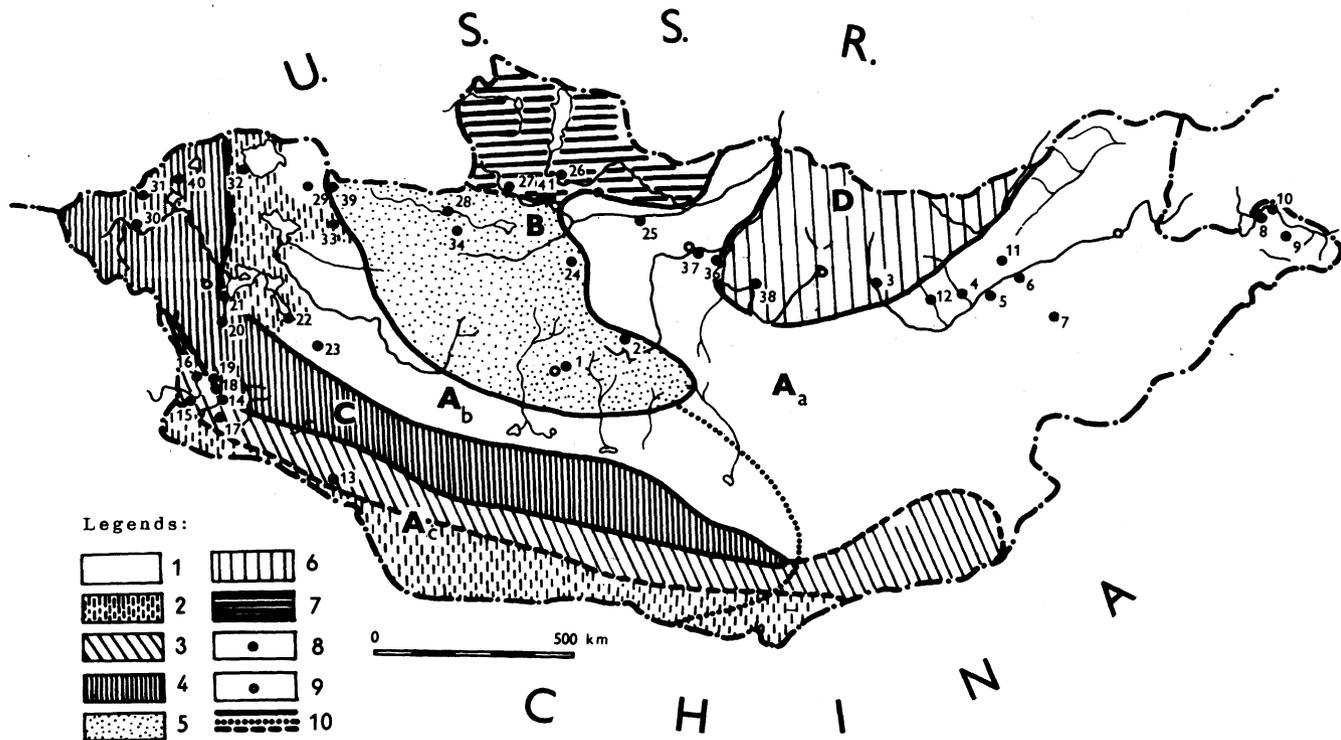


Fig. 1: Mongolia. Aa: Gobi, Ab: intramontaneous basins, Ac: Dzungaria, B: Khangai Mts, C: Altai Mts, D: Baikalian region. - Legends: 1: dry steppes of clean-cut continental type, 2: deserts of clean-cut continental type, 3: semideserts of clean-cut continental type, 4: tier of steppe thin forests, 5-6: tier of forest tundra and of continental meadow forest steppe, 7: forest tundra tier of moderate continental and continental type, 8: Dr. KASZAB's localities (1 = 200; 2 = 238; 3 = 306, 468; 4 = 324; 5 = 325; 6 = 333; 7 = 342; 8 = 391, 396; 9 = 399; 10 = 409; 11 = 456; 12 = 467; 13 = 613; 14 = 614, 622; 15 = 628, 629; 16 = 636; 17 = 643; 18 = 646; 19 = 647; 20 = 668; 21 = 673; 22 = 680; 23 = 684; 24 = 723, 724; 25 = 977; 26 = 981; 27 = 989, 990, 1115, 1117; 28 = 1001; 29 = 1014; 30 = 1024; 31 = 1046, 1047; 32 = 1056; 33 = 1090; 34 = 1109, 1110; 35 = 1121; 36 = 1141; 37 = 1141; 38 = 1148; 39 = 1009; 40 = 1040; 41 = 1126), 9: towns, 10: unity, region, subregion (according to RAUSER, 1968)

22 km W of Somon Cecerleg, 1820 m, June 22, 1968 (No. 1001), 1 ♂, 1 ♀; Delgermörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 1 ♂, 3 ♀.

A widely distributed Eurasian species in Mongolia recorded by BAYKOVA & VARYCHANOVA (1978) from the Selenke basin. Adults caught near large rivers.

Baetis vernus (Curtis) (Figs 5, 8, 11)

Material examined: Chovd aymak, Uench gol riv., Mongol Altai, 44 km N of Somon Uench, 1780 m, July 8, 1966 (No. 647), 1 ♂; Chövsgöl aymak, Egiin gol riv., 8 km N of Somon Alag-erdene, 1600 m, July 17, 1968, light trap (No. 1121), 1 ♂.

This material is most likely identical with the Eurasian species *B. vernus*. Coloration and shape of turbinate eyes (cf. MÜLLER-LIEBENAU, 1970) are identical. Forceps not distinguishable from these of European populations. Hind wings are slightly longer, costal angulation differs in being acute, conspicuously directed outwards. Colour patterns of sterna as in Fig. 5. According to our opinion these differences do not exceed the variability of East European populations. LEVANIDOVA (1982) records this species from numerous localities of North Siberia.

Baetis sp. I (Fig. 12)

Material examined: Chovd aymak, Uench gol riv., Mongol Altai, 35 km N of Somon Uench, 1750 m, July 8, 1966 (No. 646), 1 ♂, subimagoes; id., 44 km N of Somon Uench, 1780 m, July 8, 1966 (No. 647), 1 ♂, 2 ♀, subimagoes; Archangai aymak, 8 km W of Somon Urdtamir, Khangai Mts, 1680 m, July 21-22, 1966 (No. 723, 724), 1 ♀, subimago.

Large specimens, body length 10-12 mm. Turbinate eyes pale orange with lighter submarginal ring of their shafts. Thorax brown, abdomen light brown, sterna darker on sides (subimagoes male and female). Legs yellowish brown, femora darker posteriorly, in adult female whitish. Wings translucent, longitudinal veins slightly darker, grey with brown first three longitudinal veins in subimago male. Hind wings (Fig. 12) conspicuously large (only twice as long as broad), with three distinct veins and two intercalaries. Costal angulation large, triangular and obtuse at apex. This species possesses probably no relationships with other *Baetis* species from Mongolia and the Amur basin, being at least twice longer than all of TSHERNOVA's (1952) species from Amur. Adults show apparent relationship with the European *vernus*-group (cf. MÜLLER-LIEBENAU, 1970).

Baetis sp. II (Fig. 13)

Material examined: Bayan Ölgii aymak, Chovd gol riv., Ölgii, 1750 m, June 30, 1968 (No. 1046, 1047), 10 ♀.

Smaller specimens (body length 5 mm) with brown purplish abdominal terga, ventral side of body pale; wings translucent with darker longitudinal veins. According to an arrangement of the hind wings this species seems to belong to the *fuscatus*-group (cf. MÜLLER-LIEBENAU, 1970).

Baetopus asiaticus Soldán (Figs 9, 17)

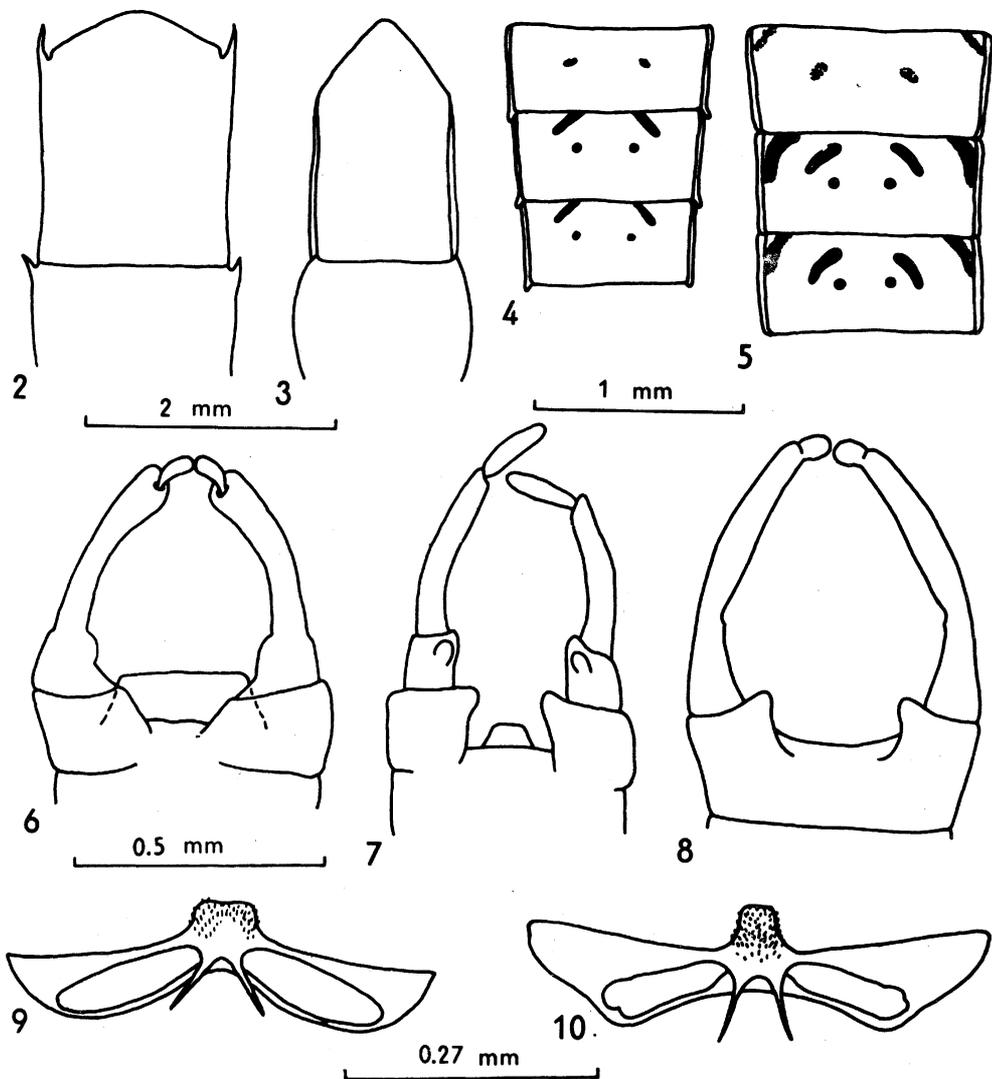
Material examined: Choybalsan aymak, Bur nuur lake, 585 m, August 11, 1965 (No. 391, 396), 1 ♀; Chövsgöl aymak, Tesiin gol riv., Alag Mort, 42 km NE of Pass Chaldzan Sogotyn davaa, 1900 m, July 14, 1968 (No. 1109, 1110), 2 ♂, 1 ♀ (Type series).

This species, closely related to *B. montanus*, is known only from Mongolia. It differs from the following species mainly in the arrangement of the penis, hind wings (Figs 9, 10, 16, 17) and in abdominal colour patterns. The genus *Baetopus* has two species in Mongolia, one in Europe and larvae of this genus were found also in Kazakhstan, USSR (KLUGE, pers. comm.). This species was earlier described from Dr. KASZAB's material (SOLDÁN, 1978).

Baetopus montanus Soldán

(Figs 4, 7, 10, 16, 18, 20, 22, 24, 26, 29, 30, 32, 33, 36)

Material examined: Chövsgöl aymak, Tesiin gol riv., Alag Mort, 42 km NE of Pass Chaldzan Sogotyn davaa, 1900 m, July 14, 1968 (No. 1109, 1110), 11 ♂, 10 ♀; Bayan Ölgii aymak, Chavcalyn gol riv., 25 km E of Somon Gagannuur, 1850 m, July 3, 1968 (No. 1056),



Figs 2-10. - Fig. 2: *Siphonurus lacustris*, female, sterna VI and VII, Fig. 3: *S. alternatus*, female, sterna VIII and IX, Fig. 4: *Baetopus montanus*, male, sternal (I-III) colour patterns, Fig. 5: *Baetis vernus*, the same, Fig. 6: *Cloeon simile*, forceps, Fig. 7: *Baetopus montanus*, the same, Fig. 8: *Baetis vernus*, the same, Fig. 9: *B. asiaticus*, penis, Fig. 10: *B. montanus*, penis

1 ♀, subimago (Type series).

Larva: Body length 7-8 mm, length of cerci 3.5 mm. Head and thorax light brownish yellow, pro- and mesonotum with darker smudges; wing pads pale, unicolorous. Episternits and epimerons of legs intensively brown. Abdominal terga light yellowish brown, terga I, II, VI and VII with intensive brownish anterior margins. Sterna paler with inconspicuous colour patterns than in adults. Labrum only slightly incurved in middle of anterior margin, with stout short bristles. Outer maxillar incisors with numerous bluntly pointed or rounded teeth, inner incisors as in Figs 18, 20. Hypopharyngeal lingua with rounded projection in middle of anterior margin, superlinguae margin-

ally emarginated, as wide as lingua. Maxillary palps 2-segmented, segment 2 as long as segment 1, twice as broad as segment 1 and incurved on inner margin. Labial palpus 2-segmented, segment 2 bulbous and bluntly pointed at apex. Glossae as long as paraglossae, bristles only in apical half. Legs pale, apex of tibiae and claws brownish. Claws long, not hooked, with two rows of minute teeth. Hind margin of abdominal terga with bluntly pointed or rounded teeth, equal in size; surface of terga with impression as in Fig. 33. Gills pale with a single medial dark stippled trachea, about 2.5-3 times longer than wide, slightly asymmetrical. Cerci pale, unicolorous with very inconspicuous rings and small bluntly pointed teeth on posterior margins of individual segments.

Larvae and adults of this species were associated according to abdominal colour patterns and shape of hind wing pads. They are well distinguished from larvae of the single European species of *Baetopus* by a large number of characters (mouthparts, gills). *B. montanus* is known only from Mongolia. This species was described from Dr. KASZAB's earlier. For distinguishing characters of adults see SOLDÁN (1978).

Centroptilum sp. I (Fig. 14)

Material examined: Chovd aymak, Uench gol riv., 3 km N of Somon Uench, 1450 m, July 2-3, 1966 (No. 614, 622), 1 ♀.

Undescribed species, characterized by very long and lanceolate hind wings with conspicuous and coiled costal angulation (Fig. 14). Body unicolorous, yellowish brown, fore wings translucent with slightly darker longitudinal veins; conspicuous dark pigmented tracheae on abdominal terga. There are no *Centroptilum* species described from Mongolia or Far East. BRAASCH (1982) mentions subimagos from Charus-nuur (Chovd aimak). The material consisting of females only does not permit description of a new species.

Centroptilum sp. II (Fig. 15)

Material examined: Gobi Altai aymak, SE Döröö nuur lake, Baga nuuriin urd els, 1200 m, July 12, 1966, light trap (No. 680), 1 ♀.

Body coloration same as in previous species, slightly darker, body length 10 mm. Shape of hind wing (Fig. 15) related to that of the European *penulatum*-group but wings of this species more asymmetrical with broader costal angulation. Fore wings translucent, longitudinal veins of the same colour. Most likely a new species.

Centroptilum sp. III

(Figs 19, 21, 23, 25, 27, 28, 31, 34, 35)

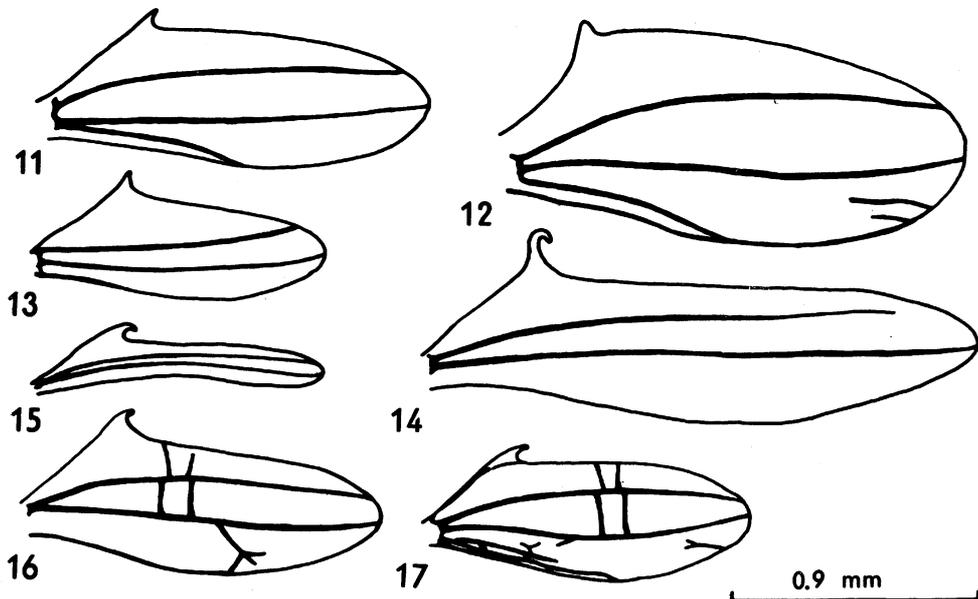
Material examined: Bayanchongor aymak, 4 km S of Somon Zhinst, Tuin gol riv., 1400 m, June 26, 1964 (No. 200), 142 larvae.

Length of body 10-11 mm, length of cerci 4.5 mm. Body whitish yellow, thoracic nota with darker smudges and diffuse spot near the anterior margin. Abdominal terga darker near anterior margin and with diffuse medial spot well apparent on terga II, V, VIII and IX; sterna pale, without margins. Labrum with flattened spines on anterior margin; maxillae with notched outer incisors, inner incisors as in figs 19, 21. Maxillary palps 3-segmented, segment 1 longer by 1/3 than segment 2 and by 1/2 than segment 3. Segment 3 of labial palps oblong shaped, its posterior margin with stout bristles; paraglossae distinctly longer than glossae. Legs pale, claws long and slender with two rows of minute bristles (Fig. 28). Gills 1-6 doubled, asymmetrical, dorsal lamella much smaller; gill 7 simple, rounded, nearly as wide as long. Long and short acute spines alternating on hind margin of abdominal terga (Fig. 34). Cerci brownish, ringed in apical half.

This larval material might be conspecific or closely related with *Centroptilum* "nb" illustrated by IMANISHI (1940) and *Centroptilum* sp. of TSHERNOVA (1952). Hind wing pads closely resemble hind wings of *Centroptilum* sp. I being very large, asymmetrical and having strongly bent costal angulation. The species I and III are therefore at least closely related. We have collected larvae of the same type in Central Asia.

Cloeon simile Eaton (Fig. 6)

Material examined: Chovd aymak, Bulgan gol riv., 10 km SSW of Somon Bulgan, 1200 m,



Figs 11-17, hind wing. Fig. 11: *Baetis vernus*, Fig. 12: *Baetis* sp. I, Fig. 13: *Baetis* sp. II, Fig. 14: *Centroptilum* sp. I, Fig. 15: *Centroptilum* sp. II, Fig. 16: *Baetopus montanus*, Fig. 17: *B. asiaticus*

July 4-5, 1966 (No. 628, 629), 1 ♂, 1 ♀.

Species closely related to or identical with *C. simile*. Penis cover and forceps range it undoubtedly to the *simile*-group. (cf. SOWA, 1980). This specimens differ from specimens from Europa in colour pattern (a pair of divergent stipes on terga IV-IX, sterna with dark brown bands, turbinate eyes brown, faceted surface pale yellowish). *C. simile* is not recorded from Mongolia. BAYKOVA & VARYCHANOVA (1978) found *C. dipterum* in the Selenka basin, BRAASCH (1982) records a species of the *dipterum*-group from Achit nuur (Uvs aimak).

OLIGONEURIIDAE

Oligoneuriella mongolica Soldán & Landa

Material examined: Chentei aymak, 15 km E of Öndörchaan, 1 km S of Kerulen riv., 1000 m, July 29, 1965, light trap (No. 325), 1 ♂, 1 ♀; 150 km ENE of Öndörchaan, 10 km S of Kerulen riv., 10 km N of Somon Tumunzagt, 1000 m, July 30, 1965, light trap (No. 333), 7 ♂, 17 ♀; 20 km SW of Somon Batnorov, 1000 m, August 20, 1965 (No. 456), 4 ♀; Suchebaator aymak, Chadatin-bulag, 60 km W of Somon Bayanterem, 950 m, August 1, 1965, light trap (No. 342), 1 ♀; Choibalsan aymak, Bur nuur lake, 585 m, August 11, 1965 (No. 391,396), 3 ♀; Chalchin gol riv., Somon Chalchingol, 600 m, August 13, 1965, light trap (No. 409), 1 ♀; Bulgan aymak, SE of Somon Daschinchilea, 1050 m, July 23, 1968, light trap (No.1141), 11 ♀ (Type series).

This species, described earlier from Dr. KASZAB's material in connection with a revision of Asian *Oligoneuriella* species, is known only from Mongolia and the USSR. It belongs to the *mikulskii*-group of *Oligoneuriella* (SOLDÁN & LANDA, 1977). KLUGE (pers. comm.) found larvae of some species of this group in Central Asia.

Cinygmula kaszabi sp.n. (Figs 37, 44, 46, 47, 54)

Material examined: Gobi altai aymak, Mongol els, 10 km SE of Somon Chechmort, 1600 m, July 13, 1966, light trap (No. 684), 1 ♂ paratype; Chövsgöl aymak, Egiin gol riv., 8 km N of Somon Alag-erdene, 1600 m, July 17, 1968, light trap (No. 1121), 1 ♂ holotype, 2 ♂, 1 ♀ paratype. Parts of paratype on slides. Holotype deposited in Hungarian Natural History Museum, Budapest.

Adult male: Body length 10-11 mm, length of cerci 16 mm. Eyes blackish grey, ocelli whitish. Abdominal segments I-VII translucent, yellowish brown, unicolorous, sterna slightly paler. Segments VIII-X light brown, forceps and penis dark brown. Fore wings translucent, longitudinal veins slightly darker. All cross veins dark brown and dark brownish bordered. Pterostigma brownish milky with about 10 cross veins, 2-4 of them forked in middle. Hind wing with intensively dark brown, bordered cross veins in anterior wing half and in submarginal area, remaining cross veins translucent, yellowish. Coxae brown; femora, tibiae and tarsi yellowish brown, tarsi of fore legs more than 1.5 times longer than tibiae, tarsal segments 2 and 3 equal in length, longer by 1/4 than segment 1. Middle and hind legs paler. Forceps base straight, without projections, forceps as in fig. 46, segment 3 shorter by 1/3 than segment 2. Penis lobes (fig. 37) parallel, rounded and produced anteromedially; titilators (fig. 44) pointed, asymmetric. Cerci slightly ringed at base, apical third unicolorous, yellowish brown.

Adult female: Body length 10 mm, length of cerci 20 mm. Body colour as in male, thorax paler, legs darker, brownish, unicolorous. Wings much more transparent than those of males; cross veins brown but only very slightly bordered. Hind margin of sternum VII only slightly incurved in the middle (fig. 47) with rounded projection.

Subimago and larva unknown.

Etyymology: This species is named for Dr. Z. KASZAB, a distinguished Hungarian entomologist and collector of the type series.

Differential diagnosis and discussion: There are four species of the genus *Cinygmula* known from Mongolia: *C. guentheri* Braasch, *C. minuta* Braasch, *C. smirnovi* Tshernova and *C. altaica* (cf. BAYKOVA & VARYCHANOVA, 1978; BRAASCH, 1979a, 1979b). Two further species are known from the Amur basin and Siberia (*C. pellucida*, *C. kurenzovi*). These species are well distinguished, occupying a relatively independent taxonomic position. *C. minuta* (known only in larval stage) is distinguished mainly by very small (3.8 mm) body length. *C. kaszabi* sp. n. is related to *C. kurenzovi* Baykova from Far East USSR. This species can be distinguished from *C. kaszabi* sp. n. by the following combination of characters: (1) body length 7.0-7.8 mm, (2) tarsal segment 1 and 4 equal in length (segment 1 distinctly longer in *C. kaszabi*); (3) penis lobes divergent; (4) titilators nearly symmetrical; (5) hind wings with dark bordered cross veins also in posterior half; (6) hind margin of sternum VII of female deeply incurved in the middle, projections bluntly pointed.

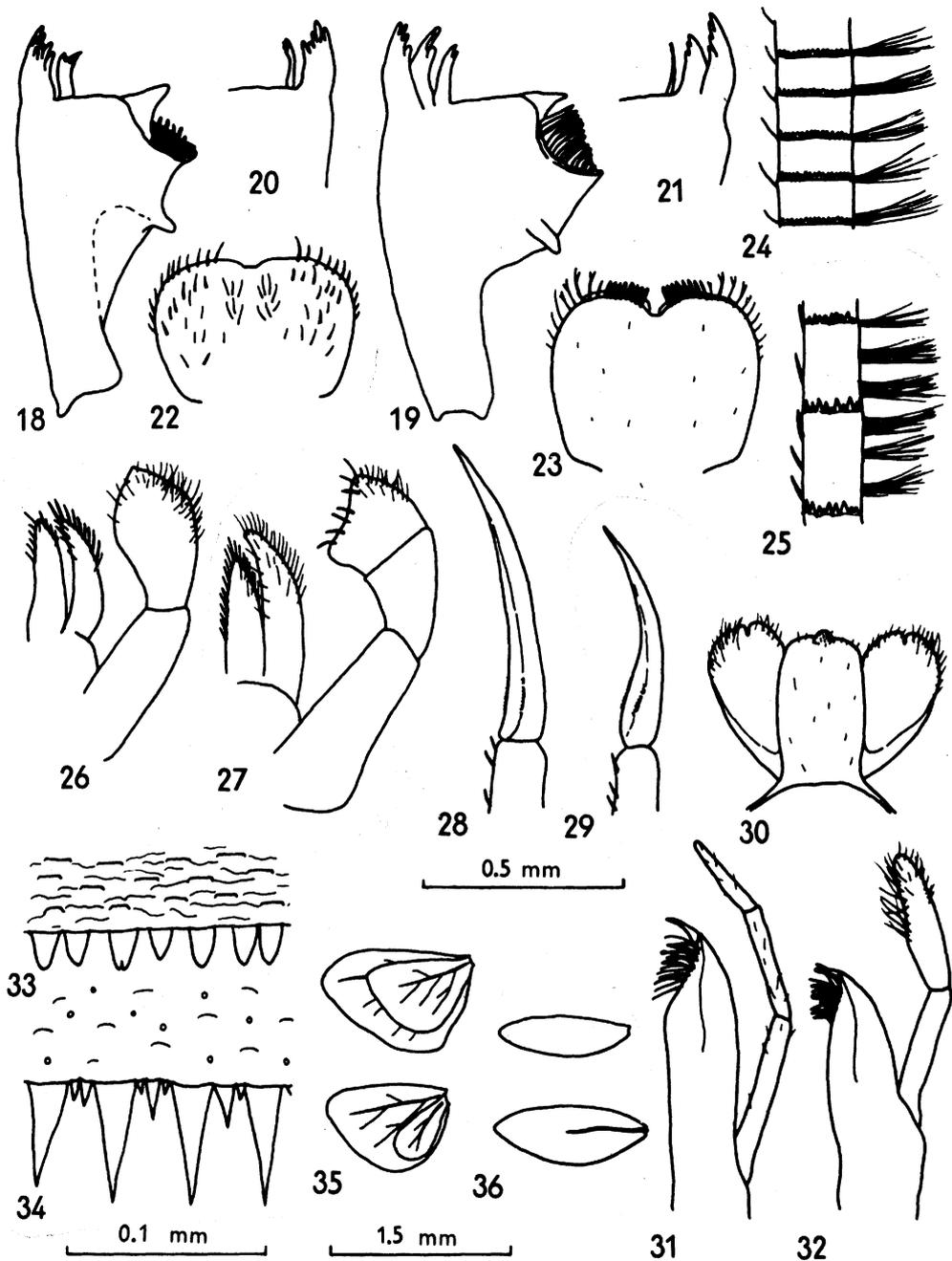
Ecdyonurus joernensis (Bengtsson)

Material examined: Central aymak, Kerulen riv., 45 km E of Bayandelger, 1340 m, July 26, 1965, light trap (No. 306, 468), 3 ♂, 4 ♀; Chovd aymak, Bodonchin gol riv., Somon Altai, 1350 m, July 2, 1966 (No. 613), 2 ♀.

North Eurasian species previously not collected in Mongolia. Closely related to *E. mongolicus* (Baykova & Varychanova) found in Mongolia at several localities (BAYKOVA & VARYCHANOVA, 1978; BRAASCH, 1979a). Specimens from Mongolia are larger (body length 6-7 mm) than those from Scandinavia.

Heptagenia flava Rostock

Material examined: Chentei aymak, 15 km E of Öndörchaan, 1 km S of Kerulen riv., 1000 m, July 29, 1965, light trap (No. 325), 1 ♀; Chovd aymak, Bulgan gol riv., 10 km SSW of Somon Bulgan, 1200 m, July 4-5, 1966 (No. 628, 629), 3 ♂, 6 ♀; Ulyasutayn gol riv., 45 km ENE of Somon Bulgan, 1400 m, July 6, 1966 (No 636), 2 ♂, 8 ♀; Bayan Ölgii aymak, Chovd gol riv., Ölgii 1750 m, June 30, 1968 (No. 1046, 1047), 3 ♀.



Figs 18, 20, 22, 24, 26, 29, 30, 32, 33, 36: *Baetopus montanus*, larva, Figs 19, 21, 23, 26, 27, 28, 31, 34, 35: *Centroptilum* sp. III, larva, Figs 18-21: maxillar incisors, Figs 22, 23 labrum, Figs 24, 25: cerci, Figs 25, 27: glossa, paraglossa and labial palpus, Figs 28, 29: claws, Fig. 30: hypopharynx, Figs 31, 32: maxilla, Figs 33, 34: hind margin of tergum III, Figs 35, 36: gills 1 and 6

A widely distributed Eurasian species known from Mongolia (BRAASCH, 1979a), Siberia and the Amur basin (as H. arsenjevi) (TSHERNOVA, 1952).

Heptagenia sp. (Fig. 42)

Material examined: Bayan Ölgii aymak, Chovd gol riv., Ölgii, 1750 m, June 30, 1968 (No. 1046, 1047), 1 ♂, 1 ♀.

Large species (body length 13 mm) resembling H. sulphurea as to body coloration (dark yellow thorax and abdomen, abdominal terga darker posteriorly). Cross veins blackish, bullae of fore wings pale. Legs without stripes. Arrangement of penis (fig. 42) is different from H. sulphurea. H. sulphurea is known from Mongolia (BAYKOVA & VARYCHANOVA, 1978, as H. soldatovi; BRAASCH, 1979a), Siberia (LEVANIDOVA, 1982) and the Amur basin (TSHERNOVA, 1952). The relationship of our Mongolian material to several Far-Eastern Heptagenia species known only in larval stage remain unknown (cf. TSHERNOVA, 1952; BAYKOVA & VARYCHANOVA, 1978).

Rhetrogena baykovae Sowa (Figs 49, 52)

Material examined: Central aymak, Kerulen riv., 45 km E of Somon Bayandelger, 1340 m, July 26, 1965, light trap (No. 306, 468), 8 ♂, 84 ♀.

A Far-Eastern species, recently described from the basins of Ussuri, Yenisey and Amur (SOWA, 1973). Recorded from Mongolia by BAYKOVA & VARYCHANOVA (1978) and BRAASCH (1979).

Rhetrogena lepnevae Brodsky (Figs 47, 48, 51)

Material examined: Chentei aymak, 10 km E of Somon Zenchermandal 1400 m, August 22, 1965, light trap (No. 467), 2 ♂, 2 ♀; Chövsgöl aymak, Delger-mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 1046, 1047), 20 ♂, 30 ♀.

Far-Eastern species, known from the basins of Ob, Yenisey, Ussuri, Amur, and also from Mongolia, Selenke basin and Uvs aimak (BAYKOVA & VARYCHANOVA, 1978; BRAASCH, 1979a).

Rhetrogena sibirica Brodsky (Figs 55-63)

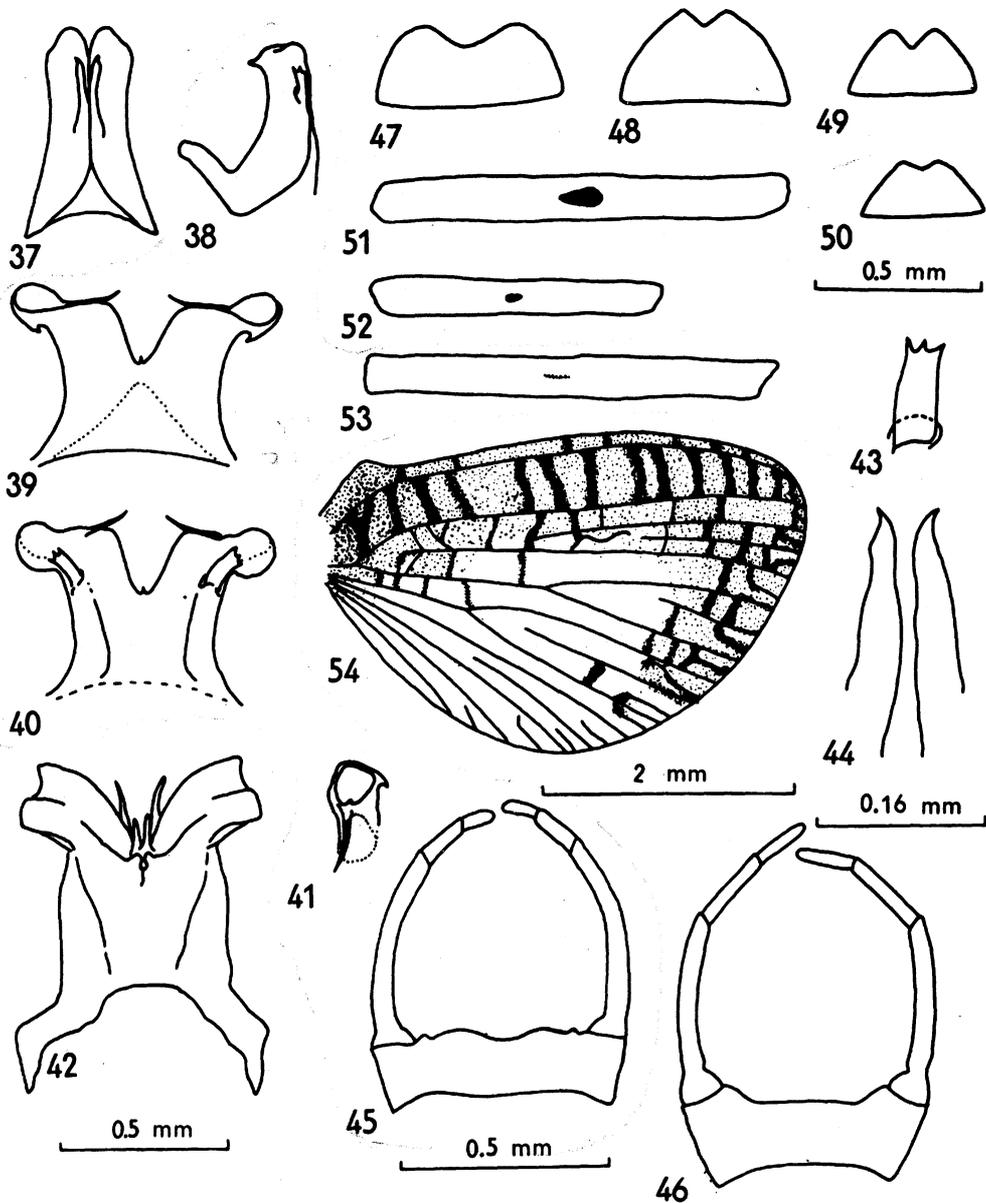
Material examined: Chovd aymak, Bodonchin gol riv., Somon Altai, 1350 m, July 2, 1966 (No. 613), 2 ♀; Uench gol riv., 3 km N of Somon Uench, 1450 m, July 2-3, 1966 (No. 614, 622), 1 ♀; id., 2 km N of Somon Uench, 1450 m, July 7, 1966 (No. 643), 2 ♂; Uench gol riv., Mongol Altai, 35 km N of Somon Uench, 1750 m, July 8, 1966 (No. 646), 1 ♀; id., 44 km N of Somon Uench, 1780 m, July 8, 1966 (No. 647), 1 ♂, 2 ♀; Chövsgöl aymak, Delger-mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 2 ♂; Egiin gol riv., 8 km N of Somon Alag-erdene, 1600 m, July 17, 1968, light trap (No. 1121), 1 ♂; Bayan Ölgii aymak, Chovd gol riv., Ölgii, 1750 m, June 30, 1968 (No. 1046, 1047), 1 ♂, 2 ♀.

Well-known and widely distributed (Yenisey, Ob, Amur basins, Kamtchatka, Sakhalin, Primorie - LEVANIDOVA, 1982). A Far-Eastern species, from Mongolia recorded by BRAASCH (1979a).

Rhetrogena sp. (Figs 38-41, 43, 45, 50, 53)

Material examined: Chövsgöl aymak, Delger-mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 1 ♂, 3 ♀.

Most likely a new species, but the material is partially destroyed. Closely related to R. lepnevae. Coloration similar to that of R. lepnevae but generally darker, spot on coxae very inconspicuous and spots on fore femora only indicated (fig. 53). Subgenital plate (forceps base) straighter, only slightly produced (fig. 45), penis lobes more produced laterally with smaller spines (figs. 38-41). Titillators as in R. lepnevae. Posterior margin of sternum VII in female is, in comparison with R. lepnevae, more triangular with straight lateral margins and less incurved in middle (cf. figs 48, 50).



Figs 37, 44, 46, 47, 54: *Cinygmula kaszabi* sp.n., Figs 38-41, 43, 45, 50, 53: *Rhithrogena* sp., Fig. 42: *Heptagenia* sp., Figs 48, 51: *Rhithrogena lepnevae*, Figs 49, 52: *R. bajkova*, Figs 37, 40, 42: penis, ventral view, Fig. 38: penis lateral view, Fig. 39: penis, dorsal view, Fig. 41: detail of penis lobe, Figs 43, 44: titillator, Figs 45, 46: forceps, Figs 47-50: sternum VII of female, Figs 51-53: male fore femur, Fig. 54: male hind wing

EPHEMERELLIDAE

Ephemerella ignita (Poda)

Material examined: Central aymak, Kerulen riv., 45 km E of Somon Bajandelger, 1340 m, July 26, 1965, light trap (No. 306, 468), 5 ♀; Chovd aymak, Uench gol riv., 3 km N of Somon Uench, 1450 m, July 2-3, 1966 (No. 614, 622), 1 ♂; Bulgan gol riv., 10 km SSW of Somon Bulgan, 1200 m, July 4-5, 1966 (No. 628, 629), 2 ♂, 269 ♀; Ulyasutayn gol riv., 45 km ENE of Somon Bulgan, 1400 m, July 6, 1966 (No. 636), 7 ♂, 2 ♀; Uench gol riv., 2 km N of Somon Uench, 1450 m, July 7, 1966 (No. 643), 1 ♀; id., Mongol Altai, 35 km N of Somon Uench, 1750 m, July 8, 1966 (No. 646), 1 ♂; id., 44 km N of Somon Uench, 1780 m, July 8, 1966 (No. 647), 1 ♂, 1 ♀; 5 km SW of Chovd, 1500 m, July 10, 1966, light trap (No. 668), 1 ♂, 2 ♀; Chövsgöl aymak, Delger-mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 1 ♂, 3 ♀; subimagoes.

A widely distributed Palaearctic species, abundant in Mongolia (BAYKOVA & VARYCHANOVA, 1978; BRAASCH, 1982).

Ephemerella mucronata Bengtsson (Figs 71, 72)

Material examined: Chovd aymak, Uench gol riv., 2 km N of Somon Uench, 1450 m, July 7, 1966 (No. 643), 1 ♂; Bayan Ölgii aymak, Chovd gol riv., Ölgii, 1750 m, June 30, 1968 (No. 1046, 1047), 5 ♀, all specimens subimagoes.

Known from Siberia, Europe and Far East. From Mongolia (Selenke basin) recorded by BAYKOVA & VARYCHANOVA (1978). Our material belongs to this species although subimaginal genitalia (Figs 72, 71) shows some differences in details.

Ephemerella sp. (Figs 69, 70)

Material examined: Bayan Ölgii aymak, Chovd gol riv., 1750 m, June 30, 1968 (No. 1046, 1047), 2 ♂.

The subimaginal material does not permit specific identification coloration as in *E. mucronata*, penis lobes resemble those of *E. kozhovi* Bajkova but they possess conspicuous medial projection. BAYKOVA & VARYCHANOVA (1978) and BRAASCH (1982) record 13 species of *Ephemerella* from Mongolia.

Drunella submontana (Brodsky) (Figs 67, 68)

Material examined: Chovd aymak, Ulyasutayn gol riv., 45 km ENE of Somon Bulgan, 1400 m, July 6, 1966 (No. 636), 1 ♀; Chövsgöl aymak, Delger-mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 1 ♂, 2 ♀, subimagoes.

A Central Asian species, from Mongolia recorded for the first time.

CAENIDAE

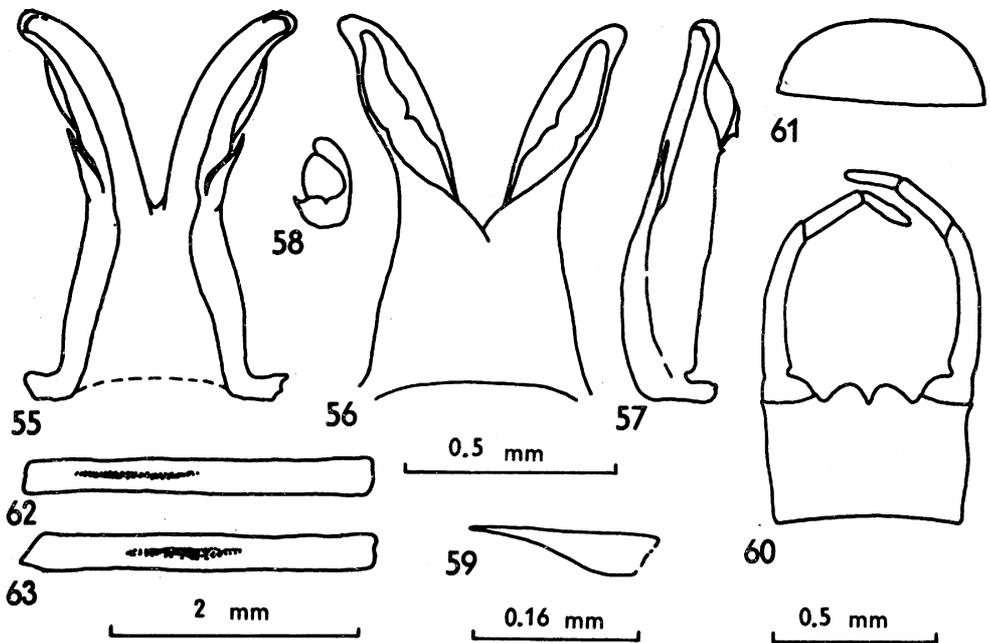
Caenis horaria (Linnaeus) (Fig. 66)

Material examined: Uvs aymak, Bag nuur lake, 6 km NE of Somon Zuungobi, 1000 m, June 25, 1968 (No. 1014), 10 ♂, 22 ♀.

A widely distributed species, known from the Amur basin (TSHERNOVA, 1952) and from the Selenke basin in Mongolia (BAYKOVA & VARYCHANOVA, 1978).

Caenis robusta Eaton (Fig. 64)

Material examined: Choybalsan aymak, Bur nuur lake, 585 m, August 11, 1965 (No. 391, 396), 12 ♂, 4 ♀; Chovd aymak, Bulgan gol riv., 10 km SSW of Somon Bulgan, 1200 m, July 4-5, 1966 (No. 628, 629), 23 ♀; Uvs aymak, Uvs nuur lake, 84 km W of Somon Zuungobi, 63 km E of Ulaangom, 790 m, June 26, 1968, light trap (No. 1024) 42 ♀.



Figs 55-63: *Rhithrogena sibirica*, Fig. 55: ventral, Fig. 56: dorsal, Fig. 57: lateral view of penis, Fig. 58: detail of penis lobe, Fig. 59: titillator, Fig. 60: forceps, Fig. 61: sternum VII of female, Figs 62, 63: fore and middle femur, male

From Mongolia recorded by BRAASCH (1982) and known (as *C. miliaria*) also from the Amur basin (TSHERNOVA, 1952). Our specimens lack dark pigmented spots on the penis seen in European populations.

Caenis jungi Braasch (Fig. 65)

Material examined: Chovd aymak, Jamatin Dolon, 40 km N of Somon Manchan, Char us nuur lake, 1200 m, July 11, 1966, light trap (No. 673), 2 ♀; Chövsgöl aymak, Egiin gol riv., 8 km N of Somon Alag-erdene, 1600 m, July 17, 1968, light trap (No. 1121), 1 ♂.

This species is most probably conspecific with *C. jungi* Braasch recently described from Uzbekistan (BRAASCH, 1980). Prof. TSHERNOVA informed us (pers. comm.) that she collected the same species in Central Asia. New to Mongolia.

Ephora nigradorsum (Tshernova)

Material examined: Central aymak, Kerulen riv., 45 km E of Somon Bayandelger, 1340 m, July 26, 1965, light trap (No. 306, 468), 1 ♂; 25 km E of Somon Lun, 1200 m, July 25, 1968, light trap (No. 1148), 20 ♀; Chentey aymak, 7 km NE of Somon Mörön, 1200 m, August 28, 1965, light trap (No. 324), 4 ♀; 10 km E of Somon Zenchermandal, 1400 m, August 22, 1965, light trap (No. 467), 2 ♂, 3 ♀; 150 km ENE of Öndörchaan, 10 km S of Kerulen riv., 10 km N of Somon Tumunzagt, 1000 m, July 30, 1965, light trap (No. 333), 1 ♂; Choybalsan aymak, Chamardavaa ul, 80 km S of Somon Chalchingol, 3 km S of Chalchia gol riv., 600 m, August 13, 1965, light trap (No. 399), 51 ♀; Bulgan aymak, Bayan nuur lake, 11 km W of Somon Bayannuur, 1000 m, July 24, 1968, light trap (No. 1141), 120 ♂.

A widespread Eurasian species, abundant and evenly distributed in the basins of large rivers in Mongolia (BAYKOVA & VARYCHANOVA, 1978) and Siberia (TSHERNOVA, 1952).

EPHEMERIDAE

Ephemera strigata Eaton

Material examined: Chövsgöl aymak, Delger mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 1 ♀.

An Eastern Palaearctic species known from Japan, Manchuria, Ussuri and Amur basin (TSHERNOVA, 1952), new to Mongolia.

Ephemera orientalis McLachlan

Material examined: Chövsgöl aymak, Delger-mörön riv., 8 km N of Somon Burenchaan, 1450 m, June 14-20, 1968 (No. 989, 990, 1115, 1117), 1 ♀.

Species of the same distribution, from Mongolia recorded by BAYKOVA & VARYCHANOVA (1978) and BRAASCH (1982).

POTAMANTHIDAE

Potamanthus luteus (Linnaeus)

Material examined: Bulgan aymak, Bayan nuur lake, 11 km W of Somon Bayannuur, 1000 m, July 24, 1968, light trap (No. 1141), 2 ♀.

A widespread and abundant trans-palaearctic species, recorded from the Selenke basin by BAYKOVA & VARYCHANOVA (1978). It seems to be rare in Mongolia owing to the lack of suitable biotopes (large lowland rivers).

ORIGIN AND CHARACTERISTICS OF THE MONGOLIAN MAYFLY FAUNA

As far as the distribution of the Mongolian mayfly species is concerned, there are three principal faunistic components: (1) widespread Palaearctic and Holarctic species; (2) Central Asian species and (3) Eastern Palaearctic species.

The first group consists of species with three principal distributional types: (1) circumpolar Holarctic species: *Siphonurus alternatus*, *Parameletus chelifex* and *Ephemerella aurivillii*. The southern limits of these species known from Scandinavia, North Siberia and North America lies just in Mongolia. (2) widespread trans-palaearctic species: *Potamanthus luteus*, *Ephemerella ignita* and probably also *Baetis fuscatus*; these species are distributed from England and North Africa to the Amur basin. (3) Eurasian species: *Baetis vernus*, *Cloeon simile*, *Caenis horaria*, *Caenis robusta*, *Ephemerella mucronata*, *Siphonurus lacustris*, *H. sulphurea*, *Heptagenia flava*, *Brachycercus minutus*, *Cloeon dipterum*, *Ecdyonurus mongolicus*, *E. joernensis* and *Ephoron nigridorsum*. The last three species are restricted to North Siberia outside Mongolia (*E. mongolicus* - cf. KLUGE, 1980) or to Scandinavia, Siberia and Amur basin (*E. joernensis*, *E. nigridorsum*). Distribution of these species in Mongolia is enabled mainly by the relatively very high altitudes of the localities. These Siberian elements occur mainly in the northern part of Mongolia, indicating close faunistic relationships of this area (cf. Fig 1) with Siberia.

The second group comprises species distributed only in Mongolia and Central Asia: *Baetopus* species (probably one of these species distributed in Kazakhstan), *Oligoneuriella mongolica*, *Centroptilum* sp. III (probably identical species in Uzbekistan) and *Drunella submontana*. These species, representing "desert" or "semidesert" elements are distributed mainly in aquatic habitats of dry steppes of the Gobi area in the southern part of Mongolia. On the other hand, some of them are able to inhabit also submontane and montane streams as in Central Asia (*Drunella submontana*). These species were not collected by previous expeditions working mainly in the Selenke basin and Uvs aimak, i.e. in Siberia like area from the faunistic point of view. Occurrence of these species in Mongolia supports the opinion concerning faunistic similarity of Central Asian and the Gobi area in Mongolia (RAUSER, 1968 and other).

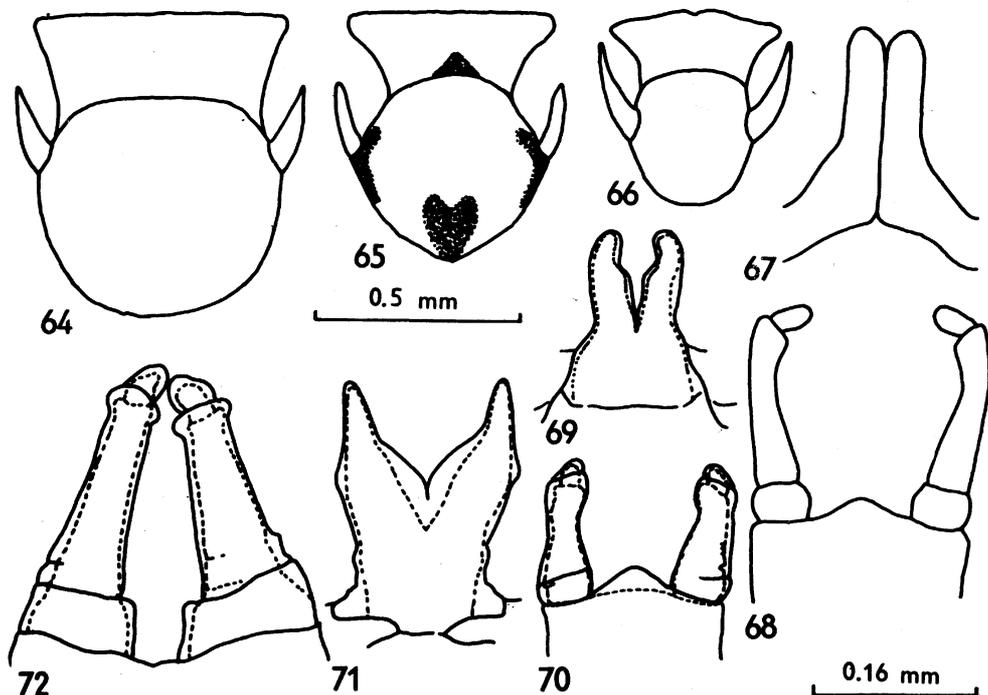


Fig. 64: *Caenis robusta*, penis, Fig. 65: *C. jungi*, penis, Fig. 66: *C. horaria*, penis, Figs 67, 68: *Drunella submontana*, penis and forceps, Figs 69, 70: *Ephemerella* sp., the same, Figs 71, 72: *E. mucronata*, the same

Third group consists of species with two principal distributional types: (1) Far Eastern and East Siberian species, some of them formerly considered as Amur basin endemic: all species of *Rhithrogena* and *Cinygmula* (*C. kaszabi* and *C. minuta* known only from Mongolia so far), *Heptagenia weretschagini*, all the species of Ephemerellidae (except those mentioned above - *E. ignita*, *E. aurivillii*, *E. mucronata* and *D. submontana*). Some of these species found by BAYKOVA & VARYCHANOVA (1978) and BRAASCH (1979a, 1982). *Epeorus latifolium*, *Isonychia japonica*, *Ephemerella trispina*, *Heptagenia kibunensis* are distributed also in Japan; (2) species distributed in Manchuria, Korea and China with northern limits of their distribution in Mongolia: *Ephemerella strigata*, *E. orientalis*. This group consists of two species only, since the severe continental climate in Mongolia probably prevents the occurrence of other species although further species are undoubtedly yet to be collected in future.

REFERENCES

- BAYKOVA, O. Ja. & VARYCHANOVA, K. V. (1978): Prirodnyje uslovy i resursy Prichubsugulja. Gidrobiologija. - Podenki Mongolii, Irkutsk-Ulan-Bator, 111-121.
- BRAASCH, D. (1977): *Rhithrogena piechockii* n. sp. aus der Mongolei. Ergebnisse der Mongolisch-Deutschen Biologischen Expeditionen, seit 1962. - Ent. Nachr. 9: 140-142.
- BRAASCH, D. (1979a): Die Eintagsfliegen (Ephemeroptera, Heptageniidae) der Mongolisch-Deutschen Biologischen Expeditionen seit 1962, Nr. 83. - Ent. Nachr. 23: 65-67.
- BRAASCH, D. (1979b): *Epeorus tshernovae* n. sp. aus der Mongolei (Ephemeroptera, Heptageniidae). - Reichenbachia, 17 (29): 243-248.

- BRAASCH, D. (1980a): Eine neue Cinygmula-Art aus der Mongolei (Ephemeroptera, Heptageniidae). - Reichenbachia, 18 (24): 161-163.
- BRAASCH, D. (1980b): Ecdyonurus klugei n. sp. aus der Mongolei. - Ent. Nachr. 24 (3): 41-43.
- BRAASCH, D. (1982): Die Eintagsfliegen der Mongolisch-Deutschen Biologischen Expedition 1964 (Ephemeroptera). - Dt. ent. Z.(S.N.), 29: 43-47.
- BRODSKY, K. A. (1930): K poznaniu Ephemeroptera Juznoy Sibirii. - Rusk. ent.obozr. 24: 31-40.
- IMANISHI, K. (1940): Ephemeroptera of Manchoukuo, inner Mongolia and Chosen. - Rep.limnobiol. Surv. Kwanhung and Manchoukuo: 169-263.
- KASZAB, Z. (1965-1968): Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei. Liste der Fundorte der II. -VI. Expedition. - Folia ent.hung. (S.n.), 18 (1965): 5-38; 18 (1965): 587-623; 19 (1966): 569-620; 21 (1968): 1-44; 21, Suppl. (1968): 389-444.
- KLJUGE, N. Ju. (1980): K poznaniu podenok (Ephemeroptera) Taymyrskogo nacialnogo okruga. - Ent. Obozr. 3: 561-679.
- LEVANIDOVA, I. M. (1982): Amfbioticheskie nasekomye gornykh oblastey dalnego vostoka SSSR. - Nauka, Moskva-Leningrad, 285 pp.
- MÜLLER-LIEBENAU, I. (1970): Revision der europäischen Arten der Gattung Baetis Leach 1815 (Insecta, Ephemeroptera). - Gewäss. Abwäss. 48, 49: 214 pp.
- RAUSER, J. (1968): Plecoptera. Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei. - Ent. Abh. Statl. Mus. Tierk. Dresden. 34 (5): 329-398.
- SOLDÁN, T. (1978): Two new species of Baetopus (Ephemeroptera, Baetidae) from Mongolia with a special reference to related genera. - Vest. čs. spol. zool. 42 (3): 209-214.
- SOLDÁN, T. & LANDA, V. (1977): Three new species of the genus Oligoneuriella (Ephemeroptera, Oligoneuriidae). - Acta ent. bohemoslov. 74 (1): 10-15.
- SOWA, R. (1973): Note sur quelques espèces paléarctiques de Rhithrogena Eaton (Ephemeroptera, Heptageniidae). - Bull. Acad. Polon. Sci., Sér. Biol. 21: 21-26.
- SOWA, R. (1980): Taxonomy and ecology of European species of the Cloeon simile Eaton group (Ephemeroptera: Baetidae). - Ent. scand. 11: 249-258.

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