# *Baetisca* (Ephemeroptera: Baetiscidae) from the western interior of Canada with notes on the life cycle

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The distributions of *Baetisca obesa* (Say) and *B. bajkovi* Neave in Canada are extended west to Saskatchewan and Alberta. Generic features of adults and nymphs and specific characters of the nymphs of the two species are illustrated. In the South Saskatchewan River nymphs of *B. bajkovi* hatch from the egg in August and September, they pass the winter under the ice, and adults emerge the following June and July. The Hudson's Bay drainage system was probably invaded by these species from the Mississippi drainage system during the last glacial retreat, since at various times dispersal routes in the form of rivers have been present from the southern refugium for migration to the north.

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Au Canada, les répartitions de *Baetisca obesa* (Say) et de *B. bajkovi* Neave s'étendent vers l'ouest jusqu'à la Saskatchewan et l'Alberta. Des figures illustrent ici les caractéristiques génériques des adultes et des larves et les caractères spécifiques des larves des deux espèces. Dans la rivière Saskatchewan Sud, les oeufs de *B. bajkovi* éclosent en août et en septembre; les larves passent l'hiver sous la glace et l'émergence des adultes se produit en juin et en juillet. Selon toutes probabilités, ces espèces ont quitté le bassin hydrographique du Mississipi pour envahir celui de la Baie d'Hudson, durant le retrait de la dernière glaciation, car des routes de dispersion, en l'occurrence des rivières, se sont ouvertes à plusieurs reprises, permettant la migration du sud vers le nord.

Of the 11 species of *Baetisca* described from North America (Edmunds and Allen 1957; Edmunds 1960) few have been found in the western part of the continent. About half the species are restricted to the southeast and northeast U.S. and eastern Canada, and another four are known from the region east of the arid parts of the great plains (Traver 1935; Burks 1953; Berner 1955, 1959). In the west, Edmunds (1960) reported an unidentified species resembling *B. bajkovi* Neave from Wyoming and he described an additional species from Washington state. In Canada, the published western limits for the genus are in Manitoba. In this paper I extend the known western distribution of two species (*B. bajkovi* and *B. obesa* (Say)) to Saskatchewan and Alberta and provide observations on the biology of *B. bajkovi* in the South Saskatchewan River.

Adults of this genus can be recognized by technical characters found in standard keys (e.g., Burks 1953) but also by the very thickset and robust appearance of the body (Fig. 1) in combination with a pair of slender pointed projections which arise ventrally between the fore coxae (Fig. 2). The nymphs are among the most distinct and unique of the mayflies. They can be recognized by the thorax which is modified to form a carapace (Fig. 3) which covers the entire thoracic region and part of the abdomen. In the species discussed here, lateral spines on the thorax are also present (Figs. 3 and 4).

Three species of *Baetisca* have been reported from Manitoba: *B. obesa*, *B. bajkovi*, and *B. lacustris* McDunnough. Nymphs of the latter two are similar morphologically (see reference by Burks (1953) for specific differences) but differ in habitat. *Baetisca lacustris* is a lake species (McDunnough 1932) and *B. bajkovi* is a river species (Neave 1934). The specimens from Saskatchewan and Alberta, all of which were collected from rivers, key to *B. obesa* and *B. bajkovi*. These two species are easily separated in the nymphal stage; the former has both dorsal and lateral mesonotal spines (Fig. 4) and the latter has only the lateral mesonotal spines (Fig. 3). The dorsal spines are represented at most by small mounds in *B. bajkovi* and not by sharp spines as in *B. obesa*.

## Distribution

*Baetisca obesa*

*General*—Illinois, Indiana, Manitoba, Michigan, New Hampshire, New York, Wisconsin.

*New records—Saskatchewan*: one mature nymph, Hudson Bay (town), summer 1958, no

other data (Can. Agric. Res. Stat. Coll., Saskatoon); 3 nymphs, North Saskatchewan River near Prince Albert, May 22, 1969, P. Tones. *Alberta*: one mature nymph, Bow River, July 4, 1959, Cushing, no other data (Can. Agric. Res. Stat. Coll., Saskatoon).

The specimen from Hudson Bay, Sask., is undoubtedly from the Red Deer River, but the data on the label are incomplete. This specimen was in a vial with two nymphs of *B. bajkovi.*

*Baetisca bajkovi*

*General*—Illinois, Indiana, Manitoba, Minnesota.

*New records—Saskatchewan*: two nymphs, Hudson Bay (town), summer 1958, no other data (Can. Agric. Res. Stat. Coll., Saskatoon); Lemsford Ferry, South Saskatchewan River, D. M. Lehmkuhl, nymphs on July 3, 1970, Sept. 26, 1970, Nov. 7, 1970, April 20, 1971, May 12, 1971, June 21, 1971, July 13, 1971; reared adults from nymphs collected on June 21, 1971 and July 13, 1971 (see Fig. 2). *Alberta*: two small nymphs, South Saskatchewan River, 2 mi S of Red Deer, Sept. 27, 1970, J. M. Hainer and J. D. Shorthouse.

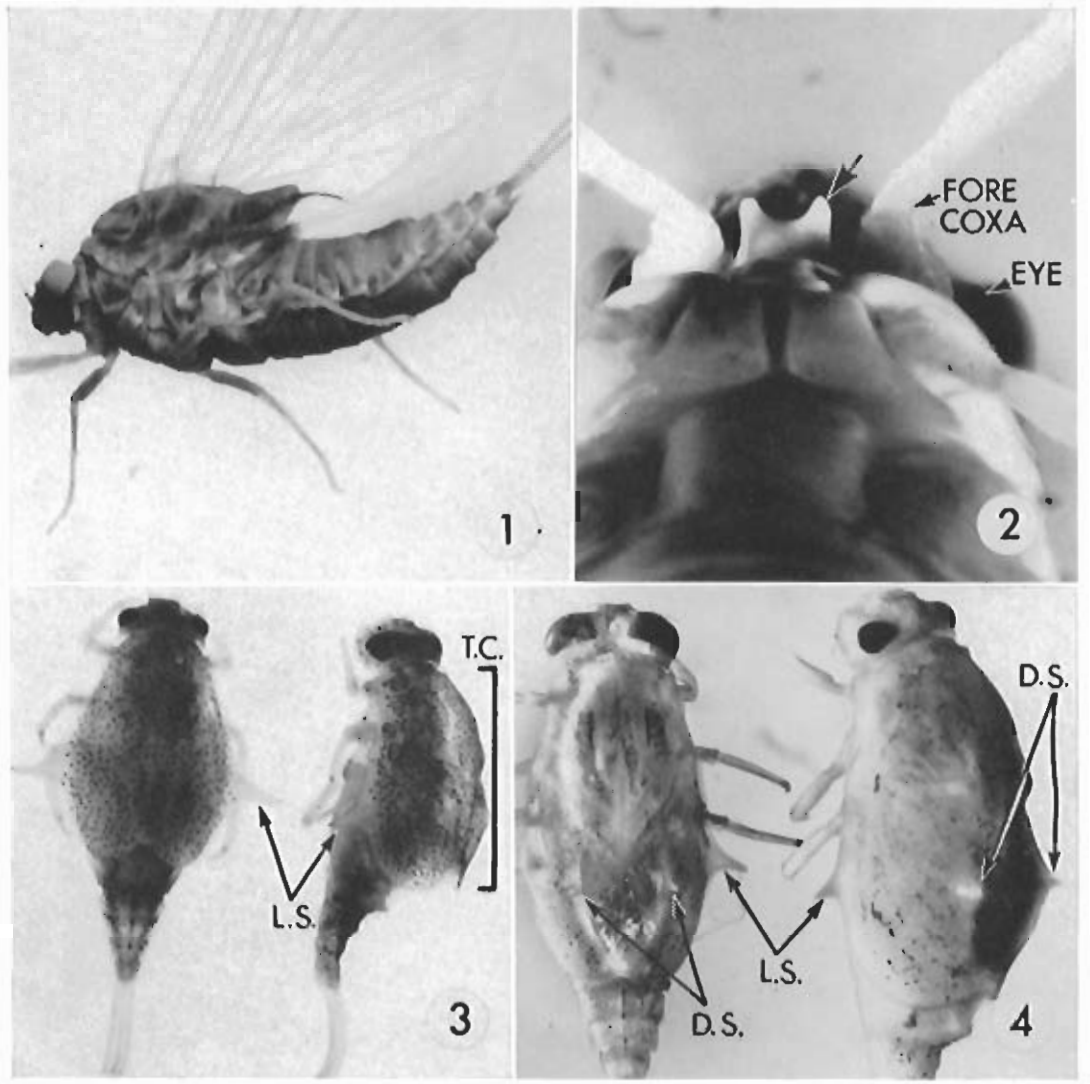
## Biology of *Baetisca bajkovi*

At Lemsford Ferry (south of Kindersley, Sask.), where most observations were made, the South Saskatchewan River is from 100 to 200 yards wide and from 10 to 25 ft maximum depth depending on the level of flooding. The river has sloping clay banks overgrown with willows and the substrate in the river varies from silt and mud to sand bars to impacted large rubble. Two periods of flooding occur in the river, one in April as a result of local runoff during the spring thaw, and one later in June as a result of the thaw in the mountains. Secchi-disk transparency on June 2, 1971 was 3 in. indicating the great sediment load of the river in the flood period. Water level drops rapidly in late June and remains low until the following spring. Ice covers the river from early November to mid-April. Water temperature rises quickly in the spring from 0°C in mid-April to 20°C in mid-May, and in the summer gradually increases to 25–26°C in mid-August. There is a steady and even decline from this mid-August maximum to freezing in early November.

Figure 5 shows the size-class distribution of *Baetisca bajkovi* nymphs in 1970–1971. Nymphs hatched late in the summer when water temperatures were high, passed the winter under the ice, and adults emerged in June and July of the following year. Adults were not observed nor collected in the field but specimens were obtained by rearing them in the laboratory from mature nymphs. Due to the turbidity of the water in the river the behavior of nymphs could not be observed in the field, but nymphs were collected with a long-handled net in habitats ranging from submerged grass and willows with a silt substrate and no current to rubble substrate in a very rapid current. In the laboratory nymphs were observed to creep slowly on the substrate (stones) and graze on the algal growths with the hypognathous mouthparts. When given a choice in the laboratory, nymphs avoided sand or silt substrate and would swim repeatedly from the soft substrate until stones and grass blades were encountered, and several specimens would soon congregate here. Thus, while nymphs of *B. bajkovi* are frequently collected in silty areas, their microhabitat appears to be a solid substrate. This differs from the idea of Hynes (1970) that *Baetisca* inhabit the silt itself and that the lateral spines are devices to prevent the nymphs from sinking into the silt. Habits within the genus undoubtedly vary.

## Zoogeographical Considerations

The species discussed in this paper are presently found in the Great Lakes region and in at least two distinct watersheds: the Hudson's Bay system and the Gulf of Mexico system. Considering that all of the northern part of the range of these species including the entire Hudson's Bay system was covered by ice 10 to 12 thousand years ago, it is obvious that colonization from the ice-free areas in the south was necessary. Considering that these species are strictly aquatic in the immature stages and that the adults have poor powers of dispersal, it is unlikely (but not impossible) that the species could disperse from the Gulf system to the Bay system as the situation presently stands. The glacial history may provide a better answer (Elson 1967). During the maximum of glacial coverage, Alberta, Saskatchewan, Manitoba, and parts of the northern U.S. were ice covered while the unglaciated parts




FIGS. 1–4. **Fig. 1.** General features of an adult female *Bactisca bajkovi* showing the thickset body which is characteristic of this genus. Fig. 2. Ventral view of a female *B. bajkovi* showing the projections (indicated by arrow) between the front coxae which are characteristic of this genus. Fig. 3. Nymphs of *B. bajkovi* showing the thoracic carapace (T.C.), the absence of dorsal spines, and the presence of lateral spines. Fig. 4. Nymphs of *B. obesa* showing the presence of both lateral (L.S.) and dorsal spines (D.S.).

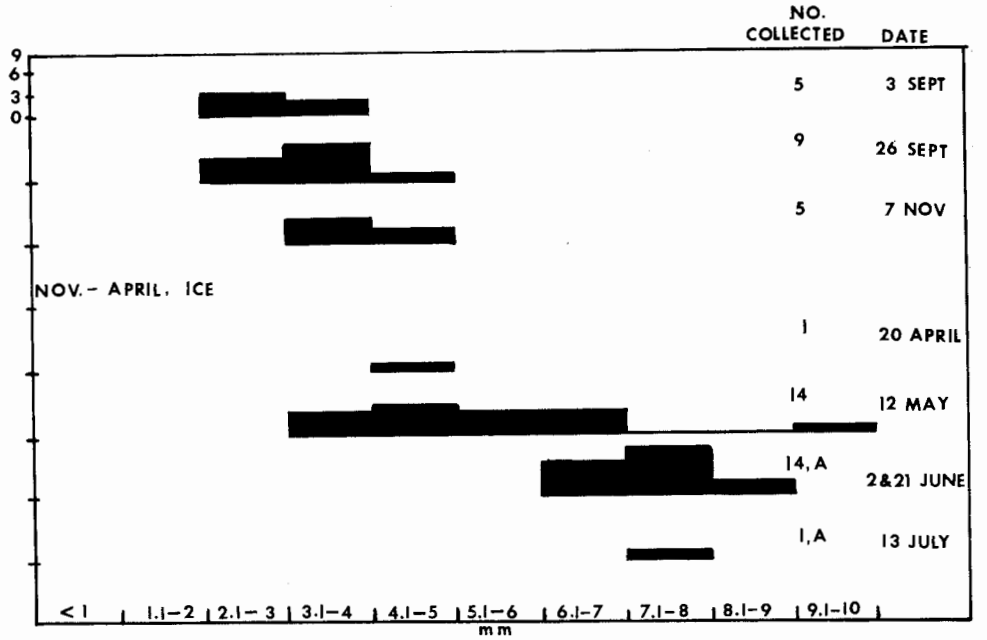



FIG. 5. Size class distribution of *Baetisca bajkovi*, 1970–1971, Lemsford Ferry, South Saskatchewan River, south of Kindersley, Saskatchewan. "A" indicates adults were present (based on emergence in the laboratory of mature nymphs collected in the field). Small nymphs are present in September and growth is gradual, leading to the emergence of adults the following June and July.

of the U.S. served as a refugium. As the ice receded to expose southern Saskatchewan and Manitoba, the Saskatchewan River system, which at present flows north, flowed into the Big Muddy – Missouri system to the south. About 12 000 B.P. the Saskatchewan River system switched from the Big Muddy – Missouri system to the Souris – Lake Agassiz system. Eventually, about 7300 B.P., the remnant of Lake Agassiz which is Lake Winnipeg switched its drainage from the south to the north into Hudson's Bay. Thus, at various times routes of dispersal in the form of rivers have been open from the U.S. refugium for invasion to the north, and subsequent changes in drainage pattern have isolated populations in the Hudson's Bay drainage from the parent populations in the Mississippi drainage.

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