MAYFLIES (EPHEMEROPTERA): ONE OF THE EARLIEST INSECT GROUPS KNOWN TO MAN

TOMÁŠ SOLDÁN

Institute of Entomology, Academy of Sciences of the Czech Republic
31 Branišovská, CZ - 370 05 České Budějovice, Czech Republic

Mortogenesia mesopotamica (MORTON, 1921) (Ephemeroptera: Palingeniidae) which appears in huge swarms in the Tigris-Euphrates river system is identified as buru.id.da (Sumerian name) and/or ku-li-lum (Akkadian name) in the 14th tablet of cuneiform scripts of Ashurbanipal (669-629 B.C.) royal library. Thanks to its size, colouration and ecology this species has been known to man for nearly 4000 years as «water locust» from about the Khammurabi (1792-1750 B.C.) period when the Sumerian language was still spoken. Earlier identification of this animal as a dragonfly and independent discovery of mayflies («Ephemeron») by Aristotle are discussed.

SYNOPSIS AND DISCUSSION

It is generally believed that the first man who recorded a notice of the order Ephemeroptera (mayflies) was the Greek philosopher Aristotle from Stageira (384-322 B.C.). In his encyclopedial works («Historia animalium» and «De partibus animalium») he wrote a few lines on a «peculiar bloodless animal» which emerged from some river near the Black Sea. According to his description this animal had four wings and four (sic) legs and a very short, one-day life span. He called it «ephemeron» that means «one day living.» However, the name was forgotten and it emerged again some 300 years later. Two hundred years after the death of Aristotle, after Athens had been conquered by Romans, many pieces of art and scrolls of manuscript were brought to Rome. The knowledge of mayflies by Aristotle can be found again in the works of the Roman encyclopedist Gaius Plinius Secundus (23-79 A.D.) although he named this animal Hemerobius (now a valid generic name within the insect order Neuroptera), a name with the same meaning as the Greek ephemeron. The same «ephemeron story» is repeated again by another Roman author Aelianus (about 175-235 A.D.). Since then mayflies are not mentioned till the early Middle Ages in Europe (for details see ESSIG, 1931 and MOL, 1984). However, the works of Aristotle were not lost after the breakup of the Roman Empire since the copies were kept in Constantinople. From there they reached Arabia including the former Mesopotamia and Baghdad.

Nevertheless, mayflies were probably known to native people of this area for more than 3000 years at that time although Aristotle undoubtedly described his ephemeron quite independently. When studying the taxonomy and biology of the conspicuous mayfly species *Mortogenesia mesopotamica* (MORTON) (SOLDÁN, 1995) I noticed some literature showing the existence of this insect group having being known to man much earlier than Aristotle mentioned it.

Within the first quarter of this century the library of cuneiform scripts was discovered at the ruins of the former Assyrian capital Niniveh (Ninive) in Mesopotamia (now in Iraq). These artifacts, most probably representing the royal library of the Assyrian king Ashurbanipal (= Aššurbanipal, Greek transcription Sardanapal) (669-629 B.C.), are now deposited in the British Museum. (cf. BODENHEIMER, 1960; HARPAZ, 1973). The collection of cuneiform texts also includes a series of tablets known as Har-ra = Hubulu in fact representing a bilingual Sumero-Akkadian lexicographical dictionary of cuneiform script. The dictionary was most probably compiled during the ninth century B.C., at the time when the Sumerian language was no longer spoken and persisted solely in the written form. The tables contain systematically arranged Sumerian names with their current Akkadian translation in the corresponding column. Sumerian names are probably those used in the period of the king Khammurabi (about 1792-1750 B.C.) but seem to originate from a much older list (HARPAZ, 1973).

Tablets of cuneiform scripts No. I-XV comprise a list of both wild and domestic animals of the air, water and land. Names are not arranged alphabetically but according to presumably related groups. All members of

Fig. 1. *Mortogenesia mesopotamica.*

Fig. 2. *Locusta migratoria.*

each group are characterized by a common prefix of Sumerian names (BODENHEIMER, 1949, 1960).

The tablet No. 14 contains the «Buru» group of animals which is roughly equivalent to the Orthoptera or at least to locusts (cf. LANDSBERGER, 1934). Item No. 234 (see Table 1) described the animal identified by LANDSBERGER (1934) as a dragonfly. However, I believe that this actually represents a mayfly, most probably the species *Mortogenesia mesopotamica* (MORTON) (family Palingeniidae), although this species escaped the attention of entomologists till the beginning of this century (MORTON, 1921; LESTAGE, 1923). The following facts support this opinion.

Judging from the translation of Sumerian name - «water locust» - this animal should resemble true terrestrial pest locusts (*Locusta migratoria*) at least in size and behaviour. The size of *Mortogenesia mesopotamica* (Fig. 1) is really comparable with that of *Locusta* (Fig. 2). *Mortogenesia mesopotamica* belongs to the largest representatives of the order reaching about 50 mm in body length or even 100 mm in length including cerci. There is no other mayfly species with comparable body length, the other species living in the Euphrates/Tigris river system reach at most 15-18 mm in body length. The general body colour of both *Mortogenesia* and *Locusta* seems to be very similar: body is pale yellowish brown or dark yellowish with dark brown patterns. Wings are coloured similarly as well - translucent, pale, unicolorous.

However, the most pronounced similarity of these two insects, which undoubtedly led the native Sumerian people to name *Mortogenesia* adults as water locust, is their behavior. Like *Locusta migratoria*, adults of *Mortogenesia* emerge (or, more precisely, metamorphose) in a very short time interval (about 1-2 hours) from the water surface, making a huge swarm or even clouds of flying animals. Since their emergence period lasts only several days a year (in February and March) they closely resemble locusts which appeared and disappeared in clouds of individuals thanks to their very high mobility in relation to the amount of food. This extremely high mobility of locusts which are mentioned many times in Biblic Lands (cf. BODENHEIMER, 1949) can be compared to the extremely short-lived (several hours only) and consequently very quick appearance and disappearance of mayflies. These similarities most probably represent the main reason for including the mayfly species into the Buru group. Although most mayfly species emerge in the evening or early in the morning at dawn, *Mortogenesia mesopotamica* emerges in the morning at full light (from about 10.00 a.m. to the noon). Consequently, the huge swarms cannot escape man's attention. Moreover, *M. mesopotamica* still live in large towns (Baghdad, Kut, Basra) even today (SOLDÁN,

Table 1. The 14th tablet of the Buru groups of the Sumero-Akkadian lexicographical dictionary (after LANDSBERGER, 1934).

Item No.	Sumerian name	Translation	Akkadian name	Translation
234	buru.id.da	river locust	Ku-li-lum	dragonfly

1995). It cannot be excluded that large *Mortogenesia* adults were eaten by native people and thus become familiar to man (cf. BODENHEIMER, 1951) like adults of the related genus *Plethogenesia* from Papua-New Guinea which still are eaten by man (SZENT-IVANY & UJHÁZY, 1973).

LANDSBERGER's (1931) translation of the Akkadian name Ku-li-lum as a dragonfly seems to be obviously a mistake. Although some large dragonfly species correspond to locusts in body size, their body and wing colouration is quite different. Although some types of intraspecific associations have been described, they have never been observed in mass emergence or mating activity. Dragonflies mate individually and thanks to their extreme mobility in flight they easily escape our attention. Moreover, their emergence is individual (never in swarms) and used to be nearly continuous in this area; dragonfly adults fly nearly all year round in the area in question.

As far as I know there is no other aquatic insect or insect group in the Tigris-Euphrates river system which could be compared to «water locust» or *Mortogenesia mesopotamica*. There are no Trichoptera (caddisflies) corresponding in body size and all the species of this order observed in Tigris (Baghdad) showed apparently late evening and/or night activity. Caddisfly swarms are always smaller, never comparable to those of *Mortogenesia*. Large Plecoptera (stoneflies) are extremely rare in the lower reaches of large Mesopotamian rivers, never forming swarms.

To conclude, the large Mesopotamian mayfly *Mortogenesia mesopotamica* has been known to civilized man for nearly 4000 years and thus mayflies belong to the earliest insects or even invertebrates known to man. Since it is arranged according to some morphological or at least ecological characteristics, the Har-ra = Hubulu lexicon most probably represents the oldest book on zoology known to date.

ACKNOWLEDGEMENTS

My sincere thanks are due to Prof. G.F. Edmunds, Jr. of the University of Utah, Salt Lake City, for careful reading and critical comments on the manuscript.

REFERENCES

BODENHEIMER, F.S. 1949. Animals in Bible Lands Bialik Foundation, Jerusalem, 350 p. (in Hebrew).

BODENHEIMER, F.S. 1951. Insect as human food. Dr. W. Jung, the Hague, 352 p.

BODENHEIMER, F.S. 1960. Animals and Man in Bible Lands. J.E. Brill, Leiden, 232 p.

ESSIG, E.O. 1931. A History of Entomology. The Macmillan Co., New York, 539 p.

HARPAZ, I. 1973. Early entomology in the Middle East. Ann. Rev. Ent. 18:21-36.

LANDSBERGER, B. 1934. Die fauna des alten Mezopotamien nach der 14 Tafel der Serie Har-ra = Hubulu. Hirzel, Leipzig, 144 p.

LESTAGE, J.A. 1923. Etude sur les Palingeniidae (Ephémères) et description de deux genres nouveaux et d'une espèce de Nouvelle Guinée. I. Historique. Ann. Soc. ent. Belgique 63: 95-112.

MOL, A.W.M. 1984. The earlier epoch in the study of mayflies (Ephemeroptera); towards a reappraisal of the work of Augerius Clutius. *In*: LANDA, V., SOLDÁN T. & TONNER, M. (Eds): Proc. IVth International Conference on Ephemeroptera, pp. 3-10, Bechyně, Czechoslovakia.

MORTON, K.J. 1921. A new species of mayfly, *Palingenia* (sensu lato) from Mesopotamia. Entomologist 69: 177-180.

SOLDÁN, T. 1995. Redescription of *Mortogenesia* LESTAGE (Ephemeroptera: Palingeniidae) with a description of the larval stage of the genus and notes to biology of *M. mesopotamica* (MORTON). Eur. J. Entomol. 91: (in press).

SZENT-IVANY, J.H. & UJHÁZY, I.V. 1973. Ephemeroptera in the regimen in some New Guinea people and in Hungarian folksongs. Eatonia 17: 1-6.