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ENDEMIC DRAGONFLIES OF LATE PLEISTOCENE AGE OF THE HULA LAKE AREA (NORTHERN ISRAEL), WITH NOTES ON THE *CALOPTERYGIDAE* OF THE RIVERS JORDAN (ISRAEL, JORDAN) AND LITANI (THE LEBANON), AND DESCRIPTION OF *UROTHEMIS EDWARDSI HULAE* SUBSPEC. NOV. (*LIBELLULIDAE*)*

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Volcanic events during the middle Pleistocene blocked the Jordan Rift at the frontier between Israel and the Lebanon. South of it, in the Hula Lake area, four endemic subspecies of dragonflies evolved, presumably during and after the Würm. They are all subspecies to Ethiopian species. North of the barrier evolved *Calopteryx hyalina* Martin, a taxon of uncertain status. The two endemic Anisoptera of Lake Hula (*Rhyothemis semihyalina syriaca* Selys and *Urothemis edwardsi hulae* ssp.n.) are probably extinct now, while the Zygoptera (*Pseudagrion torridum hulae* Dumont and *P. sublacteum mortoni* Ris & Schmidt) are still in existence.

INTRODUCTION

The dragonfly fauna of the Mediterranean coast of the Near East is quite complex. In terms of present-day zoogeographical divisions, it consists of a majority of Mediterranean elements, with an immixture of Ethiopian and Oriental species. In addition, a number of endemics occur. It is the nature of some among these endemics that forms the object of this paper.

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THE ENDEMICS OF THE UPPER JORDAN VALLEY (LAKE HULA AREA)

PSEUDAGRION TORRIDUM HULAE DUMONT, 1974

Restricted to Lake Hula where it is common. Described and figured in DUMONT, 1974. Structurally, it is almost identical to *P. t. torridum* Selys. This is widely distributed in Africa, reaching Egypt and the South-Western edge of the Sinai desert, which is the North-Eastern limit of its known distribution. The present-time disjunction of the Hula population is thus about 700 km.

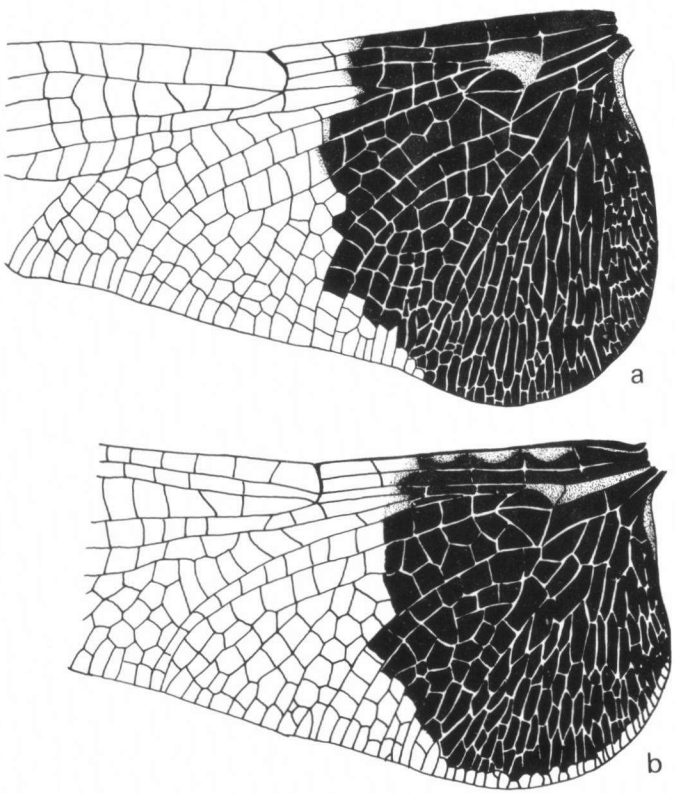

Fig. 1 (a) Hind wing of *Rhyothemis s. semihyalina*, ♂, Maun, Botswana (leg. E.C.G. Pinhey); – (b) Hind wing of *R. semihyalina syriaca*, ♀, Selys' type from "Syria".

PSEUDAGRION SUBLACTEUM MORTONI (RIS & SCHMIDT, 1936)

Occurring on Lake Hula but also in other places of the Jordan valley (see map in DUMONT, 1974). Present disjunction with the Ethiopian stock unknown, since *P. s. sublacteum* (Karsch) might occur in Egypt.

RHYOTHEMIS SEMIHYALINA SYRIACA SELYS, 1850

Figures 1 b; 2 a, b

Described by Selys on a female in the Latreille collection, labeled "Syria" without any further indication. According to the description, it differs from typical *semihyalina* in having the black spot at the base of the hindwings more reduced, leaving a narrow hyaline fringe along the posterior border of the wing. I found these characters well exemplified on the type (Brussels Museum) and on the following additional material: 2♂♂, Department of Genetics, The Hebrew University of Jerusalem, one without label, one labeled Hula, 23.VI.1952; 10 specimens in the Department of Zoology, University of Tel Aviv (7 from Hula, one from Daphne north of Hula. two without label); finally, a couple in my private collection, both from Hulata, 1.VIII.1947 and 23-28.VI.1950. These, together with a male in the collection of Kibbutz Beit Ussishkin (Israel), taken at Hula on 10.VI.1954, a series in the collection of Kibbutz Beit Gordon (Israel), taken at Tiberias, 28.V.1931, 17.V.1939, 3.V.1946, East of Bet-Yarah, 16.VI.1942 and Hula, 8.VI.1944, the male and females recorded by MORTON (1924) from Hula, 24.V.1922 and the male recorded by SCHMIDT (1938) from

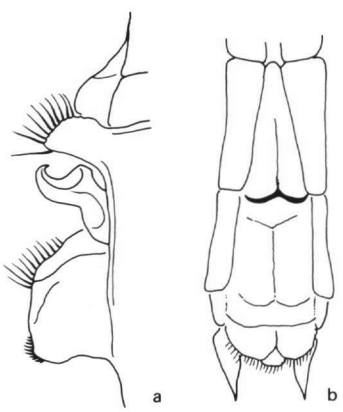

Fig. 2 (a) Accessory genitalia of *Rhyothemis semihyalina syriaca*, ♂, lateral view; – (b) ultimate abdominal segments of a female of the same, showing the valvules.

Ferum near Rosh Pina, Hula Lake, 25.VII.1928, are the only existing specimens that I know of, in all about thirty at the most.

I might add that the hyaline fringe in the hindwing is wider in females than in males, and that the base of the hindwing is less widened in *R. semihyalina syriaca* than in *R. semihyalina semihyalina* (Fig. 1a, b). Selys' "Syrian" specimens might well have come from the Lake Hula area, since all other known specimens were collected here. Structurally, the subspecies is identical with the

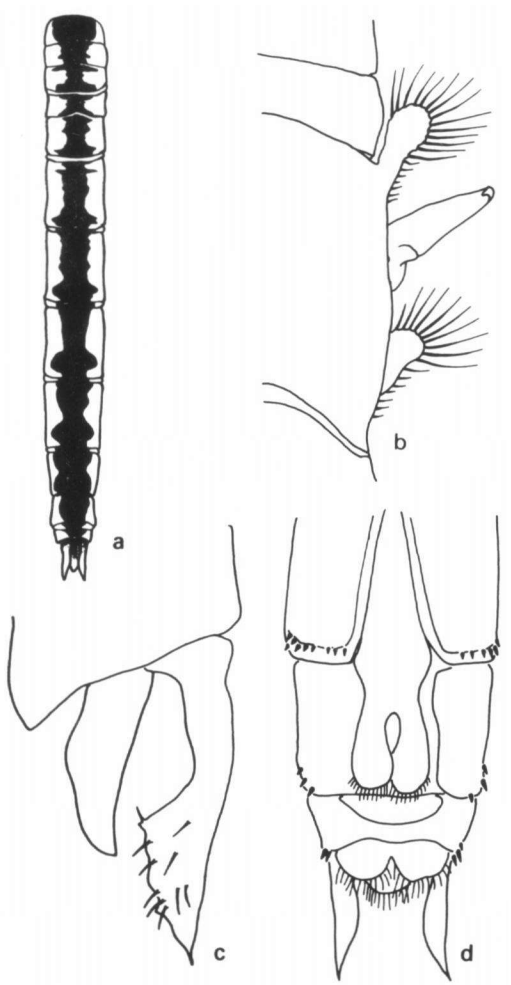

Fig. 3 ***Urothemis edwardsi hulae*** **subsp.n.: (a) Abdominal colour pattern of the male; – (b) Accessory genitalia of the male, lateral view; – (c) Appendices of the male, lateral view; – (d) Ultimate abdominal segments of a female, showing the valvules.**

nomino-typical one in both sexes (Fig. 2a, b). The disjunction is considerable: typical *semihyalina* occurs in Algeria (SELYS, 1849) and further in the whole Ethiopian region (PINHEY, 1962).

UROTHEMIS EDWARDSI HULAE SSP. NOV.

Figures 3 a-d, 4 a

Material. – Holotype: a fully adult, pruinose ♂, labeled Huleh (Hula), 9.VI.1952, deposited at the Department of Zoology, University of Tel Aviv. Paratypeseries: 7♂♂, Hula, 23.VI.1952, 6♀♀, Hula, 23.VI.1952, Department of Genetics, The Hebrew University of Jerusalem; 1♂, 1♀, same label, author's collection; 1♂, 1♀, same labels, British Museum (Natural History); 1♂, Hula, 4.XI.1946, author's collection; 1♀, Jericho, 16.VII.1942 (leg. Bytinski-Salz), 3♀♀, Hulata, 1.VIII.1947 (leg. Bytinski-Salz), 2♂♂, Hula, 9.VI.1952 and 1♀, Ulmania (Hula valley), 2.VII.1947, all at the Department of Zoology, Tel Aviv University.

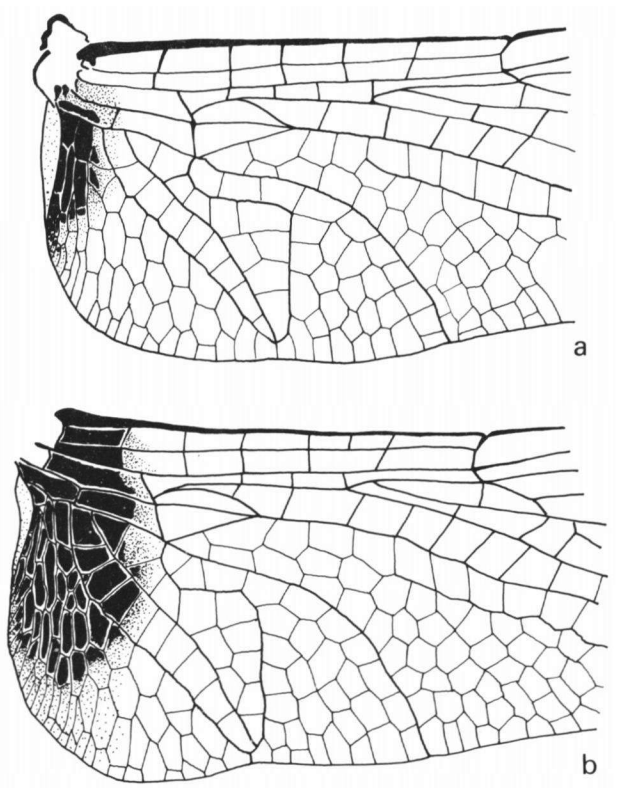

Fig. 4 (a) Hind wing of *Urothemis edwardsi hulae* subsp.n.; – (b) Hind wing of *U. e. edwardsi*, Maun, Botswana (E.C.G. Pinhey leg.).

Additional material. – 1♀, Gonen, 5.VI.1953, coll. Kibbutz Beit Ussishkin; a series in both sexes, coll. Kibbutz Beit-Gordon, from Dan, 1.VII.1953, Gonen, 5.VI.1953, and Sede Nehemya, without date. Further, a female was reported by Morton (1924) from Hula, 24.V.1922 and 4♂♂, 4♀♀ from Rosh Pina-Hula lake ("an Wassergräben"), 23.VII.1928, by SCHMIDT (1938).

M a l e : structurally identical with *U. e. edwardsi* (Selys). Hamuli and appendices as in Figures 3b, c. Differs from nominal subspecies in the extent of the basal spot on the hindwings which is greatly reduced (Fig. 4a).

F e m a l e : structurally identical to *U. e. edwardsi* (Selys). Structure of valvules as in Figure 3d. The basal spot on the hindwings reduced as in the male.

D i s t r i b u t i o n : all specimens, save a single female taken near Jericho, were captured at lake Hula and surroundings. The nominal subspecies, although described from Algeria (SELYS, 1849), is widely distributed in tropical Africa (PINHEY, 1962).

DISCUSSION

One rarely has the privilege to deal with the fauna of a lake that has been famous since antiquity. As stated by COWGILL (1969), a first rough estimate of its superficy was given by Flavius Josephus, somewhere between 69 and 79 A.D. Throughout history, stray notes on the lake were published by visitors to the holy land, some claiming that it might completely dry up during summer, others giving descriptions of its shape, depth, and the papyrus swamps that surround it. It is the first lake on the course of the River Jordan, and therefore, the parts of it directly adjacent to the channel of the river can never have been completely dry. The second and major lake, Lake Tiberias (Yam Kinneret) has a much poorer dragonfly fauna than Hula, as have many large and deep lakes.

The events of interest to this paper took place, presumably some 35-30.000 years ago, and are the damming of the Jordan Rift north of the Hula by rather complicated volcanic activities, finally resulting in a separation of the basins of the Jordan and the Litani Rivers, and the transformation of a previously existing swamp into the Hula lake. While this process was taking place, the Würm glaciation was in evidence in Europe and a corresponding pluvial existed in North Africa and Egypt. Although the synchronism of Pleistocene glaciations and pluvials is not rigorous (there have been more pluvials than glaciations), they were nicely simultaneous during the Würm, as BUTZER (1971) has shown for Libya and Egypt. For Israel, PICARD (1963) arrives at the conclusion that no appreciable climatic changes occurred during the late Pleistocene, although DAN (1961) gives pedological evidence that the basaltic soils of the upper Jordan valley are typical of a climate with a precipitation of about twice the present. This leads to the suggestion that the Arava valley and the Sinai were more humid than to-day and were no barrier to non-migrant dragonflies. Some Ethiopian

species that had followed the Nile-pathway could thus cross the Sinai and Negev deserts and reach the Jordan valley, where they moved North up to Hula, but apparently did not cross the Yarda basalt between the Naphtali mountains (of Cretaceous age) and the Hermon (of Jurassic age). The cessation of this humid period occurred in an oscillatory way (BUTZER, 1971), and may have become efficient around 15000 BP. It resulted in a progressive shrinking of the number of viable biotopes for dragonflies, not only in the South but also in the present Syrian desert. This is proven by the distribution of e.g. *Brachythemis fuscopalliata* (Selys), which now lives in the great marshes of Iraq, but has left relict populations in the Adana peninsula (S. Turkey) and at Hula (DUMONT, 1972). Likewise, the habitats suitable for the Ethiopian immigrants were reduced to the upper Jordan valley, roughly the Hula lake and its surrounding marshes.

The arguments for placing these Ethiopian immigrants in the Würm (and not at an earlier date) follow from:

(1) their absence North of the Jordan valley. The objection might be raised that we do not know enough about the fauna of The Lebanon and Western Syria to make such a statement acceptable. Indeed, two habitats exist that might have had the same role as lake Hula, viz. Lac de Homs (Syria) and Amik Gölü (Hatay, Turkey). I visited Amik Gölü in July 1973, and found it completely drained and its former bed planted with cotton. Whatever dragonfly fauna existed here will forever remain unknown. Lac de Homs, which I did not see, was visited by GADEAU DE KERVILLE (1926), who appears to have been the only one to collect dragonflies here. His collection contains none of the Hula endemics, but it was rather small and a thorough study of this area would definitely be of interest.

(2) If one compares the calopterygid fauna of the Jordan and the Litani, one is struck by the presence, on the Jordan, of *Calopteryx syriaca* (Gené), and of both *C. syriaca* (Gené) and *C. hyalina* (Martin) on the Litani. The status of the latter is uncertain (full species? subspecies? a local condition of syriaca?), but the fact which matters is that, at least, a genetic difference between populations North and South of the Yarda basalt exists, and, thus, that the barrier has been effective on both sides. As is well known, calopterygids are tightly associated with running water and cannot easily cross a mountain barrier.

CONCLUSIONS

The remarkable endemisation of dragonflies along the mediterranean coast of the Near East may well be understood bij the geological and climatic changes that took place since the end of the Tertiary epoch. BODENHEIMER (1938) believes that, at that time, a steppe fauna of Irano-Turanian origin extended through the Near-East to North Africa and the steppes of South Spain. As explained elsewhere (DUMONT, in preparation), the present-day dragonfly

fauna of Turkey shows that, in fact, at the end of the Tertiary, the Odonata of the Eastern Mediterranean (and of a large part of Europe as well) had a pronounced Oriental (i.e. not only Central-Asiatic) facies. Remnants of this fauna, either primitive species or species and whole genera that evolved from these, are still in evidence here. But in the course of the Pleistocene, owing to the wax and wane of precipitations, immigrations from the African continent took place. There has certainly been more than one Ethiopian vague, and e.g. *Pseudagrion syriacum* (Selys) has reached the Near East at a much earlier date than the Hula-fauna (DUMONT, 1974). Proof is that this animal has reached full specific status (it is remotely allied to *P. kersteni* Gerstaecker, an African species that does not even occur in Egypt any more) and has a much wider distribution, including The Lebanon and Lac de Homs (GADEAU DE KERVILLE, 1926). If one wishes to gain insight into the recent history of the West-Palearctic fauna, the Near East is the place where such knowledge should be gathered. Paraphrasing HUTCHINSON (1965), it is a theatre where evolution is being played. Evolution is not a linear function of time, and seems to be greatly stimulated by fluctuating environmental conditions. One might find great intellectual pleasure in speculating about the synchronism in the development of the Hula fauna and the important step for humanity taken by the tribes at Jericho, switching from nomadism to agriculture, another probable consequence of an environment that became more arid.

EPILOGUE

It is a bit sad to have to add that two of the endemics of Hula are probably no more in existence. Lake Hula, situated in a fertile plain was at the same time a centre for the propagation of malaria. Therefore, it was drained between 1951 and 1958, and only part of the papyrus swamp and some of the open water was preserved. The fatal thing that happened was probably not the drainage, but the subsequent cultural eutrophication which resulted in the appearance of heavy water-blooms due to blue-green algae. As a consequence, the dragonfly fauna was greatly altered. Not only *Brachythemis fuscopalliata* (DUMONT, 1972), but also *Rhyothemis semihyalina syriaca* and *Urothemis edwardsi hulae* disappeared at this occasion. Although the supervisor of the natural reserve (A. Freidberg, in litt.) claims to still see the former species now and then, there is no material evidence for this. The last captures took place in 1954, i.e. while the drainage was proceeding. Both must still have been very common around 1953, as can be judged from a random sample taken by Prof. J. Wahrman (Jerusalem) in June of that year. Therefore, this paper has the doubtful merit to be the first in which a new dragonfly taxon (*U.e. hulae*) is described after it has become extinct.

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REFERENCES

BODENHEIMER, F.S., 1938. On the presence of an irano-turanian relict fauna in North Africa. In: La vie dans la Région désertique Nord-Tropicale de l'ancien monde. *Mém. Soc. Biogéogr.* 6: 67-79.

BUTZER, K.W., 1971. Paläoklimate. In: H. Schieffers (Ed.), Die Sahara und ihre Randgebiete. I. Physiogeographie, pp. 349-388. Weltforum, München.

COWGILL, U.M., 1969. The waters of Merom: A study of Lake Huleh. I. Introduction and general stratigraphy of a 54 M Core. *Arch. Hydrobiol.* 66: 249-272.

DAN, J., 1961. Pedological evidence for climatic change during the Pleistocene in Israel. *Israel J. Earth Sci.* 11: 150-151.

DUMONT, H.J., 1972. Occurrence of Brachythemis fuscopalliata (Sélys, 1887) in the East Mediterranean area (Anisoptera: Libellulidae). *Odonatologica* 1: 241-244.

DUMONT, H.J., 1974. The Genus Pseudagrion Sélys in Israel and Egypt, with a key to the regional species (Insecta: Odonata). *Israel J. Zool.* 22 (1973): 169-195.

DUMONT, H.J., 1975. A review of the Dragonflies of Turkey and adjacent mediterranean islands, with a discussion of the regional Calopterygidae (Insecta: Odonata). *In preparation.*

GADEAU DE KERVILLE, H., 1926. Odonates. *In:* Voyage zoologique d'Henri Gadeau de Kerville en Syrie (Avril-Juin 1908). Tome Premier, pp. 78-80. [Identifications by R. Martin] Baillière, Paris.

HUTCHINSON, G.E., 1965. The ecological theater and the evolutionary play. Yale Univ. Press, 139 pp.

MORTON, K.J., 1924. The Dragon-flies (Odonata) of Palestine, based primarily on collections made by Dr. P.A. Buxton, with notes on the species of adjacent regions. *Trans. ent. Soc. Lond.* 1924: 25-44.

PICARD, L., 1963. The quaternary in the Northern Jordan Valley. *Proc. Israel Acad. Sci. (Humanities* 7) 1: 1-34.

PINHEY, E., 1962. A descriptive catalogue of the Odonata of the African continent (up to December 1959). Parts I and II. Diamang, Lisboa. 314 pp.

SCHMIDT, E., 1938. Odonaten aus Syrien und Palästina. *Sber. Akad. Wiss. Wien, Math.-naturw. Kl.* (I), 147: 135-150.

SELYS LONGCHAMPS, E. de, 1849. Libelluliens. In: Lucas, Explor. Sci. Algérie, 3^{e} partie, Animaux articulés, Neuroptera, pp. 110-140. Paris.

SELYS LONGCHAMPS, E. de, 1887. Odonates de l'Asie Mineure et révision de ceux des autres parties de la faune dite Européenne. *Ann. Soc. ent. Belg.* 31: 1-85.

SELYS LONGCHAMPS, E. de, & H.A. HAGEN, 1850. Revue des Odonates ou Libellules d'Europe. *Mém. Soc. r. Sci. Liège* 6: I-XXII + 1-408, 4 pls.