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Zoogeography and Ecology of the Dytiscidae Fauna of the Levant

by **G. Wewalka**

Abstract: The Dytiscidae fauna of six areas of the Near East were studied: the area of the Orontes river; the Upper Jordan river; the Coastal Area of Israel; the Dead Sea area; the Negev; and the Sinai. In the whole area which is called the Levant (Fig. 1) 72 species or subspecies of Dytiscidae are recorded. The taxa are listed and ecologic and zoogeographic data are given (Tab. 1). Holo- and pontomediterranean faunal elements prevail in most areas of the Near East (Tab. 3). In arid zones (Dead Sea area, Negev, and Sinai) a high percentage of syroeremic, afroeremic and iranoeremic elements occur. The african element is present in the Levant but plays no important role in the Dytiscidae fauna of this area. Zoogeographic aspects of the Dytiscidae fauna are discussed and compared with that of other animal groups.

Key words: Coleoptera Dytiscidae – Syria, Orontes river, Israel, Sinai – ecology – running water – standing water – fresh water – brackish water – zoogeography.

Extensive collections of aquatic Coleoptera in the Near East of the last 15 years now make it possible to study ecologic and zoogeographic aspects of the Dytiscidae fauna of this region. While in 1937 Bodenheimer recorded 17 species of Dytiscidae from Palestine at least 72 species have now been found in the Levant.

Material

The collections in Israel and the Sinai mainly were made by: J. Margalit, Ben-Gurion University, Beer Sheva, Israel; R. Ortal and other members of the Inland Water Ecological Service, Dept. of Zoology, Hebrew University of Jerusalem, Israel; and the author. In Syria, Lebanon and Jordan, R. Kinzelbach, F. Krupp, and W. Schneider, Inst. of Zoology, Technische Hochschule Darmstadt, FRG, collected several times; moreover some specimens were found in this area by A. Olexa, Prague. The collections of the Department of Zoology at the Tel Aviv University and of H. Bytinski-Salz were also examined. Most specimens of Dytiscidae of these collections were determined by the author. Systematic and faunal remarks on the material of these collections were published earlier (Wewalka 1974, 1975, 1977, 1984, and Wewalka &

Brancucci, in press). For this study some critically selected records were taken from the literature, especially from Zimmermann (1921, 1930–1934), Zimmermann-Gschwendtner (1935–1939), Guignot (1959–1961), and Alfieri (1976).

Geography

The region dealt with in this study is called the Levant. It is a region of land about 150 km in width, wedged in between the Mediterranean Sea and the Syrio-Arabian desert, stretching from the mouth of the Orontes River and the Amanus mountain ridges in the north to the Suez canal in the south (Fig. 1).

The topography of this region basically consists of four north to south oriented relief patterns: the Coastal Plains; the Western (Cis-Rift) Mountains; the Eastern (Trans-Rift) Mountains; and in between the Rift Valley. This longitudinal pattern is especially evident in Lebanon and Israel.

The climate of this region is characterized by the interlacing of areas with mediterranean climate on the one hand and semiarid or arid zones on the other hand. The main areas of mediterranean climate are: the area of the Orontes Valley with the coastal area of Syria; most parts of the Lebanon; northern Israel including the Mount Hermon, the Golan Hights, the Upper Jordan Valley, Galilee, Samaria, the Judean Hills, the Coastal Plains of Israel in the south as far as El Arish and the mountains of Trans Jordan south of Petra. Semiarid and arid zones are east of the Orontes River system. There is also arid climate in the Dead Sea Area, Judean Desert, Arava Valley, Negev and the Sinai.

The names of the geographic areas are defined according to those used for the Fauna Palaestina Project (Levy & Amitai, 1980) and by Kinzelbach (1980). Six of these areas that have available relevant data about the Dytiscidae fauna were chosen to study ecologic and zoogeographic aspects:

- Orontes River system and the coastal rivers in Syria;
- Upper Jordan River system including the Mount Hermon, the Golan Hights and Galilee;
- Coastal Area of Israel including Samaria, the Judean Hills and the Coastal Plains between northern Israel and El Arish;

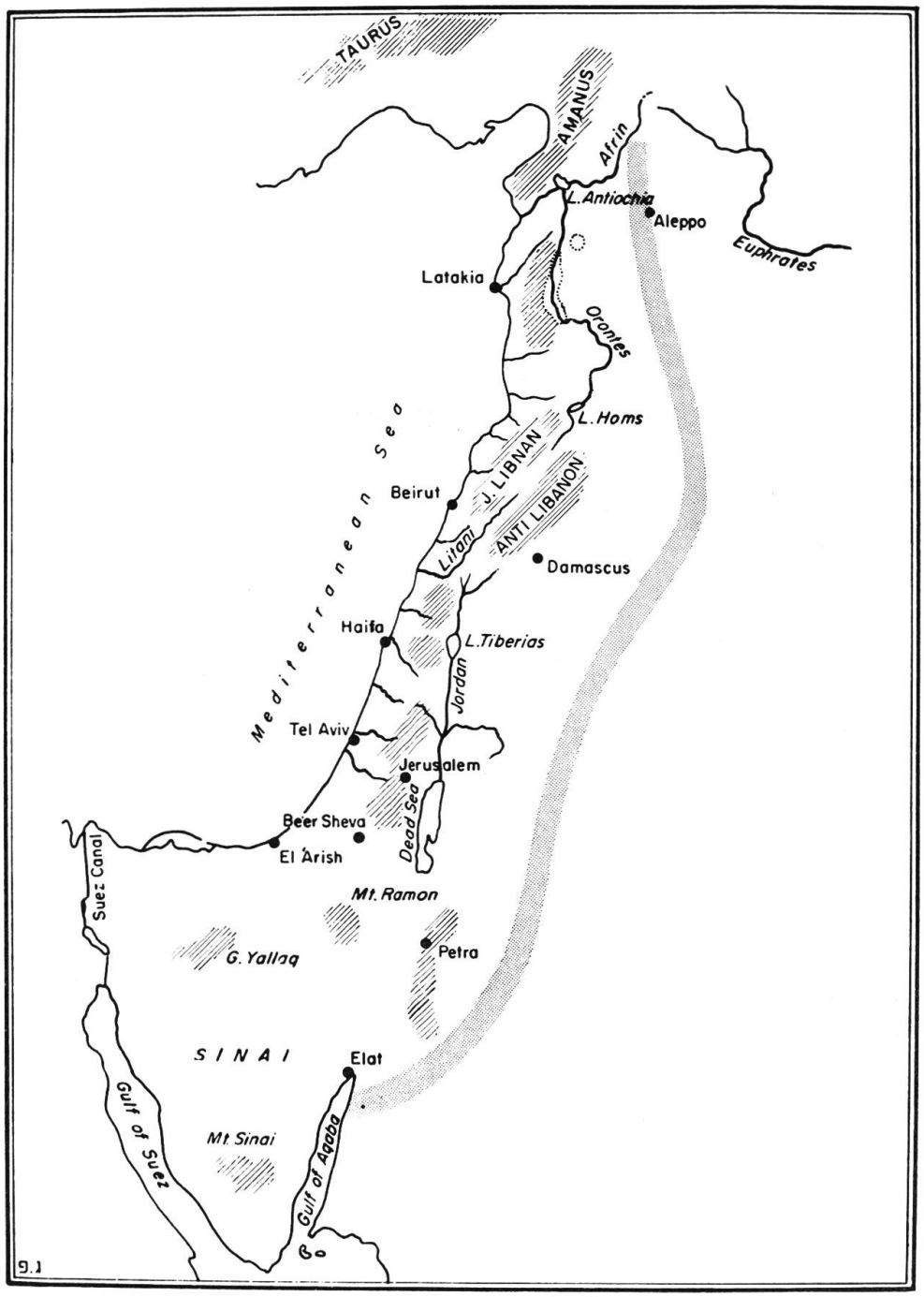

Fig. 1: Sketch map of the Levant (as defined by Por, 1975).

- Dead Sea Area including the Judean Desert;
- Negev including the Arava Valley;
- Sinai.

Ecology

In Tab. 1 all species recorded from the above-mentioned six different areas are listed. Ecologic data is given about their occurrence in standing and/or running water and about their prevalence in fresh and/or brackish water. Records dated before 1956 are marked (+°); those data taken from the literature are indicated in cases where the specimens were not seen by the author (+*).

Orontes River system

There are 32 species now known from the Orontes River system. Most of them are living in standing or slowly running water, like irrigation canals. Common representatives of this group are: *Hydroporus pubescens habelmanni* Wehncke; *Hydroporus tessellatus* Drapiez; *Noterus clavicornis* (De Geer); *Canthydrus diophthalmus* (Reiche & Saulcy); *Laccophilus hyalinus* (De Geer); *Laccophilus minutus* (Linné); *Agabus biguttatus* (Olivier); *Agabus bipustulatus* (Linné); *Agabus conspersus* (Marsham); *Agabus chalconotus* (Panzer); *Dytiscus circumflexus* Fabicius; and *Cybister lateralimarginalis* (De Geer).

Moreover there are a few less known species occurring in standing waters, e. g. *Hyphydrus sanctus* Sharp recorded from the Orontes River system (Wewalka, 1984). Two species from this area were described recently (Wewalka, 1984): *Hydroporus kasyi* Wewalka, closely related to *Hydroporus jonicus* Miller, occurring also in South Anatolia; and *Hydroporus ortali* Wewalka belonging to the *H. marginatus* group which was also found in the Jordan River system. Only a few species are specialized in running water, they are: *Deronectes syriacus* Wewalka; *Potamonectes turca* (Seidlitz); *Agabus caraboides* Sharp; and *Agabus dilatatus* (Brullé).

None of the species recorded from the Orontes River system are restricted to hyperhaline waters.

Jordan River system

The next area studied is the Upper Jordan River system where a relatively rich Dytiscidae fauna of 42 species occurs. This is partly due to its diverse topographic features and to the sufficient rainfalls of more than 1000 mm p. a. in some places, such as on the Mt. Hermon (2800 m). A characteristic species occurring on this mountain as well as on the mountains of the Lebanon is *Agabus palaestinus* (Zimmermann). *Scarodytes margaliti* is a typical species in the running waters of

Tab. 1: Dytiscidae recorded from the Levant. +* = records from the literature, specimens not seen by the author; +° = records of specimens collected before 1956.
Zoogeography; faunal elements: HM = holomediterranean; PM = pontomediterranean; Sy = syrian; Er = eremic; Et = ethiopian; Ir = iranoturanian; En = endemic.

Species	Zoogeography	Distribution						Ecology			
		Orontes River System	Jordan River System	Coastal Area of Israel	Dead Sea Area	Negev	Sinai	Running Water	Standing Water	Fresh Water	Brakish Water
Hyphydrus sanctus Sharp	Sy	+	+	–	–	–	–	–	+	+	–
Hyphydrus pictus Klug	Er	–	–	–	+	+	+	–	+	+	–
Hydrovatus cuspidatus (Kunze)	HM	+	+	+	+	+	+	–	+	+	+
Hydrovatus humilis Sharp	Et	–	+	–	–	+	–	–	+	+	–
Hydrovatus n.sp. ♀	En	–	+°	–	–	–	–	–	+	+	–
Bidessus saucius (Desbrochers)	HM	+*	+	+	–	–	–	+	+	+	–
Bidessus nasutus Sharp	PM	–	+	–	–	–	–	–	+	+	–
Bidessus anatolicus Wewalka	Sy	–	+	–	–	–	–	–	+	+	–
Hydroglyphus major (Sharp)	Er	–	+	–	+	+	+	+	+	+	–
Hydroglyphus pusillus (Fabricius)	HM	+	+	+	+	+	+	+	+	+	+
Hydroglyphus confusus (Klug)	Er	–	–	–	–	–	+*	–	+	+	+
Hydroglyphus signatellus (Klug)	HM	–	–	+	+	–	+	–	+	+	+
Coelambus saginatus (Schaum)	PM	+	–	+	–	–	–	–	+	+	–
Coelambus lernaeus (Schaum)	HM	+*	+	–	–	–	–	–	+	+	+
Coelambus confluens (Fabricius)	HM	+*	+	+	+	+	+	–	+	+	+
Hygrotus inaequalis (Fabricius)	HM	–	+	–	–	–	–	–	+	+	–
Herophydrus guineensis (Aubé)	Et	–	+	–	–	–	–	–	+	+	–
Herophydrus musicus interruptus (Sharp)	Sy	+	+	+	–	–	+*	–	+	+	–

Species	Zoogeography	Distribution						Ecology			
		Orontes River System	Jordan River System	Coastal Area of Israel	Dead Sea Area	Negev	Sinai	Running Water	Standing Water	Fresh Water	Brakish Water
Herophydrus galileae Wewalka	En	–	+°	–	–	–	–	–	+	+	–
Hyphoporus solieri (Aubé)	Er	–	–	–	–	–	+*	–	+	+	–
Hydroporus kasyi Wewalka	PM	+	–	–	–	–	–	–	+	+	–
Hydroporus marginatus (Duftschmidt)	HM	–	+	+	–	–	–	+	+	+	–
Hydroporus ortali Wewalka	Sy	+	+	–	–	–	–	+	+	+	–
Hydroporus pubescens habelmanni Wehncke	HM	+	+	–	–	–	–	+	+	+	–
Hydroporus tessellatus Drapiez	HM	+	+	+	–	–	–	+	+	+	–
Hydroporus tessellatus sinaicus Wewalka	En	–	–	–	–	–	+	+	+	+	–
Hydroporus mariannae Wewalka	En	–	–	–	+	–	–	+	+	–	+
Graptodytes phrygius Guignot	PM	–	+	+	–	–	–	–	+	+	–
Graptodytes sedilotti (Regimbart)	Sy	+*	+	–	–	–	–	+	+	+	–
Deronectes parvicollis (Schaum)	PM	–	+	–	–	–	–	+	–	+	–
Deronectes syriacus Wewalka	Sy	+	–	–	–	–	–	+	–	+	–
Potamonectes cerisyi (Aubé)	HM	–	–	–	+	+	+	–	+	–	+
Potamonectes airumlus (Kolenati)	Ir	–	+°	–	–	–	–	–	+	+	–
Potamonectes suavis (Sharp)	PM	+*	–	–	–	–	–	+	–	+	–
Potamonectes turca (Seidlitz)	PM	+	–	–	–	–	–	+	–	+	–
Potamonectes lanceolatus Walker)	Er	–	–	+	+	+	+	+	+	+	+
Potamonectes insignis (Klug)	Er	–	–	–	–	–	+	+	–	+	–
Potamonectes princeps (Sharp)	En	–	–	–	–	–	+*	+	+	+	–
Potamonectes walkeri (v.d. Brand)	Er	–	–	–	+	–	+	+	+	+	–

Species	Zoogeography	Distribution						Ecology			
		Orontes River System	Jordan River System	Coastal Area of Israel	Dead Sea Area	Negev	Sinai	Running Water	Standing Water	Fresh Water	Brakish Water
Scarodytes halensis (Fabricius)	HM	+	–	+	–	–	–	+	+	+	–
Scarodytes margaliti Wewalka	Sy	+	+	+	–	–	–	+	–	+	–
Noterus clavicornis (De Geer)	HM	+	+	–	–	–	–	–	+	+	–
Canthydrus diophthalmus (Reiche & Saulcy)	Et	+	+	+	–	–	–	–	+	+	–
Laccophilus obsoletus Westhoff	HM	+	+	–	–	–	–	–	+	+	–
Laccophilus hyalinus (De Geer)	HM	+	+	+	+	–	–	+	+	+	–
Laccophilus minutus (Linné)	HM	+	+	+	–	–	–	+	+	+	+
Laccophilus sordidus Sharp	Er	–	–	–	–	–	+*	–	+	+	–
Copelatus haemorrhoidalis (Fabricius)	HM	–	+	–	–	–	–	–	+	+	–
Copelatus pulchellus (Klug)	Et	–	–	–	–	–	+*	–	+	+	–
Aglymbus gestroi Sharp	Er	–	–	–	+	–	+	+	+	+	–
Agabus didymus (Olivier)	HM	–	+	–	–	–	–	–	+	+	–
Agabus caraboides Sharp	PM	+*	–	–	–	–	–	+	–	+	–
Agabus palaestinus (Zimmermann)	Sy	–	+	–	–	–	–	+	+	+	–
Agabus biguttatus (Olivier)	HM	+	+	+	–	–	+	+	+	+	–
Agabus dilatatus (Brullé)	PM	+*	–	–	–	–	+*	+	–	+	–
Agabus nebulosus (Forster)	HM	–	+	+	–	+*	–	+	+	+	+
Agabus conspersus (Marsham)	HM	+	–	–	–	–	–	+	+	+	+
Agabus bipustulatus (Linné)	HM	+	+	–	–	–	–	+	+	+	–
Agabus chalconotus (Panzer)	HM	+	+	–	–	–	–	+	+	+	–
Agabus hulae Wewalka	En	–	+	–	–	–	–	–	+	+	–
Rhantus suturalis (MacLeay)	HM	–	+	+	–	–	–	–	+	+	–

Species	Zoogeography	Distribution						Ecology			
		Orontes River System	Jordan River System	Coastal Area of Israel	Dead Sea Area	Negev	Sinai	Running Water	Standing Water	Fresh Water	Brakish Water
Rhantus includens (Walker)	Er	–	–	–	+	+	+	+	+	+	–
Rhantus elevatus Sharp	Er	–	–	–	–	–	+*	–	+	+	–
Colymbetes fuscus (Linné)	HM	+	+	+°	–	–	–	–	+	+	–
Colymbetes piceus Klug	Er	–	–	–	–	–	+	–	+	+	–
Eretes sticticus (Linné)	HM	–	–	–	+	+	+	–	+	+	+
Prodaticus pictus Sharp	Ir	–	–	–	+	–	–	+	+	+	–
Hydaticus decorus Klug	Er	–	–	–	–	–	+	+	+	+	–
Hydaticus leander (Rossi)	Et	–	+	+	–	–	–	–	+	+	–
Dytiscus circumflexus Fabicius	HM	+	+	+°	–	–	–	–	+	+	–
Cybister tripunctatus africanus Castelnau	Et	–	–	+°	–	–	+	–	+	+	–
Cybister lateralimarginalis (De Geer)	HM	+	+	+°	–	–	–	–	+	+	–

the Mt. Hermon and of the Golan Hights. Another species found in these biotopes is *Deronectes parvicollis* (Schaum).

As to Dytiscidology the Hula Valley is the most interesting part of the Jordan River area. It is wedged in between Mt. Hermon, the Golan Heights and the hills of Galilee. Before 1957 it was a flat lake and a swampy area but now it is drained and cultivated. Only a small area was turned into a nature reserve. There the author collected 22 different species of Dytiscidae in small ponds within a single day. Some of these species are: *Hyphydrus sanctus* Sharp; *Hydrovatus humilis* Sharp; *Hydrovatus cuspidatus* (Kunze); *Bidessus nasutus* Sharp; *Bidessus anatolicus* Wewalka; *Coelambus lernaeus* (Schaum); *Hygrotus inaequalis* (Fabricius); *Herophydrus guineensis* (Aubé); *Hydroporus marginatus* (Duftschmidt); *Canthydrus diophthalmus* (Reiche & Saulcy); *Copelatus haemorrhoidalis* (Fabricius); *Agabus nebulosus* (Forster); and *Hydaticus leander* (Rossi). One of the species collected in the Hula Nature Reserve was recently described as new (*Agabus hulae* Wewalka). Two more interesting species are known from the Hula Valley: *Herophydrus galileae* Wewalka (Wewalka, 1984) described from a single male, and a still unnamed Hydrovatus known to the author from a single female. Both specimens were collected about 30 years ago but may have been extincted in the meantime because of ecologic changes in the Hula area.

No halobiont species are recorded from the area of the Jordan River system.

South of the Hula Valley the Jordan River reaches Lake Tiberias which is poor in Dytiscidae as is usual for big lakes. Between the Lake Tiberias and the Dead Sea the Jordan River abruptly enters semiarid and arid regions.

Coastal Area of Israel

The third area considered here with predominantly mediterranean climate is the Coastal Area of Israel. Its Dytiscidae fauna includes 24 species only. Almost all of them have a widespread distribution and were found in stagnant parts of small streamlets running to the Mediterranean Sea, in small ponds or in swamps. None of the species known form the Coastal Area of Israel are specialized for running waters and none are restricted to hyperhaline waters.

Dead Sea Area

One of the arid zones of the Near East is the Dead Sea area, where 15 species of Dytiscidae were collected. This number is quite high for

an arid area. Most of these species occur in springs, rockpools and brooks of the canyons incised into the hills of the Judean Desert and in the transrift mountains of the Jordan. Nahal Arugot and Nahal David in the oasis of En Gedi are typical representatives of these biotopes. The aquatic fauna of this area recently was summarized by FURTH (1983). Typical species occurring in these and similar waters are: *Aglymbus gestroi* Sharp; *Hyphydrus pictus* Klug; *Hydroglyphus major* (Sharp); *Potamonectes lanceolatus* (Walker); *Potamonectes walkeri* (v. d. Brand); *Rhantus includens* (Walker); and *Prodaticus pictus* Sharp. All these species live in rockpools or in stagnant parts of the streamlets.

In the south part of the Dead Sea there is an area with hyperhaline ponds and springs. Two species of Dytiscidae are specialized to these conditions; one is *Hydroporus mariannae* Wewalka, endemic to this small area, the other is *Potamonectes cerisyi* (Aubé) occurring in most of the brackish waterbodies around the Mediterranean Sea.

The Negev

It stretches in the south-east of the Dead Sea Valley. Only 11 species of Dytiscidae are recorded from this arid area and having very few springs only. Hence this area has the poorest Dytiscidae fauna of all those areas considered in this paper. One of the few springs in the Negev is En Avedat originating in a narrow valley and forming some pools before the valley runs dry again. The most common species in these biotopes is *Potamonectes lanceolatus* (Walker). Other species known from the Negev are: *Hydrovatus cuspidatus* (Kunze); and *Coelambus confluens* (Fabricius). None of the species found in the Negev are restricted to running or to brackish waters.

The Sinai

The Dytiscidae fauna of the Sinai is much more diverse than that of the Negev; 26 species have been recorded. Most of them were collected in the mountains of the south part of the Sinai which are rising to 2600 m (Margilit, personal communication). Some of the species were collected above 1000 m only. One of them is *Hydroporus tessellatus* ssp. *sinaicus* Wewalka the shape of which differs from the nominate form by being more narrow. The mean quotient of the length and the width of its elytra is significantly different from that of the populations of other regions (WEWALKA 1984).

Other species restricted to the mountains of the Sinai are: Potamonectes insignis (Klug); and Colymbetes piceus (Klug). Most of the

other species occur in the valleys going down to the Red Sea. The only typical halobiont species found in the north-east of Sinai is *Potamonectes cerisyi* (Aubé).

Zoogeography

The first analysis of the Dytiscidae fauna of the Levant was performed by showing the relationship of the faunas of the different areas (Tab. 2). There is a close correlation between the Dytiscidae fauna of the Orontes River system and that of the Jordan River system. There is also a close relationship between the fauna of the Coastal Area of Israel and that of the Orontes as well as of the Jordan River system. On the other hand the Dytiscidae faunas of the arid areas are very similar. The closest correlations are between the fauna of the Negev and that of the two adjacent areas which are the Dead Sea area and the Sinai. Moreover there is a close relationship between the fauna of the Dead Sea area and that of the Sinai.

Areas	Number of Species recorded	Orontes River System	Jordan River System	Coastal Area of Israel	Dead Sea Area	Negev	Sinai
Orontes River System	32	–	72% (23)	50% (16)	13% (4)	9% (3)	19% (6)
Jordan River System	42	54% (23)	–	45% (19)	12% (5)	5% (6)	14% (6)
Coastal Area of Israel	24	67% (16)	79% (19)	–	25% (6)	17% (4)	33% (8)
Dead Sea Area	15	27% (4)	33% (5)	40% (6)	–	60% (9)	80% (12)
Negev	11	27% (3)	55% (6)	36% (4)	82% (9)	–	82% (9)
Sinai	26	24% (6)	24% (6)	32% (8)	48% (12)	36% (9)	–
all Areas	72						

Tab. 2: Relationship of the Dytiscidae faunas of the different areas of the Levant () = number of species occuring in both areas; % of species recorded from the area mentioned in the horizontal line

Studying the zoogeography by means of a Dytiscidae fauna one has to consider that it mostly follows the patterns of terrestrial animals. Only for a few species non-flying such as some *Deronectes*-species, aspects of freshwater zoogeography may play a role. Por (1975) gives the following view of the terrestrial zoogeography of the Levant (Fig. 2). The fauna of this region consists of three main zoogeographic groups. The first he refers to as the palearctic fauna. These faunal elements prevail in the western part of Syria, Lebanon and northern Israel. The second group, the paleoeremic fauna dominates the faunas of the Dead Sea Area, the Negev and the Sinai. The third group according to Por is the ethiopian fauna which does not prevail in any area but which is represented by way of its influx. The fourth possible group, the oriental faunal element is not well represented in the terrestrial fauna of the Near East. In the area of the Coastal Plains of Israel, in the Judean Mountains and in the transrift mountains there is a broad transitional zone, where palearctic and paleoeremic elements are mingled. The same goes for the mountain areas of the Sinai. Por came to these conclusions mainly when studying the fauna of amphibia, reptils, birds and mammals.

In this paper the terms for the palaearctic faunal elements are used according to the definitions of De Lattin (1967). This makes it possible to subdivide the palaearctic fauna. In the Levant three groups of palaearctic elements can be distinguished: First the holomediterranean elements having a circummediterranean distribution which in many cases expands to large parts of the palaearctic region. Second the pontomediterranean elements which are distributed in the eastern mediterranean countries and are at least absent in Spain and North Africa. There are also species which fit the distribution patterns of syrian elements (according to De Lattin, 1967). As they are not easily to be distinguished from pontomediterranean elements they are put together into one group. The third but small group of palearctic faunal elements consists of stepp-inhabiting species with irano-turanian distribution (Tab. 3).

To subdivide the eremic fauna into afroeremic, syroeremic and iranoeremic elements as proposed by De Lattin (1967) seems difficult in Dytiscidae; therefore in this paper eremic elements are treated as one group. The cathegory of endemic elements is used for species up to now known from a very limited area only.

The Dytiscidae fauna of the Orontes River system is clearly dominated by species with holomediterranean distribution. Many of them

Areas	Number of species recorded	Faunal Element: holomediterranean	pontomediterranean + syrian	irano-turanian	ethiopian	eremic	endemic
Orontes River System	32	59% (19)	37% (12)	–	3% (1)	–	–
Jordan River System	42	55% (23)	24% (10)	2% (1)	10% (4)	2% (1)	7% (3)
Coastal Area of Israel	24	67% (16)	17% (4)	–	13% (3)	4% (1)	–
Dead Sea Area	15	47% (7)	–	7% (1)	–	40% (6)	7% (1)
Negev	11	55% (6)	–	–	9% (1)	36% (4)	–
Sinai	26	26% (7)	8% (2)	–	8% (2)	50% (13)	8% (2)
all Areas	72	39% (24)	24% (17)	3% (2)	8% (6)	18% (13)	8% (6)

Tab. 3: Zoogeographic analysis of the Dytiscidae fauna of the Levant () = numbers of species; % of species recorded from the area

show further dissemination in the palearctic region. About one third of the species are pontomediterranean or syrian elements which also clearly belong to the palearctic fauna. Only one species, *Canthydrus diophthalmus* (Reiche & Saulcy), can be counted as ethiopian element.

The Dytiscidae fauna of the Jordan River system has a very similar composition to that of the Orontes River system. The difference is a slightly higher influence of ethiopian elements; these are *Hydrovatus humilis* Sharp, *Herophydrus guineensis* (Aubé); *Canthydrus notula* (Erichson) and *Hydaticus leander* (Rossi). There also occurs one stepp-inhabiting palearctic species in the Golan Heights, namely Potamonectes airumlus (Kolenati) which can be called an iranoturanian element.

In the fauna of the Coastal Areas of Israel the proportion of pontomediterranean or syrian elements is a little lower; there are three ethiopian elements: *Canthydrus diophthalmus* (Reiche & Saulcy); *Hydaticus leander* (Rossi); and *Cybister tripunctatus africanus* Cas-

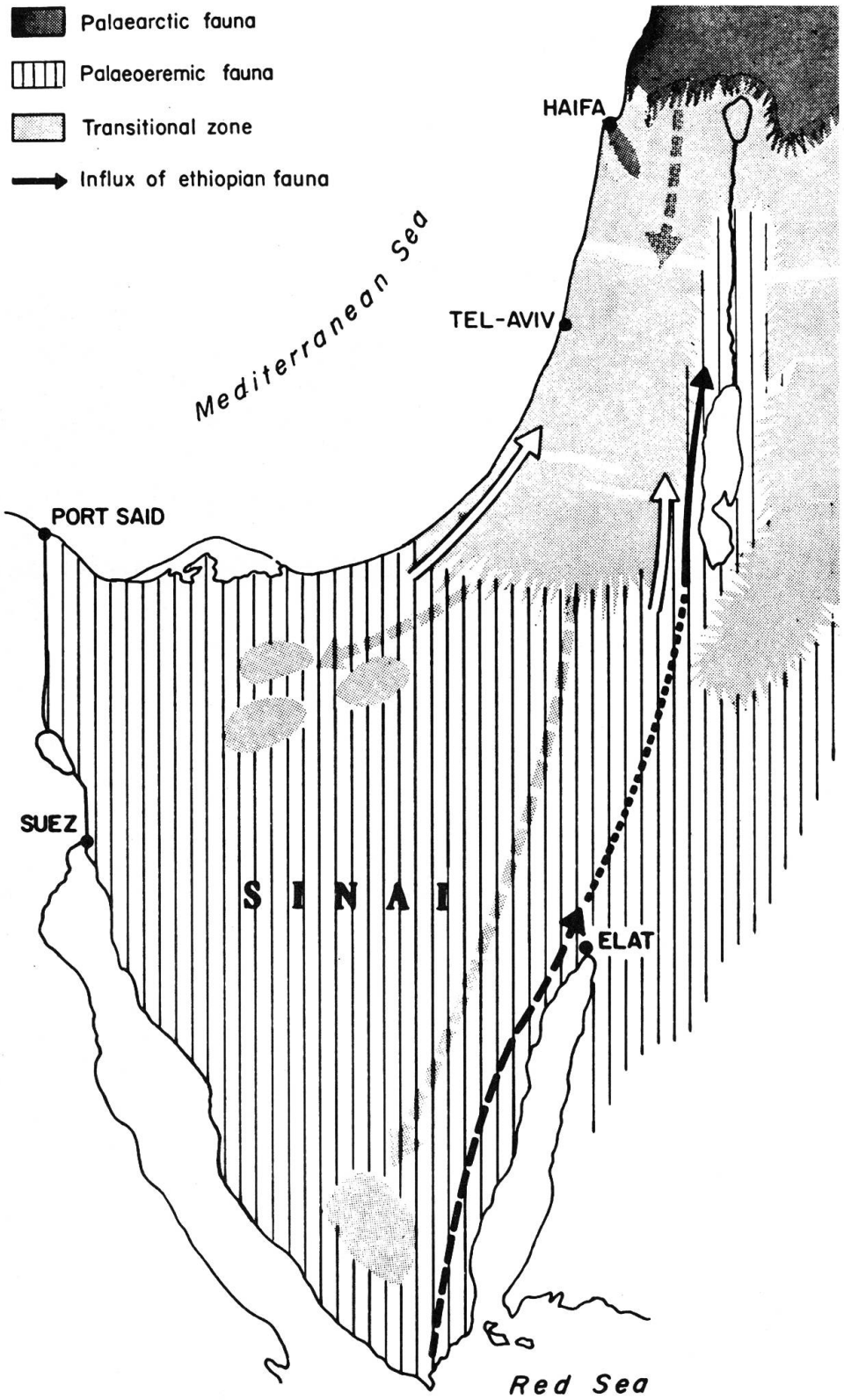

Fig. 2: Distribution pattern of the three main zoographical groups in the fauna of the Levant (after Por, 1975).

telnau; and one eremic element, namely *Potamonectes lanceolatus* (Walker). The latter just reaches some waterbodies in the south part of the coastal plains. In contrast to the conclusions of Por (1975) in which he stated that the Coastal Areas of Israel are a broad transitional zone between the palearctic and the eremic fauna, the Dytiscidae fauna of this area is clearly dominated by the palearctic members.

In the arid zones of the Levant, however, the Dytiscidae fauna predominantely consists of species adapted to the extreme conditions of this climate in one way or another. It is not easy to understand why aquatic Coleoptera should belong to a desert fauna or to the eremial (after De Lattin, 1967); however, their distribution patterns perfectly fit those of typical members of the eremic fauna, e.g. some Tenebrionidae. There is no doubt that Dytiscidae like *Potamonectes lanceolatus* (Walker), *Potamonectes walkeri* (v.d. Brand), *Potamonectes insignis* (Klug) or *Rhantus includens* (Walker) and *Aglymbus gestroi* (Sharp) are true eremic elements. In the arid areas there is of course a certain percentage of so-called palearctic species, species with holomediterranean or even broader distribution that can live there. Most of them are adapted to stand hyperhaline waters, e.g. *Hydrovatus cuspidatus* (Kunze), *Coelambus confluens* (Fabricius), *Potamonectes cerisyi* (Aubé) or *Eretes sticticus* (Linné). The mountain area of the Sinai, however, is a real transition area where palearctic species, e.g. *Agabus biguttatus* (Olivier) are found.

Endemism in Dytiscidae is infrequent in most areas of the world, including the Levant. The only real endemic species or subspecies may be *Hydroporus tessellatus sinaicus* Wewalka restricted to the high mountains of the Sinai, and *Hydroporus mariannae* Wewalka restricted to the extreme hyperhaline springs at the south shore of the Dead Sea. These two taxa clearly have palearctic origin. The other three species mentioned here are species from the Hula Valley. Two of them, *Herophydrus galileae* Wewalka and the still unnamed *Hydrovatus* were collected 30 years ago and may be extinct by now. Both may have ethiopian origin.

In the Near East there are relatively few aquatic habitats where Dytiscidae can live; many are polluted or changed by being used for irrigation. At least nowadays most springs and many other bodies of water in Israel are protected. It is hoped that similar measures will be taken in other countries of the Near East, otherwise the Dytiscidae fauna of this area could be reduced dramatically within a few years.

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