Mayflies of the Northern Levant (Insecta: Ephemeroptera)

by Stefan Koch

Abstract: For 31 species of mayflies, new records on their distribution are presented. Most of them are new to the Middle East or to the northern Levant (Turkey, Syria, Lebanon). The fauna is composed for the most part of species widespread in Europe (63%), a relatively high number (26%) of endemic species, and a few Caucasian (8%) and South European (3%) species. Using the genus Prosopistoma as an example, it is shown that the mayfly fauna of the northern Levantine has been isolated from the faunas of Africa and Asia for a very long period.

Kurzfassung: Zu 31 Arten von Eintagsfliegen werden Verbreitungsangaben vorgestellt. Die Mehrzahl der Arten ist für den Mittleren Osten bzw. für die nördliche Levante neu. Die Ephemeriden-Fauna der nördlichen Levante besteht überwiegend aus in Europa weit verbreiteten Arten (63%), einem relativ hohen Anteil an Endemismen (26%) sowie einigen südeuropäischen (3%) und kaukasischen (8%) Arten. Am Beispiel der Gattung Prosopistoma wird gezeigt, daß die Fauna der nördlichen Levante lange Zeit von der Afrikas und Asiens getrennt war.

Key words: Ephemeroptera - Lebanon - Syria - Turkey - zoogeography - Prosopistoma

1. Introduction

Until now little was known about the mayfly fauna of the Near East. Earlier publications mention only a very few species, often solely at the generic level. For instance, BODENHEIMER (1935, 1937) listed only three species: Palingenia jordania (a synonym of P. orientalis), Cloeon dipterum and Polymitarcis sp. (probably Ephemor virgo). VERRIER (1955) reported some further species in addition to Cloeon dipterum: Baetis bioculatus (a synonym of B. fuscatus), Caenis macrura, and some undetermined species of the genera Baetis, Ecdyonurus (two species, one resembling Ecdyonurus lateralis, the other Heptagenia fuscogrisea), Ephemera, Leptophlebia, and Paraleptophlebia. DEMOULIN (1963, 1965) mentioned three Baetis sp., two Afronurus sp. and a Thalerosphyrus sp. PUTHZ (1972, 1973) was able to increase the known fauna further by listing the following species: Baetis rhodani, B. alpinus, B. cf. melanonyx, Baetis sp., Cloeon sp., two species of Heptagenia (lateralis-group), Habrophlebia fusca, Ephemarella ignita, Caenis robusta, and C. macrura. Adding Siphlonurus lacustris, Baetis muticus, B. verus, Centropilum luteolum, Cloeon simile, Iron caucasicus, Epeorus sylvicola, Rhithrogena znojkoi, Ecdyonurus insignis, Neoephemera maxima, Choroterpes pictetii, Habrophlebia lauta, Ephemerella danica, Ephemerella vulgata, and Potamanthus fortunei, PUTHZ (1978) was able to list 24 species from the Near East. Additional species were recorded by DEMOULIN (1973: Ecdyonurus asiainordinis, E. galileae, Afronurus kugleri, Sigmoneuria samochai), ALOUF (1977: Prosopistoma oronti, P. phoenicium), JACOB (1977: Palingenia anatolica, P. orientalis), SOLDAN (1978: Palingenia fuliginosa) and BRAASCH (1981: Anotropus fragilis, Iron znojkoi, Rhithrogena theischingeri, Ecdyonurus ornaiipennis, E. ressli, Paraleptophlebia submarginata).
Since our knowledge of the mayfly fauna of the Near East was obviously incomplete, it was a great pleasure to study a rich collection from the area, which was generously provided by Prof. Dr. R. Kinzelbach, Darmstadt. The mayflies were collected mainly from the river Orontes and its tributaries during expeditions to Syria, Lebanon and Turkey in 1978 to 1982. This collection, containing 36 species, adds 22 species to the known mayfly fauna of the Middle East, which now has a total of 62 species. 31 of them are discussed in detail in this paper, some others having already been published elsewhere (Koch 1980, 1981, 1985).

2. Collecting Sites

The collecting sites lie mainly in Syria, with some others in the adjacent countries of Turkey and Lebanon. They mainly cover the catchment area of the river Orontes (Asi Nehri, Nahr al-'Asi) and adjoining river basins. For presentation of the results, they are arranged in areas (Fig. 1). For precise denomination and location of the sites compare the appendix and Kinzelbach, Krupp, Roth & Schneider (1989).

In the species chapter, only the year and site numbers are given instead of the full data, as set out in appendix 1.

Abbreviations: \(I\) = larva(e), \(LB\) = Lebanon, \(SY\) = Syria, \(TR\) = Turkey, \(E\) = east of, \(N\) = north of, \(S\) = south of, \(W\) = west of.

3. Species

The occurrence of the species contained in the material is compared with their known distribution, which is cited from Müller-Liebenau (1969), Puthz (1978) and original descriptions. Data concerning the preferred habitats are taken from the same authors and from Kimmins (1972), Macan (1970), Pleskot (1954) and Schoenemund (1930). The determination of the species follows the works of Grandi (1960), Kimmins (1972), Landa (1969), Macan (1970), Schoenemund (1930), Ulmer (1929), and others (mentioned in the text).

In addition to the material listed below, there are other specimens collected by Kinzelbach in Turkey which have already been published (Koch 1985). Since these findings enrich the mayfly fauna of the Near East, the additional species (Baetis macrospinus, B. vernus, Centroptilum luteolum, Prosopistoma oliaceum, Choroterpes pictetii) are discussed in section 4.

Family Baetidae

The species of Baetis were determined with Müller-Liebenau (1969). In addition, Müller-Liebenau kindly checked my identifications in some cases. She found some differences when compared with Central European specimens, which still lie, however, within the range of variation. I have tried to associate the unnamed species from Israel (Samocha 1972) with known ones. This is discussed under the individual species.

Fig. 1. Areas of the studied region, after Kinzelbach (1980) and Por (1975). 1- Lower course of Orontes. 2- Area of the Gab. 3- Middle course of Orontes and tributaries. 4- District of Homs. 5- Nahr al-Kabir (north). 6- Mediterranean rivers of the coast. 7- Nahr al-Kabir (south) and plain of Buqa'a. 8- Litani and plain of Baq'a. 9- Area of al-Balu'a. 10- System of the Euphrates. 11- Nahr Barada and Nahr al-'Awaj. 12- System of the Yarmuk.
Tab. 1. Species of mayflies contained in the material. For areas cf. Fig. 1.

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**Baetis buceratus** Eaton, 1870
Distribution: Many localities in Europe; new to Lebanon, Syria and Turkey.
Habitats: Larvae among water plants and stones near banks.

In the material this species is the most abundant mayfly. It appears to be present in Israel (SAMOCHA 1972: as *Baetis* sp. A7, male).

**Baetis digitatus** Bengtsson, 1912
Distribution: Only a few widespread localities in Europe; new to Syria.
Habitats: Larvae seem to prefer slow-flowing water; among water plants near banks.
Material: 79/12: 1, 1.
This species appears to be present in Israel (SAMOCHA 1972: as *Baetis* sp. L 57 larva).

**Baetis lutheri** Müller-Liebenau, 1967
Distribution: Southern parts of Europe, reaching the Caucasus. New to Lebanon, Syria and Turkey. Not present in England, Ireland, Iceland or the Scandinavian countries.
Habitats: Larvae in summer-warm fast-flowing rivers with stony beds.
This species is abundant. It appears to be present in Israel (SAMOCHA 1972: as *Baetis* sp. A12, male).

**Baetis melanonyx** Pictet, 1843-1845
Distribution: Southern part of Europe; new to Turkey.
Habitats: Larvae in small and medium-sized brooks.
Material: 82/269: 3, 1.

**Baetis niger** Linnaeus, 1761
Distribution: Whole of Europe; new to Syria.
Habitats: Larvae often together with the related *B. digitatus*, in rivers rich in plants.
Material: 79/129: 1, 1.

**Baetis rhodani** Pictet, 1843-1845
Distribution: Western Palaearctic region.
Habitats: Larvae in slow and fast-flowing rivers among stones or plants. Larvae do not
Insecta

**Cloeon dipterum** Linnaeus, 1761

Distribution: Holarctic region, except Iceland.

Habitats: Larvae in ponds, lakes and in slow-flowing parts of rivers, among plants.


This species appears to be present in Israel (SAMOCHA 1972: as *Beatis* sp. A 3, male).

**Cloeon similis** Eaton, 1870

Distribution: Whole of Europe, Caucasus; new to Syria. Not present in Iceland.

Habitats: Larvae often together with *C. dipterum*.

Material: 79/58: 3 I, 80/54: 1 I.

SAMOCHA (1972) figures several *Cloeon* sp.

**Family Oligoneuriidae**

**Oligoneuriella arontensis** Koch, 1980

Distribution: Israel, Lebanon, Syria, Turkey.

Habitats: Larvae in rivers with stony beds.


This recently-described species seems to be endemic in the Levant region. SAMOCHA (1972) figured the larva as *Oligoneuriella* sp. SOLDAN generously sent me larvae for study, which were found near El Hermel (Lebanon), Orontes on 7.3.1952.

**Centroptilum pennulatum** Eaton, 1870

Distribution: Widespread in Europe, especially in the Mediterranean region. New to Lebanon, Syria and Turkey.


**aff. Centroptilum pulchrum** Eaton, 1885

Distribution: Italy and the plains of Central Europe; new to Turkey.

Habitats: Larvae in rivers and streams.

Material: 82/50: 4 I.

These larvae are closely related to *C. pulchrum*. However, larvae of this species resemble those of *C. parapulchrum* Keffermüller & Sowa (KEFFERMÜLLER & SOWA 1975). A similar species is present in Israel (SAMOCHA 1972).

**Iron caucasicus** Tshernova, 1938

Distribution: Restricted to the Caucasus and Asia Minor.

Habitats: Larvae in brooks and small rivers.

Material: 82/53: 1 I.

The species was originally described as *Cinygma caucasia* (TshehNova 1938). Subsequently, *Iron fuscus* Sinitshenkova 1976 was found to be a synonym (BRAASCH 1979c).
Rhithrogena znojkoi Tshernova, 1938  
Distribution: Asia Minor, Caucasus.  
The imagines agree with the description and illustration Epeorus znojkoi (TSHERNNOVA 1938, as Ecdyonurus ? znojkoi). THOMAS (1982) established that Epeorus znojkoi is a species of the genus Rhithrogena. He was able to study an imago and the larva from which it derived. This larva showed the typical features of the Rhithrogena larvae. Consequently, at least some of the larvae recorded as Rhithrogena sp. could belong to this species. However, this cannot be confirmed, because THOMAS did not describe the larva of Rhithrogena znojkoi. I sent BRAASCH a specimen to study. He regards it as Epeion amseti Demoulin 1964, which is known from Afghanistan (DEMOULIN 1964).

Rhithrogena sp.  
The material contains only a few larvae of Rhithrogena, which cannot be determined with present knowledge. Reared material is necessary for the determination of these species. Many Caucasian species are known (BRAASCH 1979a, 1979b), and some of them are probably present in Syria and Turkey.

Ecdyonurus galileae Demoulin, 1973  
Distribution: Israel (DEMOULIN 1973; SAMOCHA 1972, as Afronurus sp. 1, SAMOCHA in litt.). New to Syria.  
Material: 78/34: 1 I, 79/30: 1 I, 79/73: 8 I, 80/6: 1 I.  
This species seems to be endemic in the Near East.

Ecdyonurus sp.  
This species cannot be determined because the larvae of Near East Heptageniidae are not sufficiently known.  
Description: The larva has seven pairs of gills; the last pair without a bunch of filaments. Spines of the femora in general shovel-shaped. Sternites with a characteristic pattern (Fig. 2).

Fig. 2. Ecdyonurus sp., 5th sternite.
Family Caenidae

The larvae of the two species in the material show some differences from Central European specimens (MALZACHER in litt.), which are probably due to variability.

Caenis luctuosa Burmeister, 1839
Distribution: Europe, except Iceland and the northern part of Sweden. New to Syria.
Habits: Larvae in the same habitats as the related C. macrura.

Caenis macrura Stephens, 1835
Distribution: Europe, Asia Minor, Caucasus. Not present in Iceland.
Habits: Larvae in slow-flowing parts of rivers with stony beds; also in lakes.
This species is one of the most abundant mayflies in the material.

Family Prosopistomatidae

Prosopistoma oronti Alouf, 1977
Distribution: Israel (SAMOCHA 1972, as P. yigali), Lebanon (ALOUF 1977). New to Syria.
Habits: Larvae allegedly carnivorous, probably living among the stones of rivers.
This species was never formally described as P. yigali (DEMOULIN in litt.), and so the name P. oronti is valid. The pattern on the larval "carapace", which is a characteristic of several species, is relatively variable in this species (Fig. 3). P. oronti, like its relative P. phoenicium Alouf, 1977, seems to be endemic in the Near East.

Family Leptophlebiidae

Choroterpes (= Euthraulus) balcanica Ikonomov, 1961
Distribution: Southern part of Yugoslavia (IKONOMOV 1961), Israel (SAMOCHA 1972, as Euthraulus sp). New to Syria.
Material: 79/20: 1 I.
Until 1961 the subgenus Euthraulus was only known from the Oriental, Ethiopian and the eastern part of the Palaearctic regions (Japanese Islands). In Europe E. balcanicus seems to be the only representative of this subgenus.

Habroleptoides modesta Hagen, 1864
Distribution: Southern part of Europe. New to Syria. Not present in Iceland, Ireland, England, northern part of Germany, Scandinavia or the northern European U.S.S.R.
Habits: Larvae in the interstitial of fast-flowing brooks.
Material: 79/128: 1 I.
Another species of this genus, H. caucasica Tshernova, 1930 (TSHERNOVA 1930, 1964), is known only in the adult stage from the Caucasus. It is thus possible that this larva may belong to the Caucasian species.

Family Potamanthidae

Potamanthus furcatus Linnaeus, 1767
Distribution: Palaeartic region, except Iceland, Ireland, Norway and northern Sweden.
Habits: Larvae mainly in large moderately flowing rivers, among stones.
Material: 79/55: 15 I.

4. Zoogeographical Remarks
Tab. 1 summarizes the species contained in the studied material. The last column (total) reflects the abundance of the species. Baeotis buceratus is the most abundant species. The data in the last line (species/area) indicates that most species seem to live in
the river Orontes, especially since more than the half of the collecting sites lie on the Orontes. There appears to be no distinct preference by individual species for particular areas: The abundant species occur in nearly all areas, and the rare ones are found too seldom to draw any conclusion. Since mayflies are able to colonize large territories, the areas studied are too small and lie too close together to show differences in the species representation.

Fig. 4 shows the connections of the mayfly fauna of the Near East with the neighbouring faunas of the Balkans and of the Caucasus. For these comparisons zoogeographical data are considered, which are given by the publications mentioned in section I and which are presented in detail in this paper. Additional data concerning the Caucasus were taken from Braasch (1980) and Zimmermann (1981). Braasch (in litt.) reported some further Caucasian species: Heptagenia coerulans, Nabrolephtoides modestia, and Ephemerda danica, whereas Epeorus sylvicola was attributed to this area by mistake (Puthz, in litt.). The fauna of the Asia Minor area is composed mainly of species which are widespread in Europe (63%). However, there are strong connections with the South European fauna (Ephemerella ikonomovi, Choroterpes italicus) and with the Caucasian fauna (Iron znojkoi, Iron caucasicus, Epeorus zaicevi, Ecdyonurus ornatipennis, Rhithrogena znojkoi). Although Asia Minor and the Balkans have more species in common than Asia Minor and the Caucasus, the latter areas have more endemic species. There is also a strikingly high number of species which are endemic to the Asia Minor area: Baetis macrospinosus, B. samochai, Oligoneuriella orontensis, Rhithrogena theischingeri, Ecdyonurus asiainoris, E. galileae, E. reselli, Afromerus kugleri, Thalerosphyrus sp., Sigmonura samochai, Prosopistoma oronti, P. phoenicium, Palingenia anatolica, and P. orientalis. This high number of endemic species in the Near East indicates the rather isolated character of this region.

What connection does the mayfly fauna of this region have with the adjacent faunas of Africa and Asia? So far as Asia is concerned, the high mountains in Iran should allow the dispersal of some species which are adapted to biotopes at these altitudes. A candidate for this type of distribution is Epeiron anselli. Braasch believes that the specimen mentioned as Rhithrogena znojkoi may possibly belong to this species. Since Epeiron anselli is known from Afghanistan (Demoulin 1964), it is conceivable that it is present in the highlands of Turkey, Iran, Afghanistan and perhaps reaches the Himalayas.

Large areas of Iran and especially of Saudi-Arabia and North Africa consist of deserts which are hostile to water-dependent insects such as mayflies. Therefore, strong connections between the fauna of the Near East and those beyond the deserts are not to be expected, but nevertheless this does need to be demonstrated. It is possible that there are some species which are present on both sides of the desert or even in suitable sites in the desert. However, since the Asian and African mayfly faunas are insufficiently known, it is impossible to compare them directly. Indirectly this can be done at the level of genera and families. A large number of families - 9 out of 19 - are present in Europe, Africa and Asia (HUBBARD 1968). This picture changes dramatically when the worldwide distribution of the genera composing these families is studied (HUBBARD 1979). These three continents have only 15 out of 127 genera in common and two of these genera are restricted to Africa and Europe only.

These figures suggest that there are indeed some faunal connections between these continents. The question is how strong these connections really are. To investigate this in detail it is necessary to compare the species of these genera, but this kind of study is hampered by at least two facts. Firstly, the number of species in several of the genera - for example Ecdyonurus, Rhithrogena and Baetis - is very high. Secondly, the species usually differ in many features. It is difficult to determine which of these is a greater weight and therefore has a higher value for estimating relationships. For these reasons, I looked for a genus which has few species that differ only in a few characters. I selected the genus Prosopistoma which is distributed with a few species in the Palaearctic, Palaeotropical and parts of the Australian regions (Tab. 2). The adult life of Prosopistoma is very short (GILLIES 1954) and thus passive drift of the adults with the wind cannot lead to the colonization of distant regions. Generally, mayflies are regarded as ideal subjects for biogeographic analyses, because their powers of dispersal appear to be rather sharply limited (EDMONDS 1972).

The larvae of Prosopistoma differ from all other mayflies by the "carapace" which covers almost the entire body (Fig. 3). Among themselves they look similar. I have dealt only with the larvae, because the imagines of nearly all species are
Tab. 2. The species of Prosopistoma.

<table>
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<th>Species</th>
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<tr>
<td>boreus</td>
<td>Philippines, Minanao</td>
<td>Peters (1967)</td>
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<td>crassi</td>
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<td>Gillies (1954, 1956)</td>
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<td>deguernei</td>
<td>West-Africa, Senegal</td>
<td>Vayssière (1893), Gillies (1954)</td>
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<td>Europe</td>
<td>Trägärdh (1911), Lafon (1952), Gillies (1956)</td>
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<td>indicum</td>
<td>India, Kerala State</td>
<td>Peters (1967), (Henry 1929: as P. sp.)</td>
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<tr>
<td>lieftincki</td>
<td>Ceylon</td>
<td>Peters (1967), Peters (1967)</td>
</tr>
<tr>
<td>oronti</td>
<td>Near East</td>
<td>Alouf (1977)</td>
</tr>
<tr>
<td>palawana</td>
<td>Philippines, Palawan</td>
<td>Peters (1967)</td>
</tr>
<tr>
<td>phoenicium</td>
<td>Near East</td>
<td>Alouf (1977)</td>
</tr>
<tr>
<td>sedlaceki</td>
<td>New Guinea, Solomon Islands</td>
<td>Peters (1967)</td>
</tr>
<tr>
<td>sp. Paulian</td>
<td>West Africa, Zaire (Belgian Congo)</td>
<td>Paulian (1947), Gillies (1954)</td>
</tr>
<tr>
<td>sp. Vayssière</td>
<td>East Africa, Kenya</td>
<td>Vayssière (1936, as P. deguernei), Gillies (1954)</td>
</tr>
<tr>
<td>variegatum</td>
<td>Madagascar</td>
<td>Latreille (1833), Westwood (1877), Vayssière (1890), Gillies (1954, 1956)</td>
</tr>
<tr>
<td>wouterae</td>
<td>Java, Sumatra</td>
<td>Lieftinck (1932), Ulmer (1939, as P. sp.), Lafon (1952), Gillies (1954, 1956), Peters (1967)</td>
</tr>
</tbody>
</table>

unknown. Comparing the characteristics and especially the mandibles, I divided the species into two groups. In group 1 the mandible has a short and thick "neck" which bears strong teeth. The prostheca is relatively short and does not reach the distal end of the mandible. Furthermore, the mandibles have five to twelve bristles (Fig. 5a - f). In group 2 a long and slender "neck" bearing three small teeth is present. The long prostheca nearly reaches the distal end of the mandible which always bears three bristles (Fig. 5g - m). Comparing the composition and distribution of each group, there is one striking feature: the European species are clearly distinct from the African ones.

To explain the distribution of the eastern species, it is necessary to consider geological and biogeographical data. The ancient Gondwanaland continent, which includes the Southern Hemisphere and India, broke up during the Jurassic to late Cretaceous and gave rise to the recent continents. During this process, India and Madagascar drifted away together from Africa and subsequently became separated; India continued drifting north and eventually reached Asia. Evidence for this is...
Himalayas separated Central Asia from the oceanic climate and brought it into the regime of a cold dry continental climate.

The northern group became extinct in this region, but colonized the warmer regions in the west (Fig. 6a, b) and in the east (Fig. 6i, m, n). This pattern of distribution is also found in the carnivorous Baetidae *Raptobaelopus tenerinus* Albarda (Europe) and *R. orientalis* Müller-Liebenau (Malaysia, Kuala Lumpur) (MÜLLER-LIEBENAU 1978a, 1978b, 1980). During the Cretaceous, the southern group, which had already colonized the areas now known as Africa, Madagascar and India (Fig. 6c, d, e, f, g, h), reached Asia by drifting with the Indian landmass. In this way the southern group was able to enter the eastern part of its territory (Fig. 6k, l).

The sea receded relatively late from Northern Africa and Saudi Arabia. By that time, immigration into the Near East had already taken place from the north. Later the deserts of the Sahara, Saudi Arabia and Iran prevented any colonization from the south and the east. The example of *Prosopistoma* explains why the mayfly fauna of the Near East has almost no connections with Africa and Asia, except for species of the high mountains in South-West Asia.

Postscriptum: When the manuscript had been finished, some further species new to Turkey have been published by KAZANGI (1986).

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Author's address: Dr. Stefan Koch, Langoner Str. 18, D-8122 Penzberg, Federal
Appendix

List of the collecting stations. For linguistic correct versions and geographic co-ordinates compare KINZELBACH, KRUPP, ROTH & SCHNEIDER (1989).

date/site number            collecting site                        area fig. 1
02-03.08.1978/8-9          SY, Homs, Lake of Homs, channel          4
03.08.1978/12              SY, Homs, Orontes                              4
03.08.1978/13              SY, Homs, Quattina, channel                           4
03.08.1978/15              SY, S Homs, al-Qusair, Orontes                         4
04.08.1978/17              SY, N Homs, ar-Rastan, Orontes                            3
05.08.1978/18              SY, Homs, Lake of Homs                             4
05.08.1978/20              SY, Homs, Orontes                               4
06.08.1978/21              SY, N Hamah, Shaizar, Orontes                           3
09.08.1978/23              SY, Hamah, Orontes                                3
11.08.1978/34              SY, al-Ghab, Abu Qubayis, spring and brook            2
11.08.1978/36              SY, W Hamah, Massyaf, al-Baisa, brook                        3
15.08.1978/40              SY, Daif al-Zur, tributary of the Euphrates                 10
17.08.1978/42              SY, E Raqqa, Mudan, tributary of the Euphrates                 10
19.08.1978/45              SY, Gisr as-Sugur, Orontes, brook                             2
20.08.1978/47              SY, Latakia, Nahir al-Kabir N                              5
23.08.1978/49              TR, Samandağı, Orontes                                        1
05.03.1979/12-13           SY, NE Latakia, Nahir al-Kabir N                             5
05.03.1979/14              SY, E Latakia, tributary of Nahir al-Kabir N                 5
05.03.1979/15              SY, E Latakia, Nahir al-Kabir N                              5
06.03.1979/17              SY, E Latakia, Nahir al-Kabir N summer-dry creek               5
06.03.1979/18              SY, E Latakia, Nahir al-Kabir N                              6
06.03.1979/20              SY, SE Latakia, Sallurin (summer-dry)                             6
06.03.1979/21              SY, SE Latakia, Lasrasir, river                                   6
06.03.1979/22              SY, SE Latakia, Haraisun, karst spring                                    6
06.03.1979/24              SY, SE Latakia, Nahir as-Sana                                           6
06.03.1979/25              SY, S Latakia, Banyas, Nahir al-Haraisun                               6
07.03.1979/29              SY, Tartus, Marqiya, Nahir Marqiya                                        6
07.03.1979/30              SY, Tartus, Nahir al-Hussain                                           6
03.08.1979/33              SY, W Homs, Buqafa-plains, creek and spring                             7
08.03.1979/34              SY, W Homs, Buqafa-plains, irrigation canals                               7
08.03.1979/35              LB, W Homs, Tall Kalah, Nahir al-Kabir S                             7
09.03.1979/37              SY, Homs, Lake of Homs, Orontes                                          4
13.03.1979/48              SY, N Abu Kamal, Mari, backwater of the Euphrates                        10
16.03.1979/57              SY, N ar-Raqqa, Gisr as-Sannin, Nahir al-Balih                           10
16.03.1979/58              SY, ar-Raqqa, Euphrates                                                 10
17.03.1979/62              TR, Samandağı, Orontes                                                   1
17.03.1979/63              TR, N Samandağı, Büyük Kara Çayı                                         1
20.03.1979/70              SY, E Gisr as-Sugur, tributary of the Rouj                               9
21.03.1979/71              SY, Gisr as-Sugur, Orontes                                              2
21.03.1979/72-73            SY, Gisr as-Sugur, Nahir al-Abiyad                                         2
22.03.1979/76              SY, Gisr as-Sugur, karst spring                                            2
22.03.1979/77              SY, S Gisr as-Sugur, ditches                                               2
22.03.1979/78              SY, S Gisr as-Sugur, karst spring                                            2
22.03.1979/79              SY, S Gisr as-Sugur, fish ponds                                              2
22.03.1979/80              SY, S Gisr as-Sugur, 'Ain Salimu drainage ditch                             2
22.23.03.1979/81            SY, S Gisr as-Sugur, 'Ain Salimu, Orontes                                 2
23.03.1979/84              SY, Hamah, Orontes                                                        3
25.03.1979/85              SY, S Gisr as-Sugur, Qal'afa al-Mudin, karst spring                      2
25.03.1979/86              SY, W Hamah, Nahir as-Sarut (summer-dry)                                     3
27.03.1979/88              SY, NW Hamah, Sai zar, Orontes                                      2
29.03.1979/94              SY, E Hamah, Kafat, Wadi Salamiya                                        2
29.03.1979/95              SY, S Hamah, Kafat, Orontes                                              3
30.03.1979/97              SY, W Hamah, al-Hansa, ditches                                              2
30.03.1979/98              SY, W Hamah, Masiyat Nabat al-Fuar, ditches                                2
30.03.1979/99              SY, W Hamah, Masiyat Nabat al-Fuar, brook                                  2
30.03.1979/101             SY, NW Hamah, al-Asarna, rain pool                                          2
30.03.1979/102             SY, NW Hamah, al-Asarna, tributary of Orontes                                2
30.03.1979/104             SY, NW Hamah, al-Asarna, Orontes                                          2
31.03.1979/106             SY, W Hamah, Nahir Abu Qubayis                                          2
31.03.1979/107             SY, W Hamah, Tall Sahab, karst spring and small lake                        2
01.04.1979/108             SY, SW Homs, al-Qusair, Orontes                                           4
06.04.1979/116             SY, SE Damaskus, as-Suvaida, Qanawat, brook                                   12
06.04.1979/117             SY, SE Damaskus, as-Suvaida, reservoir of Sad Rumi                            12
09.04.1979/119             TR, Antakya, Orontes                                                     1
09.04.1979/120             TR, N Antakya, Amik Golu, drainage ditch                                      1
09.04.1979/121             TR, N Antakya, brook                                                    1
09.04.1979/122             TR, N Antakya, springs and small ponds                                         1
09.11.1979/128             SY, Damaskus                                                          11
12.11.1979/129             SY, SW Damaskus, Qanira, S'ss'a, river                                         11
06.03.1980/86              SY, N Tartus, Nahir Marqiya                                           6
06.03.1980/7               SY, S Latakia, Benias, Haraisun, spring                                        6
07.03.1980/13              SY, Gisr as-Sugur, tributary of Nahir al-Abiyad                                   2
09.03.1980/20              SY, N Marbig, Euphrates, Nahir as-Sagur                                    10
13.03.1980/29              SY, Dair as-Zur, Palmyra, tributary of the Euphrates                         10
20.03.1980/35              SY, SW Damaskus, S'ss'a, Nahir al-Awag                                      11
20.03.1980/36              SY, SW Damaskus, S'ss'a, pond                                                11
20.03.1980/39              SY, SW Damaskus, S'ss'a, tributary of Nahir al-Awag                             11
21.03.1980/40              LB, S Zahle, Chihaura, tributary of the Litani                               8
21.03.1980/42              LB, N Baa lbeck, al Lab'a, Orontes                                          4
22.03.1980/43              SY, W Homs, tributary of Nahir al-Kabir S                                      4
22.03.1980/44-45            SY, W Homs, Tall Kalah, tributary of the Nahir al-Kabir S                    7
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