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Abstract

Results of the phreatobiological researches carried out in Iran by the Zoological Institute of the University of L'Aquila (Italy), during the years 1977-78 are reported. Numerous stygobiontes species, among amphipods, cyclopoid and harpacticoid copepods, asellid and microparasellid isopods, oligochaetes, etc. are pointed out.

Introduction

According to some Authors, for what concerns the aquatic fauna, Iran may be divided in three different faunistic provinces, one going from the coasts of the Caspian sea to the central highlands, the others respectively limited to the south-western and to the southeastern parts of the country.

In these provinces may be found subterranean elements of different origin and relationships, which are of considerable biogeographical interest. The "caspien" forms include some thalassoid elements of marine origin and of recent immigration in the underground systems, which are generally limited to the coastal interstitial systems. In the inner highlands there are mainly more ancient, palaearctic elements with different degree of specialization to the underground conditions. In the southern provinces, at last, both eastern and palaearctic elements of different age can be found together.

Nevertheless, as far as we know, with the exception of the papers of Löffler (1959, 1960) and Lindberg (1941, 1942), in which a few, sporadic records of aquatic subterranean species are listed, until now practically nothing was known about the phreatic hypogean fauna of this country.

This fact prompted us to carry out, in summer 1977 and in autumn 1978, a series of field investigations in the phreatic subterranean systems of the north-western part of Iran, viz. along the coasts of the Caspian sea (Kelar-Abad, Kargash, Nor-eshar, Chalus) and in the inner highlands around Isfahan (Shar-e-Kord, Farrochâ, Cialestore) and Teheran (Karaj).

In the course of these researches, 41 collecting stations (man-made fresh and brackish-water wells and some cisterns) were sampled using the technique of Cvetkov (1968) modified by Danielopol and Dancau (in Bou, 1974). For each of them, the main geographical, topographical and chemico-physical data, together with the biological samples, were obtained.

The biological collections are noteworthy for the presence of a considerable number of stygobiont or eustygophil species, of great systematic and biogeographical value. Mainly among the crustaceans, the majority of which revealed themselves to be undescribed or new for the Iranian fauna.

The following animal groups were identified: hydrozoa, rotifers, turbellarians, cyclopoid and harpacticoid copepods, cladocerans, ostracods, asellid and microparasellid isopods, amphipods, nematods, oligochaetes, gastropods, bivalvia, water mites, collembols and insect larvae. The copepods, the ostracods and the oligochaetes are the most abundant groups, in some samples the cyclopoid copepods or the ostracods being the dominant group.

Among the copepods, numerous species of interstitial cyclopoids and harpacticoids were pointed out: some of these were already known both from epigeal and underground waters (wells) of Iran (Chappuis, 1954; Lindberg, 1942; Löffler, 1959, 1960; Rylov, 1928), other ones are new for the Iranian fauna or for the science. In particular, the cyclopoids are represented by a few stygophil or stygobiont species, as *Diacyclops iranicus* Pesce & Maggi, *Diacyclops languidoides* (Lilljeborg), *Diacyclops languidus* (Sars), *Acanthocyclops (Acanthocyclops) cf. cephalenus* Pesce, *Bryocyclops (Haplocyclops) cf. neuter* Kiefer (Dussart, in litt.), and by more numerous stygocen species, which live both in subterranean and epigeal waters, as *Paracyclops fimbriatus* (Fischer), *Tropocyclops prasinus* (Fischer), *Eucyclops serrulatus* (Fischer), *Acanthocyclops (Megacyclops) viridis* (Jurine), *Acanthocyclops (Megacyclops) viridis deserticola* Lindberg, *Acanthocyclops robustus* (Sars), *Acanthocyclops vernalis* (Fischer), *Diacyclops crassicaudis* s.l. (Sars), *Diacyclops bisetosus* (Rehberg).

The harpacticoids are represented by true stygobiont species as *Nitocrella petkovski* Pesce and *Nitocrella paceae* Pesce, which are at present

endemic for Iran, and by other stygophil or eustygophil species as *Attheyella crassa* (Sars) and *Canthocamptus staphylinus* (Jurine) which show a wide geographical distribution.

Among the isopods, remarkable and of a great biogeographical interest is the discovery in Iran of the family Microparasellidae since, until now, no representatives of this family had been reported from this country. All the material of this group belongs to the species *Microcharon raffaellae* Pesce which was collected in a fresh-water well in the highland of Isfahan and which is at present to be considered endemic from Iran.

From a systematic point of view, the above species fits in the group of the fresh-water species of the genus *Microcharon* (after resce, in press), being close to *M. kirghisicus* Jankowskaya from central Asia and to *M. phreaticus* Coineau & Botosaneanu from Cuba.

As regard the genus *Microcharon*, it shows a wide, cosmopolitan, distribution (Europe, Asia, Africa, West Indies, New Caledonia, etc.): several species and subspecies are reported from inland subterranean waters, other ones from interstitial marine habitat. According to some authors (Coineau, 1968; Pesce, in press; Danielopol, 1980) the fresh-water species of *Microcharon* have a marine origin: they penetrated and got adapted to the inland groundwaters during the Miocene regressions of the "Tethys sea" in the same way of many other subterranean groups as cirulanids, stenassellids, thermosbenaceans, amphipods (*Bogidiella*, *Ingolfiella*) and mysids. All of this was according to a model that Stock (1977) called "Regression Model".

The other isopods which were collected belong to the family Asellidae and to the widespread species *Asellus aquaticus* (L) Racovitza which is well represented in our samples, both from the Caspian area and the inner highlands.

At the present time, the genus *Asellus* Dudich is divided in three different phyletic lines which, according to some authors, represent three distinct subgenus: *Asellus* s. str., *Mesoasellus* Birstein and *Phreatoasellus* Matsumoto.

From a biogeographical point of view, it is to be considered an euroasiatic group, with a wide geographical distribution. The species *A. aquaticus* recently penetrated deeply in western Europe, both in epigeal and subterranean waters.

The material of Amphipods belongs to a new genus, *Phreatomelita* Ruffo with the species *P. paceae* recently described by Ruffo (1979). According to the authors, the new genus is close to some indopacific genera living in subterranean fresh-waters: *Psammoniphargus* Ruffo, from interstitial waters of the island of Reunion, *Paraniphargus* Tattersall, from fresh-waters of the Andaman Islands and from Giava, *Galapsiellus* Barnard, from the Galapagos, as well as to the amphipods of the "Hadziid-group" sensu Stock (1977).

Besides its great systematic and biogeographical interest, the discovery of *P. paceae* in the underground waters of Iran is remarkable. As far as we know, it represents the only and the first amphipod which is reported from the phreatic subterranean waters of this country.

As regards the oligochaetes, which are well represented in the groundwaters, are very abundant in our collections. Most of the species belong to the families Lumbriculidae, Naididae, Enchytraeidae and Tubificidae (mostly cocoons), being generally distributed in the superficial layers of the sampled sediments. The following species were identified: *Pelosclex velutinus* (Grube); *Nais elguisi* Muller; *Tubifex tubifex* (Muller) Nais sp.; *Pelosclex* sp. and *Lycodrilus phreodriloides* Malevich.

The majority of these show a wide geographical distribution and live both in epigeal and subterranean waters, offering a little biogeographical

valuc. On the contrary, the species *Lycodrilus phreodriloides* is very interesting since, until now, it occurred only in the Lake Baikal. The other related species living together in the connected rivers Jenisej and Angara: *L. phreodriloides* lives on stony bottom or on sponges, the other species of the same genus prefer muddy or sandy sediments.

According to E. Duranika, who kindly determined these materials, the specimens from Iran differ from the original description by some details, which could assure the identity of the Iranian populations of this species.

In association with the oligochaetes, insect larvae as Chironomids, Ephemerids, etc., occur abundantly in the same wells, being very numerous in the superficial layers of the groundwater.

All the other material which was collected are still in course of study by specialists who will publish their results as soon as possible.

At the end, this first, preliminary approach to the phreatic subterranean systems of Iran already revealed their remarkable interest from a biological point of view, as well as pointed out a rich and diversified fauna living in the underground waters of this country. However, still much has to be done in this field, since the species that we reported above most probably represent only a small portion of the subterranean aquatic fauna of Iran. Therefore, it is likely that the study of the remaining samples, as well as the continuation of the biological researches in the underground systems of Iran, will lead to additional discoveries and to a better knowledge of the Iranian fauna.

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