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(Short notes)

Biochemical approaches: their present usage and future application in the systematic problems of the freshwater fishes of Mesopotamia

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Introduction

Fishes of Iraq especially found in the lower reaches of the two major rivers, the Tigris and Euphrates, are poorly known in terms of their taxonomy. A few attempts have been made to identify some commercial fish species that found in the freshwater systems of Iraq (Khalaf 1962, Mahdi 1962, Mahdi & George 1969, Al-Nasiri & Hoda 1976). But all of these efforts were misled because they were based on a confused morphological characters. In addition they tackle the taxonomical problems superficially. All the identification books and monographs that have been put forward to fascilitate the process of identification of the freshwater fish pecies of Iraq were based on information been taken from secondary or tertiary references. The same problem faced other workers on the fish fauna of this region (Almaca 1991). Thus, a taxonomical work based on actual Iraqi specimens is urgently needed. Such work should be supported by another line of research such as the biochemical approaches in aim to resolve all the systematic conflicts that might found on both the generic and specific levels.

Identification of fish stocks is another unveiled task in the area of Mesopotamia. Several fish species found in Tigris-Euphrates basin showed different population affinities this might indicates stock differentiation or similarities. Using the isozymes technique and the DNA sequencing might settle this problem and help putting forward a plan to manage the commercial species.

The aim of the present work is two folds. First, to review the previous usage of the biochemical technique in resolving the systematic and the population structure problems found in the Mesopotamian area. Second, to list the remaining most pronounced taxonomical difficulties that the freshwater fish fauna encounter at the present time and put forward a possible resolution.

Results

The present usage of biochemical technique in the identification of fish species and fish stock assessment in the lower region of Mesopotamia.

Until the mid-1980's, biochemical approaches and the use of electrophoresis in particular has not been in use for fishes of this region. The following is a review for the previous works been conducting on the fish fauna of Mesopotamia.The work of Al-Hassan (1984) represents the first published information on the use of electrophoretic technique to identify freshwater fish species. In this work and in the susequent works (Al-Hassan 1985, Al-Hassan & Elias 1988) he used the general protein stain and some specific enzyme stains as taxonomic tools to distinguish the freshwater fish species.

On the base of muscle myogen detected by the electrophoretic technique, it was possible to distinguish members of the families Mugilidae, Cyprinidontidae and Cyprinidae, but not between the families Poeciliidae and Cyprinodontidae. Within the

family Cyprinidae muscle myogen can be used as a good taxonomic characters to separate *Barbus grypus* from the remaining species of this family. On the other hand, eye lens proteins failed to distinguish between the members of the four families mentioned above, but can distinguish *B. belawayei* and *B. grypus* from the other cyprinid species studied (Al-Hassan 1984).

Isozymes to some extent succeeded to identify fish species. For instance phosphoglucose isomerase, phosphoglucose mutase, superoxide dismutase and glucose-6-phosphate dehydrogenase were used to distinguidh between members of the family Cyprinidae and Mugilidae (Al-Hassan 1985, Al-Hassan & Elias 1988).

On the other hand, the technique of electrophoresis and the use of isozymes were successfully applied to the problem of the stock identification of the fresh and marine fish species. This technique has been used also for the migratory fish species that enter Shatt al-Arab River and the greater marsh area south of Iraq during spring time for feeding (*Acanthopagrus latus* and *Liza subviridis*) and for spawning (*Thryssa hamiltonii* and *Nematalosa nasus*). Al-Hassan & Mahdi (1987) studied the stock of *L.viridis* from three localities, Shatt al-Arab River, Kuwaiti waters (Arabian Gulf) and Khor al-Zubair area (North west region of the Arabian Gulf). Two enzyme systems e.g. phosphoglucose mutase (PGM) and superoxide dismutase (SOD) were used in the stock identification. The results revealed a genetic homogeneity for the stocks in question. This is also true for the stocks of *T. hamiltonii* from Khor alZubair and Al-Hammar marsh (north of Basrah city). For the fish, *N. nasus* , the results of electrophoretic technique showed that Shatt al-Arab River stock is genetically different from those of Khor al Zubair and the Kuwaiti waters (Al-Hassan 1988).

The stocks of the migratory fish *A. latus* were examined electrophoretically and the results showed that the resident stock in the Khor al-Zubair area is genetically similar to that found in the Shatt al-Arab River. The members of the former stock enter the Shatt al-Arab waterway during the end of the summer. The comparison was made using two enzyme systems (Al-Hassan 1990).

On the other hand, the stocks of the freshwater fishes in the inland waters of Iraq, stocks of *Barbus sharpeyi*, *B. luteus* and *Liza abu* taken from Shatt al-Arab River at Basrah, the Tigris River at Ammara city and from the Euphrates River at Nasiria city were studied using the electrophoretic technique. Eleven enzyme systems were used in the process of the stock identification; the results showed that a genetic homogeneity was the rule (Al-Hassan, unpublished data).

From the above review it possible to say that more work is needed in this field to accomplish the aim of solving the systematic problems that found in the fish fauna of this region.

Future application of biochemical technique in the identification of fish and fish stock in the Mesopotamia

The future application of the biochemical techniques in the Mesopotamian area can be put in two categories. First, the application of this technique to solve the systematic problems on the species level and above. Second, the application of the biochemical methods to the systematic problems below the specific level i.e. stock identification.

Concerning the first category, there are several systematic problems on the species level and above waiting to be solved, among those I can discuss the most clear ones:

Systematic problems among the species of the family Cyprinidae

Among the major element of the ichthyofauna of Asia in general and Mesopotamia in particular the cyprinid fishes (Banister 1980, Coad 1996). More than 1600 species in over 275 genera make the Cyprinidae the most species –rich of the fish families (Nelson 1976).

Among the previous identification attempts of the ichthyofauna of Mesopotamia (Khalaf 1962, Mahdi 1962, Al-Hamed 1966, Al-Nasiri & Hoda 1976, Al-Daham 1977, 1979, 1982) there appears a number of mistakes in the identification of the member of this family. The previously mentioned references contain information based on a compilation of the species being described elsewhere that the author think they might live in the Mesopotamian area. None of those authors made any real collections and identification in the Iraqi waters. Such chaos in the systematic work of fish fauna led to the accumulation of taxonomical problems among the different fish groups. Within the family Cyprinidae, the members of the species complex *Barbus xanthopterus* showed a lot of morphological overlap, and hybridization among those closely related forms is quite possible. Thus a difficulty in their identification exists.

An overlap between *Alburnus sellal* and *Chalkalburnus mousselensis* might as well be mentioned here. Except for the eye diameter the two species can not be easily distinguished (Krupp et al.

1992). This is also true for the member of the genus *Alburnus*, which showed a great difficulty in their identification. Banister (1980) suggested that the degree of kinship between *Chalkalburnus* and *Alburnus* is unknown. Berg (1964) separated the two genera on the relative lengths of the ventral keel and the relative stoutness of the last unbranched ray in the dorsal fin. The members of the genus *Acanthobrama*, in spite of their recent exception (Goren et al. 1973) are still extremely ill defined and are very probably artificial, polyphyletic assemblages.

Another misidentified case of cyprinid fish concerns with *Systoma albus* Heckel, 1843. This species was misplaced by al-Nasiri & Hoda (1976) in *Barynotus* and their checklist contains both *Barynotus albus* and *Systoma albus*.

The genus *Gara* is found in areas other than tigris-Euphrates system such as Sudanian region of Africa, in Arabia, Baluchistan, Pakistan and South Asia from South China to Borneo (Menon 1964). As Banister (1980) stated, this genus has never been subjected to an adequate phylogenetic analysis, although in the only recent review Menon (1964) attempted to group species into supra-specific complexes.

Systematic problems among the species of the families other than the Cyprinidae

The main systematic problem in fish species other than the family Cyprinidae is the member of the genus *Silurus* (family: Siluridae). Two species were recorded from Iraq, *S. triostegus* in the lower region of Mesopotamia and *S. glanis* in the northern part of Iraq. The only characteristic feature that separates the two species is the number of barbells. In *S. triostegus*, four barbels are present and in *S. glanis* six are present. An attempt have been made by Krupp & Jawad (unpublished data) to study the differences between the two species and whether they are belong to one species. Their study based on the osteological features only. Hora & Misra (1943) and Banister (1980) put foreward some arguments to suggest that *Silurus triostegus* is no more than a variant of *S. glanis*. Some recent studies have recognised *S. triostegus* as a valid species but with some unresolved anatomical characters (Kobayakawa 1989, Unlu & Bozkurt 1996). Recently, Coad (2000) presented a description for the two species and he concluded that the only characters that can differentiate them are tooth size, jaw shape, pectoral spine structure and color. All previously mentioned characters are functional characters and might well be changed according to the environmental factors.

The members of the family Cobitidae also showed some systematic problems and no studies have been directed towrd finding solution to these problems. Members of the genus *Noemacheilus* certainly need verification and their identification is far from being settled down.

Sisord fishes also show systematic problems. The members of the genus *Glyptothorax* showed no disciplinary identification. So far more than three species have been on record from Iraq belonging to this genus (Al-Daham 1977). Since no evidence have been given in that reference concerning the sample collection, there is a great possibility that Al-Daham (1977) have compiled the species description from the literature thinking it is found in the area giving no attention to the synonymies or the ecological distribution.

The second category for the application of the biochemical techniques is through the fish stock identification. Freshwater fish populations in Mesopotamia are well distributed, but, their management and distribution are still out of reach of fisheries scientists. Thus, any study concerning population structure or genetic can not be obtained at this stage. Among the problems that could be resolved by the population genetical studies is the distribution of the major freshwater fish species like the member of the family Cyprinidae. In summer time, and for spawning purposes, the latter species showed a southern migration toward the greater marsh area (Al-Hamed 1966, Al-Hassan 1999). Thus, the population of the freshwater fishes might showed a genetical differences between the three main river systems, Tigris River, Euphrates River and Shatt al-Arab River. In addition, the distribution of some marine species into Shatt al-Arab area can be investigated since there are some evidence of such riverine migration (Al-Hassan 1999).

Conclusion

The ichthyofauna of the Mesopotamian area is poorly studied from the point view of the systematic in spite of the several attempts to resolve its taxonomic problems. Those problems remain as an unfinished background work within the systematic network of the ichthyofauna in the area. The previous attempts were conducted using the classical morphological characters and most of those problems are still unresolved.

An up to date technique, the technique of electrophoresis and enzyme polymorphism, is suggested and discussed in the present work to solve the systematic problems of the fish fauna of the

Mesopotamian area. There are a few problems been tackled by this new method and still other ones listed in the present work and a biochemical solution has been suggested.

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