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Distribution of an Invasive Fish Species, *Pseudorasbora parva* (Temminck & Schlegel, 1846) in Turkey*

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Abstract: *Pseudorasbora parva* is a small cyprinid fish native to East Asia. In 1982, the occurrence of this species was first recorded from the Thrace region of Turkey and in 1996, from Aksu Stream. In this study, specimens collected from various localities in central and west Anatolia, such as the Sakarya River Basin, Kızılırmak River Basin, and Bakırçay River Basin, between 1999 and 2004, were used to show the rapid invasion of *P. parva* in Turkish freshwater systems. This species is regarded as a pest and the rapid *P. parva* invasion throughout Anatolia could pose a threat to the diversity of the ichthyofauna in Anatolia.

Key Words: Freshwater fishes, introduced species, Turkey

İstilacı Bir Balık Türü, *Pseudorasbora parva* (Temminck & Schlegel, 1846)'nın Türkiye'deki Dağılımı

Özet: *Pseudorasbora parva*, doğal yayılış alanı Doğu Asya olan küçük bir cyprinid türüdür. Bu türün varlığı Türkiye'de ilk defa 1982'de Trakya bölgesinde, 1996'da ise Aksu Çayı'nda saptanmıştır. Orta ve Batı Anadolu'da Sakarya, Kızılırmak ve Bakırçay havzalarındaki çeşitli bölgelerden 1999 ve 2004 yılları arasında *P. parva* örneklerinin toplandığı bu çalışmada, bu türün Türkiye tatlısu sistemlerini hızla istila ettiği gösterilmiştir. Zararlı bir tür olarak kabul edilen *P. parva*'nın Anadolu'daki hızlı yayılışı, Türkiye'nin zengin tatlısu balık faunası için bir tehdit olarak kabul edilebilir.

Anahtar Sözcükler: Tatlısu balıkları, yabancı türler, Türkiye

Introduction

Due to its zoogeographic location, Turkey is a country highly rich in biodiversity of freshwater fish, with 213 species (Geldiay and Balık, 1999). Among them, 30 species are known as endemic (Balık, 1995). Additionally, a very large number of introduced or translocated species are also present in Turkey. *Coregonus macrophthalmus* (Nümann, 1954), *Oncorhynchus mykiss*, *Salmo salar*, *Ctenopharyngodon idella*, *Gambusia affinis*, *Gambusia holbrooki*, *Tilapia zillii*, and *Sander lucioperca* (Kuru, 2004), *Salvelinus fontinalis* (Turan, 2002), *Carassius gibelio* (Şaşı and Balık, 2003; Özuluğ et al., 2004), *Pseudorasbora parva* (Erk'akan, 1984; Wildekamp et al., 1997; Şaşı and Balık, 2003), *Hypophthalmichthys molitrix* [personal communication with Kadir Üstündağ, State Hydraulic Works (DSI), Managemet Office], and *Lepomis*

gibbosus (Erk'akan, 1983; Şaşı and Balık, 2003) were accidentally or intentionally introduced into freshwater environments in Turkey. Some native species such as *Tinca tinca*, *Carassius carassius*, *Cyprinus carpio*, *Silurus glanis*, *Aphanius mento*, *Atherina boyeri* (Geldiay and Balık, 1999), and *Tor grypupus* (personal communication with Kadir Üstündağ, DSI) are considered translocated species. Crivelli (1995) stated that endemic species are vulnerable to introductions throughout the world, and as a result of introductions, several endemic species have disappeared or have seen major reductions in their numbers. Moreover, the most critical effects of introductions are hybridization, predation, competition, habitat alteration (Crivelli, 1995), diseases, and parasites (Welcomme, 1988). The high level of endemism of Turkish native ichthyofauna is also very vulnerable to such introductions.

* This paper was presented in 17th National Biology Congress, June 21-24th 2004 in Adana-Turkey.

The aim of this paper was to reveal the rapid invasion of introduced *P. parva* and its possible effects on native freshwater fish species in Turkey.

Pseudorasbora parva (Temminck & Schelegel, 1846), commonly known as the topmouth gudgeon or stone moroko, is a small cyprinid originating from East Asia. Its

natural distribution area includes Japan, the Korean section of the Amur River Basin, China (basins of the rivers Yangtze and Hoanghe), and Taiwan (Berg, 1949). After the accidental introduction to Romania in 1961 (Banarescu, 1999) many of the records came from European and Asian countries and even from Africa (Table1).

Table 1. Summary of *Pseudorasbora parva* introductions to several countries and the record years.

COUNTRY	AUTHOR	RECORD YEAR
Albania	Knezevic (1981)	
Armenia	Gabrielyan (2001)	
Austria		1982
Raab and Lafnitz rivers	Weber (1984)	
	Ahnelt and Tiefenbach (1991)	1986
Belgium	Wildekamp et al. (1997)	1996
British Isles	Domaniewski & Wheeler (1996)	
Bulgaria-northern part	Marinov (1979)	
Bulgaria-Southern part	Boyadjiev & Bassamakov (1988)	
Czechoslovakia		
Tisa River	Zitnan and Holcık (1976)	1974
France		
Rhine Basin	Allardi & Chancerel (1998)	1970s
Rhone Canal	Rosecchi et al. (2001)	1993
Germany	Arnold (1985), Stein & Herl (1986)	
Greece		
Lake Mikriprespa	Rosecchi et al. (1993)	1984-1985
Makedonia, lakes Prespa and Micraprespa, River Aliakamon	Bianco (1988)	1987
Rivers Loudias, Axios and Lake Koroneia	Economidis (1991)	
Hungary	Anonymous in Zitnan and Holcık (1976)	1967
Iran		
Caspian Sea Shore	Coad and Abdoli (1993)	1991
Tigris-Euphrates	Coad (1996)	1994
Israel	Welcomme (1988)	
Italy	Sala & Spampanato (1991))	1987
Kazakhstan, Kirghizia and Uzbekistan	Arnold (1990)	
Lithuania	Barus et al. (1984)	1982
Poland	Witkowski (1991)	
Romania	Banarescu (1999)	1961
Serbia and Montenegro		
Lake Sasko	Knezevic et al. (1978)	1977
Lake Skadar and and several rivers	Knezevic (1981) Cakic et al. (2004)	1979
Spain and Algeria	Perdices & Doadrio (1992)	
Spain (Iberian Peninsula)	Caiola and De Sostoa (2002)	2001
Ukraine		
Dnjester and Dnjeper rivers	Weber (1984)	
Turkey-European part		
Meric River-İpsala	Erk'akan (1984)	1982
Turkey-Asian part	Wildekamp et al. (1997)	1996
	Şaşı and Balık (2003)	1999

The first record from Turkey was from Thrace (Erk'akan, 1984); afterwards, the presence of this species was reported by Wildekamp et al. (1997) in the Aksu River in southern Anatolia. In the Sakarya River Basin, a well-established *P. parva* population in the Kirmir Stream flowing to Sarıyar Dam Lake was observed in 1999 (Ekmekçi, 2000). Şaşı and Balık (2003) found *P. parva* in Topçam Dam Lake, which is on the Madran Stream, a tributary of the Büyük Menderes River Basin in south-western Anatolia.

In addition to records of Erk'akan (1984), Wildekamp et al. (1997), and Şaşı and Balık (2003), we have observed *P. parva* in different localities in the Sakarya, Kızılırmak, and Bakırçay River basins (Figure 1). During our excursions, we caught 22 *P. parva* samples from Kirmir Stream in January of 1998 and 10 specimens with gill nets of 10 mm mesh size from the littoral zone of Sarıyar Dam Lake (lat 40°03'00" - 40°04'00"N, long 30°45'36" - 31°45'40"E,) in November of 1999. According to the records of the contractor exploiting fish populations of Sarıyar Dam Lake, the *P. parva* population has gradually increased and in some cases, its catch rate exceeded 500 tonnes per year in Sarıyar Dam Lake between 1996 and 1999.

P. parva was collected in the Gelingüllü Reservoir (lat 39°36'30"N, long 35°03'20"E) constructed on the Kızılırmak River, which is another major catchment in Turkey. We have been monitoring this newly impounded reservoir for introduced carp since 1996, but *P. parva* did not appear in the reservoir before 2000. We collected more than a thousand *P. parva* specimens from the dam lake, both with traps with a mesh size of 1 mm and by gill nets of 10 mm mesh size between June 2002 and December 2004.

One of the authors (FGE) also caught, with traps of 1 mm mesh size, 8 *P. parva* specimens from the Yortanlı Stream (lat 39°14'07"N, long 27°18'30"E), a tributary of the Bakırçay River flowing to the Aegean Sea in western Anatolia. The specimens were preserved in 4% formalin and deposited in Hacettepe University Biology Department.

P. parva is generally regarded as a pest due to its very high reproductive rate, which gives rise to dense populations of fish that compete with fry of other species (Welcomme, 1988). This species is more resistant than many European fish species to a moderate degree of pollution, elevated temperatures, and low water levels.

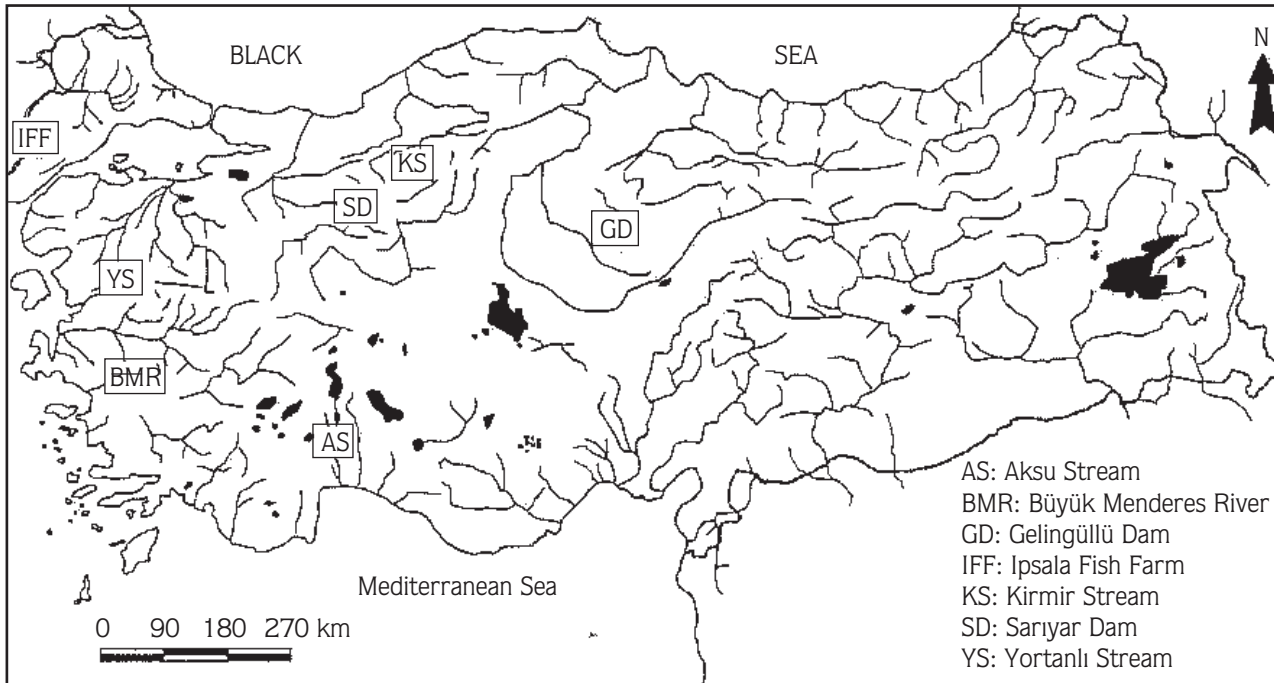


Figure 1. Distribution of *Pseudorasbora parva* in Turkey.

There is evidence that it also can move a limited distance through polluted water (Banarescu, 1999).

It is apparent from these records that *P. parva* is spreading rapidly and has successfully established populations in river networks of Turkey. High success in population growth and the colonization rate of *P. parva*, which is also known as an opportunist, could be explained by its wider ecological and physiological tolerance (Rosecchi et al., 1993; 2001). The ability to spawn on any smooth-surfaced object, such as branches, leaves, and artificial substrata, (Maekawa et al., 1996; in Gozlan et al., 2002) is another important factor likely to have contributed to the rapid dispersal of *P. parva*. This plasticity in use of spawning substratum could aid dispersal of eggs from upstream to downstream on floating objects and different catchments via canal connections (Gozlan et al., 2002). Many authors (Rosecchi et al., 1993; Xie et al., 2001; Crivelli, 1995; Economidis et al., 2000) concluded that *P. parva* develops dense populations in some water bodies and it is blamed for tough food and space competition with other species, and even for predation on their eggs and juveniles (Holcık, 1991). We observed that *P. parva* placed intense food competition pressure on other species such as *Aphanius anatolie* and *Orthrias* sp., also in aquarium conditions. In addition to these adverse ecological effects, *P. parva* has spread deadly disease to native fish fauna by an infectious pathogen (Gozlan et al., 2005).

Today, *P. parva* has a very wide distribution in Turkey, including Thrace, the Aegean Sea region, the Aksu River in the west Mediterranean Sea, and the Kızılırmak and Sakarya River Basins in central Anatolia. Although *P. parva* was recorded from the Aksu River in 1996 (Wildekamp et al., 1997), on September 22, 1993, this species was observed in the same river (Çandır-Aksu River) by a team including one of the authors (Erk'akan, Ekmekçi and Özen, unpublished data). Wildekamp et al. (1997) claimed that the penetration of this species into the Aksu River was possibly related to the origin of the O group carp used for stocking ponds and Karacaören-I Dam Lake; they also wrote that the carps originally came from husbandry ponds in Thrace. It is most probable that *P. parva* passed accidentally to the ponds of DSI (State Hydraulic Works) Ipsala Hatchery Station from the Meric-Evros River during heavy floods. This station has been

providing carp fry for newly-impounded dam lakes all over Turkey. Mirror carp fry were also transferred in 1990 from Ipsala to Karacaören-I Dam Lake on the Aksu River (Wildekamp et al., 1997). Although the origin of *P. parva* in Sarıyar Dam Lake and tributaries of the Sakarya River is still obscure, the origin of *P. parva* found in Gelingüllü Dam Lake is certainly from Sarıyar Dam Lake. This conclusion was based on information that crayfish had transferred from Sarıyar Dam Lake to Gelingüllü Dam Lake on the Kızılırmak River by a private fishing company in 1998. The present distribution of *P. parva* in Turkey is depicted in Figure 1. As shown on the map, owing to its high tolerance to different ecological and geographical conditions, this species is capable of establishing populations in large areas in Turkey.

Based on the information obtained from local fishermen, an unauthorised private fishing company has introduced crayfish from Sarıyar Dam Lake and to Aslantaş Dam Lake on the Ceyhan River in the eastern Mediterranean region. Therefore, it is reasonable to also expect *P. parva* in this region in the near future.

A summary of the translocation of *Pseudorasbora parva* from its origin is given below in order to understand its penetration and invasion into Turkey. Two invasion trajectories seem to be possible. The trajectory via the Meriç (Evros-Maritza) River, whose catchment is shared by Greece, Bulgaria, and Turkey, is almost certain, as in 1982 the first record of *P. parva* in Turkey came from this river system (Erk'akan, 1984). Entrance of this species into Turkey via an eastern trajectory is not as certain because the first records in the Iranian Euphrates and Tigris basins came in 1994 (Coad, 1996). Furthermore, we do not have any information on the existence of *P. parva* in the Iraqi section of these basins located downstream of the Turkish section. Invasion of countries neighbouring Turkey is of special importance due to the fact that Turkey has common catchments with her neighbours, which may be pathways for the penetration of new fish species. This was also the case with the penetration of *Liza (Mugil) abu* (Heckel, 1843) through the Tigris River (Kuru, 1975).

In this study, we found that this species has a distribution covering central Anatolia through the Sakarya and Kızılırmak watersheds, and in the Aegean Sea Region of Turkey. Moreover, *P. parva*, which is regarded as a pest (Welcomme, 1988), was reported by

Gozlan et al. (2005) to be the host of a deadly pathogen, which is responsible for increased mortality and inhibited spawning of an endangered native fish (*L. delienatus*) in Europe. Based on such information, *P. parva* could pose a threat to the diversity of ichthyofauna in Anatolia.

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