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Is *Carassius Gibelio* (Pisces, Cyprinidae) a Native or Non-Native Species in Romania?

OȚEL Vasile*

Danube Delta National Institute for Research and Development-Tulcea, Romania; e-mail: vasile_otel@yahoo.coms

* Address of author responsible for correspondence: vasile_otel@yahoo.com

Abstract: *Carassius gibelio* (Bloch 1783) (gibel carp, Prussian carp) is considered by some authors non-native for Europe and Romania respectively, originated from East Asia, Japan, and more recently, by others, a native species for this area, with the Euro-Asian geographical range (from Central Europe to Siberia). Those who claim non-native species take into account the history of the introduction of the goldfish (*Carassius auratus*) in Europe since the 17th century (initially from Java in Portugal, and later in several European countries, from the Far East). The introduction, propagation and linking of goldfish with the gibel carp are quite unclear in the literature. Those who claim the native status mention that the presence of the species in Europe occurred prior to introduction of the goldfish here (without clear evidence) and although there are no significant morphological differences between these two species, there are obvious genetic ones at the molecular and chromosomal levels. The most recent monographs on the ichthyofauna of Romania considered the gibel carp as non-native species. In this article we intend to carefully study some older publications that refer to the mention of the gibel carp in the territory of Romania. Following this analysis, we have concluded that *Carassius gibelio* is a native species.

INTRODUCTION

The synthesis of the nomenclature history of the species is as follows: the first description belongs to Bloch (1783), under the name *Cyprinus gibelio* (according to Paepke 1999, cited by Kalous et al. 2012, Bloch's original syntypes from Berlin Museum were lost and replaced with a *Carassius carassius* neotype.). In 1923, Berg considered the taxon to be subspecies of *Carassius auratus* (*C. a. gibelio*). Kottelat (1997) separates *Carassius gibelio* (Bloch, 1783) from *Carassius auratus* (Linnaeus 1758) and of course from *Carassius carassius* Linnaeus 1758, claiming at the same time that gibel carp is native species for Europe. The Romanian authors in their monographic publications followed the chronology of the name namely: *Carassius auratus gibelio* (Cărăușu, 1952; Bușniță, 1963; Bănărescu, 1964) and *Carassius gibelio* respectively (Oțel, 2007; Cocan & Miresan, 2018). Antipa (1909) considers that *Cyprinus gibelio* Bloch 1783 is a variety of crucian carp (*Carassius vulgaris* Nilsson 1832) but does not present details of morphological differences. The common names the most frequent used are: gibel carp and Prussian carp (English), and in Romanian caras (most commonly) as well as caras argintiu, crap-caras, caracudă argintie. Next we will use in the text the name goldfish for *Carassius auratus*, gibel carp for *Carassius gibelio* and crucian carp for *Carassius carassius*. Most European ichthyologists and all Romanian ones presented the gibel carp in their works as non-native, coming from the Far East. Bănărescu (1964), who summarizes in his book all the data on the distribution of the species until that year, states that the native area of *Carassius auratus gibelio* is the Amur basin, and for *Carassius auratus auratus* China, Korea, Japan and Vietnam, assuming that both subspecies were introduced in Romania in 1920 (without specifying the source of information). The author mentions that *C. a. gibelio* has a wide spread in the stagnant waters and the slow portions of most rivers and many ponds in Romania, and *C. auratus auratus*, named red caras, is found as an ornamental fish in aquariums, parks, botanical gardens, mentioning that it escaped into natural waters. As habitus and morphological indices these two species (*C. gibelio* vs. *C. auratus* ferral form) are almost identical, most of the meristical and somatic parameters overlapping. There are, however, genetic differences on the chromosomal set: *C. auratus* is always diploid, having 100 chromosomes (2n), while *C. gibelio*, besides diploid forms with the same number of chromosomes, also encounters triploids with 150-160 chromosomes (3n), specimens characterized by ginogenetic reproduction (Balon, 2006). Also, relatively recent researches on molecular genetics (mcDNA) reveals that *C. gibelio* is a distinct species within the genus *Carassius* (Kalous et al., 2012) and also that for example in the Czech Republic there are often hybrids between all species of the genus (Rylkova & Kalous, 2013). Kottelat's statement (1997) that the gibel carp is native to Europe is

based on Gesner's communication (1560), reinforced by other old communications such as Marsigli (1726), which mentions the species in Europe prior to the introduction of the goldfish from the Far East (1611). However, it is difficult to differentiate native populations from non-native (Kottelat & Freyhof, 2007). According to Balon (2006), the history of the goldfish is the following: gray-silver fish known in China as "chi" were initially widely used in people's diet. Occasionally there were xantic forms (reddish specimens - goldfish). Documents say the selection of these forms began during the Sung dynasty (960 AD). It was paid a more attention to the red specimens because there were so-called Buddhist ponds of mercy where the Chinese preferred to throw these fish than the usual ones. Between the 13-15 centuries the growth and selection of the goldfish in China became a fashion, being widely used as ornamental fish. Also, different breeds were obtained from aberrant specimens (monstrosities) as shapes and colors, In the 16th century goldfish arrived in Japan (Kottelat & Freyhof, 2007), from where, in 1611 in Portugal, 1691 England, 1755 France (Valenciennes 1842, cited by Kottelat 1997), then in other European states (without accurate dating) as ornamental fish. Currently, gibel carp and goldfish have a wide distribution all over the world. (Fig.1 and 2):

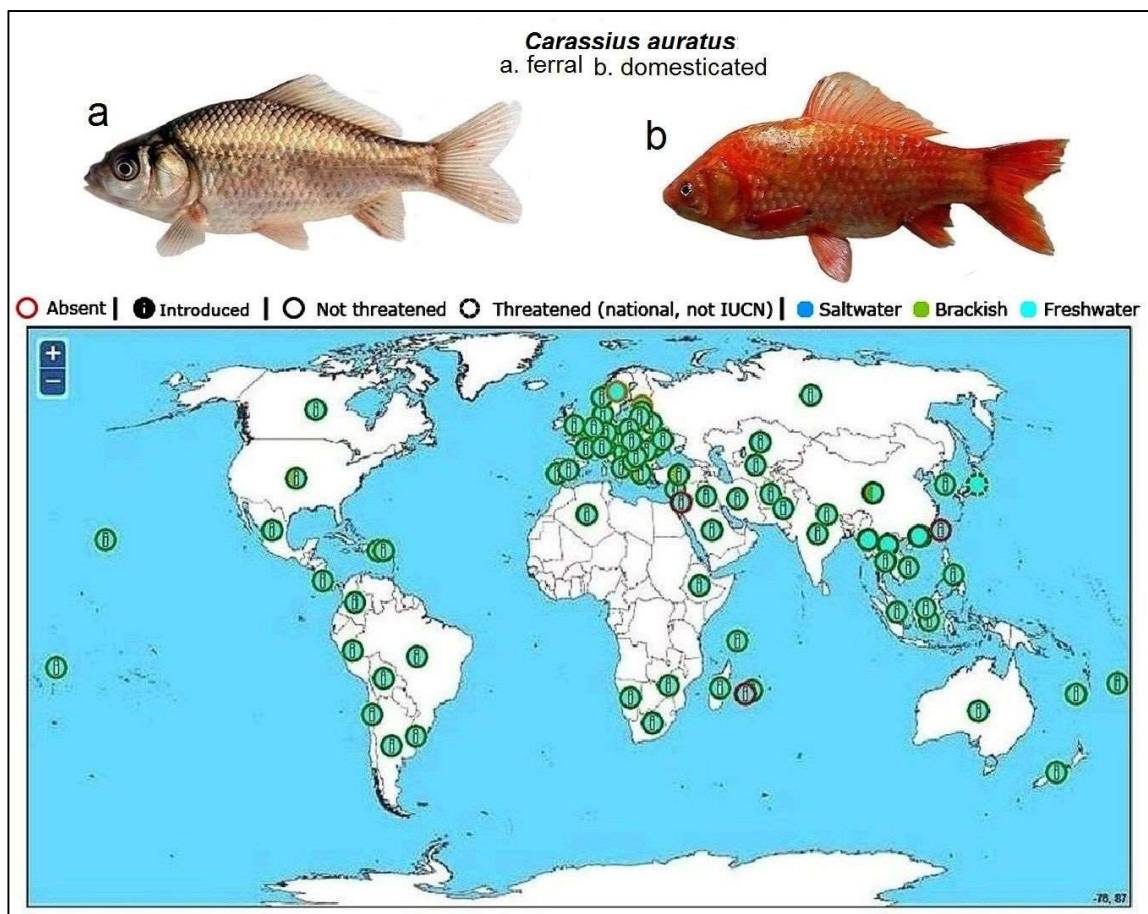


Fig. 1. Current geographic distribution of *Carassius auratus* (source: www.FishBase.org)

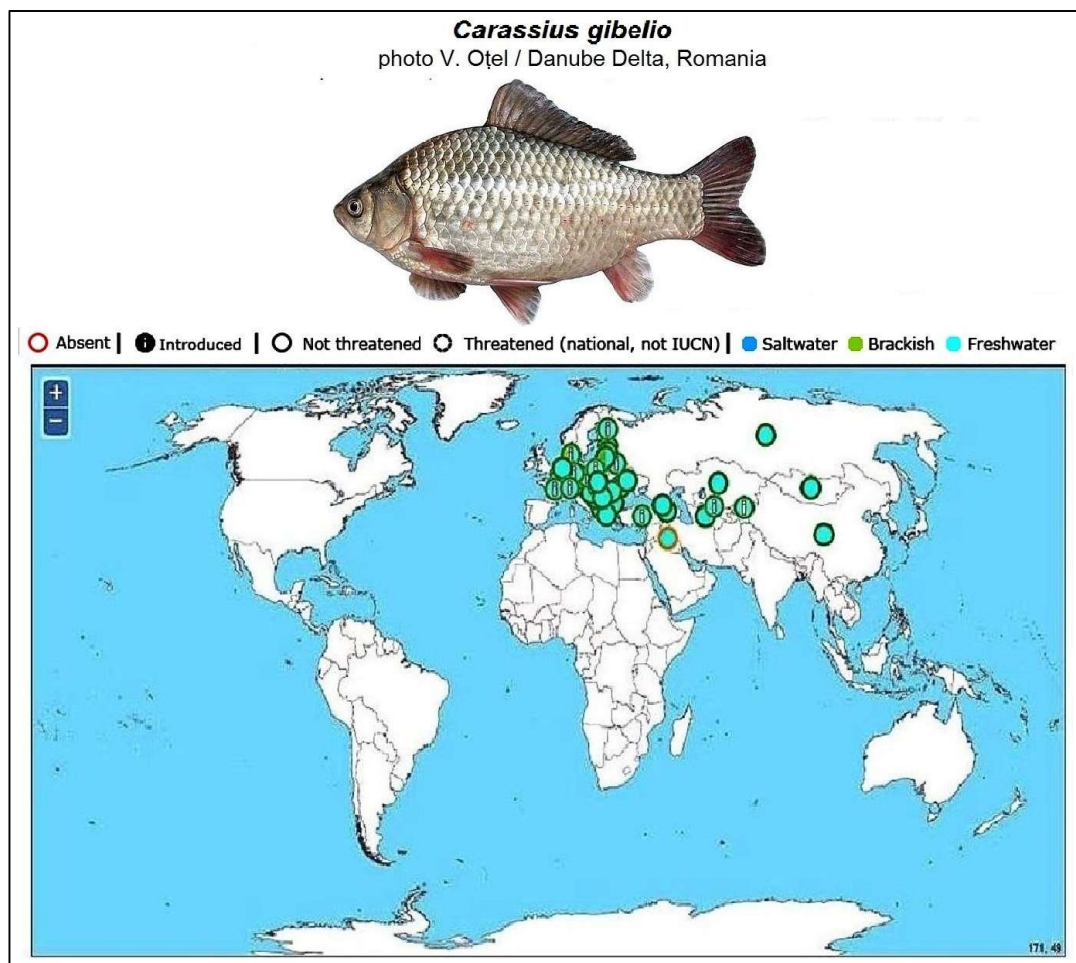


Fig. 2. Current geographical distribution of *Carassius gibelio* (source: www. FishBase.org)

In Romania, the gibel carp is currently a species with high abundance and frequency in most natural stagnant waters in the plain and hilly areas and also in the Danube river and its main tributaries, and sometimes it is found even in some storage lakes in subalpine and alpine areas, probably due to intentional or accidental introduction. In the Danube Delta it has penetrated massively after the great flood of 1970, when after 3 years there have been sudden increased the production of this species, and since then it has remained as a dominant ones in commercial and recreational fishing. It is also recorded in the coastal waters near the seashore (bays, Black Sea near the mouths of the Danube) and even recently the groups of gibel carp were filmed in the Black Sea at a distance from the Danube mouths, near Constanța town (Fig.

Fig. 3. Gibel carp in the Black Sea in 2018 near Constanța town (author: V. Marcoci)



The goldfish is also widespread in aquariums (colorful breeds, telescopic eyes, etc.) and also in some pools in large city parks, even some private ponds (Figure 4). There are currently several companies

specialized in the production and marketing of ornamental goldfish. There are proofs that they have reached in the natural environment (Figure 5).



Fig. 4. Goldfish breed Sarasa caught by angling in 2018 in a private fishpond (Turda, county Cluj) (photo. Al. Vana)



Fig. 5. Goldfish caught by angling in 2018 in river Jiu (source: Youtube).

MATERIAL AND METHODS

Our investigations consisted of consulting the old ichthyological literature referring to the territory of Romania, in order to detect the presence or suspicion of the presence of gibel carp in this territory before 1920, the year when it was considered to have been introduced in Romania (Bănărescu, 1964). We have paid particular attention to the description of the species as well as the mention of the aquatic bodies where the recordings are given, because the confusion with crucian carp (*Carassius carassius*) has often been made during those times. Bibliographical references are few and most of them refer to the territory of Transylvania when it was under the domination of the Austrian and Austro-Hungarian empires: Marsigli (1726), Leonhard (1818), Heckel & Kner (1858), Herman (1887), Bielz (1888), Antipa (1909).

RESULTS AND DISCUSSIONS

1726. Marsigli, L.F. *Description du Danube. Des Poisson du Danube, Tom. IV.*

It is the first ichthyological reserach and written testimoni on the fish of the Romanian territory. The author lived for a long time in the Danube cataract area (Ada-Kaleh) studying the fish as well. Thus it is described and presented the drawings of crucian carp under the name Carassius, metioning that he lives in stagnant waters with much reed. Under the name of "Carpe, especia premiere" and "second especia" are presented two forms of carp, namely with scales all over the body (probably wild carp) and the one with big scales (mirror carp). Under the name of "Carpe de la troisieme espece" (Fig.6) it is described and presented the drawing of a copy that fits perfectly with the gibel carp, and the mention that it is found in the Danube river reinforced the finding that it is gibel carp and not crucian one. The author believes it is the result of the cross between carp and crucian carp.

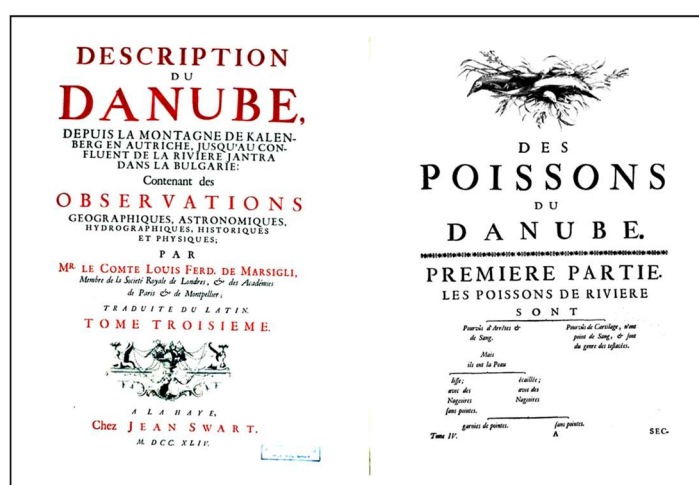


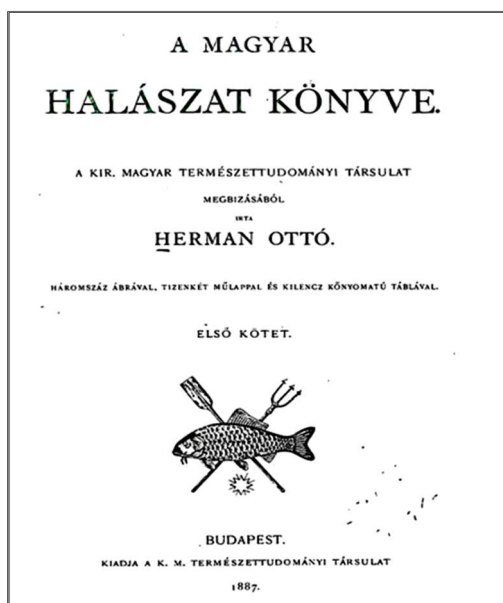
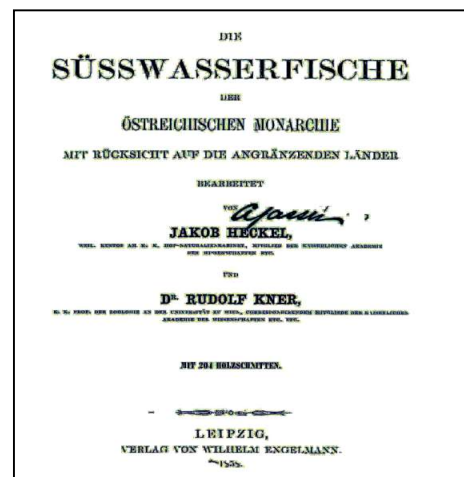
Fig. 6.

1818 Leonhard, J. *Lehrbuch zur Beförderung der Kenntnis von Siebenbürgen*

In his book entitled "Handbook for Promoting Knowledge of Transylvania", in the presentation of the species under the name *Cyprinus carassius* the information is too few to conclude if it's a gibel carp or crucian one: "*Cyprinus carassius* (u. Karasz) does not have mustaches, is very wide and long only 9 (?), the belly is reddish and lives mostly in the pond. He likes to feed especially with fry of carps and he has tasty meat, but it is rarer to us than the above species."

1858. Heckel J. & Kner R. *Die Süßwasserfische der österreichischen Monarchie.*

The fish species of the Austrian Empire, respectively Austro-Hungarian one were described, in which a part of the territory of Transylvania was included. Besides the crucian carp under the name *Carassius vulgaris*, there are also two species of the genus namely *Carassius gibelio* which by description appears to be the higher form of the gibel carp and *Carassius oblongus n. sp.* which looks like the gibel carp of the river ecotype, also mentioning that it is also found in the Carpathian rivers. He also adds that this species has nothing to do with goldfish (*Carassius auratus*).



1887. H e r m a n, O. *A magyar halászat könyve.*

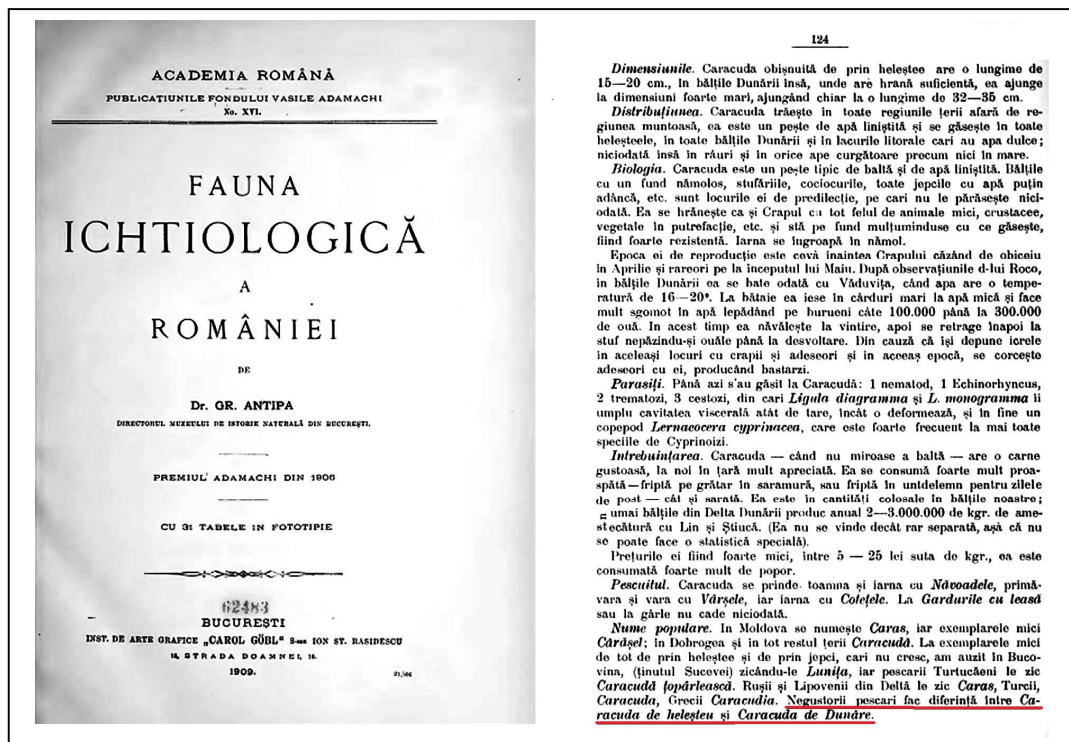
Besides the crucian carp under the name *Carassius vulgaris*, the author also mentions *Carassius Gibelio* NILLSON, with the shape more elongate and which lives in the rivers like Danube, Mureş, Someş, Tisa, but his opinion is that it is a form of the crucian carp.

1888. Bielz, E. A. *Die Fauna der Wirbellhiere Siebenbürgens nach ihrem fetzigent Bestände*

Among the mentioned fish in the area of Sibiu town is also *Carassius Gibelio* Nilss, as present in the Mureş river and its tributaries, in the Transylvanian Plain. Nominates separately on *Carassius auratus* L. (goldfisch) with the specification that it is brought from China and Japan and is widespread among aquariums, including those in Brasov.

1909. Antipa Gr. *Fauna ihtiologică a României.*

Antipa believes that the gen. *Carassius* Nilsson in Europe has a single species, namely crucian carp (*Carassius vulgaris*) represented by several varieties, including *Carassius gibelio* (Bloch), *Carassius oblongus* (Heckel & Kner) and "Carpe de la troisieme espece" (Marsigli) which is included as hybrid between carp and crucian carp, although Marsigli's specimen is devoid of mustaches (unlike Antipa's hybrids). Also Antipa makes the following statements: "Ruşii lipoveni din Deltă îi zic caras (la caracudă-n.n.).....Negustorii pescari fac diferența între caracudă de heleşteu și caracuda de Dunăre." Our observation: the Lipovan fishermen from the Delta, from the old times named the crucian carp "caracudă" and gibel carp "crap - caras". Crucian carp never lives in the Danube river, while the gibel carp is a common enough presence in the river.



CONCLUSIONS

Since in the past either gibel carp was confused with crucian carp or was considered an infraspecies of this, in the analyzed data from the old literature we have available, in addition to the presentation of morphology and drawings, an aspect that we had the most in account it was the type of aquatic environment: stagnant or running waters (rivers), because it is known that crucian carp never lives in the rivers while gibel carp often is a common presence here. The drawings are not always conclusive, because that time the designers did not always accurately present the outer morphological characters.

Thus, we consider that it is the sign of the gibel carp presence in the following analyzed papers:

- **Marsigli (1726).** In the drawing entitled "Cyprinus III", he accurately shows the characters of the gibel carp (including the slightly concave dorsal fin) and also mentions that it lives in the Danube river. The author describes separately crucian carp under the name of "Carassius", stating that it lives in stagnant waters with much reed.

- **Heckel & Kner (1858).** Under the name *Carassius oblongus* it is described a reofilic ecotype which is present in the rivers from Carpathian Mountains. The author makes the difference between crucian carp named *Carassius vulgaris* and goldfish.

- **Herman (1887).** Under the name *Carassius Gibelio* it is mention a species more elongate than crucian carp which is present in more rivers from Transylvania (Danube, Mureș, Someș and Tisa).

- **Bielz (1888).** He mention *Carassius Gibelio* Nilss in the river Mureș and his tributaries, making difference beside goldfish.

- **Antipa (1909).** The author considers that *Carassius gibelio* is a variety of crucian carp. The affirmation that "Fishermen make the difference beetwen crucian carp from fish ponds and that from Danube river" make us to believe that crucian carp from river is in fact gibel carp.

As a result of the analysis, we believe that we have arguments to support the fact that for Romania gibel carp (*Carassius gibelio*) is a native species, mentioned here from the beginning of the XVIII century.

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