

## Diseases on the Ornamental Fish in Benghazi City, Libya

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### ARTICLE INFO

Vol. 5 No. 2 December 2023

Pages (65- 72)

#### Article history:

Revised form 29 October 2023  
Accepted 22 November 2023

#### Article history:

Revised form  
Accepted

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#### Keywords:

Ornamental fish; pet industry; White  
spot disease ; Saprolegniasis ;  
erosion of the caudal fins

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review under responsibility of LJEEST

### ABSTRACT

Ornamental fish activities provide an important source of income to humans around the world; however, fundamental and substantial investments in the fish aquaculture industry in Libya is still underdeveloped. This study seeks to know the importance of ornamental fish disease which is becoming increasingly recognized with aquarium ornamental fish constituting a major sector of the pet industry. Therefore, this study order to know the serious effects caused by parasites, bacteria, and viruses on fish, or other factors. The investigations were carried out from March 2021 to September 2021, a survey of 100 fish. Fish are exposed to a difference of abiotic and biotic factor, the result have showed 3 different diseases to varied taxa. White spot disease caused by parasite, Saprolegniasis caused by fungal, and erosion of the caudal fins .

### الأمراض التي تصيب أسماك الزينة في مدينة بنغازي، ليبيا

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توفر أنشطة أسماك الزينة مصدرا هاما للدخل للبشر في جميع أنحاء العالم. ومع ذلك ، لا تزال الاستثمارات الأساسية والجوهرية في صناعة الاستزراع السمكي في ليبيا غير متطورة. تبحث هذه الدراسة في أهمية أمراض أسماك الزينة التي أصبحت معروفة بشكل متزايد في أسماك الزينة التي تشكل قطاعا رئيسيا من صناعة الحيوانات الأليفة. لذلك قرنا دراسة الآثار الخطيرة التي تسببها الطفيليات والبكتيريا والفيروسات على الأسماك أو عوامل أخرى. وأجريت التحقيقات من مارس 2021 إلى سبتمبر 2021 ، مسح 100 سمكة. تتعرض الأسماك الى عدد من العوامل الحيوية والغير حيوية التي تسبب العديد من الامراض ، وقد كشفت نتائج هذه الدراسة عن وجود ثلاثة أمراض مختلفة لأصناف متنوعة. مرض البقع البيضاء الناجم عن الطفيلي ، داء السيرولييجينا الناجم عن الفطريات ، وتآكل الزعانف الذيلية الناجم عن أسباب غير حيوية.

### INTRODUCTION

There are two main ornamental fish activity: farming, which involves import and export, breeding, and developing techniques for shipping over the world (Roberts, 2011) and hobby, with the keeping of fish considered the second most popular hobby worldwide (Sharma, 2020, Thilakarathne et al., 2003).

Ornamental fish activity has existed since 500 BCE (Roberts, 2011) and the importance of aquarium ornamental pet fish is becoming increasingly recognized as a major sector in the pet industry (Roberts, 2011). Nowadays the ornamental fish industry receives considerable attention and global distribution, and includes many species of freshwater fish, marine fish, coral reefs, and invertebrates, mainly crustaceans (Roberts, 2011 ).

The trading volume of ornamental fish has increased over the years and global exports of ornamental fish have grown more than 372 US million (CARDOSO ET AL., 2019). THERE IS A HUGE DIVERSITY IN THE SPECIES OF freshwater ornamental fish but there are also close to 1000 species of marine ornamental fish (Baker, 2008). The species of ornamental fishes which are widely spread throughout the world range from cheap guppy to expensive neon tetra (Sharma, 2020) , with many different species of fish being known as freshwater or marine ornamental fish such as Goldfish (*Carassius auratus*) Koi carp (*C. rubrofasciatus*) lamprey (*Poropanchax normani*) Dwarf gourami (*Trichogaster lalius*) Sword tail (*Xiphophorus hellerii*) (Sudthongkong et al., 2002, Sharma, 2020). Freshwater ornamental fish activity in Libya has been undeveloped for many years for several reasons including inappropriate water temperatures which may be conducive to their reproduction and poor transfer methods, another reason could be lack of keeping ornamental fish as a hobby in Libya in comparison with other countries. Several types of disease have been recorded as commonly affecting ornamental fish. In Libya, most species of ornamental fish are imported from Egypt, with many different common freshwater and marine ornamental fish species belonging to different taxa being identified in Libya such as Koi (*Cyprinus rubrofasciatus*), Goldfish (*Carassius auratus*), Guppy (*Poecilia reticulata*), mono (*monodactylus argenteus*). There have been many threats to production and aquaculture in the last century including parasites, bacteria, fungi and viruses. Other factors such as global warming, chemical pollution, and nutritional deficiencies have also negatively influenced fish aquaculture and welfare (Utne et al., 2017, Johnson and Paull, 2011, Czczuga, 1979) . as pathogens might have a significant impact on ornamental fish production and industry. Ornamental fish are kept in tanks of different sizes, completely confined within aquaria, and such conditions make the fish more susceptible to infection (Hedrick, 1998, Fioravanti and Florio, 2017). This can also adversely affect the health, growth, and reproductive activities of the fish as well as nutritional value in terms of quality or quantity (Scholz, 1999), transport methods of fish therefore all of these should be taken into account when attempting to study the pathogens in ornamental fish. One contributing factor is fish transportation, as most ornamental fish are imported in tanks from other countries including neighboring countries such as Egypt, then transferred to an aquarium in a shop using polythene bags. The fish are also exposed to a range of biotic stressors, for example, parasitism. Numerous studies have shown that parasites can lead to harmful effects (Begon et al., 1990). The prime examples of ectoparasites are monogeneans and arthropods, whereas endoparasites include nematodes and tapeworms (Goater et al., 2014). As well as parasite infection, other infections can have a significant harmful effect on fish. In general, studies have shown that parasites can cause reduced growth, poor reproduction, and may affect

behavior, and may also result in death (Bagamian et al., 2004, Barber, 2013, Barber et al., 2008, Threlfall, 1968). Additionally, fungal disease can indirectly impact the health status of fish, and is one of the most common diseases in fish (Sudthongkong et al., 2002). Saprolegnia is a common fungal infection that can affect ornamental fishes (Osman et al., 2009). The Saprolegniaceae, specifically, the genus Saprolegnia, can have negative consequences from the egg to the adult stage (Woo and Bruno, 1999). This is a fungal disease that is considered found in various categories of ornamental aquarium fish (Cardoso et al., 2019) Other factors abiotic that can increase fish susceptibility to pathogens include elevated temperature (Boeck et al., 1996) global warming, and chemical pollution. (Utne et al., 2017). In some species, anthropogenic stressors can cause high levels of mortality of ornamental fish such as poor fish transportation, lack of prevention techniques, elevated temperature, and water quality. These can all act as factors in causing infection in fish, including tail and fin rot. (Stevens et al., 2017, Fast et al., 2008, Eslamloo et al., 2014) The cause of infection of tail rot could be bacterial, as a consequence of exposure to several bacteria genus such as vibrio which causes vibriosis, (Fioravanti and Florio, 2017). relatively little is known about the specific reason behind pathogens for tail rot; therefore, this study was designed to investigate the pathogenesis that might affect fish, including both biotic and abiotic factors. it will be concentrated on some diseases that affect ornamental fish which are sold in shops in Benghazi.

## MATERIALS AND METHODS

A total of one hundred infected fish from different species including Goldfish (*Carassius auratus*), Guppy (*Poecilia reticulata*), and Mono (*monodactylus argenteus*) were collected from different private ornamental fish shops in Benghazi. These fish were bought live using polyethylene bags and transferred immediately to the laboratory of the Department of Marine Resources in the faculty of Natural Resources and Environmental Science at the University of Omar Al-Mukhtar, where they were maintained in a glass aquarium under controlled conditions. The fishes were kept in a glass tank with 60 liters of tap water until the time of examination. Two examinations were conducted to identify the pathogens in the fish: firstly, an external examination of the body, skin, fins, and eyes; and secondly, an internal examination of the intestines and all body cavities for ectoparasites. The external bodies of the fish were examined for Prevalent signs of infection. Their fins were examined for any noticeable ectoparasites, and each was photographed individually before being checked. It was difficult to identify clinical signs such as enlargement size of the liver or increased body size, therefore, some fish were euthanized and dissected under a binocular microscope, to identify any infection or any other clinical signs. Each fish was

blotted with filter tissue and then moved to a Petri dish, and the skin was immediately examined under a binocular microscope.

**RESULTS**

The results of the current study indicate that the pathogens in ornamental fish can occur as a result of several factors including biotic stressors (bacterial, viral and fungal), and abiotic stressors such as nutritional factors and environmental change. This study also found that ornamental fish are affected by both abiotic and biotic factors. At the termination of the study, three diseases belonging to different category were identified: firstly, disease which affects ornamental fish is This study indicated a prevalence of Saprolegniasis in some ornamental fish. populations (see figure 1) and found that Saprolegnia infection occurred in Koi (*Cyprinus rubrofuscus*), and was greater than other ornamental fish. In addition, the infection occurs on body, appear as a circular shaped, white, cotton, were clearly visible on the body, mostly around the fins and the caudal. The infection of Saprolegnia was quickly spread throughout body, reaching all tank in just one week, we noted that infections are common among both males and females. At the beginning of the infection was level 5%. Secondly, White spot disease the prevalence of infection over the course of the study was clearly showed the effect of *Ichthyophthirius multifiliis*. severe harm can cause skin lesions, the distribution pattern of infection intensity between the months of study was not different, although prevalence of infection showed a higher in goldfish (see figure 2) Among all fish during the experiment months, about 10-12% were infected at the beginning of infection, After being exposed to infection, as might be expected the infection level of infection and prevalence increased more than 85%. The infection of white spots on the caudal fin were very clear than other parts, the infection has shown some signs of decreased appetite, reduced growth, and weak activity. Furthermore, there are other abiotic factors, not derived from living organisms that should be taken into account when studying diseases in fish. These include fin erosion which can cause severe tissue damage as a result of fins degradation. Many infections which cause erosion have been recorded among different species of ornamental fish such as goldfish and guppy (see figure 3,4,5,6).



**Fig.1.** White spots disease infection in a Goldfish (*Carassius auratus*), Note the mass of large, white cotton on the fish's body surfaces



**Fig. 2.** Koi (*Cyprinus rubrofuscus*) infected by Saprolegnia, Note the granular



**Fig. 3.** Erosion of the caudal fin in guppy (*Poecilia reticulata*),note erosion of the caudal fin



**Fig. 4.** Erosion of the caudal fin in guppy (*Poecilia reticulata*),note erosion of the caudal fin



**Fig. 5.** Erosion of the caudal fins until tail completely rotten in Koi (*Cyprinus rubrofuscus*)



**Fig. 6.** molly (*Poecilia Mexicana*) with a large chronic skin erosion, Note that some erosion protrude above the skin surface and fin caudal.

## DISCUSSION

The main aim of this study was to investigate the prevalence and types of infection found in ornamental fish in Benghazi city. Three types of disease were found in this study which belonged to various taxa that might affect fish health in this area. However, there is a few studies about the disease of ornamental fish in Benghazi city.

Fish are exposed to many pathogens - bacterial, viral, fungal, or parasitic - which could directly or indirectly increase human susceptibility to infection (Beran et al., 2006, Lowry and Smith, 2007, Weir et al., 2012, Fulde and Valentin-Weigand, 2012, Gauthier, 2015). The results of this study show that abiotic and biotic factors are considered important factors that can have adverse effects on fish (Holmstrup et al., 2010, Laskowski et al., 2010). These include parasites (Athanasiadou et al., 2008) bacteria (Austin et al., 2007) fungi (Jobling, 2012) viruses (Woo et al., 2006) and poor transportation methods.

Generally, even though ornamental fish activity is limited in Libya, this is possibly due to it being a hobby which is not popular in the country; therefore, studies of disease in ornamental fish under these conditions are limited. Ornamental fish hold under restricted tanks including a limited quantity of water, they cannot flee from the harmful situation or the environment, Even the equipment of an aquarium has rigorous monitoring,

which cannot mimic the natural environment. thus, the maintaining of fish in glass tanks can cause severe impact. The results of this study show that the presence of some diseases is widespread in ornamental fish. The three most important diseases were recorded in this study were White Spot disease, Tail-rot disease, and Saprolegnia infections. Saprolegnia is one of the most common fungal pathogens and widespread in ornamental aquarium fish (Cardoso et al., 2019). This study also demonstrated that Saprolegnia is a common species of mycotic disease that affects freshwater and fish aquaculture (HUSSEIN et al., 2002) which can appear anywhere on the body. The results are in agreement with a study by (Bruno, 1999) which reported that the infection normally becomes visible on the body such as head, caudal, and fins (Neish and Hughes, 1980, Willoughby, 1989, Noga, 1993, Hussein et al., 2001). One possible explanation for this infection is the limited size of the tanks in which the fish are kept. These results are consistent with (Piper, 1982) that suggested that infection increases with crowding. Another factor which can lead to increased susceptibility to infection is poor water quality. In all the shops involved in this study the aquarium was supplied with tap water. There is other evidence from previous studies that Oomycete outbreaks usually increase with water poor quality (Bruno, 1999). White spot disease (*Ichthyophthiriasis*) is one of the most common and widespread diseases affecting cultured and aquarium fishes (Osman et al., 2009). White Spot disease (*Ichthyophthiriasis*), is caused by the theront stage of *Ichthyophthirius multifiliis* Fouquet, 1876 (IQBAL et al., 2013, Durborow et al., 1998) . The influence of infections on the economic sector reaches to a greater extent up to 100% (Osman et al., 2009). These ectoparasites affect the fins, gills, and skin of their host and lead to considerable economic loss (Koyuncu and Toksen, 2010)

In the wild, white spot disease is usually identified by clinical signs all over the external body surface in the form of white spots (Osman et al., 2009). *Ichthyophthiriasis* also affects freshwater and ornamental fish worldwide (Wei et al., 2013). Moreover, other cultivated freshwater fish are affected by white spot disease such as grass carp (Yulin, 1996), rainbow trout (Valtonen and Koskivaara, 1994), and channel catfish (Klesius and Rogers, 1995). In the current study, the fish were affected by a number of white spots all over the body ( see figure 1). the infections were clearly visible on the skin as white spots , the prevalence and intensity of infection of white spots disease was higher in the summer compared with spring , These results are similar to those of previous studies (Derwa, 2004, Khalifa et al., 1983, Durborow et al., 1998). The life cycle of *Ichthyophthirius multifiliis* is consisting of three stages, without the need for intermediate or final hosts (Francis-Floyd and Reed, 1991). The infective (theront) stage of *ichthyophthirius multifiliis* that affects many areas of the body, penetrates the epidermis of the fish and then settles above the basal lamina (EWING et al.,

1985, Ventura and Paperna, 1985). It then develops further to the trophont stage that penetrates fish tissue for further development into 0.5-1.0 mm, which is visible under a microscope as white spots (Buchmann et al., 2001). *Ichthyophthirius multifiliis* is widely seen in freshwater fish by fish farmers and aquarists globally. Our results showed that white spot disease had a significant effect on the growth, skin, and health status of the fish, probably due to the temperatures during the study which were between 18 - 25 °C. This is in agreement with a previous study that indicates that the development of life cycle is dependent on 18 - 25 °C (Aihua and Buchmann, 2001). In this current study, the environmental temperature was found to be an important factor in the susceptibility of the fish to the *ichthyophthirius multifiliis* infection. According to the data obtained from [www.globalclimatemonitor.org](http://www.globalclimatemonitor.org), the temperature ranged between 18- 25 during the study. One possible explanation here is that fish exposed to a variety of stress. In some cases, anthropogenic activities can enlarge levels of stress, for instance, handling, transport procedures, malnutrition, living in captivity, uncomfortable temperatures, Monitoring of water quality, nutritional status and disease (Stevens et al., 2017), these factors can increase the susceptibility of developing infections, therefore, these stressors can expose fish to infection or can inhibit immune responses, water quality appeared to be the main factor influencing fish biology. Water quality includes salinity, water temperature, dissolved oxygen and ammonia (Portz et al., 2006). These factors that should be taken into account

when improving ornamental fish welfare. Stress can impair immune in fish, This is supported by a previous study by (Cairns et al., 2005) which found that fluctuated in temperature can cause stress and have the potential to affect the immune responses. Another possible explanation is that nutrition and feeding, nutritional status is the most important factor for fish health in terms of quantity and/or quality, and when nutrition is insufficient, this can reduce growth, cause stress and susceptibility to infection (Roberts, 2011, Oliva-Teles, 2012) Generally, Within populations of ornamental species, An inadequate supply of vitamin C can cause high mortality in *Poecilia reticulata* (Lim et al., 2002).

It is known that ornamental fish activity is still as a hobby in Libya, however, in fish farming and aquaculture providing food is calculated in terms of quantity or quality; while among ornamental fish were fed randomly by fish keeper (Oliva-Teles, 2012) the manipulation of time and method of the diet regime could cause stress. Therefore it is possible that fish might be exposed to infection, These results are consistent with other studies where found that Nile tilapia *Oreochromis niloticus* had improved immune, when fed in a husbandry routine daily (Endo et al., 2002).

The Ornamental fish are also exposed to a variety of abiotic stressors in their natural environment. In this study, the infection showed that the fins were infected with erosion, which could lead to degradation or reduction in size. Many factors could increase the susceptibility to infection by erosion of fins in ornamental fish which has become a major cause for concern in recent years. In this study, the high incidence of fin erosion was increased in some ornamental fish. These results are similar to the findings of other recent studies (Latremouille, 2003). One possible explanation could be that the fish are being kept in confined conditions as well as the limited size of the tanks, as the infection of erosion fin in aquaculture production was more than natural environment (Latremouille, 2003) (Another possible explanation could be that nutritional deficiencies lead to increased susceptibility to infection (Scholz, 1999). A commercial diet was used to feed the fish in all the private shops, which is usually fed to ornamental fish in aquaria. This is similar to other studies, in which nutritional deficiencies either in terms of quantity or quality was seen to cause erosion fish (Latremouille, 2003).

## CONCLUSION

The overarching conclusion of this study that Ornamental fish in Benghazi city are exposed to a variety of abiotic and biotic factors, the result of this study revealed 3 different diseases to varied taxa. White spot disease, Saprolegniasis, and erosion of the caudal fins.

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