New Trends in Control of Parasitic Infections in Freshwater Fishes

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Abstract: The traditional methods of control and treatment of parasitic infection used to depend on chemotherapeutic antiparasitic drugs that has many disadvantages as: they are very rare and expensive and toxic with somehow may be of carcinogenic effect on the infested fish, consumer and the surrounding environment. This seems to be benefit less. Consequently, there was no escape to use recent medicines to avoid these catastrophic results on fish, human beings, environment and economy. The recent new trends to control and treat are prebiotics, probiotics, phytobiotics, immunostimulants, herbal plants, algae extracts, natural extracts (chelates), vaccines and Biosecurity for all wild and cultured fish. Good management and nutrition should be kept in mind when we manage a parasitic disorder. Probiotics, prebiotics, phytobiotics, immunostimulants and vaccines should be used as a prophylactive tools to parasitic infections. Traditional methods should not be ignored in the control of such problems. Herbal extracts such as garlic and Artemisia are considered friendly environmental antiparasitic to control of parasitic fish diseases. Chelating products such as humic and fulvic should be used in control of parasitic infections. Biosecurity should be used effectively in problems associated with parasites in aquaculture.
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Introduction

Fish production in the world in 2015 is about **16720000** ton **(FAO, 2016).** While in Egypt about **1518943** ton and a consumer uses about **20.18** kg, while the domestic production in Egypt provides only**16.85** kg/ year. So, the government imports nearly **296055** ton of frozen fish to make the balance (**GAFRD, 2015**).

Prevention of some parasites is always better than treatment (**Amal, 2017)**. Therefore, there are new approaches to solve these problems such as vaccines **(Muktar *et al*., 2016)**. In addition, the antiparasitic known such as immunostimulants (**Skov *et al.,* 2012**), probiotics (**Rajendran *et al.,* 2006**), prebiotics (**Carbone and Faggio, 2016**), phytobiotics (**Hanan and Noor El-Deen, 2017**), seaweeds (**Hutson *et al.,* 2012**), herbal medicine (**Shaheen *et al*., 2017**), Chelating materials (**Noor El-Deen *et al.*, 2010**) and biological control **(Woo, 2006)**.

Herbal plants are imperative components for customary medication, the thought that specific plants had recuperating potential was known much sooner than individual found the presence of pathogens (**Ijah and Oyebanji, 2003 and Shaheen *et al*., 2017)**. There have been expanded activities into the usage of conventional medications to control bacterial and parasitic contaminations in human and animal medicine (**Ekanem *et al*., 2004**), also the utilization of therapeutic plants for treatment of parasitic diseases in fish has been accounted in Egypt (**Mesalhy *et al.,* 2008**). Restorative plants are utilized as a part of aquaculture for treatment fish parasite and utilized as immunostimulants upgrading the immune response of fish **(Ardelli and Woo, 2006).**

Biosecurity which is the more advanced scheme which is developed recently in fish farms **(FAO, 2010 and Sommerville, 2012).**

The present state of the art aim to throw light on the new trends of diagnosis of parasitic infections of freshwater fishes like transmission and scanning electron microscope and molecular techniques for the detection and identification of parasitic fish infections. Also, the new trends for control parasitic fish infections using immunoprophylactic control like probiotics, prebiotics, phytobiotics, immunostimulants, herbal medicine, chelating materials and vaccines as well as physical, mechanical and biological control.

New trends in control of freshwater parasitic fish diseases.

1-Physical methods for treatment of fish diseases:

There are several methods for control of some parasitic fish infections such as: **Flushing, Transferring, Thermal,**

Mechanical Methods

1-1- Flushing method:

It is suitable method for ornamental fishes. The fish are held in containers with punctured base and sides for three weeks and kept up in running water.

Parasites are flushed out with water **(Noga, 2012).**

1-2-Transferring method:

It is used for some protozoal diseases in infected ornamental fishes which are transferred to parasite free aquaria every day or 12 hours. The tomonts fall down into the first container developing into theronts. The repeated transfer of fish to parasite free aquaria is continued for one week (**Noga, 2010).**

1-3-Light and thermal method:

This technique depends essentially on raising water temperature up to 30 to 32°C for *Ichthyophtheriasis* treatment **(Brazenor and Huston, 2015).** On the other hand, the sudden drop of temperatures from 18 to 8 °C lead to quicker parasites grow **(Browman *et al*., 2004** and **Brazenor and Hutson, 2015)**.

1-4-Mechanical treatment of fish parasitic infections:

These methods are used for treatment and control of crustacean parasitic diseases of fish, **for example**s:

Argulosis: They can be removed manually with a blunt forceps or soft brush, when few fish of high value (Spawners and Ornamental fishes) or embedding's sticks or wooden boards. (**Eissa, 2002)**.

Lerneosis: Female lernaea can be separated with forceps and expelling it off with a couple of scissors (**Eissa, 2002**).

1-5-Humic and fulvic acid.

These natural substances are used both antiparasitic and chelating agent. Humic acid treatment of fish was effective against parasites through the improvement of the physiological condition of the fish **(Meinelt *et al.*, 2001)**.

2-Immuno prophylactic Control:

The immunity is either innate immunity or Acquired (Adaptive) Immunity.

Innate immunity is non-specific antibodies produced soon after infection. For example, *in vitro* study on carp phagocytes suggests that this mechanism may limit the multiplication of parasite prior to production of specific antibodies **(Johnson *et al*., 2015).**

Acquired (adaptive) immunity is specific antibodies acquired after infection. For example, infected fish that survive an infection are protected and parasites are autolysed by complement-fixing antibodies in sera from immune fish **(Varela *et al*., 2010)**. Infected fish rapidly produced antibodies in the first 4 weeks of infection, peak antibody production coincided with decline in parasitaemia and most fish recovered 8–12 weeks after infection **(Aly *et al*., 2008).**

Immunoprophylactic control of fish infections includes probiotics and prebiotics medications, immunostimulation and established vaccinology, all preventive measures aimed for production compounds help the bactericidal action of phagocytes (**Yuan *et al*., 2007**).

2-1- Probiotics:

It is a live microbial food supplement which helpfully influences the host by enhancing the intestinal balance**.** An immunostimulant has been defined by **Bricknell** and **Dalmo (2005**) as: "an actually happening intensifies that improve the immune system by increasing the host's resistance against diseases" (**Kesarcodi-Watson *et al*., 2008)**. The utilization of probiotics is settled in farming domestic animal and has as of late likewise been utilized as a part of aquaculture such as *Lactobacillus acidophilus* for catfish (**Sharifuzzaman and Austin, 2009)**.

Probiotics are live microbial, dietary supplements which stay alive in gastrointestinal tract of fish to enhance the growth (**Bucio *et al*., 2004)** or combined with exogenous enzymes give result better in the growth **(Ayoola *et al*., 2013)**, hematological **(Reid and Hammond, 2005)** and immunological parameters **(Lobo *et al.*, 2014)**.

Commercial accessible probiotics, lactic acid bacteria, Bacillus sp. and yeasts are regular fixings in fish well-being nourishment (**Ma *et al*., 2009**).

Probiotic (*Bacillus subtilis*) are important for the growth parameters **(Soltan and El-Laithy, 2008)** and health condition of the freshwater fish **(Marzouk *et al*., 2008).**

Most commercial probiotic preparations have also been developed for usage in aquaculture like Biogen (B-glucans) and Ergosan (polysaccharide) from seaweed **(Bagni *et al.,* 2005, Hrnandez *et al*.,2009 and Guselle *et al*., 2010)** and Premalac **(Ghazalah *et al*., 2010) and** *Bacillus pumilus* **(Rajikkannu *et al*., 2015).**

The antimicrobial activity against fish pathogens is then tried, the pathogenicity in the host fish is checked lastly and the consequences for development and survival of fries or tested fish are inspected (**Kesarcodi-Watson *et al.,* 2008** and **Sharifuzzaman and Austin, 2009**). There are some types of probiotic microbes isolated from the host or its surroundings, more valuable than commercially accessible products (**Min-Tze, 2008 and Maurilio *et al*., 2013**).

Probiotics may also fortify characteristic protection of other cell receptors or humeral figures (**Planas *et al*., 2006** and **Rajikkannu *et al*., 2015**).

Probiotic, *L. acidophilus*, improved growth performance, hematology parameters and immunoglobulin concentration in African catfish fingerling **(Al-Dohail *et al*., 2009)** and intestinal digestive enzyme activity in fingerlings of grass carp **(Wang *et al*., 2006)** and hematological parameters of Nile tilapia **(Mohammad and Ismail,**

2012) and shrimp **(Frzanfar, 2006).**

Yeast is ordinarily utilized as a part of aquaculture, either alive to nourish live micro-organisms, or in the use of preparing, as a food fixing (**Stones and Mills, 2004**). It can stimulate the immune response in fish **(Gatesoupe, 2007)**.

The impacts of yeast *Debaryomyces hansenii* enhanced survival, and vertebral compliance of the fries, perhaps because of the watched speeding up of the development of the digestive system (**Abdel-Tawwab *et al*., 2008 and Tovar *et al*., 2010**). The impacts of yeasts, *S. cerevisiae* X2180, on European sea bass fries and larvae feed compound diets **(Tovar *et al*., 2002**). An expansion of the survival and digestive enzyme activity in *Dicentrarchus labrax* larvae should be fed on diet containing yeast *Debaryomyces hansenii* **(Tovar *et al.,* 2004)**. The utilization of commercial baker's yeast, *Saccharomyces cerevisiae* is used as a development and safety promoter for Nile tilapia **(Marcusso *et al*., 2015)**. The development of advancing impacts of baker's yeast were seen with fish and the ideal development, encourage use, and protein turn-over were gotten with 1.0–5.0 g yeast/kg diet (**Abdel-Tawab *et al*., 2008)**. β-glucans, nucleic acids and mannanoligosaccharides have the capacity to stimulate the innate immune response (**Li** and **Gatlin, 2004**)

2-2-Prebiotices:

It is "a non-digestible food ingredient that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon that can improve the host health" (**ISAPP, 2003**). It is attract containing xylose, fructose, galactose, mannose and glucose and appear to be particularly promising **(Zoleykha *et al*., 2013).**

Dietary inulin and oligosaccharides prebiotics used as feed additive for weaning *turbot, Psettamaxima* to improve immune system **(Mahious *et al*., 2006).**

2-3-Phytobiotices:

Phytobiotics feed additive such as (Veto-Acid®) are promising for protection Nile tilapia containing active natural compounds to channel catfish feed, *Ictalurus punctatus*, have been found to promote their growth performance, increase antioxidant activity, enhance muscle protein sedimentation as well as improve disease resistance of fish to invading pathogens **(Carbone and Faggio, 2016** and **Hanan Abo State and Noor El Deen, 2017**).

2-4- Immunostimulants:

It is an extensive variety of substances that improve the immune system they might be bacterial or plant substances and also some synthetic compounds (**Chettri *et al.,* 2011)**. Such probiotic alone or together with synthetic products (e.g. oligonucleotides) and beta-glucans (**Skov *et al.,* 2012**). The probiotic enhance can toll-like receptors which accordingly to start course responses which may restrain or decrease diseases infections **(Jaafar *et al*., 2011)**. For increasing the activity of inalienable parameters and enhancing disease resistance and protection should be increase vitamins, carotenoids and herbal remedies should be supplemented in fish feed (**Xueqin *et al.,* 2012**). The impacts have been useful, for instance, decreasing stress (**Verschuere *et al*., 2000, Venkat *et al*., 2004** and **Yin *et al*., 2009**).

2-5--Ascorbic acid (vitamin C) as immunostimulant:

Ascorbic acid promotes a vital part in immunity and growth of fish (**Lin and Shiau, 2005**). Fishes can't synthesize it because of the absence of L-gulonolactone oxidase that is in charge of synthesis of vitamin C (**Fracalossi *et al*., 2001**). Subsequently, an exogenous source of vitamin C required in fish diet **(Ai *et al.,* 2004).** Inadequate supply of dietary vitamin C as a rule results in various lack manifestations like spinal distortion, internal hemorrhaging, retarded growth and depressed immunity (**Chen *et al*., 2004)**. It has been imagined that to be a standout amongst the most imperative supplements identified with fish safety (**Lin and Shiau, 2005**). Vitamin C enhances immunity of Japanese eel who upgrade serum bactericidal activity when nourished an eating routine containing crystalline vitamin C. This result was reportedby **Ren *et al.,* (2005)**.

2-6- Medicinal plants used for treatment of fish parasitic infection:

2-6-1- Medicinal plants as anti-protozoal parasites of fish:

Garlic oil and crushed one are the therapeutic efficacy and preventive against *Trichodinosis* and *Gyrodactylosis* in *Oreochromis niloticus* fries **(Abd El-Galil and Aboelhadid, 2012)**. The ciliate *I. multifiliis* is a standout amongst the most pathogenic parasites of fish **(Yao *et al.*, 2010)**, who concentrated on the impacts of crude extracts, fractions, and compounds from the leaves of *Macleaya cordata* against *I. multifiliis* under in vitro conditions by bioactivity-guided isolation method (**Yao, *et al*., 2011and Picón-Camacho, *et al*., 2012**). The medicinal plants are currently used antimicrobial agents for prevent and control of fish diseases. Additionally used as a part of commercial aquaculture feed as development advancing substances, supplements and alternative to chemical drugs for production of organic fish **(Galina *et al*., 2009)**.

There is a fast growing interest in screening antiparasitic substances from plants to replace antiparasitic and disinfectant alternatives. Two such plants are garlic (*Allium sativum*) and *Artemisia vulgarism*. Garlic is one of the edible plants that had a strong interest to scientists and recognized as an important medicinal plant which has a wide spectrum of actions; not only antiprotozoal, but also has beneficial effects on the immune systems **(Harris *et al.,* 2001).** The crude and crushed garlic could treat *Trichodinaiasis* in eels **(Madsen *et al.*, 2000).** Ethanolic extract from leaves of *Macleaya cordata* against trophont stages of *I.multifiliis* in grass carp (*Ctenopharyngodon idella*) **(Yao, *et al*., 2010).**

The crude extract from two tropical medicinal plants, *Mucuna pruriens* (Fabaceae) and *Carica papaya* (Caricaceae), were used for treatment of the ciliate *I. multifiliis* which is the most pathogenic parasites of fish kept locked in imprisonment (**Buchmann *et al*., 2003).** In addition, **Ekanem *et al*. (2004)** defined that medicinal plants as vital components of traditional medicine in essentially all cultures are guarantee a less expensive hotspot for therapeutics, more precision than chemotherapeutic agents and a suitable answer for all problems. The control of *Trichodinaiasis* in fish ponds of supplied tilapia with *Allium sativum* and *Artemisa vulgarisum* to treat fishwas recorded by **Noor El Deen and Razin (2009).**

2-6-2- Medicinal plants as Anthelminthic (monogeneans).

The methanol extract of *Semen pharbitidis* against *Dactylogyrus intermedius* in goldfish (*Carassius auratus*) is more potential source of new anti-parasitic drug for the control of Dactylogyrus **(Harris *et al*., 2008 and Hao *et al*., 2012).** Plant isolates like methanolic extract of bupleurum root (*Radix bupleuri chinensis)* have affected against monogenean, *Dactylogyrus intermedius* when added to water of infected goldfish *Carassius auratus* **(Wu *et al*., 2011 and Ji *et al.,* 2012).** Petroleum ether and methanol extracts of *Dryopteris crassirhizoma, Kochia scoparia,* and *Polygala tenuifolia* were screened for *Dactylogyrus intermedius* using in vivo anthelmintic efficacy assay in goldfish **(Lu, *et al*., 2012).** Dietary crude extracts of *Radix angelicae pubescentis*, *Fructus bruceae, Caulis spatholobi, Semen aesculi,* and *Semen pharbitidis* against *Dactylogyrus intermedius* (Monogenea) in goldfish (*Carassius auratus*) was recorded by **Liu *et al*. (2010).**

2-6-3- Medicinal plants as Anti isopodasis (crustaceans).

The misuse of chemical drugs as treatments of Isopoda infecting fish causes a potential hazard, which affects both human and fish health. The efficacy of Neem, chamomilla and artemisia were estimated in vitro against fish isopods. Artemisia and chamomilla were effective at concentration of 3%, where they inhibited the activity of all the tested isopods within 15, and 5 min respectively. Concentration of 1% inhibits the isopods activity in much longer time (60 and 30 min. respectively), on the other hand, Neem had no effect on isopods **(Shaheen *et al*., 2017).**

2-6-4- Medicinal plants as immunostimulants for fish.

An immunostimulant is a substance that improves the defense systems or immune response (both specific and nonspecific), along these lines rendering fish more resistant to disease and external aggressions (**Chakraborty** and **Hancz, 2011**).

An increasing interest for the utilization of plant extracts as fish immunostimulants has emerged in the most recent decade (**Vaseeharan** and **Thaya, 2013**). A few studies have observed that the immunological parameters after intraperitoneal injection or orally administrated and it is found that treated fish indicated increased lysozyme movement, phagocytic activity, complement activity, increased respiratory burst activity and expanded plasma protein (**Galina *et al*., 2009** and **Wu *et al*., 2011**). Lysozymes assume an essential part in the protection of fish by instigating antimicrobial action within the sight of infections (**Harikrishnan *et al*., 2012**). Phagocytosis is one of the advanced defense line to pathogens, while respiratory burst is additionally a significant effect or instrument for constraining the development of fish pathogens. The increase in plasma protein, albumin and globulin, is indicator to a strong innate response in fishes. Different studies analyzed the hematological parameters which give the fish health status and they found that erythrocytes, lymphocytes, monocytes, hemoglobin and hemocrit levels fundamentally increased in fish treated with plant extracts compared to control (**Divyagnaneswari *et al*., 2007**). Some immunostimulants couldn't be utilized on account of different drawbacks, for example, high cost, constrained viability upon parentally administration (**Dügenci *et al*., 2003**).

All plant extracts added to fish diet increased the aggregate protein level in plasma with the exception of ginger (**Dügenci *et al*., 2003**). Volatile oils, tannins, phenolic compounds, saponins, alkaloids, polysaccharides, and polypeptides appeared to be powerful alternative for antibiotics (**Yuan *et al*., 2007**). The screening of plant extracts and natural products for antimicrobial activity has demonstrated that higher plants represent a potential well spring of new hostile to infective agents (**Chakraborty** and **Hancz, 2011**). The herbal diet eating methodologies enhanced immune parameters, for example, phagocytic activity and albumin–globulin proportion (**Wang, *et al*., 2010**).

2-7-Chelating materials (humic and fulvic extracts).

Humic and fulvic extract are used both as antiprotozoal in Nile tilapia by **Noor El Deen, *et al*., (2010)** and antiparasitic, against*Angulla crassus* (swim bladder disease) infected *A. anguilla* by **Dosoky (2001)**.

2-8-Vaccination against parasites of fish.

There is a big variation of parasites in both wild and cultured fish stocks. Parasitic diseases make several problems in fish cultivating, for example, amoebic gill infection, white spot disease, (**Woo *et al.*, 2002**). Cultivation of parasites for potential killed or live vaccine is much more costly (**Sommerset *et al.*, 2005**). Along these lines, known proof and production of defensive antigens is presumably the most reachable procedure towards commercial parasite vaccines, at least for low cost vaccines **(Plant** and **La Patra, 2011**). Because of the restricted size of different protozoan parasites the cell and humoral immunological arm in fish should have the necessary capacity to create defensive safety against some of these pathogens **(Muktar *et al.*, 2016)**.

The creation of commercial anti-parasite vaccine is essentially postponed because of presentation of complex structure and life cycle of parasites and the challenges in cultivating parasite need suitable amount for vaccine production. Distinguishing proof of the parasite antigen that will induce defensive safety is also required (**Xu, 2010**). This is necessary while considering recombinant protein creation, which is an appealing methodology in anti-parasite vaccine production (**Chettri *et al.*, 2009)**. The development of acquired immunity to different parasites for fish, is now known to exist. Therefore, vaccination should be developed urgently to protect fish against parasitic diseases (**Gillund *et al.*, 2008** and **Pakingking *et al.*, 2009**).

Experimental vaccines against *I. multifiliis* have been observed to be partially viable which is promising for further accomplishments (**Alishahi** and **Buchmann, 2006)**. Cysteine proteases was used as potential antigens in antiparasitic DNA vaccines **(Jørgensen** and **Buchmann, 2011).** Some fish species will deliver protective antibody response to vaccination (**Pakingking *et al*., 2009**).

2-8-1-Vaccination against Ichthyophthiriasis.

Channel catfish was vaccinated with live theronts or sonicated trophonts for acquired protection against Ich (**Xu, 2010**). The immunized fish indicated larger amounts of anti-Ich antibodies in the skin and serum than non-vaccinated fish (**Osman *et al.*, 2009)**. Parasite infection and mortality did not happen in fish vaccinated with live theronts. Fish vaccinated with sonicated trophonts had a low infection and mortality compared with non-vaccinated fish **(Xu *et al.*, 2004)**. Delivered commercial Ich vaccine was produced and exhibited that the immunization against Ich incited defensive safety and could give one of a kind answer for keep this parasitic disease **(Xu, 2010).** In Egypt, *I. multifiliis* vaccine trial for preparation was in experimental stages (**Noor El Deen *et al*., 2016**).

2-9-2-Vaccination against micospordial gill disease in trout.

The powerful vaccine spore dose of a low-virulence strain of *loma salmonae* has a good protection against experimental infection that reaches to 85% decrease of gill infections by **Speare *et al.*, (2007).**

2-8-3-Vaccination against *Cryptobia salmositica*

Fish given a high dose (100,000 parasites/fish^{-1}) had higher parasitaemias than fish given the lower dosage. Vaccinated fish had low parasitaemias and a gentle pallor and recouped rapidly after test. The live *C. salmositica* vaccine incited a trade mark parasitemia profile and humeral reaction in Atlantic salmon **(Ardelli** and **Woo, 2006)**. A single dosage of the attenuated vaccine secures 100% of salmonids (juvenils and grown-ups) for no less than 24 months **(Woo, 2012)**.

3-Biological control of fish parasites (life against life):

Biological control means "Any activity of one animal category that decreases the unfavorable impact of another". It is the best security method for control of fish parasites that used as a part of control of crustacean parasites of fish which considered as an essential restricting element in the improvement of fish culture. Under overloading conditions, parasite populaces quickly develop and may bring about high mortality in the stocked fish particularly in high water temperature where their life cycles turn out to be faster (**Woo, 2006**).

The control of Argulus is by the introduction of mosquito fish (*Gambosia*) into mud ponds that is infested with *Argulus*. *Gambosia* has a unique depressant impact on the parasitic populace as they feed upon larvae, particularly in ornamental fish ponds. The presence of freshwater shrimp (Macrobrachium species) feeds on larvae and moving as a control predator for external parasites infected fish **(Eissa, 2002)**. Moreover, all large monogeneans were cleaned by cleaner fish (**Grutter and Bashary, 2003**). Another capsalid monogenean, *Benedenia lolo*, parasitising *Hemigymnus melapterus* was subjected to predation by the cleaner fish *Labroides dimidiatus*. Along these lines future control measures may include the utilization of cleaner fish **(Grutter *et al.*, 2002**). There have been a few attempts' to remove parasites by utilizing topical cleaner fish. Neon goby and Cleaning goby could remove ectoparasitic monogeneans, for example, Lernaea from infected Arowana fish (*Scleropages sp*.), the most important aquarium fish utilizing by *Tilapia nilotica* fry as cleaner fish. The outcomes demonstrated that *Tilapia nilotica* were successful cleaner fish for Lernaea infestation which is called "topical cleaners fish" **(Cowell *et al.*, 1993 and Eissa, 2002)**.

Cleaning symbioses are inter specific relationship in which one or more member "cleaner" organism remove ectoparasites as well as tissue from the collection of another "host" organism that frequently requests the communication by receiving stereotypic stances within the sight of the cleaner. Albeit reported for some physical life forms**,** such cooperation are best archived among marine reef living beings, especially fish clients customers being cleaned by littler fishes, most prominently indo-Pacific cleaner wrasses and Caribbean cleaning gobies **(Dickman, 1992).** Cleaner fish remove ectoparasites **(Arnal and Coˆte', 2000),** and additionally harmed tissue. However, they also expel host mucous **(Grutter and Bshary, 2003).** Along these lines, whether this action really controls ectoparasitic loads and results in a net advantage to have been the source of some content **(Morand, 2005).** Shrimps and other decapods crustaceans are also called cleaners of reef-related fishes **(Rohde, 2002 and Chapuis and Bshary, 2009**). Just several studies have provided direct proof that any apparent cleaner shrimp species successfully expels parasites from fishes (**O¨stlund-Nilsson *et al.,* 2005**). Polyculture of *Macrobrachium* with fin fish (Tilapia and Ornamental) indicates that these prawns may be a particularly useful control agent snail and ectoparasitic copepods in aquaculture environments **(Roberts and Kuris, 1990).**

For example, Blue streak cleaner wrasse eat parasites that have attached themselves to the client fish that are accounted as a cleaner (**Noga, 2010).**

Black carp (*Mylopharyngodon piseus*) imported to Egypt, which is molluscivorus fish of the cyprinidae family that normally happens in Chinese water (**Soliman, 1997**). It has more profitable part against colonization of snails in repositories and aquaculture (**Slootweg *et al.,* 1994**).

4-Biosecurity in aquaculture:

Biosecurity means 'the measures and methods adopted to secure a disease free environment in all phases of aquaculture practices (i.e. hatcheries, nurseries, grow out farms) for improved profitability'. Biosecurity protocols are intended to maintain the "security" of a facility (for example, prevent entry of, or reduce overall numbers before entry) with respect to certain disease causing organisms (parasites, bacteria, viruses and fungi) that may not be present in a particular system **(FAO, 2005).** Important components of biosecurity are: **Quarantine, Sanitation and Disinfection.**

Conclusion and Recommendations

- Vaccines and Biosecurity are considered the excellent new trends in the control of parasitic infections and effectively in solving problems associated with parasites in aquaculture specially in hatcheries and imported fishes.
- Probiotics, prebiotics, photobiotic, immunostimulants and vaccines should be used as prophylactic tools to prevent and control parasitic infections.
- Herbal extracts and Vitamin C are considered friendly environmental antiparasitic to control of parasitic fish diseases.
- Immunostimulants such as Seaweed, microalgae and Chelating materials should be used in the control of parasitic infections.
- Recommended Sanitation and Disinfection Protocols to prevent or reduce the pathogen load in a system (buildings, hatcheries, farms and others).
- We must apply the quarantine measured on both national and imported fishes for one month at least before it can be released in the fish farm. This will make us avoid parasitic fish infections between lakes and farms.

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