Gill ectoparasites of goldfish (*Carassius auratus*, pearl scale variety) imported into Iran

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Abstract
Over a ten-month period, the gills of one-hundred imported pearlscale goldfish (*Carassius auratus*) were examined for ectoparasites, before released from quarantine in Iran. Of the nine species of ectoparasites isolated in this study, six were monogeneans (*Dactylogyrus vastator*, *D. baueri*, *D. formosus*, *Dactylogyrus* sp., *Gyrodactylus chinensis* and *Gyrodactylus* sp.) and three were protistans (*Ichthyophthirius multifiliis*, *Trichodina* sp. and *Cryptobia* sp.). The isolated parasites were fixed and stained by appropriate methods. The fish were imported from south-Asia. The highest and the lowest levels of parasitism were from *D. baueri* and *I. multifiliis* respectively. Though shipments came from up to three exporting regions, all shipments were found to have high prevalence and intensity of parasites. It is suggested that exact quarantine is not performed before retail selling for imported fish. We recommend that before transporting internationally, fish should be examined for high risk parasites and other pathogens to prevent the spread of disease and parasites.

Introduction
Ornamental fishkeeping is a progressively popular hobby in Iran. Goldfish (*Carassius auratus*) belongs to Cyprinidae family, the largest single grouping of freshwater fish, undoubted the most widely kept of all fish, and exist in a far wider range of colours than their name implies. Goldfish are suitable both for aquaria and ponds (Alderton 2005). These characteristics as well as, being a part of Iranian traditional table in new Persian year (being kept alive in a glass bowl). This species has several varieties; common goldfish, comet, lionhead, pearlscale and more. Pearlscale goldfish are an ancient Chinese type with rotund body and double caudal fins. This variety is not a strong swimmer and usually kept in aquaria rather than ponds. Because of goldfish varieties beauty and their global popularity, most of exported fish are sterile.

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only to minimize economic loss, but also, for health of other fishes in the same aquaria (in particular concerning parasites with direct lifecycles e.g., monogenean and ciliates).

**Materials and methods**
One-hundred live imported pearlscale (a variety of goldfish) from south-Asia, during a ten-month period, were collected from a quarantine facility (with their original water) and examined in the laboratory. These fish were derived from approximately twenty shipments. In the lab wet mounts from both left and right gill arches were examined from each fish. Then for more precise observing, stereo microscope (SA Iran, N-180) and light microscopy (LABOVAL 4) were used for gill arches. In any affected fish, photo and films was taken (Sony, SSC-DC80P- microscope digital camera). Monogenean parasites were fixed in ethanol 70%, and preserved on slides using Malmberg’s (ammonium picrate glycerine) and protozoans were airdried onto slides and stained with Giemsa solution. Identification of monogenean species was confirmed using morphological (hook, marginal hook, their bars and copulatory organs shape and number) and morphometric (hook, marginal hook and bars parameters) characteristics.

**Results**
The parasites identified from gill of one-hundred samples were found comprising: six species belonging to two genera of monogenean trematodes, *Dactylogyrus vastator* (Figure 1), *D. baueri* (Figure 2), *D. formosus* (Figure 3), *D. sp.*, *Gyrodactylus chinensis* (Figure 4) and *G. sp.*, three protistan species: *Ichthyophthirius multifiliis* (Figure 5), *Trichodina sp.* (Figure 6) and *Cryptobia sp.* (Figure 7). *D. vastator* was the highest-rate parasite in one parasitized fish and this parasite with 82% and *Gyrodactylus sp.* with 19%, respectively, indicate high and low prevalences among the monogeneans. *Trichodina sp.* with 23% and *Cryptobia sp.* with 8% also show this prevalence among the protozoans (Table 1).

**Discussion**
This study is the first report of imported pearlscale goldfish into Iran. There have been however, previous reports and articles about parasites of imported ornamental fish to different countries. Ebrahimzadeh Mousavi (2003) reported on ten common ornamental fish species in Iran noting the presence of *Gyrodactylus* sp., *G. kabayashi*, *Dactylogyrus extensus*, *D. baueri*, *Trichodina* sp., *I. multifiliis*, *Chilodonella* sp., *Ichthyobodo* sp., *Lernea cyprinacea* and *Argulus foliaceus* in goldfish. In a similar study in Sri Lanka (on thirteen species of ornamental fish) *D. extensus*, *D. vastator*, *D. spp.*, *Ergasilus ceylonensis* and *Centrocestus* spp. were found in gills of goldfish (Thilakaratne et al., 2003).

In contrast, only *Gussevia asota* (monogenean) were found from gills of fifteen imported species of ornamental fish belong to characidae, cichlidae, cyprinidae (excluding goldfish), heleosomatidae, poecilidae from Korea (Kim et al., 2002).

Evans and Lester (2001) reoported on the parasites of five commonly imported freshwater ornamental fish in Australia, but not in goldfish. Furthermore, nine parasites (*Tetrahymena corlissi*, *Chilodonella piscicola*, *Hexamita sp.*, *Cryptobia sp.*, *Chloromyxum sp.*, *Camallanus cotti*, *Centrocestus formosanus*, *Evans and Lester (2001) reoported on the parasites of five commonly imported freshwater ornamental fish in Australia, but not in goldfish. Furthermore, nine parasites (*Tetrahymena corlissi*, *Chilodonella piscicola*, *Hexamita sp.*, *Cryptobia sp.*, *Chloromyxum sp.*, *Camallanus cotti*, *Centrocestus formosanus*, *Rhabdocoela*. *Dactylogyrus* spp. and *Gyrodactylus* sp. were the most common (Guan and Cheung, 2002).
Table 1. Prevalence percentage of parasites isolated from the gills of pearlscale goldfish.

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Prevalence (%)</th>
<th>Parasite taxonomy</th>
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<tbody>
<tr>
<td><strong>Metazoans</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dactylogyrus vastator</em></td>
<td>82</td>
<td>Monogenea</td>
</tr>
<tr>
<td><em>D. baueri</em></td>
<td>50</td>
<td>Monogenea</td>
</tr>
<tr>
<td><em>D. formosus</em></td>
<td>28</td>
<td>Monogenea</td>
</tr>
<tr>
<td><em>Dactylogyrus</em> sp.</td>
<td>26</td>
<td>Monogenea</td>
</tr>
<tr>
<td><em>Gyrodactylus chinensis</em></td>
<td>30</td>
<td>Monogenea</td>
</tr>
<tr>
<td><em>Gyrodactylus</em> sp.</td>
<td>19</td>
<td>Monogenea</td>
</tr>
<tr>
<td><strong>Protozoans</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Trichodina</em> sp.</td>
<td>23</td>
<td>Ciliata</td>
</tr>
<tr>
<td><em>Ichthyobodo</em> sp.</td>
<td>8</td>
<td>Flagellata</td>
</tr>
<tr>
<td><em>Ichthyophthirius multifiliis</em></td>
<td>10</td>
<td>Ciliata</td>
</tr>
</tbody>
</table>

**Figure 1.** *Dactylogyrus baueri.*  
**Figure 2.** *Dactylogyrus vastator.*
Figure 3. *Dactylogyrus formosus.*

Figure 4. *Gyrodactylus chinensis.*

Figure 5. *Ichthyophthirius multifiliis.*

Figure 6. *Trichodina sp.*
Bothriocephalus acheilognathi, Uroleidoides reticulatus and larval nematodes) were identified on nine ornamental fish species examined in Brazil (Piazza et al., 2006) and infection prevalence of parasites in goldfish was around 2% with *Trichodina acuta, Piscinoodinium pillulare* and unidentified monogeneans being identified in this fish. Mouton et al. (2001) in a pilot study in South Africa examined four groups of fishes in which *T. mutabilis, I. multifiliis, Dactylogyrus* sp. and *Gyrodactylus* sp. were identified. Exporting conditions for the ornamental industry allow non-intermediate hosts to be moved between countries, potentially leading to increases in parasite infections. The current study shows us that exotic parasites are being probably introduced to Iran and other healthy goldfish or ornamental fish due to poorly prepared importation. However, limited data exists on the parasite fauna of native stocks of fish in Iran. Besides the monogenean parasites, protists have short direct life-cycle that no need to intermediate host, which allows them to quickly multiply to risky levels in aquarium fish. As we know, heavy monogenean infestations are usually indicators of poor sanitation and deteriorating water quality (Noga, 1996; Andrews et al. 2003). There is therefore a need to ensure adequate sanitation of fish prior to import into Iran.

**References**


Kim JH, Hayward CJ, Joh SJ and Heo GJ


