NOTE

New cultured host and a significant expansion in the known geographical range of the sea louse *Caligus rogercresseyi*

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Abstract
Parasitic copepods are common on cultured and wild marine finfish (Johnson et al., 2004; Costello, 2009). Although several species have been recognised to have the potential to affect growth, fecundity, and survival of their hosts, it has only been with the development of semi-intensive and intensive aquaculture that their importance as disease-causing agents has become evident (Johnson et al., 2004). Members of the family Caligidae, referred to as sea lice, are the most commonly reported species on fish reared in brackish and marine waters. Sea lice have a significant economic impact due to reduced growth performance resulting from the presence of the sea lice and/or the residues of chemical treatments, as well as from the costs of the treatments themselves (Sinnott, 1999; Rae, 2002; Johnson et al., 2004). Indirect and direct losses due to sea lice in salmonid aquaculture globally are estimated to be around €300 million annually (Costello, 2009). However, until now the economic impact in other marine non-salmonid culture has not been reported.

Marine salmonid aquaculture began in Chile in the 1980s with the introduction of commercial-scale coho salmon (*Oncorhynchus kisutch*) production. This was quickly followed with the development of marine rearing of rainbow trout and Atlantic salmon. As in the northern hemisphere, sea lice were quickly recognised as economically important disease-causing agents (Reyes and Bravo, 1983a, b). However, the presence of copepods of the family Caligidae as parasites of marine fish has been documented since 1840, when *C. ornatus* was first described by Milne-Edwards (Stuardo and Fagetti, 1961). At present, eight species of *Caligus* and ten species of *Lepeophtheirus* have been reported to parasitise wild marine fish in Chile. Many of these species have cosmopolitan distributions (Fagetti and Stuardo, 1961; Stuardo and Fagetti, 1961), but only two, *C. teres* and *C. rogercresseyi* (originally misidentified as *C. flexispina*), have been reported as parasites of salmonids (Reyes and Bravo, 1983a; Boxshall and Bravo, 2000). *C. rogercresseyi* has a severe economic impact on the salmon industry in Chile. The most susceptible hosts are Atlantic salmon (*Salmo salar*) and rainbow trout (*O. mykiss*) (Bravo, 2003). In

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contrast, copepodite and juvenile stages can be observed on coho salmon, but they are unable to complete development through to the adult stage on this salmonid host (Gonzalez et al., 2000; Bravo, 2003; Pino-Marambio et al., 2007; Treasurer and Bravo, in press).

*C. rogercresseyi* was recorded for the first time in Chile on Atlantic salmon reared in the Puerto Montt area (42ºS) (Figure 1). Today *C. rogercresseyi* is widely distributed in Region X, and has also spread south to Region XI (45ºS) (Figure 1). In 1998 *C. rogercresseyi* was also reported on anadromous brown trout (*Salmo trutta*) in the south of Argentina (51ºS) (Figure 1) (Bravo et al., 2006). The discovery of *C. rogercresseyi* in the south of Argentina, one year after the record of this louse in Chile, was attributed to the migratory behavior of the native species rock cod *Eleginops maclovinus*.

*E. maclovinus* was recorded as the natural host of *C. teres* (Reyes and Bravo, 1983b), and also as one of the natural hosts for *C. rogercresseyi* in Chile (Carvajal et al., 1998; González et al., 2000; Boxshall and Bravo, 2000). It is one of the most eurythermic, euryhaline and stenobathic representatives of the sub-order Notothenioidei (Pequeño, 1989). It is endemic to southern Chile, southern Argentina and the Falkland (Malvinas) Islands. The distribution in the Pacific is reported to be from Valparaíso (33ºS) to the Strait of Magellan (Tierra del Fuego, Chile, 54ºS), while in the Atlantic the distribution is from Buenos Aires (39ºC) to the Beagle Channel (Tierra del Fuego, Argentina, 54ºS) (Pequeño, 1989; Fernandez et al., 2002). However, it is still unclear whether *C. rogercresseyi* originated in the South Atlantic and spread westwards, or whether it was originally a Pacific species that spread eastwards.

An outbreak of unidentified sea lice was recorded in 2001 in tilapia (*Oreochromis mossambicus*) being cultured in seawater (34ppt) in northern Peru. The affected tilapias showed mechanical damage, petechiae and abrasion on the body surface. As an emergency measure, the tilapias were treated with freshwater baths, a procedure which served to successfully control the problem in practice and *in situ* (Conroy, 2001, 2004). In order to identify the louse species affecting tilapias in northern Peru, samples of Peruvian lice stored in 70% ethanol, were examined microscopically in the laboratory at the Aquaculture Institute of Universidad Austral of Chile, and compared with Chilean samples of *C. rogercresseyi*. The Peruvian lice did not show differences in size and shape from *C. rogercresseyi*. To confirm the identity, specimens of both sexes were compared with the paratypes of *Caligus rogercresseyi* stored in the Natural History Museum, London (BMNH 199.737-742). The samples were cleaned and mounted in lactophenol for examination using a Leitz Diaplan differential interference contrast microscope. Adults of both sexes showed similar characteristics to those of *C. rogercresseyi* paratypes. The female differed slightly from the Chilean material in that the abdomen was slightly larger relative to the size of the genital complex. However, the shape of the female genital complex can vary depending on ovigerous state. The only other observed difference was in the degree of curvature of the post-antenary process. In the Chilean material the process was more strongly curved than in the Peruvian lice. These morphological differences were too minor to indicate that these populations are distinct at the species level. Further evidence, in particular molecular data, would be necessary to challenge the conspecificity of
Figure 1. Asterisks indicate the regions where *C. rogercresseyi* has been recorded in South America. The dotted lines show the spreading recorded for *C. rogercresseyi* in South America. Region X, XI and XII, are the regions where salmonids are reared in Chile.
the Chilean and Peruvian populations.

Tilapia species have been shown to be a susceptible host for a wide range of *Caligus* species in Asia. *Caligus acanthopagri*, *C. epidemicus*, *C. orientalis* and *C. punctatus* have been reported from Mozambique tilapias (*Oreochromis mossambicus*) farmed in Taiwan, and *C. epidemicus* and *C. punctatus* have also been reported from blue tilapias (*O. aureus*) cultured in the Philippines and in Taiwan (Johnson et al., 2004; Lin and Ho, 1993). Nagasawa (2003) has reported the presence of *C. orientalis* as a parasite of farmed Mozambique tilapias in China and Taiwan, and considers this caligid species to be a potentially dangerous pathogen in coastal and brackish water aquaculture operations in China, Japan and Taiwan.

Many species of *Caligus* show a low degree of host specificity and are found on a variety of fishes (Johnson et al., 2004; Todd et al., 2006; Costello, 2009). In accord with this pattern, a wide range of wild fish, including *E. maclovinus*, *Odonthestes regia* and *Paralichthys microps*, have been identified as natural hosts of *C. rogercresseyi* (Carvajal et al., 1998; Bravo, 2003; Bravo et al., 2006). These species are frequently found in the vicinity of salmon farming cages, often attracted by surplus feed. The detection of *E. maclovinus* as a host for *C. rogercresseyi* in Río Gallegos, Argentina, stimulated speculation that this fish species could be a vector for the rapid dispersal of the parasite in the southern hemisphere. It has been suggested that *C. rogercresseyi* could have originated in the Atlantic Ocean and spread to Chile with its natural host *E. maclovinus*, through the Strait of Magellan, reaching Region X (Figure 1) where salmonids are intensively reared (Bravo et al., 2006). However, the distribution of *C. rogercresseyi* in South America seems to be wider than was previously thought and, in order to explain the presence of *C. rogercresseyi* in northern Peru, the natural hosts in that region must be identified. In addition, further research is required to confirm whether these three *Caligus* strains are truly conspecific. In the case of *L. salmonis*, there is evidence, from DNA sequence analysis, which suggests that the Atlantic and Pacific lineages are genetically different (Yazawa et al., 2008).

**References**


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