HUMAN HEALTH RISK IMPLICAT ION OF OCULAR MYXOBOLIOSIS IN FISH

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Hany M Elsheikha discusses the findings of an Egyptian tilapia study that may have consequences for UK fish

DURING a parasitological survey on freshwater fish collected from Egypt' s River Nile, a tilapia fish with bilateral ocular opacity was captured. Necropsy revealed no remarkable gross changes, except the presence of whitish and yellowish round cysts in both eyes (Figure 1).

Cysts were situated in the episclera, causing slight exophthalmia. Sizes ranged from between 1mm to 2mm in diameter. The detected cysts contained a great number of mature spores that had a relatively constant morphology (Figure 2). Spores were elongated ovoid to trapezoid in shape, wider at the anterior than the posterior end in the frontal view and lemon-shaped in the lateral view. The spores measured 10.4µm to 11.6µm (mean 10.8µm) long and 6.4µm to 7.7µm (mean 7.2µm) wide. Two polar capsules were pyriform in shape and of equal sizes, measuring 3.9µm to 4.4µm (mean 4.1µm) long and 2.6µm to 3.3µm (mean 2.9µm) wide. They constituted less than half of the total spore length. The capsules did not join at their anterior end, where the sutural plane was of uniform thickness. A round iodinophilus vacuole was found in the sporoplasm.

In general, *Myxobolus* species spores are composed of two shell valves that join at a sutural plane – a sporoplasm that is infective to the host and two polar filaments coiled within two polar capsules (Figure 3). When appropriate hosts ingest the spores, the polar filaments within the polar capsule are expelled and used for anchoring.

The morphological features and spore dimensions of the presented material were in agreement with those reported for *Myxobolus dermatobia Ishii 1915* (Myxozoa: Myxobolidae) by Copland (1982) and Abu El-Wafa (1988). *M dermatobia Ishii* was first described from the Japanese eel' s (*Anguilla japonica*) skin by Ishii in 1915 and Hoshina in 1952. It was also reported in the stomach, intestine and gills of wild *Anguilla anguilla* in England (Copland, 1982). In Egypt, Abu El-Wafa (1988) identified *M dermatobia* in smears from the skin, kidneys, liver and intestines of tilapia. These findings support the suggestion of Copland (1982) regarding the haematogenous spread of spores and the *M dermatobia' s* wider tissue distribution.

Parasites of the phylum Myxozoa have been described in lower vertebrate hosts, mainly in teleostean fish and in some amphibians. Myxosporidian parasites are the most common Myxozoan fish parasites, having a wide geographical distribution and comprising a great number of species, infecting both marine and freshwater fish (Eiras et al, 2005). The genus *Myxobolus* is the richest group among Myxosporidia, containing about 744 nominal species (Eiras et al, 2005).

In general, fish constitute a favourite biotope for the development of a large number of Protozoa, especially Myxosporidia. The occurrence of myxosporean parasites has been investigated widely in fish farms, because of their potential harmful impacts on their fish hosts. Indeed, Myxosporean epizootics have been implicated as direct causes of fish mortalities (Schafer, 1968). There are huge numbers of *Myxobolus* parasites recognised as causative agents of severe diseases, such as whirling disease, which is pathogenic to fresh and marine water, and affects almost all fish species. The deleterious impact of several myxosporean parasites have also been described, including myoliquefaction of muscle tissues after the death of the host, reduction of the respiratory function and host fecundity, and parasitic castration (reviewed in Gbankoto et al, 2001). In this report, the fish appeared to be healthy and did not demonstrate significant disease symptoms or tissue abnormalities, except the slight exophthalmia associated with the presence of protozoal cysts in both eyes.

Most *Myxobolus* species are host specific and even have a specific location within the fish host (Eszterbauer, 2004). All previous studies on *M dermatobia* reported the parasite in both the internal and external tissues of the host fish. However, in this report, the *M dermatobia* spores were found in an unusual organ locality. At this stage, until this infection documents more fish specimens from different localities or fish host species, I refrain from reporting this as a new species and prefer to consider this as an incidental finding.

The life cycle of *M dermatobia,* although unknown, appears to be indirect and involve more than one host. Transmission of this parasite seems to take place mostly through the water supply, as in other *Myxobolus* species (Markiw and Wolf, 2007). The parasite was not detected in any fish collected from other areas during the survey, indicating that the prevalence was very rare. However, the aquatic oligochaete *Tubifex tubifex* (a sludge worm) and the obligate invertebrate host for *Myxobolus cerebralis,* the causative agent of salmonid whirling disease, were found in the same location that the presented fish were captured. Does this mean that we can attribute this *M* *dermatobia* infection to the presence of the tubificids worms in the same locality? Are *Tubifex tubifex* worms involved in the life cycle? If this is correct, how?

Can infection be spread from an infected fish to neighbour fishes via fish cannibalism? In this case, the infected fish should have a higher probability of being eaten by other predators than uninfected fish, which will help to sustain the life cycle of this parasite in nature and spread the infection. A large number of water birds were also observed in the same location, but whether they have a role in the life cycle is still unknown. Further study on the epidemiology, sporogenesis and life cycle is needed to provide detailed information for this *Myxobolus* species.

Does *M dermatobia* infect humans? The zoonotic potential of *M dermatobia* cannot be ignored. The ability of some Myxosporea species to cross the transmission barrier between fish and humans (McClelland et al, 1997; Boreham et al, 1998; Moncada et al, 2001) does not preclude the possibility that the *M dermatobia* parasite may also be transmitted to humans. What factors initiated and/or mediated mutation of *Myxobolus* species (with the subsequent enhanced capacity to target mammalian species) remain idiopathic to researchers. This fact highlights the necessity of applying appropriate control measures to protect human health, especially those people with a compromised immune system due to the risk of consuming fish infected with *M dermatobia*.

The Nile tilapia (*Oreochromis nilotica)* has been an important commercial fish species in Africa for a long time. The economic importance of this fish has increased in the past few years as a result of its extensive use in aquaculture. However, parasitic diseases are a significant constraint for the development of the tilapia culture industry, among which are myxosporidi osis and especially myxobolosis, which has become one of the most notably growing parasitic infections. The problem might even get worse in ornamental fish, due to the artificially limited volume of water and the high concentration of fish in most aquarium tanks, whereby diseases can affect most or all fish in a tank.

Studies on the epidemiology of fish myxosporidiosis infections have increased our understanding of these parasites and can subsequently give a great push to the fish industry. Therefore, epidemiological data is very important for ascertaining the significance of this new parasite for aquaculture. In the meantime, early detection of the infection is advisable to avoid its dispersal in the facilities and its transfer to other systems through normal aquaculture trading. During the past few years, parasitologists have witnessed organisms, like the microsporidia, transform from unusual parasitic infections to commonly known infections in immunocompromised patients. Hence, although *M dermatobia* is detected in one case, this pathogen may continue to emerge and more cases will be encountered in the future.

No known treatment exists to counteract the effects of *M dermatobia* in infected fish. Even if the fish recover, they will retain the physical damage associated with the infection. To decrease or prevent economic losses caused by myxosporidiosis, various management techniques need to be developed for use in fish hatcheries.

The presented report aimed to provide more insights on the fish parasite *M dermatobia.* I hope it will also raise the awareness among zoologists and veterinarians, at all levels, to take counter measures against *M dermatobia* in our native fish and other vulnerable species. Collaboration between parasitologists, ecologists, disease modellers and wildlife biologists will be instrumental in tracing the factors involved in this parasite's emergence.

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Figure 1. Lateral view of a Nile tilapia fish' s head (**Oreochromis nilotica*****), showing yellowish and whitish cysts of*** **Myxobolus dermatobia Ishii 1915** ***in the eye.***

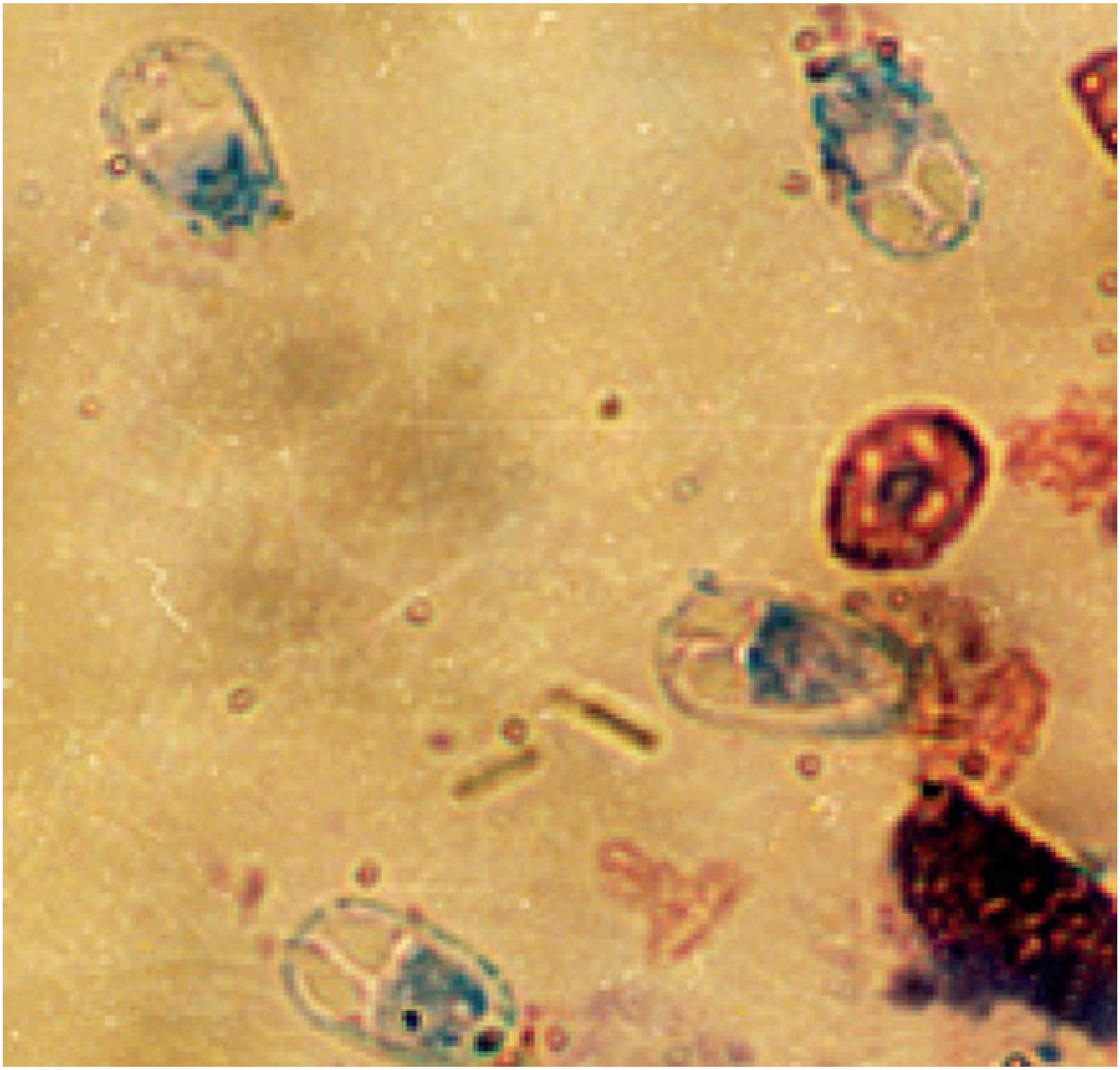

Figure 2 (left). Light micrograph of Giemsastained spores of* Myxobolus dermatobia *(Ishii, 1915) isolated from ocular cysts in a tilapia fish. Scale bar = 10µm.

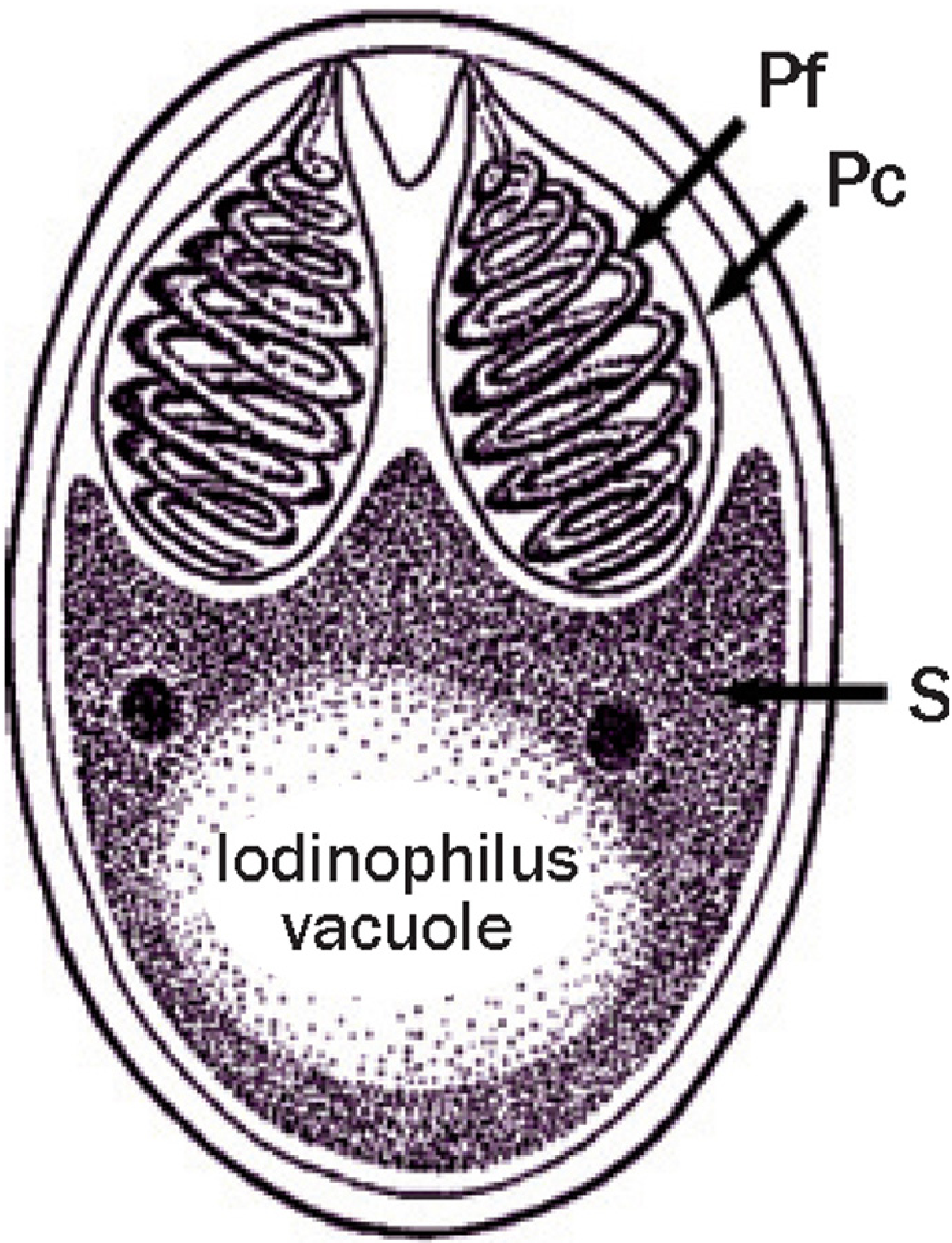
Pf
Pc
S
Iodinophilus
vacuole

Figure 3 (right). Line drawing of a mature* Myxobolus *species spore. Scale bar = 1 µm. Abbreviations: Pf = polar filament; Pc = polar capsule; and S = sporoplasm.