Eugeniusz GRABDA

Fish parasitology

EIMERIA JADVIGAE N. SP. (APICOMPLEXA: EUCOCCIDIA), A PARASITE
OF SWIMMING BLADDER OF *CORYPHAENOIDES HOLOTRACHYS*
(GÜNTHER, 1887) OFF THE FALKLANDS*

EIMERIA JADVIGAE N. SP (APICOMPLEXA: EUCOCCIDIA) PASOŻYT
PEČHERZA PŁAWNEGO
(GÜNTHER, 1887) Z WÓD FALKLANDÓW

Institute of Ichthyology,
Academy of Agriculture,
Szczecin

The parasite was found to infest 80–100%, depending on a stock, of *Coryphaenoides holotrachys* caught off the Falklands. The parasites occurred most often in the terminal part of the swimming bladder, its mucosa being strongly degenerated in the form of a 1-cm thick creamy layer filled with numerous spores of *Eimeria jadvigae*. Similar occurrence was found also in a closely related species *C. ferrieri* (Regan, 1913). The parasite is regarded as a species corresponding to the northern hemisphere's *Eimeria gadi* (Fiebiger, 1913).

INTRODUCTION

Coccidia occurring in the swimming bladder have so far been known from the North Atlantic gadids caught off Iceland. They were for the first time described as *Goussia gadi*

* The species name is given in honour of the late Dr. Jadwiga Grabda, the author's deceased wife

by Labbé. Joan Müller recorded them in cod (*Gadus callarias* = *G. morrhua*) of the area in 1842 and classified them to an undefined protozoan group called the *Psorospermia*. One ought to remember that at that time only *Eimeria stiedae* were known from mammals.

In 1913, Josef Fiebinger published a monograph on the parasite and gave it a new, still valid, name of *Eimeria gadi*. At the same time he described fairly thoroughly the pathology of the infested bladder and some developmental stages of the parasite. The invasion incidence was then 5%.

In 1948, V.A. Dogiel found a new geographic location of the parasite in gadids (*Gadus callarias*, *G. virens*, and *Melanogrammus aeglefinus*), namely the Peter the Great Bay.

In 1963, K. Priebe described a swimming bladder coccidiosis in *Molva vulgaris*, caused by *Eimeria gadi*.

Recently, P.H. Odense and V.H. Logan (1974) revealed the parasite's occurrence off Nova Scotia. They described the extent of infestation and pathologic changes in the bladder of haddock (*Melanogrammus aeglefinus*). Those authors pointed to a considerable degree of specificity of *E. gadi*. They did not find the parasite in cod (*Gadus morrhua*, 92 individuals examined), cusk (*Ophidium barbatum*, 56 individuals), white hake (*Urophycis tanais*, 34 individuals), silver hake (*Merluccius bilinearis*), and pollock (*Pollachius pollachius*, 33 individuals). In one case only they found the four-beard rockline to be infested.

Margolis and Arthur (1979) reported the infestation of *Enchelyopus cimbrius*.

In 1979, the present author found, for the first time the *Eimeria* infestation in the southern hemisphere, in *Coryphaenoides holotrachys* and *C. ferrieri* caught off the Falklands.

MATERIALS AND METHODS

Infested swimming bladders of *C. holotrachys* (Günther, 1887) (= *Macruorus holotrachys*) were found for the first time in frozen fish caught off the Falklands. The fish were being caught from March until May and the frozen materials examined between August and December 1979.

Fish pieces 16–33 cm long and weighing 180–690 g showed considerable organoleptic changes. The muscles contained dry, slightly creamy or yellowish fibres rather than white ones, turning „rubber-like” on cooking. One can wonder if these properties of muscles were not caused by something else. However, a later (1980) examination of whole specimens confirmed the earlier suggestion of the decisive effect of the swimming bladder parasites as the intestinal ones exerted no significant influence.

The infestation was more or less complete, fluctuating from 80–90% depending on a fishing ground. A closely related species, *C. ferrieri* (Regan, 1913) was also considerably infested.

The materials were examined immediately after thawing and thin sections were made and routinely stained with hemalun-eosin, Giemsa, and resorcin (for connective tissue fibres).

RESULTS

Pathologic changes

As already mentioned, the swimming bladders were pathologically changed, which was evident on opening the body cavity (Fig. 1). The outer surface of the bladder was thickened and wrinkled, particularly so in the caudal part. The inner surface of the bladder wall was covered with a white substance, 10–12 mm thick. The thicker the layer, the looser its texture; the substance was easy to remove mechanically. As a rule the substance occupied the whole posterior part of the bladder, sometimes reaching to its mid-point or even to its anterior part. In some cases the substance was slightly yellow. The substance contained numerous *Eimeria* spores, sometimes forming dense aggregations.

Fig. 1. A pathologically changed swimming bladder of *Coryphaenoides holotrachys* infested with *Eimeria jadvigae*

In less advanced stages, connective tissue fibres are regularly arranged and gradually separate, aggregations of the parasites being placed in crevices between the fibres (Fig. 2). Later the tissue becomes strongly „spongy” with numerous bubbles (Fig. 3); the fibres become more and more irregularly arranged. Spores are particularly numerous on the surface of the bubbles. Presumably the bubbles contain some gas, although in some cases they show traces of a precipitate, which is an evidence of a liquid substance of a very low density occurring in the initial phase.

Fig. 2. A swimming bladder internal membrane, loosened and containing numerous spores of *Eimeria jadvigae*

Fig. 3. A swimming bladder internal membrane at a later stage of infestation; note a spongy texture brought about by *E. jadvigae*

On one occasion, an early stage of parasitism (a weak infestation) was detected when the surface of the pathologic substance showed traces of an exudate (Fig. 4) and in places the remains of the epithelium lining the inner surface of the bladder were still visible. In most cases the inner lining of the bladder underwent lysis and was fragmented. Some individual connective tissue fibres became separated and maintained their character. A striking feature is a total lack of cell nuclei.

Spores

Elliptical spores, strongly convex, and circular on their crosssection contain 2 sporozoites each, without the remnant body. The latter is absent in the final form of the spores, but occurs very often in those spores in oocysts, i.e., juveniles (Fig. 5). The spore consists of 3 elements in a case; one element disappears and two sporozoites fill the entire spore. The sporozoites are comma-shaped, compact, their anterior parts being clearly thicker (Fig. 5). The sporozoites, the anterior part of one facing the posterior part of the

Fig. 4. Early stages of *E. jadvigae* infestation in *C. holotrachys* swimming bladder.
Infiltration visible on the internal surface of the bladder; relatively few spores

other, fill the entire interior of the case. The cases are loosely attached and easily separable (Fig. 6).

The spore size is $20\text{--}22 \times 11\text{--}12 \mu\text{m}$; the *E. gadi* spore size is $11\text{--}12.5 \times 7.5\text{--}8.5 \mu\text{m}$ (Dogiel, 1948). In Pellerdy's (1974) description, the spores of the latter species have both ends pointed, thus differing from those of the new species.

Fig. 5. Juvenile spores in oocysts; residual bodies and a mature spore visible.

Fig. 6. *E. jadvigae* spores
Photo: J. Waluga

Fig. 7. *E. jadvigae* oocysts with 4 spores.
Photo: J. Waluga

Fig. 8. A tissue fragment with spores and developmental stages (?) Spores and earlier stages shown at the same scale for comparison.

The sporocyst contains 4 spores (Fig. 7), the sporocyst membrane being very thin and tearing easily apart. The 4-spore pattern is often visible in the spore arrangement in the tissue (Fig. 7).

Developmental stages in the form of strains of fairly large polynuclear cells are often found. They are presumably schizonts (8).

CONCLUSION

Considering the size of spores, shape of sporozoids, geographic location, and a completely different group of hosts (the family *Macruoridae*), the form described is considered new for science.

REFERENCES

- Dogiel V.A., 1948: Parasiticheskie prosteyse ryb zaliva Petra Velikogo. Parasitic Protozoa of fish in Peter Great Gulf Izv. Vsechsoj. Nauc.-Isled. Inst. Ozer i Rec. Ryb. Hazjaistva, 27:17–66. (in Russian)
- Fiebiger J., 1913: Studien über die Schwimmblasencoccidien der Gadusarten *Eimeria gadi* n.sp. Arch.f.Protistenkunde, 31:95–137
- Makusok V.M., 1972: Dolgochvosty (Macruoridae, Pisces) Antarktiki (po sboram D/E „Ob” 1956–1963 g.). Trudy Instituta Okeanologii, 93:250–276. (in Russian)
- Margolis L., J.R. Arthur, 1979: Synopsis of the parasites of fishes of Canada. Bulletin of the Fisheries Research Board of Canada
- Odense P.H. and Logan V.H., 1974: Incidence and distribution of *Eimeria gadi* (Fiebiger, 1913) in the haddock. Int. Conn. for the Explor. of the Sea, Copenhagen, 1 C.M. 1974/F:20, Demersal Fish (Northern) Committee: 1–7
- Pellérdy L.P., 1974: Coccidia and coccidiosis. Akadémiai Kiado, Budapest.
- Priebe K., 1963: Einige wenig bekante parasitologische, lebensmittelhygienisch bedeutsame Befunde bei Meeresfischen. Archiv für Lebensmittelhygiene, 14 Jhrg, Nr 1: 257–260

Translated: Dr. Teresa Radziejewska

Eugeniusz Grabda

EMIRIA JADVIGAE N. SP. (APICOMPLEXA: EUCCOCCIDIA)
PASOŻYT PĘCHERZA PŁAWNEGO BUŁAWIKA FALKLANDZKIEGO
CORYPHAENOIDES HOLOTRACHYS (GÜNTHER, 1887)
Z WÓD POŁUDNIOWYCH FALKLANDÓW

STRESZCZENIE

Autor stwierdził masowe (dochodzące 100%) zarażenie pęcherza pławnego buławików falklandzkich *Coryphaenoides holotrachys* jak i *C. ferrieri* – przez *Eimeria jadvigae* n.sp.

Pasożyt osiedla się w błonie wewnętrznej pęcherza pławnego, powodując znaczne jej zgrubienie i

rozpulchnienie, która w końcowym etapie przyjmuje wygląd śmietankowej masy. Elementy komórkowe zanikają a tylko pozostają włókna tkanki łącznej jakby zatopione w jednolitej masie organicznej. Wiązki włókien ulegają rozluźnieniu a same włókna przebiegają nieregularnie. W końcowym etapie powstają liczne komory (pęcherza) tak, że całość przyjmuje charakter gąbczasty.

Eimeria ze względu na wymiary, różne grupy żywiciela, występowanie geograficzne jak i zmiany patologiczne została zaliczona do nowego gatunku *E.jadvigae*. Jest to odpowiednik podobnego gatunku – *E. gadi* Fiebiger, 1913 z półkuli północnej.

Eugeniusz GRABDA

EIMERIA JADVIGAE N. Sp. (APIEOMPLEXA:EUCOCCIDIA) ПАРАЗИТ
ПЛАВАТЕЛЬНОГО ПУЗЫРЯ У ФАЛКЛЕНДСКОГО CORYPHAENOIDES HOLOTRACHYS
(GÜNTHER , 1887) ИЗ ВОД КЖНЫХ ФАЛКЛЕНДСКИХ ОСТРОВОВ

Р Е З Ю М Е

Автором было установлено массовое (до 100%) заражение *Eimeria* n.sp. плавательного пузыря у фалклендских *Coryphaenoides holotrachys* и *C. ferrieri*.

Местом заселения паразита являлась внутренняя плёнка плавательного пузыря, что вызвало значительное её загробление и разрыхление. В конце она имела состояние сливочновидной массы. Клеточные элементы подвергались исчезновению и оставались исключительно волокна соединительной ткани, как будто затопленные в однородном органическом веществе. Пучки волокон разрыхлялись а ход волокон становился нерегулярным. В конце периода образовались многие камеры (пузыри), что в целом принимало губковидный характер.

Eimeria по размерам, различным группам кормильцов, географическом присутствии и патологическим изменениям принадлежит к новому виду *E.jadvigae* представлявшему собой эквивалент вида – *E. gadi*, Fiebiger, 1913 из северного полушария.

Address:

Received: 25 August 1982

Prof. Dr Eugeniusz Grabda
Instytut Ichtiologii A.R.
71-550 Szczecin
ul. Kazimierza Królewicza 4
Polska (Poland)