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Are ranaviruses host specific or not?


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Introduction

Ranaviruses are a group of systemic iridoviruses associated with systemic disease in mainly erythropoietic tissue, potentially causing high mortalities in affected animals. Ranaviruses have been isolated from fish, amphibians and reptiles in Austral-Asia, North America and Europe. Even though ranaviruses are often named according to the host from which they were originally isolated, little is known about the host specificity of these viruses

Table I. Published findings of natural outbreaks of ranavirus in fish (Only *Ranavirus* isolates confirmed by sequencing are included)

Fish species	Isolate	*Ranavirus* species*	Location(s)	Origin of fish	Mortality	Age of fish	Year of outbreak(s)	Reference(s)
Redfin perch (*Perca fluviatilis*)	Epizootic haematopoietic necrosis virus	EHNV	Australia	Wild	High	Mostly juvenile	1984 -> 1994	11, 20
Rainbow trout (*Oncorhynchus mykiss*)	Epizootic haematopoietic necrosis virus	EHNV	Australia	Farmed	0-0.1%	All ages	1986, 1993 & 1996	12, 21
Sheatfish (*Silurus glanis*)	European sheatfish virus (ESV)	ECV	Germany	Farmed	30-100%	Fry and adults	1988, 1990	1, 2
Catfish (*Ictalurus melas*)	European catfish virus	ECV	France, Italy	Farmed	90-100%	All ages	1990, 1993	6, 17
Doctor fish (*Labroides dimidatus*)	Doctor fish virus (DFV)	SCRV	Imported from Singapore	Farmed	ND	ND	1995	9
Guppy (*Poecilia reticulata*)	Guppy virus 6 (GV6)	SCRV	Imported from Singapore	Farmed	ND	ND	1995	9
Tilapia (*Oreochromis mossambicus*)	Bohle iridovirus**	BIV	Australia	Farmed	100%	Fry	1996	3
Threespine stickleback (*Gasterostelus aculeatus*)	Redwood creek virus (RCV)**	FV3	California	Wild	20%	ND	1996	14
Largemouth bass (*Micropterus salmoides*)	Largemouth bass iridovirus (LMBV)	SCRV	USA	Wild	ND	Adult	1996	15
Pike-perch (*Sander lucioperca*)	Pike-perch iridovirus (PPIV)	Unresolved	Finland	Farmed	0%	Fingerlings	1998	19
Grouper (*Epinephelus spp.*)	Singapore grouper iridovirus (SGIV)	Tentative	Singapore	Farmed	>90%	Fry and adults	1998	8, 18
Shortfinned eel (*Anguilla australis*)	Shortfinned eel ranavirus (SERV)	Unresolved	Imported to Italy	Farmed	0%	Juvenile	1999	7

*According to International Committee on Taxonomy of viruses. EHNV=epizootic haematopoietic necrosis virus, ECV=european catfish virus, SCRV=Santee-cooper ranavirus, BIV=Bohle iridovirus, FV3=Frog virus 3.
**Amphibian ranaviruses
ND= No data available

Methodology

The aim of this study was to identify which species of fish are susceptible to infection with *Ranavirus* and whether ranaviruses are host specific or not. This was investigated by a literature search of initial isolations of ranaviruses from fish and of experimental challenges of susceptibility of fish to ranaviruses.

For the challenge experiments, species were either designed as susceptible (Y), Infectable (I) or Non-susceptible (N) according to the following definitions: Y1: Statistically significant mortalities, Y2: High mortality and pos. virus re-isolation, Y3: High mortality, Y4: Mortality>15% and pos. virus re-isolation, I1: Mortality <5% and pos. virus re-isolation, I2: No statistically significant mortality but pos. virus re-isolation, N1: No statistically significant mortality and no virus re-isolation, N2: No mortality and no virus re-isolation, N3: Mortality<10% (For Y3 and N3 there was no data on virus re-isolation).

The results of the study can be seen in tables I &II.

Discussion

In half of the initial ranavirus-isolations, no mortalities were observed. In two cases were amphibian ranaviruses found in association with mortalities in fish, and EHNV has caused natural outbreaks in two fish species, although with different mortalities. EHNV is the most investigated *Ranavirus*, and can infect 12 different fish species, even though some only by injection.

The study showed that most of the challenge studies has been performed with very low numbers of fish, and often no information about virus re-isolation is given. This makes it difficult to determine the susceptibility of a fish species to a specific *Ranavirus*.

Table II. Published challenge trials with ranaviruses in fish. Challenge trials with fish species allready listed in table I are not included, unless it has been challenged with another ranavirus than the one it was naturally infected with.

Fish species	Virus isolate	Location	Age of animals	Type of challenge*	Temperature in challenge (°C)	No. of animals challenged	Mortality (%)	Morbility (%)	Percent positive virus re-isolations	Reference	Susceptibility**
Atlantic salmon	EHNV	Australia	Juvenile	IP	NS	15	0	100%	NS	11	Y3
Salmo salar											
Barramundi	EHNV	Australia	4 mths	Bath	18-20	10	0	0	NS	13	N3
Lates calcarifer				IP	18-20	3	0	0			N3
	BIV	Australia	NS	IP+IM	18-20	20	100		0	4	Y3
	BIV	Australia	Juvenile	IP+IM	29	20	100		75-100	16	Y2
				Bath	29	20	100		50-100		Y2
Channel catfish	EHNV	California	Fry	Bath	15	20	0		0	9	N2
Ictalurus punctatus	ESV			Bath	15	20	0		0		N2
	DFV/GFV			Bath	15	20	0		0		N2
Chinook salmon	EHNV		Fry	Bath	15	17	18		NS		Y4
Oncorhynchus tshawytscha	ESV		Fry	Bath	15	17	0				N3
	DFV/GFV		Fry	Bath	15	17	6				N3
Rainbow trout	PPIV	Finland	>1 year	IP	15-19	80	0	0	43	19	I1
Oncorhynchus mykiss				Bath	15-19	40	0	0	0		N2
	ESV	California	Fry	Bath	15	25	4		NS	9	N3
	DFV/GFV			Bath	15	25	4				N3
	ATV	USA	Adults	Oral	NS	12	0	0	0	10	N2
	BIV	Australia		IP+IM	NS		0		NS	4	N3
Tilapia	BIV	Australia	Fry	Oral	24	12	30+		0	3	Y4
Oreochromis mossambicus	EHNV	Australia	6 mths	Bath	18-20	5	0	0	0	13	N2
				IP	18-20	5	20	20	from morts		Y4
Australian bass	EHNV	Australia	2 mths	Bath	18-20	10	0	0	0	13	N2
Macquaria novemaculeata				IP	18-20	6	100	100	100		Y2
Golden perch	EHNV	Australia	3 mths	Bath	18-20	10	100	100	100	13	Y2
Macquaria ambigua				IP	18-20	5	100	100	100		Y2
Macquarie perch	EHNV	Australia	2 mths	Bath	18-20	4	0	0	50	13	I1
Macquaria australasica				IP	18-20	4	100	100	100		Y2
Murray cod	EHNV	Australia	3 mths	Bath	18-20	10,10,6	30-66	30-66	from morts	13	Y4
Maccullochella peeli				IP	18-20	5	100	100	100		Y2
Silver perch	EHNV	Australia	>1 year	Cohab	18-20	10	0	0	0	13	N2
Bidyanus bidyanus				Bath	18-20	12	0	0	0		N2
Smelt	ATV	USA	Adults	IP		8	0	0	0	10	N2
Retropinna semoni				Oral		15	20	0	0		Y3
Sunfish	EHNV	Australia	<1 year	Bath	18-20	8	0	0	0	13	N2
Lepomis cyanellus				IP	18-20	3	0	0	0		N2
Goldfish	EHNV	Australia	>1 year	Cohab	18-20	4	100	100	100	13	Y2
Carassius auratus				Bath	18-20	10	90	90	from morts		Y2
Mosquito fish	ATV	USA	Adults	IP		16	0	0	0	10	N2
Gambusia affinis				Oral		25	4	0	0		N2
Tiger barb	EHNV	Australia	<1 year	Bath	18-20	5	0	0	0	13	N2
Capoeta tetrazona											
Pike	EHNV	Denmark	Fry	Bath	12	96	100	0	95	5	Y1
Esox lucius					22	94	98	0	82		I2
	ESV				12	107	73	0	54		Y1
					22	185	97	0	94		I2
	ECV				12	98	51	0	37		I2
					22	99	98	0	68		I2
	PPIV				12	83	61	0	84		Y1
					22	101	93	0	100		I2
	SERV				12	102	100	0	82		Y1
					22	70	97	0	0		I2
	FV3				12	81	44	0	60		N1
					22	69	83	0	60		I2
Mountain galaxias	EHNV	Australia	>1 year	Bath	18-20	5	100	100	100	13	Y2
Galaxias olidus											

*IP=intraperitoneal injection, IM=intramuscular injection
**See explanation in text
NS=not stated

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