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Diagnosis and frequency of parasites in channel cat fish (*Ictalurus punctatus)* on northeastern and gulf coast farms Mexico

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Abstract
Aquaculture is of vital importance in the generation of food of high nutritional value, employment, and economic income for the population, as well as an important role as a source of inputs for the country's food and currency industry. The objective of the present study was to determine the health status and presence of pathological agents causing parasitic disease in *Channel Catfish* (*Ictalurus punctatus*) on farms in the state of Tamaulipas, Mexico, through fresh pathology and Histopathological analyzes. One of the main problems facing this activity are diseases, which play a very important role since it affects in large range the production of *Channel Catfish* (*Ictalurus punctatus*), in Mexico and thus cause high mortalities in young organisms as well as to generate large economic losses for aquaculture. These represent an important factor in the loss of production and generate economic losses which also inhibit imports and exports of food products derived from production. During the years 2013 and 2014, 176 catfish samples (*Ictalurus punctatus*) were analyzed from farms located in the state of Tamaulipas, to identify the presence of parasites. Through the techniques of fresh parasitoscopy and histopathology, the main parasites identified were *Henneguya* spp. (80.1%), *Trichoidna* spp. (60.2%), *Dactylogyrus* spp. (37.5), *Gyrodactylus* spp. (27.3), *Ichthyophthirius multifiliis* (44.3%), *Diplostomum* spp. (38.6%) and *Centrocestus* spp. (23.3%). All the farms analyzed were found to be parasitized

Keywords: Parasitosis, channel catfish, (*Ictalurus punctatus*), Mexico

Introduction
Channel catfish (*Ictalurus punctatus*) is native to the Rio Bravo basin, including Tamaulipas.1, 5 Due to its easy domestication and reproduction, as well as rapid growth, the catfish has a high commercial potential, starting its culture in Mexico in 1971. The production of catfish in the country is 2,516 tons per year, and Tamaulipas participates with 328 tons per year, which represents a value of more than 65 million pesos. However, this species is affected by various diseases, including parasitic diseases which, in addition to decreasing production, are also responsible for the imposition of non-tariff barriers preventing their export to other countries.
Aquaculture is an activity of continuous growth, with diversification, intensifying its production through technological advances to its productive process, being this one of the most important factors of its growth and change in its conceptualization. Aquaculture is conceived as an activity to meet the needs of food producers, as part of the engine of economic growth, and to achieve different goals.
Aquaculture is of vital importance in the generation of food of high nutritional value, employment, and economic income for the population, as well as an important role as a source of inputs for the country's food and currency industry. Mexico has great aquaculture potential as it has 1.6 million hectares of protected coastal waters suitable for the cultivation of fresh aquaculture and marine fish (SAGARPA 2002), with aquaculture production accounting for approximately 5% of total fisheries in Mexico (FAO, 2002) [10].
Diseases affecting aquatic organisms are one of the major problems faced by fish farmers in the production of this and other species. The normal development of an organism can be affected by a wide variety of pathogens such as; Parasites, bacteria, fungi, etc. This poses great risks to the health of organisms, reduces production, causes high tariff losses, and inhibits their

production. Therefore, it is of the utmost importance for aquaculture producers to know the state of health and to identify the main parasitic pathogens involved in the cultivation of Channel Catfish (*Ictalurus punctatus*). This is of great help to producers by enabling timely detection of agents and reducing the possible harm they cause, dissemination to other farms and states, and establishing mechanisms, together with strategies to prevent, prevent and control diseases.

Materials and Methods

The primary objective of the study was to determine the presence and identification of the main parasites that are present in catfish farms in Tamaulipas.

By means of fresh pathology and histopathology techniques, 176 catfish samples from farms located in different towns of Tamaulipas (Figure 1) were analyzed during 2010 (n = 51) and 2011 (n = 125). Fresh parasitoscopy (Fresco pathology) was performed from mucus scraping samples and gill arch placed in a Petri dish with 70% alcohol or AFA solution in 2 ml of water, and observed under light microscopy with increases 20x, 40x and 100x. Parasites were identified by pre-established classification.2, The pathological diagnosis was made from gill samples, which were fixed in 10% formaldehyde and 1 subsequently embedded in paraffin; 3-5 µm thick sections of these samples were stained with Harris hematoxylin and eosin and observed under light microscopy.

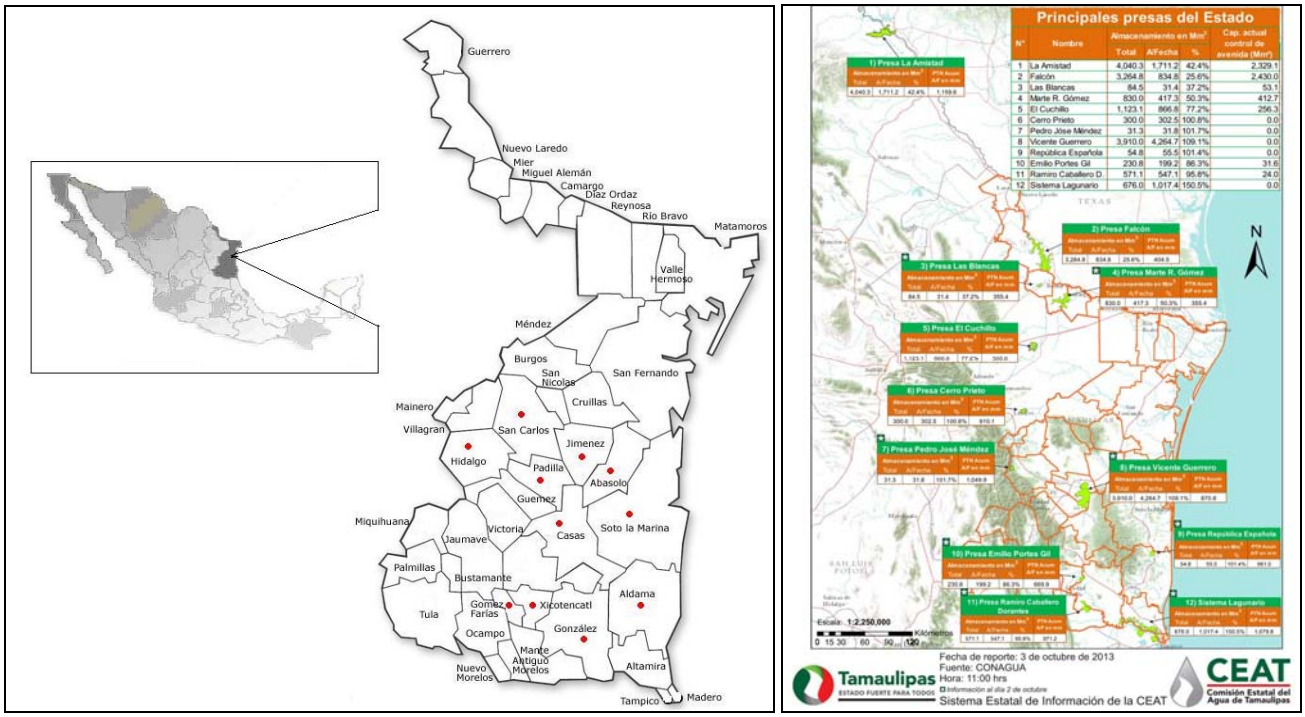


Fig 1 and 2: Scheme of the distribution of farms in Tamaulipas And main dams and bodies of water used in aquaculture production, State, taken from the state water commission of the state government (O).

Results

The identified parasites are presented in Tables 1 and 2. High percentages for *Henneguya* spp. (88.2%) followed by Gillian *Trichodina* spp. (68.6%), *Dactylogyrus* spp. (58.8)% *Ichthyophthirius multifiliis* (31.4%) of gill origin and Skin, and *centrocestum* spp (35.3 gill origin for the year 2013 compared to a difference in the following years of *Henneguya* spp (76.8%) followed by *Trichodina* spp gill (56.8%), *Ichthyophthirius multifiliis* (49.6) of gill and integumentary origin, And *centrocestum* spp (37.6) of gill origin for the year 2014. Gyro: *Gyrodactylus* spp is also reported as a new incidence, which reports an average prevalence of 27.3%, registering its highest incidence in the central area of the state in municipality Of Padilla (Vicente Guerrero Dam), in general the highest incidence of parasites was the southern part of the state in the prey of Emilio Portes Gil, Spanish republic, rio Soto la Marina, followed by the central zone, with bodies of water from Vicen Warrior, pedro J Mendez, gentleman, cerro prieto, Hidalgo.

Table 1: Parasites identified in channel catfish (*Ictalurus punctatus*) in the state of Tamaulipas.

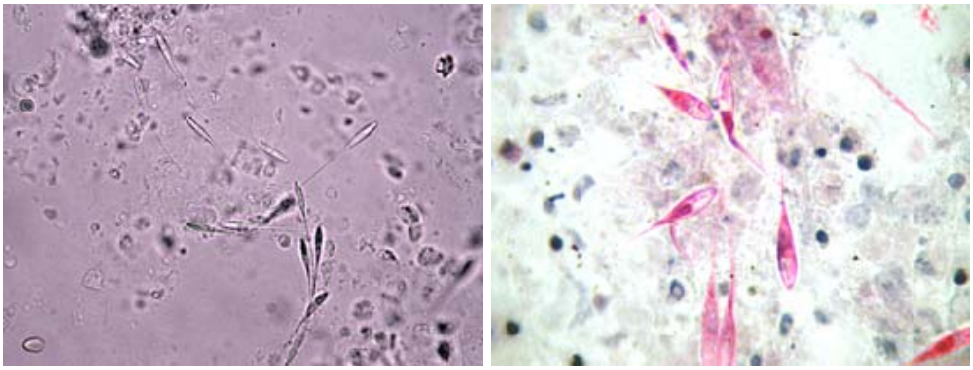
Año		Henn	Tricho	Dacty	Gyro	Ich	Diplos	Centro	Erga	Costia	Oodi	Cholo	Para	Arg
2013	n	45	35	30	21	16	21	18	9	6	12	4	9	6
	%	88.2	68.6	58.8	41.2	31.4	41.2	35.3	17.6	11.8	23.5	7.8	17.6	11.8
2014	n	96	71	36	27	62	47	23	19	8	23	7	21	20
	%	76.8	56.8	28.8	21.6	49.6	37.6	18.4	15.2	6.4	18.4	5.6	16.8	16

Henn: *Henneguya* spp.; Tricho: *Trichoidina* spp.; Dacty: *Dactylogyrus* spp.; Gyro: *Gyrodactylus* spp.; Ich: *Ichthyophthirius multifiliis*; Diplos: *Diplostomum* spp.; Centro: *Centrocestus* spp.; Erga: *Ergasilus* spp.; Costia: *Costia* spp.; Oodi: *Oodinium* spp.; Cholo: *Chilodonella* spp.; Para: *Paramecio* spp.; Arg: *Argulus* spp,

Table 2: Distribution of parasites identified in channel catfish (Ictalurus punctatus) in different municipalities of the state of Tamaulipas.

Municipio	Henn	Tricho	Dacty	Gyro	Ich	Diplos	Centro
Hidalgo	8	9	9	--	9		6
San Carlos	9	8	8	--	8	6	--
Jiménez	7	3	7	--	7	5	4
Padilla	3	4	4	4	6	4	3
Abasolo	2	2	3	3	2	3	1
Villa de Casas	1	1	2	2	1	2	2
Soto La Marina	5	5	1	1	3	1	--
Xicoténcatl	4	6	5	5	4	--	7
Gómez Farías	6	7	6	6	5	--	5
González	10	10	11	--	--	--	8
Aldama	11	11	10	--	--	--	--

Henn: *Henneguya* spp.; Henn: *Henneguya* spp.; Direct imprint of gill lamellae with 70% alcohol in which smears are observed desquamation and whole bodies of *Henneguya* spp, direct staining of Diff Quick with bodies of loose parasites (Obj 100X Ocul 10/22)

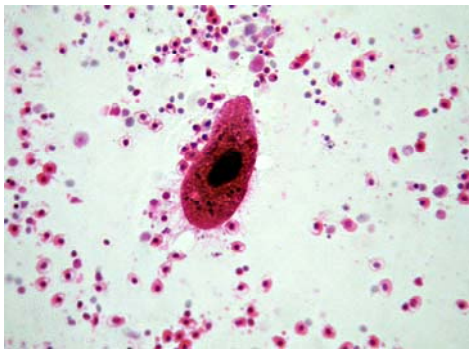


Tricho: *Trichoidna* spp; *Tricho: Trichoidna* spp; Direct imprint of gill lamellae with 70% alcohol in which desquamation is observed and whole Koller lighting bodies, and bodies of loose parasites (Obj 100X Ocul 10/22) Dacty: *Dactylogyrus* spp

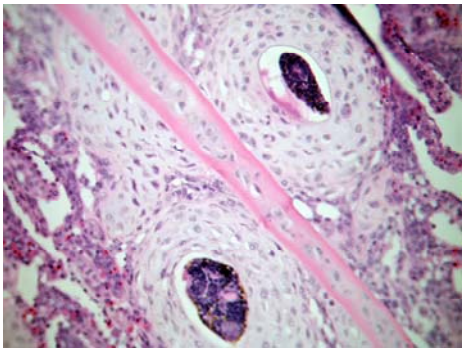
Gyro: *Gyrodactylus* spp; *Gyro: Gyrodactylus* spp; Direct imprint of gill lamellae with 70% alcohol in which scaling is observed and whole Koller lighting bodies, and bodies of loose parasites (Obj 100X Ocul 10/22) Dyplos: *Dyplostomum* spp

Erga: *Ergasilus* spp; *Erga: Ergasilus* spp*:* direct imprint of gill lamellae with alcohol at 70% in which is observed desquamation and whole bodies Koller lighting, and bodies of loose parasites (Obj 100X Ocul 10/22) *Cholo: Chilodonella* spp

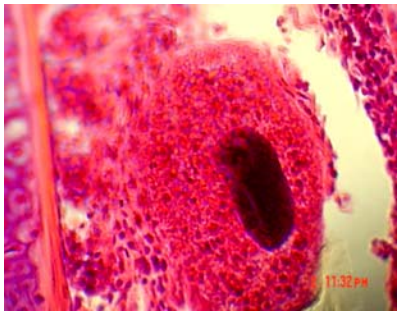

Para: *Paramecio* spp.; To: *Paramecio* spp.*;* Direct imprint of gill lamellae with 70% alcohol in which it is observed desquamation and whole bodies of *Paramecio* spp, direct staining of Diff Quick with bodies of loose parasites (Obj 100X Ocul 10/22) Arg: *Argulus* spp




***Center: Gill cysts of Centrocestus* spp.;**
Histological section stained with hematoxylin and eosin in detail the presence of cartilage-embedded structure (lesions of hyperplasia, depletion and repair) (T.H & E Cut 4 Micras, 40X Obj.) Direct imprint of gill lamellae with alcohol at 70% In which is observed desquamation and whole bodies Koller illumination, and bodies of loose parasites (Obj 100X Ocul 10/22)




Ich: Ichthyophthirius multifiliis Histological section stained with hematoxylin and eosin in which the presence of structure embedded in cartilage (lesions of hyperplasia, inflammatory cell infiltration) is detailed (T.H & E Cut 4 Micros, 100X oil Obj.)



Conclusion

Aquaculture is an activity that due to its nature can generate conditions that favor the transfer, development and growth of pathogens. These conditions can trigger infectious processes, disorders, and diseases that affect the cultivation and economic activity of this industry. Unfortunately, many of these pathogens are unknown or do not know in a timely manner their presence, distribution and species to which it affects because the studies that are carried out are sporadic. The advances obtained in the last decade have favored the development of new methods of diagnosis that allow the detection and timely identification of pathogens, reducing the presence of outbreaks or mortalities in the farm. During the years 2013 and 2014, 176 catfish samples (Ictalurus punctatus) were analyzed from farms located in the state of Tamaulipas, to identify the presence of parasites. Through the techniques of fresh parasitoscopy and histopathology, the main parasites identified were *Henneguya* spp. (80.1%), *Trichoidna* spp. (60.2%), *Dactylogyrus* spp. (37.5%), *Gyrodactylus* spp. (27.3%), *Ichthyophthirius multifiliis* (44.3%), *Diplostomum* spp. (38.6%) and *Centrocestus* spp. (23.3%). All the farms analyzed were found to be parasitized. The high proportion of positivity was because in two samples two or more parasites were identified, the frequency of affected farms as well as the proportion of catfish samples positive to parasites is high, which affects their performance and production. Therefore, it is suggested the implementation of prophylactic measures to reduce these health indicators.

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