ANTIMICROBIAL SUSCEPTIBILITY PATTERNS OF *Edwardsiella ictaluri* ISOLATED FROM VACCINATED AND NON-VACCINATED STRIPED CATFISH (*Pangasianodon hypophthalmus*)

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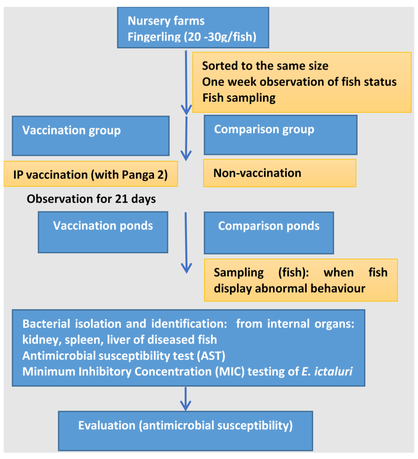
01 Introduction

Vaccine is one of the approach that are using in order to reduce the use of antibiotics and their residue. The research aim is to evaluate the antimicrobial susceptibility of *Edwardsiella ictaluri* isolated from vaccinated and non-vaccinated catfish for prevention of BNP (Bacillary Necrosis of Pangasius)



Visiting catfish farms

02 Methods



Overview of experimental design



Sampling at catfish farms

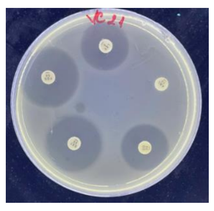


Fish with *E. ictaluri* infection (BNP)

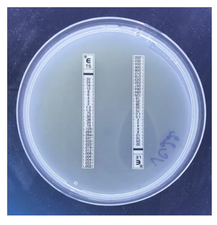


Fish dissection

- A total of 41 isolates were analyzed from 17 non-vaccinated and 24 vaccinated ponds.
- Antimicrobial susceptibility was determined by disk diffusion with ten antibiotics.
- A subset of 24 isolates (12 per group) was further evaluated by minimum inhibitory concentration (MIC) testing for doxycycline (DOX), amoxicillin (AMX), trimethoprim/sulfamethoxazole (TMP/SMX), and levofloxacin (LEV) (Interpretation of MIC values was based on applied study-specific thresholds).



Antimicrobial susceptibility testing



Minimum Inhibitory Concentration testing

03 Results

AMR patterns

Disk diffusion results showed frequent reduced susceptibility to tetracycline, gentamicin (60%-80%), and high levels of resistance to sulfamethoxazole, levofloxacin (40% - 80%) in both groups. Resistance to amoxicillin and cefotaxime was more commonly observed in isolates from non-vaccinated ponds (41% and 47%).

Sr No	Isolate	FFC	AML	CN	DO	SXT	CTX	LEV	TET	RD	FOS
1	KV009	24	40	27	24	0	36	44	15	15	42
2	KV015	33	28	23	21	0	41	37	26	10	34*
3	KV018	9	34	20	20	0	0	16	12	13	34
4	KV019	28	33	28	22	33	0	30	29	11	30
5	KV020	15	0	19	20	0	29*	27	14	21	29*
6	KV021	16	0	19	19	0	29*	26	13	23	17*
7	KV024	12	8	10	14	0	0	29	11	9	38
8	KV025	10	30	27	18	20	48	33	15	12	34
9	KV026	12	26	24	20	0	0	17	18	11	13
10	KV027	10	29	21	17	17	0	15	24	11	34
11	KV029	24	0	20	0	18	9	0	27	11	35
12	KV031	30	0	20	26	24	30*	30	30	20*	29*
13	CTU-KV001	32	27	17	25	29	37	27	31	24	12
14	CTU-KV002	33	25	16	27	28	37	28	32	ND	11
15	CTU-KV005-2	29	16	20	25	0	18	26	31	12	10
16	CTU-KV007	29	14	20	26	0	19	29	33	10	10
17	CTU-KV008	38	20	20	27	29	44	27	35	22	10

AMR patterns of non-vaccinated group

Sr No	Isolate	FFC	AML	CN	DO	SXT	CTX	LEV	TET	RD	FOS
1	VC020	27	38	21	32	0	29	0	21	13	0
2	VC022	15	0	14	21	0	35	25	11	16	29
3	VC024	32	28	17	25	24*	38	23*	29	10	22
4	VC025	9	24	15	21	0	35	22	12	11	39
5	VC028	30	35	20	23	10	19	14	24	10	36
6	VC029	31	0	18	25	20*	30	25	28	16	30
7	VC030	35	24	25	18	16	35	26	17	13	24
8	VC032	26	36	24	24	22	34	12	24	11	36
9	VC033	28	29	16	25	0	44	14	25	13	32
10	VC034	29	30	26	21	10	11	24	24	15	31
11	VC035	20	35	18	11	15	37	9	19	12	29
12	VC036	30	0	12	28	25	34	25	30	17	20
13	VC037	20	35	18	11	15	37	9	19	12	29
14	D2-G2.1.2-VC	14	32	28	25	0	47	36	15	33	14
15	D2-G2.2.2-VC-	9	33	27	24	0	44	37	10	31	11
16	D1-T6-VC	22	20	0	30	25	25	22	23	10	12
17	D1B-T5.1-VC	11	0	12	12	0	28	21	13	0	32
18	D1B-T6.1-VC	9	34	29	20	0	ND	37	9	32	12
19	D3-T2.2-VC	22	0	0	0	0	0	0	0	0	9
20	D2B-T6.1-VC	13	15	18	32	19	19	29	25	12	9
21	CTU-VC005-2	38	22	20	26	27	41	27	35	25	10
22	CTU-VC007-2	15	15	16	32	22	19	29	29	11	8
23	CTU-VC009	26	0	0	16	19	17	20	11	0	16
24	CTU-VC010	14	20	21	25	18	24	19	22	0	13

AMR patterns of vaccinated group

Non-vaccine		
Isolate	No of resistant	MAR index
KV009	3	0.3
KV015	4	0.4
KV018	6	0.6
KV019	3	0.3
KV020	7	0.7
KV021	7	0.7
KV024	9	0.9
KV025	4	0.4
KV026	6	0.6
KV027	5	0.5
KV029	4	0.4
KV031	3	0.3
CTU-KV001	3	0.3
CTU-KV002	4	0.4
CTU-KV005-2	5	0.5
CTU-KV007	6	0.6
CTU-KV008	3	0.3
Average		0.48

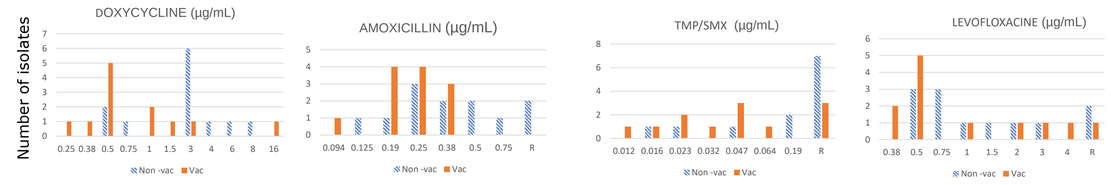
Vaccine		
Isolate	No of resistant	MAR index
VC020	5	0.5
VC022	8	0.8
VC024	3	0.3
VC025	8	0.8
VC028	6	0.6
VC029	3	0.3
VC030	6	0.6
VC032	4	0.4
VC033	4	0.4
VC034	5	0.5
VC035	5	0.5
VC036	5	0.5
VC037	5	0.5
D2-G2.1.2-VC	5	0.5
D2-G2.2.2-VC-	6	0.6
D1-T6-VC	7	0.7
D1B-T5.1-VC	9	0.9
D1B-T6.1-VC	6	0.6
D3-T2.2-VC	9	0.9
D2B-T6.1-VC	7	0.7
CTU-VC005-2	3	0.3
CTU-VC007-2	6	0.6
CTU-VC009	8	0.8
CTU-VC010	7	0.7
Average		0.58

MAR index

Multidrug resistance was widespread, with mean multiple antibiotic resistance (MAR) indices of 0.48 and 0.58 in non-vaccinated and vaccinated isolates, respectively.

MIC testing

Resistance to DOX was observed in 75% of isolates from non-vaccinated ponds compared with 17% from vaccinated ponds. For AMX, resistance was detected in 42% of non-vaccinated isolates and none of the vaccinated isolates. Resistance to TMP/SMX was higher in non-vaccinated isolates (75%) than in vaccinated isolates (25%). In contrast, comparable resistance levels to LEV were observed in both groups (33%).



MIC values of (doxycycline, amoxicillin, trimethoprim/sulfamethoxazole and levofloxacine) for *E. ictulari* from vaccinated and non-vaccinated diseased striped catfish.

04 Discussion

- *E. ictaluri* isolates from both production systems exhibited widespread multidrug resistance.
- Isolates from non-vaccinated ponds showed higher resistance to several commonly used antimicrobials.

05 Conclusion

Vaccination is considered as a strategy to reduce antimicrobial selection pressure and improve disease management in striped catfish aquaculture.

Acknowledgements

- We would like to thank Pharmaq Vietnam, Godaco Seafood Co., and stakeholders, who support us on collecting information and sampling.
- This work was carried out as part of the project "Reduction of Antimicrobial Use in Pangasius and Tilapia Aquaculture in Vietnam", funded by the International Centre for Antimicrobial Resistance Solutions (ICARS; www.icars-global.org; project no. ID100016).

Related Literature:

- Kumar A, Middha SK, Menon SV, Paital B, Gokarn S, Nelli M, Rajanikanth RB, Chandra HM, Mugunthan SP, Kantwa SM, Usha T, Hati AK, Venkatesan D, Rajendran A, Behera TR, Venkatesamurthy S, Sahoo DK. Current Challenges of Vaccination in Fish Health Management. Animals (Basel). 2024 Sep 16;14(18):2692. doi: 10.3390/ani14182692. PMID: 39335281; PMCID: PMC11429256.
- Hoang Nam Kha Nguyen, Thi Thu Hao Van, Peter J Coloe. 2016. Antibiotic resistance associated with aquaculture in Vietnam. Microbiology Australia (*In* Focus).

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