

Antimicrobial resistance to extended-spectrum cephalosporins in Enterobacteriaceae from chickens and pigs in Canada

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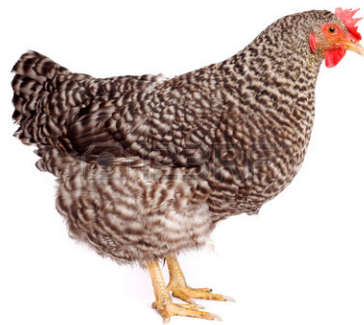
Resistance to extended-spectrum cephalosporins (ESCs)

- ❑ Enterobacteriaceae are an important cause of infections
- ❑ Preventative use of ESCs banned in poultry but not in swine
- ❑ Understanding ESC resistance is important for treatment and public health
- ❑ Situation of ESC resistance in Enterobacteriaceae other than *E. coli* and *Salmonella* is almost unknown



Hypothesis

- Due to widespread horizontal gene transfer between bacteria within a host, ESC resistance genes will be similar between commensals and pathogens from a host.



Objectives

1. Assess the occurrence of ESC resistance in Enterobacteriaceae
2. Assess the frequency of cecal carriage of ESC-resistant Enterobacteriaceae
3. Compare the distribution of ESC resistance genes and their variants between:
 - Enterobacteriaceae species
 - Generic cecal and clinical isolates

Methods

□ Sample Collection from Ontario: Nov 2015 to Oct 2016

1. Clinical isolates

- Animal Health Laboratory - isolated using non-selective media
- Chicken colibacillosis and swine diarrhea

2. Cecal samples

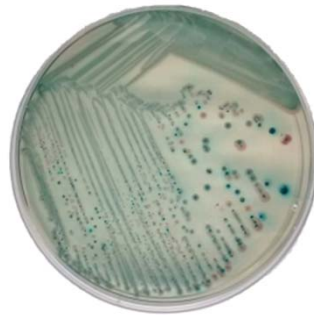
- Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) – isolated using selective media (vs routine CIPARS testing which uses non-selective media)

Methods

Incubate in
Enterobacteriaceae
Enrichment broth



Plate onto
chromogenic
REBECCA agar



Confirm expression
of ESC resistance
with disk diffusion



ID bacteria with
MALDI-TOF MS



PCR screening for major
resistance gene families



Results



Table 1. ESC-resistant Enterobacteriaceae in chicken clinical samples.

Gene Species	<i>bla</i> _{CMY}	<i>bla</i> _{CTX-M}	Other	Total Resistant Samples
<i>Escherichia coli</i>	47	3	2	49 of 234
<i>Salmonella</i> spp.	1	0	0	1 of 2
Total	96%	6%	4%	49 of 235*

Table 2. ESC-resistant Enterobacteriaceae in swine clinical samples.

Gene Species	<i>bla</i> _{CMY}	<i>bla</i> _{CTX-M}	Other	Total Resistant Samples
<i>Escherichia coli</i>	5	1	3	9 of 48
<i>Salmonella</i> spp.	2	1	0	3 of 59
Total	58%	17%	25%	12 of 96*

Results

Table 3. The ESC-resistant Enterobacteriaceae isolated from CIPARS chicken and swine cecal samples.

	Chickens	Pigs
Total cecal samples collected	242	50
Number of samples with ESC-resistant Enterobacteriaceae	238	35
Overall frequency of ESC resistance	98%	70%

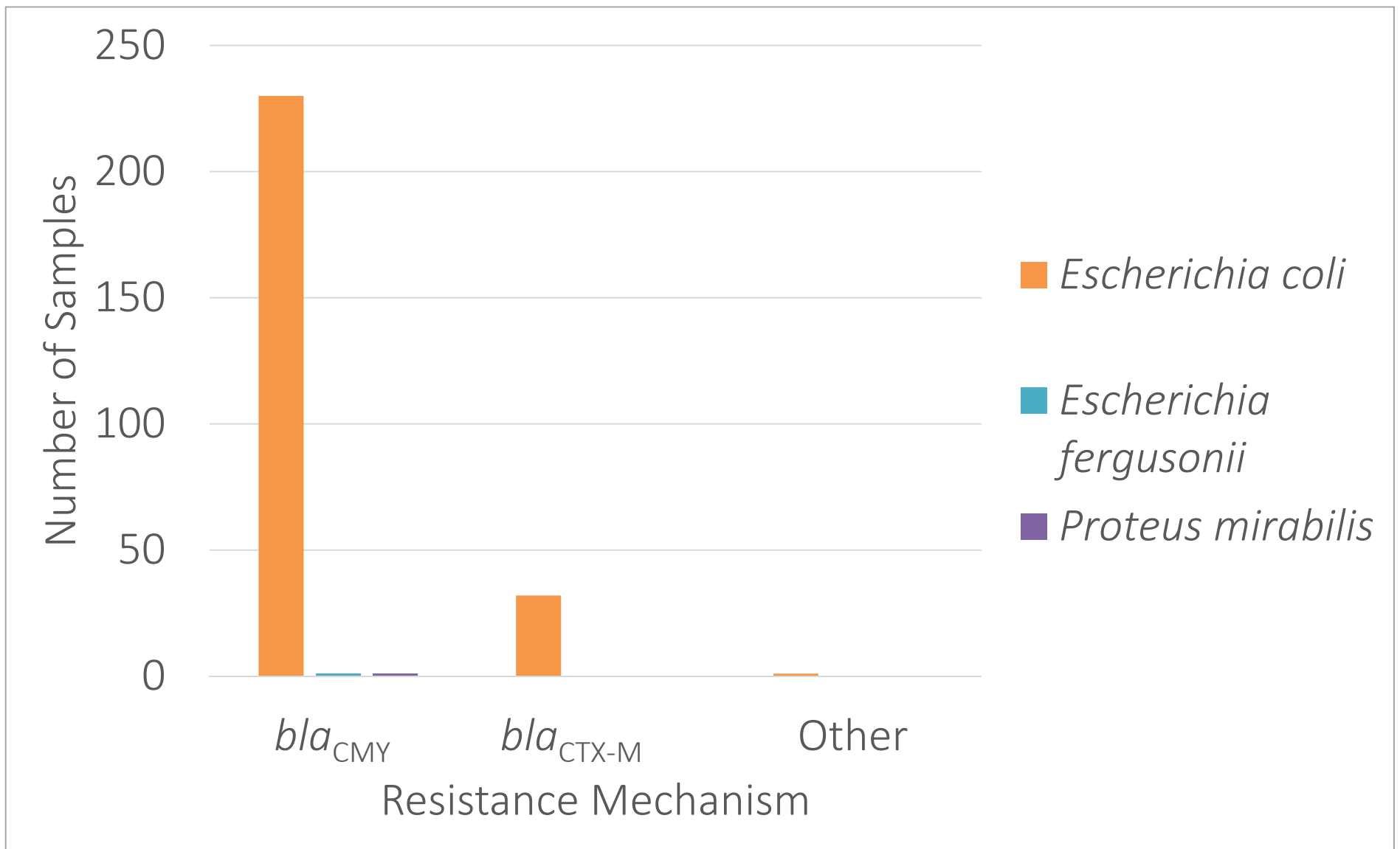


Figure 1. The frequency of ESC-resistant Enterobacteriaceae isolated from CIPARS chicken cecal samples and their resistance mechanisms.

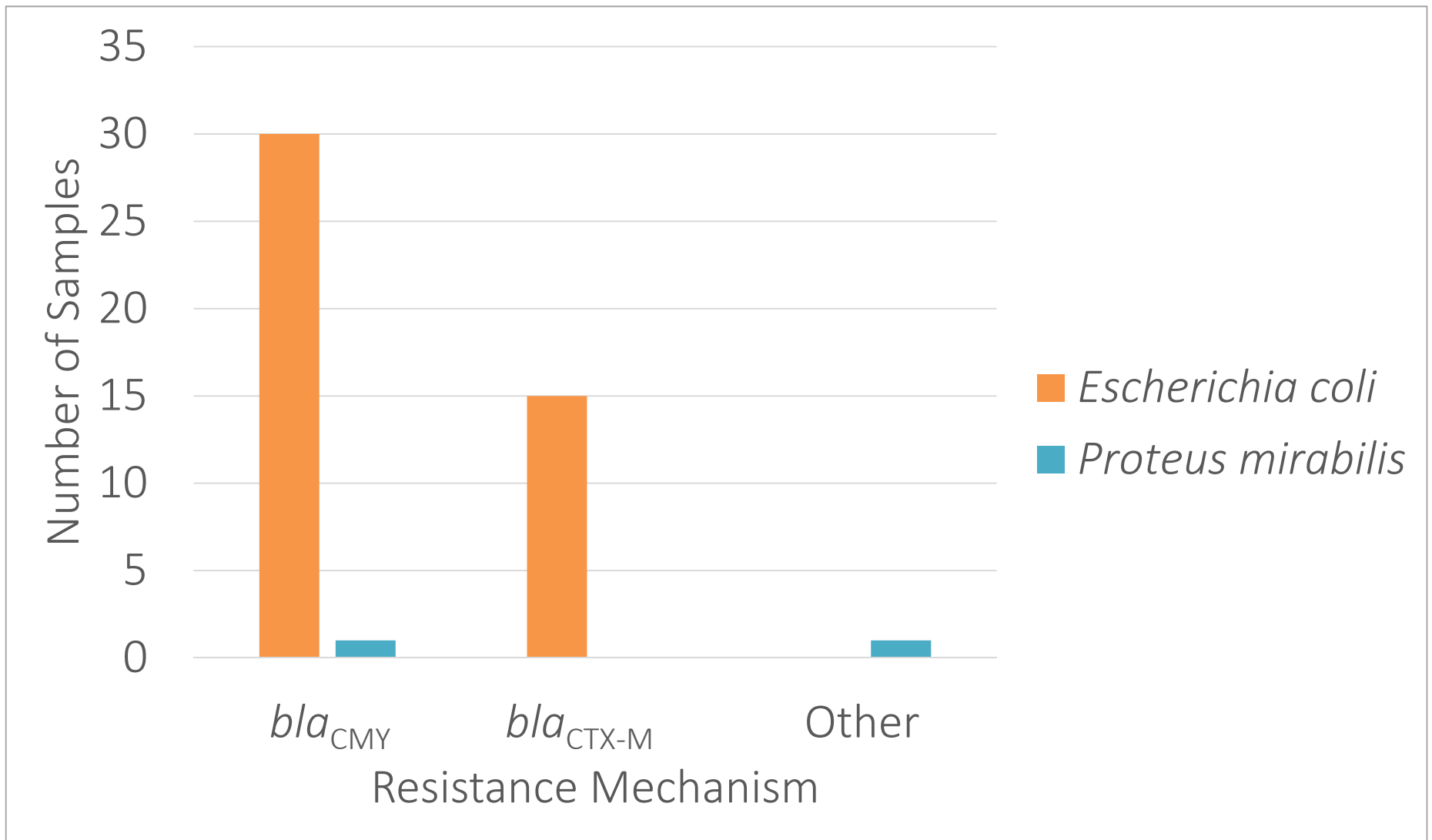


Figure 2. The frequency of ESC-resistant Enterobacteriaceae isolated from CIPARS swine cecal samples and their resistance mechanisms.

Table 4. The frequency of ESC resistance in Enterobacteriaceae in chicken and pig samples.

Animal	Origin	Frequency of ESC Resistance
Chickens	Cecal	98%
	Clinical	21%
Pigs	Cecal	70%
	Clinical	13%

Table 5. The frequency of resistance mechanisms in ESC-resistant *E. coli* from chickens and pigs.

Animal	Origin	Resistance Mechanism Frequency			Total Samples
		<i>bla</i> _{CMY}	<i>bla</i> _{CTX-M}	Other	
Chickens	Cecal	97%	13%	0.4%	238
	Clinical	96%	6%	4%	49
Pigs	Cecal	88%	44%	0%	34
	Clinical	56%	11%	33%	9

Conclusions

- ❑ Majority of cecal and clinical resistant isolates were *E. coli*
- ❑ Proportions of different ESC resistance genes were similar between commensals and pathogens
- ❑ No *bla*_{SHV} nor any major carbapenemase genes found
- ❑ A large proportion of chickens and pigs in Ontario carry ESC-resistant *E. coli* in their gut
 - But present in relatively low concentrations and most are only detectable using selective media

Acknowledgements

Advisory Committee:

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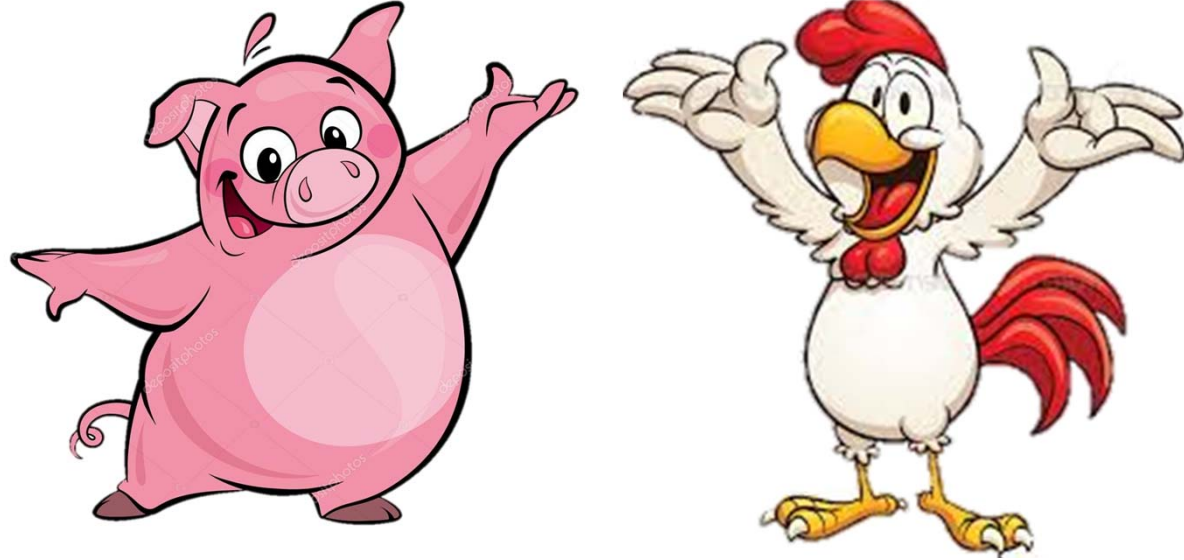
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Thank you!

QUESTIONS?

