

# Prevalence and characterization of *Arcobacter* spp. isolated from retail seafood in Germany



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## Introduction

*Arcobacter* species are considered emerging zoonotic pathogens which could provoke human gastroenteritis. However, information about the prevalence of *Arcobacter* in seafood products is still scarce. This study aimed to investigate the prevalence of *Arcobacter* spp. in retail seafood like shellfish (mussels and clams), shrimps and cephalopods (squids and octopus) in Germany, with further characterization of the isolates.

## Methods and Materials

A total of 318 seafood samples, including 106 shellfish (mussels and clams), 106 shrimps and 106 cephalopods (squids and octopuses) were collected from local retailers within a 13-month period in Berlin.

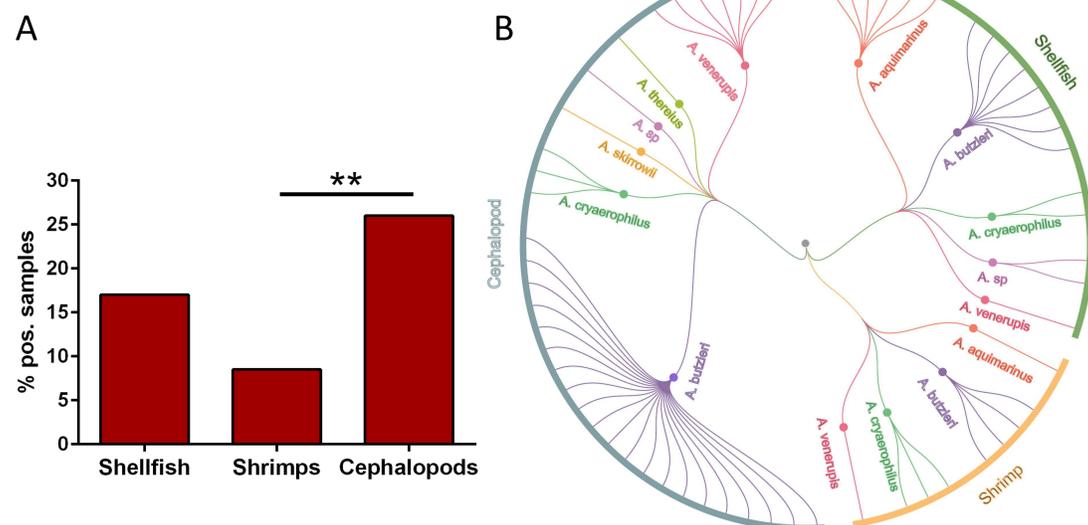
*Arcobacter* spp. were recovered and isolated by cultural methods<sup>1</sup> and verified at species level by mPCR<sup>2</sup> and *rpoB* sequencing<sup>3,4</sup>. All isolated strains were characterized by ERIC-PCR<sup>5</sup>. Furthermore, the occurrence of 10 putative *Arcobacter* virulence genes were detected by PCR<sup>6,7</sup>. Statistical differences were calculated by Fisher's exact test with GraphPad Prism V6 software.

## Results and Discussion

Overall, *Arcobacter* spp. were isolated from 55 out of 318 (17%) seafood samples with a total of 6 determined species and three isolates which could not be determined to species level by *rpoB* and 16S rRNA gene sequencing. Among all 62 isolates, 55% belong to *A. butzleri*, followed by 15% of *A. venerupis*, 13% of *A. cryaerophilus* and 11% *A. aquimarinus*. *A. skirrowii* and *A. thereius* were only detected once, respectively.

In our study, *Arcobacter* showed wide distribution among all three seafood sources (Fig. 1) with a proportion of 26% (28/106) in cephalopods, 17% (18/106) in shellfish and 8.5% (9/106) in shrimp samples.

More remarkably, cephalopods as a common food item among Mediterranean cuisines and sometimes served raw in Korean dishes possessed highest percentage of *A. butzleri*, *A. venerupis* and *A. cryaerophilus* compared to shellfish and shrimp. The highest diversity of *Arcobacter* spp. was also detected in cephalopods.



**Fig. 1** Prevalence (A) and distribution (B) of *Arcobacter* spp. isolated from retail seafood; B: each string represents one isolate

The ERIC-PCR (Fig. 2) showed limited capacity in *Arcobacter* spp. genotyping. Most strains belonging to the species *A. butzleri* were well grouped in one big cluster (Cluster I) while only one *A. butzleri* strain was excluded. Among the other minor clusters, strains of *A. venerupis* (Cluster II) and *A. aquimarinus* (Cluster III) showed somehow certain extends of homogeneity by ERIC PCR with few outsiders grouped in other clusters. However, most strains of the species *A. cryaerophilus* seemed to group more randomly, which might be due low number of strains or genetic heterogeneity.

The occurrence of virulence genes seemed to be higher in *A. butzleri* compared to the other species. All strains of *A. butzleri* contained *ciaB*, *cj1349*, *mviN*, *pldA*, *tlyA* and *cadF*. Only *ciaB* was detected among all *Arcobacter* spp. by our method.

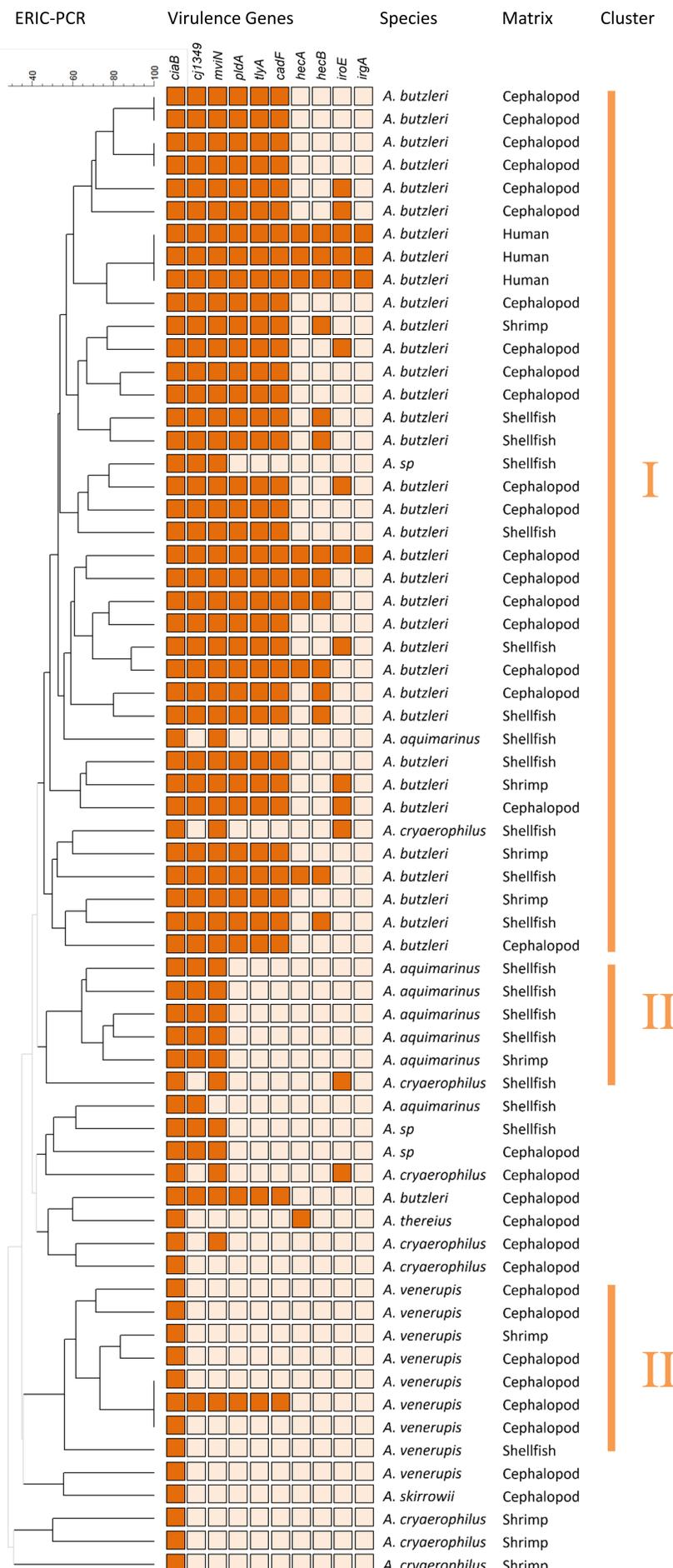
## Conclusion

In this study, the prevalence of *Arcobacter* in retail seafood was 17%, which in agreement with other studies. In addition, this is the first report of *Arcobacter* in cephalopods to our knowledge, in which *Arcobacter* spp. could be detected with a rather high prevalence. We suggest that *A. butzleri* possess the highest risk for human infection with *Arcobacter* due to its highest prevalence among seafood and highest occurrence of putative virulence genes.

These data support the potential risk of *Arcobacter* contamination and transmission to humans by consumption of retail seafood.

## References

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**Fig. 2** Dendrogram based on ERIC-PCR of 62 strains of *Arcobacter* spp. isolated from retail seafood. A human *A. butzleri* strain was included as reference strain. Virulence gene pattern: orange = gene present, pale orange = gene absent

