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Separation and analysis of different types of nematocysts from *Cyanea capillata*

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Introduction

Jellyfish have an increasing impact on ecosystems worldwide. Equipped with nematocyst bearing-stinging cells, they are competitors for fish and consume a large amount of zooplankton. Different types of nematocysts are found in the tissue and the entirety of the nematocysts, the cnidom, varies in individuals of the same species. It is unknown to what extent the environment of these animals influences the cnidom and the potential toxins of the capsules.

The aim of this study was to analyse the cnidom of the scyphomedusa *Cyanea capillata* from the North Sea and the Baltic Sea with regard to biological and biochemical aspects.

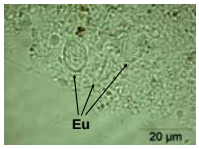

Figure 1. Eurytele (Eu) of *Cyanea capillata*

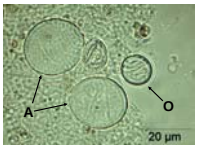

Figure 2. A- and O-isorhizas (A, O) of *Cyanea capillata*

Materials and methods

Table 1. Description of collected samples

sample	number of individuals	habitat	smallest- largest individual Ø [cm]	mean Ø [cm]
NS1	7	North Sea	16-31	24
NS2	48	North Sea	11-20	13
BS	72	Baltic Sea	11-28	21

Figure 3. *Cyanea capillata* medusa

The methods used were:

- **Counting of different types of nematocysts in the fishing tentacle capsule suspension under the microscope**
- **Measurement of capsule sizes with analySIS**
- **Separation of nematocyst types with LMPC* and analysis of capsule content of distinct capsules with MALDI-TOF MS****

***laser microdissection and pressure catapulting**
****matrix-assisted laser desorption ionization time-of-flight mass spectrometry**

Results

1. Nematocyst types and numbers

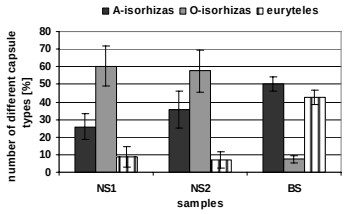

Figure 3. Number of different nematocyst types [%] in suspensions of fishing tentacles of medusae from the North Sea (NS1 and NS2) and from the Baltic Sea (BS)

Significant differences between the samples ($P > 0.05$)

- **A-isorhizas had different percentages in all three samples.**
- **The number of O-isorhizas was lower in the BS sample than in the two NS samples.**
- **There were more euryteles in the BS sample than in the two NS samples.**

2. Nematocyst sizes and shapes

Table 2. Sizes of three nematocyst types of *C. capillata* (North Sea and Baltic Sea)

	A-isorhizas			O-isorhizas			euryteles		
	length [µm]	width [µm]	length/ width	length [µm]	width [µm]	length/ width	length [µm]	width [µm]	length/ width
NS1	23.9	18.5	1.3	15.0	12.5	1.2	13.1	7.6	1.7
NS2	23.9	18.8	1.3	15.6	13.1	1.2	13.7	7.9	1.7
BS	16.6	11.5	1.5	13.3	11.0	1.2	13.3	7.6	1.8

Significant differences between the samples ($P > 0.05$)

- **A-isorhizas were shorter and narrower in BS samples than in NS1 and NS2 and had a more elongated shape than the capsules of both NS samples.**
- **O-isorhizas were shorter and narrower in BS samples than in NS1 and NS2.**
- **Euryteles from the different sampling locations did not differ significantly.**

3. Protein patterns in nematocyst types analysed with MALDI-TOF MS

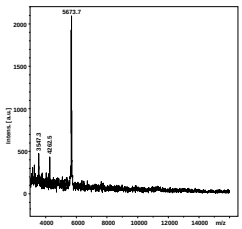

Figure 4. Example of a mass spectrum of separated O-isorhizas from *Cyanea capillata* from the North Sea (NS2)

- **A-isorhizas: The two signals detected in BS (5090.7 kDa and 7741.6 kDa) were also found in both NS samples. In NS1 some signals were detected, which were neither found in NS2 nor in the BS sample.**
- **O-isorhizas: All three samples had two signals in common (3544 kDa and 5672 kDa).**
- **Euryteles: NS1 and BS had two signals in common (3546.6/3550.4 kDa and 5674 kDa). Four signals were exclusively detected in the BS sample (5090.8 kDa, 7742.4 kDa, 12980.8 kDa and 16272.4 kDa). For NS2 no results were available.**

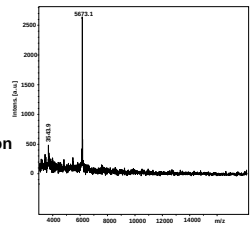

Figure 5. Example of a mass spectrum of separated O-isorhizas from *Cyanea capillata* from the Baltic Sea (BS)

Conclusions and Outlook

- ✓ **In the Baltic Sea sample an increased amount of euryteles and a decreased amount of O-isorhizas were found.**
- ✓ **Differences in size and shape of certain nematocyst types were observed.**
- ✓ **Protein patterns showed distinct differences between nematocyst types as well as between sampling locations.**
- ❖ **Further samples from the North Sea and the Baltic Sea as well as samples from controlled laboratory experiments are under investigation.**