**How does environment influence fighting? The effects of tidal flow on resource value and fighting costs in sea anemones**

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Fig S1. (a) Schematic representation of the experimental aquarium. Individuals were accommodated on both parts – the outer circle and the inner circle – but only individuals on the outer circle received flow on day 8. Arrows indicate where the reef pumps were positioned and that water flowed on both directions to simulate the tidal cycle. (b) Experimental design with and inset for the simulation of the tidal cycles, (c) in which arrows indicate the flow direction and the numbers indicate how many hours in each stage. Dotted lines indicate resting periods in which the pumps were turned off and inverted the direction.

METHODS

Startle response duration, dry weight and nematocyst length presented an exponential distribution, rather than a Gaussian distribution that is required for F-tests. Thus, we log-transformed them prior to analyses. Additionally, we scaled startle response duration 2, dry weight and nematocyst length when using them as continuous co-variables. We centered their means to zero and made their variances uniform by dividing the variable by one-time their standard deviation. Centering and scaling variables help in parameter estimation and make parameters easily interpretable and comparable when significant interactions are present (Schielzeth 2010, reference 16 in the manuscript). To test if individuals exposed to flowing seawater perceived a higher V than individuals that were not exposed to flow, we used an ANCOVA with the following model:

Log(Startle response duration 2) ~ scale(log(Startle response duration 1) \* treatment

Next, to test the effects of the treatment on contest outcome and contest escalation while controlling for RHP traits, we used the following GLMs:

Contest outcome ~ Focal\_treatment \* Opponent\_treatment + Focal\_scale(log(Startle response duration 2)) + Opponent\_scale(log(Startle response duration 2)) + Focal\_scale(log(dry weight + 1)) + Opponent\_scale(log(dry\_weight + 1)) + Focal\_scale(log(nematocyst length + 1)) + Opponent\_scale(log(nematocyst length + 1))

Contest escalation ~ Focal\_treatment \* Opponent\_treatment + Focal\_scale(log(Startle response duration 2)) + Opponent\_scale(log(Startle response duration 2)) + Focal\_scale(log(dry weight + 1)) + Opponent\_scale(log(dry\_weight + 1)) + Focal\_scale(log(nematocyst length + 1)) + Opponent\_scale(log(nematocyst length + 1))

Lastly, to test the effects of treatments on contest duration while controlling for RHP traits, we used the following linear regression:

Log(contest duration) ~ Focal\_treatment \* Opponent\_treatment + Focal\_scale(log(Startle response duration 2)) + Opponent\_scale(log(Startle response duration 2)) + Focal\_scale(log(dry weight + 1)) + Opponent\_scale(log(dry\_weight + 1)) + Focal\_scale(log(nematocyst length + 1)) + Opponent\_scale(log(nematocyst length + 1))

Table S1. Significance test from the logistic model to examine to effect of environmental cues and RHP-traits on contest outcome. All effects were log10-transformed, centred and scaled prior to being used in the model. Marginally significant effects are printed in italics.

|  |  |  |  |
| --- | --- | --- | --- |
| Effect | χ2 | df | P-value |
| Focal treatment | 1.433 | 1 | 0.231 |
| *Opponent treatment* | *3.603* | *1* | *0.058* |
| *Focal startle response 2* | *3.460* | *1* | *0.063* |
| Opponent startle response 2 | 1.030 | 1 | 0.310 |
| Focal dry weight | 1.175 | 1 | 0.278 |
| Opponent dry weight | 1.916 | 1 | 0.166 |
| Focal nematocyst length | 1.058 | 1 | 0.303 |
| Opponent nematocyst length | 0.526 | 1 | 0.468 |
| Focal treatment \* Opponent treatment | 1.002 | 1 | 0.317 |
| Residuals | 81.836 | 60 | - |

df: degrees of freedom

Table S2. Significance test from the logistic model to examine to effect of environmental cues and RHP-traits on contest escalation. All effects were log10-transformed, centred and scaled prior to being used in the model. Significant effects are printed in bold.

|  |  |  |  |
| --- | --- | --- | --- |
| Effect | χ2 | df | P-value |
| Focal treatment | 2.409 | 1 | 0.121 |
| Opponent treatment | 1.860 | 1 | 0.172 |
| Focal startle response 2 | 0.407 | 1 | 0.523 |
| Opponent startle response 2 | 0.879 | 1 | 0.348 |
| Focal dry weight | 2.770 | 1 | 0.096 |
| **Opponent dry weight** | **5.652** | **1** | **0.017** |
| Focal nematocyst length | 0.331 | 1 | 0.565 |
| Opponent nematocyst length | 0.090 | 1 | 0.763 |
| **Focal treatment \* Opponent treatment** | **6.268** | **1** | **0.012** |
| Residuals | 66.479 | 60 | - |

df: degrees of freedom

Table S3. Significance test from the linear model built to examine to effect of environmental cues and RHP-traits on contest duration. All effects were log10-transformed, centred and scaled prior to being used in the model. Significant effects are printed in bold and marginally significant are printed in italics.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Effect | Sum of squares | F-value | df | P-value |
| Focal treatment | 0.124 | 0.284 | 1 | 0.596 |
| **Opponent treatment** | **1.877** | **4.299** | **1** | **0.042** |
| Focal startle response 2 | 0.612 | 1.402 | 1 | 0.241 |
| Opponent startle response 2 | 0.129 | 0.295 | 1 | 0.589 |
| **Focal dry weight** | **1.786** | **4.090** | **1** | **0.047** |
| Opponent dry weight | 0.103 | 0.236 | 1 | 0.629 |
| Focal nematocyst length | 0.032 | 0.072 | 1 | 0.788 |
| *Opponent nematocyst length* | *1.725* | *3.952* | *1* | *0.051* |
| *Focal treatment \* Opponent treatment* | *1.697* | *3.886* | *1* | *0.053* |
| Residuals | 26.195 | - | 60 | - |

df: degrees of freedom

Table S4. Mean contest duration (log ± SE) of fighting sea anemones (*Actinia equina*) presented in Fig. 1d. Focal individuals are on columns and opponents on lines.

|  |  |  |
| --- | --- | --- |
|  | Flow | No-flow |
| Flow | 7.44 (± 0.16) | 6.71 (± 0.13) |
| No-flow | 7.00 (± 0.14) | 7.07 (± 0.18) |