FIELD ORIENTATION OF LABORATORY-BORN JUVENILES IN TWO ITALIAN POPULATIONS OF *TALITRUS SALTATOR*

Simone Gambineri and Felicita Scapini
Dipartimento di Biologia Animale e Genetica "Leo Pardi"
Università di Firenze

[1]

[2]

[3]

[4]

Figure 1 *- Talitrus saltator*

Figure 2 *- Beach of the Tenuta di San Rossore (Pisa)*

Figure 3 *- Beach of the Parco della Maremma - Uccellina (Grosseto)*

Figure 4 *- Experimental arena on the beach*

INTRODUCTION

Freshly collected and laboratory-born young of *Talitrus saltator* (Crustacea, Amphipoda) from the populations of the "Tenuta di San Rossore" (Pisa) and the "Parco Regionale della Maremma - Uccellina" (Grosseto), were tested individually to estimate the importance of local factors in the orientation on the beach and possible innate differences among the populations. The inheritance of sun orientation in was already known in this species (Pardi and Scapini, 1983), but orientation to local factors was not yet studied in inexperienced individuals (born in laboratory and tested on the beach).

MATERIALS & METHODS

The FIRST SERIES of experiments was conducted in both localities; we tested the field orientation of laboratory-born juveniles derived from the local population and maintained in controlled conditions till the experiment, and of juveniles captured in loco.

In the SECOND SERIES of experiments, we tested laboratory-born juveniles from both populations on their beach and on the different beach: on both the beaches of San Rossore and Maremma, we tested two groups of laboratory-born juveniles one after the other, one composed of individuals from San Rossore, and the from Maremma.

We released the sandhoppers on the beach and allowed the animals to use both local and astronomical references for orientation. We alternated individuals of the two samples.

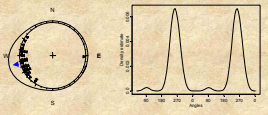
We analysed the data with models of multiple regression adapted to angular data, that included the different factors that could affect on orientation (Marchetti and Scapini, 2003).

RESULTS

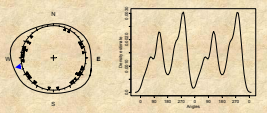
FIRST SERIES

Releases on San Rossore beach

juveniles captured in loco



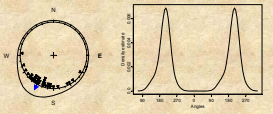
laboratory-born juveniles



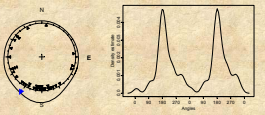
San Rossore	Numero Animali	Angolo Medio	Lunghezza Vettore	p (Rayleigh test)
Totale piccoli raccolti in spiaggia	40	257,1°	0,8846	p < 0,001
Totale piccoli nati in laboratorio	40	225,8°	0,1744	p = 0,275 *

Releases on Maremma beach

juveniles captured in loco



Laboratory-born juveniles



Uccellina	Numero Animali	Angolo Medio	Lunghezza Vettore	p (Rayleigh test)
Totale piccoli raccolti in spiaggia	40	206,1°	0,8576	p < 0,001
Totale piccoli nati in laboratorio	40	198,1°	0,5929	p < 0,001

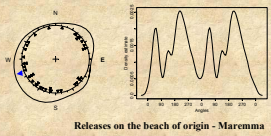
* Method of the angles redoubling: p = 0,003

The blue arrows in the circular graphics indicate the TED - theorical escape direction toward the sea -

SECOND SERIES

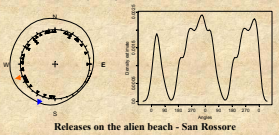
Releases on the beach of origin - San Rossore

laboratory - born juveniles from San Rossore



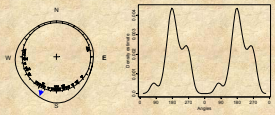
Releases on the alien beach - Maremma

laboratory born juveniles from San Rossore



Releases on the beach of origin - Maremma

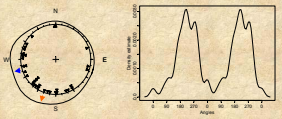
laboratory-born juveniles from Maremma



Popolazione	Numero Animali	Angolo Medio	Lunghezza Vettore	p (Rayleigh test)
Piccoli originari di San Rossore a San Rossore	40	209°	0,2087	p =0,203 *
Piccoli originari dell'Uccellina all'Uccellina	40	198,8°	0,6779	p < 0,001

Releases on the alien beach - San Rossore

laboratory born juveniles from Maremma



Popolazione	Numero Animali	Angolo Medio	Lunghezza Vettore	p (Rayleigh test)
Piccoli originari di San Rossore all'Uccellina	40	315,3°	0,4002	p = 0,001
Piccoli originari dell'Uccellina a San Rossore	36	227,4°	0,5119	p < 0,001

* Method of the angles redoubling : p = 0,066

The blue arrows indicate the TED in the alien beach of release

The orange arrows indicate the TED of the original population

The two groups of laboratory-born and freshly collected (born on the beach) juveniles from Maremma showed a unimodal orientation toward the sea, while the two groups from San Rossore showed a different orientation between them. In the latter population, the freshly collected juveniles showed a unimodal orientation toward the sea, while the laboratory-born juveniles showed a bimodal orientation to two opposite directions: the sea and the dune.

The multiple regression model best adapted to data included as significant factors: *population (expert / inexperienced) and air temperature (26° - 40°C).*

The data of the second series confirmed the orientation of laboratory-born juveniles on their beach (highlighted in the first series, on the left). In the cross releases performed on the alien beach, the laboratory-born juveniles from Maremma were able to orient to the sea also at San Rossore, while the laboratory-born juveniles from San Rossore tested on the Maremma beach prevalently assumed a scototactic direction to the falaise.

The model of multiple regression best adapted to data included as factors: *population (Maremma / San Rossore), place (Maremma / San Rossore), sky cloudness (0/8 - 4/8).*

DISCUSSION & CONCLUSIONS

The results showed a difference in the orientation behaviour of two populations. This difference seems to be innate and genetic because it was shown by laboratory-born juveniles.

The sun orientation capability of juvenile sandhoppers from the Maremma population was evident, while the San Rossore population seemed to privilege a scototactic response rather than sun orientation. The prevalence of scototaxis in the San Rossore population is presumably innate because it was shown by inexperienced juveniles.

To conclude, these experiments confirmed innate differences in the sun orientation of *Talitrus saltator* from different populations and, for the first time, highlighted differences in the response to local stimuli besides differences in sun orientation.

BIBLIOGRAPHY

Pardi L., Scapini F., 1983. Inheritance of solar direction finging in sandhoppers: mass crossing experiments. *Journal Comparative Physiology*, 151, pp. 435-440.

Marchetti G.M., Scapini F. 2003. Use of multiple regression models in the study of sandhopper orientation under natural conditions. *Estuarine, Coastal and Shelf Science 58S (2003)*, pp. 207-215

ACKNOWLEDGEMENTS

We thank the directions of the Tenuta di San Rossore and the Parco Regionale della Maremma for the permission to accomplish the experiments within the parcs. This work was funded by the European Union, Project ICA3-CT2002-10003.