Project Report Sea Urchin Development Sea urchin development on the example of Sphaerechinus granularis

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Sea urchin development on the example of *Sphaerechinus granularis*

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Introduction

Sea urchins or Echinoida belong to the Phylum of Echinodermata. In our marine excursion to Calvi, we work with three different species: *Arbacia lixula*, *Paracentrotus lividus* as well as *Sphaerechinus granularis* (Figure 1). As we have learned from the basic zoological course, there do exist two different groups of sea urchins: the Regularia and the Irregularia. Regularia have a major axis from the mouth to the anus and they exhibit a pentameric body shape, whereas the Irregularia show a secondary bilateral body axis. We collected our experimental animals, which all belong to the Regularia, in the harbor basin of the Stareso research Station at Revellata/Calvi. Typical habitats of the sea urchins we found are rocks, concrete walls in the harbor basin as well as on the near Sea floor in a depth of one to five meters. In former excursions, a mass of datasets have been collected especially for the two Species *Arbacia lixula* and *Paracentrotus lividus*. Therefore we aimed at completing a dataset for the third important species, *Sphaerechinus granularis*.

Figure 1: The three species of sea urchins found in Stareso:

Arbacia lixula	*Paracentrotus lividus*	*Sphaerechinus granularis*
Foto: by Raphael Strohmaier	Foto: by Sabine Gufler	Foto: by Werner Bader

Systematics of these species:

Phylum	Class	Order	Family	Species
Echinodermata	Echinoidea	Arbacioida	Arbaciidae	***Arbacia lixula***
Echinodermata	Echinoidea	Camarodonta	Parachiniidae	***Paracentrotus lividus***
Echinodermata	Echinoidea	Camarodonta	Toxopneustidae	***Sphaerechinus granularis***

Materials and Methods

The specimens were directly collected from the near harbor basin of Stareso and put into a bucket, which was filled with fresh sea water. This bucket was then put to the laboratory on the first floor on Stareso Marine Station. Then, further steps to get the gametes had to be done (Figure 2). We used a 0,5 M KCl solution which was placed in a syringe. The sea urchins were positioned into a measuring cup, filled with fresh sea water. This arrangement was placed in a larger plastic container, which was located below. The KCl was injected in the soft tissue in the mouth region lateral to the "Lantern of Aristoteles". Thereby the spawning was induced. Female sea urchins can be recognized on their orange to red color of their eggs and male sea urchins can be recognized on their white up to beige color of their sperms. If it was a male sea urchin, it was dissected and the gonads were cut out and put in a test tube to cool them down in a fridge in order to have more sperm stored for further fertilization experiments.

Figure 2: Spawning of a sea urchin by KCl injection and dissection of a male to get gonads.

Results

After controlled fertilization, the development could be observed under the microscope using DIC optics. The various developmental stages were documented (Figure 3), and the timing of the progression of development until the pluteus larval stage could be analyzed quantitatively.

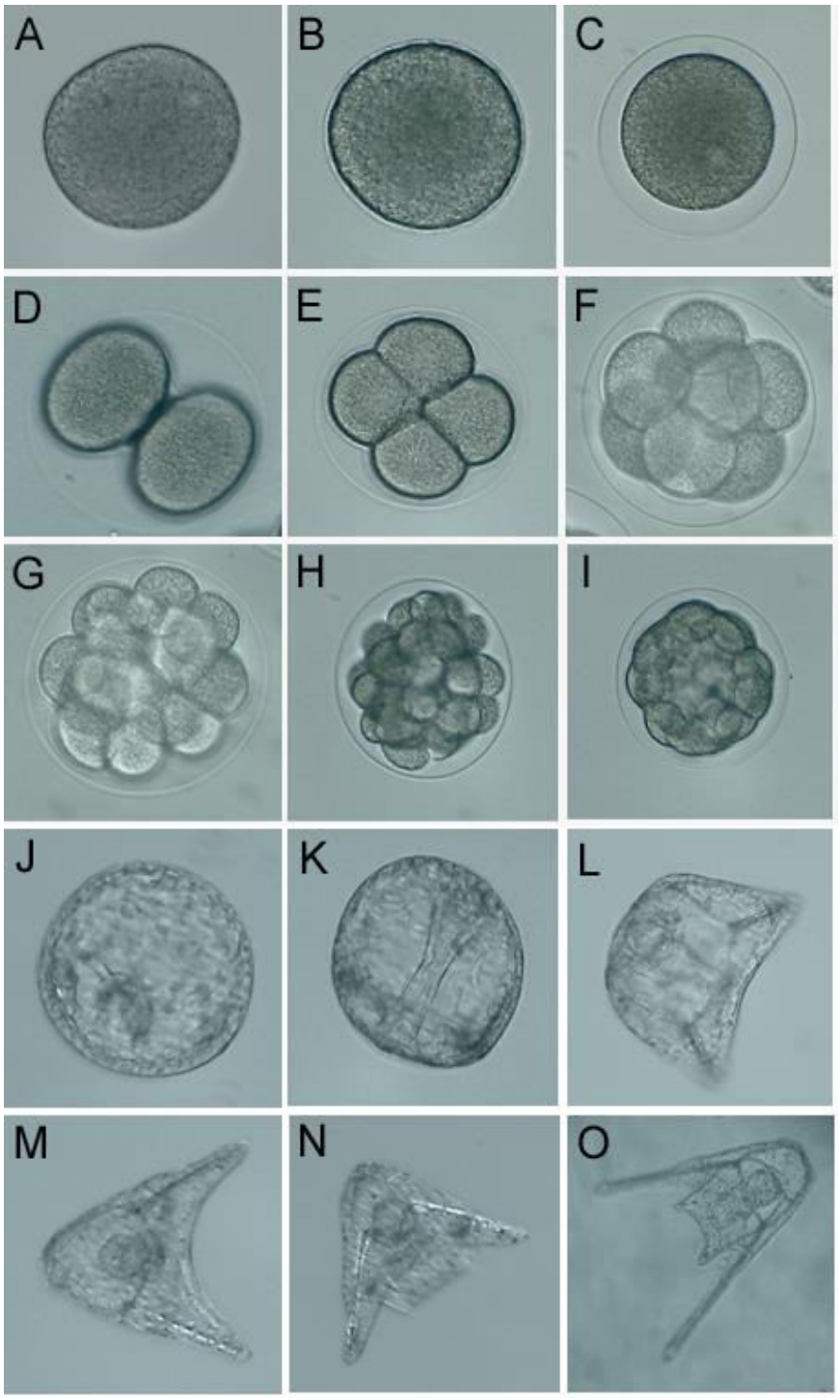

Figure 3: Developmental stages of **Sphaerechinus granularis*****. A. unfertilized egg, B. fertilized egg, C. fertilization membrane, D. 2-cell stage, E. 4-cell stage, F. 8-cell stage, G. 16-cell stage, H. 32-cell stage, I. blastula, J. early gastrula, K. gastrula, L. prism stage, M. late prism stage, N. early pluteus, O. pluteus.***

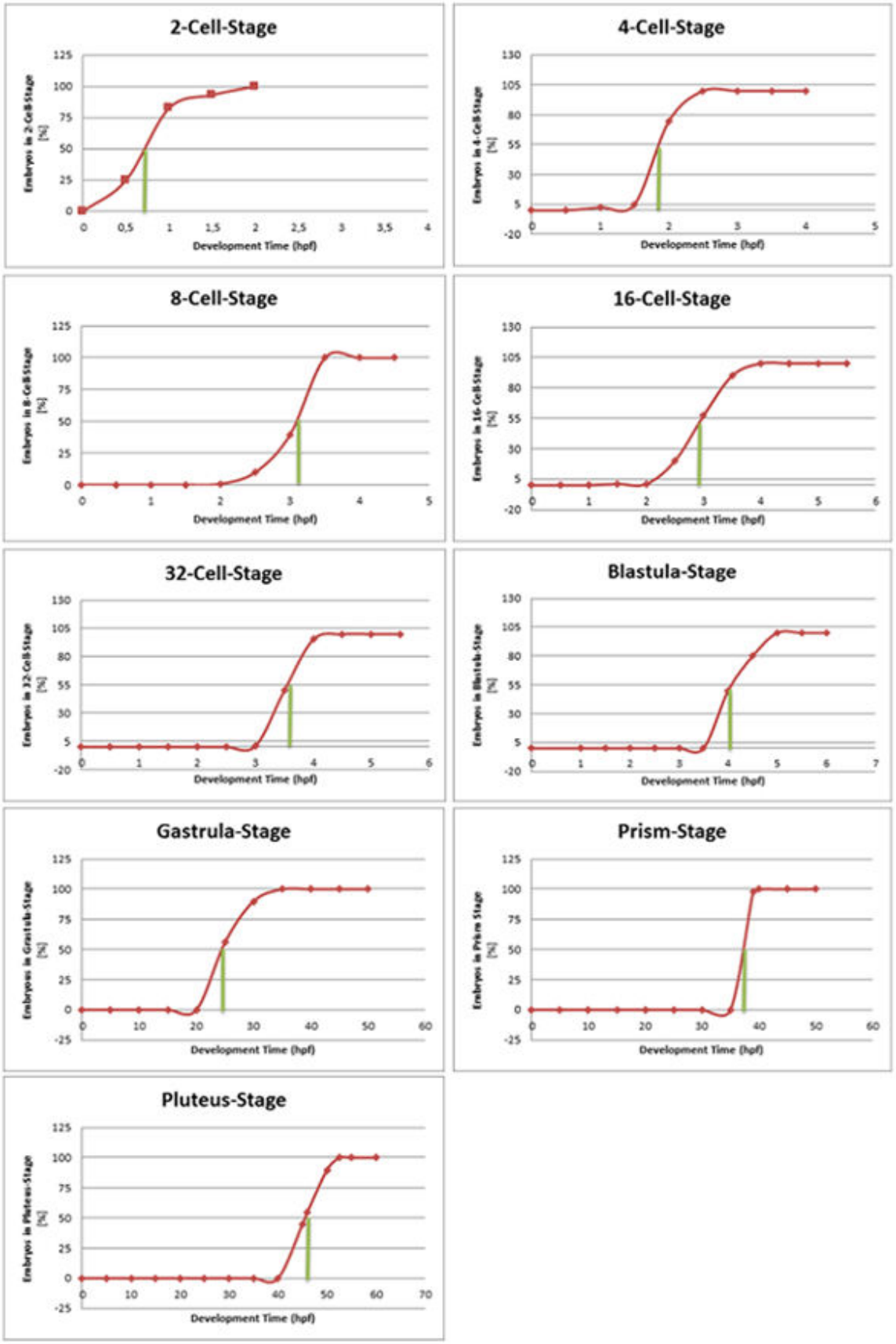

Figure 4: Timing of developmental stages of **Sphaerechinus granularis**

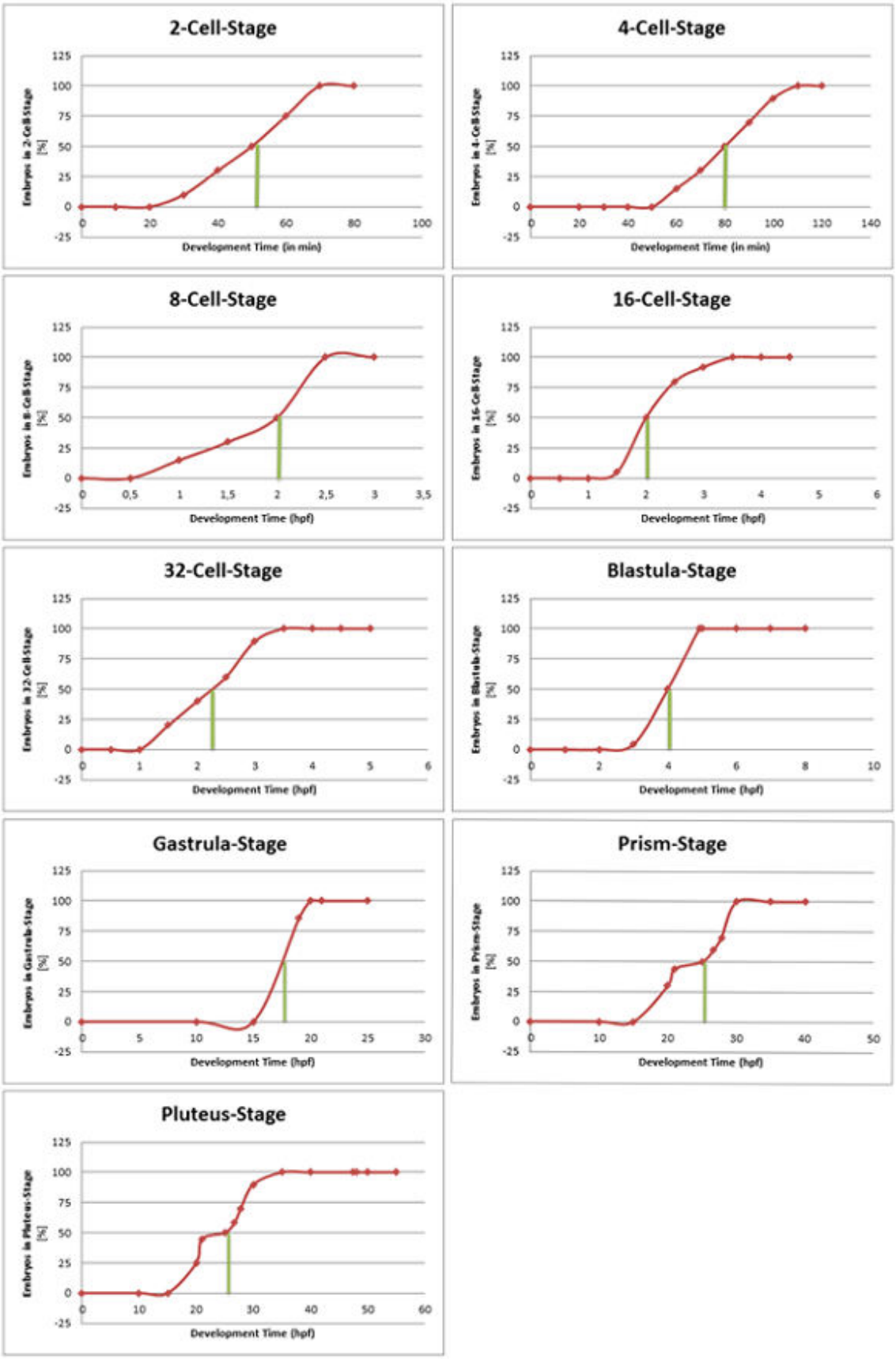

***Figure 5: Timing of developmental stages of* Arbacia lixula**

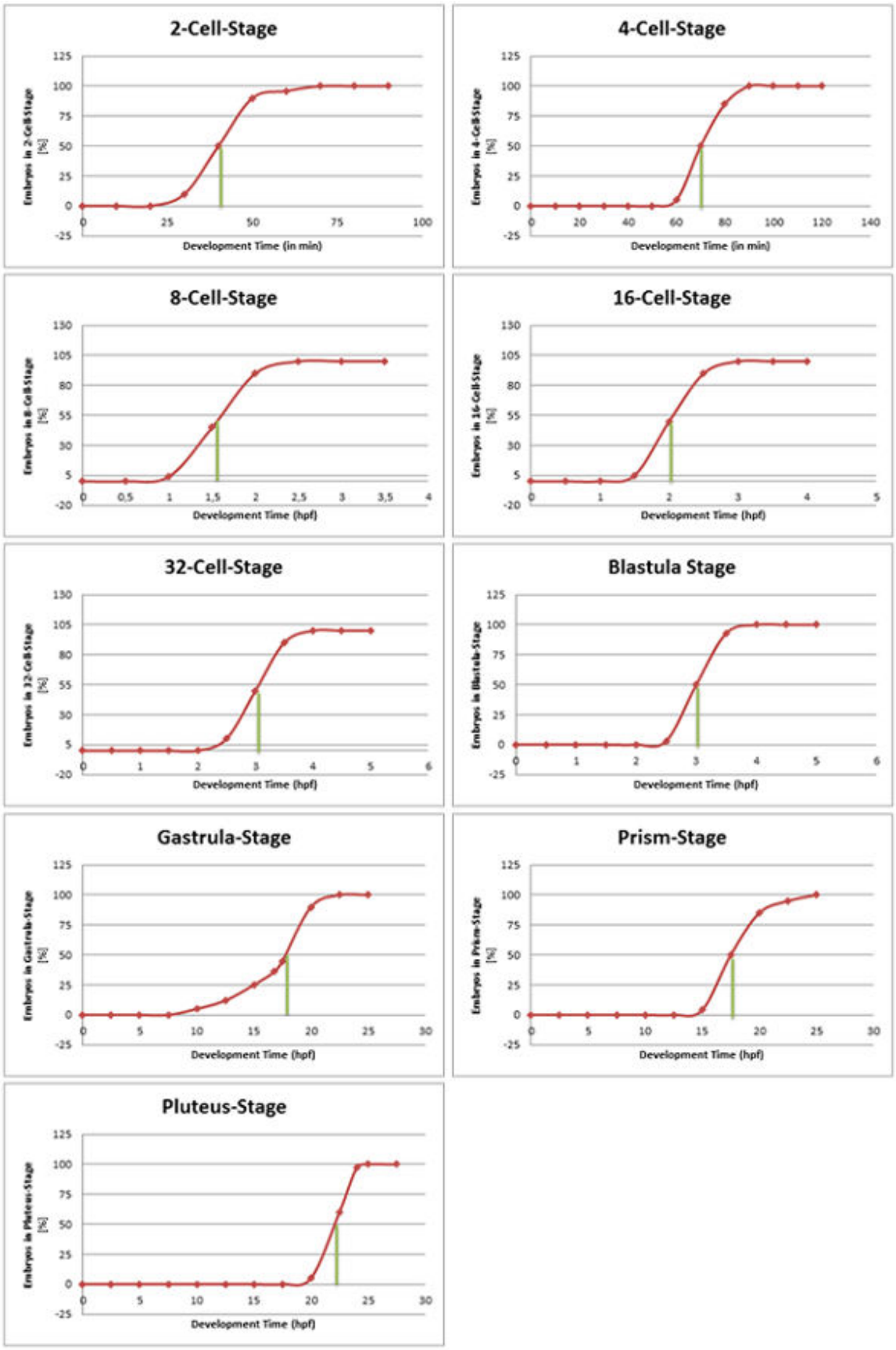

***Figure 6: Timing of developmental stages of* Paracentrotus lividus**

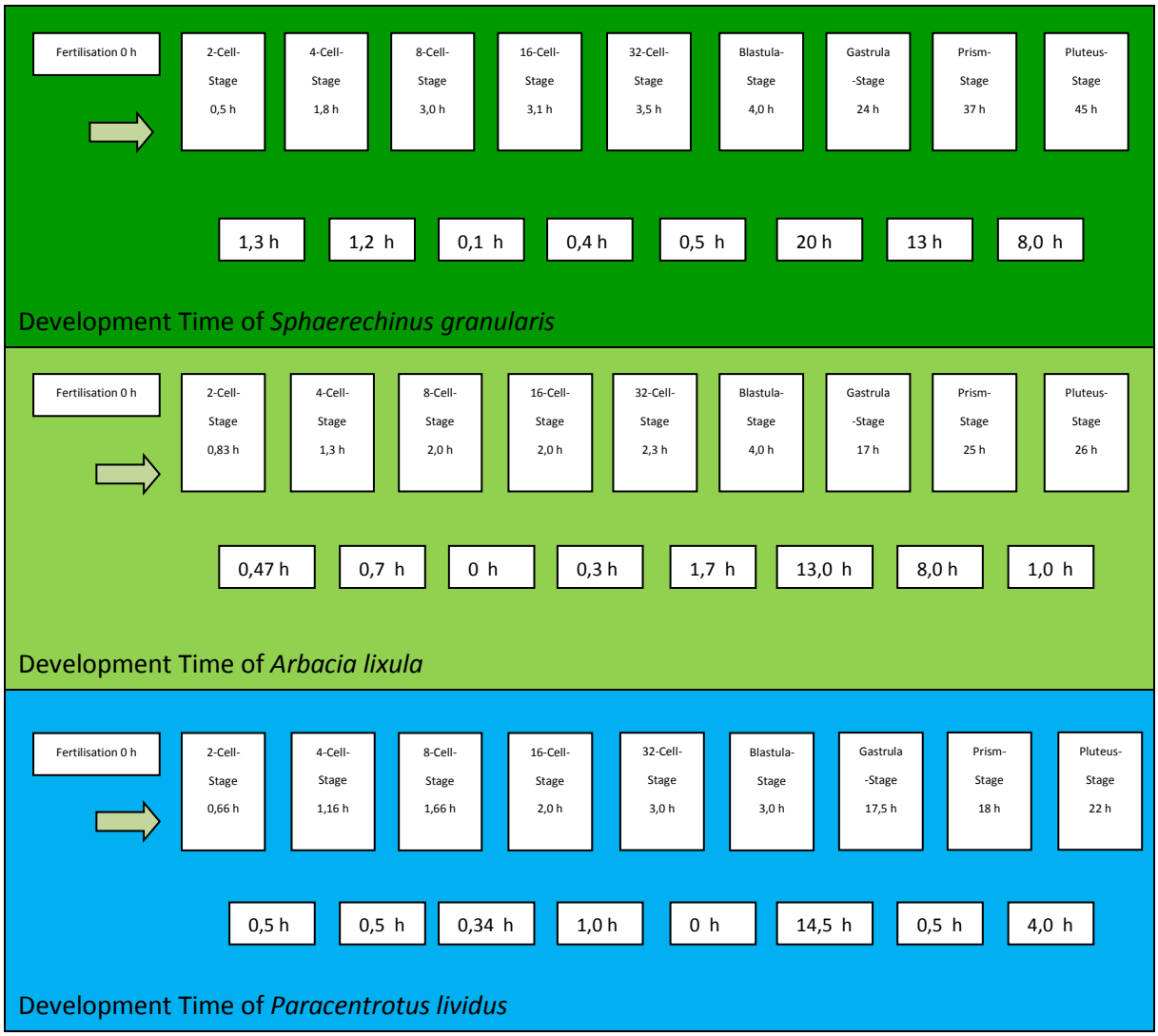

Figure 7: Comparative summary of the timing of development of the three species investigated.

Discussion

As we can recognize on the table above, the development time is significantly shorter in this year as compared with the data of the excursion to Calvi in 2012 and earlier. This is most likely due to the very good and very warm weather conditions up to 30° C all over the two weeks. They may be responsible for faster development and more rapidly occurring cleavages. Notably, also the fertilization rates were rather high during this course, even in the cross species fertilization experiments (see below).