

Effect of lower pH on settlement and development of coral, *Pocillopora damicornis* (Linnaeus, 1758)

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INTRODUCTION

The increasing levels of CO₂ in the ocean lead to a reduction in seawater pH and ocean acidification. It also threatens marine organisms which may not be able to adapt to this phenomenon. The decrease of pH can affect developmental stages of corals due to the sensitivity of the larvae in the acidity environment. In this study, we investigated the effect of lower pH on the larval development and settlement of *Pocillopora damicornis*.

METHODS

Colonies of *Pocillopora damicornis* (Linnaeus, 1758) were collected from a coastal reef of Samae San Island, Chonburi Province in the upper Gulf of Thailand and maintained in flow through aquaria at the Thai Island and Sea Natural History Museum. Larvae were randomly collected with pipettes and maintained in good condition. The experiments were prepared in the ambient temperature (28°C). Experimental pH was adjusted using an automatic CO₂ injection system, and was controlled at 7.6 and 7.9 by pH controller.



Pocillopora damicornis
larva



Study sites

MONITORING

Water quality parameters were monitored around Sattahip Bay every 3 months. Total alkalinity (TA) was measured using classical and automated Gran titration. Dissolved organic carbon, pCO₂, HCO₃⁻, CO₃²⁻, and CO₂ were then calculated using the CO2SYS program (Lewis and Wallace 1998).

CONCLUSIONS

- Larval development was delayed at pH 7.9
- Majority of larvae did not settle on the substrates at pH 7.6 and 7.9
- The rate of the larval settlement decreased more than 70% compared to the control
- A strong negative effect of pH reduction on coral larvae was observed in this study, although the function of physiology is still not clearly understood.

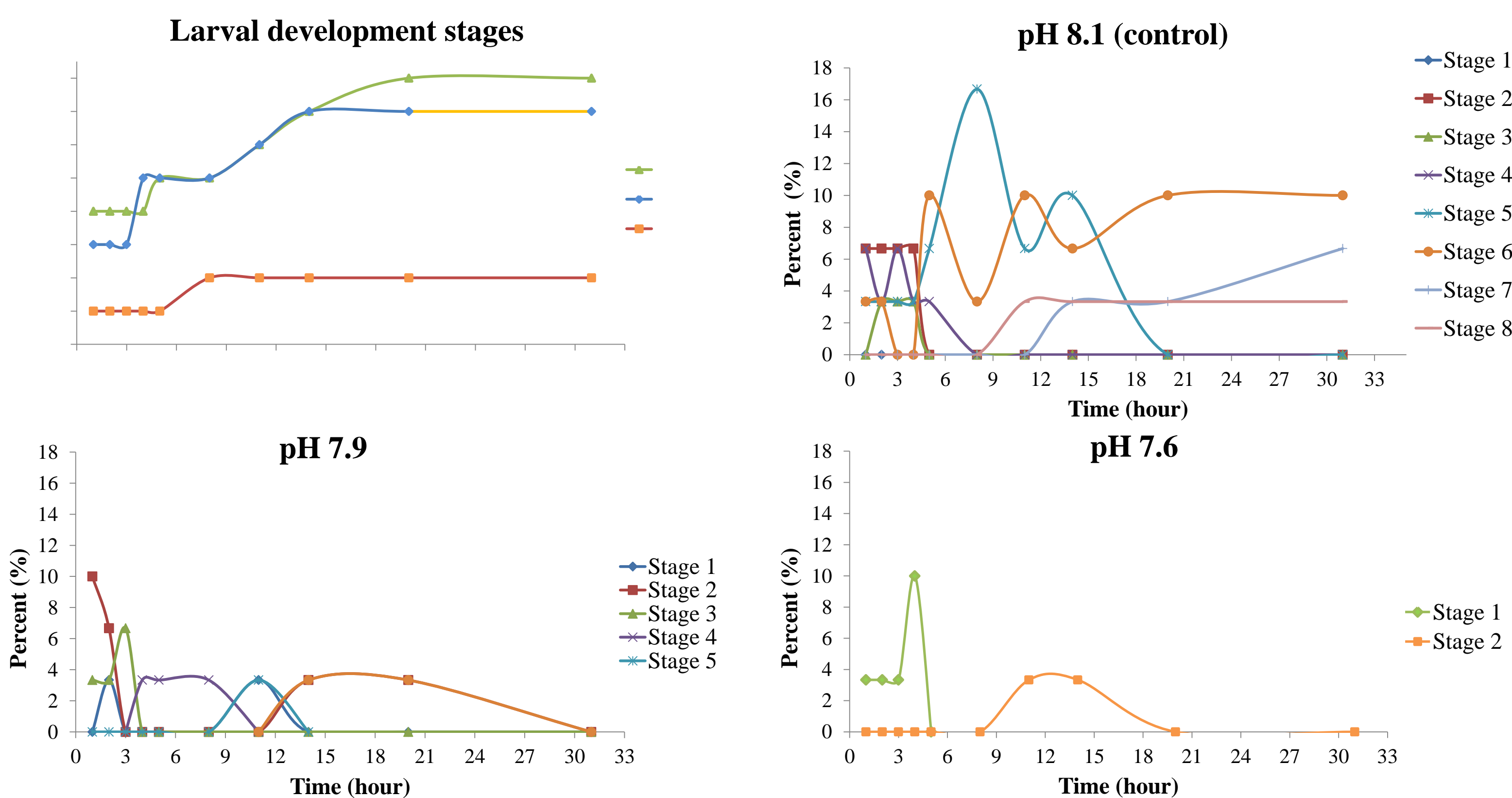
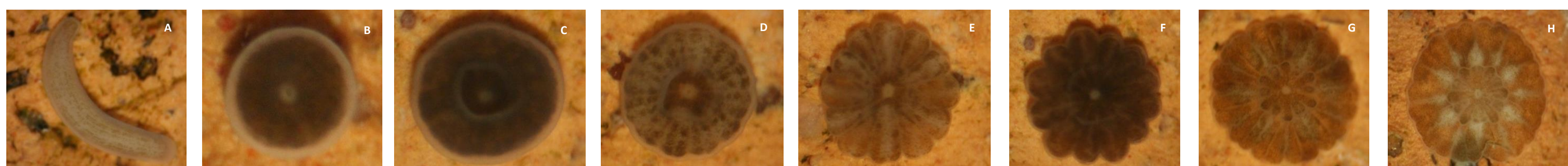
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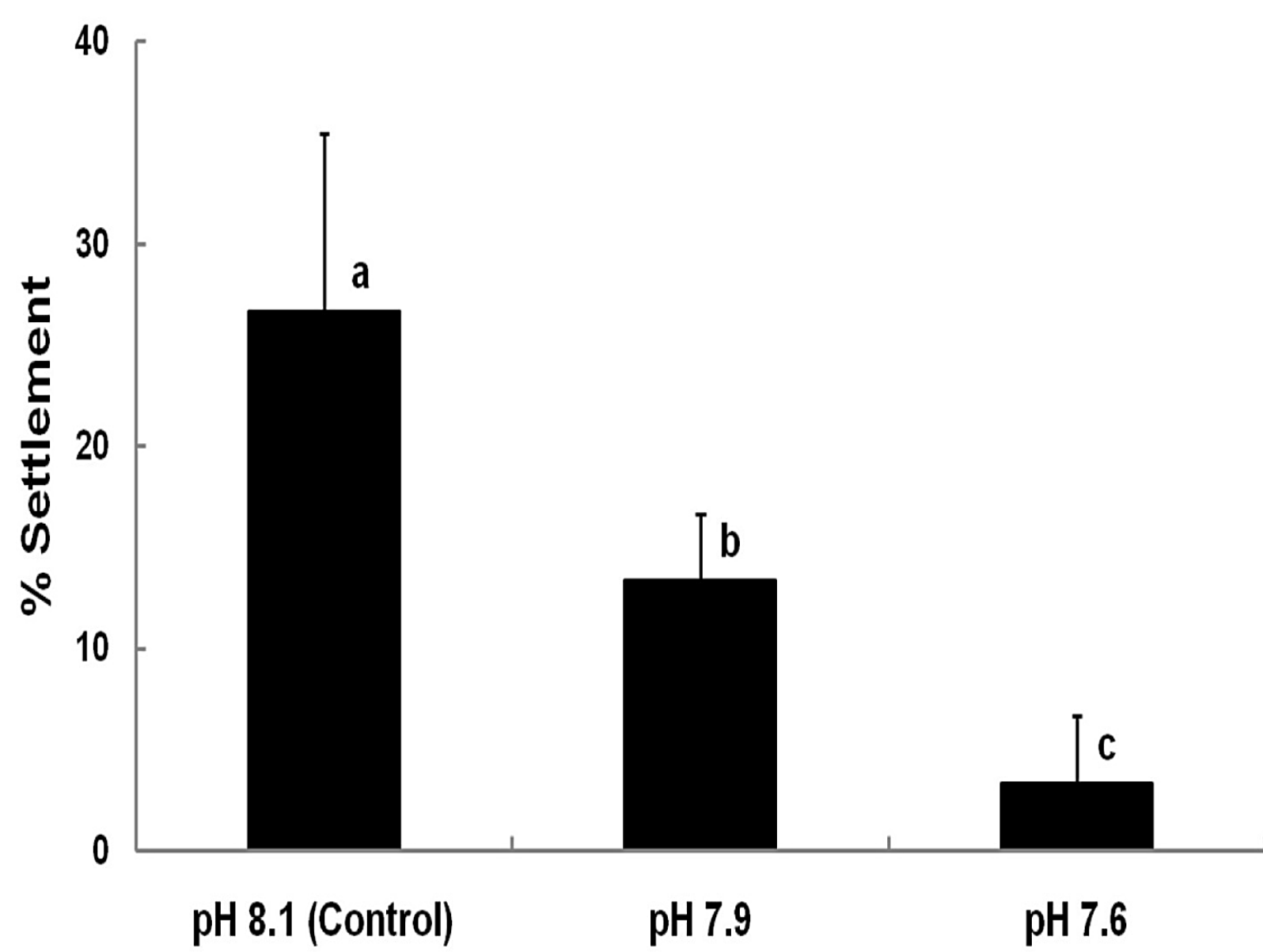
RESULTS

The results showed significant differences in the settlement rates of coral larvae between pH treatments. In addition, a decrease in pH levels caused a strong effect on larval development. For water quality monitoring, there was no difference between seasons and times.

Larval development of *Pocillopora damicornis* in the control pH



Larval development of *Pocillopora damicornis* and the percentage of each developmental stage



Mean percentages of settlement rates of *Pocillopora damicornis* plus 1 SE in three different pH conditions

Average seawater characteristics at different times around Sattahip Bay, Chon Buri Province

		Time			
		10:00	18:00	02:00	10:00
		Average ± SE	Average ± SE	Average ± SE	Average ± SE
Salinity	(psu)	30.67 ± 0.59	30.38 ± 0.38	29.89 ± 1.00	30.60 ± 0.78
Temperature	(C)	28.68 ± 0.42	28.96 ± 0.52	28.27 ± 0.15	29.19 ± 0.71
pH		8.12 ± 0.03	8.11 ± 0.02	8.12 ± 0.06	8.10 ± 0.07
TA	(μmol/kg)	2,148.37 ± 45.44	2,144.27 ± 49.45	2,178.70 ± 4.12	2,156.75 ± 46.25
DIC	(μmol/kg)	1,880.12 ± 39.10	1,859.98 ± 60.71	1,895.84 ± 23.24	1,896.44 ± 40.67
pCO ₂	(μmol/kg)	480.19 ± 4.00	437.76 ± 52.25	492.65 ± 45.56	468.29 ± 61.59
HCO ₃ ⁻	(μmol/kg)	1,673.07 ± 32.97	1,642.89 ± 65.75	1,677.68 ± 34.92	1,694.78 ± 35.23
CO ₃ ²⁻	(μmol/kg)	195.51 ± 6.14	206.51 ± 8.39	207.12 ± 12.96	189.15 ± 5.27
CO ₂	(μmol/kg)	11.58 ± 0.09	10.58 ± 1.26	11.04 ± 1.23	12.51 ± 0.17

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