

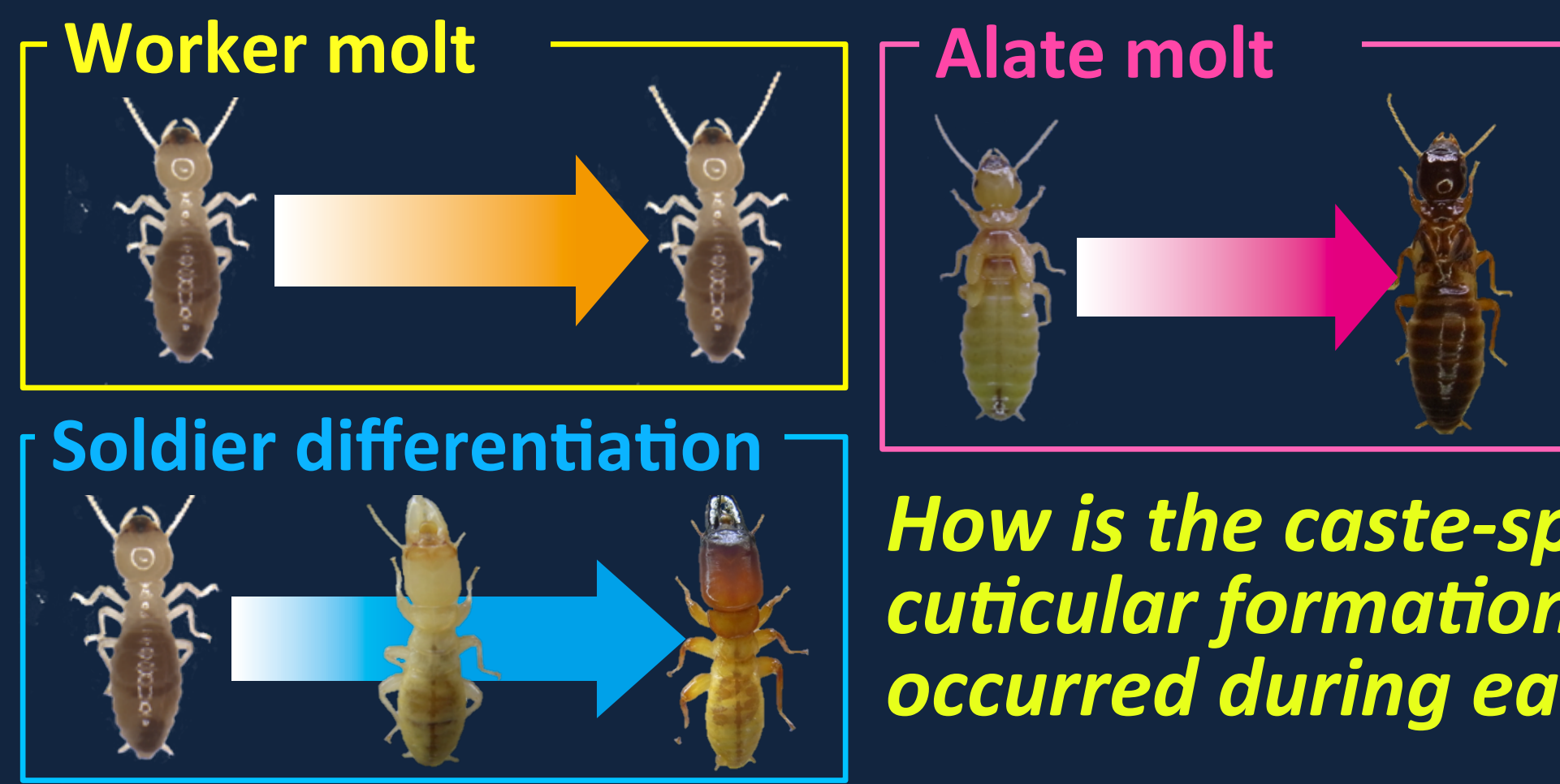
Molecular mechanisms of caste-specific cuticular tanning in termites.

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Introduction

Termite castes are morphologically specialized for each task. Especially, cuticle property is quite different among each caste.

Analyses on formation mechanisms of caste-specific traits are important for understanding the evolutionary scenario of castes.



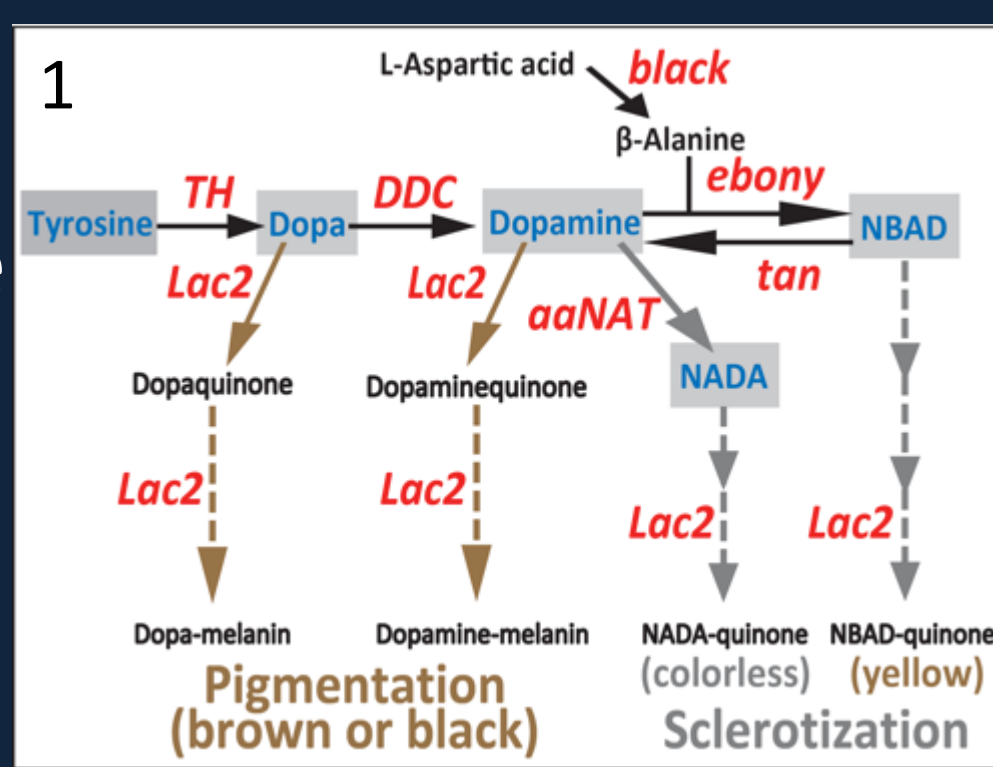
Approach

- Gene expression analysis during each molt (worker, presoldier, soldier, alate molt).
- Functional analysis of candidate genes during soldier and alate molt.

Exp.1 role of tyrosine metabolic pathway

Tyrosine metabolic pathway is involved in the tanning of insect cuticle.

In this pathway, some melanin and quinone are synthesized.



Question 1
Is this pathway responsible for the castes-specific cuticular tanning?

Answer 1

Result 1 expression of tyrosine metabolic genes

Expression patterns of each gene were different among each molt.

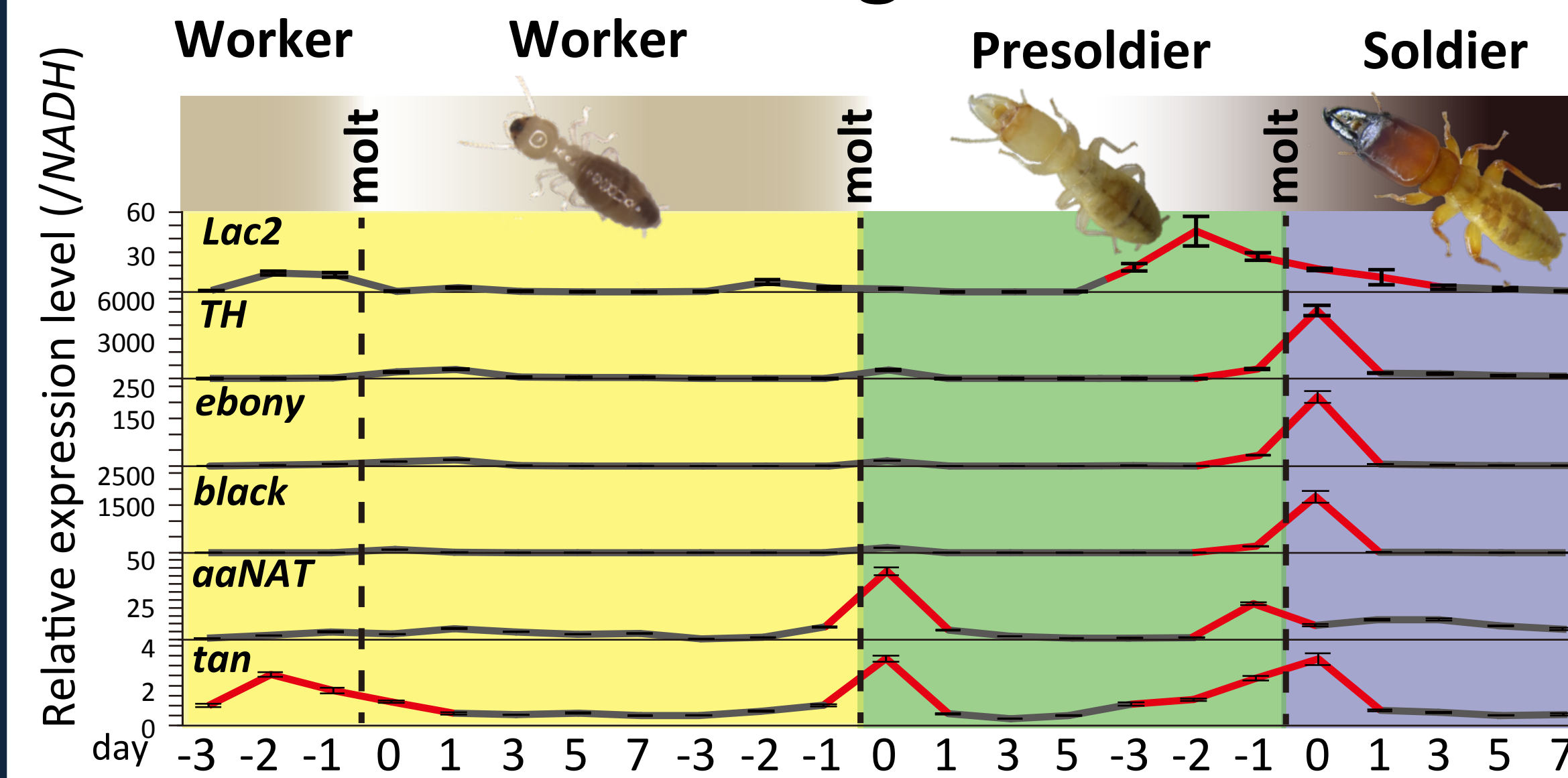


Fig. 1 Genes expression changes during each molt process. Values are mean \pm S.D. (n=3).

Function of Lac2 in soldier and alate

Lac2 RNAi resulted in the soldier and alate head with light color. Tip of mandible pigmented in both castes.

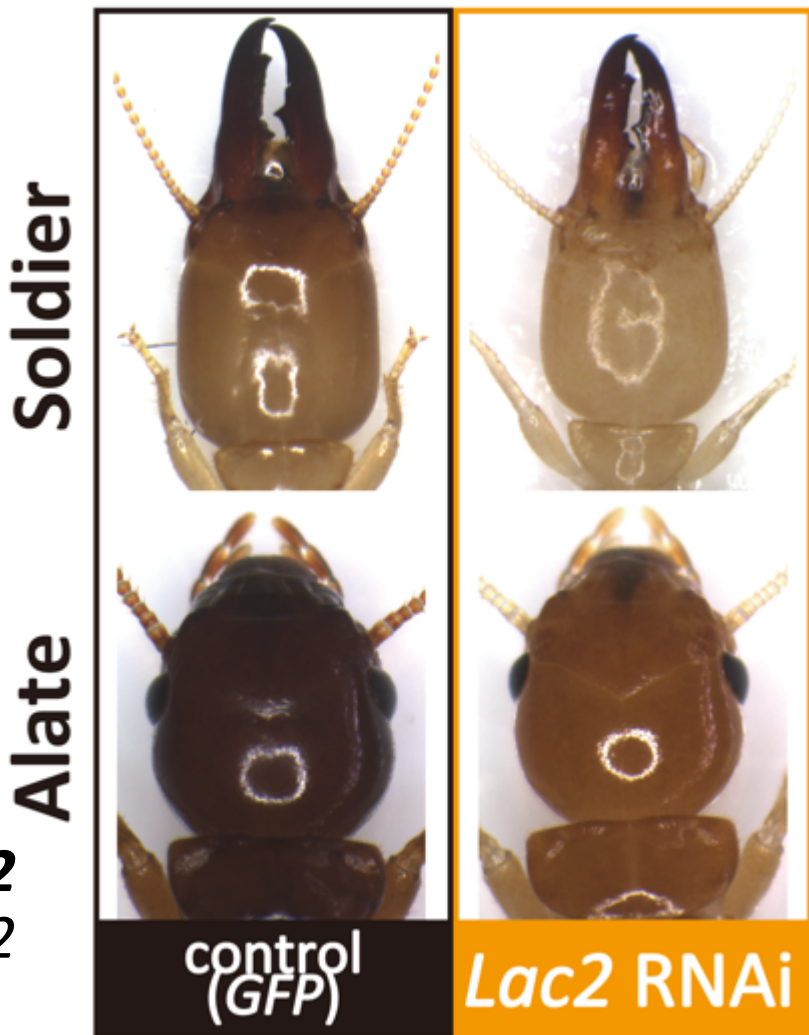
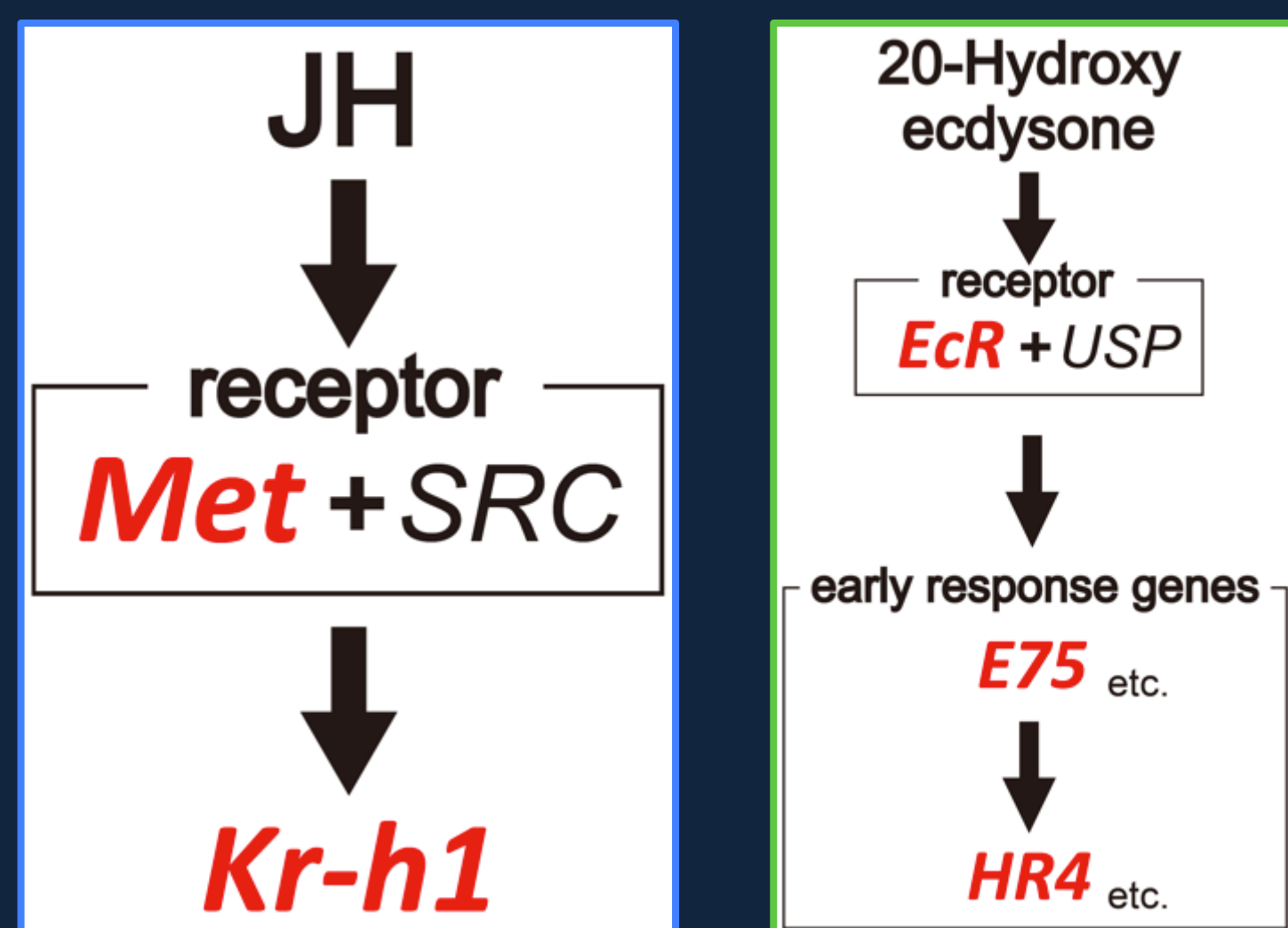


Fig. 2 Morphology of soldier head after Lac2 RNAi. Head morphology of GFP (left) or Lac2 (right) dsRNA injected soldier and alate.

Difference of expression pattern of tyrosine metabolic genes during each molt were involved in caste-specific cuticular tanning.

Exp.2 role of hormone signaling genes

Soldier differentiation needs increasing Juvenile hormone (JH) titer²⁻⁴. Some tyrosine metabolic genes might be regulated by ecdysone signaling⁵.



Question 2
These hormones regulate caste-specific cuticular tanning?

Answer 2

Result 2 expression of hormone signaling genes

All signaling genes highly expressed after molt in presoldier and soldier.

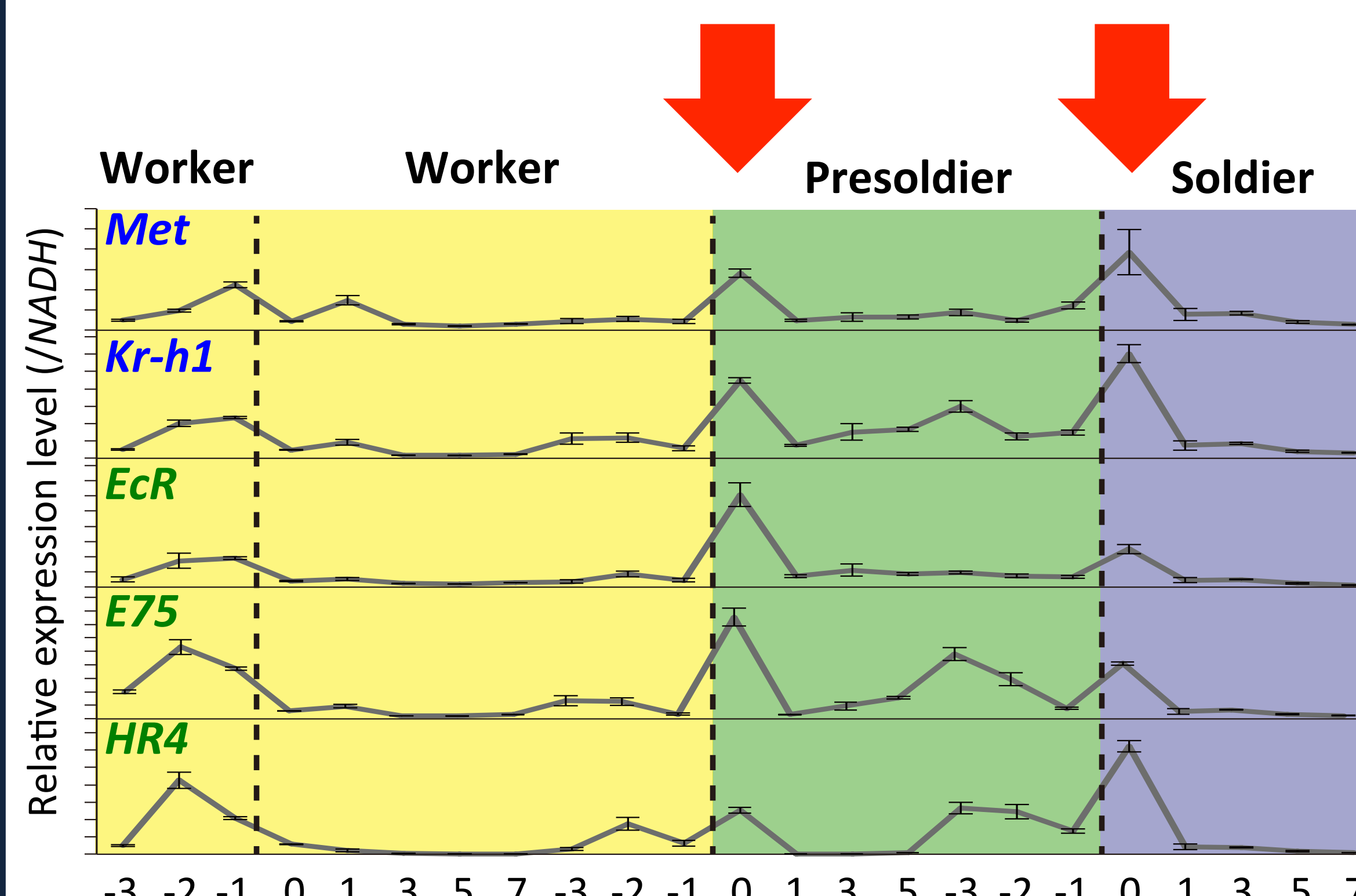


Fig. 3 Genes expression changes during each molt process. Values are mean \pm S.D. (n=3).

Function of hormone receptor genes in soldier and alate

Soldier
Met RNAi resulted in head with small but cuticule did not change. EcR RNAi resulted in head with light color.

Alate
Both genes did not affect cuticular formation.

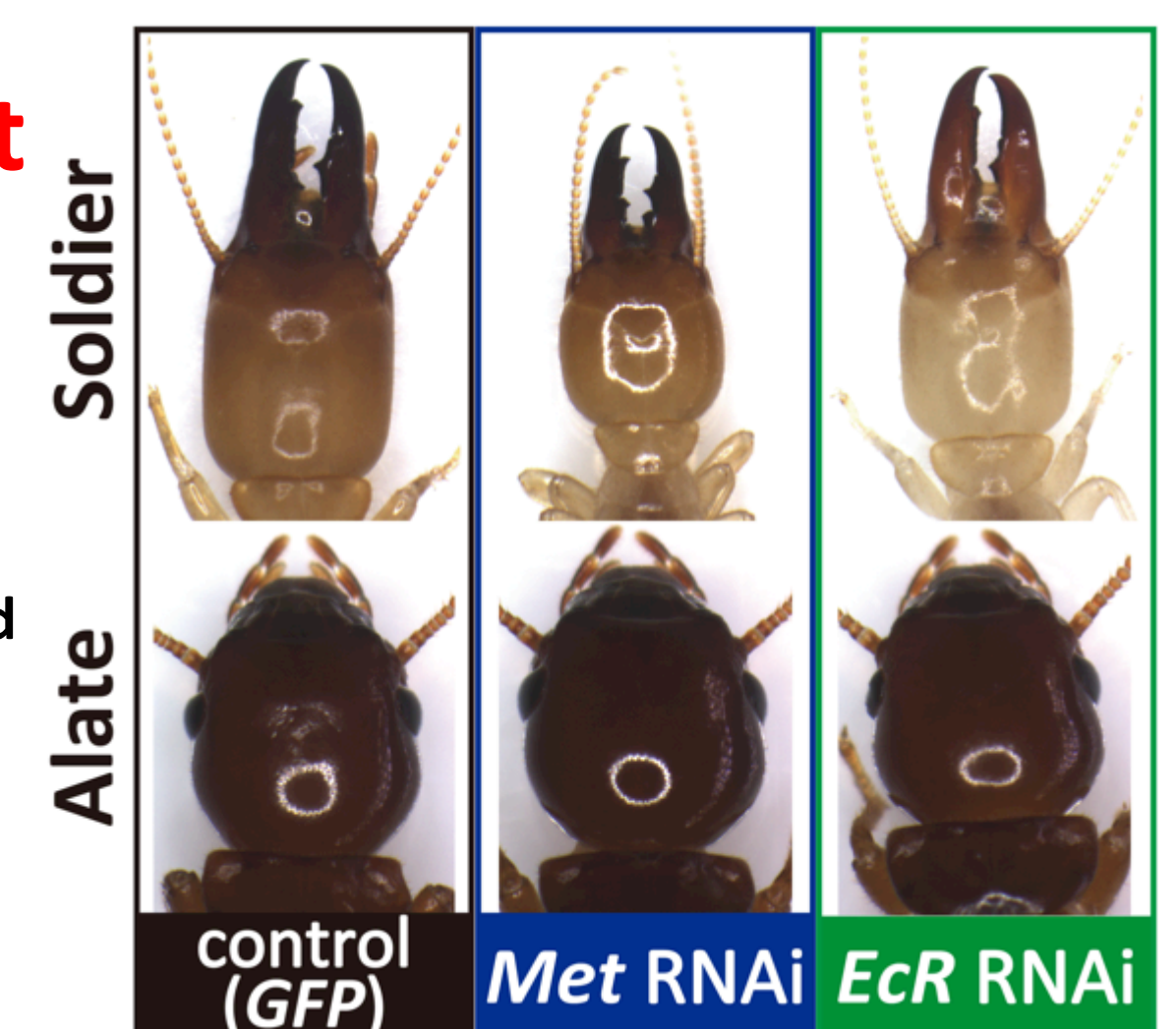
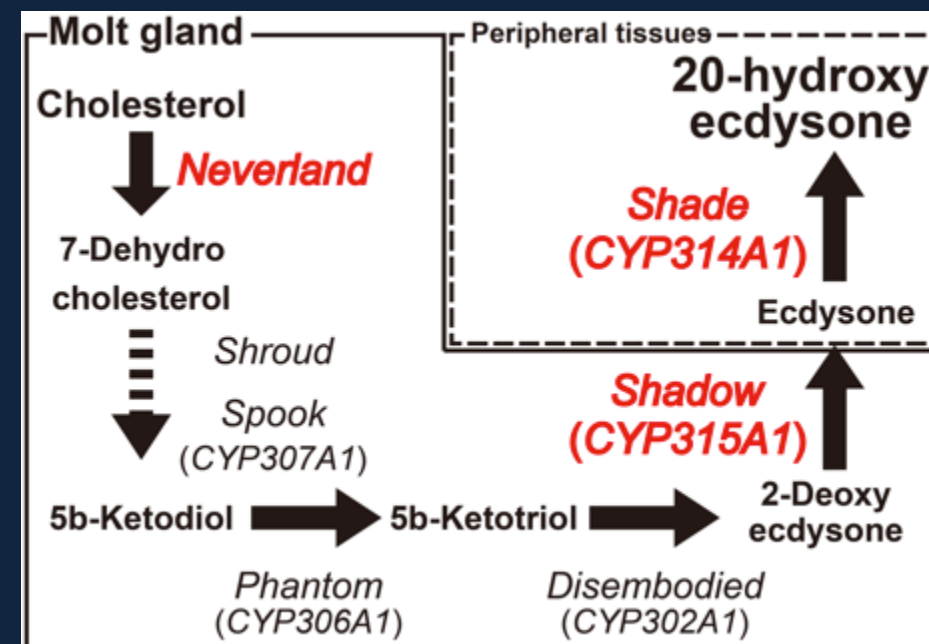


Fig. 4 Morphology of soldier head after hormone receptor genes RNAi. Head morphology of GFP (left) or Met (center) or EcR (right) dsRNA injected soldier and alate.

Ecdysone signaling might regulate soldier-specific cuticular tanning but not in alate.

Exp.3 Expression of ecdysone synthesis genes

In insects, ecdysone is synthesized from cholesterol by some CYP family genes⁶⁻⁷.



Question 3
Ecdysone synthesis level is different among each caste?

Answer 3

Result 3 expression of ecdysone synthesis genes

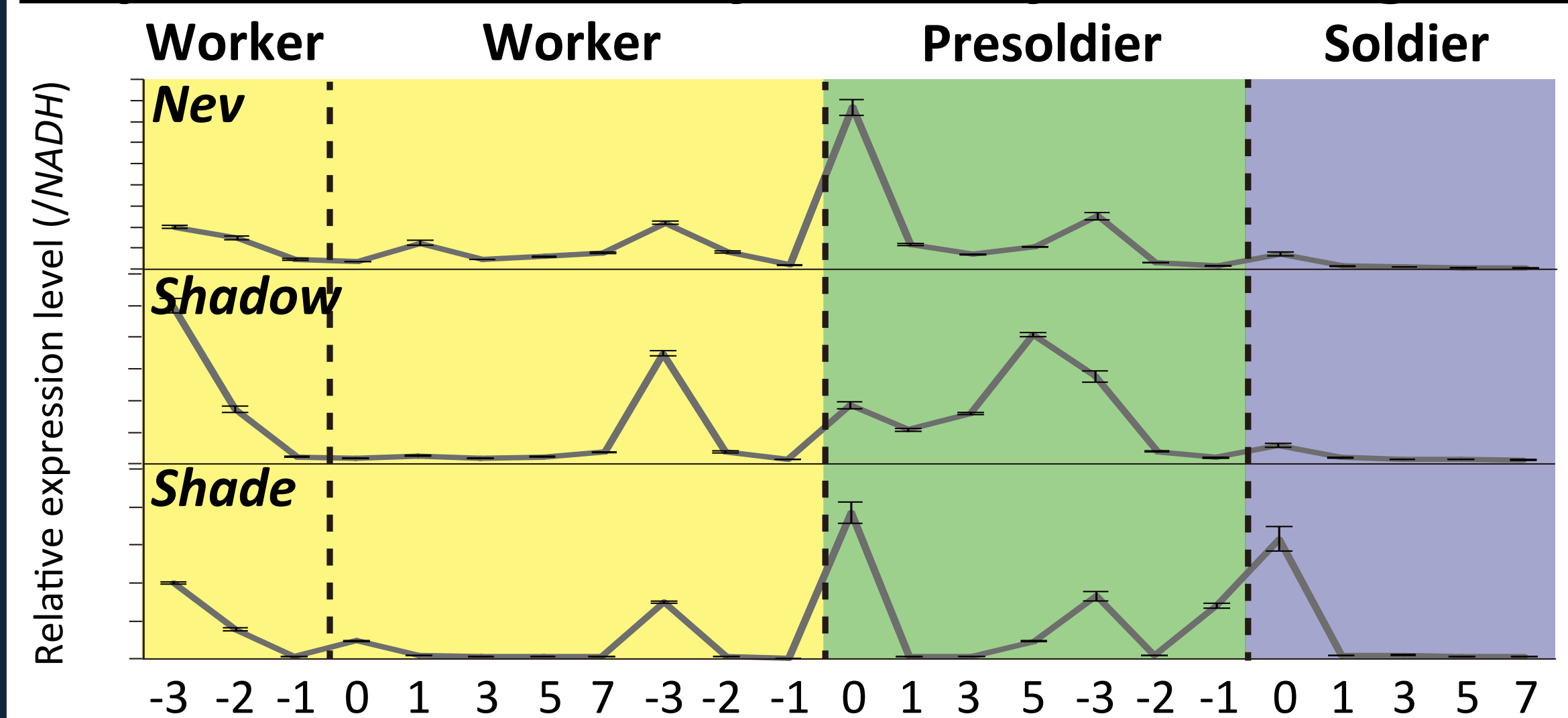


Fig. 5 Genes expression changes during each molt process. Values are mean \pm S.D. (n=3).

In presoldier period, expression of each genes increased just after molt. This expression pattern did not observe another molt.

Ecdysone titer might be high level during presoldier period.

Conclusion

- Different expression pattern of tyrosine metabolic genes were involved in caste-specific cuticular tanning
- Ecdysone signaling regulated soldier-specific cuticular tanning.
- High ecdysone titer might be involved in cuticular tanning during soldier differentiation.

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