A quantitative genetic model on sex determination under the assumption of temperature-dependent fitness
（温度依存的適応度を仮定した性決定に関する量的遺伝モデル）

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【Introduction】

TSD (temperature-dependent sex determination) is a mechanism that sex of individuals is determined by interaction with exposed temperatures during differentiation into an embryo, a larva or an adult. The mechanism is thought to have some sort of adaptive significance. One of them is “If fitness functions of male and female are dependent on temperature, TSD is more adaptive than sex determination by a chromosome”. We constructed a quantitative genetic model under the assumption that fitness functions of male and female are dependent on temperature.

【Model and Purpose】

To construct the model, we also used the below assumptions.

(1) A quantitative trait on which we focused is the boundary of temperature (it is called threshold temperature) by which sex of individuals is determined.

(2) Temperature in the habitat has a distribution.

(3) Male and female survival rates are a temperature-dependent function.

(4) Threshold temperature of offspring is determined by normal distribution with mean value as (heritability h^2)×(mid-parent value of threshold temperature)+(1－h^2)×(mean value of threshold temperature in the population)

Using the model we investigated effects of heritability, temperature variance and temperature-dependent fitness on primary and operational sex ratios

【Result】

When heritability is nearly 1, we find that primary sex ratio skews to male as temperature dependence of female fitness is strong. However, effect of temperature dependence decreases with the decrease of temperature variance of female fitness and primary sex ratio reaches 0.5 irrespective of the temperature dependence. When heritability is small, we find that primary sex ratio skews to female when the temperature dependence is strong. From the result, we find that effect of the temperature dependence on primary sex ratio is greatly affected by heritability and primary sex ratio is also affected by temperature variance when heritability is nearly 1. Operational sex ratio skews to female when the temperature dependence is strong and the tendency is not affected by heritability.