研究报告

关于最大信息熵原理与群体遗传平衡一致性的探讨

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摘要

汪小龙等建立了用最大信息熵原理推导一个基因座上群体遗传平衡的统一数学模型，并给出了模型的最大值解，此解正是Hardy-Weinberg平衡定律所给出的基因型频率。这说明当群体基因型信息熵最大时，群体基因型频率不再变化，达到平衡状态，从而证明了最大信息熵原理与Hardy-Weinberg平衡定律具有一致性，同时指出这一结论可以推广至有迁移、突变、选择、遗传漂变、近亲交配的群体以及多个基因座情形。概括地说就是：最大信息熵原理与群体遗传平衡具有一致性。但是，他们仅仅证明了最大信息熵原理与一个基因座上Hardy-Weinberg平衡定律具有一致性，本文在这个范围内将其推广至多个基因座，且每一个基因座均为复等位基因情形。至于最大信息熵原理是否与其它的群体遗传平衡具有一致性，他们的结论仅仅是猜想，并未严格推导。事实上，要想将这种一致性推广到迁移、突变、随机漂变和近亲交配等群体，则不见得正确。

关键词　Shannon信息熵；最大信息熵原理；遗传平衡；Hardy-Weinberg平衡定律

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Study on the Maximum Entropy Principle and Population Genetic Equilibrium

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Abstract

A general mathematic model of population genetic equilibrium about one locus was constructed based on the maximum entropy principle by WANG Xiao-Long <I>et al</I>. They proved that the maximum solve of the model was just the frequency distribution that a population reached Hardy-Weinberg genetic equilibrium. It can suggest that a population reached Hardy-Weinberg genetic equilibrium when the genotype entropy of the population reached the maximal possible value, and that the frequency distribution of the maximum entropy was equivalent to the distribution of Hardy-Weinberg equilibrium law about one locus. They further assumed that the frequency distribution of the maximum entropy was equivalent to all genetic equilibrium distributions. This is incorrect, however. The frequency distribution of the maximum entropy was only equivalent to the distribution of Hardy-Weinberg equilibrium with respect to one locus or several limited loci. The case with regard to limited loci was

proved in this paper. Finally we also discussed an example where the maximum entropy principle was not the equivalent of other genetic equilibria.

Key words Shannon entropy maximum entropy principle genetic equilibrium Hardy-Weinberg equilibrium law

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