

大学院入学試験問題用紙

2024 年度 1 期

科 目 名	受 験 専 攻	受 験 番 号	氏 名
英語	生物資源開発学 専攻 博士後期 課程		

問 1 下記の英文をすべて和訳せよ。

The total number of alleles for each gene in a population is the gene pool of that population. When we consider a pair of alleles A and a , we find that the percentage of gametes in the gene pool with A or a depends on the genotypic frequencies of the parental generation whose gametes form the pool. During random mating between members of a population, the zygotic frequencies expected in the next generation can be predicted based on the allelic frequencies in the gene pool of the parental population. If p = percentage of the alleles A in the gene pool and q = percentage of the alleles a , p^2 is the frequency of the next generation expected to be homozygous dominant (AA), $2pq$ is the frequency expected to be heterozygous (Aa), and q^2 is the frequency of expected homozygous recessive (aa). The sum of the three genotype frequencies is $p^2 + 2pq + q^2 = 1$. This is a binomial¹ expansion of $(p + q)^2$.

This rule is called the Hardy-Weinberg equilibrium, which indicates that in the case of a population adapting to the conditions on which the formula is based, there should be no change in allele frequencies in the population from generation to generation. Several assumptions underlie² the attainment³ of genetic equilibrium.

1. The population is very large and mates at random.
2. No selection is operative (no differential mortality⁴) and each genotype is equally efficient in producing progeny (no differential reproduction).
3. The population is closed (with no large-scale migration into or out of the mating pool).
4. There is no change in the mutation rate.
5. Meiosis is normal so that chance is the only factor operative in gametogenesis.

1.binomial : 二項式の、 2. underlie : 基礎となる、 3. attainment : 到達、 4. Mortality : 死亡率

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問2 下記の英文を読み (1) ~ (2) について答えなさい。

Experimental results for genetically segregated populations are often expected to fit certain predicted ratios. Sometimes, the data are in close proximity¹ to the ratios that there is uncertainty whether they will adapt to the predictions. However, the results often deviate² sufficiently from the prediction; therefore, a question arises whether the deviation was due to chance or to an incorrect hypothesis. In such cases, a chi-square (χ^2) test is necessary for statistical analysis. In performing a chi-square analysis, the difference (deviation) between the observed value (O) and the expected value (E) for each component of the ratio is determined. Each deviation is then squared and divided by this predicted value E , and χ^2 is derived by summing these values and then comparing the sum with a figure in a chi-square table of probabilities. If the χ^2 is very high, then the hypothesis that the ratio was an expected distribution is rejected. In contrast, the closer the observed value is to the expected value, the higher are the chances of the chi-square value becoming zero. However, if the probability of obtaining a chi-square is ≤ 0.05 , then the null hypothesis is rejected with the confidence that 95 times out of 100 instances, this was not a case of the expected ratio.

Suppose that the F_1 crossing between a pea plant having purple petals (PP) and another plant having white flowers (pp) produced 735 individuals with purple petals and 265 individuals with white petals by selfing. Determine whether these data conform to the Mendelian law of segregation for dominant and recessive alleles at a significance level of 0.05. ($\chi^2 = 0.05$ significance = 3.84).

1.proximity: : 近接, 近いこと、2. deviate : 逸脱する

- (1) 上記の英文を和訳せよ (下線部を除く)。
(2) 下線部について χ^2 値を求め、検定結果を述べよ。

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問 1 感染性クローンを用いて植物ウイルスの感染性・病原性（植物のウイルス抵抗性・罹病性）の機構解明を目的として研究を行う場合、どのような研究が展開できるか。材料や手法の例を挙げ具体的に述べよ。

問 2 アブラナ科植物では花粉培養系が確立されており、花粉由来不定胚を誘導できる。当該手法を用いて得られる不定胚の特性を活かした植物育種学的な取り組みとして、どのようなものがあるか。その利点を含めて知るところを述べよ。