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Genetic drift, Non-random mating & Mutation

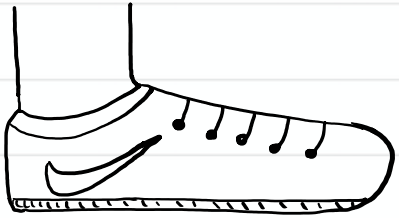
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Genetic drift # *

Gene/allele "Random shift"

- Population Genetic polymorphism.
- Sewall wright effect 1930.
- Random, Sudden phenomenon.
- Factor's : Natural calamity, Migration # Density-indep. factor

Small size pop. more effective.
Allele fixed in population.
Allele lost in population.



AA AA Aa Aa aa

AA Aa Aa aa aa

"Small size"

"Density-ind. factor"

(Natural calamity)

aa aa aa aa aa

aa aa aa aa aa

(New population)

Allelic freq.

A = 0.5

a = 0.5

"Genetic drift"

(Random shift)

Allelic freq.

A = Lost (0)

// a = Fixed (1)

I.

N = 100

AA = 25 − 5 = 20

Aa = 50 = 50

aa = 25 = 25

95

A = 0·5

a = 0·5

A = 0·47

a = 0·53

II.

N = 10

BB = 03 − 03 = 0

Bb = 04 − 02 = 02

bb = 03 = 03

05

B = 0·5

b = 0·5

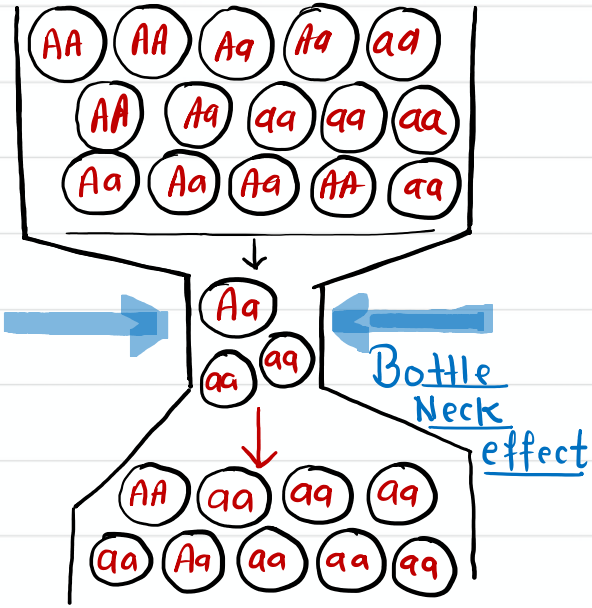
B = 0·2

b = 0·8

Genetic drift is more effective in small size pop..

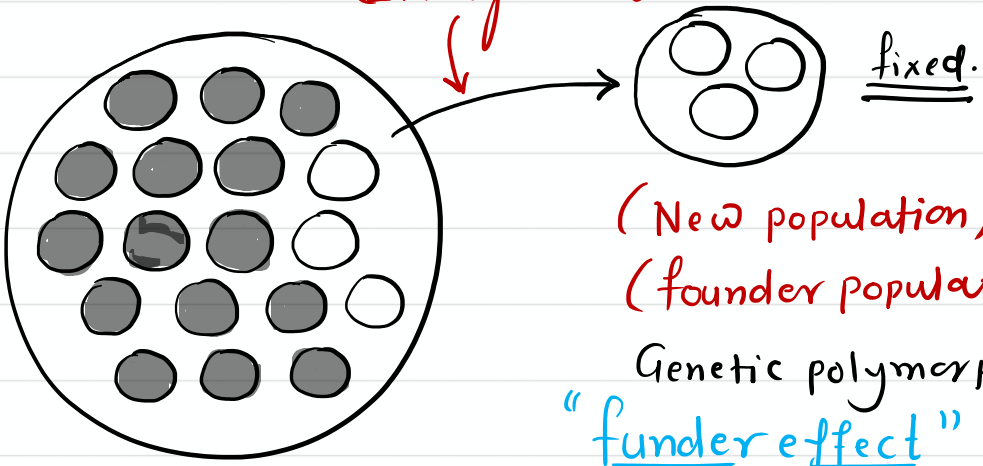
Density-indep. factor

(Natural calamity)



Migration

(Emmigration)



(New population)

(founder population)

Genetic polymorphism ↓

"funder effect"

(Crow's population)

Genetic polymorphism ↑

Probability of fixation or elimination of any allele in small population??

N = 20

1. Probability of fixation or lost increase per generation ??
2. Probability of fixation or lost Decrease per generation ??

$$\text{Increase} = \frac{1}{4N} = \frac{1}{4 \times 20} = \frac{1}{80} = 0.0125$$

$$\text{Decrease} = \frac{1}{2N} = \frac{1}{2 \times 20} = \frac{1}{40} = 0.025$$

Non-Random mating

"Selective – mating"

I. Inbreeding

- Genetic similarity
- mating bet^{h} close Relatives.
- Homozygosity ↑
- Heterozygosity ↓

e.g. (Self-Pollination Plants)

II. Assortative mating.

- Phenotypic Similarity
- Heterozygosity ↑
- Homozygosity ↓

I. Inbreeding:

- Do not leads to change in allelic freq.
- Genotype freq. change.
  - Homozygosity ↑
  - Heterozygosity ↓

14 - Homozygotes
4 - Heterozygotes.

e.g.

1. AA x AA → All Homozygous dominant → 4

2. Aa x Aa → 50% Heterozygote → 50% Homozygotes. → 2

3. aa x aa → All Homozygous Recessive → 4

= 6

4 - Hetero
2 - Homo

6

Inbreeding coefficient : (F)

"Measure of increase in Homozygosity"

(1) $$F = 1 - \frac{\text{Obs. Heterozygosity}}{\text{Exp. Heterozygosity}}$$

// Observed :
Expected : $2pq$
Heterozygosity

Sample Question:

$p = 0.3$

$q = 0.7$

observed Heterozygosity (H_o) = 0.28

Expected Heterozygosity (H_e) = $2pq = 2 \times 0.3 \times 0.7 = 0.42$

$$F = 1 - \frac{0.28}{0.42}$$

$$F = 0.33$$

or

$$F = \frac{H_e - H_o}{H_e}$$ (2)

$$= \frac{0.42 - 0.28}{0.42}$$

$$= 0.33$$

2. Assortative mating :

I. Positive assortative mating

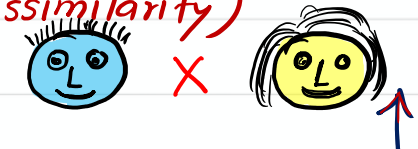
(Similar)



- Heterozygosity ↑
- Homozygosity ↓

II. Negative assortative mating

(dissimilarity)



- Heterozygosity ↑
- Homozygosity ↓

Mutation

" Sudden heritable change in genetic material "

- Create new gene's / Allele.
- Leads to change in allelic freq.
- mutation is rare event.

- Forward mutation (u): $p \xrightarrow{\sim} q$
- Backward mutation (v): $q \xrightarrow{\sim} p$

(M)

AA = 03
Aa = 04
aa = 03
N = 10

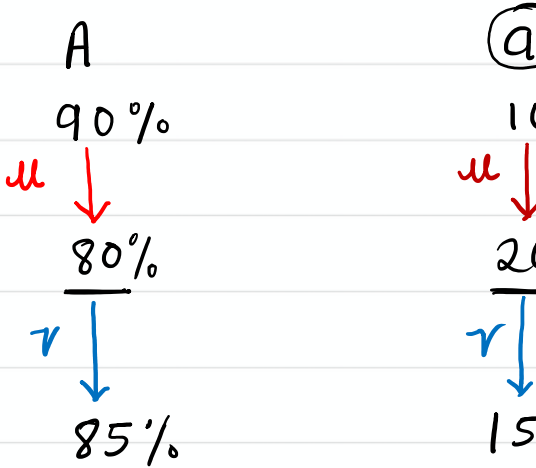
A = 0·5
a = 0·5

(M)

Aa = 03
Aa = 04
aa = 03
N = 10

A = 0·35
a = 0·65

Effect of both forward and backwar mutation ??



$$\Delta q = up$$

$$\Delta q = vq$$

overall

$$\Delta q = up - vq$$

Equal rate Forward and Backward mutation :

$\Delta q = 0$ equilibrium condition.

$$\Delta q = \frac{u}{(u+v)}$$

Sample Question:

$p = 0.9$ $\quad u = 1 \times 10^{-5}$

$q = 0.1$ $\quad v = 0.3 \times 10^{-5}$

1. Overall effect forward and backward mutation. ??
2. Change in in allelic freq. at equilibrium ??

$$\Delta q = 1 \times 10^{-5} \times 0.9 - 0.3 \times 10^{-5} \times 0.1$$

$$= 0.87 \times 10^{-5}$$

$$\Delta q = \frac{1 \times 10^{-5}}{1 \times 10^{-5} + 0.3 \times 10^{-5}}$$

$$= \frac{1 \times 10^{-5}}{1.3 \times 10^{-5}}$$

$$= 0.769$$

HAPPY LEARNING

THANKS

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