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Findings of the Mendel's First Generalization

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Abstract

An eminent Scientist Gregor Johann Mendel was born on July 20, 1822, in the Silesia, Austria (now in the Czech Republic) and gained posthumous recognition as the "Founder of the modern Science of Genetics (Father of Genetics)". He did work on several plants and insects but made him famous due to the work on peas (*Pisum sativum* and other related species) and deduced two notable generalizations related to heredity or inheritance later called as Mendel's Laws of Inheritance or Heredity or Mendelism. His research continued over as many as 8 years on pea species from 1856 to 1863, presented experimental findings in Natural History Society of Brunn in the year 1865 and published as "Versuche über Plflanzenhybriden" (Experiments in Plant Hybridization) in the year 1866 in the German Language. 34 years after, in 1900, three European botanists independently [Hugo de Vries (Netherlands), Carl Correns (Germany) and Erich Von Tshermack (Austria)] rediscovered Mendel's findings, which had remained unnoticed by the scientific community. William Bateson was the first who translated Mendel's paper into the English language in the year 1901. In this mini-review article, we summarized the findings or conclusions of Mendel's first generalization, which is based on monogenic traits. For making this article, information was collected from the Electronic Scholarly Publishing Project that is available on the internet using the following website (http://www.esp.org/foundations/genetics/classical/gm-65.pdf).

Keywords: Hybridization; Father of Genetics; *Pisum spp*.

Introduction

Before Mendel, several scientists had been worked on artificial or controlled hybridization between diverse, selected genotypes to create new and more desirable combinations among the existing genes to developed higher potential genotypes i.e., Babylonians and Assyrians pollinated date palm artificially as early as 700 B.C., 17th century heading lettuce cultivars were developed through hybridization in France. In 1717 Thomas Fairchild produced first systematic hybrid Fairchild' Mule through the crossing between carnation with sweet William. Around 1800 Knight produced several hybrids in fruit or ornamental crops through controlled hybridization. Kölreuter, Gärtner, Herbert, Lecoq, Wichura and others had also worked on hybridization programme but no generally applicable law governing the formation and development of hybrids had been successfully formulated.

IMaterials and Methods

Study selection

The value and utility of any experiment are determined by the fitness of the material. Therefore, that experimental plant must necessarily:-

1. Possess contrasting characteristics so that easily possible to differentiate.

2. The plant must be protected from foreign pollens otherwise lead to entirely erroneous conclusions.

3. The hybrids and their offspring should complete fertility in the successive generations.

Therefore, he selected leguminosae family species, especially *Pisum* genus having specific floral structure 'keel'. Thirty-four more or less distinct varieties of peas were selected from seedsman and subjected to two-year trial so that able to select

the look like plants. Majority of the pea varieties belong to the species *Pisum sativum* and some as independent species, such as *P. quadratum, P. saccharatum* and *P. umbellatum*. Mendel selected peas because of its specific features i.e. short growth period, self-pollinated, contrasting traits, easily recognizable and produced complete fertile progenies [1] (**Table 1)**.

Total	Total	Dominant form	Recessive form
1.	Ripen seeds form/shape (*P. quadratum*)	Round	Wrinkled
2.	Seed-coat color (*Pisum sativum*)	Gray	White
3.	Seed albumen (endosperm) color (*Pisum sativum*)	Green	Yellow
4.	Ripe pods form/shape (*P. saccharatum*)	Inflated	Constricted
5.	Unripe pods color (*Pisum sativum*)	Green	Yellow
6.	Position of flower (*P. umbellatum*)	Axial	Terminal
7.	Length of stem (*Pisum sativum*)	Tall (6-7.5 ft)	Dwarf (1.5-1.75 ft)
Character no. 2 was showing significantly correlation with flowering color. Observations for characters no. 2 and 3 recorded in the first year of experiment. Rest of the characters data were observed in following generation raised from hybrid seed.			

Table 1: Traits chosen for experiment with their contrasting features.

First generalization and its findings:

Mendel chosen the Pisum spp. for his experiment and basic steps were followed by him was illustrated in Figure 1.

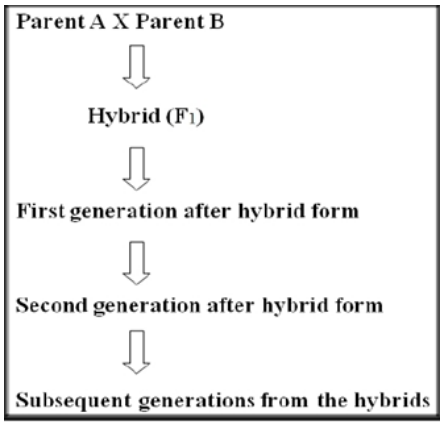

Figure 1: Experimental flow-chart.

Results and Discussion

Hybrid form

"Transitional or intermediate forms were not observed in any experiment".

1. Mendel already known about the previous workers findings like hybrid never show intermediate effects between both of the parental plants. Therefore he concluded that, in the hybrid form, for the single trait, those form expressed called as 'dominant form' and another latent by expressed trait called as 'recessive form'.

2. Variations in hybrids either due to the infestation by Beetle Buchus pisi because it affected the floral parts and chance to increase the pollination through foreign pollens or other environmental factors.

First generation after the hybrid form

1. In this generation there are reappear of dominant with recessive form for single trait in the specific ratio as 3:1.

2. Some extreme type of case also detected i.e. for seed shape trait 43 round with 1 wrinkled seed or 14 round with 15 wrinkled are observed that is describe the small population size also matters otherwise it will be gave biased results.

3. The dominant character can have here a double signification-viz. that of a parental character or a hybrid-character.

Second generation from the hybrid form

1. Those forms in first generation gave recessive form give same form in the second generation constantly.

2. From the first generation, those have dominant form, of these two-thirds yield offspring that display the dominant and recessive characters in the proportion of 3:1 and thereby show exactly the same ratio as the hybrid forms, while one-third remains with the dominant character constant [2].

3. It is now clear that ultimately it give the ratio as 2:1:1 it means the hybrids form seeds having one or other of the two differentiating characters, and of these one-half develops again the hybrid form, while the other half yield plants that remain constant and receive the dominant or the recessive characters in equal numbers.

Subsequent generation from the hybrids

If an average equality of fertility in all plants in all generations were assumed it always, show similar ratio as 3:1 or 2:1:1 means two will be hybrid-characters, one will be dominant constant and one will be recessive constant.

Second generation from the hybrid form

Conclusion

Through this experiment, Mendel concluded that single trait govern by a factor later called as 'Gene' having two forms in hybrid-character (now called as allele/allelomorph) one is dominant

which will be expressed another will be hidden by dominant form called recessive. These forms present in egg cell and pollen cell, during hybrid-character (later known as Heterozygous) by the fertilization between egg cell and pollen cell, both dominant and recessive forms (alleles) fused on equal numbers and again during the formation of egg cell and pollen cell from this hybrid both the forms separate without contaminate to each other. This was the first generalization or hypothesis of Mendel's findings after the rediscovery it is called as Law of Segregation or Law of the Purity of Gametes. All the findings were based on mathematical studies.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

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