Manifestations and the Evolutionary Background of the Fibonacci Sequence and the Golden Ratio in Plants

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My thesis examines the occurrence of certain mathematical phenomena in the phyllotaxis and seed formations of certain plants. I begin by presenting the mathematical background behind the Fibonacci sequence, a series of numbers, starting with the integer pair 0 and 1, where the value of each element is calculated as the sum of the two preceding it. The second chapter analyses the mathematical nature of the golden ratio. I derive the value of the golden ratio by processing the fractions of certain geometrical line segments. From there I will present the mathematical correlation between the Fibonacci numbers and the golden ratio. This correlation is presented by Binet's formula, the limit of the ratio of two consequent Fibonacci numbers. I will be inspecting the mathematical theorems in the growth of plants. I begin by addressing a phenomenon known as phyllotaxis, the arrangement of leaves or other parts of the plant on a plant stem. The third chapter analyses phyllotaxy by applying the golden ratio into the divergence angle, an angle between successively growing leaves, seedpods or florets. I will be presenting five specimens of the Fibonacci sequence and golden ratio in plants. I will be displaying the Fibonacci sequence in each specimen by highlighting the parastichies on each plant. In addition, I will derive the golden ratio arithmetically from the number of spirals on each plant. I will end my thesis by concluding the mathematical nature behind phyllotaxy and plant growth patterns. I will also present some further insights into the manifestations of the Fibonacci sequence and golden ratio, for example their occurrence in anatomy and architecture.