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EFFECT OF INFRARED RAYS ON POLLINATION AND REPRODUCTION OF PLANTS

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The Summary. In this article, the physical characteristics of pollination, flowering, reproduction of new species of plants as a result of the effect of infrared rays on the plant are explained.

Key words and phrases: diffusion, Brownian movement, kinetic energy, pollination, hybridization.

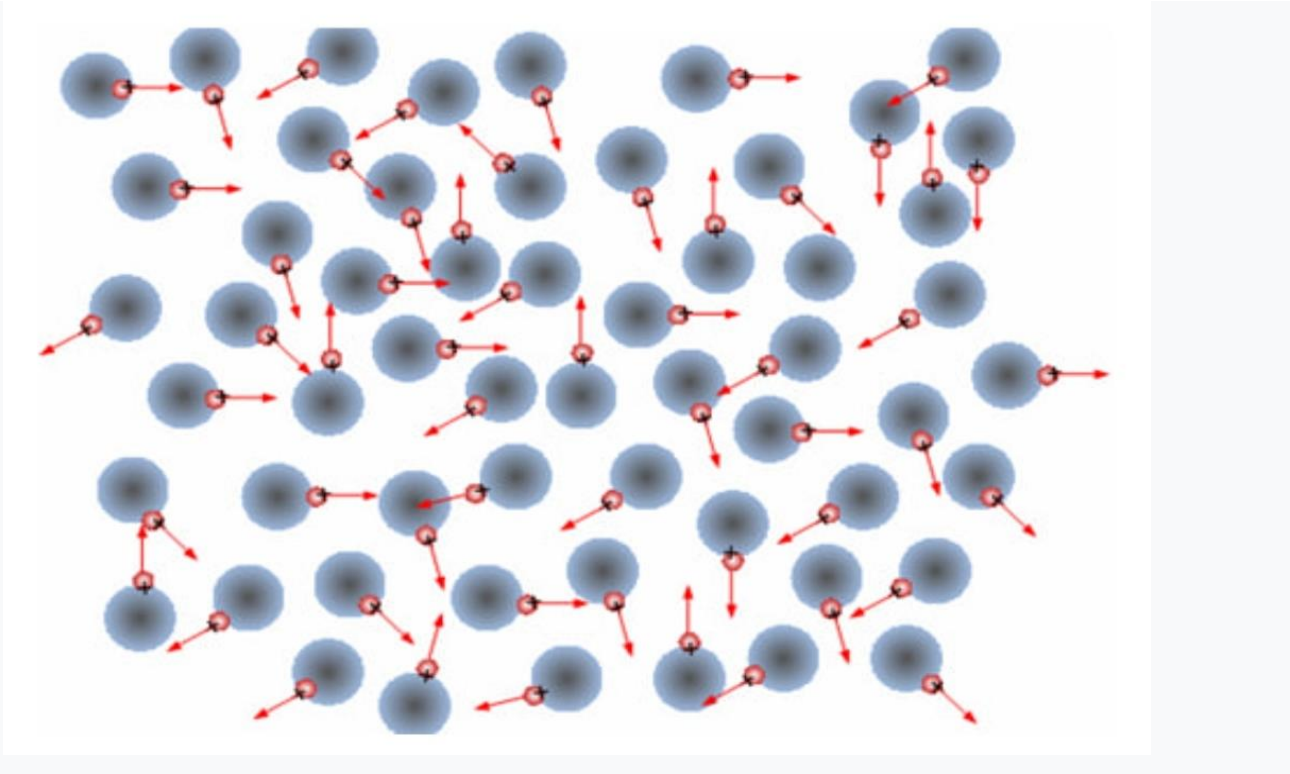
We know that physics is the science of life. It studies everything from the smallest particle to giant objects in nature. Obviously, there are 3 different states of matter: solids, liquids, and gases. We can do a lot more experiments and labs with liquids. For example: the diffusion phenomenon, determines the resulting temperature of a liquid mixture that is, determining the resulting temperature. Obviously, one of these is Brownian motion.

In 1827, the famous botanist and English physicist Robert Brown saw pollen moving irregularly and non-stop on water. Being very interested in what this moving object is, he carried out his own experiments. The speed of the Brownian diagram depends on the liquid in which the experiment is carried out, that is, the density of the liquid, the medium in which the liquid is located, and, of course, the geometric dimensions of the particles of that liquid. In 1905-1906, during the work of Albert Einstein, Polish physicist Marian Smoluchowski, and French physicist Jean Baptiste Perrin, Robert Brown clearly proved that atoms and molecules are thermally active.

As a result, he proved that each Brownian particle in a liquid or gas is hit by the molecules of the environment approximately 1012 times per second. The larger the particle's geometric size, the more it balances under the influence of all-round impulses and shocks, and it tends to maintain its initial state of rest. If the geometric size of the particles or molecules is small, then the statistical equilibrium will definitely be broken, and as a result, the particle will continue to move irregularly and without stopping during the Brownian motion. The phenomenon of Brownian motion was observed by Robert Brown as pollen grains suspended in water randomly move in a zigzag pattern. And such action occurs in colloidal systems. Such random motion can only be seen for larger particles, which are available only in special science classrooms, such as ultramicroscopes and ordinary microscopes. Brownian motion was studied perfectly by Jean Perrin, and during 1908-1913, he photographed the states formed by a chaotically moving particle in equal periods of time. Brownian motion gradually decreases as the viscosity increases due to the size of the particles or molecules they form. Brownian motion proved the existence of molecules in science once again, in addition to the random and non-stop movement of molecules. He proved that the numerical value of the velocity generated in the straight part of the trajectory of each chaotically moving particle or molecule is very large. However, the movement of a particle or molecule in another direction is small. During these experiments, Robert Brown noticed that the particles were moving non-stop and irregularly. During the experiments, this process was called "Brownian motion".

The causes of Brownian motion are explained as follows on the basis of the molecular-kinetic theory of substance structure. The molecular-kinetic theory of Brownian motion was created in 1905 by Albert Einstein. Molecules of matter continuously and irregularly collide with flower dust (Brownian particle) suspended in liquid. If the size of a Brownian particle is larger than 1 micrometer, the collision forces of the molecules hitting it from different sides cannot accelerate the particle and move it, and as a result, the molecules stop colliding with each other.

Random direction: Particles do not move in a specific direction. They move in a completely random direction. Because their speeds are completely different from each other. Therefore, the directions of their speeds are different. For example: it moves in the air in a zig-zag way, along a straight line, in a circular motion or in the form of a broken line.



It can be seen from this picture that the molecules are continuing their movement directions in different directions along a straight line. As they collide with each other during this movement, they give an impulse to a molecule that continues to move differently from itself,

$$P=m\vartheta$$

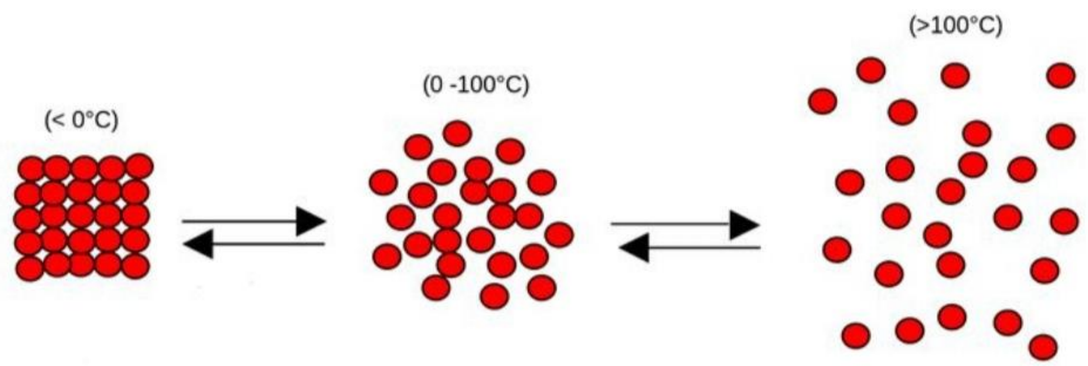
and under the influence of the impulse, it changes the value of its speed by some amount, and also changes the direction of its speed. As a result, the disordered and non-stop movement of molecules continues in its original state.

The importance of pollination and fertilization in botany has an important impact on the development of scientific knowledge about the understanding, naming, and distribution of plant taxon, taxonomy, ecology, physiology, genetics, and evolution of plants. These processes strengthen communication in the field of plant science, establish scientific cooperation in the world of plants, and develop general scientific skills in the field of plant science.

Continuous Motion: Particles move continuously. That is, they always move under a certain speed. As a result, their continuous and irregular movement is ensured.

Diffusion: Brownian motion can contribute to processes such as diffusion. This refers to the natural diffusion of particles from high density to low density.

Temperature related: As the temperature increases, the Brownian motion also increases. This is related to the increase in thermal energy at the molecular level.



It can be seen from the three pictures that one of the macroparameters of the science of molecular physics, which ensures the irregular and non-stop movement of molecules, i.e. temperature, plays the biggest role. According to the formula of the root mean square molecule of the substance:

$$\upsilon = \sqrt{3RT}/\mu$$

The higher the temperature, the greater its movement. To do this, the order is provided for irregular and non-stop movement. As you can see from this picture, when the temperature is low, the position of the page will continue to be partially small and will still move. If the temperature is in the average normal state, its movement speed will move at a higher speed than in the case when the temperature is low. If the temperature is high, the movement of the movement is also at a greater value.

If we consider the pollination of plants for one dust particle, then we can calculate its average squared speed using the formula $\upsilon = \sqrt{3RT}/\mu$ among a number of formulas. Now we can find the average kinetic energy of one dust particle.

$$E = m\upsilon^2/2 \quad (1)$$

Here we take into account the temperature dependence of "".

$$\upsilon = \sqrt{3RT}/\mu \quad (2)$$

from this formula, the following formula is formed.

$$E = 3mRT/2\mu \quad (3)$$

If the pollination of plants is affected by light, then the energy of the pollinator particle under the influence of light can be expressed by the following formula

$$E = h\nu \quad (4)$$

As a result of the increase in the energy generated in the photon, the speed of movement of each dust particle in it increases due to the increase in its energy.

The question of what triggers the flowering mechanism in plants is quite complex and does not yet have a complete answer. Knowledge of the fundamental processes as a result of which the plant blooms allows us to get closer to the truth. The key point is the influence of triggers that cause a sequential chain of reactions at the genetic and physiological levels.

As a result, a morphological change occurs in the apical shoots of the plant, which leads to flowering.

The main trigger for changes towards flowering is a light effect called photoperiodism. It is understood as a complex mechanism of a plant’s response to received light signals of a certain duration and intensity. The specificity of this phenomenon is that plants react differently to light than people or animals.

They perceive this part of the electromagnetic spectrum of a certain frequency as a signal to start certain photochemical processes and use it as energy for their successful implementation.

Plant Growth Cycles

Light has a decisive influence on the basic natural (circadian) rhythms of all living organisms, including plants. The daily repetition of the main life cycles includes a certain sequence of events, among them there are periods of activity, performance of certain tasks, and rest. All these events usually fit within a certain 24-hour period of time.

The lack of light leads to a period of rest when the chemical elements necessary for the capture of light energy by plants are unprofitable to synthesize. Light determines periods of activity not only by its quantity, but also by its quality, to which plants are very sensitive.

Fundamental environmental factors, which include the time of year and the composition of the air, influence the perception of plants through triggers and are measured by pigments that control the harmonious flow of life processes.

Cryptochromes are responsible for stomatal function, tracking and capturing sunlight, activating gene composition, synthesizing necessary pigments, and inhibiting stem growth.

Phototropins control the process of plant growth and intracellular movement of chloroplasts in order to prevent damage to the system, activating the cell's defenses.

Phytochrome is a special complex consisting of two types of pigments: Pr (reactive to red) and Pfr (reactive to infrared), responsible for many functions - germination, gene transcription, chlorophyll synthesis, and flowering. The response to bright light will start the flowering process in short-day plants due to a change in physiology from normal growth to flowering. The simultaneous influence of several factors, which include the influence of genes and hormones, causes flowering.

Light is the basis of all biochemical processes of a plant, it is the basis for growth and metabolism, and also directly affects the frequency and duration of cycles in everyday existence. Light regulates survival and determines the pace of functioning of all organisms. The correct ratio of light is an important factor that determines the harmonious development of plants and the timeliness of their flowering.

The most important color for all types of plants is red; it provides the necessary energy for plant photosynthesis, which is absorbed most efficiently. Plants can grow even with pure red color, developing quite fully. They will not look as blooming and healthy as in natural sunlight, but, nevertheless, all biochemical processes will proceed without deviation from the norm.

The expression of 660 nm red light and 730 nm infrared light is the optimal ratio of the amount of light energy that allows the plant to determine the length of day and night.

Before the old growth process on the surface, the seed grows underground in a direction that is more red than the color of the infrared spectrum. Only then do the seed cracks open and shoots appear on the surface of the earth.

Colors in the blue spectrum do not manifest themselves underground, unlike red, which the plant is able to sense in the initial phase of growth.

The influence of blue color, when a young sprout appears on the surface of the earth, occurs in the direction that the plant acquires the properties of a seedling, in contrast to the properties of a root. The plant produces leaves and directs them toward the nearest blue light source. Not enough blue and blue light causes it to continue to grow like a root and be slow to emerge above the ground. In this case, new leaves do not form, as if the plant was completely hidden from the sun.

If the sunlight is bright and exposed, the plant tends to grow squat and small in size. This happens because sunlight contains more red spectrum than infrared, and the plant reacts to this ratio - the stems will be short, and the number of nodes will be greater compared to normal conditions.

Otherwise, when the plant is under the influence of 73

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Otherwise, when the plant is exposed to 730nm light, it grows long and elongated. This effect occurs because in the natural conditions of dense vegetation, the red color is absorbed by the surrounding leaves, and the rest of the stems stretch upward in search of it. Therefore, excess infrared light can cause “stretched” plant stems. The opposite effect is obtained by simulating the onset of darkness and increasing the duration of daylight hours for plants with a short flowering period.

The discovery of Brownian motion is an important step towards understanding the existence of atoms and molecules and the interactions between these particles. At the same time, observation and analysis of this phenomenon has found applications in many fields of science, such as nanotechnology, biology, chemistry and physics.

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