

Some thoughts on evolution, symbiosis and bumblebees...

WE ALSO DEPEND ON BEES AND OTHER POLLINATORS

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At the 150th anniversary of the publication of the book "On the Origin of Species by Natural Selection" and the 200th anniversary of the birth of Charles Darwin, who wrote it, we celebrate the implementation of scientific knowledge about evolution, constant adaptation and change of the living creatures in the fight for survival. These findings had significant impact on a wide variety of fields of human thought and action. Unfortunately, many people understand the idea and had understood it only as a rule of "survival of the fittest," which has the right to displace and destroy all "inferiors". This idea was utilized also by unscrupulous capitalists and the creators of the primal myths of races and nations. It is a major simplification and misunderstanding of Darwin's ideas. Distortions of ideas and the exploitation of the great spirits of mankind occurred regularly in human history.

In fact, the living beings who strive to survive among a multitude of living and non-living threats, have a variety of different options. One among them is in fact that the specimens are becoming bigger and stronger, thus becoming safer from predators. But remember the fate of the dinosaurs. The problem of large animals, which always, sooner or later die out, are the limited food sources. Each species has, according to its needs, a certain amount of resources that can be exploited for food in an environment. If the specimens of a certain species are small, more of them can survive on a limited amount of food than large specimens could. When the size of specimens of a species increases, it is therefore inevitable that the number of specimens of this species becomes lower. And why is this important?

Natural selection that directs the evolution of living beings, can choose from the results of random changes in the heritable genetic material of living beings that create diversity between individuals. When environmental conditions change (climate changes, an epidemic disease outbreaks, or anything else) only those specimens survive that tolerate the changed conditions better. In a large number of specimens of a species, those who are better prepared for new situation may quickly be found. If the number of specimens of a species is small, it is much less likely that among them are those who can survive in the new environment. Survival of only the largest and most powerful provides security to the specimens for a short term, but in the long run, it leads to the extinction of the species that cannot adapt to the changes.

There is another way that living beings can go through in the evolution. They can associate into social groups of individuals of the same species, or live in harmony with other, often quite different kinds of living beings.

We also live in a society and without mutual assistance people would certainly not survive in history. The communities of social insects such as ants, termites, bees and wasps, will be discussed a little later. Even for the coexistence of very different kinds of creatures a whole series of cases are described. Trees in the forest live in association with fungi, which decompose litterfall on the forest floor. Orchid seeds are so tiny that they cannot germinate when they do not receive help from the fungus. Ruminants could not survive without the tiny single-celled creatures in their stomachs to help them digest cellulose. Shells and corals in the oceans host unicellular algae in their tissues, which supply them with food produced by photosynthesis. At the deep springs of hot mineral water large worms live, which have no digestive tract. They live at the expense of micro-organisms in their tissues that exploit the rich mineral resources. On land, one of the most important symbiosis between plants and animals is present everywhere and people also depend on it. It is a symbiosis between flowering plants and their pollinators. Plants cannot move, but pollination with pollen of other specimens is necessary to ensure the diversity of offspring. Pollen can be carried by the wind and many plants take advantage

out of that. However, such plants need to grow in dense stands. Some plants have taken a different path. Their flowers attract insects. In addition to pollen they offer them nectar in nectaries, and they advertise the flowers with colorful petals and smell. Insects, especially bees, butterflies, flies and others, exploit the offered food for themselves and their progeny and provide plants with pollination by flying from flower to flower. Fruits obtained in this manner represent a significant share of our food and food of animals that we grow for ourselves. We are thus also dependent on bees and other pollinators.

Honeybees that have long been bred by man are just one of many species of bees. Most species live solitary, not in colonies (families). Related to domestic bees are bumblebees. They also live in a colony (family), but this perishes in the autumn, only the young queens overwinter. In spring they start to build a new nest in a tunnel in the ground, among rocks or in a thick bunch of grass. Their first offspring are much smaller workers who are all females, but their ovaries do not develop. They take all the work in the nest and fly out to forage for pollen and nectar. Bumblebees are excellently adapted to cold climate, so they are numerous also high in the mountains and can fly in a cool and cloudy weather, when most other bees rest. Workers maintain a constant temperature around 30° C in their nests by quivering muscles. If it is too hot, they flutter with wings at the

entrance. Solitary bees can fly only when the sun warms them enough.

Researchers of evolution are occupied for a long time with the question of how the societies evolved, such as those developed in ants, bees and wasps, with a division into reproductive specimens and specimens that cannot reproduce, but sacrifice themselves to work for the community. In some halictine bees small communities exist of females that are all capable of reproduction, but one of them acquires a leading position as the largest and most aggressive. She devours all the eggs of her nestmates, who work as workers. The advantage of such a community from solitary nesting is that the nest is always protected from parasites and predators, as it always has at least one bee in it. When solitary bees fly out to forage, the nest remains undefended. Most of the genes that are transferred to the new generation, however, in the bee community are contributed by the queen. This is much more pronounced in highly developed societies of ants, honeybees and bumblebees. The queen does not affect with her genes only the properties of queens of the next generation, but also the characteristics of future workers. Workers are therefore only part of the organism, like cells in the body.

A multicellular organism, such as ours, is composed of a large number of cells in different organs. Each cell performs its task and coordinates with others in the body. However, only gametes from the genital organs pass on their genes



Halictus scabiosae bees nest in burrows, which they dig into the ground. Worker in the picture leaves a nest again, after it deposited the pollen and nectar. The queen remains in the nest and defends it against parasites and other invaders.

to the offspring. We can have a similar look at the community of ants or bees, which is a kind of superorganism, in which members work together to the common good, but only some of them pass genes on to a new generation.

Under the influence of illusions about the omnipotence of technology and the alienation of man from nature we became convinced of the self-sufficiency and omnipotence. Our actions threaten the survival of creatures which once lived in harmony with us. People who spray the fields, gardens and orchards, do not think that they destroy also the insects on which they depend, as without them there is no fruit. News on the massive dying of domestic bees are reported regularly while bumblebees and solitary bees die hidden from our view. Bumblebees and other bees have less and less space for nesting. Mechanical mowing destroys many

nests of bumblebees. More and more grasslands are intensively farmed and only grass grows there that is wind pollinated and does not offer food to the bees.

Karst is an area that is still rich in natural dry grasslands full of blooming flowers. This is one of the areas of

Slovenia, where bumblebees have the best chance of survival. But even here we see the decline of wild bee abundance and their diversity. It is time that man becomes aware of the importance of symbiosis in nature, without which he himself will not be able to survive.



Bumblebee worker (*Bombus lapidarius*) on a rattle blossom.



Garden bumblebee (*Bombus hortorum*) has a very long tongue and can reach nectar in the deepest flowers.