Adaptations to habitat anthropization

Figure 1. Tiger mosquito, Aedes albopictus. Native to tropical Asia, the tiger mosquito Aedes albopictus is a highly fecund and mobile generalist species, which has adapted to the habits and customs of the most ubiquitous species among the mammals it parasitizes: Homo sapiens. Laying its eggs in all sorts of stagnant water containers (puddles and various receptacles, including abandoned cans and used tyres), resistant to numerous insecticides, the vector species has been expanding for several decades in Europe, Africa and America, driven by international goods flows (tyres). In the course of their geographical and ecological expansion, the populations have become vectors of various infectious or parasitic diseases, whose agents (viruses, bacteria, protists...) are inoculated into the bloodstream of hosts by the bite of females: yellow fever, dengue, Zika, Chikungunya... [Source : James Gathany, CDC, Public domain, via Wikimedia Commons]

For more than 50 years, involuntary large-scale "experiments" in industry and agriculture have confirmed the **potential for genetic adaptation** of prolific species (of the 'r'-type) confronted with the **anthropization** and chemical modification (pollution) of their habitats. The resilience of mosquito populations after decimation, illustrated by their adaptation (genetic resistance) to DDT in the 1970s is well known [1]; the genetic adaptation of "weeds" and other flowering plants to various herbicides is even better known, as is that of fungi that parasitise cultivated plants (such as wheat rust, maize smut, *cycloconium* of olive trees, etc.) to fungicides, or that of phytophagous insects (including Phylloxera of the vine, the European corn borer, etc.) to insecticides (see : The adaptation of organisms to their environment).

Figure 2. Mummichogs (Fundulus heteroclitus) in an aquarium. Source: NOAA, Public domain, via Wikimedia Commons]

More recently, ecologists have demonstrated the genetic adaptation of earthworm *(Lumbricus rubellus*) populations to metal pollution in soils [2]. Similarly, although less resilient and diverse than mosquito populations, fish populations such as those of the Mummichog (*Fundulus heteroclitus*) have adapted to PCB contamination of their habitat [3].

However, the potential for genetic adaptation of highly abundant and fertile species to changes in their living conditions, and in particular to chemical pollution of their habitats, is **not unlimited**. Thus, the **decline of pollinating insect species** (bees and bumblebees, butterflies, beetles, etc.) observed in intensive agricultural regions for several decades is not only restricted to specialist species [4], [5]; it also concerns certain generalist species that were very abundant before the "green revolution", such as the honeybee, whose numbers have fallen by more than **60% in 60 years** [6] and whose populations do not seem to be adapting to the increasing scarcity of the flowers (messicolous plants) that they gather or to the growing toxicity of systemic pesticides (e.g. neonicotinoids).e.g. neonicotinoids) spread in the fields (and see focus 2, on The demogenetic strategy of bees).

Figure 3. An urban red fox, pulling on a chain hanging on the door of a pet rabbit's pen... most likely to open that door, and gain access to the resident! [Source : User Oosoom on en.wikipedia, CC BY-SA 3.0, via Wikimedia Commons]

Among vertebrates, many fish species have responded genetically to fishing pressure by reproducing earlier, allowing adults to slip through the net. Various passerine species, with relatively high intrinsic population growth rates, have adapted genetically to life in cities. For example, the song of great tits has changed in frequency in response to the background noise of urban traffic. Blackbirds, for their part, have adapted to the artificial night lights of cities through reduced stress.

It should also be remembered that all bird and mammal species that have inhabited cities and other anthropised environments for centuries have necessarily **adapted** (at least) to them **behaviourally**, demonstrating great capacities for innovation and/or learning by imitation. Among the generalist and mobile species that are easy to observe, let's mention the herring gulls and laughing gulls, two ubiquitous "seabird" species that today find their pittance not only by prospecting the coastline in search of small prey and corpses (small crustaceans, molluscs, fish.), as did their ancestors, but also by following fishing boats or waiting for them in port to feed on the docks with discarded fish, by capturing earthworms that emerge in the fields during the ploughing season, by inspecting the rubbish bins of towns and villages (like cats, rats, dogs and foxes) or by feeding on organic waste in rubbish dumps.

Notes and references

Cover image. Urban herring gull. [Source: © Anne Teyssèdre]

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