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Use science to fight the locust plague

Swarming insects are ravaging parts of Asia, Africa and the Middle East. Research on their behaviour must be furthered, funded and field-tested.

FREDRIK LERNERYD/GETTY

Desert locusts have been swarming in some areas since late 2019.

On top of coronavirus, many countries are dealing with a second dangerous plague. Since the end of 2019, gigantic swarms of the desert locust *Schistocerca gregaria* have been devouring crops across East Africa, the Middle East and southwest Asia. It is the worst locust crisis some regions have seen for 70 years.

The upsurge – which has been linked to unusually heavy rains and a tropical cyclone on the Arabian Peninsula – has produced devastating swarms in Kenya, Ethiopia, Somalia, Yemen and India, with many more countries under threat. At least 20 million people are at risk of losing their food supplies and livelihoods, according to the Food and Agriculture Organization (FAO) of the United Nations. Swarms typically contain between 4 billion and 8 billion locusts, and can eat in a day the equivalent of what at least 3.5 million people would consume.

Governments and research organizations in the affected countries are fighting to control the insects, largely by spraying pesticides from planes. But it can seem like a losing battle. The swarms are being dealt with at the 11th hour: only after the juvenile insects, which are known as hoppers, gather to take flight.

But researchers are making progress. They are starting to understand how the insects communicate; some have used data from other outbreaks to design tools to predict when and where the next ones will happen. They are calling for more real-time data to inform agricultural policies.

All this is crucial work, but just first steps. Equally important is the need to test, improve and eventually act on these findings. The results must be turned into something practical that can be used in the fight against the desert locust.

Chemical attraction

One long-standing mystery is what causes the locusts to come together periodically in sky-blackening swarms. In this issue of *Nature*, Xiaojiao Guo and her colleagues report one answer: they identify a sweet-smelling pheromone produced by the migratory locust *Locusta migratoria*, a different species that also forms swarms. The researchers, at the Chinese Academy of Sciences and Hebei University, isolated 35 compounds emitted by this insect (X. Guo *et al. Nature* **584**, 584–588; 2020). They tested a handful for their ability to attract other locusts, and found that the pheromone 4-vinylanisole (4VA) had the strongest results. The researchers also discovered that when just four or five locusts congregate, they start to produce 4VA, which then attracts others to create a swarm (see New & Views, page 528).

The researchers identified a gene, *Or35*, which produces a receptor that detects the pheromone. Using CRISPR–Cas9 gene editing, they showed that locusts with a mutated *Or35* were unable to detect or respond to 4VA.

> "Locust surveillance has been weakened by years of under-funding."

Locust forecast

In a different study, published last month, Emily Kimathi and her colleagues created the first draft of a machine-learning algorithm designed to predict desert-locust breeding sites (E. Kimathi *et al. Sci. Rep.* **10**, 11937; 2020). The team at three institutions in Kenya, working with the FAO, combined more than 9,000 locust records from Mauritania, Morocco and Saudi Arabia with information on rainfall, temperature and soil and sand moisture. The algorithm performed well at predicting breeding sites in all three locations.

All these promising findings could, at least in theory, be used in complementary ways. The model could point to potential breeding sites, where an artificial pheromone might be released to attract locusts so that they can be trapped and destroyed before they breed in large numbers. But first, the findings must clearly be validated, extended and tested in the field. The machine-learning model needs to be refined. Researchers must establish whether 4VA has the same effect on the destructive desert locust as on the migratory locust and whether other signals are involved; much more work would be needed before an artificial pheromone could be created; and researchers must investigate practical issues such as how, where and when to distribute traps.

Major locust upsurges happen infrequently – the last event was 15 years ago – and so national and international funders have not prioritized such research. That is one reason countries have not been prepared for attacks: locust surveillance, including in-country research, has been weakened by years of under-funding. This cannot be allowed to continue. It isn't known how quickly swarms will return after the present outbreak. But countries must be prepared when they do.