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Desert Locust and Climate Change: A Risk for Agriculture

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Abstract

Locusts are migratory, trans-boundary pests. Wet conditions can cause further worse locust outbreaks worst case scenario, they can destroy the livelihoods of one-tenth of the world's population, according to the FAO. As per the Food and Agriculture Organization of the United Nations (FAO), these locust attacks are going to intensify with rains. The United Nations has warned that this year, India's farmers are at a "serious risk" from locusts swarms. As greenhouse gases continue to warm up the ocean and the atmosphere, extreme events caused by the Indian Ocean Dipole (IOD) are predicted to be increasingly common place.

Introduction

Locusts are members of the grasshopper family *Acrididae*, a species of short-horned grasshoppers, have often been called piranhas of the skies. Locusts differ from grasshoppers because when meteorological conditions are favorable they have the ability to change their behavior and physiology, in particular their morphology (color and shape), in response to changes in density. Desert locusts (*Schistocerca gregaria*) are usually restricted to the semi-arid and arid deserts of Africa, area receive less than 200 mm of rain annually (near East and South-West Asia) during quiet periods (known as recessions). Locust numbers decrease in normal conditions either by natural mortality or through migration. In the deserts between Mauritania and India Desert, locusts are always present somewhere there. Desert Locusts can increase rapidly in number when there is plentiful rain falls and annual green vegetation develops and within a month or two, start to concentrate and become gregarious. Unless checked, this can lead to the formation of small groups or bands of wingless hoppers and small groups or swarms of winged adults. This is called an outbreak and usually occurs within an area of about 5000 km^2 (100 km by 50 km). A swarm measuring 1 sq. km can eat as much food as 35,000 people in one day, according to FAO's Locust Information Service.

Risk for Indian Agriculture

The worst locust outbreak seen in the last twenty-five years is a major threat to food security. As per the Food and Agriculture Organization of the United Nations (FAO), these locust attacks are going to intensify with rains. The United Nations has warned that this year, India's farmers are at a "serious risk" from locusts swarms.

As per the Environment Ministry, Rajasthan remains the worst affected state in the country. India is going to affected in these following sectors-

• As soon as the sowing season begins, the Kharif crop (rice,

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maize, pearl millet, pulses, and soybean) become vulnerable to locust attack.

- Damage to the agricultural economy.
- Livelihood of agricultural workers.
- A potential risk to food supply.

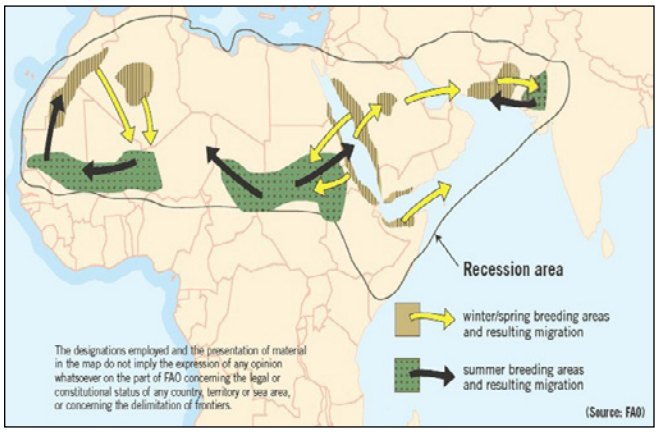

Figure 1: Desert locust range and breeding area

Locust and Weather Variables

Desert locust biology is dependent on weather, especially rainfall, temperature and wind.

Precipitation

Eggs, hoppers and adult stages of development have all been supported by the recent rains. The year 2019-20 has been extremely wet for both East Africa and India.

Temperature

Temperature requirements vary depending on the state of development. Locust swarm will fly at 15 °C when there is sunshine, but it needs to be warmer under cloudy conditions (about 23 °C) for it to be airborne.

Wind

Desert locusts usually follow the wind current. Predictions by the NOA wind pattern are being used by the FAO to try to predict their spread, although these are not associated with the locust lifecycle. In Rajasthan, the wind prevailing from April to October is from the West. However, when the wind exceeds 6-7 m/s, locust swarms are unlikely to fly.

These elements predict the movement and development of locusts and research continues to improve the forecasts further.

Locust and Climate Change

Heavy rains lead to the development of vegetation in arid areas, providing the necessary conditions for the development and breeding of locusts (World Meteorological Organization).

The warming of the Indian Ocean due to climate change is cited as the main reason for the proliferation of locusts that are now ranging from the horn of Africa to the Arabian Peninsula to the Indian subcontinent. It also includes an unusual number of low pressure systems (meaning more rain) associated with the ocean circulation patterns called the Indian Ocean Dipole (IOD) that measure the difference in water temperature between the opposite sides of the Indian Ocean. The positive phases of the IOD are becoming more common, and scientists believe climate change is responsible for this. As greenhouse gases continue to warm up the ocean and the atmosphere, extreme events caused by the IOD are predicted to be increasingly common place. The older extremely positive IOD years will probably bring floods and cyclones, such as already been seen in the unsafe and food-insecure areas of 2019.

A recent scientific report published in the Nature journal has shown that there is increased rainfall in northwest India that has led to an increase in soil moisture and vegetation in the Thar Desert. “Climate change might exert more substantial impacts on the ecosystem in arid and semi-arid regions than in the humid regions, owing to the high sensitivities and vulnerabilities to rainfall variations of the former,” the researchers said.

How Locust Attack can be Controlled?

To control these swarms vulnerable countries use remote sensing technology and ground surveys to identify and eliminate.

Control techniques for managing locust swarms include cultural control (digging, burning), baiting (scattering locust food impregnated with insecticides), dusting with insecticide and spraying liquid insecticides (chemical or biological) using ultra low volume (ULV) application. ULV spraying is one of the most preferred methods as it uses very low volumes of liquid in comparison to conventional spraying (0.5-3 litres/ha in comparison to 100s or 1000s of litres for other spraying methods) and uses oil based formulations which greatly reduce evaporation. The method is based on creating small, even sized droplets which are carried and impacted on the target by the wind.

Biopesticides such as *Metarhizium anisopliae* have previously been applied successfully using ULV methods to control locust populations as part of locust integrated management programs.

Under biocontrol using entomopathogenic fungi (*Metarhizium acridum*) (or) bio-inhibiting of pheromones (Guaiacol – especially for synthesis to attracting lowcusts and forming swarm) through application of *Pantoea agglomerans* (Zhang *et al.,* 2019).

Complications to Control Locust

• The swarm is highly mobile, migrating from 50 to more than 100 km in a day;

• The total invasion period frequently occurs in a relatively brief time, sometimes as short as a month but rarely longer than three months;

• The swarms are unevenly distributed in time, so that very large swarms may be available for only a few days, followed by relatively long periods when none is present;

• Swarms are variable in size and can extend up to thousands of hectares;

• Campaign experience, funds and supplies are often lacking in locust affected countries because of the irregular occurrence of locust upsurges and plagues.

Conclusion

In India, locust survey and control are the responsibility of the Locust Warning Organization (LWO) under the Ministry of Agriculture. India and Pakistan cooperate on the border to share information. Control operations for locusts are limited due to the paucity of resources and the ongoing pandemic, but the response continues. Tractor-mounted sprayers and fire vehicles are being used to spray areas. The government is also considering the use of drones for observation and spraying, along with restrictions around airports and international borders.

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