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# THE MENACE OF LOCUSTS

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*Locusts have harassed mankind for millennia, emerging at irregular intervals from some areas in the deserts, often following rains and consuming everything in their way. We discuss their menace, life cycles, and procedures for their control, in which advance warning and international collaboration play an important role.*

## *Introduction*

Imagine a polyphagous swarm of 50 billion flying insects (see Fig. 1), covering an area of 850 square kilometres, each insect eating 2 grammes of crops per day. It will strip the land of 100,000 tonns of vegetation every day as it moves. And now imagine, the frequency of this menace increasing as climate change increases the frequency and ferocity of prolonged droughts and heavy rains. Locusts are emerging as a big threat across all parts of the world. Southern USA is reported to be gearing up for locust invasion, as it struggles with debilitating droughts. India witnessed a locust invasion in several parts of North India in 2020.

Histories of all lands are replete with references to swarms of locusts from ancient times. Kautilya talked of extending every possible help to people by the administration during the plague of locusts in his Arthashastra. Mahabharata, Bible, and the Holy Quran have references to swarms of locusts.

Locusts are grasshoppers. There are thousands of species of grasshoppers. Out of thousands of grasshopper species, are the 22 can be described as locusts. The main locusts are the Desert Locusts, the Bombay Locusts, the Migratory Locusts, the Italian Locusts,the Moroccan Locusts, the Red Locusts, the Brown Locusts, the South American Locusts, the Australian Locusts, and the Tree Locusts. Only The Desert Locust, Migratory Locust, Bombay Locust, and Tree Locust have been reported in India (Fig. 2). The Desert Locust is the most important pest in India as well as in the intercontinental context.

Depending upon the size, the swarms are classified as an Outbreak, which has small pockets that are confined to certain areas; an Upsurge- which has slightly larger groups that are still confined to a geographical area; or a Plague- when extremely large groups that are separated by breeding locations but come together to form swarms.

Locusts are distinguished by their ability to transform from a solitary state—actively avoiding other locusts—into a social, or "gregarious", state in which masses of them darken the sky, ravage the land, and terrorize people in a phenomenon called density-dependent phenotypic plasticity[2].

## *Life of a Locust*

The desert locusts, for example, are found mainly in Africa, Arabia, and West Asia, and extend up to South Asia and Western Spain. The adult female lays eggs by digging a hole in soft soil (Fig. 3). One such pod may have 50 to 150 eggs, and they lay eggs two to three times in their life. The female secrets a disinfectant foam that protects the eggs from drying out in desiccated sandy soils and hardens and seals them from predators.

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**Fig. 1:** A Swarm of Locusts [FAO]

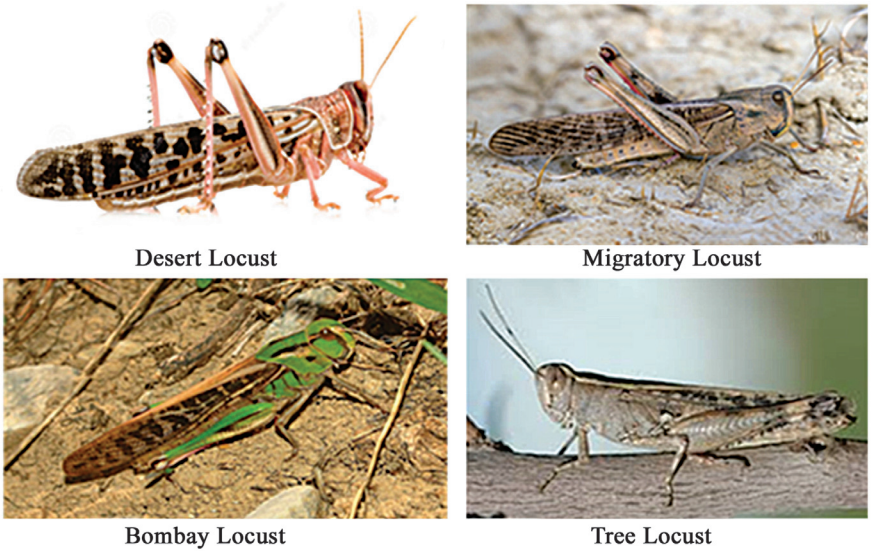


**Fig. 2:** Locusts found in India[1]

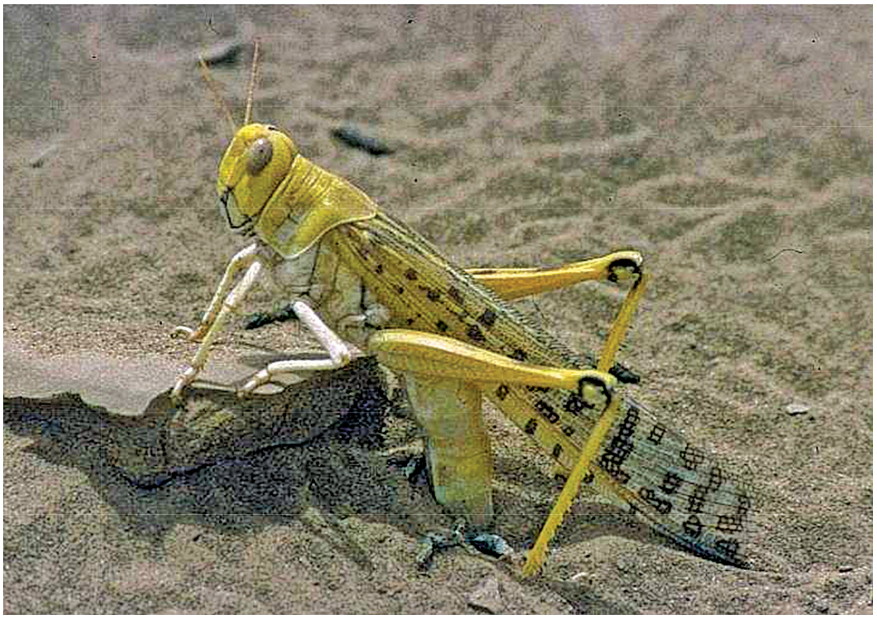

**Fig. 3:** A Desert Locust Adult Female Laying Eggs[3]

The eggs hatch, leading to wingless nymphs. These go through 4-6 stages of shedding their skins, called the instar. These develop into hoppers in about 5 weeks and then into fledglings- which can fly (Fig. 4).

At any point in that process, they can turn gregarious—if conditions are right. Transformations in their behaviour and physical traits can eventually be reversed, or they can persist and be passed on to offspring. This proceeds as follows[4] :

1. Solitary locusts, which are always in search of food are unintentionally forced together during dry spells when vegetation dies off and leaves minimal areas of green within the desert.
2. This leads to a sudden transformation and within hours of crowding, a boost of serotonin in their central nervous system spurs behavioural changes such as rapid movements, sociability, increased self-grooming, and a more varied appetite.The switch to the gregarious state includes physical changes such as a larger brain and shorter legs. The large brain perhaps helps them in more complex information processing. Offspring of gregarious locusts (Fig. 5) develop smaller femurs, which provides them increased endurance. Their hops are shorter but then they use less energy to cover the same distance. It is now known that the release of serotonin is caused by leg hairs (Argentinian) and the touch, sight, and smell of other locusts.
3. This leads to a breeding and feeding frenzy. Rains provide moist breeding grounds and new generations form groups that for age in unison (Fig. 6). The solitary females lay their eggs in isolated places. The gregarious females lay their eggs in proximity, leading to a

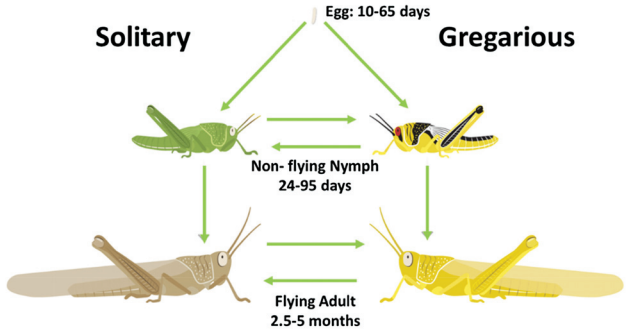


**Fig. 4:** Life of a Desert Locust, (Adapted from National Geographic[4])

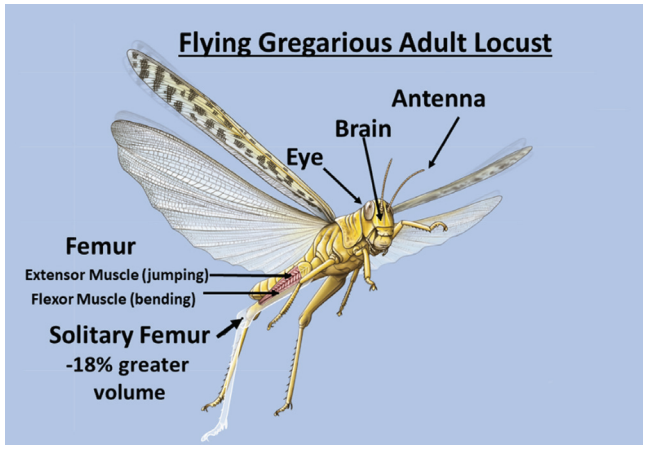


**Fig. 5:** Flying Gregarious Locust (Adapted from National Geographic[4])

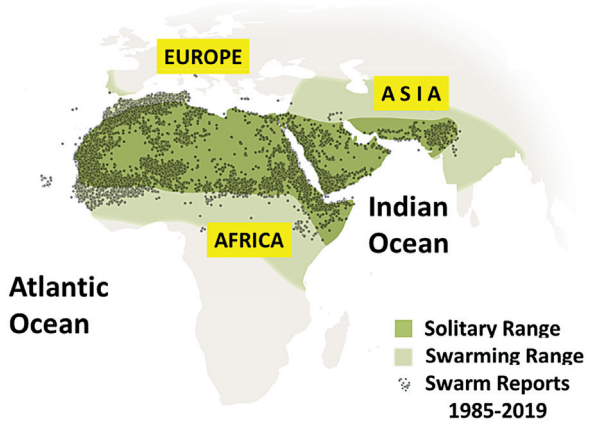


**Fig. 6:** Range of Locusts in the Old World (Adapted from National Geographic[4])

further increase in density, as the eggs hatch. Once their wings grow, the herds become flying swarms in search of more food and habitat. The swarming locusts turn bright yellow, (or orange or black)- as a signal to birds, reptiles, and other predators that they may be unappetizing or poisonous.

4. Even though not very common, a major plague begins when swarms, often travelling 50 to 100 kilometres a day, develop over multiple regions and merge. Locust swarms fly with the wind at

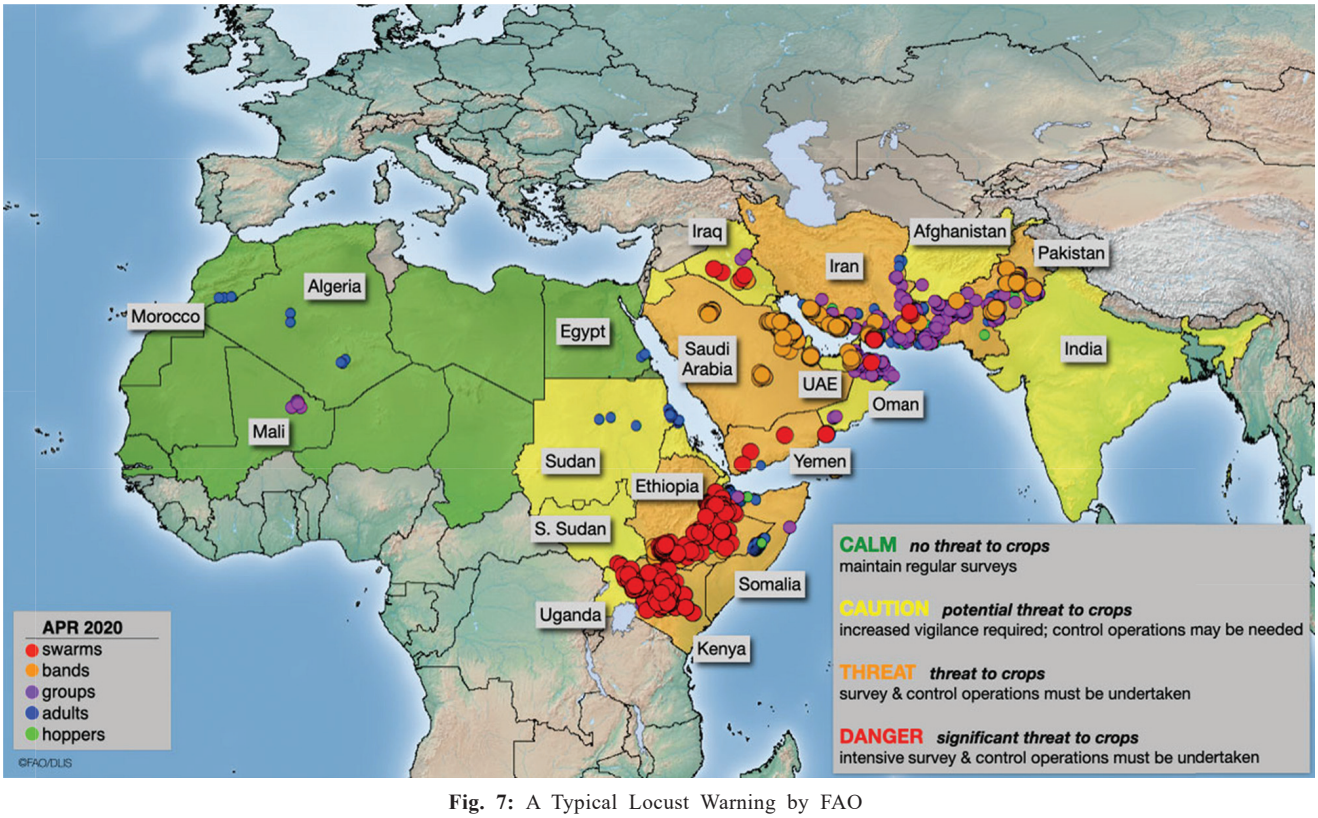


**Fig. 7:** A Typical Locust Warning by FAO

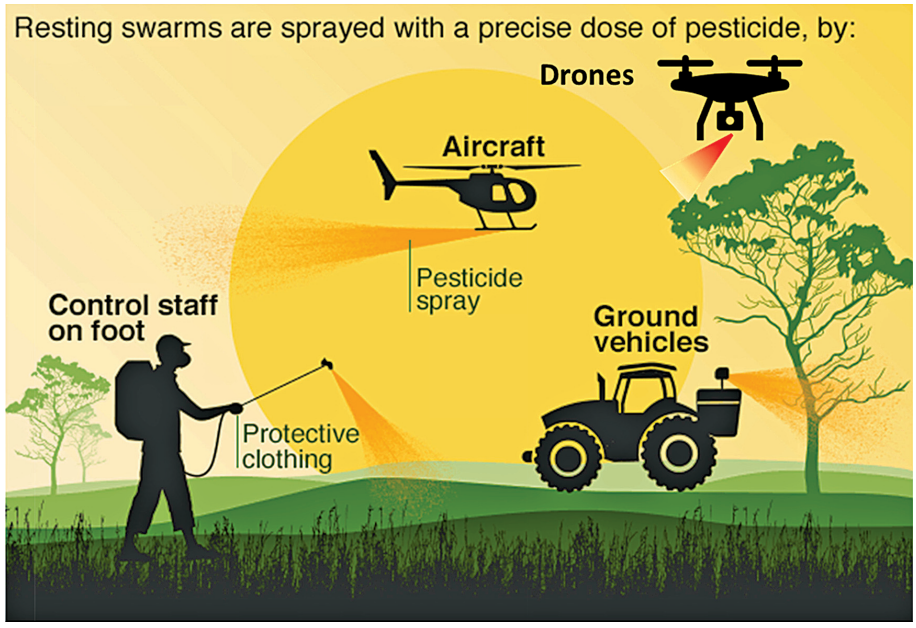


**Fig. 8:** Control of Locusts (Adopted from BBC.COM)

roughly the speed of the wind. Locusts can cover from 100 to 200 km in a day and fly at a height of up to about 2,000 m above sea level (the temperature becomes too cold at higher altitudes). Thus, swarms cannot cross tall mountain ranges such as the Atlas Mountain range in Africa, the Hindu Kush, or the Himalayas. They also do not venture into the rain forests of Africa or into Central Europe. On one occasion they flew over 5000 kilometres from Africa and reached the Caribbean, and on another occasion- they reached England. Without intervention, plagues can last years, until a natural die-off occurs.

Till the 1930s, Midwest in North America used to be routinely devastated by locusts. The conversion of their breeding grounds- the vast grasslands, to intensive agriculture and grazing eliminated them for good. One invasion in 1931 was said to be so thick that it blocked out the sun and one could shovel the locusts. Cornstalks were eaten to the ground and fields were left completely bare. Large swarms were common in South America too, and after subsiding by the 1950s; these have been seen in recent times. Australia has its own desert locust, and these erupt from time to time, causing a great loss of crops and fruits. Only Antarctica does not have locusts.

Because of their impact on the agriculture and food security of poorer nations, the Food and Agriculture Organization (FAO), United Nations monitors their emergence and issues warnings at regular intervals. One such warning, issued at the beginning of 2020, which impacted India and Pakistan, is given in Fig. 7.

**Fig.9:** Dense Hopper Bands in Sudan [Credit: Wikipedia]

Locust Warning Organization in India was established in India in 1939, with its headquarters in New Delhi and a branch in Karachi. It is now incorporated into the Directorate of Plant Protection, Quarantine, and Storage. India and Pakistan routinely cooperate in tackling the menace. The Government of India has a detailed Contingency Plan for Desert Locust Invasions and Upsurges[5] which it updates regularly, with feedback from FAO.

### *Control of Locusts*

While solitary, locusts are harmless. When gregarious

swarms are on the move, insecticides can be sprayed on them using helicopters or drones (Fig. 8). The pests can also be doused with chemicals using hand pumps and land vehicles, and whole swarms can be targeted and killed in a relatively short time. Up to 97% or more of the pests must be killed, or else they recover and develop into a swarm again. For smaller swarms, using flame throwers, smoke, and beating metallic plates has been tried.

Of course, if one can locate their breeding grounds, one can plough the area and destroy the eggs. One may also dig a 2 feet wide and 2 feet deep ditch around that place, for the flightless nymphs to get trapped.

For centuries, farmers in Africa have depended on birds like Glareola, starlings, and ibis to alert them about the impending emergence of locusts and to keep them under control, as they appear at the time of their breeding and follow them. Several bio-pesticides are now available to control locusts. As locusts are also eaten by many, care should be taken not to consume the ones exposed to pesticides.

Australia has been using satellites to locate large locust swarms. Satellite imaging can also locate sites in isolated and difficult terrains, which may hold moist earth that locusts use for laying eggs[6].

It has been known for a long time that solitary locusts become gregarious when rains follow a prolonged drought, or when rains fall on the desert leading to a large growth of vegetation. The climate change resulting in prolonged droughts and heavy rains is also leading to the frequent emergence of locust swarms.

Locusts can sense weather in advance. As the wind flows from regions of high pressure (hot and dry) to those with low pressure (cold and with rains and vegetation) so do the locusts. This is a useful indicator to follow and destroy them before their numbers assume alarming proportions. Locusts at the hopper stage are still destructive.

Once they get their wings, they would fly several tens of kilometres an hour, and get more difficult to control. Thus, the hopper stage (Fig. 9) is the best period to spray, i.e., after hatching but before growing wings. Nevertheless, we should remember that the use of insecticides has harmful effects on the ecosystem and more research is required to find safer chemicals. It is a pity that the developing countries which are most adversely affected by locusts lack financial resources and the scientific know-how to do this effectively. We add that a study has found that male locusts apply a particular scent to the females they have mated with, to make them unattractive to other male locusts. Scientists are hoping that this scent can be synthesized and applied to a general locust population. This will breakdown their production and eliminate them without harming the environment.

*In brief*, even though, a particularly menacing outbreak of locusts may affect only a few percent of the total production of food in the world, the local effect-especially on small farmers whose entire crop is destroyed is overwhelming. Climate change is likely to increase the frequency of their invasion, considerably. ❐

## *References*


1. http://ppqs.gov.in/divisions/locust-control-research/overview
2. Martina E Pocco, M Marta Cigliano, Bert Foquet, Carlos E Lange, Eliana L Nieves, Hojun Song, Density-Dependent Phenotypic Plasticity in the South American Locust, Schistocerca cancellata (Orthoptera: Acrididae), Annals of the Entomological Society of America, Volume 112, Issue 5, September 2019, Pages 458–472, https://doi.org/10.1093/aesa/saz032.
3. https://en.wikipedia.org/wiki/Desert_locust#/media/File:SGR_laying.jpg
4. https://www.nationalgeographic.com/magazine/2020/02/how-to-set-off-a-plague-of-locusts-interactive/
5. http://ppqs.gov.in/sites/default/files/contingency_plan_0.pdf
6. Locusts and remote sensing: a review; Alexandre V. Latchininsky, J. of Applied Remote Sensing, 7(2013) 075099. https://doi.org/10.1117/1.JRS.7.075099