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LOCUST PLAGUE AND ITS MANAGEMENT STRATEGIES

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Introduction

Alongside corona pandemic in the beginning of the year 2020, many countries around the globe including India have fought another battle for food security caused by the desert locust, which is small in size but millions in number. Though locust do not attack human or animals, historically it has been affecting mankind since ancient times and continue to be the world's most devastating pest as they can pose a major threat or challenge to our agriculture, food security and to the livelihoods of about 10% of the world's population which finally can lead to famine and starvation. Locust attacks have been mentioned as a curse to mankind in almost all ancient manuscripts, right from wall paintings on ancient Egyptians pyramids to the Bible and Quran. Furthermore, ancient Greeks also mentioned about locust attacks and so did Sanskrit poems date back to 747 BC. In some cases, they have often been called as piranhas of the skies which were typically originated in the desert regions across North Africa, the Middle East, and Southwest Asia as early as 2420 BC in Egyptian tombs (Nevo, 1996). The only reason that seems to be surprised by the recent locust swarms is that they have become the worst infestation in 25 years in Ethiopia and Somalia, in 26 years in India and the worst in 70 years in Kenya as per the UN Food and Agriculture Organization (Factsheet, 2020). In Indian context, there had been many locust attacks or plagues, uprisings and incursions during last two centuries approximately 12 locust plagues until 1962 and most of the attacks have been localised to Rajasthan since 1993. Though cycle of locusts is a routine phenomenon that follows its breeding and swarm movement after the rainy season, yet last year, 2020's outbreak of locusts was not in its normal routine and far more problematic to be managed. Many scientists and researchers have linked this outbreak to the climate change. Locust outbreak coincides with the cyclones of 2018 and warm weather at the end of 2019 with a supplementary effect from the heavy rains in areas including Ethiopia, Eritrea, Iran, Pakistan, Saudi Arabia and Yemen. But this time, favourable weather conditions have facilitated locust outbreak and further spread or travel from Rajasthan to Gujarat, Madhya Pradesh, Uttar Pradesh and even Maharashtra.

What are locusts?

They are actually the short- horned grasshoppers belonging to family Acrididae with highly migratory nature and a voracious feeding behaviour. So far at present there are ten important species of locusts in the world, out of that only four species are found in India namely: Desert locust (*Schistocerca gregaria*), Migratory locust (*Locusta migratoria*), Bombay locust (*Nomadacris succincta*) and Tree locust (*Anacridium* sp.). Out of these ten species, the desert locust is the most important and also the dangerous migratory pest species in India as well as in the world.

Locust swarms consume everything in their path, leaving behind ruined cropland and barren pastures. While they are not known to impact forests or natural tree cover, their voracious

consumption of most species of crop creates food scarcity for native fauna and other insects. Locust is an insect which is quite similar in appearance to grasshopper and cricket as these insects belong to the same family but differ in many ways like the latter one does not have gregarious phase and no long- distance migration. This means locusts exist in two phases (which is a unique trait)- solitary and gregarious phase. They are usually solitary, but under certain circumstances such as wet soil with frequent rainfall, good vegetation, they become more abundant and transform themselves completely in their appearance, colour, behaviour and habits, becoming gregarious to form large swarms. Problem arises only when they are in gregarious phase as they have high appetite with more endurance and their movements become more rapid. Generally, one swarm contains billions of insects per square kilometre which has the capacity to eat everything that falls in its flight path. The magnitude of the damage caused is very gigantic due to its polyphagous feeding nature, devouring the leaves, flowers, fruits, seeds, bark and growing points of almost all types of crops or non- crops plants and also by breaking down trees because of their weight when they settle down in masses and thus, leading to complete destruction wherever they pass by. It was estimated that on an average a single locust swarm eats as much food in one day as about 10 elephants, 25 camels or 2500 people.

Locust life cycle and biology

Life cycle of a locust has three distinct stages -Egg, Hopper or nymphs and Adult.

Egg: Locusts lay eggs in pods in moist sandy soil at a depth of about 10 cm at an interval of 7 – 10 days. In comparison, gregarious female usually lay lesser eggs (which may be in 2-3 egg pods having 60-80 eggs in average), than the solitary phase female that mostly lay 3-4 times having 150-200 eggs in average. The rate of development of eggs is mainly depending on soil moisture content and temperature. No development takes place below 15°C and they require 10-12 days of incubation period when the optimum temperature is between 32-35°C.

Nymph/ Hopper: Nymph or hopper (young ones) emerges from the eggs when incubation period is completed. There are 5 instars in gregarious and 5- 6 instars in the solitary phase where in each instar there is a change in its growth and characteristic colour.

The rate of development in hopper depends mainly on the temperature. It takes 22 days when the mean air temperature is hot of about 37°C and may be delayed up to 70 days when the mean temperature is cold of about 22°C.

Adult: The 5th instar adult moults into adult stage. This young adult is called 'fledgling' or 'immature adult' means they are sexually immature. The period of sexual maturity varies. In suitable condition the adult may mature in 3 weeks and under cool and /or dry condition it may take time of 8 months. Young immature adults are pink in colour but on maturation the adults become bright yellow. Males mature early as compare to females. Adults fly in search of favourable breeding ground and during this act, they may cover thousands of kilometres for search of suitable breeding condition. Oviposition commences within two days of copulation (<http://ppqs.gov.in/divisions/locust-control-research>). Locust swarm usually lasts in a given place for 17-24 hrs, but if the winds are strong, locusts tend to move to next place before that. It is estimated that a single locust can fly up to 3000 miles in its lifetime and their swarms always tend to move within a delimited area.

Locust control in India

In regard to control the locust attack, farmers have tried many ways to scare locusts away. Such activities like burning vegetation, collectively beating loud drums, tin containers, utensils and using even loudspeakers to make loud noises, barriers, smoking and battues were tried but did not give

effective results. Some have even come up with the idea of releasing poultry to feed on the insects. However, in the face of a locust outbreak, the ingenuity and hard work put in by farmers to save their crops are to no avail. The chemical insecticides currently used are more effective but it is environmentally hazardous on large-scale use. This is why research is under way to find safer, in other words less chemical, products, for instance biopesticides based on pathogenic fungi, plant extracts, etc (Lecoq, 2001).

In India, the locust control and research are governed through Locust Warning Organization (LWO) with its headquarters at Jodhpur, Rajasthan). It was established in 1939 and amalgamated in 1946 with Directorate of Plant Protection Quarantine and Storage (DPPQS) of Ministry of Agriculture and Farmer's Welfare. They undertake regular surveys in the scheduled desert areas of Rajasthan and Gujarat to monitor the presence of desert locust and ecological conditions. An assessment is made during the survey to determine, if the locust numbers have crossed the economic threshold level (ETL) which is 10,000 adults/ha and 5-6 hoppers/bush and it may require to control if the locust numbers is beyond the ETL (Sharma *et al.*, 2020).

LWO is responsible for regular, timely monitoring and planning for locust eradication and providing assistance to state governments in controlling the locust invasions. Regular vigil and necessary control measures will remain a concern in view of the global status and scenario of locusts. However, it is usually very difficult to control a locust swarm because of its huge population density. For example, locusts swarm found in Kenya in 2020 was 40 km x 60 km in dimension – 2400 km². It is estimated that even a very small swarm of 1 km² contains around 1 – 1.5 billion or more than 150 million locusts and therefore, any control measures will be futile against such a large population. Already efforts have been initiated in the aspect as the central government has advanced its preparations that include procurement of specialized sprayers equipped with latest technology, and use of helicopters, drones and aircraft sprayers aided aerial spraying to combat the situation. Because of its huge population density, reports of crop damages have been pouring in from these states, so farmers tried their best effort to get rid of locusts by smoking them out, scaring them away by making loud noises or spraying chemicals. Even the state and central machineries, including the LWO, are actively trying to control the invading locusts in India through Pakistan, but their efforts may not be enough. So far three different methods are being used for management of locust menace namely- mechanical methods, baiting and dusting or spraying insecticides. In Mechanical methods, digging trenches, beating and burning activities were done for controlling locust and in baiting method, scattering locust food impregnated with insecticide were practiced. According to the latest reports, the best carriers for locust bait were found to be maize meal, wheat bran, maize bran, cotton seed husk and rice bran and the ratio of the carrier to insecticide should be prepared in the ratio of 20:1. In dusting or spraying method, dusting are mainly done by applying a fine dust impregnated with insecticide and spraying is done with liquid insecticides.

In this current scenario, the primary or most commonly used method of controlling locust swarms is mainly dependent on organophosphate chemicals which are applied in small concentrated doses or ultra-low volume (ULV) formulation and are sprayed with the help of vehicle-mounted and aerial sprayers and to a lesser extent by knapsack and hand-held sprayers.

Currently insecticides used in locust control, approved by CIBCR are for Scheduled desert area, Dust formulation recommended are Malathion 5% DP, Fenvalerate 0.4%DP or Quinalphos 1.5% DP @25 kg/ ha using duster and in liquid formulation important ones are malathion 96% ULV @1 litre/ha or chlorpyrifos 45% ULV @0.5 litre/ ha. In cropped area of Rajasthan and Gujarat, Fenitrothion 50 EC and Chlorpyrifos are used for spraying. However, at present, when this locust plague becomes

imminent or approaching, for a quick result/ impact its control is heavily dependent on the use of fast-acting, broad spectrum and environmentally harmful insecticides as mentioned above. Instead, an alternative strategy can be implemented which focuses on pre-gregarious locusts and its main objective should be in keeping the locusts permanently in solitary phase with the use of environmentally benign tactics and good understanding of locust biology and life cycle. Eco-friendly management of locusts can be applied with the use of pheromone technology or by using bioagents like *Metarhizium sp.* Potential management techniques for locust plagues may also include using wind as a marker, monitoring the swarms and their range expansion, and biological control for pest management.

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