Role of Insects and other Animals in Prediction of Natural Calamities

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Abstract: Insects and other animals have strong receptors to detect the changes in the surrounding environment. They have the special sense organs compared to higher animals to perceive the change in the earth magnetic field and infrasound (<20 Hz) which are faster than the ultrasounds (>20 Hz). The natural calamities *viz*., earthquake, volcanic eruption, tornado, tsunami and avalanches produce the pneuma gasses and infrasound by series of mechanisms and these can be detected by insects and animals with their special receptors to evade. Various reports and eye witnesses data from different parts of the globe says that, unusual behaviour of insects and other animals before the calamities are the first sign of sensing the natural disaster compared to humans. The current article is an endeavour to explain, how insects and animals escape from the natural calamities by adopting different mechanisms with supporting examples. Also, it will promote the researcher to work in line with insects and animal prediction mechanisms against natural calamities in further details.

Key words: Insects, other animals, natural calamities, predictions

The natural phenomenons like earthquake, tsunami, cyclone, forest fire and volcanic eruption are the major calamities which could destroy the ecosystem and economy around the globe. The sign of these disasters would be very difficult to recognise by humans until it hit the earth surface. But there were many studies to tell about the insects and animal activity before the calamity happens. Many attempts were done to use insects as well as wild and domestic animal behaviour to study the earthquake and other disasters across the world (Geller, 1997; Kirschvink, 2000; Kelley and Price, 2017; Kelley et al., 2017). The important observations were recorded on elephants, pet animals and ants, but no consistent data is available to use in forecasting such disasters (Quammen, 1985; Schaal, 1988). Many studies indicated that, the insects can able to sense the earthquake by change in the magnetic field and carbon dioxide concentration in the atmosphere (Oskin, 2013; Martins, 2016; Pereira et al., 2019). For example, the red ants and other insects have chemoreceptors for carbon dioxide gradients and mechanoreceptors for change in the magnetic field (Oskin, 2013). Similarly, animals will use sound signals for predicting disasters especially earthquakes. In general, insects and bats use ultra-sound (20-200 kHz) for navigation and predation (Pollack and Imaizumi, 1999; Fenton and Simmons, 2014; Garstang and Kelley, 2017). Similarly, humans have a tendency to hear sound frequencies more than 20Hz (e.g, piano sound ~27.5 Hz), with the help of the mechanoreceptors present in the skin (Jackson, 2004; Bailey, 2019; Williams,

2020). But animals like elephants, dogs, hippos, rhinos, felines, whales, and many birds depend on infrasonic sounds for communication and navigation because these waves have the frequency of 20 Hz or lower (e.g, Rayleigh waves) (Bailey, 2019; George, 2020; Williams, 2020). For example, giant animals, such as elephants, use infrasound (<20 Hz) for communication to long-distance, which would help in evasion from predator and reproduction (Garstang, 2009; Garstang, 2015). Interestingly, infrasonic sounds and altered magnetic field with modified atmospheric (pneuma) gasses are also caused by extremely energetic events such as earthquakes, tsunami, volcanic eruptions, lightning, meteors, avalanches and iceberg shedding (Jackson, 2004; Martins, 2016; Garstang and Kelley, 2017; Bailey, 2019).

Kelley and Garstang (2013) documented that most of the animals (elephants, dogs and donkeys) could detect thunderstorms hit prior to witness human. A report stated that the elephant detected infrasound 1000 km away from the epicentre where the tsunami breaking at Sumatra seashores (Garstang, 2009). Similarly, insects can detect these disasters by their specialised sensory modification viz., proprioceptors, chemoreceptors and mechanoreceptors by observing the change in the magnetic field and atmospheric gasses (Kirschvink, 2000; Oskin, 2013; Bailey, 2019) and to sense the rainfall and cyclones occurrence based on altered humidity and temperature, insects and spiders have specialised hair-like structure called hygro-sensitive sensilla (Sayeed and Benzer, 1996; Tichy and Loftus, 1996). So, forecasting the disaster by studying the behaviour of these creatures will help to save the lives of animals and human across the globe. Hence, in the present article, I threw light on the importance of insect and animal behaviours and their actions in disaster predictions.

Important theories on disaster prediction mechanism by animals

Prime theories are classified based on the animal and insects prediction to the earthquake by two mechanisms *viz.,* by sensing earth vibration and another by identifying variations in the air or gases (pneuma gas) in the atmosphere produced from the earth (Geller, 1997; Tributsch, 2013; Bailey, 2019; George, 2020). A quantum geophysicist, Motoji Ikeya explained that the variation in electromagnetic filed can also influence most of the animals to detects disasters, especially in more sensitive creature- catfish (Kelley and Garstang, 2013; Garstang and Kelley, 2017). But the exact mechanism involved in sensing earthquake by insect and animals, with the supportive publications is still in an infant stage.

Another important mechanism to detect the calamities is by P wave or compressional wave, these are the wave produced from the seismic body which shakes the ground backward and forward in direction of the wave movement (same and opposite) and easily perceives by most of the animals than human. P waves are not-audible and can travel ten times faster than normal sound waves. Another one is, S waves or shear waves also shakes the earth crust back and forth but perpendicular to the waves moving direction and can easily sensed by humans (Schaal 1988; Kirschvink, 2000; Williams, 2020).

The activity of earth vibration (seismic) produces stress from the surface of the ground into the atmosphere in the form of energy elements (aerosols that generate heat) and those elements will form into ions that trigger the serotonin production in animals, which are

detected by rodents and other pet animals (Tributsch, 1982; Geller, 1997; Williams, 2020). Red ants, rodents and other pet animals can also able to sense the changes in the level of carbon dioxide and magnetic field, but the exact mechanism involved in the detection is unclear (Oskin, 2013; Williams, 2020; George, 2020).

Instances of behavioural alteration by various creature based on the eyewitness

Most of the data collected by the researcher were based on unusual behaviour (restlessness and disorientation) made by various creatures before happening of disaster. So, many examples are based on mere observation rather than the experimental results from the calamity areas.

- **Ants,** in usual days, were inside the mounds at night, but before the earthquake of > 2.0 magnitude, they moved outside the nest. Similarly, they construct the mounds around the entry point to protect against heavy rain and they are highly active before the downpour (Oskin, 2013; Kampwirth, 2013; Williams, 2020). As per the United states global survey (USGS) report, some small creatures such as ants, centipedes, squirrels, snakes, rats and soil dwellers leave their nest to find a safe location and many insects were aggregate in massive swarms at the seashores prior to an earthquake (Quammen, 1985; USGS, 2020; Williams, 2020). In China at Qian'an and Ninghe districts huge swarm of dragon flies were reported before the 1976 Tangshan earthquake of 7.8 magnitude (Mei et al., 1982). At the same time, people's commune Miaolingtou and Qianxi districts almost 30 and 100 beehives banished their bees before the Tangshan quake. In the vicinity of harbour town Tingbo, big vehicle and huge oil tanker were completely covered by insects swarms viz., butterflies, grasshoppers, dragon flies, crickets and cicadas (Mei et al., 1982; Tributsch, 2013). In supporting that the cicadas stopped their monotonous noise before the heavy rainfall (Rogers, 2015).

- Bees are seen aggressive and restlessness before thunderstorm approach, similarly tropical leafcutter ants and bees were rushing back into the hive before an imminent rainstorm (Rogers, 2015). The butterflies need solar radiation for their flight; if they found overcast sky then they tend to settle in shelters (Rogers, 2015), that avoid them wet from the raindrops and escape from the predator because cool weather prior to rain will reduce their flight efficiency (Raupp, 2016). The aggregation of ladybird beetle is the primary indication of forthcoming hot weather and that help to safeguard the moisture (Viegas, 2014). The beetles, *Melanophila* detect the forest fire before it approach, maybe due to the initial heat produce in the forest (Zivkovic, 2011), by using their specialised organs called as infrared (IR) receptors, which are developed from hair mechanoreceptors on the cuticle (Klocke et al., 2011; Bousack et al., 2015).

- In South-Andaman, India, fishermen stated that, if the earthworms plenty outside, termites making holes in wet soils, snails climbing trees, increased activities of insects and moving ants to the safer location are the indication of cyclone approach (Sethi *et al.,* 2011). Before the Boxing day tsunami during 2004, the flamingos were flee away from the Indian wildlife sanctuary (Martins, 2016)

- In Italy at L'Aquila toads deserted their mating site before the strike of an earthquake and it was due to atmospheric electric field alteration (Bailey, 2019).

- In Sri Lanka elephants made trumpets strangely, breach the chain holding to a pole and ran away (upper ground) from the source of sounds which was low in frequency rumbled from tsunami in the Indian Ocean (Nature news-letter, 2008).

- At Mount Etna in Sicily, many researchers noted that goat became nervous and ran away from the pens before the hour of volcanic eruption during 2012 and they hypothesised that the gasses produced from the tremors are the first sign of warning (Rachel, 2015; Bailey, 2019).

- At Yanachaga National Park, Peru in 2011, scientists observed that the unusual behaviour of the birds and mammal before the earthquake, animals activities decreased sharply with an altered ionosphere in a week before the earthquake (Rachel., 2015; Bailey, 2019). The pigeons in China flew away from the place of the earthquake at the magnitude of 4.0 and the researcher concluded that the presence of tiny sensors between the tibia and fibula are the main source of prediction. Similarly, sparrows were flying unusually, wolves running randomly in the container and dogs were barking strangely, before the earthquake of 8.5 magnitude in Ninghsia province, Haiyuan in 1920. Based on the unusual behaviour observed by deer, tigers, giant pandas, loaches, yaks and seagulls, sharks, some fish species inland and Pohai Sea respectively, made to issue a warning at Tientsin before the earthquake of 7.4 magnitude in 18th July 1969 (George, 2020).

- As per the eyewitness of the local public in Liaoning province, snakes came out from hibernation and many animals (cows, horses, dogs and pigs) showed unusual behaviour preceded to 4th February 1975 earthquake (7.3 magnitude) (George, 2020; Little Peckers, 2020). Similarly, horses and mules were jumping and kicking instead of eating till knot breach and ran away before earthquake of 7.8 magnitude hit with dazzling illuminated white flash in sky at Tangshan area in 1976, which is 40 km away from these animals shed (Tributsch, 2013; George, 2020).

- Some of the unusual behaviour recorded based earlier reports are; dogs and cats carry their offspring outdoor by picking, goats refuse to go into huts, pigs screaming weirdly, chickens jumping out of the cages at midnight and fish moving aimlessly (Bailey, 2019; George, 2020). Similarly, snakes, lizards and other small mammals evacuated their nest prior to 7.3 magnitude earthquake at Haicheng, China (Achenbach, 2016; George, 2020).

- Due to Gujarat, Bhuj earthquake 2001, peacocks were unusually screaming, dogs were restless and barking, donkey were braying in Teras located 80 km away from Bhuj epicentre (The Times of India, 2001). At the same time, unusual roaring and screaming of various animals, for example Asiatic, lions were more aggressive and restlessness (by erection of their tail) was observed in the Gir forest, India before the Bhuj quake (Vyas, 2001; Tributsch, 2013).

Conclusions

The natural calamities are most common across the world and many of the insects, wild creatures and domestic animals can able detect

the future threat of the natural disaster by the active or passive process. These natural calamities occur based on the series of events that happen after the tectonic movement (speed of light guide the earth magnetic field to form ionosphere) which helps to predict and forewarn the danger by insects and animals. So, technologies should develop in such a way that, they can detect the calamities prior to their occurrence, by artificial intelligence or simulation models comparing with insects and animals. Hence, the extensive funding is required in this arena to promote the studies on mechanism involved in the disaster prediction by insects as well as other animals that may be either behavioural changes or genetic evolutionary.

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