Forensic Pathology

The effect of global warming on forensic entomology

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Introduction

Global warming signifies the rise of the Earth's average temperature where it is most notably distinguished primarily of having an abundance of carbon dioxide in the atmosphere. It is estimated that there has been an increase of 0.8 degrees C (1.4 degrees F) on the Earth's mean surface temperature since the early 20th century, with about two-thirds of the increase since 1980.

This change in temperature would have significant effects on weather patterns and cause unpredictable and feasibly extreme weather conditions. This shift alteration of climate pattern across the globe results in species migration of plants and animals of up to three times faster than anticipated. Thus with the increased specie shift this induces a change in entomology. From a criminal justice perspective, this may conceivably carry serious consequences in the forensics area that relies upon temperature data and specie distribution during expert evidence presentation.

Forensic entomology is the application of the study of insects and other arthropods to legal disputes particularly in a court of law. Therefore, the change in entomology may result in the decline in accuracy and reliability during criminal investigations and further research would be required if insufficient knowledge is obtained that insects are particularly vulnerable to changing climate.

Forensic Entomology is a branch of forensic science whose position is to give close estimations of the post-mortems interval with the consideration of natural events and environmental forces. Climate changes rendered some existing past data unusable however with the advances of detection techniques, more factors on the impact of rate of decomposition are found. Detectives and other governing forces work closely together to provide a viable time of death that is a vital clue in the majority of homicide crimes. Decomposition is a natural process that occurs after a living organism has deceased. It is Mother Nature's inevitable recycling process. Rate of decomposition is important in estimating time of death. The mass or stage of the insects can give a good indication time of death using data already established.

Specie variation describes the differentiating decomposition rate in living organisms due to different organic composition. Estimation of PMI for Homo sapiens is a favoured topic of interest by scientists due to its useful nature in the crime related field. The decomposition of living organisms could possibly take over a year to occur without added factors. This is deemed to have zero value in crime detection. But luckily with the aid of external factors carcass succession can take place as soon as the body of that specific organism is exposed.

Climate changes raised many serious concerns over several areas. Critical problems for forensic anthropologists include the changes in insect successions and ambient temperature. Insect succession is the predictable sequence insect colonisation on a dead body. It will take place as soon as the body is discovered. Insect succession play a vital part in estimating time of death, it normally occur in a sequential order and using already established data it is possible to tell the time of death by studying the insects presence including external ambient conditions.

The constant change of core temperature (from high to low and vice versa) could decrease or accelerate the succession rate yielding unwanted results. Changes in climate also affect the habitats for the vast number of species that could also impact the rate of succession or appearance of unexpected species.

Results

There are large amount of statistic results available online, which show similar trend of species migration due to climate change.

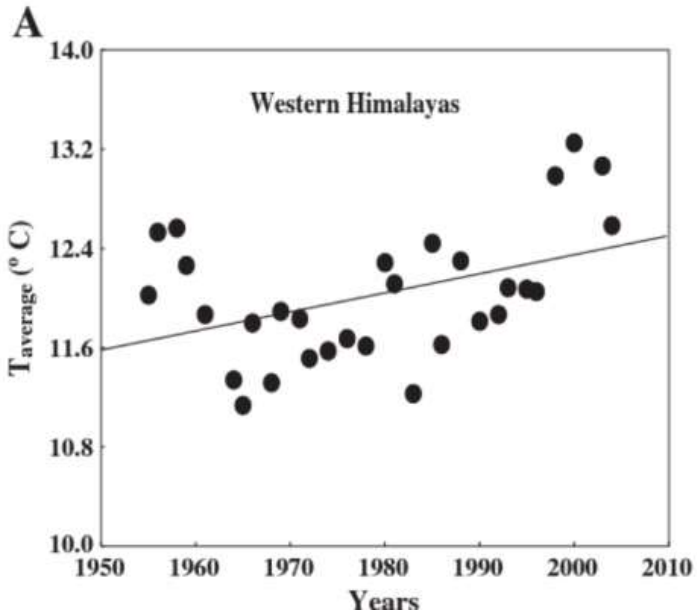

Figure 1 – showing the average temperature increase in Western Himalayas (Parkash *et al*., 2012)

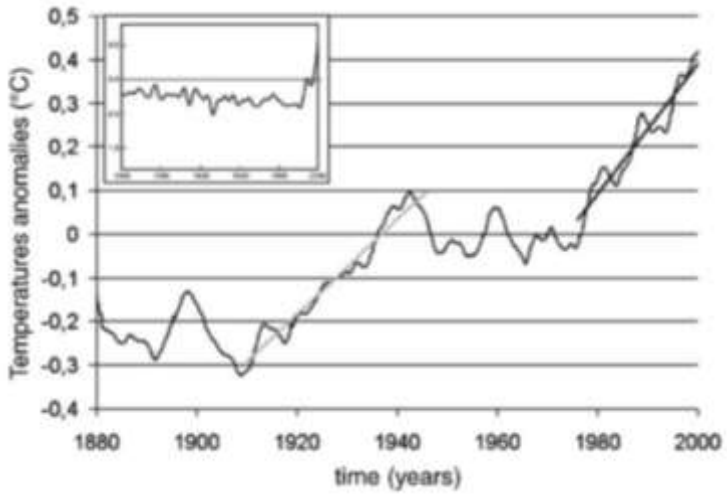

Figure 2 – Showing the temperature increase in Italy (Turchetto and Vanin, 2004).

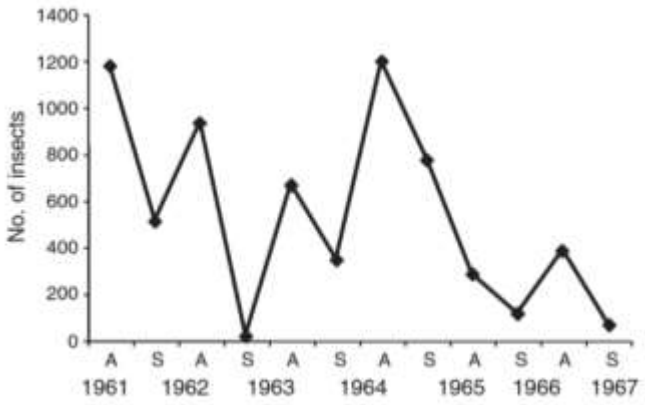

Figure 3 – show the number of N. Viridula adults found in Southern Wakayama (Kiritani, 2011).

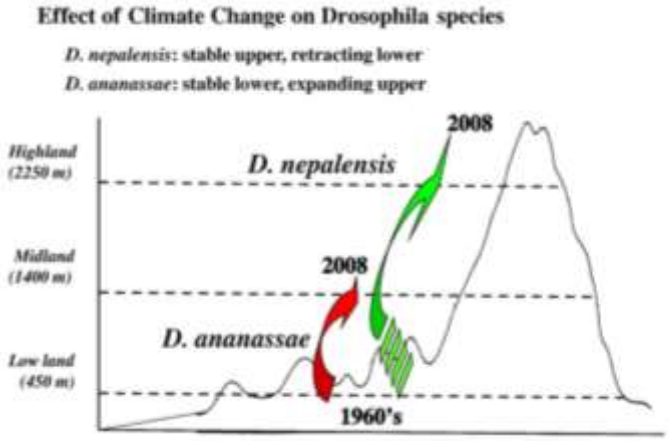

Figure 4 – the effect of climate change on Drosphila species (Parkash *et al*., 2012)

Discussion

The rise of temperature has been a growing concern for scientists and government. Recent introductions on new legislation laws imposed onto the public helps slow down global warming. It is agreed by everyone that global warming is an inevitable matter that humans have to face. The forensic department have been hit hard by this problem. The shifting of temperature has pushed existing species into extinction and introduced new species that may not have any existing forensic value. Climate data is collected worldwide by weather stations across different nations. Figure 1 & 2 show different collections by different researchers in different area. These figures show the average temperature has been increasing at a steady rate. This could be due to the advancements in human technology resulting in an increase of air pollutant being released into the atmosphere. In the past, common problems arise from the usage of unknown chemicals in which scientists were not aware of their impact on nature until an extensive period of time where the damage becomes visible. CFC is a popular chemical used in appliances, which are known to cause ozone depletion leading to damage to the ozone layer.

The damage to the climate system has led to mass species migration as seen in figure 4. Drosphila species have migrated from lower ground of 450m to an almost 4 times increase of height of 2250m.

Though Drosophila species might not be the predominant species involved in carcass succession, it is possible to imply the model onto other species. Figure 3 demonstrates a similar trend parallel to figure 4. Figure 3 displays signs of migration, leading to possible extinction of N. Viridula in Southern Wakayama.

Using the results shown in the data, it is possible to propose that climate change has potentially caused carrion insects used in succession rate to migrate from their original habitat to new habitats where they did not exist. This migration of species can invalidate all pre-existing forensic data on succession in that specific geographical area as waves of succession can only occur with the presence of carrion species. It is essential for the carcass to be colonised by insects prior, before succession can commence at a favourable rate. However, with specie migration this decreases the specific specie numbers in that specific area, therefore an increase in time would be required for insect succession to take place due to the lower number of insects.

Apart from insect migration and extinction, climate change can also impact the rate of carcass depletion. It has been found that the carcass internal core temperature can speed up the rate of enzyme activity in the deceased body which in turn accelerates the rate of succession by increased insect attraction. This is due to the production of odours that attract insects to begin initial insect succession. This would be the complete opposite in colder weather. A change in climate causes the shifting of seasons and is another main factor for the growth or decline in number of insects. This can affect the insects natural production cycle resulting in the subsequent increased off-spring production rate (Metcalf *et al*., 2013).

Conclusion

To conclude, it is vital to appreciate that the disruption of insect natural habitats can greatly affect the ability to obtain feasible results in many forensic fields due to changes in the environment. Therefore, pre-existing data is rendered unusable. Nonetheless, it is possible to overcome insect migration from climate change as long as sufficient new data is collected by entomologists. This may be achieved by taking in external factors into consideration without referencing to the pre-existing models created by past data. Hence, it is still possible to accurately predict post-mortem intervals using sequential succession predictions. However, the creation of new data may face some difficulties due to the constraint in resources allocated by government. Entomology is not widely recognised by the public and lack of knowledge in the field making it an unfavourable funding project.

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