



P-ISSN: 2349-8528  
E-ISSN: 2321-4902  
IJCS 2019; SP6: 86-87

**Chand Asaf**  
Assistant Professor,  
Department of Entomology,  
Faculty of Agriculture  
Annamalai University,  
Tamil Nadu, India

(Special Issue -6)  
3<sup>rd</sup> National Conference  
On

**PROMOTING & REINVIGORATING AGRI-HORTI,  
TECHNOLOGICAL INNOVATIONS  
[PRAGATI-2019]  
(14-15 December, 2019)**

## Effect of global warming on establishment rate of insect species

**Chand Asaf**

### Abstract

Global warming will lead to earlier beginnings and prolongation of growing seasons in temperate regions and will have pronounced effects on phenology and life-history adaptation in many species. These changes are not easy to simulate for actual phenologies because of the rudimentary temporal (season) and spatial (regional) resolution of climate model projections. Seasonal and regional climate change signals were downscaled to the hourly temporal scale of a pest phenology model and the spatial scale of pest habitats using a stochastic weather generator operating at daily scale in combination with a re-sampling approach for simulation of hourly weather data. The establishment rates of invasive alien species have been increasing worldwide during the past century. This trend has been widely attributed to increased rate of species introductions associated with increasing international trade but rarely linked to environmental changes such as global warming that can directly or indirectly influence establishment success of newly introduced alien species in their recipient regions. To better understand and manage the bio invasion process, it is crucial to understand the relationship between global warming and establishment rate of invasive alien species, especially for poikilothermic invaders such as insects.

**Keywords:** Global warming, phenology, species introductions, poikilothermic

### Introduction

Establishment rates of invasion alien species have been increasing worldwide in recent decades. These trends are widely attributed to increased rates of species introductions associated with increasing international trade but rarely linked to environmental changes such as global warming that can directly or indirectly influence establishment success of newly-introduced alien species in their recipient regions (Robinet *et al.*, 2010) <sup>[1]</sup>. To better understand bio invasions and develop more effective strategies to slow or prevent them, it is crucial to understand the relationship between bio invasions and environmental change, rising ambient temperature- sensitive invaders such as insects. Recent reviews suggest that global warming could facilitate bio invasions across all steps of the invasion process including species introduction, colonization, establishment and spread.

The study reports finding a positive relationship between the establishment rates of invasive alien insects (IAIs) and changes in average annual surface air temperature. The aim of this study is to better understand the role of global warming in the increasing rate of IAI establishments worldwide during recent decades. The focus was on insects because they are well known taxonomically and they represent a typical group of poikilothermic animals and thus should be sensitive to changes in ambient temperature.

### Correspondence

**Chand Asaf**  
Assistant Professor,  
Department of Entomology,  
Faculty of Agriculture  
Annamalai University,  
Tamil Nadu, India

## Materials and Methods

The establishment rate (Unit: species year<sup>-1</sup>) was chalked out and to build this series for India, compilation of a list of invasive alien insect species (IAIs) and their first recorded dates of occurrence in India from professional literature, particularly from checklist of invasive alien species and journal articles was carried out during the study period of 1995-2005. The majority of these were insects (84%) followed by mites (8%) and spiders (3%). Sucking bugs in the order Hemiptera comprised (28%) (= 183 species) of non-native insects that established in India. Information described as date of introduction, arrival date, or year of first record was considered to represent the year of establishment, often occurs many years before the year of first record. When the time of first record was described as a decade, the midpoint of the decade was considered and when the time was reported as prior to a specific year then that year was entered.

## Results and Discussion

Climate Change Future (CCF) analysis detected and compiled which indicated that at least 1686 exotic terrestrial invertebrates from 278 different families had established in India during 1995-2005. The relationship between increasing average annual surface air temperature and establishment rate of IAIs remained significant all through the study ( $Y/T = m/T$  max where Y = air temperature; T – Time interval and Tmax denotes establishment rate constant.) The discovery of newly established alien species depends on many factors such as the temporal pattern of alien introductions, relative abundance or size of the founding populations and the sampling efforts by humans (Costello *et al.*, 2003) [2]. Increasing foreign trade, along with a species is another important determinant of species introductions. Such results suggest that changes in average annual surface air temperature increases establishment rate which may be related to increasing ambient temperature.

The effects of increasing average annual surface air temperature on establishment rate were sufficiently robust to remain significant even when adjusted for changes in international trade, indicating that establishment rate of IAIs can increase even when there is no increase in propagule pressure/ introduction effort. Propagule pressure is a key element to why some introduced species persist while others do not. This can occur, in part because not all alien species are introduced by human activity, but rather some species arrive in new areas. It is important to recognize that IAI establishment rate can be influenced by factors other than propagule pressure and global warming. These other factors could include biotic traits and variation in the degree of invasiveness of the introduced species, influence of human disturbance on the invisibility of the recipient regions and precipitation chemistry and other aspects of climate change.

In addition, increasing the effort to survey for new IAIs would be expected to result in more discoveries of new alien species. Examining this hypothesis would be valuable but is beyond the scope of the present paper. In conclusion, the study suggests that the increase in establishment rates of IAIs in India can be partially explained by global warming given that warmer temperatures can facilitate bio invasions worldwide.

## References

1. Robinet C, Roques A. Direct impacts of recent climate warming on insect populations. *Integr. Zool.* 2010; 5:132-142.

2. Costello CJ, Solow AR. On the pattern of discovery of introduced species. *Proc. Natl. Acad. Sci.* 2003; 100:3321-3323.