



population growth potential of *S. calamistis* was studied on artificial diet under laboratory condition at six constant temperatures (12, 15, 18, 20, 25, 28, 30 and 35°C), relative humidity of 75 ± 5% and a photoperiod of L12: L12 h. Several non-linear models were fitted to the data to model development time, mortality and reproduction of the insect. We used process-based phenology models and risk mapping in a Geographic Information Systems to assess the impact of global warming on the future distribution of *S. calamistis*. Life table parameters were calculated using Insect Life Cycle Modeling (ILCYM) software. At 12 and 35°C insects failed to develop. With the Insect Life Cycle Modeling (ILCYM) software, the obtained data on the temperature-dependent development of *S. calamistis* was used to develop a process-based temperature phenology model. After, the model was used to estimate risk indices: the establishment risk index (ERI) that identifies areas in which the pest may survive and become permanently established, the generation index (GI), which estimates the mean number of generations the pest may produce within a given year and the activity index (AI). Further, a mapping and quantification of these indices changes between the climate scenarios of the years 2000 and 2050 was conducted using downscaled data of the scenario A1B from the worldClim database. The study concludes that *S. calamistis* potential establishment, damage will progressively increase in highlands regions and may decrease in warmer cropping regions of the sub-Saharan Africa.

Cassava pests

Cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero

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The cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero 1977 (Hemiptera: Pseudococcidae), like the cassava green mite, it became a serious pest for cassava soon after its accidental introduction into Africa from the Neotropics in early 1970s. It quickly spread across the cassava belt in Africa causing estimated initial losses in cassava production of up to 80%. This pest, which is largely found on cassava, was brought under biological control in much of sub-Saharan Africa with the introduction and distribution of the parasitoid *Anagyrus lopezi* (De Santis, 1964). The pest invaded Thailand in 2008 and subsequently at least four other countries in Southeast Asia. In Thailand, it was promptly brought under biological control by 2013 with the introduction of *A. lopezi* from Africa by IITA-Benin in 2009. Several publications provided comprehensive information on the response of *P. manihoti* to range of temperatures, but none of these data could be used for modeling this species phenology using the ILCYM software because the original raw data could not be obtained and ILCYM could not use published data based on means of variances. We therefore conducted experiments, similar in methodology to published experiments, under six constant temperatures (15, 20, 25, 30, 31, and 34°C), to obtain the necessary data to develop a phenology model for *P. manihoti* which were validated with data generated from similar experiments under fluctuating temperatures. We then used ILCYM to map *P. manihoti* distribution and abundance under current and future climate scenarios using 2000 and 2050 WorldClim database. The results of the phenology models compared well with published literature on *P. manihoti*, with highest simulated rates of increase between 25 and 30°C, but no development and reproduction beyond 34°C. Validation at fluctuating temperature provided good approximation for the output at the constant temperature similar to the average temperature during validation. Mapping current distribution approximated well present distribution and abundance patterns; while 2050 predictions show considerable reductions in range especially in Western Africa, Southern India, and northern areas of Southeast Asia, while a range expansion and increase abundance is predicted for southern Africa and Southeastern Asia with highest shifts in highland areas. The most effective adaptation against *P. manihoti* is monitoring and surveillance where it is not present, and the introduction and conservation of *A. lopezi* for effective biological control and risk avoidance at farm level.