



Gembloux Agro-Bio Tech
Université de Liège

Le Corps professoral de
Gembloux Agro-Bio Tech - Université de Liège vous prie
de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

Monsieur BOUKRAA Slimane,

Titulaire d'un diplôme d'ingénieur d'Etat en Agronomie,
Titulaire d'un Master Sciences, Technologies, Santé, à finalité indifférenciée,
mention Ecologie-Biodiversité, spécialité Maladies transmissibles : Dynamique et Environnement

présentera en vue de l'obtention du grade et du diplôme de

DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,

le 1^{er} juillet 2016, à 15 heures, en l'auditorium de **Zoologie (ZI),**

Passage des Déportés, 2 à 5030 **GEMBOUX.**

Cette dissertation originale a pour titre :

« *Global changes, human activities and (re-)emerging of mosquito-borne pathogens: diversity, ecology and control of potential vectors* »

Le jury est composé comme suit :

Présidente : Prof. M-L FAUCONNIER : Présidente du Département AgroBioChem,
Membres : Prof. F. FRANCIS (Promoteur), Pro. E. HAUBRUGE (Copromoteur), Prof. E. THIRY,
Prof. B. LOSSON, Prof. C. SAEGERMAN, Prof. B. DOUMANDJI-MITICHE (ENSA, Algérie),
Dr. W. DEKONINCK (IRSNB)



Résumé

Worldwide, mosquitoes (Diptera: Culicidae) are known as potential vectors of pathogens that cause infectious diseases, affecting both humans and animals, such as malaria, dengue, chikungunya, West Nile fever and dirofilariasis. In terms of morbidity and mortality, mosquitoes are considered as the most dangerous animals confronting mankind. Indeed, over three billion people live at risk of becoming infected by a mosquito-borne disease. Focus on mosquitoes has greatly increased not only in the tropic areas but also in the Palearctic region like Europe and Mediterranean areas. Researches on re-emerging vector-borne diseases are become a major issue in human and veterinary health worldwide, both in the North and South hemisphere. The spread in space and time of these many vector-borne diseases is strongly influenced by environmental factors (landscape, location and abundance of hosts and vectors, etc.) and climate (temperature, humidity, etc.) that influence population dynamics of the vector - and further transmission - and the reservoir hosts with further pathogen abundance. Global changes, as climatic or those related to the human impact, can influence the structure of the landscape and the dynamic of vector populations and thus consequently affect the emergence and spread of vector-borne diseases. The acquisition of bio-ecological and taxonomic knowledges of mosquitoes is nevertheless an essential step for the understanding and management of current risks of the (re)-emergence of mosquito-borne parasites and mainly the preparation and prevention against future threats. These results can be used as a model to prevent and analyze the risks of circulation and further spread of certain vector-borne diseases. In addition, they can provide crucial data for vector control in the event of an epidemic or its anticipation. The absence of vaccine and treatments against most of mosquito-borne diseases implies efficient vector control strategies, which are up to date mainly based on the use of chemical insecticides. However, most vectors develop resistance against currently used products whereas new chemical compounds was limited firstly by financial costs in research and development, and secondly by the toxicity of derivatives to human population, biodiversity, and environment. The exploitation of new methods, such as the use of microbial communities (mainly bacteria or entomopathogenic fungi) as organisms or bio-pesticides for vector control, will be therefore a promoted strategy at the global level.

This doctoral thesis focuses on three main objectives: (i) to inventory and identify mosquito fauna in the livestock areas and their surroundings, especially in the equestrian farms; (ii) to study the population genetic structure of the potential vector complex *Cx. pipiens s.l.*; (iii) to study the phylogeny and the origin of exotic mosquito species (*Ae. albopictus* and *Ae. koreicus*) as well as the potential tracks of their introduction; (iv) to know the bioecology and spatiotemporal dynamic of potential vectors; and finally (v) to suggest a biocontrol tool that can prevent and fight the proliferation of mosquito species especially the potential vectors and those that can cause a nuisance problem.