LIFE +
Environment Policy & Governance

ANNEX C.1.3

Deliverables C.1: Report for mosquito and mosquito-borne disease surveillance

November 2018

LIFE CONOPS (LIFE12 ENV / GR / 000466)

Development & demonstration of management plans against
- the climate change enhanced - Invasive Mosquitoes in S. Europe

Conops

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The current deliverable belongs to Action B.2.12: Database with the Dengue, Chikungunya and Zika virus status in adult females IMS in pilot areas (Final report) in the framework of LIFE CONOPS Project.

STRICTLY CONFIDENTIAL REPORT

Only for the scope of the mid-term report. Not to be distributed to third parties.

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Terminology - Abbreviations

ECDC: European Centre for Disease prevention and Control

HCDC: Hellenic Center for Disease prevention and Control

BPI: Benaki Phytopathological Institute

NSPH: National School of Public Health

DENV: Dengue virus

CHIK: Chikungunya virus

ZIKV: Zika virus,

IMS: Invasive Mosquito Species

Imported: A case the origin of which can de traced to a known malarious area outside the country in which the case was diagnosed

Autochthonous (local): A case acquired by local transmission

Indigenous: any case contracted locally without strong evidence of a direct link to an imported case

Introduced: a case contracted locally with strong epidemiological evidence linking directly to a known imported case

Induced: A case the origin of which can be traced to a blood transfusion or other form of parenteral inoculation but not to normal transmission by mosquito

VBDs: Vector-Borne Diseases are illnesses caused by pathogens and parasites in human populations.

Vectors: are living organisms that can transmit infectious diseases between humans or from animals to humans.

SUMMARY

1. Introduction

Greece

Aedes albopictus the so called “Asian Tiger Mosquito” is one of the 100 most invasive species in the world and an efficient vector of important human diseases, such as dengue, dengue hemorrhagic fever (Lundstrom 1999; Benedict et al 2007) and Chikungunya viruses (Schafner et al 2013). Its native region are the tropical forests of Southeast Asia, but the last 30 years through human travel and commerce it has spread to Africa, Europe, Australia and America (Madon et al 2002, Benedict et al 2007), namely to every continent except Antarctica. The widespread distribution of *Ae. albopictus* outside its native home - range is presumed to have been primarily human-mediated and accidental (Tatem *et al 2006)* . Due to its ability to colonize a wide range of natural and artificial breeding places together with the resistance of its eggs to desiccation and its relative lack of host specificity (Hawley, 1988), the species has successfully competed with co - occurring mosquito species and has been able to rapidly build up large populations in new geographic regions and has adapted to a variety of different environmental conditions (Lounibos et al 2002; Armistead et al 2008; Medley 2009).

Regarding Europe, after its first detection in Albania in 1979 (Adhami and Murati 1987; Adhami & Reiter 1998), the species was found in Genoa in September 1990 (Sabatini et al. 1990). This latter introduction is suggested to have resulted from tire imports from the United States (Sabatini et al, 1990; Dalla Pozza & Majori, 1992; Dalla Pozza et al, 1994). Since then, *A. albopictus* has spread throughout the entire mainland of Italy (Dalla Pozza and Majori 1992; Dalla Pozza et al. 1994; Knudsen 1995; Knudsen et al. 1996) as well as some parts of Sicily and Sardinia. In France, *Ae. albopictus* was first reported in Normandy in 1999 (Schaffner and Karch 2000). Nowadays, established homogenous populations of the species occur in all countries of the Mediterranean Sea, including parts of Turkey and the Middle Eastern states of Lebanon, Israel and Syria (Caminade et al 2012; Medlock et al 2012). Italy and southern France are the most infested regions (Medlock et al 2012), but *Ae. albopictus* also have limited local distribution in Croatia (Klobuar et al 2006), Bulgaria, Russia, Belgium, Monaco, Montenegro, San Marino, Slovenia, Spain, the Vatican City (ECDC, 2008), Germany (Pluskota et al 2008), Belgium (Schaffner et al 2004), the Netherlands (Scholte et al 2007; ECDC, 2008) and southern Switzerland (Flacio et al 2004; ECDC 2008).

In Greece, the presence of *Ae. albopictus* was reported for the first time in the northwestern region of the country by Samanidou – Voyadioglou in 2005 and till 2006 it has been established in different parts of Greece (Corfu and Thesprotia). In order to track the rapid spread, evolution and local adaptation of this species and to obtain a deeper knowledge of population structure, molecular markers for studying the genetic structure are crucially needed. Details of population genetics and structure will allow following, and possibly predicting, the geographical and temporal dynamics of its expansion. This is a fundamental requirement for the development of strict monitoring protocols and for the improvement of sustainable control measures and practical operations of control programs.

The investigation of variation in mitochondrial and nuclear DNA offers an effective tool for assessing the phylogeographic history of an organism, especially when samples are available not only from the area of introduction but also from the area of origin. Previous studies have already examined the phylogeography and phylogeographic relationships among populations of *Ae. albopictus* by using mitochondrial and nuclear markers using different populations of the insect from all over the world (Kumar et al 2007; Cywinska et al 2006; Hemmerter et al 2009; Wang et al 2012; Kumar et al 2013). All these provided evidence that in this species, mitochondrial genes display mediate to high levels of genetic variation and sequence divergence. Among them, there is only one small – scale DNA - based study conducted since now that investigates the genetic diversity of Greek populations, but it is limited to a few COI sequences from only two geographic regions of Greece (Patsoula et al 2006). The population genetics of this species, however, merit further exploration and additional sampling is a prerequisite in order to confirm the already identified patterns.

Within the framework of LIFE CONOPS, which aims to study invasive mosquito species focusing on Italy and Greece taking also into consideration the Climatic Change, population parameters and socioeconomic factors in both countries, populations of the species were collected from different regions of Greece using the ovitraps of LIFE CONOPS. The objectives of this study were: (1) to determine the pattern of genetic variability within the Greek *Ae. albopictus* populations based on analyses of the sequence diversity of the mitochondrial gene cytochrome oxidase I (COI) and (2) to establish the evolutionary relationships of these Greek populations with other *Ae. albopictus* populations and (3) to determine the geographic origin of the populations that colonized Greece.

Italy

In the Mediterranean basin, the occurrence of several Aedes mosquito species, including *Aedes albopictus*, *Ae. aegypti*, *Ae. koreicus*, *Ae. japonicus*, *Ae. cretinus*, *Ae. geniculatus*, has been documented, and some of them have been shown to rapidly diffuse across this geographic area.

In this context, an early detection (e.g. as egg or larval stage) of which mosquito species are present in a target area, as well as the assessment of their relative abundance should be a mainstay of the control practices. Because the most convenient surveillance method is currently based on ovitraps