Anophelines biology in Camargue - France

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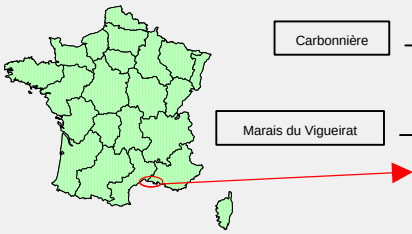
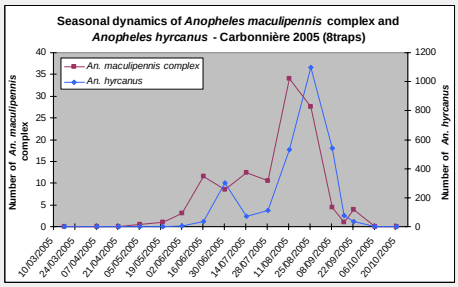


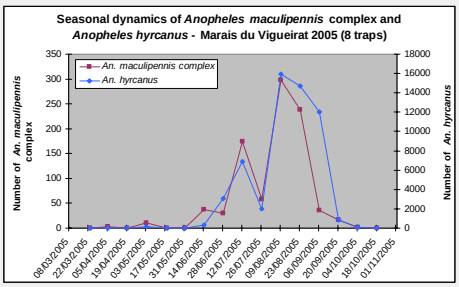
Camargue

Biology of potential malaria vectors has been studied in France within the frame of work package 2 of EU – EDEN – MALARIA integrated project.
Field researches were conducted in Camargue, in the South-East of France, mainly in 2 areas :
• Marais du Vigueirat
• Carbonnière
These areas present a large variety of biotopes and human activities. Moreover, Carbonnière is included in an area where fight is conducted against pest mosquitoes whereas Marais du Vigueirat is a natural reserve where human activities and human impacts are very limited.
About 720 000 mosquitoes were trapped in these areas using different methods, from March to December 2005.

Anopheles dynamics

Regular trappings with CDC-light traps associated with carbon dioxide dry ice were conducted in both areas, 2 consecutive nights, one week over two from March to October. For each night, 8 CDC-light traps were hung in 8 places during the 8 months of survey. The 8 places were located all over the area, in different biotopes. Results show the mean number of mosquitoes collected in the area by the 8 traps per night.
Identification of species within the Maculipennis complex was based on a diagnostic PCR[1].

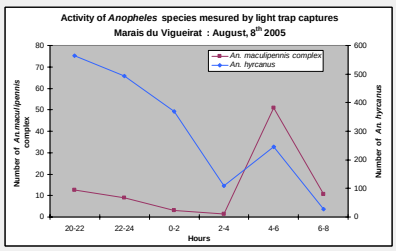




An. hyrcanus was the most trapped species (about 120 000 specimens), especially in Marais du Vigueirat whereas number of collected *An. maculipennis* complex were lower (about 5000). Among 1004 *An. maculipennis* complex specimens analysed, 5% were identified as *An. atroparvus* and 95% as *An. melanoon*. Some *An. maculipennis* s.s. were collected in others biotopes in Camargue[3]. It appears that *An. atroparvus* ratio depends on the collecting method, this species being more frequent in resting sites than in CDC-light traps. Very few *An. algeriensis* were trapped and only in Marais du Vigueirat.
An. hyrcanus and *An. maculipennis* complex present globally the same dynamics in the 2 areas for the year 2005. Their populations begin increasing in the middle of June, they reach a peak near the middle of August and they decrease drastically in the middle of September (although *An. maculipennis* complex decrease a bit earlier). Dynamics of these species collapse brutally near the end of July in the 2 areas. Furthers investigations should explain this drop : intrinsic species dynamics, wind or lack of breeding sites due to drought in summer?

Anopheles activity

Mosquitoes nightly activity was recorded by collecting 2 CDC-light traps every 2 hours in both areas once in August and once in September. Results show the mean number of mosquitoes collected during August in Marais du Vigueirat.
An. hyrcanus is more active just after the sunset whereas the *An. maculipennis* complex members seem to be more active later in the night.



Feeding preferences

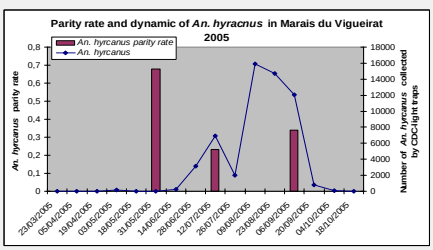
Species	Host	Number of analysed mosquitoes
Anopheles maculipennis complex	Horse	249
	Bovine	38
	Boar	10
	Dog	1
	Mixt : horse/bovine	1
	Mixt : horse/sheep	1
	Mixt : horse/boar	1
	Other host	9
Anopheles hyrcanus	Horse	8
	Boar	1
	Other host	1

357 blood fed females were analysed. They were collected in resting sites or trapped in CDC-light traps. Blood meals were processed using an ELISA assay[2]. Few *An. hyrcanus* were analysed because of the low number of blood fed collected specimens (this species is mostly exophilic).
An. maculipennis complex was not found fed on Human. They showed a strong preference for animals, especially mammals. These results confirm the observations during sessions of human bait catches. During 3 sessions in both area, 3 volunteers captured mosquitoes on their legs. Results are :
• only 10 *An. maculipennis* complex collected
• **7473** *An. hyrcanus* collected
An. hyrcanus was very aggressive to humans.

Parity rate

Parity rate was determined using Detinova method. 889 females collected by CDC-light traps+CO_2 or in resting places were dissected. Results shows parity rates of *Anopheles* females trapped by CDC-light traps+CO_2.
Parity rates are inversely connected to populations dynamics. An high parity rate is observed for *An. hyrcanus* in Marais du Vigueirat at the beginning of June as this population is small and doesn't grow. For both areas and different species, parity rates are very low in July. This reflects the growth of populations during summer to reach a peak near the middle of August. During the growth phase, lots of females emerge which increase the number of nulliparous females. Parity rates increase again at the beginning of September as *Anopheles* populations decrease. *An. hyrcanus* parity rate still remains low at this date because this population doesn't decrease as drastically as the others.

Date	Marais du Vigueirat				Carbonnière			
	Anopheles maculipennis complex		*Anopheles hyrcanus*		*Anopheles maculipennis* complex		*Anopheles hyrcanus*	
	Total	Parity rate	Total	Parity rate	Total	Parity rate	Total	Parity rate
23/03/2005			5	1,000				
04/04/2005	4	0,750	5	0,800				
31/05/2005 - 02/06/2005			25	0,680	5	0,400	7	0,143
11/07/2005 - 15/07/2005	47	0,277	116	0,233	14	0,500	87	0,218
05/09/2005-08/09/2005	33	0,909	118	0,339	10	0,400	132	0,667



Acknowledgements :

We are grateful to the associations **Marais du Vigueirat** and **Centre du Scamandre** for hospitality and informations. Special thanks to the **mosquito control department** of **EID** for their precious informations and support.

References:

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2. Beier JC *et al.*, 1988. Bloodmeal identification by direct enzyme-linked immunosorbent assay (ELISA) tested on *Anopheles* (Diptera: Culicidae) in Kenya. *J Med Entomol*, 25 : 9-16.
3. Balenghien T *et al.*, (submitted). Equine, avian, and human mosquito captures in a West Nile virus focus of southern France. *J Med Entomol*