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Inventory of Culicidae in the region of El Taref (North-east Algeria)

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Abstract

The aim of this study was to carry out an inventory of Culicidae species and the associated fauna of crustaceans harvested in the Echatt region of north eastern Algeria for a period extending from January 2014 to December 2014. The systematic study of Culicidae was carried out using the keys of [1,2] reveals the presence of 11 species: five belonging to the genus (*Culex pipiens*, *Culex hortensis*, *Culex univittatus*, *Culex brumpti* and *Culex modestus*). Three species belonging to the genus *Culiseta* (*Culiseta subochrea*, *Culiseta annulata* and *Culiseta moristans*), two in the genus *Aedes* (*Aedes pullatus* and *Aedes vexans*) and one species in the genus *Anopheles* (*Anopheles coustani*). In order to characterize the Culicidal stand in our study area, ecological indices were calculated to determine abundance, the richness, the centesimal frequency and the distribution of abundance of the different species composing this stand.

Keywords: inventory, culicidae, biodiversity, systematics

1. Introduction

Mosquitoes are insects that belong to the family Culicidae, classified in the order of Diptera and suborder Nematoceras. The family Culicidae is divided into three subfamilies, the Toxorhynchitinae, the Anophelinae and the Culicinae; [3, 4]. Culicidal fauna, by its wide distribution and its high abundances, is responsible for the nuisance by its painful and embarrassing stings as it is involved in the transmission of several human and veterinary diseases, viral and parasitic diseases such as malaria, which is a fatal disease that causes more than one million human deaths every year, mainly in the tropical regions of Africa, the Americas and Asia. *Anopheles gambiae* is the main vector of *Plasmodium falciparum* malaria in sub-Saharan Africa [5]. In this regard, [6,7] wrote: "Mosquitoes are the most important vector group in human health. They are involved in the transmission of malaria, yellow fever and dengue fever, haemorrhagic fevers, lymphatic filariasis, etc. "

Culicidae have generally clear morphological features, which facilitate the identification of the family and allow a good description of the species. On the other hand, their grouping into subfamilies and genera or subgenera is much more complex [1]. The systematic study and confirmation of the specific diagnosis of Culicidae, relates to the microscopic observation of morphological criteria, using dichotomous keys.

In recent decades, culicidal fauna has been the subject of several research projects in Algeria, focusing on the systematics, chemical and biological control and biochemistry of mosquitoes from different parts of the country.

The purpose of this study is to establish a systematic inventory of Culicidae species at a lake that is part of the eastern Algerian wetland and is located at the center of a rural agglomeration.

2. Materials and methods

2.1. Presentation of the study area

The study was carried out in the El Taref region, which covers an area of 3 339 km² with 7 Circumscriptions and 24 communes and is located in the extreme northeast of Algeria. It lies at a latitude of 36 ° 46'0 "to the north and 8 ° 19'0" of longitude to the east. It is 16 m above sea level. It is bordered on the north by the Mediterranean Sea, on the east by Tunisia, on the south by the wilaya of Souk-Ahras, on the southeast by the wilaya of Guelma and on the west by the wilaya of Annaba. Our study site concerned a small endoretic lake located two kilometers from Echatt, which is part of Ben Mehidi and the wilaya of El Taref (Figure 1). This lake is fed by the water table. During the dry season in summer, the lake shrinks and the water condenses in the center.

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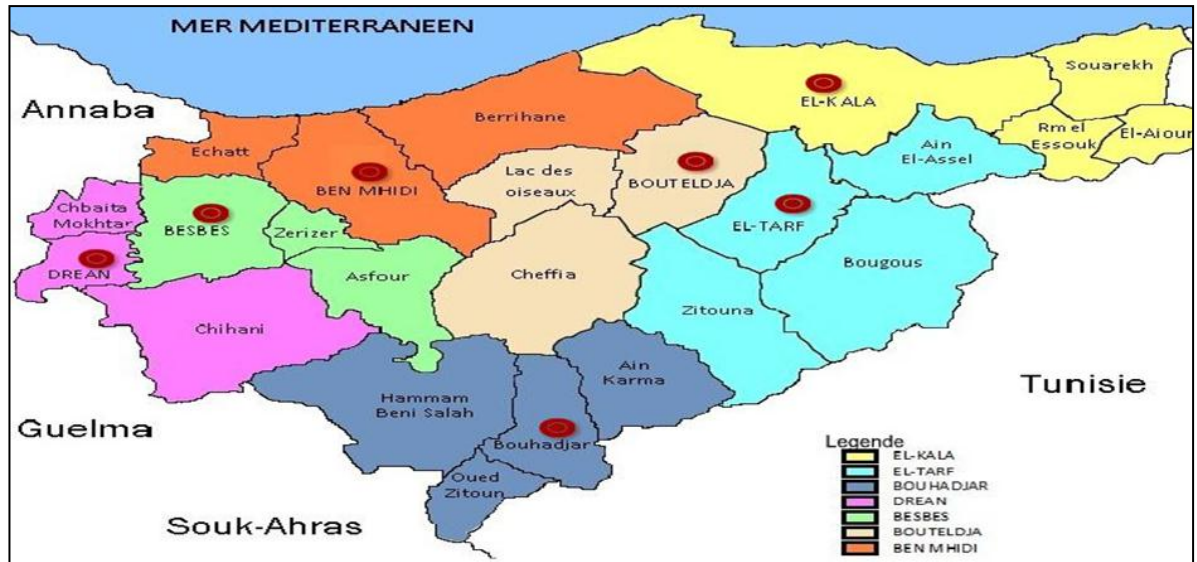


Fig 1: Geographical location of the study site (Echatt) (Dsp-eltarf.dz)

2.2. Study Stations

This study took place from January 2014 to December 2014, i.e. over a 12-month period. It was carried out on a sampling in 4 stations, located on the periphery of the lake, spaced about 50 m apart and selected according to the accessibility to the water.

2.3. Biological model

The Culicidae or mosquitos are part of the order of the Diptera and the Suborder of Nematocera according to [8]. The mosquitoes are distinguished from the other Nematoceras by their long horn and the presence of scales on the wing veins. Their life cycle is represented by pre-imaginary aquatic stages, which begin with eggs, larvae, nymphs and an adult aerial stage characterized by a clear dimorphism [9].

2.4. Sampling technique

Sampling is carried out using a ladle with a capacity of 500 ml. It is immersed in water and then displaced in a uniform manner while avoiding the eddies and a strainer whose netting is 1 mm in diameter. The fauna thus collected will be placed in containers filled with heeling water, hermetically sealed and labeled (indicating the date of sampling and station) to be transported to the laboratory [10].

2.5. Mounting

The larvae were identified after lightening the specimens in a 10% NAOH solution for 2 to 3 days. The specimens will be rinsed with distilled water in two baths for 2 to 3mins. Lastly, the assembly takes place between blade and slide in a drop of glycerine, fixed with nail varnish.

2.6. Identification

The systematic determination of Culicidae was carried out

according to the dichotomous keys [1], and computerized according to the identification software of the African mosquitoes [2]. This allowed us to identify the species, based on a set of criteria and structural descriptors, microscopic very precise.

2.7. Ecological Index

The results of this study are exploited by sampling quality and ecological indices. After processing the results by sampling quality, ecological parameters were calculated to know, total and average richness [11], relative abundance [12], Schanon-Weaver frequency [13] Fairness index [14].

3. Results

The culicidal fauna of our study site (Echatt), revealed the presence of 11 species: five belonging to the genus *Culex* (*Culex pipiens* Linnaeus 1758, *Culex hortensis* Ficalbi 1889, *Culex univittatus* Theobald 1903, *Culex brumpti* Galliard 1931 and *Culex modestus* Ficalbi 1890), three in the genus *Culiseta* (*Culiseta subochrea* Edwards 1921, *Culiseta annulata* Schranck 1776 and *Culiseta morsitans* Theobald 1901), two in the genus *Aedes* (*Aedes pullatus* Coquillett 1904 and *Aedes vexans* Meigen 1930) and one species in the genus *Anopheles* (*Anopheles coustani* Laveran 1900). The *Culex* genus occupies the first position, represented by 5 species, and the *Culex pipiens* species is the most abundant and best represented (Table 1). The analysis of the structure of the culicidal stand revealed, that the month of December presents the greatest abundance with 125 individuals and four species. September had the lowest population size with 9 individuals and one *Culex pipiens* species. However, *Culex pipiens* species; *Culiseta Subochrea* and *Culiseta Annulata* their abundance was significant during the months of May and June.

Table 1: Total wealth of Culicidae species harvested in the Echatt region (January 2014 to December 2014).

Month \ Species	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Non.	Dec.
<i>Culex.pipiens</i> Linnaeus 1758	/	/	18	15	8	19	/	/	9	6	19	80
<i>Culex hortensis</i> Ficalbi 1889	/	/	/	/	/	2	/	/	/	/	/	/
<i>Culex univittatus</i> Théobald 1903	/	/	/	/	/	/	/	/	/	/	/	27
<i>Culex brumpti</i> Galliard 1931	/	/	/	/	/	/	/	/	/	/	/	16
<i>Culex modestus</i> Ficalbi 1890	/	/	/	5	/	/	/	/	/	/	/	/
<i>Culiseta subochrea</i> Edwards 1921	/	/	/	/	62	4	/	/	/	/	/	/
<i>Culiseta annulata</i> Schranck 1776	/	/	/	/	8	/	/	/	/	/	/	/

<i>Culiseta morsitans</i> Theobald 1901	/	/	/	/	/	/	/	/	/	/	/	/	2
<i>Aedes pullatus</i> Coquillett 1904	/	/	/	/	/	2	/	/	/	/	21	9	/
<i>Aedes vexans</i> Meigen 1930	/	/	/	/	/	2	/	/	/	/	/	/	/
<i>Anopheles coustani</i> Laveran 1900	/	/	/	3	6	/	/	/	/	/	/	/	/
Total	/	/	18	23	84	29	/	/	/	9	27	28	125

From our results, 343 individuals were harvested at the different stations in the Echatt region and the total wealth was high with 11 species. The results shown in Table 2 show the Shannon & Weaver diversity index (H'), maximum diversity (H' max), and equispread (E). The diversity index reveals values ranging from 1.35 for the third station to 1.60 for the first station, this value presents a species-rich stand (6 species), the equitability for comparing stand structures displays values between 0.52 and 0.97 in the station quarters, and these values indicate that the populations are not balanced. Regarding relative abundance in the Echatt region, we noted

that the *Culex pipiens* species ranks first with 171 larvae, or 49.85%. Secondly, *Culiseta subochrea* is positioned with 66 larvae, 19.24% and in third position *Aedes pellatus* with 32 larvae, or 9.32%. For the other species, their relative abundance varies from one species to another (0.58-8.74) (Figure 2).

All species harvested belong to the same category (Accidental) except *Culex pipiens*, which is of a different category (Accessory). This seems to be related to different annual ecological conditions and climatic conditions.

Table 2: Total and average wealth. Shannon - Weaver Diversity Index (H'). Maximum diversity index (H' max). Equidispensing index (E) of Culicidae in the 4 study stations.

Stations	Station 1	Station 2	Station 3	Station 4
<i>Culex pipiens</i> Linnaeus 1758	159	4	/	8
<i>Culex hortensis</i> Ficalbi 1889	/	/	2	/
<i>Culex univittatus</i> Theobald 1903	27	3	/	/
<i>Culex brumpti</i> Galliard 1931	12	/	/	4
<i>Culex modestus</i> Ficalbi 1890	5	/	/	/
<i>Culiseta subochrea</i> Edwards 1921	66	/	/	/
<i>Culiseta annulata</i> Schranck 1776	8	/	/	/
<i>Culiseta morsitans</i> Theobald 1901	/	/	2	/
<i>Aedes pellatus</i> Coquillett 1904	/	/	28	4
<i>Aedes vexans</i> Meigen 1930	/	/	2	/
<i>Anopheles coustani</i> Laveran 1900	/	3	6	/
Effectif / station	277	10	38	16
H' / station	1.6	1.54	1.35	1.5
S/ station	6	3	5	3
H' max	2.58	1.58	2.32	1.58
E / station	0.62	0.97	0.52	0.94

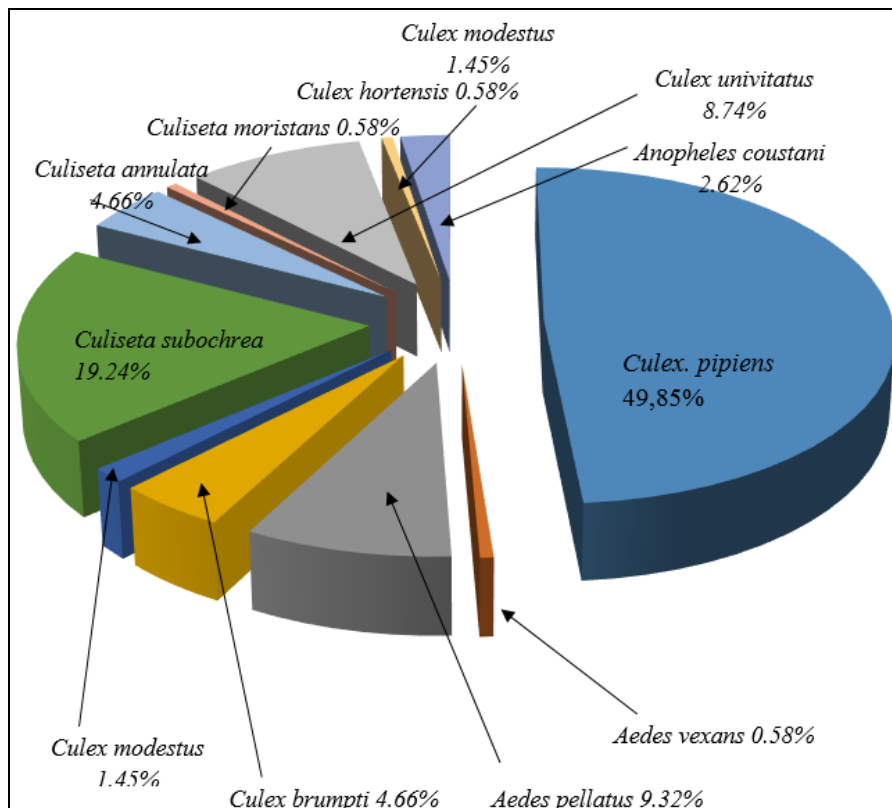


Fig 2: Relative abundance of Culicidae species in our study site (January 2014 to December 2014).

4. Discussion

Arthropods are the most important branch of animals, both by the number of individuals present on earth and in all environments, and by the diversity and number of species recorded on our planet: eight out of ten animal species are Arthropods. More than one million species of Arthropods have been described, including a large majority of Insects [15]. Culicidae are highly replicated insects in the world and in Algeria. Over the past 20 years, the culicidal fauna of Algeria have been the subject of a large number of studies focusing on bio-ecology, systematics and chétotaxy, biochemistry, morphometry, Chemical and biological. In the region of Annaba, the works of several authors have been reported [16-20]. In the El Kal region [21, 22]. The work developed by [23-25] concerned the Skikda region. Other work was carried out by [26, 27] in the Constantine region. Several authors in the regions of Tebessa, Guelma and Oum El Bouagui [28-31] were also interested in the Culicidae. However, many authors have been largely interested in the bio-ecology of mosquitoes, in the Biskra region and in the west of the country, as well as in the northern region of Algiers and Tizi-Ouzou, thus their studies remain inevitable works [32-36].

According to [37], the abundance and biodiversity of Culicidae are conditioned by temperature and the biological or chemical composition of the water. The physicochemical components of water can play a crucial role not only in the biology of a species but also in the structure and dynamics of the whole biocenosis [26]. The low numbers may be caused by a number of causes, the most common of which are water quality, depletion of eggs, low availability of nutrients, drying out of dry-season hoppers, leaching Gestation by precipitation, slowing of larval development following temperature decline and mortality by invertebrate or vertebral predators. [26] From our results, 343 individuals were harvested at the various stations in the Echatt region. Four genera have been identified *Culex*; *Culiseta*; *Aedes*; *Anopheles* and 11 species: *Culex pipiens*, *Culex hortensis*, *Culex univittatus*, *Culex brumpti* and *Culex modestus*, *Culiseta subochrea*, *Culiseta annulata*; *Culiseta morsitans*; *Aedes pullatus*; *Aedes vexans* and *Anopheles coustani*.

5. Conclusion

In conclusion, the results obtained are useful to develop a control program, to direct the operations and evaluate their efficiencies. This work deserves to be investigated further by new approaches of Enzymological and Molecular approaches which could perhaps elucidate certain systematic problems.

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7. References

- Himmi O, Dakki M, Bouchera T, EL, Agbani MA. The culicidae of morocco: identification keys, with biological and ecological data. Work of the scientific institute. Zoological collection Rabat. 1995; 44:50-56. 25.
- Schaffner F, Angel G, Geoffroy B, Hevry JP, Rhaiem A, Brunhes J. European mosquito. Research institute for development IRD. Identification software, 2001.
- Matile L. Western European Diplomas. Introduction, study techniques and morphologies. Nematoceres, Brachycères, Orthorraphes et Aschizes.

Ed. Boubée, Paris, 1993.

- Brunhes J, Rhaim A, Geoffroy B, Angel G, Hervy JP, Culicidae of Africa, 1999.
- El ouali lalami A, Cherigui M, Ibsouda Koraichi S, Maniar S, EL, Maimouni N *et al*. Malaria imported into the North center of Morocco. Cah. Health. 2009; 19(1):43 - 47.
- Himmi O. Culicidae (Insects, Dipteres) from Morocco : systematic, ecology and epidemiological studies pilots. Doctoral thesis in Biology, specialty ecology. Faculty of sciences. University Mohamed V. Agdal. Morocco, 2007.
- Berchi S, Aouati A, Louadi K. Typology of favourable biotopes to the larval development of *Culex pipiens* L. 1758 (Diptera-Culicidae), source of nuisance at Constantine (Algeria). *Ecologia mediterranea*. 2012; 38(2):2012.
- Seguy E. New Atlas of entomology of dipteres of france, Belgium and Swiss. Tomes 1 and 2. Ed. N. Boubée. 1951; 19-83(67):84-109.
- Bendali-Saoudi F. Bioecological study, Systematics and of biochemical Culicidae (Diptera- Nematocera) of the Annaba region. Biological control anticulicidienne, Doctorate Thesis in Natural Science, Badji Mokhtar University Annaba, Algeria, 2006.
- Bendali-Saoudi F. Study of *Culex pipiens pipiens* anautogene. Systematic, biology, fight (*Bacillus thuringiensis israeliensis* serotype H14, *Bacillus sphaericus* 1953) and two species of hydracarians. Thesis by Magister en Arthropodologie, Univ. of Annaba, 1989.
- Blondel J. Analysis of bird stands. Element of an ecological diagnosis. The method of progressive frequency sampling (E.F.P.). Rev. Ecol. Earth and vi. 1975; 29(4):533-589.
- Daget P. Mathematical models in ecology. (ed). Masson. Paris, 1976, 172.
- Dajoz R. Precision of ecology. (ed). Dunod. Paris, 1971, 434.
- Ramade F. Elements of ecology. Fundamental ecology. Ed. Mc Graw-Hill. Paris, 1984, 397.
- Rhodain F, Perez C. Precipitation of medical and veterinary entomology. Maloine. S A Editor 27, Street of the school medicine 75006, Paris, 1985, 443.
- Tine-Djebbar F, Soltani N. Biological activity of a nonsteroidal agonist of the molting hormone on *Culiseta longiareolata*: morphometric, biochemical and energetic analyzes. *Synthesis*, 2008, 18.
- Soltani N, Larhem AB, Boudjelida H. Chemical control of mosquitoes: evaluation of a selective insecticide to larvae of *Culex pipiens*. Work of the scientific institute, serie Zoology, Rabat. 2010; 47:177-182.
- Bouaziz A. Inventory and control of mosquitoes in a semi-arid region (Tebessa). Thesis in Animal biology, University of Annaba, 2012, 150.
- Bendali Saoudi F, Boudemagh N, Soltani N. Inventory of Culicidae (Diptera: Nematocera) in the region of Collo (North-East Algeria), 2013.
- Djehghader NEH, Aissaoui L, Amira K, Boudjelida H. Impact of a chitin synthesis inhibitor, Novaluron on the development and the reproductive performance mosquito of *Culex piens*. Word Applied science journal. 2014; 29(7):954-960.
- Aouati A. Study of the biodiversity of the Culicidae of the Marsh Lake of the birds. Engineering memory. Univ. Annaba, 2005.
- Berzeg W. Inventory of Culicidae in the Brabtia

- subaery at El Kala National Park, 2007.
23. Boulkenafet F. Contribution to the study of the biodiversity of Phlebotommes. (Diptera: Culicidae) in the region of Skikda. Memory of magister in Entomology. University Mentouri. Constantine, Algeria, 2006, 192.
 24. Merabet-Nouri N. Bio-ecological and Epidemiological Study of Culicidae in the Annaba and Skikda Region. Magister's Thesis in Animal Ecology. Option: Negative Interactions in Animal Communities (Parasitism and predation). University of Annaba, 2010.
 25. Boudemagh N, Bendali-Saoudi F, Soltani N. Inventory of *Culicidae* (Diptera: Nematocera) in the region of Collo (North-East Algeria). *Annals of Biological Research*. 2013; 4(2):94-99.
 26. Berchi S. Bioecology of *Culex pipiens* (Diptera, Culicidae) in the constantine region and perspective of control. Thesis Doc. Es. Science. University of Constantine, 2000.
 27. Messai N, Berchi S, Boulknafed F, Louadi K. Systematic inventory and biological diversity of Culicidae (Diptera: Nematocera) in the Mila region of Algeria. *Faunistic Entomology - Faunistic Entomology*. 2011; 63(3):203-206.
 28. Hamaidia H. Inventory and biodiversity of Culicidae (Diptera-Nematocera) in the Souk Ahras and Tebessa region (Algeria). Thesis by Magister. University of Constantine, 2004.
 29. Tine-Djebbar F. Bioecology of mosquitoes in the Tebessa region and evaluation of two growth regulators (Halofenozide et Methoxyfenozide) in against of two mosquito species *Culex pipiens* and *Culiseta longiarolata*: toxicology, morphometry, biochemistry and reproduction. Doc. es. Science, University of Annaba, 2009, 170.
 30. Hamaidia K. Biodiversity of mosquitoes in the Souk-Ahras region and chemical fight: ecological, morphometric, biochemical and toxicological aspects. Doctoral thesis in Animal Biology, University of Annaba, 2014.
 31. Oudainia W. Bioecological and systematic study of the Culicidae of the Oum El Bouaghi region. Effect of temperature on the aggressiveness and biology of *Culex pipiens*. Thesis of Doctorate L.M.D (3rd cycle) in Animal Ecology. Option: Biology of the Populations. Department of Biology. Faculty of Sciences. Badji Mokhtar Annaba University, 2015.
 32. Merabeti B, Ouakid ML. Contribution to the study of mosquitoes (diptera: Culicidae) in the oases of the Biskra region (North East of Algeria). *Proceedings of the International Seminar on Fauna Biodiversity in Arid and Semi-Arid Zones*. 2011, 185-189.
 33. Benhissen S, Habbachi W, Masna F, Mecheri H, Ouakid ML, Bairi AM. Culicidae Inventory of Arid Zones : Case of Ouled Oases (Biskra, Algeria) Inventory Culicidae dry lands : Inventory Culicidae dry lands : The case of Oasis Ouled Djellal (Biskra, Algeria). *El Wahat Review for Research and Studies*. *El Wahat Review for Research and Studies*, ISSN. 2014; 7(2):1112 -7163
 34. Metge G, Hassaine K. Study of the environmental factors associated with oviposition by *Aedes detretus* along a transect in Algeria. *J AMCA*. 14(3):213-244.
 35. Hassain K. Biogeography and biotopology of Culicidae (Diptera: Nematocera) of Mediterranean Africa. Bioecology of the most vulnerable species (*Ae. caspius*, *Ae. mariae* et *Cx. pipiens*) of the Western Algerian region. Thesis doc status. Univ Tlemcen, 1989, 1998, 2002. 203.
 36. Lounaci Z. Biosystematics and bioecology of Culicidae (Diptera - Nematocera) in rural and agricultural environments. Thesis by Magister. INA. El Harrach.
 37. Aron M, Grasse P. *Animal Biology*. Ed., Masson *et al.* 1966, 2003, 1013-1023.