International Journal of Biotechnology and Bioengineering

Research Article ISSN 2475-3432

Evidence of Complement Genes in the Ophuir id: Ophiocomina Nigra. Comparisons with the Sea Star a Sterias Rubens

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Abstract

All the complement component genes of the Alternate and Classical Pathways, are present in the Ophuirid: Ophiocomina nigra like in the sea star Asterias Rubens genome we studied recently.

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Citation: Michel Leclerc et al. (2018), Evidence of Complement Genes in the Ophuirid: Ophiocomina Nigra. Comparisons with The Sea Star Asterias Rubens. Int J Biotech & Bioeng. 4:1, 06-09.
DOI:

Received: December 19, 2017
Accepted: December 29, 2017
Published: January 17, 2018

Introduction

In recent papers, we have found in the Asterias Rubens genome, all the component genes of the alternative and classical pathways (ref.1)
More recently, we have discovered in the Ophuirid: Ophiocomina nigra genome, an Ophuirid IGKappa gene (ref.2) which can play a fundamental rôle in the antibody-like immune reactions (ref.3)
It seemed interesting to look for Complement component genes in the Ophiocomina nigra genome

Materials and Methods

Ophiocomina nigra was collected at Roscoff (Biologic Station). Digestive coeca were excised from the O.nigra body.
O. nigra mRNA was obtained from Uptizol(Interchim)
Sequencing was operated on Illumina Next Seq 500 with Paired-end:2.75 bp.
Transcriptome was assembled from RNA-Seq fastq files using Trinity v2.1.1 (ref.4) with default parameters. A BLAST database was created with the assembled transcripts using make blast DB application from ncbi-blast+ (v2.2.31+). The sequences of transcripts of interest were then blasted against this database using blastn application from ncbi-blast+ (ref.5) with parameter word_size 7.

Results :

The component C3 is central for both the classical and alternate pathways: it is following a sequence :

```
>BC029976.1 Mus musculus complement component 3, mRNA (cDNA clone IMAGE:5038612)
5′CGGACGCGTGGGGGCTGTTAAATGGTTGATTCTGGAGAAACAGAAGCCGGATGGTGTCTTTCAGGAGGAT
GGGCCCGTGATTCACCAAGAAATGATTGGTGGCTTCCGGAATGCCAAGGAGGCAGATGTGTCGCTCACAG
CCTTCGTCCTCATCGCACTGCAGGAAGCCAGGGACATCTGTGAGGGGCAGGTCAATAGCCTTCCTGGGAG
CATCAACAAGGCAGGGGAGTATATTGAAGCCAGTTACATGAACCTGCAGAGACCATACACAGTGGCCATT
GCTGGGTATGCCCTGGCCCTGATGAACAAACTAGAGGAACCTTACCTCGGCAAGTTTCTGAACACAGCCA
AAGATCGGAACCGCTGGGAGGAGCCTGACCAGCAGCTCTACAACGTAGAGGCCACATCCTACGCCCTCCT
GGCCCTGCTGCTGCTGAAAGACTTTGACTCTGTGCCCCCTGTAGTGCGCTGGCTCAATGAGCAAAGATAC
TACGGAGGCGGCTATGGCTCCACCCAGGCTACCTTCATGGTATTCCAAGCCTTGGCCCAATATCAAACAG
ATGTCCCTGACCATAAGGACTTGAACATGGATGTGTCCTTCCACCTCCCCAGCCGTAGCTCTGCAACCAC
GTTTCGCCTGCTCTGGGAAAATGGCAACCTCCTGCGATCGGAAGAGACCAAGCAAAATGAGGCCTTCTCT
CTAACAGCCAAAGGAAAAGGGCAAGGCACGTTATCGGTGGTGGCAGTGTATCATGCCAAACTCAAAAGCA
AAGTCACCTGCAAGAAGTTTGACCTCAGGGTCAGCATAAGACCAGCCCCTGAGACAGCCAAGAAGCCCGA
GGAAGCCAAGAATACCATGTTCCTTGAAATCTGCACCAAGTACTTGGGAGATGTGGACGCCACTATGTCC
ATCCTGGACATCTCCATGATGACTGGCTTTGCTCCAGACACAAAGGACCTGGAACTGCTGGCCTCTGGAG
TAGATAGATACATCTCCAAGTACGAGATGAACAAAGCCTTCTCCAACAAGAACACCCTCATCATCTACCT
AGAAAAGATTTCACACACCGAAGAAGACTGCCTGACCTTCAAAGTTCACCAGTACTTTAATGTGGACTT
ATCCAGCCCGGGTCGGTCAAGGTCTACTCCTATTACAACCTCGAGGAATCATGCACCCGGTTCTATCATC
CAGAGAAGGACGATGGGATGCTCAGCAAGCTGTGCCACAGTGAAATGTGCCGGTGTGCTGAAGAGAACTG
CTTCATGCAACAGTCACAGGAGAAGATCAACCTGAATGTCCGGCTAGACAAGGCTTGTGAGCCCGGAGTC
GACTATGTGTACAAGACCGAGCTAACCAACATAGAGCTGTTGGATGATTTTGATGAGTACACCATGACCA
TCCAGCAGGTCATCAAGTCAGGCTCAGATGAGGTGCAGGCAGGGCAGCAACGCAAGTTCATCAGCCACAT
CAAGTGCAGAAACGCCCTGAAGCTGCAGAAAGGGAAGAAGTACCTCATGTGGGGCCTCTCCTCTGACCTC
TGGGGAGAAAAGCCCAACACCAGCTACATCATTGGAAGGACACGTGGGTGGAGCACTGGCCTGAGGCAG
AAGAATGCCAGGATCAGAAGTACCAGAAACAGTGCGAAGAACTTGGGGCATTCACAGAATCTATGGTGGT
TTATGGTTGCCCCAACTGACTACAGCCCAGGCCTCTAATAAAGCTTCAGTTGTATTTCACCCCAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA3′
```

The following sequences obained from a blast against Homo sapiens show simultaneously alternate and classical pathway components:

```
>TRINITY_DN6841_c0_g1_i1 len=689 (C9)

5'GGCTCTACGAACTGATCTATGTCTTGGATAAAGCTTCCATGAAAGAGAAAGGTGTTGAAC
TGAGCGATGTAAAGCGGTGTCTTGGGTTTAACCTGGATGTTTCTCTATATACGCCTCTAC
AAACCACCTTAGAAGGACCATCATTGACAGCCAATGTTAATCACAGTGATTGCTTAAAGA
CAGGGGATGGTAAAGTAGTAAACATCAGCCGCGATCACATCATAGATGATGTTATTTCAT
TCATAAGAGGAGGGACCAGGAAGCAAGCAGTTCTCCTGAAAGAGAAGCTTCTCAGAGGAG
CCAAGACGATTGATGTGAATGACTTCATCAACTGGGCCTCATCCTTGGATGACGCTCCAG
CTCTCATTAGTCAAAAACTGTCCCCTATCTATAATCTCATTCCTTTGACAATGAAAGATG
CATACGCAAAGAAACAGAATATGGAAAAGGCTATTGAAGACTATGTGAATGAATTCAGTG
CTAGAAAGTGCTACCCATGTCAAAACGGAGGCACAGCAATTCTTCTGGATGGACAGTGCA
TGTGCTCCTGCACAATCAAGTTTAAGGGGATTGCCTGCGAAATCAGTAAACAAAGATAGC
CTTCAGGAAACAAAGCAAAACCTGGTTCACATGGAAGGTGGAAAAAAGGACAAAAAAAAG
AAGAAGAAGGAGGAGGAGGAGGAGGAAGA3'

>TRINITY_DN5844_c0_g1_i1 len=217 (C5)

5'AAAGAAACAGCATGTAAACCAGAGATTGCATATGCTTATAAGGTCAGGATCACGTCGGCC
ACGGAAGAAAACATTTTTGTCAAGTACACTGCGACGCTTCTGGATATTTACAAAACAGGG
GAAGCCGCTGCTGAGAAGGACTCTGAGATCACCTTCATTAGAAAGATAAGCTGTACCAAC
GCCAACCTGGTGAAAGGAAAGCAATATTTAATCATGG3'

>TRINITY_DN6320_c0_g1_i1 len=213 (C2)

5'AGAGGACACGTCATTCTGAGCGTAAGGGCCGCAGCGAAAGGTGGCAGGGCCCGCGCTTTT
AAAGGCTGAAATCCCGGCGGCTCAGGCCTGTCGTTTCCAGCACTTTGGGAGGCCCAGGAA
GATGGATCGCTTGAGGCCAGGAGTTCGGGACTAGCCTGGCCAACATGGTGAACACCCGTC
TCTACTAAAAATAGATCGGAAGAGCGTCGTGTT3'

>TRINITY_DN228128_c0_g1_i1 len=258 (C1S)

5'TTTTTTTTTTATAAATAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAATATATACAATAAGC
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ATAACTGTACTAAGCGGGTATTTCATCACATATGCAAGCGCAAAACAACACTTAAATAAA
GATGTCCAGAATTAGATTTCAATTTCCTTTAAATATTTTTCTCACGACGCTAGCTTTTTC
CTGACGTCCTGTGCTTCCATATCCTTTTCACCCTAGGCTCAAGTTAAATAAATATTTGTC
CTTTCCATTTACTCGGGG3'

>TRINITY_DN38594_c0_g1_i1 len=481 (C7)

5'ATATATCATATATGATATAGTACCTTTGTTATATATCATAATACATATAAATGTGTATTA
TGTTATCTATAATTATATAATTTCATATATAAGATGTATAATATGTATCATATATTATAT
ATGTTATGTAATATATATAGTATATATAAGATGACACAGGATAAATATTATATACTATGA
CATATAAAATATATGAGGTTATATGTTACATATAAGGCATAGCACATAACATGTAATATA
TATCATATATAATTTTTTTTTAGACAGAATCTTGTCCTGTTGCACAGGGTGGGGTACAAT
GGCGCCATCTTTGCTCACTGCAACTTCTGCCTCACGGGTCCAAGCGATTGTCCTCCCTCA
GCCTCCCAGGTAGCTGGGACTACACCACACTGGGACTACACCAGCTGCCACCATGCCTAG
CTAATTTTTGTATTTTTGGTAGAGACAGGGTTTTGCCGTGTTGCCCAGGCTGGTAGATCG3'

>TRINITY_DN17398_c0_g1_i1 len=230 (C1R)

5'GATTTCATACCTTTTTGTGTGTTATATTTAATGAATATTTTCATGTGTTCTTAGATTTCC
GCTTGCTTAGGACTGTGCAAAAAGCGCAGAAAATTCTACTATTGCTGTATTGCCTTACAG
ACTGCCGTTACTATACTGCAAATTCAAGCACTGCAAATTTGGTCTAATCTACAGTGTGTC
AAAAAAAAAAAAAAAAAAAAAAAAAGGCAAAAAAAAAATTGATAATAAAAA3'

>TRINITY_DN221697_c0_g1_i1 len=246 (C8B)

5'GTTTTACTGCTGCAATTGATGAATTGCAAACAGACATATGCTAATGACATAATAGGGTTG
TATATATAACTGTGAATTGTTCACACATTAACACCTGTGATACCAACACTATGATTTACC
GGCATGCTTGCAGTTAACCACCTCCAGAAATGCTGAAGGAAGGCTCAGTTTGATGATTTA
ATATAATTTCTGGTAAAGGCAAAAAAAAAAAAAAAAAATAAAACCCTTGGGTGCAGATAA
ACAAAG3'

>TRINITY_DN49516_c0_g1_i1 len=307 (C4B)

5'GGCAAACACTTCAGATGGTGAAAAACTCTCAACTTTTTTTTAATGTTAAGTCGAGGGATG

AGGCTGTGGATCTTGCAATTGCAACAGATGAAGGCCTACGTAATGTACACTATGTGACAT
ATCATAACTTGTTAGTGTTGTAAAGTCACGTTGTGTGCTACAGTGTGTGAGAGGCCACAG
ACTAAAAAAGAGGAAAATTACTAAAAAAGCTGAAAAACAGTGTAAAATAGAGGGAAAAAT
GCCCTAAATGGACTGAAAATAAGAGAAAATGCAGAAATGTTGGCCAAAAAAAAAAAAAAA
AAGCTGA3'

A table summarizes all these results as following: Table 1(Note the high significant e-values)

QueryID	QueryName	SubjectID	Identity	Length	Mismatch	Gapopen	E-value
NM_001737.4	C9	TRINITY_DN6841_c0_g1_i1	76,81	595	111	16	4,00E-83
NM_001317163.1	C5	TRINITY_DN5844_c0_g1_i1	83,87	217	35	0	3,00E-52
NM_001735.2	C5	TRINITY_DN5844_c0_g1_i1	83,87	217	35	0	3,00E-52
NM_001282459.1	C2	TRINITY_DN6320_c0_g1_i1	85,71	98	12	2	5,00E-21
NM_001317164.1	C5	TRINITY_DN38594_c0_g1_i1	77,95	127	27	1	1,00E-13
NM_001346850.1	C1S	TRINITY_DN228128_c0_g1_i1	94,87	39	2	0	1,00E-08
NM_001734.4	C1S	TRINITY_DN228128_c0_g1_i1	94,87	39	2	0	1,00E-08
NM_201442.3	C1S	TRINITY_DN228128_c0_g1_i1	94,87	39	2	0	1,00E-08
NM_000587.3	C7	TRINITY_DN38594_c0_g1_i1	74,81	135	33	1	1,00E-07
NM_000587.3	C7	TRINITY_DN38594_c0_g1_i1	83,08	65	11	0	1,00E-07
NM_001346850.1	C1S	TRINITY_DN32341_c0_g1_i1	96,88	32	1	0	2,00E-06
NM_001734.4	C1S	TRINITY_DN32341_c0_g1_i1	96,88	32	1	0	2,00E-06
NM_201442.3	C1S	TRINITY_DN32341_c0_g1_i1	96,88	32	1	0	2,00E-06
NM_001733.5	C1R	TRINITY_DN17398_c0_g1_i1	94,12	34	2	0	8,00E-06
NM_001354346.1	C1R	TRINITY_DN17398_c0_g1_i1	94,12	34	2	0	8,00E-06
NM_001346850.1	C1S	TRINITY_DN27085_c0_g1_i1	84,21	57	5	3	8,00E-06
NM_001734.4	C1S	TRINITY_DN27085_c0_g1_i1	84,21	57	5	3	8,00E-06
NM_201442.3	C1S	TRINITY_DN27085_c0_g1_i1	84,21	57	5	3	8,00E-06
NM_001733.5	C1R	TRINITY_DN57346_c0_g1_i1	93,94	33	2	0	3,00E-05

Conclusion and Discussion

We observe that the main complement components genes are present in Ophiocomina nigra, in a similar way than in the asteroid Asterias Rubens [ref.1].

In Echinodermata, only asteroids and ophiurids, show alternate (C3, C5, C7, C8, C9) and classical pathway components(C1r, C1s, C2, C4) : It is a reality, not a coincidence, we cannot neglect, in the future works of comparative immunology, in Echinodermata, which study the innate and adaptative immunity.

References

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Citation: Michel Leclerc et al. (2018), Evidence of Complement Genes in the Ophuirid: Ophiocomina Nigra. Comparisons with The Sea Star Asterias Rubens. Int J Biotech & Bioeng. 4:1, 06-09. DOI: