Ukrainica Bioorganica Acta 1 (2005) 25—27

www.bioorganica.org.ua

Influence of a tetranucleotide, CGCG, on marine algal viruses

O. A. Stepanova

Alexander O. Kovalevsky Institute of Biology of Southern Seas,
National Academy of Sciences of Ukraine
2 Nakhimov avenue, Sevastopol, 99011, Ukraine

Summary. The author shows a tetranucleotide, CGCG, to inhibit infectious activities of some algal viruses by 10^2—10^4 times. This process depends on the duration of CGCG-virus contact. The results obtained seem to be interesting from the practical point of view.

Key words: CGCG, algal viruses, infectious activity.

Introduction. Any water environment contains always soluble DNA molecules. 2—74 % of total soluble DNA molecules are presented by cell DNA fragments appeared as a result of lysis due often to virus activities. Viral DNA makes about 20 % of the soluble DNA [1]. Some data show the contact of native DNA and viruses in water environment *in vitro* results in chemical interaction fixed by a microcalorimetry method demonstrating the increase of heat production and «cooperative transition». Preliminary ultraviolet (UV) irradiation of DNA or viruses accelerates the heat production during their contact. In some experiments [2] the effect of the adenosine triphosphate (ATP) and interferon on DNA-virus interactions were studied. There is no doubt the UV press to become increased under natural conditions as a result of the ozone layer thinning. It is known the formation of dimers including two adjacent thymidine or cytosine residues or a thymidine and a cytosine residue is a consequence of the UV irradiation. The relative content of these dimers depends on the cytosine/thymidine ratio in the DNA as well as on frequency of their closest neighbourhood. The UV radiation effect is also accompanied by cytosine and uracil hydroxylation, formation of cytosine-thymidine adductors (adducts) breaks in DNA chains and DNA denaturation. Thus, the additional UV press leading to the DNA chain breaks and other structural impairs, can facilitate the activation of chemical links between different segments of the damaged DNA and the appearance of tetra-, oligo-, and polynucleotides in solution [3—5]. What is a mechanism of these nucleotide sequences effect on marine algal viruses in water environment?

In this paper we describe the influence of a tetranucleotide, CGCG, on the infectious activities of some algal viruses.

Material and methods. In our experiments, preparations of a tetranucleotide, CGCG («Sigma»), were used. The infective activities of all viruses, treated and non-treated by the CGCG, were determined following their titration on liquid cultures of the *Tetraselmis viridis* Norris (Chlorophyta). This alga known also as *Platymonas viridis* Rouch (Chlorophyta) had been isolated from the Black Sea waters in our Institute [6]. Infective activities of viruses used were 10^5—10^9 infectious units.

The CGCG effect on viral infectious activities was studied following this tetranucleotide addi-

*** Corresponding author.**
Tel./fax: +380692-555477
E-mail address:
solar@ibss.iuf.net

Table

Effect of the CGCG on infectious activities of some algal viruses

Viral isolate	Time of the CGCG contact with viral isolates, days	Infectious virus titers for samples:		Changes of viral infectious activities in treated samples comparing to control ones
		CGCG-treated	control	
TvV-S1	11	10^3	10^5	Drop by10^2 times
	19	10^3	10^5	Drop by 10^2 times
	35	0	10^4	Drop by 10^4 times
TvV-S10	6	10^5	10^7	Drop by 10^2 times
	19	10^5	10^7	Drop by 10^2 times
TvV-S19	1	10^9	10^9	Without changes
	7	10^6	10^9	Drop by 10^3 times
	21	10^5	10^9	Drop by 10^4 times
TvV-7/2	6	10^5	10^8	Drop by 10^3 times
	19	10^5	10^8	Drop by 10^3 times

tion (0.2 ml of the 10 % CGCG aqueous solution) to purified virus suspension (1.8 ml) and virus titration using susceptible *T.viridis* cultures, the final CGCG concentration being 1 %. Simultaneous titrations of treated and control samples were made in 2—35 days following the CGCG addition.

The isolation and titration of algal viruses were carried out using liquid cultures of a microseaweed, *Tetraselmis viridis* Norris (Chlorophyta), according to an approach patented by the author [7].

Results and discussion. Our experiments were carried out to investigate the CGCG effect on infectious activities of some algal viruses listed in the Table. Following the CGCG addition to viral suspensions, the infectious titers of both treated and control virus-containing suspensions were determined. The results obtained are given in the same Table.

It is seen the infective activity of algal viruses following the CGCG treatment during 6 days becomes by 10^2—10^4 times lower. The drop of infectious virus titers depends on the time of their contact with the CGCG. In one of the experiments (with the viral isolate TvV-S19) after a day of contact with CGCG no decrease of virus titer was found. In another experiment (with the isolate TvV-S1) we observed the full elimination of virus infectivity following 35 days of such contact.

We suppose the interaction between viruses and the CGCG leading to decreased viral infectivity is caused by electrical and chemical mechanisms.

It is probable there are no such high concentrations of natural viruses and tetranucleotides in natural water environment as the concentration used in our experiments. However, our study shows the possibility of natural virus elimination in water environment as well.

It is possible that results our further researches concerning the nucleotide-virus and DNA-virus interactions might be useful for viral infection prophylaxis and in other fields.

Conclusions. Our experiments show the CGCG to inhibit infectious activities of some algal viruses by 10^2—10^4 times. This process depends on the duration of CGCG-virus contact.

Вплив тетрануклеотиду ЦГЦГ на морські альговіруси

О. А. Степанова

Інститут біології південних морів ім. О. О. Ковалевського НАН України
пр. Нахімова, 2, Севастополь, 99011, Україна

Резюме. У водоймах присутня розчинна ДНК, на частку якої припадає 2—74 % клітинної і 20 % вірусної ДНК. Підвищення фону ультрафіолетового випромінювання в природі спричинює руйнування розчинної ДНК, розрив ланцюгів, денатурацію оліго- та полінуклеотидів. Експериментально встановлено, що контакт тетрануклеотиду ЦГЦГ із альговірусами призводить до зниження інфекційної активності останніх у 10^2—10^4 разів. Цей процес залежить від тривалості контакту вірусів із тетрануклеотидом. Можливо, результати подальших досліджень взаємодії вірусів та ДНК, а також оліго- та полінуклеотидів знайдуть широке практичне застосування в лікуванні й профілактиці вірусних інфекцій.

Ключові слова: тетрануклеотид ЦГЦГ, альговіруси, інфекційний титр.

References

1. *Wommack K.E., Colwell R.R.* Virioplankton: viruses in aquatic ecosystems // Microbiol. & Molec. Biol. Revs. — 2000. — Vol. 64, No 1. — P. 69—114.

2. *Stepanova O.A., Shaida V.G., Boyko A.L.* Study of heat production of interaction between DNA and viruses in vitro // 30th Pacem in Maribus: Intern. Conf.: Abstr. Book. A year after Johannesburg: Ocean governance and sustainable development: Ocean and Coasts, a Glimpse into the Future. (Kiev, Ukraine, Oct. 27—30, 2003). — Kiev, 2003. — P. 125—126.

3. *Назим А., Джеймс А.* Жизнь в условиях интенсивного облучения // В кн.: Жизнь микробов в экстремальных условиях. — М.: Мир, 1981. — Гл. 11. — С. 470—497.

4. *Starr C.* Biology Concepts and Applications. — 3d Ed. — Belmont; Albany; Bonn etc.: Wadsworth Publishing Company. — 1997. — 743 p. + 1 appendix.

5. *Ленинджер А.* Основы биохимии. — М.: Мир, 1985. — 1056 с.

6. *Stepanova O.A., Boyko A.L., Shevchenko T.P., Polischuk V.P.* Algoviruses of Tetraselmis viridis (Chlorophyta) and Phaeodactylum tricornutum (Bacillaroophyta) from Sevastopol bays / Bioresources and Viruses. IV Intern. Conf. Sept. 27—30, 2004, Kyiv, Ukraine. — Taras Shevchenko Kyiv National University. — 2004. — P. 118—119.

7. *Степанова О.А.* Спосіб ізоляції альговірусів одноклітинних водоростей, наприклад, Platymonas viridis Rouch (Chlorophita). Пат. 65864A UA, МКИ 7 C12 N 1/12. — N2003065499; Заявлено 13.06.03; Опубл. 15.04.04, Бюл. № 4 // Промислова власність. — 2004. — № 4. — С. 1—4.