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Effects of various environmental conditions on morphology, genetics and some physiological factors of 8 population of red algae pertaining to Southern Coastlines of Iran

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Key words: Environmental conditions, *Gracilaria,* Iran, red algae.

Abstract

In this research which is performed during 2012 and 2013 , 8 population of red algae which were regarded as 8 suspected , and separated species were compared in 3 replications from the viewpoint of habitat , apparent form , DNA sequence in region of Choloroplastic*rbcL*, Protein amount , dry weight , chlorophyll and cartenoide amount . The derived data appointed these 8 populations pertaining to *Gracilariacorticata*and *Gracilariaarcuata*species, because of nondifference in DNA sequence and protein amount, despite they were influenced by environmental conditions and they indicated meaningful changes from the viewpoint of chlorophyll and cartenoide amounts and in some cases dry weight, as well as their morphology indicated some changes in various ecologic conditions.

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Introduction

Algae are considered as the first producer of ecosystems of marine and other waters. More than 44 presents of photosynthesis present in biosphere is performed by aquatic autotroph organisms. Cell walls of algae have secondary compounds and polysaccharide with different medicinal and industrial and food uses. (Dawes, 1997).

The red algae are a branch of algae that due to having precious polysaccharide compounds in its cell wall have a special economic and commercial value (Kianmehr 2005). One of the most important families of red algae is Gracilariaceae, which because of having agar polysaccharide compound in the large number of members of this family, is important in global trade (Hosseini 2004). Gracilariaceae genera is among red algae. It was firstly introduced by Nageli (1847). Since it's introduced by Negeli, this genus has experienced many variations in terms of number and kind of members belonged to this species.

At first, this genus was classified in the group of Gigarniales (kylin, 1932, 1956). But after studies on species "*Gracilaria verrucosa*", it was classified as a disrete group, named Gracilariales. (Fredericq and Hommersand, 1989). This family contains seven genera, which one of the most important of them is *Gracilaria*. A large number of *Gracilaria* species are part of significant species of universe agarophyte. Graislaria is economically the the most important kind among marine algae. Doty (1979) and Brid (1995) estimated that per year, 5000 tone of produced agar in the world is obtained from *Graislaria*. This value is equivalent to 25000 to 30000 tone of its dry weight. Basically, it's obtained from natural media of regions of chili and Argentina.The economic value of agar in various industries has stimulated many biologists in order to research on exact identifying of species of this genus (Mirzabagheri *et al*., 2012). The presence of many similarities and intense polymorphisms between the members of this family has faced identifying of its member with the problem and had made plenty of mistakes, for example, today more than 300 species of this genus have been reported but only 110 species of them have been formally identified (Oliveira andPlastino 1994). Persian Gulf and Oman sea coasts are also very suitable beds for growing this class of algae. These beaches have warm water and algal species of this region have many similarities with Indian Ocean species. Branch of red algae in the southern Persian Gulf and Oman Sea, Iran has the highest number of algal species among other species of marine algae found in the region, which some belong to the genus *Gracilaria* (Gharanjik2010). Until now, there have been reports indicating that some species of algae "*Gracilariacorticata*" exists in some regions such as chabahar, lenge, Bushehr and Persian Gulf (Hoseini and Abkenar, 2004).

Algae are considered as the first producer of ecosystems of marine and other waters. More than 44 presents of photosynthesis present in biosphere is performed by aquatic autotroph organisms. Cell walls of algae have secondary compounds and polysacharid with different medicinal and industrial and food uses. (Dawes, 1997) The offered reports regarding species of genus *Gracilaria* are different and numerous (Mirzabaqeri *et a.,l* 2007, 2008, 2009), (Sohrabipour and Rabii2009 and 1999), (Gharanjik1999 and 2010), (Borgessen 1939), (Nizamuddin 1970). The main cause of differences in the reports is very similar of this class of algae with each other and deformation of some species in response to different environmental conditions. In this study eight populations of these algae have been studied, which were given as eight separate species. By using PCR technical, we can differentiate the various species. The differences among chili and newzeland populations in the species "Gracilariachilensis" are well studied. (Goff and Coleman, 1998). The review which was conducted was based on the study of appearance of algae, the study of DNA sequence analysis and algae compared with other world regions, the study of chlorophyll a and Carotenoid levels and protein and dry weight of this class of algae.

Materials and Methods

During the study, Iran southern coasts were visited and studied and the habitat of mentioned algae was identified (Table 1).

Table 1. Four geographic location of the study area.

Elevation	Latitude	Longitude	Area
18 m	50° 8′	27° 17′	Booshehr
20 m	27° 11′	56° 16′	Bandar abass
1.32 m	26° 58′	56° 17′	Gheshm
11 m	25° 18′	60° 37′	Chabahar

Table 2. The name of populations and relative habitats to them.

Name of population	habitat
Population 1 from : *Gracilariacorticata*	Booshehr : Niroogah
Population 2 from : *Gracilariacorticata*	Bandar abass : Khajeata
Population 3 from : *Gracilariacorticata*	Gheshm : Koveie
Population 4 from : *Gracilariacorticata*	Chabahar : Park saheli
Population 1 from : *Gracilariaarmata*	Chabahar : Park saheli
Population 2 from : *Gracilariaarmata*	Chabahar : Ramin
Population 1 from : *Gracilariaarcuata*	Chabahar : Park saheli
Population 2 from : *Gracilariaarcuata*	Chabahar : Ramin

Sampling

In this study, the mentioned species were collected from relative habitats of the Persian Gulf and Oman Sea in 2012 and 2013. For this purpose, prior to sample collection operations to obtain information from condition of study areas were gotten information about condition of each region from meteorological and geological organizations of each region, which in the same way some tables provided to us. The time of collecting samples was more in the mid and also late and early lunar month because in these times there were the most ebb but for this purpose there are tables, which were obtained from meteorological organization. Sample collections from tidal area were performed in the hours, which there were most marine ebbs that for this reason were used from relative tables. But in general, most of these samples were collected at 4 am before sunrise or before sunset at 4 pm, but collected samples in the morning were better than evening because of lower level of marine ebb. Thus the samples were separated using a palette knife completely from its bed. From the beginning of collection, each species was placed separately in the plastic bag to distinguish them easily. Then the samples were completely cleaned of sediments, which for this purpose some samples were washed completely with sea water and then their surfaces were cleaned by using of tissue paper. For the analysis of DNA, of top of sample branches in about 100 grams were placed in Bluesilicagel for drying. Also in order to do the morphological and anatomical studies and identify of any species, samples were fixed in 4% formaldehyde and were transferred to the laboratory of Islamic Azad University of Bam. For measuring the rate of photosynthesis pigments, after collecting were immediately frozen and after being frozen placed in Yunuliti boxes and through the air to analysis were transferred to Isfahan University.

Dry weight measurement: in order to measure the dry weight of samples, they separately were weighted by scale with accuracy of 0/001mg. samples for 48 hours in the oven with a temperature of 70 centigrade were dried and weighted again and then dry weight was calculated based on percentage of dry weight.

Measurement of photosynthetic pigments (chlorophyll and carotenoids): in order to measure the degree of photosynthetic pigments 0/2 grams of tissue was weighed with accurate laboratory scale with 0/001 mg accuracy and grinded well in mortar containing 4 ml of 80% acetone and after arriving to 8 volumes, was centrifuged with 3000 Rpm by 80% acetone for 5 minutes. In order to set the

spectrophotometer machine was used from eighty percent acetone as control. The pigment concentrations were calculated using the formula Lichtentaler, 1994.

Protein extraction and measurement

proteins were extracted from mortar and all procedures performed at a temperature of 4 degrees Celsius. For this purpose, we poured samples in the mortar and after adding buffer, the extraction of potassium phosphate ratio 1 to 3, grinding operation was performed by liquid nitrogen until samples were homogenized. Then the resulting homogenous samples were transferred to the centrifugal tube and with using of centrifugal device, model Beckman (LE80k), and were centrifuged at 4 ° C with 13000 rpm for 45 minutes. After ending centrifugal operation, the floating solution was passed through 6 tiffany layers and was distributed in sterile Apendorf tubes and was maintained at 70 °C freezer. These samples were used for protein measurement. In order to measure the protein concentration, we poured 100 micro liter of soluble protein extract into the test tube and then added 1 ml of Bradford reagent to the samples and were vortexed. After 15 minutes absorbance, the samples were read at 595 nm wavelength. It should be noted that the time interval for measuring of proteins is not longer than one hour (Bradford, 1976).each of the parameters of dry weight, protein, chlorophyll and carotenoid levels were measured with three replicates of each population. Finally, the data were statistically analyzed with Mstat-c software and graphs were plotted with using of the excel software.

DNA sequence

From the collected samples were preserved in silica gel were used for extraction. DNA extraction was performed with using of modified method CTAB Doyle and Doyle 1987. Analyzed DNA was belonged to the rbcLchloroplastic region and rbcS and the space between these two regions. In order to examine the phylogenetic relations, the following primers were tested (Table 3).

Table 3. List of primers used in the analysis of DNA.

Primer name	Primer type	Sequences
rbcL-753	Forward	F: 5-GGAAGATATGTATGAAAGAGC-3
rbcR1	Riverse	R: 5-CGGTAGTCCCCATAATTCCC-3
rbcS-753	Riverse	R: 5-GCTCTTTCATACATATCTTCC-3
rbcL-57	Forward	F: 5-CTAATTCCATATGCTAAAATGGG-3
R-rbcS start	Riverse	R: 5-TGTGTTGCGGCCGCCCTTGTGTTAGTCTCAC-3

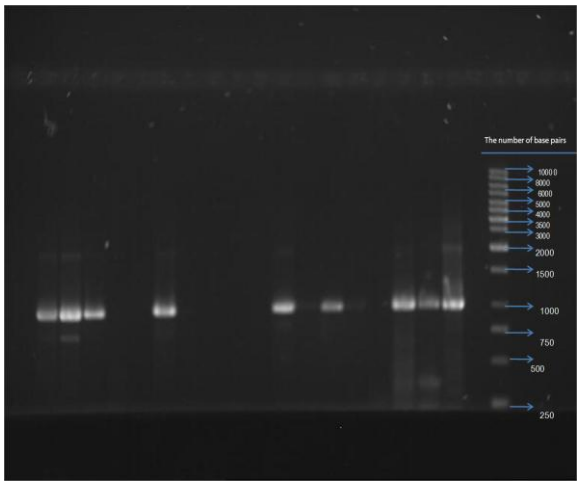

Fig. 1. Electrophoresis of PCR.

The primers were obtained from Gene Fanavaran (Tehran, Iran). PCR was carried out in 25 µl volume in a reaction mixture containing 2 µl of chitinasecDNA, 0.4 µM each primer, 200 µMdNTP, 2.5 mM MgCl2, 1X PCR buffer, and 1 unit of Taq DNA polymerase.

The polymerase chain reactions were performed on a thermocycler CGI-96 system (Corbett) in 35 cycles. PCR was carried out in initial activation step at 94°C for 5 min and denaturation for 60 s in other cycles, annealing at 45°C for 90 s, extension at 72°C for 90 s, and final extension for 10 min.Amplicons were

purified in 1.2% Agarose gel. The products with 800-1000 base pairs length, with a single distinct band and 30 ng concentrations were used to DNA sequencing analysis. Sequencing primer rbcL-753 was used in this study.

Result and discussion

1. Comparison of protein degree in the different populations of Gracilariacorticata

Obtained data indicate that the initial test with respect to the CV value is valid and date are confirmed, but regarding to this point that the F Value degree of column 2 is less than 1, becomes clear that the impact of environmental conditions on protein degree of four populations of species *Gracilariacorticata* was completely meaningless and the four populations in terms of protein levels are very close together also observed difference in the diagram is in the ten-thousandth decimal level, which is very small digit and is not intended as a difference.

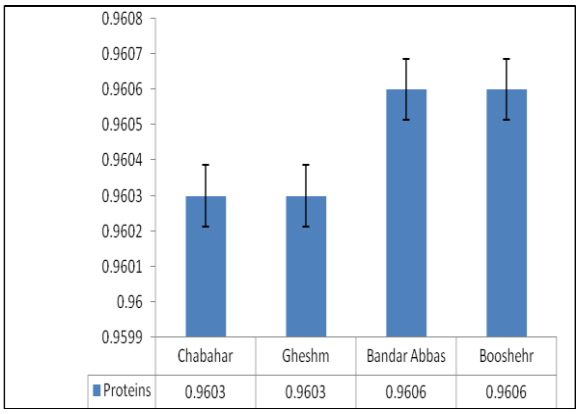

Fig. 2. The impact of different ecological conditions on four populations of *Gracilariacorticata*.

Table 4. Protein degree variance analysis.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.0000	0.0000	0.0000	
2	Factor A	3	0.0000	0.0000	0.2500	
3	Error	6	0.0000	0.0000		
	Total	12	0.0000			

Coefficient of variation :0.07%

2. Comparing the dry weight in different populations of Gracilariacorticata

Obtained data indicated that the effect of different environmental conditions on the dry weight of four populations of species *Gracilariacorticata*, with a probability of 96%, was significant and the dry weight of algae will change under the influence of different ecological conditions with a probability of 96% and the most difference was observed between the populations of Bushehr and Gheshm and the least difference was belonged to the populations of Bandar Abbas and Gheshm that they have the nearest distance to each other geographically.

Table 5. Variance analysis of dry weight level.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.002	0.001	0.2727	
2	Factor A	3	0.047	0.016	5.0909	0.0436
3	Error	6	0.018	0.003		
	Total	11	0.067			

Coefficient of variation :0.57%

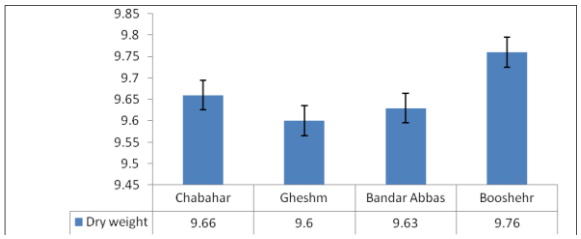

Fig. 3. The impact of different ecological conditions on the dry weight rate of four populations of *Gracilariacorticata*

3. Comparing the carotenoid degree in different populations of Gracilariacorticata

Obtained data indicated that the impact of different environmental conditions on the carotenoid degree of four populations of species *Gracilariacorticata* with probability of 100% was significant and the carotenoid degree of alga will change under the effect of different ecological conditions. The most difference in this respect was observed between the populations belonging to Chabahar and Bushehr that they had the greatest distance geographically and the least difference was belonged to the populations of Bandar Abbas and Qeshm that they had the nearest distance geographically.

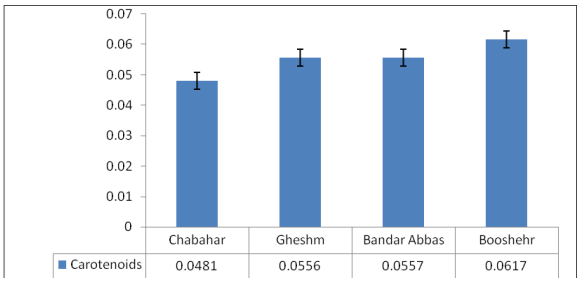

Fig. 4. The effect of different ecological conditions on the Carotenoids degree of four populations of *Gracilariacorticata*.

Table 6. Analyzing the variance of carotenoid level.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.000	0.000	8.3333	0.0185
2	Factor A	3	0.000	0.000	1330.1084	0.0000
3	Error	6	0.000	0.000		
	Total	11	0.000			

Coefficient of variation :0.48%

4. Comparing the degree (amount) of chlorophyll in different populations of Gracilariacorticata

Obtained data indicated that the effect of different environmental conditions on the chlorophyll rate of four populations of species *Gracilariacorticata*, with a probability of 96%, was significant and the chlorophyll level of algae will change under the impact of different ecological conditions with a probability of 96% and the most difference was observed between the chlorophyll rate of populations belonging to Bushehr and Chabahar that they had the greatest distance geographically and the least of which was belonged to the populations of Bandar Abbas and Gheshm that they have the nearest distance geographically.

It is worth notified that the obtained data taken from caronetoid and chlorophyll levels in comparison with each other determined that the populations with more chlorophyll have less carotenoid than which with less chlorophyll and these values act inversely.

Table 7. Analyzing the variance of chlorophyll rate (amount).

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.000	0.000	1.1856	0.3682
2	Factor A	3	0.001	0.000	5.2100	0.0415
3	Error	6	0.001	0.000		

	Total	11	0.002
	Coefficient of variation :1.57%		

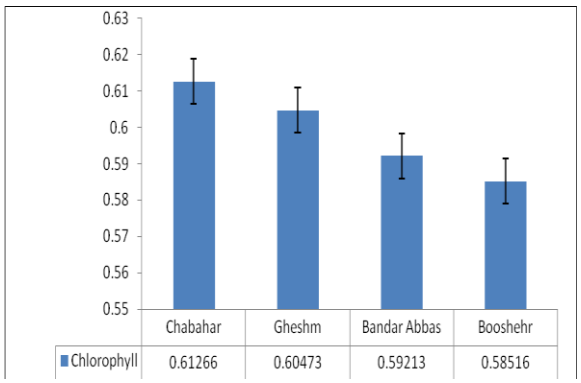

Fig. 5. the impact of different ecological conditions on amount of Chlorophylle in four populations of *Gracilariacorticata*

5. Comparing the protein level in different populations of Gracilariaarcuata and Gracilariaarmata

Obtained data indicate that with respect to CV value the initial test is valid and data are confirmed, but with respect to obtained probability there was no significant relationship among the populations and different environmental conditions leave a negligible and invalid impact on the protein degree of algae in terms of statistics. With studying table of iterations for each population is identified that the values of different populations in the most cases were the same or are very close to each other.

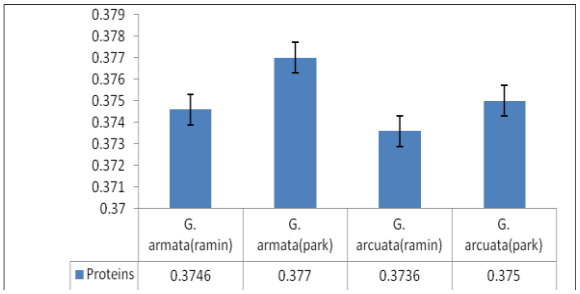

Fig. 6. The impact of different ecological conditions on the protein degree of different populations of *Gracilariaarcuata* and *Gracilariaarmata*.

Table 8. Analyzing the variance of protein level.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.000	0.000	3.0000	0.1250
2	Factor A	3	0.000	0.000	2.1100	0.2003
3	Error	6	0.000	0.000		
	Total	11	0.000			
					Coefficient of variation :0.44%	

6. Comparing the dry weight in different populations of Gracilariaarcuata and Gracilariaarmata

Obtained data define that with respect to the CV value the initial test is valid and data are confirmed, but with respect to this point that the F Value of column 2 is less than 1 becomes clear that the effect of environmental conditions on the dry weight of algae was quite meaningless and these four populations in terms of dry weight are very close together.

Table 9. Analyzing the variance of dry weight rate.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.022	0.011	5.5715	0.0429
2	Factor A	3	0.003	0.001	0.5714	
3	Error	6	0.012	0.002		
	Total	11	0.037			
					Coefficient of variation :0.47%	

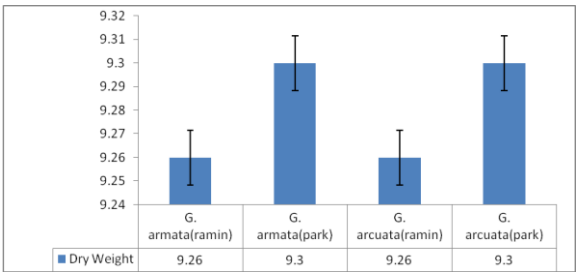

Fig. 7. The effect of different ecological conditions on the dry weight rate of different populations of *Gracilariaarcuata* and *Gracilariaarmata*.

7. Comparing the carotenoid rate in different populations of Gracilariaarcuata and Gracilariaarmata

Obtained data indicated that the impact of different environmental conditions on the carotenoid rate of these populations with the probability more than 99% was significant and the carotenoid rate of algae changes under the influence of different ecological conditions. The least difference concerning this is seen between the population Gracilariaarmata belonging to Ramin coast and *Gracilariaarcuata* belonging to the same beach and also between population *Gracilariaarmata* belonging to the Chabahar coastal park and *Gracilariaarcuata* belonging to the same beach, but the significant difference was not seen among the populations relative to these two species that belong to one beach.

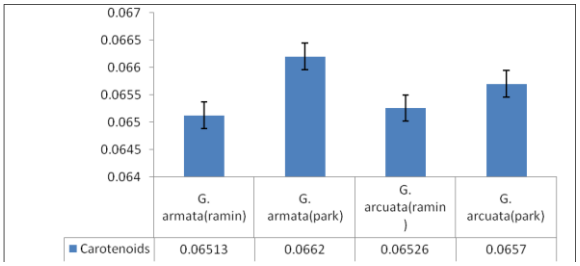

Fig. 8. the effect of different ecological conditions on the carotenoid rate of different populations of *Gracilariaarcuata* and *Gracilariaarmata*

Table 10. Analyzing the variance of carotenoid rate.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.0000	0.0000	3.9295	0.0811
2	Factor A	3	0.0000	0.0000	35.3097	0.0003
3	Error	6	0.0000	0.0000		
	Total	11	0.0000			

Coefficient of variation :0.21%

Obtained data indicated that the effect of different environmental conditions on the Chlorophyll rate of these populations, with probability of 93%, was significant and the chlorophyll amount of alga changes under the effect of different ecological conditions. It is worth notified that in this respect no difference was observed between the population of *Gracilariaarmata* belonging to the Ramin coast and *Gracilariaarcuata* belonging to the same beach and also between the population of *Gracilariaarmata* belonging to the Chabahar coastal park and *Gracilariaarcuata* belonging to the same beach.

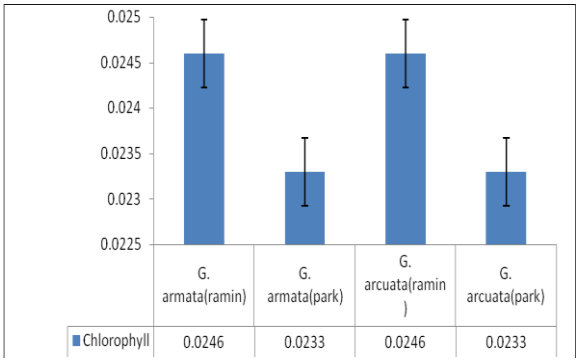

Fig. 9. the impact of different ecological conditions on the chlorophyll rate of different populations of *Gracilariaarcuate* and *Gracilariaarmata*.

Table 11. Comparing the chlorophyll rate in different populations of *Gracilariaarcuata* and *Gracilariaarmata*.

K value	source	DF	SS	MS	F Value	Prob
1	Replication	2	0.0000	0.0000	2.2500	0.1866
2	Factor A	3	0.0000	0.0000	4.0000	0.0701
3	Error	6	0.0000	0.0000		
	Total	11	0.0000			
					Coefficient of variation :2.78%	

9. Morphological comparison of eight populations of red alga A. Gracilariacorticata

In general this alga is seen in the red color, but the populations belonging to the Chabahar coasts are in the bright red and when we become closer towards Bushehr coasts the red color of them becomes darker and they come nearer to the brown color. Usually the Thall height of these algae is changeable between 5 to 15 cm, but at the Bushehr shores observed the algae with the Thall height nearly 20 cm. the algae are in the form of dense and batch and they have cartilaginous tissue with dicotomy divisions, which at the Chabahar coasts mostly observed as irregular sequential divisions, but at the Bushehr coasts their divisions are regular. They have round and compressed basic part and upper part is broad and flat and the width of it is about 5 mm, which this width in the algae of Bushehr coasts becomes nearer to 7 mm. At the Chabahar coasts can be seen the dense and bushy branches in the end parts of these algae. The top of dicotomy divisions is usually blunt, but in some algae belonging to the Bushehr coasts we can see the sharp top. Blade thickness in the middle sections is about 600 microns.

B. GracilariacorticataandGracilariaarmata

These algae from the view point of Thall height show the significant difference so that the populations belonging to the Chabahar coastal park had higher height, which sometimes they were attained to 25 cm in height. But the algae belonging to the Ramin coast have demonstrated the less Thall height and usually are seen maximum to 15 cm height. The color of the algae is red –brown or dark purple that the algae belonging to the coastal park are seen darker than the algae of Ramin coast. The secondary divisions or branches of this plant become curved and bent and splitting of them is usually one- way and upwards, which appear on the arches and curvatures. The basic section of branches became constipated and they became narrower to the sharp tip, but in regard to the top of branches they placed in two categories so that some of them have sharp tip and some have blunt tip and so heterogeneous state is seen among them.

10. The results of alignment of DNA sequence

Due to this alignment, all populations belonging to the *Gracilariacorticata* showed similar results and in comparison these four populations with two populations of the same alga from the southern coasts of Africa observed minor difference about a few nucleotides. The list of DNA sequence has been previously reported.

Due to alignment four populations belonging to the species *Gracilariaarcuata* and *Gracilariaarmata* we observed the quite similar results. Comparing DNA sequence analysis relative to these four populations with two populations of species *Gracilariaarcuata* belonging to the Okinawa, Japan showed similar results.

DNA sequences, all were belonged to the chloroplast rbcl area and rbcs area and the space between these two regions. Also the sequences belonging to Japan and Africa were belonged to this area taken from the Gene World Bank (ddbj).

Table 12. Name of species together with sample code and DNA bank number, the location of collection and the name of the collecting person or company.

Entity (species and sample code)	Location (country)	Collector or auther	*Rbcl*accession number
Gracilariacorticata(J. Agardh) J. Agardh , GCO1	South Africa	Iyer,R., Bolton,J.J. and Coyne,V.E.	AY241137
Gracilariacorticata (J. Agardh) J. Agardh , KZN9	South Africa	Iyer,R., Bolton,J.J. and Coyne,V.E.	AY241155
*GracilariaarcuataZ*anardini	Okinawa in Japan	Shimada,S. and Terada,R.	AB193456
*GracilariaarcuataZ*anardini	Okinawa in Japan	Shimada,S. and Terada,R.	AB193457

Discussion

With respect to the obtained data, determined that four populations belonging to the species *Gracilariacorticata*, which were considered as four suspicious and separate species, all of them are one species and the accuracy of identification of species *Gracilariacorticata* was confirmed because populations of species *G. corticata* collected from Babdar Abbas, Bushehr, Chabahar and Gheshm, despite having little differences in terms of morphology, they are similar to each other in terms of molecular aspect and also they are in the neighborhood of *G. corticata* located in the southern part of Africa. Of course despite being similar the species in Iran with species in Africa, there are some differences in the sequence of nucleotides, which indicates that the Iranian species are Haplotype of African species. On the other hand, the same amount of protein in these four populations is known to us that these four populations have not difference with each other regarding DNA. In general, we can see the difference in color, morphology and pigment rate in these four populations belonging to the different geographical areas, but these differences have occurred under the impact of different ecological conditions, but these differences did not have impact on the genetics of this group of algae and did not cause four different species. For example, the populations belonging to the Chabahar coasts are bright red and when we become closer to the Bushehr coasts, the red color relative to these algae become darker and closer to the brown color and this is while the algae relative to the Bushehr coasts have more carotenoid and less chlorophyll, which these two factors will change significantly under the influence of environmental conditions. On the other hand with decreasing chlorophyll, the amount of Phykoeritrin pigment of red algae generally increases, which the high level of Phykoeritrinand carotenoid will significantly influence on the color. Usually the maximum thall height of these algae is 15 cm, but among the algae collected from Bushehr were seen algae with 20 cm length and width of some of these algae was little more than usual, which this issue influenced the higher dry weight of them. From the other hand, at Chabahar coasts usually there are bigger waves than the other beaches, which this matter had influence on the more irregular binary branches of their algae than the other beaches and the thick and dense divisions of the final sections of some algae in this area show the final wounded and damaged parts of them.

The analysis of DNA and using rbcl data is the most accepted molecular technic in solving the phylogenetic relations of Gracilariacea genera. (Frederic *et al*, 2004).

These studiy is about nuclear Ribosomcistron (Bird 1992, Goff 1994) and the space between these two

regions (Goff, 1994). Their results discriminate new species of Gracilariopsis (Gurgel 2003) and also verrucosa and Gracilariopsislemanieiformis that are complex (Bird 1994, Goff 1994).

In this study, by using successive rbcl, spacer and chloropelasticrbcl, eight populations of red algae were identified that are considered as eight discrete species in different habitats and exhibit variations of morphology under different conditions.

The results made clear to us that after determining chloroplast rbcS, spacer, rbcL sequence of *G.arcuata* collected from the great sea coast of Chabahar and comparing it with species *G.arcuata* collected from the same area was observed that these two species are quite similar regarding chloroplast rbcS, spacer, rbcL sequence. For this purpose we compared another population of *G.armata* belonging to the Chabahar,Ramin coast with *G.arcuata* belonging to the great sea coast of Chabahar, which these two populations were quite similar to each other in terms of gene sequences and these four populations had the great similar in this respect with two populations belonging to the species *G.arcuata*, Japan. Now regarding these similarities on the one hand and nonexistence of protein degree of this group of algae on the other hand, is determined that the name of alga *G.armata* has changed to the *G.arcuata* and these four populations are belonged to the one species Gracilariaarcuata. Of course we should consider that the impact of different environmental conditions is considerable and significant on the amount of pigments, morphology and dry weight. For instance, the populations belonging to the algae of Seaside Park are seen darker than Ramin coast and this is while that the algae belonging to the coastal park show more carotenoid and less chlorophyll that these two factors under the influence of environmental conditions will change significantly. From the other hand, with decreasing chlorophyll, the amount of phycoeritrin of red algae generally increases, which the high amount of phycoeritrin and carotenoid will significantly influence on the color. The maximum Thallheight of these algae is 15 cm, but among the algae collected from the coastal park sometimes ware observed the algae with 25 cm length, which this issue had little impact on the higher dry weight of them. On the other hand, the heterogeneous state of the tip of these algae is also influenced by extreme environmental conditions.

Generally this group of algae can change regarding different ecological conditions and is observed the extreme polymorphism among them under different ecological conditions that molecular data help to us greatly in order to confirm the name of species.

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