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THE ANTIMICROBIAL, ANTIVIRAL, ANTI-INFLAMMATORY AND ANTIFUNGALACTIVITIES OF ALGAE COLLECTED OFF THE MOROCCAN COAST

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ABSTRACT
Studies carried out in Morocco on the bioactivity of seaweeds against bacteria, fungi and inflamatory viruses have been consulted to provide a consolidated report. Little information is available on the metabolites of algae collected off the Moroccan coast, which display antimicrobial and anti-inflammatory activities. This study provides details on the type of algae (80 species are distributed in 22 species of Chlorophyceae, 22 of Phaeophyceae and 36 of Rhodophyceae), the location of harvest, time of collection, the active compound against microorganisms and the reference source.

Keywords: Bioactivity, algae, antimicrobial, anti-inflammatory.

1. INTRODUCTION
Morocco enjoys a privileged geographical position, with two coastlines of more than 3000 km includingthe Mediterranean Sea to the north and the Atlantic Ocean to the west and northwest.This particular geographical position gives Morocco a remarkable and varied bioclimates. This characteristic also gives a richness of marine algae constituting a reserve of species with considerable economic, social and ecologic potential.

Marine organisms are important in producing biologically active compounds [1, 2, 3, 4]. These bioactive compounds offer rich pharmacological potential [5]. In recent years, there have been many reports of macroalgae derived compounds that have a broad range of biological activities, such as antibiotic, antiviral, antioxidant, antifouling, anti-inflammatory, cytotoxic and antimitotic activities [6]. Martí *et al.*[7] and Salvador *et al.*[6] have shown that antimicrobial activity has been thought to be related with environment in which the algae grow. Seaweeds produce secondary metabolites in response to ecological pressures such as competition for space, maintenance of unfolded surfaces, deterrence of predation and the ability to successfully reproduce [8].

Several studies have focused on algae products either as a structural model or the poor development actives analogues. In Morocco, the multiplication of such work, in recent years is justified by the discovery of several pharmacological substances in several species of marine algae [9, 10, 11, [12, 13, 14, 15,16,17,18], but so far no work brings these investigations together. In this study we compile the literatures on the bio-activity of seaweed collected off the Moroccan coast with antimicrobial,anti-inflammatory and anticanceractivities. This work is to facilitate research in algae producing biologically active substance in Morocco.

2. MARINE ALGAE PRODUCING VARIOUS BIOACTIVE SUBSTANCES

Algae were collected from Bel younech, Briech, Dalya, El Jadida, Ksar-sghir, Marina smir, Martil, Nador, Oualidia, Rabat and Sidi abslam coast in Morocco during different periods. The different methods of testing, looking for biological activity in marine algae, have been decrypted in the literatures [10, 11, 12, 13, 14, 15, 16, 19, 17, 20, 21, 22, 23].

Table 1: On the basis of a survey of literature a consolidated list of the biological screening of seaweed extracts has been indicated.

Algae	The time of collection	the location of harvest	Solvant extraction	activities searched		Anti-inflammatory % inhibition		Anti-Parasitic	cytotoxic (cancer cells KB)	Reference
				Anti-bacterial	Anti-Fungal	PLA2	elastase			
Chlorophyceae										
Bryopsis balbisiana	Mar-apr 2000	El Jadida	Méthanol, acétone, Hexane, chlorforme, extrait aqueux	-	-					Elkouri et al., 2004
			Méthanol-dichlorométhane (1 :1)	-	-	22	29			
Cladophora prolifera	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta Ent, klu						Chiheb et al., 2009
Caulerpa prolifera	?	Nador	Méthanol	Eco, Sta, Ent						Zbakh et al. 2012
Chaetomorpha linum	?	Nador	Méthanol	Eco, Sta						Zbakh et al. 2012
	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta	-					Chiheb et al., 2009
Codium adhaerens	Mar-apr 2000	El Jadida	Méthanol, acétone, Hexane, chlorforme, extrait aqueux	-	-					Elkouri et al., 2004
			Méthanol-dichlorométhane (1 :1)			50	25			
Codium bursa	Mar 2004	Ksar-sghir	Méthanol	-	-					Chiheb et al., 2009
Codium dichotomum	Fev 2004	Martil	Méthanol	Sta						Chiheb et al., 2009
		Ksar-sghir	Méthanol	Sta	-					
Codium elongatum	Mar-apr 2000	El Jadida	Méthanol, acétone, Hexane, chlorforme, extrait aqueux	-	-					Elkouri et al., 2004
			Méthanol-			44	45			

			dichlorométhane (1 :1)							
Codium fragile	Mai 2005	Martil	Méthanol	Sta	-					Chiheb et al., 2009
Codium tomentosum	Spt 2003	Martil	Méthanol	Sta	-					Chiheb et al., 2009
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	-	C. neof					Younes et al., 2009
Enteromorpha clathrata	Mar- mai 1997	El Jadida	Méthanol	Sta M. sme, C. spo						Etahiri 2002
			Acétone	C. spo, Sta						
			Chloroforme, Éthanol, Extrait Aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
			Chloroforme	Sta	-					
			Éthanol, Extrait Aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
Enteromorpha compressa	?	Ksar seghir	Méthanol	Eco, Sta, Ent						Zbakh et al. 2012
	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Kle, Ent	-					Chiheb et al., 2009
	Fev 2007	Ksar-sghir	Méthanol	-	-					
	Mar-apr 2000	El Jadida	Méthanol	Sta, B. sub, B cer						Elkouri et al., 2004
			Acétone	Sta, B. sub						
			Hexane, Extrait Aqueux	Sta						
			Chloroforme, Éthanol	-	-					
			Méthanol-dichlorométhane (1 :1)			83	94			
Enteromorpha intestinalis	?	Nador	Méthanol	Eco, Sta						Zbakh et al. 2012
	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Kle	-					Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol, Acétone, Chloroforme	Sta	-					Etahiri 2002
			Éthanol, Extrait Aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
Enteromorpha linza	?	Nador	Méthanol	Eco. Sta						Zbakh et al. 2012
	Mai 5005	Sidi abslam	Méthanol	Eco, Sta						Chiheb et al., 2009
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	C. neof					Younes et al., 2009
Enteromorpha muscoides	Mar- mai 1997	El Jadida	Méthanol, Acétone	Sta, B. cer						Etahiri 2002

Enteromorpha ramulosa	Aut 2003	Ksar-sghir	Méthanol	Sta	-					Chiheb et al., 2009
Rhizoclonium riparium	Mar- mai 1997	El Jadida	Méthanol, Acétone, Chloroforme	Sta	-					Etahiri 2002
			Éthanol, Extrait Aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
Ulva crispa	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	-	-					Younes et al., 2009
Ulva fasciata	Mai 2005	Sidi abslam	Méthanol	Eco, Sta, Kle	-					Chiheb et al., 2009
Ulva lactuca	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Ent, Kle	-					Chiheb et al., 2009
	Mar-avr 2000	El Jadida	Méthanol	Sta, B. sub, B. cer						Elkouri et al., 2004
			Acétone, Hexane	Sta, S. aur	-					
			Chloroforme, Éthanol	-	-					
			Extrait aqueux	Sta	-					
			Méthanol-dichlorométhane (1 :1)			55	55			
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	-					Younes et al., 2009
	Fev 2007	Ksar-sghir	Méthanol	-	-					Chiheb et al., 2009
		Nador	Méthanol	Eco, Ent						Zbakh et al. 2012
Ulva olivascens	Aut 2005	Nador	Méthanol	Sta, Ent	-					Chiheb et al., 2009
		Nador	Méthanol	S. aur, Ent						Zbakh et al. 2012
Ulva rigida	Mar- mai 1997	El Jadida	Méthanol	Eco, Sta, B. cer, M. sme						Etahiri 2002
			Acétone	B. cer, M. sme						
			Chloroforme	Eco, Sta						
			Méthanol-dichlorométhane (1 :1)			91,4	-	-	-	
			Éthanol, Extrait aqueux	-	-					
	?	Ksaer Seghir	Méthanol	Eco, Sta, Ent	-	-	-	-	-	Zbakh et al. 2012
Phéophyceae										
Bifurcaria bifurcata	Aut 2005	Rabat	Méthanol	Eco, Sta	-					Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol, acétone	Sta, B. cer, M. sme						Etahiri 2002
			Chlorforme	Sta						
			Hexane	Sta, B. sub, B. thu, B. cer						

			Extrait aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer,	C. neof					Younes et al., 2009
Cladostephus spongiosus	?	Martil	Méthanol	Eco, Sta, Ent						Zbakh et al. 2012
	Spt 2003	Martil	Méthanol	Eco, Sta, Ent, Kle	-					Chiheb et al., 2009
Colpomenia sinuosa	Mar- mai 1997	El Jadida	Méthanol, Acétone, chloroforme	Sta						Etahiri 2002
			Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
Cystoseira humilis	?	Nador	Méthanol	Eco, Sta, Ent						Zbakh et al. 2012
	Apr 2005	Nador	Méthanol	Eco, Sta, Kle						Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol, Acétone	Sta, B. sub, B. thu, B. cer, M. sme						Etahiri 2002
			Chloroforme	Sta						
			Hexane	B. sub, B. thu, B. cer,						
			Extrait aqueux							
			Méthanol-dichlorométhane (1 :1)			100	100	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	C. neof					Younes et al., 2009
Cystoseira Compressa		Nador	Méthanol	Sta						Zbakh et al. 2012
	Aut 2003	Ksar-sghir	Méthanol	Sta	-					Chiheb et al., 2009
Cystoseira crinita	Mai 2003	Ksar-sghir	Méthanol	Eco, Sta, Kle						Chiheb et al., 2009
Cystoseira mediterranea	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Ent, kle						Chiheb et al., 2009
	Fev 2007	Ksar-sghir	Méthanol	-	-					
Cystoseira tamariscifolia	Spt 2003	Martil	Méthanol	Eco, Sta, Ent, Kle, Entf						Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol, Acétone	S. aur, C. spo						Etahiri 2002
			chloroforme	Sta						
			Hexane	C. spo						
			Extrait aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mar 2006	Oualidia	Méthanol-	Sta, B.	C. neof					Younes et

			dichlorométhane (1 :1)	cer						al., 2009
		Rabat Oued Eykem	Éthanol		S. cer, C. al, Klu, Deb, Pic					Bennamara et al., 1999
	Nov 1991	Rabat	$CHCl_3$/EtOH	E. coli, A. tum						Souhaili et al., 2004
			Ethère	-	B. cin F. oxy					
Cystoseira usneoides	Aut 2003	Marina smir	Méthanol	Eco, Sta, Ent						Chiheb et al., 2009
	Fev 2007	Marina smir	Méthanol	-	-					Chiheb et al., 2009
Dictyota dichotoma	Mar-avr 2000	El jadida	Méthanol	Eco, Sta, B. sub, B. cer	C. tro					Elkouri et al., 2004
			Acétone, Hexane, chlorforme, extrait aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			77	56			
Dictyota linearis	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Kle	-					Chiheb et al., 2009
Dictyopteris membranacea	Stp 2003	Martil	Méthanol	Eco, Sta, Kle	-					Chiheb et al., 2009
Dictyopteris polypodioides	Mar-avr 2000	El Jadida	Méthanol, acétone, Hexane, chlorforme, extrait aqueux	-	-					Elkouri et al., 2004
			Méthanol-dichlorométhane (1 :1)			16	17			
Fucus spiralis	Apr 2004	Ksar-sghir	Méthanol	Sta	-					Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol	Sta, B. cer, C. spo						Etahiri 2002
			Acétone	Sta, B. cer, S. thu, C. spo						
			Hexane, chloroforme, extrait aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	-					Younes et al., 2009
Fucus vesiculosus	Jul 2005	Briech	Méthanol	Eco, Sta	-					Chiheb et al., 2009
Fucus platycarpus	Aut 2003	Ksar-sghir	Méthanol	-	-					Chiheb et al., 2009
Halopteris scoparia	Mar-avr 2000	El Jadida	Méthanol, acétone, Hexane, chlorforme, extrait aqueux	-	-					Elkouri et al., 2004

			Méthanol-dichlorométhane (1 :1)			23	23			
Laminaria ochroleuca	Mai 2005	El Jadida	Méthanol	Eco, Sta, kle						Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol, Acétone, chloroforme	Sta						Etahiri 2002
			Hexane, Extrait Aqueux							
			Méthanol-dichlorométhane (1 :1)			94	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	C. neof					Younes et al., 2009
Padina pavonica	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Kle, Entf	-					Chiheb et al., 2009
	Mar-avr 2000	El Jadida	Méthanol	Eco, Sta, B. sub, B. cer	-					Elkouri et al., 2004
			Acétone, Hexane, chloroforme, extrait aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			72	45			
Phyllariopsis brevipes	Spt 2003	Marina smir	Méthanol	-	-					Chiheb et al., 2009
Sacchoriza polyschides	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Ent, Kle						Chiheb et al., 2009
		Oualidia	Méthanol-dichlorométhane (1 :1)	Eco	C. neof					Younes et al., 2009
	Fev 2007	Ksar-sghir	Méthanol	-	-					
Sargassum vulgare	Aut 2005	Ksar-sghir	Méthanol	-	-					Chiheb et al., 2009
	Mar- mai 1997	El Jadida	Méthanol, Acétone	Sta, B. cer, C. spo						Etahiri 2002
			chloroforme	Sta						
			Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			100	-	-	-	
Stypocaulon scoparium	Aut 2003	Ksar-sghir	Méthanol	Eco, Sta, Kle						Chiheb et al., 2009
Rhodophyceae										
Alsidium corallinum	?	Nador	Méthanol	Eco, Sta						Zbakh et al. 2012
	Mai 2005	Nador	Méthanol	E. coli, K. pne , Sta						Bouhlal et al., 2010b
Aspargopsis armata	?	Ksar Seghir	Méthanol	Eco, Sta, Ent						Zbakh et al. 2012
	Mar-mai 1997	El Jadida	Méthanol	B. cer, C. spo	C. tro					Etahiri 2002
			Acétone	Sta, B. cer, C. spo						
			Chloroforme	Eco, Sta,						

			Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	-					Younes et al.,2009
	Jun 2006	Dalya	Méthanol	Sta						Bouhlal et al., 2010b
Acrosorium venulosum	Mar-avr 2000	El Jadida	Méthanol	Sta, B. sub, B. cer						Elkouri et al., 2004
			acétone, Hexane, chlorforme, extrait aqueux	-	-					
			Méthanol-dichlorométhane (1 :1)			50	33			
Boergeseniella thuyoides	Mai 2006	Ksar Seghir	Méthanol	Sta						Bouhlal et al., 2010b
Bornetia secundiflora	Mar-mai 1997	El Jadida	Méthanol, Acétone, chloroforme	Sta						Etahiri 2002
			Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	+	
Callithamnion granullatum	Oct 2003	Ksar sghir	Méthanol	Sta						Bouhlal et al., 2010b
Caulacanthus ustulatus	Mar-mai 1997	El Jadida	Méthanol, chloroforme	Sta						Etahiri 2002
			Acétone, Hexane, extrait aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	+	
	Mai 2005	Marina smir	Méthanol	Sta, K. pne						Bouhlal et al., 2010b
Centroceras clavulatum	?	Nador	Méthanol	Eco, Sta						Zbakh et al. 2012
	Mai 2005	Marina smir	Méthanol	Sta						Bouhlal et al., 2010b
Ceramium rubrum	Aut 2003	Ksar sghir	Méthanol	Eco, Sta, Ent						Bouhlal et al., 2010b
Chondria dasyphylla	Mar-apr 2000	El Jadida	Méthanol	Eco, Sta, B. sub, B. cer,	C. tro					Elkouri et al., 2004
			Acétone	Eco, Sta, B. sub, B. cer,						
			Hexane, chloroforme, éthanol	-	-					
			Extrait aqueux	Sta	-					
			Méthanol-dichlorométhane (1 :1)			72	68			
Chondrocanthus acicularis	Mai 2005	Marina smir	Méthanol	Eco, Sta, Ent K. pne						Bouhlal et al., 2010b
Corallina	Mar-mai	El	Méthanol,	Sta, B.						Etahiri

elongata	1997	Jadida	Acétone	sub, B. cer, B. thu C. spo						2002
			Chloroforme	Eco, Sta						
			Hexane, extrait aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
Corallina officinalis	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	-					Younes et al., 2009
Gelidium attenatum	Mai	Dalya	Méthanol	Eco, Sta, K. pne, Ent						Bouhlal et al., 2010b
Gelidium latifolium	Mar-mai 1997	El Jadida	Méthanol, Acétone	Sta, B. sub						Etahiri 2002
			Hexane	B. sub						
			Chloroforme, Extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mai 2006	Dalya	Méthanol	Sta						Bouhlal et al., 2010b
Gelidium pulchellum	Aut 2005	Ksar Seghir	méthanol	Eco, Sta, Ent						Bouhlal et al., 2010b
Gelidium pusillum	Jan 2004	Marina smir	Méthanol	Eco, Sta, K. pne, Ent						Bouhlal et al., 2010b
Gelidium spinolosum	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer, Eco	C. neof					Younes et al., 2009
	Mai 2005	Ksar sghir	Méthanol	Eco, Sta, Ent						Bouhlal et al., 2010b
Gelidium sesqupedale	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer, Eco	C. neof					Younes et al., 2009
	Aut 2006	Ksar sghir	Méthanol	Eco, Sta						Bouhlal et al., 2010b
Gigartina acicularis	Mar-mai 1997	El Jadida	Méthanol, Acétone, Chloroforme	Sta						Etahiri 2002
			Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			94	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	-					Younes et al., 2009
Gigartina pistillata	Mar-apr 2000	El Jadida	Méthanol, acétone, Hexane, chlorforme, extrait aqueux	-	-					Elkouri et al., 2004
			Méthanol-dichlorométhane (1 :1)			55	68			
Gracilaria confervoides	?	Nador	Méthanol	Sta, Eco						Zbakh et al. 2012
	Aut 2006	Ksar	Méthanol	Sta						Bouhlal et

		sghir								al., 2010b
Gracilaria bursa- pastoris	?	Nador	Méthanol	Sta, Eco						Zbakh et al. 2012
Gracilaria multipartida	Mar-mai 1997	El Jadida	Méthanol, Acétone, extrait aqueux	Sta, C. spo						Etahiri 2002
			Chloroforme	Sta						
			Hexane	C. spo						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	-					Younes et al., 2009
	Aut 2006	Ksar sghir	Méthanol	Sta, K. pne						Bouhlal et al., 2010b
Gracilaria verrucosa	Mar-mai 1997	El Jadida	Méthanol, Acétone	Sta, B. cer						Etahiri 2002
			Chloroforme	Sta						
			Hexane	-						
			extrait aqueux	B. cer						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
Gymnogongrus patens	?	Ksar sghir	Méthanol	Sta, Eco						Zbakh et al. 2012
	Mai 2005	Ksar sghir	Méthanol	Sta						Bouhlal et al., 2010b
Halopitys incurvus	Mar-mai 1997	El Jadida	Méthanol	Sta, B. cer, C. spo						Etahiri 2002
			Acétone	B. cer, C. spo						
			Chloroforme	Eco, C. spo						
			Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	Sta, B. cer	C. neof					Younes et al., 2009
	Jui 2006	Dalya	Méthanol	Eco, Sta, K. pne, Ent						Bouhlal et al., 2010b
Hypnea musciformis	?	Nador	Méthanol	Eco, Sta, Ent						Zbakh et al. 2012
	Mar-mai 1997	El Jadida	Méthanol, Acétone	Sta, B. sub						Etahiri 2002
			Chloroforme, Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	100	-	-	
	Mai 2006	Ksar sghir	Méthanol	Eco, Sta, K. pne, Ent						Bouhlal et al., 2010b
Laurencia pinnatifida	Mar 2006	Oualidia	Méthanol-dichlorométhane (1 :1)	-	-					Younes et al., 2009
Plocamium coccineum	?	Ksar sghir	Méthanol	Sta, Eco						Zbakh et al. 2012

	Aut 2003		Méthanol	Sta						Bouhlal et al., 2010b
Plocamium cartilagineum	Mar-mai 1997	El Jadida	Méthanol, Acétone	Sta, B. sub						Etahiri 2002
			Chloroforme, Hexane, extrait Aqueux	-						
			Méthanol-dichlorométhane (1 :1)			-	-	-	-	
	Mai 2006	Bel younech	Méthanol	Eco, Sta, Ent						Bouhlal et al., 2010b
Osmundea pinnatifida	Mai 2006	Ksar sghir	Méthanol	-						Bouhlal et al., 2010b
Pterocladea capillacea	Jun 2006	Dalya	Méthanol	Sta						Bouhlal et al., 2010b
Pterosiphonia complanata	Mar-avr 2000	El Jadida	Méthanol	Eco, Sta, B. sub, B. cer, M. sme	C. tro					Elkouri et al., 2004
			Acétone	Sta, B. sub, B. cer						
			Hexane	Sta						
			chlorforme	-						
			extrait aqueux	Eco, Sta, B. sub, B. cer,						
			Méthanol-dichlorométhane (1 :1)	Eco, Sta, B. sub, B. cer		88	70			
			Méthanol-dichlorométhane (1 :1)							Younes et al., 2009
	Mai 2006	Ksar sghir	Méthanol	Eco, Sta, Ent						Bouhlal et al., 2010b
Rhodymenea pseudopalmata	Aut 2005	Ksar sghir	Méthanol	Sta						Bouhlal et al., 2010b
Sphaerococcus coronopifolius	Mar-mai 1997	El Jadida	Méthanol, Acétone, Hexane, extrait Aqueux	Sta				-		Etahiri 2002
			Chloroforme,	Eco, Sta						
			Méthanol-dichlorométhane (1 :1)			-	-	Plasmodium falsciparum	-	
	Apr 2006	Bel younech	Méthanol	Sta, Ent						Bouhlal et al., 2010b

Legend: S. cer –Saccharomyces cereviceae, Klu – Kluveromyces, Deb –Debaryomyces, Pic– Pichia, Rho– Rhodotorula, C. alb– Candida albicans, A. tum–Agrobacterium tumefaciens, B. cin – Botrytis cinerea, F. oxy – Fusarium oxysporum sp. Sta – staphylococcus aureus, B. sub –Bacillis subtilis, B. cer – Bacillis cereus, Eco–Eschrichia coli, K.pne –Klebsiella pneumoniae, Ent – Enterococcus faecalis . Jan – January, Fev – February, Mar–March, apr – april, Aut – August, ? – not signalized, - – inactivity

3. ANTIMICROBIAL ACTIVITY

Algae are a rich and diverse source of molecules with various biological activity and large structural originality [10, 11, 15, 24]. Therefore, algae are gaining more and more attention [25].

A study has been recently conducted on the antibacterial activity of algae harvested from the coast the Mediterranean Coast of Morocco [10, 11, 12, 13, 15, 17, 19, 21, 22, 23,24, 26, 27, 28,29] and the Strait of Gibraltar as well [19, 20, 27, 28].

Seasonal variation of antibacterial activity and anti-inflammatory extracts was evaluated to determine the effect of harvest time on the biological activity by Farid, [22], Elkouri *et al.*, [15], and Etahiri [12].Seaweeds tested for antifungal activity and found many of them active ([12, 15, 16, 22, 24]. Farid [22] and Elkouri *et al.,* [15], observed the seasonality in the fungicidal activity of seaweeds.

Bouhlal and al. [20] showed that the seaweed extract shows antiviral activity, the highest inhibitory effect on HSV showed by the hot water extract of *A. armata, C. rubrum, G. spinullosum, H. incurvus, H. musciformis, P. cartilagineum, P. thuyoides, P. complanata and S. coronopifolius,* followed by that from the dichloromethanolic extract of G. pusillum.

Etahiri *et al.* [11] demonstrated that the organic extract of the red alga *Sphaerococcus coronopifolius* shows antimalarial activity, against the chloroquine resistant *Plasmodium falsciparum* FCB1 strains. The brown alga *Bifurcaria bifurcata* collected off the Atlantic coast was tested in vitro for their cytotoxicity and proved to be active against the NSCLC-N6 cell line [30]. Valls *et al.* [31] found that the extract of *Bifurcaria bifurcata* possessed to activity against sea urchin eggs. We found few published on the anti-inflammatory; the only publication is that of Farid [22] Elkouri *et al*. [15] Etahiri [12].

4. MOLECULES

An antibacterial compound from *Sphaerococcus coronopifolius*, *Pterosiphonia complanata* was isolated by Etahiri and al. [11,13], Bultel-Poncé *et al.* [29] isolated the anti-inflammatory compound from *Hypnea musciformis* (red alga). Mokrini *et al.,* [24] have purified three molecules from *Cystoseira baccata*, these compounds are endowed with antibacterial and antifungal activity. An anti-cancer cells and against sea urchin roe compounds from *Bifurcaria bifurcata* by Gernald *et al*. [32] and Valls *et al.* [31]. The Sulfated Polysaccharides Isolated from *Sphaerococcus coronopifolius* showed antiviral activities [27]. Bennamara et al. [33] purify an active principle showed an antimicrobial effect from *Cystoseira tamariscifolia*. Other scientific studies on the algae s have a great value in nutrition value [16, 34] or use of these algae as indicators of pollution [35].

The pathogenic bacteria, dermatophytes, phytopathogenes, yeasts, viruses and protozoa are becoming increasingly resistant to traditional antibiotics exist; the metabolites of algae could become another alternative source of these chemicals products.

5. CONCLUSION

Several parameters have been recalled to explain the variation in the production of secondary metabolites, this variation may be the cause of ecological parameters induced by climatic factors, temperature, salinity, light, dissolved oxygen and nutrients, or related to the biology and physiology of the algae itself. In the wild, light, temperature, mineral salts and water movement are the key environmental parameters in determining the fertility of the algae. Light and temperature are the cause of seasonal variation and spatial algal flora, they act both on the growth of algae on their morphological characters. Temperature fluctuations which are mainly related to the seasons is an important determinant of the seasonal cycle of the marine flora. In this context, it was shown that the growth of algae is not the same throughout the year, it is maximum when the conditions of light and temperature are favorable, in the case of the temperate regions where the fertility of a large number of species is highest in spring and autumn, but some species are known to be fertile throughout the year [25]. This phase of active growth and sexual maturity of the algae is the period of synthesis of secondary metabolites responsible for biological activities [36]. Therefore, the influence of environmental parameters (related to seasonal variation) on the biology and physiology of algae can also reach the production of secondary metabolites. To summary the biological activity of algae varies from one species to another and depending on the collected period, the solvent extraction, parity of the algae, the reproductive stages and processing conditions. As far as the environment, is concerned the algae undergo changes as will as daily and seasonal quantitative and qualitative metabolite that is probably active due to the occupied and specific placed in the seaweed.

The studies on the influence of place of harvest and natural habitat on the chemical nature and activity of metabolites purified from algae are rare.

6. REFERENCES

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