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COMMON AND NEW RECORDS OF LICHENS FROM IRAQI KURDISTAN REGION, IRAQ

Farhad Hasan Aziz* and Srwa Burhan Qadir
Environment Department, College of Science, University of Salahaddin
Erbil, Iraqi Kurdistan Region, Iraq
*Email: farhad.aziz1948@gmail.com

ABSTRACT

Based on collections made during March to September 2012. A totals of 58 species belong to 33 genera were identified from extra north to extra south of Erbil governorate, among them 30 species are registered as a new record to flora of Iraq. Most attention was paid to the most common and abundant lichens that present almost in most locations, which were *Collema cristatum, Diploschistes scruposus, Lecanora dispersa, Lecanora murales, Pertusaria flavicunda, Placidium lacinulatum, Thelomma californicum* and *Verrucaria Maura.*
Keywords: *Common, Erbil, Iraq, Kurdistan, Lichens, New records.*

INTRODUCTION

Lichens are photosynthetic, non vascular, dual microorganisms. They are composed of fungal (mycobiont) and algal (phycobiont) species growing in symbiotic relationships (Brodo *et al.*, 2001). The body of lichen is called thallus; the mycobiont and photobiont are either stratified in distinct layers or intermixed (Goward *et al.*, 1994). The thallus may assume a variety of forms depending on the fungal and algal partners involved (Hawksworth and Rose, 1979). The photobiont is completely surrounded by mycobiont in the lichen thallus, while the mycobiont normally form the greater part of lichen thalli, the phycobiont accounting for no more than 20% (Hale, 1974; Purvis, 2000). The mycobionts of lichens are mainly Ascomycetes but a few Basidiomycetes, while the Sphycobiont generally belongs to Cyanophyceae or sometimes to Chlorophyceae (Hawksworth and Rose, 1979; Nash, 2008). The most frequent are the green algae *Trebouxia* sp. and *Trentepholia* sp., and the blue green algae are mostly *Nostoc* sp. (Lahham and El Oqlah, 1986). The algae provide the fungus with carbohydrate nutrients while it gain mechanical protection from fungal filaments, thus each member depends on other for its survive in nature (Aziz, 2005). On the basis of their morphology, the lichens are classified into five forms crustose (forming a crust over the surface they grow on), squamulose (with many scale-like lobes), leprose (powdery in appearance), foliose (leaf-like) and fruticose (bushy or upright with many stems, pendent or mat-forming (Hale, 1974; Dobson 2005).

Reproduction and dispersal mechanisms of lichens are carried out by means of vegetative fragmentation, so fragments can be broken off easily and transported by wind or by animals (Aziz, 2005). Several lichens produce stalk-like structure termed isidia (Brodo *et al.*, 2001). A further means of reproduction is by production of special units termed soridia which is a powdery mass located near the center surface of the thallus consists of algal cells and fungal hyphae (Bendre and Kumar, 2010). In sexual reproduction most lichens produce apothecia or perithecia ascospores containing asci in a number of Ascomycota. Economically, lichens are useful for animals and birds as food, especially in winter and for nesting materials (Aziz, 2005).

Lichens are extremely slow-growing organisms, many increasing in size no more than 1mm to 1cm per year and can live for very long times (Dobson, 2005). They are also extremely widespread in nature, ranging from arctic to antractic and from rocky shores of the sea to near the summits of the highest mountains (Lahham and El Oqlah, 1986; Pandey and Upreti, 2000). They grow on a variety of habitats, and are common on rocks, bark of trees, etc; many of them grow under extreme conditions of cold, humidity and drought (Nash, 2008). These organisms are perennial and maintain a uniform morphology over time. All these features make lichens interesting and significant in environmental and economical terms (Zsigmond and Urak, 2011). Many natural factors have shown to affect the growth characteristics of lichens and influence their survival, include rainfall, moisture status, light and topography (Batts *et al.*, 2004). The economic importance of Lichens includes formation of soil as most crustose lichens growing on rocks dissolve and disintegrate them into soil particles. Lichens have been used as food by man, and they are common food for insects and slugs. They are also used in making dyes, perfumes, brewing, distillation, cosmetics, tanning, etc. (Nash, 2008). Lichens also have a long and continuing history of use in medicines for many purposes like headaches and toothaches, tuberculosis, diabetes, and asthma, as well as the lichen extracts has been used as antibiotics to treat tuberculosis and some skin diseases (Batts *et al.*, 2004). Finally, there is a long history of using lichens as indicators of air pollution assessment and biomonitoring (Berryman *et al.*, 2009).

MATERIALS AND METHODS

Description of the studied area:

Erbil governorate is located in the north of Iraq. Geographically Erbil is elevated by about 411m above sea level. Erbil Governorate covers an area of 164840 km^2 in the north of Iraq. Erbil governorate longitude is 42°15´E to 46°30´E and latitude 34° 25´N to 37°50´N. Average temperatures in Erbil range from above 48°C to below freezing. Precipitation occurs in the spring and winter, while heavy snowfall occurs in the mountains and at higher altitudes during the winter (WFP, 2002). Ten locations were selected from the north to south of Erbil governorate Barzewa village, Kawlokan area, Zargali area, Sisawa village, Aquban village, Baraka village, Sulawk village, Safin-Kawanian mountain, Dibaga village and Qarajugh Mountain.

Geologically, Erbil situated within recent sediment which belongs to Palaeocian age that represents old river sedimentation, which came from Backtiaric formation (WFP, 2002). The stone of these sediments differ and compose of lenticels and stereographs with stone, sand, silt and alluvial, the thicknesses of the sediments vary largely within Erbil governorate (Muhammad, 2003). The soil of Kurdistan Region of Iraq is calcareous because it is originated from limestone and dolomite of different formation, generally gravelly, sandy with clay and of a brownish color. Chemically, soil pH is alkaline, rich in organic matter more than 2% and rich in $CaCo_3$ and Mg CO_3. The climate of Erbil governorate (Tables 1 and 2) is most closely approaches the Irano -Turanian type, and it similar to that of the other parts of Kurdistan region and the other northern parts of Iraq, which is semi-arid and characterized by hot dry summer and moderately rainy cold winters. The higher altitude parts of the area have colder winters and receive more precipitation than the area of lower elevations (WFP, 2002). Usually, precipitation occurs during the months from September until April, rainfall and humidity play a great role on the climate, all together with temperature. The climate is characterized by the assurance of four seasons, cold winter and mild growth period of spring, hot dry summer and autumn pointed out that period from June to the end of January is rainless, whereas the wettest months are between December and April (Guest,1966; Aziz, and Al-

Dabbagh, 2009). As shown in Table (1) Monthly mean air temperature values was 28.4^{o}C for the study locations within Erbil governorate during study period from March, Apr and May-Jul, Aug and Sep, 2012.

Table (1): Monthly mean air temperature values for study locations within Erbil governorate during period from March, Apr and May – Jul, Aug and Sep, 2012.

Month / Location	Wet condition			Dry condition		
	Mar	Apr	May	Jul	Aug	Sep
Choman district	6.2	14.6	20.8	31	28	25.9
Soran district	7.4	17.4	22.7	31.3	31.1	27.4
Rwandiz district	6.9	16	22	30.3	31.1	27
Harir district	6.5	16.3	24.5	31.2	33.8	29.9
Shaqlawa district	6.5	15.7	19.6	28.1	28	23.3
Salahaddin sub district	11.2	21.95	27.1	35.9	35.15	30.8
Makhmour district	12.3	25.05	28.3	37.05	36.7	32
Mean	8.14	18.14	23.57	32.12	31.98	28.04

Source: Meteorological Center of Erbil, LSD ($P<0.01$) =7.44

Table (2): Monthly relative humidity (%) and rainfall value of the studied locations within Erbil governorate during periods from March, Apr and May to Jul, Aug and Sep, 2012.

Month / Location	Humidity %						Rainfall					
	Mar	Apr	May	Jul	Aug	Sep	Mar	Apr	May	Jul	Aug	Sep
Choman district	74.2	64.8	59.6	53.3	31.7	51.3	126.4	52.6	17.3	0	0	0
Soran district	71.7	64.4	62	52.2	53.3	55.6	108.3	51.2	17.1	0	0	0
Rwandiz district	73.1	66.2	63	53	52	51.3	123	52.3	17.7	0	0	0
Harir sub district	61.1	53	32.5	19	18.9	18.5	165	32.3	6.7	0	0	0
Shaqlawa district	64.7	54	43.5	21	18.9	18.5	167	34.5	12	0	0	0
Salahaddin sub district	62	50	42	22	29	29	72.1	14.5	26.8	T.R	0	0.2
Makhmour district	53	40	30	25	25	28	26.5	8	3.3	0	0	T.R
Mean	65.7	56.1	47.5	35.1	32.7	36.0	112.6	35.1	14.4	0	0	0.03

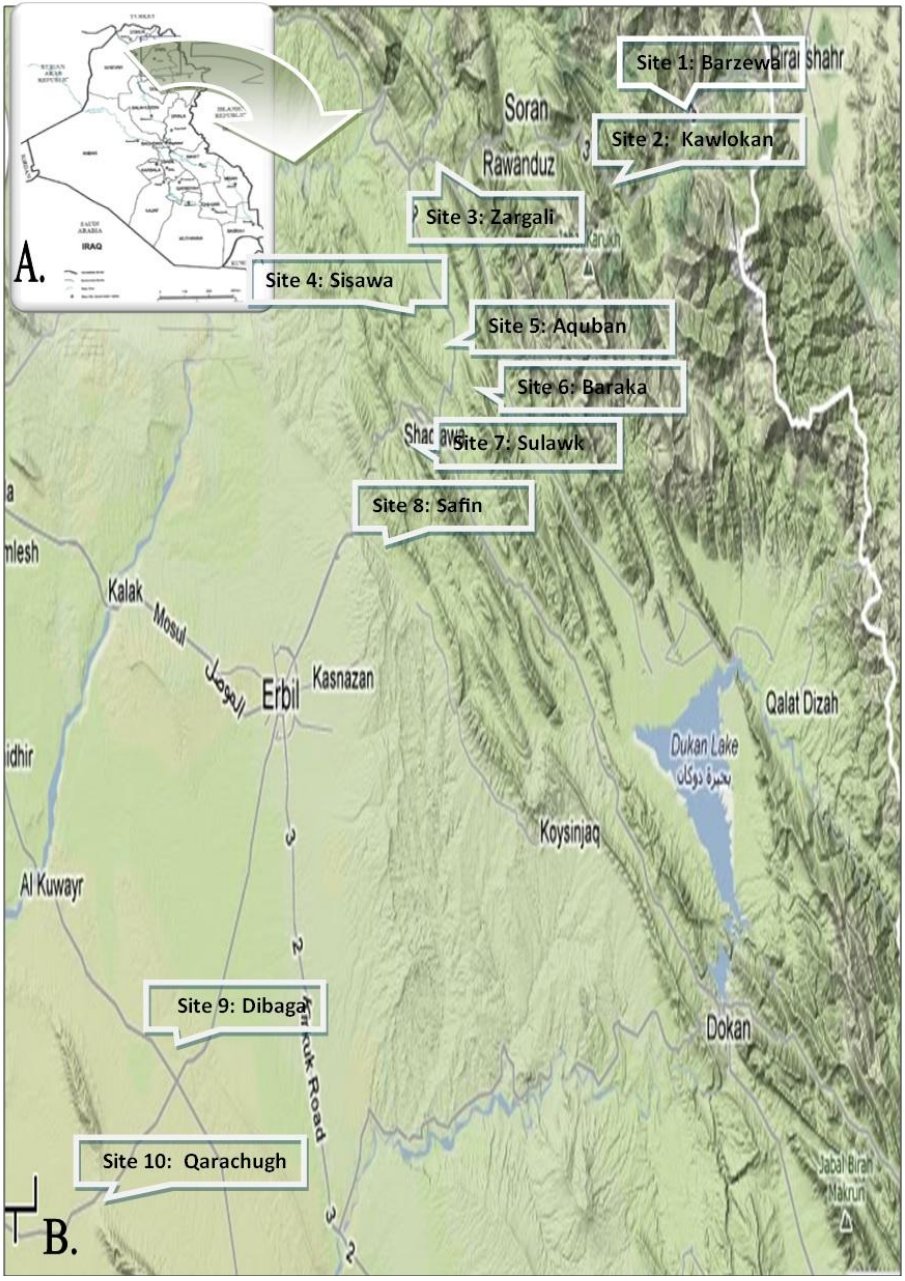


Figure (1): Map of study area including Iraq, Erbil and study locations.

Lichens collection:

For the purpose of identification, different epilithic lichen species (lichens growing on rocks and on soil surface) were collected from periods of March, April and May, 2012 (wet season) and July, August and September, 2012 (dry season) in the 10 selected locations within Erbil governorate. Only the most abundant lichen species were collected. Lichen samples were sampled from roadside located in about 1km from main roads of the below mentioned locations. Samples were scraped off with a knife and hummer with a chisel to chip off the some crustose species, put in news papers.

Lichens identification and classification:

Identification of lichen species have been done as proposed by lichenologists (Hall,1979; Goward *et al.*, 1994; Purvis *et al.*, 1992; Purvis; 2000; Brodo *et al.*, 2001; Aziz, 2004; Aziz, 2005 and Dobson, 2005). Based on studying morphological characteristics, specific lichen keys, chemical analyses (spot tests), type of phycobiont partnership. Lichen classification was made according to Coppins (2002).

RESULTS

In this study the most common and abundant lichen species in ten locations of the study area have been collected within Erbil governorate. The total of 58 species has been identified in 33 genera in which 30 species were new records to Iraqi and Kurdistan flora (List 1). The variation of species richness between studied locations was observed which was between 10 to 22 species. The highest number of species was found in Safin-Kawanian mountain, the species richness at this mountain may be due to significant weather variation as high relative humidity, rainfall, and low to moderate temperature degrees all over the year. Followed by Kawlokan (20 species), whereas the lowest number of species were recorded in Qarajugh may be due to low humidity and high temperature degrees at this mountain, followed by Dibaga and Sulawk location. The most common lichen species that selected for this study were abundant in most studied locations (Fig. 1).

List (1): Lichens flora recorded in study locations.

1. *Acarospora impressula* Th. Fr. *
2. *Acarospora strigata* (Nyl.) Jutta
3. *Aspicilia caesiocinerea* (Nyl.ex Malbr.) Arnold*
4. *Aspicilia calcarea* (L.) Mudd.
5. *Aspicilia candida* (Anzi) Hue.
6. *Aspicilia leprosences* (Sandst.)*
7. *Buellia spuria* (Schaer.) Anzi
8. *Caloplaca auranta* (Pers.) Hellbom
9. *Caloplaca citrina* (Hoffm.) Th. Fr.*
10. *Caloplaca feracissima* H.Magn.
11. *Caloplaca ochracea* (Schaer.) Flagey*
12. *Caloplaca thallincola* (Wedd.) Du Rietz*
13. *Caloplaca verruculifera* (Vainio) Zahlbr.
14. *Coccocarpia erthroxyli* (Sprengel)*
15. *Collema cristatum* (L.) F.H.Wigg
16. *Collema flaccidum* (Ach.)Ach.*
17. *Dermatocarpon miniatum* (L.) W. Man n.
18. *Diploschistes caesioplumbeus* (Nyl.) Vain.*
19. *Diploschistes scruposus* (Schreb.) Norman

20. *Dirina catalinarie* (Hasse)*
21. *Fulgensia fulgens* (Sm.) Elenkin
22. *Lecanora dispersa* (L.) Sommerf.*
23. *Lecanora garovaglii* (Korber) Zahlbr.
24. *Lecanora murales* (Schreb.) Rabenh.
25. *Lecidea atrobrunnea* (Lam. & DC.) Schaer.
26. *Lecidea fuscoatra* (L.) Ach*
27. *Lecidella stigmatea* (Ach.) Hertel & Leuckert
28. *Leproloma vouauxii* (Hue)J.R. Laundon*
29. *Neofuscelia pulla* (Ach.) Essl.*
30. *Pannaria rubiginosa* (Ach.) Bory
31. *Parmelina quercina* (Willd.) Hale*
32. *Pertusaria aspergilla* (Ach.) J.R. Laundon*
33. *Pertusaria flavicunda* Tuck.
34. *Pertusaria lactea* (L.)
35. *Physcia aipolia* (Ehrh. Ex Hump.) Furnr.
36. *Physcia biziana* (A.Massal) Zahlbr.
37. *Physcia caesia* (Hoffm.) Furnr.
38. *Placidium lacinulatum* (Ach.) Breuss*
39. *Psora decipiens* (Hedwig) Hoffm.
40. *Psora lurida* (Ach.) DC.*
41. *Rhizocarpon chioneum* (Norman) Th. Fr.
42. *Rhizocarpon disporum* (Naegeli ex Hepp.) Mull.
43. *Rhizocarpon hochstetteri* (Korb.) Vain.*
44. *Rhizocarpon reductum* Th. Fr*
45. *Rhizocarpon richardii* (Nyl.) Zahlbr*
46. *Rinodina atrocinerea* (Hook.) Korb.*
47. *Rinodina bolanderi* H. Magn.
48. *Squamarina crassa* (Hudson) Poelt
49. *Tephromela grumosa* (Pers.) Hafellner & Cl. Roux*
50. *Thelomma californicum* (Tuck.)
51. *Trapelia placodioides* Coppins & P. James*
52. *Umbilicaria americana* (Poelt & T. Nash)*
53. *Verrucaria amphibia* Clemente *
54. *Verrucaria baldensis* A. Massal.*
55. *Verrucaria maura* Wahlenb
56. *Xanthoparmelia plittii* (Gyeln.) Hale*
57. *Xanthoria elegans* (Link) Th. Fr.*
58. *Xanthoria parietina* (L.) Th. Fr.*

*: New records

Description of new records:

***Acarospora impressula* Th. Fr. (Pl.1, Fig.1):**

Thallus dark red-brown to almost black, thin, with even, small, angular areoles (less than 2mm wide) forming colonies up to 3 cm across, looking like crazy paving (Plate 1). Apothecia 0.2-0.4 mm, almost black, innate, spores 3-4 x 2-2.25 µm (Dobson, 2005, P.52).

***Aspicilia caesiocinerea* (Nylex Malbr) Arnold. (Pl.1, Fig.2):**

Thallus bluish to brown-grey, thick and cracked or with areoles having flat to slightly concave tops, sharp edges and a slightly rough surface, usually surrounded by a dark grey prothallus. Apothecia up to 1.5 mm diam., immersed, somewhat sessile (Dobson, 2005, P.72).

***Aspicilia leprosescens* (Sandst) Hav. (Pl.1, Fig.3):**

Thallus areolae, pale to mid grey, consisting of an indistinct crust or of loosely attached areoles, often limited by a greenish grey prothallus. Apothecia were uncommon, up to 1mm diameter, innate becoming somewhat raised. Spores are 8 per ascus, 14-30 x 7-16µm (Dobson, 2005, P.75).

***Caloplaca citrina* (Hoffm) Th Fr. (Pl.1, Fig.4):**

Thallus dark yellow to yellow-orange, consisting of irregularly shaped areoles that become granular sorediate starting at the edges, often reducing the entire thallus to a leprose crust. Apothecia rare, with sorediate margins (Brodo *et al.*, 2001, P. 198).

***Caloplaca ochracea* (Schaer) Flagey. (Pl.1, Fig.5):**

Thallus is matt, patchy light yellow to pale golden yellow with grayish areas, superficial, almost granular, flattened, thin, mosaic-forming. Margin is thick and slightly paler. Spores 12-15 x 5-7µm (Dobson, 2005, P.106).

***Caloplaca thallincola* (Wedd) Du Rietz. (Pl.1, Fig.6):**

Thallus placodioid, usually forming neat rosettes, bright orange, lobes long, very convex, may be slightly flattened near the tips. Apothecia up to 1mm diam, in
center of the thallus, convex, orange with paler margins. Spores often lemon-shaped, type 3, 10-15 x 8-12µm (Dobson, 2005, P.107).

***Coccocarpia erthroxyli* Sprengel. (Pl.2, Fig.1):**

Thallus is blue-gray, with rounded shell-like lobes, mostly 2-7mm wide, upper surface often having concentric ridges, otherwise smooth and even shiny, without isidia. Lower surface is pale to dark brown. Brown convex apothecia, 1-4 mm in diameter (Brodo *et al.*, 2001, P. 280).

***Collema flaccidum (Ach.) Ach.* (Pl.2, Fig.2):**

Thallus is dark green-brown to black and leaf-like, not greatly swelling when wet. Lobes up to 3 mm long, ragged, incised, crumpled, raised towards the margins. Isidia become flattened and lobate as they mature. Rarely fertile, apothecia to 2.5mm diam, with smooth margins. Spores 24-36 x 6-7µm, 3-5 septate (Goward et al., 1994, P. 48)

***Diploschistes caesioplumbeus* (Nyl) Vain. (Pl.2, Fig.3):**

Thallus mid to dark leaden-grey, craked areolae, smooth, slightly shiny, often with a grey prothallus. Apothecia immersed, looking like the ostioles of perithecia, several often found in each areole. Mature apothecia mainly pruinose and under 0.3mm diam. Spores becoming dark, muriform, 30-50 x 10-25µm (Dobson, 2005, P.166).

***Dirina catalinarie* (Hasse) (Pl.2, Fig.4):**

Thallus variable, milky white to brownish gray, smooth to cracked areolae to verrucose, rarely becoming partially fruticose at the margins of some areoles, usually producing round, and hemispherical soralia with coarse, granualer soredia (Brodo *et al.*, 2001, P. 305).

***Lecanora dispersa* (L) Sommerf (Pl.2, Fig.5):**

Thallus usually growing between the rock crystals and absent from view. Apothecia 0.4-1.2mm in diameter, round or somewhat angular, crowded or dispersed, pale to dark yellow-brown or pinkish brown, without pruina when mature, usually with prominent white margins; spores ellipsoid, 8.5-14 x 3.5-7µm (Brodo *et al.*, 2001, P. 380).

***Lecidea fuscoatra* (L) Ach. (Pl.2, Fig.6):**

Thallus is craked into areoles to 3mm wide, uniform, limited by a black prothallus, reddish brown to grey. Apothecia normally present, up to 2mm diam, innate, with a black, often white-pruinose disc, sometimes convex with a persistent proper margins (Dobson, 2005, P.235).

***Leproloma voluoxii*. (Pl.3, Fig.1):**

Thallus yellow-white to pale grey-green, thick, puckered, consisting of powdery granules up to 0.5mm across, often eroded and then showing the white medulla. Margins is not or is only weakly lobed, and it has a poorly developed hypothallus (Dobson, 2005, P.245).

***Neofuscelia pulla* (Ach) Essl. (Pl.3, Fig.2):**

Thallus large, up to 15cm diam, grey-brown to dark brown, rinkled, lobes adpressed and not widening at the apices, under surface black with sparse, simple rhizines that sometimes become branched, light brown and bare towards the margins. Apothecia dark brown (Dobson, 2005, P.278).

***Parmelina quercina* (Willd) Hale. (Pl.3, Fig.3):**

Thallus grey, smooth and more or less shiny, adpressed. Lobes rounded with crenulate tips. Under-surface black with simple rhizines which grow almost to the tips of the lobes. Usually fertile. Apothecia with red-brown discs and thick margins. The under-surface of the apothecia frequently has black rhizines (Dobson, 2005, P.306).

***Pertusaria aspergilla* (Ach) JR Laundon. (Pl.3, Fig.4):**

Thallus is thin, grey, cracked, sometimes with a pale grey to white prothallus. White punctiform soralia 0.5-1 mm diam were evenly scattered over the surface. It is very rarely with small isidia. Not known fertile (Goward et al., 1994, P. 106)

***Placidium lacinulatum* (Ach) Breuss. (Pl.3, Fig.5):**

Thallus consisting of thick red-brown squamules, green when wet, whithout any pruina, dispersed or contiguous but rarely overlapping, with black dots, scattered over the surface; squamules approximately 2-3 mm across, some lifting at the edges; lower surface pale of light brown (Brodo *et al.*, 2001, P. 570).

***Psora lurida* (Ach) DC. (Pl.3, Fig.6):**

Thallus green to coffee or dark chestnut-brown, under-surface often dark and attached to the substratum by a pale hyphal net. Squamules imbricate, to 5mm wide, convex and contorted, often forming a thick crust. Apothecia up to about 1mm, crowded, black or dark brown margins (Goward et al., 1994, P. 173)

***Rhizocarpon hochstetteri* (Korb) Vain. (Pl.4, Fig.1):**

Thallus pale to dark brown, very thin, usually smooth and continous, Apothecia 0.9-1.5mm in diameter, broadly attached and flat to convex, black to dark brown with thin, usually persistent margins the same color as the disk, spores colorless (Brodo *et al.*, 2001, P. 636).

***Rhizocarpon reductum* Th Fr. (Pl.4, Fig.2):**

Thallus grey to mouse-brown, cracked-areolae, often with a thin black prothallus. Apothecia innate becoming sessile, black, almost flat, about 1 mm diam, with a persistent, thick, proper margin. This was often paler on the inner side (Brodo *et al.*, 2001, P. 389).

***Rhizocarpon richardii* (Nyl) Zahlbr. (Pl.4, Fig.3):**

Thallus cholate-brown to brownish grey with a purplish tinge, areolate-cracked, often with a fimbriate brown-black prothallus. Apothecia about 1mm diam. Innate, flat, black, with a thin proper margin. Epithecium dark green to grey.

***Rinodina atrocinerea* (Hook) Korb. (Pl.4, Fig.4):**

Thallus light grey, sometimes yellowish, with a conspicuous black prothallus continuting between the areoles, very angular-areolate. Apothecia up to 1 mm across, becoming sessile. Thalline margin even, thin. Disc dark brown to black. Spores thick-walled, 1-septate, locules not angular, 16-12 x 9-14µm (Hale, 1974, P. 102).

***Tephromela grumosa* (Pers) Hafellner & Cl Roux. (Pl.4, Fig.5):**

Thallus light to medium grey, smooth or warted, often with a thin dark prothallus. Usually fertile, mainly with apothecia in the more central part of the thallus. Apothecia large, up to 3mm diam, immersed becoming sessile, disc black with a thick margin. When mature the disc is flat with a grey contorted and crenulate margin (Hale, 1974, P.142).

***Trapelia placodioides* Coppins & P James. (Pl.4, Fig.6):**

Thallus creamy white to pinkish white, often continuous, forming patches, cracked in the centre and almost placodioid at the margins. Yellow-green to cream soralia erupt from the edges of the areoles, these may coalesce to form lines of soredia. Apothecia were very rare (Hale, 1974, P.144).

***Umbilicaria americana* (Poelt & T Nash) . (Pl.5, Fig.1):**

Thallus pale gray or brownish gray, usually with a coarse white pruina over the surface, thick and rather stiff, 2-7cm in diameter; lower surface covered with a velvet-like nap of closely packed, unbranched or forked, black rhizines, each one coated with a layer of black granules. Apothesia uncommon, convex, with disks having concentric ridges (Brodo *et al.*, 2001, P. 699).

***Verrucaria amphibia* Clemente. (Pl.5, Fig.2):**

Thallus black, greenish in shade, green and slightly translucent when wet, thin to thick, almost lobate. Numerous narrow, radiating ridges scattered over the surface of the thallus. Surface was less regularly cracked and often more glossy. Often forming neat patches up to 5cm diam. Usually fertile, perithecia about 0.4mm, with a flat or more usually dimpled and/or crenulate, volcano-like top. Spores 10-15 x 7-10µm (Hale, 1974, P.151).

***Verrucaria baldensis* A Massal. (Pl.5, Fig.3):**

Thallus white to pale grey, thin, smooth, or immersed, usually wih a dark, narrow prothallus. Thallus crowded with many small immersed perthecia. Up to about six very fine cracks extend from the ostiole, often resembling a hot cross bun. Involucrellum almost flat, like a man-hole cover, the perthecia leaving empty pits when they fall out. Spores 15-21 x 7-10µm. It seems to take longer to colonize gravestones (Hale, 1974, P.133).

***Xanthoparmelia plittii* (Gyeln) Hale. (Pl.5, Fig.4):**

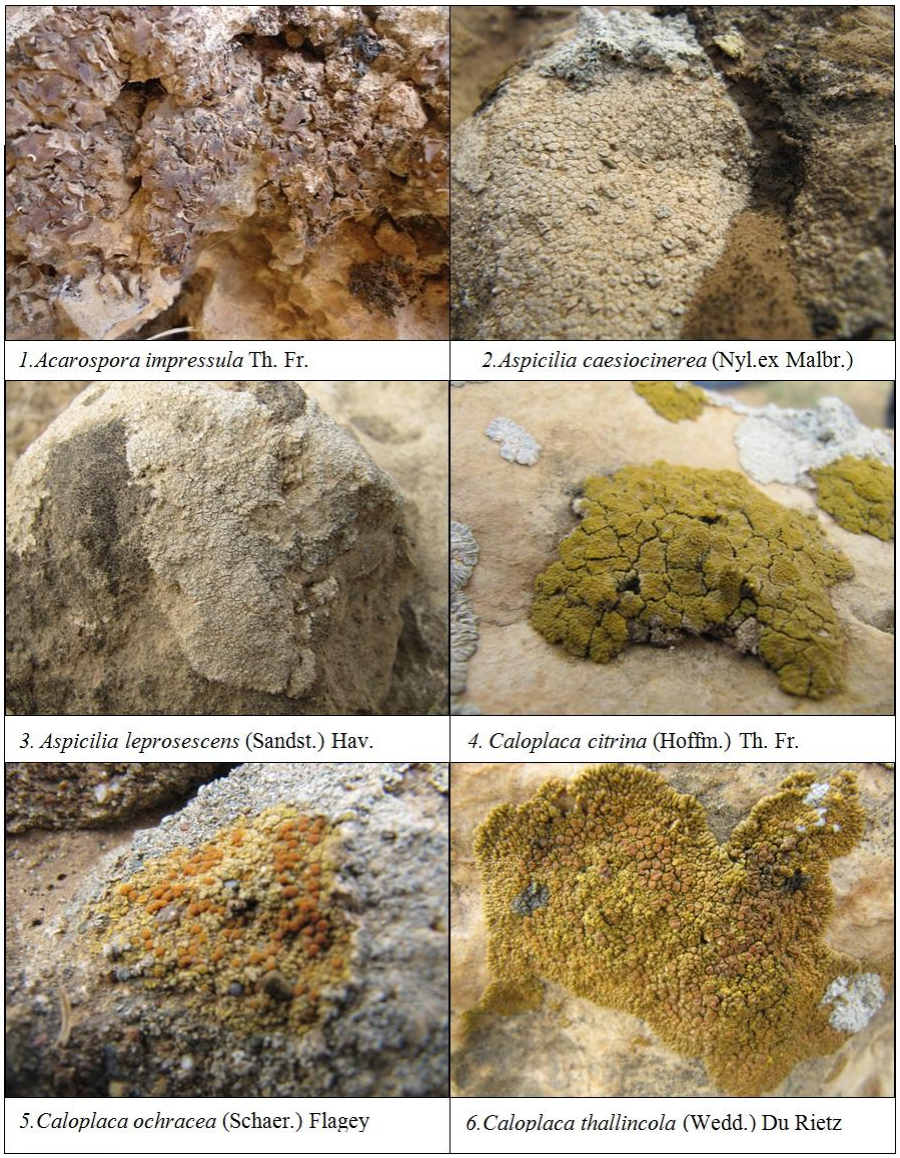
Thallus closely or loosely attached to the rock, pale to dark brown or mottled (never black) lower surface. Lobes fairly narrow, 1-3mm wide, crowded and often overlapping, with spare to dense globular to branched cylindrical isidia on the upper surface (Brodo *et al.*, 2001, P. 735).

***Xanthoria elegans* (Link) Th Fr. (Pl.5, Fig.5):**

Thallus foliose to almost crustose, very closely attached, with narrow, convex, radiating lobes, 0.4-1mm wide, extremely variable in color, from pale yellowish orange to dark red-orange, rarely pruinose, soredia and isidia absent, but some forms can produce papillate outgrowths on the lobe surface; lower surface white, wrinkled, without rhizines. Apothecia can be abundant, 1-3mm in diameter (Brodo *et al.*, 2001, P. 744).

***Xanthoria parientina* (l.) Th. Fr. (Pl.5, Fig.6):**

Thallus yellow-orange to orange, with shade forms that are gray-green with orange patches, forming large rosettes up to 10 cm in diameter; lobes broad, 0.7-3.2mm across, flat to wrinkled and somewhat concave at the tips, without soredia or isidia; lower surface white, attached to the substrate by the lower cortex, with broad holdfasts, or with spare, short rhizines. Apothecia almost always present, broad, flat to concave, with dark orange disks and thallus-colored margins (Brodo *et al.*, 2001, P. 746).



1.Acarospora impressula Th. Fr.

2.Aspicilia caesiocinerea (Nyl.ex Malbr.)

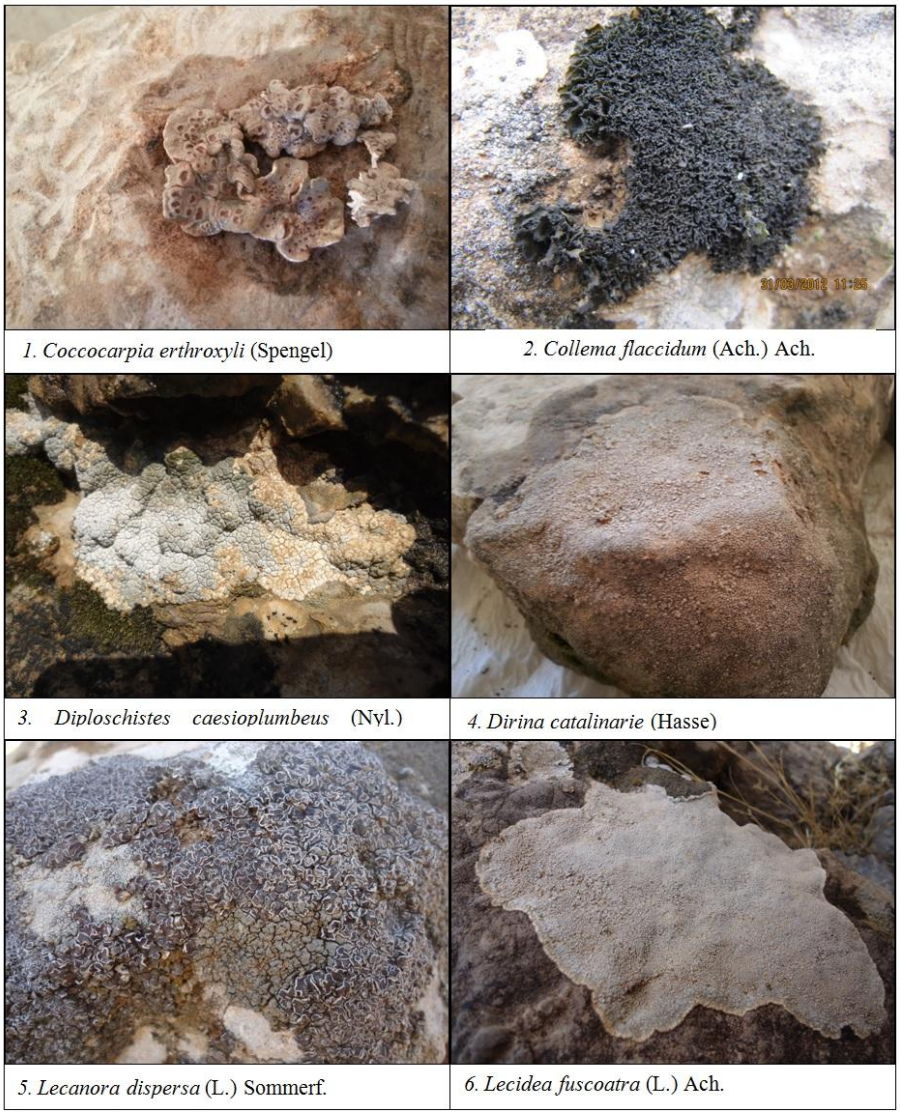
3. Aspicilia leprosescens (Sandst.) Hav.

4. Caloplaca citrina (Hoffm.) Th. Fr.

5.Caloplaca ochracea (Schaer.) Flagey

6.Caloplaca thallincola (Wedd.) Du Rietz

Plate (1): New records of lichen species at studied locations.



1. *Coccocarpia erthroxyli* (Spengel)

2. *Collema flaccidum* (Ach.) Ach.

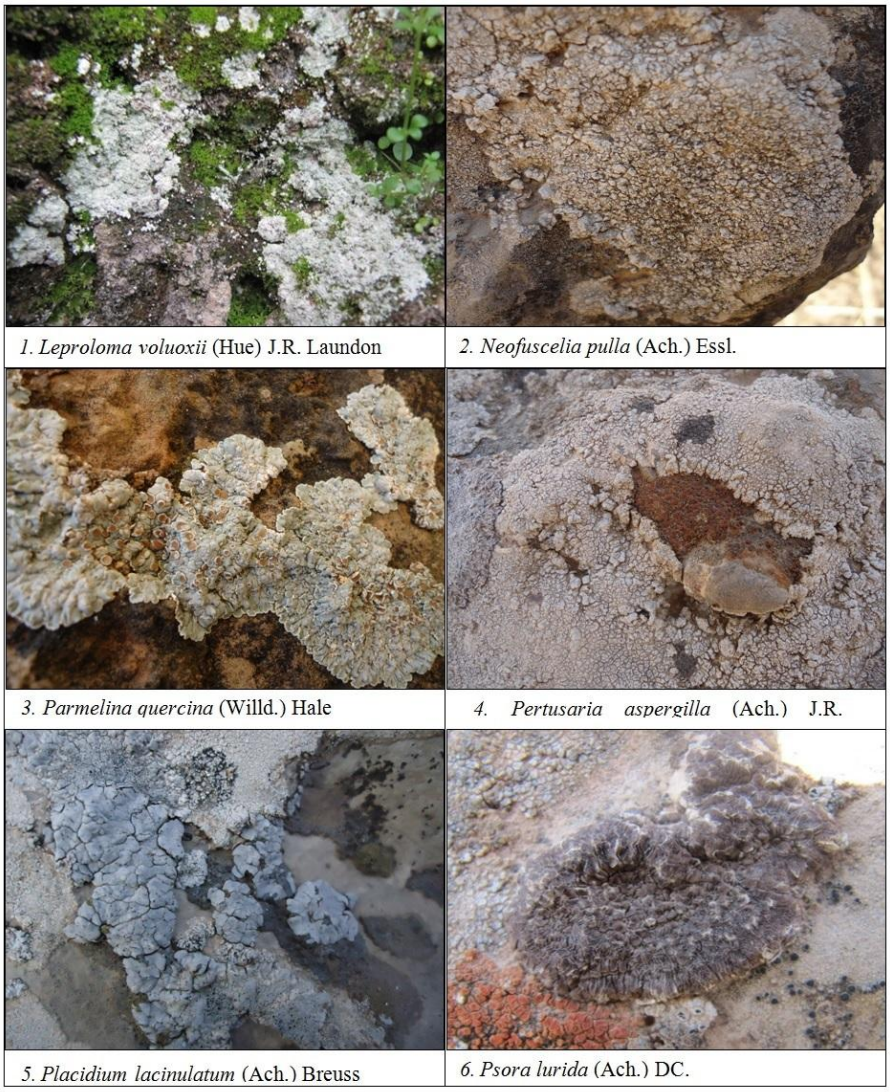
3. *Diploschistes caesioplumbeus* (Nyl.)

4. *Dirina catalinarie* (Hasse)

5. *Lecanora dispersa* (L.) Sommerf.

6. *Lecidea fuscoatra* (L.) Ach.

Plate (2): New records of lichen species at studied locations.



1. Leproloma voluoxii (Hue) J.R. Laundon

2. Neofuscelia pulla (Ach.) Essl.

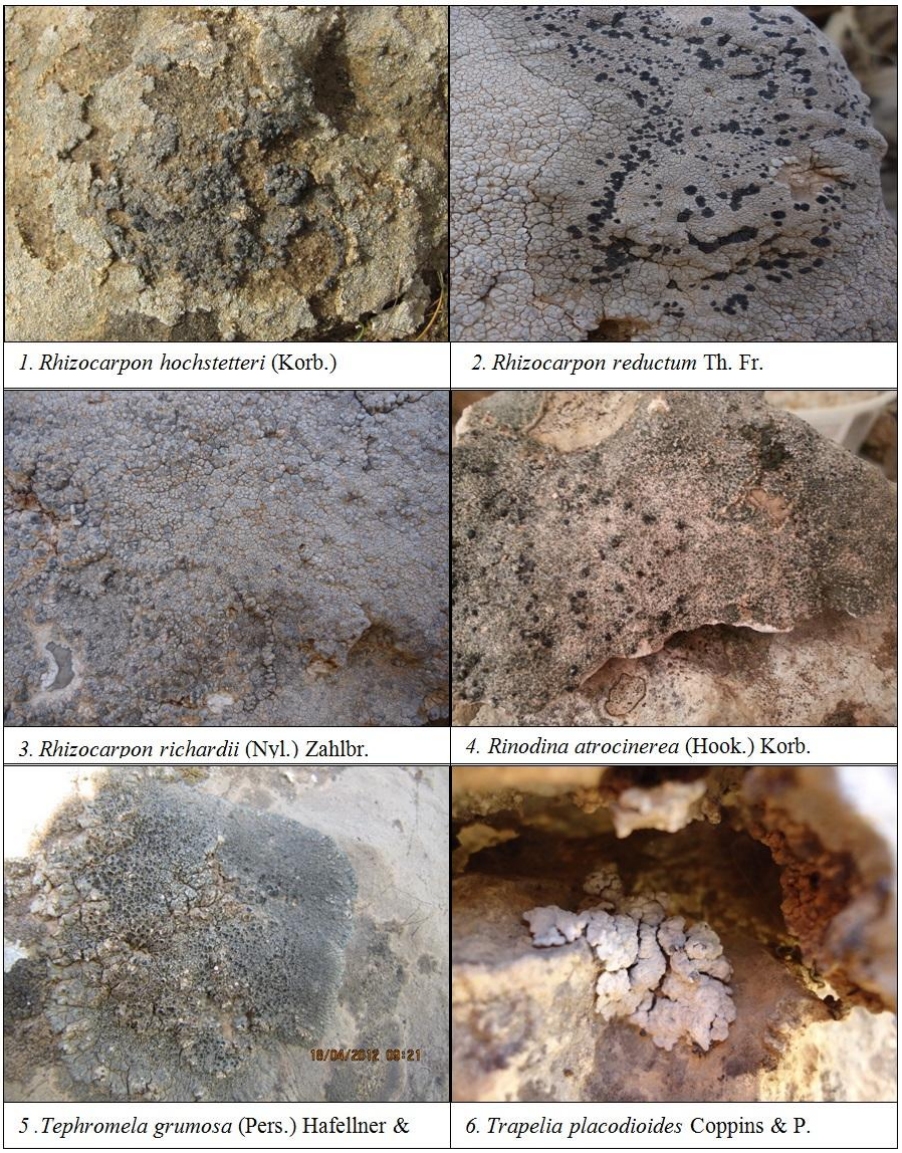
3. Parmelina quercina (Willd.) Hale

4. Pertusaria aspergilla (Ach.) J.R.

5. Placidium lacinulatum (Ach.) Breuss

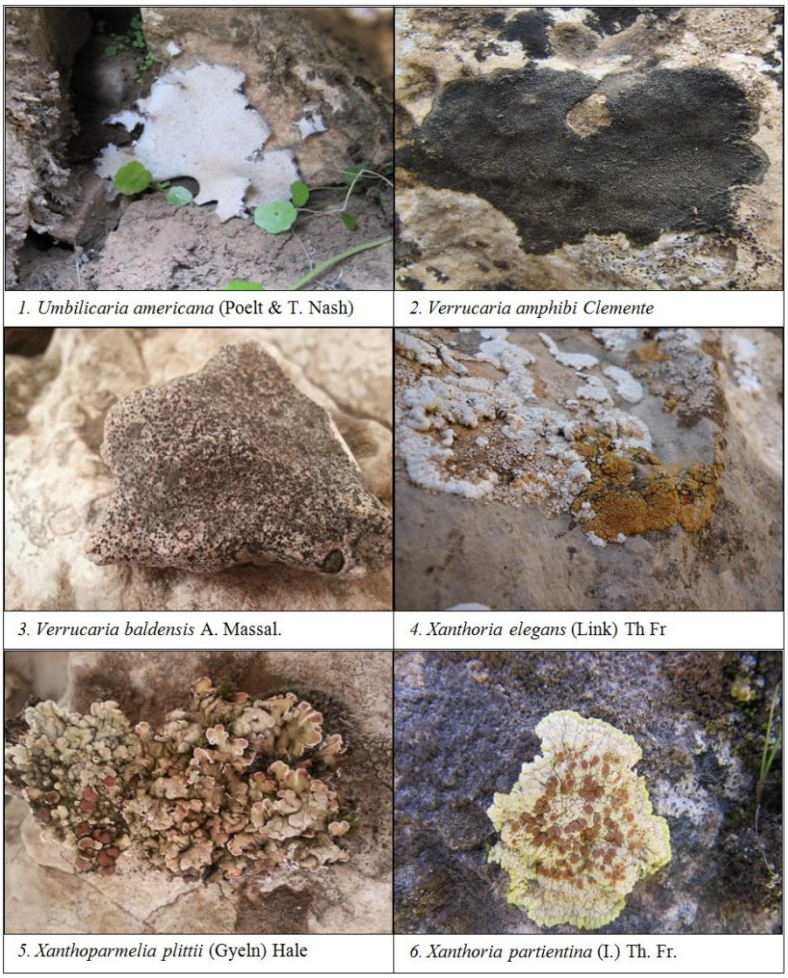
6. Psora lurida (Ach.) DC.

Plate (3): New records of lichen species at studied locations.



1. Rhizocarpon hochstetteri (Korb.)	*2. Rhizocarpon reductum* Th. Fr.
3. Rhizocarpon richardii (Nyl.) Zahlbr.	*4. Rinodina atrocinerea* (Hook.) Korb.
5 .Tephromela grumosa (Pers.) Hafellner &	*6. Trapelia placodioides* Coppins & P.

Plate (4): New records of lichen species at studied locations.



1. Umbilicaria americana (Poelt & T. Nash) | *2. Verrucaria amphibi Clemente*

3. Verrucaria baldensis A. Massal. | *4. Xanthoria elegans* (Link) Th Fr

5. Xanthoparmelia plittii (Gyeln) Hale | *6. Xanthoria partientina* (I.) Th. Fr.

Plate (5): New records of lichen species at studied locations.

LITERATURE CITED

Aziz, F.H. 2004. Some observations on the lichens flora in mountain area of Hawler province Iraqi Kurdistan region, Iraq: In Hasan Beg mountain area. *Zanco. The Sci. J. of Pure and Appl. Sci. Salahaddin Univ. Erbil.* Iraq. 17(2): 89-117.

Aziz, F.H. 2005. Some observations on the lichens flora in mountain area of Hawler province Iraqi Kurdistan region, Iraq: In Saifn, Jundian, Kawlokan, Haji Omaran and Kawshan., *Zanco. The Sci. J. of Pure and Appl. Sci. Salahaddin Univ.Erbil.* Iraq.17 (2): 79-119.

Aziz, F.H. and Al-Dabbagh, J.J. 2009. Evaluation of Outdoor and Indoor Dust Deposition as Environmental Pollution in Erbil Province. Air Pollution, 157. WIT Press, Southampton, Boston. UK.

Batts, J.E, Calder, L.E. and Batts, B.D. 2004. Utilizing stable isotope abundances of Lichnes to monitoring environmental change. Chemical Geology 204, 345-368.

Bendre, A.M. and Kumar, A. 2010. A Text Book of Practical Botany-1. Rastogi Publication. New Delhi, India.

Berryman, S., Straker, J. and D. 2009. Using Lichnes as Bio-indecators of Air Pollution Deposition Near Remote Mining Operations. Stantee Ltd. Sedny.

Brodo, I.M., Sharnoff, S.D. and Sharnoff, S. 2001. Lichens of North America. Yale University Press, New Haven and London. 795 pp

Coppins, B.J. 2002. Checklist of Lichens of Great Britain and Ireland. British lichen Society.

Dobson, F.S. 2005. Lichens. An illustrated Guide to the British and Irish species. Richmond Publishing Co Ltd; 5th illustrated edition, England. 450pp.

Goward, T., Mc Cune, B and Meidinger, D. 1994. The Lichens of British Columbia Illustated Keys. Ministry of Forests Research Program.

Guest, E. 1996. Flora of Iraq. No.1. Ministry of Agricultural, Baghdad.

Hale, M.E. 1974. The Biology of Lichens. 2nd ed. Edward Arnold Ltd., London.

Hall, M.E. 1979. How to know the Lichens, 2nd ed. Dubuque, Lowa W. C. Brown. USA.

Hawksworth, D.L. and Rose, F. 1979. Lichens as Pollution Monitors. Edward Arnold Ltd., London.

Lahham, J.N. and El-Oqlah, A.A.C. 1986. Common Lichens of Jordan. *Biological Research Center, Council for Scientific Research*, No.6:1-26.

Muhammad, S.F. 2003. Ecological study on some air pollutants impact on human health, *Nerium olender* L. and *Phragmits australis* L. plants within Hawler city. M. Sc. Thesis, College of Education, University of Salahaddin-Hawler.

Nash, T.H. 2008. Lichen Biology. 2nd ed. Cambridge University Press, Cambridge.

Purvis, O.W. 2000. Lichens. Smithsonian Institute Press and Natural History Museum, London.

Purvis, O.W., Coppins, B.J., Hawksworth, D.L., James, P.W. and Moore, D. M. 1992. The Lichen flora of Great Britain and Ireland. Natural History Museum Publication with the British Lichen Society. London.

Upreti, D.K. and Pandey, V. 2000. Determination of heavy metals in Lichens growing on different ecological habitats in Schirmacher Oasis, East Antarctica. *Spectroscopy Letters*, 33(3), 435–444.

WEP. (World Food Program) 2002. Statistical Report on Population of Iraqi Kurdistan Region. UN.

WHO. (World Health Organization) 2007. Health risks of heavy metals from long range trans boundary air pollution.

Zsigmond, A.R. and Urák, I. 2011. Assessment of heavy metal content of Lichens and soil collected from the Hasmas Mountains, Romania, *Biharean Biologist*, 5(1): 69-72.

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الاشنات السائدة والجديدة في اقليم كردستان، العراق

فرهاد حسن عزيز* **سروة برهان قادر**
قسم البيئة / كلية العلوم/ جامعة صلاح الدين/ اربيل
*Email: Farhad.aziz1948@gmail.com

الملخص

اعتمادا على الاشنات التي جمعت خلال المدة اذار- ايلول ٢٠١٢ من اقصى الشمال الى اقصى الجنوب لمحافظة اربيل، شخصت العينات الى ٥٨ انواعا تعود الى ٣٣ جنساً؛ سجل ٣٠ نوعا جديدا لأول مرة للعراق من بين المدروسة . ركزت نتائج الدراسة على الانواع السائدة والتي تتواجد بكثرة في معظم المناطق المختارة و من ضمنهم *Collema cristatum* , و*Diploschistes scruposus* و *Lecanora dispersa* و *Lecanora murales* و *Pertusaria flavicunda* و *Thelomma californicum* و *Verrucaria Maura* .