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ECOLOGICAL STUDIES ON *RESEDA PRUINOSA DEL.* GROWING IN EGYPT

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Reseda pruinosa Del., family Resedaceae is an annual herb, collected during spring and summer of 2002 from El-Quesyma, El Arish, and Ageba Matruh. The soil supporting the plant was sandy loam in texture at the two layers habitat while it was rocky sand at surface layer and sandy loam at bottom layer at Ageba habitat.

Soil salinity at Ageba habitat was relatively higher than that of El-Quesyma habitat. The soil was slightly alkaline in reaction at both habitats. Calcium ions were the major component, while magnesium ions were the second major component of the soil at the two habitats. Calcium, magnesium and sodium ions were higher at the surface and bottom layers at Matruh than that at El-Quesyma habitat. Sulphate content was higher in soil of Ageba than that of El-Quesyma. Bicarbonates were the major anion component of the soil at Ageba, while chlorides were the major anion component of the soil of El-Quesyma habitat. The vegetation analysis at El-Quesyma habitat revealed that the dominant species was *Zygophyllum album* while, *Reseda pruinosa* Del. represent the 2nd dominant species in spring and 6th dominant species in summer. Meanwhile, the dominant species at Ageba was *Reseda pruinosa Del* in spring and 3rd dominat species in summer. It was followed by *Alhagi maurorum*, *Artemisia herba alba*, *Asphodelus microcarpus* and *Urginea maritima*. in spring. Concerning the eco-physiological studies it was found that *R.pruinosa* Del. stored water in its tissues to overcome the dry weather conditions, where its moisture content was higher at spring than that at summer at the two habitats. The total-soluble and insoluble carbohydrates, total nitrogen and total lipids were slightly higher at Ageba than that at El-Quesyma habitat, where it reached its maximum values during spring and its minimum values during summer at the two studied areas. The total ash content, acid and water insoluble ash and crude fiber were slightly higher at El-Quesyma than that at Ageba habitats, where it reached its maximum values during summer

and its minimum values during spring at the two investigated areas due to the increase in total ion accumulation as a result of increasing soil moisture stress conditions.

Concerning the active constituents it was found that the percentages of total flavonoids, total alkaloids, total saponins and total tannins were higher during spring than summer. Also it was revealed that the active constituents of the plant were higher at Ageba than that at El-Quesyma habitats.

Keywords: Resedaceae, ecological studies, climatic facfors, metablolic products, active constituent.

Family Resedaceae is a limited family, it contains only 6 genera and 75 species distributed in the world. Some members of the family are herbs while the others are shrubs (Ghazanfar 1994). Family Resedaceae was found to be serving as a source of many type of glycosides. Schraudolf (1965) found that the plants belonging to family Resedaceae contain glycosides mostly as glucobrassicin specially in seedling stage. Reseda is the most important genus in this family because it is not only rich with phenolics and glycosides as a whole but also rich with flavonoid glycosides.

In Egypt many plants of this family are used in folkmedicine as antimicrobial remedies, where crude preparations of such plants are used in different forms for oral and external local applications to treat microbial infections. Among the disorders treated are anti- inflammatory, analgesic activities and in external hemorrhoidal treatment (Susplugas *et al.*, 1993).

The plant under investigation *Reseda pruinosa* Del. can be classified taxonomically as follows according to (Tackholm, 1974).

Division	:	Angiospermae
Class	:	Dicotyledoneae
Sub. class	:	Archichlamydeae
Order	:	Rhoedales
Family	:	Resedaceae
Genus	:	Reseda
Species	:	Pruinosa

The plants belonging to this family are herbs or shrubs with alternate stipulate leaves and bisexual zygomorhplic flowers in racemes; sepals 4-8, petals 0-8, stamens 3-40, ovary of 2-6 carpels; gynoecium and androceium placed on a short "androgynophore" which is expanded on one side into a prominent disc; fruit a capsule, rarely berry or of free 1-seeded carpels.

Reseda species are annual or perennial herbs or shrubs with frutescent base. Flowers white or yellow in a terminal raceme. Perianth 4-8 merous, upper

petals cleft or parted. Stamens 10-40 inserted upon a floral disc inside periarth. Fruit of 3-4 toothed capsule with gaping mouth, open even before seeds ripen.

The medicinal values reported for certain members of Resedaceae which have been reviewed in the literature, stimulated us to carry out the present study. The reviewed literature showed that nothing was traced concerning *R. pruinosa* Del. as far as our aware. So it was decided to carry out ecological and eco- physiological studies of *R. pruinosa* Del. growing naturally in Egypt to investigate the conditon under which *R. pruinosa* Del. can live and survive.

MATERIALS AND METHODS

Ecological studies

Ecological studies of *R. pruinosa* Del. were done in two selected localities; El-Quesyma (North Sinai) and Ageba at Marsa Matruh (North Western Coast), during the growth seasons, spring and summer (2002).

Climatic factor

The mean values of climatic factors for both investigated habitats were obtained from the Meteorological Department of Egypt.

Edaphic factors

Soil samples were collected for physical and chemical analysis from soil supporting *Reseda pruinosa* Del. at two depths (0-20 and 20-40cm).

Soil physical properties (granuleometric analysis)

Soil texture was determined by sieve shaker method (Jackson 1967). The soil moisture content was determined at two depths (0-20 and 20-40cm) using the method described by Rowell (1994).

Soil chemical properties

Determination of soil soluble salts involved an estimation of anions and cations in 1:5 soil solution; which was prepared according to Piper (1947).

Anions: carbonates, bicarbonates, chloride and sulphate ions were determined according to the method described by Jackson (1962) and Brower and Zar (1984).

Cations: sodium and potassium ions were measured using flame photometer according to Rowell (1994). Calcium and magnesium were measured by titration against EDTA (Brower and Zar, 1984).

The hydrogen ion concentration of the soil was measured using electric pH meter. Electrical conductivity (E.C.) of the soil was measured by electrical conductivity meter (Rowell, 1994).

Vegetation (community) analysis

The structure of vegetation of *R. pruinosa* Del. was analyzed sociologically according to procedures described by Braun- Blanquet (1964). The component species in the community were listed counted in a series of 20 quadrates, 10×10m each. The species area relationship was then deduced.

The frequency index, frequency class and frequency diagram were compiled and calculated according to Ambasht (1986). The importance of component species was determined by computation of density and relative density.

Eco-physiological studies

The over ground parts of the plants used in the present investigation were obtained from El-Quesyma (El-Arish) and Ageba (Matruh) during spring and summer (2002).

Determination of water content

It was estimated according to the method described by Rowell (1994) during spring and summer seasons.

Metabolic products

The total soluble and insoluble carbohydrates in the plant were determined according to Chaplin and Kennedy (1994). The total nitrogen and protein contents were determined according to James (1995) and the total lipid were determined according to Christie (1982).

Determination of certain pharmacopoeial constants

The total ash content, acid and water insoluble ash and crude fiber contents were determined according to Askar and Treptow (1993).

Active constituents

Preliminary phytochemical screening:

It includes, test for flavonoids (Wall *et al.*, 1954), test for alkaloids (Woo *et al.*, 1977), test for saponin and tannins (Balbaa, 1986).

Determination of total flavonoid (%):

The total flavonoids (as quercetin) of *R.Pruinosa* Del. at the two studied habitats were determined by spectrophotometerically method described by Karawya and Aboutable (1982).

Determination of total alkaloids (%):

The total alkaloid of *R. pruinosa* Del. at the two studied habitats were estimated using two methods the acid- base titration and the gravimeteric methods as described by Balbaa (1986) and Woo *et al.* (1977).

Determination of total saponin (%):

Saponin content of *R. pruinosa* Del. at the two localities were determined according to Balbaa (1986).

Determination of total tannins (%):

The total tannins was estimated according to Makkar and Googchild method (1996).

RESULTS AND DISCCUSSION

Ecological Studies

Phenology

Reseda pruinosa Del. is an annual scabrous pruinosa herb. Lower leaves linear lanceolate entire, other ternate with linear lobes, capsules longer than broad, cylindrical- clavate, usually pruinosa. It is distributed in sandy places in the following regions:

The Nile valley from Cairo to Wadi Halfa, the Oases of the Libyan desert, the western mediterranean coastal region, the red sea region, Sinai proper (South of El-Tihdesert) Geble Elba and surrounding mountains, situated in the south-east corner of Egypt at the Sudan frontier (Tackholm, 1974).

It is of interest to mention that the phenology of *Reseda pruinosa* Del. was largely dependent on the environmental condition associated with its growth. During the period of investigation, it was observed that the plant reached its maximum heights during spring 54.8 and 68.7cm at El-Quesyma and Ageba, respectively (Table1), while its mean minimum heights were 39.2and 54.3cm during summer in El-Quesyma and Ageba, respectively. Its height was higher in Ageba than that of El-Quesyma during the two seasons.

TABLE (1). Mean values of the average heights of ten plants *Reseda pruinosa Del.* at the two habitats

Seasons	Mean heights (cm)	
	El-Quesyma	Ageba
Spring 2002	54.80	68.70
S.D	4.24	4.28
Summer 2002	39.20	54.30
S.D	4.59	2.89

S.D= Standard deviation

Climatic factors

The climatic data in tables (2 and 3), represents the conditions in the two studied areas, which clearly indicate that the mean maximum temperature was ranged between 17.2°C in January and 34.4°C in July at El-Quesyma, while it was ranged between 16.3°C in January and 31.5°C in July and September at Ageba habitat. The mean minimum temperature varied from 8.5°C in January to 22°C in August at El-Quesyma, while it varied from 8.4°C in January to 23.4°C in August at Ageba habitat.

Data indicated that the relative humidity was 62.7% in November as minimum value and 77.0% in January as maximum value at El-Quesyma while at Ageba habitat, it was 61.0% in October as minimum value and 73.7% in June as maximum value. Data also indicated that wind speed at El-Quesyma reached its minimum of 2.8 Knot/hour in August and maximum of 5.4 knot/hour in January and December while it reached its minimum of 6.9 knot/hour in October, and its maximum of 10.9 knot/hour in January at Ageba habitat. Data revealed that the total annual amount of rainfall was 33.2 mm and 40.6 mm at El-Quesyma and Ageba habitats, respectively. *R. pruinosa* Del. grows and flourishes well under condition of moderate temperature (27.8 maximum and 14.6 minimum at El- Quesyma and 25.1

maximum and. 18.6 minimum at Ageba habitat) during its vegetative growths at May .

TABLE (2). Mean values of climate particular for El-Quesyma region (El-Arish) obtained from Meteorological Department of Egypt.

Months	Temperature °C		Relative Hu%	Water vapour pressure H.Pa	Wind speed at Knot	Amount Rainfal (mm)
	Mean Max	Mean Min				
January	17.2	8.5	77.0	10.5	5.4	14.8
February	21.6	8.8	72.7	12.0	4.5	3.7
March	24.1	11.0	67.7	13.4	5.0	4.0
April	25.1	12.7	65.0	13.5	4.5	0.8
May	27.8	14.6	69.0	16.7	3.2	0.1
June	30.9	18.4	69.3	21.5	3.0	0
July	34.4	21.4	71.0	25.7	4.0	0
August	33.6	22.0	69.0	25.9	2.8	0
September	32.3	20.0	67.7	22.6	3.1	0
October	29.1	18.1	72.7	20.9	2.9	0.9
November	26.7	12.3	62.7	13.7	3.4	0.1
December	21.1	9.9	69.3	11.6	5.4	8.8
Total						33.2

TABLE (3). Mean values of cliamte particular for Ageba region (Marsa Matruh) obtained from Meteorological Department of Egypt.

Months	Temperature °C		Relative Hu%	Water vapour pressure H.Pa	Wind speed at Knot	Amount Rainfal (mm)
	Mean Max	Mean Min				
January	16.3	8.4	73.0	10.4	10.9	18.5
February	19.0	10.0	71.7	11.5	8.7	2.5
March	20.3	11.6	69.7	12.7	9.3	0.2
April	26.1	13.2	62.3	12.9	8.2	3.7
May	25.1	18.6	72.3	17.3	7.8	0
June	27.5	18.6	73.7	21.3	7.6	0
July	31.5	23.3	70.3	25.3	7.8	0
August	31.0	23.4	64.7	23.5	7.4	0
September	31.5	22.2	65.3	22.4	7.1	0
October	27.1	18.7	61.0	17.1	6.9	4.0
November	23.9	14.4	64.7	14.1	7.1	2.3
December	20.2	10.9	66.7	11.4	9.5	9.4
Total						40.6

Edaphic factors

Physical properties of the soil

Results of granuleometric analysis of the soil supporting *R. pruinosa* Del. indicated that soil is sandy loam in texture at El-Quesyma at the two layers, rocky sand in 0-20 cm and sandy loam in 20-40 cm at Ageba region. The main bulk of the soil was mixed sand at the two studied areas (Table 4).

TABLE (4). Granuleometric analysis of the soil supporting *Reseda pruinosa* Del. at the two habitats.

Locality	Soil depth cm	Soil texture	Granuleometric analysis of soil fractions (mm%)				
			Fine gravel 1-2 mm	Coarse sand 0.5-1 mm	Fine sand 0.125-0.25 mm	Silt 0.063-0.25 mm	Clay < 0.063 mm
El-Quesyma	0.20	Sandy loam	6.1	37.10	26.0	18.2	12.6
	20-40	Sandy loam	16.9	32.50	12.5	22.8	15.2
Ageba	0-20	loamy sandy	9.2	20.3	25.8	28.6	15.1
	20-40	Sandy loam	12.1	15.6	27.9	30.5	13.9

The soil moisture content (Table 5) show the seasonal variation coinciding with the seasonally climatic factors. The values reached their maximum in spring with rain season and their minimum in summer associated with drought, high rates of evaporation and low relative humidity.

The soil moisture content reached its maximum value at the bottom layer (20- 40 cm), while its minimum value was obtained at the surface layers (0-20 cm), and was slightly higher at Ageba region. The data show that there was a general trend in layers at the two seasons for increasing soil moisture contents with increasing soil depths, which may be attributed to the fact that surface layers of the desert soil are subjected to intense evaporation and the deep layers are protected against evaporation (Shalaby *et al.*, 1981).

TABLE (5). Mean values of five samples of soil moisture content of *Reseda pruinosa* Del. at the two habitats during the growth season (2002)

Locality	Sample depth (cm)	Soil moisture content %	
		Spring	Summer
El-Quesyma	0-20	1.83	0.68
	20-40	3.08	0.97
S.D		0.28	0.31
		0.11	0.07
SX		0.14	0.15
		0.05	0.04
Ageba	0-20	3.94	2.42
	20-40	5.36	3.15
S.D		0.04	0.33
		0.51	0.20
S_X		0.02	0.16
		0.25	0.10

S.D= Standard deviation
Sx=Standard error

Chemical properties of the soil

Cation contents

Calcium constituents form the major ion of the soil associated *R. pruinosa* at the upper and bottom layers at both habitats. Its ion concentration was relatively high. It ranged between 3.55 and 4.91 meq/100 g at El-Quesyma and between 14.81 and 8.20 meq/100 g at Ageba region (Table 6). Magnesium constituents form the second major ion of the soil. The ion concentration ranged between 2.89 and 1.52 meq/100 g at El-Quesyma and 6.96 and 5.15 meq/100 g at Ageba region. It was observed that Ca^{++}, Mg^{++} and Na^{+} ions concentrations were higher at the surface and bottom layers at Ageba than at El-Quesyma habitat. It was also observed that K^{+} was relatively low in the two studied habitats (Table 6).

TABLE (6). Chemical analysis of soil associated with *Reseda Pruinosa* Del. at the two halitats

Locality	Soil depth (cm)	pH	E.C. m-mhos / (cm)	Analysis of the soil saturation extract							
				Soluble cations (meq/100g)				Soluble anions (meq/100g)			
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}
El-Quesyma	0-20	7.5	0.7	3.55	2.89	0.89	0.37	Traces	1.69	3.18	0.30
	20-40	7.7	1.3	4.91	1.52	0.67	0.25	Traces	1.47	2.60	0.98
Ageba	0-20	7.8	1.7	14.81	6.96	6.13	1.50	0.39	20.3	4.26	1.78
	20-40	7.9	2.6	8.20	5.15	4.71	0.81	0.91	17.2	12.95	3.61

Clarkson and Hanson (1980) reported that Ca^{++} concentration are generally required to protect the roots of the plants from the deleterious effects of salinity. In 1984, Imamual -Hug and Larher recorded that Ca^{++} lowered proline content which is an indicator for stress severity.

Ca^{++} has a role in the maintenance of membrane integrity, Leopold and Willing (1984) stated that Ca^{++} is an important factor in the resistance of plants to salinity. Energy which is used in osmoregulation and maintenance respiration would be alternatively utilized for growth in the presence of Ca^{++}.

Anion contents

The soluble carbonates were traces at El-Quesyma, while it ranged between 0.39 and 0.91 meq/100g at Ageba.

Meanwhile HCO_3^{-} from the major ion at Ageba ranged between 20.3 and 17.2 meq/100g while it was lower and ranged between 1.69 and 1.47 meq/100g at El-Quesyma, chlorides ions the major anion of the soil 3.18 and 2.6 meq/100g at El-Quesyma while it was higher 4.26 and 12.95 meq/100g at Ageba habitat.

The salinity at Ageba habitat was relatively high than that of El-Quesyma, which may be due to the increase in chloride and sodium ions at Matruh habitats. These results are in agreement with those obtained by

Brower and Zar (1984). Generally, Cl^- content increased on passing from the rainy season to the end of the dry season (El-Monayeri *et al.*, 1986a).

It is clear from table (6) that sulphate (SO_4^{--}) contents of soil sample in the two studied areas were relatively low. It ranged between 0.30 and 0.98 meq/100g at El-Quesyma and between 1.78 and 3.61 meq/100g at Ageba. The sulphate content was higher at soil of Ageba habitat than that at El-Quesyma habitat (Table 6). SO_4^{--} was taken up by plants mostly in smaller amounts than Cl -ions and are used for amino acid and enzyme syntheses and for counteracting the increased Cl^- ions accumulation (El-Monayeri *et al.*, 1986 a). pH value and electrical conductivity (E.C.) of the soil. The soil was slightly alkaline in reaction, with pH ranging between 7.5 and 7.7 and 7.8 and 7.9 for the surface and the bottom layers at El-Quesyma and Ageba habitats, respectively (Table 6). The electrical conductivity (E.C.) ranged between 0.7 and 1.3 and 1.7 and 2.6 m mohs/cm at the surface and bottom layers at El-Quesyma and Ageba habitats respectively (Table 6).

The increase in E.C. of Ageba soil solution than that of El-Quesyma may be due to the increase in the sum of total anions and cations. The discussion reported by Brower and Zar (1984) are in agreement with the present data.

Vegetation analysis

Vegetation at El-Quesyma habitat (Table 7) revealed that the dominant species was *Zygophyllum album* in spring and summer with frequency index 100% and density 13.3% at spring and 15.8% at summer.

Reseda pruinosa Del. resembled the second dominant species in spring with frequency index 100% and density 6.8% while it resembled the sixth dominant species in summer with frequency index 65% and density 4.4%. It was followed by *Salsola tetrandra, Artemisia herba-alba, Artemisia monsperma and Alhagi maurarum* in spring .

The vegetation analysis at Ageba habitat (Table 8) revealed that the dominant species was *Reseda pruinosa* Del. with frequency index 100% and 75% and density 7.9% and 5.2% in spring and summer, respectively. It was followed by *Alhagi maurarum, Artemisia herba-alba, Asphodelus microcarpus* and *Urginea maritima* in spring .

TABLE (7). Floristic composition of 20 quadrates (10×10m) representing *Reseda pruinosa* Del. community studied in El-Quesyma during 2002.

Species	Seasons									
	Spring					Summer				
	Total No.	Fr%	Fr.C.	D%.	R.D.%	Total No.	Fr%	Fr.C.	D%.	R.D.%
Zygophyllum album	260	100	5	13.3	21.0	315	100	5	15.8	29.5
Reseda pruinasa Del	135	100	5	6.8	10.9	88	65	4	4.4	8.3
Salsola tetrandra	105	100	5	5.3	8.5	137	100	5	6.9	12.9
Artemisia herba- alba	85	95	5	4.3	6.9	62	70	4	3.1	5.8
Artemisia monosperma	110	95	5	5.5	8.9	95	85	5	4.8	8.9
Alhagi mauorum	140	85	4	7	11.3	85	65	4	4.3	8.0
Launaea spinosa	50	75	4	2.5	4.1	46	75	4	2.3	4.3
Asphodelus tenuifolius	75	60	3	3.8	6.1	53	50	3	2.7	5.0
Hyoscyamus muticus	85	50	3	4.3	6.9	75	40	3	3.8	7.1
Astragallus spinosus	63	50	3	3.2	5.9	23	30	2	1.2	2.2
Suaeda fruticosa	45	40	3	2.3	3.7	29	30	2	1.5	2.8
Salvia lanigera	38	40	3	1.9	3.1	17	25	2	0.9	1.6
Haloxylon scoparium	33	40	3	1.7	2.7	30	35	3	1.5	2.9
Astragallus tribuloides	15	20	2	0.8	1.3	15	20	2	0.8	1.5

Fr%=Frequency%
Fr.C.=Frequency Class
D%=Density%
R.D.=Relative Density

TABLE (8). Floristic composition of 20 quadrates (10×10m) representing *Reseda pruinosa* Del. community studied in Ageba during 2002.

Species	Seasons									
	Spring					Summer				
	Total No.	Fr%	Fr.C.	D%.	R.D. %	Total No.	Fr%	Fr.C.	D%.	R.D. %
Reseda pruinosa Del	185	100	5	7.9	17.5	103	75	4	5.2	15.7
Alhagi maurorum	165	95	5	8.3	18.3	115	70	4	5.8	17.6
Artemisia herba-alba	97	95	5	4.9	10.8	78	80	4	3.9	11.6
Asphodelus microcarpus	65	85	5	3.3	7.2	50	80	4	2.5	7.6
Urginea maritima	87	80	4	4.4	9.7	75	70	4	3.8	11.5
Limonium tubiflorum	46	75	4	2.3	5.1	23	40	3	1.2	3.5
Limonium angustifolium	63	70	4	3.2	7.0	44	50	3	2.2	6.7
Noaea mucronata	55	50	3	2.8	6.1	47	40	3	2.4	7.2
Polygonum equisetiforme	36	50	3	1.8	4.0	19	35	3	0.9	2.9
Echinopus spinosissimums	25	45	3	1.3	2.8	21	45	3	1.0	3.2
Salvia aegyptiaca	21	30	2	1.1	2.4	12	20	2	0.6	1.8
Suaeda fruticosa	40	25	2	2	4.5	30	15	1	1.5	4.6
Stachys aegyptiaca	25	25	2	1.3	2.8	17	15	1	0.9	2.6
Thymelaea hirsuta	14	15	1	0.7	1.6	14	15	1	0.7	2.1
Capparis spinosa	7	15	1	0.4	0.8	7	15	1	0.4	1.1

Fr%=Frequency%
Fr.C.=Frequency Class
D%=Density%
R.D.=Relative Density

Eco-physiolgoical studies

The present work attempted to study the water content, the metabolic and active constituents of ability for adapting itself to severe conditions of the desert habitats. The investigated materials were collected during the growth season 2002 in the two natural habitats, El-Quesyma and Ageba habitats.

Water content

Table (9) indicate that the percentage of water content of *R. pruinosa* reached its maximum values (38.6 and 56.3%) in spring and its minimum values (22.8 and 31.5%) in summer at El-Quesyma and Ageba habitats, respectively. It was observed that the percentage of water content of *R. pruinosa* Del. was slightly higher in plants growing at Ageba habitat than at El-Quesyma habitat.

Data also indicated that the percentage of water content of *R. pruinosa* Del. was higher in spring than in summer at the two habitats.

TABLE (9). Mean value of water content in ten plants of *R. pruinosa* Del. at the two habitats.

Item	Seasons	El-Quesyma	Ageba
Water content %	Spring	38.6	56.3
	Summer	22.8	31.5
S.D		1.98	0.70
		1.98	2.12

S.D= Standard deviation

During spring, as the soil moisture is more avaliable and other climatic and edaphic factors favour less evapotranspiration and more dilution of soil solution, desert plants accumulate high amounts of carbohydrate and nitrogenous compounds (El-Monayeri *et al.*, 1986a).

Metabolic products

Total -, soluble -, and insoluble - carbohydrates %

It is clear from table (10) that the percentages of total, soluble and insoluble carbohydrates of *R. pruinosa* Del. at spring were higher than that at summer at Ageba, while insoluble carbohydrate at summer was higher than that at spring. Data indicated that the total, soluble and insoluble carbohydrates were slightly higher at Ageba than that of El-Quesyma habitats.

El-Monayeri *et al.* (1981) stated that the decline in total carbohydrates concentration as a result of increasing water stress may be attributed to the decrease in photosynthesis associated with the increase of respiration rate in different plants.

Total nitrogen

Data presented in table (10) indicated that the percentage of total nitrogen of *R. pruinosa* Del. reached its maximum values of 0.98 and 0.76% in spring and its minimum values of 0.80 and 0.72% in summer at Ageba and El-Quesyma habitats, respectively. Data also indicated that the total

nitrogen contents were slightly higher at Ageba than El-Quesyma habitat, the high amounts of total nitrogen content is mainly due to high metabolic rates of *R. pruinosa* as a result of high water resources of the soil during spring months than during the dry periods, which accounts to Stocker's assumption (1960).

Total lipids

The total lipid contents of *R. pruinosa* reached it's maximum value of 3.41 and 2.06% in spring and minimum value of 2.57 and1.87% in summer at Ageba and El-Quesyma habitats, respectively (Table 10). The increase of lipid content during spring may be due to the increase of carbohydrates concentration which converted to lipid by oxidation reaction (El-Monayeri *et al.*, 1981).

TABLE (10). Mean value of total -, soluble -, and insoluble - carbohydrates, total nitrogen and total lipids of *Reseda pruinosa* Del. at the two habitats.

Item	Seasons	El-Quesyma	Ageba
Total carbohydrates g/100 dry wt.	Spring	1.08	1.46
	Summer	0.89	1.17
Soluble carbohydrates g/100 dry wt.	Spring	0.82	0.97
	Summer	0.58	0.78
Insoluble carbohydrates g/100 dry wt.	Spring	0.26	0.49
	Summer	0.31	0.39
Total nitrogen %	Spring	0.76	0.98
	Summer	0.72	0.80
Total lipids %	Spring	2.06	3.41
	Summer	1.87	2.57

Certain pharmacopoeial constants

Data presented in table (11) indicated that the total ash, acid and water insoluble ash and crude fibers contents of *R. pruinosa* Del. were less at Ageba habitat than those at El-Quesyma habitat which may be attributed to the high moisture content at Ageba habitat than that of El-Quesyma habitat. The increase of ash content in the two habitats during summer may be due to the increase in total ion accumulation as a result of increasing soil moisture stress (El-Monayeri *et al.*, 1981). Total ash content of the plant material as well as the individual minerals of Na, Cl,K, Mg and Ca increased in tissues with the increase of soil moisture stress, which coincides with the dry hot season (El-Monayeri *et al.*, 1986b).

TABLE (11). Certain pharmacopoeial constants of *R. pruinosa* Del. at the two habitats.

Item (%)	Seasons	El-Quesyma	Ageba
Ash content	Spring	14.5	12.5
	Summer	17.4	14.0
Acid-insoluble ash	Spring	3.3	2.9
	Summer	4.5	4.0
Water- insoluble ash	Spring	9.3	7.4
	Summer	11.8	7.0
Crude fiber content	Spring	27.65	23.50
	Summer	31.01	26.97

Active constituents

Preliminary phytochemical screening

The preliminary phytochemical screening of *R. pruinosa* Del. at the two habitats indicated that the plant contained flavonoids, alkaloids, saponins and tannins as active constituents.

Total flavonoids %

The percentage of total flavonoids were illustrated in table (12). Data indicated that the percentages of total flavonoids were 1.64 and 1.03% at El-Quesyma and 2.00 and 1.30% at Ageba during spring and summer, respectively. Data also indicated that the percentages of total flavonoids at the two habitats were higher during spring than summer.

The natural plants produce different kinds of natural secondary metabolites during their metabolism, where the natural secondary compounds vary according to environmental conditions. Some of these compounds have an essential role in growth and development but the majority of them are involved in chemical defence systems, which protect plants from herbivores and microbial infection (Michael, 1997).

In spring months the metabolic rate increases the total nitrogen and total carbohydrates increase as a result of high water resources of the soil than autumn months (Stocker, 1960).

TABLE (12). Percentages of total flavonoids, alkaloids, saponins and total tannins of *Reseda pruinosa* Del. during the period of investigation (2002).

Item (%)	Seasons	El-Quesyma	Ageba
Total flavonoids	Spring	1.64	2.00
	Summer	1.03	1.30
Total alkaloids	Spring	0.19	0.36
	Summer	0.17	0.22
Total saponins	Spring	7.70	8.57
	Summer	5.64	6.78
Total tannins	Spring	9.33	7.63
	Summer	7.57	7.03

Total alkaloids

The total alkaloids of *R. pruinosa* Del. at the two localities were illustrated in table (12). Data indicated that the percentages of total alkaloid were 0.19 and 0.17% at El-Quesyma and 0.36 and 0.22% at Ageba during spring and summer, respectively. It is well known that the amount of alkaloids in plant is small, so the differences appear as a very small amount. Data indicated that the total alkaloids at the two habitats were relatively higher during spring than summer. Alkaloids are poisonous agents protecting the plant against insects and herbivores, so during growth and development of plants alkaloids are used as defensive agents and concentrated near the

surface regulatory growth factors and they are capable of supplying nitrogen or other elements to the plants (Balbaa, 1986).

Total saponins

The total saponins at the two habitats were illustrated in table (12). Data indicated that the percentages of total saponin of *R. pruinosa* Del. were 7.70 and 5.64% at El-Quesyma and 8.57 and 6.78% at Ageba in spring and summer, respectively. Saponins at the two habitats were higher during spring than summer. Saponin are toxic to animals, so accumulation of them in plants are defensive against herbivory especially on the surface (Balbaa, 1986).

Total tannins %

The total tannins of *R. pruinosa* at the two habitat were illustrated in table (12) indicated that the percentages of the total tannins were 9.33 and 7.57% at El-Quesyma and 7.63 and 7.03% at Ageba in spring and summer, respectively.

Data indicated that the percentages of total tannins at the two habitats were higher during spring than summer. Tannins serves as a protective to the plant during certain stages of growth.

Tannins inhibit the growth of many fungi (Balbaa, 1986). Tannins play a role in protecting the plants against grazing animals as they cause increase of the excretion of saliva and thus decrease the palatability and rate of digestion in animals (Michael, 1997).

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دراسات بيئية وفسيوبيئية على نبات ريسيدا بيرنوزا النامى فى مصر

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تضم العائلة الريسيديه كثيرا من النباتات ذات الأهمية الاقتصادية والطبية وقد تم اختيار نبات (ريسيدا بيرنوزا) كأحد أنواع هذه العائلة لدراسته من الناحية البيئية والفسيوبيئية.

تم جمع عينات من النبات من منطقتين ذات بيئتين مختلفتين لنمو النبات وهما منطقة القصيمة ومنطقة عجيبة حيث تم دراسة عوامل التربة التى ينمو بها النبات وصفاتها الطبيعية والكيميائية بالاضافة لتقييم الظروف المناخية التى ينمو فيها النبات فى البيئتين المختلفتين ، ومدى تأثير تلك الظروف على نمو وإزدهار النبات.

وقد تلخصت النتائج فيما يلى:

١ – ينمو النبات فى ظروف جغرافية تتميز بانخفاض نسبة الأمطار وارتفاع معدل البخر وارتفاع درجة الحرارة خاصة فى فصل الصيف ، كما دلت النتائج على أن منطقة عجيبة أكثر البيئتين ملائمة لنمو النبات وكذلك محتوى النبات من المواد الفعالة.

٢ – من التحليل الكيماوى للتربة إتضح أن الكالسيوم يمثل المركب الأساسى ويمثل الماغنسيوم المركب الثانى بالتربة فى كلا من منطقتى الدراسة وكان محتوى التربة من الكبريتات فى منطقة عجيبة أعلى منه فى منطقة القصيمة وكانت البيكربونات تمثل المركب الأيونى الأساسى فى منطقة عجيبة بينما الكلوريدات هى الأيون الأساسى فى تربة القصيمة . تميزت التربة بالقلوية إلى حد ما فى كلا المنطقتين مع زيادة ملوحة التربة نسبيا فى منطقة عجيبة عنها فى منطقة القصيمة .

٣ – إتضح من العشيرة النباتية التى يسود بها نبات ريسيدا بيرنوزا إنه يأتى فى المرتبة الثانية فى فصل الربيع والمرتبة السادسة فى فصل الصيف من حيث الوفرة بينما أكثر النباتات الموجودة بوفرة فى منطقة القصيمة هو زيجوفللم البيم . أما فى منطقة عجيبة فإن الريسيدا بيرنوزا يأتى فى المرتبة الأولى فى الربيع والمرتبة الثالثة فى الصيف من حيث الوفرة .

٤ – أوضحت الدراسة الفسيولوجية البيئية للنبات أن المحتوى المائى للنبات كان أعلى فى الربيع عنه فى الخريف فى كلا المنطقتين . كانت الكربوهيدرات الكلية والذائبة والغير ذائبة والمحتوى النتروجينى الكلى والدهون الكلية للنبات أعلى خلال فصل الربيع عنه فى فصل الصيف وكانت أيضا أعلى بمنطقة عجيبة عنها بمنطقة القصيمة ، بينما كان المحتوى الكلى والرماد الغير ذائب فى الحمض وفى الماء والاليانف الكلية للنبات أعلى فى منطقة القصيمة عنها فى منطقة عجيبة .

٥ – اتضح من دراسة تقديرنسب المواد الفعالة الموجودة بالنبات أن نسبة كل من الفلافونيدات والقلويدات والصابونينات والتانينات كانت أعلى فى النبات ككل فى فصل الربيع عنها فى فصل الصيف . كذلك كانت أعلى فى منطقة عجيبة عنها فى منطقة القصيمة.