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Effect of different isolates of *Trichoderma harzianum* fungus on Lettuce (*Lacttuca sativa*) seedling growth traits in soilless culture

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***Abstract*—** In this study, the effects of five isolates of *Trichoderma harzianum* fungal species on Lettuce plant growth rate under greenhouse conditions and soilless culture were evaluated in the CRD in four replications. To conduct the research, only the 10% concentration of the extract per total amount of irrigation (water + chemicals) of each pot was used. Wet and dry weights of shoot and root were used as growth indices in this experiment. The test results showed that the isolates had different effects on the lettuce plant growth indices, and indicated a significant statistical difference at 1% level using the LSD test. Among the isolates, the T_{Bi} isolate showed the strongest growth effect with the following features: 66.66% increase in fresh shoot weight, 45.21% increase in dry shoot weight, 87.81% increase in fresh root weight, and 51.12% increase in dry root weight. The possible use of isolated strains as plant growth promoting factors is discussed in this paper.

***Keywords*—** *Trichoderma harzianum,* soilless culture, growth promoter, lettuce

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I. INTRODUCTION

Based on this study, it was demonstrated that the use of *Trichoderma spp*. inoculants as biomass mixed with soil increased the dry weight of horseradish shoots more than using them as spore suspension [1]. Osli et al. [9] showed that some isolates of *T. harzianum* only by 1% of the concentration in the soil increased the growth of lettuce shoots and roots. However, the reaction of various plants to the growth effects of Trichoderma fungal isolates would be different. Research has shown that the type and rate of metabolites produced by Trichoderma isolated strains can negatively or positively contribute to the growth of different plants. In a greenhouse experiment, adding conidial suspension of *Trichoderma spp*. to the soil caused a significant increase in dry weight of tomato, pepper and cucumber plants, but made no increase in the growth of bean and radish plants [3]. Considering the proven antagonistic effects of Trichoderma species, especially *T. harzianum* (compared with bacterial species with similar properties, and even many of antagonistic fungi) against many soil pathogens [11], it should also noted that this species of Trichoderma fungus is common in Iran's soils, and in other words, it is considered as the most frequent species of Trichoderma in Iran's soils [15]. Lettuce is the annual plant which has been transferred from coastal Europe or Central Asia to other parts of the world. Some of the researchers believe that India is the main source of lettuce [11]. Lettuce has Vitamins A, B, C and other substances such as iodine, iron, phosphor, magnesium, zinc, manganese and copper in terms of nutritional value. Today, lettuce is cultivated to extract oil from its corn and consume fresh fruit [5]. Lettuce is divided into two large groups: *Lactuca sativa* var capitata which has two types of Butter head and Crisphead and is produced almost in greenhouse conditions as hydroponic cultivation or soil greenhouse cultivations and *Lactuca sativa* var Crispa and *Lactuca sativa* var longifolia (which is known as Romain or Coshead) are cultivated in open space [6]. The lettuce is mostly grown in transplants. Thus, it was tried to study the developmental and growth effects of 5 isolates of the fungus *T. harzianum* on lettuce plant aimed at evaluating the impact of isolated strains of T_{65}, T_{20}, T_{14}, T_{Bi} and T_{95} and the mentioned fungus on important growth factors of lettuce seedling, including fresh and dry weight of shoot and root.

II. MATERIAL AND METHODS

An experiment was planned in the form of a completely randomized design with 4 replications. The strains were prepared from the Phytopathology department of Faculty of Agriculture, which included T_{65}, T_{20}, T_{14}, T_{Bi} and T_{95} Each of the isolates was maintained within PDA medium in Petri dishes 10 cm in diameter at 25 ° C in the oven for 5 days so the fungi can grow properly for the next stage.

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Growth of fungus in medium Davet:

To prepare extract of fungi from the Davet selective culture medium which included 1gram of nitrate calcium, 1 gram of chloride calcium, 250 mg of nitrate potassium, 250 mg of phosphate Monopotassium, 50 mg of citric acid, 2 grams of sucrose, 25 grams of agar, 30 mg of Streptomycin sulfate for each liter of distilled water and culture medium with 0.2 grams of magnesium sulfate, 0.9 grams of phosphate di-potassium, 1.5 grams of potassium chloride, 3 grams of glucose, 20 grams of agar for each liter of distilled water were prepared [14]. This culture medium was poured in 2-liter Erlenmeyer which had been sterilized before for 20 min with autoclave at 120 ˚C under pressure of 10 atm. Now, it is time to transfer the grown biomass of fungus into these containers. In this way, scalpel was used and pieces of the fungus with approximate dimensions of 2*2 cm along with culture medium of PDA were transferred to the containers. The containers were aerated with aquarium pipes which were connected to an air pump and kept for 8 days at 25˚C. The Erlenmeyer flasks were kept on shaker for aeration for 8 days at 25 ° C. After this period, the solid phase was isolated from the liquid phase using tiffany that fiberglass put at its bottom, and the liquid phase was kept in the refrigerator for the next steps. The lettuce seeds, variant Siaho, were transferred into pots with a 10 cm span filled with coco peat and perlite by 50% ratios. The pots were kept in the research greenhouse of Faculty of Agriculture, Ferdoowsi University of Mashhad. The daily requirement of seedlings was provided from 90% of Hoagland food solution and 10% of Trichoderma isolates extracts. The 10% concentration of extract was used for the whole solution consumption. The fresh and dry weights of shoot and root were weighed after 25 days, and data analysis was performed by Minitab16-2001 software.

III. DISCUSSION OF RESULTS

Analysis of data obtained from this test showed that Trichoderma fungus had different growth effects on growth parameters of lettuce. Based on analysis of variance (Table 1), the effects of isolate on fresh and dry weight of roots and shoots were significant at 1% probability level.

Comparison of means showed that the T_{Bi} isolate had the strongest growth effect with the following features: 66.66% increase in fresh shoot weight, 45.21% increase in dry shoot weight, 87.81% increase in fresh root weight, and 51.12% increase in dry root weight. It had a significant difference with other isolates 1% probability level. The strain T_{14} showed the lowest effect or in better words, the negative effect (compared with control treatments) in growth indices (Table 2).

The studies results indicate that the plant type and the type and amount of secondary metabolites secreted by different isolates and strains of Trichoderma species can affect their growth effects in plant - Trichoderma interactions [12].

Based on conducted studies, the developmental effects of 31 isolates from 8 common species of Trichoderma on tomatoes and eggplant were studied. The results showed that the highest growth effects on tomato were obtained by the strains of two species, *T. viride* and *T. harzianum*, while the highest growth effects on eggplant were achieved using three species of *T. polysporum*, *T. album* and *T. hamatum* [13]. Differences in various strains of *T. harzianum* fungus performance in this test could also possibly be attributed to differences in the secretion of biochemical substances. As an example, it was found in a research that certain values of antimicrobial compound of Viridiol produced by *T. virens* species are highly toxic for rice, and cause a significant decrease in the plant seedlings growth [6]. It has been proved that one of the most important metabolites produced by 6-pentyl-α-pyrone is *T. harzianum* which has been known as plant growth stimulant in low concentrations. This compound in higher concentrations M (10^{-3}) prevented growth of wheat coleoptiles. Here, two hypotheses were mentioned that this compound acted as an auxin like compound (auxin causes growth of different organs of the plant in lower concentrations and prevents growth of different organs' in higher concentrations) or it played role in production of auxin inductors. In any case, effect of this compound or other similar compounds on increase or prevention of plants growth should be studied more [4]. On the other hand, many researchers believe that different isolates of *Trichoderma spp.* stimulate growth of plants by producing biochemical materials or reduce effects of inhibiting effects of growth of some compounds, biological and chemical toxins in soil and even change rate of soil soluble elements [12], [8], [13]. Exudation of organic acids such as gluconic acid, citric acid and fumaric acid by Trichoderma species reduces pH of soil and finally increase solubility and absorb important micronutrients required for growth of plant such as iron, manganese, magnesium, mineral cations and phosphats [2], [12]. Thus, it can be expected that using the examined strains, optimal conditions for growth of plants such as lettuce can be better provided.

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Table 1: Analysis of variance of effect of Trichoderma fungi isolates on the growth characteristics of lettuce, cultivar Siaho.

Sources of changes	Degrees of freedom	Mean squares			
		Shoot fresh weight	Root fresh weight	Shoot dry weight	Root dry weight
Strains	3	465.46**	6.29**	3.39**	0.08**
Experimental error	15	59.66	0.53	0.22	0.01

** Significance at 1% probability level.

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Table 2: Comparison of the average effect of *Trichoderma harzianum* fungal isolates on lettuce growth traits.

Measured traits	Strain					
	Control	T_{14}	T_{20}	T_{65}	T_{95}	T_{Bi}
Shoot fresh weight (g)	15.11^{c}	15.04^{c}	16.34^{c}	21.15^{b}	17.14^{c}	24.25^{a}
Root fresh weight (g)	0.83^{c}	0.81^{c}	0.84^{c}	1.13b^{c}	0.95^{c}	1.65^{a}
Shoot dry weight (g)	0.82^{c}	0.80^{c}	0.85^{c}	0.92b^{c}	0.83^{c}	1.20^{a}
Root dry weight (g)	0.07^{c}	0.06^{c}	0.07^{c}	0.09b^{c}	0.08^{c}	0.124^{a}

* Numbers with dissimilar letters in each row have significant differences at the 5% probability level using LSD test.

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Study of anthocyanin content and Anthocyanin distribution location using ArcGIS software in natural habitat's violets (*Viola odorata*) in Iran

Narges Asadi . Alireza Babai

Abstract Ever Green sweet violet *(Viola odorata)* has been cultivated for cosmetics and medicine in Europe since antiquitythroughout most parts of the world. To measure the anthocyanin content of the flowers of violets, sampling with flowers was done in April 2013 of natural habitats Violets in forests of northern Iran. Samples at the locations sampled, were frozen in liquid nitrogen Then samples were transferred to Tarbiat Modares university and flowers frozen were placed in the freezer for subsequent experiments.Anthocyanin extraction was used Chiriboga and Francis's method. Anthocyanin data were entered Excell software. Then maps of the distribution of anthocyanin flower's violets in habitat areas, respectively Obtained using ArcGIS software. The results of total anthocyanin showed that lowest anthocyanin content were observed in the white flowers with 0.33 mg/l and the highest anthocyanin content were observed in the violet flowers with 66.12 mg/l.Also anthocyanin in the flowers of each group were statistically significant.

Keywords Anthocyanin, Anthocyanin distribution location ArcGIS software, Iran ,violet's flowers.

INTRODUCTION

The genus *Viola L*., the largest of the *Violaceae* family, comprises 525–600 species distributed(7) . Recent centers of morphological and taxonomic diversity are found mainly in the Northern Hemisphere(1) ,(18). *Viola odorata* has been cultivated for cosmetics and medicine in Europe since antiquitythroughout most parts of the world. *Viola odorata* L. (*Violaceae*), the familiar Sweet Violet, a native of southern Europe, north-western Africa, and western Asia (12). The familiar Sweet Violet contains a circular mini-proteins (cyclotides) that they have valuable medicinal properties(8).To date, the biological sources of cyclotides are plants belonging to Rubiaceae, Violaceae, Cucurbitaceae and Fabaceae (4). However, out of these, Violaceae stands out in that all of the so far investigated members have been found to containcyclotides ; moreover, the large share of the cyclotides known today are isolated from Violaceae species. Cyclotides are gene-encoded plant mini-proteins that contain a unique circular and cystine knotted amide backbone(14). Because of that ultra stable scaffold and the ability to harness a wide variety of sequences and biological activities within the scaffold, cyclotides find interesting potential applications for drug discovery and in agriculture(5). The potential applications of cyclotides in the discovery include the employment of the ultra-stable framework as a scaffold to unstable drugs, and also theuseof cyclotides for the inherent biological/pharmacological properties they exhibit across a wide range of biological systems. Their effects include anti-HIV (2),(4). Several studies suggest that natural anthocyanins found in fruits and vegetables have a negative impact on many cardiovascular diseases(13). Kamei *et al* (1995) reported that anthocyanins more than other flavonoids are effective to inhibit the growth of tumor cells. Also Anthocyanins may have anti-cancer properties(3),(10). The flowers violets are containing anthocyanins. Anthocyanins are pigments flavonoids that responsible for red, purple and blue colors in the fruits and flowers(9),(15),(16).

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Material and Methods

-Measurement of total anthocyanins

To measure the anthocyanin content of the flowers of violets, sampling with flowers was done in April 2013 of natural habitats violets in forests of northern Iran. A total of 34

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individuals from of Viola were collected in the northern provinces of Gilan, Mazandaran and Golestan . Figure 1: Map of the location - areas with Ever Green sweet violets(*V.oderata*), using Google Earth software (Google earth)

Figure 1: Map of the location - areas with Ever Green sweet violets(V.oderata), using Google Earth software (Google earth)

Flowers collected from the color were segregated in three colors ; Violet, Pale purple and White flowers.Samples at the locations sampled, were frozen in liquid nitrogen Then samples were transferred to Tarbiat Modares university and flowers frozen were placed in the freezer for subsequent experiments.

In this study, anthocyanin extraction was used Chiriboga and Francis's method. 0.1 g of flower was powdered in liquid nitrogen and was dissolved with 1 mL of acidified methanol. Then it Was placed in the dark for a day to be completely extracted.

The total anthocyanin content was measured using the pH difference. This method using, absorption spectrophotometry were measured at wavelengths of 520 and 700 nm with buffers with different pH: 1 and 4.5. These buffers were used; potassium chloride (0.025 M, pH=1) and Sodium acetate (4.5 M, pH=4.5). The total anthocyanin content According mg/L of cyanidin 3 - glucoside was calculated using the following formula:

Absorbance (A) = (A520 pH 1- A700 pH1) – (A520 pH 4.5- A700pH4.5)

Total anthocyanin (mg/L) = (A/26900) (10 3) (445.2) (20)

-Anthocyanin distribution maps using ArcGIS software

Anthocyanin data were entered Excell software. Then maps of the distribution of anthocyanin violet flowers in habitat areas, respectively obtained using ArcGIS software. The maps based on anthocyanin in flowers According to flower color; (Violet, Pale purple, White) were prepared separately.

results

-The results of total anthocyanin

Lowest anthocyanin content were observed in the white flowers with 0.33 mg/l and the highest anthocyanin content were observed in the purple flowers with 66.12 mg/l. Also anthocyanin in the flowers of each group were statistically significant.

The highest amount of anthocyanins in violet flowers grup (v) were observed in flowers collected of Neka with 66.12 mg/l and the lowest anthocyanins in violet flowers grup (v) were observed in flowers collected of Qasim Abad ;Roudsar with 20.4 mg/l.

The highest amount of anthocyanins in pale purple flowers grup (p) were observed in flowers collected of Amol with 16.36 mg/l and the lowest anthocyanins in pale purple flowers grup (p) were observed in flowers collected of Noshahr with 2.33 mg/l.

The highest amount of anthocyanins in white flowers grup (w) were observed in flowers collected of Neka with 21.7 mg per litr and the lowest anthocyanins in white flowers grup (w) were observed in flowers collected of Bshl with 0.33 mg per litr.

Results anthocyanin in flowers are given in Tables 1 ,2 and 3.

Table 1- amount of anthocyanins in Violet flowers grup (v)

cod	anthocyanin content mg/l
Ghasem abad	20.04
Beshel	22.04
Noshahr	22.79
Siyah cal	23.71
Cisangan	23.71
Salman shahr	25.38
Ghaem shahr	27.39
Komele	32.73
Beh shahr	33.06
Kashpel	33.4
Amlash	34.4
Amol	37.4
Namakabrud	41.08
Shirgah	41.08
Babol	42.41
Sari	48.26
Neka	66.12

Table 2- amount of anthocyanin in pale purple flowers grup (p)

cod	anthocyanin content mg/l
Noshahr	2.33
Kashpel	3.3
Kochesfahan	11.02
Cisangan	12.02
Namakabrud	13.7
Amol	16.36

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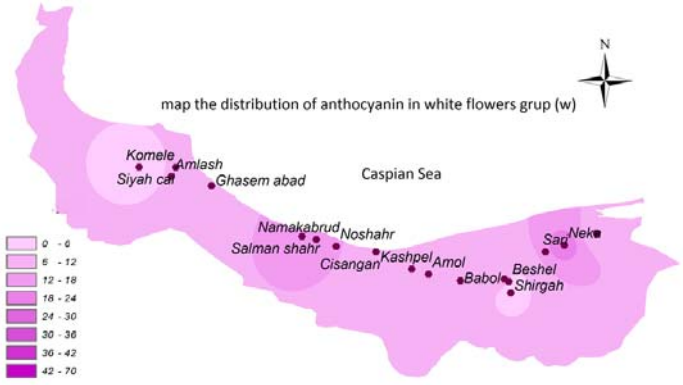
Table 3- amount of anthocyanin in white flowers grup (w)

cod	anthocyanin content mg/l
Beshel	
Shirgah	4
Siyah cal	4.34
Beh shahr	8.35
Kashpel	8.69
Amol	10.35
Ghasem abad	10.68
Ghaem shahr	13.35
Salman shahr	14.7
Neka	21.7

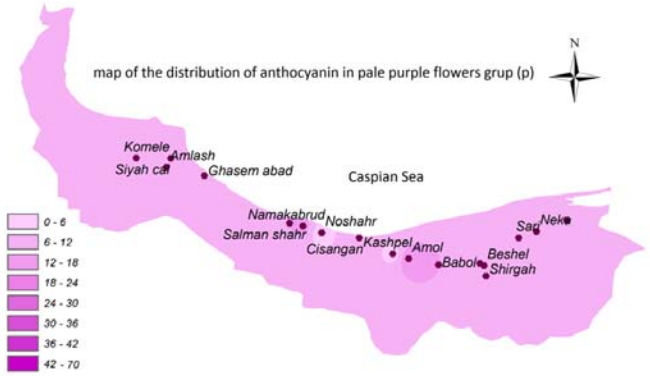
-Results anthocyanin distribution maps using ArcGIS software

According to the map the distribution of anthocyanin in violet flowers grup (v), anthocyanin content was in flowers collected from the East Caspian Sea (Mazandaran Province) more than anthocyanin content in flowers collected from the West Caspian Sea (Gilan province).

According to the map the distribution of anthocyanin in white flowers grup (w) , anthocyanin content was in flowers collected in the East and West sides of the Caspian Sea, more than anthocyanin content in flowers collected from the central part of the Caspian Sea.



According to the map the distribution of anthocyanin in pale purple flowers grup (p), anthocyanin content was in flowers collected in the East and West sides of the Caspian Sea, less than anthocyanin content in flowers collected from the central part of the Caspian Sea.



Discussion

According to the Map of the location - areas with Ever Green sweet violets*(V.oderata)*and growing areas of violets Can be offered in these areas large-scale cultivation of medicinal violets.

According to distribution maps seem to anthocyanin content in flowers collected from Shirgah Bshl similar to amount of anthocyanin flowers are collected from West Caspian Sea (Gilan province). one of the reasons Might be similar to the weather of these regions or the same soil type them togheter.

Also It seems to light up has a positive impact in Creation anthocyanins in the flowers so that the flowers of plants grown in the East Sea (Golestan) that the weather of these regions are fewer rainy and more sunny days with light than the West Caspian Sea (Gilan district), they have more anthocyanin content than flowers of plants grown are in the West Sea.

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The effect of different levels of salinity on seed germination of *Kochia prostrata*

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Abstract— In this study, the effect of salinity on seed germination of Kochia prostrata was studied. Factorial experiment in a completely randomized design levels (zero, 50, 100, 200, 400, 800 and 1600 mM sodium sulfate salt was studied in triplicate with seven of salinity. The results of variance analysis showed that there is no significant difference in the level of 5% of different levels of salinity on seed germination. Comparison of germination percentage mean showed that the germination of seed germination is reduced with increasing salinity. So that the lowest percentage of germination was 1600 mM Na_2so_4 and the highest germination percentage of the control. We were observed Substantially reduced from 800 mM to 1600 mM Na_2so_4 (zero percent).

Keywords— Germination, Salt, Seeds, *Kochia prostrata*

I. INTRODUCTION

Salinity and temperature are important environmental factors that sustainability threaten in arid and semi-arid , particularly where evapotranspiration is greater than precipitation [6]. More than 800 million hectares (approximately 7 %) of the land is affected by salinity [17] .

The extent of saline soils in Iran is 24 million hectares, equivalent to 15% of the country's territory . Preservation and development of rangelands desert areas vegetation is one of the biological ways of Dedesertification and rangelands management strategies as natural ecosystems. The most suitable species for the ranglands releveant are native species and compatible with environmental conditions , with high forage value, effective in soil stabilization and environmental protection Unfortunately, this species have been destruct of due to the practical rangelands exploitation of severely. So that, restoration of desert areas where are difficult ecological conditions, it seems to be necessary [10]. There of the halophytes on saline land depends on resistance to salt stress at different stages of the life cycle [16]. One of the most important stages of life cycle halophyte is seed germination stage, because the terms that are exposed later can be characterized [4]. The salt whit Reducing availability seed to water or interfere with some aspects of metabolism, such as growth regulators changing the balance will prevent of seed germination [13]. The first step in the restoration of vegetation in these areas is study germination and establish of species has been in such sites. Therefore, the results of such studies can be effective in management of plant communities and proper harvest of plant species. The studied species whit scientific name of *Kochia prostrata,* plant is shrub and permanent of Chenopodiaceae, by varieties and ecotypes that have adapted to different climates. In Central Asia, this species is used for reclemationof the dry areas. This species in arid , semi -arid are used to make fuel for nomads. Horses and camels have a keen interest in this plant . desert , semi-desert , arid and semi-arid Central Asia, the Caucasus , Turkey , Tibet , central Russia and Iran native, This species is sparse in different parts of Iran, including Damavand , Karaj, south of Tabriz, Urmia, Sabzevar, Shhreza, Golpaygan, Arak, Lorestan [15]. This research aims to understand the impact of different levels of salinity on the germination of Kochia prostrata and determine the salinity tolerance threshold of these. Although the conservation and protection of rangelands plants, especially native palatable and key species in rangelands Rehabilitation, it is inevitable to avoid

II. LITERATURE

According to Shanone(1984) In many plants, the most sensitive stage of the life cycle of plants towards salinity is germination and flowering. While Grim and Campbell (1991) The most sensitive plants to salinity know during seed germination and early seedling growth. In addition, it has been determined that the seed germination index , germination percentage and germination rate are the most important affected in salinity conditions [18]. Stone et al (1979) reported that alfalfa in the early stages of growth is extremely sensitive to salinity and at seed germination stage, there is interaction between salinity and temperature . Askaryan (1382) The effect of salinity on germination and establishment of two types of tree species Elymus junceus and Kochia prostrata stated that with increasing salinity, decreases germination , growth and species weight. Gulzar t al (2001) also reported that seeds germinated woman setulosa Urochondra were decreased with increasing salinity and decreasing germination percentage with Increasing the temperature from 25 to 35^0c compared to the temperature change from 15 to 20 ° C is more severe.

III. MATERIAL AND METHODS

To study the effect of different levels of salinity on seed germination and growth of K. prostrata seeds of this species collected of the

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Markazi province Rangelands in the fall 1391 were collected seeds were sterile by sieving and hand. with its checks and empty and pesticides seeds were removed from the set goals. Then, each of the 10 sets of 100 of seeds selected randomly and was measured. In this study, a factorial experiment was conducted in a CRD with three replications, treatments consisted of listed three range species in above, seven different levels of brine solution containing Na_2so_4 pure with concentration(0, 50, 200, 400, 800 and 1600 mM) and temperature 15°C.

Table1. Determination of Thousand grain weight

Specie	Thousand grain weight
K. prostrata	2.5

befor the test seeds were disinfected by sodium hypochlorite 5% superficially the term 2 minute and were washed several times with distilled water again. After sterilizing all instruments ranging from a petri dish , pipette , forceps 2 hours in incubation, the number 20 seed was used disposable Ptrydish whit diameter 10 cm contains a number of Whatman filter paper. To Each Petri dish added 5 mL solution of Na_2so_4 in various concentrations and after placing a filter paper was closed petri door. on each Petri was posted replications , respective treatments and iteration Petri dishes containing the seeds of the studied species were used to 28 days of treatment 15^0c with 16-hr light and 8 h dark period in the growth chamber (Germinator). To evaluate germination was count germinated seeds every 24 hours . Seeds to germinated , the seeds are that embryo is split your cover and exposed after beginning growht and roots out is of seed to size of 1 mm . Counting was continued until the increase was not been found in the number of germinate seed and the case was fixed for 5 consecutive days . data from counts of germinated seeds the last day was used result to calculate germination percentage:

$$GP = \Sigma [n / N] * 100 \qquad (1)$$

In this equation: n = number of germinated seeds, N = total number of seeds, GP = percentage of germination [3].

Data analysis: The analysis of data was performed using MSTAT-C and SPSS17 software. After normalizing the data and ensure the necessary conditions for the analysis, comparison mean was performed whit Duncan test. Excel software was used in the charts.

IV. CONCLUSIONS AND RECOMMENDATIONS

The relationship between Ec and Molar of Na_2So_4

The results show that increasing the concentration of Na_2So_4 increases salinity.

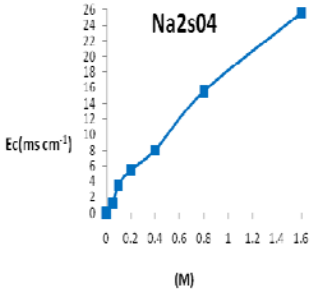

Fig 1. Fitting regression line Relation between concentration and salinity of Na_2So_4

Effect of salinity on seeds germination of *K. prostrata*

Analysis of variance for germination of *K. prostrata* at 15 ° C under different levels of salinity, sodium sulfate indicate significant differences between treatments.

Table 2. Variance Analysis of Salinity seven levels of Na_2So_4- Germination of *K. prostrata* at Temperature 15^0C

Df	Mean Square	F Value
2	3431.46	144.133*

*: Significant differences at 5% level.

Comparison of means by Duncan on germination of *K. prostrate* at temperature 15 ° C indicates that the reduction in germination with increasing salinity Na_2So_4 takes place slow and slow process and treatment means are placed in several classes.

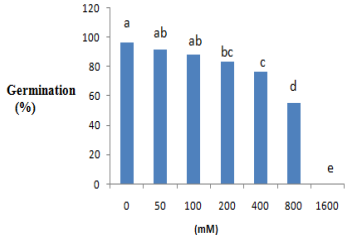

Fig 2. Comparision of Germination Mean of *K. prostrata* at Different Consentration of Na_2So_4 at Temperature 15^0c

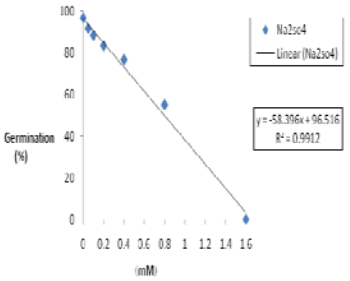

Fig3. Between concentration of Na_2So_4 and germination of *K. prostrata* at Temperature 15^0c

In the present study, germination *K. prostrata* of family Chenopodiaceae was performed to concentration 1600 mM. high concentration of Na_2So_4 in plant has been unsuitable enviormental provide for seeds germination. So that increasing salinity decreased germination percentage. Minimum of germination percentage was salinity level 1600 Mm.

decreasing germination with increasing solute is a situation that can be observed in many plant species . Similar results have been reported by the Nezami et al (2009) on *K. scoparia*, Rasouli *et al* (2010) on *Seidlitzia rosmarinus*, Pooresmaeil(2002) in *Suaeda fruticosa*, Farkhah (2002) in *Aleluropus, Alhagi and Salsola,* Ji Song et al in *Kalidium foliatum Halostachy caspica and Halocnemum strobilaceum* .

Generally, decreasing germination with increasing salt concentration in inviormental is dissolved, as a result the physicochemical effects or because of toxic - osmotic effects solutes in salt. In fact , with

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increasing osmotic pressure (osmotic potential becomes more negative) resulting from increasing salinity , on the one hand , the flooding has disrupted the seed and on the other hand , the presence of high concentrations of anions and cations (especially Na^+ and Cl^-) in environment , with the poisoning of seed is prevented of germination its[18, 11].

The results also showed that seeds *K. prostrata* passing through the salt concentration of 800 mM show a considerable reduction in germination. However several studies was performed in the field resistance of plants against salinity different results are obtained in different growth periods. So that some plants at germination stage have shown your littleresistanse against salt stress but at other stages of growth have greater resistance than salinity[20].

The rates obtained in this study will be the case only the germination and early growth stage.

These reports show that halophyte can function as a conventional irrigated crops are party size . Due to high levels of salt ranglands and reduce available forage crop can be used to planting these plants, especially *K. prostrata* In addition to providing animals food , in order to reduce the level of salt in the soil. Given the importance of salt in Iran and also there various species in country will be suggest this experiment to be on a broaer scale and the area surface and the result of its to be relevant export. To tolerant to salinity species due to their forage and medicinal value will be offered to society of natural resources (especially in arid and semi-arid).

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Predicting surface runoff using a moisture-related runoff coefficient in the spatially distributed hydrological model, wetspa

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Abstract— This paper explains how the WetSpa models calculate surface runoff. Since this method does the computation of runoff in an interesting rantional way, therefore the paper tries to give a detail explanation about it. A spatially distributed hydrologic model (WetSpa) is used to estimate daily/hourly runoff and river water discharge for each grid cell in the erea basin. The model combines topography, landuse and soil maps, and observed daily/ hourly meteorological time series to predict discharge hydrographs and the spatial distribution of hydrological parameters in the catchment. The discharge hydrograph at the outlet is composed of three components, i.e. surface runoff, interflow and groundwater flow. The model was applied on the Dinvar watershed in the Karkheh river basin of Kermanshah, with 72 months of meteo-hydrological measurements. In this study, a moisture-related runoff coefficient method is propose for calculating surface runoff in each grid cell, which allows the actual runoff coefficient to vary in time, and in function of rainfall intensity, rainfall duration and cell characteristics, giving an approximation to the surface runoff volume at each time step. The simulation results show that the model predicts the daily hydrographs with a good accuracy, 66% according to the Nash-Sutcliffe and the simulated total runoff volume is 48.01 that composed of surface runoff (2.4%), groundwater flow (21.28%), and Interflow (25.7%) and finally amount simulated total runoff(48.01) correspond measured total runoff (48.07).

Keywords—: Surface runoff, Moisture - related runoff coefficient, Wetspa model, Karkheh River.

I. INTRODUCTION

Incident rainfall first encounters the plant canopy, which intercepts all or part of the rainfall until the interception storage capacity is reached. The excess water reaches the soil surface and can infiltrate the soil zone. Water that does not infiltrate goes to depression storage, and is diverted as surface runoff along with depression storage simultaneously. The depression storage is subject to evaporation and further infiltration. The sum of the interception and depression storage forms the initial losses at the beginning of a storm, and does not contribute to the storm flow. A fraction of the infiltrated water percolates to the groundwater storage and some is diverted as interflow. Soil water is also subject to evapotranspiration depending on potential evapotranspiration rate and available soil moisture. Groundwater discharges to the nearest channel according to the groundwater storage and the recession coefficient. Evapotranspiration from groundwater storage is also accounted, which gives the effect of a steeper recession during dry period. Total runoff from a grid cell is then the summation of surface runoff, interflow and groundwater discharge. The model simulation the hortonian overland flow and the variable-source area concepts of runoff generation. The model takes Hortonian flow as the main overland flow process, which occurs when rainfall intensity exceeds the infiltrability of soil. However, for a complex terrain, particularly suburban and urban areas, precise estimation of infiltration parameters is rather difficult due to the high heterogeneity of the land and soil characteristics. Hence, simplified methods are still widely used by the hydrologists for surface runoff estimation in water resources planning, design and practices, for instance the rational method and the soil conservation service (SCS) method. The rational formula is the most commonly used method of determining peak discharge from small drainage areas since it was developed in the late nineteenth century [1]. This method is traditionally applied to design storm sewers, channels, and other drainage structures by making use of intensity-duration-frequency (IDF) curves, which are statistical summaries of the historical precipitation records. Since the method does not produce a hydrograph, and does not account for the change of time dependent conditions such as soil moisture or rainfall intensity, it is in general incapable to predict floods that result from individual predefined runoff events [2]. The SCS method is an empirical approach to estimate infiltration within a

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watershed, in which the runoff depth is calculated as a function of the rainfall and the SCS retention factor, which is estimated from the land surface properties using an empirical relationship depending upon a curve number [1]. The SCS method is widely used for estimating floods in small to medium-sized ungauged catchments in the US. However, intensive calibrations need to be performed for the model parameters against local conditions when applying this method to other areas. The paper tries to give a detail explanation about it.

Model history:

In applied hydrology, the prediction of peak flow and the simulation of flood hydrographs in a stream or river is a very complex process, because the hydrological variables vary both in space and time as a function of the meteorological inputs, topography, land use and soil types [3]. WetSpa (Water and Energy Transfer between Soil, Plant and Atmosphere) is a distributed hydrological model originally developed by Wang et al. [3].and adapted for flood prediction by De Smedt et al. [4].and Liu [5]. And also another applied by several researchers for flood prediction and stream flow simulations (Bahremand et al., 2005,.,zeinivand, 2009. kabir, 2011. AzinMehr, 2012) [7,8,9,1]. A mixture of physical and empirical relationships is used to describe hydrological processes using a grid approach. The model predicts peak discharges and hydrographs in any location of a channel network4 and the spatial distribution of hydrological characteristics. Hydrological processes in each grid cell are set in a cascading way, starting from a precipitation event. Incident precipitation first encounters the plant canopy, which intercepts all or part of the precipitation until the interception storage capacity is reached.

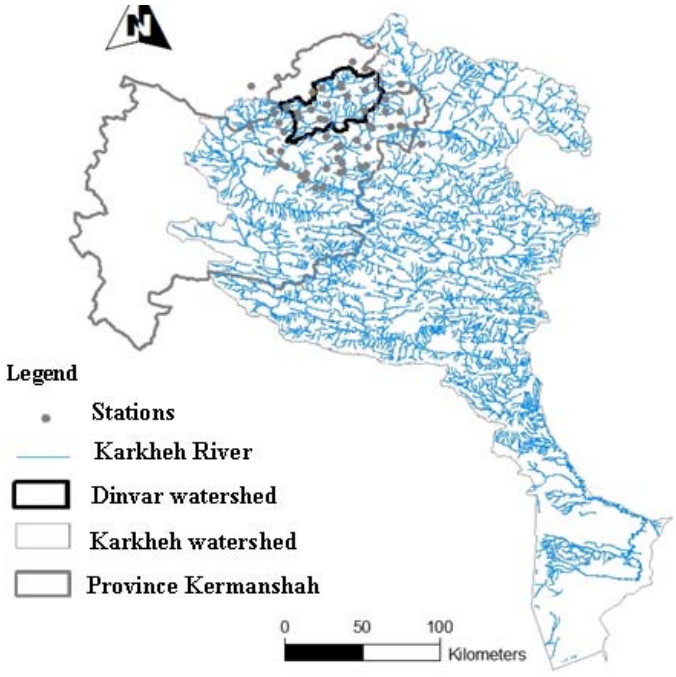

Figure 1. Location of the Dinvar watershed in province Kermanshah in upstream of Karkheh dam

II. MATERIALS AND METHODS:

Dinvar watershed:

The Dinvar basin is located in province Kermanshah, Iran and the river is a tributary of the Karkheh River. The watershed has an area of 1717 km^2 up to Karkheh dam and a perimeter of 285 km^2 with elevation ranging from 1336 to 3377 m. the most rivers of the watershed are Permanent and lead to the Dinvar rivers(Fig 1) and the mean slope about 19.27% (Fig 2). The mean annual precipitation of the watershed is 549.1(mm/y) and the mean annual temperature of the watershed is about 13.9(^{0}c). The annual potential evapotranspiration based method Blanney-criddle in the basin is 1623(mm/y). The climate of the basin is semi-arid cold to very wet. The warmest month in the dinvar basin is July and January is the coldest month of the year. The landuse types of the watershed are inclusive grassland and pasture, forest, agriculture area, gardens, a mixture of garden and agriculture, Wasteland, urban area, Floodplains. The watershed has two soil types which the dominant soil texture is clay loam, which covers about 97% of the basin area (fig 2).

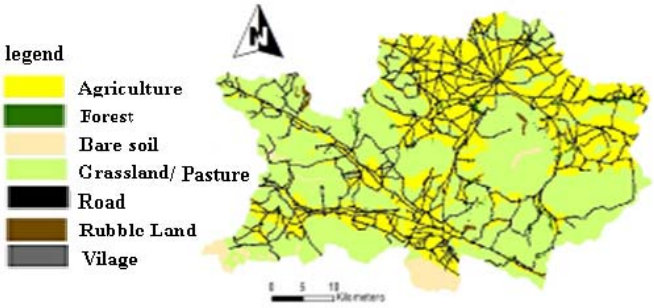

Figure 2. land use map of the Dinvar watershed

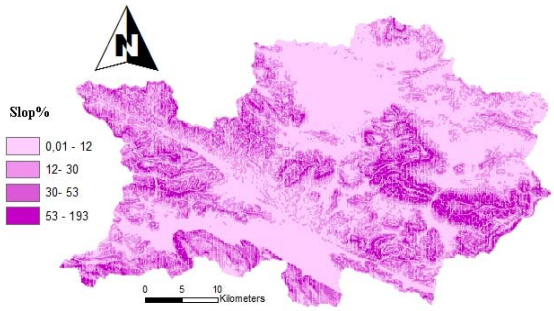

Figure 3. Slop map of the Dinvar watershed

Data preparation:

Daily hydrometeorological data were obtained from 2006 to 2012(6years) for use in the wetspa model that include

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precipitation, temperature, evaporation and discharge (for evaluation of the model). Also three base map, i.e. DEM, landuse and soil types are prepared in the GIS from using 100× 100 m cell size.

The WetSpa hydrological model:

WetSpa is a grid-based distributed hydrologic model for water and energy transfer between soil, plants and atmosphere, For each grid cell, four layers are considered in the vertical direction, i.e. the plant canopy and soil surface, the root zone, the soil percolation zone, and the groundwater zone. The hydrologic processes considered in the model are precipitation, interception, depression, surface runoff, infiltration, evapotranspiration, percolation, interflow, ground water drainage, and water balance in the root zone and the saturated zone (Fig 4). The model predicts peak discharges and hydrographs, which can be defined for any numbers and locations in the channel network, and can simulate the spatial distribution of basin hydrological variables (Fig 5).

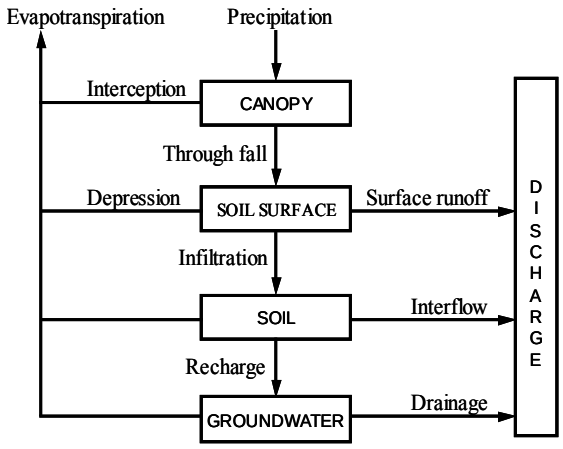

Figure 4. Model structure at pixel cell level

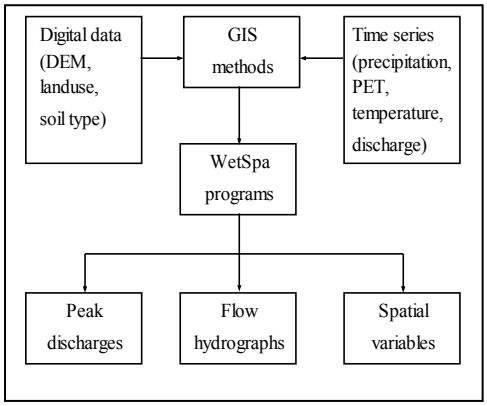

Figure 5. Inputs and outputs of the model

The surface runoff or rainfall excess is calculated using a moisture-related modified rational method with a potential runoff coefficient depending on land cover, soil type, slope, rainfall intensity, and antecedent soil moisture. The values of potential runoff coefficient are taken from literature and a lookup table is generated, linking values to slope, soil type and land-use classes [6]. The routing of overland flow and channel flow is implemented by the method of the diffusive wave approximation [6]. An approximate solution using a two-parameter response function, termed average flow time and the standard deviation of the flow time, is used to route water from each grid cell to the basin outlet or a selected convergent point in the basin. The flow time and its variance are determined by the local slope, surface roughness and the hydraulic radius for each grid cell. The flow path response function at the outlet of the basin or any other downstream convergence point is calculated by convoluting the responses of all cells located within the drainage area in the form of the probability density function. This routing response serves as an instantaneous unit hydrograph and the total discharge is obtained by convolution of the flow responses from all spatially distributed precipitation excesses generated in the grid cells. Because groundwater movement is much slower than the movement of water in the surface and near surface water system, and little is known about the bedrock, groundwater flow is simplified as a lumped linear reservoir on small GIS derived sub-basin scale. Considering the river damping effect for all flow components, overland flow and interflow are routed firstly from each grid cell to the main channel, and joined with groundwater flow at the sub-basin outlet. Then the total hydrograph is routed to the basin outlet by the channel response function. The total discharge is the sum of overland flow, interflow and groundwater flow, and is obtained by a convolution integral of the flow responses from all grid cells. An advantage of this approach is that it allows to take into account spatially distributed runoff and hydrological parameters. Inputs to the model include digital elevation data, soil type, land-use data, and measured climatologic data. Stream discharge data is optional for model calibration. All hydrological processes are simulated within a GIS framework, and model equations are physically based and well supported by previous studies.

Equation of The computation surface runoff in the model:

In this study, a moisture-related runoff coefficient method is proposed for calculating surface runoff in each grid cell, which allows the actual runoff coefficient to vary in time, and in function of rainfall intensity, rainfall duration and cell characteristics, giving an approximation to the surface runoff volume at each time step. The initial losses due to interception and depression are considered separately in the formula:

$$V = c_s c_r (P - I_a) - D_a \quad (1)$$

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where V [LT^{-1}] is the surface runoff in depth over the time, P [LT^{-1}] is the rainfall intensity, I_a [LT^{-1}] is the interception loss, D_a [LT^{-1}] is the depression loss, c_s [-] is a moisture related coefficient relying on the relative soil moisture content of the root zone, and c_r [-] is the potential runoff coefficient.

The components of the Equation surface runoff:
moisture related coefficient(this is most important part of the Equation surface runoff):
The moisture related coefficient, c_s is time dependent and calculated as a function of the soil moisture and rainfall intensity as:

$$c_s = (\theta_t / \theta_s)^{\alpha} \quad (2)$$

Where θ_t [L^3L^{-3}] is the soil moisture content at time t [T], θ_s [L^3L^{-3}] is the soil porosity, and α [-] is an exponent variable reflecting the effect of rainfall intensity and the modelling time step on the volume of surface runoff, which can be expressed as:

$$\alpha = Min\left[1, \alpha_0 + \frac{1-\alpha_0}{P_m} P\right] \quad (3)$$

in which α_0 [-] is the exponent at a near zero rainfall intensity, $\alpha_0 \geq 1$, and P_m [LT^{-1}] is the rainfall intensity, over which α equals 1 and the volume of surface runoff will not be affected by the rainfall intensity. Normally, α_0 approaches to 1 for a short time interval, and increases when the time scale is enlarged. These two parameters mainly affect the amount of surface runoff for small storms so that more water will infiltrate into the soil. P_m has no sense if α_0 is set to 1 for which a linear relationship is assumed between the surface runoff and the soil moisture content. Equation (1) reveals that the surface runoff achieves its potential rate when the soil is saturated, and approaches to zero as the soil dries out. This is logical from a hydrological point of view that wet soil tends to produce more surface runoff, and dry soil tends to give more infiltration.

Potential runoff coefficient:
The runoff coefficient of a grid or catchment is the ratio of runoff volume to rainfall volume. A simple and practical technique is developed in WetSpa model to estimate the runoff coefficient under varying land use, soil type, slope, rainfall intensity and antecedent soil moisture condition. Undoubtedly, these variables act independently but also interact in their effect on the runoff coefficient. A table of potential runoff coefficient is built for deferent land use, slope and soil type combinations and under the condition of near saturated soil moisture(Table 1)

Tabel1. Potential runoff coefficient for diffrent land use, soil type, slope.

Land use	Slope (%)	Sand	Loamy sand	Sandy loam	Loam	Silt loam	Silt	Sandy clay loam	Clay loam	Silty clay loam	Sandy clay	Silty clay	Clay
Forest	<0,5	0.03	0.07	0.10	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40
	0,5-5	0.07	0.11	0.14	0.17	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44
	5-10	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50
	>10	0.25	0.29	0.32	0.35	0.39	0.42	0.45	0.49	0.52	0.55	0.59	0.62
Grass	<0,5	0.13	0.17	0.20	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50
	0,5-5	0.17	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44	0.47	0.51	0.54
	5-10	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60
	>10	0.35	0.39	0.42	0.45	0.49	0.52	0.55	0.59	0.62	0.65	0.69	0.72
Crop	<0,5	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60
	0,5-5	0.27	0.31	0.34	0.37	0.41	0.44	0.47	0.51	0.54	0.57	0.61	0.64
	5-10	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70
	>10	0.45	0.49	0.52	0.55	0.59	0.62	0.65	0.69	0.72	0.75	0.79	0.82
Bare soil	<0,5	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70
	0,5-5	0.37	0.41	0.44	0.47	0.51	0.54	0.57	0.61	0.64	0.67	0.71	0.74
	5-10	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80
	>10	0.55	0.59	0.62	0.65	0.69	0.72	0.75	0.79	0.82	0.85	0.89	0.92
IMP		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The potential runoff coefficients for impervious (including open water surface) are set to 1.In addition, surface slope is discritized into 4 classes as shown in Table 2. Values in the table are taking the reference from literature [11]. In order to estimate the potential runoff coefficient on the basis of a continuous slope, a simple linear relationship between potential runoff coefficient and surface slope is used, which can be described as:

$$C = C_0 + (1 - C_0)\frac{S}{S + S_0}$$

where C is the potential runoff coefficient for a surface slope S (%), C0 is the potential runoff coefficient for a near zero slope corresponding to the values listed on the first row of each land use class in Table 2, and S0 (%) is a slope constant for different land use and soil type combinations, as listed in Table 2, which is calibrated using the data in Table 2.

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Table 2. Slop constant S0 for determining potential runoff coefficients

Land use	Sand	Loamy sand	Sandy loam	Loam	Silt loam	Silt	Sandy clay loam	Clay loam	Silty clay loam	Sandy clay	Silty clay	Clay
Forest	0.680	0.650	0.620	0.590	0.560	0.530	0.500	0.470	0.440	0.410	0.380	0.350
Grass	0.580	0.551	0.522	0.493	0.464	0.435	0.405	0.376	0.347	0.318	0.289	0.260
Crop	0.500	0.471	0.442	0.413	0.384	0.355	0.325	0.296	0.267	0.238	0.209	0.180
Bare soil	0.420	0.393	0.365	0.338	0.311	0.284	0.256	0.229	0.202	0.175	0.147	0.120

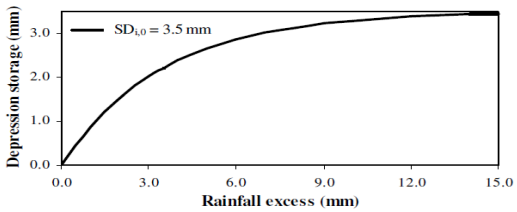

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Figure 6. Gives a graphical presentation of the grid potential runoff coefficient for a forest cover as a function of slope and different soil types

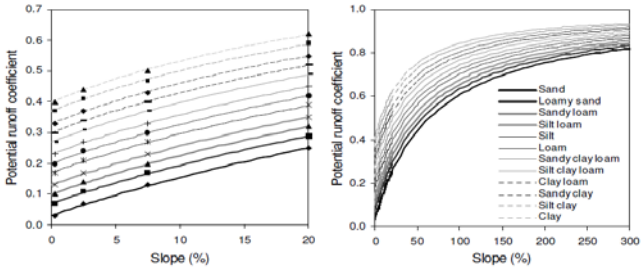

Figure 7. Potential runoff coefficient vs. Slop for forest and different soil types

The left figure of Figure 7 shows the potential runoff coefficient for a slope rangingfrom 0 to 20% and the supporting points, and the right one shows the potential runoff coefficient for a slope ranging from 0 to 300%. Clearly, the potential runoff coefficient approaches to C0 when slope is very small, and 1 when slope is infinite. The figure also shows that the changing magnitude of potential runoff coefficient is decreasing along with the increasing of surface slope. This conforms that the runoff volume for a certain amount of rainfall is less or even not affected by slope beyond a critical slope [12]. The influence of urban areas to the storm runoff is self-evident. Due to the grid size, cells may not be 100% impervious in reality. In WetSpa model, the remaining area is assumed to be pervious and covered by grass, and therefore, the potential runoff coefficient for urban areas is calculated as:

(5)

$$C_u = IMP + (1 - IMP)C_{grass}$$

where Cu and Cgrass are potential runoff coefficient for urban and grass grid, and IMP is theproportion of impervious area. Table 3 is developed to associate an impervious cover percent with several of the specified land use categories. Impervious percent for residential area, commercial and industrial is estimated based on the information in Chow et al. [13]. Other estimates are considered reasonable guesses. Zero impervious percent is assumed for land use categories not listed (i.e. agriculture, grass land, and forest land).

Tabel 3. Impervious percentage with selected land use classes

No.	Land use description	Impervious percent (%)
1	Residential area	30
2	Commercial and industrial area	70
3	Mixed urban or built-up land	50
4	Transportation and communication utilities	100
5	Streams, Canals, lakes and reservoirs	100
6	Forest wetland	100
7	Bare exposed rock	100

In case the model is applied to a medium or large watershed, direct flow generated from the flow surface becomes an essential part of the storm runoff.

Excess rainfall, (P - Ia):

The first term on the right side of Equation (1) is the excess rainfall calculated with the net precipitation (P - Ia) multiplied by a potential runoff coefficient and a moisture related coefficient. The difference between net precipitation and excess rainfall is the amount of infiltration into the soil(Fig 8).

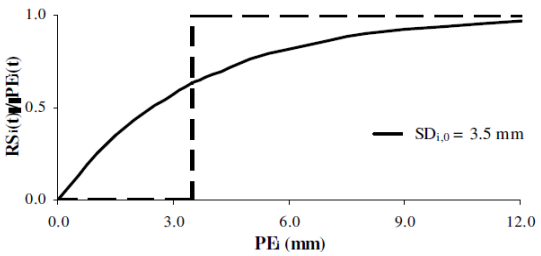

Figure 8. Graphical presentation of excess rainfall and overland flow

Interception:

Interception is that portion of the precipitation, which is stored or collected by vegetal cover and subsequently evaporated. In studies of major storm events, the interception loss is generally neglected. However, it can be a considerable influencing factor for small or medium storms and water balance computations would be significantly in error if evaporative losses of intercepted precipitation were not included.Mass balance of the interception storage Interception is a complicated process, which is affected by the storm characteristics, the species of vegetation, percentage of canopy cover, growth stage, season, and wind speed, etc. Interception loss is higher during the initial phase of a storm and approaches zero thereafter. In WetSpa model, the rainfall rate is reduced until the interception storage capacity is reached. If the total rainfall during the first time increment is greater than the interception storage capacity, the rainfall rate is reduced by the capacity. Otherwise, all rainfall is intercepted in the canopy, and the remainder of interception is removed from the rainfall in the following time increments. The equation can be expressed as:

(6)

where Ii(t) is the interception loss at cell i over the time interval (mm), Ii,0 is the cell interception storage capacity (mm), SIi(t-1) is the cell interception storage at time step t-1 (mm), and Pi(t) is the cell precipitation amount (mm). The mass balance of interception storage at a pixel cell is computed as:

(7)

$$SI_i(t) = SI_i(t-1) + I_i(t) - EI_i(t)$$

where SIi(t-1) and SIi(t) are cell interception storage at time step t-1 and t (mm), EIi(t) is the cell evaporation from interception storage (mm). EIi(t) = 0 when interception storage is zero, or during the storm event. EIi(t) = SIi(t-1) under the

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condition of Pi(t) =0 and EP > SIi(t-1) > 0, in which EP is the potential evaporation (mm). And EIi(t) = EP for the rest conditions. 2) Seasonal variation of interception storage capacity Interception storage capacity is a function of leaf area index and vegetal species. Evidently, it varies with season in template regions. Typical values can be found in the literature [11]. Through physical analysis and interpolations, a lookup table of maximum and minimum interception storage capacity corresponding to summer and winter extremes for different vegetation types are established (Table 4). Specifically, the interception storage capacity of crop is set to 0.8 mm during growing season and null for the rest. For wetting losses on impervious areas, the adsorption storage capacity is set to 0.5 mm [14]. Since the interception storage capacity varies continuously with time, a simple sine-shaped variation curve is proposed for the convenience ofmodel programming. The empirical equation is similar as that of estimating daily potential evaporation based on statistical analysis of long-term measurements [15], and is written as:

(8)

$$I_{i,0} = I_{i,\min} + \left(I_{i,\max} - I_{i,\min}\right)\left[\frac{1}{2} + \frac{1}{2}\sin\left(2\pi\frac{d-87}{365}\right)\right]^b$$

in which Ii,min is the minimum interception storage capacity at cell i (mm), Ii,max is the maximum interception storage capacity (mm), and d is the day of the year. The exponent b controls the shape of the variation curve, and can be adjusted according to the local conditions. Hourly interception storage capacity is assumed to be constant during a day in the model. Therefore, the interception storage capacity is only a function of the date. Figure 9 gives a graphical presentation for the annual variation of grass interception storage capacity, for which the minimum and maximum interception capacity is 0.5 and 2.0 mm respectively, and the exponent b is set to 1.35.

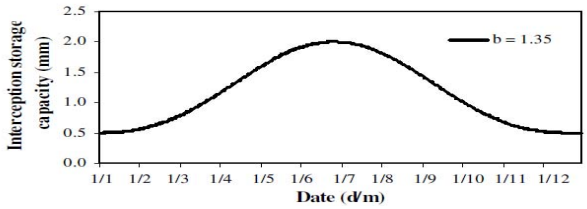

Figure 9. Annual variation of grass interception storage capacity

$$I_i(t) = \begin{cases} I_{i,0} - SI_i(t-1) & for\ P_i(t) > I_{i,0} - SI_i(t-1) \\ P_i(t) & for\ P_i(t) \le I_{i,0} - SI_i(t-1) \end{cases}$$

Table 4. Default parameters characterizing land use classes

Category	Cover	Interception capacity(mm)		Root	Manning's	Vegetated	Leaf area index(-)	
		Maximum	Minimum	depth(m)	Coefficient	fraction(%)	Maximum	Minimum
1	Evergreen Needleleaf Forest	2	0.5	1.0	0.40	80	60	50
2	Evergreen Broadleaf Forest	3	0.5	1.0	0.60	90	60	50
3	Deciduous Needleleaf Forest	2	0.5	1.0	0.40	80	60	10
4	Deciduous Broadleaf Forest	3	0.5	1.0	0.80	80	60	10
5	Mixed Forest	3	0.5	1.0	0.55	83	60	30
6	Closed Shrublands	3	0.5	0.8	0.40	80	60	10
7	Open Shrublands	2	0.5	0.8	0.40	80	60	10
8	Woody Savannah	3	0.5	1.0	0.50	80	60	8
9	Savannahs	2	0.5	0.8	0.40	80	60	5
10	Grasslands	2	0.5	0.8	0.30	80	20	5
11	Permanent Wetlands	1	0.2	0.5	0.50	80	60	5
12	Croplands	2	0.5	0.8	0.35	85	60	5
13	Urban and Built-Up	0	0.0	0.5	0.05	0	0	0
14	Cropland / Natural Vegetation	2	0.5	0.8	0.35	83	40	5
15	Snow and Ice	0	0.0	0.1	0.05	0	0	0
16	Barren or Sparsely Vegetation	1	0.2	0.5	0.10	5	20	5
17	Water Bodies	0	0.0	0.1	0.05	0	0	0

Obtained and Adapted from Dickinson et al. (1993), Lull (1964), Zinke (1967), Rowe (1983), Chow (1964), Haan (1982), Yen (1992) and Ferguson (1998).

By substituting Eq. (7) to Eq. (8), the interception loss and interception storage at each time step can be estimated. No interception loss exists when the interception storage capacity is achieved, and all precipitation reaches ground surface. The intercepted water in canopy loses by evaporation and returns to the hydrological cycle with potential evaporation rate modified by a correction factor. Although interception losses may be highly significant in the annual water balance, it is relatively unimportant for flood-producing storms.

Depression storage:
Precipitation that reaches the ground may infiltrate, or get trapped into several small depressions. Water held in depression at the end of rain either evaporates or contributes to soil moisture and subsurface flow by the following infiltration. Depression storage may be of considerable magnitude and may play an important role in hydrological analysis. Depression losses usually occur during the initial period of the storm and are negligible after a certain time. Factors that affect depression storage include: (1) nature of terrain; (2) slope, the more slope gradient, the less depression losses; (3) type of soil surface, the more sandy soil, the more depression losses; (4) land use, the more woody land. Due to the extreme variability of affecting factors, it is very difficult to specify general relationship for the depression losses. In WetSpa Extension, a simple empirical equation suggested by Linsley is used to estimate depression storage[16]:

$$SD_i(t) = SD_{i,0}\left(1 - \exp\left(-\frac{PC_i}{SD_{i,0}}\right)\right)$$

(10)

in which SDi(t) is the cell depression storage at time t (mm), SDi,0 is the cell depression storage capacity (mm), and PCi is the accumulative excess rainfall on the soil surface (mm). The concept of Eq. (10) is that both overland flow and depression storage occurs simultaneously, allowing some of the water delivering as overland flow, even if excess rainfall is less than

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the depression storage capacity. A sketch of SDi(t) as a function of Pei is shown in Figure 10.

Tabel 4. Depression storage capacity for different landuse, soil type and slope

Land use	Slope (%)	Sand	Loamy sand	Sandy loam	Loam	Silt loam	Silt	Sandy clay loam	Clay loam	Silty clay loam	Sandy clay	Silty clay	Clay
Forest	<0,5	8.00	7.50	7.00	6.50	6.00	5.50	5.00	4.50	4.00	3.50	3.00	2.50
	0,5-5	6.31	5.91	5.52	5.13	4.73	4.34	3.94	3.55	3.15	2.76	2.37	1.97
	5-10	3.92	3.68	3.43	3.19	2.94	2.70	2.45	2.21	1.96	1.72	1.47	1.23
	>10	1.92	1.80	1.68	1.56	1.44	1.32	1.20	1.08	0.96	0.84	0.72	0.60
Grass	<0,5	5.00	4.73	4.45	4.18	3.91	3.64	3.36	3.09	2.82	2.55	2.27	2.00
	0,5-5	3.94	3.73	3.51	3.30	3.08	2.87	2.65	2.44	2.22	2.01	1.79	1.58
	5-10	2.45	2.32	2.18	2.05	1.92	1.78	1.65	1.52	1.38	1.25	1.11	0.98
	>10	1.20	1.14	1.07	1.01	0.94	0.87	0.81	0.74	0.68	0.61	0.55	0.48
Crop	<0,5	3.00	2.86	2.73	2.59	2.45	2.32	2.18	2.05	1.91	1.77	1.64	1.50
	0,5-5	2.37	2.26	2.15	2.04	1.94	1.83	1.72	1.61	1.51	1.40	1.29	1.18
	5-10	1.47	1.40	1.34	1.27	1.20	1.14	1.07	1.00	0.94	0.87	0.80	0.74
	>10	0.72	0.69	0.66	0.62	0.59	0.56	0.52	0.49	0.46	0.43	0.39	0.36
Bare soil	<0,5	1.50	1.45	1.41	1.36	1.32	1.27	1.23	1.18	1.14	1.09	1.05	1.00
	0,5-5	1.12	1.09	1.05	1.02	0.99	0.95	0.92	0.88	0.85	0.81	0.78	0.75
	5-10	0.74	0.72	0.70	0.67	0.65	0.63	0.61	0.58	0.56	0.54	0.52	0.49
	>10	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.25	0.24
IMP		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

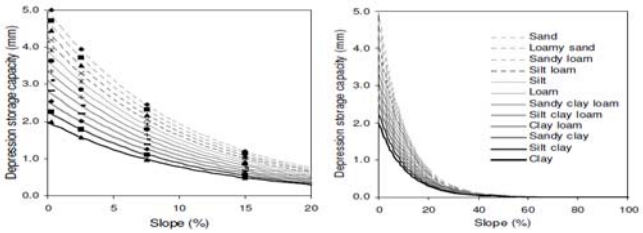

Figure 10. Depresssion storage capacities vs. Slop for grass and different soil types

II. RESULTS AND DISCUSSION

Model simulation:

Figure 11 shows the distribution of potential runoff coefficients that result from the different slope, soil type and land use class combinations. The watershed is covered by either dense plants or impervious areas. Impervious areas have a significant influence on runoff production, because they can generate direct runoff even during small storms. Due to the model grid size, cells may not be 100% impervious in reality. In this study, the percentage of impervious area in a grid cell is computed based on land use classes, with 30% for residential areas, 70% for commercial and industrial areas and 100% for streams, lakes and roads. Default runoff coefficients for these areas are calculated by adding the impervious percentage with a grass runoff coefficient multiplied by the remaining percentage. This results in potential runoff coefficients of 40 to 100% in urban areas, while other areas have much smaller values, down to 3% for forests in valleys with practically zero slopes. As it can be seen in Figure 10, the non-forested and steeper areas generate a very high runoff coefficient, whereas the forested and gentle slopes generate less surface runoff. The calculated average potential runoff coefficient is 0.71 for the entire catchment.

Evaluation results of the model:

One can notice a reasonable agreement between the simulation results and the observed hydrograph. Peaks in the hydrograph are rather well simulated, as well as for their shape and time of occurrence. From the 72 months simulation results, about 3.59% of the total rainfall is lost by interception, 33.19% of the total rainfall returns to the atmosphere as evapotranspiration, and 24.9% is recharged to the groundwater, which mainly happens during the winter season. The simulated flow volume is composed of surface runoff (2.4%), groundwater flow (21.28%), and Interflow (25.7%). Interflow is an important flow component in this study area, due to the fact that the slope is too small to generate lateral flow in the unsaturated zone. Infiltrated water either stays in the soil and is lost as evapotranspiration, or is recharged to the saturation zone for generation of baseflow. Floods occur frequently in the winter season, because of saturated soils and high baseflow, even though the storms were not very intensive. High surface runoff was mainly generated from the impervious areas and open water surfaces, while surface runoff for other areas was rather small, especially for the areas covered by forest and sandy soils. Therefore in the study, three years (2006-2009) of measured daily discharge data are used for model calibration. The evaluation criteria for the model performance are given in Table 5. Four evaluation criteria used by Hoffmann et al. are used[16]. The first one evaluates the ability of the model to reproduce the water balance. The accuracy of the model to simulate the discharge is evaluated with the Nash-Sutcliffe criterion. Two adapted Nash-Sutcliffe efficiencies are used to assess the model's performance for low flows and high flows respectively. 4 there is no significant difference between the two approaches and the performance is satisfactory for both methods. This indicates that the WetSpa model is able to simulate hydrologic processes in a spatially realistic manner including resulting in a fairly high accuracy for both high and low flows. For avaluatin results of the model, a graphical and statistical comparision between observed and calculated. In figure 11 a graphical comparision between calculated daily at Dinvar basin for the years 2006-2009 from the calibration period.

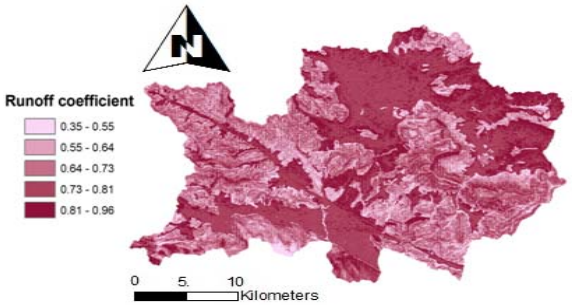

Figure 11: Distribution of potential runoff coefficient map of the Dinvar watershed

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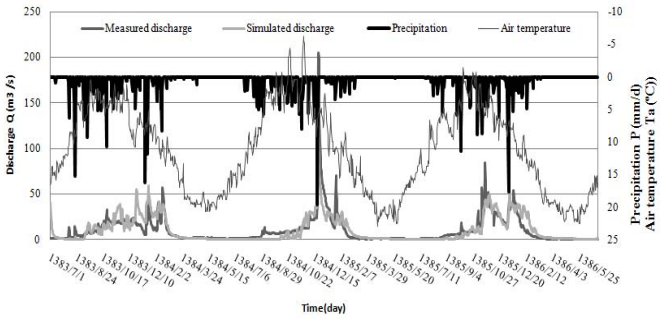

Figure 12. Graphical comparision between calculated daily at Dinvar basin for the years 2006-2009 from the calibration period

Table5. Evaluation criteria for the model performance

Code	Description	Value of the model
CR_1	Model bia for evaluating the ability of reproducing the water balance	0.6
CR_3	Model efficiency for evaluating the ability of reproducing all stream-flows	0.66
CR_4	Model efficiency for evaluating the ability of reproducing low flows	0.59
CR_5	Model efficiency for evaluating the ability of reproducing of high flows	0.72

IV. CONCLUSION:

In this paper, according to previous contexts presented, such resulting that high rainfall intensity or rainfall with long duration tends to give higher percentage of runoff. The product of c_s and c_f forms the actual runoff coefficient, which varies both with time and rainfall intensity depending upon the soil moisture content, and allows computing excess rainfall for each time step during the model simulation. In studies of major storm events, the interception loss is generally neglected. However, it may be a very significant factor for small or medium storms, and water balance computations would be significantly in error if evaporative losses of intercepted moisture were not included The sum of interception and depression losses forms the initial abstraction, which does not contribute to runoff. Depression storage may have a considerable magnitude and plays an important role in flood modelling for small or medium storms. in which the depression storage is assumed to be a function of depression storage capacity and increases exponentially with rainfall intensity up to the point where depression storage capacity is reached. This allows overland flow and depression storage to occur simultaneously. With the component of depression storage, the model can handle surface runoff production more properly. For instance, the depression storage capacity in forest areas is much higher than that of other land use areas. Hence, there will be no or little surface runoff generated in those areas during the initial phase of a storm or for a small rainfall, because most of the produced excess rainfall will contribute to the depression storage. Hence In such a way The generation of surface runoff depends upon rainfall intensity and soil moisture status and is calculated as the net precipitation times a runoff coefficient, which depends upon slope, land use and soil type. this results show that the spatially distributed model, WetSpa can be a good coputated and simulation by the mehtod a moisture- related runoff coefficient in compare with two the other ways are the rational method and the soil conservation service (SCS) method. Therefore in this study an attempt is made to outline a method for estimating flow hydrograph in the Dinvar basin by using detailed basin characteristics together with meteorological data as an in to the wetspa spatially distributed model. The 6 years (2006-2012) measured daily discharge data are used for model Performance. It is sufficient to note that for the 3 years calibration period the obtained model efficiency (Nash-Sutcliffe efficiency) is 0.66. Hence, the model calibration has been performed successfully. Model performance for calibration was evaluated through qualitative and quantitative measures, involving graphical comparisons and statistical analysis. Figure 12 gives the observed versus simulated peak flows selected from 72 months of meteo-hydrological measurements in the simulation period. The high peak discharges are reproduced reasonably well, while the estimations are slightly poorer for small flows. Simulation results show that the important runoff processes, which contribute to storm runoff, are mainly surface runoff from urban areas and partly from cropland, grassland for larger storms. Interflow from woodland, grassland and cropland forms the recession of the flow hydrograph, but also contributes considerably to the peak discharges for the flows in the wet season. The evaluation results are presented in Table 5. CR_1 is the model bias, for which the value 0 represents a perfect simulation of the flow volume. CR_2 is the Nash-Sutcliffe coefficient for evaluating the ability of reproducing the time evolution of flows with a best value of 1. CR_3 is a logarithmic transformed Nash-Sutcliffe criterion, giving emphasize for evaluating the quality of low-flow simulations. CR_4 is an adapted version of the Nash-Sutcliffe criterion giving more weight to high discharges, and used for evaluating model efficiency for high flows. The numerical values of the 4 criteria show that the WetSpa model is able to provide good fits to the observed hydrographs at the stations with values of CR_1 varying between -0.04 and 0.02, CR_2 from 0.60 to 0.66, CR_3 from 0.50 to 0.59, and CR_4 from 0.56 to 0.72 for calibration period. These indicate that the model is able to consider the precipitation, antecedent moisture and runoff generating processes in a spatially realistic manner, giving the simulation a fairly high degree of precision, and the general hydrologic trends being very well captured by the model.

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Review of diffusiveness and role of fungal factors in black crown and root rot of strawberry

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***Abstract*—** In order to diagnose pathogenic factors and determine diffusiveness level as well as it's infection level in the main regions which strawberry produces, sampling was taken place from fields of Golestan, Mazandaran, Kordestan and greenhouses of Alborz province during 1388-89. The resultant isolates were identified and pathogenic test conducted under greenhouse conditions. The results of review showed diseases diffusion in all given fields and greenhouses. In the present research, the number of 390 fungous isolates was determined which of most important ones in Iran included *R. fragariae*, *M. phaseolina*, *F. oxysporum*, *F. solani*, *P. ultimum*, *F. proliferatum* and *V. dahlia* respectively.

***Keywords*—** Alborz, diffusion, Golestan, Kordestan, Mazandaran.

I. INTRODUCTION

The fertile cultivation level of strawberry under field conditions was estimated about 2400 ha and mean production of strawberry fields is about 13 ton/ha in Iran [12].

The countries such as America, Spain and Japan with producing 736000, 265000 and 206000 ton strawberry respectively, have highest production level among countries which produce strawberry [13].

Ershad and Alizadeh (1971) isolated *Phytophthora cactorum* and *P. megasperma* from Alizadeh (1971) decayed root of strawberry respectively and reported it in Iran for the first time [11].

Safaee and Minasiyan were reviewed the causes of strawberry root rot and introduced *R. fragariae* as a pathological factor in Khuzestan. Based on growth trend of strawberry cultivation and high costs of production and lack of enough information about black root rot of strawberry in Iran, the present research conducted with aim to determine pathogens factors and their role in pathogenesis.

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II. LITERATURE

One of the most important diseases which restricts strawberry production in the world wide is crown and root rot. The damage caused by this disease, has been estimated about 15-20 percent of yield reduction or 3-4 million dollar per year in the states located on east south of America [4]. In the world, the various factors were posed as the reasons of black root rot of strawberry which the main ones included *Rhizoctonia* spp., *Pythium* spp., *Fusarium* spp., *Cylindrocarpon* sp. and lesion nematode *Pratylenchus penetrans* [3, 7, 9, 18, 19, 23, 25, 31]. In most studies which were conducted in order to determine possible role of different fungal factors that involved in creating black root rot of strawberry, two fungous species i.e. *R. fragariae* and *P. cactorum* were assigned as the main factor of disease [17, 20, 21, 22, 25, 27].

Including signs which are observed in the infected roots include decay of root cortex in the primary roots and destruction of secondary roots [13]. This disease has been diagnosed and studied in most of countries producing strawberry such as South Africa [3], Australia [26] and USA [6, 9, 15, 33, 34].

III. MATHERIALS AND METODS

In order to review the reasons of ring and root decay of strawberry in Iran, the samples of strawberry containing infection signs was collected from fields of provinces Kordestan, Golestan, Mazandaran and greenhouses of Alborz in 1388. The sampling was conducted based on cultivation level and dispersal of fields and greenhouses. In given fields, five rows of each hectare were selected randomly and the bushes about 50 m from each row counted. Also, the number of bushes with signs of root rot was determined.

In order to determination disease intensity of bushes the methods of grading based on desiccation rate of bushes (healthy = 0, ¼ dried bushes = 1, ½ dried bushes = 2, ¾ dried bushes = 3, total dried bushes = 4) was used. After washing and disinfection of samples, the small slices of them (1 cm) was prepared and transferred into Potato-

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Dextrose-Agar (PDA) and Corn-Flour-Agar (CMA) culture medium and dedicated *Phytophthora* (PARPH) [11, 21, 22]. The purification of colonies was conducted by using hyphal tip and single spore method and in water-agar medium (WA) [28]. The identification of fungi was conducted based on valid identify keys and related papers and the obtained isolates encoded based on given province and farmland.

The separation and identification of species belong to *Rhizoctonia* was performed by staining nucleus with use of Bandoni [2], Stanghelini and Kroneland method [16].

In order to do pathogenesis test on obtained pathogens, the method of infection cultivation bed was used. In this method, the 4-6 weeks strawberry bushes of Gaviota variety which were prepared from healthy runners were cultivated in the soil which was infected with inoculum of given fungus. The cultivation of four-leaf strawberry transplants was conducted in 1.5 liter pots and cultivation and substrates perlite + sterile peat moss. The experiment was done based on complete random design with three replications under greenhouse conditions $\left(19-20^{\circ}C\right)$ [21]. The inoculum of fungi were prepared with twice autoclaved barley and adding 4 cake slices of each isolate [11, 22, 29, 32]. The primary wilt signs appeared in some of bushes after 45 days. Then the bushes were checked each 15d (45, 60, 75, 90d) and wilted bushes were excluded from soil and evaluated in terms of crown and root rot. The disease intensity of isolates was ranked based on rot rate (Table I).

Table I: Disease severity scale based on the extend of crown and root rot spreading in strawberry plantlets, completed by **Morocko** *et al*. (2006) [24]

The intensity of decay signs in measurement scale of crown and root	
Healthy roots	0
Decayed secondary roots but with healthy primary roots	1
Decayed secondary roots and discolored primary roots	2
Decayed secondary roots and about half of primary roots are decayed	3
Decayed secondary roots and over half of primary roots are decayed and crown is decaying	4
Decayed secondary roots and primary roots and crowns are decaying	5

To obtain pathogenesis intensity of each isolate, with regard to infection occurrence time, the following formula derived from Cooke and his colleagues [5] was used:

$$\text{Disease intensity at the time, in percent} = \frac{\text{Decay intensity in evaluated bush}*}{\text{Minimum time of infection signs emergence(wilt)}\times 100} \over \frac{\text{Evaluation time of given bush}*}{\text{Maximum scale of decay intensity}}$$

IV. RESULTS AND DISCUSSIONS

The samplings showed that all of under study fields and greenhouses are infected to black root and crown rot. The mean infection percent of bushes to root and ring decay infection in Golestan, Kordestan and greenhouses of Alborz were measured 11.8, 8.5, 7.4 and 8.41 respectively. Also, the average infection intensity were 2.17, 2.11, .58 and 2.26 in the field of provinces Golestan, Mazandaran, Kordestan and greenhouse of Alborz respectively. Of 390 obtained isolates, 183, 99, 64 and 44 isolates belongs to Kordestan, Golestan, Mazandaran and Alborz respectively. Categorizing of the average pathogenesis intensity of isolates lead to grouping them in 23 groups. Also, results showed that, maximum numbers of isolates were related to *Rhizoctonia fragariae* in the provinces Kordestan, Mazandaran and Alborz with 22.40, 32.81 and 45.45 percent respectively and in the province Golestan was related to *Macrophomina phaseolina* with frequency of 39.39. There is meaningful variance at 1 percent among treatments based on analysis data belong to pathogenesis intensity of 191 isolates, and comparing average pathogenesis intensity of isolates at 5 percent level showed that highest pathogenesis isolates included SRS21.5 (*F. proliferatum*) isolated from Kordestan, SRG 2.2 (*R. fragariae*) from Golestan, SCS 15.1 (*F. oxysporum*), SCS 11.5 (*R. fragariae*), SCS 5.6 (*R. fragariae*) and SRS 1.2 (*F. oxysporum*) from Kordestan. The isolates SRS 19.3 (bi-nucleate Rhizoctonia), SRM 13.1 (*F. reticulatum*) and SCM 17.3 (*F. oxysporum*) weren't pathogenesis. The *R. fragariae*, *F. oxysporum*, *F.*

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proliferatum isolates of Kordestan had highest pathogenesis percents. In province Golestan, the highest pathogenesis rates were belonged to *R. fragariae*, *F. oxysporum* and *R. solani*.

The fungi *R. fragariae*, *R. solani* and *Coniothyrium* sp. also in province Mazandaran had maximum pathogenesis rate but in greenhouses, *R. fragariae*, *F. oxysporum* and *R. solani* had highest pathogenesis rate.

Based on given results, *R. fragariae*, *F. oxysporum*, *M. phaseolina*, *F. solani* and *R. solani* as the main pathogenesis factors.

The highest and lowest frequency of infection is belonging to Golestan and Kordestan respectively. Probably, the different weather of two provinces, soil infection of Golestan caused by two cultivation periods during a year and continuous utilization of soil and chemical manures, especially nitrate, are reasons of this difference. However, the infection level in Golestan is lower than Kordestan which could attribute it to cultivation method of strawberry in Golestan as stack and ditch and use of plant for one season, but in Kordestan, cultivation is conducted as terrace and perennial (mostly 3 year). The cultivation of strawberry in Mazandaran is performed in two methods of raw and semi mechanized as terrace under fruit trees. Reviewing the factors of occurrence and infection level restriction shows that, gardeners of the given region mostly utilized transplants with health certification and greaten to fields and gardens management. Use of manure and stacks covering with mulch in the strawberry cultivation regions in Mazandaran, is common (authors observations).

The identification of obtained isolates from strawberry cultivation regions of Iran showed that *R. fragariae* (28.71%), *F. oxysporum* (20%), *M. phaseolina* (14.61%), *F. solani* (8.71%) and *R. solani* (7.71%) had highest frequency among fungi (fig 1).

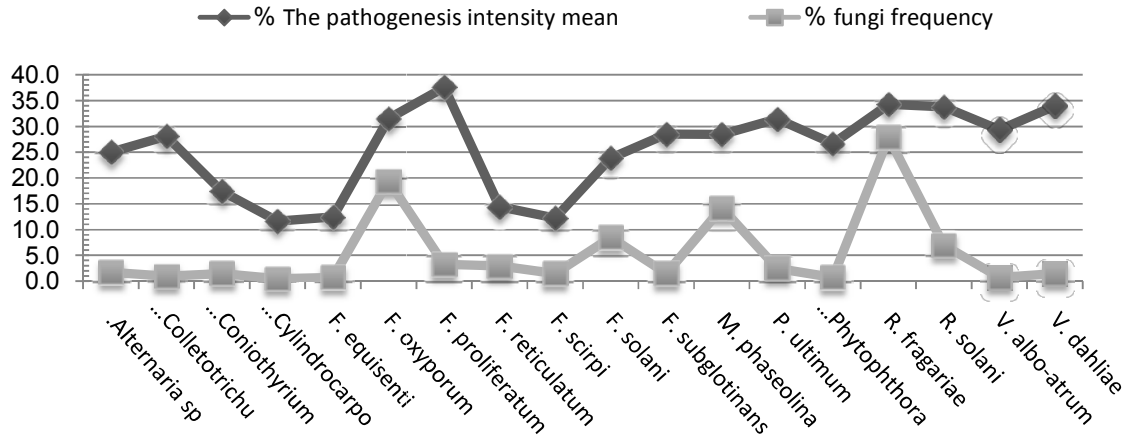

Fig 1. Frequency of isolated fungi from different regions and percentage of mean pathogenesis intensity.

With regard to pathogenesis intensity and frequency of fungi, the main pathogens of Iran were introduced in priority order as *R. fragariae*, *F. oxysporum* and *M. phaseolina*.

The various reviews which were done on the disease in different regions of the world show that *Rhizoctonia* spp. is the main factor of black root rot of strawberry. According to the researches which were done in the Connecticut State of America in 1987, the main portion of isolates which extracted from infectious roots was belonged to *Rhizoctonia* spp. Also, over 90% of 400 obtained Rhizoctonia isolates were bi-nucleate [11]. This fungus is one of the main factors which cause restriction in potato production in Iran and by creating chancre of stem and node lead to reduction. Based on obtained results, *R. fragariae* and *F. oxysporum* had highest frequency among fungi respectively. *F. oxysporum* is one of the important variable species among Fusarium ones and is able to infect various plants. Abad [1] introduced given fungus as one of the main factors of wilt and root rot of strawberry and emphasized capability of its transfer via infected transplant. The greenhouses show the highest infection rate to given fungus, which could attribute it to transplant selection and irrigation system type (often hydroponic).

It seems that the root and crown rot of strawberry in Golestan is affected by plants grown in rotation and dominant plant-disease of the region so that *M. phaseolina*

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determined as of infection. This fungus is known as one of the main plant pathogens in Iran.

V. CONCLUSIONS AND RECOMMENDATIONS

The results of this research prove that infection with different intensity and frequency present in all of the reviewed fields and greenhouses of strawberry. Based on disease diffusion, it is necessary to use of preventive methods and also resistant varieties to prevent of disease progress. Non-accessibility of producers to healthy and certificated transplants is of another factor of infection development which by resolving this problem, would be controlled significantly.

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Study of water management in Iran

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Abstract- This study examines water management in Iran**.** Water is the source of life and growth and human development. With increasing population, increasing need for water becomes even greater. 97% of Earth's water is brackish and the ocean holds the remaining 3% is a percentage of water on earth, fresh water and can be used in humans. Water is a scarce element; many of the battles are created for water. Many countries are facing water shortages Iran is a country that is facing a water shortage. Each year due to climate change and global warming will be more droughts. So any water source should be used to optimize and manage it. Rainfall in the winter season in most parts of the country occurs, Due to the serious need water, we need water management by saving the rain and system design with pond and water absorbent polymers. Because rainwater-harvesting methods are much every way suited to the topography, distribution of rainfall, soil depth, and economic and social conditions in each region can be selected.

Keywords- water management, drought, seasonal rainfall

I. INTRODUCTION

Water is already a scarce element. Asymmetric distribution of rainfall in different areas led to the emergence of arid and semiarid climates in different regions has been. 97% of the planet's water resources are brackish ocean. The remaining 3 percent, two-thirds of its glaciers and snow in mountainous areas has been accumulated at the poles. That's one percent of the Earth's water is fresh water constitutes 98% of the groundwater is included. 13]. Water is one of the most important factors in the development of life on Earth and therefore has a source of water. The geography of the land, which is located in a region where water scarcity is quite noticeable. We have been conflicts in the world where water is referred to the war. In today's world, the sense of mastery means control over the wealth and power of water management (Kayhan 04/08/90). Water is the source of life and growth and development of human societies. Due to the increasing human population and the need to eat every day need, this vital resource becomes more pronounced. So stop wasting this important resource is inevitable that the need to plan properly and promptly. One way to prevent loss of water by runoff control systems, water retention, and reduces moisture evaporation from the soil surface is kept. [2]. Iran's arid and semi-arid climate and average annual rainfall of around 250 mm of water millimeter most countries is low. [10]. Iran hydrological characteristics such as size, 413 rainfall, evapotranspiration 296 and 117 billion cubic meters of water available per 1900 cubic meters of renewable water (average water vaporized World 7600 cubic meters) of 314 billion cubic meters, about 65 percent of its the underground water is provided, faced with the difficult conditions in providing water. Especially as regards the protection of 220 Plains, 63 Plains in the category are prohibited. In addition to the above hydrological, Iran is the amount of exposure to the populous countries of China and India and picked up 75 percent from renewable sources, water adds to the growing concerns. [3].

According to the revised figures for water resources management and strategic planning of national economic and social development is inevitable and serious. This Important work in recent years through a review of the rules of operation and Development operations including the transfer of water between basins, Water Supplies, artificial nutrition and operations of water and soil conservation in this program is of follow-up. Water scarcity is one of the

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biggest challenges of this century, which is considered one of the major problems of humankind in the future. Drought leads to water crisis phenomena in such a way that during the last 40 years, 27 droughts that occurred in Iran shows Bella, a common phenomenon of climate in the country. The recent drought was so severe that most of the damage caused by this phenomenon remains as irreparable damage to the heaviness of the statue into the rural communities. [11]. Today, due to increasing human population and scarcity of water resources, the issue of rain water harvesting in all parts of the world have been seriously considered and Huge investments by the international community and local government to develop it as a solution to combat dryness and drought is ongoing. Since even small amounts of rainfall occur almost everywhere, before it evaporates to form and flooding becomes unavailable or is contaminated in its flow path. Ways to help save the rain can be collected and driven stored and used. This method can be used irrespective of distance, proximity to water sources or other sources, Water for drinking, agriculture, and industry has achieved near, as complex.there will be not problems as as dehydration or dehydration and long distance water transfer. By Save the Rain project, there will be not problems as dehydration or lack of water for drinking and agricultural water requirements in the industry and a large part of this land (8).

Humans need water to surface water because a human being within easy reach and special attention is sweet and clean.

Rain catchment systems and levels of management method and operation of rainwater that can be used to assist the production of runoff from rainfall impact and it can be used effectively to rain Drarazy surrounding area. [5].

In this article according to the resources available in rainwater management are examined. Research studies such as harvesting rainwater. Tabatabai, Yazdi and partners with a way to manage the rainfall in arid regions that results like this was done: According to variability, the rainwater harvesting techniques should choose the appropriate technique for such properties, the distribution of rainfall, topography, soil type, soil depth and attention to every area of economic and social factors. Research as water retention system and its role in keeping water and reduce evaporation by Hussein et al (1390) study that the results show that the diamond shape is due to the concentration of runoff from the improved performance and are effective in reducing evaporation. Weather and Agriculture Organization projects have been done in the area that the design of the rain and the first city in the country where weather Javanrood was conducted on 15/11/90., with the plan without a drop of water from springs, wells and rivers the total water requirements required to take won.

GOALS

1 - harvesting rain water and prevent water loss
2 - Keep rain water and reduce evaporation pond system using
3 - The use of water in dry places and shallow water
4 - Use absorbent polymers to increase water productivity and prevent desertification

MATERIALS AND METHODS

Using library and Internet data collection and documentation methods were analyzed.

CONCLUSIONS

Considering that water is life and the development of communities and because country is located on the dry belt and the average precipitation is about 250 mm. Requires a proper planning principles so that we can manage the rainwater. Rainwater storage project of the important ways to use rainwater, runoff control by water retention and terraces and some other systems such as diamond shapes, arches, and is rectangular. Use absorbent polymers to prevent evaporation of water that they can prevent the rainwater loss, and we are better able to use rainwater. Considering that we have winter rainfall in most parts of the country, we can supply design for optimal use of rainfall and rainwater catchment systems can be used in most parts of Iran. However, due to the diversity of rainwater extraction

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techniques, appropriate methods should be selected characteristics such as distribution of rainfall, topography, soil depth and attention to every area of economic and social factors. Iran is one of countries that are water shortages and need not to waste a drop of rainwater.

SUGGESTIONS

1 - The use of the saving plan of rain in most parts of Iran
2 - Make terraces on sloping areas for groundwater supply
3 - Use absorbent polymer in the dry desert.
4 - Use a diamond-shaped pond system

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Environmental factors affecting on the cover of some medicinal species in the rural south rangelands of Golestan

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Abstract— The distribution of each species within a certain range is possible because each species has specific environmental requirements And given that ambient environmental conditions and compliance is established the main objective of this study vegetation relationships with environmental factors such as soil factors and physiographic factors on pastures of Chaharbagh**.** In order to investigate vegetation relationship and soil the area was typing method fyzyonomic. Then he key area of each vegetation type was certain And vegetation and soil sampling was carried out in these areas. Then, to investigate the correlation of vegetation, soil and physiographic factors Canoco4.5 software was used. Initial analysis software, using DCA (unbiased conventional analysis) was done because the gradient was less than the number 3 Principal component analysis method (PCA) was used. Results showed that species *Cichorium intybus* and *Gallium verum* have positive correlation with the amount of sand and clay and high organic carbon And species of *Euphorbia rigida* has positive correlation with the amount of silt, lime and PH. *Asteragalus.gossypinus* has negative correlation with the amount of silt, PH and lime.

***Keywords*—** Vegetation, correlation, Soil, physiographic

INTRODUCTION

The ecological range of a species is known, the presence of a particular habitat habitat conditions (soil, climate), it is predictable. Or conversely the presence of a species in a habitat can be indirectly realized habitat conditions[4]. Climate in combination with other environmental factors has been much used to explain the main vegetation patterns around the
World [1], [2], [6], [7], [14], [15], [17], [18]. Soil quality is the capacity of soil to perform its functions in the ecosystem as a viable component[10]. Soil quality is a concept that biological factors, physical and chemical soil in the form of soil resources assessment suggests[3]. TWINSPAN analysis, DCA, PCA were employed to understand relationships between soil variables and vegetation in the present study. TWINSPAN analysis is a numerical method for the classification of vegetation samples into similar groups[9]. DCA is an indirect gradient analysis technique; PCA is a direct gradient analysis. This technique greatly improves the power to detect specific effects of cross variable association and has been shown to be a robust model for detecting the relationship between species and their environment[12]. Researchers have conducted many studies in this field are briefly mentioned some of this research will be. The effects of environmental gradients on the vegetation distribution was shown that the complex gradients of soil Including soil depth, water holding capacity and the amount of clay react and PH, nitrogen, phosphorus, organic matter and chemical properties were correlated with the masses ordination[8]. Reference [5], [16] shows that the importance of topography in explaining the variation in soil properties and composition among different stretches of land, in its hydrological features and the distribution of plants. Seeds collected in other studies as planned pasture legume family of plants on the demonstrated relationship between vegetation and environmental factors that There are relationship between distribution characteristics in different species of this family range of soil characteristics, topography, latitude and longitude. And the environmental factors studied, vegetation more affected by altitude, latitude and longitude, depth, slope and soil[13]. Also, other researchers have investigated the physical and chemical properties of soil on the region's dominant pasture species Qom concluded There is a special relationship between soil properties and vegetation and changing soil properties, vegetation also changes so that the canopy is most correlated with clay and PH [11]. This study examined the relationship between percent cover of plant species *Ga.va, As.go, Ci.in* and *Eu.ri* with environmental factors in the study area.

Materials and Methods

Chahar Bagh area in the Alborz mountains and 20 km south of Gorgan and is located 45 km North West of the city shahrood. Mountainous area of summer pastures in the watershed Nekarud That geographic range of 40 degrees and 60 minutes

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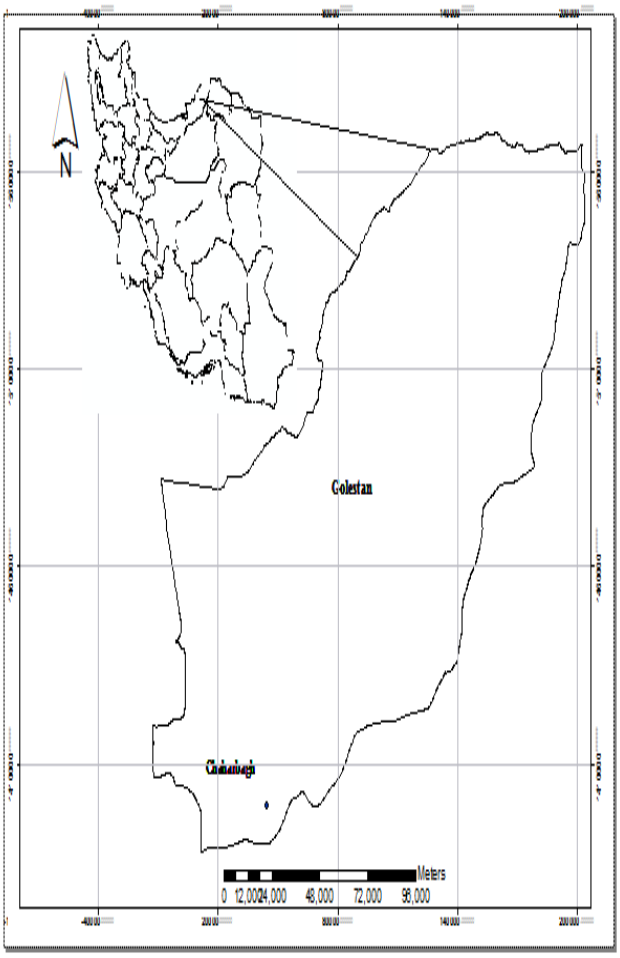
north and 28 degrees 04 minutes east until 40 degrees 50 minutes north and 27 degrees 45 minutes east is located.



FigI. Location of the study area

In this region, three vegetation types were studied. The three transects in each vegetation type using a length of 50 meters Systematic - randomly placed. The 5-foot intervals on each transect was placed 10 plots so that each plot type 30 was shot down. The percentage cover of different species in order to determine the effect of soil properties on the type and percentage cover was calculated. In each study area to determine soil texture, pH, electrical conductivity, organic matter, total nitrogen, and the amount of lime, three soil samples to a depth of 30 cm were sampled on three transects. The data related to the environment and to process vegetation canoco 4.5 software was placed.

Results and Discussion

According to data obtained from a natural soil data analysis software canoco 4.5 Relationship between plant species and environmental factors, the method DCA (Analysis conventional unbiased) was performed (Table I), and given that the gradient is less than 3 . PCA method was used and the results of correlation coefficients (Table II and III) and the diagram (Fig. II and III) of the plant species and the relationship of vegetation and soil and physiographic factors were presented.

Table I. Values equity axes of the ordination of four plant species with environmental factors DCA method.

Axis	١	٢	٣	٤	Resident Sum
Eigenvalues	٠/٨٢٨	./٢٧٣	٠/٠٨٣	٠	٢/٠٨٠
During grad	٢/٦٩٩	٢/٣٩٨	٢/٤٤٤	٠	
Correlation of species-enviroment	٠/٧٤٧	./٧٢٢	0/719	٠	
Cumulative percentage of variance					
Species data	٣٩/٨	٥٢/٩	٥٦/٩	٠	
Relation of species-environment	٤٣/١	٧٣/٧	٠	٠	

Table II. Values equity axes of the ordination of four plant species to environmental factors by PCA

Axis	١	٢	٣	٤	**Resident Sum**
Eigenvalues	٠/٥٠٤	٠/٤٥١	٠/٠٢٧	٠/٠١٨	١
Correlation of species-enviroment	٠/٣٢٤	٠/٦٩٣	٠/٦٠٠	٠/٤٦٧	
Cumulative percentage of variance					
Species data	٥٠/٤	٩٥/٤	٩٨/٢	١٠٠	
Relation of species-environment	١٨/٦	٩٥/١	٩٨/٦	١٠٠	

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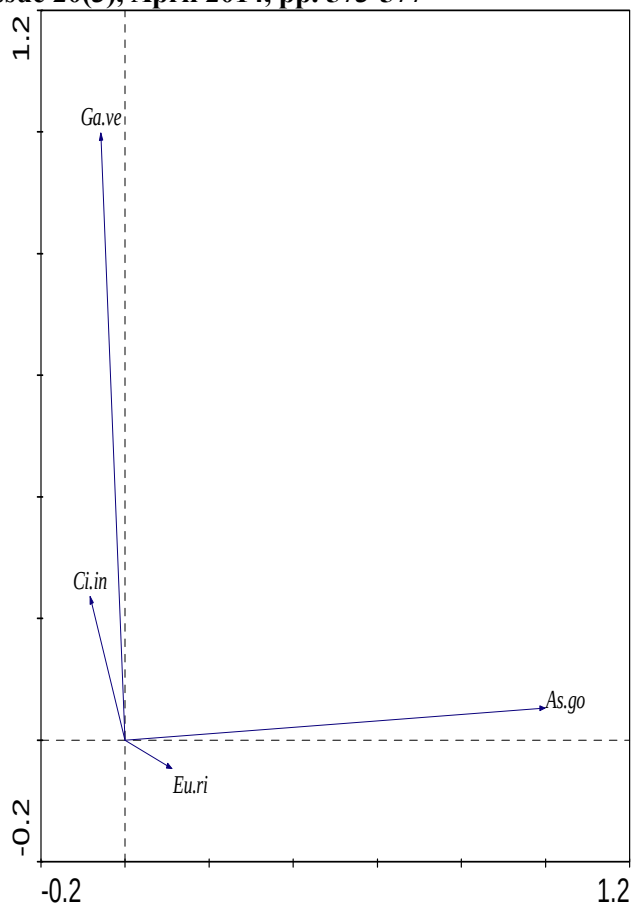
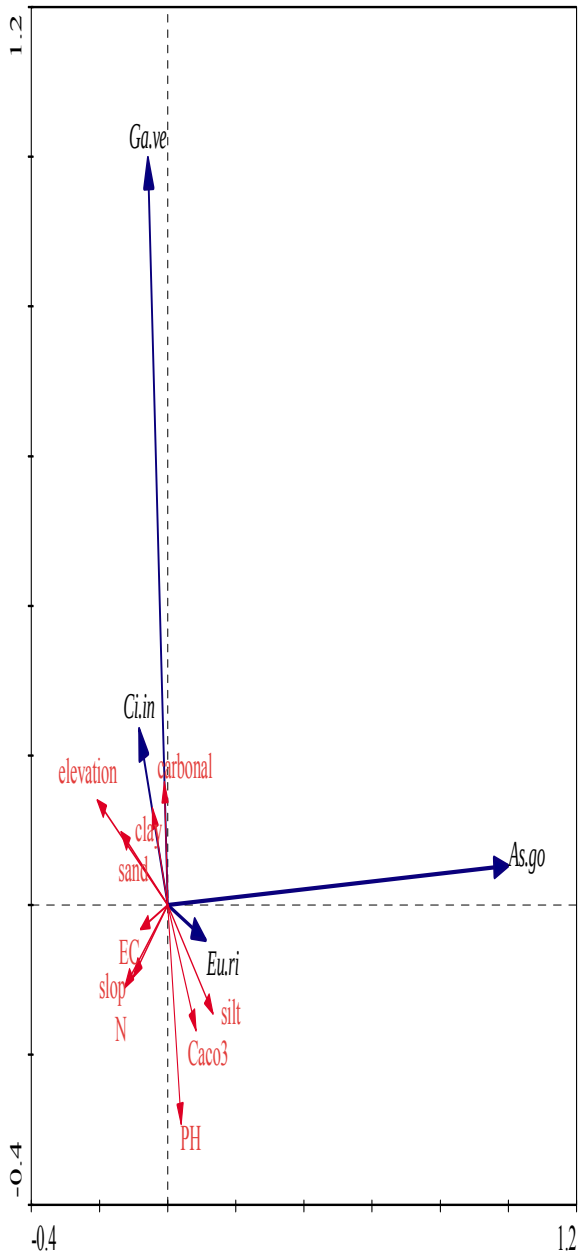


1. *Gallium verum* 2. *Cichorium intybus* 3. *Euphorbia rigida* 4. *Asteragalus.gossypinus*
FigII. Distribution of plant species in habitat



1. *Gallium verum* 2. *Cichorium intybus* 3. *Euphorbia rigida* 4. *Asteragalus.gossypinus*
FigIII. Diagram of the factors related species

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Table III. Correlation coefficients between species axes (SPEC), environmental issues (ENVI) and pasture sites studied environmental factors in the PCA ordination method

	SPEC AX1	SPEC AX2	SPEC AX3	SPEC AX4	ENVI AX1	ENVI AX2	ENVI AX3	ENV I AX4
SPEC AX1	١	*	*	*	*	*	*	*
SPEC AX2	٠	١	*	*	*	*	*	*
SPEC AX3	٠	٠	١	*	*	*	*	*
SPEC AX4	٠	٠	٠	١	*	*	*	*
ENVI AX1	٠/٣٢	-٠/١٤	-٠/١٢	٠/٠١	١	*	*	*
ENVI AX2	-٠/٠٦	٠/٦٩	٠/٠٠٠٤	-٠/٠٥	-٠/٢٠	١	*	*
ENVI AX3	-٠/٠٦	/٠٠٠٥ ٠	٠/٥٩	٠/٠٥	-٠/٢٠	٠/٠٠٠٧	١	*
ENVI AX4	٠/٠١	-٠/٠٨	٠/٠٦	٠/٤٦	٠/٠٣	-٠/١١	٠/١١	١
Sand	-٠/١٣	٠/٠٩	-٠/٣٣	-٠/١٠	-٠/٤٢	٠/١٤	-٠/٥٦	-٠/٢٢
Clay	٠/٠٤	٠/١٢	-٠/٢٩	-٠/١١	-٠/١٣	٠/١٨	-٠/٤٨	-٠/٢٣
Silt	٠/١٣	-٠/١٤	٠/٣٦	٠/٠٨	٠/٤١	-٠/٢٠	٠/٦٠	٠/١٧
Caco3	٠/٠٨	-٠/١٦	-٠/٣٣	٠/١٣	٠/٢٥	-٠/٢٤	-٠./٥٥	٠/٢٩
N	-٠/١٢	-٠/١٠	-٠/٤٠	٠/٠٠٥	-٠/٣٨	-٠/١٥	-٠/٦٨	٠/٠١
Organic-carbon	-٠/٠٠٩	٠/١٦	٠/٤٠	٠/٠٨	-٠/٠٢	٠/٢٣	٠/٦٧	٠/١٧
Ph	٠/٠٤	-٠/٢٩	-٠/١٨	-٠/٠٦	٠/١٢	-٠/٤٢	-٠/٣٠	-٠/١٢
Ec	-٠/٠٧	-٠/٠٣	-٠/٣١	-٠/١٣	-٠/٢٤	-٠/٠٤	-٠/٥٣	-٠/٢٨
ElevatioN	-٠./٢٠	٠/١٤	٠/٤٢	٠/٠٦	-٠/٦٣	٠/٢٠	٠/٧٠	٠/١٣
Slop	-٠/١٠	-٠/٠٩	-٠/٤٦	-٠/٠٥	-٠/٣١	-٠/١٣	-٠/٧٧	-٠/١٢

Conclusion

Due to environmental factors, including 8 cases: sand, clay, silt, pH, electrical conductivity, organic matter, total nitrogen, and the amount of lime soil and physiographic factors of slope and altitude. Results with respect to the species is as follows for each of these factors influenced the correlation is determined by other factors. Ordination diagrams, respectively, of the image of the arrow on the arrow indicates the location of the origin of coordinates ordination species in relation to environmental factors. According to FigIII, which shows the influence of environmental factors on vegetations, species *Cichorium .intybus and Gallium. Verum* have a high and positive correlation with the amount of clay, sand and organic carbon and altitude, Some environmental factors directly and indirectly affect on each other. Height indirectly affect the soil and directly affects other factors such as temperature. According to, the species distribution will change and affected ecosystem structure and species. With the change in altitude, the amount and type of precipitation and evapotranspiration will be changed and will also change accordingly vegetation. And this species have a high and negative correlation with the amount of N and EC and Slop. *Euphorbia rigida* have a high and positive correlation with the amount of silt and PH and lime. *Asteragalus.gossypinus* has negatively correlated with the amount of silt and lime and PH. Therefore, due to the importance and impact of environmental factors on the relationship between environmental factors and vegetations study soil factors in any area.

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