COMPETITION BETWEEN TWO WILD PLANT SPECIES (*Imperata cylindrica* and *Cynodon dactylon)* IN SEMI-NATURAL PASTURE.

Abdulkhaliq S. Mahdi

Hort. Dept.- College of Agriculture - University of Diyala-Republic of Iraq.

Email: abdulsmahdi@yahoo.com

ABSTRACT

Very strong evidence was obtained from this observation of competition between two wild plant species (*Imperata cylindrica* and *Cynodon dactylon*), those two species living at semi-natural pasture, in competition and coexisting conditions with reduced densities. The two species have different life-forms, therefore effect of mowing activities was in benefit of *C. dactylon.* as creeping plant which suffer less of mowing process. The plowing disturbance plot was invaded by only species that had already exist at the plot (*C. dactylon* and *Alhagi maurorum*). There was no *I. cylindrica,* recover, in spite of this species was existing at the same pasture. Concluding that there is (might be) chemical (allelopathic) substances produced by *C. dactylon,* inhabited germination seeds of *I. cylindrical.*

Key words: Competition, *Cynodon dactylon, Impereta cylindrica,* Coexisting**,** Allelopathy**.**

INTRODUCTION

The effect of competition not one completely eliminated the individuals species by another, but lowering the performance competing numbers (Begon *et al*., 1994; Kikvidze and Brooker, 2010). This is usually manifested in reduction the numbers of individuals plant by another species, this lead to negative association between two species, (Yodzis, 1986; Tilman, 1988; Violle *et al.,* 2009). Much of details work on competition had been carried out under control conditions (Damgaard and Fayolle, 2010), since in the field is often difficult to distinguish factors involved by competition from others, which was possible caused by negative association, (Abramsky and Sallah, 1982; Andel and Aronson, 2005; Meier *et al.,* 2009). The implication of disturbance is upset normality and change the form of community. The activity of herbivores is often disturbance in the 'normal' course, (Begon *et al.,* 1994, Micintry *et al.,* 1996; Agrawal *et al.,* 2007 Chesson and Kuang, 2008; Bernhardt-Romermann *et al.,* 2011). Moreover, the effects of herbivores are opening up gaps for colonization another or same species to invite those gaps. Grazing had apparently kept the aggressive dominant

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species allowed with great diversity flora to persist, (Silvertown and Lovett-Doust, 1993, Shea and Chesson, 2002; Melbourne *et al.,* 2007).

This study was carried out in semi-natural pasture, and all of the vegetation data were taken from this natural vegetation. Created gaps as disturbance events by plowing process, as well as heavy grazing on another plot by mowing activities. All these events to observe the effect of disturbance on competition between two dominant species: *Imperata cylindrica* and *Cynodon dactylon,* how they balance and coexistince in the natural conditions.

MATERIALS AND METHODS

The Site: The site is semi-natural pasture, near Horticulture Department, Agriculture College, University of Diyala, 50 m from the Department, across the main road, between Education Sport College, and Agriculture College. The area of pasture about (200 x 25 m). The observation period from February to July 2010.

Soil analysis: The soil samples were taken randomly from the site by core (11 cm^2) at depth 15 cm, in six replication, to estimate SP% (Saturation Percentage), FC% (Field Capacity), EC $ds.m^{-1}$ (Electrical Conductivity), pH, Soil Texture and amount of nutrient elements (N^+, P^{3+}, K^+, Na^+ , Mg^{++} , Ca^{++}, and Cl^- ppm). The method described by Allen *et al.,* 1974, Moor and Chapman, 1986.

Vegetation: Quantitative study of vegetation was started in February 2010, three plots (15 x 5 m) were chosen randomly at the site. The first plot was used for heavy grazing, using mowing machine, cutting vegetation canopy at 3cm level. The second one was used for plowing process at 15 cm depth and removed all the rhizomes of plant thoroughly. The third one was left as natural state, represented control.

The characteristics quantitative vegetation were estimated for Frequency%, vegetation cover% and density m^{-2}. It was taken first, before any process observation. The total of relative frequency, relative density and relative dominance (Dominance = cover% + density) on subsequent month observation time represent (IVI) Importance Value Index, (Grieg-Smith, 1983; Kershaw and Looney, 1995). At the same time, the height of the individuals species were estimated as well. The quadrates used was (100 x 100 cm), taken randomly in each plot, and in outside the plot, within the site. Samples size was six replicates for each plot bimonthly.

RESULTS AND DISCUSSION

Soil Characteristics: The soil tended to be alkaline, pH about 8. Soil texture was clay loam, EC was about 4 $ds.m^{-1}$. Nutrient elements were very high for Na^{+1} (5500 ppm), Cl^{-1} 14600 ppm. Whereas relatively low for N^{+}, P^{3+}, K^{+} (85, 112, and 170 ppm respectively), and medium for Mg^{++}, Ca^{++} (1400 and 1600 ppm respectively, Table 1.

Vegetation**:** The community considered of 15 species (Table 2). The dominant species were *Imperata cylindrica* (IVI = 140), and *Cynodon dactylon* (IVI = 117). Subdominant species were *Alhagi maurorum* and *Prosopis fractum* (IVI = 98, 68 respectively. Five species were regard as rare species (IVI = 5). The taller plant was *Nitraria retusa* (rare species) 70 cm. Whereas the taller one of the common species was *Imperata cylindrica* (40 cm), and the short one was *Cynodon dactylon* (creeping species).

Table 1: *Soil characteristics of the site, soil taken from depth (0 - 15 cm). SE refer to Stander Error of means.*

Soil Characteristics	Mean	SE
Saturation Percentage (SP%)	44.3	1.86
Field Capacity (FC%)	24	1.00
Electrical Conductivity (EC) $ds.m^{-1}$	4.2	0.95
pH	7.9	0.23
Soil Texture		
Sand%	30.7	2.57
Silt%	38.9	2.05
Clay%	30.5	2.27
Texture Class	Clay loam	
N^{+}	85	8.7
P^{3+}	112	14.5
K^{+}	171	16.7
Mg^{++}	1461	246.2
Ca^{++}	1606	22.7
Na^{+}	5536	392
Cl^{-}	14569	1397

Table 2: *Community consist of species. Important Value Index (IVI) and the tall for each species.*

Seq.	species	IVI	Tall (Cm)
1	*Imperata cylindrica*	140	40
2	*Cynodon dactylon*	117	5
3	*Alhagi maurorum*	98	25
4	*Prosopis farctum*	68	31
5	*Convolvulus arvensis*	41	15
6	*Lactuca secriola*	38	21
7	*Salsola kali*	24	30
8	*Cardaria draba*	20	10
9	*Malva parviflora*	11	8
10	*Nitrarea rutusa*	5	70
11	*Phragmitis communis*	5	30
12	*Beta vulgaris*	4	10
13	*Schanginia aegyptiaca*	4	10
14	*Plantago ovata*	3	10
15	*Asteriscus pygmaeus*	2	10

Competition between *Cynodon dactylon* and *Imperata cylindrica:* It is obvious from Fig. 1 that there is a very strong Correlation Coefficient for the number of pairs observed (r-value = -0.544**), the negative correlation between *C. dactylon* and *I. cylindrica* is very highly significant.

Disturbance events (Gap invaded), there was 5 species at this plot before the plowing process. Two species (*C. dactylon* and Alhagi maurorum) were growing again (Table 3).

Table 3: *Plowing plot (5 x 5 m). The plant species before and after plowing with quantitative description at period from February to July 2010.*

Species	Description	February*	March	April	May	June	July
Cynodon dactylon	Frequency% Cover% Density m^{-2}	66.7 21.7 4.4	-	-	16.7 5 0.01	22.4 10 0.33	33.3 15 0.4
Convolvolus arvensis	Frequency% Cover% Density m^{-2}	100 14.2 9.5	-	-	-	-	-
Cardaria draba	Frequency% Cover% Density m^{-2}	50 9.2 4.8	-	-	-	-	-
Malva parviflora	Frequency% Cover% Density m^{-2}	50 9.2 4.8	-	-	-	-	-
Alhagi maurorum	Frequency% Cover% Density m^{-2}	66.7 14.2 3.3	-	-	-	-	16.7 5 0.01

*Before plowing process

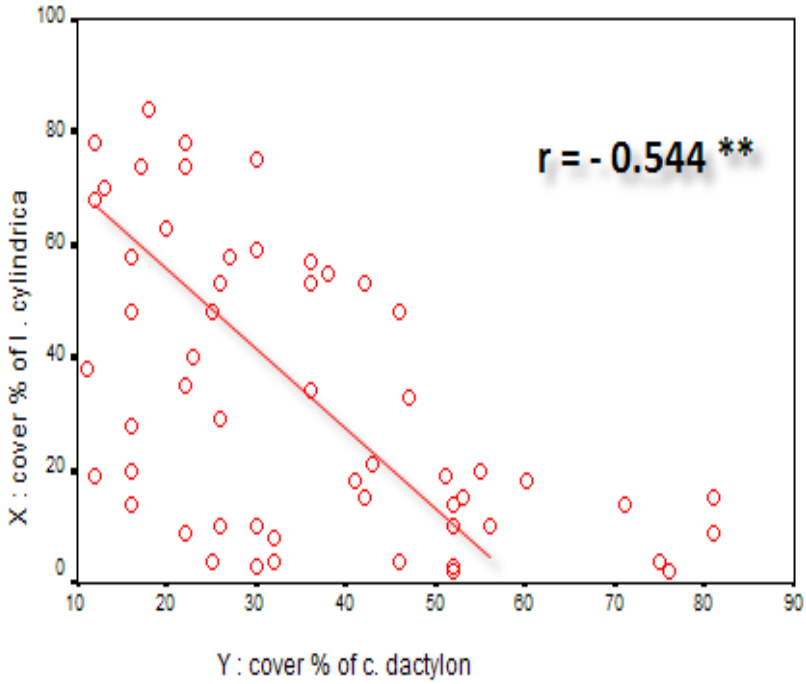

Fig. 1: *A scatter diagram of the relationship between vegetation cover% of Imperata cylindica and Cynodon dactylon.*

Mowing: both of *I. cylindrica* and *C. dactylon* by reduction cover and density (Table 4). Species *C. dactylon* recovered soon, and even increased of those two characteristics. Whereas in *I. cylindrica* decreased of those two characteristics.

Table 4: *Mowing plot (5 x 5 m). Plant species before and after mowing with quantity characteristics.*

Species	Descriptions	February*	March	April	May	June	July
Imperata cylindrica	Frequency%	100	100	100	100	100	100
	Cover%	55.8	40.7	38.3	35	33.3	25
	Density m^{-2}	37.8	32	25.8	19.7	18.3	12.8
Cynodon dactylon	Frequency%	83.3	83.3	100	100	100	100
	Cover%	19.2	15	26.7	31.7	33.7	31.7
	Density m^{-2}	4	3	5.4	6.4	6.5	6.4
Prosopis farctum	Frequency%	-	-	-	33.3	33.3	33.3
	Cover%				1.2	1.2	1.2
	Density m^{-2}				0.3	0.3	0.3
Alhagi maurorum	Frequency%	-	-	-	-	16.7	33.3
	Cover%					1.7	2.8
	Density m^{-2}					0.7	1
Salsola kali	Frequency%	-	-	-	-	16.7	16.7
	Cover%					1.7	2.5
	Density m^{-2}					0.3	0.5
Convolvulus arvensis	Frequency%	16.7	16.7	33.3	33.3	-	-
	Cover%	1.7	3.3	3.3	4.2		
	Density m^{-2}	0.7	2.3	2.2	2.5		
Lactuca secriola	Frequency%	-	33.3	33.3	33.3	-	-
	Cover%		0.8	1	1.2		
	Density m^{-2}		0.3	0.5	0.7		
Asteriscus pygamaeus	Frequency%	-	-	-	16.7	16.7	-
	Cover%				0.2	0.3	
	Density m^{-2}				0.1	0.2	

*Before mowing processes.

Control: Species *I. cylindrica* was increased by vegetation cover 43.3% in February to 47% in July. Whereas the density increased from 20.8 m^{-2} to 23 m^{-2} for the same period. In term of *C. dactylon,* the increasing by vegetation cover was 10% in February to 13% in July. Whereas in density the increasing was from 2 m^{-2} in February to 2.7 $^{m-2}$ in July.

Table 5: *The control plot (5 x 5 m), as intact or natural quantitative description (no mowing or plowing processes) of species consist of this plot.*

Species	Description	February	March	April	May	June	July
Imperata cylindrica	Frequency%	100	100	100	100	100	100
	Cover%	43.3	43.3	45.5	46	46.4	47
	Density m^{-2}	20.8	21.7	21.8	22.1	22.4	23
Cynodon dactylon	Frequency%	33.3	33.3	50	50	66.7	66.7
	Cover%	10	11.3	12	12.7	12.9	13
	Density m^{-2}	2	2.3	2.4	2.5	2.6	2.7
Cardaria draba	Frequency%	16.7	33.3	-	-	-	-
	Cover%	2.1	4.2				
	Density m^{-2}	1.2	2.3				
Nitraria retusa	Frequency%	-	16.7	16.7	16.7	16.7	16.7
	Cover%		8.3	8.3	8.3	8.3	8.3
	Density m^{-2}		2.8	2.8	2.8	2.8	2.8
Prosopis farctum	Frequency%	-	-	16.7	33.3	50	83.3
	Cover%			0.8	1.7	3.3	4.3
	Density m^{-2}			0.2	0.3	1	1
Alhagi maurorum	Frequency%	-	-	-	-	66.7	66.7
	Cover%					9.2	9.2
	Density m^{-2}					2.2	2.2
Salsola kali	Frequency%	-	-	-	-	16.7	66.7
	Cover%					1.7	7.1
	Density m^{-2}					0.2	1.4

Growth of most species were increased in March as well as the diversity of the community, according to suitable weather elements. Whereas *Cardaria draba* was decreased (Table 5), because this species regarded as a winter species. The soil characteristics gives an indication of good texture, and tend to alkaline (pH =7.9) as in Table 1. Salinity was slightly high (EC = 4 $sd.m^{-1}$). The evidence of salinity was monitored in high state of Na^{+} (5500 ppm) and Cl^{-1} (14600 ppm). In general, the nutrition elements were not very good balance. Therefore the diversity of the community was limited, only 15 species (Whatkinson, 1984; Violle *et. al.,* 2009). It is well known that *I. cylindrica* blooms when the ground water near the surface of soil. Both species (*I. cylindrica* and *C. dactylon*) have ability to resist effect of light salinity as in this case (4 $sd.m^{-1}$), particularly by *C. dactylon.*

Very obvious from Fig. 1, that there was a strong competition between *I. cylindrica* and *C. dactylon.* The life-form of those two species were different (40 cm for *I.*

cylindrica, and 5 cm for *C. dactylon*). Therefore the mowing process (represent heavy grazing) was in benefit for *C. dactylon.* Unselective grazer (mowing machine) was still have differential effects on the growth of different species. Tall plant species (*I. cylindrica)* usually suffer more than those which are short one (creeping form as *C. dactylon*). The species with large underground storages, here *C. dactylon,* might recover early and benefit from reduction of competition and invade new space, (MacCdonald and Lieffers, 1993; Agrawal, *et al.,* 2007; Bernhardt-Romermann, *et al.,* 2011). It is obvious from Table 5, as a control, that both species are in balance coexistence, they increased by vegetation cover and density at approximately the same proportion. Therefore the effect of heavy grazing on the community, depends on which group of species suffers most, here. *I. cylindrica,* (Harper, 1977; Damgaard and Fayolle, 2010).

Having in mind that any gap which appears is rapidly very often invaded by seeding product. In this case seeds are either in the act of dispersal or component of persistent seed bank in soil. Which seed plant developed first to established gaps, and then which species existing at seed bank, the successful seedling rapidly established (Mahdi, 1988; Fridley *et al.,* 2007; Thomson *et al.,* 2010). Whereas no evidence of invading gaps by *I. cylindrica* in plowing plot, (Table 3) outside this plot. There were no any seedling appeared by this species, in spite of this species is in dominant state in the site. Might be at least that seeds bank in this plot had not received seeds from even a short distance. Another possibility are the seeds of *I. cylindrica* is unable to germinate, might be because chemical substances (allelopathy) by *C. dactylon*, inhibited the seeds germination of *I. cylindrica.* (Rice, 1984, Saadawi *et al*., 1993; Thorpe *et al.,* 2009). In mixed stand each species inhabit the other, but even though can be coexist with other species in reduced density, (Turkington and Joliffe, 1996; Violle *et al.,* 2009; Kikvidze and Brooker, 2010; Matesanz *et al.,* 2011).

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التنافس بين نوعين من النباتات البرية (ألثيل و ألحلفا) في حقل شبه طبيعي .

عبد الخالق صالح مهدي

قسم البستنة و هندسة الحدائق - كلية ألزراعة - جامعة ديالى -العراق.

المستخلص

أستطاع هذا ألبحث أن يبرز ألتنافس ألقوي بين نوعين من ألنباتات ألبرية هما ألثيل و ألحلفا في حقل شبه طبيعي، حيث إن ألنوعين في حالة توازن في ألطبيعة باختزال كثافتيهما بسبب ألتنافس وبحكم ألاختلاف في شكل ألحياة و مقدار خزين ألرايزومات والبذور في داخل ألتربة. لقد كان تأثير ألرعي ألشديد (ألحش) لصالح ألثيل. أما ألمساحة ألمحروثة والمزالة منها جميع ألرايزومات، فقد نمت عليها فقط ألأنواع ألتي كانت موجودة أصلاً في هذه ألمساحة وهي ألثيل وألعاقول، ولم تظهر ألحلفا، بالرغم من وجودها في ألحقل تحت ألدراسة. نستنتج أنه ربما هناك مواد كيمياوية مثبطة (تعارض بايوكيميائي او أليلوباثي) من قبل ألثيل أفشلت إنبات بذور ألحلفا.

الكلمات المفتاحية: ألتنافس، ألثيل، ألعقول، ألتعايش، ألتعارض ألبايوكيميائي.