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Importance of *Kochia prostrata* (L.) Schrad in arid and semi arid regions for livestock feeds

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Abstract. The limiting factor in primary productivity in arid and semi arid regions is precipitation. So, selected forage species that are tolerant to drought and salinity are very important for livestock production. Forage kochia [*Kochia prostrata* (L.) Schrad.] which grows in unsuitable conditions, is important plant in desert and semi-desert regions. Forage kochia is a perennial xerophyte and semi-shrubby plant which grows up to 30-100 cm tall. The root system of forage kochia may extend to a depth of 10 m or more. *Kochia prostrata* is very variable and there are a lot of eco-types in the world and particularly in Turkey. Forage kochia is especially important for artificial dry land pastures (100-350 mm rainfalls per years). Forage kochia has been used as a year around grazing forage plant and when properly managed survives long years (average: 15 years).

Keywords. *Kochia* – Arid land – Livestock – Pasture.

Importance de *Kochia prostrata* (L.) Schrad dans les régions arides et semi arides pour l'alimentation du bétail

Abstract. Le facteur limitant la productivité primaire dans les zones arides et semi arides est la précipitation. Ainsi, les espèces fourragères sélectionnées qui sont tolérantes à la sécheresse et à la salinité sont très importantes pour la production animale. Le fourrage kochia [*Kochia prostrata* (L.) Schrad.] qui se développe dans des conditions sévères, est une plante importante dans les régions désertiques et semi-désertiques. Il est une plante vivace, xérophite et semi arbustive qui grandit à 30-100 cm de hauteur. Son système racinaire peut s'étendre à une profondeur de 10 m ou plus. *Kochia prostrata* est très variable et il y a beaucoup d'éco-types dans le monde et particulièrement en Turquie. *Kochia* est particulièrement important pour les pâturages artificiels en terres arides (100-350 mm annuels). *Kochia* a été utilisée comme plante fourragère à pâturer pendant toute l'année et lorsqu'elle est bien gérée, elle survit longues années (moyenne: 15 ans).

Mots-clés. *Kochia* – Zone aride – Bétail – Pâturage.

I – Introduction

It is very difficult find enough to feed the animals from herbaceous plants at adversely pasture areas places arid soil and climate conditions as Karapınar in Turkey. The plant should be given priority form the alternative methods in these areas especially the drought-resistant shrubs and plants (Acar and Dursun, 2010). Forage kochia [*Kochia prostrata* (L.) Schrad is very resistant to drought and heat, it may grow even easily in regions with 160-200 mm rainfall. It endure up to -2, -4°C during the germination period. It can live comfortably between -40°C and +40°C (Kerimbekov, 1994). The Forage kochia is found in many parts of the world, and is located in different provinces (Kastamonu, Sivas, Erzurum, Kars, Konya, Kayseri, Erzincan, Van, Ağrı) in Turkey (Davis, 1967; Anonymous, 2012) (Fig. 1).

Kochia prostrata (L.) is a perennial, xerophyte plant and its height is between 30-120 cm. Forage kochia can grow at the dry steppe and desert conditions with roots that can go down deep. When the Forage kochia is mown or grazed, new shoots grow from the lower stems. Stalk colour varies from green to red-brown. The lower branches become a woody structure. The

leaves of the forage kochia are small. Flowers shapes looks like to clusters or clusters complex. Flowers constitute a flowers ball coming together. Generally forage kochia being in the foreign offspring, pollens is transferred by wind. Seeds of forage kochia are oval or round shaped. The diameter of the seed is about 2 mm. Seeds do not store for a long time. Seed or embryo is interior, with 5 perigone leaves as like beet seeds (Fig. 2) (Davis, 1967; Tokluoğlu, 1979; Kerimbekov, 1994; Anonymous, 2010; Dzyubenko and Dzyubenko, 2010). Weight of the 1000 seeds is about 0.6-1.5 g (Kerimbekov, 1994). Trials for plant yield and seed germination of kochia were conducted in Konya in 2010 and 2011.

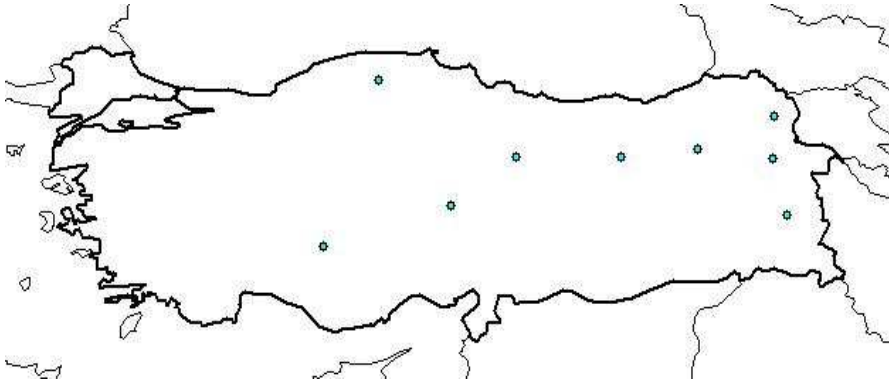
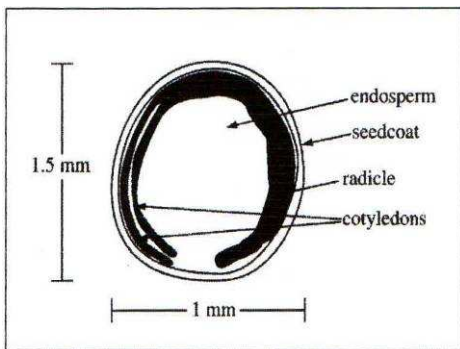
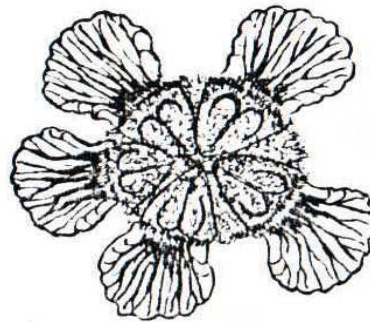


Fig. 1. Geographic distribution of *Kochia prostrata* in Turkey (Anonymous, 2012).



A



B

Fig. 2. A: longitudinal section of a seed of *Kochia prostrata* (Kitchen and Monsen, 2008). B: flower of *Kochia prostrata* (Davis, 1967).

II – Materials and methods

Yield of kochia in natural areas in Konya and germination of kochia seeds were measured in 2010 and 2011. *Kochia prostrata* seeds collected from pasture in October and November (2009) months in Konya and sown in May (2010), but germination was not achieved (Acar and Dursun,

2010). In 2010, *Kochia prostrata* seeds were collected from pasture in October and November months in Konya and sown in January (2011), and germination was achieved in greenhouse. It is very important to sow after harvesting for germination of *Kochia* (Fig. 3).



Fig. 3. *Kochia* seedlings was grown in the greenhouse.

In the other research, forage *kochia* has been obtained from natural habitat in Selcuk University (*kochia* is found in natural areas within the Selcuk University campus area) on 1 September 2010 with relating data in the field. Some plant characteristics and green and dry forage yield of forage *kochia* were determined. The data were obtained from two locations (A and B), and four plants from each plant type were measured.

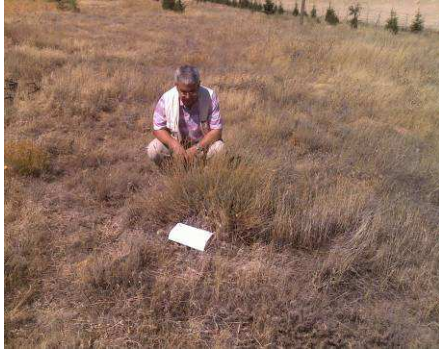
III – Results and discussion

The obtained data can be seen in Table 1 and Fig. 4. As shown in Table 1, some differences have been detected between green and red colour plants (Acar and Dursun, 2011). Kerimbekov (1994) exposed that, there are three different types of forage *kochia*; these are sandy, clay and mountain, depending if Forage *kochia* grows at sandy, clay and stony places. Forage *kochia* grown in clay soils was red, and forage *kochia* grow where it vary depending stated. Differences noted by researchers were also suggested in our study. Again plant height given by researchers (Dzyubenko and Dzyubenko, 2010; Tokluoğlu,1979), were in harmony with their findings.

Table 1. Some features of the *Kochia prostrata* found in natural areas and with the different colours

Parameters	Green colour stem			Red colour stem		
	A	B	Average	B	A	Average
Plant high (cm)	71.20	69.60	70.40	90.60	90.40	90.50
Plant diameter (cm)	98.30	74.10	86.20	108.10	101.00	104.50
Main rood diameter (cm)	6.10	7.00	6.50	6.30	5.40	5.80
Main stem amount	13.40	10.30	11.80	8.40	7.20	7.80
Fresh forage yield (g/plant)	520.20	1100.40	810.30	902.60	509.80	706.20
Hay ratio (%)	73.10	66.76	69.93	61.55	51.38	56.46
Hay yield (g/plant)	380.10	734.30	557.20	555.10	261.50	408.30

Source: Acar and Dursun (2011).



A: Forage kochia with the green colour stem



B: Forage kochia with red colour stem

Fig. 4. An image of *Kochia prostrata* in the natural growing habitat with different stem colours (Acar and Dursun, 2011).

In a study in the United States, *Elytrigia elongate* and *Kochia prostrata* were used mixture in different proportions for animal nutrition and *Kochia prostrata* increased digestibility of low-quality feed, and could be usable for livestock feed in winter period. Nevertheless, in this study, dry matter ratio of *Elytrigia elongata* and *Kochia prostrata* were found as 91.4% and 93.6% respectively, the resulting the CP, NDF and ADF rates for *Elytrigia elongata* are 3.6%, 77.7% and 50.6% DM whereas 9.6%, 53.8% and 32.2% were found for *Kochia prostrata* (Stonecipher *et al.*, 2004). Waldron *et al.* (2010) indicated that *Kochia prostrata* is a C4 plants with 6.5 m deep roots, tolerance to heat and drought an also salt resistant, and 1000 to 1800 kg/ha yield was reported depending on subspecies with annual rainfall of 100-200 mm. In addition it was indicated that especially during late summer and winter, it has nutritious and highly efficient nutritive value, with low tannin and oxalate, without nitrate accumulation.

IV – Conclusion

Forage kochia can be found a peculiarity at the natural pasture in many places of Turkey. It may be adequate for rehabilitation of the disrupted natural balance resulting of i global warming, water resources reducing and improper usage and it is important to gain marginal areas and rangelands. At the same time it is a plant that can be used for erosion prevention works. Due to its resistance, this plant could have advantages for the use of waste water for its production. For these reasons, we have to give the necessary importance to the this plant. If it is necessary, seedling production may be raised in greenhouse conditions for production of seed germination and seedling formation, that are difficult tasks for forage kochia (Acar and Dursun, 2011).

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