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### AFRICAN PURSLANE (*ZALEYA PENTANDRA* L.), A BLESSING IN ARID ECOSYSTEMS: A REVIEW

Wajiha Anum<sup>1</sup>, Muhammad Arshad Hussain<sup>1</sup>, Sana Munawar<sup>2</sup>, Liaquat Ali<sup>1</sup>, Muhammad Umair Raza<sup>3</sup>, Imtiaz Ali<sup>1</sup>, Mashal Rehman<sup>1</sup>, Umair Nisar<sup>1</sup>, Manzoor Hussain<sup>1</sup>

<sup>1</sup> Regional Agriculture Research Institute, Bahawalpur, Pakistan.

<sup>2</sup> Department of Agronomy, The Islamia University of Bahawalpur, Pakistan.

<sup>3</sup> Department of Agronomy, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan.

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#### ABSTRACT

African purslane (*Zaleya pentandra*), native to Africa, is a new plant species. Owing to its extensive use in the traditional cure of many diseases, it paved way for managing an originally weed species and shifting its status from a weed to a blessing in arid regions. In this review, *Z. pentandra* is explored as a weed along with its medicinal and folkloric uses. As a fodder plant, it can boost up an economic profile of less productive and drought-prone arid ecosystems by rearing livestock and protecting natural flora and controlling erosion losses. Shifting the status from weed to a cover crop, *Z. pentandra* can supplement soil with huge quantities of mineral nutrients. As a vital issue, desert encroachment with its control measures is a prerequisite in drylands. *Z. pentandra* includes in natural flora of arid lands, hence its characterization as a blessing or/and threat is a strong topic for researchers struggling towards better utilization of natural products for curing diseases as it leads to saving the economy of a country as well as better land utilization. The purpose of this review is to summarize the current state of knowledge about its potential utilization as a medicinal and fodder crop or threat as a weed in crops.

Corresponding Author: Muhammad Arshad Hussain

Email: [arshad.sikhani@gmail.com](mailto:arshad.sikhani@gmail.com)

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#### INTRODUCTION

African purslane (*Zaleya pentandra*, family Aizoaceae), is an important annual weed in arid and semiarid regions of the world. Native to Africa, it prevails in most of the regions in the world (Hyde et al., 2018) while exists as an invasive weed species in Arab, Zambia, Pakistan (Mahmood et al., 2012) and India (Suthari et al., 2011). It belongs to the genus *Trianthema* which consists of 20 species, but a few of them are reported as potential important ones for their use either as fodder or erosion controlling plants (Geethalakshmi et al., 2010). In Pakistan *Z. pentandra* prevails in the desert areas

(Cholistan and Thar) and arid regions where the rainfall is extremely low. Regardless of the extreme conditions, this plant shows vigorous growth with strong root system binding soil particles thus making way for its potentiality as an erosion control plant. The vigorous information presented on this plant makes way for further studies related to phytochemical and pharmacological standardization of extracts, separation, and recognition of vigorous constituents, pharmacological studies and the mode of action, formulation development, toxicological and therapeutic efficiency.

*Z. pentandra* currently possesses the status of a desert

weed, but allied to its utilization as a fodder and medicinal plant, this species can be utilized effectively in controlling health, feed for livestock and land conservation in arid regions where all resources are always limited. This paper demonstrates and reviews the existing information on inventive questions of interest on weeds. With the advent of resource conservation methods, researchers are making efforts to conserve dry land areas which are highly prone to erosion and for this purpose, *Z. pentandra* can serve as a blessing. By keeping in view these needs, valuable information is gathered and presented to assist scientists for future recommendations.

**Taxonomy:** *Zaleya pentandra* belongs to the family Aizoaceae (Munawar et al., 2015) consisting of 127

genera spread in the tropics and sub-tropics of South Africa (Mabberley, 2008). Six species were reported from Australia, Africa, and Asia. From Pakistan, *Z. pentandra* is the only reported species (Kanwal et al., 2009).

**Synonyms and common names:** *Z. pentandra* is recognized with different names specific to the region of occurrence. Its synonymical names are *Rocamaprostrate* Forssk, *Rocama Arabica*, *Trianthemia digyna* DC and *Trianthema govindia*. While heterotypic nomenclature of *Z. pentandra* includes *Limeum keniense*, *Trianthema pentandra* var *hirtulum*. African purslane has a Homophytic name as *Trianthema* (Hassler, 2014; Hepper and Friis, 1994). The common names of *Z. pentandra* in different regions are listed in Table 1.

Table 1: Common names of *Z. pentandra*.

Country/language	Name	Reference
Sudan/Arabic	Al-Rabaa	Elsafori et al. (2012)
English:	horse purslane	Dalziel (1937)
	Unchava or Xicalandemba	Burkill (1995); Jeffery (1960)
	pentandra L	
Arabic	رقمه، لعنه، ربع	Hepper and Friis (1994)
Arabic	Rabah	Burkill (1995)
Pakistan/Urdu	Wasanh	Mughal (2009)
Bhimber, Pakistan/Urdu	Slathi	Mahmood et al. (2011)
Jizan	Laniyh	Alfarhan et al. (2005)
Indus ecoregion	Bishkapra, Wahoo, It-sit, Narwa	Akbar and Khatoon (2012)
Sudan/Arabic	Arig alarab	Abusuwar and Mohammed (2011)
Tanzania	Isindura	Chirangi (2013)
English	African purslane	
Nigeria (Hausa):	<i>Gadon maciji</i>	Darlington and Janak (1945)
Kenya	Kikuyu	(Riley and Brokensha, 1988)
Central sudan	Al-rabaa	Elsafori et al. (2012)
Pakistan	It sit	
Kenya	Ki-thua-kia-mbiti	Riley and Brokensha (1988)
Ethopia	Raphuudhimaa	Wondimu et al. (2007)
South Africa	Muisvygie	Quattrocchi (2006)
Hindi	khari-buti	Ved et al. (2017)
Kannada	bilee komme, gaija soppu	Ved et al. (2017)
Tamil	Charanai	Ved et al. (2017)
Telugu	Galijaeru, thellagalijaeru	Ved et al. (2017)

**Distribution:** Native to Africa *Z. pentandra* L. is distributed widely in regions of Arabian Peninsula, Palestine, Iran, India, Pakistan (Akbar and Khatoon, 2012) Zambia, Farasan Islands, Zimbabwe, Madagascar, South Africa (Gonçalves, 1970), Egypt, Senegal and Sinai.

Recently it was reported from Mauritania, Mali, Niger, Zambia, Zimbabwe, Malawi, Chad, Sudan, Ethiopia, Uganda, Kenya, Ghana, Angola, Eritrea, Somalia, Socotra, Tanzania, E.D.R. Congo (Zaire), Mozambique and Algeria (Hassler, 2014). Prevalence of *Z. pentandra* has been

illustrated in Figure 1. It is characterized as a plant having the potential to spread to other regions of the world. Now

the question, that whether to stop its spread or utilize it effectively in arid regions open new gates in research.



Figure 1. Worldwide distribution of *Zaleya pentandra*.

**Habitat, climate and soil:** *Z. pentandra* grows in a large variety of climates and soils. It is a weed of gravelly and sandy soils. It is found along roadsides and marginal lands. *Z. pentandra* is reported to be very common in woodlands, high saline and desert areas (Muhaidat et al., 2007; Norton et al., 2009). Owing to its hardy nature and large scale spread in arid lands, *Z. pentandra* may also be referred to as a drought tolerant plant species which is found at an elevation of 1600 m from sea level (Jeffery, 1960). It is adapted to a wide variety of ecological zones which categorize it as xerophytic, terrestrial plant, neutrophils plant, sciophytic, phreatophytic, lithophytic, mesophytic, halophytic, therophytic and acidifuge plant (Ehsen et al., 2016). *Z. Pentandra* hence is likely to occur across a diversity of habitats and climatic conditions. A keen observational herbarium research must be carried out to indicate species manifestation.

#### **Morphological and anatomical description**

**Morphology:** *Z. pentandra* is a slightly succulent prostrate herb. The branches are pubescent and leaves differ in size and shape, sometimes oblanceolate, opposite and elliptic generally 1-2 cm in length. Leaf color varies from slightly gray to green tinges on the surface.

The petioles are short compared to the blades and form scarios wings sheathings (Alfarhan et al., 2005). Flowers are very minute forming a cluster at axial. They are sessile and subsessile and lack corolla. Two styles with a red capsule, five stamens and perianth lobes are present. Colour of flowers varies in the shades of pink. Four black seeds are encapsulated in jelly-like red color fruit. Aril is absent in shiny black seed, which is elliptic in shape with a sub-central hilum. Its seed size varies from 1.6 to 1.8 mm and testa is Aerolate, and rugose. Its seed does not contain any aril (Kanwal et al., 2009).while its pollen morphological description is shown in table 2.

**Anatomy:** *Z. pentandra* is a eudicot which has a double layered integument. It is among the 16 known eudicot species that follows Kranz anatomy along with C<sub>4</sub> photosynthesis. It follows a photosynthetic subtype of NAD-ME. The Enzymatic activity  $\mu\text{mol.mg chlorophyll}^{-1}\text{hr}^{-1}$  in NAD-ME was found to be  $395.4 \pm 5.8$  (Muhaidat et al., 2007). There is emerging evidence that some C<sub>4</sub> eudicots involve the photosynthetic enzyme PEP-CK in carbon acquisition alongside other decarboxylation enzymes. Muhaidat and McKown (2013) examined leaf ultra-structural characteristics together with enzyme activities and

immune-localizations in *Z. pentandra*. They found out the involvement of NAD-ME in *Z. pentandra*, occurring irrespective of biochemical subtype or the position of bundle sheath chloroplasts (Muhaidat and McKown, 2013). No

literature to date is present about the stem, flower and root anatomy determined at the cellular level. This gap needs to be filled by applying various microscopic techniques in combination with the tissue sectioning.

Table 2: Pollen morphological Description of *Zaleya pentandra* (Jeffery, 1960).

Name of taxa	<i>Zaleya pentandra</i>
Shape	Sub-pr
Polar length (P)	41.21 um
Equatorial diameter (E)	35.9 um
Colpus length	35.9µm
Mesocolpium	28.7m
Apocolpium	3.95.8m
Exine thickness	1.43m
Tectum	Scb-punct

**Phytochemistry:** Phytochemical analysis of *Z. pentandra* confirmed the presence of alkali salts. Its fruit portion is being used ancestrally as a miscellaneous toxic or a repellent. The whole plant contains significant concentrations of saponins, glycosides, and steroids (Burkill, 1995). At Timbuktu (Mali), the plant has been burnt to extract potash which is used for making soap (Burkill, 1995) and to furnish

a vegetable salt. The presence of micro molecules combinations like C-methylflavone, leptorumol, trianthenol, triantemine is confirmed in some studies (Suthari et al., 2011). Photochemical investigation of *Z. pentandra* leaf confirmed the presence of alkaloids, glycosides, tannins, carbohydrates and volatile oils as presented in Table 3. Leaf of *Z. pentandra* can be therapeutically recommended.

Table 3: Phytochemical Investigation of the leaf of *Zaleya sp.* (Shailendra et al., 2014).

S. No.	Chemical Constituent	Leaf Aqueous extract	Leaf Chloroform extract	Leaf Alcoholic extract	Leaf Pet ether Extract
1.	Alkaloids	-ve	+ve	+ve	+ve
2.	Glycosides	+ve	+ve	+ve	+ve
3.	Tannins	-ve	+ve	+ve	+ve
4.	Volatile oil	-ve	-ve	-ve	-ve
5.	Carbohydrates	+ve	+ve	+ve	+ve

### Pharmacological and folkloric uses

**Medicinal uses:** Utilization of medicinal plants is a component of human heritage. Traditional therapeutic knowledge is the sum of the expertise and practices based on the theories, beliefs, and experiences. Medicinal plants are helpful in safeguarding the health and helps in the prevention, diagnosis, or treatment of physical and mental illness (Timmermans, 2003). Weeds are extensively used as folk remedies or as the medicaments in the modern medicinal system (Alok, 1991; Stepp and Moerman, 2001). *Z. pentandra* is an astringent in snake bite and cure malaria (Seifu et al., 2006). It is digestive, stomachic, cure respiratory tract infections and cough

(Hameed et al., 2011; Qasim et al., 2011). Roots cure abdominal troubles and when hanged on neck its roots cure jaundice in the Subcontinent (Shah et al., 2013). In Punjab (Pakistan), its leaves and roots are used to cure general infections, gynecological and skin disorders. The plant's juice is extracted and utilized as purgative and diuretic. Moreover, the decoction of the plant is given as amenorrhea. In Bhimber (Pakistan), the whole plant is used to treat different diseases (Mahmood et al., 2011). In Sudan, gonorrhoea is cured when the weed dried powder is taken with millet beer. This sets up acute inflammation of the urino-genitary tract resulting in haematuria, vomiting and bloody stools, and thus 'purging' the

infection (Dalziel, 1937). Its roots are anti-phlegmatic in nature (Qureshi and Bhatti, 2008) and extensively utilized to cure influenza.

*Z. pentandra* is used against scorpion bites when its roots are rubbed on the affected area hence reducing the poison effect. It is antiseptic in nature; it cures athlete's foot and septic wounds when dried powder is applied directly on the infected area. *Z. Pentandra* is used in the preparation of sexual tonic; it reduces Labor pains during delivery when its roots are chewed with *Voandzeia subterranea* (Chirangi, 2013). However, in India, it is considered as a dangerous poison, where it is believed to have the ability to cause paralysis, diarrhea, and death by acute nephritis (Burkill, 1995).

**Fodder uses:** *Z. pentandra*, a non-legume forb, shows

moderately low methane to total gas ratios, hence it can be potentially used in the low methane emission forage diet. Its presence has been confirmed in sheep diet regardless of its absence or low occurrence in rangelands showing that it is a preferred diet of sheep.

It is liked by almost all the stocks like camels, cattle in every season and exploited widely as fodder for cattle (Seifu et al., 2006). In Senegal, it is ranked as one of the ideal fodder for livestock. Hence a weed can be converted to fodder by efficient management (Burkill, 1995). However, as far as the case is concerned in Tana River region of Kenya it is one of the few herbs shunned by cattle (Global Plants, 2016). Analysis of *Z. pentandra* species (Dougall and Bogdan, 1958) as a fodder revealed the contents as depicted in Table 4.

Table 4. Fodder Analysis of *Zaleya pentandra* (Dougall and Bogdan, 1958).

Main analysis	Unit	Avg
Crude protein	% DM	16.5
Crude fiber	% DM	23.1
Ether extract	% DM	2.5
Ash	% DM	17.9
Gross energy	MJ/kg DM	16.6
Minerals	Unit	Avg
Calcium	g/kg DM	10.4
Phosphorus	g/kg DM	2.7

Leaves are cooked and consumed in African and taken as a famine food in India, harvested as wild for edible purposes, regardless of conflicting reports about its edibility. The leaves are also burnt for vegetable salt (Burkill, 1995). African purslane forms a close cover over wasted land; hence owing to this character it can be referred to as a potential cover crop. However, on the other hand, it can harbor snakes which may cause problems for man and animals (Jeffery, 1960).

#### CONCLUSION

*Z. pentandra* is considered as a plant which can be beneficial or harmful for agriculture sector and humanity. Owing to the information compiled and investigated we can make two conclusions. First of all, *Z. pentandra* infestation increases the total stand density and biomass in its root area, thus diminishing the land value. This noxious weed invades dense meadows and disturbs roadsides and pastures. These attributions categorize it as a problematic weed which has the capability to diminish cropped land value. It establishes its weed

monoculture on the bare grounds and gradually deteriorates the survival of drought tolerant herbaceous plants in the surrounding areas. Based on this development, *Zaleya* as a weed can create a significant confront in crop production. From these baseline ideas, a number of people have the propensity to weaken the impact of this noxious weed. So, protecting those sensitive areas through integrated multidisciplinary loom seems compulsory. Closely monitoring and taking a direct measure of the main factors contributing to the fast invasion of the cultivated lands are due attention to overcome the problem. Continuing with the same fashion in the future in the occurrence of ever increasing Invasive Alien Species can lead to the very risky situation. Thus, closely monitoring the vegetation status and taking suitable range management, measure will be found obligatory. Secondly, we conclude that *Z. pentandra* with its absolute pharmaceutical values can render as the most inexpensive source of cure for developing countries. Moreover, research needs to be expanded concerning its

fodder value. This weed, when maintained efficiently, can turn out to be a valuable source of income for countries regarding medicinal, fodder, and animal industry.

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