Indian Journal of Agricultural Sciences **80** (10): 869–71, October 2010

Evaluation of Indian myrrh (*Commiphora wightii*) landraces for hyper arid Thar desert

R S MERTIA[1], N K SINHA[2], B K KANDPAL[3] and DALEEP SINGH[4]

Regional Research Station, Central Arid Zone Research Institute, Jaisalmer, Rajasthan 345 001

Received: 29 December 2009; Revised accepted: 8 July 2010

ABSTRACT

A study was carried out at the research farm of the Central Arid Zone Research Institute, Jaisalmer, during 2005–09 to evaluate 5 landraces of Indian myrrh [*Commiphora wightii* (Arn.) Bhandari], namely 'Dantiwara', 'Mangaliawas', 'Kukma-Bhuj', 'Bhind-Murena' and 'Jaisalmer Local' in relation to changes in growth behaviour and total phenol content in 4-year-old planted plants. Out of all the 5 landraces, plant height (197.4 cm), number of branches (9.3), Stalk collar diameter (62.2 mm), main stem diameter and crown spread (266.5 cm) was recorded significantly higher in 'Mangaliawas', followed by 'Jaisalmer Local', 'Dantiwara', 'Kukma-Bhuj' and 'Bhind-Murena' in all the successive years. Maximum amount of phenol was recorded in 'Jaisalmer Local'. Hence 'Mangaliawas', 'Jaisalmer Local' and 'Dantiwara' can be used for hyper arid situation at Thar desert.

Key words: *Commiphora wightii*, Guggal, Provenance, Phenol

Indian myrrh [*Commiphora wightii* (Arn.) Bhandari], is a well known herbal plant popularly known as *guggal* and belongs to family Burseraceae (APG II 2003). It is a small tree that has a thick main stem with crooked knotty branches. It is used in the Allopathic, Ayurvedic and Unani systems of medicines due to its anti-inflammatory, antirheumatic, hypocholesteremic, hypolipidemic and antifertility activities (Satyawati 1991, Tajuddin *et al.* 1997). Recent studies have shown that the plant of *C. wightii* possess anti-cancer activity (Singh *et al.* 2007, Xiao and Singh 2008) because of the presence of oleo-gum resin in its exudates commonly known as guggal or Indian myrrh or Indian bdellium is the economically important product of this plant. Unfortunately the plant *C. wightii* has become endangered because of its slow growing nature, poor seed setting, lack of cultivation, and poor seed germination rate. This plant is incorporated in Data Deficient category of IUCN's Red Data list. The plant is endemic to arid regions of the Thar desert of India and adjoining part of Pakistan. In India it is found in arid, rocky tract of Rajasthan and Gujarat. However, in last few decades there has been a sharp decline in natural population of this species and there is hardly a commercial cultivation. The increasing commercial demand of gum resin excessive and unscientific tapping for its gum resin by the pharmaceutical industries and traditional healers resulting in excessive and unscientific tapping of plants, is putting further pressure on this endangered species. This pressure can be reduced through cultivation of suitable landraces on commercial basis in its natural habitat. Keeping this view in mind a long-term experiment was started during January 2001 to identify comparatively fast growing landraces of *C. wightii* suitable for extremely arid situations.

[1]Principal Scientist and Head (e mail: mertiars @rediffmail.com); [2]Senior Scientist (e mail: nksinha.cazri @gmail.com);

[3]Principal Scientist, DRMR, Bharatpur (e mail: basantkandpal @gmail.com);

[4]Technical Officer (e mail: eeshan.nk@gmail.com).

MATERIALS AND METHODS

A field experiment was conducted during 2005–09 in 4-year-old planted plants of Indian myrrh [*Commiphora wightii* (Arn.) Bhandari] at the research farm of Regional Research Station, Central Arid Zone Research Institute, Jaisalmer. The soil was sandy skeletal, calcareous, typic torripsamments in nature, deficient in organic carbon (0.08%), available N (6.5 kg/ha), P (215 kg/ha) and K (6.9 kg/ha) with *p*H of 7.9. The seedling of promising landraces of *C. wightii*, viz 'Dantiwara', 'Mangaliawas', 'Kukma-Bhuj', 'Bhind-Murena' and 'Jaisalmer Local' were raised from 6 to 7 mm thick cuttings in poly tubes during first week of December 2000 and transplanted in first week of February 2001 in the plot size of 6 m × 8 m with the spacing of 3 m × 4 m in randomized block design and replicated 4 times in its natural habitat of rocky and shallow soils.

The data on plant height, number of branches, stalk collar

diameter, main stem diameter and crown spread was taken after 4 years of guggal transplanting, and in 5 consecutive years, viz 2005 to 2009. Since plants produce leaves during the short rainy season (July–October) though the mature leaves from the plant were collected in the last week of October in 2005 to 2009 for analyses of phenol content and it was estimated in the laboratory of the Institute.

Dried leaves (100 mg) were extracted in 80% ethanol and centrifuged at 3000 g after heating gently with 5 ml of 80% ethanol and the supernatant was collected. Final volume of the supernatant was made up to 10 ml with 80% ethanol. One ml of folin-phenol reagent and 2 ml of 20% Na_2CO_3 were added to 0.5 ml of supernatant so collected as above and boiled for 1 min. Optical density of the blue colour so developed was read at 670 nm. Total phenol was calculated against the standard curve using pyragallol.

RESULTS AND DISCUSSION

Data obtained in Table 1 revealed that plant height after 4 years of plantation showed maximum in 'Mangliawas' (197.4 cm), followed by 'Jaisalmer Local' (193.6 cm) and 'Dantiwara' (163.6 cm), 'Kukma-Bhuj' (120.9 cm) and 'Bhind-Murena' (80.2 cm). Same trend in increasing of height of the plant was observed up to 8 years of plantation. All landraces provided similar input although they showed variation among themselves. Variation in plant growth might be attributed to their genetic make up. However, the genotype 'Jaisalmer Local' showed very close and highly significant relationship with 'Mangaliwas'.

Regarding number of branches as depicted in the Table 1, showed higher in'Mangaliwas' in all the studied consecutive years, viz 4 to 8 and all other landraces showed same trend as plant height but the rate of branch emergence was observed very slow in all studied landraces. This might happen due to the plants was well acclimatized with the existing habitat. Stalk collar diameter was observed to be highest in 'Mangliwas' (62.2 mm), followed by 'Jaisalmer Local' (61.5 mm) and 'Dantiwara' (55.8 mm), 'Kukma-Bhuj' (38.0 mm) and 'Bhind-Murena' (31.8 mm). Same trend was observed up to 8 year. Vigour in stalk collar diameter would be very useful in long-term establishment of the plant because arid zone is characterized by high wind velocity which may excavate and break the plant.

Further, main stem diameter also showed the similar trend as stalk collar diameter with the duration of plant ageing. Higher collar and stem diameter showed more biomass partitioning which would be highly useful in successful gum tapping.

Maximum crown spread was found in 'Mangliawas' (266.5 cm), followed by 'Jaisalmer Local' (260.5 cm) and 'Dantiwara' (165.3 cm), 'Kukma-Bhuj' (63.6 cm) and 'Bhind-Murena' (57.5 cm) in the fifth year of plantation and the same was maintained up to 8 years but the difference among 'Mangliawas' and 'Jaisalmer local' is non-significant (Table 1). More crown spread symbolizing higher trapping of solar radiation causing higher metabolite formation in the plant.

Total phenol contents in the leaves of *C. wightii* varied with the landraces. 'Jaisalmer Local' had the highest phenol content followed by 'Mangliawas', 'Dantiwara', 'Kukma-Bhuj' and 'Bhind-Murena' (Table 2). Highest phenol content in 'Jaisalmer Local' showed more suitability in its existing habitat by forming metabolites best suited for such fragile ecosystem of Thar desert. However, phenol content in 3 landraces of *C. wightii*, such as 'Jaisalmer local', 'Mangliawas' and 'Dantiwara' showed at par to each other.

Table 1 Plant height, number of branches, stalk collar diameter, main stem diameter and crown spread of *Commiphora wightii* landraces as affected by ageing

Landrace	Plant height (cm) after years					Number of branches after years					Stalk collar diameter (mm) after years				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
'Dantiwara'	163.6	172.2	185.2	192.6	196.8	5.9	6.3	6.6	7.0	7.4	55.8	63.7	70.5	74.9	78.4
'Mangliawas'	197.4	209.3	232.5	245.4	253.0	9.3	9.8	10.2	10.5	10.8	62.2	66.3	76.5	82.2	91.5
'Kukma-Bhuj'	120.9	135.5	146.0	158.4	164.5	5.3	5.4	5.6	5.9	6.5	38.0	42.2	54.9	57.5	62.2
'Bhind – Murena'	80.2	95.5	142.5	146.7	151.4	1.5	1.9	2.1	2.3	2.7	31.8	31.9	33.2	35.6	38.1
'Jaisalmer Local'	193.6	208.2	228.2	240.6	249.8	9.1	9.6	9.9	10.3	10.7	61.5	64.5	77.3	80.2	90.6
CD (*P*=0.05)	23.7	24.7	26.5	27.2	27.6	4.6	4.8	4.9	5.0	5.2	13.1	13.8	14.9	15.3	15.8

	Main stem diameter (mm) after years					Crown spread (cm) after years				
'Dantiwara'	35.6	38.5	42.3	47.5	51.6	165.3	212.9	260.8	289.6	302.2
'Mangliawas'	41.8	44.0	46.4	54.6	58.5	266.5	344.6	382.3	401.8	421.7
'Kukma-Bhuj'	31.1	32.9	42.2	45.9	50.4	63.6	114.5	155.6	183.6	205.5
'Bhind – Murena'	15.0	16.5	22.5	28.4	36.1	57.5	83.2	96.8	107.3	126.4
'Jaisalmer Local'	40.2	42.5	44.5	50.4	54.6	260.5	336.5	360.8	385.5	405.8
CD (*P*=0.05)	10.6	11.0	11.9	12.8	13.7	23.7	24.8	26.6	23.3	27.81

Table 2 Phenol content from the leaves of *Commiphora wightii* landraces as affected by ageing

Landrace	Phenol (µg/mg dry weight) after years				
	4	5	6	7	8
'Dantiwara'	110.4	126.5	132.3	138.2	142.2
'Mangliawas'	118.2	132.5	136.5	141.0	146.3
'Kukma-Bhuj'	95.5	105.6	111.6	114.5	121.3
'Bhind-Murena'	88.9	94.2	99.4	104.6	109.5
'Jaisalmer Local'	119.5	133.2	138.2	142.5	149.2
CD (*P*=0.05)	9.6	7.2	6.7	4.5	7.6

Further, it has been suggested that the plant grown under the harsh situation produce higher amount of secondary metabolites for their survival which have great potential in disease cure (Sinha and Srivastava 1997). Phenol is also regarded as the growth-controlling compound (Moghadam *et al.* 2007) which enables plant to survive in extremely adverse situation by regulating the growth of plant. Further, phenols are reported to have multiple biological effects, including antioxidant activity, anti-tumor, anti-mutagenic and anti-bacterial properties (Shui and Leong 2002). In such way, phenol helps the plant to survive in extremely adverse condition by its free radical scavenging activity vis-à-vis in medicinal use. Therefore, phenol content might be useful in practical purposes in screening for evaluation of survival tolerance of *C. wightii* in hyper arid situation.

Thus it is concluded that 'Mangliawas', 'Jaisalmer Local' and 'Dantiwara' would be suitable landrace for hyper arid situation of Thar desert.

REFERENCES

APG II. 2003. An update of the Angiosperm Phylogenetic Group classification for the orders and families of flowering plants: APG II. *Botanical Journal of the Linnean Society* **141**: 399–436.

Moghadam G E, Talaie A, Mokhtarian A. 2007. Relationship between total phenol content, mineral nutrition and vigor of some selected dwarf Iranian Mahaleb (*Prunus mahaleb* L.) genotypes. *Journal of Plant Sciences* **2** (1) : 82–8.

Satyawati G V. 1991.Guggulipid: a promising hypolipidemic agent from gum guggal (*Commiphora wightii*). (*in*) *Economic and Medicinal Plant Research*, Wagner H and Farnsworth N R (Eds) Academic Press, London.

Shui G, Leong L P. 2002. Separation and determination of organic acids and phenolic compounds in fruit juices and drinks by HPLC. *Journal of Chromatography* **77**: 89–96.

Singh S V, Choi S, Zeng Y, Hahm E R, Xiao D. 2007 Guggulsterone-induced apoptosis in human prostate cancer cells is caused by reactive oxygen intermediate dependent activation of c-Jun NH2–terminal kinase. *Cancer Research* **67**: 7439–49.

Sinha N K, Srivastava A K. 1997. Medicinal and aromatic plants under stress: A review. (*in*) *Proceedings of the paper presented in South Asian Countries Seminar on Medicinal Plants*, pp 22–3, held during 9–12 November 1997 at Patna.

Tajuddin, Agarwal S K, Tyagi B R, Ram M, Dwiwedi S, Kumar S. 1997. Development of cultivar marusudha of guggul (*Commiphora wightii*). *Journal of Medicinal Aromatic Plant Sciences* **19**: 1043–4.

Xiao D, Singh S V. 2008, Z-Guggulsterone, a constituent of Ayurvedic medicinal plant *Commiphora mukul*, inhibits angiogenesis *in vitro* and *in vivo*. *Molecular Cancer Therapeutics* **7**: 171–80.