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Registration of high yielding variety 'CIMAP Chetak' suitable for medium irrigated areas of Nagori ashwagandha (*Withania somnifera* L. Dunal)

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ABSTRACT

A new variety of Nagori ashwagandha (Withania somnifera L Dunal) named herafter as CIMAP chetak was bred for high dry root yield (11.77 ql/ha v/s check 5.45 ql/ha) with high total Withanolide content (0.40 v/s 0.20% in check). The fresh and dry leaf yield are also high (1.722 and 0.453 ql/ha v/s 0.872 and 0.147 ql/ha in check) with high withaferine content 1.223v/s 0.788 % in the traditional cultivated check. The variety CIMAP Chetak of Ashwgandha has been developed through half sib family selection breeding methods. This variety will find direct utility in pharmacological/medical industries.

INTRODUCTION

Ashwagandha (*Withania somnifera*), also known as Indian ginseng, is an important ancient plant, the roots of which have been employed in Indian traditional systems of medicine, Ayurveda and Unani. Nagori type *Withania somnifera* grows as a short (35-75 cm) with a central stem from which branch extend radically in a star pattern and covered with a dense matte of wooly hairs. The flowers are small and green, while the ripe fruit is yellow and has milk-coagulating properties. The plant also has long brown tuberous roots that are used for medicinal purposes. It is cultivated in many of the drier regions of India such as Manasa, Neemuch, and Jawad tehsils of the Mandsaur district of Madhya Pradesh, Punjab, Sindh and Rajasthan. In Madhya Pradesh alone it is cultivated in more than 5000 hectare. The estimated production of Ashwagandha roots in India is more than 1500 tonnes and the annual requirement is about 7000 tonnes necessitating the increase in its cultivation and higher production. It grows in dry and sub-tropical regions. Being hardy and drought tolerant species with its enormous bio-compounds, its usage is forever regarded and continuous to enjoy the monopoly in many parts of India, particularly in Madhya Pradesh. It grows in dry parts in sub-tropical regions. Ashwagandha root drug finds an important place in treatment of rheumatic pain, inflammation of joints, nervous disorders and epilepsy. Dried roots are also used as tonic for hiccup, cold, cough, female disorders, as a sedative, in care of senile debility, ulcers, etc. its leaves are applied for carbuncles, inflammation and swellings. Leaf juice is useful in conjunctivitis. Bark decoction is taken for asthma and applied locally to bed sores. Ashwagandha and its extracts are used in preparation of herbal tea, powders, tablets and syrups. In the view of above interest, variety CIMAP Chetak of Ashwgandha has been developed by CIMAP through half sib family

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Table 1. Mean performance (pooled over two years) of selected genotype in dwarf genotypes of Nagori ashwagandha in BST and PST field evaluation trials.

S. No.	Entries	BST (E-10, RBD, Reps-3, Plot size= 30 m^2), (two years- 2003-04 and 2004-05)				PST (E-5, Plot size=100 m^2) (two years- 2005-06 and 2006-2007		Mean yield (mean of BST and PST) ql/ha		Total Withanolide content
		Fresh root yield		Dry root yield		Fresh root yield	Dry root yield	Fresh root yield	Dry root yield	In dry root
		Kg/plot	ql/ha	Kg/plot	ql/ha	ql/ha	ql/ha	ql/ha	ql/ha	%
1.	NGR-1	13.56	45.15	4.067	13.54	40.00	10.00	42.58	11.77	0.40
2.	MNAS	4.72	15.72	1.92	6.39	15.50	7.00	15.61	6.70	0.30
3.	WB 4	3.98	13.25	2.04	6.79					
4.	NGR-9	7.20	23.98	2.58	8.59	15.30	6.50	19.64	7.55	0.28
5.	AGR-1	6.24	20.78	2.28	7.59					
6.	AGR-2	6.78	22.58	2.64	8.79					
7.	AGR-3	8.04	26.77	2.58	8.59					
8.	AGR-4	6.30	20.98	2.88	9.59	13.89	6.20	17.44	7.90	0.24
9.	AGR-5	6.60	21.98	1.74	5.79					
10.	Check	3.96	13.19	1.77	5.89	12.00	5.00	12.60	5.45	0.20
	CD (5%)	0.65		0.38						
	CD (1%)	0.89		0.52						

Table 2. Mean performance (pooled over two years) of leaf yield of selected genotype in dwarf genotypes of Nagori ashwagandha in field evaluation trials.

S. No.	Entries	PST (E-10, RBD, Reps-3, Plot size= 30 m^2), (two years- 2005-06 and 2006-2007			
		Fresh leaf yield		Dry leaf yield	
		Kg/plot	ql/ha	Kg/plot	ql/ha
1.	NGR-1	0.517	1.722	0.136	0.453
2.	MNAS	0.399	1.329	0.104	0.346
3.	WB 4	0.374	1.245	0.066	0.220
4.	NGR-9	0.379	1.262	0.048	0.160
5.	AGR-1	0.340	1.132	0.065	0.216
6.	AGR-2	0.373	1.242	0.069	0.230
7.	AGR-3	0.384	1.278	0.058	1.931
8.	AGR-4	0.422	1.405	0.069	0.230
9.	AGR-5	0.345	1.149	0.047	0.157
10.	Check	0.262	0.872	0.044	0.147
	CD (5%)	0.025		0.0123	
	CD (1%)	0.034		0.0169	

selection in Nagori land races. This variety will find direct utility in pharmacological/medical industries.

Origin of the variety: Under the genetic improvement programme on Ashwagandha, (*Withania somnifera*), by applying half sib family selection followed by individual plant selection in

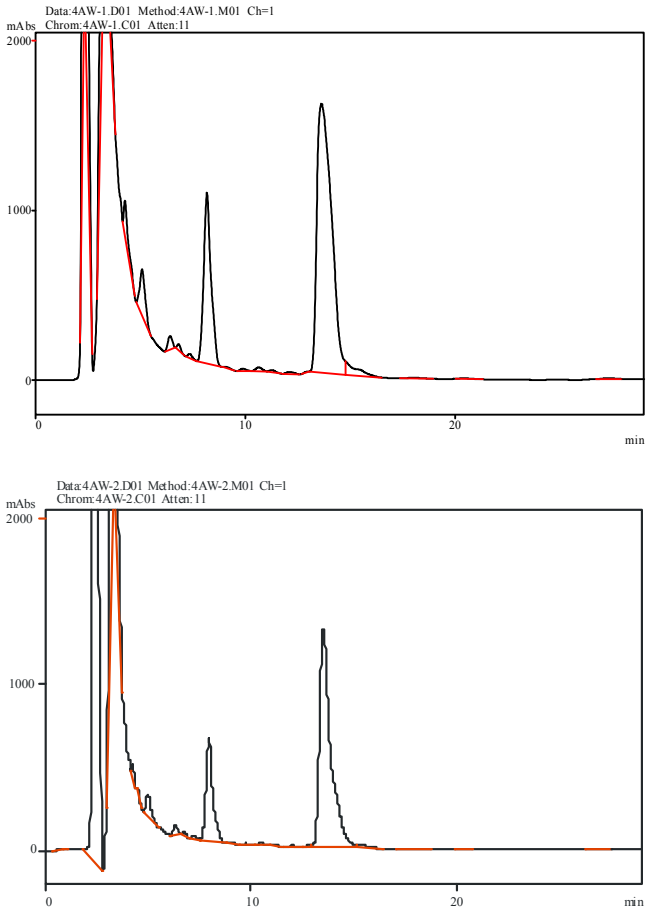

Figure 1. Chromatogram of variety CIMAP Chetak (NGR-1) and check (below)

Table 3. Main chemical constituents in dry leaf powder in Nagori ashwagandha

S. No.	Entries	Constituents in dry leaf powder (%)		
		Withaferin–A contents	12-deoxywith-astramonocide content	Withanolide A content
1.	NGR-1	1.223	0.041	0.002
2.	Check (Local)	0.783	0.009	0.001

Nagori (dwarf) types collections: In the available genetic stocks, 15 lines were selected on the basis for high dry roots type followed by quality analysis of dry powder of root and identified nine superior lines. These nine superior lines along with check variety were placed in Bench Scale Trial (BST, RBD-3 reps, E -10, plot size, 30 m^2) during 2003-04 and 2004-05. As a result, four superior lines: NGR-1, MANS, NGR-9 and AGR-4 were identified for high dry root yield with high total Withanolide content (%) and placed in PST (100m^2, 2005-06; 2006-07) for further evaluation along with the check.

Figure 2. Individual plant, dry roots and yellow colour berries of variety CIMAP Chetak of Ashwagandha

Table 4. Description of the strains/varieties.

Attributes	CIMAP Chetak	Check
Selections	Dward genotypes (Nagori Type)	
Plant height (cm)	60.00	45.00
Root length (cm)	18.00	15.00
Root width (cm)	1.00	1.00
Growth habit	Semi open	Open
Leaf	Small, medium green	Small and light green
Stem colour	Whitish green	Light green
Fresh root yield (ql/ha)	42.58	12.60
Dry root yield (ql/ha)	11.77	5.45
Fresh leaf yield (ql/ha)	1.72	0.87
Dry leaf yield (ql/ha)	0.45	0.15
Fiber quality in dry root	Very less fibers in roots	In late harvesting more fiber in roots
Total withanolide content (%)	0.40	0.20
In dry leaf powder:	-	-
Withaferin A content (%)	1.223	0.788
12-deoxywithastramonocide	0.041	0.009
Withanolide-A	0.002	0.001

One genetic stock, namely NGR-1 was found to be highly promising for high dry root yield (11.77 ql/ha v/s check 5.45 ql/ha) with high total Withanolide content 0.40 v/s 0.20% in check (Table 1, 2, 4; Figure 2). The fresh and dry leaf yield was also high (1.722 and 0.453 ql/ha v/s 0.872 and 0.147 ql/ha in check) with high withaferine content 1.223v/s 0.788 % in the check (Table 2, 3 and 4; Figure 1). The elite strain released as variety CIMAP **- Chetak** for commercial cultivation**.**

4. Statement of distinction: Variety CIMAP Chetak is a semi vigorous, medium green small leaves size and whitish green stem; these are its distinguishing morphological features of following variety.