

## CIM-Sunahari: High-yielding, yellow (pili) satawar variety of (*Asparagus adscendens* Roxb.)

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### ABSTRACT

Yellow satawar (family: *Asparagaceae*) is a very important medicinal plant, which is used in Ayurveda and traditional medicine system used as a reproductive tonic. It is also used treating gonorrhea, piles, diabetes, increasing lactation, antihelminthic, rheumatism, cough, diarrhea, dysentery, gastric troubles and headache etc. The major active constituents of *Asparagus* are steroidal saponin (shatavarin) that is present in the roots. Other active compounds are quercetin, rutin, vitamin A, B1, B2, C, E, Mg, P, Ca, Fe and folic acid. Dry roots of pili satawar with good quality are in high demand in national/international market due to its high prices (250/kg). The global production of pili satawar is around 200 tonnes/year in which 150 tonnes exported to European countries including USA by the China, India and Nepal. A new variety (CIM Sunahari) of *Asparagus* has been developed at CSIR-CIMAP, Lucknow through half sib family selection) approach for high yield of roots with desirable quality of saponin. The variety CIM Sunahari consistently showed higher root yield in field trials with an average dry root yield of 97.55 q/ha and 11.027% saponins. The newly developed variety CIM Sunahari is able to produce 40 % more root yield than the check. The cultivation of this new variety is likely to boost societal economic impact on farmers societies of Uttarakhand and northern.

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### INTRODUCTION

Yellow satawar (*Asparagus adscendeus* Roxb.) belongs to family "Asparagaceae". The saponins of satawar are extracted from the tuberous roots or rhizomes. The plant is a spiny under-shrub, with tuberous, short root stock, bearing numerous

succulent (10-30 cm long and 10-15 mm thick) tuberous roots that are silvery white or ash colored externally and white internally. The stem is woody, whitish grey or brown colored with small spines. The plant flowers during July-September leaving a mild fragrance in its surrounding and by the end of October, fruits can be seen with attractive red berries. Shatawari is a very important Ayurvedic medicinal herb, which is used in many allopathically incurable diseases. Traditionally, this plant is used

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Table 1. Mean performance of selected genotypes of pili satawar in IET

SI No	Entries	IET* (Entries = 24, RBD, Reps-3, Plot = 3 m <sup>2</sup> )									
		Plant Height (cm)	Number tillers/ plant	Number of roots/ plant	Root length (cm)	Width of root (mm)	Fresh yield/ plant (g)	Fresh yield/plot (3m <sup>2</sup> )	Dry yield/ plot (3m <sup>2</sup> )	Saponin content (%)	Satavarin content (%)
1	YS-2	118.06	2.87	86.33	18.60	13.47	1572.00	12.52	1.78	2.16	0.263
2	YS-3	126.80	3.27	75.33	15.20	12.10	1658.33	13.36	2.04	2.12	0.043
3	YS-4	110.50	3.47	95.33	19.52	12.48	1540.33	12.21	1.79	4.86	0.017
4	YS-5	106.85	2.27	111.33	16.40	13.40	1333.33	10.27	1.91	4.02	0.217
5	YS-6	108.62	2.17	97.67	17.66	14.66	1325.00	10.65	1.68	4.07	0.183
6	YS-7	114.31	3.37	97.67	15.55	13.41	1269.67	10.47	1.55	5.47	0.223
7	YS-8	116.61	4.87	106.00	20.27	13.28	1426.67	11.65	1.77	2.97	0.227
8	YS-9	119.91	4.47	75.00	19.60	12.56	1753.67	14.26	2.04	4.07	0.207
9	YS-10	125.26	2.57	93.67	18.40	14.09	1954.67	15.99	2.44	3.89	0.083
10	YS-11	109.33	4.97	73.67	21.28	13.48	1534.00	12.27	1.87	4.07	0.223
11	YS-12	111.41	4.87	113.67	20.55	12.18	1462.67	11.49	1.69	4.16	0.343
12	YS-13	122.52	4.27	110.67	17.54	12.44	1330.00	10.76	1.56	6.72	0.243
13	YS-14	118.30	3.17	66.67	18.36	12.44	1857.67	15.59	2.26	6.65	0.220
14	YS-15	127.64	3.06	88.67	20.75	13.46	1725.67	14.27	2.17	10.56	0.223
15	YS-16	<b>105.55</b>	<b>6.27</b>	<b>134.33</b>	<b>28.30</b>	<b>15.72</b>	<b>2226.67</b>	<b>18.03</b>	<b>2.66</b>	<b>11.03</b>	<b>0.180</b>
16	YS-17	118.90	4.17	90.67	16.39	12.53	1884.33	15.38	2.27	1.74	0.020
17	YS-18	106.12	3.57	69.67	15.61	12.46	1668.67	13.29	1.94	4.08	0.336
18	YS-19	119.25	2.57	80.67	16.48	13.54	1164.33	9.66	1.43	4.48	0.080
19	YS-20	120.57	4.77	84.67	17.36	13.99	1542.67	12.52	1.81	6.19	0.083
20	YS-21	107.72	3.87	97.33	21.45	13.17	1458.33	11.66	1.78	4.66	0.183
21	YS-22	121.71	4.07	121.67	20.29	13.56	1683.00	13.61	2.15	3.25	0.087
22	YS-23	123.53	3.17	89.33	22.27	12.36	1205.00	9.65	1.46	4.38	0.257
23	YS24	128.96	4.97	72.67	18.52	12.41	1612.33	13.32	1.94	7.35	0.033
Chcek	YS-1	106.50	2.47	53.00	16.47	12.69	1136.00	9.13	0.45	1.73	0.833
GM		116.46	3.73	91.07	18.87	13.16	1555.21	12.58	1.85	4.78	0.169
RANGE		105.55-128.96	2.17-6.27	53.00-134.33	15.20-22.27	12.10-15.72	1136.00-2226.67	9.13 - 18.03	0.45 - 2.66	1.73 - 11.03	0.017-0.833
CD <sub>5%</sub>		6.39	0.016	4.35	0.77	0.403	52.00	0.30	0.93	0.25	0.012
CD <sub>1%</sub>		8.52	0.021	5.80	1.02	0.538	69.42	0.40	0.12	0.34	0.015

\*P&lt;0.01

**Table 2. Mean performance of selected genotypes of pili satawar in BST**

SI No	Entries	BST* (Entries = 14, RBD, Reps-3, Plot = 3 m <sup>2</sup> )									
		Plant Height (cm)	Number tillers/plant	Number of roots/plant	Root length (cm)	Width of root (mm)	Fresh yield/plant (g)	Fresh yield/plot (3m <sup>2</sup> )	Dry yield/plot (3m <sup>2</sup> )	Saponin content (%)	Satavarin content (%)
1	YS-2	119.31	3.63	85.67	18.53	12.13	1566.67	12.90	1.96	4.44	0.077
2	YS-3	126.92	3.43	84.00	13.53	11.73	1641.67	13.69	2.04	5.92	0.243
3	YS-4	117.23	4.67	95.00	15.83	12.53	1541.67	12.71	1.92	5.06	0.060
4	YS-9	122.45	4.70	74.67	19.43	12.33	1768.67	14.53	2.17	6.25	0.020
5	YS-10	113.09	5.40	76.00	21.33	12.37	1401.33	11.57	2.23	9.56	0.063
6	YS-11	122.91	3.67	64.33	16.93	12.43	1805.00	14.75	2.18	4.06	0.243
7	YS-14	129.52	3.30	87.00	20.83	13.77	1780.00	14.68	2.18	4.66	0.223
8	YS-15	116.62	4.70	92.33	14.93	11.60	1783.33	14.65	2.03	6.01	0.223
9	YS-16	<b>106.55</b>	<b>6.60</b>	<b>133.00</b>	<b>28.23</b>	<b>14.98</b>	<b>2290.00</b>	<b>18.80</b>	<b>2.77</b>	<b>11.20</b>	<b>0.203</b>
10	YS-17	112.23	3.67	65.00	15.30	11.70	1656.67	13.59	1.92	4.56	0.043
11	YS-18	120.18	5.40	80.33	17.30	14.63	1546.67	12.68	2.05	4.47	0.063
12	YS-20	123.47	4.47	114.67	20.43	12.16	1663.00	13.36	2.00	7.53	0.080
13	YS-22	131.76	5.40	70.33	15.83	11.45	1627.67	13.34	2.01	7.85	0.043
14	Check	123.40	3.50	93.33	17.90	11.87	1956.67	16.18	1.75	5.95	0.403
GM		120.41	4.47	86.83	18.31	12.55	1716.36	14.10	2.09	6.25	0.14
RANGE		106.55-131.76	3.30 - 6.60	64.33 - 133.00	13.53 - 28.23	11.45 - 14.98	1401.33-2290.00	11.57 - 18.80	1.75 - 2.77	4.06-11.20	0.020 - 0.403
CD <sub>5%</sub>		2.61	0.29	4.48	0.74	0.52	26.85	0.21	0.39	0.50	0.0083
CD <sub>1%</sub>		3.53	0.40	6.05	0.99	0.71	36.29	0.28	0.52	0.68	0.0112

\*P&lt;0.01

**Table 3. Mean performances of selected genotypes of pili satawar in PST**

SI No	Entries	PST * (Entries = 9, RBD, Reps-3, Plot = 3 m <sup>2</sup> )										
		Plant Height (cm)	Number tillers/plant	Number of roots/plant	Root length (cm)	Width of root (mm)	Fresh yield/plot (3m <sup>2</sup> )	Dry yield/plot (3m <sup>2</sup> )	Fresh yield (qtl/ha)	Dry yield (qtl/ha)	Saponin content (%)	Satavarin content (%)
1	YS-3	126.75	3.70	81.33	14.47	11.30	14.19	2.12	472.88	70.77	5.05	0.227
2	YS-9	124.24	4.60	76.33	19.39	10.33	15.19	2.27	506.33	75.77	6.00	0.020
3	YS-10	122.75	3.13	96.00	17.83	12.90	15.30	2.28	510.11	76.11	5.90	0.307
4	YS-14	125.00	4.20	62.33	16.37	14.33	14.95	2.25	498.44	74.88	4.53	0.447
5	YS-15	129.55	3.40	95.00	21.83	13.15	14.79	2.20	492.88	73.55	4.58	0.247
6	YS-16	<b>104.75</b>	<b>6.47</b>	<b>129.67</b>	<b>29.68</b>	<b>17.80</b>	<b>19.38</b>	<b>2.93</b>	<b>645.88</b>	<b>97.55</b>	<b>11.03</b>	<b>0.187</b>
7	YS-17	117.42	4.63	85.33	14.47	12.27	14.56	2.18	485.44	72.55	6.25	0.267
8	YS-18	130.83	6.19	78.66	15.38	11.26	13.62	2.05	458.22	68.44	7.45	0.020
9	Check	114.62	3.73	65.67	14.47	10.74	13.75	2.04	454.11	67.88	5.08	0.047
	GM	121.77	4.45	85.59	18.21	12.68	15.08	2.26			6.21	0.19
	RANGE	104.75-130.83	3.13 - 6.47	62.33 - 129.67	14.47 - 29.68	10.33 - 17.80	13.62 - 19.38	2.04 - 2.93	454.11-645.88	67.88-97.55	4.53 - 11.03	0.020 - 0.447
	CD <sub>5%</sub>	1.61	0.34	4.24	0.67	0.63	0.33	0.18			0.59	0.0044
	CD <sub>1%</sub>	2.22	0.47	5.84	0.92	0.87	0.46	0.25			0.82	0.0061

\*P&lt;0.01





**Fig. 1. Field view of Variety CIM Sunehari of pili satawar**

as a reproductive tonic. It is also used for treating gonorrhea, piles, diabetes, increasing lactation, antihelminthic (pertaining to a substance capable of destroying or eliminating parasitic worms, especially human intestinal helminthes), rheumatism, cough, diarrhea, dysentery, gastric troubles and headache [2].

The major active constituents of *Asparagus* are steroidal saponins (shatavarins) that are present in the roots. Other active compounds are



**Fig. 2. Close up view of variety CIM Sunehari of pili satawar**



**Fig. 3. Processed dry roots of variety CIM Sunehari**

quracetin and rutin. This plant also contains vitamin A, B1, B2, C, E, Mg, P, Ca, Fe and folic acid. The CIM Sunehari variety of *Asparagus* has been developed by CSIR-CIMAP through intensive

breeding efforts for high yield of roots with desirable quality of saponin [1]. The average dry root yield of this new variety is 97.55 q/ha with 11.025% saponins.

To the best of our knowledge and understanding, CIM-Sunehari is the first genetically improved variety of Pili Satawar that has been developed and released by CSIR-CIMAP for its commercial cultivation in the country.

#### Origin of the variety:

Under the genetic enhancement programme of pili satawar, using half sib selection methods, 50 collections were initially screened for high fresh and dry root yield v/s local check in the year 2009. In all, 23 selection were made for further testing. These 23 selections were evaluated in Initial evaluation trial {IET, entries 24 (23 + one Check), RBD, replications 3, plot size = 3.00 m<sup>2</sup>} in the year 2009-10; 2010-2011 followed by Bench Scale trial {Entries = 14 (13 + one Check), RBD, Reps-3, Plot size = 3m<sup>2</sup>} in the year 2011-12 and 2012-13 followed by large Scale Trial (PST, Entries = 9 (8 + one Check), plot size 3m<sup>2</sup>) during 2013-14, 2014-15 for root yield (fresh and dry) with better quality (Tables 1-3). The highest yielder genotype CIM Y.S.-16 consistently maintained its superiority over check for high fresh and dry root yield (645.88 q/h and 97.55q/ha v/s check 454.10q/ha and 67.88 q/ha) with high saponin content 11.027% v/s check 4.527%.

**Statement of distinction/ Breeder's claims:** Variety CIM Sunehari is mild bushy with green, leaves (Fig. 1,2) and bold roots (Fig. 3) These are distinguishing morphological features of this strain. The strain has the following DUS (Distinctiveness, Uniformity and Stability) characteristics:

1. The strain is morphologically distinct from other pili satawar varieties and clearly identifiable by its dark green broad leaves with brown

tingeing in centre.

2. Color of the petiole is light purple.
3. Light purple stolen color.
4. The strain has a unique feature of erect stem, recurved and terete leaves.
5. The crude saponins extracted from dry roots from this strain are high (11.027%).

About 1 kg seed material is presently available with CSIR-CIMAP. The variety is being multiplied now for its distribution to farmers for commercial cultivation.

**Table 4. Description of the variety CIM Sunehari**

Attributes	CIM-Sunehari	Check
Growth habit	Erect and very fast growing	Sub-erect and slow growing
Leaf	Broad and dark green	Small and light yellow
Stem color	light green	Yellowish green
Fresh root yield (q/ha)	645.88 q/h	454.10q/ha
Dry root yield (q/ha)	97.53 q/ha	67.88 q/ha
Saponin content (%)	11.027%	4.527%

The others distinguishing morphological features of this variety are given in following Table - 4 below:

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