

Original Research Article

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Impact of Varieties and Integrated Nutrient Management on Incidence of Aphid (*Aphis gossipy* Glover) on Isabgol (*Plantago ovata* Forsk.) under Northern Dry Zone of Karnataka

Siddalingayya V. Salimath*, Y. K. Kotikal, K. N. Kattimani,
N. S. Nagarja, Jameel Jhalegar, D. R. Patil and J. Venkatesh

College of Horticulture, University of Horticultural Sciences, Bagalkot, India

*Corresponding author

ABSTRACT

Keywords

Aphis gossipy,
INM, Gujarat
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The field experiment was conducted to evaluate the performance of two Isabgol cultivars and INM on the incidence of aphids in northern dry zone of Karnataka during 2015-16 and 2016-17. The experiment was laid out in split plot design (SPD) with sixteen INM treatment combinations at the college of horticulture, Bagalkot. Pooled data analysis of two years data exhibited lower aphid (*Aphis gossypii* Glover) incidence in Vallabh Isabgol-1 with integrated nutrient management. The lower aphid incidence was recorded with supply of 75 % RD of FYM + 75 % RD of NPK + *Azospirillum* + *PSB* + $ZnSO_4$ + $FeSO_4$ (N_{11}) and maximum aphid incidence was recorded with supply of 50 % RD of FYM + 50 % RD of NPK + *Azotobacter* (N_{13}) at 90 DAS. In interaction effect minimum aphid infestation was recorded in Vallabh Isabgol-1, supplied with Vermicompost + 50 % RD of NPK + *Azospirillum* + *Azotobacter* (V_1N_6) followed by Vallabh Isabgol-1, 75 % RD of FYM + 75 % RD of NPK + *Azospirillum* + *PSB* + $ZnSO_4$ + $FeSO_4$ (V_1N_{11}) as compared to other treatment. The maximum aphid incidence was recorded in Gujarat Isabgol-2, supplied with RD of FYM + RD of NPK (V_2N_1).

Introduction

Isabgol seeds and husk are mainly used in medicine because of mucilaginous nature. It is used as safe bulk-laxative, promoting regular bowel movement. It is a popular medicinal crop in Ayurvedic and Unani systems of medicine for problems like chronic diarrhoea, dysentery, constipation, reducing cholesterol and treatment of cancer. Recent studies have shown that, an intake of 10.2 g of husk per day as part of a diet significantly lowers the

blood cholesterol level. Since 1998, the US Food and Drug Administration approved the health claim on the association between consumption of Isabgol husk and reduction in risk of coronary heart disease. The seeds are also used for the treatment of chronic amoebic dysentery, where constipation is one of the main symptoms (Kumar *et al.*, 2015).

India exports 400 corers Isabgol annually. As the whole, India holds monopoly in the production and export of isabgol to the world

market and about 80 to 90 per cent produce is mainly exported to U.S.A., West Germany, United Kingdom and France. Isabgol is commercially grown as a winter crop, which remain in the field for about four to five months.

The most important component of isabgol is husk obtained from its seed. Isabgol husk is popularly known as “Sat isabgol” in Indian market. It is an important medicine for intestinal and stomach disorders. Isabgol crop is attacked by number of insect pest, out of which aphid, *Aphis gossypii* Glover (Homoptera: Aphididae) has been reported as major pest of isabgol (Sagar and Jindla, 1984).

A. gossypii is a polyphagous pest which infesting number of field crops. The work on *A. gossypii* was carried out by various workers on different hosts in India as well as in abroad. *A. gossypii*, which has been observed to attack 220 host plant belonging to 46 families throughout the world (Roy and Behura, 1983). Present practices followed for the management of aphids was use of synthetic pesticides.

The continuous and indiscriminate use of synthetic pesticides cause the problem of resistance, resurgence, environmental pollution, health hazards, harmful residues on food crop and adverse effect on activity of parasites and predator of crop pests.

Inspite of regular occurrence of *A. gossypii* on isabgol crop in North Gujarat and South Rajasthan regions causing economic losses, no any systemic work has been done on various aspects of such an important pest of isabgol in Gujarat State. Keeping this in view, to overcome lacunae and to develop an ecofriendly and effective pest management strategy, the present study was undertaken.

Materials and Methods

The experiment was conducted in the field at department of plantation spices medicinal and aromatic plants, college of horticulture, Bagalkot at Haveli farm during the years 2015-16 and 2016-17. Geographically, this experimental site lies in northern dry zone (Zone-3) of Karnataka state within the agro-climatic zone of Karnataka, situated at 16° North latitude and 74°59' East longitude and at an altitude of 533.0 m above mean sea level. The soil of experimental field was red clay loamy in texture, with percentages of sand 22.60, silt 26.10 and clay 52.20 bulk density 1.25, EC 0.24 dS m⁻¹ and pH 8.22 (alkaline in reaction) with organic carbon 1.63 and available 268.02, 34.80, 273.69 NPK kg ha⁻¹. The source of seed collection was DMAPR Anandh Gujarat *i.e.* Vallabh Isabgol-1(V₁) and Gujarat Isabgol-2 (V₂). Seed were sown in 18 November 2015 and 2016 with gross plot size of 3.6 m x 1.5 m = 5.40 m² in split plot design in sixteen INM sub treatments with three replications as subplot listed below.

N₁ -RDF FYM (10 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹),

N₂-RDF FYM (0 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹) + ZnSO₄ (15 kg ha⁻¹),

N₃-RDF FYM (10 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹) + FeSO₄ (7.5 kg ha⁻¹),

N₄-RDF FYM (10 t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹) + FeSO₄ (7.5 kg ha⁻¹) + ZnSO₄ (15 kg ha⁻¹),

N₅-Vermicompost (1t ha⁻¹) + RDF NPK (50:25:30 kg ha⁻¹)

N₆-Vermicompost (1t ha⁻¹) + 50% RDF NPK (50:25:30 kg ha⁻¹) + *Azospirillum* (5kg ha⁻¹) + *Azotobacter* (5kg ha⁻¹),

N₇-75% RDF FYM (7.5 t ha⁻¹) + 75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹), N₈-75% RDF FYM (7.5 t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *Azotobacter* (5kg ha⁻¹),

N₉-75% RDF FYM (7.5 t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹)+ *Azospirillum* (5kg ha⁻¹),

N₁₀-75% RDF FYM (7.5 t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *PSB* (3kg ha⁻¹), N₁₁-75%RDF FYM (7.5tha⁻¹) + 75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *Azospirillum*(5kg ha⁻¹)+ *PSB* (3kg ha⁻¹) + ZnSO₄ (15kg ha⁻¹) + FeSO₄ (7.5 kg ha⁻¹) N₁₂-50%RDF FYM (5t ha⁻¹) + 50% RDF NPK (25:12.5:15 NPK kg ha⁻¹)

N₁₃-50% RD FYM (5t ha⁻¹) +50% RDF NPK (25:12.5:15 kg ha⁻¹) +*Azotobacter* (5kg ha⁻¹),

N₁₄-50% RDF FYM (5t ha⁻¹) +50% RDF NPK (25:12.5:15 kg ha⁻¹) + *Azospirillum* (5kg ha⁻¹), N₁₅-50% RDF FYM (5t ha⁻¹) +50% RDF NPK (25:12.5:15 kg ha⁻¹) +*PSB* (3kg ha⁻¹),

N₁₆-50%RD FYM (5t ha⁻¹) +75% RDF NPK (37.5:18.75:22.50 kg ha⁻¹) + *Azospirillum* (5kg ha⁻¹) +*PSB* (3kg ha⁻¹) + Znso₄ (15kg ha⁻¹)+FeSO₄ (7.5 kg ha⁻¹).

Azotobacter (*Azotobacter* sp. 02 X10-9 cfu/g), *Azospirillum* (*Azospirillum* sp., 02 X10-9 cfu/g) and Phosphate solubilising bacteria (*Bacillus megaterium* 02 X10-9

cfu/g) produced in the UHS Bagalkot biocontrol laboratory. The experiment after layout then treatments were applied as per above nutrient combination, then mixed thoroughly in plots before imposing the treatments. Zinc was applied in the form of ZnSO₄ at the time of sowing half dose of N was applied as a basal and remaining half was applied one month after sowing as top dressing full dose of P and K were applied at the time of sowing below the seed in furrows made with the help of land hoe. Manual thinning weeding and hoeing were done at one month after sowing to provide an ideal environment to the crop a light irrigation was given immediately before sowing, however six and seven irrigation were given as per requirement of the crop with the help of sprinkler as per package of practices cropping pattern and its management have been taken Scoring of aphid infection was done at 30, 60 and 90 days after planting in two years by following aphid index given by the Bank (1954) were fixed for estimating the population of aphid and the average aphid index was worked out by adopting following formula.

$$\text{Average aphid Index plant}^{-1} = \frac{0N + 1N + 2N + 3N + 4N}{\text{Total number of plant observed}}$$

Where, 0, 1, 2, 3, 4 are aphid index

N = Number of plant showing respective aphid index

Aphid Index	Degree of infestation
0	Plant free from aphid
1	Aphid present, but colonies did not build up. No injury due to pest apparent on the plant
2	Small colonies of aphid were present
3	Large colonies of aphid were present on tender parts. Counts of aphids in colonies were possible and tender plant part show damage symptom due to aphids
4	Entire plant was covered by aphids. Counts of aphids in colonies were impossible and plant show damage symptom due to aphids

Results and Discussion

Aphid (*Aphis gossypii* Glover) infestation was calculated with score of 0-4. The least aphid incidence was recorded in Vallabh Isabgol-1 (2.28, 2.2.39 and 2.34) and highest aphid incidence was recorded in Gujarat Isabgol-2 (2.41, 2.51 and 2.46) during 2015-16, 2016-17 and pooled data respectively.

The highest aphid incidence was recorded in Gujarat Isabgol-2 (2.41) during 2015-16, 2016-17 and pooled data at all the stages of crop growth.

At 30 DAS, aphid infestation was recorded but colonies did not build up to cause any injury to crops due to pest apparent on the plant.

But during other stages of crop growth viz. 60 and 90 DAS it was found that aphids were present in small colonies this result minimum incidence and varietal response. Similar findings were recorded by Sagar *et al.*, (1987), Prajapati and Yadav (2005).

The aphid incidence was influenced by integrated nutrient management at 90 DAS. Significantly minimum incidence (1.55, 1.67) was recorded with application of N₁₁ (75 % RD of FYM + 75 % RD of NPK + *Azospirillum* + *PSB* + ZnSO₄ + FeSO₄), which was on par with N₆ (1.6, 1.70), N₄ (1.67, 1.77.) and N₁₆ (1.73, 1.86).

Maximum aphid infestation was (2.77, 2.85) recorded with application of N₁₃ (50% RD of FYM + 50% RD of NPK + *Azatobacter*) during 2015, 2016 respectively.

Similar trend was recorded in pooled data. INM helps release of nutrients at faster rate results plants healthy growth and showing minimum resistance to insects. Similar findings reported by Patel *et al.*, 2014.

The aphid infestation was influenced by varieties and integrated nutrient management at 90 DAS. Significantly less aphid incidence (1.45, 1.55) was recorded in Vallabh Isabgol-1 supplied with N₆ (Vermicompost + 50 % RD of NPK + *Azospirillum* + *Azatobacter*), which were on par with V₂N₁₆ (1.52, 1.62), V₁N₁₁ (1.54, 2.59) and V₂N₁₁ (1.56, 1.66).

Higher aphid incidence (2.86, 2.78) was recorded in (V₁N₁₁) Vallabh Isabgol-1, supplied with 50% RD of FYM + 50% RD of NPK + *Azatobacter* during 2015, 2016 respectively. Similar trend was recorded in pooled data.

The aphid infestation influenced by varieties, integrated nutrient management at 90 DAS. Significantly less aphid incidence was recorded in Vallabh Isabgol-1 supplied with T₆ (Vermicompost + 50 % RD NPK + ASP + AZB) (1.45), which were on par with V₂T₁₆ (1.52), V₁T₁₁ (1.54) and V₂T₁₁ (1.56).

More aphid incidence was recorded in Vallabh Isabgol-1 (T₁₃) supplied with 50% RD FYM + 50% RD NPK + AZB (2.86) during 2015-16.

Similar trend was recorded 2016-17, pooled data (Table-1 and Figure-1).

The varieties and integrated nutrient management significantly influenced by aphid infestation at 90DAS. Significantly less aphid infestation was recorded in Vallabh Isabgol-1, supplied with Vermicompost + 50 % RD of NPK + *Azospirillum* + *Azatobacter* (V₁N₆) followed by Vallabh Isabgol-1, 75 % RD of FYM + 75 % RD of NPK + *Azospirillum* + *PSB* + ZnSO₄ + FeSO₄ (V₂N₁₁) as compared to other treatment combinations.

Table.1 Aphids infestation as influenced by Isabgol varieties and integrated nutrient management (0-4 Scale)

6	2015									2016									Pooled data								
	30 DAS			60 DAS			90 DAS			30 DAS			60 DAS			90 DAS			30 DAS			60 DAS			90 DAS		
	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean	V ₁	V ₂	Mean
N ₁	1.36	1.41	1.38	1.95	2.09	2.02	2.48	2.78	2.63	1.40	1.57	1.49	1.97	2.16	2.07	2.59	2.97	2.78	1.38	1.49	1.43	1.96	2.13	2.04	2.53	2.87	2.70
N ₂	1.40	1.57	1.48	1.96	1.89	1.92	2.45	2.44	2.44	1.56	1.41	1.48	2.06	2.02	2.04	2.53	2.54	2.53	1.48	1.49	1.48	2.01	1.95	1.98	2.49	2.49	2.49
N ₃	1.28	1.61	1.45	1.77	2.11	1.94	2.30	2.68	2.49	1.31	1.68	1.50	1.91	2.28	2.09	2.38	2.78	2.58	1.29	1.65	1.47	1.84	2.20	2.02	2.34	2.73	2.54
N ₄	0.90	0.82	0.86	1.25	1.28	1.26	1.60	1.73	1.67	0.95	0.84	0.89	1.32	1.38	1.35	1.70	1.83	1.77	0.93	0.83	0.88	1.28	1.33	1.30	1.65	1.78	1.72
N ₅	1.47	0.84	1.15	2.06	1.75	1.91	2.46	2.45	2.46	1.74	1.26	1.50	2.23	1.86	2.05	2.56	2.55	2.56	1.61	1.05	1.33	2.15	1.81	1.98	2.51	2.50	2.51
N ₆	0.91	0.62	0.76	1.18	1.19	1.18	1.45	1.76	1.60	0.92	0.64	0.78	1.45	1.26	1.36	1.55	1.86	1.70	0.91	0.63	0.77	1.31	1.23	1.27	1.50	1.81	1.65
N ₇	1.44	1.70	1.57	1.95	2.11	2.03	2.43	2.66	2.55	1.52	1.64	1.58	2.28	2.28	2.28	2.57	2.73	2.65	1.48	1.67	1.57	2.12	2.20	2.16	2.50	2.70	2.60
N ₈	1.45	1.69	1.57	1.91	2.13	2.02	2.38	2.67	2.52	1.49	1.69	1.59	2.41	2.26	2.34	2.48	2.77	2.62	1.47	1.69	1.58	2.16	2.20	2.18	2.43	2.72	2.57
N ₉	1.67	1.59	1.63	2.18	1.97	2.08	2.69	2.52	2.61	1.73	1.62	1.68	2.25	2.07	2.16	2.77	2.62	2.70	1.70	1.61	1.65	2.21	2.02	2.12	2.73	2.57	2.65
N ₁₀	1.61	1.68	1.64	2.20	2.19	2.20	2.65	2.74	2.70	1.82	1.84	1.83	2.36	2.33	2.35	2.77	2.91	2.84	1.71	1.76	1.74	2.28	2.26	2.27	2.71	2.83	2.77
N ₁₁	0.85	0.85	0.85	1.19	1.21	1.20	1.54	1.56	1.55	0.86	0.95	0.90	1.29	1.34	1.32	1.67	1.66	1.67	0.85	0.90	0.88	1.24	1.27	1.26	1.60	1.61	1.61
N ₁₂	1.71	1.88	1.79	2.55	2.29	2.42	2.65	2.64	2.65	1.86	2.45	2.15	2.65	2.39	2.52	2.74	2.74	2.74	1.79	2.16	1.97	2.60	2.34	2.47	2.69	2.69	2.69
N ₁₃	1.92	1.92	1.92	2.62	2.78	2.70	2.68	2.86	2.77	1.96	1.97	1.96	2.72	2.88	2.80	2.78	2.93	2.85	1.94	1.95	1.94	2.67	2.83	2.75	2.73	2.90	2.81
N ₁₄	1.58	1.95	1.77	2.62	2.67	2.64	2.55	2.70	2.62	1.94	1.88	1.91	2.81	2.77	2.79	2.65	2.80	2.72	1.76	1.92	1.84	2.71	2.72	2.71	2.60	2.75	2.67
N ₁₅	1.95	1.95	1.95	2.14	2.85	2.50	2.32	2.77	2.55	1.96	1.96	1.96	2.37	2.94	2.66	2.42	2.91	2.66	1.96	1.96	1.96	2.26	2.90	2.58	2.37	2.84	2.61
N ₁₆	0.86	0.79	0.83	1.40	1.16	1.28	1.93	1.52	1.73	0.96	0.84	0.90	1.56	1.20	1.38	2.09	1.62	1.86	0.91	0.82	0.87	1.48	1.18	1.33	2.01	1.57	1.79
MEAN	1.40	1.43		1.93	1.98		2.28	2.41		1.50	1.52		2.10	2.09		2.39	2.51		1.45	1.47		2.02	2.03		2.34	2.46	
	S.Em ±	C.D at 5%		S.Em ±	C.D at 5%		S.Em ±	C.D at 5%		S.Em ±	C.D at 5%		S.Em ±	C.D at 5%		S.Em ±	C.D at 5%		S.Em ±	C.D at 5%	S.E m ±	C.D at 5%		S.Em ±	C.D at 5%		
Varieties (V)	0.007	NS		0.05	NS		0.07	NS		0.002	0.006		0.056	NS		0.07	NS		0.003	0.009	0.05	NS		0.07	NS		
Nutrients (N)	0.06	0.17		0.05	0.15		0.07	0.20		0.07	0.20		0.064	0.18		0.07	0.20		0.05	0.16	0.05	0.15		0.07	0.20		
N at same V	0.08	0.24		0.07	0.21		0.10	0.29		0.10	0.29		0.090	0.26		0.09	0.28		0.07	0.22	0.07	0.22		0.09	0.28		
Vat same or different N	0.03	0.10		0.20	0.57		0.28	0.81		0.02	0.08		0.219	0.62		0.30	0.86		0.02	0.07	0.21	0.59		0.29	0.83		

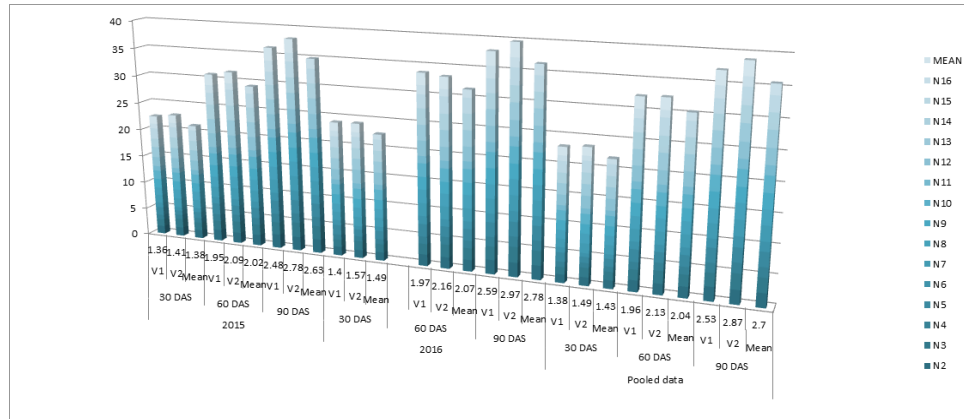
V₁- Vallabh Isabgol- 1
 N₁-RDF FYM + RDF NPK+FeSo₄
 N₂- 75% RDF FYM + 75% RDF NPK
 N₃- 75% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₄- 50% RDF FYM + 50% RDF NPK + PSB
 Vermicompost (1 t ha⁻¹), RDF FYM (10 t ha⁻¹), Azospirillum (ASP)@5 kg ha⁻¹, PSB @3 kg ha⁻¹, Azotobacter (AZB)@ 5 kg ha⁻¹, RDF NPK (50:25:30 kg NPK ha⁻¹), ZnSo₄(15 kg ha⁻¹), FeSo₄(7.5 kg ha⁻¹)

V₂-Gujarat Isabgol-2
 N₁- RDF FYM + RDF NPK + ZnSo₄ + FeSo₄
 N₂- 75% RDF FYM + 75% RDF NPK + AZB,
 N₃- 50% RDF FYM + 50% RDF NPK
 N₄- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₅- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₆- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₇- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₈- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₉- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₀- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₁- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₂- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₃- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₄- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₅- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄
 N₁₆- 50% RDF FYM + 75% RDF NPK + ASP + PSB + ZnSo₄ + FeSo₄

N₁- RDF FYM + RDF NPK (kg ha⁻¹)
 N₂- Vermicompost (1 t ha⁻¹) + RDF NPK
 N₃- 75% RDF FYM +75% RDF NPK +ASP
 N₄- 50% RDF FYM + 50% RDF NPK + AZB
 NS = Non-significant

N₂- RDF FYM + RDF NPK+ ZnSo₄
 N₃- Vermicompost + 50% RDF NPK + ASP + AZB
 N₄- 75% RDF FYM + 75% RDF NPK + PSB
 N₅- 50% RDF FYM + 50% RDF NPK + ASP
 DAS = Days after sowing

Fig.1 Aphids infestation as influenced by Isabgol varieties and integrated nutrient management



The maximum aphid incidence was recorded in Gujarat Isabgol-2, supplied with RD of FYM + RD of NPK (V₂N₁). The higher aphid infestation was recorded in Gujarat Isabgol-2, supplied with RD of FYM + RD of NPK (V₂N₁) due to varietal characters and more nutrients absorption helps to build resistance mechanism towards pest.

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