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Influence of seed priming with gibberlic acid on antidiabatic vine - bitter gourd (*Momordica charantia* L.) Genotypes

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Abstract
Bitter gourd (*Momordica charantia* L.) is a tropical and subtropical vine crop belongs to the family Cucurbitaceae. It finds prime place among the high valuable vegetables, because of its nutritive value and medicinal properties such as antidiabetic, antidote, antipyretic, appetizing and stomachic. In crop production the germination of seed is very important factor which decide the crop stand as it has hard seed coat. Hence, the study was conducted at College of Horticulture, Mudigere during 2017-18 to enhance seed germination in bitter gourd using GA_3. Among all the genotypes, Hassan local treated with 100ppm gibberlic acid recorded significantly higher germination percentage (75.80 %) followed by Shivamogga local (74.15 %) and the lowest germination percentage was observed in Bidar local (22.5 %). From the present investigation it was concluded that soaking of seeds in gibberlic acid @ 100ppm for 24 h helps to enhance the seed germination percentage in bitter gourd.

Keywords: Bitter gourd, Gibberlic acid, Germination percentage

Introduction
Bitter gourd or karela (*Momordica charantia* L.) (2n=22) is one of the important member of cucurbitaceae family along with watermelon, muskmelon and cucumber. It is a popular tropical and sub-tropical vegetable in India having economic, nutritional and medicinal uses. It is extensively grown in India, Indonesia, Malaysia, Singapore, Thailand, Japan, tropical Africa and South America (Miniraj *et al*., 1993) [1]. In India, it is extensively grown in Uttar Pradesh, Orissa, West Bengal, Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu and Kerala. It has high export potential to South-East Asia, Gulf and also European countries.
Bitter gourd (*Momordica charantia*, L.), a cucurbitaceous fruit-vegetable is popular as a medicinal vegetable (Anonymous, 2011) [2]. Fruits and leaves are considered as anthelmentic and vermifuge. It is also used to cure piles, leprosy and jaundice. Roots are astringent and useful in haemorrhoids. Karela is recommended for many diseases like; cholera, bronchitis, anemia, blood diseases, ulcer, diarrhea, dysentery, sexual tonic and as a cure for gonorrhea. Karela contains an array of biologically active plant chemicals including triterpens, proteins, steroids, alkaloids, saponins, flavonoids and acids due to which plant possesses anti-fungal, anti-bacterial, anti-parasitic, anti-viral, anti-fertility, anti-tumorous, hypoglycemic and anti-carcinogenic properties. Fruits are used as traditional medication to cure various diseases like: rheumatism, gout, worms, colic, disease of liver and spleen. It is also found useful in the treatment of cancer. It is a potent hypoglycemic agent due to alkaloids and insulin like peptides and a mixture of steroidal sapogenins known as charantin. With respect to the nutrition value, bitter gourd fruits are rich in iron (2.0mg/100g), vitamin A, B, C and good source of proteins (2%) and minerals. It is also grown as ornamental crop in USA, Japan and other countries.
Bitter gourd is grown by seed. Seeds are sown in April or May into containers or directly to the field when the soil temperature rises 8-10^{0}C. Planting seedlings is advisable but due to the presence of hard seed coat (Pandita and Nagarajan, 2004) [3] the germination rate of seeds is not 100%. So the seed coat dormancy creates a major problem in germination with all the bitter gourd genotypes. Gibberlic acid is known to enhance seed germination in bitter gourd (Rakesh, 2013) [4].

Therefore, the present investigation was undertaken with an objective to improve the seed germination in 24 bitter gourd genotypes using gibberlic acid.

Materials and methods

The experiment was carried out to enhance the seed germination in bitter gourd (*Momordica charantia* L.) during 2017-18 at College of Horticulture, Mudigere, Chikkamagaluru, Karnataka. Twenty four different bitter gourd genotypes were collected from different locations. Before sowing, the seeds were treated with 100 ppm GA3 solution for 24 hours followed by air drying. The poly bags were filled with a mixture of sand, soil and well rotten FYM in the ratio of 1:2:1 respectively. After seed treatment, only one seed is sown per poly bag by dibbling and then covered with a thin layer of soil and the morphology of all the 24 bitter gourd genotypes were studied including seed colour, test weight (gm), cotyledon Weight (gm) surface structure, shape of the seed, seed width (mm), seed length (mm) and coat thickness (mm) as mentioned in Table 2.

Treatment details

Total 24 genotypes were collected from different regions and research institutes are Bidar local (GL), Chamrajpet local, Belur local, Kadur local, Arka harit, Chikmanglore local, Dharwad local-1 (GL), Bagalkot local (GL), Kolar local, Hubli local (WL), Davangere local (GO), Kadur local-1, Chitradurga local (GO), Co-1, Shivamogga local, Chitradurga local (WL), Dharwad local-2 (WL), Hiriyur local-1, Hiriyur local-2, Javgal local, Hassan local, Pusa Do Mousami, HK-127 and Shivamogga local-2.

Record keeping

Observation for germination parameters were recorded each day up to one month from sowing and the morphology of bitter gourd were recorded.

Days to initiate germination

The poly bags were observed daily for seed germination. The days on which the first seedling emerged was expressed days to initial germination.

Days to 50 per cent germination

Number of days taken by 50 percent of the seeds to germinate was calculated.

Germination percentage

After priming the seeds were subjected to germination test. The number of seedlings produced in each replication was counted. The first and final count was taken on 4th and 14th day of the test respectively ISTA procedure (Anon 2001) [5]. Germination percentage was worked out using the following formula

$$\text{Germination percentage} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds sown}} \text{ X } 100$$

Test weight

100 seeds were weighed using electronic balance and recorded.

Seed length, seed width and coat thickness

Seed length, width and coat thickness was taken using vernier caliper for all the 24 bitter gourd genotypes.

Statistical analysis of data

The experiment was carried out in randomized complete block design. Data were analyzed by analysis of variance (ANOVA) to detect significant differences between mean. Significantly differing mean were tested based on F test value at 0.05 probability level. Variance in data has been expressed as mean ± standard error.

Results and discussion

Seed germination

Germination period

The data pertaining to number of days taken for germination presented in Table 1. Seed germination started on the 8th day after sowing which is the earliest germination and it was continued up to 35 days. The first initiation of germination (8th day) and days taken for 50 percent of the seeds (12th day) was found in case of Hassan local seeds treated with gibberlic acid 100 ppm for 24 hours and the delayed initiation of germination (19th day) and maximum days taken for 50 percent of the seed germination (28th day) was found in case of Hiriyur local-2 and Bidar local respectively. Similar results were reported by Rakesh (2013) [4] in bitter gourd when the seeds treated with GA_3 100ppm maximum germination (%), speed of germination, vigour index and field emergence (%). The possible reason for early germination was found with GA3 treatment is due to softening of seed coat resulting in seed coat permeability to water and it is also depends on genetic factor with respect to different genotypes.

Germination percentage

The highest germination percentage was recorded in Hassan local (75.80%) followed by Shivamogga local (74.15 %) and the lowest germination percentage was observed in case of Bidar local (22.5 %) seeds upon treatment with GA3 at 100 ppm concentration presented in Table:1. The maximum germination with GA3 treatment may be due to GA3 induced enzyme activity during germination that digest the endosperm rapidly and efficiently that reduces the mechanical restraints to endosperm, thus providing energy to start and sustain embryo growth which produced rapidly during the early stage of germination. Similar findings were reported by Reddy and Khan (2001) [6] in Khirni, Ruminska *et al* (1978) [7], Singh *et al* (1973) [8] in cucurbits, Renuga Devi and Jacqueline (1994) [9] in bitter gourd, Andreoli and Khan (1999) [10] in chilli, Gayathri (2001) [11] in tomato, and Thirusenduraselvi and Jerlin (2009) [12] in bitter gourd.

Table 1: Enhancement of germination in bitter gourd using gibberlic acid.

Genotypes	Number of days to initiation of germination	Days to 50% germination	Germination percentage
Bidar local (GL)	18.2	28	22.5
Chamrajpet local	14.3	22	33.3
Belur local	13.1	21	65.8
Kadur local	18	26	57.5
Arka harit	12.10	19.00	61.65
Chikmanglore local	16.40	24.00	61.65
Dharwad local-1 (GL)	12.60	20.00	60.00

Bagalkot local (GL)	12.90	18.50	66.65
Kolar local	12.50	18.00	56.65
Hubli local (WL)	11.30	19.50	47.50
Davangere local (GO)	19.40	25.50	48.30
Chitradurga local	15.40	21.00	61.65
Co-1	13.30	19.00	69.95
Shivamogga local	11.40	17.00	65.80
Chitradurga local	16.30	21.00	74.15
Dharwad local-2	9.40	14.00	66.65
Hiriyur local-1	9.30	14.50	61.65
Hiriyur local-2	10.80	15.50	51.65
Javgal local	19.50	23.50	50.80
Hassan local	19.80	25.50	59.95
Pusa Do Mousami	8.60	12.00	75.80
HK-127	13.20	17.00	66.65
Shivamogga local-2	11.70	16.50	67.45
Bidar local (GL)	9.60	13.50	64.95
S.EM	0.93	1.26	2.57
CD @ 5%	2.72	3.70	7.51

Table 2: Morphological characters of bitter gourd seeds.

Treatments	Seed colour	Test weight (g)	Cotyledon Weight (g)	Surface structure	Shape of the seed	Seed Width (mm)	Seed length (mm)	Coat thickness (mm)
Bidar local (GL)	Dark brown	14	0.11	Rough	Small	7.61	10.58	0.40
Chamrajpet local	Dark brown	30.6	0.16	Rough	Long	9.71	16.31	0.53
Belur local	Light brown	21.8	0.12	Rough	Medium	8.93	12.21	0.98
Kadur local	Medium brown	22.6	0.09	Rough	Medium	8.92	14.95	1.22
Arka harit	Light brown	21	0.17	Rough	Long	8.99	16.79	1.20
Chikmanglore local	Medium brown	20	0.15	Rough	Long	8.44	15.56	1.09
Dharwad local-1 (GL)	Dark brown	23.2	0.18	Rough	Long	7.91	15.02	0.81
Bagalkot local (GL)	Dark brown	25.8	0.18	Rough	Long	9.14	15.53	0.68
Kolar local	Light brown	22	0.15	Smooth	Long	8.90	15.08	0.74
Hubli local (WL)	Light brown	25	0.18	Medium	Oval	8.64	14.83	0.84
Davangere local (GO)	Dark brown	18.8	0.15	Rough	Oval	8.34	11.74	0.78
Chitradurga local	Medium brown	19.4	0.13	Rough	Oval	7.57	12.26	0.74
Co-1	Medium brown	24	0.17	Rough	Oval	9.05	13.69	0.94
Shivamogga local	Dark brown	23.8	0.16	Rough	Long	9.28	16.02	1.25
Chitradurga local	Medium brown	22.6	0.16	Rough	Oval	8.61	14.56	0.79
Dharwad local-2	Medium brown	24	0.17	Rough	Long	8.33	15.46	0.93
Hiriyur local-1	Medium brown	32	0.21	Smooth	Long	9.23	15.61	0.94
Hiriyur local-2	Medium brown	24.8	0.15	Rough	Oval	8.69	13.88	1.05
Javgal local	Dark brown	18.4	0.22	Rough	Oval	7.60	12.55	1.02
Hassan local	Light brown	30	0.21	Rough	Long	9.17	15.91	0.68
Pusa Do Mousami	Medium brown	22	0.15	Medium	Long	9.03	15.17	1.01
HK-127	Light brown	17.4	0.12	Medium	Long	8.35	15.06	0.80
Shivamogga local-2	Light brown	16	0.47	Rough	Oval	8.65	13.93	0.78
Bidar local (GL)	Dark brown	23.8	0.16	Rough	Long	9.16	14.98	0.89

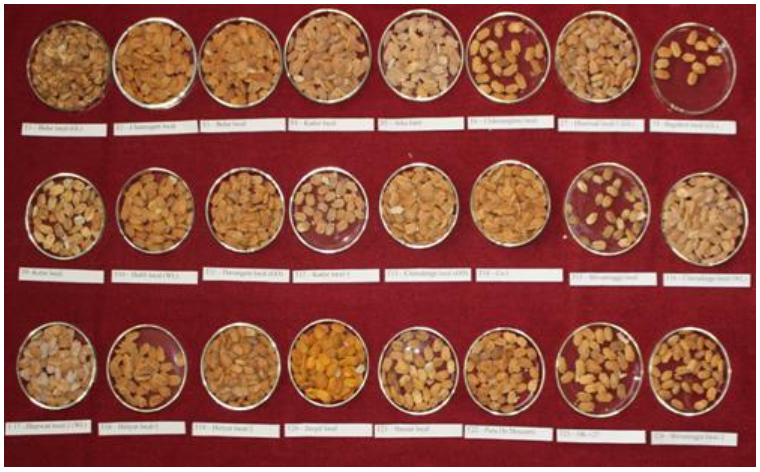

Fig 1: Seeds of twenty four bitter guard genotypes

Conclusion

It was concluded that the seeds treated with gibberlic acid @ 100 ppm for twenty four hours resulting in improved germination of some bitter gourd genotypes by improving permeability of water, promoting digestive enzymes and also depends on genetic constitution of the seed. Among all the genotypes Hassan local showed significantly improved germination than all other genotypes.

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