International Journal of Agriculture and Plant Science
www.agriculturejournal.in
E-ISSN: 2664-7664
Received: 21-09-2026, Accepted: 21-10-2026, Published: 05-11-2026
Volume 8, Issue 4, 2026, Page No. 166-171

Study of yield and its components and pest complex of some putative mutant lines in snake gourd *(Trichosanthes anguina* L.*)*

Subhrajit Roy[1], M K Pandit[1], Satadal Das[1*], Sanjita Marandi[1], Nafisa Yeasmin[1], Ritoban Pandit[2], Aurolipsa Panda[3], Paramita Karmakar[4]

[1] Department of Vegetable Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India
[2] Department of Agricultural Meteorology and Physics, Bidhan Chandra KrishiVishwavidyalaya, Mohanpur, Nadia, West Bengal, India
[3] Department of Vegetable Science, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India
[4] Department of Seed Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India
Corresponding Author: Satadal Das
DOI: https://doi.org/10.66856/ijaps.2026.8.4.8324

Abstract
Snake gourd (*Trichosanthes anguina* L.) is an important cucurbitaceous vegetable valued for its nutritional, medicinal and functional properties; however, its productivity is constrained by limited availability of superior planting materials and infestation by diverse insect pests. The present investigation was undertaken to evaluate yield and yield-attributing traits, determine the seasonal incidence and infestation pattern of major insect pests, and identify promising putative mutant lines of snake gourd with superior agronomic performance. The experiment was conducted at the Horticultural Research Station, Mondouri, Nadia, West Bengal, during January–May 2020–2021. Fifteen genotypes comprising 14 putative mutant lines and the Nilgunj local control were evaluated in a randomized block design with three replications. Observations were recorded on vine length, internodal length, days to first male and female flowering, days to first fruit harvest, sex ratio, fruit length, fruit girth, number of fruits per plant, average fruit weight and fruit yield per plant. The incidence of major insect pests was monitored at five-day intervals throughout the crop period. Substantial variability was observed among the mutant lines for growth, flowering, fruit and yield attributes. Vine length at 90 days after sowing ranged from 265.0 to 427.7 cm, with ML6 recording the maximum value. ML13 exhibited the shortest internodal length (11.11 cm), whereas ML7 showed the longest (16.04 cm). ML11 and ML5 were the earliest lines for first fruit harvest, requiring 88.34 and 89.32 days, respectively. ML3, ML11 and ML13 recorded comparatively lower male: female sex ratios than the control. Fruit length ranged from 38.32 to 56.00 cm, while fruit girth varied from 9.47 to 12.64 cm. ML13 produced the maximum number of fruits per plant (11.50), whereas ML7 recorded the highest average fruit weight (503.34 g) and fruit yield (2.87 kg plant^{-1}), followed by ML13 (2.59 kg plant^{-1}) and ML12 (2.54 kg plant^{-1}). A diverse insect-pest complex comprising red pumpkin beetle, fruit fly, Epilachna beetle, aphids, whitefly, caterpillar, thrips, mirid bug, snake gourd semilooper and leaf miner was recorded. Red pumpkin beetle was most abundant during early February, whereas fruit fly incidence increased markedly after fruit formation and reached a peak during late April (11.11 flies plant^{-1}). Epilachna beetle population increased during April, while whitefly, thrips and semilooper populations were comparatively higher towards May. Pest incidence showed varying relationships with temperature, relative humidity and rainfall. Overall, the study demonstrated considerable genetic variability among the putative mutant lines and identified ML7, ML13 and ML12 as promising genotypes for further evaluation and utilization in snake gourd breeding programmes, particularly for improving yield under insect-pest-prone conditions.

Keywords: *Trichosanthes anguina*, snake gourd, induced mutagenesis, putative mutants, yield, insect pests, seasonal incidence, fruit fly, genetic variability, pest complex

Introduction
Snake gourd (*Trichosanthes anguina* L.) is an important annual cucurbitaceous vegetable cultivated widely in tropical and subtropical regions, particularly in South and Southeast Asia, owing to its nutritional, functional and medicinal importance. It is a vigorous monoecious climber producing long, slender fruits that are consumed primarily as a vegetable. The fruit contains appreciable amounts of vitamins, minerals, dietary fibre and diverse phytochemicals, including phenolic compounds, flavonoids, carotenoids and triterpenoids, which contribute to its potential antioxidant, anti-inflammatory and ant diabetic activities (Atugwu *et al*., 2022; Shinde & Savalia, 2025) [2, 16]. Recent studies have further highlighted the potential of snake gourd as a nutrient-rich and functional food crop because of its bioactive constituents and micronutrient content. Despite its nutritional and medicinal potential, genetic improvement of snake gourd remains relatively limited compared with major cucurbit crops. The availability of a high-quality genome assembly of approximately 919.8 Mb, containing more than 22,000 predicted protein-coding genes, provides an important genomic resource for understanding its evolution, fruit development and genetic improvement (Ma et al., 2020). Induced mutagenesis is an established crop-improvement approach for generating novel genetic variation and has been used to develop desirable agronomic traits, including improved yield, earliness and resistance to biotic and abiotic stresses. Both physical and chemical mutagens can generate useful variation that may be exploited in breeding programmes for developing improved crop genotypes (Khan *et al*., 2022).

Insect-pest infestation is one of the major constraints limiting the productivity and marketable quality of snake gourd. The crop is attacked by a diverse complex of insect pests, including cucurbit fruit flies, red pumpkin beetles, Epilachna beetles, aphids, whiteflies, caterpillars, thrips, semiloopers and other sucking and foliage-feeding insects. Among these, cucurbit fruit flies are particularly destructive because females oviposit in developing fruits and the resulting maggots feed within the fruit tissues, causing rotting, premature fruit drop and substantial reduction in marketable yield. Recent investigations in West Bengal have confirmed the importance of fruit flies in snake gourd agro ecosystems, with *Zeugodacus cucurbitae*, *Bactrocera dorsalis* and *Z. tau* reported as important fruit-fly species and fruit infestation varying considerably during the fruiting season (Pramanik *et al*., 2022) [8]. Population dynamics of *B. cucurbitae* in cucurbit crops have also been associated with environmental factors such as temperature and rainfall, demonstrating the importance of seasonal pest monitoring for effective management (Patel & Das, 2021) [11]. In addition to fruit flies, defoliating and sap-sucking insects can adversely affect photosynthetic activity, plant growth and reproductive development. Therefore, identification and evaluation of genetically diverse planting materials with high yield potential and comparatively lower pest susceptibility are important components of snake gourd improvement programmes. In this context, the present study was undertaken to evaluate yield and yield-attributing traits, assess the seasonal activity and infestation pattern of the major insect-pest complex, and identify promising putative mutant lines of snake gourd with superior agronomic performance and comparatively better response to insect-pest infestation.

Materials and Methods

The experiment was conducted at the Horticultural Research Station, Mondouri, Nadia, West Bengal, during January–May of 2020 [9]–2021. The experimental site was situated at approximately 22.56° N latitude and 88.32° E longitude, at an elevation of 9.75 m above mean sea level, and represented the new Gangetic alluvial plains of West Bengal. The soil was sandy loam, slightly acidic (pH 6.5), with 0.57% organic carbon, 0.06% total nitrogen, 30.1 kg ha^{-1} available phosphorus and 115.7 kg ha^{-1} available potassium. The experiment was laid out in a Randomized Block Design with 15 genotypes comprising 14 putative mutant lines and the Nilgunj local check, with three replications and eight plants per plot. Plants were spaced at 75 × 100 cm, with 45 cm wide irrigation channels. Individual pits were prepared and incorporated with farmyard manure at 2 kg pit^{-1} and 0.5 kg NPK (10:26:26) per bed, followed by application of urea at 10 g $plant^{-1}$ at 30 days after sowing (DAS). Seeds were soaked in water for 48 h and subsequently incubated in cloth bags under a straw heap to facilitate uniform germination before sowing. Light irrigation was provided after sowing, followed by irrigation at the four-leaf stage and subsequently at 10–12 day intervals as required. The vines were trained on a trellis. No plant protection measures were applied during the experiment. Meteorological observations, including temperature, relative humidity and rainfall, were recorded throughout the experimental period.

Observations on yield and yield-attributing characters were recorded from selected plants in each replication. The parameters included main stem length at 90 DAS, sex ratio (male: female), internodal length, days to first male and female flower, days to first fruit harvest, fruit length, fruit girth, number of fruits $plant^{-1}$, average fruit weight and fruit yield $plant^{-1}$. Vine length was measured from ground level to the growing tip at 90 DAS, while sex ratio was calculated from the number of male and female flowers. Fruit number and yield were recorded at each picking and summed over the cropping period to obtain the total number of fruits and fruit yield per plant. Fruit length and girth were measured from randomly selected edible fruits using a measuring tape, and mean values were calculated. For pest studies, observations were recorded at five-day intervals, preferably during the morning (7:00–10:00 h). The incidence and damage caused by fruit fly, red pumpkin beetle, Epilachna beetle, sucking pests, lepidopteron defoliators and bugs were assessed. For fruit fly, total and damaged fruits $plant^{-1}$ and the number of maggots per damaged fruit were recorded, and fruit damage percentage was calculated from the ratio of damaged fruits to total fruits. For red pumpkin beetle and Epilachna beetle, ten nearly mature leaves were selected from each plant to record damaged leaves and adult beetle population, and percentage leaf damage was calculated. Sucking pests were assessed on young, intermediate and mature leaves, whereas lepidopteron defoliators were evaluated based on adult population, larvae $plant^{-1}$ and damaged leaves $plant^{-1}$. The population of *Nesidiocoris tenuis* was recorded by counting nymphs on five randomly selected shoots of each plant. Mean values of pest population and damage were calculated for each genotype and observation period to determine the seasonal incidence and infestation pattern of the major insect-pest complex.

Results and Discussion

The putative mutant lines exhibited substantial variability for vegetative growth, flowering behaviour, fruit characters and yield attributes, indicating the effectiveness of induced mutagenesis in generating useful phenotypic variation in snake gourd. Vine length at 90 DAS varied from 265.0 to 427.7 cm, with ML6 recording the maximum vine length (427.7 cm), followed by ML4 (405.3 cm), while ML7 had the shortest vine (265.0 cm). Internodal length ranged from 11.11 to 16.04 cm, with ML13 showing the shortest internodes and ML7 the longest. Such variability in vegetative characters is consistent with recent genetic studies in snake gourd, where considerable variation has been reported for vine growth, internodal length and other morphological traits (Fathima *et al*., 2025; Kumar *et al*., 2024) [4, 6]. Earlier evaluation of advanced snake-gourd mutant lines also demonstrated significant differences among mutants for qualitative and quantitative traits, including plant architecture, flowering, fruit characters and yield (Layek *et al*., 2019) [7]. The observed variation may be attributed to genetic alterations induced during mutagenesis, which can create novel allelic combinations and phenotypic expressions. Gamma irradiation has been demonstrated to generate sufficient variability in snake gourd, with different radiation doses producing significant changes in germination and seedling growth and providing suitable material for subsequent breeding programmes (Layek *et al*., 2022) [8]. The availability of a high-quality snake-gourd genome further provides opportunities for understanding the genetic basis of such phenotypic variation and utilizing

mutant-derived variability in crop improvement (Ma *et al*., 2020). Considerable variation was also observed in flowering behaviour. ML5, ML3, ML7, ML12 and ML11 were comparatively early in male flowering, whereas ML2, ML3, ML5, ML7, ML10, ML11, ML12 and ML13 were early in female flowering. ML11 and ML5 were the earliest genotypes for first fruit harvest, requiring only 88.34 and 89.32 days after sowing, respectively. Early flowering and harvesting are important breeding objectives because they can facilitate early marketable production and potentially allow better adaptation to seasonal pest pressure. Similar variability for days to first male and female flowering and days to first harvest has been reported among snake-gourd germplasm and inbred lines (Ahmed *et al*., 2024; Fathima *et al*., 2025) [1, 4]. The comparatively lower sex ratio recorded in ML3, ML11 and ML13 than in the control is also a desirable characteristic because a lower male: female ratio generally indicates relatively greater female flower production and may contribute to increased fruit set. Earlier evaluation of snake-gourd mutant lines similarly identified mutants with reduced sex ratio and improved fruit number and yield, demonstrating the potential of mutation breeding for modifying reproductive traits (Layek *et al*., 2019). Upadhyay *et al*. (2019) [7] further reported significant positive associations of fruit yield with main-stem length, flowering, fruit length, fruit girth, average fruit weight and number of fruits per plant in advanced mutant lines, emphasizing the importance of simultaneous selection for these traits. Recent studies have likewise reported substantial genetic variability and high heritability for fruit length, individual fruit weight, number of fruits per plant and fruit yield, suggesting good prospects for selection in snake gourd (Ahmed *et al*., 2024; Kumar *et al*., 2024; Fathima *et al*., 2025) [1, 4, 6].

Marked differences were also observed in fruit morphology and yield performance. Fruit length ranged from 38.32 to 56.00 cm, with ML4 producing the longest fruits, whereas ML13 produced the shortest fruits. Fruit girth varied from 9.47 to 12.64 cm, with ML6 recording the maximum girth. ML13 produced the highest number of fruits per plant (11.50), followed by ML12 (9.79), whereas ML7 recorded the highest average fruit weight (503.34 g). Consequently, considerable variation in fruit yield per plant was recorded, ranging from 1.24 to 2.87 kg. ML7 recorded the highest yield (2.87 kg plant^{-1}), followed by ML13 (2.59 kg plant^{-1}) and ML12 (2.54 kg plant^{-1}), while ML1 showed the lowest yield (1.24 kg plant^{-1}). The superior yield of ML7 appears to be associated mainly with its greater individual fruit weight, whereas the high yield of ML13 was associated with its exceptionally high number of fruits per plant. This interpretation agrees with previous studies showing that fruit number and individual fruit weight are important contributors to yield in snake gourd (Ahmed *et al*., 2024; Khan *et al*., 2016; Upadhyay *et al*., 2019). Ahmed *et al*. (2024) [1, 5, 7] reported significant positive relationships between fruit yield and individual fruit weight, number of fruits per plant and harvest duration, while Kumar *et al*. (2024) [6] observed high genetic variability and heritability for fruit length, average fruit weight, number of fruits and fruit yield. Similarly, Fathima *et al*. (2025) [4] reported substantial variability for fruit length, fruit weight, and number of fruits per plant and fruit yield and suggested these traits as important selection criteria for snake-gourd improvement. Earlier studies on mutant lines also demonstrated that induced mutations can produce substantial variation in fruit length, fruit girth, sex ratio, number of fruits and fruit yield (Layek *et al*., 2019) [7]. Thus, the superior performance of ML7, ML13 and ML12 in the present investigation indicates their potential value as promising breeding materials, although their performance should be confirmed across seasons and locations before recommendation. The present findings also support the broader utility of mutation breeding in snake gourd, where induced variation has already been exploited for modifying fruit characters and developing distinct short-fruited lines (Layek *et al*., 2022 [8]; Ma *et al*., 2020).

A diverse insect-pest complex was recorded during the crop season, consisting of red pumpkin beetle (*Aulacophora foveicollis*), fruit fly (*Bactrocera cucurbitae*), Epilachna beetle (*Henosepilachna vigintioctopunctata*), aphid (*Aphis gossypii*), whitefly (*Bemisia tabaci*), caterpillar (*Diaphania indica*), thrips (*Thrips palmi*), mirid bug (*Nesidiocoris tenuis*), snake-gourd semilooper (*Anadevidia peponis*) and leaf miner (*Liriomyza trifolii*). The occurrence of a diverse pest complex in the present study is in agreement with the comprehensive pest survey of snake gourd conducted by Sharath *et al*. (2021) [15], who recorded 17 insect-pest species belonging to Lepidoptera, Coleoptera, Diptera and Hemiptera. In the present investigation, red pumpkin beetle was active throughout the crop period, with its population reaching a maximum of 4.9 beetles plant^{-1} during early February and subsequently declining sharply during March and remaining very low during April and May. Such seasonal fluctuations are consistent with observations in cucurbit crops, where beetle abundance is strongly influenced by crop stage and prevailing weather conditions. Sharath *et al*. (2021) [15] also reported a significant relationship between *Aulacophora* population and rainfall in snake gourd. Fruit fly incidence, in contrast, was negligible during February and March but increased rapidly following fruit initiation, reaching 11.11 flies plant^{-1} during late April and remaining comparatively high during early May. This seasonal pattern is particularly comparable with the detailed study of Pramanik *et al*. (2022) [8] in snake gourd in West Bengal, where *Zeugodacus cucurbitae*, *Bactrocera dorsalis* and *Zeugodacus tau* were recorded and fruit infestation ranged from 6.93 to 44.09%. The increasing fruit-fly population during the fruiting period in the present study suggests that host availability was an important factor determining pest abundance. Epilachna beetle population was relatively low during March but increased during April, whereas aphid infestation remained low and was restricted mainly to the control and a few mutant lines. Whitefly abundance increased towards May, while *D. indica* occurred at low levels throughout the crop period. Similar seasonal variation in *D. indica* has been documented in cucurbit crops, with pest abundance being influenced by temperature and relative humidity (Sharada Devi & Venkatesha, 2022) [14]. The present study also recorded low and scattered populations of thrips, with the highest population during May (5.625 plant^{-1}), while *N. tenuis* was comparatively abundant throughout the season and attained higher populations during March and April. The occurrence of *N. tenuis* as a pest of cucurbitaceous crops has also been documented in India, particularly in relation to damage to tender plant tissues and fruits (Bhatt & Patel, 2022). The snake-gourd semilooper showed a gradual increase in abundance and reached its highest population during May

(4.1 larvae plant^{-1}). Screening studies have demonstrated considerable genotypic differences in semilooper infestation among snake-gourd genotypes, indicating that host genotype can influence pest abundance and damage (Devi & Jayaraj, 2017). Similarly, Sharath *et al*. (2021) [3, 15] found significant associations between *A. peponis* population and relative humidity, supporting the role of weather conditions in determining seasonal pest abundance.

The relationship between pest incidence and meteorological variables varied considerably among insect species. Fruit fly incidence in the present investigation showed positive associations with minimum temperature, maximum temperature and rainfall but a negative association with relative humidity, indicating that warmer conditions accompanied by rainfall may favour population build-up during the fruiting period. The seasonal increase in fruit-fly activity observed here is consistent with the population dynamics reported for snake gourd by Pramanik *et al*. (2022) [8]. Whitefly incidence showed a strong positive association with relative humidity, whereas temperature showed negative associations, suggesting that humid conditions may favour its establishment during the later crop period. The caterpillar population showed a positive association with maximum temperature and negative associations with minimum temperature, rainfall and relative humidity. In another cucurbit study, Sharada Devi and Venkatesha (2022) [14] similarly demonstrated significant relationships between *D. indica* abundance and weather variables. The mirid bug population in the present study showed positive relationships with rainfall and relative humidity but negative relationships with temperature, while semilooper incidence was positively associated with rainfall and negatively associated with relative humidity and temperature. These observations are broadly supported by Sharath *et al*. (2021) [15], who reported significant relationships between several snake-gourd pests and weather factors, including positive associations of *A. peponis* with morning relative humidity, *Liriomyza trifolii* and *D. indica* with afternoon relative humidity, and *Aulacophora* spp. with rainfall. The symptoms recorded during the study included characteristic leaf scraping and defoliation by beetles and caterpillars, sap-feeding damage by aphids, whiteflies and thrips, shoot and flower damage associated with mirid bugs, and direct fruit damage caused by fruit-fly larvae. Overall, the results demonstrate that the putative mutant lines differed considerably in yield potential and their exposure to the insect-pest complex. Among the evaluated materials, ML7, ML13 and ML12 were particularly promising on the basis of yield and yield components. However, because pest abundance varied considerably with crop stage and weather conditions, further multi-season and multi-location evaluation is necessary to determine the stability of these mutant lines and to identify genotypes combining high yield with comparatively lower pest susceptibility.

Table 1: Growth and yield characteristics of the putative mutants

Treatments	Vine length at 90 das (cm)	Internode length (cm)	Days to first male flower	Days to first female flower	Days to first fruit harvest from sowing	Sex ratio	Fruit length (cm)	Fruit girth (cm)	No of fruit/plant	Fruit weioght(gm)	Yield/plant (kg)
ML1	278.30	14.88	80.67	93.30	106.34	24.32	42.32	10.50	5.33	213.67	1.24
ML2	345.00	13.89	70.10	78.60	91.33	27.14	44.67	10.26	6.10	271.65	1.35
ML3	299.70	12.50	68.00	79.31	92.67	23.10	47.68	10.40	5.67	305.00	1.45
ML4	405.30	12.14	74.00	83.87	96.65	27.77	56.00	11.00	6.00	466.68	1.51
ML5	296.70	13.26	66.33	76.46	89.32	25.21	46.31	9.47	7.66	326.64	1.87
ML6	427.70	13.83	72.30	83.00	96.67	24.98	47.32	12.64	5.70	281.65	1.32
ML7	265.00	16.04	67.32	79.67	92.68	27.84	47.00	9.35	5.00	503.34	2.87
ML8	336.70	13.92	75.35	86.00	99.00	26.26	44.33	11.20	6.25	298.34	1.77
ML9	380.00	14.20	76.00	81.33	94.32	25.00	47.36	9.87	5.30	340.00	1.81
ML10	358.00	14.21	70.67	79.39	91.65	24.54	52.30	9.60	6.00	360.00	1.63
ML11	326.70	12.77	67.65	74.67	88.34	23.75	44.31	11.72	5.67	393.36	1.74
ML12	349.00	12.20	69.33	79.70	93.32	26.30	43.35	10.54	9.79	321.64	2.54
ML13	365.00	11.11	70.00	78.52	91.67	22.46	38.32	11.27	11.50	200.00	2.59
ML14	316.30	14.33	74.00	81.37	94.68	24.54	45.34	10.50	6.00	486.68	2.10
CONTROL	288.30	15.32	72.33	82.37	97.00	24.03	50.00	9.22	5.45	376.00	1.87
SE(m)	0.177	0.819	1.639	1.840	2.026	0.200	2.876	0.386	0.595	54.079	.014
CD at 5 %	51.5	2.386	4.773	5.357	5.90	0.581	8.376	1.124	1.73	157.47	.506

Table 2: Insect-pest of Snake gourd

Common Name	Scientific Name	Family	Order	Plant part
Red Pumpkin Beetle	*Aulacophora foveicolis (Lucas)*	Chrysomellidae	Coleopters	Leaves
Fruit fly	*Bactrocera cucurbitae(Coquillett)*	Tephritidae	Diptera	Fruits
Epilachna Beetle	*Henosepila chnavigitionto punctata(Fabricius)*	Coccinellidae	Coleoptera	Leaves
Aphid	*Aphis gossypii (Glover)*	Aphididae	Hemiptera	Leaves
Whitefly	*Bemicia tabaci (Gennadius)*	Alyrodidae	Hemiptera	Leaves
Caterpillar	*Diaphania indica (Saunders)*	Crambidae	Lepidoptera	Leaves and Flowers
Thrips	*Thrips palmi (Karney)*	Thripidae	Thysanoptera	Flowers and leaves
Bug	*Nesidioc oristenius*	Miridae	Hemiptera	Flowers and top of shoot
Snake gourd semi looper	*Anadevi diapeponis (Fabricius)*	Noctuidae	Lepidoptera	leaves
Leaf Miner	*Leriomyzatri folii*	Agromyzidae	Diptera	Leaves and fruits

Table 3: Incidence of pests over putative mutant lines

Treatments	Epilachna grub	Adult epilachna	Adult RPB	Adult fruit fly	White fly	Bug	Aphids	Thrips	Semilooper	Caterpillar
1	2.57	0.73	2.54	2.50	7.67	4.17	22.34	12.32	4.27	4.17
2	2.40	0.30	1.92	1.84	8.33	6.00	13.65	11.99	4.65	4.50
3	2.95	0.48	1.85	2.77	10.34	8.00	14.00	12.34	3.92	4.15
4	1.84	0.42	2.92	1.95	7.33	8.65	11.00	11.65	3.51	4.00
5	1.22	0.72	1.65	2.12	7.34	8.00	8.00	10.67	2.63	6.12
6	1.77	0.33	1.04	2.01	7.00	6.00	24.00	10.65	5.25	4.34
7	2.32	0.32	2.15	2.66	8.50	6.32	19.50	10.00	4.14	1.32
8	1.44	0.27	1.60	1.63	7.97	7.34	10.00	8.17	3.40	4.00
9	1.22	0.51	2.08	3.13	8.68	7.14	3.00	7.20	3.50	7.50
10	1.37	0.30	2.63	2.61	9.00	5.50	7.34	9.00	4.90	9.32
11	1.27	0.36	1.70	3.55	2.61	4.82	21.00	11.00	7.15	7.67
12	2.44	0.46	1.69	2.43	8.00	5.67	3.67	11.00	4.26	7.82
13	1.07	0.41	1.12	2.15	7.00	5.50	3.83	10.00	4.80	6.68
14	0.77	0.20	1.00	1.40	6.67	4.50	17.33	11.34	2.48	3.15
15	1.42	0.24	2.10	2.50	7.32	7.17	7.33	10.32	5.33	8.67
SE(m)	0.179	0.109	0.189	0.322	0.862	0.552	3.044	0.974	0.631	0.669
CD at 5%	0.522	0.316	0.552	0.938	2.510	1.608	8.865	2.837	1.838	1.949

Conclusion

The present study demonstrated considerable variability among the putative mutant lines of snake gourd for growth, flowering, fruit and yield attributes, as well as their response to the prevailing insect-pest complex. Among the evaluated genotypes, ML7 recorded the highest fruit yield (2.87 kg plant^{-1}) and average fruit weight, while ML13 showed the highest number of fruits per plant (11.50) and a high yield (2.59 kg plant^{-1}), and ML12 also performed well with 2.54 kg plant^{-1}. ML5 and ML11 exhibited comparatively early fruit harvesting, whereas ML3, ML11 and ML13 showed lower sex ratios than the control, indicating desirable reproductive characteristics. Several major insect pests were observed, with fruit fly, red pumpkin beetle, Epilachna beetle, whitefly, aphids, caterpillars, thrips, mirid bug and semilooper showing distinct seasonal patterns influenced by prevailing weather conditions. Overall, the results indicate that induced mutagenesis can generate useful variability for improving yield and associated traits in snake gourd, and the promising lines identified in the present investigation, particularly ML7, ML13 and ML12, may be further evaluated across seasons and locations for their stability, yield potential and tolerance to insect-pest infestation before their utilization in future breeding programmes.

Acknowledgment

Authors are thankful to Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India for extending support for carrying out the research work**.**

Ethical Approval

Not Applicable

Funding

No funding is received

Conflict of Interest

No conflict of interest

Author Contributions

All authors contributed significantly towards the final make-up of the paper. Conceptualization (SR, SD and MKP); Data curation (SR, MKP and SM); Visualization (SR, SD, MKP and SM); Supervision (NY, PK, RP and AP); Writing-original draft (SR, SD, MKP and SM); Writing-reviewing and editing (PK, NY, RP and AP).

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