

Assessment of sapota varieties and hybrids for tolerance and susceptibility to chiku moth, *Nephopteryx eugraphella* (Ragonot)

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Abstract

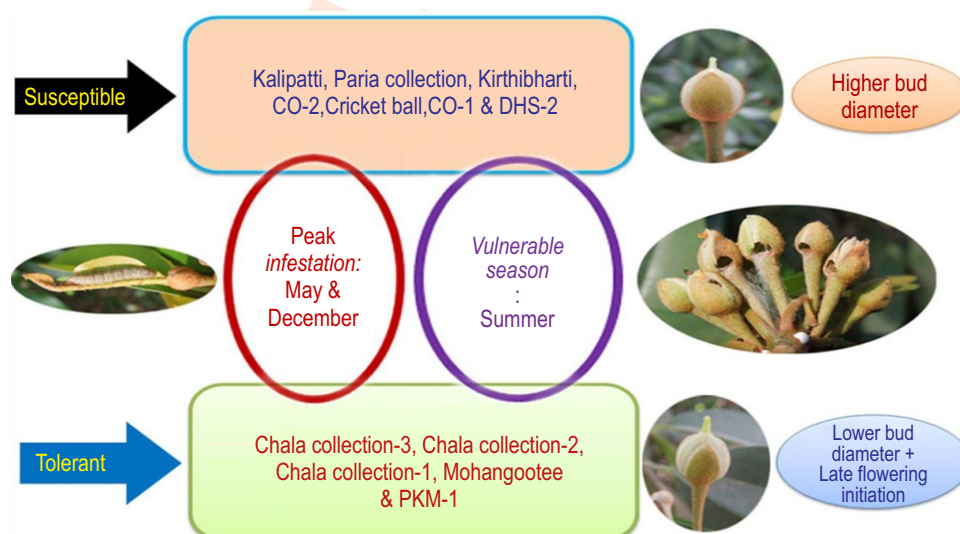
Aim: To assess the tolerance and susceptibility to chiku moth against major varieties and hybrids as compared to commercial cultivar Kalipatti in sapota.

Methodology: Efficacy of 23 sapota varieties and hybrids against chiku moth, *Nephopteryx eugraphella* (Ragonot) was evaluated at FRS, NAU, Gandevi, during five-year period (2018-19 to 2022-23). Bud damage intensity was deliberated to decide the tolerance and susceptibility level with bud morphology and eight biochemical contents.

Results: According to screening results, chiku moth caused more damage to Kalipatti, Paria collection, Kirthibharti, CO-2, Cricket ball, CO-1 and DHS-2 to the extent of 15.62, 15.20, 14.38, 14.28, 13.51, 12.99 and 11.93%, whereas Chala collection-3, Chala collection-2, Chala collection-1, Mohangootee and PKM-1, had less damage up to 7.05, 7.34, 7.66, 8.11 and 8.46%, respectively. The varieties/hybrids with higher bud diameter (6.22-6.47 mm) were more susceptible than smaller (5.30-5.78 mm). Nevertheless, non-significant associated was revealed between eight bio-chemical contents and bud damage.

Interpretation: May and December were the most critical months for pest incidence in many susceptible varieties/hybrids. Due to late flowering initiation, escape type resistance was seen in less damaged varieties/hybrids and bigger bud diameter was more vulnerable to chiku moth.

Key words: Chiku moth, *Nephopteryx eugraphella*, Sapota, Varieties



Introduction

In horticultural agro-ecosystem of South Gujarat, sapota/chiku [*Manilkara zapota* (Mill.) Fosberg], is significant and gaining increasing importance due to its expanding cultivation. Currently, India is one of the leading producers in the world with total acreage of 75.0 thousand ha and production of 898.0 thousand MT (Agril Stat, 2023). Because it takes lengthy 8-11 months from flowering commencement to fruit maturation along with asymmetrical and overlapping flowering and fruiting bearing pattern, pest intervention during these phases mostly affects sapota productivity (Patel et al., 2013). Previously, Butani (1979) enlisted 25 insect pests infesting sapota tree in India, while Patel (2002) noted about 16 insect pests and mites in Gujarat. Now, about 33 pests have been identified on sapota in India, spanning several states, with 23 insect and mite pests registered in Gujarat (Bisane et al., 2018). One of the most common bud boring complex pests of sapota in India is chiku moth, *Nephopteryx eugraphella* (Ragonot) (Lepidoptera: Pyralidae).

In relation to succession of chiku moth in sapota, the infestation was noticed throughout the year, with two phases of crest damage during peak flowering (May-June) and new foliage and fruiting initiation stage (Nov.-Dec.) (Bisane, 2018, 2019). In a study conducted in South Gujarat, chiku moth and bud borer were observed all round the year which caused a yield loss of roughly 25–27% in sapota (Bisane, 2018). As well, chiku moth infestation appeared in cv. Kalipatti more or less throughout the year in North Gujarat (Hajare et al., 2012), Middle Gujarat (Chaudhary et al., 2017) and in Chhattisgarh (Ghirtlahre et al., 2015). Such investigation is deficient in other major varieties and hybrids cultivating in main sapota growing belts of India.

Kalipatti is a dominant sapota variety in India, especially in Gujarat. However, several southern varieties and hybrids are being evaluated to meet the growing demand as alternatives to Kalipatti. For that, a fundamental understanding of pest severity across varieties is crucial for developing effective management strategy, particularly under changing climatic conditions. Pest screening is a critical stage in breeding and development process, as it ensures that new varieties are superior, resilient and easily accessible to farmers. Thus, looking the losses and damage intensity, a screening trial on the prevalence of chiku moth was carried on sapota.

Materials and Methods

The trial for assessing the performance of different varieties and hybrids of sapota against chiku moth was investigated during five consecutive years from 2018-19 to 2022-23 at germplasm plot of ICAR-AICRP (Fruits), Fruit Research Station, NAU, Gandevi (20.807545° N 73.022260° E). The screening trial was based on bud damage in 23 varieties/hybrids of sapota (IC numbers) viz., PKM-1 (IC-395173), PKM-2 (IC-395184), PKM-3 (IC-395181), PKM-4, PKM-5, CO-1 (IC-395166), CO-2 (IC-395167), CO-3 (IC-

395182), DHS-1 (IC-395174), DHS-2 (IC-395183), Murabba (IC-614619), Mohangoottee (IC-395157), Zumakhiya (IC-395159), Bhuripatti, Pilipatti (IC-395155), Cricket ball, (IC-395153) Singapore (IC-395178), Kirthibirthi (IC-395160), Paria collection, Chala collection-1, Chala collection-2, Chala collection-3 and Kalipatti (IC-395179) as a standard check was examined planted at 10x10 m spacing. The varieties depicting PKM series was developed at Horticultural College and Research Institute, TNAU, Periyakulam; CO series at TNAU, Coimbatore (Tamil Nadu) and naming Dharwad Hybrid Sapota developed at University of Horticultural Sciences, Bagalkot (Karnataka), while others were selected local collections from Navsari and Valsad districts of Gujarat. The experiment plot was kept free from any insecticidal spray during the research period.

In sapota orchard, randomly selected 30 twigs of each variety (10 twigs/tree) were observed at monthly intervals for the infestation of chiku moth during March to June and October to January from 2018-2019 to 2022-2023. The total number of buds as well as damaged buds were counted on each twig to calculate per cent bud infestation. Both yearly average and peak damage intensity were considered to decide the tolerance and susceptibility level. The data on bud damage was statistically analyzed using WASP 2.0 software for a randomized block design with three replications (one tree as one replication). Also, varietal damage response over Kalipatti was calculated to check the susceptibility/tolerance level.

Varietal bud damage was used to categories susceptibility/ resistance against chiku moth into six groups. For this purpose, the mean per cent damage value of individual varieties/ hybrids (X_i) was compared with grand mean percent value of all varieties/ hybrids (X) and standard deviation (SD) by using the statistical formula (Gupta and Kapoor, 1997).

Category	Code	Scale formula
Highly Resistant	HR	$X_i \leq (X - 2 SD)$
Resistant	R	$(X - SD) \geq X_i > (X - 2 SD)$
Moderately Resistant	MR	$X \geq X_i > (X - SD)$
Moderately Susceptible	MS	$X < X_i \leq (X + SD)$
Susceptible	S	$(X + SD) < X_i \leq (X + 2 SD)$
Highly Susceptible	HS	$X_i > (X + 2 SD)$

For correlation matrix analysis for bud morphology, total 10 buds were randomly selected from each treatment and length and diameter of bud was measured along with standard deviation. Additionally, eight biochemical contents viz., crude protein, total carbohydrate, reducing sugar, non-reducing sugar, total soluble sugar, crude fiber, total phenol and lipid from bud was quantified at Food Quality Testing Laboratory, N.M. College of Agriculture, NAU, Navsari to verify association with the bud damage.

Results and Discussion

Chiku moth caterpillars enter the base of the bud and feed the internal matter, forming larger holes than bud borer larva. As a result, the injured bud and flowers fail to set the flowers or retain as fruits, which eventually reduces the yield. Table 1-12 shows the varietal differences of sapota against chiku moth. During first year (2018–19), the annual bud damage caused by the moth was higher in Kalipatti (9.88%), Murabba (9.36%), Paria collection (9.17%), Kirthibharti (9.04%), CO-2 (8.85%) and CO-1 (8.80%) and later 5 varieties had comparable damage with 5.32-10.97% less vulnerability than Kalipatti (Table 1). Whereas, the lower damage was in Chala collection-2 (2.91%), Chala collection-3 (3.64%), PKM-4 (3.79%) and PKM-2 (4.33%) and had 56.18-70.54% less damage than Kalipatti. Peak damage was observed during December in Kalipatti and CO-1; November in Kirthibharti and May in CO-2. The extent of injury was slightly higher in summer (11.17%) than winter. Annual infestation in second year (2019–20) was higher in Kalipatti (12.09%) and showed alike damage with CO-1 (10.14%), Paria collection (9.99%),

Kirthibharti (9.75%), Cricket ball (9.72%) and CO-2 (9.63%) and were 16.09-20.31% less vulnerable than Kalipatti (Table 2). Whereas, lower incidence was reported in Mohangootee (3.62%), Chala collection-2 (3.85%), PKM-3 (4.39%), PKM-4 (4.45%), PKM-1 (4.64%) and Chala collection-1 (4.74%) and exhibited 60.75-70.03% lower damage than Kalipatti. Peak damage was registered during December in Kalipatti, Paria collection, Kirthibharti and CO-2; in CO-1 and May in Cricket ball. Overall bud infestation was slightly more in summer (10.48%) than winter. During third year (2020–21), the annual bud damage was notably higher in Kalipatti (15.05%), Kirthibharti (14.62%), CO-2 (13.38%), Paria collection (11.75%), Cricket Ball (11.49%), and DHS-2 (11.01%), wherein later 5 varieties demonstrated nearer vulnerability to Kalipatti with 2.82-26.81% (Table 3). In contrast, lower damage was noticed in Mohangootee (5.34%), Zumakhiya (5.51%), Chala collection-2 (5.75%) and Chala collection-3 (6.02%) exhibiting a significantly lower susceptibility of 54.30-64.53% than Kalipatti. Peak damage was observed with Kalipatti during Dec.; Kirthibharti, CO-2, Cricket Ball and DHS-2 in May and Paria collection in April.

Table 1: Performance of sapota varieties/hybrids against chiku moth (1 year- 2018-19)

Varieties	Average percent bud damage*			Peak damage (%)	Peak activity month	% Variation over Kalipatti
	March-June	Oct-Jan	Mean (March-Jan)			
PKM-1	4.76 (2.06)	4.76 (2.26)	4.76 (2.16)	7.15	June	-51.81
PKM-2	5.19 (2.26)	3.47 (1.83)	4.33 (2.04)	7.94	April	-56.18
PKM-3	6.20 (2.51)	3.95 (1.99)	5.08 (2.25)	7.41	May	-48.64
PKM-4	4.06 (2.12)	3.52 (1.91)	3.79 (2.01)	4.97	May	-61.64
PKM-5	4.68 (2.26)	6.40 (2.61)	5.54 (2.43)	8.36	December	-43.94
CO-1	9.18 (3.10)	8.41 (2.96)	8.80 (3.03)	11.34	December	-10.97
CO-2	8.96 (3.05)	8.75 (3.02)	8.85 (3.03)	10.97	May	-10.41
CO-3	7.21 (2.74)	4.60 (2.25)	5.90 (2.50)	10.15	June	-40.25
DHS-1	7.73 (2.85)	7.38 (2.80)	7.56 (2.82)	9.35	April	-23.52
DHS-2	6.50 (2.63)	5.14 (2.36)	5.82 (2.49)	7.46	April	-41.11
Murabba	9.24 (3.10)	9.47 (3.14)	9.36 (3.12)	10.90	December	-5.32
Mohangootee	4.50 (2.06)	6.66 (2.65)	5.58 (2.35)	7.41	November	-43.50
Zumakhiya	5.59 (2.39)	3.48 (1.86)	4.54 (2.12)	6.74	June	-54.10
Bhuripatti	7.78 (2.86)	5.34 (2.33)	6.56 (2.60)	8.93	May	-33.64
Pilipatti	6.41 (2.60)	6.43 (2.61)	6.42 (2.60)	9.11	December	-35.03
Cricket ball	9.41 (3.03)	3.96 (1.91)	6.69 (2.47)	13.39	June	-32.33
Singapore	4.58 (2.23)	4.39 (2.19)	4.48 (2.21)	5.85	June	-54.61
Kirthibarathi	8.45 (2.97)	9.63 (3.16)	9.04 (3.07)	10.93	November	-8.51
Paria coll.	9.52 (3.12)	8.83 (3.04)	9.17 (3.08)	12.34	May	-7.15
Chala coll.-1	4.20 (1.97)	4.71 (2.15)	4.46 (2.06)	7.11	November	-54.91
Chala coll.-2	3.13 (1.70)	2.69 (1.49)	2.91 (1.60)	4.95	November	-70.54
Chala coll.-3	4.07 (1.89)	3.21 (1.71)	3.64 (1.80)	4.65	June	-63.19
Kalipatti	9.37 (3.12)	10.39 (3.29)	9.88 (3.21)	12.17	December	-
Season Avg.	6.55%	5.89%	11.17% over Oct.-Jan.			
CD at 5%	T	0.46	0.33	0.48		
	M	0.19	0.20	0.20		
	TxM	NS	NS	NS		
CV%		23.64	23.54	23.40		

* Figures in parenthesis are (x+0.5) square root transformed values. T=Treatments, M=Month.

Table 2: Performance of sapota varieties/hybrids against chiku moth (II year- 2019-20)

Varieties	Average percent bud damage*			Peak damage (%)	Peak activity month	% Variation over Kalipatti
	March-June	Oct-Jan	Mean (March-Jan)			
PKM-1	4.86 (2.28)	4.42 (2.18)	4.64 (2.23)	6.34	May	-61.63
PKM-2	6.21 (2.57)	8.69 (3.00)	7.45 (2.78)	11.44	December	-38.39
PKM-3	5.44 (2.42)	3.34 (1.87)	4.39 (2.15)	5.96	May	-63.69
PKM-4	3.59 (2.00)	5.31 (2.38)	4.45 (2.19)	7.69	January	-63.15
PKM-5	5.04 (2.33)	5.92 (2.49)	5.48 (2.41)	7.68	December	-54.67
CO-1	9.96 (3.21)	10.33 (3.27)	10.14 (3.24)	12.76	January	-16.09
CO-2	9.90 (3.20)	9.36 (3.12)	9.63 (3.16)	11.03	December	-20.31
CO-3	6.42 (2.54)	5.58 (2.37)	6.00 (2.46)	7.58	January	-50.37
DHS-1	7.44 (2.80)	6.41 (2.59)	6.93 (2.70)	9.55	May	-42.69
DHS-2	3.69 (1.91)	4.02 (1.96)	6.07 (2.53)	8.03	April	-49.79
Murabba	9.10 (3.07)	6.47 (2.61)	7.78 (2.84)	11.90	May	-35.61
Mohangootee	4.21 (2.14)	3.04 (1.87)	3.62 (2.00)	6.44	May	-70.03
Zumakhiya	7.04 (2.73)	5.86 (2.48)	6.45 (2.61)	8.44	May	-46.64
Bhuripatti	9.99 (3.20)	4.92 (2.31)	7.46 (2.76)	12.97	May	-38.33
Pilipatti	7.68 (2.84)	3.35 (1.86)	5.52 (2.35)	8.95	April	-54.35
Cricket ball	11.18 (3.39)	8.26 (2.94)	9.72 (3.17)	13.29	May	-19.58
Singapore	7.11 (2.74)	4.96 (2.31)	6.03 (2.53)	8.49	April	-50.11
Kirthibarthi	9.89 (3.18)	9.61 (3.16)	9.75 (3.17)	12.69	December	-19.36
Paria coll.	10.07 (3.24)	9.91 (3.21)	9.99 (3.22)	12.11	December	-17.37
Chala coll.-1	4.70 (2.25)	4.79 (2.20)	4.74 (2.22)	7.48	December	-60.75
Chala coll.-2	3.69 (1.91)	4.02 (1.96)	3.85 (1.93)	6.51	January	-68.13
Chala coll.-3	3.48 (1.86)	6.32 (2.53)	4.90 (2.20)	8.29	December	-59.44
Kalipatti	11.47 (3.44)	12.71 (3.61)	12.09 (3.53)	15.67	December	-
Season Avg.	7.17%	6.49%	10.48% over Oct.-Jan.			
CD at 5%	T	0.37	0.37	0.26		
	M	0.15	0.15	0.15		
	TxM	NS	NS	NS		
CV%		17.06	17.77	17.46		

* Figures in parenthesis are $(x+0.5)$ square root transformed values. T=Treatments, M=Month.

The data indicates that winter displayed a slightly more infestation (7.70%) overall due to increased susceptibility in contrast to previous two years. During fourth consecutive year (2021–22), the annual bud damage remained higher in Kalipatti (11.92%), followed by Paria collection (11.58%), DHS-2 (10.91%), Kirthibharti (10.48%) and CO-2 (10.21%) and exhibited equivalent vulnerability of 2.86-14.34% to Kalipatti (Table 4). Conversely, Chala collection-3 (5.49%), Chala collection-2 (6.49%), PKM-3 (6.54%), Chala collection-1 (6.70%), Zumakhiya (6.94%), and PKM-1 (6.95%) demonstrated greater resilience, with 41.65-53.89% less damage than Kalipatti. Peak damage was observed with Kalipatti and Kirthibharti in March; DHS-2 in May; Paria collection and CO-2 in June. Damage intensity in summer was significantly higher (37.69%) due to increased pest activity.

During the last fifth year (2022-23), the annual bud damage was higher in Paria collection (17.19%), CO-1 (14.69%), Kalipatti (14.56%), Kirthibharti (13.99%) and CO-2 (13.58%) (Table 5). Wherein, Paria collection and CO-1 were more susceptible than Kalipatti with 1.84-18.84% vulnerability, while

Kirthibharti, CO-2, DHS-2 and PKM-4 were analogous 3.29 to 15.23% less vulnerable. The infestation was low in Pilipatti (7.07%), Chala collection-3 (7.95%), Chala collection-2 (8.08%), Bhuripatti (8.18%) and PKM-1 and had 43.11-51.12% less vulnerability than Kalipatti. The maximum infestation was noted in Paria collection, CO-1, Kalipatti, Kirthibharti and CO-2 during May. Bud damage in summer was 30% more than winter.

In pooled data of five years (Table 6), the average infestation was higher in Kalipatti (12.68%), followed by Paria collection (11.94%), Kirthibharti (11.57%), CO-2 (11.13%) and CO-1 (10.52%), which had comparable 5.86-17.06% less than Kalipatti. Whereas, the lower mean damage was recorded in Chala collection-2 (5.42%), Chala collection-3 (5.60%), PKM-1 (6.23%), Mohangootee (6.25%), Chala collection-1 (6.28%) and Zumakhiya (6.33%) and had 50.50-57.28% less vulnerability than Kalipatti. The maximum damage was noted in May-June (11.66-15.20%) as well as in Dec-Jan (12.76-15.62%), at the time of foliage and flowering initiation in Kalipatti, Paria collection, Kirthibharti, CO-2 and CO-1, especially in May and December (Table 7).

Table 3: Performance of sapota varieties/hybrids against chiku moth (III year- 2020-21)

Varieties	Average percent bud damage*			Peak damage (%)	Peak activity month	% Variation over Kalipatti
	March-June	Oct-Jan	Mean (March-Jan)			
PKM-1	6.13 (2.55)	6.98 (2.60)	6.56 (2.58)	12.77	January	-56.43
PKM-2	8.72 (3.01)	9.09 (3.01)	8.91 (3.01)	15.78	January	-40.81
PKM-3	7.30 (2.74)	9.25 (3.11)	8.28 (2.92)	10.96	December	-44.99
PKM-4	7.37 (2.70)	9.53 (3.13)	8.45 (2.92)	12.22	December	-43.83
PKM-5	8.57 (2.92)	9.66 (3.16)	9.11 (3.04)	12.43	January	-39.43
CO-1	9.37 (3.12)	11.85 (3.49)	10.61 (3.3)	13.04	December	-29.49
CO-2	14.32 (3.81)	12.44 (3.56)	13.38 (3.68)	16.93	May	-11.05
CO-3	4.69 (2.22)	9.52 (3.14)	7.11 (2.68)	11.63	December	-52.77
DHS-1	11.65 (3.47)	8.54 (2.98)	10.10 (3.23)	13.60	April	-32.89
DHS-2	12.50 (3.59)	9.53 (3.14)	11.01 (3.37)	14.75	May	-26.81
Murabba	7.57 (2.81)	8.16 (2.87)	7.86 (2.84)	13.45	January	-47.73
Mohangootee	3.65 (2.01)	7.02 (2.68)	5.34 (2.34)	10.96	January	-64.53
Zumakhiya	4.34 (2.17)	6.69 (2.59)	5.51 (2.38)	10.77	January	-63.34
Bhuripatti	3.71 (2.03)	11.21 (3.38)	7.46 (2.71)	14.55	December	-50.39
Pilipatti	9.97 (3.22)	9.30 (3.09)	9.64 (3.15)	11.80	May	-35.95
Cricket ball	12.18 (3.54)	10.80 (3.33)	11.49 (3.43)	14.64	May	-23.61
Singapore	7.97 (2.84)	9.96 (3.10)	8.96 (2.97)	13.74	December	-40.42
Kirthibarthi	15.45 (3.97)	13.79 (3.76)	14.62 (3.86)	18.42	May	-2.82
Paria coll.	12.76 (3.60)	10.74 (3.34)	11.75 (3.47)	14.36	April	-21.89
Chala coll.-1	7.57 (2.72)	6.18 (2.50)	6.88 (2.61)	10.99	January	-54.30
Chala coll.-2	6.20 (2.38)	5.31 (2.23)	5.75 (2.31)	10.65	January	-61.77
Chala coll.-3	5.18 (2.34)	6.86 (2.69)	6.02 (2.51)	7.38	June	-59.99
Kalipatti	14.29 (3.83)	15.80 (4.00)	15.05 (3.92)	20.18	December	-
Season Avg.	8.76%	9.49%	-7.70% over Oct.-Jan.			
CD at 5%	T	0.41	0.35	0.27		
	M	0.17	0.15	0.16		
	TxM	NS	NS	0.76		
CV%		17.13	14.25	15.70		

* Figures in parenthesis are $(x+0.5)$ square root transformed values. T=Treatments, M=Month.

Bud damage level had rational margin between March-June (Summer) and Oct-January (Winter) span in all varieties, except few, however, 15.83% more infestation was reported in summer season (Table 6). Cricket ball, Murabba, Chala collection-2, Singapore, PKM-1, Pilipatti, Mohangootee, Paria collection and CO-2 had comparatively incline damage in summer than winter as compared to Kalipatti and other varieties. There was significant variation among month-wise infestation in all five years, but interaction was non-significant. While, interaction was significant in mean of eight months data during later three years (2020-21 to 2022-23). There was some significant and few non-significant links found between interaction of months and years and the reason may be first two years had less infestation among varieties; however, subsequent three years had persuaded incidence cause mounting dissimilarity (Table 7).

The peak infestation was recorded in May and December (Table 8), wherein the maximum 17 varieties were infested in May and 15 in December. Other months had lesser infestation due to late flowering initiation, wherein less susceptible varieties/hybrids

had minimum infestation. Therefore, escape type resistance can be seen in these lesser damaged varieties, including year-wise data. The findings on cataloguing based on average bud damage of chiku moth is shown in Table 9. Under grouping in pooled, none of varieties/hybrids were found highly resistant, however, Chala collection-2 and 3 were grouped as resistant. There were 12 varieties categorized under moderately resistant rank and four grouped under moderately susceptible category. Varieties like CO-1, CO-2, Kirthibarthi and Paria collection were ranked as susceptible and Kalipatti as highly susceptible. Like the scaling with respect to peak bud damage (Table 10) in pooled, none of the varieties/hybrids were found as highly resistant and highly susceptible, while Chala collection-1, 2 and 3 were ranked as resistant. There were 11 varieties ranked in moderately resistant and four in moderately susceptible category. CO-2, Cricket ball, Kirthibarthi Paria collection and Kalipatti were ranked as susceptible. Under individual year's categorization as well as average and peak damage scaling, nearly matching trend was seen in ranking and slight variation may be due to ecological factors and crop phenology impact.

Table 4: Performance of sapota varieties/hybrids against chiku moth (IV year- 2021-22)

Varieties	Average percent bud damage*			Peak damage (%)	Peak activity month	% Variation over Kalipatti
	March-June	Oct-Jan	Mean (March-Jan)			
PKM-1	8.97 (2.31)	4.93 (2.26)	6.95 (2.66)	10.32	June	-41.65
PKM-2	10.21 (2.69)	6.65 (2.62)	8.43 (2.93)	11.96	June	-29.24
PKM-3	5.88 (2.77)	7.19 (2.74)	6.54 (2.62)	9.93	Jan.	-45.12
PKM-4	10.13 (3.16)	9.33 (3.09)	9.73 (3.17)	11.94	Jan.	-18.33
PKM-5	9.33 (2.94)	8.41 (2.94)	8.87 (3.02)	11.75	March	-25.55
CO-1	8.66 (2.91)	8.01 (2.85)	8.33 (2.92)	12.28	Jan.	-30.06
CO-2	12.80 (2.77)	7.62 (2.81)	10.21 (3.22)	14.34	June	-14.34
CO-3	6.83 (2.81)	7.50 (2.79)	7.16 (2.73)	9.54	Jan.	-39.88
DHS-1	8.58 (2.91)	8.36 (2.91)	8.47 (2.95)	11.45	Jan.	-28.92
DHS-2	12.11 (3.08)	9.72 (3.12)	10.91 (3.32)	14.84	May	-8.42
Murabba	11.44 (2.57)	6.57 (2.57)	9.01 (3.01)	12.60	March	-24.43
Mohangootee	10.77 (2.42)	5.36 (2.38)	8.06 (2.85)	12.64	March	-32.33
Zumakhiya	8.43 (2.42)	5.45 (2.38)	6.94 (2.67)	11.89	March	-41.76
Bhuripatti	13.09 (2.60)	6.48 (2.60)	9.78 (3.13)	16.41	March	-17.89
Pilipatti	9.26 (2.63)	6.62 (2.63)	7.94 (2.87)	10.83	March	-33.37
Cricket ball	9.90 (2.60)	6.51 (2.57)	8.21 (2.89)	10.34	May	-31.14
Singapore	8.91 (2.61)	6.56 (2.61)	7.74 (2.82)	12.44	March	-35.06
Kirthibarthi	12.29 (3.01)	8.67 (2.98)	10.48 (3.27)	14.70	March	-12.06
Paria coll.	15.08 (2.85)	8.07 (2.86)	11.58 (3.39)	18.55	June	-2.86
Chala coll.-1	6.35 (2.74)	7.05 (2.72)	6.70 (2.65)	9.88	Dec.	-43.74
Chala coll.-2	7.09 (2.44)	5.89 (2.44)	6.49 (2.59)	8.77	June	-45.53
Chala coll.-3	6.24 (2.30)	4.75 (2.23)	5.49 (2.39)	7.84	March	-53.89
Kalipatti	14.64 (3.03)	9.19 (3.07)	11.92 (3.47)	17.99	March	-
Season Avg.	9.87%	7.17%	37.69% over Oct.-Jan.			
CD at 5%	T	0.31	0.25	0.20		
	M	0.13	0.10	0.12		
	TxM	NS	NS	0.56		
CV%		12.06	11.41	11.94		

* Figures in parenthesis are $(x+0.5)$ square root transformed values. T=Treatments, M=Month.

In a study conducted by Bisane and Naik (2016), Bhuripatti, Singapore and Mohangootee varieties continued to show lower levels of infestation (2.40–2.94%), while Pilipatti, DHS-1, Murabba and Paria collection showed higher damage (7.88–8.70%). In the present study, however, Pilipatti demonstrated moderate resistance and Murabba was moderately susceptible, suggesting a shift in varietal response patterns. Moreover, chiku moth activity has intensified in recent years, particularly in Kalipatti, which now exhibits two clear infestation peaks, May–June and December ranging between 7.24–9.42% (Bisane, 2019). This year-round pest pressure suggests that Kalipatti may no longer be a viable option for cultivation in highly infested zones unless IPM strategies are rigorously implemented. Supporting this, our findings align with the reports of Khambhu and Bisane (2017), who found that PKM-1, PKM-4, and CO-3 varieties displayed lower susceptibility, while DHS-2 and Kalipatti varieties were significantly affected under high-density plantation (5x5 m). Interestingly, spacing appeared to have minimal effect on varietal susceptibility in the current context, reinforcing the idea that genetic resistance plays a more pivotal role.

Solanki *et al.* (2022) also noted higher damage in Kalipatti (13.25%) and Cricket Ball varieties (9.00%), while PKM-3 (4.57%) and PKM-1 (4.74%), showed stronger resistance, similar to present study. Although high-density plantations generally exacerbate infestation, varietal genetics again seem to be a decisive factor. Such regional variation may stem from environmental interactions or localized pest dynamics. Varietal study by Vijayaraghavendra and Basavanagoud (2017) on leaf damage in Karnataka found that chiku moth incidence was higher in Cricket ball and lower in DHS-1, with damage occurring more frequently from August to November and less from December to July.

To assess the relevance, correlation matrix with bud morphology and eight biochemical contents (Table 11) were validated using bud damage. There was no significant link between bud length and damage, although bud diameter had a substantial positive relationship (Table 12). Cricket ball, DHS-1, DHS-2, Kirthibharti, Kalipatti, and Murabba varieties with advanced bud diameter (6.22-6.47 mm) and medium (6.05-6.12

Table 5: Performance of sapota varieties/hybrids against chiku moth (V year- 2022-23)

Varieties	Average percent bud damage*			Peak damage (%)	Peak activity month	% Variation over Kalipatti
	March-June	Oct-Jan	Mean (March-Jan)			
PKM-1	9.70 (3.12)	6.76 (2.67)	8.23 (2.89)	14.60	May	-43.11
PKM-2	11.92 (3.41)	7.81 (2.85)	9.86 (3.13)	18.52	May	-31.79
PKM-3	12.73 (3.61)	9.17 (3.07)	10.95 (3.34)	15.62	May	-24.27
PKM-4	13.43 (3.67)	11.09 (3.35)	12.26 (3.51)	17.14	May	-15.23
PKM-5	11.93 (3.48)	9.15 (3.07)	10.54 (3.27)	14.57	May	-27.11
CO-1	14.97 (3.85)	14.42 (3.79)	14.69 (3.82)	20.73	Dec.	1.61
CO-2	14.98 (3.88)	12.19 (3.51)	13.58 (3.70)	19.24	May	-6.06
CO-3	10.97 (3.36)	10.63 (3.27)	10.80 (3.31)	13.98	May	-25.32
DHS-1	10.61 (3.25)	8.84 (3.00)	9.72 (3.12)	15.87	May	-32.76
DHS-2	13.06 (3.64)	12.12 (3.50)	12.59 (3.57)	17.39	May	-12.94
Murabba	12.64 (3.41)	6.91 (2.68)	9.78 (3.05)	21.44	May	-32.40
Mohangootee	11.40 (3.4)	5.91 (2.51)	8.66 (2.95)	16.04	May	-40.15
Zumakhiya	9.83 (3.11)	8.61 (2.99)	9.22 (3.05)	13.59	May	-36.25
Bhuripatti	8.58 (2.96)	7.78 (2.85)	8.18 (2.90)	11.80	May	-43.42
Pilipatti	7.10 (2.66)	7.04 (2.72)	7.07 (2.69)	10.99	May	-51.12
Cricket ball	13.01 (3.62)	8.41 (2.94)	10.71 (3.28)	16.97	May	-25.95
Singapore	12.68 (3.57)	6.82 (2.68)	9.75 (3.13)	16.82	May	-32.60
Kirthibarathi	17.20 (4.17)	10.77 (3.33)	13.99 (3.75)	21.89	May	-3.29
Paria coll.	18.45 (4.27)	15.93 (3.99)	17.19 (4.13)	24.74	May	18.84
Chala coll.-1	8.56 (2.92)	8.64 (3.01)	8.60 (2.96)	12.96	May	-40.52
Chala coll.-2	10.27 (3.20)	5.88 (2.45)	8.08 (2.83)	15.63	May	-44.16
Chala coll.-3	9.40 (3.06)	6.50 (2.61)	7.95 (2.83)	13.37	May	-45.03
Kalipatti	15.27 (3.91)	13.66 (3.73)	14.46 (3.82)	20.76	May	-
Season Avg.	12.12%	9.35%	29.59% over Oct.-Jan.			
CD at 5%	T	0.28	0.25	0.19		
	M	0.12	0.10	0.11		
	TxM	0.57	0.50	0.54		
CV%		10.19	10.11	10.25		

* Figures in parenthesis are (x+0.5) square root transformed values. T=Treatments, M=Month.

Table 6: Performance of sapota varieties/hybrids against chiku moth (5 years pooled)

Varieties	Average percent bud damage*			Peak damage (%)	Peak activity month	% Variation over Kalipatti
	March-June	Oct-Jan	Mean (March-Jan)			
PKM-1	6.89 (2.61)	5.57 (2.40)	6.23 (2.80)	8.46	May	-50.88
PKM-2	8.45 (2.86)	7.14 (2.66)	7.80 (2.58)	10.40	May	-38.51
PKM-3	7.51 (2.75)	6.58 (2.56)	7.05 (3.43)	8.66	May	-44.42
PKM-4	7.72 (2.75)	7.76 (2.77)	7.74 (3.50)	9.77	Dec.	-38.97
PKM-5	7.91 (2.82)	7.91 (2.85)	7.91 (3.22)	9.49	Dec.	-37.62
CO-1	10.43 (3.26)	10.61 (3.27)	10.52 (2.77)	12.99	Dec.	-17.06
CO-2	12.19 (3.51)	10.07 (3.20)	11.13 (2.69)	14.28	May	-12.19
CO-3	7.22 (2.71)	7.57 (2.76)	7.39 (2.96)	9.29	Dec.	-41.68
DHS-1	9.20 (3.07)	7.91 (2.86)	8.56 (3.54)	11.01	May	-32.52
DHS-2	6.07 (3.19)	8.44 (2.92)	9.28 (2.90)	11.93	May	-26.80
Murabba	10.00 (3.17)	7.52 (2.77)	8.76 (2.59)	13.15	May	-30.93
Mohangootee	6.91 (2.59)	5.60 (2.42)	6.25 (2.48)	8.11	May	-50.69
Zumakhiya	7.05 (2.67)	6.02 (2.46)	6.53 (2.92)	8.37	May	-48.48
Bhuripatti	8.63 (2.94)	7.15 (2.70)	7.89 (2.90)	9.92	May	-37.78
Pilipatti	8.09 (2.88)	6.55 (2.58)	7.32 (2.50)	9.72	May	-42.29

Table continued

Cricket ball	11.14 (3.36)	7.59 (2.74)	9.36 (2.51)	13.51	May	-26.15
Singapore	8.25 (2.88)	6.54 (2.58)	7.39 (2.58)	9.23	May	-41.69
Kirthibarathi	12.65 (3.57)	10.49 (3.28)	11.57 (2.88)	14.38	May	-8.71
Paria coll.	13.18 (3.63)	10.70 (3.29)	11.94 (2.90)	15.20	May	-5.86
Chala coll.-1	6.28 (2.49)	6.28 (2.52)	6.28 (2.30)	7.66	May	-50.50
Chala coll.-2	6.07 (2.39)	4.76 (2.12)	5.42 (2.21)	7.34	June	-57.28
Chala coll.-3	5.67 (2.34)	5.53 (2.35)	5.60 (3.10)	7.05	May	-55.82
Kalipatti	13.01 (3.63)	12.35 (3.54)	12.68 (2.71)	15.62	Dec.	-
Season Avg.	8.89%	7.68%	15.83% over Oct.-Jan.			
	T	0.15	0.17	0.16		
	M	0.07	0.07	0.07		
CD at 5%	Y	0.07	0.08	0.07		
	TxM	NS	0.34	0.31		
	TxY	0.34	0.38	0.35		
	MxY	0.16	0.16	NS		
	TxMxY	NS	0.76	0.70		
CV%		15.60	15.77	17.02		

* Figures in parenthesis are (x+0.5) square root transformed values. T=Treatments, M=Month, Y=Year.

Table 7: Trend of bud damage with flowering period months in sapota varieties/hybrids (5 yearspooled)

Varieties	Flowering initiation	Average percent bud damage				Flowering initiation	Average percent bud damage			
		March	April	May	June		Oct	Nov	Dec	Jan
PKM-1	April	5.29	6.03	8.46	7.76	Nov.	4.09	4.37	6.09	7.73
PKM-2	April	6.15	8.36	10.40	8.89	Nov.	4.65	5.80	9.04	9.08
PKM-3	April	6.30	6.58	8.66	8.49	Nov.	4.67	6.38	7.47	7.81
PKM-4	March	5.38	6.72	9.36	9.41	Oct.	4.74	7.19	9.77	9.33
PKM-5	March	6.22	7.93	9.27	8.22	Oct.	5.26	7.51	9.49	9.38
CO-1	March	9.01	9.99	11.66	11.04	Oct.	7.08	9.79	12.99	12.56
CO-2	March	9.51	11.34	14.28	13.64	Oct.	7.29	9.40	12.44	11.16
CO-3	March	6.16	6.26	7.83	8.63	Oct.	4.87	7.02	9.29	9.09
DHS-1	March	6.66	9.49	11.01	9.65	Oct.	5.09	7.60	9.30	9.63
DHS-2	March	7.54	10.19	11.93	10.82	Oct.	5.00	8.17	10.60	9.99
Murabba	March	6.88	8.52	13.15	11.44	Oct.	5.14	6.51	8.81	9.62
Mohangootee	April	5.54	6.58	8.11	7.39	Nov.	4.17	5.32	6.74	6.16
Zumakhiya	April	5.67	6.76	8.37	7.39	Nov.	4.46	5.44	7.04	7.12
Bhuripatti	March	7.94	8.06	9.92	8.60	Oct.	5.18	6.60	8.56	8.25
Pilipatti	April	7.03	6.85	9.72	8.74	Nov.	4.69	5.90	7.82	7.78
Cricket ball	March	8.82	10.04	13.51	12.18	Oct.	5.79	7.09	9.30	8.16
Singapore	April	7.11	8.16	9.23	8.51	Nov.	5.10	5.56	8.53	6.96
Kirthibarathi	March	11.09	11.50	14.38	13.65	Oct.	7.73	9.80	12.76	11.68
Paria coll.	March	9.49	13.15	15.20	14.86	Oct.	7.53	10.06	13.07	12.12
Chala coll.-1	April	5.10	5.15	7.66	7.19	Nov.	4.96	5.98	7.37	6.79
Chala coll.-2	April	4.80	5.03	7.13	7.34	Nov.	2.28	4.39	5.75	6.61
Chala coll.-3	April	3.96	4.87	7.05	6.83	Nov.	4.05	5.42	6.92	5.72
Kalipatti	March	10.74	12.10	14.93	14.28	Oct.	8.63	11.80	15.62	13.35
Avg.	7.06	8.25	10.49	9.78		5.32	7.09	9.34	8.96	
CD at 5% (T)	0.38	0.31	0.33	0.35		0.34	0.34	0.30	0.27	
CD at 5% (Y)	0.18	0.14	0.15	0.16		0.16	0.16	0.14	0.12	
CD at 5% (TxY)	0.84	0.69	0.73	0.77		0.76	0.76	0.67	0.60	
CV%	19.77	14.82	14.05	15.48		20.14	17.69	13.73	12.38	

Dark orangecolour:>10% damage, Light green colour: 5-10% damage, Yellow colour:<5% damage. T=Treatments, Y=Year

Table 8: Month-wise trend of chiku moth in sapota

Year	No. of varieties/hybrids with peak damage							
	March	April	May	June	Oct.	Nov.	Dec.	Jan.
2018-19	--	3	5	6	--	4	5	--
2019-20	--	3	8	--	--	--	8	4
2020-21	--	2	5	1	--	--	7	8
2021-22	10	--	2	5	--	--	1	5
2022-23	--	--	22	--	--	--	1	--
Pooled	--	--	17	1	--	--	15	--

Table 9: Categorization of sapota varieties/hybrids based on average bud damage

Scale	2018-19	2019-20	2020-21	2021-22	2022-23	Pooled
Highly Resistant	--	--	--	--	--	--
Resistant	PKM-4, Chala coll.-2, Chala coll.-3	PKM-3, Mohangootee, Chala coll.-2	Chala coll.-2, Chala coll.-3, Mohangootee, Zumakhiya	PKM-3, Chala coll.-1, Chala coll.-2, Chala coll.-3	Pilipatti, Chala coll.-2, Chala coll.-3	Chala coll.-2, Chala coll.-3
Moderately Resistant	PKM-1,PKM-2, PKM-3,PKM-5, CO-3,DHS-2, Mohangootee, Zumakhiya, Pilipatti, Singapore, Chala coll.-1	PKM-1,PKM-4, PKM-5,CO-3, DHS-2, Zumakhiya, Pilipatti, Singapore, Chala coll.-1, Chala coll.-3	PKM-1,PKM-2, PKM-3,PKM-4, PKM-5,CO-3, Murabba, Bhuripatti, Singapore, Chala coll.-1	PKM-1,PKM-2,CO-1, CO-3,DHS-1, Mohangootee, Zumakhiya, Pilipatti, Cricket ball, Singapore	PKM-1,PKM-2, PKM-5,DHS-1, Murabba, Mohangootee, Zumakhiya, Bhuripatti, Cricket ball, Singapore, Chala coll.-1	PKM-1,PKM-2, PKM-3,PKM-4, PKM-5,CO-3, Mohangootee, Zumakhiya, Bhuripatti, Pilipatti, Singapore, Chala coll.-1
Moderately Susceptible	DHS-1, Bhuripatti, Pilipatti, Cricket ball	PKM-2,DHS-1, Murabba, Bhuripatti	CO-1,DHS-1, DHS-2,Pilipatti, Cricket ball, Paria coll.	PKM-4,PKM-5, CO-2,Murabba, Bhuripatti	PKM-3,PKM-4, CO-3,DHS-2	DHS-1, DHS-2, Murabba, Cricket ball
Susceptible	CO-1,CO-2, Murabba, Kirthibarathi, Paria coll., Kalipatti	CO-1,CO-2, Cricket ball, Kirthibarathi, Paria coll.	CO-2, Kirthibarathi	DHS-2,Kirthibarathi, Paria coll.,Kalipatti	CO-1,CO-2, Kirthibarathi, Kalipatti	CO-1,CO-2, Kirthibarathi, Paria coll.
Highly Susceptible	--	Kalipatti	Kalipatti	--	Paria coll.	Kalipatti

Table 10: Categorization of sapota varieties/hybrids based on peak bud damage

Scale	2018-19	2019-20	2020-21	2021-22	2022-23	Pooled
Highly Resistant	--	--	Chala coll.-3	--	--	--
Resistant	PKM-4, Singapore, Chala coll.-2, Chala coll.-3	PKM-1, PKM-3, Mohangootee, Chala coll.-2	--	CO-3, Chala coll.-2, Chala coll.-3	Bhuripatti, Pilipatti, Chala coll.-1	Chala coll.-1, Chala coll.-2, Chala coll.-3
Moderately Resistant	PKM-1,PKM-2, PKM-3,PKM-5, DHS-2, Mohangootee, Zumakhiya, Chala coll.-1	CO-3,PKM-4, PKM-5,DHS-1, DHS-2,Zumakhiya, Pilipatti, Singapore, Chala coll.-1, Chala coll.-3	PKM-1,PKM-3, PKM-4,PKM-5, CO-1,CO-3, Mohangootee, Zumakhiya, Pilipatti, Chala coll.-1,	PKM-1,PKM-2, PKM-3,PKM-4, PKM-5,CO-1, DHS-1 Zumakhiya, Pilipatti, Cricket ball,	PKM-1,PKM-3, PKM-5,CO-3, DHS-1, Mohangootee, Zumakhiya, Chala coll.-2, Chala coll.-3	PKM-1,PKM-2, PKM-3,PKM-4, PKM-5,CO-3, Mohangootee, Zumakhiya, Bhuripatti, Pilipatti,

Table continued

Moderately Susceptible	CO-2,CO-3,DHS-1, Murabba, Bhuripatti, Pilipatti, Kirthibarathi	PKM-2,CO-2, Murabba, Paria coll.	Chala coll.-2 PKM-2,DHS-1, DHS-2,Murabba, Bhuripatti,Cricket ball,Singapore, Paria coll.	Chala coll.-1 CO-2,DHS-2, Murabba, Mohangootee, Singapore, Kirthibarathi	PKM-2,PKM-4, CO-2,DHS-2, Cricket ball, Singapore	Singapore CO-1, DHS-1, DHS-2, Murabba
Susceptible	CO-1, Cricket ball, Paria coll., Kalipatti	CO-1, Bhuripatti, Cricket ball, Kirthibarathi	CO-2, Kirthibarathi	Bhuripatti	CO-1, Murabba, Kirthibarathi, Kalipatti	CO-2,Cricket ball,Kirthibarathi, Paria coll., Kalipatti
Highly Susceptible	--	Kalipatti	Kalipatti	Kalipatti Paria coll.	Paria coll.	-

Table 11: Morphological and biochemical parameters of bud in sapota varieties/hybrids

Varieties	Bud length (mm+SD)	Bud diameter (mm+SD)	Crude Protein (%)	Total Carbo-hydrate (%)	Reducing Sugar (%)	Non-reducing Sugar (%)	Total Soluble Sugar (%)	Crude Fiber (%)	Total Phenol (%)	Lipid (%)
PKM-1	9.02+0.65	6.04+0.20	4.91	33.83	1.02	8.42	9.40	8.34	2.39	5.80
PKM-2	9.85+0.77	6.31+0.25	4.12	55.31	1.60	6.21	7.80	8.90	1.79	4.30
PKM-3	10.47+1.00	5.94+0.36	4.53	65.60	1.49	4.87	6.40	7.23	2.66	4.45
PKM-4	11.39+0.77	6.17+0.20	4.24	51.71	1.40	8.08	9.50	8.63	1.47	4.00
PKM-5	8.69+0.54	5.12+0.39	3.64	33.03	0.62	7.91	8.50	9.22	2.21	3.75
CO-1	10.61+0.74	6.05+0.31	3.46	47.62	2.50	6.28	8.80	8.23	2.52	3.55
CO-2	9.20+0.75	6.12+0.20	7.98	42.00	0.34	6.89	7.20	9.80	1.98	3.65
CO-3	9.82+0.96	6.07+0.31	11.86	57.46	6.38	4.25	10.63	6.58	1.29	4.60
DHS-1	10.31+1.01	6.37+0.25	9.21	32.36	0.15	4.10	4.30	8.22	2.98	5.40
DHS-2	10.69+0.95	6.30+0.41	7.80	38.23	0.87	5.75	6.60	8.56	2.95	5.80
Murabba	9.65+0.46	6.22+0.23	3.04	29.99	1.43	10.65	12.10	7.57	2.03	4.60
Mohangootee	9.49+0.58	5.30+0.45	2.95	48.59	1.96	8.78	10.70	5.36	1.83	7.40
Zumakhiya	9.29+1.05	5.57+0.24	3.37	49.76	1.76	10.50	12.30	7.21	3.28	5.40
Bhuripatti	9.54+0.74	5.24+0.40	7.63	46.34	2.34	8.71	11.10	7.36	2.96	3.25
Pilipatti	9.64+0.37	6.20+0.26	4.49	38.53	1.34	5.96	7.30	6.21	3.60	3.00
Cricket ball	11.20+0.64	6.47+0.23	2.80	70.46	1.10	7.85	8.90	4.23	1.54	5.55
Singapore	10.30+1.28	6.15+0.48	4.47	49.09	2.14	8.27	10.40	7.23	2.23	4.80
Kirthibarathi	9.00+0.47	6.26+0.33	6.06	51.79	4.40	6.01	10.40	8.23	1.79	4.20
Paria coll.	8.58+0.45	6.05+0.31	5.98	46.72	1.89	7.04	8.90	5.31	3.84	4.80
Chala coll.-1	9.29+0.57	5.78+0.25	5.66	53.73	1.58	9.22	10.80	5.89	2.71	4.45
Chala coll.-2	9.41+0.56	5.41+0.22	5.38	49.17	1.44	8.47	9.90	8.21	2.53	4.60
Chala coll.-3	9.40+0.53	5.73+0.41	3.17	51.41	2.92	8.51	11.40	6.23	1.76	3.20
Kalipatti	8.91+0.61	6.26+0.53	4.97	41.50	2.73	8.10	10.80	5.69	3.63	5.35

Table 12: Correlation matrix of bud morphology and biochemical parameters of varieties/hybrids with bud damage bychiku moth

Parameters	Bud damage#
Bud length	-0.103 (-0.048)
Bud diameter	0.489* (0.560)*
Crude Protein	0.173 (0.113)
Total Carbohydrate	-0.124 (-0.135)
Reducing Sugar	0.079 (0.015)
Non-reducing Sugar	-0.262 (-0.192)
Total Soluble Sugar	-0.182 (-0.163)
Crude Fiber	0.014 (-0.027)
Total Phenol	0.242 (0.188)
Lipid	-0.054 (-0.004)

** Correlation is significant at 1% and * at 5%. # Figures in parenthesis are correlation matrix analyzed for peak bud damage and outside are average damage

mm) in Paria collection, CO-1 and CO-2 were more susceptible to chiku moth whereas Mohangootee, Chala collection-1, 2, 3, Zumakhiya possessing comparatively smaller bud diameters (5.30–5.78 mm), were identified as tolerant. The perusal of data showed no correlation between bud damage and Biochemicals such as crude protein, total carbohydrate, reducing sugar, non-reducing sugar, total soluble sugar, crude fiber, total phenol and lipid (Table 12), and further research is needed to determine precise biochemical features. In the absence of earlier reports on the linkage between chiku moth damage and morphological as well as biochemical attributes, the present study provides novel insights into this unexplored interaction.

The findings of this study suggests that future research should focus on exploring the advance biochemical traits of sapota varieties to better understand their resistance mechanisms against chiku moth to sustain the economic impact of incidence on sapota yield.

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