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FIELD EVALUATION OF SWEET POTATO GENOTYPES FOR RESISTANCE TO *CYLAS FORMICARIUS*

Vadde Mounika[1], Chandra Deo[1], Siddhartha Singh[2], Ajaykumara K M[3]*, P Raja[3], Arwankie Shadap[1], Nimbolkar Prasanth Kisan[4], Talamarla Yeswanth Mahidar Gowd[1] and Andoinam Bidyalaxmi Devi[1]

[1]Department of Vegetable Science; [2]Department of Basic Sciences and Humanities;
[3]Department of Plant Protection; [4]Department of Fruit Science, College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh, India
*Email: ajaykumarakmath@gmail.com (corresponding author): ORCID ID 0000-0002-4553-3068

ABSTRACT

Sweet potato weevil *Cylas formicarius* is a major insect pest in Siang valley of Arunachal Pradesh which inflicts damage on the leaves, vines, and tubers as part of their normal feeding and survival habit. The study was conducted to evaluate 29 local genotypes of Northeast India, along with two commercial cultivars, Sree Bhadra and ST-14, for their relative susceptibility to pest. Sweet potato weevil and grasshopper incidence on the vines were lowest in CHFSP-10, while thrips infestations was lowest in CHFSP-07. In terms of tuber incidence, the genotypes CHFSP-10, CHFSP-14and CHFSP-15 performed better against *C. formicarius*. The substantially decreased sensitivity of CHFSP-10, CHFSP-14 and CHFSP-15 to sweet potato weevil indicates the feasibility of using them in varietal development to improve breeding programmes.

Key words: *Cylas formicarius*, sweet potato genotypes, tuber and vine incidence, latex, grass hopper, northeast India, correlation

Sweet potato (*Ipomoea batatas*) is a third most important tuber crop tubers are used as a high-carbohydrate feed for cattle, while the vines provide a cheap source of fodder (Tadda et al., 2022). Among the insect pests of sweet potato, the sweet potato weevil *Cylas formicarius* is the most prevalent and destructive. In North East India (NEI) farmers cultivate the crop in the altitudes ranging between 600-1600 msl where, the *C. formicarius* is causing huge economic losses. Weevils feed on vines and roots for survival and to deposit eggs (oviposition), resulting in 60 to 100% reductions in production (Kyereko et al., 2019). This infestation renders sweet potato tubers unfit for ingestion due to the tuber's synthesis of poisonous sesquiterpenes (Misra et al., 2001). Current study was undertaken to find the possible source of resistant genotype against sweet potato weevil including thrips and grasshopper.

MATERIALS AND METHODS

The present investigation was carried out at the Vegetable block of the College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh, India. Twenty-nine sweet potato genotypes were collected from different states of the North-eastern region of India to assess their susceptibility to the insect pest's infestation under natural conditions in a randomised block design with three replications during rabi 2021-22 and 2022-23. Latex production in the vines and tubers was observed based on the IBPGR descriptors of sweet potato genotypes (Huaman et al., 1991). Sweet potato weevil infestation on the tuber was calculated by counting the number of holes per tuber, damage length in tuber (cm), number of infested, uninfected and total number of tubers/ vine, weight of infested, uninfected and total weight of tubers/ vine was calculated. Damage based on number and tuber was calculated. Pearson correlation analysis was performed by R studio. Data were transformed by using square root transformation and arc sin values (Payne et al., 2011).

RESULTS AND DISCUSSION

The results of a pooled data on the incidence of sweet potato weevil, grasshopper, and thrips on vegetative growth of sweet potato are presented in Table 1. Sweet potato weevil infestation was observed minimum in genotype CHFSP-10 (4.42%), and maximum in CHFSP-29 (36.77%). Infestation due to grasshopper incidence was lowest in genotype CHFSP-10 (4.82%) and highest in genotype CHFSP-13 (38.13%). Minimum thrips infestation was recorded in CHFSP-07 (0.45%) and the maximum in CHFSP-24 (40.50%). Prasad et al. (2022) stated that none of the genotype was free from the incidence of sweet potato

Table 1. Effect of incidence of sweetpotato weevil, grasshopper and thrips on the vines and leaves of sweet potato

Genotypes	Sweet potato weevil infestation (%)	Grasshopper infestation (%)	Thrips infestation (%)	Latex production
CHFSP -1	21.53 (27.65)	17.00 (24.35)	9.92 (18.36)	Some
CHFSP -2	23.67 (29.11)	32.00 (34.45)	6.92 (15.25)	Little
CHFSP -3	16.33 (23.84)	17.50 (24.73)	10.08 (18.51)	Abundant
CHFSP -4	14.38 (22.28)	24.67 (29.78)	8.92 (17.37)	Abundant
CHFSP -5	20.02 (26.58)	22.17 (28.09)	12.92 (21.06)	Some
CHFSP -6	33.82 (35.56)	14.17 (22.11)	14.17 (22.11)	Little
CHFSP -7	18.75 (25.66)	28.33 (32.16)	0.45 (3.85)	Abundant
CHFSP -8	33.33 (35.26)	13.50 (21.56)	8.12 (16.55)	Some
CHFSP -9	33.33 (35.26)	11.33 (19.67)	26.95 (31.27)	Some
CHFSP -10	4.42 (12.13)	4.82 (12.68)	14.27 (22.19)	Abundant
CHFSP -11	9.17 (17.62)	18.17 (25.23)	34.83 (36.17)	Abundant
CHFSP -12	22.33 (28.20)	29.83 (33.11)	20.83 (27.16)	Little
CHFSP -13	22.50 (28.32)	38.33 (38.25)	5.42 (13.46)	Some
CHFSP -14	13.17 (21.28)	7.17 (15.53)	4.58 (12.36)	Abundant
CHFSP -15	10.83 (19.22)	9.67 (18.11)	25.17 (30.11)	Abundant
CHFSP -16	20.00 (26.57)	19.50 (26.21)	17.42 (24.67)	Abundant
CHFSP -17	27.50 (31.63)	10.25 (18.67)	14.83 (22.65)	Little
CHFSP -18	23.00 (28.66)	13.50 (21.56)	10.75 (19.14)	Some
CHFSP -19	16.72 (24.13)	30.50 (33.52)	13.92 (21.90)	Some
CHFSP -20	15.67 (23.32)	14.33 (22.25)	34.17 (35.77)	Little
CHFSP -21	22.58 (28.37)	13.67 (21.70)	26.67 (31.09)	Little
CHFSP -22	32.67 (34.86)	8.17 (16.61)	21.17 (27.39)	Little
CHFSP -23	16.42 (23.90)	10.50 (18.91)	19.77 (26.40)	Little
CHFSP -24	18.17 (25.23)	20.67 (27.04)	40.50 (39.52)	Some
CHFSP -25	27.42 (31.57)	13.17 (21.28)	21.83 (27.86)	Little
CHFSP -26	33.25 (35.21)	13.33 (21.42)	7.67 (16.07)	Little
CHFSP -27	16.83 (24.22)	33.33 (35.26)	21.93 (27.93)	Some
CHFSP -28	26.13 (30.74)	34.00 (35.67)	23.07 (28.70)	Some
CHFSP -29	37.67 (37.86)	34.67 (36.07)	29.83 (33.11)	Some
Sree Bhadra	12.98 (21.12)	21.83 (27.86)	16.33 (23.84)	Abundant
St-14	10.85 (19.23)	18.33 (25.35)	14.08 (22.04)	Abundant
SE(m)	0.87	1.00	0.86	
C.D.	2.46	2.82	2.42	

*Figures in the parentheses are square root transformed values

weevil. These findings are congruent with earlier ones (Tanzubil, 2015; Chen, 2017; Fite et al., 2017). Among all genotypes, latex production on the vine was abundant in ten genotypes, some in ten genotypes, and little quantity in remaining eleven genotypes (Table 1). Latex production on the vine was recorded at its highest in CHFSP-14 (4.31) and lowest in CHFSP-2 (2.36). The total number of tubers/ vine was observed at its maximum in CHFSP-15 (4.70) and at its minimum in CHFSP-21 (3.05). Damaged tuber/ vine was lowest in CHFSP-14 (5.91) and highest in CHFSP-2 (33.77). The CHFSP-14 had the lowest number of infested tubers, uninfected tubers, and damaged tuber/ vine, whereas CHFSP-15 had the highest total quantity of tubers (Table 2). Sweet potato weevil infection was determined by external factors such as form, thickness, and neck length, as well as skin colour (Stathers et al. 2005). The weight of infested tubers/ vine was lowest in CHFSP-14 (56.20 g) and the weight of uninfected tubers/ vine was highest in CHFSP-10 (737.90 g) and lowest in CHFSP-7 (150.80 g). The total weight of tubers/ vine was highest in CHFSP-15 (831.10 g) and lowest in CHFSP-7 (216.2). Damage tuber on a weight basis was lowest in CHFSP-10 (8.03%).

Some latex production was accounted for in 16 genotypes, and little latex production was recorded in four genotypes (Table 2). CHFSP-14 has the fewest

Table 2. Effect of infestation of sweet potato weevil on the number of tubers per vine infested and weight of tuber

Genotypes	Number of infested tubers vine^{-1}	Number of uninfested tubers vine^{-1}	Total Number of tubers vine^{-1}	Damaged tubers vine^{-1} (% on number basis)	Number of holes tuber^{-1}	Damage length in tubers vine^{-1} (cm)	Weight of infested tubers vine^{-1} (g)	Weight of uninfested tubers vine^{-1} (g)	Tuber weight vine-^{1} (g)	Damaged tubers vine-1 (% on weight basis)	Latex production on tuber
CHFSP -1	1.02 (0.59)	3.34 (1.96)	4.00 (2.12)	14.91 (22.72)	17.00 (24.35)	4.81	116.3	367.0	481.4	24.13 (29.42)	Abundant
CHFSP -2	1.13 (0.79)	2.36 (1.67)	3.15 (1.91)	33.77 (35.53)	30.01 (35.24)	3.31	93.8	235.6	335.8	27.97 (31.93)	Some
CHFSP -3	1.04 (0.58)	3.67 (2.04)	4.25 (2.18)	15.39 (23.10)	27.33 (31.52)	4.42	102.0	672.9	774.2	13.33 (21.41)	Some
CHFSP -4	1.06 (0.63)	2.62 (1.52)	3.24 (1.93)	21.81 (27.84)	17.67 (24.85)	4.30	101.5	522.9	625.7	16.22 (23.75)	Some
CHFSP -5	0.99 (0.49)	3.25 (1.62)	3.74 (2.06)	13.97 (21.95)	14.21 (22.15)	4.41	105.7	337.6	444.0	23.69 (29.12)	Little
CHFSP -6	1.08 (0.67)	2.53 (1.74)	3.20 (1.92)	23.41 (28.94)	16.17 (24.09)	3.40	94.7	418.1	509.6	18.92 (25.78)	Little
CHFSP -7	0.97 (0.43)	3.98 (2.11)	4.42 (2.21)	11.15 (19.51)	10.33 (18.75)	3.02	64.2	150.8	216.2	29.63 (32.98)	Some
CHFSP -8	1.02 (0.55)	3.99 (2.18)	4.54 (2.24)	14.58 (22.45)	39.51 (38.94)	3.38	90.5	650.8	739.1	12.24 (20.48)	Little
CHFSP -9	1.06 (0.63)	2.62 (1.62)	3.25 (1.94)	23.23 (28.82)	19.00 (25.84)	5.69	135.0	317.7	442.2	29.90 (33.15)	Abundant
CHFSP -10	0.92 (0.35)	4.15 (2.16)	4.51 (2.24)	8.75 (17.20)	7.25 (15.62)	2.45	64.3	737.9	801.3	8.03 (16.46)	Abundant
CHFSP -11	0.95 (0.41)	2.89 (1.83)	3.30 (1.94)	15.00 (22.79)	31.95 (34.93)	4.67	109.7	235.5	355.4	30.93 (33.79)	Some
CHFSP -12	0.96 (0.42)	2.78 (1.81)	3.19 (1.92)	14.31 (22.22)	12.42 (20.63)	3.82	59.5	255.7	316.7	18.80 (25.70)	Some
CHFSP -13	1.06 (0.62)	3.62 (2.03)	4.24 (2.18)	16.30 (23.81)	28.83 (32.48)	4.35	108.0	601.6	712.0	15.17 (22.920	Abundant
CHFSP -14	0.87 (0.26)	4.31 (2.19)	4.57 (2.25)	5.91 (14.07)	4.48 (12.22)	2.07	56.2	358.7	409.4	13.72 (21.73)	Abundant
CHFSP -15	1.12 (0.76)	3.94 (1.81)	4.70 (2.28)	17.46 (24.70)	11.67 (19.97)	4.20	100.0	731.0	831.1	12.03 (20.30)	Abundant
CHFSP -16	0.91 (0.32)	3.89 (1.48)	4.21 (2.17)	7.87 (16.29)	9.53 (17.98)	4.30	116.5	688.2	805.8	14.46 (22.35)	Some
CHFSP -17	1.08 (0.67)	2.57 (1.75)	3.25 (1.93)	23.54 (29.02	23.92 (29.28)	3.09	81.7	249.9	337.8	24.05 (29.37)	Some
CHFSP -18	1.07 (0.64)	2.73 (1.80)	3.37 (1.97)	20.20 (26.71)	14.33 (22.24)	5.42	102.5	312.1	415.2	24.87 (29.91)	Abundant
CHFSP -19	1.03 (0.56)	3.26 (1.92)	3.82 (2.08)	15.83 (23.45)	9.75 (18.19)	5.67	115.5	318.3	434.8	27.10 (31.37)	Some
CHFSP -20	1.36 (0.78)	2.76 (1.81)	3.54 (2.01)	24.74 (29.83)	20.75 (27.10)	3.02	92.0	390.1	485.4	18.96 (25.82)	Little
CHFSP -21	1.05 (0.60)	2.45 (1.72)	3.05 (1.88)	22.40 (28.25)	18.92 (25.78)	5.09	100.0	251.6	353.3	28.29 (32.13)	Abundant
CHFSP -22	1.06 (0.62)	3.11 (1.83)	3.74 (2.06)	18.42 (25.41)	29.92 (33.16)	3.48	114.5	313.5	431.3	26.56 (31.02)	Some
CHFSP -23	0.98 (0.45)	3.45 (2.06)	3.91 (2.10)	12.14 (20.39)	8.75 (17.21)	5.89	153.5	343.1	492.0	31.58 (34.19)	Some
CHFSP -24	1.01 (0.52)	2.66 (1.78)	3.17 (1.92)	17.15 (24.47)	18.50 (25.47)	3.72	118.7	481.9	608.8	19.53 (26.23)	Abundant
CHFSP -25	1.04 (0.58)	2.65 (1.77)	3.23 (1.93)	20.67 (27.04)	17.50 (24.73)	4.02	89.3	353.8	447.1	19.97 (26.55)	Abundant
CHFSP -26	1.19 (0.92)	2.82 (1.81)	3.73 (2.05)	31.08 (33.88)	29.17 (32.69)	3.58	76.0	298.8	371.6	20.46 (26.90)	Some
CHFSP -27	1.18 (0.88)	3.58 (2.01)	4.46 (2.22)	23.47 (28.98)	27.83 (31.84)	3.43	86.5	383.6	477.0	18.14 (25.21)	Some
CHFSP -28	1.06 (0.63)	3.50 (2.00)	4.13 (2.15)	17.35 (24.61)	28.25 (32.11)	3.75	106.2	340.7	453.4	23.44 (28.96)	Some
CHFSP -29	1.06 (0.62)	2.89 (1.84)	3.50 (2.00)	19.05 (25.88)	30.75 (33.68)	5.07	107.8	411.2	519.7	20.93 (27.22)	Some
Sree Bhadra	0.94 (0.38)	4.02 (2.13)	4.41 (2.21)	8.67 (17.13)	35.42 (36.52)	5.08	152.0	287.7	438.2	34.31 (35.86)	Some
St-14	0.98 (0.46)	3.93 (2.10)	4.39 (2.21)	10.95 (19.33)	15.35 (23.07)	3.78	139.2	443.2	578.0	23.21 (28.80)	Abundant
SE(m)	0.06	0.12	0.05	2.68	0.692	0.26	1.6	3.3	3.2	0.85	
C.D.	0.17	0.33	0.16	7.57	1.957	0.74	4.5	9.4	9.1	2.40	

*Figures in the parentheses are arc sin transformed values hole/ tuber (4.48), followed by CHFSP-10 (7.25) and the highest in CHFSP-08 (39.51). Variations in the number of holes were observed due to latex synthesis by these cultivars, which could act as a defence mechanism (Rukarwa et al., 2013). According to Anyanga (2015), latex significantly reduces weevil feeding, oviposition, and feeding punctures. Yoseph et al. (2021) recorded genotypes with high latex flow were not resistant. Damage length was recorded less in CHFSP-14 (2.07 cm) and highest in CHFSP-23 (5.89 cm). Fewer infested tubers were observed in CHFSP-14 (0.87) and a greater number of tubers were affected in CHFSP-20 (1.36).

Sree Bhadra was documented with highest incidence (34.31%). The CHFSP-10 had the least tuber damage (8.03% based on weight) and had the maximum tuber yield/ vine (831.10 g). The majority of sweet potato genotypes demonstrated deep-rooting characteristics during the trial, which was critical in decreasing the impact of infestation on the storage roots. These findings are congruent with a prior study (Parr et al., 2016). According to the findings, higher weevil infestation on the vine had the most damaged tubers/ vine (% on a numerical basis). More the sweet potato infestation on the vegetative growth showed more the infestation on the tuber and root length. Similar results were reported by Yoseph et al. (2021).

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AUTHOR CONTRIBUTION STATEMENT

Chandra Deo and Ajayakumara conceptualized and crafted the research proposal. Vadde Mounika conducted the experiment, curated data, and prepared the original draft. Talamarla Yeshwanth Mahidar Gowd analysed the results, while Oinam Bidyalaxmi Devi assisted in sample collection. P. Raja, Siddarath Singh, Nimbolkar Prasanth Kisan contributed to draft corrections. All authors thoroughly reviewed and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

Anyanga M O. 2015. Phytochemical mediated resistance in sweet potato weevils (Doctoral dissertation, Thesis). University of Greenwich, London.

Chen J 2017. Evaluation of control tactics for management of sweetpotato weevil (Coleoptera: Curculionidae). Louisiana State University and Agricultural & Mechanical College.

Fite T, Getu E, Legesse H, Sori W. 2017. Reaction of sweet potato genotypes to sweet potato weevils (*Cylas puncticollis* (boheman) and *Alcidodes dentipes* (olivier), coleoptera: curculionidae) and viruses in Eastern Hararge, Oromiya, Ethiopia. Journal of Entomology and Nematology 9(6): 46-54.

Huaman Z. 1991. Descriptors for sweet potato. Rome- CIP; AVRDC; IBPGR: 134-150.

Kyereko W T, Hongbo Z, Amoanimaa-Dede H, Meiwei G, Yeboah A. 2019. The major sweet potato weevils; management and control: A review. Entomology Ornithology Herpetology 8(218): 2161-0983.

Misra A K, Singh R S, Pandey S K. 2001. Relative efficacy of chemicals and botanical insecticide against sweet potato weevil, *Cylas formicarious* Fab. Annals of Plant Protection Sciences (India) 9(2): 201-204

Netam R S, Netam C R, Nanda H C, Kumar S. 2008. Screening of sweet potato germplasm for weevil (*Cylas formicarius*) under rainfed condition of Bastar. International Journal of Plant Protection 1(2): 73-75.

Parr M C, Ntonifor N N, Jackai L E. 2016. Evaluation of sweet potato cultivars for differences in *Cylas puncticollis* (Curculionidae: Brentidae) damage in South Western Cameroon. International Journal of Research in Agricultural Sciences 3(1): 2348-3997.

Payne R W, Murray D A, Harding S A, Baird D B, Soutar D M. 2011. GenStat for Windows (14th Edition) Introduction. Hemel Hempstead: VSN International.

Prasad R, Reddy N D, Narayan A, Alam T, Giri G S, Singh P P. 2022. Field screening of orange flesh sweet potato genotypes against sweet potato weevil (*Cylas formicarius* fab.). Journal of Experimental Zoology India 16(10): 19-04.

Rukarwa R J, Prentice K, Ormachea M, Kreuze J F, Tovar J, Mukasa S B, Ghislain M. 2013. Evaluation of bioassays for testing Bt sweet potato events against sweet potato weevils. African Crop Science Journal 21(3): 235-244.

Stathers T, Namanda S, Mwanga R O M, Khisa G, Kapinga R. 2005. Manual for sweet potato integrated production and pest management farmer field schools in sub-Saharan Africa.

Tadda S A, Kui X, Yang H, Li M, Huang Z, Chen X, Qiu D. 2021. The response of vegetable sweet potato (*Ipomoea batatas* Lam) nodes to different concentrations of encapsulation agent and MS salts. Agronomy 12(1): 19.

Tanzubil P B. 2015. Insect pests of sweet potato in the Sudan savanna zone of Ghana. Journal of Entomology and Zoology Studies 3(2): 124-126.

Yosep S M A U, Margerita N W, Antonius S S N, Jenny E R, Markus, I G B Adwita A. 2021. A screening of resistance to sweet potato weevil (*Cylas formicarius* Fab.) in a collection of sweet potato clones under laboratory conditions. International Journal of Tropical Dryland 5(2): 41-47.

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