Evaluation of bitter gourd genotypes for pest and diseases incidence under natural condition

Abstract: Bitter guard or bitter melon botanically *Momordica charantia* L. is susceptible to many pest and diseasesarenow days challenge in its cultivation. So in the present study elucidate the incidence of pest (Fruit fly) and disease (mildews) of bitter gourd. The experiment was conducted under northern dry zone of Karnataka.Fifty six bitter gourd genotypes was under study but none of them shows resistance but the severity various with genotypes. Genotypes exhibit powdery mildew incidence from moderately susceptible (20.89%) to highly susceptible (66.67%) and downy mildew.Genotype ABG-DG-T-1 showed lower infestation for fruit fly (12.90%) and downy mildew (32.00%) among all the genotypes under study.

Key words: Genotypes, Mildews, Infestation and Susceptible.

Introduction: Bitter gourd is one the popular vegetable crop grown in eastern part of the world. It's well known for its nutracutical value, antidiabetic property of bitter gourd is well proven (Joseph and Jini, 2013).In spite of its popularity the major constraints in bitter gourd cultivation are occurrence of powdery mildew, downy mildew and fruit fly infestation and hence the bitter gourd genotypes, were evaluated against these constraints. Therefore, the work done on these aspects were presented here under.

Powdery mildew is one of the major diseases in bitter gourds irrespective of its cultivable topography. This disease predominantly prevalent in the cooler spring and early summer months. Downey mildew occurs worldwide where conditions of temperature and humidity allow its establishment and can result in major losses.Fruit fly is highly polyphagous pest, infesting more than 250 plants belonging to 40 families including many commercial crops (Stanley *et al*., 2015). The investigation was undertaken to determine the extent of powdery mildew, downy mildew and fruit fly incidence under natural condition.

Material and methods: The experiment was laid out in a Randomized Block Design (RBD) with two replications. Under natural conditions 56 bitter gourd genotypes were screened for pest and disease incidence. In each replications five plants were randomly selected to record per cent diseases incidence. The method followed for every screening were presented in following sub headings.

Incidence of powdery mildew: Powdery mildew disease scoring based on per cent leaf area infected and 0–9 rating scale was followed for disease ratings as suggested by Jenkins and Wehner (1983) and percent diseases index (PDI) was calculated (Fanourakis 1990).

Table 1. Diseases rating scale used for powdery mildew incidence

Sl. No	Per cent leaves infected	Score	Reaction category
1	0	0	No disease
2	0 to 3	1	Few small leaf lesions
3	3 to 6	2	Few lesions on few leaves with no stem lesions
4	6 to 12	3	Few lesions on few leaves or with superficial stem lesions
5	12 to 25	4	Few well-formed leaf lesions or superficial stem lesions
6	25 to 50	5	Few well-formed leaf lesions or enlarging stem lesions
7	50 to 75	6	Many large leaf lesions or deep stem lesions with abundant sporulation or plant more than 50% defoliated
8	75 to 87	7	Plants largely defoliated, leaf or stem with abundant sporulating lesions Plants dead
9	87 to 100	8	Many large coalescing leaf or stem lesions, over 75% of plant area affected or defoliated
10	100	9	Plants dead

$$\text{PDI} = \frac{\text{Sum of numerical values}}{\text{Number of leaves graded} \times \text{Maximum ratings}} \times 100$$

(Mayee and Dattar, 1986)

Incidence of downy mildew: The incidence of downy mildew was measured under natural epiphytotic conditions by using the score card given below and entries/parents/hybrids were classified into different categories as per Girisha (1989).

$$\text{PDI} = \frac{\text{Sum of numerical values}}{\text{Number of leaves graded} \times \text{Maximum ratings}} \times 100$$

(Mayee and Dattar, 1986)

Table 2. Diseases rating scale used for downy mildew incidence

Sl. No	Per cent leaves infected	Score	Reaction category
1	0	0	Immune
2	1 to 10	1	Resistant
3	11 to 25	2	Moderately resistant
4	26 to 50	3	Moderately susceptible
5	51 to 75	4	Susceptible
6	76 to 100	5	Highly susceptible

Fruit fly infestation (%): From each harvest, the number of fruits infested with fruit flies were recorded and values for all the harvests were summed up to get total number of infested fruits for each experimental plot. The incidence of fruit fly under natural field condition was calculated as under.

$$\text{Fruit fly incidence} = \frac{\text{Number of fruits infested}}{\text{Total numbers of fruits}} \times 100$$

Entries/parents/hybrids were classified as given below

Table 3. Fruit fly incidence rating scales and interpretations.

Sl. No	Per cent fruit infected	Reaction category
1	0 to 5	Resistant

2	5.1 to 10.0	Moderately resistant
3	10.1 to 20.0	Moderately susceptible
4	20.1 to 50.0	Susceptible
5	> 50.0	Highly susceptible

Result and discussion: All the 56 genotypes were screened under natural epiphytic conditions for pest and disease incidence. The results were represented in table 4,5 &6.

Infestation of powdery mildew in bitter gourd genotypes

The incidence of powdery mildew in bitter gourd is represented in table 4 and figure 1. The genotypes ABG-DG-T-1, ABG-DG-T-3, ABG-DG-T-4, ABG-DG-T-7, ABG-DG-T-9, ABG-DG-T-15, ABG-DG-S-3, ABG-DG-S-8, ABG-LG-S-3, ABG-LG-S-7, ABG-WT-4, ABG-WT-7 , ABG-WT-9, ABG-DG-T-12, ABG-WT-14, ABG-LG-T-5 and ABG-LG-T-6were moderately (20% to 40%) susceptible to incidence of powdery mildew. All other genotypes recorded higher percentage infestation of diseases under natural condition. This results were in line with earlier research findings of Prajapatiand Ramesh 2022.Premature senescence of infected leaves can result in reduced market quality because fruit become sunburnt or ripen prematurely or incompletely. Powdery mildew infection predisposes plants to other diseases. s is most common and destructive toward end of the season (August and September) with higher day temperature and relative humidity.

Table 4: Evaluation of bitter gourd genotypes for powdery mildew incidence under natural condition

Sl. No.	Accession	Per cent disease incidence	Interpretation
1	ABG-DG-T-1	37.33	Moderately susceptible
2	ABG-DG-T-2	43.11	Susceptible
3	ABG-DG-T-3	34.22	Moderately susceptible
4	ABG-DG-T-4	29.78	Moderately susceptible
5	ABG-DG-T-5	61.33	Highly susceptible
6	ABG-DG-T-7	21.78	Moderately susceptible
7	ABG-DG-T-9	28.44	Moderately susceptible

8	ABG-DG-T-11	49.33	Susceptible
9	ABG-DG-T-12	41.33	Susceptible
10	ABG-DG-T-13	62.22	Highly susceptible
11	ABG-DG-T-14	64.44	Susceptible
12	ABG-DG-T-15	23.11	Moderately susceptible
13	ABG-DG-T-16	42.22	Susceptible
14	ABG-DG-T-17	41.33	Susceptible
15	ABG-DG-T-18	53.33	Susceptible
16	ABG-DG-T-19	62.22	Highly susceptible
17	ABG-DG-T-20	43.56	Susceptible
18	ABG-DG-T-24	44.44	Susceptible
19	ABG-DG-S-1	41.33	Susceptible
20	ABG-DG-S-2	62.22	Highly susceptible
21	ABG-DG-S-3	37.33	Moderately susceptible
22	ABG-DG-S-4	61.33	Highly susceptible
23	ABG-DG-S-5	46.67	Susceptible
24	ABG-DG-S-6	45.33	Susceptible
25	ABG-DG-S-7	42.22	Susceptible
26	ABG-DG-S-8	35.56	Moderately susceptible
27	ABG-DG-S-9	40.89	Susceptible
28	ABG-DG-S-10	42.22	Susceptible
29	ABG-LG-S-1	63.56	Highly susceptible
30	ABG-LG-S-2	43.56	Susceptible
31	ABG-LG-S-3	35.56	Moderately susceptible
32	ABG-LG-S-4	62.22	Highly susceptible
33	ABG-LG-S-5	44.00	Susceptible
34	ABG-LG-S-6	48.89	Susceptible
35	ABG-LG-S-7	32.00	Moderately susceptible
36	ABG-WT-1	65.33	Highly susceptible
37	ABG-WT-2	40.89	Susceptible
38	ABG-WT-3	47.56	Susceptible
39	ABG-WT-4	26.67	Moderately susceptible
40	ABG-WT-5	66.67	Highly susceptible
41	ABG-WT-6	22.22	Susceptible
42	ABG-WT-7	30.22	Moderately susceptible
43	ABG-WT-8	44.44	Susceptible
44	ABG-WT-9	32.44	Moderately susceptible
45	ABG-WT-10	43.11	Susceptible
46	ABG-WT-11	44.44	Susceptible
47	ABG-DG-T-12	25.33	Moderately susceptible
48	ABG-WT-13	44.44	Susceptible
49	ABG-WT-14	30.22	Moderately susceptible
50	ABG-LG-T-1	66.67	Highly susceptible
51	ABG-LG-T-2	60.89	Highly susceptible
52	ABG-LG-T-3	42.22	Susceptible
53	ABG-LG-T-4	62.22	Highly susceptible

54	ABG-LG-T-5	20.89	Moderately susceptible
55	ABG-LG-T-6(25)	32.00	Moderately susceptible
56	ABG-LG-T-7	42.22	Susceptible

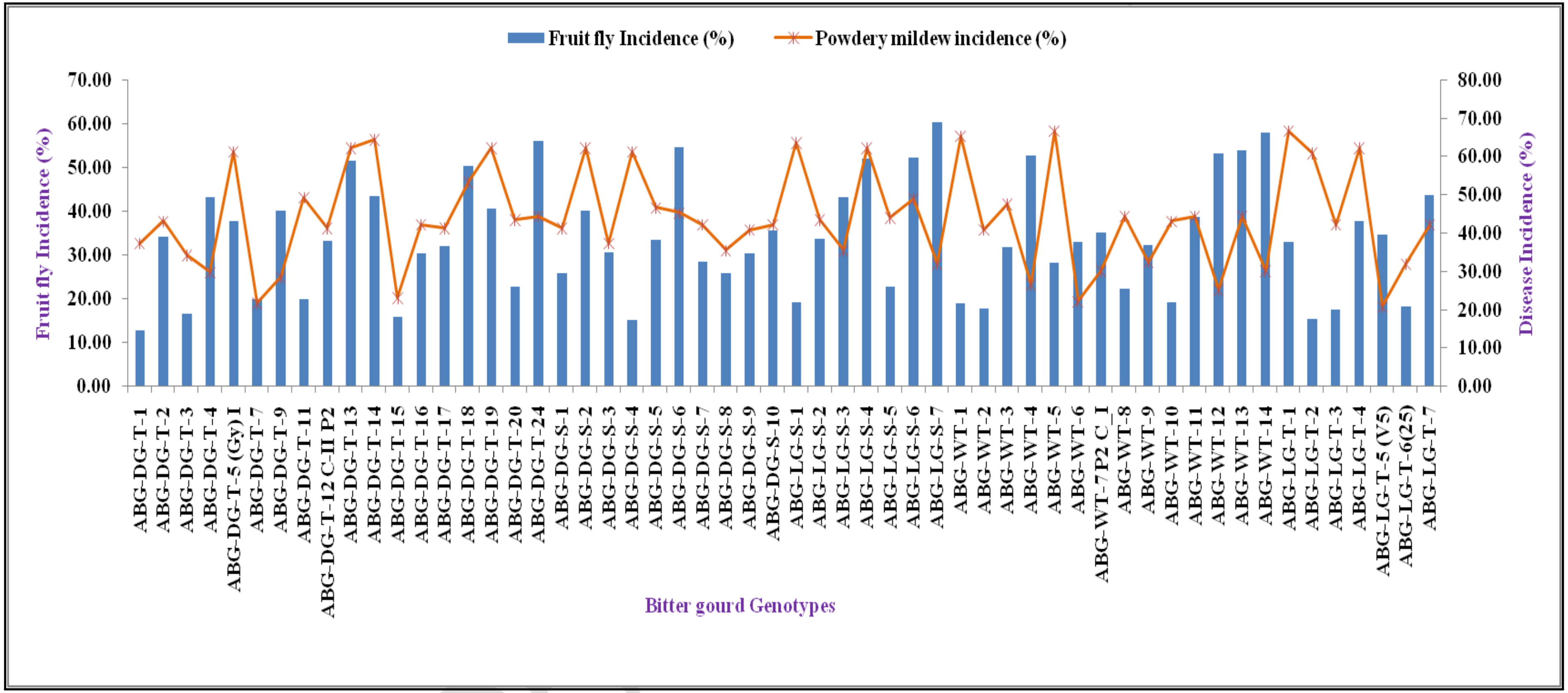

Fig 1. Incidence of fruit fly and powdery mildew in different bitter gourd genotypes

Infestation of downy mildew in bitter gourd genotypes

The incidence of downy mildew in bitter gourd is represented in table 5. Severe infection of downy mildew results in leaves that are completely dead and curled up. This symptom has been described as “wildfire” as the leaves appear to be burned (Colucci and Holmes, 2010). The genotypes ABG-DG-T-4, ABG-DG-T-9 and ABG-WT-7 showed moderately resistant (11 to 25%). The genotypes ABG-DG-S-8, ABG-WT-3 and ABG-WT-13 exhibited higher percentage (>76%) downy mildew (*Pseudoperonosporacubensis)* incidence under natural condition. similar moderate t susceptible results were documented by Asalkar*et al*. 2023.

Table 5: Evaluation of bitter gourd genotypes for downy mildew incidence under natural condition.

Sl. No.	Accession	Per cent disease incidence	Interpretation
1	ABG-DG-T-1	32.0	Moderately susceptible
2	ABG-DG-T-2	47.2	Moderately susceptible
3	ABG-DG-T-3	52.0	Susceptible
4	ABG-DG-T-4	24.8	Moderately resistant
5	ABG-DG-T-5	36.8	Moderately susceptible
6	ABG-DG-T-7	40.0	Susceptible
7	ABG-DG-T-9	24.8	Moderately resistant
8	ABG-DG-T-11	72.0	Susceptible
9	ABG-DG-T-12	39.2	Moderately susceptible
10	ABG-DG-T-13	34.4	Moderately susceptible
11	ABG-DG-T-14	52.0	Susceptible
12	ABG-DG-T-15	44.8	Moderately susceptible
13	ABG-DG-T-16	52.0	Susceptible
14	ABG-DG-T-17	48.8	Moderately susceptible
15	ABG-DG-T-18	58.4	Susceptible
16	ABG-DG-T-19	46.4	Moderately susceptible
17	ABG-DG-T-20	36.8	Moderately susceptible
18	ABG-DG-T-24	40.0	Moderately susceptible
19	ABG-DG-S-1	42.4	Moderately susceptible
20	ABG-DG-S-2	60.8	Susceptible
21	ABG-DG-S-3	48.8	Moderately susceptible
22	ABG-DG-S-4	56.0	Susceptible
23	ABG-DG-S-5	51.2	Susceptible
24	ABG-DG-S-6	34.4	Moderately susceptible
25	ABG-DG-S-7	73.6	Susceptible
26	ABG-DG-S-8	33.6	Highly susceptible
27	ABG-DG-S-9	50.4	Susceptible

28	ABG-DG-S-10	57.6	Susceptible
29	ABG-LG-S-1	42.4	Moderately susceptible
30	ABG-LG-S-2	40.8	Moderately susceptible
31	ABG-LG-S-3	48.8	Moderately susceptible
32	ABG-LG-S-4	62.4	Susceptible
33	ABG-LG-S-5	32.8	Moderately susceptible
34	ABG-LG-S-6	54.4	Susceptible
35	ABG-LG-S-7	37.6	Moderately susceptible
36	ABG-WT-1	62.4	Susceptible
37	ABG-WT-2	56.0	Susceptible
38	ABG-WT-3	76.0	Highly susceptible
39	ABG-WT-4	48.8	Moderately susceptible
40	ABG-WT-5	62.4	Susceptible
41	ABG-WT-6	52.8	Susceptible
42	ABG-WT-7	24.8	Moderately resistant
43	ABG-WT-8	36.8	Moderately susceptible
44	ABG-WT-9	72.0	Susceptible
45	ABG-WT-10	47.2	Moderately susceptible
46	ABG-WT-11	64.0	Susceptible
47	ABG-DG-T-12	38.4	Moderately susceptible
48	ABG-WT-13	80.0	Highly susceptible
49	ABG-WT-14	34.4	Moderately susceptible
50	ABG-LG-T-1	73.6	Susceptible
51	ABG-LG-T-2	56.0	Susceptible
52	ABG-LG-T-3	38.4	Moderately susceptible
53	ABG-LG-T-4	45.6	Susceptible
54	ABG-LG-T-5	57.6	Susceptible
55	ABG-LG-T-6(25)	59.2	Susceptible
56	ABG-LG-T-7	57.6	Susceptible

Infestation of fruit fly in bitter gourd genotypes

The per cent fruit fly infestation in bitter gourd genotype is shown in Table 6. The genotype ABG-LG-S-7 showed highest infestation (60.30%) and genotypes ABG-DG-T-1 showed lower infestation (12.90%). None of the genotypes under study was resistant and ABG-DG-T-1, ABG-DG-T-7, ABG-DG-T-3, ABG-DG-T-11, ABG-DG-T-15, ABG-DG-S-4, ABG-LG-S-1, ABG-WT-1, ABG-WT-2, ABG-WT-10, ABG-LG-T-2 and ABG-LG-T-3 susceptible, similar level of infestation was recorded by Beer *et al*. 2021.

Table 6: Evaluation of bitter gourd genotypes for fruit fly incidence under natural condition

Sl. No.	Accession	Per cent fruit fly incidence	Interpretation
1	ABG-DG-T-1	12.90	Moderately susceptible
2	ABG-DG-T-2	34.09	Susceptible
3	ABG-DG-T-3	16.60	Moderately susceptible
4	ABG-DG-T-4	43.24	Susceptible
5	ABG-DG-T-5	37.74	Susceptible
6	ABG-DG-T-7	20.00	Moderately susceptible
7	ABG-DG-T-9	40.00	Susceptible
8	ABG-DG-T-11	19.90	Moderately susceptible
9	ABG-DG-T-12	33.28	Susceptible
10	ABG-DG-T-13	51.40	Highly susceptible
11	ABG-DG-T-14	43.48	Susceptible
12	ABG-DG-T-15	15.81	Moderately susceptible
13	ABG-DG-T-16	30.30	Highly susceptible
14	ABG-DG-T-17	32.00	Susceptible
15	ABG-DG-T-18	50.31	Highly susceptible
16	ABG-DG-T-19	40.54	Susceptible
17	ABG-DG-T-20	22.73	Moderately susceptible
18	ABG-DG-T-24	56.00	Susceptible
19	ABG-DG-S-1	25.86	Moderately susceptible
20	ABG-DG-S-2	40.20	Susceptible
21	ABG-DG-S-3	30.67	Susceptible
22	ABG-DG-S-4	15.27	Moderately susceptible
23	ABG-DG-S-5	33.52	Susceptible
24	ABG-DG-S-6	54.55	Highly susceptible
25	ABG-DG-S-7	28.57	Susceptible
26	ABG-DG-S-8	25.75	Moderately susceptible
27	ABG-DG-S-9	30.30	Susceptible
28	ABG-DG-S-10	35.71	Susceptible
29	ABG-LG-S-1	19.31	Moderately susceptible
30	ABG-LG-S-2	33.76	Susceptible
31	ABG-LG-S-3	43.10	Susceptible
32	ABG-LG-S-4	52.08	Highly susceptible
33	ABG-LG-S-5	22.73	Susceptible
34	ABG-LG-S-6	52.24	Highly susceptible
35	ABG-LG-S-7	60.30	Highly susceptible
36	ABG-WT-1	19.01	Moderately susceptible
37	ABG-WT-2	17.86	Moderately susceptible
38	ABG-WT-3	31.75	Susceptible
39	ABG-WT-4	52.63	Highly susceptible
40	ABG-WT-5	28.23	Susceptible
41	ABG-WT-6	32.92	Susceptible

42	ABG-WT-7	35.03	Susceptible
43	ABG-WT-8	22.32	Moderately susceptible
44	ABG-WT-9	32.35	Susceptible
45	ABG-WT-10	19.14	Moderately susceptible
46	ABG-WT-11	38.61	Susceptible
47	ABG-DG-T-12	53.19	Highly susceptible
48	ABG-WT-13	53.81	Highly susceptible
49	ABG-WT-14	57.80	Highly susceptible
50	ABG-LG-T-1	32.92	Susceptible
51	ABG-LG-T-2	15.46	Moderately susceptible
52	ABG-LG-T-3	17.54	Moderately susceptible
53	ABG-LG-T-4	37.74	Susceptible
54	ABG-LG-T-5	34.65	Susceptible
55	ABG-LG-T-6(25)	18.18	Moderately susceptible
56	ABG-LG-T-7	43.75	Susceptible

Conclusion: In the current study among 56 genotypes ABG-DG-T-1 exhibitedcomparativelylower incidence of Downy mildew and fruit fly and this is one of the top performing genotypes for advanced breeding programme in resistance breeding of bitter gourd. Genotype ABG-LG-T-5 exhibited lower incidence of powdery mildew among all the genotypes. These genotypes need to evaluate under different geographical condition to elucidate its stable performance as well screen with reported marker to confirm its resistance at molecular level.

Reference:

Asalkar, U.A., Hasabnis, S.N. and Narute, T.K., 2023. Management of downy mildew disease in bitter gourd with minimizing fungicidal applications.*J. Pharm. Innov*. 12(1): 124-130

Beer, D., Chandra, U., Yadav, J.K. and Kumar, S., 2021. Population dynamics of fruit flies in bitter gourd (*Momordica charantia* L.) and its relationship with weather factors.*J. Pharm. Innov*. 10(10): 975-978

Colucci, S.J. and Holmes, G.J., 2010. *Downy mildew of cucurbits. The plant health instructor. DOI: 10.1094*. PHI-I-2010-0825-01.

Fanourakis, N.E. 1990. Screening procedures for powdery mildew resistance in the cucumber. Acta Hort. 287:147–154.

Girisha, K. N. (1989). Studies on biological control of powdery mildew pathogens with Cladosporium spp., M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Bangalore.

Jenkins, S.F. and T.C. Wehner. 1983. A system for the measurement of foliar diseases in cucumbers. *Cucurbit Genet. Coop. Rpt*. 6:10-12.

Joseph, B. and Jini, D., 2013. Antidiabetic effects of *Momordica charantia* (bitter melon) and its medicinal potency. *Asian Pac. J. Trop. Dis*., 3(2), pp.93-102.

Mayee, C. D. and Dattar, V. V., 1986, Phytopathometry. Techical Bulletin-1,Marthwada Agriculture University, Parabhani. pp-68.

Prajapati, A.K. and Singh, R., 2022. Incidence of downey mildew of bitter gourd in eastern Uttar Pradesh. *Ann. Plant Prot. Sci*., 30(1), pp.42-44.

Stanley, J., Gupta, J.P. and Rai, D., 2015. Population dynamics of fruit flies, Bactrocera Spp. in north western himalaya. *Indian J. Entomo.*, *77*(3), pp.214-220.