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Screening of different germplasm of uredbean against POD borer complex

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Abstract
Screening of different germplasm of urdbean against pod borer complex was conducted during *Kharif* 2021-22 at the Research cum Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). Among the all tested germplasm, the germplasm DKU116 was found minimum pod damage by *Helicoverpa armigera* with 0.5 per cent. Due to infestation of *Maruca vitrata*, the minimum pod damage was observed in germplasm KUG 878 with 3.5 per cent. The highest grain yield of urdbean was recorded in RVSU 21 -2 as 754.83 kg/ ha followed by LBG 787 as 741.67 kg/ ha.

Keywords: Black gram, urdbean, *Maruca vitrata*, *Helicoverpa armigera*, Germplasm

Introduction
Pulses, such as chickpea, pigeonpea, green gram, urdbean, cowpea, lentil, and many more, are a major source of protein in our diet and are often referred to as "poor man's meat" (Reddy, 2010) [8]. In India, pulses are consumed at a considerably higher rate than any other form of protein; over 89 per cent of the population take pulses at least once a week, while only 35.4 per cent consume fish or chicken/meat at least once a week (IIPS, ORC Macro, 2007). Furthermore, any decrease in pulse prices will stimulate consumption by the poor more than by wealthier customer (Mittal, 2006) [6]. India has made remarkable progress in enhancing the production of pulses during the past 15 years. During 2005-06, the total production of pulses in India was 13.38 million MT, which increased to 25.58 million MT during 2020-21. This shows an impressive growth of 91% or a compound annual growth rate (CAGR) of 4.42%. During 2020-21, chickpea had a lion's share of 49.3% in the total pulses production. Among remaining pulses, pigeonpea contributed 16.2%, mungbean 10.3%, urdbean 9.3%, lentil 4.9% and other pulses 9.9%. During the past 15 years, the highest growth in production was observed for mungbean (178%), followed by chickpea (125%), urdbean (90%), pigeonpea (51%), and lentil (34%) **(**Gaur, 2021) [1]. Urdbean is a leguminous crop that originated in India and has been cultivated since ancient times. It is one of the most expensive pulses in India and Pakistan.The nodulated urdbean may fix 30 to 60 kg of nitrogen per hectare, depending on soil and environmental condition (Panikkar *et al*., 1990) [7]. There are number of insect pests belonging to different orders which cause damage to black gram among which the most important in India are aphid (*Aphi craccivora Koch*), *thrips* (*Scirtothrips spp.*), *leafhopper* (*Empoasca kerri Pruthi*), *pod bugs* (*Clavigralla gibbosa Spinola and Riptortus pedestris Fabricius*), *bihar hairy caterpillar* (*Spilosoma obliqua Walker*), *tobacco caterpillar* (*Spodoptera litura Fabricius*), *sphinx moth or hawk moth* (*Acherontia styx Westhood*), *grey weevil* (*Myllocerus discolour Boheman*) and the poborers like gram caterpillar (*Helicoverpa armigera* Hubner), pod weevil (*Apionam plum* Faust), tur pod fly (*Melanagromyza obtuse* Malloch), blue butterfly (*Lampoides boeticus* L.) and spotted pod borer (*Maruca vitrata* Geyer) (Kumar *et al*., 2007) [5].

Materials and Methods
The experiment was carried out during *Kharif* 2021-22 at the Research cum Instructional Farm, IGKV, Raipur (C.G.), by growing a total of 47 medium varieties group germplasm of urdbean in RBD design with 2 replications. The Crop was sown on 23rd July during *Kharif* 2021-22; maintaining a row to row and plant to plant spacing of 30 cm x 10 cm, respectively. The observations were recorded as: (i) Pod damage (%): Per cent Pods damaged were separated on basis of shape and size of the hole of different pod borers in 100 randomly collected pods from each plot at the time of harvest and the Nature of damage of *Helicoverpa armigera* is Large round and regular holes on the pods while *Maruca vitrata* cause Irregular

scrapping and holes on the pods. (ii) Yield Parameters: Grain yield was recorded at the time of harvest. Afterward, the total number of pods and the number of damaged pods by pod borers on each demarcated plant were counted and converted into percentage. The percentage of pod damaged and grain yield Kg/ha were estimated with the help of following formula:

$$\text{Pod Damage (\%)} = \frac{\text{Number of damaged pods}}{\text{Total Number of pods (Healthy + Damage)}} \times 100 \quad \textbf{(A)}$$

$$\text{Grain yield (kg/ha)} = \frac{\text{Weight of grains in kg/plot}}{\text{Plot area in m}}$$

Statistical Analysis

The data obtained were statistically analyzed after using the appropriate transformation. Data obtained from the population complex of pod borer larvae were converted to a square root transformation; Using the formula ($\sqrt{x}$ + 0.5), data on pod and grain damage from plants were first collected and then converted to percentage. Percentage data were processed under the sin-1 arcsine transform ($\sqrt{x}/100$) before statistical analysis. Then these transformed data were analyzed using the analysis variance method described by Gómez and 18 Gómez (1984). The "F" test was used at a 5 per cent level of significance. The following formulae were used for standard error, critical difference and coefficient of variance estimations:

$$C.D. = \sqrt{\frac{2EMSR}{R}} \times t\ (D.F.at\ 5\%)$$

Result and Discussion

Screening of different germplasm of urdbean against gram pod borer, *Helicoverpa armigera* (Hubner)

The incidence of insect pest was assessed in the percentage pod damage at the harvesting of the crop. The germplasm differed significantly in terms of percent pod damage, which ranged from 0.5 to 9.5 per cent (Table 01). Among the tested germplasm, the minimum pod damage by *H. armigera* was observed in germplasm DKU116 with 0.5 per cent, which was found at par with Ku 19-10, KPU 405, and LBG 787 with 1.00, 1.5, and 1.5 per cent pod damage, respectively, whereas the maximum pod damage was observed in germplasm BCU 20 - 10 with 9.5 per cent. The present findings are in agreement with Sundararajan and Chitra (2014) [9] who reported that pod damage due to *Helicoverpa armigera* was in range of 0 to 3.0% among different genotypes. Among the all genotypes, minimum and maximum pod damage were recorded in genotypes CBG 08 – 008 & PLU 998, respectively.

Similarly, Yadav *et al*. (2021) [11] observed 27 minimum pod infestations by *H. armigera* in the four genotypes KU-99-05, Azad Urd- 1, Shekhar-2, and PU-6 as 5.83, 6.17, 8.50, and 9.83 per cent, respectively against *H. armigera*.

Screening of different germplasm of urdbean against spotted pod borer, *Maruca vitrata* (Geyer)

The insect pest incidence was observed in terms of per cent of pod damage at the harvesting of the crop. The germplasm showed significant differences with each other for per cent pod damage, which varied from 3.5 per cent to 26.00 per cent (Table 01). Among the tested germplasm, the minimum pod damage by *M. vitrata* was observed in germplasm KUG 878 with 3.5 per cent, which was found at par with PUSA B 43, IPU 94-1, PU 1804, PUSA B 34, KPU 405, RUG 59, Ku 96-3, Ku 19-10, PU 31, Shekhar 3, Barkha, NUL -7, PU 1706, KUG 888, PU 1814 and SKAU – UB -3 with 4, 4.5, 6.5 ,6.5, 6.5, 6.5,7.00 ,7.5, 7.5, 7.5 ,7.95, 9.00, 9.00, 8.5 and 9.5 per cent pod damage, respectively. Whereas the maximum pod damage was observed in IPU 11-02 with 26 per cent (Table 01). The present findings are in agreement with Sundararajan and Chitra (2014) [9] who reported that pod damage due to *Maruca vitrata* was in range of 0 to 14.0% among different genotypes. Among the all genotypes, minimum & maximum pod damage were recorded in genotypes CBG 08-008 & CBG 08 -037, respectively. Similarly, Yadav *et al*. (2021) [11] observed minimum pod infestations by *M. vitrata* in the two genotypes *viz*., KU-99-05 and Azad Urd-1 as 7.67 and 9.67 per cent respectively against *Maruca vitrata.*

Grain Yield

The grain yield of various urdbean germplasm ranged from 448.33 kg/ha to 754.83 kg/ha. The germplasm RVSU 21-2 produced the highest grain yield (754.83kg/ha), followed by germplasm LBG 787 (741.67kg/ha). Whereas, germplasm Daftri 471 has the lowest grain yield (448.33 kg/ha), followed by germplasm IPU 19-9 (485 kg/ha) (Table 01). These findings are in agreement with Srivastava and Singh (2017) [10] who reported that the highest grain yield was recorded from VGG 10-008 (819 kg/ha) while the lowest grain yield was reported from KM 2348 (416 kg/ha). Similarly, Kumar and Singh (2014) [4] who reported that the highest yield was obtained from RVSU-11-8 (7.82 q/ha), followed by KPU-1-10 (7.51 q/ha) and AKU10-4 (6.87 q/ha),and the lowest yield from TU-631 (2.33 q/ha).

Table 1: Per cent pod damage by pod borer complex and grain yield in different germplasm of urdbean (*Kharif* 2021-22)

S. No.	Germplasm	Pod damage (%)		Grain Yield (kg/ha)
		H. armigera	*M. vitrata*	
1	BCU 20-10	9.5 (17.89)	12 (20.19)	543.17
2	Daftri 471	2.5(9.04)	21.5 (27.60)	448.33
3	DBGV 90	6.00(14.12)	18.5 (25.22)	703.33
4	DKU 116	0.5 (2.86)	8.5 (16.93)	521.67
5	DKU 87	4.00(11.53)	12.5 (20.38)	606.67
6	IPU 11-02	2.00(7.85)	26 (30.64)	606.50
7	IPU 18-7	2.5(9.04)	13.5 (21.46)	620.17
8	IPU 19-9	3.5(10.75)	23 (28.6)	485.00
9	IPU 2-43	3.00(9.83)	16.5(23.93)	553.33
10	IPU 94-1	4.5(12.22)	4.5(12.22)	608.33
11	IU 05-2	6.5(14.75)	20(26.54)	541.67
12	IU 92-14	7.5(15.82)	14 (21.85)	600.00
13	JAUG 2	3.00(9.83)	16.5 (23.89)	593.33
14	JLPU 819-18	4.00(11.44)	14(21.95)	601.83
15	KPU 20-13	3.00(9.97)	21.5(27.60)	620.17
16	KPU 20-28	3.5(10.75)	15 (22.60)	581.67
17	KPU 405	1.5(6.63)	6.5 (12.99)	601.67
18	Ku 19-10	1.00(4.06)	7.5(15.44)	633.50
19	Ku 96-3	2.00(7.85)	7.00 (15.33)	741.67
20	KUG 479	2.5(9.04)	15.5(23.11)	680.00
21	KUG 878	5.5(13.54)	3.5 (10.52)	570.00
22	KUG 888	4.5(12.22)	8.5(16.88) h	641.50
23	KUG 921	2.00(8.12)	12.5(20.66)	534.83
24	LBG 752	2.5(9.04)	15 (22.67)	699.83
25	LBG 787	1.5(6.63)	19 (25.80)	741.67
26	LBG 922	2.5(8.63)	10.5(18.65)	628.17
27	LBG 941	3.5(10.75)	19.5(26.17)	540.00
28	NUL-7	2.00(7.85)	9.00(16.37)	593.17
29	PBU 18-1	1.5(6.93)	16(23.52)	603.17
30	PU 1706	3.00(9.83)	9.00 (16.37)	588.17
31	PU 10	8.5(16.93)	13(20.75)	604.83
32	PU 1804	2.5(9.04)	6.5(12.99)	648.50
33	PU 1814	3.00(9.83)	8.5 (16.88)	698.33
34	PU 31	2.00(7.85)	7.5(15.44)	730.17
35	PUSA B 43	2.5(9.04)	4 (11.44)	691.67
36	PUSA B 34	2.5(9.04)	6.5(12.99)	496.50
37	RUG 59	1.5(6.93)	6.5(12.99)	586.67
38	RVSTU 21-1	3.5(10.75)	12.5(20.38)	708.33
39	RVSU 21-2	3.5(10.75)	12(20.26)	754.83
40	Shekhar 3	1.5(6.93)	7.5(15.44)	571.67
41	SKAU-UB -3	5.00(12.91)	9.5 (17.02)	543.50
42	SKNU 1809	4.00(11.44)	12.5(20.60)	583.17
43	SVU 6	3.00(9.97)	10.5 (18.77)	678.33
44	TBG 141	4.5(12.22)	11 (19.36)	623.50
45	TBG-4	4.5(12.22)	13(20.89)	545.00
46	VBG 17-021	2.5(9.04)	13 (20.89)	603.50
47	Barkha (NC)	6.00(14.12)	7.95 (16.35)	565.00
CD at 5%		4.05	7.47	89.32
SE(m)		1.41	2.61	31.27

Figure in parenthesis () are angular transformed value

Conclusion

Germplasm screening trail showed significant difference between tested germplasm on different parameters *viz*, percent pod damage and grain yield. The germplasm DKU 116 and KUG 878 were found least affected by *Helicoverpa armigera* and *Maruca vitrata* respectively. The highest grain yield of urdbean was recorded in germplasm RVSU 21 -2.

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