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KNM 1638 - A High Yielding Gall Midge Resistant Early Duration PJTSAU Rice (*Oryza sativa* L.) Variety Suitable for Telangana State

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ABSTRACT

The promising high yielding rice genotype, KNM 1638 is a medium slender, early duration (120 –125 days) and photo insensitive culture with high yield potential (7356 kg ha^{-1}) having resistance to gall midge and leaf blast, and moderately resistant to neck blast with better adaptability. This rice culture KNM 1638, a derivative of the cross JGL 11727×JGL 17004 was released through State Varietal Release Committee on the name of Kunaram Vari 2 for Telangana state during the year 2021 as an alternate variety to BPT 5204. It has semi-dwarf plant type with moderate tillering, semi-erect flag leaf, all plant parts green, semi-compact well exerted semi-erect attitude of branching panicle, straw-colored awn less grains and its grain classified as a translucent medium slender grain. In the overall performance, KNM 1638 recorded mean productivity of 7356 kg ha^{-1} in the eight years of trials with 12.8% increase over the check varieties. It has good grain, cooking and eating quality, and good marketing facility as quality-wise it recorded 63% head rice recovery and 21.47% amylose content with soft gel consistency and moderate gelatinization temperature. The rice variety, KNM 1638 is suitable for cultivation during *kharif*, late *kharif* and *rabi* seasons throughout Telangana State with higher yield, better pest and disease resistance and good cooking quality in comparison to the check varieties.

KEYWORDS: Amylose, blast, gall midge, KNM 1638, early duration

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1. INTRODUCTION

More than half of the world's population use rice as an essential staple food (Rao et al., 2016; Nili et al., 2017; Poli et al., 2018; Suman et al., 2021) and Asian countries produce and consume 80% of the world's rice. Globally rice is cultivated in an area of 162.06 million ha, with 755.47 million t paddy production and 4.66 t ha^{-1} productivity (Anonymous, 2019). Among rice growing countries in the world, rice is cultivated about 44.1 million ha with a production of 165.3 million t in India (Kesh et al., 2021). In Telangana State, rice is the principal crop extensively cultivated during both *kharif* and *rabi* seasons. Rice is grown in an area of 2.01 million ha with a production of 7.43 million t and an average productivity of 3694 kg ha^{-1} in Telangana State (Indiastat, 2020). Like yield, rice grain quality has now become a primary consideration for producers and consumers to get the premium price in the market. Milled rice of rice variety, BPT 5204 fetches premium market price in Telangana and Andhra Pradesh of Southern India. However, BPT 5204 which is popularly cultivated in the Telangana state during the rainy season is susceptible to the gall midge biotype 3, and also requires more water to complete its crop growth period as it is a long duration (145–150 days) variety results in increasing the cost of cultivation. Important agronomic trait, earliness (120–125 days) is one of the objectives of the modern breeders, has an advantage of varieties to suit various cropping situations, especially where the water supply is a limited period of time (Bagchi et al., 2012; Hazell, 2010; Bueno and Lafarge, 2017). However, traditional rice varieties take about 160–200 days (De Datta, 1981) to mature and are highly susceptible to climatic events. Hasan (2014) also reported that growing short duration rice is one of the most important ways of mitigating methane emission, a greenhouse gas that contributes to climate change. Climate change is imminent and the world is already experiencing extreme weather events threatening world food production (Wassmann et al., 2009). Many adverse factors, such as diseases and pests, pose a serious threat to rice production. Among these threats, rice gall midge (*Orseolia oryzae*) is considered to be one of the most destructive pests after borers and planthoppers (Bentur et al., 2016) in the world. In India also, it is rated as the third most important pest of rice in terms of spread, severity of the damage, and yield loss (Bentur, 2015). It is most prevalent in the states of Andhra Pradesh, Telangana, Tamil Nadu, Kerala, Goa, Karnataka, Maharashtra, Madhya Pradesh, Bihar, Odisha, Assam, Manipur, and in certain niches of West Bengal, and Uttar Pradesh of India (Chelliah et al., 1989; Rajamani et al., 1998; Samui et al., 2004; Sinha et al., 2017). Gall midge biotype 3 is one of the important insect pests in the Northern Telangana Zone of Telangana State which results in considerable yield losses as affected tillers bear no panicles or grains. In contrast, the maggots fail to induce gall formation on the resistant varieties and perish in 2–4 days after hatching. Hence, breeding for gall midge resistant varieties has been an important strategy with more yield and acceptable grain quality (Henrichs and Pathak, 1981; Sreedhar, 2018). Keeping in view of the above gaps, breeding program was taken up with the objective of developing an early duration (120–125 days) high yielding gall midge resistant medium slender rice genotype without compromising quality.

2. MATERIALS AND METHODS

The present investigation was carried out at Agricultural Research Station (ARS), Kunaram from *kharif* season (June–November) 2012 to *kharif* season (June–November) 2021 with an aim to develop high yielding gall midge resistant early duration rice variety including good quality by pedigree method of breeding selecting two parents, JGL 11727 and JGL 17004. The female parent, JGL 11727 is noted for its good cooking quality with medium slender grains, high yielding potential, medium duration, as well as having gall midge (biotype-3) resistance developed at Rice Research Scheme, Regional Agricultural Research Station (RARS), Jagtial. JGL 17004 is a short-statured medium slender non-lodging variety with good quality and is selected for its extra earliness and multiple gall midge resistance developed at Rice Research Scheme, RARS, Jagtial used as male parent. Field screening by planting the test materials to coincide with high pest populations has been a successful technique. The gall midge resistance can be easily transferred to the desirable genotypes due to its simple inheritance. These two parents were crossed and raised the F_1 and crossed plants were confirmed, based on the characters at RARS, Jagtial from the year 2010 to 2011. The seeds of F_2 were collected by Agricultural Research Station (ARS), Kunaram and F_2 was evaluated with approximately 10,000 population during *kharif* season (June–November) 2012. The farm is geographically situated at 18.6°N Latitude, 79°E Longitude and an elevation of 231 m AMSL. The soil is silty loam with *p*H 7.43 and EC 0.26 dS m^{-1}. Pedigree method of breeding was followed in the F_3, F_4, and F_5 populations by selecting single plants for the characters, such as medium slender grain, semi-dwarf, long panicle, with a greater number of grains. Simultaneously, segregating material was left unprotected and allowed for gall midge incidence and the susceptible plants were removed leaving the resistant plant in the field and the selection was practiced only among the gall midge resistant plants. This process was continued up to F_6 till these lines attained uniformity in height, panicle length, grain type along gall midge resistance. The breeding line with Index No. KNM 1638 resulted from the bulk

harvest of F_6 family during *kharif* season 2014 and it was subsequently evaluated in the yield trials from *kharif* season 2014 to *kharif* season 2016 at Agricultural Research Station, Kunaram.

3. RESULTS AND DISCUSSION

During *kharif* and *rabi* seasons, KNM 1638 recorded a mean grain yield of 7133 kg ha^{-1} and 7660 kg ha^{-1} over commercial check, JGL 3844 in the station trials, respectively from *kharif* season (June–November) 2014 to *kharif* season (June–November) 2015 at Agricultural Research Station, Kunaram. During *kharif* season (June–November) 2016 in Multi-Location Trials, KNM 1638 showed a mean grain yield of 7618 kg ha^{-1} over the commercial check, RNR 15048 (6517 kg ha^{-1}) in six locations, Jagtial, Kampasagar, Kunaram, Rajendranagar, Rudrur and Warangal, and 16.9% yield increase was noticed. Minikit trials were conducted over 328 locations in Telangana State with KNM 1638 from *kharif* season 2018 to *rabi* season 2020–21 and recorded 6737 kg ha^{-1} yield, and 10.5% yield increase was manifested over the checks. In the overall performance, KNM 1638 recorded a mean productivity of 7356 kg ha^{-1} in eight years of all the trials with 12.8% increase over the check varieties (Table 1). During the *kharif* seasons (June–November) of 2019 and 2020, agronomy field experiments were conducted at Agricultural Research Station, Kunaram, to know the response of three rice cultures KNM 733, KNM 1638, and RNR 15048 with four different levels of nitrogen (75%, 100%, 125%, 150% N ha^{-1} of recommended dose) in transplanted rice. The pooled interaction effect of grain yield of pre-released rice cultures with different nitrogen levels was found to be significant. The highest grain yield of 7316 kg ha^{-1} was observed with rice culture KNM 1638 with the application of 150% N ha^{-1} recommended dose followed by 125% N ha^{-1} recommended dose with rice culture KNM 733 (7165 kg ha^{-1}) and 100% N ha^{-1} recommended dose with rice culture KNM 1638 (7074 kg ha^{-1}) (Table 2). Similar experiment was conducted at Agricultural Research Station, Kunaram during the *rabi* seasons of (November–April) 2018–19 and 2019–20. The pooled interaction effect of grain yield of pre-released rice cultures with different nitrogen levels was found to be also significant. Table 3 showed that

Table 1: Summary yield data of the rice variety, KNM 1638 in the station, MLT and minikit trials

Trial Name	Season/ No. of Locations	Yield of KNM 1638 (kg ha^{-1})	Check	Check yield (kg ha^{-1})
Station trials (2014-15)	*Kharif* season	7133	JGL 3844	6642
	Rabi season	7660	JGL 3844	6995
Multilocation Trial, 2016 (At Station level)	*Kharif* season	7631	RNR 15048	6355
Multilocation Trial, 2016 (Pooled)	*Kharif* season (6)	7618	RNR 15048	6517
Minikit trials (2018-21)	*Kharif* and *Rabi* seasons (328)	6737	RNR 15048/ BPT 5204	6098
Overall mean		7356		6521
Percentage yield increase		12.8%		

Table 2: Interaction effect of different nitrogen levels on grain yield (kg ha^{-1}) of rice variety, KNM 1638 during *kharif* season (Pooled data of 2019 and 2020)

	Factor II-Nitrogen levels				
	N_1-75%	N_2-100%	N_3-125%	N_4-150%	Grand
Factor I-Varieties	RDN	RDN	RDN	RDN	Mean
V_1-KNM 733	6263	6937	7165	6108	6618
V_2-KNM 1638	6849	7074	6469	7316	6927
V_3-RNR 15048	6170	6126	6660	6126	6271
Grand Mean	6427	6713	6765	6517	
Nitrogen levels×Varieties					
SEm±	89.55				
CD (p=0.05)	268.46				

the highest grain yield (8524 kg ha^{-1}) was observed with rice culture KNM 1638 with the application of 150% N ha^{-1} recommended dose followed by 150% N ha^{-1} recommended dose with rice culture KNM 733 (8495 kg ha^{-1}). Similarly, grain yield was significantly increased with increasing N levels in rice (Rajesh et al., 2015; Ramulu et al., 2020).

The proposed promising high yielding rice genotype, KNM 1638 is a medium slender and photo-insensitive culture with high yield potential (7356 kg ha^{-1}) having resistance to gall midge and leaf blast, and moderately resistant to neck blast with better adaptability and good cooking quality. It has been released through State Varietal Release Committee on the name of Kunaram Vari 2 for Telangana state during *kharif* season 2021 as an alternate variety to BPT 5204. It is a relatively short duration variety, with a total growth duration of about 120–125 days with non-shattering in nature. It is suitable for both *kharif* and *rabi* seasons. This is a semi-dwarf rice variety with moderate tillering, erect flag leaf, all plant parts green, semi-compact well exerted semi-erect attitude of branching panicle, and straw-colored awn less grains culture. It has around 336–380 ear bearing tillers m^{2-1} and the height is in the range of 100–105cm with a strong culm having an internodal thickness of 6–7 mm. The panicle length ranged from 23.7–27.6 cm with 248–312 grains per panicle. The panicle is compact in nature showing full exertion without any awns and sterility. The grains are with a 1000 grain weight of 14–15 g without any abdominal white in milled rice resembling BPT 5204 (Table 4). Its grain is classified as translucent medium slender grain with a Length and Breadth (L/B) ratio of 2.92. Quality wise, it recorded 70.6% milling and 63.0% head rice recovery which is in similar to the findings of Oko et al. (2012); Robin et

Table 3: Interaction effect of different nitrogen levels on grain yield (kg ha^{-1}) of rice variety, KNM 1638 during *rabi* season (Pooled data of 2018–19 and 2019–20)

Factor I-Varieties	Factor II-Nitrogen levels				
	N_1-75%	N_2-100%	N_3-125%	N_4-150%	Grand
	RDN	RDN	RDN	RDN	Mean
V_1-KNM 733	8152	7744	7813	8495	8051
V_2-KNM 1638	7626	7912	8151	8524	8053
V_3-RNR 15048	7358	8104	8469	8042	7993
Grand Mean	7712	7920	8145	8354	
Nitrogen levels×Varieties					
SEm±	216.87				
CD (p=0.05)	650.12`				

Table 4: Distinguishing morphological characters of rice variety, KNM 1638

Habit	: Semi-dwarf plant type with medium tillering green foliage
Coleoptile colour	: Colourless
Plant height	: 100–105 cm
Leaf: Intensity of green colour	: Dark Green
Basal leaf: Sheath colour	: Green
Leaf: Anthocyanin pigment	: Absent
Leaf Blade	: Broad, Dark green and non-pigmented
Flag leaf	: Semi erect and non-pigmented
Junction, Auricle, Ligule, Septum	: Anthocyanin pigment absent
Internode thickness	: 6–7 mm
Ear bearing tillers m^{2-1}	: 336–380
Awns	: Awn less
Panicle	: Semi-straight main axis, semi-compact and semi-erect attitude of branching
Exertion	: Well exerted

Table 4: Continue...

Panicle length	: 23.7–27.6 cm
Number of grains panicle^{-1}	: 248–312
Lemma, Palea	: Straw colour
Apiculus	: Straw colour
Husk colour	: Straw colour
Rice colour	: Translucent, white colour
Abdominal white	: Absent
Grain: L×B (mm)	: 7.35×1.87 (mm)
1000 grains weight (g)	: 14.0–15.0 g (Paddy), 12.5–14.0 g (Rice)
Brown rice: LxB (mm)	: 5.18×1.77 (mm)
Rice grade	: Superfine translucent medium slender grain
Maturity (Days to 50% flowering)	: 90–95 days (*Kharif* season), 100–105 days (*Rabi* season)
Days to maturity (Seed to seed)	: 120–125 days (*Kharif* season), 130–135 days (*Rabi* season)

al. (2019) who reported a significant positive association of head rice recovery with milling outturn. It has intermediate amylose content (21.47%), soft gel consistency with good cooking and eating quality. Upon cooking, the volume expansion ratio (VER) was found to be 4.2 (Table 5). It has been becoming popular and accepted by the farmers, millers, and consumers replacing BPT 5204 due to its high yield potential, early duration, gall midge and blast resistance, and non-shattering with good head rice recovery and good cooking and eating quality.

KNM 1638 has resistance to gall midge biotype 3 as it recorded nil damage against biotype 3 at Regional Agricultural Research Station, Jagtial during the *kharif* seasons (June–November) of 2015 and 2016 (Table 6). It also showed nil damage against biotype 1 across the locations in National Screening Nurseries (NSN) for the *kharif* seasons (June–November) of 2015 and 2016 (Table 7 and 8). Rice varieties Kangwenqingzhan and ARC 5984 are highly resistant to gall midge, and Kangwenqingzhan and ARC 5984 have been detected to carry the gall midge

Table 5: Quality characters of the rice variety, KNM 1638

Genotype	HR (%)	MR (%)	HRR (%)	KL (mm)	KB (mm)	L/B ratio	VER	WU (ml)	KLAC (mm)	KER	ASV	AC	GC	Grain chalk
KNM 1638	80.4	70.6	63.0	5.18	1.77	2.92	4.2	235	11.3	2.18	5	21.47	22	A
BPT 5204	80.8	70.1	61.0	4.98	1.85	2.69	5.2	245	10.2	2.04	4	23.40	24	VOC

HR (%): Hulling Recovery (%); MR (%): Milling Recovery (%); HRR (%): Head Rice Recovery (%); KL (mm)= Kernel Length (mm); KB (mm): Kernel Breadth (mm); L/B ratio: Length and Breadth ratio; VER: Volume Expansion Ratio; WU (ml): Water Uptake (ml); KLAC (mm): Kernel Length After Cooking (mm); KER: Kernel Elongation Ratio; ASV: Alkali Spreading Value; AC: Amylose Content; GC: Gel Consistency; A: Absent;VOC: Very Occasionally Present; (Source: AICRIP - Progress report, IIRR 2016) (Source: Annual Report 2016–17, Quality control lab, PJTSAU, Hyderabad)

Table 6: Reaction of rice variety, KNM 1638 in Gall midge Screening Trial during *kharif* season 2015 and *kharif* season 2016 at Regional Agricultural Research Station (RARS), Jagtial

Entry	*Kharif* season 2015		*Kharif* season 2016	
	Gall midge biotype 3–50 Days After transplanting		Gall midge biotype 3–50 Days After transplanting	
	% Damaged plants	% Silver shoots	% Damaged plants	% Silver shoots
KNM 1638	0.0	0.0	0.0	0.0
TN1 (SC)	73.0	16.0	56.0	9.0
Aganni (RC)	0.0	0.0	0.0	0.0

SC: Susceptible Check; RC: Resistant Check (Source: Annual Reports 2015–16 and 2016–17, RARS, Jagtial, PJTSAU)

Table 7: Reaction of rice variety; KNM 1638 (IET 26245) against various gall midge biotypes in gall midge national screening trial during *kharif* season 2015

Entry	GMB1		GMB2	GMB3	GMB4		GMB4M	GMB5	GMB?
	IIRR	CHP	CTC	JGT	RGL	SKL	WGL	PTB	JDP
	GH	50 DAT	45 DAT	50 DAT	50 DAT	50 DAT	50 DAT	50 DAT	50 DAT
	% DP	% DP	% SS	% DP	% DP	% DP	% DP	% DP	% DP
KNM 1638	0.0	0.0	81.8	0.0	0.0	0.0	80.0	4.8	0.0
TN1(SC)	100.0	40.0	100.0	90.0	50.0	100.0	84.2	76.2	60.0
Aganni (RC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.5	0.0

SC: Susceptible Check; RC: Resistant Check; GMB: Gall midge Biotype; IIRR: Indian Institute of Rice Research; CHP: Chiplima; CTC: Cuttack; JGT: Jagtial; RGL: Ragole; SKL: Sakoli; WGL: Warangal; PTB: Pattambi; JDP: Jagdalpur; GH: Greenhouse reaction; DAT: Days After Transplanting; % DP: % Damaged plants; % SS: % Silver shoots (Source: AICRIP - National Screening nurseries IIRR 2015)

Table 8: Reaction of rice variety, KNM 1638 (IET 26245) against various gall midge biotypes in gall midge national screening trial during *kharif* season 2016

Entry	GMB1		GMB
	IIRR	CHP	JDP
	GH	50 DAT	50DAT
		% DP	
KNM 1638	0.0	0.0	0.0
TN1(SC)	100.0	90.0	70.0
Aganni (RC)	0.0	10.0	60.0

SC: Susceptible Check; RC: Resistant Check; GMB: Gall midge Biotype; IIRR: Indian Institute of Rice Research; CHP: Chiplima; JDP: Jagdalpur, GH: Greenhouse reaction; DAT: Days After Transplanting; % DP: % Damaged plants (Source: AICRIP - National Screening nurseries IIRR 2016)

resistance genes Gm6 and Gm5, respectively (Li et al., 2020; Zhou et al., 2020). Vijaya Lakshmi et al. (2006) also reported that genes, Gm3, Gm4 and Gm8 confer resistance against 4M gall midge biotype. KNM 1638 was also screened in multiple resistant screening trials against blast at the university level during the *kharif* seasons (June–November) of 2016, 2017 and 2018, wherein it was found to be resistant to leaf blast, moderately resistant to neck blast (Table 9 and 10). Under AICRIP, culture KNM 1638 was screened in NSN against all the epidemic diseases viz., blast, bacterial blight, sheath rot, sheath blight, brown spot and rice tungro disease under artificially inoculated conditions during *kharif* seasons (June–November) of 2015 and 2016, and found to be moderately resistant to Blast (Table 11 and 12). PJTSAU Rice KNM 1638 with higher yield, pest and disease resistance with superior cooking quality in comparison to the check, BPT 5204 was released during 2021. This variety can be cultivated as a transplanted crop during *kharif*, late *kharif*, and *rabi* seasons wherever early maturing rice varieties are cultivated throughout Telangana State.

Table 9: Screening of rice variety, KNM 1638 against leaf blast/neck blast and sheath rot during *kharif* season 2016 and *rabi* season 2016–17 at Rice Research Centre, Agricultural Research Institute, Rajendranagar, Hyderabad, PJTSAU

Entry	Disease score based on 0–9 scale / Reaction		
	Kharif season 2016 and r*abi season* 2016–17		
	Leaf blast*	Neck blast	Sheath rot
KNM 1638	3 (Resistant)	5 (Moderately Resistant)	7 (Susceptible)
Susceptible check			
TN 1	9 (Susceptible)	9 (Susceptible)	9 (Susceptible)
BPT 5204	7 (Susceptible)	9 (Susceptible)	9 (Susceptible)

Table 9: Continue...

Entry	Disease Score based on 0–9 scale / Reaction		
	Kharif season 2016 and *rabi season* 2016–17		
	Leaf blast*	Neck blast	Sheath rot
Resistant check			
NLR 34449	1 (Resistant)	1 (Resistant)	5 (Moderately Resistant)
RNR 15048	0 (Resistant)	1 (Resistant)	5 (Moderately Resistant)

* Leaf blast screening done during *rabi* 2016–17 (Source: Annual report 2016–17, Rice Research Centre, ARI, Rajendranagar, PJTSAU)

Table 10: Screening of rice variety, KNM 1638 for resistance to key diseases under field conditions during *kharif* season 2017, and Uniform Blast Nursery (UBN) during *rabi* season 2017–18 at Regional Agricultural Research Station, Jagtial

Entry	Disease Score based on 0–9 scale / Reaction			
	Kharif season 2017 (Field condition)			*Rabi* season 2017–18 (UBN)
	Sheath blight	Brown spot	Neck blast	Leaf Blast
KNM 1638	7 (Susceptible)	7 (Susceptible)	5 (Moderately resistant)	3(Resistant)
Resistant check				
RNR 15048	-	5(Moderately resistant)	0(Resistant)	3(Resistant)
NLR 34449	5 (Moderately resistant)	3(Resistant)	0(Resistant)	6(Susceptible)
Susceptible check				
TN 1	8 (Susceptible)	8(Susceptible)	9(Susceptible)	8(Susceptible)

(Source: Annual report 2017–18, RARS, Jagtial, PJTSAU)

Table 11: Reaction against major diseases of rice variety, KNM 1638 (IET 26245) in National screening nurseries during *kharif* season 2015

Disease	Check varieties							
	No. of locations	Variety KNM 1638	IR 64 RC (Blast)	HR 12 SC (Blast)	RP bio 226 RC (BLB)	TN1 SC (BLB; RTD)	Vikramarya RC (RTD)	Tetep RC (Blast)
Leaf blast	23.0	4.3	3.6	6.5	5.7	5.6	5.5	3.3
Neck blast	8.0	4.3	4.6	5.4	4.6	5.4	4.6	2.1
BLB	20.0	5.8	5.9	6.1	4.4	7.4	6.4	5.5
Brown spot	15.0	3.7	4.5	4.7	4.2	5.1	5.5	4.4
Sheath blight	21.0	6.4	6.3	5.6	6.0	7.0	6.3	5.2
Sheath rot	9.0	4.9	6.0	6.4	6.8	5.0	6.1	4.9
RTD	5.0	3.4	4.2	4.4	4.4	4.6	3.8	4.0

BLB: Bacterial leaf blight;RTD: Rice tungro disease; RC: Resistant check; SC: Susceptible check (Source: National Screening Nurseries 2015)

Table 12: Reaction against major diseases of rice variety, KNM 1638 (IET 26245) in National screening nurseries during *kharif* season 2016

Disease	Check varieties							
	No. of locations	Variety KNM 1638	IR 64 RC (Blast)	HR 12 SC (Blast)	RP bio 226 RC (BLB)	TN1 SC (BLB, RTD)	Vikramarya RC (RTD)	Tetep RC (Blast)
Leaf blast	14.0	5.1	4.4	8.1	6.9	7.1	6.7	3.4

Table 12: Continue...

Disease	Check varieties							
	No. of locations	Variety KNM 1638	IR 64 RC (Blast)	HR 12 SC (Blast)	RP bio 226 RC (BLB)	TN1 SC (BLB, RTD)	Vikramarya RC (RTD)	Tetep RC (Blast)
Neck blast	4.0	6.3	6.3	6.3	6.0	9.0	6.3	2.3
BLB	14.0	7.4	6.3	7.4	4.6	8.0	6.6	6.3
Brown spot	10.0	5.9	5.4	6.2	5.8	6.7	5.9	5.1
Sheath blight	12.0	7.8	7.0	6.7	7.0	7.5	6.7	5.7
Sheath rot	5.0	6.6	5.4	7.0	7.4	7.0	6.6	4.1
RTD	1.0	5.0	7.0	5.0	5.0	7.0	3.0	6.0

BLB: Bacterial leaf blight; RTD: Rice tungro disease, RC: Resistant check; SC: Susceptible check (Source: National Screening Nurseries, 2016)

4. CONCLUSION

Rice variety, KNM 1638 has been widely accepted by the farmers, millers, and consumers due to its high yield potential, earliness (120–125 days), gall midge and blast resistance, and non-shattering with good head rice recovery and good cooking and eating quality.

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