

# Effect of *Suidasia nesbitti* Hughes (Acari: Suidasiidae) Infestation on Seed Germination in Bengal Gram Grains

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**Abstract** *Suidasia nesbitti* Hughes (Acari: Suidasiidae) is a pest of stored grains and products which is responsible for causing quantitative, qualitative damage to grains and allergic reactions in human beings. As the mite feeds on the germinal portion of the grain, the qualitative damages are higher than quantitative losses. The main objective of the present study was to evaluate the effect of the *S. nesbitti* infestation on seed germination in Bengal gram, the third most important pulse crop worldwide. For this purpose, under *in vitro* conditions, twenty mites of *S. nesbitti* were released in per g of *Desi* and *Kabuli* channa grains and were allowed to feed for 30, 60, 90, 120, 150 and 180 days. At each duration, grains were drawn from each replicate and subjected to germination tests. When observation periods were compared, significantly higher radicle and plumule length was found at 0 day which declined at 30, 60 and 90 days, respectively. In the present study, no seeds germinated after 120, 150 and 180 days of infestation. Germinated seeds of *Desi* channa at 0 day were statistically higher (84.61%) as compared to 72.72, 62.50 and 25 percent germinated seeds at 30, 60 and 90 days of infestation, respectively. Maximum per cent germination in *Kabuli* channa (90.90%) was recorded at 0 day which significantly decreased to 87.50, 75 and 37.50 percent at 30, 60 and 90 days. The varietal susceptibility was also evaluated in terms of changes in plumule and radicle length, seed germination of seeds due to *S. nesbitti* infestation. It was observed that plumule, radicle length and germination were significantly lower in *Desi* channa (6.45, 7.67 cm) than in *Kabuli* channa (8.10, 8.64 cm). The studies reflect

the damage potential of *S. nesbitti* infestation in Bengal gram.

**Keywords** *Desi* Channa, Germination, *Kabuli* Channa, Plumule, Radicle, *Suidasia nesbitti*

## 1. Introduction

In stored grains, pests are divided into two groups based on their grain-injury patterns: Primary or main pests (large arthropods species) which totally devour the seed and secondary pests (mites) that make cavities in the germ and cause injury primarily to the seed germ. Many farmers are uninformed of the damage and losses caused by the stored mites mainly due to their tiny size [1]. Mites' feeding on germinal portion causes qualitative and quantitative losses in stored grains. Secondly, the flour prepared by contaminated grains is bitter in taste, more acidic and show pungent smell.

There are reports which showed that *S. nesbitti* infestation reduced the wheat germination by 46.30 percent [2], pulses germination by 69.8 percent [3] and pearl millet germination by 73.13 percent [4]. Stejskal *et al.* [5] estimated 5 per cent decrease in seed germination after three months of infestation under laboratory conditions. However, in Bengal gram such studies are lacking although it is the third most important pulse crop with a worldwide production of 14,792.5 thousand tonnes annually, out of

which India produced 9075 thousand tonnes [6]. Hence, the present study was planned to evaluate the effect of *Suidasia nesbitti* Hughes (Acari: Suidasiidae) infestation on seed germination in two varieties of Bengal gram grains.

## 2. Materials and Methods

Whole grains of *Desi* and *Kabuli* channa were kept separately in six sub sets of 30, 60, 90, 120, 150 and 180 days under triplicate conditions. In each replicate, twenty mites of *S. nesbitti* were released in per g of *Desi* and *Kabuli* channa grains in petri dishes. Whole grains of 0 day acted as control. After 30 days, one sub set was taken out and mites were extracted through Berlese Funnel method. Similar procedure was followed for 60, 90, 120, 150 and 180 days. Grains were drawn from replicates of each sub set and kept for germination test through standard procedures. Germination of the infested *Desi* and *Kabuli* channa grains was compared with the control (0 day, uninfested grains).

For germination trial, separate wet germination sheets were used for each sub set. Whole grains of infested and uninfested Bengal gram were placed sufficiently far apart on the sheet to minimize the effect of adjacent seeds on seedling development. The seeds were covered with another germination sheet, the sheets were carefully folded and prepared for seed germination between two layers of germination paper. The rolled germination sheets were placed side by side and tied together. These were then kept inside the seed germinator in an upright position at optimum humidity and temperature. After four days, sheets were examined for first count and final count was made after eight days. Number of seeds germinated and not germinated was counted sub set wise. Germination percentage was expressed as:

$$\text{Germination percentage} = \frac{\text{Total number of seeds} - \text{number of seeds germinated}}{\text{Total number of seeds}} \times 100$$

The radicle and plumule length of germinated seeds of each replicate was measured with the help of a ruler and expressed in centimeter. Total seedling length was computed by addition of radicle and plumule length of each seed and expressed in cm. Vigour Index was calculated by multiplying the germination percentage with seedling length. The changes in plumule and radicle length, seed germination of seeds due to *S. nesbitti* infestation were analysed by ANOVA.

## 3. Results and Discussion

Data on the effect of *S. nesbitti* population on the plumule length are presented in Table 1. The results showed statistically higher length of plumule (16.58 cm) at 0 day which significantly decreased to 14.41, 11.80 and 8.19 cm at 30, 60 and 90 days, respectively due to increase in *S. nesbitti* population in grains (CD= 0.22; p=0.05). Significantly lower plumule length (0 cm) was recorded at 120, 150 and 180 days. Amongst the varieties, plumule length was significantly lower (6.45 cm) in *Desi* channa as compared to *Kabuli* channa (8.10 cm) (CD= 0.12; p=0.05). The interaction between observation period and Bengal gram varieties was found to be non-significant (CD= NS; p= 0.05), indicating non-significant difference in plumule length of *Desi* channa and *Kabuli* channa due to mite feeding at different observation periods. Plumule length declined to 13.15, 10.58, 7.07 cm in *Desi* channa and 15.67, 13.01, 9.31 cm in *Kabuli* channa after 30, 60, 90 days.

**Table 1.** Effect of *Suidasia nesbitti* on Plumule length of Bengal gram grains

Observation period (days)	Plumule length (cm)		Mean
	<i>Desi</i> channa	<i>Kabuli</i> channa	
0	14.40 (3.90)	18.76 (4.42)	16.58 (4.16)
30	13.15 (3.73)	15.67 (4.06)	14.41 (3.90)
60	10.58 (3.37)	13.01 (3.72)	11.80 (3.55)
90	7.07 (2.80)	9.31 (3.19)	8.19 (2.99)
120	0.00 (1.00)	0.00 (1.00)	0.00 (1.00) <sup>a</sup>
150	0.00 (1.00)	0.00 (1.00)	0.00 (1.00) <sup>a</sup>
180	0.00 (1.00)	0.00 (1.00)	0.00(1.00) <sup>a</sup>
Mean	6.45 (2.40)	8.10 (2.63)	

Figures in parentheses are  $\sqrt{n+1}$  transformations

CD (p=0.05) for Observation period =(0.22); SE(m) = (0.08)

CD (p=0.05) for Bengal gram varieties =(0.12); SE(m) =(0.04)

CD (p=0.05) for Observation period× Bengal gram varieties =NS; SE(m) = (0.11)

Values denoted by similar letter do not differ significantly with each other

Data pertaining to changes in radicle length of Bengal gram grains as a result of *S. nesbitti* feeding at different observation periods are presented in Table 2. Radicle length was significantly lower in *Desi* channa (7.67 cm) than in *Kabuli* channa (8.64 cm) (CD= 0.109; p= 0.05). When observation periods were compared, significantly higher radicle length (18.27 cm) was found at 0 day which differed significantly with radicle length of Bengal gram grains at other observation periods (CD= 0.204; p= 0.05). Irrespective of varieties, the radicle length of grains declined to 16.18, 13.20, 9.46, 0.00, 0.00 and 0.00 cm at 30, 60, 90, 120, 150 and 180 days. No significant difference in the radicle length of Bengal gram grains was recorded at 120, 150 and 180 days, a trend similar to as observed with plumule length. The interaction between observation period and Bengal gram varieties with respect to radicle length was non-significant (CD= NS; p= 0.05). Radicle

length decreased from 17.22 cm at 0 day to 15.38, 12.46, 8.66, 0.00, 0.00, 0.00 in *Desi* Channa in 30, 60, 90, 120, 150 and 180 days infested Bengal gram grains. In *Kabuli* channa, radicle length decreased from 19.32 cm at 0 days to 16.97, 13.95, 10.27, 0.00, 0.00 and 0.00 cm after 30, 60, 90, 120, 150 and 180 days. After 24 weeks of *S. nesbitti* infestation, weak and under developed or stunted plumule and radicle were also recorded by Singh [7] in infested seeds of pearl millet and chickpea. Arvind [8] also obtained significantly lower shoot and root length (2.1 and 3.2 cm) in *T. putrescentiae* infested wheat grains after 180 days as compared to 5.4 and 4.4 cm in uninfested grains. The present findings are also in agreement with those of Kumar [9], Seema [4] and Dalal [10] who recorded significantly lower root and shoot length in *S. nesbitti* infested pearl millet grains and *S. nesbitti* infested cowpea grains.

**Table 2.** Effect of *Suidasia nesbitti* on radicle length of Bengal gram grains

Observation period (days)	Radicle length (cm)		Mean
	<i>Desi</i> channa	<i>Kabuli</i> channa	
0	17.22 (4.25)	19.32 (4.50)	18.27 (4.37)
30	15.38 (4.03)	16.97 (4.22)	16.18 (4.13)
60	12.46 (3.64)	13.95 (3.85)	13.20 (3.75)
90	8.66 (3.07)	10.27 (3.33)	9.46 (3.20)
120	0.00 (1.00)	0.00 (1.00)	0.00 (1.00) <sup>a</sup>
150	0.00 (1.00)	0.00 (1.00)	0.00 (1.00) <sup>a</sup>
180	0.00 (1.00)	0.00 (1.00)	0.00 (1.00) <sup>a</sup>
Mean	7.67 (2.57)	8.64 (2.70)	

Figures in parentheses are  $\sqrt{n+1}$  transformations

CD (p=0.05) for Observation period =(0.204); SE(m) = (0.073)

CD (p=0.05) for Bengal gram varieties =(0.109); SE(m) =(0.039)

CD (p=0.05) for Observation period× Bengal gram varieties =NS; SE(m) = (0.103)

Values denoted by similar letter do not differ significantly with each other

**Table 3.** Effect of *Suidasia nesbitti* on seed germination of Bengal gram grains

Observation Period (Days)	<i>Desi</i> channa			<i>Kabuli</i> channa		
	Total seedling length (cm)	Seed germination (%)	Vigour Index*	Total seedling length (cm)	Seed germination (%)	Vigour Index*
0	31.62 (5.69)	84.61	2675.37	38.08 (6.24)	90.90	3461.47
30	28.53 (5.41)	72.72	2074.70	32.64 (5.76)	87.50	2856.00
60	23.04 (4.91)	62.50	1440.00	26.96 (5.22)	75.00	2022.00
90	15.73 (4.06)	25.00	393.25	19.58 (4.49)	37.50	734.25
120	0.00 (1.00) <sup>a</sup>	0.00 <sup>a</sup>	0.00	0.00 (1.00) <sup>a</sup>	0.00 <sup>a</sup>	0.00
150	0.00 (1.00) <sup>a</sup>	0.00 <sup>a</sup>	0.00	0.00 (1.00) <sup>a</sup>	0.00 <sup>a</sup>	0.00
180	0.00 (1.00) <sup>a</sup>	0.00 <sup>a</sup>	0.00	0.00 (1.00) <sup>a</sup>	0.00 <sup>a</sup>	0.00
C.D. (p=0.05)	3.07 (0.29)	3.34		3.10 (0.36)	3.78	
SE(m)	1.00 (0.09)	1.09		1.01 (0.09)	1.23	

\* Vigour Index = Germination (%) × Seedling length (cm)

Figures in parentheses are  $\sqrt{n+1}$  transformations

Column wise, values denoted by similar letter do not differ significantly with each other

Data on the effect of observation period on seedling length of infested Bengal gram grains (Table 3) exhibited that the average seedling length was significantly higher in non-infested grains of *Desi* channa (31.62 cm) followed by 28.53, 23.04 and 15.73 cm in 30, 60 and 90 days of infested grains, respectively (CD = 3.07;  $p=0.05$ ). Observation periods of 120, 150 and 180 days were statistically comparable with each other as no seed germinated in these durations. Similar trend was recorded in *Kabuli* channa also; 38.08, 32.64, 26.96, 19.58 cm average seedling length was recorded at 0, 30, 60 and 90 days of infested grains, respectively, (CD = 3.10;  $p=0.05$ ) which differed significantly with each other.

The preference of stored mites to feed on grain germ due to high protein content and soft part of the grain, caused germination losses in grains. As early as Soloman [11] concluded that mites first feed on germ, defeat its contents and can consume up to 3 percent of grains weight. Later on, studies conducted by other researchers [12, 7, 13, 14, 8] also reported 20-100 percent loss in germination depending upon population levels in various stored grains. These trends are in line with present observations which showed significant and progressive germination loss in Bengal gram varieties due to *S. nesbitti* infestation. The perusal of data in Table 3 revealed that germinated seeds of *Desi* channa at 0 day were statistically higher (84.61%) as compared to 72.72, 62.50 and 25 percent germinated seeds at 30, 60 and 90 days of infestation, respectively. These

were statistically significant with each other (CD = 3.34;  $p=0.05$ ). Significantly lesser number of germinated seeds (0 %) was recorded in 120, 150 and 180 days of infested grains. Significant effect of observation period was also seen in case of per cent germination in *Kabuli* channa grains. Maximum per cent germination (90.90%) was recorded at 0 day which significantly decreased to 87.50, 75 and 37.50 percent at 30, 60 and 90 days (CD = 3.78;  $p=0.05$ ). The germination percentage was nil at 120, 150 and 180 days. This difference in germination was also shown with the help of photographs, in which higher germination is visible at 0 day grains (Plate I) followed by poor germination after 30 (Plate II) and 90 (Plate III) days of infested grains. No germination was observed in highly infested seeds at 180 days (Plate IV). Seema [4] also recorded decrease in pearl millet seed germination to 73.13, 51.47, 34.78 and 7.14 percent at 30, 60, 90 and 120 days due to *S. nesbitti* infestation from 90 percent at 0 day. Dalal [10] observed that in cowpea, germination at 0 days was 92.59 percent which decreased to 85.19, 74.07, 66.67, 51.85, 40.74 and 29.63 percent at 30, 60, 90, 120, 150 and 180 days as the number of mites increased significantly.

Vigour Index calculated from per cent germination in seeds and seedling length showed highest Vigour Index (2675.37, 3461.47) at 0 day in *Desi* and *Kabuli* channa grains (Table 3). It reduced to 2074.70, 1440, 393.25 in *Desi* channa and 2856, 2022, 734.25 in *Kabuli* channa grains after 30, 60 and 90 days of *S. nesbitti* infestation.



Plate I: Chickpea grain germination at 0 day



Plate II: Chickpea grain germination at 30 day



Plate III: Chickpea grain germination at 90 day



Plate IV: Chickpea grain germination at 180 day

## 4. Conclusion

During the present investigation, *Suidasia nesbitti* Hughes (Acari: Suidasiidae) feeding on *Desi* and *Kabuli* channa grains significantly reduced the plumule, radicle length, Vigour Index and seed germination in both the varieties of Bengal gram. No seeds were germinated after 120, 150 and 180 days of its infestation due to high population in the grains.

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