QUALITY OF VEGETABLE SEEDS COLLECTED FROM MYMENSINGH REGION IN BANGLADESH

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Abstract

Seed quality and health status of 11 vegetable crop seeds of viz. Cabbage (Brassica oleracea var. capitata), Indian cabbage (Brassica oleracea var. indica), Indian spinach (Basella alba), Spinach (Beta vulgaris var. bengalensis), Red amaranth (Amaranthus tricolor), Bitter gourd (Momordica charantia), Bottle gourd (Lagenaria siceraria), Sweet gourd (Cucurbita moschata), Carrot (Daucus carota var. sativa), Radish (Raphanus sativus), and Turnip (Brassica rapa) collected from the greater Mymensingh region of Bangladesh were tested. The germination percentage of seeds of the collected samples ranged from 11 to 100. The highest germination was recorded in Indian cabbage (100%) followed by carrot (92%) and radish (90%), while the lowest was recorded in Indian spinach seeds (11%). Altogether 10 fungi were found associated with the seeds which were Alternaria spp., Aspergillus flavus, Aspergillus niger, Botrytis cinerea, Chaetomium funicola, Curvularia spp., Fusarium spp., Penicillium spp., Phoma spp. and Rhizopus spp.. The highest total seed-borne fungal infection was found in bottle gourd (155%) followed by sweet gourd (145%). The lowest infection was found in turnip seeds (6%). The maximum number of dead seeds was found in Indian spinach (89%) and no dead seed was found in Indian cabbage. Among the vegetables seed samples, seedling vigour ranged from 59 to 3083, where the highest seedling vigour was observed in sweet gourd (3083) and the lowest was in Indian spinach (59).

Keywords: Vegetable seed; Health; Germination; Vigour

Introduction

Vegetables constitute a potential and important group of crops in Bangladesh. They are important for their low production cost, short duration of production and high nutritive value. Seed is the vital input in agriculture. Among the agricultural inputs, seed is the most important input for crop production. Quality and healthy seed is the crying need of the day. Healthy or pathogen free seeds of good quality are considering as the vital factor for desired plant population and good harvest. Health of seeds can be affected by direct infection of pathogens or through contamination of seeds by pathogenic propagules as contamination in, on or with the seeds or as concomitant contamination (Rashid and fakir, 2000). Infection of seed by pathogenic organisms and presence of propagules of pathogen in a seed lot is vitally important because of germination failure and subsequent infection to seedlings and growing plants. That’s why good and healthy seed is considered as important factor for successful crop production. Seeds of vegetables are more vulnerable to attack by pathogens and quickly deteriorate in storage. Their inherent quality can not be assessed easily just from their external appearances. For good crop, good seed is essential which indicate that the seed should be pure, viable and healthy. Use of good seeds can contribute to increase vegetable yield as high as 30% remaining all other factors of production as content (Khanom, 2011). Seeds of different vegetables of Mymensingh region of Bangladesh had not been thoroughly studied earlier. As a result quality of vegetable seed under this region is not known to farmers, researchers as well as seed producing farms. Considering the above facts, the present research was undertaken to assess the health and quality of vegetable seeds collected from the Mymensingh region.

Materials and Methods

Seeds of different vegetables under Mymensingh region were collected from Bismillah beezer vander, Krishan Agro service, New Mousumi beezer vander, Sharika seed store, Al-Madinabeen vander, Al-Amin beezer vander, Yasin beezer vander, Mousumi beezer bitan, Arian seed company, Krish beezer vander, Angkur beezer bitan and Isamia beezer vander. All experiments were conducted at Seed Pathology Centre, Bangladesh Agricultural University, Mymensingh during the period from 2010 to 2011. Seeds of three different...
categories of vegetables were studied for their health and quality. The categories of vegetables were i) Leafy vegetables viz. Cabbage, Indian cabbage, Indian spinach, Spinach and Red amaranth, ii) Cucurbits viz. Bitter gourd, Bottle gourd and Sweet gourd and iii) Root vegetables viz. Carrot, Radish and Turnip. A working sample of 400 seeds was used for Blotter test for detection of seed-borne fungi following the International Rules for Seed Testing (ISTA, 2001). Growing on test was conducted with 200 seeds for germination, normal seedlings, abnormal seedlings, diseased seedlings and dead seeds that were recorded thrice at 7, 14, 21 days after sowing. For determination of seedlings vigour of vegetables, 10 seedlings per replication were selected randomly and their individual shoot and root length were measured. The vigour of the seedlings was determined by the following formula of Baki and Anderson (1972).

The experiments were conducted in Randomized Complete Block Design (RCRBD) with four replications and data were analyzed by using statistical package program MSTAT-C. The level of significance and analysis of variance along with the Least Significant Difference (LSD) were done following Gomez and Gomez (1984).

**Results and Discussion**

The prevalence of different vegetables seed (11 vegetable crops) collected from different seed shops of Mymensingh region were recorded and presented in table 1. Vegetable seeds yielded nine genera viz. Alternaria spp., Aspergillus spp., Botrytis cinerea, Chaetomium funicola, Curvularia spp., Fusarium spp., Penicillium spp., Phoma spp. and Rhizopus spp. Among these fungi, eight were detected from leafy vegetable seeds (Table 1), fungi in order of prevalence were Fusarium spp. (16.1%), Phoma spp. (6.3%), Aspergillus flavus (5%), Alternaria spp. (2.9%), Aspergillus niger (2.9%), Penicillium spp. (1.6%), Rhizopus spp. (1.5%) and Curvularia spp. (0.7%). In case of Alternaria spp., maximum prevalence (6%) was recorded in seeds of cabbage, but spinach seeds were free from Alternaria spp. Maximum prevalence of Aspergillus flavus was recorded in Indian cabbage (7%), while spinach seeds had no Aspergillus flavus incidence. The prevalence of Aspergillus niger was highest in Indian cabbage (6.5%), but not in Red amaranth. The fungi Curvularia spp. and Phoma spp. were recorded only in Indian spinach (3.5%) and spinach (31.5%), respectively. In case of Fusarium spp., maximum prevalence was recorded in seeds of Indian spinach (50.5%) and minimum in Red amaranth (2%). The highest prevalence of Penicillium spp. was recorded in Red amaranth (5%) but not found in spinach and Indian cabbage. In case of Rhizopus spp., maximum incidence was recorded in Indian spinach (4.5%), but Indian cabbage and Red amaranth seeds were free from Rhizopus spp.. The highest total seed-borne fungal infection was observed in Indian spinach (68.5%) followed by spinach (54%). In this case most predominant fungus was Fusarium spp. (16.1%) followed by Phoma spp. (6.3%), Aspergillus flavus (3%), Alternaria spp. (2.9%), Aspergillus niger (2.9%), Penicillium spp. (1.6%), Rhizopus spp. (1.5%) and Curvularia spp. (0.7%). Of all these fungi recorded in seeds of leafy vegetables, Aspergillus flavus, C. spinacea and Penicillium spp. were reported in Bangladesh by Islam (2005). Good number of seed borne fungi of leafy vegetables has also been reported by Richardson (1990). Four different fungi viz. Alternaria spp., Aspergillus spp., Fusarium spp. and Penicillium spp. were found in seeds of Red amaranth. Among these fungi, A. niger, Colletotrichum capsici, Fusarium spp., Penicillium spp. and Rhizopus stolonifer were reported in seeds of the crops by Islam (2005). Richardson (1990) reported only one fungal species Alternaria amaranthi in the seeds of Amaranthus spp.

Fungi detected in seeds of Cucurbits collected from different seed shops of Mymensingh region are also presented in Table 1. Prevalence of total seed-borne fungal infections varied significantly depending on the seed of different vegetables. In case of Aspergillus flavus and Aspergillus niger, maximum prevalence was recorded in bottle gourd (31% and 27%) and minimum in sweet gourd (25% and 19%). The highest incidence of Botrytis cinerea was recorded in bottle gourd (12.5%), but seeds of bitter gourd were free from Botrytis cinerea. Maximum incidence of Chaetomium funicola was recorded in bitter gourd (6.5%) but seeds of sweet gourd were free from Chaetomium funicola. The highest prevalence of Fusarium spp was recorded in sweet gourd (58.5%) and lowest in bitter gourd (18.5%). The highest incidence of Penicillium spp. was found in bitter gourd (28%) and lowest in sweet gourd (2%). Maximum Rhizopus sp. was recorded in sweet gourd (32%) and lowest in bitter gourd (16%). The highest total seed-borne fungal infection was observed in bottle gourd seed (155%) followed by sweet gourd (145.5%), while the lowest seed borne infection was recorded in seeds obtained from bitter gourd (123.5%). The most predominant fungi were Fusarium sp. (38.7%), followed by Aspergillus flavus (28.5%), Rhizopus sp. (25.2%), Aspergillus niger (23.7%), Penicillium spp. (14.7%), Botrytis cinerea (7%) and Chaetomium funicola (3.7%). Peregrine et al. (1984) and Peregrine and Ahmed (1983) reported that the fungi Aspergillus spp., Rhizopus spp., Cladosporium spp., Helminthosporium spp., Alternaria spp., Fusarium spp., Curvularia spp., Penicillium spp., Botrytis spp., Verticillium spp., Cylindrocladium spp., Colletotrichum spp., Corynespora spp. and Ascochyta spp. were associated with seeds of cucurbits. On the other hand, Sultana (2009) reported Aspergillus spp., Curvularia spp., Colletotrichum spp., Fusarium spp., Penicillium spp. and Botrytis spp. as seed-borne fungi of vegetables.
Table 1: Prevalence of seed-borne fungi of different vegetable seeds (Blotter method)

| Seed categories | Vegetables | Alternaria spp. | Aspergillus flavus | Aspergillus niger | Botrytis cinerea | Chaetomium funicola | Curvularia spp. | Fusarium spp. | Phoma spp. | Penicillium spp. | Rhizopus spp. | % seed borne infection | Total seed borne fungal infections (%) |
|----------------|------------|----------------|-------------------|----------------|----------------|-------------------|----------------|--------------|------------|----------------|---------------|----------------|----------------------------------|
| Leafy vegetables | Cabbage    | 6.0            | 2.0               | 2.5            | -              | -                 | 0.0            | 4.0          | 0.0        | 1.5            | 1.5           | 17.5           |                                  |
|                 | Indian cabbage | 3.0          | 7.0               | 6.5            | -              | -                 | 0.0            | 7.5          | 0.0        | 0.0            | 0.0           | 24             |                                  |
|                 | Indian spinach | 3.0            | 4.5              | 1.0            | -              | -                 | 3.5            | 50.5         | 0.0        | 1.5            | 4.5           | 68.5           |                                  |
|                 | Spinach    | 0.0            | 0.0               | 4.5            | -              | -                 | 0.0            | 16.5         | 31.5       | 0.0            | 1.5           | 54             |                                  |
|                 | Red amaranth | 2.5            | 1.5               | 0.0            | -              | -                 | 0.0            | 2.0          | 0.0        | 5.0            | 0.0           | 11             |                                  |
| Total average   |             | 2.9            | 3.0               | 2.9            | -              | -                 | 0.7            | 16.1         | 6.3        | 1.6            | 1.5           | 35             |                                  |
| Lsd (P ≥0.05)   |             | 1.03           | 0.68              | 4.87           | -              | -                 | 2.27           | 1.91         | 1.01       | 3.87           | 4.23          |                 |                                  |
| Cucurbit vegetables | Bottle gourd | -            | 31.0              | 27.0           | 12.5           | 4.5               | -              | 39.0         | -          | 14.0           | 27.0          | 155.0          |                                  |
|                 | Bitter gourd | -            | 29.5              | 25.0           | 0.0            | 6.5               | -              | 18.5         | -          | 28.0           | 16.0          | 123.5          |                                  |
|                 | Sweet gourd | -            | 25.0              | 19.0           | 8.5            | 0.0               | -              | 58.5         | -          | 2.0            | 32.0          | 145.0          |                                  |
| Total average   |             | -            | 28.5              | 23.7           | 7.0            | 3.7               | -              | 38.7         | -          | 14.7           | 25.2          | 141.3          |                                  |
| Lsd (P ≥0.05)   |             | -            | 4.1               | 2.9            | 3.4            | 7.3               | -              | 4.9          | -          | 2.2            | 4.6           |                 |                                  |
| Root vegetables | Carrot     | 5.5           | 0.0               | 2.5            | -              | -                 | 0.0            | 4.5          | -          | 1.0            | -             | 13.5           |                                  |
|                 | Radish     | 4.5           | 5.0               | 3.0            | -              | -                 | 3.5            | 10.5         | -          | 1.5            | -             | 28.0           |                                  |
|                 | Turnip     | 0.0           | 0.0               | 0.0            | -              | -                 | 0.0            | 2.5          | -          | 3.5            | -             | 6.0            |                                  |
| Total average   |             | 3.3           | 1.7               | 1.8            | -              | -                 | 1.2            | 5.8          | -          | 2.0            | -             | 15.8           |                                  |
| Lsd (P ≥0.05)   |             | 1.36          | 6.38              | 0.74           | -              | -                 | 5.88           | 2.74         | -          | 3.32           | -             |                 |                                  |

- , Not found
In case of seeds of root vegetables, six fungi were found associated (Table 1), namely *Fusarium* spp. (5.8%), *Alternaria* spp. (3.3%), *Penicillium* spp. (2%), *Aspergillus niger* (1.8%), *Aspergillus flavus* (1.7%) and *Curvularia* spp. (1.2%). Maximum incidence of *Alternaria* spp. was found in carrot (5.5%), but seeds of turnip were free from *Alternaria* spp.. In case of *Aspergillus niger*, the highest prevalence was recorded in radish (3%), but no incidence in turnip. *Aspergillus flavus* (5%) and *Curvularia* spp. (3.5%) were found only in radish. Maximum prevalence of *Fusarium* spp. was recorded in radish (10.5%) and minimum in turnip (2.5%). The incidence of *Penicillium* spp. was high in turnip (3.5%), while low in carrot (1%). The highest total seed-borne fungal infection was observed in radish (28%) followed by carrot (13.5%), while the lowest seed borne infections were recorded in seeds obtained from turnip seed (6%). In this case, most predominant fungus was *Fusarium* spp. (5.8%) followed by *Alternaria* spp. (3.3%), *Penicillium* spp. (2%), *Aspergillus niger* (1.8%), *Aspergillus flavus* (1.7%) and *Curvularia* spp. (1.2%).

Out of seeds of 11 crops studied, The highest total seed-borne fungal infection was found in bottle gourd (155%) followed by sweet gourd (145%), while the lowest was found in turnip (6%). In this case, most predominant fungus was *Fusarium* spp. (5.8%) followed by *Alternaria* spp. (3.3%), *Penicillium* spp. (2%), *Aspergillus niger* (1.8%), *Aspergillus flavus* (1.7%) and *Curvularia* spp. (1.2%).

Out of seeds of 11 crops studied, The highest total seed-borne fungal infection was found in bottle gourd (155%) followed by sweet gourd (145%), while the lowest was found in turnip (6%) followed by red amaranth (11%). Among all the fungi detected in the present study, *Alternaria* spp., *Botrytis cinerea*, *Curvularia* spp. and *Chaetomium funicola* are known pathogens of various crops (Richardson, 1990).

In growing-on-test, number of normal seedlings, number of abnormal seedlings, number of diseased seedlings and dead seeds varied significantly depending on seed of different vegetables (Table 2). The highest number of normal seedlings were recorded in seeds of Indian cabbage (100%) followed by carrot (86%) and radish (86%), while the lowest was recorded in Indian spinach seeds (7%). The highest number of abnormal seedlings was found in sweet gourd (14%), while abnormal seedling was not found in Indian cabbage. The highest number of diseased seedlings was recorded in sweet gourd (8%) and no diseased seedlings were found in Indian cabbage, Indian spinach and carrot. The notorious fungi, *Fusarium* spp. cause seedlings infection (foot and root rot disease). *Fusarium* spp. is an established seed-borne pathogen capable of causing germination failure/ seed rot, damping-off, seedling blight foot and root rot and wilt in many crops (Mathure et al. 1975; Richardson, 1990). Maximum number of dead seed was found in Indian spinach (89%), while dead seeds were not found in Indian cabbage.

Table 2. Growing-on-test of seeds of different vegetables

| Seed categories | Name of vegetables | Normal seedlings (%) | Abnormal seedlings (%) | Diseased seedlings (%) | Dead seeds (%) |
|-----------------|--------------------|----------------------|-----------------------|------------------------|---------------|
| Leafy vegetables | Cabbage            | 66                   | 10                    | 6                      | 18            |
|                 | Indian cabbage     | 100                  | 0                     | 0                      | 0             |
|                 | Indian spinach     | 7                    | 4                     | 0                      | 89            |
|                 | Spinach            | 70                   | 6                     | 6                      | 18            |
|                 | Red amaranth       | 75                   | 11                    | 3                      | 11            |
| Cucurbit vegetables | Bottle gourd      | 43                   | 6                     | 5                      | 46            |
|                 | Bitter gourd       | 54                   | 4                     | 4                      | 38            |
|                 | Sweet gourd        | 62                   | 14                    | 8                      | 16            |
| Root vegetables | Carrot             | 86                   | 6                     | 0                      | 8             |
|                 | Radish             | 86                   | 2                     | 2                      | 10            |
|                 | Turnip             | 64                   | 5                     | 3                      | 28            |
| Lsd (P ≥0.05)   | 1.780              | 0.9595               | 0.691                 | 1.708                  |

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Table 3. Germination and seedling vigour test of different vegetable seeds (Growing on test)

| Name of vegetables | Germination (%) | Shoot length (cm) | Root length (cm) | Vigour index |
|--------------------|-----------------|-------------------|------------------|--------------|
| Bitter gourd       | 62.00           | 20.36             | 12.53            | 2039.18      |
| Bottle gourd       | 54.00           | 6.470             | 5.640            | 653.94       |
| Cabbage            | 82.00           | 9.900             | 1.420            | 928.24       |
| Carrot             | 92.00           | 5.100             | 1.170            | 576.93       |
| Indian cabbage     | 100.0           | 1.680             | 5.930            | 761.0        |
| Indian spinach     | 11.00           | 4.250             | 1.150            | 59.4         |
| Radish             | 90.00           | 9.960             | 1.420            | 1024.20      |
| Red amaranth       | 89.00           | 7.300             | 1.450            | 778.75       |
| Spinach            | 82.00           | 6.670             | 1.630            | 680.76       |
| Sweet gourd        | 84.00           | 26.23             | 10.47            | 3082.8       |
| Turnip             | 72.00           | 10.64             | 1.590            | 880.56       |
| Lsd (P ≥0.05)      | 2.339           | 0.7424            | 0.4263           | 5.673        |

10 seedlings per replication were counted for evaluating vigour index.

Significant variation of seedling vigour was recorded on testing seedling vigour of 11 vegetable seeds (Table 3). Among the vegetables seed samples, highest seedling vigour was encountered in sweet gourd (3083) and the lowest in indian spinach (59). The highest germination percentage in growing-on-test was recorded in indian cabbage (100%) and lowest in indian spinach (11%). Shoot length was highest in sweet gourd (26.23) and lowest in indian cabbage (1.68). Root length was highest in bitter gourd (12.53) and lowest in carrot (1.17). There was significantly difference among the seeds of different vegetables in respect of % germination, shoot length, root length and vigour index.

Conclusions

From the findings of the present study, it may be concluded that the seed samples of different vegetables collected from Mymensingh region are not so good quality except indian cabbage, radish and carrot. Therefore, routine seed health and quality study should be undertaken in order to reveal the exact picture regarding the prevalence of seed-borne fungi and the role they do play on seed health.

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