Publisher homepage: www.universepg.com, ISSN: 2663-7804 (Online) & 2663-7790 (Print)
https://doi.org/10.34104/ajeit.021.034044
Australian Journal of Engineering and Innovative Technology
Journal homepage: www.universepg.com/journal/ajeit

Prevalence of Insects in Traditionally Stored Rice at Farmhouses in Bangladesh

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ABSTRACT

A survey was conducted to investigate rice storage practices at the farmer's level and the prevalence of insects' status through a pretested questionnaire in Mymensingh and Jashore districts, Bangladesh. For seed purposes, large, medium, and small farmers store about 40, 10, and 5 kg, respectively in the *Aman* season for 7 months whereas in the *Boro* season large and medium farmers keep about 80 and 20 kg for 5 months. Average storage time was the highest (7 months) for *Boro* and *Aman* rice by large and small farmers, respectively for consumption. Eleven storage items namely, *Dole, Motka,* Tin, Plastic Drum, Gunny Bag, Bamboo *Gola, Dhari,* Bamboo *Auri, Berh,* Steel Drum, and Plastic Bag were found. About 57 and 74% of farmer's stored rice, among them 47 and 58% used traditional *Dole* in Jashore and Mymensingh, respectively. Tin and *Berh* (1%) were the least used storage structures. About 11 and 17%; 3 and 4% of farmers used neem leaf and chemicals especially phostoxin in storage as an insect repellent in these areas, respectively. The use of Plastic Bags increased sharply due to light weight, availability, and low price, whereas Bamboo *Gola, Berh, Motka* users decreased re-markably. Relative abundance of the insect species was: Rice Moth *Sitotroga cerealla,* Rice Weevil *Sitophilus oryzae,* Red Flour Beetle *Tribolium casteneum* and Lesser Meal Worm *Alphitobious diaperinus*. Maximum insect infestation was found in stored paddy in *Dole* followed by *Motka,* and Plastic Bag; and the least amount was observed in Plastic Drum in both regions. Three fourth of the respondents took no measures to control insect pests in stored rice.

Keywords: Rice, Traditional, Storage structures, Bamboo *Auri*, *Motka*, Prevalence, Farmhouse and Insect.

1. INTRODUCTION:

Bangladesh is the fourth largest paddy consuming (35,000 thousands metric tons) country in the world (STATISTA, 2017). In 2018-2019, agriculture sector contributed about 13.07 % of her total GDP (STATISTA, 2020). Paddy provides about two-thirds of total calorie supply and one half of the total protein intake of an average person in the country. Bangladesh will require about 44.6 million tons of rice in the year 2050 (Kabir, 2015). During this time total paddy area will also shrink to 10.28 million hectares. When paddy is stored in sacks the losses were 3.5-6% in India, 3-5% in Nepal, 2-3% in the Philippines, 5% in Thailand and in Brazil is 2.4% (FAO, 2004). In present

context, to fulfillment of uniform consumption throughout the year, storage of produced rice is a must. Rice is generally stored by the farmers to meet their own consumption, facing emergency needs and seeds for the next sowing season. Losses in storage are occurred due to insect infestation and growth of mold and fungi: temperature and moisture are the most important factors affecting the abundance of insects, mold, and fungi. Hot and humid weather of Bangladesh favors rapid insect development and deterioration of seed. Storage losses are higher in Bangladesh compared to other developing countries where better storage systems are available (Abedin *et al.,* 2012).

The net availability of rice is considerably less than its gross production due to all these factors. Seed is the basic input of agriculture for quality crop production. Only 10% of certified seed is available in Bangladesh (Fakir *et al*. 2002). Combined effort of public and private sectors had been able to meet on average only about 41% of the total requirement, indicating that, on average, about 59% seeds are being used from seeds retained by the farmers (http://www.thedailystar.net/dilemma-in-quality-rice-seed-production-37652). To meet up the food requirements of the ever growing population of the country, quality seed and improved storage technology may contribute as vital factors. In Bangladesh, around 85 percent of country's seed requirement is fulfilled by farmers' through traditional practices which involve saving seed from own harvest, and using seed for re-sowing, sharing, exchanging and bartering (CUTSI, 2013). These technologies are not robust in providing optimum storage conditions up to the next planting season. Seed comes from farmers own saved sources which is not standard in quality especially germination capacity is quite low compared to existing provision of seed standard of the country (Hossain, 2020). The study was undertaken to (i) investigate the farm level paddy storage practice; (ii) determine the extent to which farmers are aware of prevalence storage insect, and; (iii) ascertain their main control method, if any; and, (iv) to determine the insect species those are commonly found in stored paddy at household level.

2. MATERIALS AND METHODS:

2.1 Site selection - Survey was conducted during *Boro* rice storage from 200 farmers of different sizes (large, medium and small) at two selected sites of Phulpur, Mymensingh and Manirampur, Jashore district, Bangladesh (**Table 1**). Twenty five farmers from a village and four villages from each site were taken. Phulpur is located in between 24°15´ and 25°12´ north latitudes and in between 90°04´ and 90°49´ east longitudes Manirampur upazilla of Jashore district is located at 23.0167°N and 89.2333°E. Manirampur is the second largest upazilla of Bangladesh, located in between 22°48' and 23°22' north latitudes and in between 88°51' and 89°34' east longitudes. Total cultivable land, rice area, absentee farmers are 24,337; 22,200 ha and 13%, respectively in Phulpur, Mymensingh district. Corresponding values are 29879, 20,896 and 15%, respectively in Manirampur, Jashore district. These study sites as shown in **Fig 1** were selected on the basis of weather, rice dominancy, farmers' attitude to cooperation, availability of all storage technologies used for rice storage by farmers and adequate road facility. Women of the householders of are doing postharvest activities themselves. That's why these sites were taken to conduct the study.

2.2 Development of survey questionnaire - A questionnaire was prepared to identify available rice storage technologies and document quantity and duration of storage for consumption, sale and seed purposes at farmer's level. Questionnaire was carefully designed in English considering the objectives of the experiment and also prepared in Bengali for well understanding of the farmer. Before finalizing the questionnaire, it was pre-tested for judging the suitability of questionnaire to respondents by skilled enumerators. Further modification and correction were done according to respondents' opinion.

2.3 Identification of rice storage structure – Purposive sampling technique was followed for data collection in a face to face interview manner and personal visits to the selected farmers' house. *Boro* rice growing households were selected with the help of Non Government Office (NGO's) named Grameen Manobic Unnayan Sangstha (GRAMAOUS) and Sustainable Food Linkages (SOFOL) in the study areas. Land size, purpose, insecticides use in storage, type, amount and duration of storage were asked to the respondents. Data were classified; tabulated and analyzed statistically in accordance with aims and objectives of the study.

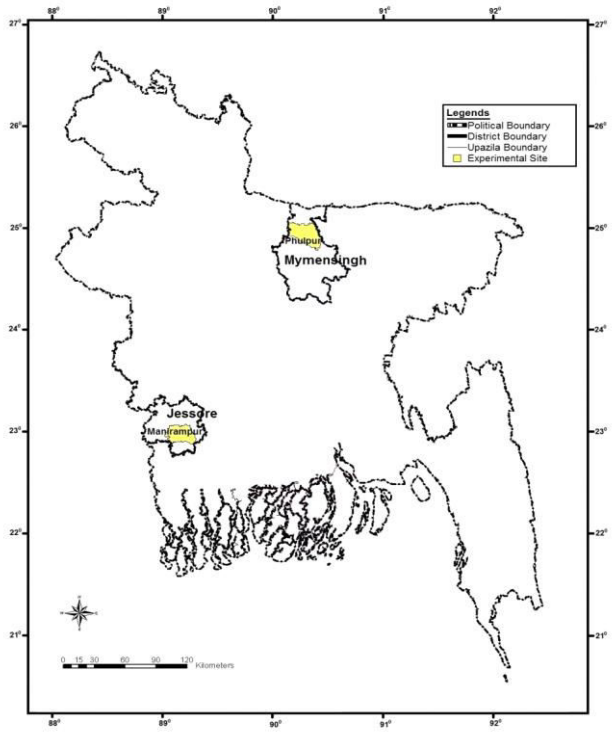

Fig 1: Location of study areas- Phulpur, Mymensingh and Manirampur, Jashore of Bangladesh.

2.4 Farm wise sample distributions - Samples of *Aman* and *Boro* rice growing households were chosen with stratified random sampling technique and classified into four groups based on their land ownership. These were: marginal farmer having land less than 1.0 acre (<0.4 hectares), small farmer having land with 1.0-2.49 acres (0.4-0.99 hectares), medium farmer having land with 2.50-7.49 acres (1.0-3.0 hectares) and large farmer having land with more than 7.50 acres (>3.0 hectares). Then samples were taken separately as *Aman* and *Boro* rice producing householders from each site.

2.5 Prevalence of insect pest - Rice sample of 250 g was collected from the top layer (10-15 cm) of farmer's storage technologies by a sampler and kept in polythen bag with an identification card and tied with a thread. Samples were kept in deep freeze (2-4^{0}C) for few minutes to make insect immobile. Then total number of insect was counted for each sample. Prevailing insects were identified based on their respective identifying character.

3. RESULTS:

3.1 Existing storage techniques - Survey data revealed that the farmers practice both bulk and bag storage of rice seeds in eleven different storage technologies namely, *Dole, Motka,* Tin, Plastic Drum, Gunny Bag, Bamboo *Gola, Dhari,* Bamboo *Auri, Berh,* Steel Drum, and Plastic Bag. However, all of those could be grouped as the following five categories:

A. Bamboo woven storage: *Dole,* Bamboo *Gola,* Bamboo *Auri, Berh* and *Dhari*
B. Earthen jar: *Motka/Kolshi*
C. Metal container: Tin and Steel Drum
D. Bag storage: Plastic Bag, Gunny Bag and Polythen Bag
E. Miscellaneous: Plastic Drum

Among these, *Gunny bag* and *Plastic bag* were the mostly used storage technologies by farmers for storing rice for short duration and also carrying rice from field to farmers' premises. On the other hand, *Dole, Gola, Motka,* Steel/Plastic Drum was the containers used for long period of storage. These storage technologies are commonly used by farmers' in the study areas are described in the following:

A. Bamboo woven storage - Bamboo is locally abundant to make the storage. Technical person to make bamboo woven storage at cheapest rate is available in Bangladesh (Hossain *et al.,* 2021).

a) *Dole* - *Dole* oval shaped or a cylindrical container with an open upper surface stands under cover on layers of straw or rice husk. To load and unload larger capacity *Dole*, sometimes ladder is used. Its usual capacity ranges from 180-1000 kg. Photograph of representative technology of *Dole* as found in the locality is as shown in **Fig 2**.

b) Bamboo *Auri* - Bamboo *Auri* is a medium size storage container made of split bamboo as depicted in **Fig 3**. It is made as cylindrical or oval shaped container opened to one side having a hay or tin roof. It is staged above ground of several feet high in home yard by farmer. Its' rice holding capacity is ranged from 80-1600 kg.

c) *Dhari* - *Dhari* is a cylindrical bamboo container made of several mats (usually 2-5) together to give it the usual shape. At junction of the *Dhari*, two bamboo splits of desirable strength are fastened by wires to make it cylindrical. The bamboo splits act as reinforcement, which can usually withstand the probable lateral pressure.

Fig 2: *Dole*

Fig 3: Bamboo *Auri*

Fig 4: *Dhari*

Dhari is open at both ends. Before filling, straw made rope is placed around the inner base. For filling and unloading ladders are used. Its storage capacity varies from 400-1200 kg. Photograph of representative structures of *Dhari* found in the rural area is shown below in **Fig 4**.

d) Bamboo *Gola* - This is a small to medium size storage structure used by farmers for storing rice or wheat as shown in **Fig 5**. It is built on a bamboo platform several feet above the ground. It is circular or rectangular in shape and its capacity ranges from 1-10t.

e) *Berh* - *Berh* is a spherical or oval shaped container opening on both sides. Before filling the container, straw made rope is placed at the base where lateral pressure is dominant, the storage capacity of a *Berh* ranges from 750-1500 kg. Photograph of *Berh* as found in the rural area is shown below in **Fig 6**.

Fig 5: Bamboo *Gola*

Fig 6: *Berh*

B. Earthen jar - Traditionally storage item used in rough and milled rice, dry fish etc.

a) *Motka* - *Motka,* an earthen container of varying sizes and made of clay, and burnt in kilns. It is made by potter and sold in the local markets and extensively used by the farmers for storing rice seed and grains. Its capacity varies from 80-200 kg. Photograph of representative technology of *Motka* as found in the locality is shown below in **Fig 7**.

C. Metal container - This comes from abroad as imported container bearing chemicals, dye and medicine. After the commercial use it is sold in local at minimum price which used in storing rough and milled rice.

a) Steel Drum - Steel Drum is of cylindrical shape container made of steel. The material is light in relation to strength and homogeneous in nature. Steel Drum, after having filled with grains or rice seed, the top opening is kept closed by a lid. Its capacity ranges from 20-200 kg. Photograph of representative technology of Steel Drum as found in the locality is shown below in **Fig 8**.

b) Kerosene Tin - Kerosene Tin is square and made of thin iron sheet. Filling with grains or paddy the top opening is kept closed by a lid. Its capacity ranges from 14-19 kg. Photograph of representative structures of Kerosene Tin as found in the locality is shown below **Fig 9**.

Fig 7: *Motka*

Fig 8: Steel Drum

Fig 9: Kerosene Tin

D. Bag Storage - As bulk it is widely used in rice storage in mills and traders warehouses.

a) Gunny Bag - Gunny Bag is made of jute. Farmers purchased it from local market. Grains or rice are popularly stored in Gunny Bag. Rice is commonly stored in bags, heaped on a raised platform. The capacity of the bag ranges from 50-100 kg. Photograph of representative technology of Gunny Bag as found in the locality is shown below in **Fig 10**.

b) Plastic Bag - Plastic Bag is made of poly propylene as shown in **Fig 11**. Farmers get it in local market. It is cheap, light in weight and handy. Rice is popularly stored in Plastic Bag and heaped on a raised platform. Its' capacity ranges from 40-50 kg.

E. Miscellaneous

a) Plastic Drum - Plastic Drum is cylinder with an opening at the top. It is usually placed inside of the room. Its capacity ranges from 20-40 kg. Photograph of representative technology of Plastic Drum as found in the rural area is shown in **Fig 12**.

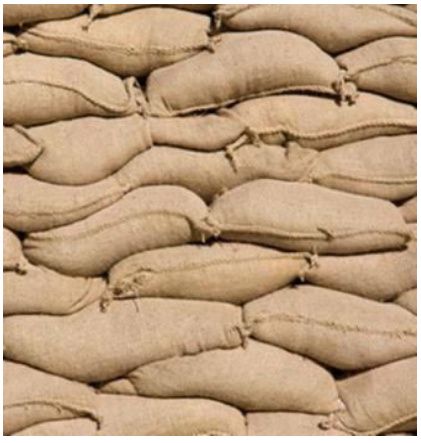

Fig 10: Gunny Bag

Fig 11: Plastic Bag

Fig 12: Plastic Drum

3.2 Farm category, purpose and duration of rice storage - Study showed that storage quantities range from 5 to 8,000 kg as shown in **Table 1**. The storage time of rice varied from 2.5 to 7.0 months in accordance with purpose. In seed purposes, large, medium and small farmers store about 40, 10, and 5 kg, respectively in *Aman* season for 7 months whereas in *Boro* season only 1 and 5% large and medium farmers keep seed around 80, 20 kg for 5 months. The average storage time was the highest (7 months) for *Boro* rice by large farmer and *Aman* season by small farmer in consumption purposes.

On an average, *Aman* rice was stored for about 5, 6 months; and *Boro* rice for about 5.7, 6 months for all farms in sale and consumption purposes. It is observed that the average storage time was the highest (6.8 months) in Jashore region for large farm while it was the lowest (3.6 months) in Mymensingh region for the same farm. In *Boro* season 1000, 1400, 2000 kg rice is kept by small, medium and large farmers while in *Aman* season 400, 600 kg rice is kept by small and medium farmers. Large farmers usually kept *Boro* rice for year round consumption due to its premium quality.

3.3 User (%) of rice storage

Manirampur, Jashore - It is found that 13, 47, 1, 2, 10, 3, 2, 1, 4, 1, 2, 1 and 11% farmers of the study area used Plastic Bag, *Dole*, Tin, *Motka*, Bamboo *Auri,* Bamboo *Gola* and Plastic Bag, Bamboo *Gola and Motka*, Bamboo *Berh*, Gunny Bag, Floor of the tin shed building, Bamboo *Gola* and Gunny Bag, *Dhari* and Bamboo *Gola*, respectively as shown in **Fig 13**. *Dole* (47%) is commonly used storage container and maximum famers use it. Bamboo *Gola* is becoming less popular while Plastic Bag is becoming more popular among the farmers due to its low cost, light weight and availability. Tin and Bamboo *Berh* (1%) is the least used storage structure at farmers' level. Contract seed growers of Bangladesh Agricultural Development Corporation (BADC) keep rice in the floor of their household after harvesting then sell to BADC seed wing. Very few numbers of farmer produced milled rice just after drying of harvested rice and stored in Steel Drum for year round consumption. Very few farmers stored rice one year or more to sell at peak price of the season. Large and medium farmers use simultaneously 2-5 types of container in rice storage.

Phulpur, Mymensingh - About 8, 58, 1, 2, 5, 3, 1, 4, 2, 1, 3, 3, 10 and 9% farmers used Plastic Bag, *Dole,* Tin, *Motka,* Bamboo *Gola and* Plastic Bag, Bamboo *Gola and Motka,* Bamboo *Berh,* Gunny Bag, Bamboo *Gola and* Plastic Drum, Floor of the tin shed building, Bamboo *Gola and* Gunny Bag, *Dhari,* Bamboo *Auri and* Bamboo *Gola*, respectively as shown in **Fig 14**. *Dole* (58%) is commonly used storage container and maximum famers use it. Saha *et al.* (1996) reported similar observations. Plastic Bag is becoming more popular among the farmers due to its low cost, light weight and availability while Bamboo *Gola* is becoming less popular. Tin and Bamboo *Berh* (1%), is the least used storage structure at farmers' level. Contract seed growers of BADC keep rice in the floor of their household after harvesting then sell to BADC seed wing.

Table 1: Purpose and duration of rice storage by different farm sizes.

Farm Category	Purpose	Average storage time (months)		Amount of rice (kg)	
		Aman Season	Boro Season	Aman Season	Boro Season
Large (3%)	Seed	7	5	40	80
	Sale	4	6	4,000	8,000
	Consumption	-	7	-	2,000
Medium (10%)	Seed	7	5	10	20
	Sale	3	4	2,500	4,000
	Consumption	6	6	600	1,400
Small (87%)	Seed	7	5	5	-
	Sale	2	7	600	800
	Consumption	7	5	400	1,000

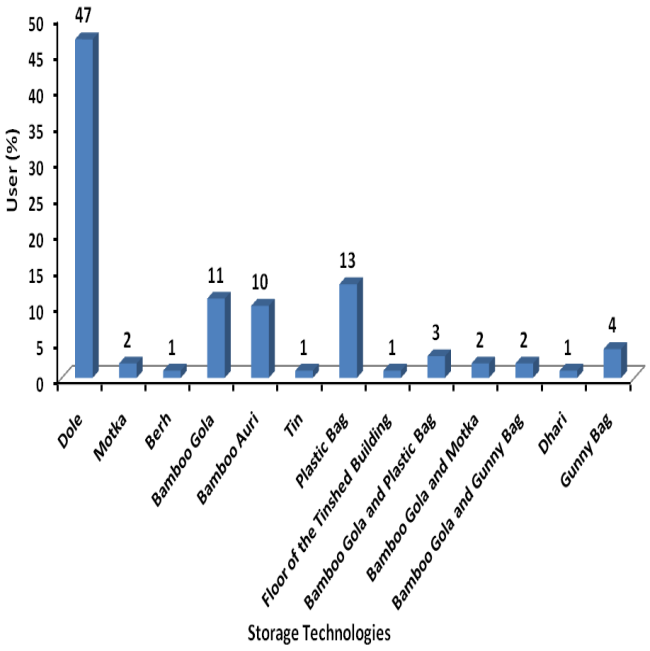

Fig 13: Percentage of user of traditional storage structure at Manirampur, Jashore.

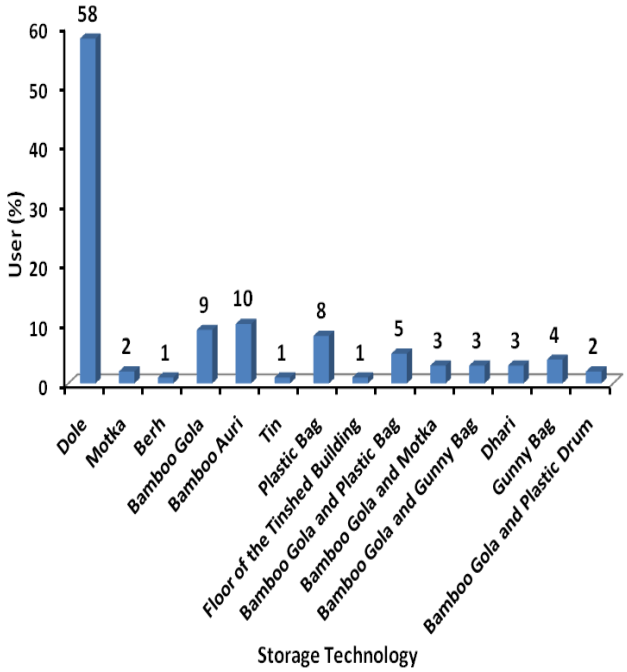

Fig 14: Percentage of user of traditional storage structure at Phulpur, Mymensingh.

3.4 Identified storage insects in farm household - Four insect species were trapped in prepared glue paper and identified in stored rice seed in different storage technologies at farmers' houses in *Boro* season. These were: Angoumois grain moth, *Sitotroga cerealla* Oilv. (gelechiidae: Lepidoptera), Rice weevil, *Sitophilus oryzae* L. (Curculionidae: Colleoptera), Red flour beetle, *Tribolium casteneum* Hebst, (Tenebronidae: Coleoptera) and Lesser meal worm, *Alphitobious diaperinus* (Panzer) Fab. (Tenebrionidae: Coleoptera. Lesser Meal Worm was found in higher moisture content (16.7%) sample in traditional *Dole* only which is widely used storage structure in Bangladesh (Hossain *et al.,* 2019).

3.5 Abundance of the prevailing insect species in different storage structures - Abundance of the prevailing insect pests viz, *S. cerealla*, *S. oryzae*, *T. casteneum*, and *R. domonica* were varied with storage technologies. Insect population abundance irrespective of species in different storage technologies is presented in **Fig 15**. It also shows that insect population influenced by storage technologies. Maximum population was found in *Dole* (223 insects/250 g sample) followed by *Motka* (170 insects/250 g sample), Plastic Bag (65 insects/ 250 g sample) and Plastic Drum (7 insects/ 250 g sample).

3.6 Relative abundance of stored insect species - *Sitotroga cerealla (SC) is* found maximum in all traditional technologies followed by *Sitophilus oryzae (SO), Tribolium casteneum (TC) and Alphitobious diaperinus (AD)* as shown in **Fig 16**. Relative abundance of the infested insect was in the order: *Sitotroga cerealla (SC)> Sitophilus oryzae (SO)> Tribolium casteneum (TC)> Alphitobious diaperinus (AD). Sitotroga cerealla* is the dominant insect for both study areas.

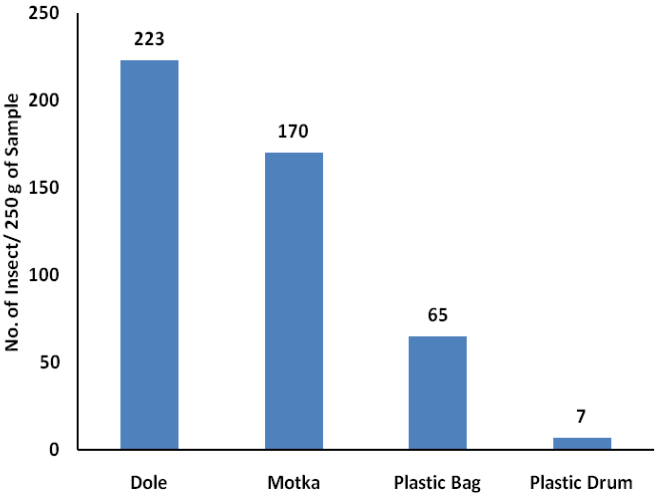

Fig 15: Abundance of the prevailing insect species in different storage structures

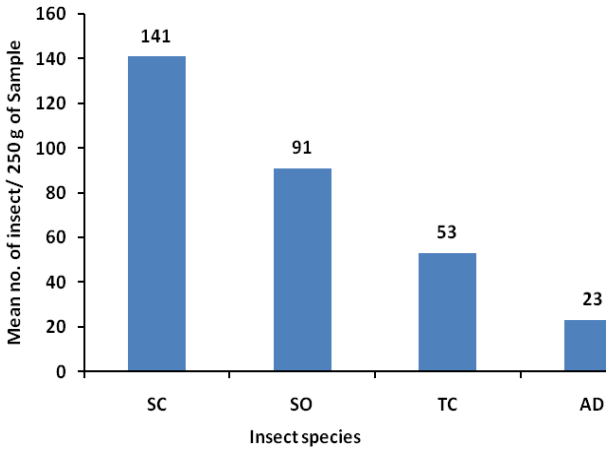

Fig 16: Insect species found in stored rice at different technologies.

4. DISCUSSION:

4.1 Existing paddy storage structures - Farmers practice both bulk and bag storage of paddy in eleven different types of storage technologies namely, *Dole, Motka,* Tin, Plastic Drum, Gunny Bag, Bamboo *Gola, Dhari,* Bamboo *Auri, Berh,* Steel Drum, and Plastic Bag. This finding was supported with Clements *et al*. (1984) and Howlader *et al*. (2004). Farmers of Bangladesh use similar storage structures for seed and food grain storage of different crop like rice, wheat pulse. Similar reports also made by Saha *et al.* (1996) and Howlader *et al*. (2004). Most of the farmers store rice in *Dole* in both areas due to ease of manufacturing, availability of construction materials and less technical knowledge is required to design. Load or unload paddy and cleaning of it is easy. As *Dole* has large opening developed insects can come out easily stored paddy of it is less infested rather than *Motka*, Bamboo *Gola* and *Auri*. Plastic Bag is becoming more popular among the farmers due to its low cost, light weight and availability while Bamboo *Gola* is becoming less popular (Hossain, 2019 & 2020). Tin and Bamboo *Berh* (1%) is the least used storage structure at farmers' level. Large and medium farmers use simultaneously 2-5 types of container in paddy storage. Large farmer usually kept *Boro* paddy for year round consumption due to its premium quality. Contract seed growers of BADC keep paddy in the floor of their house after harvesting then sell to BADC seed wing. Farmers, millers and traders are storing paddy mostly in Gunny bag. Paddy stored in gunny bags which are inexpensive, reusable with good inherent toughness. High permeability and low resistance to insect and rodent attack of it results in frequent application of pesticides to prevent infestation (Maina *et al*., 2016; Meenatchi *et al*., 2018).

4.2 Paddy storage practices- About 7-9%, 68-73% farmers stored paddy for seed purpose; and 52-57%, and 23-26% farmers stored it for food purpose in *Boro* and *Aman seasons*, respectively. Most of the farmers purchased *Boro* seed from BADC or seed companies. Especially in *Aman* season they stored paddy for seed purposes. About one-fourth farmers used *Nishinda*, *Neem leaf* or others as bio-insecticide in storage container. Only 4% farmers covered upper surface of the storage container using polythen. About 3-4% farmers use chemicals specially Phostoxin collecting from their local market. Very few numbers of farmer produced milled paddy just after drying of harvested paddy and stored in Steel Drum for year round consumption. Using good quality seed paddy yield could be increased by 15% to 20%. In Bangladesh more than 80% of the paddy seeds are produced and preserved by farmers (Sultana *et al*., 2016; Fakir, 2004). Chemical fumigants are a prominent method of controlling pests and microorganisms in stored grain (Navarro, 2006). However, chemicals applied improperly, leave harmful residues in the grain that can creates potential health hazard for the person doing fumigation (Navarro, 2012). Major pests of stored cereals such as *Rhyzopertha dominica* and *Liposcelis bostrychophila* are developing resistance against commonly used chemical fumigants (Nayak *et al*., 2003; Collins *et al*., 2005; Lorini *et al*., 2007). Seed storage is an important aspect, because it is much helpful to yield healthy, vigorous plant (FAO, 2011) and reduce postharvest loss of rice (Hossain, 2016).

In most cases farmer's stored seeds are badly infested with stored grain pests and molds with very poor germination. A good quality seed may also be seriously deteriorated if stored under sub optimal condition. Consequence, the average annual wastage of seed could be estimated as 0.353 million mt. equivalent to Taka 5,295 million i.e. US$ 91.3 million (Sultana *et al*., 2016).

4.3 Paddy storage scenario - Large and medium farmers store *Boro* and *Aman* paddy seed while small farmer store *Aman* paddy seed only. In *Boro* season all categories farmers and in *Aman* season small and medium farmers kept paddy for consumption (Abedin *et*

al., 2012). Large farmer usually kept *Boro* paddy specially BRRI Dhan28 for year round consumption due to its premium quality, fineness of paddy. Small and medium farmers store bold varieties of *Boro* and *Aman* paddy for that purpose.

Large farmer stores aromatic paddy for occasions while small and medium farmers sell due to its high price. In Phulpur, Mymensingh region, about half of the production is sold without drying and cleaning to meet farmers' emergency need i.e. labor wage, loan payment, etc. In Jashore region, threshed paddy without drying and cleaning is merely sold. Price of cleaned paddy is much higher than that of rough paddy. Single paddy farmers sell on an average 15% of stored paddy intermittently to fulfill their family requirement. Only single paddy farmers store paddy up to one year due to uncertainty of next harvest. In double paddy areas, farmers store paddy for maximum five months.

5. CONCLUSION:

Storage loss, a major contributor to post-harvest losses of rice is one of the causes of food insecurity in Bangladesh. *Dole, Motka,* Tin, Plastic Drum, Gunny Bag, Bamboo *Gola, Dhari,* Bamboo *Auri, Berh,* Steel Drum and Plastic Bag are used in rice storage in Mymensingh and Jashore regions. Large and medium farmers store *Boro* and *Aman* paddy seed while small farmers store *Aman* paddy seed only. In *Boro* season all categories farmers; in *Aman* season small and medium farmers kept paddy for consumption. Large farmer usually kept *Boro* paddy specially BRRI Dhan28 for year round consumption due to its premium quality, fineness of paddy. Small and medium farmers store bold varieties of *Boro* and *Aman* paddy for that purpose. Large farmers store aromatic paddy for occasions while small and medium farmers sell due to its high price. In Phulpur, Mymensingh region. Large farmers usually kept *Boro* rice for year round consumption due to its premium quality. Majority farmers use *Dole* for storing rice in storage. They took no measure to control insect pests in their stored rice. About one-fourth farmers used *Nishinda*, *Neem leaf, Biskatali* or others as bio-insecticide in storage container. Relative abundance of the infested insect was in the order: *Sitotroga cerealla*> *Sitophilus oryzae*> *Tribolium casteneum*> *Alphitobious diaperinus.* In all cases, insect infestation was found higher in traditional storage container *Dole, Motka,* Plastic Bag and the least amount is in Plastic Drum. Farmers use mostly Plastic and Gunny Bags in rice storage. Within 3 months of storage, the quality of the rice gets deteriorated in these due to improper storage condition, which leads to insect infestation. To overcome these issues, Plastic Drum can be used in seed storage. Excellent way to increase food supply is to promote better storage, in the face of limited available land, rainfall, the upside of increasing food production. It does not require additional land and water. Reducing storage farmers can increase the amount of available food for their own consumption or for sale to markets; lowers household expenditures per unit of food consumed; these savings can be spent on health, education, and other household benefits; reduces the cost to food production, fertilizer applications and use of energy for producing, processing, transporting and storing food.

6. ACKNOWLEDGEMENT:

This research was performed as part of PHLIL project ''USAID Post-Harvest Loss Reduction Innovation Lab-Bangladesh Component'' funded by the USAID and ADM Institute for the Prevention of Post Harvest Loss, University of Illinois, USA (Grant Number: UReRA 2015-05296-01-00).

7. CONFLICTS OF INTEREST:

The authors declared no possible conflicts of the interest with respect to the research, authorship and publication of this article.

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Citation: Hossain MA, Awal MA, Alam MM, Ali MR, Howlader MTH, and Zahan A. (2021). Prevalence of insects in traditionally stored rice at farmhouses in Bangladesh, *Aust. J. Eng. Innov. Technol.*, **3**(3), 34-44. https://doi.org/10.34104/ajeit.021.034044