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Evaluation of different storage bags against *Caryedon serratus* Olivier in stored groundnut

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Abstract

The laboratory experiment was conducted to studies on evaluation of different storage bags against *Caryedon serratus* Olivier in stored groundnut at Department of Agricultural Entomology, Oilseed Research Station, Latur during academic year 2020-21. The groundnut pods stored in PICS bag without bruchid release recorded less per cent pod damage by count (4.29%) up to six months of storage period, while groundnut pods stored in jute gunny bags with bruchid release recorded high per cent pod damage by count (44.14%). The groundnut pods stored in PICS bag without bruchid release recorded less per cent pod damage by weight (4.75%) up to six months of storage period, whereas groundnut pods stored in jute gunny bags with bruchid release recorded high per cent pod damage by weight (43.43%). The groundnut pods stored in PICS bags without bruchid release were recorded high per cent germination (94.25%) which was not significantly decreased up to six months of storage period, while groundnut pods stored in jute gunny bags with bruchid release decreases the per cent germination from 91.75% to 50.75% in six months of storage period.

Keywords: Groundnut, *C. serratus*, PICS bags, Jute gunny bags, germination

1. Introduction

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in India and in Maharashtra. Its productivity is only 1148 kg/ha (Anonymous, 2020) ^[1]. From nutritional point of view, groundnut is very rich source of protein 26 per cent and edible oil 45-50 per cent, so it is also known as poor's man almond. Groundnut is also good source of minerals like phosphorus, calcium, boron, iron, zinc, magnesium, potassium and vitamin K E and B (Dwivedi and Nigam, 2003) ^[3].

Groundnut bruchid, *Caryedon serratus* Olivier belongs to family Bruchidae order Coleoptera. In India, *C. serratus* was first reported to be infesting groundnut in Andhra Pradesh and Tamil Nadu in 1914 (Fletcher, 1914) ^[4]. It is the only pest which infests both pods and kernels of groundnut. A single grub can make a large excavation in the cotyledons, but no sign of damage is visible externally at this stage. The larva of *C. serratus* bore into the seeds via small holes and feed on the embryo and the endosperm. Mature larva emerges partially or completely from the pod through exit holes and constructs an oval papery cocoon. *C. serratus* causes heavy loss in quantity and quality of stored groundnut. The extent of damage was recorded as 77.1 per cent in pods and 67.8 per cent in kernels by (Kumari *et al.*, 2002) ^[5] and 50-70 per cent in pods and 80-85 per cent in kernels by (Devi and Rao, 2000) ^[2]. It is truly said that "a grain saved is a grain produced". At present, the only solution for stabilizing per capita availability is to reduce storage losses.

The continuous usage of chemicals as prophylactic and curative treatment contaminates the groundnut and leads to serious health hazards and environmental problems. Hence development of alternative, control measure for stored grain protection such as use of storage triple layer hermetic bags which are eco-friendly methods of storage pest management. Therefore present study was undertaken to evaluate different storage bags against groundnut bruchid *Caryedon serratus* Olivier.

2. Material and Methods

The study on "Evaluation of different storage bags against *Caryedon serratus* Olivier in stored groundnut" was conducted in department of Entomology, Oilseed Research Station, Latur, Maharashtra, during 2020-21.

Treatment Details

- T1:** Jute gunny bags without bruchid release,
T2: 160 -micron High Density Polyethylene (HDPE) bags without bruchid release,
T3: Purdue Improved Crop Storage (PICS) bags without bruchid release,
T4: Cotton cloth bags without bruchid release,
T5: Plastic fertilizer bags without bruchid release,
T6: Jute gunny bags with bruchid release,
T7: 160-micron High Density Polyethylene (HDPE) bags with bruchid release,
T8: Purdue Improved Crop Storage (PICS) bags with bruchid release,
T9: Cotton cloth bags with bruchid release and
T10: Plastic fertilizer bags with bruchid release

All the above types of bags of 50 Kg capacity were taken and filled with 10 Kg of groundnut pods. Freshly emerged bruchid beetles (one day old) were released into the bags of T6, T7, T8, T9 and T10 @ 5 pairs per bag. Then the bags were closed air tight. These ten treatments were made in four replications to know the effect of different storage bags at monthly interval up to six months storage period. First observation on

per cent pod damage by count, by weight and per cent germination were taken after 60 days of storage and subsequent observation were taken at 30 days interval i.e. Second after 90 days of storage, third after 120 days of storage, fourth after 150 days of storage and fifth after 180 days of storage, respectively to record the data.

3. Results

3.1 Per cent pod damage (by count)

Pod damage (by count method) was found to be significantly increasing in all treatment (bags) during six months of storage period but in PICS bag and HDPE bag without bruchid release observed no significant increase in pod damage. Pod damage was not found in HDPE bag and PICS bag both with and without bruchid release at 60 DAS. Maximum pod damage due to attack by *C. serratus* was observed in jute gunny bag with bruchid release (6.41%) and it was at par with cotton cloth bag with bruchid release (6.33%) and plastic fertilizer bag with bruchid release (6.08%). Jute gunny bag without bruchid release was recorded 1.73% pod damage; however it was on par with cotton cloth bag without bruchid release (1.44) and plastic fertilizer bag without bruchid release (1.23%).

Table 1: Per cent pod damage (by count) caused by *C. serratus* in different storage bags

Sr. No.	Storage bags	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS
T1	Jute gunny bags without bruchid release	1.73 (7.33)	5.42 (13.41)	11.02 (19.37)	22.95 (28.60)	31.75 (34.27)
T2	160-micron High Density Polyethylene (HDPE) bags without bruchid release	0.00 (0.0)	1.01 (5.72)	1.02 (5.79)	4.37 (13.06)	5.08 (13.02)
T3	Purdue Improved Crop Storage (PICS) bags without bruchid release	0.00 (0.0)	0.00 (0.00)	0.74 (4.26)	1.53 (6.99)	4.29 (11.94)
T4	Cotton cloth bags without bruchid release	1.44 (6.79)	4.53 (12.27)	10.26 (18.66)	21.32 (27.49)	30.44 (33.47)
T5	Plastic fertilizer bags without bruchid release	1.23 (6.28)	4.45 (12.15)	9.42 (17.85)	20.51 (26.91)	30.13 (33.27)
T6	Jute gunny bags with bruchid release	6.41 (14.60)	10.41 (18.80)	24.06 (29.36)	38.03 (38.06)	44.14 (41.62)
T7	160-micron High Density Polyethylene (HDPE) bags with bruchid release	0.00 (0.0)	1.58 (7.17)	6.74 (14.98)	9.34 (17.78)	12.10 (20.40)
T8	Purdue Improved Crop Storage (PICS) bags with bruchid release	0.00 (0.0)	1.48 (6.92)	3.73 (11.12)	7.59 (15.96)	8.56 (17.00)
T9	Cotton cloth bags with bruchid release	6.33 (10.65)	10.18 (18.59)	23.05 (28.67)	35.42 (36.50)	43.32 (41.14)
T10	Plastic fertilizer bags with bruchid release	6.08 (10.24)	9.82 (18.25)	22.47 (28.28)	34.15 (35.74)	42.28 (40.54)
	SEm _±	0.61	0.44	0.60	0.52	0.33
	CD(0.05)	1.78	1.27	1.74	1.52	0.97

DAS- Days after storage

Values in parentheses are angular transformed value

Pod damage was not found in PICS bag without bruchid release at 90 DAS. Least pod damage was observed in HDPE bag without bruchid release (1.01%) followed by PICS bag with bruchid release (1.48%) and HDPE bag with bruchid release (1.58%), which were at par with each other. Jute gunny bag without bruchid release recorded 5.42% pod damage, which was at par with cotton cloth bag without bruchid release (4.53%) and plastic fertilizer bag without bruchid release (4.45%). Maximum pod damage was recorded in jute gunny bag with bruchid release (10.41%), which was at par with cotton cloth bag with bruchid release (10.18%) and plastic fertilizer bag with bruchid release (9.82%). Lowest per cent pod damage (0.74%) was recorded in PICS bag without bruchid release at 120 DAS, which was on par with HDPE bag without bruchid release (1.02%).

Significantly maximum pod damage was observed in jute gunny bag with bruchid release (24.06%) at par with cotton cloth bag with bruchid release (23.05%) and plastic fertilizer bag with bruchid release (22.47%). Jute gunny bag without bruchid release recorded 11.02% pod damage followed by cotton cloth bag without bruchid release (10.26%) and plastic fertilizer bag without bruchid release (9.42%), which were at par with each other. PICS bag with bruchid release was recorded 3.73% pod damage and HDPE bag with bruchid release recorded 6.74% pod damage.

Significantly minimum pod damage was found in PICS bag without bruchid release (1.53%) at 150 DAS. Jute gunny bag with bruchid release recorded significantly maximum per cent pod damage (38.03%). HDPE bag without bruchid release recorded 4.37% pod damage. PICS bag and HDPE bag with

bruchid release recorded pod damage 7.59% and 9.34%, respectively. Plastic fertilizer bag without bruchid release recorded 20.51% pod damage and it was at par with cotton cloth bag without bruchid release (21.32%). Jute gunny bag without bruchid release recorded 22.95% pod damage. Plastic fertilizer bag with bruchid release recorded 34.15%, which was at par with cotton cloth bag with bruchid release (35.42%).

The maximum pod damage (44.14%) was found in jute gunny bag with bruchid release at 180 DAS, which was at par with cotton cloth bag with bruchid release (43.32%). Plastic fertilizer bag with bruchid release recorded 42.28% pod damage. Minimum pod damage at 180 DAS was observed in PICS bag without bruchid release (4.29%) followed by HDPE bag without bruchid release (5.08%), which were at par with each other. PICS bag and HDPE bag with bruchid release recorded pod damage 8.56% and 12.10%, respectively. Plastic fertilizer bag without bruchid release recorded 30.13% pod damage. Cotton cloth bag without bruchid release was recorded 30.44% pod damage and it was at par with jute gunny bag without bruchid release (31.75%).

After 180 days of storage period, PICS bag without bruchid release recorded less than 5% pod damage (4.29%) which is significantly different from other types of bags. HDPE bag without bruchid release also recorded low pod damage by count method (5.08%). After 180 days of storage period, jute gunny bag with bruchid release recorded highest per cent of pod damage (44.14%).

The results obtained in the present investigation are coincided with the findings of Njoroge *et al.* (2014) [6]. He recorded lowest grain damage (0.0%) in PICS Bags without insect release, while highest grain damage (73.9%) was recorded in

wooven polypropylene bag with insect release. Ramesh Babu *et al.* (2020) [7] also recorded lowest grain damage (0.0%) in PICS Bags without insect release and highest (70.67%) in jute bags with insect release.

3.2 Per cent pod damage (by weight)

Pod damage (by weight method) was found to be significantly increasing in all treatment (bags) during six months of storage period expect PICS bag and HDPE bag without bruchid release.

Pod damage was not observed in PICS bag and HDPE bag in both with and without bruchid release at 60 DAS. Maximum pod damage caused by *C. serratus* was recorded in jute gunny bag with bruchid release (6.55%), which was at par with cotton cloth bag with bruchid release (6.05%). Plastic fertilizer bag with bruchid release were recorded 5.65% pod damage. Remaining bags such as jute gunny bag, cotton cloth bag and plastic fertilizer bag without bruchid release were recorded pod damage 1.91%, 1.38% and 1.24%, respectively.

Pod damage was not observed in PICS bag without bruchid release at 90 DAS. Next minimum pod damage was found in HDPE bag without bruchid release (0.54%). Significantly maximum pod damage was observed in jute gunny bag with bruchid release (10.86%). PICS bag with bruchid release recorded 1.14% pod damage and which was at par with HDPE bag with bruchid release (1.86%). Plastic fertilizer bag without bruchid release recorded 3.86% pod damage, which was at par with cotton cloth bag without bruchid release (4.11%) and jute gunny bag without bruchid release (4.91%). Cotton cloth bag with bruchid release recorded 9.04% pod damage and it was at par with plastic fertilizer bag with bruchid release (8.73%).

Table 2: Per cent pod damage (by weight) caused by *C. serratus* in different storage bags

Sr. No.	Storage bags	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS
T1	Jute gunny bags without bruchid release	1.91 (7.90)	4.91 (12.76)	10.38(18.77)	21.54 (27.64)	29.82 (33.08)
T2	160-micron High Density Polyethylene (HDPE) bags without bruchid release	0.00 (0.0)	0.54 (4.20)	1.38 (6.62)	4.14 (11.73)	5.32 (13.33)
T3	Purdue Improved Crop Storage (PICS) bags without bruchid release	0.00 (0.0)	0.00 (0.0)	0.98 (5.66)	1.82 (7.72)	4.75 (12.58)
T4	Cotton cloth bags without bruchid release	1.38 (6.65)	4.11 (11.64)	8.71 (17.14)	19.74 (26.37)	28.11 (32.00)
T5	Plastic fertilizer bags without bruchid release	1.24 (6.33)	3.86 (11.28)	8.19 (16.59)	18.68 (25.59)	27.80 (31.80)
T6	Jute gunny bags with bruchid release	6.55 (14.78)	10.86 (19.23)	22.38 (28.22)	36.28 (37.02)	43.43 (41.21)
T7	160-micron High Density Polyethylene (HDPE) bags with bruchid release	0.00 (0.0)	1.86 (7.78)	5.91 (14.04)	8.29 (16.72)	11.48 (19.79)
T8	Purdue Improved Crop Storage (PICS) bags with bruchid release	0.00 (0.0)	1.14 (6.09)	4.31 (11.94)	6.82 (15.12)	8.52 (16.96)
T9	Cotton cloth bags with bruchid release	6.05 (14.22)	9.04 (17.48)	22.19 (28.08)	35.42 (36.51)	41.90 (40.32)
T10	Plastic fertilizer bags with bruchid release	5.65 (13.74)	8.73 (17.16)	21.42 (27.56)	32.54 (34.76)	40.46 (39.48)
	SEm±	0.38	0.45	0.45	0.32	0.31
	CD (0.05)	1.11	1.31	1.31	0.94	0.91

DAS- Days after storage

Values in parentheses are angular transformed value

120 days after storage (DAS), minimum pod damage was found in PICS bag without bruchid release (0.98%) and it was at par with HDPE bag without bruchid release (1.38%). Maximum pod damage caused by *C. serratus* was recorded in jute gunny bag with bruchid release (22.38%), it was at par with cotton cloth bag with bruchid release (22.19%) and

plastic fertilizer bag with bruchid release (21.42%). Jute gunny bag without bruchid release recorded 10.38% pod damage. Cotton cloth bag without bruchid release (8.71%) and plastic fertilizer bag without bruchid release (8.19%) which were on par with each other. HDPE bag and PICS bag with bruchid release recorded pod damage 5.91% and 4.31%,

respectively.

PICS bag without bruchid release recorded significantly minimum pod damage (1.82%) at 150 DAS. Jute gunny bag with bruchid release recorded maximum pod damage (36.28%) on par with cotton cloth bag with bruchid release (35.42%). Plastic fertilizer bag with bruchid release recorded 32.54% pod damage. Jute gunny bag without bruchid release and cotton cloth bag without bruchid release recorded pod damage 21.54% and 19.74%, respectively. Plastic fertilizer bag without bruchid release recorded 18.68% pod damage. HDPE bag and PICS bag with bruchid release recorded pod damage 8.29% and 6.82%, respectively. HDPE bag without bruchid release recorded 4.14% pod damage.

Highest pod damage caused by *C. serratus* was observed in jute gunny bag with bruchid release (43.43%) at 180 DAS. Minimum (4.75%) pod damage was found in PICS bag without bruchid release and it was at par with HDPE bag without bruchid release (5.32%). PICS bag and HDPE bag with bruchid release recorded pod damage 8.52% and 11.48%, respectively. Plastic fertilizer bag without bruchid release recorded 27.80%, which was at par with pod damage cotton cloth bag without bruchid release 28.11%. Jute gunny bag without bruchid release recorded 29.82% pod damage. Plastic fertilizer bag with bruchid release and Cotton cloth bag with bruchid release recorded pod damage 40.46% and 41.90%, respectively.

After 180 days of storage period, PISC bag without bruchid release recorded less than 5% pod damage (i.e. 4.75%) which is significantly different from other types of bags. HDPE bag without bruchid release also recorded low pod damage by weight method (5.32%). After 180 days of storage period, jute gunny bag with bruchid release recorded highest per cent of pod damage (43.43%).

3.3 Per cent germination

Per cent germination of groundnut was found to be significantly decreasing in all treatment (bags) during six months of storage period expect PICS bag and HDPE bag

without bruchid release.

PICS bag and HDPE bag without bruchid release recorded highest per cent germination (99.50% each) at 60 DAS, which were at par with PICS bags with bruchid release (99.25%) and HDPE bags with bruchid release (99.00%). Lowest per cent germination was observed in jute gunny bag with bruchid release (91.75%) and it was at par with cotton cloth bags with bruchid release (92.25%) and plastic fertilizer bags with bruchid release (93.25%). Jute gunny bag without bruchid release was recorded 96.50% germination, it was at par with Plastic fertilizer bags without bruchid release (97.00%) and Cotton cloth bags with bruchid release (97.25%).

90 days after storage (DAS), maximum (98.25%) per cent germination was observed in PICS bag without bruchid release and it at par with PICS bags with bruchid release (97.50%), HDPE bags without bruchid release (97.50%) and HDPE bags with bruchid release (96.00%). Significantly lowest per cent germination was recorded in jute gunny bag with bruchid release (84.75%) at 90 DAS. Plastic fertilizer bag with bruchid release was recorded 88.25% germination, which was at par with Cotton cloth bags with bruchid release (88.50%). Jute gunny bags, plastic fertilizer bags and Cotton cloth bags without bruchid releases were recorded germination 91.25%, 91.25% and 92.00%, respectively, which were at par with each other.

Pod stored in PICS bag without bruchid release recorded 97.50% germination at 120 DAS and it was at par with HDPE bag without bruchid release (95.75%). Pod stored in PICS bags with bruchid release recorded 94.00% germination, which was at par with HDPE bags with bruchid release (91.25%). Plastic fertilizer bags, jute gunny bags and cotton cloth bags without bruchid release were recorded 88.25%, 86.75% and 86.25% germination, respectively, which were at par with each. Lowest germination percentage was recorded in jute gunny bag with bruchid release (73.50%), it was at par with cotton cloth bag with bruchid release (75.25%) and plastic fertilizer bag with bruchid release (76.00%).

Table 3: Germination per cent of groundnut kernels stored in different storage bags

Sr. No.	Storage bags	60 DAS	90 DAS	120 DAS	150 DAS	180 DAS
T1	Jute gunny bags without bruchid release	96.50	91.25	86.75	74.50	65.00
T2	160-micron High Density Polyethylene (HDPE) bags without bruchid release	99.50	97.50	95.75	92.75	92.50
T3	Purdue Improved Crop Storage (PICS) bags without bruchid release	99.50	98.25	97.50	96.25	94.75
T4	Cotton cloth bags without bruchid release	97.25	92.00	86.25	75.00	68.25
T5	Plastic fertilizer bags without bruchid release	97.00	91.25	88.25	77.50	69.75
T6	Jute gunny bags with bruchid release	91.75	84.75	73.50	56.25	50.75
T7	160-micron High Density Polyethylene (HDPE) bags with bruchid release	99.00	96.00	91.25	89.25	84.50
T8	Purdue Improved Crop Storage (PICS) bags with bruchid release	99.25	97.50	94.00	91.75	91.00
T9	Cotton cloth bags with bruchid release	92.25	88.50	75.25	59.75	52.25
T10	Plastic fertilizer bags with bruchid release	93.25	88.25	76.00	62.00	55.25
	SEm+	0.65	1.02	1.17	1.21	1.00
	CD(0.05)	1.89	0.95	3.40	3.32	2.91

DAS- Days after storage

Pod stored in different types of bags showed significant difference in per cent germination at 150 DAS. Maximum (96.25%) per cent germination was observed in PICS bag without bruchid release, it was at par with HDPE bag without bruchid release (92.75%). Significantly the lowest per cent germination was observed in jute gunny bag with bruchid release (56.25%). Cotton cloth bag with bruchid release recorded 59.75% germination and it was at par with plastic fertilizer bag with bruchid release (62.00%). Jute gunny bag without bruchid release recorded 74.50% germination, which

was at par with cotton cloth bag without bruchid release 75.00% and plastic fertilizer bag without bruchid release (77.50%). HDPE bag with bruchid release recorded 89.25% germination and which was at par with PICS bag with bruchid release (91.75%).

Pod stored in different types of bags showed significant difference in per cent germination at 180 DAS. Maximum (94.75%) per cent germination was observed in PICS bag without bruchid release, it was at par with HDPE bag without bruchid release (92.50%). Lowest per cent germination was

recorded in jute gunny bag with bruchid release (50.75%) followed by cotton cloth bag with bruchid release (52.25%), which were at par with each other. Plastic fertilizer bags with bruchid release recorded 55.25% germination. Jute gunny bags without bruchid release recorded 65.00% germination. Cotton cloth bag without bruchid release recorded 68.25% and which was at par with plastic fertilizer bag without bruchid release (69.75%). HDPE bags and PICS bags with bruchid release were recorded 84.50% and 91.00% germination, respectively.

After 180 days of storage period, per cent germination was decreased from 91.75% to 50.75% in jute bag with bruchid release due to damage caused *C. serratus*. Germination percentage was decreased 99.50% to 94.75% in PICS bags without bruchid release, which was significantly higher as compare to other treatment (bags).

The results obtained in the present investigation are coincided with the findings of Njoroge *et al.* (2014) ^[6]. He recorded highest germination percentage (78.1%) in PICS Bags without insect release, while lowest germination percentage (12.7%) was recorded in wooven polypropylene bags with insect release. Ramesh Babu *et al.* (2020) ^[7] also recorded highest germination percentage (90.67%) in PICS Bags without insect release and lowest (18.67%) in jute bags with insect release.

4. Conclusion

PICS bag without bruchid release afforded complete protection to the groundnut pods up to six months of storage period with less damage caused *C. serratus*, while maximum damage was found in jute gunny bag with bruchid release. PICS bag without bruchid release retained the high germination percentage because of low damage caused by *C. serratus*, while low germination percentage was observed in jute gunny bag with bruchid release due to high pod damage caused by *C. serratus*.

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