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Field infestation of certain stored grain insect pests in Guntur district, Andhra Pradesh

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Abstract
A study was conducted to know the extent of field carryover to storage godowns for grain insect pests of rice, blackgram, greengram and groundnut in Guntur district during 2015-16 and 2016-17, that is responsible for initiation of insect pest infestations and serious damage to grains. Among the stored grain insect pests only Angoumois grain moth, *Sitotroga cerealella* was recovered from the field collected paddy grain samples. During 2015-16, 46% of the field collected paddy grain samples were infested with *S. cerealella*, whereas during 2016-17, only 15% of the samples were found with infestation. There was no field infestation of bruchids in pulses and groundnut. Field infestations were influenced by grain moisture, delayed harvesting, proximity to mills and stores, and weather conditions.

Keywords: Field infestation, grain insects, paddy, pulses, groundnut

Introduction
Rice (*Oryza sativa* L.) is the most important food crop grown in almost all agro-climatic zones of Andhra Pradesh state under various cropping systems. Pulses are referred as the second most important food source after cereal grains as they are cheapest and richest source of plant protein in the daily diet of most vegetarian population. Rice–pulses cropping system is more predominant especially in Krishna delta region of Andhra Pradesh [19]. Pulses, mainly blackgram [*Vigna mungo* (L.) Hepper] and greengram [*Vigna radiata* (L.) Wilczek] are grown in upland areas during *kharif* and as rice fallow crop during *rabi* [25]. Groundnut [*Arachis hypogea* (L)] is another important food crop grown in the sandy tracts of coastal Andhra Pradesh. Grains are stored for consumption, seed and trade purposes in various quantities for different lengths of periods. Most of the cases, field carried inoculums are responsible for initiation of insect pest infestations and further multiplication in large numbers in storage godowns result in serious damage to grains. Several researchers recorded pre harvest infestations of grain insects in cereals and pulses [6, 10, 14, 15, 16]. The Angoumois grain moth, *Sitotroga cerealella* (Oliv.) (Lepidoptera: Gelechiidae) infestations of corn can also begin in the field from moths laying eggs before harvest [3]. The cowpea weevil, *Callosobruchus maculatus* (Fab.) (Coleoptera: Chrysomelidae), is the principal field-carryover storage pest of pulses including cowpea, chickpea, green gram, black gram and red gram [12], they multiply at a rapid rate and sometimes cause total destruction of the seeds within six months [23]. Higher numbers of pulse beetles observed in traps during the first two weeks of monitoring were due to population build up in the stored pulses *viz*., bengalgram, redgram, blackgram, and greengram resulted from cross and field infestations [24]. The bruchid, *Caryedon serratus* (Olivier), (Coleoptera: Chrysomelidae) is the most important insect pest that infests both kernels and intact pods of groundnut during storage [20]. It was reported that the carryover of *C. serratus* was from field to storage through seeds of *Acacia nilotica* (L.) which also acts as secondary host for the population build up of *C. serratus* and spreads to its primary host *i.e*., groundnut [22]. Prevention of the pest at entry from field to the store will be highly useful in safe guarding the produce, for which knowledge about the incidence of various stored grain insect pests in the field prior to harvest or before the produce is transported to store houses is an important consideration in developing a pest management programs. Pre-harvest insecticidal sprays were also advocated to prevent carryover of stored grain insect pests like cowpea weevil in pulses [1, 8, 9], Angoumois grain moth and rice weevil in various cereal crops [13, 21]. Keeping this in view, a study was conducted to know the extent of field carryover to storage godowns for grain insect pests of rice, blackgram, greengram and groundnut in Guntur district.

Materials and Methods

Pre-harvest and harvested grain samples of rice, blackgram, greengram and groundnut were collected from the fields of Repalle and Tenali agricultural divisions of Guntur district during 2015-16 and 2016-17 and observed in the laboratory at Post Harvest Technology, Centre, Baptla.

Matured or harvested crop fields were identified and from each identified field, samples of pods or grains (about 250 g) were collected in a plastic container (500 ml capacity) and observed for emergence of adult grain insects in the laboratory after 45 - 60 days. For paddy, only *kharif* crop samples were collected both the years. Paddy grain samples were drawn from both matured standing crop as well as from the sheaves kept for drying in the field. During the first year, pulses samples of matured dry pods were obtained from ready to harvest crops of upland fields (*kharif*) while the second year, the samples were obtained from rice fallows (*rabi*). As groundnut crop is grown round the year with staggered sowings field samples were drawn both during *kharif* and *rabi* seasons of 2015-16 and 2016-17 respectively. Thus, a total of 217 samples (paddy: 97, blackgram: 40, greengram: 20, groundnut: 60) were collected during the two years and observed for adult emergence. After identifying the insects, data on numbers of samples infested and numbers of adults per sample were recorded and percentage of infested samples was worked out.

Results and Discussion

Among the stored grain insect pests only Angoumois grain moth, *S. cerealella* was recovered from the field collected paddy grain samples. During 2015-16, 46% of the field collected paddy grain samples were found to be infested with *S. cerealella*, whereas during 2016-17, only 15% of the samples were found with infestation (Table 1). From blackgram and greengram samples collected during both the seasons, no field infestation of pulse bruchid was observed. Similarly, the emergence of *C. serratus* adults was not found in any of the field collected samples indicating that there was no field infestation of groundnut bruchid while drying of pods on threshing floor in fields.

Field infestation of *S. cerealella* was found higher (50%) in paddy grain samples collected from the harvested and kept as sheaves in the field for drying compared to those samples collected from ready to harvest ripened standing paddy crop (28.57%) during *kharif*, 2015-16 (Table 2). The mean number of insects emerged from paddy grain after 45 days of sample collection was also higher (13.8) in sheave samples compared to standing crop samples (4.5). In contrast, *S. cerealella* infestation was found higher (30%) in paddy grain samples collected from ripened standing crop compared to the samples collected from sheaves (7.50%) during *kharif* 2016-17. However, the mean number of insects emerged from paddy grain after 60 days was also higher in both the samples collected from sheaves and standing crop (85.67 and 85.0, respectively).

The findings corroborate the observations of earlier workers with respect to grain infesters of various crops [4, 17, 18]. At the early stage of ripening, maize is attacked by *S. oryzae* in standing crop before harvest itself and carried over to stores as potential source of initiation of population build-up during storage [7]. As in this study, Trematerra (2015) [27] observed various levels of infestation by *S. cerealella* in the wheat fields. Normally, the *kharif* paddy crop in this area comes to harvest during the second fortnight of November and takes a month or so to complete in the entire region. Because of the untimely rains during second and third weeks of November, 2015 and rains due to 'Waarda' cyclone during second week of December, 2016; in several places paddy harvesting was postponed though the crop was already ripened. In some cases, paddy crop which was already cut and left as sheaves for drying had to be kept for extended period in the field as they were drenched in rains. This pushed the harvesting dates by at least a week and delayed all other post harvest operations in the field. Longer the period of stay of ripened crop in the field, more it is prone to the pest infestations. Adults of *S. cerealella* are strong fliers and known to have preferences to some kernel characteristics in the selection of its host for feeding, oviposition and sex communication. The males and females respond to kernel volatiles such as n-nonanal, n-decanal and geranyl acetone [5]. This may be true particularly moist grain when left in the field for extended periods of drying predispose them to *S. cerealella* activity as observed during the study period. Large populations of *S. cerealella* can build up if crop is left in the field to dry [2]. The population of weevil in stored maize was directly proportional to the length of time that maize left in the field before harvest. Late harvest of maize considerably increased the infestation [11].

It was also observed that there were traditional rice mills in the rural villages of surveyed area where the activity of grain handling in bulk quantities is being carried out round the year. Most of them are not big enough with sufficient storage facilities and finding scientific grain preservation is a rarity. Often the paddy grain bags to be milled are heaped outside or in the premises of the mill with or without a proper cover. The rough rice does not receive much care and protection as the milled rice which is stored in special packing for marketing. Thus infested paddy grain at mills contributes for the field infestation of gain insect pests. True to this, the highest numbers of moths trapped in wheat fields wherein the same area many traditional warehouses of different cereal species were present suggested adult migration of the Angoumois grain moth from stored cereals [26]. Adults were captured in fields located at 0.9 km and also in a forest about 5 km away from a known source of infestation at storage facilities [26]. Thus, the field infestations were influenced by grain moisture, delayed harvesting, proximity to mills and stores, and weather conditions prevailed during the period of harvesting and drying in the fields. As stated by Trematerra (2015) [27], the attractiveness of volatile substances produced by host plants in the environment, wind speed and direction can also influence the dynamics of grain insects' dispersion from the warehouse to the cultivated fields. Therefore, these horizontal infestations in the field produce should be removed before storage by solar drying to kill the egg stages of the insects, dried to safe moisture level and while storage appropriate treatments of chemical protectants or fumigants can be used to prevent further cross infestations. The information generated in this study may be useful in developing integrated pest management strategies for stored product insect pests.

Table 1: Field incidence of certain stored grain insect pests in Guntur district

Crop	Season	Period of sample collection	Samples collected (No.)	Infested samples (No.)	Field infestation (%)
Paddy	*Kharif*, 2015-16	1st week of December	37	17	46
Paddy	*Kharif*, 2016-17	2nd to 3rd week of December	60	9	15
Blackgram	*Kharif*, 2015-16	1st week of December	10	0	0
Blackgram	*Rabi*, 2016-17	1st to 3rd week of March	30	0	0
Greengram	*Kharif*, 2015-16	1st week of December	10	0	0
Greengram	*Rabi*, 2016-17	1st to 3rd week of March	10	0	0
Groundnut	*Kharif*, 2015-16	4th week of August to 1st week of September	30	0	0
Groundnut	*Rabi*, 2016-17	2nd week of March to 2nd week of April	30	0	0

Table 2: Field incidence of Angoumois grain moth, *S. cerealella* in paddy

Crop stage	Samples collected (No.)	Infested samples (No.)	Range	Mean no. of insects
Kharif, 2015-16				
Sheave	30	15	1 to 77	13.8
Pre-harvest	7	2	4 to 5	4.5
Kharif, 2016-17				
Sheave	40	3	77 to 102	85.67
Pre-harvest	20	6	5 to 192	85.00

Conclusion

Field infestation of paddy grains by *S. cerealella* was found higher in samples collected from the harvested and kept in the field for drying compared to those samples collected from the crop at pre-harvest stage. However, non observance of field infestations of pulse bruchid and groundnut bruchid does not necessarily mean the absence of their field activity. Since the harvested produces of these crops are not being handled to the extent of rice bulks, also frequent insecticidal sprays to whatever quantities stored, might be reasons that store to field infestations could not be traced out in case of pulses and groundnut crops. Moreover field infestations are often too low to detect at harvest, but they are capable of causing complete damage to the produce after storage for a reasonable period. Hence, detection and removal of field infestation from the grains are important control measures for longer and safe storage.

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References

1. Borikar PS, Pawar VM. Effect of insecticidal application on field infestation and carryover of *Callosobruchus chinensis* (L.). Agricultural Science Digest, 1998; 18:271-273.
2. CABI. *Sitotroga cerealella*. In: Crop protection compendium, CAB International, Wallingford, UK. 2004. [online] URL: http://www.cabi.org/isc/datasheet/50238.
3. Campbell JF, Arthur FH, Mullen MA. Insect management in food processing facilities. Advances in Food and Nutrition Research. 2004; 48:239-295.
4. Cogburn RR, Vick KW. Distribution of Angoumois grain moth, Almond moth, and Indian meal moth in rice fields and rice storages in Texas as indicated by pheromone-baited adhesive traps. Environmental Entomology. 1981; 10(6):1003-1007.
5. Fouad HA, D'Antonino F, Vilela EF, DeLimae R. Flight responses of *Sitotroga cerealella* (Lepidoptera: Gelechiidae) to corn kernel volatiles in a wind tunnel. Arthropod Plant Interactions. 2013; 7:651-658.
6. Hagstrum DW. Pre harvest infestation of cowpeas by the cowpea weevil (Coleoptera: Bruchidae) and population trends during storage in Florida. Journal of Economic Entomology. 1985; 78:358-361.
7. Haines CP. Insects and arachnids of tropical stored products: Their biology and identification. Chatham: NRI, 1991.
8. Jayaraj J, Srinivasan G, Shanthi M. Pre-harvest and storage treatment of botanicals on *Callosobruchus chinensis* (L.) in black gram. Indian Journal of Entomology. 2019; 81(4):727-729.
9. Kabeh JD. Harvest time modification, neem seed products and pirimiphos-methyl as methods of reducing field infestation of cowpeas by storage bruchids in the Nigerian Guinea Savannah. International Journal of Agricultural Research. 2007; 2:870-876.
10. Khadim K, Sembene M. Cowpea (*Vigna unguiculata* (L.) Walp) field infestation by the bruchids (Coleoptera: Bruchidae) in the northern Senegal: preliminary biological and ecological data. Journal of Applied Biosciences. 2011; 41:2788-2796.
11. Lakshmi Soujanya P, Sekhar JC, Chikkappa GK, Vidhyadhari V, Suby SB, Sunil N *et al*. Impact of harvesting time on field carry over infestation of *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) in different maize genotypes. Phytoparasitica. 2017; 45:485-499.
12. Loganathan M, Jayas DS, Fields PG, White NDG. Low and high temperatures for the control of cowpea beetle, *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) in chickpeas. Journal of Stored Products Research. 2011; 47:244-248.
13. Longiswaran G, Venugopal MS. Efficacy of neem oil, insecticides and their combinations on pre-harvest infestation by rice Angoumois grain moth, *Sitotroga cerealella* Oliv. Pesticide Research Journal, 1994; 6:98-99.
14. Mohan S, Subba Rao PV. Field record of *Callosobruchus chinensis* L. infesting black gram, *Vigna mungo* (L.)

Hepper and green gram, *Vigna radiata* (L.) Wilczek in Tamil Nadu. Bulletin of Grain Technology. 2000; 33:73-74.
15. Muthukumar M, Ragumoorthi KN. Impact of different maize cultivars on pre harvest infestation by *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelechiidae). International Journal of Entomological Research. 2015; 3:47-54.
16. Paul UV, Hilbeck A, Edwards PJ. Pre-harvest infestation of beans (*Phaseolus vulgaris* L.) by *Acanthoscelides obtectus* Say (Coleoptera: Bruchidae) in relation to bean pod maturity and pod aperture. International Journal of Pest Management. 2010; 56:41-50.
17. Perez MJ, Weaver DK, Throne JE. Development and survivorship of immature Angoumois grain moth (Lepidoptera: Gelechiidae) on corn. Environmental Entomology. 2004; 33:807-814.
18. Prakash MA, Chhillar BS, Kashyap RK. Studies on the biology of Angoumois grain moth, *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelechiidae) on wheat varieties. Indian Journal of Entomology. 2004; 66:264-266.
19. Radha Krishna Y, Swamy SVSG, Ramana MV. Influence of plant densities and nitrogen levels on yield of transplanted rice. The Andhra Agricultural Journal. 2015; 62(2):384-387.
20. Rekha G, Swamy SVSG, Sandhyarani Ch, Prasanna Kumari V. Physical tolerance of groundnut pods of certain genotypes to *Caryedon serratus* (Olivier). The Andhra Agricultural Journal. 2017; 64(2):406-409.
21. Sharma RK. Preharvest spray for the control of *Sitotroga cerealella* (Oliv.) and *Sitophilus oryzae* (Linn.) in stored maize. Indian Journal of Entomology, 1995; 57:157-158.
22. Singal K, Toky OP. Carryover of bruchid, *Caryedon serratus* (Olivier) (Coleoptera) from field to stores through seeds of *Acacia nilotica* (L.) Willd. in India. Tropical Pest Management, 1990; 36(1):66-67.
23. Srinivasan T, Duraimurugan P, Singh SK, Chattopadhyay C. Bruchids infestation in pulses and its management. Indian Farming, 2010; 60:13-16.
24. Swamy SVSG, Suneel Kumar GV. Management of bruchid, *Callosobruchus maculatus* Fab. through monitoring and chemical interventions in stored pulses. The Andhra Agricultural Journal, 2018; 65(4):885-889.
25. Swamy SVSG, Ramana MV, Radha Krishna Y. Evaluation of mungbean varieties against legume pod borer incidence, yellow mosaic and powdery mildew diseases under rice fallows. The Andhra Agricultural Journal, 2013; 60(2):366-368.
26. Trematerra P, Gentile P. Insect pests in hulled wheat warehouses of central-southern Italy and field occurrence of *Sitotroga cerealella* (Olivier), In: Proceedings of 8th International working conference on stored-product protection, 22-26 July, York, UK. 2002, 288-292.
27. Trematerra P. Adult dispersal of *Sitotroga cerealella* in a conventional small-farm in Southern Italy. Bulletin of Insectology. 2015; 68(1):111-118.