



A short term study on insects associated with cluster beans crop in an agro-ecosystem at Jhunjhunu district of Rajasthan

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Abstract

The **Guar** or **cluster beans** (*Cyamopsis tetragonoloba*) is an annual legume and the source of guar gum. This legume is a very valuable plant within a crop rotation cycle, as it lives in symbiosis with nitrogen-fixing bacteria. In fact, agriculturists in semi-arid regions of Rajasthan follow crop rotation and use Guar as a source to replenish the soil with essential fertilizers and nitrogen fixation before the next crop. About 80% of world production occurs in India and 70 per cent in Rajasthan. The present study was undertaken to survey the insect fauna associated with this crop in an agro-ecosystem situated in the Indian desert in Jhunjhunu district of western Rajasthan. The insect visitors were surveyed and collected every week from July to October. Cage net was used for insect collection. In all, 51 insect species belonging to 7 orders and 27 families were collected from the crop of which 6 were dominant, 25 were frequent and 20 were rare forms. Maximum density as well as diversity of entomo-fauna was noted in the month of July while October was the month which had minimum density and diversity of insects.

Key words: Insects, diversity, density, cluster beans, agro-ecosystem.

Introduction

India has an agriculture based economy. The task of farmers is to maintain the natural balance among elements in the agro-ecosystem, ensuring a good environment for the crop to grow well. Field observation is the key to make appropriate crop cultivation decisions. By observing the field and its surrounding environment thoroughly and regularly, farmers will know exactly what the conditions in the field are like. Hence, they do not have to be afraid of any unexpected problems, such as a pest outbreak or drought.

Arid zone of Rajasthan which covers 60% area of total Indian desert has the most serious problem of food production and plant protection directly or indirectly associated with it. Both our government and public in general are equally interested in meeting this problem successfully. In recent years, the losses caused by insect pests to the crops are high. The arid zone crops are the potential hosts of several insect species and some of them are at the pest status minimizing the yield.

The **Guar** or **cluster bean** (*Cyamopsis tetragonoloba*) is an annual legume and the source of guar gum. It grows well in arid to semiarid areas, but frequent rainfall is necessary. This legume is a very valuable plant within a crop rotation cycle, as it lives in symbiosis with nitrogen-fixing bacteria. In fact, agriculturists in semi-arid regions of Rajasthan follow crop rotation and use Guar as a source to replenish the soil with essential fertilizers and nitrogen fixation before the next crop. Guar as a plant has a multitude of different functions for human and animal nutrition but its gelling agent containing seeds (guar gum) are today the most important use. Cluster bean are used as a vegetable for human consumption and also grown for cattle feed and as a green manure crop. Being leguminous crop, it is also a good source of Ca, Fe and vitamins. Cluster bean is attacked by different insect pests at various growth stages of the crop and cumulatively it causes heavy losses in yield. Demand is rising rapidly due to industrial use of guar gum in hydraulic fracturing (oil shale gas). About 80% of world production occurs in India and 70 percent in Rajasthan. The present study was undertaken to survey the insect fauna associated with this crop in an agro-ecosystem situated in the Indian desert in Jhunjhunu district of western Rajasthan.

Materials and method

The study area

The state of Rajasthan, the land with vivid topographical features and cultures, is the largest state of Indian republic occupying an area of 3,42,239 sq km.. Geographically, it is located between 23°3'-30°12' N and 69°30'-78°17' E. The state is divided into two unequal parts, the north-west 3/5th part constitutes a major portion of Indian desert having arid and semi-arid landscapes, while the eastern 2/5th part consist of fertile plains. The study area under study falls in the Indian desert in Jhunjhunu district situated in western Rajasthan. Jhunjhunu is located at 28°08'N&75°24' E and 28.13°N&75.4°E. The agro-ecosystem in the form of crop fields studied lies about 5km away from the city of Jhunjhunu, covering an area of 1000 x 500

m.

Methodology

The study concentrated on documenting the diversity and density of insect visitors to cluster beans crop cultivated in the crop field employing an indigenously designed cage of size 1mx1mx1m of nylon mesh for insect collection which has earlier been used by Saigal (2002). The cage covered the 1m³ volume while holding the crop inside. The fauna trapped within the cage was mechanically picked up. Using cage the insects were collected between 7A.M to 11A.M, and again in the afternoon from 4 P.M. to 6 P.M. The insect visitors were surveyed and collected every week from July to October.

The insects collected by the above method were transferred to killing bottles, killed and preserved. The fauna were sorted out and identified following pertinent literature, help from the Section of Entomology, Department of Agriculture, Bikaner and Desert regional Station of the Zoological Survey of India, Jodhpur was also taken for identification and for confirmation. Besides, the reference collection in the Department of Zoology, Dungar College was consulted. The count of insect fauna collected using cage was averaged for each month and expressed as no/m³ or number/trap.

For the study, the field area was divided into five stations. The insects collected by the above method were transferred to killing bottles, killed and preserved. The fauna were sorted out and help from the Section of Entomology, Department of Agriculture, Bikaner and Desert regional Station of the Zoological Survey of India, Jodhpur was also taken for identification and for confirmation. Besides, the reference collection in the Department of Zoology, Dungar College was also consulted.

Results and Discussion

The entomo-fauna collected from the crop of cluster beans has been presented in Table 1.

In all, 51 insect species belonging to 7 orders and 27 families were collected from the crop of which 6 were dominant, 25 were frequent and 20 were rare forms. Maximum density as well as diversity of entomo-fauna was noted in the month of July while October was the month which had minimum density and diversity of insects.

Of the ten coleopteran species documented, two (*A. ferruginea* and *C. pictus*) were dominant, seven (*A. bengalensis*, *O. bonasus*, *Adoretus* sp., *Ochodeus* sp., *P. nasutus*, *Cicindella* sp. and *Mylocherus* sp.) were frequent and only one (*Melanotus* sp.) as a rare form. Further, *A. bengalensis*, *Ochodeus* sp., *P. nasutus*, *A. ferruginea*, *C. pictus* and *Mylocherus* sp. were noted throughout the cropping period.

Among sixteen lepidopteran insects documented *L. boeticus* was dominant, eleven (*C. vestalis*, *C. fieldii*, *E. insulana*, *M. separata*, *T. orichalcea*, *A. ipsilon*, *C. chalcites*, *H. recurvalis* *C. pomona* and *Tephрина* sp.) were frequent and five (*C. pomona*, *D. chrysippus*, *S. exigua*, *H. peltigera*, *E. zinckenella* and *U. pulchella*) were rare forms. The lepidopterans which were always noted on this crop were *C. vestalis*, *E. hecabe*, *L.*

boeticus, *M. separata*, *T. orichalcea*, *A. epsilon*, *C. chalcities*, *H. recurvalis*, *E. zinckenella* and *Tephрина* sp.

Of the six hemipterans, one (*Piezodorus* sp.) was observed as frequent and the other five viz., *N. viridula*, *B. hilaris*, *A. janus*, *D. cingulatus* and *Clavigrella* sp. were rare forms. Only one *Clavigrella* sp. was regularly observed on the crop. Eight hymenopterans were noted on the crop, of which four (*A. dorsata*, *A. florea*, *D. affinis* and *Formica* sp.) were frequent and four (*A. cerana*, *A. mellifera*, *S. brunneum* and *E. farternus*) were rare forms. Further, *A. cerana*, *A. mellifera*, *A. dorsata*, *A. florea*, *D. affinis*, *Formica* sp. and *E. fraternus* were noted as regular visitors of the crop. Only three dipterans were reckoned on the crop of which, *M. domestica* and *C. quinquefasciatus* were dominant while, *M. nibe* as a rare form. Further, *M. domestica* and *C. quinquefasciatus* were always noted on this crop.

Among six orthopteran species documented, one (*Chrotogonus* sp.) was dominant, two (*A. domesticus* and *Gryllus assimilis*) were frequent and three (*Ochrilidia* sp., *O. chinensis* and *Eucenocephalus* sp.) were rare. The orthopterans which were always noted on the crop were *Chrotogonus* sp., *Ochrilidia* sp., *O. chinensis*, *A. domesticus* and *G. assimilis*. Only two odonates *P. flavescens* and *A. femina* were documented as rare forms.

Roonwal (1982) found aphids to attack beans and other vegetables. *Acherontia styx* minor pest of beans (Butani & Jotwani, 1984; David, 2001). Free (1993) noted various bees on cluster beans. The regular insect pests which occurred during kharif season were the green jassid *Amrasca kerri*, semi-looper *Plusia orichalcea*, whitefly *Bemisia tabaci*, leafminer *Acrocercops phaeospora*, coreid bug *Cletus*, green stink bug *Nezara viridula*, flower beetle *Mylabris pustulata* and green pod borer *Maruca testulalis*. The sporadic insect pest found during kharif season were the galerucid beetle *Madurasia obscurella*, surface grasshopper *Chrotogonus trachypterus*, Bihar hairy caterpillar *Spilosoma obliqua*, green slender bug *Creontiades pallidifer*. The stray insects recorded during kharif were aphid *Aphis craccivora*, grasshopper *Oxya velox*, grey weevil *Myllocerus undecimpustulatus*, black beetle *Cyrtosoma cognata*, painted bug *Bagrada hilaris*, red pumpkin beetle *Raphidopalpa foveicollis*, red cotton bug *Dysdercus koenigii*, pod weevil *Apion* sp. and pulse beetle *Callosobruchus chinensis*. The regular insect pests which occurred during summer were the green jassid and leafminer, the sporadic pests were galerucid beetle, aphid, grasshopper, green slender bug, coreid bug, green stink bug and the stray insects recorded were painted bug and pulse beetle.

Earlier, Bhardwaj et al. (2014) recorded insect visitors to inflorescence of coriander in an agro-ecosystem, while, Bhardwaj & Srivastava (2012) documented insects on cucurbit crops and reported various insect orders on them. Sima et al. (2014) in another study noted floral visitors on different crops from desert region, while, Bhardwaj et al. (2012) documented hymenopteran floral visitors. Similarly, entomo-fauna associated with Bajra crop have been documented by Sima & Srivastava (2012). A survey has also been conducted to compare the insect fauna collected employing two different methods of collection (Sima &

Srivastava, 2014).

Sardana (1986) found that cowpea is attacked by several insect pests at different stages of crop growth. He recorded galerucid beetle *Madurasia obscurella* Jacoby, green jassid *Amrasca kerri* Pruthi, semilooper *Plusia orichalea* Fabr, leafminer *Acrocercops phaeospora* Meys, flower beetle *Mylabris testulalis* Geyer as major pests while aphid *Aphis carccivora* Kuch.; whitefly *Bemisia tabaci* Genn., surface grasshopper *Chrotogonous trachypterus* Bla., white grub *Holotrichia consaguinea* Bla., Bihar hairy caterpillar *Spilosoma obliqua* Wlk. and green stink bug *Nezara viridula* as minor pests and red pumpkin beetle *Raphidopalpa pericollis* Luc., black beetle *Crytozemis cognata* Marsh., gundhi bug *Leptocorisa acuta* Jhun., red cotton bug *Dysdercus koenigii* Wlk., painted bug *Bagrada hilaris*, pulse beetle *Callobruchus chinensis* F. as stray insects. Mathur & Singh (1986) recorded *Aphis craccivora*, *Achrythosiphon kondoi*, *Aphis gossypii*, *Hydaphis corinadri* and *Rhapalosiphum maidis* infesting clusterbean. According to Nayar *et al.* (1998) the pests attacking cluster bean include *Aphis craccivora*, *Bemisia tabaci*, *Coptosoma cribraria*, *C. nazirac*, *Cyclopelta siccifolia*, *Megaleurothrips usitatus*, *Asphondylia* sp. *Alcidodes bubo*, *Blosyrus inaqualis*, *Myllocerus maculosus*, *Cyrtozenia caquata* and *C. dispar*. All these are in conformation with the present findings suggesting that many insects are associated with the cluster beans crop depending upon the time, age of the crop and area of cultivation.

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Table 1. Entomo-faunal diversity and density (number) on cluster beans crop during the period of study

	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	STATUS
Order: Coleoptera										
Family: Scarabaeidae										
<i>Anomala bengalensis</i>	-	-	-	-	7	11	5	8	-	F
<i>Onthophagus bonasus</i>	-	-	-	-	31	23	3	-	-	F
<i>Adoretus</i> sp.	-	-	-	-	17	5	3	-	-	F
<i>Ochodeus</i> sp.	-	-	-	-	19	11	9	6	-	F
<i>Peltonotus nasutus</i>	-	-	-	-	21	19	7	4	-	F
<i>Apogonia ferruginea</i>	-	-	-	-	57	48	44	22	-	D
Family: Curculionidae										
<i>Myllocerus</i> sp.	-	-	-	-	19	9	8	5	-	F
Family: Cicindelidae										
<i>Cicindella</i> sp.	-	-	-	-	49	31	13	-	-	F
Family: Elateridae										
<i>Melanotus</i> sp.	-	-	-	-	7	3	-	-	-	R
Family : Meloidae										
<i>Cylindrothorax pictus</i>	-	-	-	-	41	25	29	30	-	D
Order: Lepidoptera										
Family: Pieridae										
<i>Catopsila pomona</i>	-	-	-	-	19	8	9	2	-	F
<i>Colotis vestalis</i>	-	-	-	-	22	20	18	-	-	F
<i>Colias fieldii</i>	-	-	-	-	30	19	11	7	-	F
Family: Lycaenidae										
<i>Lampides boeticus</i>	-	-	-	-	69	51	14	10	-	D
Family: Danaidae										
<i>Danaus chrysippus</i>	-	-	-	-	10	8	-	-	-	R
Family: Noctuidae										
<i>Earias insulana</i>	-	-	-	-	9	7	4	-	-	F
<i>Mythimna separata</i>	-	-	-	-	24	26	11	15	-	F
<i>Agrotis ipsilon</i>	-	-	-	-	31	29	14	11	-	F
<i>Chrysodeixis chalcites</i>	-	-	-	-	17	23	9	16	-	F

	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	STATUS
<i>Thysanoplusia orichalcea</i>	-	-	-	-	36	31	21	3	-	F
<i>Heliiothis peltigera</i>	-	-	-	-	27	14	-	-	-	F
<i>Spodoptera exigua</i>	-	-	-	-	8	-	-	-	-	R
Family: Crambidae										
<i>Hymenia recurvalis</i>	-	-	-	-	28	11	9	3	-	F
Family: Pyralidae										
<i>Etiella zinckenella</i>	-	-	-	-	6	3	2	3	-	R
Family: Arctidae										
<i>Utethesia pulchella</i>	-	-	-	-	9	3	3	-	-	R
Family: Geometridae										
<i>Tephrina sp.</i>	-	-	-	-	39	23	17	18	-	F
Order: Hemiptera										
Family: Pentatomidae										
<i>Nezara viridula</i>	-	-	-	-	4	2	-	-	-	R
<i>Bagrada hilaris</i>	-	-	-	-	5	4	2	-	-	R
<i>Aspongopus janus</i>	-	-	-	-	2	-	-	-	-	R
<i>Piezodorus sp.</i>	-	-	-	-	25	11	9	-	-	F
Family: Pyrrhocoridae										
<i>Dysdercus cingulatus</i>	-	-	-	-	7	2	-	-	-	R
Family : Coreidae										
<i>Clavigrella sp.</i>	-	-	-	-	4	2	2	2	-	R
Order: Hymenoptera										
Family: Apidae										
<i>Apis cerana Fab.</i>	-	-	-	-	6	1	4	3	-	R
<i>Apis mellifera</i>	-	-	-	-	5	3	2	5	-	R
<i>Apis dorsata</i>	-	-	-	-	20	4	5	11	-	F
<i>Apis florea</i>	-	-	-	-	17	5	6	16	-	F
Family: Formicidae										
<i>Dolichoderus affinis</i>	-	-	-	-	2	4	5	6	-	F
<i>Formica sp.</i>	-	-	-	-	15	6	7	8	-	F
Family: Vespidae										
<i>Eumenes fraternus</i>	-	-	-	-	3	3	2	1	-	R
Family: Sphecidae										

	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	STATUS
<i>Sceliphron brunneum</i>	-	-	-	-	-	-	2	1	-	R
Order: Diptera										
Family: Muscidae										
<i>Musca nibulo</i>	-	-	-	-	2	-	-	-	-	R
<i>Musca domestica</i>	-	-	-	-	24	28	32	29	-	D
Family: Culicidae										
<i>Culex quinquefasciatus</i>	-	-	-	-	29	39	33	16	-	D
Order: Orthoptera										
Family: Acrididae										
<i>Chrotogonus sp.</i>	-	-	-	-	37	41	20	10	-	D
<i>Ochrilidia sp.</i>	-	-	-	-	1	2	2	1	-	R
<i>Oxya chinensis</i>	-	-	-	-	2	4	3	1	-	R
Family: Tettigoniidae										
<i>Eucenocephalus sp.</i>	-	-	-	-	1	2	3	2	-	R
Family: Gryllidae										
<i>Acheta domesticus</i>	-	-	-	-	11	14	17	20	-	F
<i>Gryllus assimilis</i>	-	-	-	-	7	9	8	1	-	F
Order: Odonata										
Family: Libellulidae										
<i>Pantala flavescens</i>	-	-	-	-	-	-	11	4	-	R
Family: Coenagrionidae										
<i>Agriocnemis femina</i>	-	-	-	-	6	3	2	-	-	R

D-Dominant, F-Frequent, R-Rare

D>100 100>F>16 R□16