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Research Article

Insects Associated with *Sorghum* Crop: A Short Term Study in an Agro-Ecosystem at Jhunjhunu District of Rajasthan

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Abstract

Sorghum bicolor, commonly called *Sorghum* and also known as jowar, or milo, is a grass species cultivated for its grain, which is used for food for humans, animal feed, and ethanol production. It is cultivated widely in tropical and subtropical regions. *Sorghum* is the world's fifth-most important cereal crop after rice, wheat, maize, and barley. In India, where it is commonly called jwaarie, jowar, jola, or jondhalaa, Sorghum is one of the staple sources of nutrition in Rajasthan and the Deccan plateau region in states of Maharashtra, Karnataka and Telangana.

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 study concentrated on documenting the diversity and density of insect visitors to *Sorghum* crop cultivated in the crop field employing an indigenously designed cage. The insect visitors were surveyed and collected every week from April to June. In all, 39 insect species belonging to 6 orders and 21 families were collected from the crop of which none were dominant, 15 were frequent and 24 were rare forms. Maximum diversity and density of entomo-fauna was found in the month of June, while the minimum density and diversity was noted in the month of April.

Keywords: *Insects; Diversity; Density; Sorghum; 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.

Sorghum bicolor, commonly called *Sorghum* and also known as jowar, or milo, is a grass species cultivated for its grain, which is used for food for humans, animal feed and ethanol production. It is cultivated widely in tropical and subtropical regions. *Sorghum* is the world's fifth-most important cereal crop after rice, wheat, maize and barley. In many parts of Asia and Africa, *Sorghum* grain is used to make

flat breads that form the staple food of many cultures. The grains can also be popped in a fashion similar to popcorn. *Sorghum* is one of a number of grains used as wheat substitutes in gluten-free recipes and products. In India, where it is commonly called jwaarie, jowar, jola, or jondhalaa, *Sorghum* is one of the staple sources of nutrition in Rajasthan and the Deccan plateau region in states of Maharashtra, Karnataka, and Telangana. It has 74.63g of carbohydrate, 6.3g of dietary fiber, 3.30g of fat and 11.30g of protein content per 100g of grain and of 339 kcal.

In Australia, South America, and the United States, *Sorghum* grain is used primarily for livestock feed and in a growing number of ethanol plants. In some countries, sweet *Sorghum* stalks are used for producing biofuel by squeezing the juice and then fermenting it into ethanol.

It has five features that make it one of the most drought-resistant crops:

- It has a very large root-to-leaf surface area ratio.
- In times of drought, it rolls its leaves to lessen water loss by transpiration.
- If drought continues, it goes into dormancy rather than dying.
- Its leaves are protected by a waxy cuticle.
- It uses C4 carbon fixation thus using only a third the amount of water that C3 plants require.

Aim of the Study

The present study was undertaken to survey the insect fauna associated with this crop in an agro-ecosystem to document the diversity and density of the entomo-fauna.

Materials and Methods

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 $3/5^{th}$ part constitutes a major portion of Indian desert having arid and semi-arid landscapes, while the eastern $2/5^{th}$ part consist of fertile plains. The study area under study falls in the Indian desert in Jhujhunu district situated in western Rajasthan located at 28°08'N and 75°24' E and 28.13°N and 75.4°E. The agro-ecosystem in the form of crop fields studied lies about 5 km away from the city of Jhunjhunu, covering an area of 1000 x 500m.

Methodology

The study concentrated on documenting the diversity and density of insect visitors to *Sorghum* crop cultivated in the crop field employing an indigenously designed cage of size 1m x 1m x 1m of nylon mesh for insect collection which has earlier been used by Saigal [1]. The cage covered the $1m^3$ volume while holding the crop inside. The fauna trapped within the cage was mechanically picked up. Using cage the insects were collected between 7 A.M to 11 A.M and again in the afternoon from 4 P.M. to 6 P.M. The insect visitors were surveyed and collected every week from April to June.

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/m^3 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 *Sorghum* during the survey period has been presented in table 1.

	Apr	May	Jun	Status
Order: Coleoptera				
Family: Scarabaeidae				
Anomala bengalensis	7	8	10	F
Onthophagus bonasus	3	4	4	R
Peltonotus nasutus	5	11	9	F
Apogonia ferruginea	15	13	18	F
Family: Coccinellidae				
Coccinella septempunctata	2	1	-	R
Menochilus sexmaculatus	5	5	-	R
Family: Curculionidae				
Myllocerus sp.	20	17	14	F
Hypolixus truncatulus	9	11	11	F
Family: Meloidae				
Cylindrothorax pictus	2	5	4	R
Order: Lepidoptera				
Family: Pieridae				
Colias fieldi Menetries	2	3	3	R
Eurema hecabe	-	-	1	R
Family: Danaidae				
Danaus chryssipus	3	4	4	R
Family: Crambidae				
Hymenia recurvalis	10	11	14	F
Cnaphalocrocis medinalis	4	6	4	R
Family: Noctuidae				
Earias insulana	4	6	5	R
Mythimna separata	1	4	5	R

Agrotis ipsilon	7	9	6	F
Thysanoplusia orichalcea	11	14	16	F
Heliothis peltigera	6	7	8	F
Family: Pyralidae				
Sphenarches caffer	-	-	1	R
Scirpophaga nivella	-	1	-	R
Etiella zinckenella	-	4	-	R
Family: Arctidae				
Utethesia pulchella	4	5	1	R
Family: Geometridae				
Tephrina sp.	10	11	10	F
Order: Hemiptera				
Family: Pentatomidae				
Nezara viridula	-	4	6	R
Family: Pyrrhocoridae				
Dysdercus cingulatus	-	5	5	R
Order: Hymenoptera				
Family: Apidae				
Xylocopa violacea	1	5	13	F
Apis florea	8	10	30	F
Family: Formicidae				
Dolichoderus affinis	5	4	6	R
Formica sp.	2	1	1	R
Family: Vespidae				
Polistes sp.	2	3	-	R
Unidentified species A	2	4	4	R
Order: Diptera				
Family: Muscidae				
Musca domestica	-	2	3	R
Family: Asilidae				
Stichopogon sp.	-	5	5	R
Family: Culicidae				
Culex quinquefasciatus	6	4	4	R
Order: Orthoptera				
Family: Acrididae				
Chrotogonus sp.	11	8	16	F
Ochrlidia sp.	1	1	8	R
Oxya chinensis	-	4	6	R
Family: Gryllidae				
Acheta domesticus	3	4	9	F

Table 1: *Entomo-faunal diversity and density (number/m3) on Sorghum crop at the agro-ecosystem studied. D-Dominant, F-Frequent, R-Rare. D > 100, 100 > F > 16, R > 16.*

In all, 39 insect species belonging to 6 orders and 21 families were collected from the crop of which none were dominant, 15 were frequent and 24 were rare forms. Maximum diversity and density of entomo-fauna was found in the month of June, while the minimum density and diversity was noted in the month of April.

Of the total nine coleopteran species observed, five (*A. bengalensis, P. nasutus, H. truncatulus, A. ferruginea*, *Myllocerus* sp.) were frequent and four (*O. bonasus, C. pictus, M. sexmaculatus, C. septempunctata*) were rare. *A. bengalensis, O. bonasus, P. nasutus, H. truncatulus, Myllocerus* sp., *A. ferruginea* and *C. pictus* were noted throughout the cropping period. Among, fifteen lepidopteran insect species, five were frequent (*A. ipsilon, T. orichalcea, H. fasciles* and *Tephrina* sp.) and ten (*D. chrysippus, C. fieldii, E. hecabe, E. insulana, M. seprata, S. caffer, S. nivella, C. medinialis, E. zinckenella* and *U. pulchella*) were rare forms. Further, *C. fieldii, D. chrysippus*, *E. insulana, M. seprata, A. ipsilon, T. orichalcea, H. petigera, H. fasciles, C. medinialis, U. pulchella* and *Tephrina* sp. were observed throughout the cropping period. The, two hemipteran insects reckoned were *N. viridula* and *D. cingulatus* and both were rare forms. Of the six hymenopteran species two viz., *X. violacea* and *A. florea* were frequent and four namely, *Polistes* sp., *D. affinis*, *Formica* sp. and an unidentified sp. E were rare forms. *Hymenopteran* which were always noted on the crop were *X. violacea, A. florae, D. affinis, Formica* sp. and unidentified sp. A. Only three dipteran were observed on *Sorghum* crop which, included *C. quinquefasciatus, M. domestica* and *Stichopogan* spp and all these were rare forms. *C. quinquefasciatus* was always found on the crop during the survey. Among four *Orthopteran* species noted on this crop, two *Chrotogonus* sp. and *A. domestica* were frequent which the other two *Ochirilldia* sp. and *O. chinensis* were rare forms. Further, *Chrotogonus* sp., *Ochirilidia* sp. and *A. domestica* were reckoned throughout the cropping period.

Earlier, Bhardwaj., *et al.* [2] recorded insect visitors to inflorescence of coriander in an agro-ecosystem, while, Bhardwaj and Srivastava [3] documented insects on cucurbit crops and reported various insect orders on them. Sima., *et al.* [4] in another study noted floral visitors on different crops from desert region, while, Bhardwaj., *et al.* [5] documented hymenopteran floral visitors. Similarly, entomo-fauna associated with Bajra crop have been documented by Sima and Srivastava [6]. A survey has also been conducted to compare the insect fauna collected employing two different methods of collection from the region [7].

The present work gets support from the earlier works of Vyas., *et al.* [8] who studied the varietal susceptibility of *Sorghum* to *Chilo zonellus*, a major pest of grape-wine in Rajasthan. *Myllocerus undecimpustulatus maculosus* was reported to be polyphagous pest of maize by Singh and Singh [9]. *Sorghum* has been noted to be damaged by *Mythimna separata* [10-12] and *Spodoptera exempta* also called as African armyworm [9,10]. *Nezara viridula* has been reported to be one of the most abundant species infesting *Sorghum* panicle [13]. Pests attacking *Sorghum* include, *Sorghum* shoot fly, *Sorghum* midge, ear head caterpillar etc. as suggested by Kumar and Nigam [14]. *Sorghum* has been noted to be attacked by different pests which included *Chrotogonus* sp., *Oxya* sp., *Pyrilla perpusilla, Nezara viridula, Piezodorus* sp., *Melanotis leda, Agrotis ipsilon, Heliothis armigera*, *Mythimna separata, P. orichalcea, Anomala bengalensis, Cylindrothorax tenicollis* and *Myllocerus* sp. as suggested by Nayar., *et al* [15]. All these reports corroborate and support the present findings.

Conclusion

The present study suggests that many insects are associated with the *Sorghum* crop depending upon the time, age of the crop and area of cultivation and therefore a variation is noted in the entomo-faunal diversity and density.

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