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A Short-Term Study on entomo-fauna Documented on sorghum Crop at an Agro-Ecosystem Near Bikaner, Rajasthan

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Abstract - *Sorghum*, is a plant which belongs to family Poaceae and is cultivated as cereal for human consumption as well as grown in pastures for animal feed, being the fifth major staple cereal after wheat, rice, maize and barley. It is especially valued in hot and arid regions for its resistance to drought and heat. Not only, diverse niches are occupied by insects ecologically, but also, they play many different roles important in sustaining the dynamics of ecosystem process. A base line study was proposed to document information relating to insect status in such sewage irrigated farms which are coming up at alarming rates in and around Bikaner, Rajasthan. In all, 60 insects belonging to 6 orders and 33 families were collected from the crop, of which based on density 3 were dominant, 48 frequent and 9 were rare forms. Both, the maximum density and diversity was observed in the month of September while, the minimum density and diversity was noted in the month of May.

Keywords – *Sorghum*, agro-ecosystem, family Poaceae.

I. Introduction

Sorghum, is a plant which belongs to family Poaceae and is cultivated as cereal for human consumption as well as grown in pastures for animal feed, being the fifth major staple cereal after wheat, rice, maize and barley. The grains are edible and nutritious, can be eaten raw when young and milky, while boiled when older. *Sorghum bicolor* also called great millet, Indian millet, is an important crop worldwide, used for food, animal fodder, the production of alcoholic beverages, and biofuels. Sorghum being resistance to drought and heat is especially valued in hot and arid regions.

An agro-ecosystem is characterized by a much simpler composition with regard to the number of species residing in the system and the relative simplicity of energy flows than a natural, stable ecosystem. Agro-ecosystems are distinct from unmanaged ecosystems as they are intentionally altered, and often intensively managed, for the purposes of providing food,

fiber and other products; hence they inherently have human community, economic and environmental-ecological dimensions.

Not only, diverse niches are occupied by insects ecologically, but also they play many different roles important in sustaining the dynamics of ecosystem process (Walker, 1992). They could be pollinators, decomposers, predators, scavengers and pests, besides each group or species having altogether different feeding habits. As such they are closely associated with the habitat and are a part of two biota, viz., resource and destructive.

The agro-ecosystems in the Indian desert are specific in a number of features including extremes of daily and annual temperature, long sunshine hours, fewer cloudy days, low soil and air moisture content, dry violent winds, high evaporation rate, poor nutrient level of soil etc. which greatly mar the heterotroph population and insects are no exception.

It seems true that since ancient times man has been making use of wastewater for irrigation from the time he has undertaken cultivation and farming. One can consider wastewater to be problem as well as a resource. Since last few years, it is becoming a common practice to use sewage waters for irrigation purpose in rural and also peri-urban areas of our Country. The pH of such ago-ecosystems is low, while the organic matter content is high and the soil is very good for cropping because of accumulation of humus. It can therefore be termed as a natural farming.

A base line study for every aspect is therefore of prime importance. Looking into this, it was proposed to document information relating to insect status in such sewage irrigated farms which are coming up at alarming rates. The present work therefore was undertaken to study the insect scenario in a sewage irrigated agro-ecosystem in and around Bikaner, Rajasthan.

II. 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. Located between 27°11' and 29°03' North latitudes and 71°52' and 74°12' East longitudes, Bikaner district lies in North–Western part of Rajasthan, the total area being 30289 sq. km and a general elevation lies between 154 to 429 m above the mean sea level. The range of sand dunes in height is from 6 to 30 m. The agro-ecosystem in the form of crop field comprising of sorghum crop studied lies about 10 to 15 km away from the city, covering an area of 6 hectares. It is irrigated by sewage water.

Collection and preservation of the entomo-fauna

The study of entomo-fauna was carried out in the agro-ecosystem from May to December. Insect collection was done by employing an indigenously designed cage (net) of 1m×1m×1m of nylon mesh (Saigal, 2002), and mechanically picking up the trapped insect fauna. The cage covered the $1m^3$ volume while holding the crop inside. Using cage, the insects were collected between 7A.M to 11A.M, and again in the afternoon from 5pm. to 7 p.m. Sampling was done fortnightly. Ten sampling sites were selected at random during each collection.

The insects collected by the above method were transferred to killing bottles and the killed insects were preserved. Large winged insects were put to dry preservation by pinning them in insect boxes, while, smaller insects were preserved in 70% alcohol. Identification of the entomo-fauna was done using pertinent literature and earlier collections in the laboratory. The count of insect fauna collected using cage was averaged for each month and expressed as number/trap.

III. Observations

Sorghum was one of the major crops cultivated during May to December in the agro-ecosystem. Table-1 depicts the entomo-fauna collected during the present study from Sorghum crop.

In all, 60 insects belonging to 6 orders and 33 families were collected from the crop, of which based on density 3 were dominant, 48 frequent and 9 were rare forms. Both, the maximum density and diversity was observed in the month of September while, the minimum density and diversity was noted in the month of May.

Among fourteen lepidopteran species, thirteen (*D. chrysippus, Zizina* sp., *E. hecabe, A. aurota, C. pomona, C. fieldii, H. recurvalis, C. medinalis, Tephrina* sp., *U. pulchella, H. peltigera, S. exigua* and *A. ipsilon*) were frequently observed while the only one, *L. orbonalis* was rarely noted.

Of the twelve coleopteran species noted on this crop, eight (*Cicindella* sp., *A. bengalensis, O. bonasus, P. nasutus, A. ferruginea, C. septempunctata, M. sexmaculatus* and *C. pictus*) were frequently and four (unidentified species A&B, *Melanotus* sp. and *H. truncatulus*) were rarely observed.

Enicospilus sp., *Campsomeris* sp., *Scoliasoror* sp., *D. affinis, Formica* sp., *P. carolina, Prionyx* sp., *Halictus* sp., *X. violacea, A. florae*, unidentified species A, B and C were thirteen frequently noted hymenopterans, while, *C. vagus* and *Polistes* sp. were the two rarely observed hymenopteran species on this crop.

The five hemipteran insect species reckoned were *D. cingulatus, N. viridula, A. spinidens, Oncocephalus* sp. and unidentified species B, all were frequent forms.

Of the six orthopteran, five species were observed as frequent (*Chrotogonus* sp., *Ochrilidia* sp., *O. chinensis, Pyrgomorpha* sp. and unidentified species A) and only one (*A. domesticus*) as a rare form.

Among eight dipteran species documented, three (*C. quinquefasciatus, S. peregrine* and *M. domestica*) were dominant, four were frequent (*Stichopogon* sp., Syrphid fly, *C. rufifacies* and *D. cucurbitae*) and one was a rare (unidentified species A) form.

IV. Discussion

The present work gets support from the earlier works of Vyas et al. (1977) 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 & Singh (1997). Sima (2011) also in the study conducted at Jhunjhunu in Rajasthan has reported the presence of *Myllocerus* sp., *Nezara viridula, Chrotogonus* sp., *Oxya* sp., and *Agrotis ipsilon* visiting the crops. Saigal et al. (2007) earlier have studied the diversity and population dynamics of entomofauna of two diverge agro-ecosystems in the Rajasthan desert while, Bhati et al. (2020) studied the dynamics of entomo-fauna in some sewage irrigated agro-ecosystems. Parvez, & Srivastava (2010) conducted a short-term surveillance of coleopteran fauna in an agro-ecosystem near Bikaner (Western Rajasthan), India while, Sharma & Srivastava, (2010) surveyed the lepidopteran fauna. Earlier Hymenopteran visitors of *Tagetes erecta* have been observed by Bhardwaj et al. (2010) while, Srivastava & Bhardwaj (2011) studied lepidopteran visitors of *Tagetes erecta* from the same region.

Sorghum has been noted to be damaged by *Mythimna separata* (Kalshoven, 1981; Kranz et al., 1977); and *Spodoptera exempta* also called as African armyworm (Karnz et al., 1977 and Kalshoven, 1981). Krugar et al. (2008) reported *Nezara viridula* to be one of the most abundant species infesting sorghum panicle. Pests attacking sorghum include, sorghum shoot fly, sorghum midge, ear head caterpillar etc. as suggested by Kumar & Nigam (1991).

Bhardwaj et al. (2012) conducted a study on hymenopteran floral visitors on various crops in the region. Bhardwaj et al. (2014) documented the insect visitors to inflorescence of *Coriandrum sativum* while, Sima & Srivastava (2012) studied the entomo-fauna associated with Bajra crop and Bhardwaj & Srivastava (2012) studied insect visitors of certain cucurbit vegetable crops. Sima et al. (2012) documented floral visitors of different crops from an agroecosystem near Jhunjhunun, Rajasthan. Bhati & Srivastava (2016). recorded entomo-fauna from cauliflower crop while, Chaudhary et al. (2018) studied insects associated with mustard crop and Sima & Srivastava, (2020) recorded insects associated with mung bean crop. Bhati et al. (2020) recorded insect visitors of ridged gourd while, Bhardwaj et al. (2023) documented insect visitors of eggplant *Solanum melangona* Linn.

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. (1998). Sima et al. (2014) reported *C. fiedii, E. hacebe, D. chryssipus, T. seprata, H. fasciles, T. disputara, A. florea, Polistes* sp., *C. quinquefasciatus* on this crop which also corroborate the present findings.

Overall, most of the insect species documented was frequent, eight being rare and only three dipterans being dominant forms. The density of mosquitoes and flies could be higher due to sewage water.

V. References

1. **Bhardwaj, H., Bhati, D. and Srivastava, Meera 2014. Insect visitors to inflorescence of *Coriandrum sativum* as observed in an agro-ecosystem near Bikaner, Rajasthan (India). *Asian Academic Research Journal of Multidisciplinary*, 1(2): 396-408.**

2. **Bhardwaj Harshwardhan, Parul Thaker and Meera, Srivastava 2010. Hymenopteran visitors of *Tagetes erecta* as observed in an agro-ecosystem near Bikaner, Rajasthan. *Current Biotica*, 4 (1): 94-102.**

3. **Bhardwaj Harshwardhan, Preeti Srivastava and Meera Srivastava 2023. Insect visitors of eggplant *Solanum melangona* Linn. Documented from an agro-ecosystem in Rajasthan, India. *International Research Journal of Natural and Applied Sciences*, 10 (01): 34-39.**

4. **Bhardwaj, H., Thaker, P. and Srivastava, Meera 2012. Hymenopteran floral visitors as recorded from an agroecosystem near Bikaner, Rajasthan. *Global Journal of Science Frontier Research*, 12(3):18-34.**

5. **Bhardwaj Harshwardhan & Srivastava, Meera 2012. A study on insect visitors of certain cucurbit vegetable crops in an agro-ecosystem near Bikaner, Rajasthan, India. *Journal Academica*, 2(3): 99-126.**

6. **Bhati Dheeraj & Meera Srivastava 2016.A study on entomo-fauna as recorded from cauliflower crop in an agro-ecosystem near Bikaner, Rajasthan, India. *Int. J. Microbiol.App.Sci*., 5(4):539-545.**

7. **Bhati, Dheeraj, Bhanu P. Jangir and Meera Srivastava 2020. Dynamics of entomo-fauna as documented in some sewage irrigated agro-ecosystems in and around Bikaner, Rajasthan, India. *International Journal of Creative Research*, 8(8): 1904-21.**

8. **Bhati Dheeraj, Harshwardhan Bhardwaj and Meera Srivastava 2020. Insect visitors of ridged gourd as documented from an agro-ecosystem near Bikaner, Rajasthan. *JOJ Wildl. Biodivers. 2(5): 555600.***

9. **Chaudhary Sima, Bhanu P. Jangir and Meera Srivastava 2018. Insects associated with mustard crop as observed in an agro-ecosystem in Rajasthan, India. Rajasthan. International Journal of Allied Practice, Research and Review, *Int. J. of Allied Practice, Research and Review*, V (IX): 1-12.**

10. **Kalshoven, L.G.E. 1981. Pests of crops in Indonesia. Ichtiar Baru pp701. (Revised and translated by P.A. van Der Laan. Van Hoeve), Jakarta.**

11. **Kranz Jürgen, Heinz Schmutterer, Werner Koch, 1977. Diseases, pests and weeds of Tropical crops. *Agricultural pests*, Parey, pp 666.**

12. **Krugar, M., Berg, J.V.D. and Plessis, H. 2008. Diversity and seasonal abundance of sorghum panicle - feeding Hemiptera in South Africa, 27: 444 - 451.**

13. **Kumar, A. & Nigam, P.M. 1991. *Economic and applied entomology*. Emkay Publications, New Delhi. pp. 530.**

14. **Nayar, K.K., Ananthakrishnan, T.N. and David, B.V. 1998. General and applied entomology. Tata McGraw-Hill Publishing Company Limited, New Delhi, pp. 589.**

15. **Parvez, Asif & Srivastava, Meera 2010. A short-term surveillance of coleopteran fauna in an agro-ecosystem near Bikaner (Western Rajasthan), India. *Biological Forum- An International Journal*, 2 (1): 23-29.**

16. **Saigal, D. 2002. A study on entomofauna and its ecology in some agroecosystem in the arid around Bikaner (NW Rajasthan). Ph.D Thesis, Maharshi Dayanand Saraswati University, Ajmer. pp. 1-129.**

17. **Saigal, Deepak, Srivastava, Meera and Saxena, M.M. 2007. Diversity and population dynamics of entomofauna of two diverge agro-ecosystems in the Rajasthan desert. *Uttar Pradesh J. Zool*., 27(3): 375-379.**

18. **Sharma, Manju & Srivastava, Meera 2010. Lepidopteran fauna of an agro-ecosystem in Western Rajasthan: A short-term surveillance. *J. ent. Research*, 34 (3): 249-258.**

19. **Sima, Dheeraj Bhati and Meera Srivastava 2014. Floral visitors of different crops as recorded from an agro-ecosystem near Jhunjhunu, Rajasthan (India).** ***International Journal of Science and Research*****, 3(9): 1732-1738.**

20. **Singh, K.M. and Singh, R.N. 1977a. The upsurge of** ***Myllocerus undecimpustulatus maculosus*** **Desb. On pearl-millet under dryland condition at Delhi.** ***Indian J. Ent.*****, 39(3): 300.**

21. **Srivastava, Meera & Harshwardhan Bhardwaj 2011. Lepidopteran visitors of** ***Tagetes erecta*** **as observed at an agro-ecosystem near Bikaner, Rajasthan.** ***Bionano Frontiers*****, 5(1): 140-143.**

22. **Sima & Srivastava, Meera 2012. Entomo-fauna associated with Bajra crop as observed in an agro-ecosystem in Rajasthan, India.** ***International Journal of Theoretical & Applied Sciences*****, 4(2): 109-121.**

23. **Sima & Srivastava, Meera 2020. Insects associated with mung bean crop: A short-term study in an agro-ecosystem at Jhunjhunu district of Rajasthan.** ***Int. J. Creative Res. Thoughts (IJCRT), 8(7):1725-1733.***

24. **Vyas, H.K., Sharma, S.K. and Bohara, O.P. 1977. Varietal susceptibility of sorghum to stem borer,** ***Chilo zonellus*** **(Swinhoe), under field conditions. In:** ***The Natural Resources of Rajasthan*****, 1: 413-415.**

25. **Walker, B.H. 1992. Biodiversity and ecological redundancy.** ***Conservation Biol*****., 5: 18-23.**

Table 1. Entomo-faunal diversity and density (number/trap*) on sorghum during the period of study

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Status
Order: Lepidoptera									
Family: Danaidae									
Danaus chrysippus Linn.	-	-	-	-	8	4	2	2	F
Family: Lycaenidae									
Zizina sp.	-	-	-	2	6	6	2	-	F
Family: Pieridae									
Eurema hecabe Linn.	-	-	-	4	8	8	4	-	F
Anaphaeis aurota Fab.	-	-	-	-	7	8	-	-	F
Catopsila pomona Cramer	-	-	-	-	4	4	4	-	F
Colias fieldii Menetries	-	-	-	-	7	8	4	2	F
Family: Crambidae									
Leucinodes orbonalis Guenee	-	-	-	-	2	2	-	-	R
Cnaphalocrocis medinalis Guenee	-	-	-	-	4	4	4	-	F
Hymenia recurvalis Fab.	-	-	2	2	4	4	2	-	F
Family: Geometridae									
Tephrina sp.	-	-	-	3	4	4	2	-	F
Family: Arctidae									
Utethesia pulchella Linn.	-	-	-	-	6	4	2	4	F
Family: Noctuidae									
Heliothis peltigera Schiff	-	-	2	4	5	3	4	4	F
Spodoptera exigua Hubner	-	-	-	3	4	4	-	-	F
Agrotis ipsilon Hufnagel	-	-	4	4	4	4	-	4	F
Order: Coleloptera									
Family: Cicindelidae									
Cicindella sp.	-	11	-	-	-	-	-	-	F
Family: Carabidae									

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Status
Unidentified sp. A	-	-	-	-	-	2	2	-	R
Family: Scarabaeidae									
Anomala bengalensis Blanch.	6	4	-	-	4	-	-	-	F
Onthophagus bonasus Fab.	-	-	-	4	-	-	4	4	F
Peltonotus nasutus Arrow	-	-	-	6	-	-	-	5	F
Apogonia ferruginea Fab.	-	-	5	4	4	-	-	-	F
Unidentified sp. B	-	-	-	-	-	2	-	-	R
Family: Elateridae									
Melanotus sp.	-	-	-	-	-	-	-	1	R
Family: Coccinellidae									
Coccinella septempunctata Linn.	8	6	-	-	-	-	-	8	F
Menochilus sexmaculatus Fab.	-	-	-	-	12	-	-	-	F
Family: Meloidae									
Cylindrothorax pictus Fab.	11	-	-	-	7	-	-	-	F
Family: Curculionidae									
Hypolixus truncatulus Fab.	-	3	-	-	2	1	-	-	R
Order: Hymenoptera									
Family: Ichneumonidae									
Enicospilus sp.	-	-	-	-	10	4	2	-	F
Family: Scoliidae									
Campsomeris sp.	-	-	-	-	4	6	5	4	F
Scoliasoror sp.	-	-	-	-	2	2	2	-	F
Family: Formicidae									
Dolichoderus affinis Emery	-	-	-	4	6	4	4	-	F
Formica sp.	-	-	-	-	7	6	6	6	F
Camponotus vagus	2	1	-	-	-	-	-	-	R
Family: Vespidae									
Polistes carolina	-	-	-	-	6	7	5	6	F
Polistes sp.	4	-	-	-	-	-	-	-	R
Family: Sphecidae									
Prionyx sp.	-	-	-	-	11	10	-	-	F
Family: Halictidae									
Halictus sp.	-	-	-	-	5	8	-	-	F
Family: Apidae									
Xylocopa violacea Linn.	-	-	-	-	7	5	-	-	F
Apis florea Fab.	-	-	-	8	5	7	1	-	F
Unidentified sp. A	-	-	-	3	4	4	1		F
Unidentified sp. B	-	-	-	-	6	8	-	-	F
Unidentified sp. C	-	-	-	-	7	6	-	-	F
Order: Hemiptera									
Family: Pyrrhocoridae									
Dysdercus cingulatus Fab.	4	6	3	-	3	-	-	-	F
Family: Pentatomidae									

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Status
Nezara viridula Linn.	7	-	-	-	-	-	3	3	F
Andrallus spinidens Fab.	3	4	3	-	2	2	-	-	F
Oncocephalus sp.	4	-	4	4	4	-	-	-	F
Unidentified sp. B	4	-	-	-	4	4	-	-	F
Order: Orthoptera									
Family: Gryllidae									
Acheta domesticus Linn.	-	-	-	2	1	2	-	-	R
Family: Acrididae									
Chrotogonus sp.	4	-	-	-	5	4	-	-	F
Ochrilidia sp.	-	-	3	3	3	3	-	-	F
Oxya chinensis Thunberg	-	2	2	2	-	-	4	4	F
Family: Pyrgomorphidae									
Pyrgomorpha sp.	4	-	-	-	-	-	4	3	F
Unidentified sp. A	4	2	2	-	-	2	2	1	F
Order: Diptera									
Family: Culicidae									
Culex quinquefasciatus Say	15	16	7	8	10	5	4	5	D
Family: Asilidae									
Stichopogon sp.	2	2	3	4	-	-	2	2	F
Family: Syrphidae									
Syrphid fly	-	-	7	-	-	8	-	-	F
Family: Calliphoridae									
Chrysomya rufifacies Mucuqurt	13	12	-	-	-	-	-	-	F
Family: Tephritidae									
Dacus cucurbitae	4	-	4	-	2	2	1	1	F
Family: Sarcophagidae									
Sarcophaga peregrina	11	20	14	12	12	1	2	2	D
Family: Muscidae									
Musca domestica Fab.	55	36	21	12	13	12	-	-	D
Unidentified sp. A	-	-	-	-	1	1	-	-	R

* Average of all the ten crop sites

D-Dominant, F-Frequent, R-Rare

>26 and above >11-25 ≤10