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RESEARCH ARTICLE

STRATEGIES FOR THE USE OF ENTOMOPATHOGENIC FUNGI IN THE CONTROL OF ACRIDID SPECIES FROM THAR DESERT SINDH PAKISTAN

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ABSTRACT

The grasshoppers and locusts are considered as pests to many agricultural crops, and the increased concerns over the deleterious environmental and health effects of using chemical insecticides to control their outbreaks. Like other microbial agents Entomopathogenic fungi are also responsible for suppression of grasshopper and locust population. During the present study an attempt has been made to investigate the lethal effect of entomopathogenic fungi eg: (Aspergillus, Metarhizium and Beauveria) on many grasshoppers' species under laboratory conditions. Prepared medium of these bio-pesticides was sprayed on different species/stages of Acridinae, Calliptaminae and Gomphocerinae. Large numbers of species including their all developmental stages which were treated with this bio-pesticide showed significant suppression effect. Further, it was observed that insect's undergone very interesting behavioral modification after the infection of pathogen and insect population decline rapidly in laboratory. However, improved prediction and monitoring are needed to facilitate the use of bio-pesticides and other IPM techniques against these pests. Beside this, in this paper we have also documented: how biological control option could be incorporated into integrated pest management (IPM) strategies and what future and development work is necessary to implement such IPM strategies in Pakistan.

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INTRODUCTION

Grasshoppers are major agricultural pests Roonwal (1978), COPR (1982), Riffat and Wagan (2010-2012) and Riffat *et al*. (2013), they are polyphagous defectively damage rice, sugarcane, wheat, maize and fodder crops in Pakistan. For their control farmers expends millions of rupees per year when their population increased, many species exhibit migratory and gregarious behavior. This behaves lead to the formulation of spectacular swarm. For this purpose the biological control is very important it is despicable safe for all organisms as well for their environment. It is one of the oldest and most effective means of achieving insect's pest control. Therefore, an attempt was made to introduce pathogenic fungi, against the reduction of grasshopper's population. previously many authors carried work on this subject Hermandez Crespo and Santigo Alvarez (1997) given by Kassa (2003), Tounou (2007), Cummings (2009) and Kumar *et al.* (2014a,b) against different insect pests but introduction of this bio-control an agent is yet unknown from this region, therefore, present study was designed to implement this pathogen against acridid population in Sindh. Entomopathogenic fungi are regard as bio-pesticides and predictable to have a significant and growing role for the control of locust and grasshopper in world with Pakistan Riffat *et al.* (2013). These microbial agents are commonly famous as myco-insecticides that have great potential to kill locust and grasshopper species. Beside this; it is also beneficial to control flies, beetles and aphids in field Roditakis *et al.* (2000). Pathogenic fungi penetrate into host's outside surface after utilization of pathogenic fungi large number of grasshoppers and locusts were killed, this finding suggests that this microbial agent is very useful against many pest species. Microbial agents that include: bacteria, virus, nematodes, protozoan and pathogenic fungi are good bio-control agents. Lomer *et al.* (2001) stated that pathogenic fungi are very important and interesting bio-control agent due to its observed capacity that lead to formation of epizootics. Formerly, several workers have done research on this i.e. Goettel *et al*. (2005, 2008), Pell (2007), Vega *et al*. (2009), Hajek (2009), Jaronski (2009), Pell *et al*. (2010) and Riffat *et al.* (2013). This microbial agent is considered very useful in IPM program. Therefore, efforts made in the investigation to isolate, identify and characterize my-coflora associated with natural mortality of various pest species of grasshopper and to study the prospect of bio-control from this area. Operation of different chemicals put very harsh impact on the environment and

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frequent use of chemicals enhance the resistance power in insect's body. Therefore this study has been designed.

MATERIALS AND METHODS

Sampling

The stocks of insect were collected from 05 important cities Mithi, Nangarparkar, Islamkot, Chachro and Umerkot regular survey after each forthnight has been carried out in different field. Large numbers of insect were capture and brought to laboratory for further analyses. For identification of samples scheme given by Riffat and Wagan (2015) was followed. Beside this insect contaminated with pathogenic fungi was also collected for preparation of entomopathogenic medium. Infected specimens were captured with large forceps. All were sorted out into different host species and kept in clean cages on Zea *mays*. All observations after 12, 24 and 48 hours were noted done. All insect were kept under laboratory condition where temperature was (28±2°C to 41±2°C) and Relative humidity (RH) was (26.5% to 60.5%).

Isolation and sporulation test for presence of fungi

Same procedure given by (Kumar *et al.,* 2013) was adopted with slight modification in this After SDA (Sabouraud Dextrose Agar) medium was formulated into oil (coconut) after preparing the oil formulation this fresh suspension was kept in sonicator for 60 sec to break the conidial chain now medium is ready for insertion and Bioassay pathogencitytest has been done by following Balogun and Fagade (2004) in this different fungi species were isolated and then isolates was grown at 28°C where photoperiod ratio: 12hrs light, and 12hrs dark for about 15 days Sterile spatula after incubation was used to harvest the conidia from fungal culture and two different formulations oil and water based used against pest species insect individual reared in bottle and captivity in cage than this prepared medium were spray on the grasshopper and after 12. 24. 48 and 72 hours complete reading were taken.

RESULTS AND DISCUSSION

During the present study, different area of Thar viz: Mithi, Nagar Parker, Islamkot, Chachro and Umerkot were visited but

Table 1. Lethal infection level ofdifferent entomopathogenic fungi in various species of grasshoppers collected from Thar Desert

Sub-family	Species/Sub-species	No. of Incubated	No. of *Aspergillus* Sporulation	No. of *Beauveria* Sporulation	No. of *Metarhizium* Sporulation	UK Sporulation
Acridinae	*Acrida exaltata*	64	21	17	19	07
	A. gigantean	83	23	25	31	04
	Duroniella laticornis	05	00	02	03	00
	Gelastorhinus semipictus	10	03	02	04	01
	Phlaeoba infumata	07	01	00	05	02
	P. tenebrosa	03	00	02	00	00
	Truxalis exmia exmia	06	01	02	03	00
	T. fitzgeraldi	04	01	01	00	00
Calliptaminae	*Acorypha glaucopsis*	13	05	03	01	04
	Sphodromerus undulates undulatus	07	01	02	01	03
Gomphocerinae	*Chorthippus indus*	04	01	01	00	02
	Ch. dorsatus	00	00	00	00	00
	Gonista rotundata	03	00	01	02	00
	Ochrilidia geniculate	08	03	05	00	00
	Oxypterna afghana	11	02	04	03	02

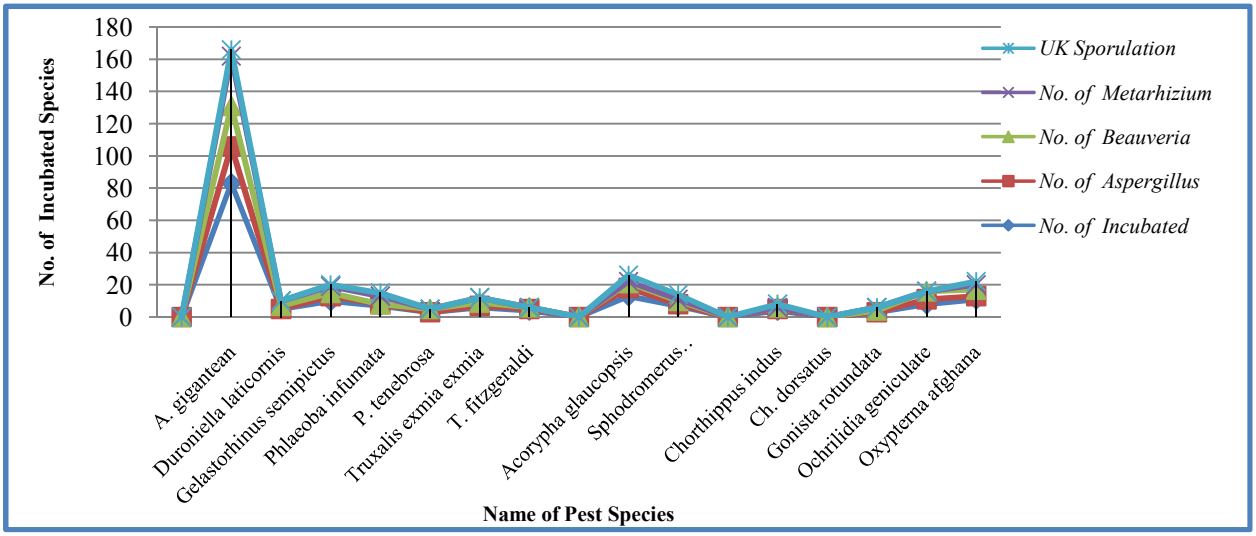

Figure 1. Lethal infection level ofdifferent entomopathogenic fungi in various species of from Thar Desert during year 2016

extensive collection was carried out from the district Umerkot. It might be the due to lush vegetation and favorable climatic condition of this region.

Table 1 showed that lethal infection of various species of entomopathogenic fungi such as *Aspergillus*, *Beauveria* and *Metarhizium* of different adults of grasshoppers that are very serious and considering major pest of valued crops. As the thar region already suffered by insufficient dietproducts there yet capacity is very less compare to other dry regions of country. Its yet capacity is affected by numbers of pest including grasshoppers. According to Fig-1 greater numbers of *A. gigantean* was incubated followed by *Acrida exalata* and very less numbers of *P. tenebrosa* was incubated it might be the collection of less numbers of Acridinae. Similarly in case of Calliptaminaei-e *Acorypha glaucopsis* was captured in fair numbers compare to *Sphodromerus undulatus undulates*. InGomphocerina 05 species were captured and greater numbers were reported for *Oxypterna afghana* while *Ochrilidia geniculate*, *Ch. dorsatus*, *Gonista rotundata*, and *Chorthippus indus* were collected in less numbers. Present study, recommended that insect pathogenic fungi is very fruitful to suppress the grasshopper's population. Still now only *Metarhizium* and *Beauveria* was tested but only few reference regarding *Aspergillus* application is unviable it is suggested that the bio-pesticides should be utilized in future.Hoy (2008) reported that entomopathogenic fungi have been used in 3 categories of biological control viz: conservation, classification and augmentation in Pakistan introduction of this bio-pesticide is very limited. As this bio-pesticide drastically reduce the use of conservation broad spectrum chemical pesticides it has been expected that genomic data will also assist the development of products with improved efficacy and host rang. During the present study, all bio-pesticides are applied directly using spraying on the colony or as on individual treatment with special formulation. However, Present study, recommends that stickers, gustatory stimulants and UV protectant would be routinely incorporated into tank mixes to improve efficacy of this bio-pesticides. Beside this, present finding also suggest that some new techniques should be implement for crop protection. Because in the next era use of precisely applied inocula in place of tradition blanket spraying hopefully by this way exploiting the entomopathogen because more successful and it also overcome the issue of cost and availability in the market. Besides this, the infection of unknown fungi was also reported on these species but its correction identification was still in progress. It was also observed that after the application of entomopathogenic fungi insects show greater change in their physical behavior and reduce or completely stop feeding. Further, they restricted then movement, mating and oviposition behavior is also infected insect show slight or nil response towards the reproduction activity after the 72 hours majority of insect die.

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