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FARMERS' AWARENESS ABOUT SPIDER AS NATURAL PREDATOR OF COTTON PESTS AND HAZARDOUS EFFECTS OF PESTICIDES ON THEIR HEALTH FROM THREE DISTRICTS OF PUNJAB COTTON BELT: PAST FINDINGS AND FUTURE PRIORITIES

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Spiders are cosmopolitan in nature and being incalculable predators of insect pests, they can reduce pest population upto ETL (economic threshold level). But, use of non-selective pesticides to control different invading pests on cotton, is disrupting their ecological status. To use them as successful bio-control agent, basic knowledge about their ecology and farmers' awareness regarding their predatory potentials is pre-requisite to conserve their identity. Therefore, present study was conducted to explore the farmers' awareness about spiders as natural predators of insect pests and: hazardous impacts of pesticides on their health. 75 farmers from each locality were interviewed through well structured questionnaire at open ended discussion for suggestions *viz.* Faisalabad, Rahim Yar Khan and Multan. After interviewing the farmers, independent variables *viz.* age, education, size of land holding, type of tenure and experience of agriculture, and cotton sowing were compared with various dependent variables through Chi-square analysis. Level of awareness about spider importance, their predatory role and hazardous impacts of pesticides to human health were recorded significantly correlated with education; other independent variables were recorded least supporting. Majority of respondents were aware about hazardous impacts of pesticides and importance of natural insect predators and among them, spider was utmost. It has been concluded from entire survey that use of pesticides is much dangerous. However, betterment of education standards can improve the situation by creating awareness about importance of spider and can safeguard their life from hazards of pesticides.
Keywords: Spiders, pesticides, awareness, cotton pests

INTRODUCTION

Being an agricultural country, topography of Pakistan spread between subtropical to semi-arid climate and agriculture occupies a strategic place in its economy. Cotton has major contribution in this sector and in foreign exchange earnings (Govt. of Pakistan, 2010) and it has been growing on more than 3.0 million hectares in Pakistan under a very broad range of climates, soils and cultural practices since ancient time (Sanghar, 2005; Govt. of Pakistan, 2010). But, there are several factors which are causing economically unacceptable damage to cotton, *e.g.* phytophagus insect and insect pests; they cause 30-50% pre and 20-25% post harvesting damages (Sanghar, 2005). Therefore, all embracing efforts are trying for their control including use of pesticides. Owing to this commotion, non-target species (natural competitors and predators of pests) get killed; resulting ecological imbalance in biosphere. Consequently, appearance of resistant pest strains occurs; who demanded more intensive/ repeated doses of pesticides (Pekar and Haddad, 2005). Therefore, to safeguard future, there is a dire need to develop alternative strategies. Spiders offer such opportunity to solve this problem and are environment friendly. Their significance to control different invading pests on cotton has been acknowledged worldwide (Pearce *et al*., 2004). They feed on wide range of animal groups; however, in general they concentrate on insects prey (Wise, 1993).

Despite their prominence, spiders have received little attention in cotton to manage invading pests has been overlooked usually. Their conservation is possible only by using them frequently in bio-control practices (Rajeswaran *et al*., 2005). Many studies in Pakistan were conducted on spiders in different habitats and on different aspects in Pakistan but focus was only to diversify their community (Mushtaq *et al*., 2003 and 2005; Ghafoor, 2002; Ghaffar *et al*., 2011). Unfortunately! no systematic study has yet been conducted to access the awareness of farmers about spiders being bio-control agent: a pre-requisite for future sustainability. Recently, interest has shifted to manage the pest through bio-control, rather than reliance on pesticides (Whitehouse *et al*., 2009). However, major obstacle for spider conservation is lack of public support, possibly due to fears and ignorance. Fears regarding them can be decreased through pointing out that only a few easily identifiable species are dangerous to mankind. By stressing beauty, interesting behaviors and qualities, attitudes towards this

fascinating creature can be changed (Robinson, 1991). Therefore, present study was conducted to evaluate the awareness of cotton growing farmers about spiders as bio-control agent. They were interviewed through well structured questionnaires from three districts of Punjab cotton belt (Faisalabad, Rahim Yar Khan and Multan), for future strategies.

Materials and Methods:

Based on topographical and physiographic feature, climate, land use, and water availability, country has been divided into ten agro-ecological zones (FAO, 2005). Over viewing ecological facts of all zones, to fulfill the objectives of the present study, three districts from Punjab cotton belt *viz.* (i) Faisalabad (low input of pesticides) (ii) Multan (high input) and Rahim Yar Khan (moderate) were selected for interviewing of farmers. Study was designed as purpose sampling design to elaborate awareness of farmers about the importance of spiders as natural predator of cotton pests and hazardous effects pesticides on their health. Because, resource-poor cotton grower farmers in our country have limited awareness about usage and hazardous impacts of pesticides and its alternative for the control of pests like arthropods, weeds and diseases particularly in the areas with inadequate state-sponsored health coverage facilities. They frequently depend on traditional methods of cotton sowing, pest management by hazardous chemical to improve productivity without knowing their residual effects on their own health.

From each district, 75 farmers were interviewed to gather the information regarding their awareness level about the importance of spiders as natural predator of cotton pests and hazardous impacts of pesticides as well as about conservation of these natural predators to utilize them for management of cotton pests. Demographic characters (independent variables) includes age, education, size of land holdings, type of tenure, farming experience and experience of cotton sowing of the respondents, whereas, dependent variables were include awareness of respondents (farmers) about beneficial (Chrysopa, Wasps, Green lacewing and Spiders), their habitats, symptoms of diseases, and source of information etc.

Each month, survey was conducted as field study for interviewing the cotton growing farmers at three places to evaluate their awareness about spiders as bio-control agent and hazards of pesticides. Total 225 farmers (respondents) were interviewed. The collected data was analyzed statistically and different variables was compared between three districts through Chi-square test and interpreted for pertinent conclusions (Steel *et al*., 1997).

RESULTS

Demographic characteristics vary person to person in the community. They play key role in life of each person to establish the economic status. They include age, education and size of land holding. However, type of tenure among farmers which are not owners and cotton sowing experience is also part of demographic characters. It was recorded that least population of farmers pertaining to <25 and >65 year of age were indulged in farming. While, education levels was better at Faisalabad – majority were recorded up to Matriculation (48% respondents), 28% were above Matric and 20% up to Middle. However, majority of the respondents were small land holders (<12.5 Acre) at Faisalabad (72% respondents) as compared to Rahim Yar Khan and Multan. However, size of land holding was higher in Rahim Yar Khan and Multan up to 25 acre and above, respectively.

As far as, ownership was concern nearly all respondents (96%) were in Faisalabad were owner, majority in Rahim Yar Khan (58.67%) and Multan (68%), followed by owners-cum-tenant 28% in Rahim Yar Khan and 26.67% in Multan. Ratio of owners was exceeding over tanants at Faisalabad owing to trend as self harvesting than Rahim Yar Khan and Multan. However, from the entire survey, it was recorded that farmers in Faisalabad were cultivating cotton crop upto maximum limit (92%) instead of other two localities. It might be owing to its bumper cash advantages and easy access to market and industries.

According to report of World Bank (2005), an overwhelming majority of people in Pakistan are facing health problems due to polluted drinking water; major cause of this situation is use of pesticides. Despite to this severe abnormality, awareness about pesticides hazards was recorded few and far between majorities of respondents. An overwhelming majority (90-100%) was aware about hazardous effects of pesticides. Nearly, all respondents in Faisalabad and Rahim Yar Khan were aware about these problems; rather in Multan the ratio was somewhat different because being a central cotton growing area, pesticide agencies were trying to provide information to the farmers about their advantages, instead of disadvantages. Major symptoms were recorded as dizziness, loss of consciousness, confusion, sour throat and suffocation with different ratios and least was reported in case of dizziness, headache, nausea, skin irritability.

In bio-control strategies, awareness of respondents about spiders as beneficial insects of cotton was significant in Rahim Yar Khan rather than Faisalabad and Multan. It was recorded pragmatic from Rahim Yar Khan and little bit better at Multan and Faisalabad as compared to other usual predators. However, a vast majority was aware about their habitats in houses (96% - in Faisalabad, 94.67% in Rahim Yar Khan and 86.67% in Multan), followed by sunny places (100%) only in Rahim Yar Khan, and then between the branches of trees (94.67% in Rahim Yar Khan and 82.67% in Multan). As for as cotton fields as their habitat was concerned, hardnosed awareness was recorded from Multan

(97.33%), followed by Rahim Yar Khan (64%) and only 16% respondents at Faisalabad were aware about their habitats in cotton fields.

Results about source of information were highly astonishing regarding all the focals in Faisalabad. However, in Rahim Yar Khan, friends and relatives, pesticides agencies were recorded as best source of information, while, in Multan, agriculture department was recorded fulfilling its role for providing requisite information among cotton growers, followed by pesticides agencies, friends and TV. While, an overwhelming majority was aware that spiders were beneficial to mankind as a successful part of IPM program, serve as predator against cotton pests and reduces cost of pesticides, at three places. However, it is very much important that maximum number of the respondents at Multan were aware that it can improve environmental quality and least was aware that it can improve quality of life.

Results were pragmatic about their predatory role from Rahim Yar Khan, because, response of 62.67% respondents was aware about their important predatory role. Whilst, only 24% respondents in Faisalabad and 33.67% respondents in Multan were aware about the importance of spiders as bio-control agent. Whereas, in Rahim Yar Khan, 98.67% respondents were willing to use spiders in integrated pest management programme, 68% in Faisalabad and only 40% in Multan were in its favour. However, an overwhelming majority of the respondents were agreed to use them on cotton crop as bio-control agent, 98.67% in Rahim Yar Khan, followed by Faisalabad (68.42%) and then Multan (67.33%). Similarly, an overwhelming majority of the respondents was agreed to get training for rearing of spiders to use them on cotton crop as bio-control agent and conservational strategies.

For conclusions, independent variables were analyzed statistically through Chi-square analysis against dependent variables to highlight random effects for policy. Being central cotton producing area and related research activities, education of the respondents in Multan was recorded with significant relationship against beneficial insects, importance of spider, spider found in houses, radio as a source of information, spider as a part of IPM and beneficial for sustainable agriculture, artificial rearing. However, type of tenure was only recorded with significant relationship with spider found in dark places. All other parameters were recorded with non significant correlation (Table 1).

Results of Chi-square analysis from Rahim Yar Khan about age against dizziness, vomiting and spider found in houses; education against soar throat, crysopa, wasp as beneficial insect, spider found in houses neighbor and agriculture department, spiders to reduce cost of pesticides, environmental pollution improve the quality of biotechnology and sustainable agriculture; size of land holding against dizziness, wasp as beneficial insect and to reduce the cost of pesticide; and type of tenure against crysopa and pesticide agencies as a source of information were recorded with significant correlation ($p = 0.05$). All the other independent and dependant variables were recorded with negative correlation (Table 2).

At Faisalabad results of Chi-square analysis were not realistic. Therefore, only results of age of the respondents against habitat of spiders "spider found in houses"; size of land holding against neighbours and pesticide agencies as a source of information; and type of tenure against spider beneficial to mankind were significant and rest of the all independent and dependant variables were recorded with negative correlation (Table 3).

Table 1. Relationship between education and type of tenure of farmer respondents of study area, Multan with different selected study variables

Independent Variable	Dependent Variable	χ^2_{cal}
Education	Beneficial insects	15.744*
	importance of spider	23.964*
	Spider found in houses	15.417*
	Radio as a source of information	21.563*
	Spider as a part of IPM	14.269*
	Beneficial for sustainable agriculture	17.386*
	Spider venom used as pesticide	16.714*
	Artificial rearing of spider	14.640*
Type of tenure	Spider found in dark places	10.489*

Education *df = 7* $\chi^2_{tab} = 14.0671$
Type of tenure *df = 4* $\chi^2_{tab} = 9.48773$
p value = 0.05 **Significant* χ^2 *= Chi-square*

Table 2. Relationship between age, education, size of landholding and type of tenure of farmer respondents of study area, Rahim Yar Khan with different selected study variables

Independent Variable	Dependent Variable	χ^2cal
Age	Dizziness	42.894*
	Vomiting	38.839*
	Spider found in houses	43.310*
Education	Soar throat	15.041*
	Crysopa	17.921*
	Wasp as a beneficial insect	33.453*
	Spider found in houses	19.272*
	Neighbors	15.713*
	Agriculture Department	13.620*
	Reduce cost	12.832*
	Environmental pollution	13.663*
	Biotechnology	15.094*
	Sustainable Agriculture	19.349*
Landholding	Dizziness	44.178*
	Wasp as a beneficial insect	52.431*
	Reduce cost	53.556*
Type of tenure	Crysopa	6.139*
	Pesticide agencies as a source of information	6.845*

Age	*df = 25*	*χ^2tab = 37.6525*
Education	*df = 6*	*χ^2tab = 12.5916*
Size of landholding	*df = 30*	*χ^2tab = 43.7729*
Type of tenure	*df = 2*	*χ^2tab = 5.99147*
p value = 0.05	**Significant*	*χ^2 = Chi-square*

Table 3. Relationship between age, size of landholding and type of tenure of farmer respondents of study area, Faisalabad with different selected study variables

Independent Variable	Dependent Variable	χ^2cal
Age	Spider found in houses	74.494*
Size of landholding	Neighbors as a source of information	25.000*
	Pesticide agencies as a source of information	25.000*
Type of tenure	Beneficial to mankind	8.054*

Age	*df = 42*	*χ^2tab = 55.7585*
Size of landholding	*df = 10*	*χ^2tab = 18.3070*
Type of tenure	*df = 3*	*χ^2tab = 7.81473*
p value = 0.05	**Significant*	*χ^2 = Chi-square*

DISCUSSION

During present study various parameters about the awareness of natural predators (Crysopa, Wasps, Green lace wing and Spider) and hazardous effects of pesticides were recorded to conjecture the farmers' opinion from three districts and these parameters were evaluated against independent variables (age, education, land size, type of tenure and farming experience), because, independent variables are important for adoption of any innovation and helped a lot in creating awareness (Hassan *et al*., 2002). Among these predators, spiders were well known due to their predatory activities, although their life histories and potential to reduce pests and prey population was poorly understood to farmers in these areas. This was owing to difference between farmers' and scientists' knowledge (Bentley, 1992). Among independent variables, age of an individual is an imperative factor that broadens his vision with experience which he attained with passage of age from its surroundings. It also makes an individual to think maturely and took rational decision (Hassan *et al*., 2005). It has also been observed in most of cases that age of respondents did not affect behavior of adoption as observed in the present study where age did not positively associated with different parameters from the three sites. It means that age has a negative impact regarding farmers whether they are literate or illiterate. Education is one of the most authoritative tools for the advancement of knowledge, wisdom and other desirable skills in the life (Evenson and Mwabu, 1998). It also brings a positive change in the

behavior of an individual (Hassan *et al*., 2003). During present survey, it has been noted that the educated farmers were more competent to uplift their crops successfully and utilized available resources more wisely, and effectively than uneducated. It has also been observed that the farmers of Faisalabad were more literate than other two areas under study and likewise their awareness about the hazardous effects of pesticides sprayed on the cotton, about beneficial insects/spiders, sources of information and use of spiders in IPM was higher. However, educational level was not much associated with awareness of various study aspects. It may be due to the fact that a few decades ago cotton was extensively grown in this area, earlier it was replaced by production of surplus grains almost 20-30 years ago. Due to high economy and now after lapse of time once again the same crop is gaining popularity but still its average production was very low as compared to sugarcane, rice and wheat. Therefore, awareness about beneficial/harmful insects/pests of cotton, use of pesticides and their hazardous effect was much lower at Faisalabad compared to the Rahim Yar Khan and Multan. Whereas, personals with high education was higher aware about various spider related aspects because they were more exposed to different sources of information. This showed that education increase exposure to sources of information also increase awareness about spider and pesticides hazards.

Use of pesticides in the agriculture sector poses serious environmental and public health problems (Chitra *et al*., 2007). They highlighted the extent of pesticide use, signs and symptoms of illnesses due to direct pesticides exposure among farmers through interview using pre-tested interview questionnaires. During interview, they recorded following acute signs and symptoms: excessive sweating, burning/ stinging/ itching of eyes, dry/sore throat, excessive salivation with higher prevalence among the sprayers and concluded that there is dire need for creating awareness among farmers and ensuring use of protective measures while handling pesticides. Javed (2011) reported that owing to use of pesticides, mortality of a million people per year occurred in the world and nearly 20,000 in Pakistan annually along with severe health problems *e.g.* asthma, emphysema, cancer such as Parkinson's disease, Lou Gehrig's disease etc., and it also enhance pollution among all ecosystems. Yassi *et al*. (2001) said that a vast majority of population in India (56.7%) has been found engaged in agriculture and are directly exposed to the pesticides used in agriculture. They released into environment and come into human contact directly or indirectly, and their inhalation, ingestion and dermal contact occur by various routes. Exposure to pesticides results in acute and chronic health problems.

The other two aspects, i.e. size of landholdings and type of tenure was recorded with little impact on the study attributes. It might be due to the reason that as size of landholdings increases the landlords does not directly exposed to pesticides and were less prone to the hazardous effects of these chemicals, therefore, were less interested in the application of spider against pests of cotton. Moreover, the small land holders were unable to utilize the hired labour or sophisticate spraying machinery; therefore, they were compelled to spray themselves. Due to unawareness and slackness on their part, they can not observe the safety measures necessary during spraying, consequently, they are facing the pesticides hazards from mild to severe reactions and ultimately disturbing their health severely as earlier reported by Chitra *et al*. (2007).

***Conclusions*:** It is concluded from the entire survey that awareness of farmers about the usefulness of spider was not significant, but they were agreed to use this environment friendly creature to control invading pests in cotton fields instead of hazardous pesticides. However, to change the situation, dissemination of proper information with appropriate training programs can reduce pesticides usage and health risks to humanity. For future sustainability, restriction on the use of non-compatible technologies, use of bio-control instead of chemical control and up-lifting of education standard can improve the situation.

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