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Population dynamics of aphids on turnip (*Brassica Rapa*) in Peshawar

Bismillah Shah, Faisal Ayub, Nazeer Ahmed

Abstract
To study the population dynamics of aphids on turnip *(brassica rapa*) in Peshawar, the present research work was carried out at New Developmental Farm (Malakandher), The University of Agriculture, Peshawar during 2014. Turnip *Brassica rapa* subsp. rapa (Brassicaceae: Brassicales) is a root vegetable commonly grown in temperate climates worldwide for human consumption and as feed for livestock. It is an herbaceous annual or biennial plant in the family Brassicaceae grown for its edible roots and leaves. The turnip's root is high in vitamin C. The green leaves of the turnip top are a good source of vitamin A, folate, vitamin C, vitamin K and calcium. Losses occur in turnips are due to weeds, diseases, predators, and insects. Weeds are generally not a problem once the turnip crop is established. Flea beetles, Wireworms and Root maggots. Besides these the most serious pest of the Turnip is the Turnip aphid *Lipaphis erysimi* Kaltenbach (Aphididae: Homoptera). The aphid population generally makes its appearance sometimes during winter and it continues to breed parthenogenetically till the end of spring when winged individuals are produced and large-scale dispersal takes place. From the experiment, it was concluded that the aphids appear and fluctuate throughout during the growing season. Overall mean density of aphids was higher on Purple Top White Globe of Jerryseeds (Pak.) than on Purple Top White Globe of Chriseeds (USA).

Keywords: Turnip, root vegetable, edible roots, insects, aphid, pests.

1. Introduction
Turnip or white turnip *Brassica rapa* subsp. *rapa* (*Brassicaceae: Brassicales*) is a root vegetable commonly grown in temperate climates worldwide for its white, bulbous taproot. Small, tender varieties are grown for human consumption, while larger varieties are grown as feed for livestock. In the north of England and Scotland, turnip (or *neep*; the word *turnip* is an old compound of *neep*) refers to the larger, yellow rutabagaroot vegetable, also known as the "swede" (from "Swedish turnip") [1]. Wild forms of the hot turnip and its relatives the mustards and radishes are found over west Asia and Europe, suggesting their domestication took place somewhere in that area [2]. Turnip, *Brassica rapa*, is an herbaceous annual or biennial plant in the family Brassicaceae grown for its edible roots and leaves. The plant possesses erect stems and 8–12 leaves forming a crown. The leaves are light green in color, hairy and thin. The plant produces light yellow flowers which are clustered at the top of a raceme and are often extended above the terminal buds [3]. Turnips are eaten as a vegetable after cooking. The shoots and leaves can be eaten fresh in salads or the entire plant can be used as forage for livestock [3]. Turnip produces high-quality forage if harvested before heading. Livestock eat the stems, leaves and roots of turnip plants. Above-ground parts normally contain 20 to 25% crude protein, 65 to 80% in vitro digestible dry matter (IVDDM), about 20% neutral detergent fiber (NDF) and about 23% acid detergent fiber (ADF). The roots contain 10 to 14% crude protein and 80 to 85% IVDDM [4]. Pliny the Elder considered the turnip one of the most important vegetables of his day, rating it "directly after cereals or at all events after the bean, since its utility surpasses that of any other plant" and it "prevents the effects of famine" for humans [5]. Losses occur in turnips are due to weeds, diseases, predators, and insects. Weeds are generally not a problem once the turnip crop is established. Insect pests of turnip include flea beetles, aphids, wireworms, and root maggots in which aphid is the most serious pest. The aphid population generally makes its appearance sometimes during winter and it continues to breed parthenogenetically till the end of spring when winged individuals are produced and large-scale dispersal takes place. The population, however, dwindles mostly due to climatic reasons and practically disappears for the whole of the summer and also most of the autumn [6]. These aphids are small (about 2 mm), generally globular with piercing and

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Study on the biology of blowfly and the food consumption of blowfly maggots

Bismillah Shah, Imtiaz Ali Khan, Nazeer Ahmed

Abstract
To study the biology of blowfly and the food consumption of blowfly maggots, the present research work was carried out at Entomology research laboratory, The University of Agriculture, Peshawar during 2013. The blowfly (green bottles, blue bottles or carrion flies), is a well known scavenger insects and primary insects commonly utilized to indicate a post-mortem interval. Due to its importance as a death indicator in forensic entomology, a considerable amount of data on its growth and development has been generated. This experiment was conducted in two steps. In step 1, fresh meat was exposed to collect the eggs which were reared and used to study the biology of blowfly. Calculating the age of different life stages of blowfly, hourly developmental data is presented i-e eggs hatched in 16 hours while all the three instars of larvae took 92 hours followed by the pupal stage which was 336 hours. Adult's life was recorded 192 hours. In this way the total duration was recorded 636 hours. In step 2, to study the food consumption of blowfly maggots, three plastic jars provided each with known amount of meat and 10 active feeding 1st instar larvae were placed in an incubator at a constant temperature and relative humidity. The average meat consumed by 10 larvae was 19.3 gm and the average meat consumed per larvae was recorded 1.93 gm. This report recommends the study of biology of blowflies on different feeding sources plus growth rates and food consumption rate of blowfly maggots on different body tissues or food sources.

Keywords: Blowfly, Green bottles, Blue bottles, Carrion flies, Scavengers, Maggots, Instar, Forensic entomology.

1. Introduction
The blowflies (green bottles, blue bottles or carrion flies), is well known scavenger insects and belongs to family Calliphoridae and order Diptera. The name blowfly comes from an older English term for meat that had eggs laid on it, which was said to be fly blown. Blowflies are recognized as being among the first wave of the faunal succession on human cavaders [1, 2]. The adults are commonly 7 to 16 mm in length. Calliphorides are shiny with metallic coloring, often with blue, green or black thoraces and abdomens. Antennae are three-segmented and aristate. The characteristics and arrangement of hair like bristles are used to tell the difference between members of this family. All blow flies have bristles located on the meron. The postscutellum is absent or weakly developed. The costa is unbroken and the subcosta is apparent on the insect [3]. About 1,100 species of blow flies are known, with 228 species in the Neotropics, and a large number of species in Africa and Southern Europe. The most common areas to find Calliphoridae species are in India, Japan, China, Central America, and the Southern United States. The typical habitats for blow flies are temperate to tropical areas that provide a layer of loose, damp soil and litter where larvae may thrive and pupate. Adult blow flies are attracted to nectar, carrion, garbage, and other refuse and soggy, bloody or soiled hair, fur, or wool. Adult blow flies are occasional pollinators, being attracted to flowers with strong odors resembling rotting meat, such as the American pawpaw or dead horse arum. Most blow fly larvae feed in carrion or other decaying organic matter. They often infest wounds of sheep, goats, cattle, and other animals. The current theory is that females visit carrion both for protein and egg laying. Blowfly eggs, usually yellowish or white in color, are about 1.5 mm x 0.4 mm and when laid, look like rice balls. While the female blowfly typically lays 150–200 eggs per batch, she usually lays around 2,000 eggs during the course of her life. Blow flies have caught the interest of researchers in a variety of fields, although the large body of literature on calliphorids has been concentrated on solving the problem of myiasis in livestock. Maggot debridement therapy (MDT) is the medical use of selected, tested and disinfected fly larvae, including blowfly maggots, for cleaning non-healing wounds.

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Screening of two varieties of spinach against grasshopper under field condition

Bismillah Shah, Kamran Sohail, Numan Nisar, Nazeer Ahmed

Abstract

To study the screening of two varieties of spinach against grasshopper under field condition, the present research work was conducted at the New Developmental Farm (NDF) of The University of Agriculture, Peshawar in December 2014. Spinach is an edible flowering plant. Spinach occupies a good position among the vegetables due to its high nutritional value. There are certain insect pests and diseases that limit the growth and yield of spinach like Grasshoppers, Aphids, leaf minor and field cricket. In this experiment, two spinach varieties of *i.e.* single and double were purchased from the local market and were sown. Population of grasshoppers were observed from the plant emergence to crop maturity. In single spinach, the highest mean percent damage of 36% was recorded in second week whereas the lowest (21%) was recorded in week third. The mean percent damage recorded in week 1st was 29% which was followed by week 4th, 5th and 6th i.e. 27, 28 and 28%, respectively. In double spinach, the highest mean percent damage of 54% was recorded in third week whereas the lowest (36%) was recorded in week first. The mean percent damage recorded in week 1st was 36% which was followed by week 4th, 5th and 6th i.e. 49, 49 and 38%, respectively. On the basis of the study findings, it is recommend that single spinach variety should be used for better yield against grasshopper.

Keywords: Spinach, Grasshopper, high nutritional value.

Introduction

Spinach, *spinacia oleracea* (Amaranthaceae) in the order Caryphyllales is an edible flowering plant. Its native place is central and southwestern Asia. It is annual plant and rarely biennial. There are three basic types of spinach; savoy which has dark green curly and crinkly leaves, smooth leaf spinach which has broad smooth leaves and semi-Savoy is hybrid variety with slightly crinkled leaves. Plant grows up to 30 cm. Spinach may survive winter in temperate regions. Leaves are oval to triangular and are simple and alternate; leaf size is variable, about 2-3cm long and 1-15 broad. Flowers are inconspicuous, yellow green in colour having diameter of 3-4 mm. Flowers when matured turned into small, hard, dry and lumpy cluster 5-10 mm which consists of several seeds (Wikipedia).

China is the leading country in spinach production, followed by U.S.A, Japan, Turkey and Indonesia. Pakistan is ranked at 10th position among spinach producing country with the production of 82239 MT, during 2008. Top importing countries are Canada, U.K, Netherlands, Germany and Singapore. Top countries related to spinach export include U.S.A, Spain, Italy, Netherlands and Mexico (FAO 2008).

Requirements of highly productive spinach crop include well drained soil and efficient irrigation and fertilizer management. Quality seed should be used. Most commonly adopted seed sowing method is broadcasting. After sowing, irrigation is applied to keep the soil moist. After germination, irrigation frequency is adjusted accordingly. A nitrogenous fertilizer application aids in obtaining dark green, healthy and vigorous leaves. Flowering stalks appear from the plant, as the temperature rises.

Spinach occupies a good position among the vegetables due to its high nutritional value. It contains high anti oxidant properties along with several beneficial vitamins such as A, C, E, K and B2. It is also consists of magnesium, manganese, folic acid, iron, calcium, copper, phosphorous, zinc and selenium along with Proteins. Boiling of spinach leaves can reduce the nutritional value in some aspects. Spinach also has reportedly anti aging properties, anti-cancer effects, reducing the risk of cardiac disorders, muscular degeneration and vision-related discrepancies. It also helps in blood pressure regulation. It proves to be an efficient remedy for constipation, anemia, acidosis, night blindness, tooth and respiratory disorders, pregnancy and lactation and urinary disorders (Tahira Abbas *et al.* 2010) [1].

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Evaluation of vegetable extracts as natural lures for female *Bactrocera cucurbitae* (Diptera: Tephritidae)

Misbah Ullah, Mian Inayatullah, Nazeer Ahmed, Kamran Sohail, Habibullah, Saeed Ahmed, Muhammad Kamran

4-5

Nazeer Ahmed

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Saeed Ahmed

Muhammad Kamran

Abstract

The experiments on the attraction of female fruit flies *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) to the extracts of different vegetables as lures was conducted at the Nuclear Institute for Food and Agriculture (NIFA), Peshawar. The experiment was laid out in Completely Randomized Design. There were seven treatments including a control and each treatment was replicated three times. The lures were first tested in the field cages (controlled conditions) initially and then at Farmer's field. The treatments included the combination of round gourd and bitter gourd in ratios of 20:80 (T_1), 40:60 (T_2), 60:40 (T_3), 80:20 (T_4), 00:100 (T_5), 100:00 (T_6), respectively, and a control (T_7). Overall results revealed that extracts of bitter gourd (T_6) and round gourd (T_5) were significantly more attractive to female fruit flies than its other different combinations. These extracts reduced the infestation to 11.63% and 31.05% in experimental field and in farmer's field, respectively. However, no significant difference in yield was found between farmer and experimental field. Thus extracts of bitter gourd as well as round gourd were found to be effective in attracting the females of *B. cucurbitae* and can be used for effective control of fruit fly in IPM programs.

Keywords: natural lures, *Bactrocera cucurbitae*, toxicants bait, fruit fly

Introduction

Fruit flies (Diptera: Tephritidae) are among the world's worst pests attacking many types of fruits, vegetables, ornamentals and some nuts. The true fruit flies comprising over 4,000 species distributed over most of this planet. Depending on the environmental conditions and susceptibility of the crop species, the extent of losses varies between 30 to 100% (Gupta and Verma 1992; Dhillon *et al.* 2005; Shooker *et al.* 2006) [6, 4, 14]. The larvae damage the fruit internally, causing it to ripen prematurely and rot. Up to 100% of fruit may be damaged by fruit flies when infestations are uncontrolled (Hardy 1997) [7].

In Pakistan, the fruit fly complex may cause losses that range from 20 to 90% in different areas of the country. Fruits and vegetables suffer extensive damage due to impacts on yields and fruit quality. Citrus, mango, guava and peach industries on average suffer loss by 7.5, 15, 35 and 30%, respectively. In melons, levels of infestation of 50, 37 and 23% were found in Dera Ismail Khan, Rahim Yar Khan and Kulachi areas of Pakistan, respectively (Stone house *et al*. 1998) [16].

For the management of fruit flies, increasing applications of pesticides are facing resistance from environmentalists and the general public (Cark *et al*. 1996) [3]. The situation is further complicated because biological and cultural control methods do not yield immediate results necessary for successful eradication programs (Baranowski *et al*.1993; Aliniazee and Croft 1999) [1].

Female fruit flies are the dominant factor for multiplication of the pest. Female fruit flies attractive baits are needed in any applicative system for their monitoring and direct control (Mazor *et al*. 2002) [11]. They need protein source to mature sexually and also for the development of their eggs. Exploiting this need, female targeted system normally consists of traps baited with a liquid solution made from protein and fermenting sugar (Epsky *et al.* 1999; Mazor *et al.* 2002) [5, 11]. Increasing knowledge on behavior associated with attraction of both sexually immature females and egg laying females would improve detection and delimitation of fruit flies and provide increased protection of crops adversely affected by their presence (Ravikumar and Viraktamath 2007) [13]

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Study on the efficacy of ladybird beetle as a biological control agent against aphids (*Chaitophorus spp.*)

Shumaila Mushtaq, Nazeer Ahmed, Imtiaz Ali Khan, Bismillah Shah, Ashraf Khan, Murad Ali, Muhammad Tahir Rashid, Muhammad Adnan, Khwaja Junaid, Arqam Bakhtyar Zaki, Saeed Ahmed

Abstract
The Present study was carried out in laboratory of Entomology Department (28 ºC, 65% RH) at PMAS-Arid Agriculture University Rawalpindi during the year 2012. Fully matured ladybird beetles and aphids (*Chaitophorus spp.*) were collected from the willow trees in front of PMAS-Arid Agriculture University Rawalpindi on April 2, 2012. These natural enemies were reared on the aphids for the collection of larvae of ladybird beetles. The results from the current study show that there was significant control of *Chaitophorus spp*. by the ladybird beetles. The efficacy of ladybeetle from 1st to 3rd instars against *Chaitophorus spp*. was tested during the whole experiment. The immature stage of the beetles instars when feed on aphids have more survival rate and grows very fast. So the efficacy of ladybird beetle against the *Chaitophorus* species is very good. Plants can be saved from the attack of aphid by using the ladybird beetles.

Keywords: Ladybird beetles, aphids, natural enemy

1. Introduction
Ladybird beetles are the member of class insecta and belong to family Coccinellidae. As all other insects, beetles have an outer skeleton known as exoskeleton (Minks, a. k. & harrewijn, p. 1988) [11]. This outer skeleton gives protection and provides the attachment places for muscles. Body of these insects is consisting of three main regions: head, thorax and abdomen (white, r. E. & Peterson, r. T. 1998) [18]. Ladybird beetles have very distinctive shape and can be easily identified. Some species of ladybird beetles are judged as pests due to their attack on the vegetative parts of plants (Watts, B. 2004) [17]. But the larval and adult stages are very good predators of aphids and other small insects and mites (Hangay, g. & zborowski, p. 2010) [7]. Beetles act as biocontrol agent that feed very rapidly on aphids. When there is fine excess of aphids fed to beetles they always lay little or vast bunches of eggs (Dixon, a. F. G. 2000) [3]. The insects of Coccinellidae family are very gracious and valuable. These are predators of many other insects that help farmers in controlling the crop damaging insects below threshold level (Vincent, c., goettel, m. S. & lazarovits, g. 2007) [16].
Almost 4000 species of aphids are there worldwide; mostly occur in temperate areas (Sexton, c. 2008) [13]. Aphids have small bodies and are plant sucking insects which suck the sap from plant body (Dixon, a. f. g. 1998) [2]. Generally most of the aphid species can increase their generations by both sexual and asexual reproduction (Minks, a. k. & harrewijn, p. 1988) [11]. Due to this capability of asexual reproduction these insects are thought to be very successful on zoological point of view. In temperate regions aphids are very harsh pests on the growing crops. Aphids are present around the world but mostly these insects are present in the temperate regions (Van emden, h. f. & harrington, r. 2007) [15]. Body of the aphids is very delicate in nature. These insects may be green, black, brown, pink are about colorless (Heymann, g. & nanao, j. 1986) [9]. The mouthparts of the aphids are sucking called stylets formed by the modification in the maxilla and mandible. (Miller, f. P., vandome, a. F. & mcbrewster, j. 2010) [10] *Chaitophorus* specie of aphids mainly attack on willow tree (Salix spp.) which can be controlled by natural enemies of aphids like beetles. To achieve the integrated control of insect pests of willow tree by natural enemies a few studies have been done (Hangay, g. & zborowski, p. 2010) [7]. This study was undertaken to check the effectiveness of ladybird beetle against the *Chaitophorus* species.

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Evaluating larvicidal action of *Coriandrum sativum* (Dhania) and Mentha (mint) plant extracts against *Aedes aegypti* and *Aedes albopictus* larvae under laboratory conditions

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Abstract
An experiment was carried out on "evaluating larvicidal action of *Coriandrum sativum* (dhania) and Mentha (mint) plant extracts against *Aedes aegypti* and *Aedes albopictus* larvae". Rural areas of Islamabad i-e Rumli, Bari-Iman, Karlot, Barakahu and Rawal town were selected for vector collection. *Aedes aegypti*, vector of dengue belongs to class insecta, Order Diptera and Culicidae family. *Aedes albopictus* is vector of dengue and also found in Pakistan. Mentha (Mint) was found to be more efficient as it starts showing mortality at 10%. A significant mortality was observed at 10 to 15% concentrations, followed by complete mortality at subsequent concentrations as compared to *Coriandrum sativum* (Dhania). No significant mortality was observed at 15% concentration of *Coriandrum sativum* (Dhania) plant extract but it was observed at 20% concentration. This study intends to evaluate larvicidal action of *Coriandrum sativum* (Dhania) and Mentha (Mint) plant extracts against *Aedes aegypti* and *Aedes albopictus* larvae.

Keywords: Aedes *aegypti*, Aedes albopictus, Dengue, *Coriandrum sativum,* Mentha (mint),

1. Introduction
Mosquitoes are the most nuisance causing insects ever known to human race. They kill more humans worldwide in five minutes, than sharks do in a year (CDC, Centers for Disease Control and Prevention, 2008) [1]. Ever since these blood sucking creatures are known to cause diseases, humans are trying to work out methods for their reduction and elimination. Diseases that have caused a serious impact on public health include Malaria, Dengue, chikungunya, Japanese Encephalitis and many more. Among all the mosquito-borne diseases, the most recent one that has threatened public is dengue. The Dengue is global public health concern. It is endemic in more than 100 countries of Africa, Southeast Asia, the Eastern Mediterranean, the Western Pacific, and the Americas. Dengue causes more illness and death than any other arbovirus. Worldwide, there are approximately 2.5 billion people at risk of infection, and the World Health Organization (WHO) estimates that there are about 50 to 100 million cases per year (2, 3). Although dengue-like symptoms had been reported earlier, the first known pandemic of dengue-like illness (Pai H, Lu Y, Hong Y, Hsu E, 2005) [4].
Pakistan has experience a number of dengue fever outbreaks since 1992 (Khan E, Hasan R. J, 2005) [5]. In Pakistan first confirmed outbreak of Dengue fever was reported in 1994 (WHO, 2011) [6]. The disease was endemic in southern parts of Sindh and Baluchistan since 1994 however since 2004-5 dengue has been spread across the country (Guidelines for Dengue Vector) [7] High disease incidence and annual epidemic trend was observed during November 2005 in Karachi, Sindh (Experience and Lessons Learned during the 2011) [6] and 4,500 dengue cases were registered and the epidemic continued to affect a large number of people in Azad Jammu & Kashmir in 2006 but went largely unreported (Khan E, Hasan R. J, 2005) [5]. Lately as a result of Lahore epidemic-2011, dengue has become an important public health issue in Pakistan (Dengue GCP Guidelines) [8] Pakistan is at high risk of being hit by large epidemics because of many over crowded cities, unsafe drinking water, inadequate sanitation, large number of refugees and low vaccination coverage. (Jahan F, 2011) [9]

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Relative abundance of insect pollinators on two cultivars of sunflower in Islamabad

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Abstract
An Experiment was conducted during the year 2012 to evaluate the Relative abundance of insect pollinators on two cultivars of sunflower at Honey bee Research Institute, National Agriculture Research Center, Islamabad i.e., Hysun-33 and SMH-0942. Honey bees were the dominant group of pollinators that constituted about 79.96 and 78.49% on cultivars Hysun-33 and SMH-0942 respectively. Among honey bees *Apis mellifera* dominant on both cultivars. Other insect pollinator shows low activity on sunflower.

Keywords: Sunflower, insect, Pollinators, cultivars

1. Introduction
Pollinators are the most important insects playing vital role in the process of sunflower pollination. Bees visit a greater number of flowers to fulfill the needs of their colony, instead of other insects that visit flowers only for their own food [3]. Honey bees (*Apis mellifera*), due to higher numbers, vigorous daily activity, as well as their body structure conduct pollen transportation from one sunflower inflorescence to another. This provides an excellent pollination of the tube shaped sunflower florets [2]. The main issue in studies of sunflower pollination is foraging pattern of bees. Rearing of bees is an important requirement for good pollination, for excellent production providing a greater understanding of plant biology [6]. Bumble bees prove to be efficient pollinators due to their enhanced fluffy body, their long tongues, and the fact that they can carry out under low temperature and dark conditions. Bumble bees have an economical significance in most wide and cultured plants [4]. Other insect pollinators such as flies, butterflies and wasps also visit flowers and conduct pollination; however their activities are not considerable. The flowers visited by honeybees per minute were more in open pollination compared to other insect pollinators. Hence sufficient number of bee colonies in the surrounding area of the crops during flowering period was envisaging [5].

2. Materials and Methods
The present field investigations were carried out at Honey Bee Research Institute, National Agriculture Research Center Islamabad-Pakistan. The field experiment was conducted during March to June 2012. Two cultivars of sunflower Hysun-33 and SMH-0942 were sown in 70 m^2. Plant to plant and row to row distance was kept as 30 and 60 cm respectively. A 30-cm path between the plots was maintained. All recommended cultural practices were done with no spray during flowering period. All types of pollinators were collected using hand net from sub plot and main plot. Pollinators visiting sunflower were counted twice a day throughout the blooming period of the crop.
Relative abundance of each species was determined by using the following formula:

$$\text{Relative abundance of species} = \frac{\text{Number of individuals visiting flower}}{\text{Total number of pollinators counted}} \times 100$$

3. Results and Discussion
Table-1 shows data on relative abundance of pollinator's fauna of sunflower. Among the 12 species, honey bees were dominant group of pollinators on cultivars Hysun-33 and SMH-0942

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Description of key to different species of Genera of Aphidiinae (Homoptera: Aphididae) of District DI. Khan, KPK, Pakistan

Misbah Ullah, Maid Zaman, Nazeer Ahmed, Muhammad Ali, Jawad Ali Shah

Abstract
The present study was conducted on the basis of Aphidiins specimens collected during 2012 and 2013 form different ecological zones of District Dera Ismail Khan i.e Paharpur, Rangpur, Dhakkee, Kaich, Keri Khasoor, Biloot and Bahkhwai. Aphidiins are very small in size therefore sweeping of hand net was employed for their collection. Aphidiins were sorted out from the collection and were preserved in 70% alcohol. Specimens were then put in 97% alchohol for 24 hours before mounting on card point.

Keywords: Aphidiinae, Areas

1. Introduction
Aphidiinae is a large group of aphid parasitoids which can be recognized by the fragile habitus (body) and weakly sclerotized abdominal tergites. The antennal segments are less than twenty in most species. The suture between abdominal segments 2 and 3 is flexible which allow the abdomen to bend at this point. With the exception of two genera (*Ephedrus* and *Toxares*), the wing venation is greatly reduced. Many species have a single large median cell in the fore wing; hind wing cross vein cu-a absent. The scutellar sulcus is smooth and occipital carina is present [2].

More than 55 genera and about 400 species are known in the subfamily Aphidiinae. The genus *Praon* Haliday is one of the largest genera with more than 50 described species worldwide and many species of the genus are important biological control agents in various agro- and forest ecosystems [11].

An overall research interest in Aphidiinae has increased all over the world. Aphidiinae parasitoids were also found to be rather useful subjects for several fundamental studies. (1998) reviewed tritrophic associations for 11 genera from different parts of Pakistan [4]. listed host records for eight genera of aphidiins from different areas of Pakistan. Some work was done on the genera of Aphidiinae and host parasitism in KPK [3, 2, 1].

Dera Ismail Khan has not been studied for aphidiins. Keeping in view the importance of Aphidiinae as a biological control agent, the present study has been conducted to record the genera, provide taxonomic notes and and key to the identification of genera collected in Dera Ismail Khan area.

2. Materials and Methods
Study was based on the aphidiins specimens collected during 2012 and 2013 from different ecological zones of District Dera Ismail Khan i.e Paharpur, Rangpur, Dhakkee, Kaich, Keri Khasoor, Biloot and Bahkhwai. Aphidiins are very small in size therefore use of sweeping hand net was employed. Aphidiins were sorted out from the collection and were preserved in 70% alcohol. Specimens were then put in 97% alchohol for 24 hours before mounting on card point. Every specimen was labeled with a field label that includes (a) locality (b) collection date (c) collector's name (d) host (if any) and with identification label includes the subfamily and genus name. The Comstock Needhm System of wing vein nomenclature was followed. Wing vein and other morphological terminology was followed form [24]. Identification of the specimens was done with help of available literature [20, 6, 24, 18, 12]. Specimens were examined under an Olympus stereo-zoom microscope with magnification up to 440X. Morphometric measurements were taken using an ocular micrometer. Important diagnostic characters were drawn with free hand drawings and graphic software "Corel Draw 9". Key to the identification

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Identification and record of insect pollinators on two cultivars of sunflower

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Abstract
Field experiments were conducted in Honey bee Research Institute at National Agriculture Research Center, Islamabad during the year 2012 to record the of insect pollinators on sunflower. Two cultivars of sunflower viz. Hysun-33 and SMH-0942 were sown on 2nd April, 2012. There were open to pollinators respectively. Different species of insect pollinators visiting sunflower were collected and identified at the National Insect Museum, NARC, Islamabad. These species included *Apis mellifera L, Apis dorsata L, Apis florea, Apis cerana, Bombus haemorrhoidalis, Halictus sp, Xylocopa iridipennis, Polistes wattii, Delta dimidiatripinnae, Danis chrysippus, Catopsilia circle and Eristalinus sp*.

Keywords: Insect, Pollinators, Sunflower, Cultivar, *Apis mellifera, Apis dorsata*.

Introduction
Pollinators are essential in seed production for male-sterile (i.e., no pollen producing) sunflowers since pollen must be transferred from male-fertile to male-sterile plants [1]. Yield of sunflower is extremely dependent on proper pollination which is made by the melliferous bees and other natural insects. The melliferous bees play significant role in assuring pollination of the sunflower crops. Honey bees (*Apis mellifera*), due to higher numbers, rigorous daily activity, as well as their body structure conduct pollen transportation from one sunflower inflorescence to another. This provides an excellent pollination of the tube shaped sunflower florets [2].
Bumblebee especially *Bombus terrestris* L., have been shipped all over the world in huge numbers [3] since they were familiar as commercially important pollinators of glasshouse crops in the late 1980s [4]. Bumble bees prove to be efficient pollinators due to their enhanced fluffy body, their long tongues, and the fact that they can carry out under low temperature and dark conditions. Bumble bees have an economical significance in most wide and cultured plants [5]. Other insect pollinators such as flies, butterflies and wasps also visit flowers and conduct pollination; however their activities are not considerable. The flowers visited by honeybees per minute were more in open pollination compared to other insect pollinators [6]. The objective of this study was to record different species of insect pollinators visiting two cultivars of sunflower and their relative abundance.

Materials and Methods
The present field carried out in Honey Bee Research Institute at National Agriculture Research Center Islamabad. The field experiment was conducted during April, 2012. Two cultivars of sunflower viz. Hysun-33 and SMH-0942 were sown in $70m^2$ main plot and sub plots $4m^2$ with in randomized complete block design with three replications. Plant to plant and row to row distance was kept as 30 and 60 cm respectively. A 30 cm path between the plots was maintained. Two cultivars of sunflower (Hysun-33 and SMH-0942) were sown. All recommended cultural practices were done.

Collection of different species of insect pollinator visiting sunflower
The experimental plot was kept free from any spray during flowering period. Observations were made on different pollinators visiting the sunflower field during flowering. All types of pollinators were collected using hand net from sub plot.

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Population dynamics of corn flea beetle and four-spotted leaf beetle on different maize cultivars at Peshawar

Bismillah Shah, Imtiaz Ali Khan, Rasheed Akbar, Walija Fayaz, Maid Zaman, Mir Manzar Ud Din, Nazeer Ahmad, Muhammad Adnan, Khwaja Junaid, Syed Rizwan Ali Shah, Inayat-ur-Rahman

Abstract
The present study aimed to record population dynamics of corn flea beetle and four-spotted leaf beetle on different maize cultivars at Peshawar was conducted at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. The overall mean density of corn flea beetle and four-spotted leaf beetle were found statistically non-significant on the seven tested maize cultivars. However, the overall mean density of corn flea beetle was recorded higher (2.26 beetle leaf^{-1}) on Pahari cultivar and lower (2.10 beetle leaf^{-1}) on Climax 30M62. Overall mean density of four-spotted leaf beetle was found maximum (1.23 beetle plant^{-1}) each on Pahari and Azam and lower (0.99 beetles plant^{-1}) on C-3055. On the basis of lower incidence of insect pests, all of the seven tested maize cultivars are recommended for cultivation during spring season at Peshawar.

Keywords: Corn Flea Beetle, Four-spotted Leaf Beetle, Maize cultivars, Population dynamics

1. Introduction
Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. Maize is worldwide distributed crop [2]. It is the fourth largest grown crop in Pakistan after wheat, cotton and rice. After wheat and rice, maize occupies third position among the world's most important cereal crops, but second after wheat in Khyber Pakhtunkhwa province [3]. Classification of maize occurs on the basis of grains structure. Popcorn, flint, pod, dent, sweet and flour are major types of maize [4].

In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [5]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [6]. In Pakistan, the most dependable, profitable and staple crop after potato is maize [7].

There are many factors which are responsible for low yield of maize [8] among which insect pests are major ones. During the initial growth phase, corn crop is more susceptible to the insect damage particularly up to 30 percent losses can be caused by the soil insects which may necessitate the replanting of the crop. Maize germinating seeds and seedlings are damaged by other insect pests such as cutworms, wireworm, false wireworms, black field earwigs, maize stem borer and beetles such as African black beetle. Traditional methods such as spraying in furrows and various other agronomic practices at the time of sowing are also very effective [9]. Invertebrate insect pests that attack the maize crop at the development and maturity stages include corn aphid, green vegetable bug, corn earworm, red shouldered leaf beetle, common army worm, maize leaf hopper, two-spotted spider mite, maize weevil and thrips [10]. To control specific pests, selective pesticides have been developed [11].

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Correlation between proximate chemical composition and insect pests of maize cultivars in Peshawar

Bismillah Shah, Imtiaz Ali Khan, Ashraf Khan, Mir Manzar Ud Din, Khwaja Junaid, Muhammad Adnan, Syed Rizwan Ali Shah, Maid Zaman, Nazeer Ahmad, Rasheed Akbar, Walija Fayaz, Inayat-ur-Rahman

Abstract
The present study was conducted at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. Results of the proximate chemical composition of maize cultivars showed the moisture percentage in the range of 9.59%-12.27%. Similarly ash content was recorded in the range of 0.83%-1.13%, crude fats of 2.65% -2.97%, crude protein in the range of 10.03%-1.96%, fiber of 0.89%-1.37% while carbohydrates content of 71.12%-75.31% respectively. From the correlation matrices of the insect pests densities with biochemical characters, minimum moisture percentage, minimum protein content, higher ash content were proved to have contribution for resistance in maize cultivars against the insect pest attack. From the information mentioned above, the maize cultivar Climax 3055 was proved resistant while Pahari was proved susceptible cultivar among the seven tested maize cultivars.

Keywords: Insect Pest, Resistance, Maize cultivars, Ash, Protein, Carbohydrate, Crude Fat, Crude Fiber, Moisture

1. Introduction
Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [2]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [3]. In Pakistan, the most dependable, profitable and staple crop after potato is maize [4].

benefits and uses are countless. Chemical proximate composition shows that maize usually contains 10 percent proteins, 3.5 percent fiber, 2 percent minerals and 80 percent carbohydrates. Vitamin B and Iron are also present in maize [5]. Culinary oil (edible oil) is also extracted from maize seeds. A chemical called Levulinc acid is an ingredient used as antifreeze is also a maize derivative. There are many factors which are responsible for low yield of maize [6] among which insect pests are major ones. Maize germinating seeds and seedlings are damaged by other insect pests such as cutworms, wireworm, false wireworms, black field earwigs, maize stem borer and beetles such as African black beetle. Invertebrate insect pests that attack the maize crop at the development and maturity stages include corn aphid, green vegetable bug, corn earworm, red shouldered leaf beetle, common army worm, maize leaf hopper, two-spotted spider mite, maize weevil and thrips [7].

An important component of Integrated Pest Management (IPM) which is environment friendly, compatible with other control methods and is packaged in seed is the Host Plant Resistance (HPR) [8]. Numbers of plant characters are involved in host plant resistance. Herbivores and their natural enemies are influenced rather positively or negatively by the

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Determination of physio-morphic basis of resistance in different maize cultivars against insect pests

Bismillah Shah, Imtiaz Ali Khan, Ashraf Khan, Mir Manzar Ud Din, Muhammad Adnan, Khwaja Junaid, Syed Rizwan Ali Shah, Maid Zaman, Nazeer Ahmad, Rasheed Akbar, Walija Fayaz, Inayat-ur-Rahman

Abstract

The present study aimed to determine physio-morphic basis of resistance in maize cultivars against insect pests at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. The results of physio-morphic plant characters of maize cultivars revealed that plant height ranged from 195.62–221.63 cm, stem diameter 20.16-23.84 mm, cob length 1873-24.81 cm, number of nodes plant^{-1} 12.39 - 13.83, number of leaves plant^{-1} 12.44 - 14.33, leaf trichomes density 87.01 - 102.94, leaf length 71.25-83.73 cm, leaf width 7.55-9.19 cm, thousand grains weight 192.80-282.56gm and grain yield 2644–5389 kg/ha. From the correlation matrices of physio-morphic plant characters with insect pest densities, it was noted that lower plant height, high trichomes density and more number of nodes plant^{-1} contributed for resistance in maize cultivars against the insect pest attack. On the basis of lower incidence of insect pests and physio-morphic plant characteristics, all of the seven tested maize cultivars are recommended for cultivation during spring season at Peshawar.

Keywords: Maize cultivars, Physio-morphic, Resistance, Insect Pests.

1. Introduction

Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. Maize is worldwide distributed crop [2]. It is the fourth largest grown crop in Pakistan after wheat, cotton and rice. After wheat and rice, maize occupies third position among the world's most important cereal crops, but second after wheat in Khyber Pakhtunkhwa province [3]. In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [4]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [5]. In Pakistan, the most dependable, profitable and stable crop after potato is maize [6].

Maize benefits and uses are countless. Chemical proximate composition shows that maize usually contains 10 percent proteins, 3.5 percent fiber, 2 percent minerals and 80 percent carbohydrates. Vitamin B and Iron are also present in maize [7]. Culinary oil (edible oil) is also extracted from maize seeds. A chemical called Levulinc acid is an ingredient used as antifreeze is also a maize derivative. From corn stocks, fabrics and plastics are produced. Ethanol which can act as a biomass fuel is also obtained from it. There are some herbal supplements that are obtained from (corn silk) stigmas of female corn flowers. For home eating furnaces, straw of maize is commonly used as a cheap source of energy. Corn crop can also be used for forage purpose, to feed the livestock and after the fermentation of corn stocks silage can be made [8].

There are many factors which are responsible for low yield of maize [9] among which insect pests are major ones. During the initial growth phase, corn crop is more susceptible to the

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Screening of different maize Cultivars against maize shootfly and red pumpkin beetle at Peshawar

Imtiaz Ali Khan, Bismillah Shah, Ashraf Khan, Maid Zaman, Mir Manzar Ud Din, Syed Rizwan Ali Shah, Khwaja Junaid, Muhammad Adnan, Nazeer Ahmad, Rasheed Akbar, Walija Fayaz, Inayat-ur-Rahman

Abstract

The present study aimed to screen out different maize cultivars against maize shootfly and red pumpkin beetle at Peshawar was conducted at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. The overall mean density of maize shootfly and red pumpkin beetle were found statistically non-significant on the seven tested maize cultivars. However, highest overall mean density of shoot fly was recorded (0.46 flies plant^{-1}) each on Babar, Pahari and Iqbal while lower (0.41 flies plant^{-1}) on Climax 3055, Climax 30M62 and Jalal while Red pumpkin beetle overall mean density was found maximum of 1.10 beetles plant^{-1} on Pahari while lower of 0.98 beetles plant^{-1} on C-3055. On the basis of lower incidence of insect pests, all of the seven tested maize cultivars are recommended for cultivation during spring season at Peshawar.

Keywords: Shootfly, Red Pumpkin Beetle, Maize cultivars, Population dynamics

1. Introduction

Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. Maize is worldwide distributed crop [2]. It is the fourth largest grown crop in Pakistan after wheat, cotton and rice. After wheat and rice, maize occupies third position among the world's most important cereal crops, but second after wheat in Khyber Pakhtunkhwa province [3]. Classification of maize occurs on the basis of grains structure. Popcorn, flint, pod, dent, sweet and flour are major types of maize [4].

In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [5]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [6]. In Pakistan, the most dependable, profitable and staple crop after potato is maize [7].

There are many factors which are responsible for low yield of maize [8] among which insect pests are major ones. During the initial growth phase, corn crop is more susceptible to the insect damage particularly up to 30 percent losses can be caused by the soil insects which may necessitate the replanting of the crop. Maize germinating seeds and seedlings are damaged by other insect pests such as cutworms, wireworm, false wireworms, black field earwigs, maize stem borer and beetles such as African black beetle. Traditional methods such as spraying in furrows and various other agronomic practices at the time of sowing are also very effective [9]. Invertebrate insect pests that attack the maize crop at the development and maturity stages include corn aphid, green vegetable bug, corn earworm, red shouldered leaf beetle, common army worm, maize leaf hopper, two-spotted spider mite, maize weevil and thrips [10]. To control specific pests, selective pesticides have been developed [11].

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Study on the population densities of grass hopper and armyworm on different maize cultivars at Peshawar

Imtiaz Ali Khan, Bismillah Shah, Maid Zaman, Mir Manzar Ud Din, Khwaja Junaid, Syed Rizwan Ali Shah, Muhammad Adnan, Nazeer Ahmad, Rasheed Akbar, Walija Fayaz, Inayat-ur-Rahman

Abstract
The present study aimed to record Population densities of Grass hopper and Armyworm on different maize cultivars at Peshawar was conducted at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. The overall mean density of grass hopper and armyworm were found statistically non-significant on the seven tested maize cultivars. However, highest overall mean density of grasshoppers of 0.48 grass hoppers plant^{-1} was found on Azam while lower of 0.42 grass hoppers plant^{-1} on each of C-3055 and C-30M62. Overall mean density of worms was recorded higher of 0.77 worms plant^{-1} on Pahari while lower of 0.66 worms plant^{-1} on C-30M62. On the basis of lower incidence of insect pests, all of the seven tested maize cultivars are recommended for cultivation during spring season at Peshawar.

Keywords: Maize cultivars, Grass hopper, Armyworm, Population densities.

1. Introduction
Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. Maize is worldwide distributed crop [2]. It is the fourth largest grown crop in Pakistan after wheat, cotton and rice. After wheat and rice, maize occupies third position among the world's most important cereal crops, but second after wheat in Khyber Pakhtunkhwa province [3]. Classification of maize occurs on the basis of grains structure. Popcorn, flint, pod, dent, sweet and flour are major types of maize [4].
In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [5]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [6]. In Pakistan, the most dependable, profitable and staple crop after potato is maize [7].
There are many factors which are responsible for low yield of maize [8] among which insect pests are major ones. During the initial growth phase, corn crop is more susceptible to the insect damage particularly up to 30 percent losses can be caused by the soil insects which may necessitate the replanting of the crop. Maize germinating seeds and seedlings are damaged by other insect pests such as cutworms, wireworm, false wireworms, black field earwigs, maize stem borer and beetles such as African black beetle. Traditional methods such as spraying in furrows and various other agronomic practices at the time of sowing are also very effective [9]. Invertebrate insect pests that attack the maize crop at the development and maturity stages include corn aphid, green vegetable bug, corn earworm, red shouldered leaf beetle, common army worm, maize leaf hopper, two-spotted spider mite, maize weevil and thrips [10]. To control specific pests, selective pesticides have been developed [11].

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Study on the management of potato black scurf disease by using biocontrol agent and phytobiocides

Imran Khan, Sartaj Alam, Hammad Hussain, Bismillah Shah, Ahmad Naeem, Waseem Ullah, Waqar Ali Khan, Muhammad Adnan, Khwaja Junaid, Syed Rizwan Ali Shah, Nazeer Ahmed, Mazhar Iqbal

Abstract
In this study three phytobiocides (turmeric, chilli and pepper) were used *in vitro* and two in screen house along with biocontrol agent *Paecilomyces sp.* against *Rhizoctonia. solani.* All the three phytobiocides, effectively restricted the fungal growth, when pre-amended in PDA medium. After 21 days of incubation the minimum colony diameter (32mm) was recorded in the plates that were treated with turmeric followed by chilli (45mm) and pepper (47mm) respectively when compared with control (56.50mm). A second experiment, to check the efficacy of phytobiocides and biocontrol agent was carried out in the screen house condition. Two most effective phytobiocides (turmeric and chilli) and biocontrol agent (*Paecilomyces sp.*) were used at the rate of 10 and 20 g/pot. Turmeric was found to be the most effective, decreasing disease severity to 10.50% when compared with diseased control. Similarly, *Paecilomyces sp.* was also effective in reducing disease severity to 14.75%. Conversely, chilli was the least effective phyto biocide.

Keywords: Phytobiocides, Biocontrol agent, *Paecilomyces spp*

1. Introduction
Potato (*Solanum tuberosum*) ranks fifth in total crop production and third among food crops after wheat and rice in Pakistan [30]. Pakistan is a major potato producing country, contributing an area of 159000 ha with a total annual production of 3491000 tonnes. While KPK shares an area of 8900 ha with a total production of 118000 tonnes [1]. Potato is one of the richest sources of carbohydrate i.e. 10-30% while other components including proteins, fats and vitamins are 1-1.5%, 1-2% and 0.45% respectively [29].
Potato is one of the important crops which have major pathological problems. In our country, more than fifteen diseases so far have been reported on potato [32]. Their importance, however, varies considerably in different potato production zones [5]. Seed and soil -emerging diseases of potato are a huge threat to potato growth and production in all the 8 agro potato ecological zone in Pakistan [2, 3, 24, 34] and almost in all the potato growing zones in the entire world [39].
Rhizoctonia canker means ("roots death" from Greek) ordinary called black scurf. It is one of the oldest and the most ordinary infection of potato stems and stolons beneath the soil surface. It attacks the potato plants all the time, from planting to harvest but early stage is the most dangerous one because it causes eye germination inhibition, sprout death [25]. In later phase it causes the sunken black to brown zones on stolon and stem. Other symptoms are malformation, cracking, pitting and necrosis on stem end which results in poor quality tubers [11, 21].
Weedy plants namely *Lantana camara* and *Capparis decidua* have been used to manage *R. solani* [36]. Due to safe and non phytotoxicity many higher plants natural products have been successfully used in plant disease control. Now researchers are looking for other management approaches like use of different levels of soil moisture and different biocontrol agents and phytobiocides. Biological control and use of environment friendly phytobiocides can be more effective in control of this soil borne disease. The objective of this study was to determine the effect of phytobiocides against *R. solani in vitro* conditions and to determine the combine effect of biocontrol agent (*Paecilomyces sp.*) and phytobiocides for the control of black scurf of potato in screen house conditions.

2. Materials and Methods
The study was carried out at Malakandher Research Farm and laboratory of Plant Pathology Department, The University of Agriculture, Peshawar during 2013.

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Evaluation of phytobiocides and different culture media for growth, isolation and control of *Rhizoctonia solani in vitro*

Imran Khan, Hammad Hussain, Bismillah Shah, Waseem Ullah, Ahmad Naeem, Waqar Ali Khan, Nangial Khan, Muhammad Adnan, Khwaja Junaid, Syed Rizwan Ali Shah, Nazeer Ahmed, Mazhar Iqbal

Abstract
Evaluation of different culture media (Corn meal agar, water meal, potato dextrose agar, malt extract agar) for isolation and growth of *Rhizoctonia solani* and phytobiocides (Neem oil, garlic, ginger, turmeric and pepper) to investigate their effect upon the inhibition of mycelial growth of *R. solani* was carried out *in vitro*. Maximum biomass (21.50 mg) was harvested from potato dextrose broth followed by malt extract broth (19.50 mg), while the lowest biomass (3.50 mg) was produced by sterilized tap water. Food poison technique was used by amendment of phytobiocides in potato dextrose agar (PDA). Neem oil was used @of 0.1 ml/20ml potato dextrose agar medium, while the rest of phytobiocides were added @of 60mg/20ml of the medium. *R. solani* was inoculated aseptically on the center of the phytobiocides amended medium. Results of the study revealed that all the phytobiocides reduced the colony diameters of the *R. solani* significantly ($P \leq 0.05$) except ginger, compared with control (Un-amended PDA medium). Garlic was found to be the most effective inhibitory phytobiocides restricting the colony diameter to (38.25mm) as compared with other tested plant products.

Keywords: *Rhizoctonia solani,* Phytobiocides, Culture media, Mycelia.

1. Introduction
Rhizoctonia solani (teleomorph *Thanatephorus cucumeris*) was initially reported as a potato pathogen more than 150 years ago [16], and has since been proven to be a widespread and destructive fungal pathogen of many plant species [18]. There are currently 13 anastomosis groups (AGs) of *R. solani* [6], with those belonging to AG 3 predominately responsible for the infection of potato plants worldwide [10, 3, 8, 9, 14, 17]. Inoculum sources of *R. solani* include seed tubers and soil, both of which can harbour mycelium and sclerotia [22]. *R. solani* infects subterranean stems and stolons and severe lesions can have a negative effect on plant growth and tuber development [4]. The development of sclerotia on the surface of progeny tubers is a significant problem for growers, with severe black scurf infestations significantly reducing the quality and value of crops destined for both the ware and seed markets [7, 21]. Black scurf is is widely spread in Pakistan, especially in northern areas of Swat, Kaghan, Dir and Hunza valley etc. A few areas of Punjab are also affected.
The vegetative mycelium of *R. solani* and other *Rhizoctonia* fungi are colorless when young but become brown colored as they grow and mature. The mycelium consists of hyphae partitioned into individual cells by a septum containing a dough-nut shaped pore. This septal pore allows for the movement of cytoplasm, mitochondria, and nuclei from cell to cell. The hyphae often branch at a 90º angles and usually possess more than three nuclei per hyphal cell. The anatomies of the septal pore and the cellular nuclear number have been used extensively by researchers to differentiate *R. solani* from other *Rhizoctonia species*.
R. solani causes a wide range of commercially significant plant diseases. It is one of the fungi responsible for damping off in seedlings, as well as black scurf of potatoes, bare patch of cereals, root rot of sugar beet, belly rot of cucumber, sheath blight of rice and much other pathogenic condition.
Sclerotia consist of loosely constructed knots of melanised hyphae, with no cellular differentiation into a rind or medulla [22, 24]. Unlike many other sclerotia forming plant Pathogens, *R. solani* sclerotia only undergo direct myceliogenic germination, whereby

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Substrates evaluation for the quality, production and growth of oyster mushroom (*Pleurotus florida* Cetto)

Babar Iqbal, Hakim Khan, Saifullah, Imran Khan, Bismillah Shah, Ahmad Naeem, Waseem Ullah, Nangial Khan, Muhammad Adnan, Syed Rizwan Ali Shah, Khwaja Junaid, Nazeer Ahmed, Mazhar Iqbal

Abstract
Present study was conducted in the laboratory as well as in mushroom house to determine the effect of different agricultural wastes (wheat straw, rice straw, sugarcane bagasse, maize straw and sorghum straw) on growth, production and quality of oyster mushroom (*Pleurotus florida).* The culture was maintained on Malt Extract Agar medium. Spawn was prepared on wheat grains. Spawn running took less time i.e. 20 days on wheat straw as compared to other substrates. The appearance of pinhead and their maturity also took less time i.e. 29 days and 30 days, respectively on wheat straw. Maximum yield i.e. 1360 gram was recorded on wheat straw. The first flush gave the maximum yield in all treatments and there was a progressive decrease in the yield of successive flushes. The maximum biological efficiency of 136% was observed in case of wheat straw. The maximum moisture (93.44%) and ash (1.006%) were recorded in oyster mushroom obtained from sorghum straw. Percent protein content (8.75 gram), crude fat (10%) and crude fiber (3.5%) were maximum in oyster mushroom grown on sugarcane bagasse, maize straw and wheat straw respectively.

Keywords: Substrates, growth, production, quality, oyster mushroom

1. Introduction
Oyster mushroom (*Pleurotus florida* Cetto) is an edible mushroom. It contains adequate amount of phosphorous, iron, protein, lipid, riboflavin and thiamine. Oyster mushroom fresh fruiting bodies indicates a high quantity of moisture (90.8%), where as dry as well as fresh oyster mushrooms are rich in carbohydrate (57.6%), protein (30.4%), fiber (8.7%), fat (2.2%) and ash (9.8%) with 345 kilocalories energy value on 100 g dry weight. Mushrooms are an excellent source of minerals and protein and also known as the vegetarian's meat [44]. The proteins of mushroom are considered to be intermediate between that of vegetables and animals [42]. The amino acids essential for human body are present in oyster mushroom [36].

P. florida productivity is maximum in a short time providing more protein per unit area than any other crop [35]. The high content of nitrogen and protein in oyster mushroom increases the biological efficiency and yield while it reduces the growth period. *P. florida* contains 18 essential amino acids such as methionine, isoleucine, lysine, glutamic acid, cysteine, aspartic acid phenylalanine, tyrosine, tryptophan, valine, arginine, histidine, alanine, glycine serine and proline [26]. The vitamins such as niacin, riboflavin and thiamin are found in oyster mushroom. The minerals such as ferrous sulfate, phosphorus, sodium and calcium are present in oyster mushroom [60]. It is used for both medicine and food [6]. According to Furlani and Godoy [32], mushrooms are considered as food with high nutritional value and delicious taste. Due to their low caloric value they are suitable for diets. The *P. florida* produces metabolites of medicinal and pharmacological interest, such as antimicrobials, immunostimulants, antioxidants and antitumourals [28, 56, 38].

The substrate source, spawn quality, strain and compost affect the performance and growth of oyster mushroom [77, 39]. The genus *Pleurotus* are well- known for the conversion of substrates into mushrooms. Moreover, its commercial production is easy and least expensive [9, 61].Various substrates such as wheat straw, rice straw and sawdust are used for oyster mushroom cultivation [69]. The oyster mushrooms are known for anti-inflammatory and immune-modulator effects [48]. The cultivation is easy under both temperate and tropical climatic conditions and they are cultivated and harvested all over the year [7].

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Medicinal plants rhizosphere exploration for the presence of potential biocontrol fungi

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Abstract
During the present study, different fungi including *Paecilomyces sp*. from the rhizosphere of two medicinal plants i.e. *Aloe vera* (Ghee kuwar) and *Punica granatum* (Pomegranate) were isolated. For further biocontrol studies, *Paecilomyces sp*. which produced the highest (9 mm) and the lowest (2.7 mm) inhibition zone against *Fusarium solani* and *Helminthosporium sp*, respectively in dual culture tests was used. In screen house study the application of conidial concentration of *Paecilomyces sp.* against Fusarium wilt of chilli significantly reduced the disease. The highest disease reduction (90.1%) was recorded in the treatment when the chilli seedling roots were prior dipped in the conidial concentration of (1×10^4 conidia ml^{-1}) of *Paecilomyces sp.* Application of *Paecilomyces sp.* also positively affected the yield and the biomass i.e. fresh and dry shoot weight, fresh and dry root weight and plant height of chilli plants.

Keywords: Rhizosphere, *Paecilomyces sp*, *Fusarium solani*, medicinal plants, *Aloe vera*, *Punica granatum* L

1. Introduction
Medicinal plants constitute a large portion of the flora which provide raw materials for cosmetic and pharmaceutical industries i.e. *Punica granatum* L. (Pomegranate). It is medicinal fruit specie that belongs to family *Punicaceae.* It is a rich source of protein, carbohydrate, antioxidant, minerals, and vitamin A, B and C. It is also useful in treating tuberculosis, diarrhoea, acidity, leprosy patients, fever and pain in the abdomen. Similarly *Aloe vera* (Ghee kuwar) is another medicinal plant species that belongs to *Liliaceae* family. *Aloe vera* gel is a traditional medicine for inducing wound healing, anti-cancer, and anti-viral agent. *Aloe vera* makes arbuscular mycorrhizal associations, a linkage that helps plant in getting nutrients from the soil [13]. Due to huge colonization capacity and nitrogen fixation, the colonization of microorganism in the rhizosphere of medicinal plants is more as compared to non-rhizosphere soil and endosymbiotic linkages are established after entering the rhizosphere soil [18]. It stimulates the exudation of plant growth promoting substances e.g. kinetins, vitamins and gibberellins, that help in increasing the quality and quantity of the crops.
The major source of biological diversity is present in soil which is important for the ecosystem and rhizosphere [9]. The microorganisms are active in this area [19] involving huge community of microbes that influence plant development. The community structure of these microorganisms is influenced by specie of plant present, soil structure, land preparation, interacting microbes accompanied with effects of environment [16]. Microbes are added to rhizosphere for increasing soil aggregation, to suppress pathogenic microorganisms enhancing plant development [12].
Soil microorganisms establish relationship between plants and soil [11]. Fungi e.g. *Penicillium oxalicum*, *Trichoderma viride,* and bacteria e.g. *Bacillus subtilis* are regarded as useful microorganisms, *Rhizobacteria* species of *Trichoderma* and *Gliocladium* and some other sterile fungi have been investigated to enhance growth of plants [3]. Provision of nutrients to plants is enhanced due to the activities of rhizosphere microorganisms [2]. Biological control can be defined as the utilization of useful microbes, e.g. fungi or bacteria that stop pathogenic microbes to attack plants [6]. Biological control is an effective way to reduce the losses due to pathogens. Plant growth as a result of PGPR is stated to be due to fixing nitrogen, nutrients solubilization, enhancing activities of mycorrhiza, balancing ethylene within roots, production

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Study on the biological control of fusarium wilt of tomato

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Abstract
In present study, the effect of a root colonizing fungus *Penicillium* sp. EU0013_90S as biocontrol agent (BCA) against Fusarium wilt pathogens was observed in dual culture experiment as well as under screen house conditions. Dual culture experiment was conducted to see whether EU0013_90S has an inhibitory effect on different fungal pathogens especially Fusarium wilt pathogens e.g. *Fusarium oxysporum* f. sp. *lycopersici* race 1 CU1, race 1 MAFF 305121, and race 2 JCM. The radial colony developments of the pathogens were inhibited by zone of different lengths. In screen house experiment, different conidial concentrations (1×10^4, 1×10^5, 1×10^6 ml^{-1}) of *Penicillium* sp. EU0013_90S were treated with tomato seedling followed by Fusarium wilt pathogens of tomato (JCM, MAFF) having different conidial concentrations (1×10^5, 1×10^6, 1×10^7 ml^{-1}) A week after the treatment, tomato plants were observed for external symptoms. Stunting, yellowing and wilting of leaves were caused by *Fusarium oxysporum* isolates (JCM, MAFF). Disease severity was assessed through visual observation. The data was taken with two days interval for 24 days. Treatment of tomato plants with EU0013_90S resulted in significant disease reduction. Disease reduction varied with the different conidial concentrations of BCA and the Fusarium wilt pathogens (JCM, MAFF) used. The highest disease reduction (95.24% and 80.58%) occurred in the treatment where BCA was applied at lowest conidial concentrations (1×10^4 conidia ml^{-1}) with JCM and MAFF respectively.

Keywords: *Penicillium* spp. *Fusarium oxysporum,* biocontrol agent, pathogens

1. Introduction
Tomato is economically the second most important vegetable produced worldwide at around 115.95 million tons per year [4]. In 2008 the production of tomato in Pakistan was 536,217 tonnes. In Pakistan per hectare yield of tomato is very low. Many factors effect field losses e.g. susceptibility of tomato to many plant pathogens and pests, as well as post harvest losses due to improper handling practices.

One of the most destructive and economically damaging diseases of tomato is tomato wilt caused by *Fusarium oxysporum* f. sp. *lycopersici*. The characteristic symptoms include wilting, chlorosis, stunted seedlings [13]. As a result the infected plant dies. It is difficult to control due to various constraints e.g. crop rotation is not effective as the pathogen is soil inhabiting and polyphagus in nature. The most economical and environmental friendly method of disease control is the use of resistant cultivars but new races of pathogens break the resistance of tomato. The use of chemicals is neither economical nor environmental friendly [21]. So the difficulty in controlling Fusarium wilt has stimulated researchers for biological control.

A large number of biological control agents have been used for protecting tomato plants against wilt diseases including various fungal and bacterial species [5, 14]. Among the biocontrol agents non-pathogenic isolates of *F. oxysporum* and *F. solani* are reported to be effective antagonists and provide significant disease reduction [15]. 'biological control or biocontrol is the use of living organisms to suppress the density or impact of a specific pest organism, making it less abundant or less damaging than it would otherwise be. Aim of the present study is to analyse whether *Penicillium* sp. EU0013_90S can be used as a biocontrol agent against Fusarium wilt of tomato in Malakander (KPK, Agricultural University Peshawar) under screen house conditions.

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Survey of the distribution of leaf miners on Vegetables and other alternative host plants

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Abstract
The main aim of the present investigation was to know about the importance of leaf miners and the damage percentage they cause the present study was proposed to identify the species responsible for damaging the vegetables and other alternative host plants. The research was conducted during the year 2011, to determine the damage percentage of vegetables and other alternative host plants caused by leaf miner. All the vegetables are rich source of carbohydrates and vitamins which were selected in above survey. On the numerical basis of the data the minimum damage percentage (13.74%) was showed by the radish plants after the time interval of 7 days and the maximum damage percentage (52.08%) was showed by the tomato plants after the time interval of 84 days.

Keywords: leaf minor, vegetables, days, percent damage

Introduction
Leaf miners belong to four different orders of insects which are Diptera, Hymenoptera, Lepidoptera and Coleoptera [1]. According to metamorphosis, all these four orders of leaf miners are holometabolous. Their larval stages are morphologically different from each other. Adult female of a leaf miner laid eggs externally on the leaves or just beneath the epidermis of the leaves [2]. After the hatching of eggs the larvae enter in to the leaves and produce mines between the layers of epidermis and feed on the internal tissues of the leaves for some days or for their total larval life. The mines which are produced by the larvae may have a variety of shapes, these mines may be narrow, linear, spiral or blotch type which are always visible from the outside of the leaves [3]. Vegetables are very important for human life as they provide nutritions to human body [4]. Leaf miners have become serious insect pests of different vegetables and many others alternative host plants in Vietnam [5, 6]. In the recent years leaf miners have become a major threat to vegetables in Turkey [7]. Leaf miners cause cosmetic as well as economic damage on a wide range of host plants. The leaf miner *Chromatomyia syngenesiae* is a common pest with a wide host range mostly attack on cultivated plants such as chrysanthemum and lettuce [8]. The first outbreaks of the non-indigenous leaf miner *Liriomyza huidobrensis* were confirmed in 1989 and these early infestations spread rapidly from ornamental plants to vegetables in UK [9]. *Liriomyza* is a polyphagous group of leaf miners that contains up to three hundred species and the larvae of this genus attack on vegetables, ornamentals as well as some other alternative host plants that belong to Solanaceae, Asteraceae, Cucurbitaceae, Brassicaceae and Fabaceae family. *Liriomyza* species of leaf miner can damage to the plants in both ways either directly or indirectly [10, 11]. In case of direct damage the larvae feed on the parenchyma tissues of the leaves by producing various Shape of mines and cause nearly 62% reduction in the photosynthetic activities of the plants [12]. While in case of indirect damage both adult males as well as adult females feed on the plants without making mines to the plants. An adult female may act as a vector of various diseases during its oviposition [13, 14]. It has been reported that the *Liriomyza trifolii,* (Burgess) feed on nearly 79 various species of plants in India [15, 16, 17]. *Liriomyza huidobrensis* (Diptera: Agromyzidae) is a polyphagous leaf miner. 91% depends on vegetables ornamentals and cultivated host plants for their survival. This species of leaf miner was quickly spread due to transportation of various plant materials for the plastic tunnels and greenhouses [18, 19, 20].
Knowing the importance of leaf miners and the damage Percentage they cause the present study was therefore proposed to identify the species responsible for damaging the vegetables and other alternative host plants.

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Correlation between proximate chemical composition and insect pests of maize cultivars in Peshawar

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Abstract
The present study was conducted at Agronomy Research Farm (ARF), The University of Agriculture, Peshawar (UAP), Pakistan during 2015. Seven maize cultivars, namely Azam, Jalal, Babar, Pahari, Iqbal, Climax 3055 and Climax 30M62 were tested. Results of the proximate chemical composition of maize cultivars showed the moisture percentage in the range of 9.59%-12.27%. Similarly ash content was recorded in the range of 0.83%-1.13%, crude fats of 2.65% -2.97%, crude protein in the range of 10.03%-1.96%, fiber of 0.89%-1.37% while carbohydrates content of 71.12%-75.31% respectively. From the correlation matrices of the insect pests densities with biochemical characters, minimum moisture percentage, minimum protein content, higher ash content were proved to have contribution for resistance in maize cultivars against the insect pest attack. From the information mentioned above, the maize cultivar Climax 3055 was proved resistant while Pahari was proved susceptible cultivar among the seven tested maize cultivars.

Keywords: Insect Pest, Resistance, Maize cultivars, Ash, Protein, Carbohydrate, Crude Fat, Crude Fiber, Moisture

1. Introduction
Corn, usually called "maize" (*Zea mays* L.) (family Poaceae) is an annual, cross pollinated, Kharif crop. Zea, makai, corn, jovar and silk corn, etc. are other synonyms used to recognize maize. Corn provides food for humans, feed for animals particularly poultry and livestock and raw materials for various industries, hence it is a multipurpose crop [1]. In Pakistan, the total area under maize cultivation in 2013-14 was more than one million hectares and it yielded 3.5 million metric tons. The total area contribution of Khyber Pakhtunkhwa province under maize was 56 percent which contributed 63 percent of the total production [2]. Maize is mostly grown in Haripur, Swabi, Mardan, Malakand, Charsadda, Peshawar, D.I. Khan, Kohat and Bannu districts of Khyber Pakhtunkhwa [3]. In Pakistan, the most dependable, profitable and staple crop after potato is maize [4].

benefits and uses are countless. Chemical proximate composition shows that maize usually contains 10 percent proteins, 3.5 percent fiber, 2 percent minerals and 80 percent carbohydrates. Vitamin B and Iron are also present in maize [5]. Culinary oil (edible oil) is also extracted from maize seeds. A chemical called Levulinc acid is an ingredient used as antifreeze is also a maize derivative. There are many factors which are responsible for low yield of maize [6] among which insect pests are major ones. Maize germinating seeds and seedlings are damaged by other insect pests such as cutworms, wireworm, false wireworms, black field earwigs, maize stem borer and beetles such as African black beetle. Invertebrate insect pests that attack the maize crop at the development and maturity stages include corn aphid, green vegetable bug, corn earworm, red shouldered leaf beetle, common army worm, maize leaf hopper, two-spotted spider mite, maize weevil and thrips [7].

An important component of Integrated Pest Management (IPM) which is environment friendly, compatible with other control methods and is packaged in seed is the Host Plant Resistance (HPR) [8]. Numbers of plant characters are involved in host plant resistance. Herbivores and their natural enemies are influenced rather positively or negatively by the

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Impact of various insecticides and planting dates on the management of maize stem borer *Chilo partellus*

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Abstract
Field experiment on the impact of various insecticides and planting dates on the management of maize stem borer *Chilo partellus* in maize crop was conducted at Malakandair farm of The Agricultural University, Peshawar. Maize variety Jalal was raised on three different dates viz. 22nd June, 04 July and 16th July, 2014; and treated with Furadon 3G, Thimet 5G, Ripcord 10EC, Thiodan 35 EC, Karate 25 EC. Results revealed that means for number of healthy plants m^{-2}, infested plants m^{-2}, larvae in stubbles m^{-2}, dead hearts m^{-2}, and grains yield kg ha^{-1} showed significant effects due to insecticides and sowing dates. The number of healthy plants m^{-2} and yield in kg ha^{-1} were highest while the number of infested plants m^{-2}, dead hearts m^{-2} and larvae in stubbles m^{-2} were lowest in the plots treated with Furadon 3G (77.46, 1759.44, 11.63, 9.42 and 3.56) followed by Thimet (75.16, 1643.22, 14.64, 10.34 and 5.00) as compared to other extremes in Control (61.91, 1131.78, 21.48, 17.29 and 10.56). The number of healthy plants m^{-2} and yield in kg ha^{-1} were highest while the number of infested plants m^{-2}, dead hearts m^{-2} and larvae in stubbles m^{-2} were lowest in the plots sown on 22nd June (74.09, 1596.44, 15.20, 10.88 and 5.28) as compared to other extremes in plots sown on 16th July (71.24, 1401.50, 17.13, 13.73 and 7.44 respectively). The sowing date of 22nd June along with the application of Furadon 3G showed significant results for all the recorded parameters as compared to other treatments.
Keywords: Insecticides, Planting dates and Maize Stem Borer

INTRODUCTION

Maize (*Zea mays* L.) ranges third in world's cereals productivity. The origin of maize crop is US and has been domesticated about 7000 years ago. It is used for feed and food but its average productivity is low. Among the crops, maize is versatile having high nutritive value (Chaudhary, 1983). It is relatively short duration crop for the area of high altitude where chilling conditions and snow fall limit the growing period. In Pakistan, maize yield is 3037 kg ha^{-1} and in Khyber Pakhtunkhwa about 1780 kg ha^{-1} (MINFAL, 2009).

Maize stem borer, Chilo partellus Swinhoe (Lepidoptera: Pyralidae) is one of the major biotic constraints in successful maize and sorghum production worldwide (Pingali, 2001; James, 2003), particularly in Asia and Africa (Arabjafari & Jalali, 2007). It has been reported to cause severe losses in maize crop throughout its geographical distribution including Pakistan. This pest attacks all parts of the plant except roots, and causes damage by the destruction of the growing point in the whorl (dead heart), loss of photosynthetic leaf area due to foliar feeding, lodging due to burrowing in the stem, and extensive damage to young kernels due to feeding of larvae from the second and third generations. Damage is critical when the growing points of young plants are completely damaged, when there is extensive lodging due to stem boring, and when second and third generation larvae feed directly on the cob. Yield loss as high as 40% has been attributed to stem borers (Chabi *et al*., 2005).

A number of control methods have been used by the researchers to control the pest but due to heavy infestation and greater damage, chemical control is the most important method. Proper sowing time may enhance germination, establish stand and contribute higher in production by utilization of the resources effectively and suppressing the stem borers as well. Granular formulations of chlorpyriphos and carbofuran were reported effective against the pest by Bhat and Baba (2007). Keeping in view the importance of the crop, the devastating capacity of the pest and the ever dynamic pesticide market, the present research work was initiated to investigate the suitability of some insecticides for effective and safe suppression of Chilo partellus Swinhoe. Furthermore, various sowing dates were used in order to find the most suitable date for control of Chilo partellus Swinhoe in the area.

MATERIAL AND METHODS

An experiment on the "Impact of various insecticides and planting dates on the management of maize stem borer *Chilo partellus*" was conducted on maize variety Jalal at Malakandair farm of Khyber Pakhtunkhwa Agricultural University, Peshawar.

Field Layout:

The seeds were planted on three different sowing dates i.e. first on 22nd June, second on 04th July and third on 16th July, 2014. The row to row and plant to plant distance was kept 75 and 25 cm, respectively. Size of each experimental unit was maintained 4x5 m^2. A buffer zone of one meter width was kept between the experimental

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Studies on the efficacy of selected insecticides against anopheles mosquitoes of village Goth Bhoorji (Sindh) Pakistan

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Abstract
Anopheles subpictus mosquitoes were exposed to various diagnostic doses of three pyrethroids (Deltamethrin, Lambda-cyhalothrin, and Permethrin), one organophosphate (Malathion), and one chlorinated hydrocarbon (DDT), showed a range of mortalities in village Goth Bhoorji of district Mirpur Khas. *Anopheles subpictus* was resistant to two out of five insecticides in village Goth Bhoorji. Results of test done on *Anopheles subpictus*, against diagnostic dose of 4% DDT shown percentage mortality 100%. *Anopheles subpictus*, shown no resistance against 5% Malathion with mortality rate of 100%. Test results against 0.05% Deltamethrin diagnostic dose showed susceptibility in *Anopheles subpictus* with percentage mortality 100%. Wild caught female *Anopheles subpictus* showed percentage mortality 67.79% against 0.05% Lambda-cyhalothrin, while against 0.75% Permethrin the species were resistant with percentage mortality 67.54%.

Keywords: *Anopheles subpictus,* Pyrethroids Deltamethrin, Lambda-cyhalothrin, Permethrin, Organophosphate Malathion, one Chlorinated hydrocarbon DDT.

1. Introduction
Malarial disease is caused by female Anopheles mosquitoes. It is preventable and treatable, yet it kills millions of people every year [1]. Approximately half of the world's population is at risk of malaria and most malaria cases and deaths occur in sub-Saharan Africa. However, Asia, Latin America, and to a lesser extent the Middle East and parts of Europe are also affected. In 2011, 99 countries had ongoing malaria transmission. According to the latest estimates, there were about 219 million cases of malaria in 2010 and an estimated 660 000 deaths. Most deaths occur among children living in Africa where a child dies every minute from malaria [2]. In 2010, four countries accounted for 97% of the confirmed cases which were Sudan (58%), Pakistan (22%), Yemen (10%) and Afghanistan (6%) [3]. Malaria is the second most prevalent and devastating disease in Pakistan. Malaria has a tendency for epidemic outbreaks over larger area, particularly in Balochistan, NWFP and Sindh province. However, the disease is now emerging as a prominent health problem in FATA particularly along the international border with Iran and Afghanistan. In 2011, the total number of confirmed malaria cases in Pakistan (public sector), reported from all the districts were 319,592 [4].
About 380 species of Anopheles occur around the world. Some 60 species are sufficiently attracted to humans to act as vectors of malaria [5]. In Pakistan, out of total 24 Anophelines, there are two major vector species named *Anopheles culicifacies* and *Anopheles subpictus.* Recently two new species *An. fluviatilis* and *An. annularis* have been identified from Baluchistan province. Previously these two species have been considered confirmed malaria vectors in Iran and Afghanistan. However, their role as malaria vector needs to be confirmed through systematic operational research [4]. Vector control is an important part of the global malaria control strategy. Vector control is highly dependent on the use of pyrethroids, which are the only class of insecticides currently recommended for ITNs or LLINs. In recent years, mosquito resistance to pyrethroids has emerged in many countries. In some areas, resistance to all four classes of insecticides used for public health has been detected. Sub-Saharan Africa and India are characterized by high levels of malaria transmission and widespread reports of Insecticide resistance. The development of new insecticides for use on bed nets is a particular priority. Detection of insecticide resistance should be an essential component of all national

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Adulticidal efficacy of *Azadirachta indica* (neem tree), *Sesamum indicum* (til) and *Pinus sabinaena* (pine tree) extracts against *Aedes aegypti* under laboratory conditions

Arqum Bakhtyar Zaki, Nazeer Ahmed, Imtiaz Ali Khan, Bismillah Shah, Ashraf Khan, Muhammad Tahir Rasheed, Muhammad Adnan, Khwaja Junaid, Zelle Huma, Saeed Ahmed

Abstract
Due to the development of resistance to synthetic insecticides, residue problems in the environment and toxic effects on humans and non-target organism, investigators now direct their attention towards the development of new plant based insecticides with less harmful effects. Various compounds including phenolic, terpenoids and alkaloids exist in plants and may jointly or independently contribute to the generation of larvicidal activities of mosquitoes. The results obtained from Pine oil extract used in this study were satisfactory and establish the efficacy. Mortality increases with increase in plant extract concentrations and complete mortality was observed at the concentrations of 8 percent to 10 percent. The lower concentrations were still useful as they showed restless movement for some times with abnormal wagging and then died. Keeping in views the interpretation criteria Neem oil and Til oil considered low adulticidal activity at 24 hours exposure period Pine oil showed high adulticidal activity while after 48 hours exposure period all plant oil extracts showed high adulticidal activity. From the results it can be concluded the crude extract of pine oil extract was an excellent potential for controlling dengue vector mosquito, *Aedes aegypti*.

Keywords: Adulticidal activity, Neem oil extracts, Pine oil extract and Til oil extract, *Aedes aegypti*, Dengue vector.

Introduction
Mosquitoes are important vectors of a number of human diseases. There are about 3400 species of mosquitoes belonging to 42 genera [1]. Globally there are about 950 species have been reported under genus *Aedes*, while in Pakistan there are about 30 species of genus *Aedes*. Out of them two species are major vector for viral diseases i. e. *Aedes aegypti* and *Aedes albopictus* [7].*Aedes aegypti* is the primary vector of dengue while *Aedes albopictus* (Asian tiger mosquito) acts as a secondary vector [2]. Dengue is considered as one of the most important arthropod-borne viral diseases in Southeast Asia [3]. It is transmitted by the bite of a mosquito, infected with one of the four dengue virus serotypes (DEN1, 2, 3, and 4). It is a febrile illness that affects infants, young children and adults with symptoms appearing 3-14 days after the infective bite [4]. Dengue fever affects 50 million people annually, and approximately two fifth population of the world is at risk of infection. More than 100 countries in South East Asia, South and Central America, Mexico and Africa are currently experiencing dengue [5]. One recent estimate indicates 390 million dengue infections per year (95% credible interval 284–528 million), of which 96 million (67–136 million) manifest clinically [6]. According to World Health Organization, about 2.5% deaths occur globally every year and large proportion of which are children [8]. The outbreak of dengue has been documented in Eastern Mediterranean Region possibly as early as 1799 in Egypt and its frequency of repeated outbreaks continue to increase [9]. Recent outbreaks have been recorded in Pakistan, Saudi Arabia and Yemen [10]. Dengue Surveillance Cell Sind province in 2001 reported 1,809 suspected dengue cases out of which 881were confirmed with 5 deaths while 16 confirmed cases were reported in Islamabad. However, there was no mortality [17]. In the year 2005, Dengue emerged as the most significant mosquito-borne viral disease affecting humans [12].

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Rearing and identification of *Callosobruchus maculatus* (Bruchidae: Coleoptera) in Chickpea

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Abstract
To study the rearing and identification of *Callosobruchus maculates* (Bruchidae: Coleoptera) in chickpea, the present research work was carried out at the Entomology Research Laboratory of The University of Agriculture, Peshawar, during 2014. *C. maculatus*, (Bruchidae; Coleoptera) is an important stored grain insect pest distributed in Asia and Africa, ranging from tropical to subtropical world. It has been reported that the favorite hosts for *C. maculatus* are cowpea and chickpea but it also feed on other legumes as well. Grains were collected from various godowns of village Maneri (Swabi) and were brought to the Research Laboratory of The University of Agriculture Peshawar. Grains were kept in jars at 28±2 ºC and 65±5% Relative humidity (RH) and covered with muslin cloth in order to supply adequate humidity to the grains. To establish the stock culture of *C.maculatus* chickpea was used as a host. Grains of Chickpea were kept in the jars and the jars were covered with muslin cloth and placed at 28.5 ºC and 67.25 RH. The parasitoid from the culture of *C.maculatus* was collected with the help of aspirator and was then preserved in 70% alcohol. The parasitoid was identified with the help of literature and specimens present in the Insect museum of the Department of Entomology, The University of Agriculture, Peshawar. Both the pest and the collected parasitoid were properly mounted and labeled for demonstration purposes and were then deposited in the Insect museum of the Department of Entomology, The University of Agriculture, Peshawar.

Keywords: *Callosobruchus maculatus*, chickpea, legumes, stock culture, aspirator and parasitoid.

1. Introduction
Pests are a major problem both in the field and store houses. They cause losses of more than half of the expected yield [1]. Presently, pest control measures in storage rely on the use of synthetic insecticides and fumigants, which is the quickest method of pest control [2]. During storage, food commodities are attacked by the number of insect pest like *Sitophilus granarius, Rhyzopertha dominica, Callosobruchus chinensis* and *Callosobruchus maculatus.* Among them, *Callosobruchus maculatus*, (Bruchidae; Coleoptera) is an important stored grain insect pest distributed in Asia and Africa, ranges from tropical to subtropical world. It has been reported that the favorite hosts for *C. maculatus* are cowpea and chickpea but it also feed on other legumes as well [3]. Bruchid attack of pulses initially begins in the field and rapidly builds up during storage. Bruchid can cause an infestation from 60 to 100% during three to six months storage. Life cycle of *C. maculatus* is typically adapted to development in mature legume seeds. The larvae upon hatching enter into the cotyledons and spend the entire larval stage within the seeds. [4] As the larvae of these beetles are unable to migrate between seeds, the oviposition behavior of the female parent is crucial in determining the survival prospect of the progeny [5]. Recent studies have documented sample evidence to suggest that natural selection has molded the oviposition behavior and related life history traits such as fecundity, adult production etc. of these insects in a way that maximizes the individual fitness. The larvae of *C. maculatus* is totally dependent on the seed of legumes but the adults of this pest do not require water and feed but instead spend their limited life on mating and lying eggs. The eggs are being laid by an adult female on the surface of seed which are attached on its surface as if glued on the surface of seed at 30-35ºC and 70-90% R.H, are considered as ideal conditions for the oviposition and hatching takes place after 6 days of oviposition. Adults emerge within 3-4 weeks under favorable conditions [6]. *C. maculatus* males and females both have an average life time of 7 days under laboratory conditions and only few of them can survive more than 2 weeks [7, 8]. Both male and female can mate soon after their emergence and both can mate sever Times during their life time.

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Research Article

Different IGRs concentrations against maize stem borer (*Chilo partellus* Swinhoe) in field condition of Faisalabad-Pakistan

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Abstract

The experiment was conducted at the Youngwala experimental area of the Department of Agri. Entomology, University of Agriculture, Faisalabad in a Randomized Complete Block Design (RCBD), with 24 treatments excluding one control. The data for maize stem borer population was recorded after 3 days, 7 days and 14 days post IGRs application. The results obtained are concluded that all the insect growth regulators were equally effective against maize stem borer at different concentrations and on the numerical basis lowest stem borer population and its infestation was recorded in the pyriproxyfen® and priority® at 2x concentration and at concentration of field recommended concentration followed by other treatments concentrations. So, among the entire tested insect growth regulators pyriproxyfen® and priority® were the most effective IGRs against maize borer. Among the entire tested insect growth regulators viper® and sitara® were the least effective IGRs against maize borer.

Keywords: Maize borer *(Chilo partellus* Swinhoe*)*; Formulation; IGRs

Introduction

Agricultural gross domestic product and 85% of export revenue and employment to a total of 25 to 50% of the labor force, according to Pakistan's economy is built on the national level. Corn (L Egypt), popular Pakistani food, feed and fodder crops. Pakistan produced only 8,92 t ha -1, the United States, Canada and 7.82 T, China and France, 7.14 tons of HA-1 [1] of 4.85 tons, and in Pakistan, corn planting 967,000 hectares, with an annual output of more than 3.0, the average yield of 1970 kg HA-1 of the 1731 tons 6.4% of corn grain production in the country [2]. Agriculture being the backbone of Pakistan's economy employs

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EFFECT OF DIFFERENT PLANTS EXTRACTS ON TERMITE SPECIE (*HETEROTERMIS INDICOLA*)

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ABSTRACT

This study was carried out to find the effect of some commonly present plant products on termite species (*Heterotermis indicola*) which are a major threat worldwide. Three different concentrations (20%, 10%, 5%) of various solutions consisting of garlic, Neem and tobacco was used in hot and cold water. Hot and cold water results showed that a high concentration treatment of the garlic (20%) solution caused 100% mortality after 48 hours, but in the case of the tobacco concentration (20%) of the solution in only cold water resulted in 100% mortality. As the concentration become lower, the efficiency becomes slower. 100% mortality in the 10% & 5% solutions of garlic and tobacco occurred in different days. In case of Neem, both hot and cold water was found less effective as compared to garlic and tobacco. The mortality occurred using Neem was significantly less than garlic and tobacco.

Keywords: Termite, Hot and Cold Water, percent mortality, days, different Concentrations

INTRODUCTION

Termites are a group of insects (Isoptera) consisting of 2500 species, of which 300 are considered pests. Termites are social insects found in a wide range of terrestrial environments distributed throughout the world. Termites feed on the decomposition of organic wastes like leaves, animal dung, and living or dead wood. Approximately 2600 species and 281 genera have been described. (Kambhampati and Eggleton, 2000).

Termites are the one of the most damaging pests in the tropics and cause considerable problems in housing, agriculture and forestry. Termites have families, including sub-families. Some have nests underground, others in wood. For example, some termites hollow out trees and some build mounds. The most difficult types of termites in agriculture are termites on fungal growth, residues of crops and other organic material used for feeding, like mulches and organic soil matter (humus). However, they also feed on the material of live plants when they don't find their required food, including crops such as groundnuts, millets and maize (Zaheer *et al*. 1998.).

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Evaluation of Diver® concentration against cotton mealybug, *Phenacoccus solenopsis* (Hemiptera: Pseudococcidae) and its parasitoid, *Aenasius bambawalei* (Hymenoptera: Encyrtidae) in Laboratory

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ABSTRACT

Bio-assay of Diver® for mealy-bug and its parasitoid, *A. bambawalei*, was carried out during 2010-2011 in the IPM Laboratory, Department of Agri. Entomology, University of Agriculture, Faisalabad. All the concentrations of Diver®, which were applied in laboratory conditions, were effective against mealy-bug. Diver® is the best mineral oil to control mealy-bug when compared to other synthetic pesticides. On the numerical basis of data, which were recorded on mortality basis, the highest concentration of Diver® was most effective against mealy-bug, followed by the other concentrations. All the concentrations of Diver® on the parasitoid of mealy-bug swerve less and their effects were increased day by day, e.g. in 3 days the effect was minimal and in 21 days the effect of mortality was at its maximum because the residual toxicity of Diver® was present for a long time.

Keywords: cotton, mealy bug, parasitoids, Diver®, Hemiptera.

INTRODUCTION

Agriculture is the primary and leading sector of Pakistan and has a vital role in Pakistan's economy. Its contribution to GDP is more than 22% and it provides direct employment to 45% of the total labor. Most of the population of the Pakistan is located in rural areas that have a direct or indirect relationship with agriculture. Agriculture is much more important as it provides raw material to the industry. Cotton is the most important cash and fiber crop of Pakistan. Pakistan is the fifth largest producer of cotton, but almost 40% of cotton is consumed domestically.Leftover cotton is exported. Pakistan is the third largest exporter of raw cotton on the globe. Cotton and its products contribute up to 10% to the country's GDP (Anonymous, 2007).

The mealybug, *Phenacoccus solenopsis,* has recently emerged as a severe pest of cotton in Pakistan (Ahmed *et al*., 2012).Itwas first found in Asia (Pakistan) in 2005 (Abbas *et al*., 2005; Zaka *et al*., 2006)

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Volatile-Mediated Attraction of Greenhouse Whitefly *Trialeurodes vaporariorum* to Tomato and Eggplant

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The behavior of the greenhouse whitefly, *Trialeurodes vaporariorum* Westwood (Hemiptera: Aleyrodidae), is known to be affected by plant volatile cues, but its attraction or repellent to specific volatile cues has not been deeply studied yet. Therefore, the aim of our study was to identify the most attractive plant among cultivars of tomato (*Solanum lycopersicum*) and eggplant (*Solanum melongena*) to evaluate the volatiles of plants to identify the chemical compound(s) that attract *T. vaporariorum*. We speculated that whitefly–host plant interaction primarily depends on plant volatile emissions and that once the plant is damaged, it might attract more whiteflies. Three intact (uninfested) tomato, four intact eggplant cultivars and whitefly infested plants of the most whitefly attractive tomato and eggplant cultivars were examined by behavioral assay experiments for attractiveness to *T. vaporariorum* and headspace volatile were determined by solid-phase microextraction (SPME) and gas chromatography-mass spectrometry. Whiteflies had the highest preference for the intact eggplant Kuai Yuan Qie (KYQ) among the eggplant and the tomato plant cultivars in bioassay experiments. Although both male and female whiteflies were significantly more attracted to infested KYQ plants than to intact plants, whitefly females did not select conspecific-infested YG plants. The volatile emissions among different plant cultivars in individual species and infested versus intact plants were significantly different. Among these volatiles, identified major green leaf volatiles [(Z)-3-hexen-1-ol] and terpenoids [α-pinene, (E)-β-caryophyllene, α-humulene, azulene] showed a constitutive relationship with the most whitefly preference plants. Our findings provide new insights into the chemical compounds that attract or repel whiteflies.

Keywords: ***Trialeurodes vaporariorum*, tomato plant, eggplant, conspecific-infested plants, headspace volatiles, SPME**

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INTRODUCTION

In agro-ecosystems, plants and herbivores interact with plant metabolites either directly or indirectly. Volatile-mediated foraging behavior is prominent in herbivore pests when they target host plants (Dicke and Baldwin, 2010). In natural conditions, plants produce different blends of volatiles like monoterpenes, sesquiterpenes, aldehydes, and green leaf volatiles (GLVs)

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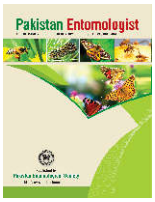

INFESTATION OF SUGARCANE BORERS AND REMEDY BY FARMING COMMUNITY AT DARGAI MALAKAND

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ABSTRACT

A study was conducted to record sugarcane borer infestation at Dargai Malakand during the year 2012. The experiment was carried out in a randomized complete block design with three replications. Data were recorded on weekly basis from the 3rd week of June to the 1st week of September. The lowest infestation (8.30%) was recorded during the 3rd week of June with gradual increase to its peak (52.90%) in the 3rd week of July. The percentage infestation recorded in the 4th week of June was 16.1 followed by 25.8 and 42.09% in the 1st and 2nd week of July; respectively before pesticide application. After spray application the lowest infestation recorded was 19.7% during the 1st week of September and the highest (38.6%) in the 4th week of July. The infestation recorded during the 1st week of August was 32.9% followed by 28.8, 26.0 and 23.3% in the 2nd, 3rdand 4th week of August. Maximum reduction in the infestation was recorded during 1st week of September which was 56.74% followed by 52.6, 49.80, 46.39 and 37.51% in the 4th, 3rd 2nd and 1st week of August and 26.01 % in the 4th week of July. The study concluded that Lorsban proved to be an effective chemical against sugarcane borer in the field and is recommended to use this pesticide to suppress the pest population significantly.

Keywords: Borers, Farming community, Infestation, Sugarcane

INTRODUCTION

Sugarcane *(Saccharum officinarum)* is an important cash crop of Pakistan. It is also an important source of income and employment for the farming community of Pakistan. Sugarcane provides raw materials for industries like paper and chipboard manufacturing. Its shares in value added agriculture and GDP are 3.4 percent and 0.7 percent, respectively (Food and Agriculture Division, 2009).

Total cane area in Pakistan during 2010-2011 was 987.6 thousand hectares with a total cane production of 55308.5 thousand tons with an average yield of 56.0 tons per hectare. Among this Khyber Pakhtunkhwa has 88.4 thousand hectare with a total production of 4030.3 thousand tons with average yield of 45.6 tons per hectares (Agriculture Statistics of Pakistan 2010-11)

Sugarcane is the main source of white sugar in Pakistan. It is the fourth major crop after wheat, cotton and rice. Sugar industry is regarded as the second largest industry after textile and pays around 15 billion rupees in various taxes annually. It contribute 2 % to the country's GDP and its contribution in manufacturing sector is around 12.80 % (Ashraf, 2003). The average cane yield in Pakistan ranges from 44-47 tons/ha, which is much below the other competing countries such as India (69 tons/ha), USA (84 tons/ha) and Egypt (107 tons/ha). Lower cane yield is not only due to the climatic barriers but also involves improper cultural practices, lack of irrigation, cultivation of uncertified seeds, late sowing and harvesting, unbalance nutrition, bad ratooning, insect pests and diseases. Due to these constraints, present yield of sugarcane in the country is nearly 80 % below the demonstrated achievable potential (Riaz, 2003).

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Intraguild predation on the aphid parasitoid *Aphelinus asychis* by the ladybird *Harmonia axyridis*

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Abstract We investigated intraguild predation (IGP) on an aphid parasitoid, *Aphelinus asychis* Walker (Hymenoptera: Aphelinidae), by the multicolored Asian ladybird, *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae), and used the green peach aphid, *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) as the prey/host in the laboratory. The ladybirds reared on artificial diet and on aphids consumed more aphids than mummies, while those reared on parasitized aphids consumed similar numbers of aphids and mummies. The ladybirds chose more mummies in treatments when mummies were more abundant, and more aphids when numbers of aphids and mummies were equal, or when aphids were more abundant. However, at all density treatments, rejection rates of mummies (36%) were much greater than of aphids (2%). *H. axyridis* prey on more aphids than *A. asychis* mummies, which enhances biological control by the two species. However, prior feeding experience affected subsequent choice, increasing the competition between natural enemies which would reduce their combined effectiveness for biological control.

Keywords Coleoptera · Coccinellidae · Hymenoptera · Aphelinidae · Feeding experience · Prey quality

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Introduction

Biological control systems usually involve a diverse community of natural enemies (Snyder and Ives 2003). Aphidophagous predators and specialist aphid parasitoids are widely used to control aphids (Bilu and Coll 2007; Costamagna et al. 2007). However, the interactions between predators and parasitoids are not always harmonious (Gontijo et al. 2015). Most generalist predators are able to prey on specialist parasitoids (Chacón and Heimpel 2010). The interaction when a predatory ladybird consumes the mummy of a parasitoid wasp when both are feeding on aphids is termed intraguild predation (IGP) (Polis and Myers 1989; Arim and Marquet 2004). The killing and eating of a guild member may reduce potential competition

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POPULATION TREND OF APHID (*Lipaphis erysimi* Kalt) ON CANOLA (*Brassica spp.*) CULTIVAR IN PESHAWAR

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ABSTRACT

Four canola cultivars viz, (Durre-NIFA, Abasin, Raya-NIFA and Bulbul) were tested for their resistance/tolerance against aphid (*Lipaphis erysimi*) attack in randomized complete block design (RCBD) at the new developmental farm of Khyber Pakhtunkhwa agricultural university Peshawar, during the rabi season of 2011. The results of overall mean revealed that minimum aphid infestation (25.48) leaf^{-1} was recorded on canola cultivar Bulbul and maximum aphid infestation (58.67) leaf^{-1} was recorded on Raya-NIFA. Similarly the highest aphid (30.19) infestation per 2.8 cm of inflorescence was recorded on the Raya-NIFA and the lowest number (12.19) of aphids/2.8 cm of inflorescence was recorded on Bulbul. The cultivar Raya-NIFA could not tolerate aphid attack and resulted in stunted growth. Bulbul resulted in maximum yield (3085.56), oil content (49.1), siliqua plant^{-1}(117.96), 1000-seed weight (14.17), seed siliqua^{-1} (22) and low aphid infestation. Raya-NIFA presented better result to plant height (127.215), protein content (23.5) and moisture content (4.0). It was concluded from the study that aphid population on all the tested cultivars fluctuated and non of the cultivar showed complete resistance to aphid during most of the season probably due to lack of antixenosis or antibiosis. However, the data on yield and other agronomical characteristics indicated that the cultivar Bulbul possess some levels of resistance.

Keywords: Aphid infestation, canola cultivars, correlation of aphid infestation, plant characteristics

INTRODUCTION

Brassica napus L. belong to the family Cruciferae. Commonly this crop is known as "Sarsoon". The most important types grown in Pakistan are *Eruca sativa, B. campestris, B. juncea* and *B. napus*. Rape seed refers to *B. campestris* and *B. napus*. Local type (Desi) belongs to the *B. compestris* group. This group also contains yellow sarsoon, brown sarsoon and toria. Due to low concentration of erucic acid and glucosinolate content *B. campestris* and *B. napus* have been preferred over other species of *Brassica*. Human use its oil for food and oil seed cake (Khal) can be used for cattle. The edible oil production in Pakistan is low. In Pakistan after cotton seed, the rape seed and mustard seeds are vital source of edible oil due to their 17% contribution in oil production (PARC, 1998).

The name canola refers to the cultivars of those species that produce seed with lower level of glucosinolate and erucic acid than rape seed cultivars. In Pakistan, "canola" (*B. napus* and *B. campestris* .) is attaining the status of leading oil seed crop. Pakistan oil seed development board (PODB) has developed synthetic and hybrid varieties of canola with indigenous resources. Indigenous varieties performed better than the exotic varieties under different agro-ecological conditions of the country. Local canola seed production has resulted in self-sufficiency in the seed requirements of the country and now Pakistan is not importing any canola seed (Mohammad, 2008). The oil production can further be increased by improving the normal agronomic practices and overall by protecting the crop from the attack of insect pests. The production of edible oil in Pakistan is meeting only 25% of the total requirements. Presently, cotton is the most important crop of Pakistan, contributing more than 60% of the domestic production, while rape seed-mustard is the second important

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Research Article

Response of cauliflower (*Brassica oleracea* L. botrytis) cultivars to phosphorus levels

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Abstract

Cauliflower is one of largely produced vegetable in however low per hectare yield is a major problem. While improper and less frequent use of high yielding cultivars may be one reason, inadequate and unbalanced doses of fertilizer may be another important constrains leading towards lower yield of vegetable in Pakistan. So, this experiment was conducted to investigate the response of cauliflower cultivars to phosphorus levels, at Horticulture Farm, University of Agriculture, Peshawar. Randomized Complete Block Design was designed with split plot arrangement having two factors i.e., phosphorus levels (0, 40, 60, 80 kg ha^{-1}) and cauliflower cultivars (Peshawar local, Silver Star, White Diamond, White King), which were repeated thrice. It was found that Cauliflower cultivars and phosphorus levels significantly affected growth and yield parameters. The results revealed that maximum number of leaves $plant^{-1}$ (25.13), days to curd initiation (104), curd diameter (30.64 cm), curd weight (800 g) and yield ha^{-1} (27.55 tons) were recorded at phosphorus level of 80 kg P_2O_5 ha^{-1}, while lower value for all parameters were observed in control plots. Among cultivars, White King showed maximum number of leaves $plant^{-1}$ (23), days to curd initiation (104), curd diameter (30 cm), curd weight (793 g) and yield ha^{-1} (19 tons). As the interaction between phosphorus levels and cauliflower cultivars concerned, most of the growth and flowering attributes of cauliflower performed maximum results when cultivar White King was treated with 80 kg P_2O_5 ha^{-1}. It was concluded that application of phosphorus @ 80 kg ha^{-1} and cultivar White King showed maximum results regarding yield, and hence recommended for Peshawar growers.

Key words: *Brassica oleracea* var. Botrytis L; response; cultivars; phosphorus; levels.

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RESPONSE OF CORIANDER (*Coriandrum sativum* L.) TO DIFFERENT NITROGEN LEVELS AND SOWING DATES

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ABSTRACT

Field experiment for different levels of nitrogen and sowing dates for coriander crop was performed under field conditions during year 2011-12. Sowing of Coriander was practiced on three dates with fortnight interval from 20th October to 20th November). Nitrogen fertilizer was applied at four levels of 0, 20, 40 and 60 kg ha^{-1}. Maximum days to germination, plant height, number of days to first umbel maturity and seed yield kg ha^{-1} were observed in plants provided with at 60 kg ha^{-1} nitrogen at 5th November sown crop, hence recommended for better production of coriander under the agro climatic conditions of Swat.

Keywords: Coriander (*Coriandrum sativum* L.), Nitrogen levels and sowing dates.

INTRODUCTION

Regarding low yield of coriander in Pakistan, several factors are responsible. Appropriate sowing time and judicious use of fertilizers are of supreme importance in this regard. This crop has its own requirement for low temperature and light to precede germination, growth and maturity. Its need of low temperature initially could be observed in early sowing as temperature is above optimum which adversely affects germination due to the action of several bacteria and fungi on embryo and endosperm. This mainly happens by the activities of fungi and bacteria encouraged by temperature above optimum (Naeem et al*.,* 2002). Late crop sowing results in less number of branches per plant and poor or stunted crop growth due to severe low temperature. In order to obtained higher yield of coriander, there is need to improve the efficiency of available land by judicious use of fertilizers and selection of proper sowing time. Soil fertility and crop productivity could be improved by proper nitrogenous fertilization (Akanbi et al., 2001).

Application of nitrogen fertilizer improved seed yield and biomass of coriander by 43-68% and 25-42%, respectively (Heng et al., 2001). Various production factors are responsible for improving crop yield, however, nutrient management the most important significantly affecting yield in crops. Low crop productivity in recent years is mainly attributed to decline in fertility status of the soil. Major problems faced by farmers in maintaining soil fertility are, shortage in production of fertilizer and availability at required times. Due to variation in yield potential of different soils, ensuring proper nutrient supply throughout the growing season is the greatest challenge of the day for agriculture scientist. For sustainability in crop production and improvement in soil health, balanced fertilization is very important (Sharif et al., 2004). Nitrogen fertilization plays major role in crop yield improvement with better plant health (Kizil and Ipek, 2004). Regarding various nutrients, nitrogen is the most limiting nutrient and coriander requires approximately 50 Kg N ha^{-1}. Efficient application of nitrogen from organic and inorganic sources effectively enhances yield and quality of coriander and soil health. Nitrogen as a fertilizer is consider the most limiting factor affecting marketable yields as well as nitrate accumulation in coriander. Application of excess nitrogen, however, is often much more than utilized by the plants. Higher nitrate build up due to arbitrary incorporation of nitrogen is getting importance as a public health concern. Considering the importance of nitrogen dose rate and effective sowing date for improved coriander crop yield, present study was planned under field conditions to find out the best sowing time and nitrogen application rate.

MATERIALS AND METHODS

The experimental plots were ploughed well and the soil sample was taken for analysis. Soil

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Response of Potato Cultivars to Organic and Inorganic Fertilizers Under the Agroclimatic Conditions of Skardu (Gilgit-Baltistan)

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Abstract. Field research was conducted during summer season in 2010, in order to determine the effective combination between potato varieties i.e., the best yielding potato cultivar under organic or inorganic fertilizer in Skardu valley, Gilgit-Baltistan, Pakistan. A randomized complete block design (RCBD) was used for the trial and both the experimental factors (cultivar and fertilizer type) significantly affected the crops growth and yield variables. Among the nine different organic and inorganic fertilizer treatments, the maximum mean values of sprouting rate 43.1%, plant height 49.5 cm, number of tubers/plant (8.5), weight of tubers/plant (385.9 g), tuber diameter 3.8 cm and yield (25.7 t/ha) were obtained in the crops which received 10 tonnes FYM/ha + 150 kg N/ha. Among the cultivars tested, Desiree showed the maximum mean values of sprouting rate 30.4%, plant height 36.7 cm, number of tubers/plant 7.3, weight of tubers/plant 350.3 g, tuber diameter 3.7 cm and yield 23.4 t/ha. Overall results revealed that the treatment matched to 10 t/ha FYM + 150 kg/ha N (T7) led to the highest tuber yield and Desiree showed better performances than other cultivars.

Keywords: potato cultivars, fertilizer levels, yield, Skardu

Introduction

In Gilgit-Baltistan (Pakistan), agriculture is the mainstay of the people living in the area, as more than 90% of the population depends upon agriculture (Alam *et al*., 2007). The climate is ideally suited for the cultivation of potato, but the productivity of this crop is very low despite the high labour employment. In fact, potato yield per ha is lower than that obtained in the rest of the country 17.7 vs 23.6 tonnes, respectively.

Total area devoted to potato cultivation in Gilgit-Baltistan was 6483 ha in 2005 MINFAL (2005). Notably, in 1950 two varieties, Katwar Red and Phulwar White, were mainly grown there, whereas after 1955-56 another variety named Ultimas was approved for cultivation and it is still grown in Skardu, Gilgit and the surrounding areas (FAO, 2010). Currently, the most famous cultivars grown in Gilgit-Baltistan are Desiree, Cardinal, Ultimus (red) and Diamond (white).

Unfortunately, in Pakistan fertilizers are very expensive and sometimes not available by the dealers hence, the farmers fail to apply the inorganic fertilizers to crops at an appropriate time and accordingly, they are not able to manage the crops properly. In this scenario, organic manure is being used by farmers' community as a source of plant nutrients which is easily available to the farmers and cheaper, as compared to inorganic fertilizers. Notably, organic fertilizers such as cattle manure, poultry manure and green manure include high quantity of nutrients which influence plant growth and yield, by improving biological, chemical, and physical fertility of the soil (Benke *et al*., 2009). Moreover, in previous research (Caruso *et al*., 2013) potato crops grown under organic nutrition showed yield and quality performances comparable with those usually obtained under mineral fertilization. The present study was designed to assess the combined effect of organic and inorganic fertilizers on the yield of different potato cultivars in the climatic conditions of Skardu (Gilgit-Baltistan).

Materials and Methods

A research was conducted on potato (*Solanum tuberosum* L.) at the Agriculture Research Station Skardu (Gilgit-

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