CHAPTER-1

INTRODUCTION

INTRODUCTION

Rice is grown world wide in over 124 million hectares under diverse cultural conditions and over a wide geographical range. The need for higher levels of production has caused expanded areas to be planted and more crops per year to be harvested. Rice is adaptable to a wide range of environmental conditions, because, it has an efficient system of air passage from shoot to root. This system allows rice to grow in waterlogged soils. Insect pests attack all portions of the rice plant and all stages of plant growth.

Although, rice insect outbreaks have been recorded over the last 1300 years, they have become much more frequent and the insect pest complex has changed in the last three decades. Certain insects, such as the leaf and plant hoppers have increased in severity, whereas, others such as certain stem borer species have declined in importance. The spread of the dry season crop has caused shifts in the composition in the tropics have increased in severity, some species such as the white stem borer, *Scirpophaga innotata* (Walker), have decreased in importance because its larvae aestivate in stubble and are destroyed by the dry season land preparation, species dependent on standing water, such as the whorl maggot *Hydrellia phillipina* Ferino, and the rice case worm *Nymphula depunctalis* (Guenee), has come more abundant.

For many decades, insecticides have been widely used to control rice pests. However, the continuous use of a wide range of pesticides has caused many side effects, including loss of biodiversity, the problem of secondary pests, insecticide resistance, residual toxicity, the resurgence of insect pests, and environmental pollution. Recently, many efforts have been made to combine various non- chemical control methods with insecticides in systems of Integrated Pest Management (IPM). One such effort is the combined use of natural enemies to control agricultural pests have been reported (Van den Bosch *et al.* 1992).

As rice scientists and farmers have gained experience in the cultivation of the modern varieties and the agronomic practices that have accompanied the "Green Revolution" they have become acutely aware of the need to develop more effective and economical pest management strategies, this resulted in a shift from a primarily unilateral approach of insect control with a strong reliance on insecticides to a multilateral approach involving a mix of control approaches.

Alternative pest control tactices have been developed and integrated into control program. This approach known as integrated pest management (IPM) in the simplest terms is referred to as "a broad ecological attack combining several tactics for the economic control and management of pest populations" (Smith and Calvert, 1978).

IPM programs are having a significant impact on minimizing the adverse effects of insecticides, and increase in the profitability of rice production. It has been estimated that the cost savings from research leading to increased insect pests management efficiency on rice in south and southeast Asia will be $ 973 million in insecticide by the year 2000 (Flinn, 1984).

The important root and stem feeders are mole crickets, *Grylotalpa africana,* rice mealy bug, *Brevennia rehi,* Black bugs, *Scotinophora coarctata, S. lurida,* Asian rice gall midge, *Orseolia orizae,* rice seedling flies, *Altherigona exigua, A. orizae* ;chafers, such as *Anomala dimidiate, Holotrichia seticollis, Popillia cupricolis,* rice root weevil, *Echinocnemus orizae,* Paddy root weevil, *Hydronomidius molitor.*

Gold-fringed rice borer, *Chilo auricilius,* spotted stem borer, *Chilo partellus,* dark headed stem borer, *Chilo polychrysus,* rice stripped borer, *Chilo suppressalis,* yellow stem borer, *Scirpophaga incertulas* (Panda *et al.,* 1976), white stem borer, *Scipophaga innotata;* pink stem borer, *Sesamia inferens* and large rice grasshoppers; *Hieroglyphus banian* and *H. nigrorepletus* (Nair, 1978; Singh and Dhamdhere, 1982) are the major stem borers of rice plant.

The riceleaf-folder,*Canphalocrocis medinalis,* earlier considered as a minor and sporadic pests of rice in many Asian countries. Misuse of insecticides and excessive use of nitrogenous fertilizers have been cited as the cause of high leaf-folder populations (Dhaliwal *et al.,* 1979).

When modern improved rice varieties were introduced in the mid-1960s, chemical insecticides were embraced as part of the package of technologies of the green revolution, with increased adoption of new high yielding varieties, use of insecticides also increased. The destruction of predators and parasitoids that followed insecticides misuse resulted in resurgence of several rice pests including the brown plant hopper (BPH), *Niloparvata lugens* (Stal) (Heinrichs and Mochida, 1984; Kemmore *et al.*, 1984), green leaf hopper (GLH), *Nephotettix spp.* (Kobayashi, 1961) and rice stem borers (Lim *et al.*, 1980). Chronic outbreaks of the brown plant hopper in Indonesia in the mid 1960s were attributed to excessive use of insecticides in rice fields. The result was the Presidential decree in banning use in the rice environment of more than 57 insecticides (England, 1987).

Nickel (1964) recommended an excessive survey of natural enemies of the pests followed by detailed ecological studies. Studies of the rice insect pests and their natural enemies should be a continuous part of research program, both to identify important natural enemies and to promote practices that enhance their conservation.

Although, species diversity and total number of predators and parasitoids in tropical rice are impressive, generalizations about the precise role and relative importance of individual species are difficult. Clearly abundance shifts seasonally and geographically, but in general, only relatively few species have been shown to impact heavily on target insect pests. This is primarily due to fact that little definitive work has been done and techniques that allow researchers to dissect these communications of parasitoids and predators and determine their individual roles are not available. A comprehensive review of techniques for evaluating arthropod natural enemies has been published by Luck *et al.* (1988), although relatively few of the techniques have been used in rice.

The importance of predators in natural control of stem borers has received little attention. Pantua and Litsinger (1984) reported up to 65% of the eggs of yellow stem borer were consumed by *Conocephalus longipennis* (de Haan) (Orthoptera: Tettigonidae). Predation on eggs of the yellow stem borer averaged about 30% during entire season at the IRRI farm (Shepard and Arida, 1986).

The single most important predator was the grasshopper, *C. longipennis*. Although, *C. longipennis* has been reported no damage rice panicles (Rothschild, 1971; Barrion and Litsinger, 1987; van Vreden and Abdul Latif, 1986), its predatory role is more significant. Rubia *et al.* (1990) showed that *C. longipennis* could consume over eight yellow stem borer egg masses in three days. The grasshopper population increased late in the season, when yellow stem borer is usually a more serious problem.

Other predatory orthopterans such as *Metioche vittaticollis* (Stal) (Orthoptera: Gyrallidae) that feed readily on eggs of the stripped stem borer, *C. suppressalis,* would not feed on yellow stem borer egg masses (Rubia and Shepard, 1987). Than Htun (1976) reported that the wolf spider, *Lycosa pseudoannulata* (Boesenberg and Strand) (Araneae: Lycosidae), confined to small area in the laboratory killed up to 90% of 130 borer larvae in one day. This wolf spider is also capable of attacking stem borer moths.

Spiders are of major importance in ecosystems and are recognized as effective natural control agents in agroecology. They are classified into 106 families with about 40,000 species, but the actual number of species is expected to be many times higher.These are carnivorous arthropods and are found all over the world in almost every kind of habitat. They mainly prey on insects, although they may also feed on various other kinds of prey. The population densities and species abundance of spider communities in agricultural fields can be as high as in natural ecosystems (Turnbull, 1973; Tanaka, 1989 and Riechert, 1981).

Spiders play an important role in regulating insect pests in the agricultural ecosystem. There are a large number of species many of them with high population densities, There are 22 families, 99 genera and 175 species of spiders in Korean rice fields. They limit the availability of habitats open to insect pests of rice by occupying various microhabitats. They have a wide range of prey species, catch significant numbers of prey and use various foraging strategies. Most of the spiders in rice fields seem to evacuate the field after the application of insecticides and move back into the field later. Their predatory capacity can have a synergistic effect in suppressing densities of insect pests when they are used to complement the effects of insecticides. They consume a large number of pray, and do not damage plants. They can achieve and equilibrium in pest control, after which their own numbers are suppressed by their territoriality and cannibalism. For some time, spiders have been considered important predators which help regulate the population densities of insect pests (Pickett *et al.*, 1946; Dondale, 1956; Duffey, 1962; Kajak *et al.*, 1968; Fox and Dondale, 1972 and Tanaka, 1989). In particular, spider communities in areas with a temperate climate achieve equilibrium in the control of agricultural pests. In spite of this, they have not usually been treated as an important biological control agent, because there is so little information on the ecological role of spiders in pest control (Turnbull, 1973, Riechert and Lockley, 1984).

The family Araneidae is diverse; orb weavers vary in colors, sizes, and shapes. The webs of orb weavers consist of radial strands, like spokes of a wheel, and concentric circles. Most orb weavers build their webs vertically, attaching them to branches, stems, or man made structures. Araneidae webs may be quite large, spanning several feet in width. The orb weavers are one of the three largest spider groups.

All members of the family Araneidae possess eight similar eyes, arranged in two rows of four eyes each. Despite this, they have rather poor eyesight and rely on vibrations within the web to alert them to meals. Orb weavers have four to six spinnerets, from which they produce strands of silk. Many orb weavers are brightly colored, and have hairy or spiny legs.

Like all spiders, orb weavers are carnivores. They feed primarily on insects and other small organisms entrapped in their sticky webs. Some larger orb weavers may even consume hummingbirds or frogs they've successfully ensnared.

The orb weaver's web is a masterful creation, designed to ensnare meals efficiently. The spokes of the web are primarily non-sticky silk, and serve as walkways for the spider to move about the web. The circular strands do the dirty work. Insects become stuck to these sticky threads on contact.

Most orb weavers are nocturnal. During daylight hours, the spider may retreat to a nearby branch or leaf, but will spin a trapline from the web. Any slight vibration of the web will travel down the trapline, alerting her to a potential catch. The orb weaver possesses venom, which she uses to immobilize her prey.

Orb weaver spiders live throughout the world, with the exceptions of the Arctic and Antarctic regions. In North America, there are approximately 180 species of orb weavers. Worldwide, arachnologists describe over 3,500 species in the family Araneidae.

The jumping spider family (Salticidae) contains more than 500 described genera and about 5,000 described species, making it the largest family of spiders with about 13%of all species. Jumping spiders have good vision and use it for hunting and navigating. They are capable of jumping from place to place, secured by a silktether. Both their book lungs and tracheal system are well developed, as they depend on both systems (bimodal breathing). Jumping spiders live in a variety of habitats. Tropical forests harbor the most species, but they are also found in temperate forests, scrublands, deserts, intertdal zones and even mountains. *Euphrys omnisuperstes* is a species reported to have been collected at the highest elevation, on the slopes of Mount Everest.

Jumping spiders are generally recognized by their eye pattern. All jumping spiders have four pairs of eyes with very large anterior median eyes.

Jumping spiders are generally diurnal active hunters. Their well developed internal hydraulic system extends their limbs by altering the pressure of body fluid (haemolymph) within them. This enables the spiders to jump without having large muscular legs like a grasshopper. Most jumping spiders can jump several times the length of their body. When a jumping spider is moving from place to place, and especially just before it jumps, it tethers a filament of silk (or *dragline*) to whatever it is standing on. Should it fall for one reason or another, it climbs back up the silk tether.

Jumping spiders have very good vision centered in their anterior median eyes (AME). Their eyes are able to create a focused image on the retina, which has up to four layers of receptor cells in it (Harland and Jackson, 2000). It seems that all salticids, regardless of whether they have two, three, or four kinds of color receptors, are highly sensitive to UV light (Peaslee and Wilson, 1989). Some species (for example, Cosmophasis umbratica) are dimorphic I the UV spectrum, suggesting a sexual signaling (Lim and Li, 2005). Color discrimination has been demonstrated in behavioral experiments.

Jumping spiders are active hunters, which means that they do not rely on a web to catch their prey. Instead, these spiders stalk their prey. They use their superior eyesight to distinguish and track their intended meals, often for several inches. Then they pounce, giving the insect little to no time to react before succumbing to the spider's venom.

Some species exhibit an amazing resemblance with ants and are called "ant like" spiders. They belong to the genus *Myrmarachne*. Because of its resemblance to ants, it can walk between them without being attacked.

The family-Tetragnathidae is the tenth largest spider family of the world encompassing almost 1000 species in 4 subfamilies and 51 genera. They range in size from small to large (2-23 mm body size). Many species build delicate sometimes more or less horizontal orb webs with an open hub and few, wide-set radii and spirals. The webs have no signal line and no retreat and are often found in vegetation near water. The spiders often sit in the centre of the web. If disturbed they drop to the ground or cling to the vegetation adopting a stretch position with the long legs stretched out rendering themselves inconspicuous.

The tetragnathids belong to the group of ecribellate spider families having 8 eyes and 3 tarsal claws. Many members of the family are usually elongated spiders characterized by the often very long legs and chelicerae (subfamilies Tetragnathinae and Leucauginae). Colours vary, quite often with bright white, green, red and yellow colours often with coppery or silvery blotches.

Ground spiders (family *Gnaphosidae*) include nearly 2,000 described species in over 100 genera, distributed worldwide. This makes the family the seventh largest known. New species are still being discovered. They are closely related to *Clubionidae* (PLATNICK AND SHADAB, 1983).

Common genera include *Gnaphosa, Drassodes, Micaria, Cesonia, Zelotes* and many others. There are 14 species known to northwest Europe (PLATNICK AND SHADAB, 1983).

Generally, ground spiders are characterized by having barrel-shaped anterior spinnerets that are one spinneret diameter apart. The main exception to this rule is found in the ant mimicking genus *Micaria*. Another characteristic is an indentation in the endites (paired mouthparts anterior and lateral to the labium, or lip). All ground spiders lack a prey-capture web and generally run prey down on the surface. They hunt at night and spend the day in a silken retreat. The thick-walled egg sacs are guarded by the mother until the spiderlings hatch (PLATNICK AND SHADAB, 1983).

Huntsman spiders (Sparassidae) is a family of spiders also known as the giant crab spiders, due to their size and appearance. Larger specimens of these spiders are also some times referred to as wood spiders, due to their preference for inhabiting woody places (forest, mine shafts, woodpiles, wooden shacks). They are known as rain spiders in southern Africa (Larsen, Norman, 2010).

These eight-eyed spiders are found in Australia, New Zealand, South Africa, Southeast Asia, the Meditterranean, Florida and Hawaii and possibly in many tropical and semitropical regions. While frequently very large in Laos, *Heteropoda maxima* males can attain a legspan of 250–300 mm (9.8–11.8 in). As with all spiders, they use venom to demobilise or digest prey, but they are not deadly to healthy humans.

Many huntsman spiders are dull shades of brown or grey. Their legs are covered with fairly prominent spines, but the rest of their bodies appear smooth. The tropical or Brown Huntsman (*Heteropoda*) is also large and hairy, with mottled brown, white and black markings. The eyesight of these spiders is not nearly as good as that of the Salticidae (jumping spiders). Nevertheless, their vision is quite sufficient to detect approaching humans or other large animals from some distance.

Members of the huntsman family of spiders are very common in Australia, but also in many tropical and semi-tropical parts of the world. They have been introduced to many parts of the world,including China, Philippines, Japan, India an d southern parts of the United States, such as Florida and Puerto Rico. As adults, huntsman spiders do not build webs, but hunt and forage for food: their diet consists primarily of insects and other invertebrates, and occasionally small skinks and geckos. They live in the crevices of tree bark, but will frequently wander into homes and vehicles.

Spiders of the **family Theridiidae** are also called comb-foot spiders. Theridiids have a row of setae, or bristles, on their fourth pair of legs. The setae help the spider wrap its silk around captured prey. Cobweb spiders are sexually dimorphic in size; females are larger than males. Female cobweb spiders have spherical abdomens and long, slender legs. Some species practice sexual cannibalism, with the female eating the male after mating. The black widow gets its name from this practice.

Cobweb spiders build irregular, 3-dimensional webs of sticky silk. Not all spiders within this group build webs, however. Some cobweb spiders live in social communities, with spiderlings and adult females sharing a web. Others practice kleptoparasitism, stealing prey from other spiders' webs.

Cobweb spiders feed on insects, and occasionally other spiders. When an insect becomes ensnared in the sticky strands of the web, the spider quickly injects it with venom and wraps it tightly in silk. The meal can then be consumed at the spider's leisure.

With dozens of genera in the Theridiidae family, adaptations and defenses are as diverse as the cobweb spiders. *Argyrodes* spiders, for example, live along the edges of other spiders' webs, dashing in to grab a meal when the resident spider isn't around. Some Theridiids mimic ants, either to trick potential ant prey or to fool possible predators.

Cobweb spiders live throughout the world, with more than 2200 species described to date. Well over 200 Theridiid species live in North America.

Lynx Spiders are the members of the family *Oxyopidae*. They all are hunting spiders that spend their lives on plants, flowers and shrubs. There are several genera and they tend to differ in their habits and adaptations. For example most *Oxyopes* and *Hamataliwa* species are small to medium in size; they tend to be drab and especially the latter tend to be ambush hunters in ways resembling the crab spiders (*Thomisidae*). Some occupy flowers and wait for pollinating insects, whereas others lie in wait on plant stalks or bark. The *Peucetia* species on the other hand, commonly are larger, vivid green, and rangy; they are active runners and leapers. Oxyopidae in general rely on keen eyesight in stalking, chasing, or ambushing prey, and also in avoiding enemies. Six of their eight eyes are arranged in a hexagon-like pattern, a characteristic that identifies them as members of the family *Oxyopidae*. The other two eyes are smaller and generally situated in front and below the other six. The *Oxyopidae* also have spiny legs, and in many species those legs, augmented by the spines, seem to be used as a sort of catching-basket in trapping flying insects. Common genera in the United States include *Oxyopes* – the **common lynx spiders** – and *Peucetia* – the **green lynx spiders.**

Some members of the genus *Oxyopes* are abundant enough to be important in agricultural systems as biological control agents. This is especially true of the striped lynx spider (*Oxyopes salticus*).

Lynx spiders are among the major predators of insects in low shrubs, grasses and crop fields. Few detailed observations have been made on the feeding habits of lynx spiders, but investigations by W.H. Whitcomb have disclosed that the lynx spiders are important predators of crop-damaging insects. In the field, green llynx spiders have been observed feeding on many species of moths of the families Noctuidae, Geometridae and Pyralidae, including some of the most important crop pests. *Oxyopes salticus,* one of the most common spiders in Arkansas cotton fields, has been reported as the chief predator of the bollworm, Heliothis zea. *Peucetia viridans* also preys on the moth pest.

Wolf spiders are members of the family Lycosidae from the Ancient Greek word "λύκος" meaning "wolf". They are robust and agile hunters with good eyesight. They live mostly solitary lives and hunt alone. Some are opportunistic hunters pouncing upon prey as they find it or even chasing it over short distances. Some will wait for passing prey in or near the mouth of a burrow.

Wolf spiders resemble Nursery web spiders (Family- Pisauridae) but they carry their egg sacs by attaching them to their spinnerets (Pissauridae carry their egg sacs with their chelicerae and pedipalps). Two of the Wolf spider's eight eyes are large and prominent, which distinguishes them from the Nursery web spiders whose eyes are all of approximately equal size.

There are many genera of wolf spider, ranging in body size from less than 1 to 30 millimetres (0.04 to 1.18 in). They have eight eyes arranged in three rows. The bottom row consists of four small eyes, the middle row has two very large eyes (which distinguishes them from the Pisauridae), and the top row has two medium-sized eyes. They depend on their excellent eyesight to hunt. They also possess an acute sense of touch.

Their eyes reflect light well, allowing someone with a flashlight to easily hunt for them at night. Flashing a beam of light over the spider will produce eyeshine. The light from the flashlight has been reflected from the spider's eyes directly back toward its source, producing a "glow" that is easily noticed. This is also especially helpful because the wolf spiders are nocturnal and will be out hunting for food, making it easier to find them.

Wolf spiders are unique in the way that they carry their eggs. The egg sac, a round silken globe, is attached to the spinnerets at the end of the abdomen, allowing the spider to carry her unborn young with her. The abdomen must be held in a raised position to keep the egg case from dragging on the ground, however despite this handicap they are still capable of hunting. Another aspect unique to wolf spiders is their method of infant care. Immediately after the spiderlings emerge from their protective silken case, they clamber up their mother's legs and crowd onto her abdomen.

Because they depend on camouflage for protection, they do not have the flashy appearance of some other kinds of spiders. In general their coloration is appropriate to their favorite habitat.

Hogna is the genus with the largest of the wolf spiders. Among the *Hogna* species in the U.S., the nearly solid dark brown *H. carolinensis* (Caroli-na wolf spider) is the largest, with a body that can be more than one inch long. It is sometimes confused with *H. helluo*, which is somewhat smaller and entirely different in coloration.

Some members of the *Lycosidae*, such as *H. carolinensis*, make deep tubular burrows in which they lurk much of the time. Others, such as *H. helluo*, seek shelter under rocks and other shelters as nature may provide. They may wander from place to place, and are therefore, more likely to be the ones attracted into human habitation when the weather starts to turn colder in autumn.

There are many smaller wolf spiders. They live on pastures and fields and are an important natural control on harmful insects.

Crab spider is a common name applied loosely to many species of spiders, but most nearly consistently to members of the **family Thomisidae.**

Among the Thomisidae it refers most often to the familiar species of "flower crab spiders", though not all members of the family are limited to ambush hunting in flowers.

Family Miturgidae is newly separated from family Clubionidae. Spiders in this family are usually small in size. Most of them are nocturnal hunters. They had eight legs arranged in two rows.

Researches have shown that spiders in rice fields can play an important role as predators in reducing the densities of plant hoppers and leafhoppers (Hamamura, 1969; Sasaba *et al.*, 1973; Gavarra and Raros, 1973; Samal and Misra, 1975; Kobayashi, 1977; Chiu, 1979 and Tanaka, 1989). In Korea, many studies have been carried out to evaluate spiders as a biological control agent. This Bulletin reviews past research into spiders in rice fields in Korea, and presents an effective method of using spiders as a biological control agent.

Since Strand, E. first described *Ganphosa Koreae* in 1907, there have been many publications about spiders in Korea. Currently, a total of 46 families, 222 genera and 626 species of spiders are recorded from Korea (Namkung *et al.*, 2000).

Up until 1970, most of the research on spiders concentrated on identification. From the early 1970s, researchers began to study the basic ecological and biological Characteristics of spiders as biological control agents. Spiders in rice fields have been studied more than spiders on other crops (Park *et al.*, 1972; Paik and Kim 1973; Paik *et al.*, 1974; Choi and Namkung, 1976; Okuma *et al.*, 1978; Paik *et al.*, 1979; Yun and Namkung, 1979; Paik and Namkung, 1979; Kim *et al.*, 1990; Kim, 1992; Lee *et al.*, 1993a, 1993b; Song and Lee, 1994; Kim and Kim, 1995; Kim 1995a, 1995b, Im and Kim, 1999). However, most of these studies where limited to the identification of spiders, and to investigating the dominant spider species, their regional distribution, seasonal fluctuations and the effect of insecticides. There were few studies on the spatial distribution of spiders, how this is related to their ecological role, and how many insect pests they consume in rice fields.

It has been reported that *P. subpiraticus, P. clercki* and *G. dentatum* are dominant spider species in rice fields (Paik *et al.*, 1979).

Spiders in rice fields in Korea start to build up their populations in the middle of July, 40-45 days after transplanting, (Kim 1992 and Yun 1997). The same Pattern is seen in Japan, which has a similar agricultural environment (Kobayashi and Shibata 1973). Hamamura (1969) has reported that the density of spiders in rice fields in Japan is always low when transplanting is taking place. Lee *et al.*, (1997) suggested that the different time taken by different spider species to immigrate from levees into paddy fields is the cause of the low initial population densities, in spite of the abundance of prey. However, Kim (1998) showed that the immigration rate of over wintering spiders from levees into paddy fields was low. He suggested that most of the dominant spider species immigrated from outside areas into the rice fields by ballooning (Note: "Ballooning" is the term used to describe the habit of young spiders of sailing through the air borne by silk strands on wind currents). He also suggested that the immigration of the spiders was delayed after transplanting because the young rice plants are too small to provide a suitable habitat for either hunters or web builders.

Kim (1998) pointed out that if spiders are being used as biological control agents, it is very important to understand their life styles. Both web builders and hunters follow a foraging strategy. Song and Lee (1994) suggested that web builders such as *P. clercki* were better able to suppress insect pests than hunters such as *P. subpiraticus* However, hunters are usually active predators which follow a " Pursue and Kill" foraging strategy, while web builders follow a passive " Sit and wait" strategy (Enders, 1974). Furthermore, the webbing sites of web builders are easily affected by environmental factors. In addition, when the web spaces overlap, there is competition with and between species of web builders. Therefore, hunters probably are more effective predators than web builders.

Yamano (1977) suggested that spiders are the most important biological control agents regulating insect populations in rice fields, including insect pests. Predators tend to cluster in stable sites where many species of prey are maintained at a high density (Schmitt, 1987). Seasonal fluctuations in the numbers of spiders in rice fields showed a constant numerical interaction with those of other arthropods, including insect pests.

The brown Plant hopper (*Nilaparvata lugens* Stal) is a pest which feeds only on rice plants (Otake and Hokyo, 1976). Insecticides have been widely used to control brown plant hoppers in Asian countries, including Korea (Nagata, 1985). Integrated pest management programs to control this pest have been proposed, using natural enemies of plant hoppers. Studies have reported numerous parasitic and predatory natural enemies of plant hoppers. For predators alone, there are 14 species belonging to 13 genera in Korea (Okuma, 1958; Suenaga, 1963; Gavarra and Raros, 1973; Samal and Misra, 1975; Hamamura, 1971; Chiu, 1979; Kuno and Dick, 1984; Shepard *et al.*, 1987, Chua and Mikil, 1989; Tanaka, 1989; Kim *et al.*, 1991; Choi *et al*, 1992; Choi and lee, 1990; Shepard and Ooi, 1991; Ooi and Shepard, 1994 and Choi *et al.* 1996).

Spiders represent more than 90 % of the natural enemies of brown plant hoppers living in paddy fields in Korea (Lee *et al.*, 1997). Because of this fact, most of the studies related to biological control of plant hoppers have focused on spiders. Sub adults of *P. subpiraticus* consumed the greatest number, although the total numbers consumed by *C. kurilensis* and *G. dentatum* were as high. Spiders belonging to the species *P. subpiraticus* showed the greatest variation in daily consumption, while the number of plant hoppers consumed each day by *C. kurilensis* and *G. dentatum* varied by only 0-4 plant hoppers.

Spiders are an important group of predators in various ecosystems. However, their role in pest control and crop protection has not been utilized properly in India. Various living organisms lived in perfect harmony and balance with each other in different ecosystems before chemical agriculture and chemical pest control came into the picture. Today, we see a kind of agricultural development which is based on monoculture and extensive use of chemicals. This has led to the emergence of several pests which has in turn led to the failure of crops. The number of pests developing resistance to pesticides over the years has been increasing at a very alarming rate. The pesticides have proven to be extremely toxic and have led to a number of side effects: impact on public health, toxic residues in food and disturbance of local ecosystems. Use of such chemicals has also led to the eradication of natural predators such as spiders which normally keep pest populations in balance.

Use of chemical pesticides has killed off natural predators not only in the agro ecosystems but also in households. Several toxic chemicals are often recommended to control pests in households. Often, these chemicals are mistakenly ingested by children, domestic pets or even birds.

Spiders are voracious predators of insects. They are well adapted to certain habitats because of their ability to withstand periods of low food availability and also to take advantage of periods of prey abundance. Spiders are important predators of pests of cotton, rice, apple, banana and various other crops and plantations.

For the past several years, there has been increased interest in the utilization of natural enemies, particularly the predators for the management of insect pests of crops. In nature, amongst the biotic agents, spiders play a major role in keeping the pest population under check. Aranae is the sixth or seventh largest animal order in terms of species described. About 36,000 valid described species belonging to 3,050 genera and 106 families have been described. The estimated total world spider species can only be guessed. Conniff (2001) commented that up to 170,000 species could exist. Spiders are a major component of the predatory arthropod trophic level in many ecosystems, but there has been little documentation of their impact on herbivore population or general ecology (Wise, 1993).The presence of spiders in biotic environment of insect pests greatly influence their population dynamics (Judd, 1966; Singh *et al.*, 1975; Sadana and Sandhu, 1977; Sadana and Kumari, 1977; Sadana and Kaur, 1979 ; Jackson 1992 ; Sandidaque, 2005; Rajeshwaram *et al.*, 2005; Bastawade and Khandal, 2006; Haunt *et al.*, 2005; Singh and Sihag, 2007). Many spiders eat a wide variety of prey species (usually insects), and they usually present a sedentary foraging behavior (Wise, 1993), suggesting that selection for habitat, not for prey, should be the rule. However, several prey capture specializations can be seen (Greenstone, 1979; Riechert and Luczak, 1982; Uetz, 1992; Alderweireldt, 1994; Onkonbury and Formanowicz, 1997; Nyffeler, 1999 and Toft, 1999), and some may have been an important influence on the evolution of insect defense behavior (Uetz 1990). It has been recognized that the choice of habitat (patch) in spiders is of primary importance through its effect on feeding rates, growth and reproduction (Riechert, 1981 and Morse and Stephens, 1996). Nevertheless, once in a feeding patch, spiders typically are confronted with an array of potential prey species. Indiscriminate feeding is not advantageous because prey vary enormously in quality due to toxicity or nutrient content. Thus, active prey selection by spiders serves to find the optimal compromise between three ‘‘nutritional goals’’: to maximize energy intake, to balance nutrient composition of the body, and to minimize toxin consumption (Toft, 1999).

Nesticodes rufipes (Lucas) (Araneae, Theridiidae) (referred to as *Theridion rufipes* in references) is widely distributed in tropical and subtropical regions, extending to temperate zones, and these spiders construct irregular webs with a disordered aspect (Gonza´lez, 1989). Its exact distribution is not easy to determine, since it is strongly associated with humans (Downes, 1988; Gonza´lez and Este´vez, 1988 and Gonza´lez, 1989). Behavioral and ecological studies considering predation by *N. rufipes* are scarce. Fox (1998) highlighted the strategic importance of these spiders to the natural control of *Aedes aegypti* (Diptera, Culicidae), since the spiders incorporate a paralyzing substance in the webs, which paralyzed the mosquitoes through contact, increasing their capture efficiency. Barreto *et al.* (1987) also mentioned the importance of *N. rufipes* as predators of *Rhodnius prolixus* (Hemiptera, Reduviidae) (Levine and Levine, 1991).

Vijayalakshmi and Ahimaz (1993) have given a descriptive account of spiders. Gajbe (2004) has provided a detailed account of spiders of Jabalpur, Madhya Pradesh, Rao *et al.* (2005) have described arachnid fauna of Nallamalai region, Eastern Ghats Andhra Pradesh (India) and Majumder (2004, 2005 and 2007) has given a detailed account of taxonomic studies of some spiders from Mangrove and Semi-Mangrove areas of Sunderban, studies on some spiders from Eastern Coastal region of India and various aspects of spiders of Sunderbans, West Bengal (India) respectively. Recently Mishra *et al.* (2012[a] and 2012[b]) have reported *Neoscona nautica* and *Neoscona crucifera* and *N. adianta* from Azamgarh district and Yadav *et al* (2012[a] and 2012[b]) have reported *Leucauge decorata* from Azamgah and *Hippasa holmerae* from Azamgarh and Mau districts of U.P., India. They have described habit and habitat, morphology, feeding capacity and prey preference of these spider species and also suggested for use of spiders as bio-control agents in controlling insect pests of crop fields.

From the review of literature, it appears that role of spiders as bio-control agents in agriculture, poultry as well as in controlling house-hold insects is being studied in various parts of the world, but unfortunately, no proper investigation, regarding role of these efficient bio-control agents in India is scanty.

As of today, major part of spider diversity remains undiscovered and un-described. There is no documentation of spider faunal diversity or their habitat or general ecology in U.P. (India).

Thus the present study has been undertaken to study spider fauna and feeding potential/ prey preference of common spider species found in Azamgarh district of Uttar Pradesh (India).