CHAPTER TWO

Literature Review

2.1 Taxonomic Status of the Asian Corn Borer

The Asian corn borer, *Ostrinia furnacalis* Guenee (Lepidoptera: Pyralidae) was previously denominated as *O. nubilalis* prior to 1980 in China. It was designated it as *O. furnacalis* by Li (1980a, 1980b, 1985). According to Zhang (1981), Litsinger et al. (1991) and Lu (1992), *Ostrinia furnacalis* is similar to *O. nubilalis* but differ in varying the following characters:

1. *O. furnacalis* has fewer flattened and scale-like spines armed with the dorsal lobe of clapper than in *O. nubilalis*.

2. A small tooth-like dorsal marginal process on shaft of clapper, situated somewhat more ventured than in *O. nubilalis* , and

3. *O. furnacalis* also has the sacculus bearing 3 or 4 large spines, sometimes 2 large spines with another small one. These number of spines are averaging more than that in *O. nubilalis*.

2.2 The Biology of Asian Corn Borer

The adult males have a forewing spread of about 30 mm and yellowish brown with postmedian fascia and square discal spot ochreous yellowish patches. Hindwing brown,. with broad median band of yellowish white; terminal line and cilia pale orchreous. Head and thorax ochreous yellow or brown; abdomen brown; antennae threadlike. Female moths have pale ochreous yellow forewings; fascine and discal spot brown. Hindwing ochreous white with brown suffusion: fasciae brown. Head and thorax pale ochreous yellow; abdomen pale grayish brown; antennae as male. The moths are small and rather delicate species.

The females deposit eggs on leaf structures near the ears Eggs are in masses of 5 to 60; they are initially white then turn yellow with continued development (Hu and Sun 1979)

The larvae of early instar feed initially feed on pollen deposits found primarily in the leaf axial, on sheath, collar, husk tissue, and on silks before entering in the whorl (Lu et al. 1991). Larvae are from 3 to 50 cm long with a brown head when full grown are grayish or brownish white. Peritreme of spiracles, pinnacula, thoracic legs, and anal plates are light brown. Prothoracic plate with dark brown markings.

Pupa are light reddish brown; dorsal surface of abdomen with fine transverse lines strait. The apex of the last segment of the abdomen slightly elongate, with six closely grouped, hooked setae.

During the lifetime, the Asian corn borer goes through four stages of development: egg, larva, pupa, and moth. The succession of these four stages constitutes a generation. The borers have five larval stadia. During fifth instar, all become full grown prior to pupation. Diapause in full grown larvae is induced by daylength, temperature, and genetic composition of a population (Zhang 1981). They overwinter in cornstalks, corn cobs, weed stems, or in cornfield debris. Moths emerge in late of April in the southern areas, and in mid - May in the central areas; moth begins mating on early May and oviposition on mid - May in southern areas; and late May for mating early June for oviposition in central areas of Yunnan, respectively (Lu, 1992).

The number of ACB generations per year varies among geographical areas. Li (1980b) reported that the one to six generations per year in China. The bivoltine type, however, is more common in Yunnan (Lu 1992).

2.3 Status of Asian Corn Borer as a Pest

The Asian corn borer is a specialist of corn occurring commonly throughout China (Zhang 1981). In Yunnan where the present study take places, the Asian corn borer occurs in high numbers and rises to the levels of economic significant (Lu 1992). Damage to corn caused by this insect is characterized by Hu and Sun (1979), Zhang (1981) and Lu (1992)

1. Leaf feeding destroys the leaf surface, breaks the midribs, and reduces yields.

2. Stalk tunneling destroys food channels, weakens the plant, and decreases yields; stalk rot organisms enter these tunneled areas, weaken the stalk and increase stalk lodging, making the crop more expensive and difficult to harvest.

3. Shank infestation causes damage, and prevents the ear from developing properly.

Yield losses during all stages of corn development can be extremely high during severe infestations, especially if damage begins just before the tassel emerges (Wen, 1989).

2.4 Management of Asian Corn Borer

Several control strategies have been practiced to limit losses to this pest. These management have met with varying degrees of success. Cultural practices viz. stalk. shredding and stalk composting are potentially useful in the control of over wintering larvae (Lu 1992). However, these practices are difficult to implement because Chinese farmers need corn stalk for their forage and fuel (Lu et al. 1991). Planting attractive crops near the corn fields to dilute the population of Asian corn borer are restricted by the efficacy of attractive plants (Zhang 1981). Resistant hybrids are useful to against the corn borers, but the resistance is easily lost and there usually are the conflicts between higher-resistance and higher-yielding (Li et al. 1992). The difficulties related to the use of biological control proved to be unsuitable for widespread practices in China (Zhang 1981).

From 1979 to 1992, pesticide applications as prophylactic sprays have commonly applied against the ACB in most corn belts of China (Zhang 1981, Lu 1992). These applications have been inadequate against heavy infestations (Hu and Sun 1979). Hu and Sun (1979) and Zhang (1981) reported applications usually fail to control live larvae tunnel in plant stems. Many workers have pointed out that insecticide treatment against corn borer must be applied when young larvae are present before they bore into stalk (Hu and Sun 1979, Zhang 1981, Lu 1992). And this period can be determined by observing either moth flight or the occurrence and magnitude of egg mass deposition (Zhang et al. 1979, Zhang 1981). The use of insecticides when timed on the basis of egg mass and larval scouting is a major tactic for the management of the European corn borer (Pedigo 1989). Apple (1952) proposed using degree-day model as a guide to indicate the proper time to make an evaluation of the corn borer infestation and time to make insecticide applications. He recommended that treatment must be applied at 1,000 degree-days which was equivalent to the time of 50 per cent egg hatching. If ear damage was more than 25 per cent, a second insecticide application was suggested at 1,200 degree-days.

In the United States, the relationship between degree-days and cumulative percentages of first- and second-generation European corn borer moth flight and oviposition have been demonstrated by Jarvis and Brindley (1965). Monitoring the accumulation of degree-day was proven useful in predicting European corn borer stage phenology in North Dakota (Frye 1971) and Ohio (Clement et al. 1981). Since the use of sex pheromone and blacklight trap has been recognized as an essential part in all studies on the phenology and behavior of many insects in the field, the pheromone - baited and blacklight traps as suggested by HNURG (1977) are being used to study on Asian corn borer in Yunnan, China.

2.5 The Natural Control of Asian Corn Borer

The natural control of insect pests in agricultural systems depends on complex ecological interactions occurring between plants and pests and natural enemies within spatially and temporally heterogeneous environments (Ishii-Elteman 1993). Whitford and Showers (1987) studied the natural control of the European corn borer and concluded that the control was produced by an indissoluble complex of agricultural, meteorological and parasitic factors. They found that Coleoptera, Othoptera, and Homoptera were abundant and accounted for 98% of the total insect fauna. They also reported that about 5 species were the most abundant predators inhabiting the grassy canopy of European corn borer adult action sites. Peter (1974) pointed out that diversity was composed two distinct components: (1) species richness and (2) species evenness. The idea about plant architecture and the diversity of phytophagous insects was also suggested by Lawton (1983). His idea made an attempt to explain how plant architecture affect arthropod species diversity.

Identifying the distribution pattern of corn borer has been known as a basic to implementation of a management program (Calvin et al. 1986). Chiang and Hodson (1959) found that distribution pattern of first-generation egg masses of European corn borer was random with a trend toward contagiousness as density increased. Wu et al. (1965) reported the similar results. They found that egg masses also randomly distributed on the spring corn plants in northern China. Shelton (1986) reported that the distribution of second-generation egg masses and larvae of European corn borer on sweet corn was random between plants. He also found that early instar larvae tend to be more aggregated than mature larvae. Coll and Bottrell (1991) reported that first instars of second-generation were aggregated distribution but egg masses, later instars, and pupae were randomly distribution in the field. However, causes for the shift from an aggregated distribution in the first instar to a more random distribution in the later instars was not determined (Ross and Ostlie 1990). These are providen a somewhat comprehensive information to the integrated pest management program of Asian corn borer.