REVIEW OF LITERATURE

For the sake of convenience, review of literature has been described under the following headlines:
1. Insect pest occurrence on soybean
2. Studies on susceptibility of different varieties of soybean against insect pests
3. Studies on efficacy of insecticides against insect pests of soybean
4. Studies on susceptibility of stored soybean to insect pests

1. Insect pest occurrence on soybean

As early as 1914, Fletcher reported the incidence of larvae of Lamprosoma indicata Fab. on soybean in plains of South India. Later on in 1920 and 1922, he reported the leaf-miner, Stomopteryx subsecivella Zeller as sporadic pest in Maharashtra and Diacrisia obliqua Walker as polyphagous pest feeding upon soybean and other cereals, fibers, pulses, oil seeds and vegetables etc.
Dutt (1915) described girdle beetle (*Oberea brevis* Swed.) as stem borer from Bihar.

Isely (1936) reported 91% population of *Heliothis* larvae feeding on soybean foliage during September at Arkansas.

Shihgolev (1939) observed in North Caucasus that 98% leaves were infested by *Heliothis* sp. when temperature was high.

Ayyar (1940) stated that girdle beetle, *Oberea brevis* Swed. occurred as a serious pest of soybean in South India.

The leaf roller, *Lamprosema indicata* Fab. was reported by Planks (1946) causing damage upto 75 per cent of leaf area in Seminole variety at Puerto-Rico.

Kretzschmar (1949) recorded 84 species of *Empoasca* during a survey at Minnesota and stated that 39 of these species caused serious damage to soybean.

Chewsebpong (1949) categorised the stemfly, *Melanagromyza phaseoli* coq. as an important pest causing serious damage to soybean crop. He attributed its abundance in the soybean field to sunnhemp (*Grotolaria juncea*) crop which served as its alternate host.
Khan and Rao (1950) reported two species of aphids namely *Myzus persicae* Swiz. and *Aphis craccivora* Koch. sucking the sap from the leaves, both during nymphal and adult stages.

Agarwal and Pandey (1961) reported from Kanpur that *Melanagromyza phaseoli* coq. attacked soybean from August to November. The infestation was 10 to 22 per cent.

In a survey conducted by Singh (1968) at different heights of Tarai region in India, the stemfly infestation varied from 60 to 100% in the fields situated at sea level except Jeolikote (Nainital) where infestation was nil. He interpreted it to the fact that Nainital was located in a valley at 3500 ft. above sea level.

Singh (1969) described tobacco caterpillar *Spodoptera littoralis* as a serious pest of soybean in the Himalayan area defoliating the crop during the month of September.

Singh and Chibber (1969) reported that *Plusia orichalcea* Fab. occurred as a polyphagous pest attacking soybean besides cauliflower, cabbage and other crops.

Kapoor *et al.* (1971) stated that girdle beetle affected adversely the pod formation and reported infestation up to 29.4 per cent. These workers noted that continuous wet season favoured the abundance of this insect whereas dry
season was unfavourable for its activity.

Seed corn maggot, *Hylemya (Della) ciliicrura* Rond. was first reported from Jabalpur in the month of December, 1970 and January/February, 1971. Its population varied between 9.25 and 14.50 maggots per 100 seeds (Gujrati *et al.* 1971). They also described *Mocis undata* Fab. as a pest of soybean and recorded its activity during rainy season from August to October.

Todd *et al.* (1975) reported that green stink bug, *Nezara viridula* L. damaged the developing seeds of soybean.

Bhattacharjee (1977) reported two species of leaf roller, *Lamprosema indicata* Fab. and *Lamprosema dimenalis* Gn. attacking sporadically and causing considerable damage to soybean in India.

Bhattacharya *et al.* (1979) reported *Plusia orichalcea* Fab. as a regular pest in Uttar Pradesh and he indicated its period of activity in Tarai from August to October and March to April.

Sachan and Gangwar (1980) conducted studies on seasonal incidence and damage of soybean crop during 1977 and 1978 at two altitudes of the Khasi hills of Meghalaya i.e. Upper Shillong (1760 m MSL) and Nayabunglow (800 m MSL). More than 23 species of insect pests have been reported
causing minor to moderate damage to the crop at different stages of the plant growth. No insect was recorded as a serious pest of the crop.

In Madhya Pradesh, Rawat et al. (1969) gave a list of arthropod pests attacking soybean crop.

*Diacrisia obliqua* Walker was observed by Gangrade (1971) attacking crop in patches during September, October and even up to December in late growing cultivars. He also reported the attack of *Heliothis armigera* Hubner in the early phase of growth and sometimes during the pod developing stage when the larvae consumed the developing grains. He found that leaf-miner occurred as a sporadic pest during September, 1971 at Jabalpur. In 1972, he reported stemfly, *Melanagromyza phaseoli* (Tryon) as a serious pest of soybean in Madhya Pradesh infesting over 95 per cent plants in Kharif and up to 60 per cent in Rabi season. Later in 1974, Gangrade reported linseed caterpillar *Laphygma exigua* Hubner attacking young soybean from July to March. This pest preferred to feed inside the unfolded growing point of soybean plant which showed perforations as a results of its attack. *Prodenia litura* Fab. made its appearance during September and continued to feed up to maturity of the crop. Damage by *Scopula remotata* Guen. in second week of September and by black spiny caterpillar, *Syntonis fortunei* Orza. in October
was also observed by him. He also noted that brown coreid bug, *Riptortus linearis* Fab. was found sucking on soybean pods in the month of October 1974.

2. **Studies on susceptibility of different varieties of soybean against insect pests**

Rawat *et al.* (1969) screened five varieties against stemfly, *Melanagromyza phaseoli* (Tryon), namely Harosoy, Clark-63, Wayne, Shelly and local Seoni yellow and reported maximum infestation (32.92%) in Harosoy and minimum infestation of 2.97% in Seoni yellow. Variety Wayne showed moderate infestation (28.00%). Again in 1969, they screened 13 other varieties of soybean on the basis of population of larvae and pupae of stemfly per five randomly selected plants and found that four varieties namely Hempton, IC-130004, EC-144474 and Hardae were less susceptible, varieties Clark-63, Dare, Imp-pelican and Hill were most susceptible and the remaining five varieties viz. Bragg, Tiachung, Wayne, Punjab-1 and Seemens were intermediate.

Gangrade (1970) screened 20 varieties against *Lamprosoma indica* Fab. and *Melanagromyza phaseoli* (Tryon). *Lamprosoma indica* Fab. made its appearance both in kharif and rabi season and recorded 2.85 and 14.47 larvae per 100 plants.
Beohar et al. (1980) reported that variety JS 72-44 (Gaurava) showed less susceptibility to most soybean pests except stemfly.

Jakhmola et al. (1980) reported susceptibility of different soybean varieties namely, Type-49, JS 72-148, JS 76-188, Punjab-1, JS 72-44, BC-1116082, Kalitur, JS 75-1 JS-2, JS 72-280 (Durga), JS 72-73, Ankur and Bragg against leaf-miner, *Stomopteryx subsecivella* Zeller and found that variety JS-2 was least susceptible (14.33 larvae per 30 plants), followed by variety Punjab-1, JS 72-73, JS 75-1 (15 to 49 larvae per 30 plants).

Kawatheker (1981) investigated the susceptibility of 18 different varieties against leaf-miner and observed that JS 75-46 was least susceptible while Bragg and JS 75-134 were most susceptible. During screening of 18 soybean varieties against leaf-miner, Bhattacharjee (1982) found that JS 75-46 was less susceptible than JS 72-44.

Thombre (1982-83) worked on the susceptibility of nine different varieties of soybean against leaf-miner and reported that JS-2 was least susceptible (1.91 per plant) whereas JS 72-44 was most susceptible (2.44 per plant).

Bichoo (1982) tested 12 varieties of soybean against girdle beetle, *Obera brevis* Swed. He found that variety
JS 72-128 was least susceptible, while JS-2 and JS 72-44 were most susceptible.

3. **Studies on efficacy of insecticides against insect pests of soybean**

Singh and Singh (1966) found application of telodrin 0.03 per cent emulsion to be superior than 0.03 per cent diazinon and 0.1 per cent malathion in preventing oviposition of girdle beetle.

Gangrade (1969) tested nine soil insecticides on arthropod pests of soybean and found that phorate gave best results against sucking insects. Benzene Hexa Chloride (BHC) was better, though not the best in respect to stemfly. In 1971, he reported monocrotophos (0.04%) to give significant result in the control of stemfly. While evaluating the effect of granular and foliar insecticides against stemfly and other insects, Gangrade (1972) observed significantly less plant infestation in treatment by phorate (23.33%) which was followed by disyston (28.35%) and BHC (43.33%). Dimethoate (0.03% spray) treatment proved to be less effective than phorate. The average length of damaged stem in phorate was minimum (44.00%) as compared to the maximum in dimethoate (126.33%). In 1973, he also observed the effective check of girdle beetle, *Oberea brevis* Swed. by spraying endosulfan 0.05%, methyldemeton 0.03% and
dimethoate 0.05%. Monocrotophos (0.04%) and trichlorophos (0.03%) were not so good.

Shrivastava (1971) obtained an increase of 42.06% yield when Bragg variety of soybean was treated with a mixture of dimethoate and diazinon (0.03%) in the ratio of 1:1.

Kapoor et al. (1971) found that treatment of endosulfan 0.05 per cent at 15 days interval was effective in controlling *Oberea brevis* Swed. In 1973, they carried out trials on the chemical control of stemfly, *Melanagromyza phaseoli* (Tryon) by foliar and soil insecticides and reported that monocrotophos (0.04%), dimethoate (0.03%) and endosulfan (0.05%) were best chemicals for giving complete protection to crop against the stemfly attack. Monocrotophos and Dimethoate gave highest yield also. In September, 1975 he again tested eleven chemicals viz. dusts of BHC, lindance, dieldrin, ethyl parathion and sprays of carbaryl, dimethoate, phosphamidon, endosulfan, endrin, methyldemeton and fenitrothion in two separate replicated field experiments for their efficacy against the leaf-miner, *Stomopteryx subsecivella* attacking Bragg and Semesanin epidemic form. It was found out that fenitrothion (0.05%), carbaryl W.P. (0.2%) and ethyl parathion dust were effective in giving spectacular mortality of first and second instar larvae of *Stomopteryx subsecivella*. None of these chemicals were
effective against the full grown third instar larvae and pupae.

Chaudhary et al. (1976) tested systemic granular insecticides viz. mephosfolan, aldicarb, phorate and carbofuran against stem miner, Melanagromyza sojae (Zehntner) and white fly, Bemisia tabaci Gennabius and found that aldicarb (at the rate of 1.00 kg a.i. per hectare) was very effective.

Rawat et al. (1977) achieved complete protection against leaf folder, Lamprosema indicata Fab. by foliar spray of monocrotophos 0.04% and parathion 2% dust.

Thombre (1982-83) evaluated seven insecticides against leaf folder, Lamprosema indicata Fab. and found that monocrotophos 0.05% was more effective than cypermethrin 0.01%.

4. Studies on susceptibility of stored soybean to insect pests

As far as the author is aware, the literature on the topic is very scanty. Kapoor et al. (1972) reported that soybean seeds within pod got damaged by larvae of Almond moth, Ephestia (Cedra) cautella in Madhya Pradesh.