Seasonal incidence of pests of soybean (Glycine max (L.) Merrill) influenced by different sowing dates

Sable GS, More DG, Munemanik RM and Wahekar GR

Abstract
Field experiment was conducted at the Farm of All India Coordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during kharif-2015 to study pest incidence of soybean as influenced by sowing dates, to work out the correlation of pest incidence with weather parameters and to study the effect of sowing dates and pest incidence on soybean yield. During the season of kharif 2015, girdle beetle and stemfly were observed as major pests. Incidence of defoliators viz., H. armigera, S. litura and semiloopers was found moderate to low while low to high incidence of jassids and whitefly was observed. Population of grey weevil, Myllocerus sp. was also observed. Among natural enemies, spiders were found predominantly. Girdle beetle infestation on the crop sown on 15th and 30th June showed positive significant correlation with rainfall and morning relative humidity whereas, it showed significant negative correlation with minimum temperature, bright sunshine hours and wind velocity while the crop sown on 15th July, 30th July and 15th August showed significant positive correlation with maximum temperature while minimum temperature has negative significant correlation. Semiloopers showed negative significant correlation with evaporation when the crop was sown on 15th June. It also showed positive correlation with minimum temperature when the crop was sown on 15th July and 15th August.

The population of jassids on the soybean crop sown on 15th June showed significant positive correlation with morning and evening RH while with maximum and minimum temperature, evaporation and bright sunshine hours, it showed significant negative correlation. Jassid population showed significant positive correlation with evaporation when the crop was sown on 30th July. Whitefly also showed significant positive correlation with morning RH while it showed negative significant correlation with maximum temperature and bright sunshine hours.

Keywords: Soybean, major pests, seasonal incidence, weather factors

Introduction
Soybean (Glycine max (L.) Merrill) belongs to family Leguminaceae. Soybean is reported to be originated in Eastern Asia and was used as food long before the existence of written record. The first known record however, indicates that soybean emerged as domesticated crop around the eleventh century in China (Nagata, 1960) and was introduced in India in 1870-80 (Andole, 1984). Soybean is important from nutritional point of view. Soybean contains 43.2 percent protein, 19.5 percent fat and 20.9 percent carbohydrate. It is also rich in soluble phosphate and sulphate (Bower, 1939). It also contains a good amount of potassium and vitamin E. Soybean protein is mainly rich in amino acids like leucine, methionine and threonine. During the late sixties and early seventies, the soybean crop was considered to be safest crop as regard the insect pest attack. Now the situation is changed drastically and as many as 275 insect species have been recorded Attacking soybean crop in India (Singh and Singh, 1989a). Whereas in Maharashtra, particularly in Marathwada region 19 insect species have been identified attacking this crop (Munde, 1982). Among the pest species, leaf miner, girdle beetle, semfly, semilooper, sucking pests (jassid, whitefly, aphid) and defoliators are the most important.

Every year insect- pests cause 20 to 25 percent average losses in soybean yield (Sharma and Shukla, 1997). Insect feeds on soybean crop right from germination to harvest stage. Singh and Singh (1990) reported the incidence and damage by M. sojae on soybean and recorded 30.26 percent yield loss. Kundu et al., (1995) reported 18.6 percent to 40.1 percent yield losses in soybean due to stemfly (Melanagromyzoa sojae). In India, stemfly infestation is as high as 85-90 percent. Ansari and Sharma (2000) observed 19.5 percent to 30.72 percent girdle beetle
infestation while Shetgar and Thombre (1984) recorded 100 percent damage to plant population and 75 percent damage to leaflets.

Materials and methods

Field experiment was conducted at the farm of All India Coordinated Research Project on Soybean, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra), during kharif 2015 to study the seasonal incidence of insect pests of soybean influenced by different sowing dates. The experiment was laid out with five dates of sowings and MAUS 162 varieties in factorial RBD. Crop was sown during 15th June, 30th June, 15th July, 30th July and 15th August. Line sowing of seed was done by keeping 45 cm distance between two rows and 5 cm between two plants.

Method of recording observations

Defoliators

a. Number of larvae (spp. wise)/MRL (meter row length)
b. Observations were recorded at three places and mean was recorded in per meter

Girdle beetle: One meter rows were marked at three (03) places and number of total plants and girdled plants were recorded. From this, percent plants infested by girdle beetle were worked out.

Stemfly

a. Seedling mortality: Total number of plants and number of plants succumbed to stemfly infestation/MRL at 3 places per plot on 7-10 DAG were recorded. Mean of percent seedling mortality was worked out.
b. Stem tunneling: At physiological maturity, plant height and stem tunneled in 10 plants/plot were measured and percent stem tunneling was worked out.

Sucking pests (whitefly and jassids): No. of insects (nymphs and adults) on 3 leaves / plant (upper, middle and lower Leaf) in ten randomly selected plants were recorded and mean was worked out.

Results and Discussion

Pest incidence on soybean crop sown on 15th June 2015

Infestation of girdle beetle O. brevis commenced from about 20 days after germination and recorded 1.71 percent infested plants during 28th Meteorological Week (hereafter MW). Thereafter the girdle beetle infestation increased gradually and reached to 9.70 percent in 31st MW (30 July to 5 August). Among the different species of semilooper, only Gesonia gema was found damaging the soybean crop during the season and it never crossed the economic threshold level of 3 larvae/MRL in an entire season. The incidence of G. gema started in 27th MW (2-8 July) by recording 0.33 larvae/ MRL during 27th MW. Thereafter, the population increased very slowly due to very high temperature during June and July and recorded a peak of 1.17 larvae/ MRL during 32th MW (6.12 August). During the season kharif 2015, tobacco leaf eating caterpillar was observed only as minor pest and a highest of only 0.42 larvae/MRL were observed during 32nd MW (6-12 August).

The incidence of jassid was noticed from. 28th MW (09-15 July) by recording 0.28 jassids/3leaves/ plant and showed a increasing trend as the crop stage advances up to maturity of the crop due to rise in temperature in the month of July and August. A peak of 2.25 jassids/3leaves/plant were observed in 34th MW (20-26 August). The incidence of whiteflies was noticed from. 28th MW (9-15 July) by recording 0.45 whiteflies/3leaves/plant and showed increasing trend in population up to the harvest. It reached to a peak of 3.40 whiteflies/3 leaves/plant during 33rd MW (13-19 August)

Pest incidence on soybean crop sown on 30th June 2015

Infestation of girdle beetle O. brevis commenced from about 25 days after germination by recording 1.86 percent infested plants during 31st MW. Overall the incidence of semilooper, G. gema was observed very low. The larvae first noticed in 30th MW (23-29 July) (about one month after germination of the crop) and recorded 0.17 larvae/ MRL during 30th MW. Very low or negligible population of tobacco leaf eating caterpillar, S. litura was observed throughout the season of kharif 2015. Though its first appearance was noted in 29th MW (16 to 22 July) with 0.08 larvae/MRL, it was not observed in next three weeks. In 33rd MW (13-19 August) it recorded 0.25 larvae/MRL and in the last week of August it reported the seasons highest of 0.58 larvae/MRL.

Jassids were present in the field right from seven days after germination up to harvest and their population ranged in between 0.35 to 1.90 jassids/3 leaves/plant. The incidence was first observed during 28th MW(9-15 July) by recording 0.35 jassids /3 leaves/plant), thereafter their population increased gradually up to mid August and reached to a peak of 1.90 jassids /3 leaves/plant during 33rd MW (13-19 August). The population showed a gradual decreasing trend in population up to harvest and in 38th MW (17-23 September) it recorded 0.38 jassids/3 leaves/plant.

The whiteflies were observed throughout the season on soybean crop sown at 30th June 2015. It population varied in between 0.98 to 3.55 whitflies/3 leaves/plant. The incidence was first observed during 28th MW i.e. about seven days after germination of the crop by recording 0.98 whiteflies/3 leaves/plant.

Pest incidence on soybean crop sown on 15th July 2015

Infestation of girdle beetle O. brevis commenced from about 15-20 days after germination of the soybean crop sown on 15th July 2015 and recorded 0.44 percent infested plants during 32th MW (6-12 August). In next three weeks the infestation increased steadily and reached to 9.05 percent. The incidence of G. gema started at 20 days after germination and recorded 0.42 larvae/MRL during 32th MW (6-12 August). In next two weeks the population reached to a peak of 3.40 larvae/MRL during 34th MW (20-26 August)

The whiteflies were observed in only two observation weeks i.e. 35th (34-39 August) and 36th (3-9 September) week where it recorded only 0.25 and 0.42 larvae/MRL, respectively. Jassid incidence was observed throughout the crop season and the population ranged in between 0.03 to 1.58. First incidence of jassid was noticed in 31st MW (30 July-05 Aug) by recording 0.05 jassids/ 3 leaves/plant.

Pest incidence on soybean crop sown on 30th July 2015

Infestation of girdle beetle O. brevis commenced from 34th MW (20-26 August) and recorded 0.76 percent infested
plants. In next week the infestation reached to 4.76 percent. The incidence of *G. gema* started at 20 days after germination and recorded 0.08 larvae/MRL during 35th MW (27 August-02 September). The population showed increasing trend thereafter up to 38th MW (17-23 September). Very negligible population of tobacco leaf eating caterpillar was observed throughout the season on the soybean crop sown on 30 July 2015. Its first appearance was noted in 37th MW (10-16 September) when 0.08 larvae/MRL were reported. Peak population of 0.17 larvae/MRL was noted in 39th MW (24-30 September). The overall jassids population ranged in between 0.28 to 0.93 jassids/3 leaves/plant. Though the population was observed throughout the season, the population observed was very low and it remained below 1.0 jassids/3 leaves/plant. Peak population of 0.93 jassid/3 leaves/plant was noted during 35th MW (27 August-2 September).

The incidence of whiteflies was noticed from 34th MW (20-26 August) up to harvesting of the crop i.e. 43rd MW (22-28 October). The incidence was first observed during 34th MW (20-26 August) by recording 0.63 whiteflies/3 leaves/plant and reached to a peak of 1.78 whiteflies/3 leaves/plant during 37th MW (10-16 September).

**Pest incidence on soybean crop sown on 15th August 2015**

Infestation of girdle beetle *O. brevis* commenced from 36th MW (3-9 September) by recording 1.52 percent infested plants. In next week the infestation reached to 7.90 percent. Thereafter, the infestation increased gradually up to the end of the crop. The girdle beetle infestation crossed the economic threshold level (15% infested plants) during 41st MW (8-14 October) by recording 15.12 percent infestation.

Semilooper incidence was noticed form last week of August up to first week of October. The incidence of *G. gema* observed just seven days after germination of the soybean crop sown on 15th August 2015 and recorded 0.25 larvae/MRL during 35th MW (27 August-2 September). The peak of 0.33 larvae/MRL was recorded during 40th MW (1-7 October). Overall, the population of semilooper observed was only 0.08 and 0.17 larvae/MRL, respectively.

Jassids were also observed throughout the season. Highest population of 0.90 jassids/3 leaves/plant was observed in 37th MW (10-16 September). With slight fluctuations in the number the jassids population remained at same level up to the end of the crop. Same trend as that of jassids was observed with respect to whitefly population and it is seen damaging the crop throughout the season. Also, its infestation started just seven days after germination of the crop by recording 0.9 whiteflies/3 leaves/plant and with slight changes in number the population was seen up to the harvest of the crop with a peak of 1.03 whiteflies/3 leaves/plant during 39th MW (24-30 September).

**Comparison of incidence of major pests of soybean sown on different sowing dates**

### 1. Girdle beetle

Girdle beetle was the major pest observed throughout the *kharif* 2015 season causing damage to the crop. Joshi (1998) also mentioned the damaging nature of girdle beetle. When the girdle beetle infestation observed on the soybean crop sown at different dates at the interval of fifteen days starting from 15th June to 15th August is compared, it is observed that when the crop was sown on first two sowing dates i.e. 15th and 30th June, more than 50% plants were infested by the girdle beetle. Even though the girdle beetle infestation was more on the crop sown on 15th and 30th June. This might be due to the fact that Parbhani has become hot spot for girdle beetle and the hibernating grubs of the last season come out of the resting stage and completes the pupal stage and adult emergence took place as soon as about 125 mm rains were received in the month of June. The emerged adults continue to damage the crop sown on these two dates. However, the dry spell occurred in the month of July restrict their infestation to some extent, due to which comparatively less infestation was observed on the crop sown on 15th July, 30th July and 15th August. Raj and Patel (1990) concluded his study on girdle beetle conducted during 1988 with the remarks that the low level (0.86 to 12.09%) of girdle beetle infestation during the period of activity might be due to late planting of the soybean crop and low rainfall, supporting the findings of present investigation.

The results corroborate the findings of Chechani et al., (1999) who observed girdle beetle infestation after 30 days of sowing which continued up to 75 days and that of Jena and Kulia (1997) who reported girdle beetle activity from 35 days after sowing and continued up to 80 days after sowing. Findings of present investigation are on line with the findings of Yeotikar et al., (2015) who reported that the girdle beetle, *Obereopsis brevis* infestation started in 30th MW (1.36%) and reached to 61.22% at harvest. Kundu and Trimohar (1986) noticed high incidence of 24.87 percent in crop sown on July 1, 1985 which was reduced to 3.29 percent in crop on August 1, 1985, supporting the findings of present investigation were also July sown crop recorded more girdle beetle incidence than the August sown crop.

### 2. Semilooper, *G. gema*

Overall, the population of semilooper observed was very low and it never crossed the economic threshold level of 3 larvae/MRL. But, when the population observed on the soybean crop sown on different dates was compared, it is noticed that for first three sowing dates i.e. 15th June, 30th June and 15th July, more or less same semilooper population was observed but the peak population observed was towards decreasing trend i.e. 1.17, 1.0 and 0.92 larvae/MRL, in 32nd (6-12 August), 33rd (13-19 August) and 34th MW (20-26 August), respectively. Singh and Singh (1987) reported highest population of green semilooper on 1st September with 14.67 larvae/10 plants. However, in the present investigation, highest semilooper population was observed in the month of August. Also in present study, the semiloopers were observed damaging the crop for comparatively less period i.e. for crop sown on 15th June, the larvae were observed on crop for eight (08) observation weeks while they are found in six (06) observation weeks when the crop was sown on 30th July and 15th August.

### 3. Jassids and whitefly

Jassid and whiteflies were seen on the soybean crop right from 28th MW (9-15 July) to 45th MW (5-11 November). Chechani and Joshi (2000) carried out investigation on the incidence of foliage pests of soybean and revealed that jassids (*Amrasca spp*) and whitefly were present in soybean throughout the season supporting the findings of present study. When jassids and whitefly population observed on soybean crop sown at different sowing dates is compared, it is
found that more population of jassids and whiteflies was observed on the crop sown on 15th and 30th June (jassid’s peak of 2.25 and 1.90/3 leaves/ plant and whitefly’s peak of 3.40 and 3.55/3 leaves/ plant). As the sowing date advances, jassid and whitefly population showed decreasing trend. During the season, about 125 mm rains were received in the month of June which helped the crop growth. However, the dry spell in July hampered the growth of the crop sown from 15th July onwards. The succulent plants of first two sowing date might be the reason of more jassids and whitefly population. Bhattacharjee (1986) reported that whitefly, B. tabaci infestation in soybean took place right from unifoliate stage of the plant and continued as long as they remain green. The findings of present study, where whitefly incidence was noticed just seven days after germination of the crop, are in conformity with above findings. Bhattacharjee (1986) also mentioned that the whitefly thrived well where both temperature and humidity were quite high and rainfall retarded its activities as its wings get choked with rain and made it inactive. The increased temperature and dry spells experienced during the present study also helped for multiplication of both the sucking pests.

4. Stemfly, *Melanagromyza sojae* (Zentener)

The data revealed that no seedling mortality due to stemfly *M. sojae* was observed at 7-10 days after germination in any of the sowing date from 15th June to 15th August indicating that the stemfly infestation is starting at later stage of the crop. This finding was in collaboration with the finding of Chechani et al., (2002) who reported that the infestation of stemfly commenced 30 days after sowing, supporting the present findings. However, differences were observed with respect to the stem tunneling by stemfly which is recorded at physiological maturity. The crop sown on 15th June 2015 recorded a stem tunneling of 16.83 percent. The tunneling percentage goes on increasing as the sowing date advances up to mid July and in the crop sown on 30th June it reported 18.20 percent stem tunneling while a highest of 22.42 percent stem tunneling was recorded in the crop sown on 15th July.

References

1. Andole VC. Soybean it's cultivation, uses and values in dietetics, 1984, 29