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Survey on the seasonal incidence of insect pests of soybean in Bemetara district of Chhattisgarh state

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Abstract
Survey work for visualization of real pest problem of four blocks *i.e.* Bemetara, Berla, Saja and Nawagarh of Bemetara district (C.G.) was conducted during Kharif, 2017-18 and 2018-19. Ten villages in each block were visited during crop growth period. Girdle beetle, *S. litura, C. acuta, B. tabaci* and *E. kerri* were observed as major insect pests in soybean ecosystem under the blocks of Bemetara district. The maximum block seasonal mean activity of girdle beetle was recorded in Berla block with 5.3 damaged plants/mrl in which the Damai village of Berla block having maximum intensity of girdle beetle with 9.5 damaged plants/mrl. Bemetara block was earmarked for maximum block seasonal mean population of leaf defoliators *i.e. S. litura and C. acuta* with 3.2 larvae/mrl and 3.7 larvae/mrl, respectively. However, Mohbatta village of Bemetara block received maximum population of *S. litura* (7.6 larvae/mrl) and *C.acuta* (6.2 larvae/mrl). In Nawagarh block, highest block seasonal mean intensity of *B. tabaci* was recorded with 19.0 whiteflies/five plants. Another sucking pest *E. kerri* showed maximum block seasonal mean population in Bemetara block (6.9 jassids/five plants). Among the different blocks, Bemetara and Berla blocks were found favourable for maximum activities of predatory insects.

Keywords: survey, insect pest, soybean

Introduction
Soybean is one of the most important oilseed commercial crops of India. It is world's most useful and cheapest source of protein, vitamins, minerals, salts, carbohydrate and other ingredients and known as miracle bean and golden bean of the twentieth century. Soybean is mainly grown for their seeds and is the second largest oil seed after groundnut in India. Soy-oil and soy-meal are consumed worldwide as food and animal food stuff, respectively. In the world, soybean occupies an area of 108.51 million ha with production potential of 345.96 million metric tons and average productivity of 3.18 metric tons/ha (USDA, 2016) [3]. In India, soybean occupies an area of 109.71 lakh ha with production potential of 114.90 lakh tons. Major production comes from Madhya Pradesh (57.16 lakh t) followed by Maharashtra (39.45 lakh t) and Rajasthan (9.49 lakh t). Other soybean producing states are Andhra Pradesh, Karnataka, Chhattisgarh and Gujarat (SOPA, 2016) [13]. In Chhattisgarh, out of 137.00 lakh hectares geographical area, 43 percent area comes under cultivation in which soybean occupies an area of 1.34 lakh ha with a production potential of 1.30 lakh tons (SOPA, 2016) [13]. In Chhattisgarh, among the different districts, Rajnandgaon has the maximum area and production of soybean followed by Durg, Kabirdham, Raipur, Bemetara and Kanker upland area. There are many problems in cultivation of soybean in India as well as Chhattisgarh, as all stages of this crop are prone to heavy infestation by pest complex. The luxuriant crop growth, soft and succulent foliage attracts many insects and provides unlimited source of food, space and shelter. Insect pests caused severe damage and consequent reduction in yield (Singh *et al*., 1991 and Sharma, 1999) [10, 9]. In India, 20 insect species have been recorded as major insect pests infesting soybean crop (Singh and Singh, 1990) [11]. In Chhattisgarh, soybean crop is attacked by many species of insect-pests *viz*., girdle beetle, *Obereopsis brevis* Swedenbord; tobacco caterpillar, *Spodoptera litura* Fabricius, green semilooper, *Chrysodeixis acuta* Walker; whitefly, *Bemisia tabaci* Gennadius and jassid, *Empoasca kerri* Pruthi. Girdle beetle is a serious insect of soybean that causes the yield loss by 14 to 42% (Kumawat *et al*., 2010) [5].

Girdle beetle infests throughout rainy season and its host range includes mainly soybean, pigeonpea, cluster-bean, Indian bean and cowpea (Garge *et al.* 2014 and Tagde, 2015) [4, 12]. The soybean defoliators mainly include tobacco caterpillar *Sopdoptera litura* (Fab.) and green semilooper, *Chrysodeixis acuta*. Immature stages (larva or caterpillar) of both tobacco caterpillar and green semilooper damage the crop at vegetative stage and in severe case, it completely defoliates the crop and cause drastic yield loss. *Spodoptera litura* larvae even damage to soybean pods also (Singh *et al.*, 2000, Patil 2002 and Sastawa *et al*., 2004) [7, 8]. The Bihar hairy caterpillar, *S. obliqua* is a voracious feeder which gregariously feed on soybean leaves. In case of severe infestation, the entire crop is damaged badly thus causing 40 per cent defoliation of leaf area. In soybean *Bemisia tabaci* occurred in large populations, the plants weakened by the extraction of large amounts of sap (Vieira *et al.* 2011) [14]. Jassids, *E. kerri* and whiteflies, *B. tabaci* were recorded as the major sucking insect pests on soybean variety JS 93-05 causing damage at various stages of the crop (Netam *et al.* 2013) [6]. In Bemetara district of Chhattisgarh state, no systematic survey was carried out in recent past hence, the present study was undertaken to get the information about the incidence of soybean crop pests in the area so that their proper management tactics could be evolved. Keeping these points in view insect pest survey was conducted for two consecutive years to ascertain the insect pests scenario of soybean-ecosystem.

Materials and Methods

A roving survey was undertaken to know the status of insect pests in soybean ecosystem of Bemetara, Berla, Saja and Nawagaon blocks of district Bemetara, Chhattisgarh as detailed in Table 1 and location map of Bemetara district.

Table 1: Site selection for survey of insect pests of soybean in Bemetara district during Kharif, 2017-18 and 2018-19

Roving survey on different villages of four blocks of Bemetara district				
Villages	Block of Bemetara district			
	Bemetara	Berla	Saja	Nawagarh
	Mohbatta	Damai	Ninwa	Nawagarh
	Pikari	Nawagaon	Hundi	Ataria
	Lolesara	Bahigaon	Kandai	Dhangaon
	Gangapur	Dagania	Katalbod	Padkidih
	Bhaijee	Baherghat	Semaria	Andhiyarkhor
	Kenwachi	Sandi	Khairjhitti	Chherkapur
	Dholia	Baijalpur	Shyampur	Murketa
	Charbhata	Salda	Tarkapur	Jogipur
	Majhgaon	Mujhgahan	Hardas	Hardi
	Pandharbhat	Khamatiya	Padumsara	Amora

Location map of Bemetara district

To study the incidence of insect pests of soybean, roving survey was carried out in ten villages of each block of Bemetara district during kharif season 2017-18 and 2018-19. In each block, five fields/village were surveyed. Survey was undertaken at different stages of the crop. Observations were made on 10 randomly selected plants from each field during flushing, flowering and harvesting at an interval of 15 days; using suitable techniques for different insects as explained below:

Girdle beetle

Number of girdle beetle damaged plants in per meter row length were worked out.

Leaf eating caterpillars

Observations on larval population of leaf eating caterpillar, *S. litura* and semiloopers, *C.acuta* were made at three randomly selected spots of one meter row length in each treatment; leaving the border rows. Larval counts were made by shaking

the plants gently over a white cloth placed between the rows. Average number of caterpillars found per meter row length (mrl) was worked out.

Sucking pests

Observations on number of plants infested by sucking insect pests *i.e.* whiteflies, and thrips from randomly selected ten plants and insect count were recorded from three leaves, (upper, middle and bottom part of the plant). Later on, mean number of sucking insect pests per plant was calculated.

Natural enemies

Observations on the incidence of predators were recorded at three randomly selected spots of one meter row length in each treatment leaving the border rows.

Results and Discussions

Soybean is cultivated extensively in Bemetara district. Hence, the area of operation for this study was confined to the selected four blocks namely Bemetara, Saja, Berla and Nawagarh of Bemetara district to record the different insect pests infesting soybean by conducting roving survey. Ten villages in each block were visited during the crop growth stages. Table 2 shows that seasonal incidence of major insect pests of soybean in Bemetara block of district Bemetara during Kharif, 2017-18 and 2018-19. Maximum number of girdle beetle damaged plants with 7.0 plants/mrl was observed in Charbhata village with the block seasonal mean of 4.4 damaged plants/mrl across the village. While, Gangapur village having minimum damaged plant by girdle beetle (2.0 damaged plants/mrl). Leaf defoliators; S.*litura* and *C.acuta* were recorded maximum in number with 7.6 and 6.2 larvae/mrl in Mohbatta village with the block seasonal mean of 3.2 and 3.7 larvae/mrl, respectively over all the villages. However, minimum number of plant defoliators was recorded in Pikari village. Maximum population of sucking insect pests *i.e. B. tabaci* (25 whiteflies/five plants) and *E. kerri* (13.5 jassids/five plants) recorded in Dholia village with the block seasonal mean of 14 and 6.9 insects/ five plants, respectively however, the lowest number of these sucking insect pests were recorded in Pikari village with 5.5 whiteflies/five plants and 4.0 jassids/ five plants. Side by side number of natural enemies also recorded across the villages and found that the population of lady bird beetle (0.5 no./plant) and spider (0.7 no./plant) was more active in Charbhata, Bhaijee and Pandharbhat villages, respectively which is depicted in Fig.1.

Table 2: Survey for seasonal incidence of major insect pests of soybean in Bemetara block of Bemetara district during Kharif, 2017-18 and 2018-19

Block: Bemetara	Incidence per meter row length			No. of sucking insect pest/five plant		No. of predator/plant		
	No of girdle beetle damaged plant	No of caterpillar		*B. tabaci*	*E. kerri*	Coccinellid beetle	Pentatomid bug	Spiders
		S. litura	*C. acuta*					
1. Mohbatta	4.0	7.6	6.2	8.2	7.0	0.1	0.3	0.0
2. Pikari	3.5	1.0	0.5	5.5	4.0	0.0	0.3	0.3
3 Lolesara	4.3	2.5	2.5	8.0	7.0	0.4	0.1	0.1
4. Gangapur	2.0	3.5	2.5	12.0	9.0	0.4	0.3	0.0
5. Bhaijee	4.5	1.5	2.0	14.0	5.0	0.5	0.2	0.4
6. Kenwachi	3.5	2.0	1.5	24.0	8.0	0.4	0.1	0.3
7. Dholia	3.5	3.0	6.0	25.0	13.5	0.4	0.2	0.2
8. Charbhata	7.0	3.0	4.0	12.0	5.5	0.5	0.2	0.2
9. Majhgaon	5.0	5.5	4.5	19.5	4.5	0.4	1.1	0.4
10. Pandharbhat	6.5	3.0	6.0	11.5	5.5	0.3	0.3	0.7
Block seasonal mean	4.4	3.2	3.7	14.0	6.9	0.3	0.3	0.3

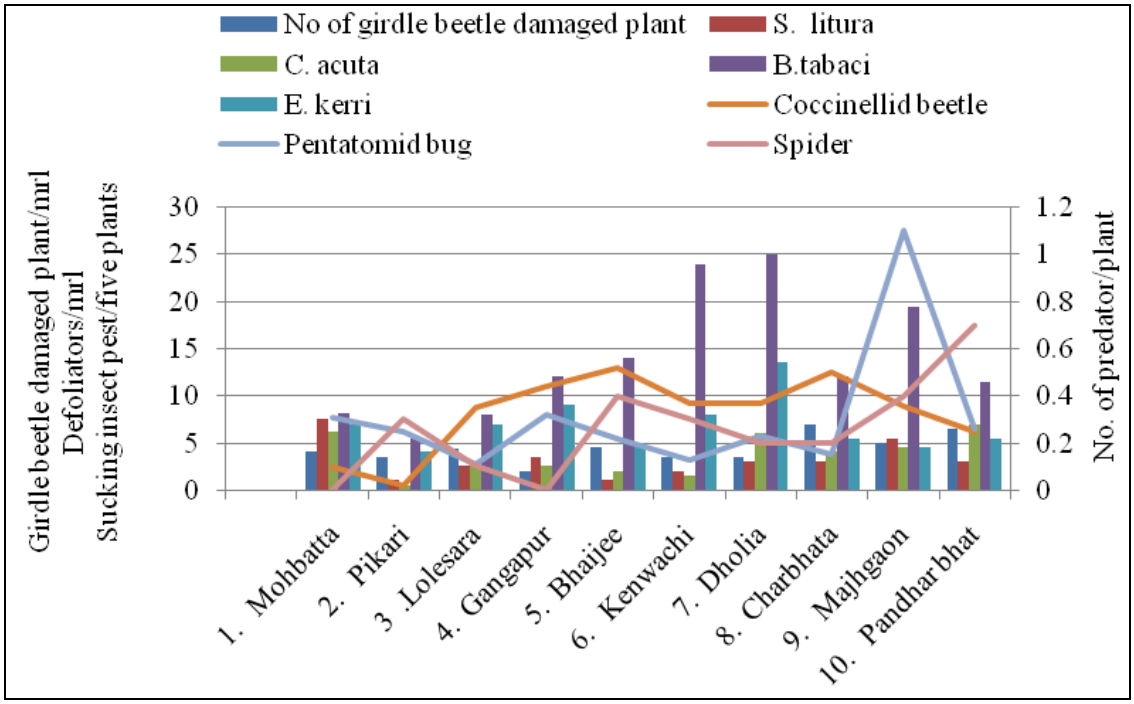

Fig 1: Village of Bemetara block

Table 3 and Fig. 2 revealed that maximum number of girdle beetle damaged plant with 9.5 damaged plants/mrl observed in Damai village with block seasonal mean of 5.3 damaged plants/mrl across the village. Baherghat and Baijalpur villages were scored 2nd and 3rd rank, respectively in terms of maximum girdle beetle damaged plants. Sandi and Bahigaon villages were earmarked for maximum catches of *S. litura* (4.0 larvae/mrl) and *C. acuta* (3.0 larvae/mrl), respectively with the block seasonal mean of 1.1 and 1.7 larvae/mrl, respectively. While, Khamatiya village was free from the attack of *S. litura* and Salda village having minimum number of *C. acuta*/mrl. With respect to sucking insect pests, *B. tabaci* (10 whiteflies/five plants) and *E. kerri* (6.5 jassid/five plants) recorded in maximum number in Mujhgahan and Khamatiya villages, respectively with the block seasonal mean of 5.7 and 3.1 insects/five plants, respectively. Among the predators, pentatomid bug found more active in Mujhgahan village with 0.8 bug/plant followed by Khamatiya (0.5 bug/plant), Dagania (0.5 bug/plant) and Damai (0.4 bug/plant).

Table 3: Survey for seasonal incidence of major insect pests of soybean in Berla block of Bemetara district during Kharif, 2017-18 and 2018-19

Block: Berla	Incidence per meter row length			No. of sucking insect pest/five plant		No. of predator/plant		
	No of girdle beetle damaged plant	No of caterpillar		*B. tabaci*	*E. Kerri*	Coccinellid beetle	Pentatomid bug	Spiders
		S. litura	C. acuta					
1. Damai	9.5	0.5	1.5	6.5	3.5	0.0	0.4	0.1
2. Nawagaon	4.5	0.5	1.5	6.5	1.5	0.2	0.3	0.2
3. Bahigaon	4.5	1.5	3.0	6.0	1.5	0.3	0.2	0.3
4. Dagania	4.6	0.3	1.6	4.5	1.5	0.2	0.5	0.1
5. Baherghat	7.5	1.1	1.5	2.2	2.0	0.6	0.1	0.5
6. Sandi	4.0	4.0	2.5	5.5	5.0	0.5	0.1	0.3
7. Baijalpur	5.0	1.1	1.1	3.5	4.5	0.3	0.0	0.4
8. Salda	4.5	1.0	0.5	5.5	1.5	0.4	0.3	0.6
9. Mujhgahan	4.5	1.5	1.0	10.0	3.5	0.5	0.8	0.4
10.Khamatiya	4.6	0.0	2.5	7.0	6.5	0.1	0.5	0.5
Block seasonal mean	5.3	1.1	1.7	5.7	3.1	0.3	0.3	0.3

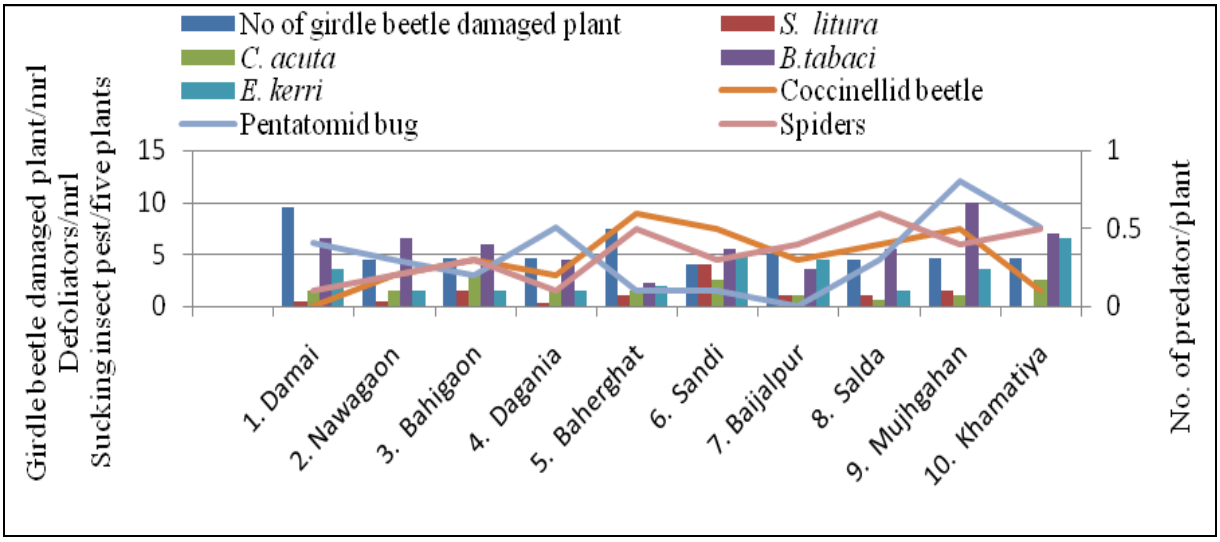

Fig 2: Village of Berla block

The major insect pests recorded at block Saja had been given in Table 4 and depicted in Fig.3, girdle beetle damage varied from 1.0 to 5.5 damaged plants/mrl. Minimum girdle beetle damaged plant with 1.0 plant/mrl was recorded in Hundi, Kandai and Khairjhitti villages however, maximum infestation of girdle beetle with 5.5 damaged plants/mrl was observed in Shyampur village with the block seasonal mean of 2.3 damaged plants/mrl. In case of plant defoliators, maximum intensity of *S. litura* was recorded in Ninwa village with 0.5 larva/mrl, while, Hundi, Katalbod, Khairjhitti and Padumsara villages associated with minimum activity of *S. litura* (0.1 larva/mrl) with the block seasonal mean of 0.2 larva/mrl. Comparatively highest incidence of *C. acuta* /mrl was recorded in Kandai village with 3.0 larvae/mrl however, the lowest incidence was recorded in Tarkapur village with 0.5 larva/mrl with the block seasonal mean of 1.7 larvae/mrl. Maximum population of *B. tabaci* was recorded in Kandai village (5.5 whiteflies/five plants) followed by Padumsara (4.5 whiteflies /five plants) and Hardas (3.8 whiteflies/five plants) with the block seasonal mean of 2.8 whiteflies/five plants. While, the maximum activity of *E. kerri* was observed in Padumsara village (5.6 jassids/five plants) followed by Ninwa (4.0 jassids/five plants) and Katakbod (3.9 jassids/five plants) with the block seasonal mean of 3.0 jassids/five plants. Among the predators spider was more active in all the villages of Saja block with the block seasonal mean of 0.4 spider/plant.

Table 4: Survey for seasonal incidence of major insect pests of soybean in Saja block of Bemetara district during Kharif, 2017-18 and 2018-19

Block: Saja	Incidence per meter row length			No. of sucking insect pest/five plant		No. of predator/plant		
	No of girdle beetle damaged plant	No of caterpillar		*B. tabaci*	*E. kerri*	Coccinellid beetle	Pentatomid bug	Spiders
		S. litura	*C. acuta*					
1. Ninwa	1.5	0.5	1.5	3.5	4.0	0.1	0.2	0.1
2. Hundi	1.0	0.1	1.5	3.0	1.0	0.0	0.0	0.4
3. Kandai	1.0	0.2	3.0	5.5	0.0	0.1	0.4	0.2
4. Katalbod	2.5	0.1	1.6	3.5	3.9	0.2	0.3	0.3
5. Semaria	2.5	0.3	1.5	2.0	3.5	0.1	0.1	0.4
6. Khairjhitti	1.0	0.1	2.5	0.0	2.5	0.2	0.0	0.6
7. Shyampur	5.5	0.2	1.1	2.0	3.0	0.3	0.3	0.5
8. Tarkapur	2.5	0.3	0.5	0.0	2.5	0.0	0.2	0.3
9. Hardas	2.5	0.2	1.0	3.8	4.1	0.4	0.4	0.2
10.Padumsara	2.5	0.1	2.5	4.5	5.6	0.3	0.3	0.7
Block seasonal mean	2.3	0.2	1.7	2.8	3.0	0.2	0.2	0.4

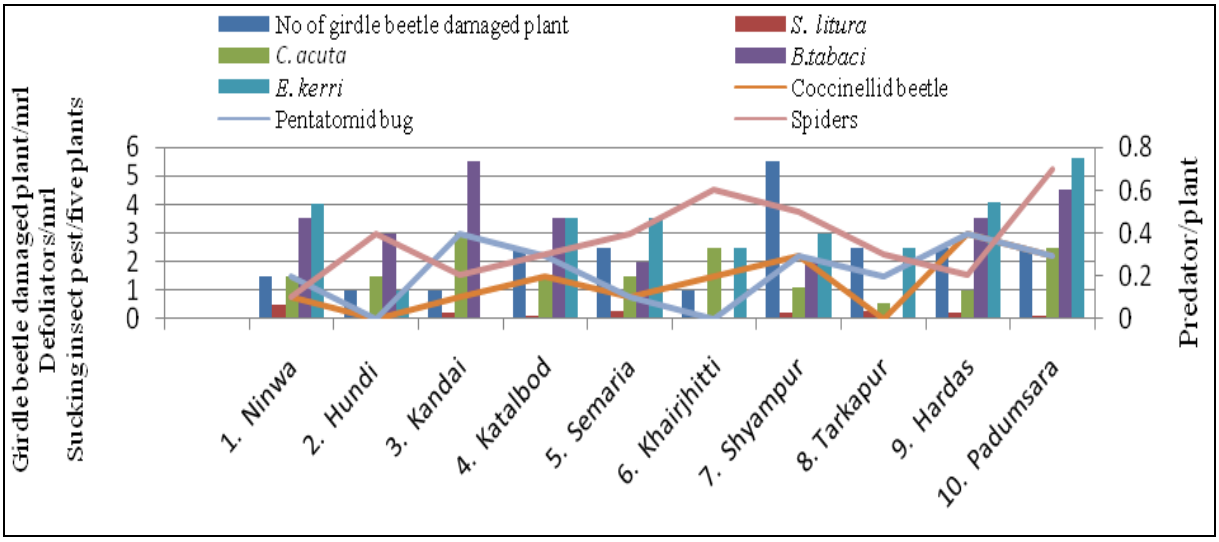

Fig 3: Village of Saja block

Table 5 and Fig.4 represented survey for seasonal incidence of major insect pests of soybean crop in Nawagarh block revealed that soybean crop was more prone to the attack of girdle beetle (8.3 damaged plants/mrl) and whitefly; *B. tabaci* (27.5 whiteflies/five plants) in Padkidih village with the block seasonal mean of 4.4 damaged plants/mrl and 19.0 whiteflies/five plants, respectively. However, maximum population of defoliators *i.e. S. litura* (3.1 larvae/mrl) and *C. acuta* (1.7 larvae/mrl) was recorded in Chherkapur village with the block seasonal mean of 1.4 and 0.8/ larvae/mrl, respectively across the village of block Nawagarh. Population of sucking insect pest *i.e. E. kerri* found maximum in Andhiyarkhor village with 7.0 jassids/five plants with the block seasonal mean of 4.4 jassids/five plants over all villages. Predator spider was more active in this block followed by coccinellid beetle and pentatomid bug.

Table 5: Survey for seasonal incidence of major insect pests of soybean in Nawagarh block of Bemetara district during Kharif, 2017-18 and 2018-19

Block: Nawagarh	Incidence per meter row length			No. of sucking insect pest/five plant		No. of predator/plant		
	No of girdle beetle damaged plant	No of caterpillar		*B. tabaci*	*E. kerri*	Coccinellid beetle	Pentatomid bug	Spiders
		S. litura	*C. acuta*					
1. Nawagarh	2.7	1.3	0.0	1.2	1.1	0.2	0.1	0.2
2. Ataria	3.5	1.2	0.5	15.0	5.5	0.1	0.2	0.3
3. Dhangaon	5.5	2.1	1.1	18.0	2.5	0.3	0.2	0.2
4. Padkidih	8.3	1.0	0.0	27.5	4.5	0.1	0.1	0.4
5. Andhiyarkhor	4.2	1.1	0.6	24.1	7.0	0.2	0.4	0.5
6. Chherkapur	6.5	3.1	1.7	23.2	2.5	0.3	0.5	0.3
7. Murketa	2.0	0.5	1.2	21.5	6.5	0.1	0.0	0.4
8. Jogipur	0.1	1.2	1.0	27.2	5.2	0.0	0.1	0.5
9. Hardi	7.5	1.3	0.5	20.3	6.2	0.5	0.4	0.2
10. Amora	3.5	1.0	0.9	12.2	3.0	0.4	0.2	0.4
Bockseasonal mean	4.4	1.4	0.8	19.0	4.4	0.2	0.2	0.3

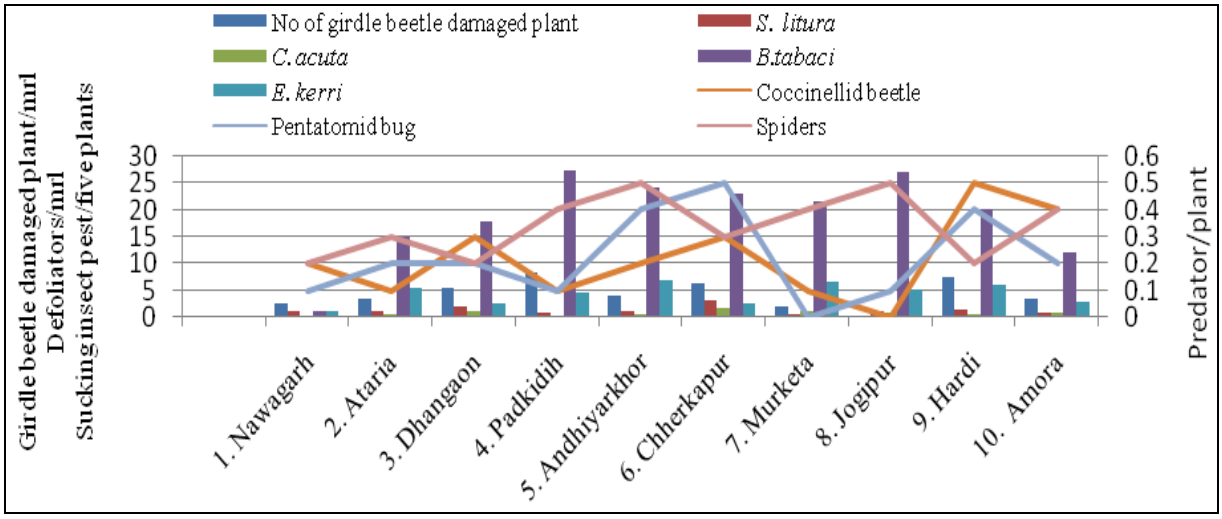

Fig 4: Village of Nawagarh block

On the basis of two years data of survey for seasonal incidence of major insect pests of soybean recorded across the four blocks of district Bemetara. Fig. 5 revealed that the maximum block seasonal mean incidence of girdle beetle was observed in Berla (5.3 damaged plants/mrl) followed by Bemetara (4.4 damaged plants/mrl), Nawagarh (4.4 damaged plants/mrl) and Saja (2.3 damaged plants/mrl). Adimani (1976) [1] also reported the infestation of girdle beetle ranging from 5 to 10 per cent. Fig.6 showed maximum block seasonal mean population of plant defoliator *i.e. S. litura* was recorded in Bemetara block (3.2 larvae/mrl) which was followed by Nawagarh block (1.4 larvae/mrl), Berla block (1.1 larvae/mrl) and Saja block (0.2 larva/mrl) and, however, maximum block seasonal mean activity of *C. acuta* was also observed in Bemetara (3.7 larvae/mrl) followed by Berla (1.7 larvae/mrl), Saja (1.7 larvae/mrl) and Nawagarh (0.8 larva/mrl). This finding is supported by Patil (2000) and Singh (1996) who reported that *S. litura* and *C. acuta* were major plant defoliators in soybean ecosystem. Highest block seasonal mean intensity of *B. tabaci* was recorded in Nawagarh (19.0 whiteflies/five plants) followed by Bemetara (14.0 whiteflies /five plants), Berla (5.7 whiteflies /five plants) and Saja (2.8 whiteflies /five plants) while, *E. kerri* was recorded with maximum block seasonal mean population of 6.9 jassids/five plants in Bemetara followed by Nawagarh (4.4 jassids/plant), Berla (3.1 jassids/plant) and Saja (3.0 jassids/plant). Among the predators, spider population was more active in all blocks of Bemetara district. Both Bemetara and Berla blocks were received the maximum activities of predator across the blocks. The presents observations are in agreement with that of Ahirwar (2013) [2].

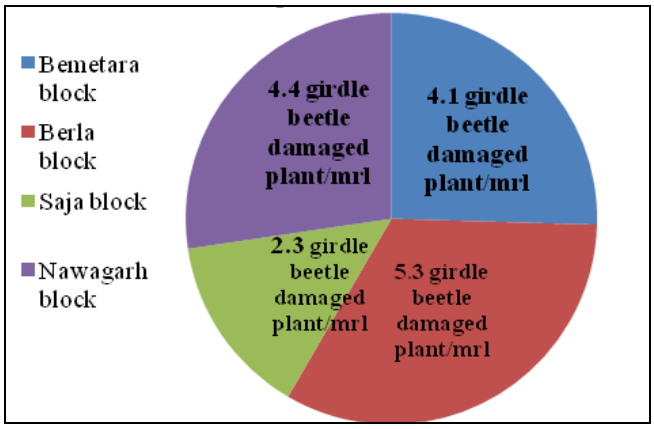

Fig 5: Block seasonal mean of girdle beetle damaged plant/mrl

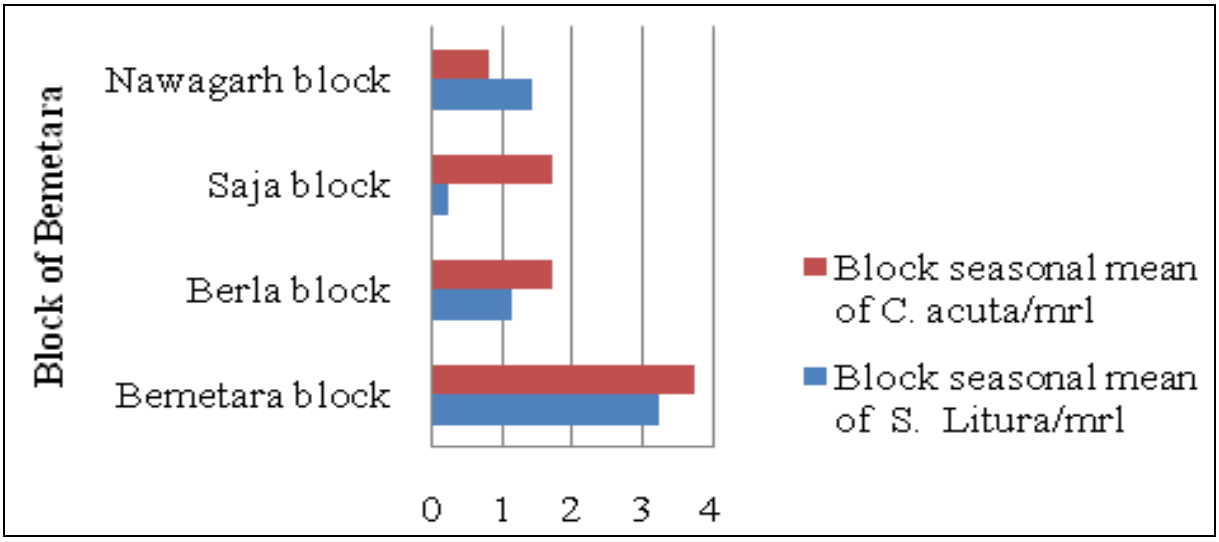

Fig 6: Block seasonal mean of leaf defoliators/mrl

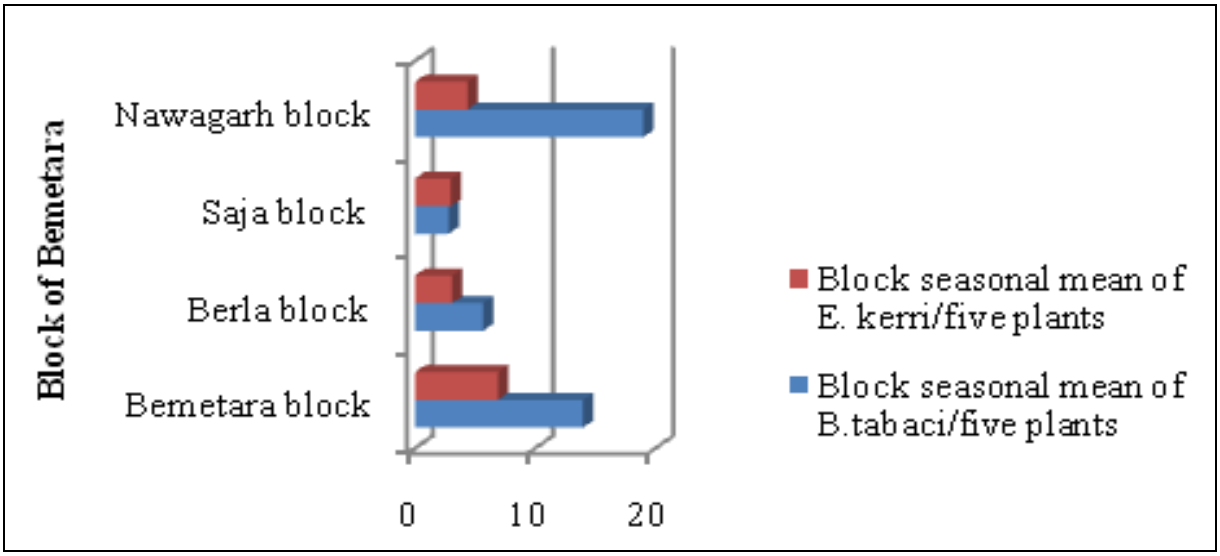

Fig 7: Block sea sonal mean of sucking insect pest/fiveplants

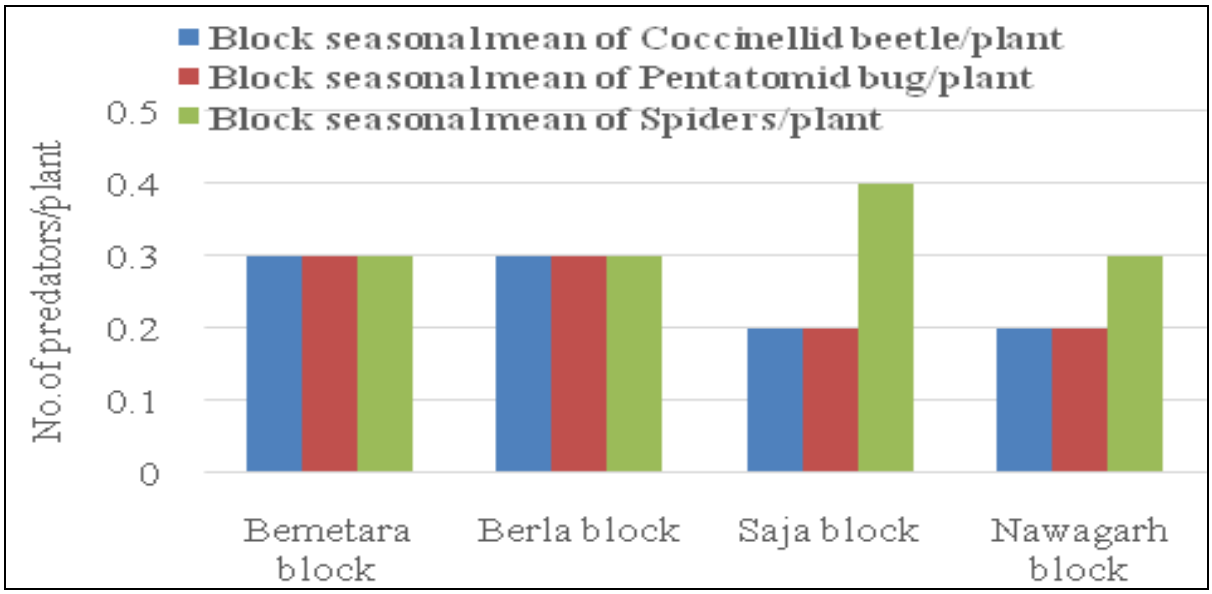

Fig 8: Block of Bemetara district

Conclusion

This seasonal activity of major insect pests of soybean crop across the four different blocks of Bemetara district showed the differences for preference to different insect pests of soybean. Bemetara block is more favourable for multiplication of leaf defoliators and jasids insect pests while, Nawagarh block is more susceptible to whitefly insect pest. In Berla block, the more intensity of girdle beetle insect pest was observed. Maximum seasonal activities of predators are found in Bemetara and Berla blocks. The Bemetara and Berla blocks might certainly be possessing favouring habitat/niche to the natural enemies It may be due to change in micro climate within the blocks. Therefore, continuous studies on weather parameters and incidence of insect-pests of soybean should be taken up which will help in formulation of management module against major insect pests of the respective block of Bemetara district.

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