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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(4): 962-966

www.thepharmajournal.com
Received: 11-02-2021
Accepted: 14-03-2021

Sagar Vinod Somatkar
Department Agronomy, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, India

Mayur Gopinath Thalkar
Assistant Professor, Agronomy Domain, School of Agriculture, Jalandhar, Punjab, India

Pawan D Thorhate
Department Agronomy, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, India

Vishal Kailas Sonawane
Department Agronomy, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, India

Corresponding Author:
Mayur Gopinath Thalkar
Assistant Professor, Agronomy Domain, School of Agriculture, Jalandhar, Punjab, India

A review on evaluation of bio intensive practices against major insect pest of soybean

Sagar Vinod Somatkar, Mayur Gopinath Thalkar, Pawan D Thorhate and Vishal Kailas Sonawane

Abstract
Soybean (*Glycine max* L. Merrill) is major crop belongs to the leguminous family. It has a good nutritional value than the other leguminous crop and used for the manufacturing the various antibiotics, paints, adhesives, lubricants, varnishes but on the production of crop different factors affecting on it such as abiotic and biotic constraints. But belongs to the biotic factors such as various disease and pest like spodoptera, Green Semilooper, Tobacco Caterpillar, whitefly, Girdle beetle, pod borer, bean fly and *Helicoverpa armigera* etc., For controlling to these different insect pests by the various practices like chemical control i.e biopesticides, plant extracts like biodynamics mixture, other antifeedant properties like cow urine, cow dung etc., physical control and Biological control such as bio-agents like predator, parasitoid etc are effectively against these biotics stress.

Keywords: Soyabean, insect-pest, management practices, yield

1. Introduction
Soybean (*Glycine max* L. Merrill) is major legumes crop in the world in relations of total production. Soybean seed contains fourty percent protein and twenty percent oil on dry basis. It's a major contains is an amino acid, minerals and vitamins. Soybean meal is valuable ingredients in formulated feeds for poultry & fish. It is an attractive crop by countless potentials of not only civilizing agriculture, but also subsidiary enterprises such as manufacturing antibiotics, paints, varnishes, adhesives, lubricants.
In specific, it is assumed that the soil biotas do not distress the agro-ecology role or the facilities providing by them (Wall & Nielsen, 2012) [1]. Between the maximum growing crops (maize, rice, wheat), soybean (Glycine max (L.) Merr.) is the one leguminous species that can be associated with rhizobia & arbuscular mycorrhizal (AM) fungi, with ability to be more exploited. Pagano & Covacevich (2011) reviewed the present info on the adventage of AM fungi in agro-ecology, revealing that the increasing recognition of the effects of agricultural strengthening & usage of agrochemicals harmfully affect soil superiority, altering the quantity, multiplicity, & action of the soil microbiota, with the populaces of synergetic fungi. Mutualistic relations such as AM fungi have significant ability for soybean creation (Pagano, 2012; Simard & Austin, 2010). Soybean (G. max (L.) Merr.) It is a major source of protein for humans and as a high-quality animal feed (FAO, 2003). Soybean constitutes one of the largest sources of vegetable oil and of animal protein feed in the world (Sugiyama *et al*., 2015) [15].
World soybean production for 2019-20 is 336.563(MMT) according to SOPA 2019-20. In 2019-20 the crop is mainly cultivated in USA with production in MMT 96.615 china 17.100, Brazil 123.000, Argentina 53.00, & India 9.00. In 2019(Kharif) Foremost soybean crop cultivating states in India are Rajasthan, M.P, M.H, A.P, Chhattisgarh, Gujrat. The flourishing crop growing, soft & moist foliage entices several insects & offers limitless source of food, space & shelter. The beet armyworm, *Spodoptera exigua* (Hubner) (Lepidoptera: Noctuidae) is origin to Asia but has been announced universal and is nowadays available nearly wherever its several host crops are grownup. It is an significant nuisance of soybean in Iran (Mojtahedi. 1979) & few region of the biosphere (Abdullah *et al*., 2000; Idris & Emelia 2001) [3, 4] It is solitary of the record mutual & damaging arthropods of supplementary than ninety plant species in at least eighteen families everywhere the biosphere (Abdullah *et al*., 2000; Wilson, 1932; Smits, 1987) [3] The extensive host range of the *Spodoptera* comprises soybean, sugar beet, cabbage, cauliflower, brussel sprouts, tomato, maize, cotton, lettuce, peanut, alfalfa, shallot, pastures crops, and various wild hosts (Abdullah *et al*., 2000) [3]. The severe use of insecticides for management of this nuisance has led to in high levels of resistance to nearly

all marketable insecticides in various region of the biosphere (Idris & Emelia 2001; Tisdale & Sappington,2001) [4]. HPR is unique way of managing arthropods that is safe to the atmosphere & similarly diminishes expenditures for cultivators (Hill & Hartman, 2004) [5]. In current years, the *Spodoptera* has become a serious nuisance on soybean in few regions of Iran.

The soybean pod borer, *Maruca vitrata* is a mostly significant arthropods of tropical legumes (Baoua *et al*. 2011) [6], since of its varied host range, harmfulness, & supply (Sharma 1998) [7]. It is the more extensively dispersed species in the biosphere (Liao & Lin 2000; Sharma *et al*. 1999a, 1999b; Taylor 1978). However, it is one of the significant nuisances of the tropical part, the topographical range of *M. vitrata* has prolonged even to few region of Europe because of climate variation & global warming (Kimber 2018). It is a probable nuisance of arhar, common beans, soybean, & cowpea in Asia involved Korea (Barroga 1969; Jung *et al*. 2007; Saxena 1974; Srivastava 1974; Subasinghe & Fellows 1978). These arthropod impacts harm to whole phases of crop growth, nourishing on the tender leaf axils, flower buds, flowers & young pods by webbing & boring (Sharma 1998; Singh & Allen 1980; Singh & Taylor 1978; Taylor 1967; Traore *et al*. 2013) [7]. Exclusively, the larvae of this pod borer harm the buds, flowers & pods of crop by webbing & boring, & this typical feeding habit protects the larvae from adverse environmental conditions, natural enemies and chemical sprays (Sharma 1998) [7]. Damage to stems, peduncles, flowers and pods leads to significant yield losses of legume species (Chang & Ramasamy 2014; Patel & Singh 1976; Schläger *et al*. 2015; Singh & Allen 1980)

Soybean crops is announced to remain argued through nearly three hundred and fifty species of insects in various regions of the world (Luckmann, 1971) [10]. Around sixty-five arthropods have been recorded to occurrence on soybean crop from pod development to harvesting period (Rai *et al*., 1973; Adimani, 1976; Thippaiah, 1997 & Jayappa, 2000) [16, 11, 17]. About more than 90 arthropods species attacking soybean crop at Jabalpur Gangrade (1976). Vieira *et al*. (2011) recorded that when infestation whitefly is observed in large population on plants cause drawing large amount of liquid from plant. Kumawat (2007) reported that there were common arthropods complex infecting soybean crops such as Green Semilooper, Tobacco Caterpillar, whitefly, Girdle beetle etc. And other defoliators like tobacco cutworm or cotton leaf worm, slender burnished brass moth etc can damage to crop and cause skelatalization of leaves and reducing the photosynthetic capacity of plants. Adimani ,1976 [11, 17] reported that Pod borers like pink pod borer, *Helicoverpa armigera* (Hub.), Pod borer and Bean fly reason monetary loss, above which pink pod borer is of predominant significance as its major nuisance of soybean and exposed to severe injury and losses of crop. Out of them some are virulent to this crop. McCornack *et al*., 2004 reported that also one aphid species *A.glycine* damaged to soybean crop in summer season, and the population of insect or pest are not managed which cause huge loss of yield (Ragsdale *et al*. 2007) [13]

To control the losses to crops by insect pest's different management practices are followed i.e. chemical control, physical control, Biological control etc., of which chemical control measures are generally adopted and most effective than other. Dhaliwal and Arora, 1998 Reported that the examination on artificial natural insecticides established in 20th century originally providing fabulous outcomes in reducing the arthropods which show to regular nuisance management performs. Lakhansingh & Sanjeev Kumar,1998 reported that Extensive usage of insecticides which have shown to issue such as insecticide resistance, nuisance recovery & ecological contamination also discouraging the natural ecology. Nyunt,2008 reported that predator of lepidopteran pest which is *Eocanthecona furcellata* (Wolff) in Southeast Asia. Gardiner *et al*. 2011 reported that *Coccinella septempunctata* and *Harmonia axyridis* are the natural enemies are found in soybean field.

The investigators future documented the injurious effects of pesticides & annoyed to carry ecological tactics to diminish pesticide load in atmosphere by using bio-agents & biopesticides but these are not easily available and are costly. So, it has been tough for growers to use these tools in nuisance control. Narayanaswamy,1999 reported that to reduce these complications, plant-based constituents & indigenous practices suggestion harmless & well substitute approaches of nuisance control programme (Narayanaswamy, 1999).

2. Review of Literature

2.2 Incidence of major insect pests and natural enemies in soybean ecosystem

2.1.1 Seasonal incidence of defoliator pest of soybean

Luckmann,1971 [10] reported that in the many parts of world 380 insect's species are gather from soybean crops. Rawat *et al.* (1969) reported that twenty- four different pest species are occurred on soybean crop in Madhya Pradesh and Thirty-two insect and non-insect's pest on soybean crop in M.P. state in India (Saxena 1972). Singh (1973) recorded fifty- six arthropods & mites on same crop from U.P, Pantnagar. Rai *et al.* (1973) [16] reported twenty- four insect species which are attacking on soybean crop in Karnataka, among that huge loss by the caterpillar of *Lamprosoma indicata* F, *Stomopteryx subsecivella* Zeller, *Diacrisia oblique* Walker & the gelechid shoot borer. Around eighty- five insect species which are belonging to 6 various orders & mite on soybean crop in M.P, India by Gangrade (1962). Adimani (1976) [11, 17] reported fifty-nine insects species fitting to 6 Orders stirring around Dharwad on soybean in Karnataka. The Semilooper, *Thysanoplusia orichalcea* was a nuisance chiefly in *kharif* while it was seen in stray instances through summer also (Mundhe, 1980). Singh *et al.* (1988) reported a more larva population of noctuid's *Rivula* sp. Sontakke & Patro (1991) recorded the occurrence of around twenty arthropods on soybean in Western Orissa. Field studies were conducted during 1988 to 89 in Chiplima, Orissa, India, & the *kharif* crop of soybeans agonized better loss by arthropods than the winter crop. minimum nuisance occurence & greater outputs were noted with early sowings (20th June, 5th July and 1st ,15th November) in both periods. Three need-based spray of monocrotophos in June-july and two in winter offered pleasing management of all the arthropods, since in improved grain yield of 11.2 & 3.1 q/ha, respectively as equated to management as reported by Sontakke & Mishra (1994) [20] Field studies carried out in H.P., India, in 1993 resulting that postponing the sowing date of soybeans lead to in the decrease of yields. The more yield (3.69 tones/ha) was attained by sowing on 28th May & the minimum yield (1.45 tones/ha) was attined by sowing on June 25th (Chandel and Gupta, 1995).

2.1.2 Seasonal incidence of pod borers

Taylor (1964) seen 4 -5 peers of the cotyledon borer *C. ptychora* on 2 crops of cowpea that were grown in series exclusively year in Nigeria. Until now, the cyclical dissimilarity in the concentration of cotyledon borers was studied by sowing crop in diverse months. Maximum percent cotyledon injure was reported in the crop sown in the months of July & Aug. Where ever, the crop sown in the months of Nov, Dec, Jan, Feb, March & April persisted free from invasion (Kumar, 1978). Olaifa & Akingbohungbe (1982) recorded that the cyclic population variation of cowpea moth, *C. ptychora* in black gram improved from May - Sept & decrease in respite of the months of the year. The occurence of cotyledon borer *C. ptychora* on green gram was detected from the month of May & the crop sown after Oct was allowed from occurence of cotyledon borer. The greater occurence (70.80%) was seen in the crop sowing in the July which regularly decrease in the crop sown in resultant months. Where ever, the crop sown in respite of the year was allowed from occurence (Katti, 1984).

2.1.3 Seasonal incidence of natural enemies

Sprenkel *et al*. (1975) carried out field trials uninterruptedly for 3 years to perceive the possessions of growing date (initial & later), row width (61, 91 & 122 cm) & sowing rate (2, 6 & 12 seeds per 0.3 m^2) on the occurrence of various nuisance & their predator in soybean ecology. Planting soybean early (earlier 5th june) in narrow rows at a higher seedrate had high percentage of death of the complete larval density due to *N. riley.* Insect mycopathogen, *N. rileyi* was dynamic through the period in soybean field at Jabotical Brazil in Novr, 1982 to May 1983 (Leite & Lara, 1985). The occurence & injured infest by the noctuid, *Chrysodexis acuta* (Walker) to soybean cotyledon & flowers was diminished by contagion with *N. rileyi* as of July to Sept, 1984 in M.P, India (Singh & Singh, 1987). Death of *A. gemmatalis* (Hubner) owing to parasitoids &pathogens jointly were 56 %, of this 29% was owing to *N. rileyi* in Brazil (Silva & Silva, 1993). 72 types of spiders were stuck in 4 rubbish-tip habitats in Germany (Northwest of Leipzig).

2.2 Efficacy of herbal arthras and extracts against insect pests

2.2.1.1 Insecticidal property of plant products

Plant based insecticides have been used in agriculture since time immemorial (1200 BC) Chinese used wood ash for pest control in enclosed spaces with botanicals *viz*., pyrethrum for seed treatments (Jones, 1973) [19]. In Vrikhsayurveda, a branch of ayurveda which deals with plant health drugs possessing specific quality, treatments are recommended against insect attacks. Aragvedha (*Cassia fistula* L.), Karanja (*Pongamia pinnata* L.), Saptapurana (*Alstonia scholaris* (L.), R. Br. and Nimb (Neem: *Azadirachta indica* (A. Jass.) are included in Aragwadhadigana of Surrata for use against worms (maggots). The oil of Bhaltaka (*Scenecarpus anacrdius* L.) is also mentioned in Krimighna Gana of Charaka (Vijayalakshmi and Shyamsundar, 1994) [20]. A number of texts in Vedic period mention the pesticidal properties of neem (Chitra Shankar and Solanki, 2000) [21]. The ether extracts of *Annona* sp. possessed both toxic and repellent action against the larvae of *Plutella maculipennis* Curt (Harper *et al*., 1947) [22].

2.2.1.2 Antifeedant activity

The antifeedant property of neem was discovered by Pradhan *et al*. (1962) [23]. Extract of *parthenium* protected the castor leaves against third instar larvae of *S. litura i.e.,* 19.53 to 62.21 per cent protection with reduction in defoliation (Gajendran and Gopalan, 1982 and Gopalan *et al*., 1987) [24, 25]. According to Joshi *et al*. (1984) [26, 33], neem seed kernel suspension at 0.05, 0.75 and 1.0 per cent concentration protected tobacco from attack by *S. litura* for seven days, but had adverse effect on the quality of flue cured tobacco. The repellency of neem seed kernel suspension (Joshi and Sitharamaiah, 1979) [27] and neem oil (Venkateshwarlu, 1988) has been proved against various pests. Oleic and linolic acid in the seed oil of *Datura alba, Bassia latifolia* Roxb., *Polyalthia longifolia* (Sonn.0) thw., *A. squamosa* were the cause for antifeedant activity against *S. litura* (Kumar and Thakur, 1988) [28]. Ramachandra Rao *et al*. (1990) [29] evaluated commercial formulations from neem seeds against *S. litura* and reported that neem (3.0%) and neem oil (3.0%) exhibited high repellency, followed by neem oil (2.0%) and Neemark® (2.0%). Aqueous and alcohol extracts of *Euphorbia* spp. and *Lantana camera* exhibited antifeedant activity to the larvae (Mani *et al*., 1990) [30].

2.2.1.3 Evaluation of cow urine with plant products

High per cent antifeedant property of cow urine against *S. litura* was observed at 10 per cent concentration (More *et al*., 1989 and Mathew, 1997) [31]. Mixture of extracts from Pongamia (10%), aloe (5%), NSKE (10%) and cow urine (30%) recorded highest antifeedant activity with 75.57 and 68.63 per cent reduction in larval weight of *S. litura* and *H. armigera* respectively, over control (Barapatre, 2001). Among the various indigenous tools evaluated, the maximum larval mortality of *S. litura* (91.66%) was caused by vitex (5%) + aloe (5%) followed by Pongamia (10%) + aloe (5%) + NSKE (10%) + cow urine (30%) (88.33%), both being statistically on par with each other, but significantly superior to all other treatments. NSKE inflicted the highest larval mortality of *H. armigera* (89.92%) and was as effective as a combined treatment of Pongamia (10%), aloe (5%), NSKE (10%) with cow urine (30%) (78.88%), whereas, cow urine and cow dung were ineffective as they were unable to inflict any mortality even after lapse of maximum post application period of 96h (Barapatre and Lingappa, 2003) [32].

2.2.1.4 Performance of plant products and biodynamic pesticides on defoliators.

According to Joshi *et al*., (1984) [26, 33] neem seed kernel suspension of 0.5, 0.75 and 1.0 per cent protected tobacco plants from *S. litura* for seven days. Laboratory and field experiments have shown that neem-based insecticides, azadirachtin (Koul, 1985, Rao and Subramanian, 1987), reduced *S. litura* growth and its damage on foliage of groundnut resulting in higher pod yields. Plant extracts from *V. negundo* and *Stachytarpheta uticifolia* (Salish) Sims were also found to cause mortality of the third instar larvae of *S. litura* in castor (Bai and Kandaswamy, 1985). At Sehore, NSWE (4 and 5%) were found effective against green semilooper, stemfly and leaf miner as triazophos and monocrotophos 36 EC (0.04%). Maximum grain yield was obtained from NSWE (5%), triazophos (0.05%), NSWE (4%) and monocrotophos (0.04%) (Anon., 1992). Vijayalakshmi *et al*. (1996) reported effectiveness of garlic extract in combination with other extracts like neem, chilli, ginger, tobacco, cow urine (with soap solution) against *H. armigera* and *S. litura* in field crops up to 13 days of spray. Sadwarte and Sarode (1997) [37] reported that the combination of cow dung and cow urine with half dose of insecticides observed to

have moderate impact on *H. armigera* on pigeon pea while NSKE + half dose of insecticide was most effective treatment, while sole application of cow dung and cow urine were found ineffective. Ginger extract as natural pesticide, alone and in combination with other plant products like chilli, garlic and cow urine was found effective against *H. armigera* (Vijayalakshmi, *et al*., 1997).

3. Conclusion

This review concluded that management of insect pest on soybean through various practices such as biodynamics mixture, cow urine, cow dung and biopesticides and it is effectively results of controlling insect pest as compare to the synthetic insecticides.

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