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Different Arthropod Pests of Cashew with Special Reference to Red Banded Thrips (*Selenothrips rubrocinctus giard*)-A Review

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***Abstract*: Cashew yield is highly influenced by adopting scientific management practices. However the crop suffers from biotic and abiotic stress situations for which the cashew yield is drastically affected if not attended in time. Earlier many workers have done intensive studies on the influence of environmental factors on crop physiology and yield of this crop. The crop is also reported to be attacked by a number of insect pests as well as microbial pathogens causing diseases. About 400 species of arthropods are known to infest cashew till now (Technical Bulletin, DCR, 2015) while 70 species of insect pests have been reported to infest cashew in different stages of crop growth in India (Pillai et al .,1979). Among these several insect pests cashew stem and root borer is the most important pest of this region followed by the incidence of Tea Mosquito Bug. Besides this Shoot Tip Caterpillar, Leaf Miner, Leaf and Blossom Webber, Apple and Nut Borer and Thrips also cause yield reduction in unmanaged plantations. I reviewed 1) The various arthropod pests of Cashew 2) Different species of thrips infesting cashew 3) Red banded thrips of Cashew and their morphology , seasonal incidence and biology 4) Damage and control of Red Banded Thrips of Cashew. It is recommended that minimizing the pesticides applications and adopting different IPM practices against insects and pests, larger consideration should be given to farmer and their educational formats. The present article will shed light on the efficacy of various insecticides for the control of a highly devastating and emerging pest Red Banded Thrips in Cashew.**

***Keywords*: Cashew, foliage thrips, Bioefficacy, Selonothrips rubrocinctus Giard.**

1. Introduction

Cashew (Anacardium occidentale L.) belongs to native of South America (Brazil) and is now found in many tropical areas. The English name cashew is derived from the Portuguese name “caju”. The cashew tree was first described by Thivet (1558). In the 16th century cashew was introduced to India (Goa) by the Portuguese and it spread all along the laterite hill slopes in the Western area from Mumbai to Cape Comorian and to the sandy soil on the Eastern coast as well as over inland areas in the Southern states. The major cashew producing states in India are Kerala, Karnataka, Tamil nadu, Andhra Pradesh, Odisha, Maharashtra, Goa and West Bengal and interior tracts of Chhattisgarh, Andaman and Nicobar Islands, Gujarat, Jharkhand and North Eastern regions. Cashew is highly economical crop which can be grown on a variety of land such as laterite, loamy, and sandy soils except black soils. Cashew gained commercial importance in the beginning of 1950,s where some private processors exported cashew kernels to European countries. At present in India among the various agri horticultural commodities involved in the global trade cashew has attended a prominent place (Hubballi, 2018). Cashew kernel derived by the processing of raw nut is highly nutritious. Cashew kernel is a rich source of protein, carbohydrate and fat which is comparable with the almond, with respect to protein, carbohydrate, fibre and minerals. Apart from cashew kernel, cashew nut shell liquid (CNSL) expelled during processing is a valuable industrial raw material and has number of uses in the industries as friction lining, paints, varnishes etc. Cashew apple is a rich source of vitamin-C and fibre. It also contains free soluble sugar The total cashew nut area in the country is 10.11 lakh ha producing annually 7.25 lakh ton of cashew. India occupies 1st position in area, 2nd in production or else the productivity is 5th among the cashew growing countries. In Odisha the total area of cashew is 1.8 lakh ha with production of 85.5 metric tons. The state occupies 3rd in area and production, the productivity is 474 kg/ha (Quinquennial report, AICRP on Cashew, 2015). Cashew kernel is obtained by processing the raw cashew nut in the processing plant. At present 3940 processing units are functioning units are functioning in India with a processing capacity of 16.48 lakh metric tons. On the contrary the total annual nut production in the country is 7.25 lakh ton. Thus there is shortfall of 7-8 lakh ton of cashew nut to run the processing plants and the country has to depend on other cashew producing countries by importing nuts to run its plants throughout year as mentioned by Guruprasad (2018). Therefore Govt of India has taken a massive step to

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increase the domestic production of cashew twice by 2020 through area expansion programme in order to reduce the gap between cashew domestic production and demand of the cashew domestic production and demand of the cashew processing plants as raw materials. Cashew yield is highly influenced by adopting scientific management practices. However the crop suffers from biotic and abiotic stress situations for which the cashew yield is drastically affected if not attended in time. Earlier many workers have done intensive studies on the influence of environmental factors on crop physiology and yield of this crop. The crop is also reported to be attacked by a number of insect pests as well as microbial pathogens causing diseases. About 400 species of arthropods are known to infest cashew till now (Technical Bulletin, DCR, 2015) while 70 species of insect pests have been reported to infest cashew in different stages of crop growth in India (Pillai et al .,1979). Among these several insect pests cashew stem and root borer is the most important pest of this region followed by the incidence of Tea Mosquito Bug. Besides this Shoot Tip Caterpillar, Leaf Miner, Leaf and Blossom Webber, Apple and Nut Borer and Thrips also cause yield reduction in unmanaged plantations. Since last two years (2015-16) foliage thrips (Selenothrips rubrocinctus) had been recorded from Bhubaneswar seriously affecting the growth and yield of the cashew plants. Some cashew varieties in the germplasm block were observed to be highly susceptible to the pest. The affected trees showed leaf sheddings and drying of the branches and panicles. Red Banded Thrips was first reported in Cacao (Cocoa) plant in the country West Indies by Broadway (1898). The pest was found in the leaf with high population of 70-80 nymphs and adults per leaf and in high infestation, all the leaves are affected. Both nymphs and adults scrap and suck the cell content. Under severe conditions the leaves turn silvery white and shed off. Red Banded Thrips was also found attacking grape, mango, avocado, guava along with cashew and cocoa. However available literatures on seasonal incidence, biology and management of the pest in cashew are very scanty.

2. Arthropod Pests of Cashew

The insect pests associated with cashew have been reported by different workers from different parts of world. 1) Pillai (1976) reported that in India cashew nut is attacked by more than 60 species of insect pests during different stages of its growth and their development causes mild to severe havoc to the Cashew plantation. 2) Furthermore Pillai et al., (1979) again enlisted a total of 196 species of insects and mites as pests of Cashew in different countries, out of which 84 species (79 insects and 5 mites) were reported from India. 3) Rai (1984) presented an exclusive compilation of pests of cashew in India and reported a total of 151 species of insects including 17 new species of insects and 9 vertebrate species. Later on Sundararaju (1993) documented 180 species out of which 151 were insect species, 8 mites and 21 vertebrate species on cashew with an inclusion of 13 species as a new record. 4) Dowmoh et al., (2008) conducted several field surveys between July 2003 to October 2005 in different parts of Ghana, Africa to identify the insect fauna of Cashew. He collected a total of 170 species out of which 89 were identified to family level and 57 were identified to generic level. The survey of 170 insects comprised of 31 Hemiptera, 60 coleoptera, 31 Hymenoptera, 5 Dictyoptera, 13 Orthoptera, 17 Lepidoptera, 5 Odonata, 4 Homoptera, 3 Diptera, and 1 Thysanoptera. 5) In Odisha 47 species of insects pests attacked Cashew (Satapathy, 1982). 22 species including 3 species of thrips were reported to be intimately associated with various growth stages of the crop (Panigrahi, 1988). 6) Studies were also made at the Directorate of Cashew Research, Puttur, and Karnataka in 2012 on arthropod fauna other than TMB (Anonymous 2012). Survey were carried out during 2009-2010 in 22 cashew orchards (5 young and 17 mature) to study the relative importance of insect orders associated with cashew trees in Benin Republic, West Africa (Agboton et al., 2014). He enlisted 262 insect species belonging to the orders Hemiptera (94 spp), Coleoptera (65 spp), Hymenoptera (57 spp), Diptera (25 spp), Orthoptera (10 spp), Lepidoptera (3 spp), Isoptera (3 spp), Neuroptera (2 spp).

3. Thysanoptera

Thysanoptera order of the world comprise 5500 species in 750 genera as reported by Moritz et al.,(2004). They are more common in warmer tropical parts of the world than in the temperate regions. About 50% of them are fungal feeders, while 40% feed on living tissues of dicotyledonous plants and grasses and the balance exploit primitive plants or are predatory as revealed by Morse and Hoddle (2006). Species infesting higher plants are found on leaves, shoots, flowers, flower buds, axillary buds, young fruits and cones of Conifers as studied by Lewis (1973). Others inhabit lichens, mosses, ferns, dead tree trunks and leaf litter reported by Mound (2004). The author also reported that those infesting living tissues of plants are sap feeders while flower dwelling species feed on pollen. A few predate on mites, scale insects and other thrips. Lewis (1973) reported that thrips play destructive as well as beneficial roles in agriculture. They are plant pests causing scarring and silvering of leaves, petals and fruits, premature flower fall, pollen depletion, leaf shedding and also leaf deformity. The author also reported that they also form leaf galls. Furthermore, thrips are important vectors of tospoviruses that cause serious crop losses around the world as revealed by Mound, (1996). Predatory species such as Franklinothrips orizabensis have been used in the biological control of Scirtothrips persea as studied by Hoddle et al., (2004). Thrips are increasingly being recognized as plant pollinators in plants as diverse as oil palm as revealed by Syed (1979). The thrips of the Indian subcontinent have been extensively documented by Ananthakrishnan and Sen (1980), Bhatti (2004) and Ananthakrishnan (1980).

4. Thrips Pests of Cashew

Varatharanjan et al., (2010) considered thrips to be one of the most important group of insects causing significant damage to a number of economically important plants by the way of feeding, breeding, and transmitting plant diseases species of thrips known from India, 18 were considered as potential pests on different plants. Panigrahi (1988) studied on thrips and found 3 species to be intimately associated with various growth stages of Cashew. There were also reports of thrips species from different parts of India and abroad which are intimately associated with Cashew plants. (Table 1.)

Table 1
Cashew plants

S.no	Scientific Name	Plant Part Affected
1	Frankiniella schultzei(Trybom)Mound	Flowers
2	Haplothrips ceylonicus Schuntz.	Flowers, young nuts
3	Rynchothrips raoensis G	Flowers, young nuts
4	Scirtothrips dorsalis Hood	Tender shoots , leaves
5	Retithrips syriacus (Mayet.)	Leaves
6	Riphiphorothrips cruentatus Hood	Leaves
7	Selenothrips rubrocinctus (Giard.)	Older leaves

5. Foliage Thrips

1. *Retithrips syriacus (Mayet)*: Retithrips sp commonly called as grape vine thrips of Egypt was first recorded in India by Seshadri and Ananthkrishnan (1954). Occurrence of this in cashew has been recorded by Abhraham (1958) ,Pillai (1980), Raghunath Reddy (1976) in Karnataka, Bhattee(1979) in Goa, Satapathy(1982) in Odisha, Ganeshkumar et al., (1982) in Tamil Nadu and Chatarjee(1989) in West Bengal.
2. *Riphiphorothrips cruentatus Hood:* Riphiphorothrips cruentatus was recorded in India for the first time by Ramakrishna Ayyar (1928) from foliage of grape vine in Coimbatore. As a pest of cashew nut this thrips were reported as early as 1937 by Rahman and Bharadwaj and subsequently by Abhram (1958). Varatharanjan (2015) reported the activity of the species from the leaves of cashew. Ayyanna et al., (1985) reported that it caused 20-80% leaf damage in cashew in Andhra Pradesh.Its gregarious feeding resulted in heavy sap loss and reduced photosynthesis due to deposition of excretal fluid attributed to death of young seedling (Panigrahi, 1988). The thrips population was maximum during the month of February-April when temperature varied between 31-34°C, RH 72-75% and rainfall was significant.
3. *Selenothrips rubrocinctus (Giard.)*: S. rubrocinctus (Red banded thrips), was first observed as a stray creature in flowers of Aporosa and Cardenia in Calcutta (Moulton, 1928). Cashew, mango, and teak were observed to be the hosts of Red Banded thrips as reported by Ayyar and Margabandhu (1940), Abraham (1958) and Pillai (1980). The pest was reported from Odisha (Sathapathy and Jena, 1987), Karnataka (Reddy, 1976), Goa (Bhattee, 1979). According to Hill (1975), Red Banded Thrips have an almost completely worldwide distribution. Present investigation during PG Studies at Dr.Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra during 1999-00 revealed that the Red Banded Thrips infested the cashew especially in the Konkan region where cashew was intensively cultivated. Selenothrips rubrocinctus(Giard.) was studied on cashew at Okigwi , Eastern Nigeria by Boboye and S.O. (1968) following a severe outbreak in February 1966 which caused premature leaf fall of the infested crop . Smith (1964) reported the Red Banded thrips in Queensland infesting avocado, mango and other trees. It was first observed there in 1950.
4. *Economic importance of Red Banded Thrips*: Denmark et al .,(2005) revealed that the larva and adults of the thrips feed on the foliage and the fruit by piercing the epidermis with their mouth parts. The pests prefer young foliage and their feeding causes distortion and leaf drop. Honey dew excretory products fall to leaves and fruits and give rise to black sooty mould.
5. *Distribution of Red Banded Thrips:* Chin and Brown (2008) reported that the Red Banded Thrips is a tropical-sub tropical species thought to have originated in Northern South America and is found in China, Malaya, Ghana, Uganda, Zaire, Hawaiian islands, New Guinea, United States, Mexico, West Indies, Brazil, Equador, Suriname and Venezuela.
6. *Host range of Red Banded Thrips:* Astridge (2005) revealed that the Red Banded Thrips is a pest of many plants. In the West Indies, it has been a serious pest of cacao and mango. The species of tropical fruit trees, ornamentals and shade trees that it attacks are too numerous to list. The favourite tropical fruit hosts in Florida are mango and avocado. It has also been a problem in sweet gum trees in Central Florida.

6. Morphology of Red Banded Thrips

Chin and Brown (2008) revealed that the female is about 1.2 mm in length and has a dark brown to black body underlain by red pigment chiefly in the first three abdominal segments; the anal segments retain a reddish black colour, and the wings are dark. The male is similar, and is seldom collected. The nymph and pupa are light yellow to orange with the first three and last segments of the abdomen bright red. They also reported that after hatching, there are two nymphal stages lasting nine to ten days. Fully-grown second stage nymphs are about 1 mm long. The two nymphal stages are followed by two resting stages (pre-pupal and pupal stages). The resting stages last three to five days before adults emerge. Female dark blackish brown; forewing dark with 2 rows of black setae; tarsi and apices of tibiae yellow; antennal segments III & V yellow in basal half, IV yellow at base and apex. Head with cheeks constricted to basal neck. Antennae 8-segmented. Pronotum short, surface with transverse lines of sculpture. Mesonotum without median division. Metanotum with clearly defined triangle. Tarsi 1-segmented. Forewing with costal cilia longer than costal setae; both veins with row of widely spaced setae.

Abdominal tergites reticulate laterally; tergites III-VIII with pair of long setae medially; VIII with complete comb of long microtrichia. Male with abdomen slender; sternites III-VII with small round glandular area; tergite IX with 3 pairs of stout thorn-like setae.This description was given by Mound L. (2005).

7. Seasonal Incidence of Red Banded Thrips

The red banded Thrips incidence was found to be severe in established cashew plantations and the population was observed to be severe between 2nd fortnight of February to 2nd fortnight of April as observed by Patnaik et al .,(1987). Jalgaokar et al., (2006) conducted various field experiments in 2004-2006 at the Regional Fruit Research Station, Vengrula, and Maharashtra to monitor the infestation of cashew in relation to the weather parameters. He carried out path coefficient analysis to understand the direct and indirect effect of the individual weather parameters on the incidence of thrips in cashew. He further reported that the thrips population was negligible below 18±1°C. The maximum population was observed in between 18±1°C to 21±1°C. Regarding afternoon humidity, thrips population was found to be negligible below 53±1%. Maximum population was observed in between 53±1% to 64±1%, and then afterwards it declined. The minimum average population of thrips was recorded in 1st fortnight of April (0.08%) whereas maximum average population was noticed in 2nd fortnight of January (0.98%). Population was started from December I (0.25%) which coincided with vegetative flushing and flower initiation. The temperature then shooted up to 33.25°C in the 1st fortnight of May which marked the rapid decline of the thrips population from May onwards (Jalgaonkar et al ., 2015). Navik et al.,(2015) studied the seasonal incidence of cashew Red Banded thrips during 201014 under Konkan region of Maharashtra. The peak incidence of thrips was noticed during first fortnight of February, 2013 with 3.23 thrips/ panicle. During 2013-14, the peak outbreak was noticed in the second fortnight of January with 3.42 thrips/panicle. Patil and Dumbre (2008) reported severe incidence of thrips during February-March in Konkan region of Maharashtra. Pattnaik et al.,(2001) recorded large number of foliage thrips during second fortnight of February and declined at end of March in Orissa. Chatterjee et al.,(2005) reported activity of thrips during December to April and absent from May to November in West Bengal. He also reported that the correlation study between thrips population with weather parameters revealed that the minimum temperature, evening relative humidity showed significant but negative correlation with thrips population whereas, bright sunshine hours was significant positive with thrips population. Studies on foliage thrips of cashew (Anacardium occidentale L.) with special reference to Red Banded Thrips (Selenothrips rubrocinctus) under Bhubaneswar conditions" were conducted during the cropping season 2016-17 and 2017-18 under field conditions at Cashew Research Station (CRS), Orissa University of Agriculture and Technology (OUAT) ,Ranasinghpur, Bhubaneswar (BBSR) and the results of the experiment with respect to the seasonal incidence of the Red Banded Thrip has been summarised in table 2

Table 2
Pest distribution of Red banded thrips (Selenothrips rubrocinctus)

Period	2016-17 Foliage thrips (No./leaf)	2017-18 Foliage thrips (No./leaf)
July 1	0.00	0.00
July 2	0.00	0.00
August 1	0.00	0.00
August 2	0.00	0.00
September 1	0.00	0.00
September 2	0.00	0.00
October 1	0.00	0.00
October 2	0.00	0.00
November 1	0.00	23.86
November 2	0.00	21.54
December 1	0.00	10.53
December 2	0.00	8.22
January 1	0.00	5.04
January 2	0.00	5.32
February 1	0.00	23.67
February 2	0.00	51.87
March1	16.40	66.78
March 2	24.40	77.54
April1	25.40	45.30
April 2	13.56	30.21
May 1	11.76	17.56
May2	2.23	8.04

8. Biology and Life Cycle of Red Banded Thrips

Chin and Brown (2013) reported that Red Banded Thrips, avoid direct light and, when not feeding, shelter on the underside of leaves, in curled-up leaves and on the buds of developing flush. The female inserts eggs into the lower surface of the leaf and covers the point of insertion with a drop of fluid which dries to form a black disc-like cover. Females lay up to 50 eggs and live for up to one month. The eggs hatch within 12-16 days. After hatching, there are two nymphal stages lasting nine to ten days. During these two stages the nymphs feed widely on the plant. Fully grown second stage nymphs are about 1 mm long. The two nymphal stages are followed by two resting stages (pre-pupal and pupal stages) during which the nymphs congregate towards the end of the underside of leaves. The resting stages last three to five days before adults emerge. The average duration from the time eggs are laid to adults emerging is about two to three weeks. The authors also reported that the female is about 1.2mm in length and has a dark brown to black body having red pigment chiefly in the first three abdominal segments, the anal segment retain a reddish black colour, and the wings are dark. The male is similar, but smaller and is seldom collected. Reproduction by the Red banded Thrips is parthenogenetically as given by Avidov and Harpaz (1969). Females live upto 7 weeks and lay an average of 25 eggs, hatch in 12-18 days reported by Hill (1975) .The nymphal stage lasts 6-10 days and the pre-pupa; the pupal stage together 3-6 days as observed by Wait and Pinese (1991).

The authors also revealed that each female has a reproductive capacity of laying 30-50 eggs over a period of 4-5 weeks. The eggs are laid on the lower surface of leaves by inserting them singly in the tissues along the mid rib of tender leaves. Eggs are reniform (kidney shaped) and hyaline when laid but turn pale yellow just before hatching. The eggs hatch in about 4-6 days. The nymphs are pale yellow and wingless. They moult 2-3 times passing through 3-4 instars (12-18 days) according to the prevailing temperature. Full grown nymphs seek sheltered places and then pass through two resting stages called pre-pupa and pupa. Pupal period lasts for 6-10 days. Since, they have shorter life span, the overlapping generation of the thrips cause serious damage to cashew. Satpathy (1982) reported that the insects congregate abundantly on lower surface of leaves, emerging shoots and inflorescence. Rarely, they are found on the upper leaf surface also. Nymphs feed in company with the adults by lacerating the tender tissues and suck the oozing sap. Due to sustained feeding by large number of thrips, the terminal leaves begin to curl downwards from the margin towards mid-rib. In due course, the young leaves fall from the plant. Heavily infested trees exhibit sickly and faded appearance which can be recognised even from a distance. Young trees suffer comparatively more than the matured trees during summer months.

9. Extent of Damage

Chin and Brown (2013) studied that nymphs and adults are generally found on the underside of new flush and mature leaves where they feed byrasping leaf tissue and sucking the contents out of leaf cells. Developing fruit is also attacked in a similar fashion. Nymphs usually carry a drop of liquid at the tips of their upturned abdomens. This excrement periodically falls onto the leaf surface; when it dries, it forms dark brown spots on the leaf. In the early stages, feeding damage is seen as a silvery sheen on the leaves and skin of fruit. The margins of leaves tend to curl downward as a result of feeding. In severe infestations, leaves take on a brown sun-scorched appearance and may drop, while the skin of fruit becomes covered in silvery or brown scars, making it unmarketable. Red Banded Thrips prefer recently-hardened flush to new flush and older leaves. Igboekwe (1985) reported that the feeding punctures cause the development of chlorotic spots and premature leaf drop, small brown patches of excretory droplets, typical of thrips infestation are an obvious means of identifying damage. Bigger (1960) reported that Selenothrips rubrocinctus is a leaf feeding thrip and both the nymphs and adults are found on the underside of the leaf where the feeding results in resetting of the upper surface of the leaf .The older leaves which have been attacked generally fall giving the tree a thin appearance. With respect to leaf damage the number varied from 11.2 to 25.4 per leaf the highest being 25.4 as reported by Satpathy et al., (1990). Dennil and Erasmus (1992) reported that symptoms of attack of the Red Banded Thrips on cocoa result from feeding by adults and larvae on the leaves and pods. On leaves, the feeding punctures cause the development of chlorotic spots and premature leaf drop while on the pods, they cause brown patches that coalesce during severe infestations to form a dark brown, corky layer of dead cells that make the estimation of pod ripeness virtually impossible .Necrotic lesions are produced in the leaves and pods by adults and larvae, and in the flowers by adults. Distortion, leafdrop and sooty mould occur on mango and avocado. The damage caused to young cashew plants (Anacardium occidentale L.) by the Red Banded thrips was studied by Igboekwe (2006) with the objective of establishing the economic injury threshold of this insect on the crop to effect a timely control. Six infestation levels (0, 40, 80,160,240 and 320) of adult thrips were used on a 6-week old cashew seedling in a randomized complete block desgine of five replicates. The results showed that the mean leaf number and shoot weight had significant linear relationships (P less than 0.001) to increased number of thrips These insects suck and feed on new tender shoots , flower panicles and young developing fruits (NARI 2010). Igboekwe and Azam –Ali (2006) observed that the Red Banded thrips attack leaf and floral flushing shoots causing early abortion of young nuts and substantial loss of yields. Omole et al., (1976) studied on the level of infestation by Selenothrips rubrocinctus on 13 varieties of cashew in Nigeria on 3 occasions in January to June 1976. The percentage of the total plants attacked increased progressively with time, and nearly all plants became infested. . Zhong –Run Zhang (2008) studied on the effects of fertilisers with different ratios of nitrogen ,Phosphorous and potassium on the infestation of cashew Red Banded thrips and the results indicated that there was significant negative correlation between nitrogen content and damage index caused by Red banded Thrips on cashews when the nitrogen content ranged from 1.43 % to 1.72%.The damage of Red Banded Thrip on different orientation of a plant was not different ,which indicated that light intensity had no significant effect.

10. Chemical Management

Among the different insecticides tested against cashew thrips, 0.003 per cent lambda cyhalothrin (three sprays) was observed to be the most effective in reducing the incidence of Red banded thrips as reported by Patil and Dumbre (1979). Navik and co-workers reported the efficacy of lambda cyhalothrin 5 EC (0.003 %) and fipronil 5 EC (0.005%) against cashew thrips. Jadhav and co-workers reported the efficacy of lambda cyhalothrin 5 EC against foliage thrips of cashew. Jalgaonkar (2015) reported the efficacy of 0.003 per cent lambda cyhathorin and 0.01 per cent triazophos against cashew thrips. Considering the cashew foliage thrips as a limiting factor in cashew production, experiments were conducted at Regional Fruit Research Station Vengurle during the year 2012-13 to 2014-15 for effective management of cashew foliage thrips. Ravindran et al ., (2016) reported that lambda cyhalothrin (0.003%) as more promising insecticide for the management

of foliage pests of cashew .The residue analysis of lambda cyhalothrin (0.003%) showed that no residue was detected upto 0.01 ppm (Ravindra et al., 2016 and Geetha et al., 1999). This is perhaps due to fast degradation and sufficient time interval between application and harvest (around 30 days), as lambda cyhalothrin has been known to dissipate faster under tropical conditions reported by (Sindhe et al 2014 and Gobinda et al ., 2016). The present findings are in close conformity with Jalgaonkar and Mahapatro who reported lambda cyhalothrin 5EC (0.003%) and fipronil 5EC (0.005) % most effective against cashew foliage thrips. Both lambda cyhalothrin and Thiamethoxam were found most effective in controlling the Red Banded thrips and the effectiveness of both the insecticides has been mentioned in (Annual report, AICRP 2010-11 to 2014-15, Raviprasad, 2009).

11. Natural Enemies

Callan et al.,(2009) reported that the Red Banded Thrips were controlled by the Eulophid parasite Dasyscapus parvipennis in the West Indies from the Gold Coast in 1935 .It is now successfully established in Trinidad ,Puerto Rico and Jamaica .The importance of natural enemies is discussed and observations are made on the feeding properties of some of the predators in the laboratory. Chrysopids are regarded as the most important. Funderburk et al.,(2000) studied that the Red Banded Thrips are preyed upon by a large assortment of natural predators such as spiders, mites, lacewings, predatory thrips, and predatory bugs, especially minute pirate bugs.

12. Way Forward

The study of life cycle indicated that the pest had completed its life cycle in less than 3 weeks, thus several generations of the pest were completed during the crop growth stage. However the influence of environmental factors played a great role on the seasonal activity indicating low to nil population during the stress periods i:e extreme hot summer months as well as during the cold months of the year. During rainy season also lowest population was observed. This species can be managed effectively with insecticides like L-Cyhalothrin, Carbosulfan, and Thiamethoxam etc. During the period of observation some of the cashew germplasms had completely shed up its leaves and the terminal branches along with inflorescence and leaves were dried out, keeping in view of the seriousness of the pest as an emergent pest the future strategy may be planned out to study the resistance. Both morphological and biochemical factors needed to be evaluated. Several other biological control methods and use of biopesticides also need to be evaluated for controlling this emerging pest of Cashew.

13. Conclusion

This paper presented an overview of different arthropod pests of cashew with special reference to red banded thrips (*selenothrips rubrocinctus giard*)-a review.

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