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Insect pest complex of Pigeon pea (*Cajanus cajan*) in agro ecosystem of Tripura, N.E. India

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Abstract

The pest complex associated with Pigeon pea crop grown in Tripura, a North Eastern state of India has been recorded for the first time during 2015-16 and 2016-17. A total of 64 insect pests belonging to 7 orders and 32 families were recorded. Among these, 9 species were recorded as major, 30 were recorded as minor and remaining 25 were recorded as negligible pests. A total of eleven species of insect pests constituting the pod borer complex have been recorded, out of which three species viz., *Maruca vitrata* (Fabricius), *Melanagromyza obtusa* (Malloch) and *Apion clavipes* (Gerst.) were found to be the most destructive key pests. 36.4 and 42% pod damage by *Apion*, 34.8 and 36.5% by pod fly, 5.2 and 6% by *Helicoverpa*, 1.6 and 3% by *Lycaenid* larvae, 3.8 and 4.8% by *Exelastis atomosa* and 2 and 2.2% by *Etiella zinckenelia* were recorded during two consecutive seasons.

Keywords: Pigeon pea, pest complex, pod borers, Tripura, North East India

1. Introduction

Pigeon pea (*Cajanus cajan* (L.) Millsp.) is the second most important pulse crop grown in India, after chickpea [20]. Growing of pulses including Pigeon pea in Tripura is gaining momentum in recent years.

Tripura (22°56' to 24°32' N and 091°09' to 092°20' E) with an area of 10,490 km² is largely forested along with its adjacent provinces of Mizoram, Manipur, Meghalaya and Assam in India, forms part of biodiversity hotspot, and is predominantly hilly with five hills ranges (elevations between 244–939 m above mean sea level) which run parallel from north to south and decrease in elevation southwards and finally merge into the eastern plains. Winter (late November to February), summer (March to May), monsoon (June to September) and autumn (October to mid-November) are the four main seasons. Average annual temperature varies from the minimum average of 10°C in winter to the maximum average of 35°C in summer. The average annual rainfall is 2,000–2,500 mm and during monsoon season, south–west monsoons bring maximum rainfall (65%) to the province. The average humidity during the summer is 50–74%; during the monsoon season, it is above 85% [11, 18].

Pigeon pea harbours a large number of pests, some of which may assume serious proportions particularly during the reproductive stage of the crop [28, 9]. The major constraint in the production of pigeon pea is the damage caused by insect pests with avoidable losses extending up to 78% in India [17]. Several insects have been recorded as pests on Pigeon pea in India but only a few are responsible for economic losses and so can be regarded as major pests [2, 7, 12, 14, 22, 24, 25, 28, 31, 33, 35, 39, 41]. Moreover, insect pest complex of any particular crop vary from region to region with the variation of agro-ecological conditions. Proper information pertaining to occurrence of pests on any crop grown in a particular locality or region is of prime importance in order to formulate suitable integrated pest management strategy as well as to prevent misuse of chemical pesticides. Such information on pigeon pea is lacking from Tripura, a North Eastern state of India. So the present work was carried out to study the occurrence of pests of pigeon pea in this state.

2. Materials and Methods

The experiment was conducted during 2015-16 and 2016-17 crop season in the experimental farm of the College of Agriculture, Lembucherra, Tripura.

2.1 Crop studied: Pigeon pea crop (Variety: UPAS-120) was grown following all standard agronomic practices excepting plant protection measures.

2.2 Method of observation: Insect pests occurring on pigeon pea plants were observed at weekly intervals from 30 randomly selected and tagged plants from seedling stage to maturity of the crop through Plant Inspection Method (PIM).

2.3 Grouping of insect pests: Recorded insect species were categorized as major, minor and negligible pests on the basis of their incidence pattern. Insects which infested the crop in considerable numbers and were responsible for economic loss with prominent damage symptoms like growth retardation or damage to economic plant parts i.e. flowers and pods (more than 5% pod damage) or death of plant were considered as major pests. Insects which were frequently encountered but in small number were designated as minor pests whereas, insects which appeared less frequently and that too in a very low number were considered as negligible pests.

2.4 Records on pod borer infestations: During the pod development stage one hundred fifty pods were randomly plucked four times at an interval of 15 days for recording the pod borers' infestation and converted into per cent pod damage.

3. Results and Discussion

The pest species recorded during the present study are presented in Table 1. A total of 64 insect pests belonging to 7 orders and 32 families were recorded, of which maximum number of species were belonging to Order Hemiptera (13 families with 29 species) followed by Lepidoptera (10 families with 25 species) and Coleoptera (5 families with 6 species). Remaining four orders namely, Isoptera, Hymenoptera, Diptera and Thysanoptera were represented by one species each. Percentages of insect pests belonging to different orders are shown in Fig.1. Out of total 64 species of pests recorded during the present study, nine pests viz., *Maruca vitrata* (Fabricius), *Helicoverpa armigera* (Hübner), *Nanaguna breviscula* (Walker), *Melanagromyza obtusa* (Malloch), *Apion clavipes* (Gerst.), *Empoasca kerri* (Pruthi), *Aphis craccivora* (Koch), *Megalurothrips* sp., and termites have been recorded as the major pests in the field. 30 species were frequently observed but with low numbers and thus were considered as minor pests whereas, 25 species which were encountered less frequently and also with very low numbers were considered as negligible pests.

All parts of the pigeon pea plant have been found to be infested by different insects, of which the pod borer complex was responsible for direct crop loss. A total of eleven species of insect pests namely, *Maruca vitrata* (Fabricius), *Melanagromyza obtusa* (Malloch), *Apion clavipes* (Gerst.), *Helicoverpa armigera* (Hübner), *Exelastis atomosa* (Walsingham), *Etiella zinckenella* (Treitschke), *Lampides boeticus* (Linnaeus), *Catochrysops strabo* (Fabricius), *Euchrysops cnejus* (Fabricius), *Callosobruchus chinensis* (Linnaeus) and *C. maculatus* (Fabricius) constituting the pod borer complex have been recorded, out of which three species viz., *Apion clavipes* (Gerst.), *Melanagromyza obtusa* (Malloch) and *Maruca vitrata* (Fabricius), were the most destructive key pests and are considered as limiting factors in the successful cultivation of pigeon pea in this region.

Apion clavipes has been recorded as one of the most important pests and was associated with the crop starting from

seedling to harvesting stage. This finding is in agreement with Patra *et al.* [22]. The adults fed by nibbling on leaflets, buds flowers and pod surface. The grubs fed on the seed and pupate inside the pod. Infested pods could be recognized easily by their deformed shapes. Earlier, infestation of *Apion clavipes* on pigeon pea was reported from West Bengal [5, 23], Bihar [1, 32] and Meghalaya [22, 26, 29].

Like *Apion*, the pod fly (*Melanagromyza obtusa*) also oviposits in the tender pods. The maggots feed on the seeds and pupate inside the pods. It is one of the most serious pests of pigeon pea in many parts of the country causing the grain damage ranging from 10 to 80 per cent [13, 15, 30, 36, 38].

The spotted pod borer, *Maruca vitrata* (Geyer) is serious pest of grain legume crops including mungbean, urdbean, pigeon pea and common beans [6]. During the present study this insect was found to cause extensive damage to floral buds, flowers and pods. They webbed together the flowers, buds, pods and leaves and fed from within. They also damaged the seeds by boring into the pods. This is undoubtedly one of the most serious pests of pigeon pea in this state. The seriousness of this pest species has been reported by many authors from other parts of the country [8, 10, 19, 21, 40]. Besides *Maruca*, some other lepidopteran insects namely, *Nanaguna breviscula*, *Anisogona hilaomorpha*, *Phycita* sp. and *Eublemma versicolor* were also recorded to web together the flowers, pods and leaves. Among these four species, only *Nanaguna breviscula* was recorded as the major pest. It was found to infest the pod surfaces by scrapping on green tissues.

Helicoverpa armigera Hubner is the most dreaded and polyphagous pest of pigeon pea worldwide [30]. In this present study also it has been recorded as one of the predominant species in the pod borer complex causing damage to both flowers and pods. The larvae enter its head and part of the body into the pod and feed on the seeds. A single larva can damage several pods during its life time.

Other lepidopteran pests of the pod borer complex are *Exelastis atomosa* (Walsingham), *Etiella zinckenella* (Treitschke), *Lampides boeticus* (Linnaeus), *Catochrysops strabo* (Fabricius) and *Euchrysops cnejus* (Fabricius) all of which were recorded as minor pod borer species. According to Srivastava [34] *M. obtusa*, *E. atomosa*, *H. armigera*, *E. cnejus*, *M. testulalis* and *Anarsia ephippias* are the important pod borers which cause great damage to this pulse crop in Uttar Pradesh (India). Shanower *et al.*, [30] considered *H. armigera* and *M. vitrata* as the most important polyphagous pests in both tropics and sub-tropics, while Reed *et al.* [27] considered the pod feeding species such as *H. armigera*, *E. atomosa* and *M. obtusa* as major pest problems of pigeon pea. During the vegetative stage of the crop whitefly (*Bemisia tabaci*), cow bug (*Leptocentrus taurus*), fulgoroid bug (*Lawana conspersa*, *Ricania speculum* and *Flata ocellata*), aphids (*Aphis craccivora* and *Aphis gossypii*), leaf hopper (*Empoasca kerri*), scale insect (*Drepanococcus cajani*), mealy bugs (*Coccidohystrix insolita*, *Ferrisia virgata* and *Phenacoccus solenopsis*), termites (unidentified), lablab bug (*Coptosoma cribreria*, *Coptosoma fimbriatum* and *Coptosoma* sp.), lymantrid hairy caterpillars (*Somera scintillans*, *Euproctis fraterna*, *Artaxa guttata*, *Dasychira mendosa*, *Calliteara strigata*, *Orgyia postica*), and the leaf cutter bee (*Megachile* sp.) started infestation and continued up to maturity stage of the pods. The incidence of the leaf webber, *Omiodes indicata* was more during the early vegetative stage of the crop. The termite problem was very serious during very early stage of crop growth and was responsible for gappy stand in the field. Four species of

Coreid bugs (*Riptrotus pedestris*, *Riptrotus linearis*, *Cletus punctiger* and *Clavirgalla gibbosa*) were recorded to infest the pods but did not attend the status of a major pest.

Seven species of pentatomid bugs namely, *Dolicoris indicus*, *Piezodorus hybneri*, *Menida formosa*, *Menida versicolor*, *Halyomorpha picus*, *Plautia crossota* and *Nezara viridula* were noticed to infest the tender apical plant parts of the crop and were of negligible significance. Three species of fulgoroid bugs namely, *Ricania speculum*, *Lawana conspersa* and *Flata ocellata* were recorded to infest on stem, branches and leaves of the plant. *Lawana conspersa* was of minor status whereas; *Ricania speculum* and *Flata ocellata* were of negligible status. The Plataspidids, *Coptosoma cribreria*, *Coptosoma fimbriatum*, *Coptosoma* sp. and the Membracid, *Leptocentrus taurus* (cow bug) were found congregating on the tender branches of a few plants in the field.

Blister beetle (*Mylabris pustulata*) and chaffer beetle (*Oxycetonia versicolor*) were observed to infest the flowers but in a negligible proportion. Infestation of flower chaffer beetle, *O. versicolor* on pigeon pea and mungbean was reported from Punjab, India [37]. The flower thrips, *Megalurothrips* sp. was recorded to infest the flowers and large numbers of flowers were dropped due to attack of this pest.

Six species of Lymantrid hairy caterpillars namely, *Somana scintillans*, *Euproctis fraterna*, *Artaxa guttata*, *Calliteara* (= *Dasychira*) *strigata*, *Dasychira mendosa* and *Orgyia postica* were found to feed on leaves and flowers. However, none of these has assumed the status of a major pest.

The curculionid weevil, *Mylocerus dorsatus* were observed to feed on the leaflets and the leaf cutter bee, *Megachile* sp. was found to cut the leaflets in a semicircular fashion from margins.

Very low population of a Notodontid insect (*Neostauropus alternus*) and four species of Geometrid looper larvae (*Spaniocentra* sp., *Ectropis* sp., *Pingasa* sp. and *Hyposidra* sp.) have been recorded to feed on the leaves and all of these were of negligible status. Two species of Noctuid semilooper larvae (*Mocis undata* and *Chrysodeixis eriosoma*) have been recorded to infest the leaves, buds and flowers in a negligible proportion.

Khokhar and Singh [14] documented 38 species of insect pests on pigeon pea at Hisar. Subharani and Singh [35] documented 30 insect pest species on T-21 pigeon pea variety during various growth stages of crop at Imphal (Manipur), of which eleven pests were considered as major. Balikai and Yelshetty [4] recorded 30 insect pests feeding on pigeon pea from Bijapur and Gulbarga districts of northern Karnataka. Out of these, they recorded only two pests viz., *Helicoverpa armigera* (Hubner) and *Aceria cajani* Channa. as major pests on this crop [4]. 31 insect pest species from nine different orders were reported from eastern U.P by Yadav *et al.* [41]. Srilaxmi and Paul [33] recorded 18 pests belonging to 6 orders and 16 families out of which 7 were considered as major pests in Gulbarga, Karnataka. Recently Yadav *et al.* [39] encountered only seventeen insect species on pigeon pea variety UPAS 120 in Western Uttar Pradesh and the number of insect pest recorded is much less as compared to that of present findings on the same variety grown in Tripura. Patra *et al.* [22] recorded 41 species of insect pest on pigeon pea variety Bahar in Meghalaya of which, pod boring insects (*H. armigera*, *L. boeticus*, *A. clavipes* and *M. obtusa*) were most

destructive in this region. It is, therefore, evident from the present findings that pigeon pea crop grown in agro ecosystem of Tripura, which itself is part of a mega biodiversity hotspot (North East India), is infested by considerably large number of insect pests as compared to many other parts of the country. Moreover, total number and diversity of pest species recorded here is much more in comparison with some other north eastern states like Manipur [35] and Meghalaya [22].

3.1 Records on pod borer infestations

Among pod borers, per cent pod damage due to *Apion*, Pod fly, Lycaenid larvae, *Helicoverpa*, *Exelastis atomosa* and *Etiella zinckenella* were counted and the results are presented in Fig. 2. During first season (2015-16), highest number of pods were damaged by *Apion* (36.4%) followed by pod fly (34.8%), *Helicoverpa* (5.2%), *Exelastis atomosa* (3.8%), *Etiella zinckenella* (2%) and Lycaenid larvae (1.6%). During second season (2016-17) also *Apion* was the most damaging pod borer which caused 42% pod damage. Other pod borers i.e. pod fly, *Helicoverpa*, *Exelastis atomosa*, *Etiella zinckenella*, Lycaenid larvae were responsible for 36.5%, 6.0%, 4.8%, 2.2% and 3%, pod damage, respectively. Mean pod damage by *Apion*, pod fly, *Helicoverpa*, *Exelastis atomosa*, *Etiella zinckenella* and Lycaenid larvae were 39.2, 35.65, 5.6, 4.3, 2.1 and 2.3%, respectively. 9.6% and 14% pods were infested by both *Apion* and pod fly during first and second season, respectively. Sinha and Yadav [32] also reported 31.5 to 59.5% pod damage by *A. clavipes* in Bihar. The present findings regarding pod damage by *Apion*, pod fly and *Helicoverpa* are in agreement with that of Patra *et al.* [22]. However, Azad Thakur *et al.* [3] reported 77.8% pod damage and 43.1% seed damage due to infestation of *Apion clavipes*. Crop loss due to pod fly has been estimated from 10-80% [15, 30]. Yadav and Yadav [38] reported 40.00% pod damage by pod fly. The present findings are in agreement with Khan *et al.* [13] who recorded 21.00 to 38.50% pod and 12.29 to 19.87% seed damaged by pod fly and 5.50 to 12.50% pod damaged by Lepidopteran pod borer. According to Lal *et al.* [16] pod borers caused 60 to 90 per cent loss in the grain yield under favourable conditions and damage of seed by pod fly ranged from 14.3 to 46.6 per cent. Patra *et al.* [22] recorded 8.75 and 6.25% pod damage by *Helicoverpa armigera*, 7.50 and 5.25% by *Lampides boeticus*, 31.25 and 67.5% by *Apion clavipes* and 44.94 and 17.75% by *Melanagromyza obtusa* during first and second seasons, respectively.

4. Conclusion

It is evident from the present study that a considerably large number (64) of insect pests are associated with pigeon pea crop in the agro ecosystem of Tripura, of which nine species are major pests that need primary focus in the field for formulating effective management strategies for profitable cultivation of this important pulse crop in this state.

5. Acknowledgments

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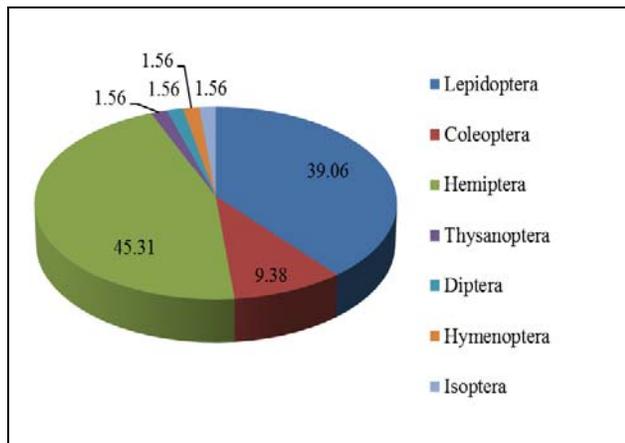


Fig 1: Percentage of Insect pest of different orders associated with pigeon pea.

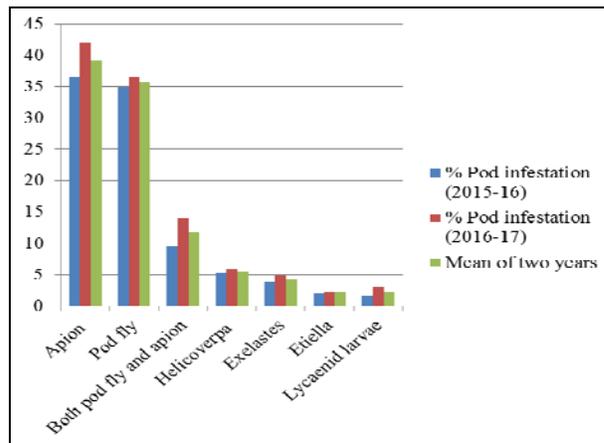


Fig 2: Percent pod damage by pod borers during two seasons of study.

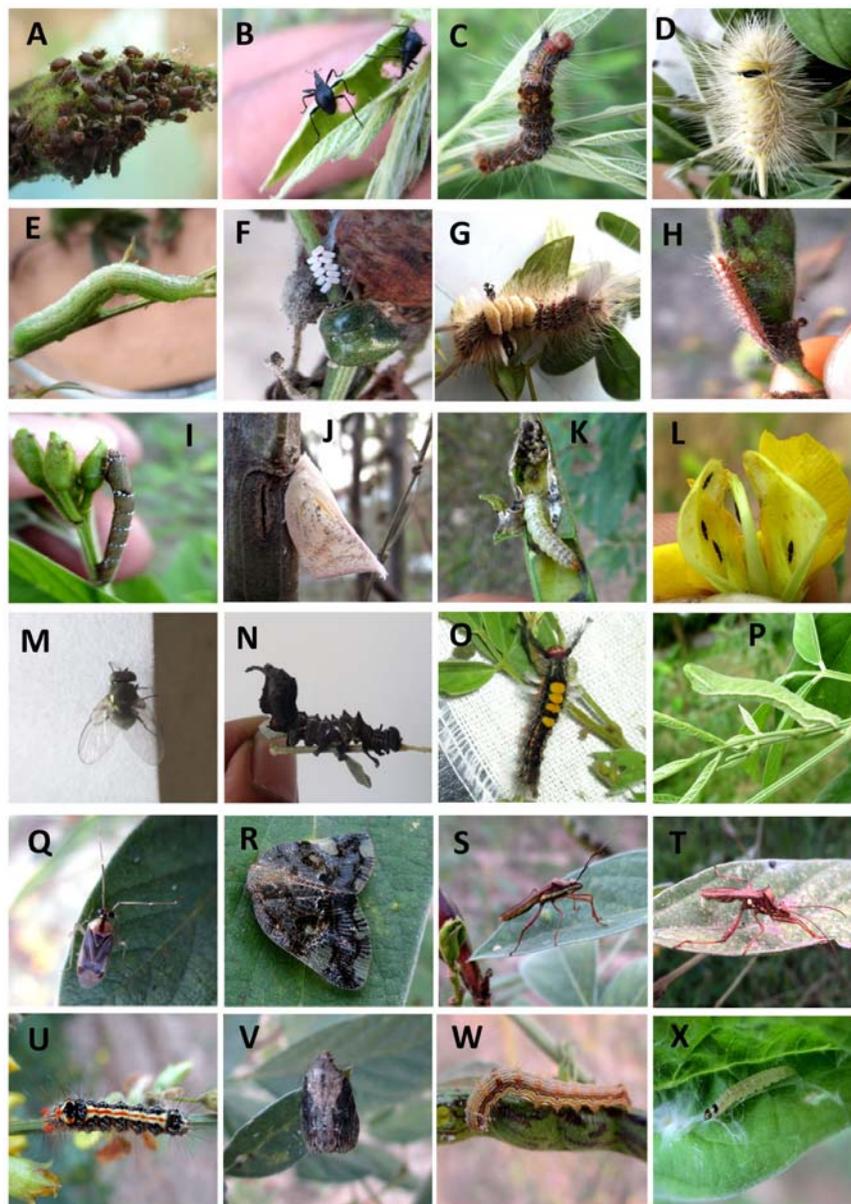


Fig 3: Insect pests of Pigeon pea: A. *Aphis craccivora*, B. *Apion clavipes*, C. *Artaxa guttata*, D. *Calliteara strigata*, E. *Chrysodeixis eriosoma*, F. *Coptosoma cribreria*, G. *Dasychira mendosa*, H. *Melanagromyza obtusa*, I. *Hyposidra* sp., J. *Lawana conspersa*, K. *Maruca vitrata*, L. *Megalurothrips* sp., M. *Melanagromyza obtusa*, N. *Neostauropus alternus*, O. *Orgyia postica*, P. *Pingasa* sp., Q. *Poppiocapsidea biseratense*, R. *Ricania speculum*, S. *Riptrotus linearis*, T. *Riptrotus pedestris*, U. *Somena scintillans*, V. *Nanaguna breviscula*, W. *Helicoverpa armigera*, X. *Omiodes indicata*.

Table 1: Insect pests associated with Pigeon pea in Tripura

Sl. No.	Order & Family	Scientific name	Crop stages	Plant part infested	Status	
					2015-16	2016-17
Lepidoptera						
A						
1	Crambidae	<i>Maruca vitrata</i> (Fabricius)	Flowering-pod filling	Leaves, buds, flowers, pods and seeds within the pods	Major	Major
2	Pterophoridae	<i>Exelastis atomosa</i> (Walsingham)	Flowering-pod filling	Buds, flowers, pods and seeds	Minor	Minor
3	Pyralidae	<i>Etiella zinckenella</i> (Treitschke)	Pod filling	Seeds within the pods	Minor	Minor
4	Noctuidae	<i>Helicoverpa armigera</i> (Hübner)	Flowering-pod filling	Leaves, buds, flowers, and seeds	Major	Major
5	Noctuidae	<i>Mocis undata</i> (Fabricius)	Flowering	Leaves, buds and flowers	Negligible	Negligible
6	Noctuidae	<i>Chrysodeixis eriosoma</i> (Doubleday)	Flowering	Leaves, buds and flowers	Negligible	Negligible
7	Lycanidae	<i>Lampides boeticus</i> (Linnaeus)	Flowering-pod filling	Flower buds and seeds	Minor	Minor
8	Lycanidae	<i>Catochrysops strabo</i> (Fabricius)	Flowering-pod filling	Flower buds and seeds	Minor	Minor
9	Lycanidae	<i>Euchrysops cnejus</i> (Fabricius)	Flowering-pod filling	Flower buds and seeds	Minor	Minor
10	Noctuidae	<i>Eublemma versicolor</i> (= <i>Autoba versicolor</i> Walker)	Flowering-pod filling	Flowers and leaves	Negligible	Negligible
11	Nolidae	<i>Nanaguna breviscula</i> (Walker)	Flowering-pod filling	Flowers, leaves and pod surface	Major	Major
12	Tortricidae	<i>Anisogona hilaomorpha</i> (Turner)	Flowering-pod filling	Flowers and leaves	Minor	Minor
13	Crambidae	<i>Omiodes indicata</i> (Fabricius)	Vegetative	Leaves	Minor	Minor
14	Crambidae	<i>Phycita</i> sp.	Flowering-pod filling	Flowers and leaves	Minor	Minor
15	Lymantriidae	<i>Somena scintillans</i> (Walker)	Vegetative-flowering	Leaves and flowers	Minor	Minor
16	Lymantriidae	<i>Euproctis fraterna</i> (Moore)	Vegetative-flowering	Leaves and flowers	Minor	Minor
17	Lymantriidae	<i>Artaxa guttata</i> (Walker)	Vegetative-flowering	Leaves and flowers	Minor	Minor
18	Lymantriidae	<i>Dasychira mendosa</i> (Hubner)	Vegetative-flowering	Leaves and flowers	Minor	Minor
19	Lymantriidae	<i>Calliteara strigata</i> Moore (= <i>Dasychira strigata</i> Moore)	Vegetative-flowering	Leaves and flowers	Minor	Minor
20	Lymantriidae	<i>Orgyia postica</i> (Walker)	Vegetative-flowering	Leaves and flowers	Minor	Minor
21	Notodontidae	<i>Neostauropus alternus</i> (Walker)	Vegetative	Leaves	Negligible	Negligible
22	Geometridae	<i>Spaniocentra</i> sp.	Vegetative	Leaves	Negligible	Negligible
23	Geometridae	<i>Ectropis</i> sp.	Vegetative	Leaves	Negligible	Negligible
24	Geometridae	<i>Pingasa</i> sp.	Vegetative	Leaves	Negligible	Negligible
25	Geometridae	<i>Hyposidra</i> sp.	Vegetative	Leaves	Negligible	Negligible
Diptera						
B						
26	Agromyzidae	<i>Melanagromyza obtusa</i> (Malloch)	Pod filling	Seed	Major	Major
Coleoptera						
C						
27	Apionidae	<i>Apion clavipes</i> (Gerst.)	Seedling-pod maturity	Adult: Leaflets, flower buds, flowers and pods. Grubs: seed.	Major	Major
28	Meloidae	<i>Mylabris pustulata</i> (Thunberg)	Flowering	Buds and flowers	Minor	Minor
29	Scarabaeidae	<i>Oxyctonia versicolor</i> (Fabricius)	Flowering	Buds and flowers	Negligible	Negligible
30	Curculionidae	<i>Mylocerus dorsatus</i> (Fabricius)	Vegetative	Leaflets	Minor	Minor
31	Bruchidae	<i>Callosobruchus chinensis</i> (Linnaeus)	Pod filling-maturity	Seed	Negligible	Negligible
32	Bruchidae	<i>C. maculatus</i> (Fabricius)	Pod filling-maturity	Seed	Negligible	Negligible
Hemiptera						
D						
33	Aleyrodidae	<i>Bemisia tabaci</i> (Gennadius)	Vegetative	Leaflets	Minor	Minor
34	Membracidae	<i>Leptocentrus taurus</i> (Fabricius)	Vegetative-maturity	Green stems and branches	Minor	Minor
35	Pentatomidae	<i>Dolicoris Indicus</i> (Stal)	Vegetative-flowering	Tender shoot, leaves and buds	Negligible	Negligible
36	Pentatomidae	<i>Piezodorus hybneri</i> (Gmelin)	Vegetative	Tender shoot and leaves	Negligible	Negligible
37	Pentatomidae	<i>Menida formosa</i> (Westwood)	Vegetative-flowering	Leaves and buds	Negligible	Negligible
38	Pentatomidae	<i>Menida versicolor</i> (Gmelin)	Vegetative-flowering	Leaves and buds	Negligible	Negligible
39	Pentatomidae	<i>Halymorpha picus</i> (Fabricius)	Vegetative-flowering	Leaves and buds	Negligible	Negligible
40	Pentatomidae	<i>Plautia crossota</i> (Dallas)	Vegetative	Tender shoot and leaves	Negligible	Negligible
41	Pentatomidae	<i>Nezara viridula</i> (Linnaeus)	Pod filling	Seeds through pod walls	Negligible	Negligible
42	Aphididae	<i>Aphis craccivora</i> (Koch)	Vegetative-pod maturity	Tender shoot, leaves, buds, flowers, pods	Major	Major
43	Aphididae	<i>Aphis gossypii</i> Glover	Vegetative-pod maturity	Tender shoot, leaves, buds, flower and pods	Minor	Minor
44	Cicadellidae	<i>Empoasca kerri</i> (Pruthi)	Vegetative-pod maturity	Leaves	Major	Major
45	Coreidae	<i>Riptrotus pedestris</i> (Fabricius)	Pod filling	Green pods	Minor	Minor
46	Coreidae	<i>Riptrotus linearis</i> (F.)	Pod filling	Green pods	Minor	Minor
47	Coreidae	<i>Cletus punctiger</i> (Dallas)	Flowering-pod filling	Tender shoot, buds and pods	Negligible	Negligible
48	Coreidae	<i>Clavigralla gibbosa</i> (Spinola)	Pod filling	Green pods	Minor	Minor
49	Plataspididae	<i>Coptosoma cribreria</i> (Fabricius)	Vegetative-pod maturity	Tender shoot and branches	Minor	Minor
50	Plataspididae	<i>Coptosoma fimbriatum</i> (Distant)	Vegetative-pod maturity	Tender shoot and branches	Minor	Minor
51	Plataspididae	<i>Coptosoma</i> sp.	Vegetative-pod maturity	Tender shoot and branches	Minor	Minor
52	Ricaniidae	<i>Ricania speculum</i> (Walker)	Vegetative-pod maturity	Stem, branches and leaves	Negligible	Negligible
53	Flatidae	<i>Lawana conspersa</i> (Walker)	Vegetative-pod maturity	Stem, branches and leaves	Minor	Minor
54	Flatidae	<i>Flata ocellata</i> (Fabricius)	Vegetative-pod maturity	Stem, branches and leaves	Negligible	Negligible
55	Miridae	<i>Poppiocapsidea biseratense</i> (Distant)	Flowering	Flower buds	Negligible	Negligible
56	Miridae	<i>Eurystylus</i> sp.	Flowering	Flower buds	Negligible	Negligible
57	Scutelleridae	<i>Chrysocoris stollii</i> (Wolff)	Vegetative	Leaflets	Negligible	Negligible
58	Coccidae	<i>Drepanococcus cajani</i> (Maskell)	Vegetative-pod maturity	Stem and shoot	Minor	Minor
59	Pseudococcidae	<i>Coccidohystrix insolita</i> (Green)	Vegetative-pod maturity	Stem, shoot and leaves	Minor	Minor
60	Pseudococcidae	<i>Ferrisia virgata</i> (Cockerell)	Vegetative-pod maturity	Stem, shoot and leaves	Minor	Minor
61	Pseudococcidae	<i>Phenacoccus solenopsis</i> (Tinsley)	Vegetative-pod maturity	Stem, shoot and leaves	Minor	Minor
Thysanoptera						
E						
62	Thripidae	<i>Megalurothrips</i> sp.	Flowering	Buds and flowers	Major	Major
Isoptera						
F						
63	Termitidae	Unidentified	Seedling-pod maturity	Basal stem and root	Major	Major
Hymenoptera						
G						
64	Megachilidae	<i>Megachile</i> sp.	Vegetative	Leaflets	Negligible	Negligible

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