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# Different diseases and insect pathogens in *Cajanus cajan* that causes economic loses: A review

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**ABSTRACT**

*Cajanus cajan* is a very important legume crop, it is used as both food crop and forage crop. Pigeon pea is grown in rainy season (July-October) and post rainy (November-January) season and is successfully grown in black cotton soil with temperature ranging from 20˚C to 26˚C and pH 7-8.5. More than 80% of Pigeon pea is produced in 6 major states of India namely Jharkhand, Gujarat, Madhya Pradesh, Bihar, Uttar Pradesh and Maharashtra. The various parts of plant contain many components like the root bark contain flavanoids (cjaflavanone, cajanone and triterpenes), leaves can be used against respiratory condition like bronchitis and cough, flowers and leaves is diuretic and is used as diabetes remedy etc. There are some major pest of pigeon pea which attack during different stages of growth like firstly Pod Borers- its infestation starts within 90days after sowing, the female lays yellowish colour eggs which feed on leaves in starting and later on pods resulting in makings small holes in pods and as the time passes the larva changes its colour, to prevent the crop from damage we can Spray it with fenvalerate (*e.g.* Fenfen) or cypermethrin (*e.g.* Ripcord or Cymbush) etc. Secondly comes Tur Pod Fly it is a small black colour fly which lay eggs on the immature pods and after the larva is fully grows it tends to damage the wall of pods, it remains unnoticed to the farmer until it is fully grown therefore, to prevent the crop from getting damage we can Spray Quinalphos 25 EC or Phenthoate 50 EC at 50 % flowering stage and after 10 - 15 days neem seed kernel extract should be used. And then Plume Moth, the adult moth is small and slender in shape with wings greyish in colour whereas, the larva stage is greenish – brown in colour with hair and spine projection, it lays minute eggs on the shoots or pods. We can control it by dusting 4 per cent or emulsion of phosalone 0.07 per cent or Endosulfan 0.07 % or Dusting of Endosulfan 4% or corboryl 10% 0r dust at 25 kg/ha once at initiation of flowering. Lastly comes Diseases like Sterility mosaic disease and wilt, these two indicates late symptoms and damage the leaves by changing its colour and changing the colour of stem. This review gives a brief review about the different diseases and insect pathogens in *Cajanus cajan* present during the growth stages.

**KEYWORDS**

Fevalerate, Quinalphos, Endosulfan, Monocrotophos, Cjaflavanone

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*Cajanus cajan* also known as Adhaki, Arhar, Pigeon pea or Tur which comes under the family fabaceae. General names are congo pea, red gram, gungo pea. Cultivation of arhar is started from long back of more than 1000yaers ago. The origin is Asia, from where it exports to East Africa and through trade to the American continent. Plant is branched, erect and hairy like shrub with height range from 1 to 2 m high with three leaflets, the leaves are oblong-lanceolate to oblanceolate and flowers are yellow in colour and are 1.5 cm in length. Hairy pod with two to seven seeds and a length of 4 to 7 cm and a width of 1 cm. India is one of the world's largest producers of pigeon peas, accounting for about 90% of global production. It currently covers 3.85 million hectares and produces roughly 2.68 million tonnes per year.

It is a multipurpose plant as it is broadly eaten as a pulse/dal. Green pods are cooked as a vegetable, tops are used as feed as well as green manure and husk, and green leaves are used to rear silkworms. It has a variety of medical applications, including pain relief in traditional Chinese medicine and as a relaxing agent. It's also been used to treat wound healing, ischemic necrosis of the caput femoris, aphtha and bedsores in recent years. Two globulins, concajanin and cajanin, are present in it which can be used to cure a variety of ailments like skin irritations, hepatitis, sores, measles, jaundice, stabilizing menstrual period, diabetes, dysentery, for expelling bladder stones and many other illnesses. Diseases are major biological constraints which restrain crop for growing in addition to these more than 60 pathogens counting bacteria, fungi, mycoplasm, viruses and nematodes can infect pigeon peas. Out of these some causes economic loss of the crop. For example *Melonagromyza obtusa* (Pod fly), *Helicoverpa armigera* (Pod borers), *Exelastis atomosa* (Plume moth) these are some pathogens which effect the yield of plant at different stages of growth.

*Cajanus cajan* is the world's sixth most significant legume, accounting for 5% of all pulse production. According to the Food and Agriculture Organization (FAO), global pigeon pea production in 2019 was 5.6 Mt, with India accounting for 59 percent.

## Morphology of Crop

Pigeon pea is a short-lived, erect perennial leguminous shrub that grows to a height of 1 to 2 meters but can reach 2 to 5 meters. The stem in angular and branched along with woody at the bottom, the leaves can be trifoliate as well as alternate in shape with leaflet are oblong and lanceolate, in shape, the length and width of leaves are 5-10 cm and 2-4 cm respectively. The flowers are golden or pale yellowish in colour and they are striated with purplish lines at times. The corolla is approximately 2 to 2.5 cm. The fruit part is a straight with structure slightly flat in appearance and pubescent pod is 5 to 9 cm long and 12 to 13 mm wide. It has 2 to 9 red, brown, or blackish coloured seeds that are small and occasionally hard-coated.

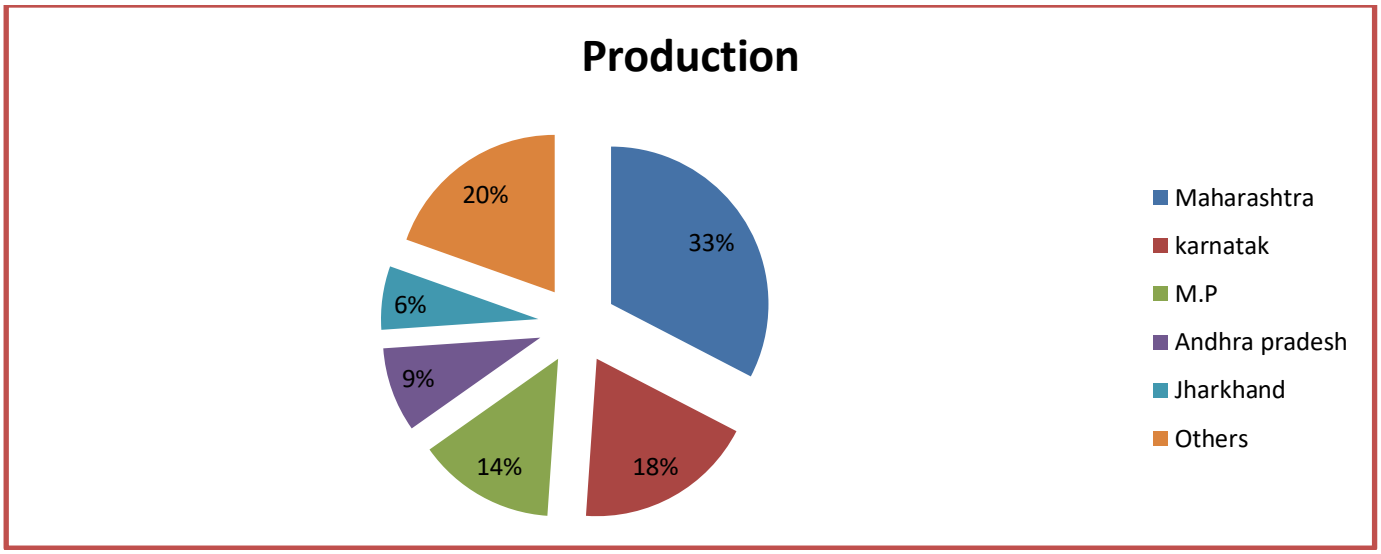


**Fig 1. Major state producing pigeon pea**

## Distribution of Crop

The beginning of cultivation of *Cajanus cajan is* North-Eastern Africa and India, but it is now a subtropical and pantropical species predominantly suitable for rain fed agriculture in semi-arid areas mainly because of its fast growing habit, deep taproot, heat tolerance plus high economic value.

It is produce in diverse parts of the world having more than 22 countries counting India, Kenya, Tanzania, Malawi, Nepal, Philippines, Myanmar and Bangladesh. In recent times this crop has been cultivated in China were it is grown on the hilly slopes mainly to confirm soil erosion (Saxena, 2008). In India it is grown in 316 districts in more than eighteen states.

Concerning 85% of the crop is produced in 6 Major states specifically, Maharashtra, Andhra Pradesh, Gujarat, M.P, Jharkhand and Karnataka. It is also grown traditionally in the foothills of Dehradun (Uttrakhand) at 1500 m altitude, where it's called as 'Tur.' It favours grassy environments in tropical and cold-free zones with an ideal annual rainfall of 600-1000 mm.

**Cultivation**

Pigeon pea needs 26ºC - 30ºC temperature with moderate rainfall for its proper growth because they are sensitive to low radiation at pod development state. It can be grown in black soil with pH ranging from 7-8, planting is mainly done in rainy reason with early sowing for short duration varieties and delay sowing in mainly done in last week of July, and it is recommended to do sowing before June for good yield. After sowing, irrigation is very important step which is done primarily at 3 stages that is firstly at branching stage, secondly at flowering stage and lastly at podding stage. The first sixty days for the crop is very crucial therefore mechanical weeding is done two times, first at 20-25 days of sowing and second after 40-45 days. When pod is grown up to 2/3 in size and colour is changed to brown it can be best time to harvest, usually it is cutted 25 – 75cm above the ground level, further it is sun dried for 5-6 days, then threshing is done by Pullman thresher or by beating the pod method, this is followed by cleaning of seeds and storing them for future purpose.

**Table 1. Crop Management**

| Treatments | Management |
|---|---|
| Seed treatment | Carbendazim 50 WP – (2g) + Metalaxyl-M 45.3% 2g / Kg seed + thiride 75 WP, (2g) |
| Soil treatment | Trichoderma viride (2.5 kg/hectare) + neem cake (5q per hectare) + Carbofuran (1Kg ai/ha) Farm Yard Mannure |
| Weeds | Pre-emergence treatment of pendimethalin (1.5 kg/ ha) Two times weeding at thirty and sixty Days |
| Disease Management | Deep ploughing, Ridge sowing, Field sanitation |
| Fertilizers | Different types of fertilizers |

**Different Insect Pathogens and Diseases in Pigeon Pea**

**Pod Borers (*Helicoverpa armigera*)**

*Helicoverpa armigera is* the most harmful pathogen for pigeon pea because of the components present in the crop which shows resistance at developing stage in different wild range of crop like *Cajanus scarabaeoides* (ICPW 280), *C. sericeus, C. acutifolius* and *Flemingia bracteata*. The resistance lays due to the low level of sugar and high level of phenols and tannis which are present in *H. armigera*. Females oviposit during nigh time and fecundity is very high, up to 3000 eggs from a single female which is recorded. When the eggs are first laid, they are white, but as time passes, they turn a dark brown colour, eggs starts to hatch in 3–5 days, and the number of instars varies depending on temperature and host plant, ranging from 5 to 7.

*H. armigera's* generation time varies greatly, in tropical areas it can be as little as 28 days, with up to 11 generations each year. The average development time for pupae and larvae on six short-duration pigeon pea genotypes is 15 days for pupae and 21 days for larvae. Pupation takes place in a pupal cell 2 to 18 cm underground, the prepupal stage is approximately of 1 to 4 days. For nondiapausing individuals, the pupal stage takes about 10 to 14 days, but it can persist for several months during diapauses. The overlapping generations in the field are caused by the varied development period on different host plants, changing number of generation per year, strong migratory capacity and the co-occurrence of diapausing and nondiapausing individuals.

**Damage**

After hatching larvae it feed on twigs and tender leaves, but during the pod formation they puncture the pods while they feed on developing grain also. They are observing during podding and vegetative stages.

**Table 2. Control measure from pod borers**

| Pathogens | Chemicals and control measures |
|---|---|
| Pod Borers | 1. Use *Helicoverpa armigera* pheromone trap –1/2 hector<br>2. Spray the crop with Emamectin benzoate 5% SG- 220G/HA<br>3. Indoxacarb – 15.8% SC-33 ml/ha |

**Tur Pod Fly (*Melanagromyza abtusa*)**
**Damage**

It is measured to be one of the destructive pests of *Cajanus cajan*. The insect's maggot feeds on the grain as it grows. The infested pods do not show any external signs of harm until the maggots have grown to full size and the larvae have drilled holes in the pod walls. The maggots pierce the grain and tunnel through them. This hole gives an emergence "window" through which the adults exit the pod. The attached pods are twisted and deformed; it can damage upto 60-80% of grain in severe case.

**Control**

- Sowing is done at earlier stage,
- Use of resistant varieties.
- Crop rotation or intercrop with other crops like maize, jawar or groundnuts

**Table 3. Control measure from Tur pod fly**

| Pathogens | Chemicals and control measures |
|---|---|
| Tur Pod Fly | 1. Spray Quinalphos 25EC-1.6 ml/ litre<br>2. Penthoate 50EC- 1.4ml/litre of water during 50% flowering stage<br>3. Neem seed kernel extract after 10-15 days<br>4. Monocrotophos (Nuvacron) |

**Plume Moth (*Exelastis atomosa*)**
**Damage**

The larvae damaged buds, pods and flower as well as feed on developing grains. Holes are formed in which caterpillar enters the pod and fungus starts to develops. Colour of the moth is greenish-brown with fringed, short hairs and spines present on the body.

**Management**

- Sowing at proper time
- Crop rotation or intercrop with other non-host crops
- Field sanitation

**Table 4. Control measure from Plume moth**

| Pathogens | Chemicals and control measures |
|---|---|
| Plume Moth | 1. Spray should be done during 50% of flowering stage so that we can protect the crop from larvae and moth<br>2. Neem oil 2%<br>3. Azadirachtin 0.03% WSP 2500-5000g/ha<br>4. Emamectin benzoate - 5% SG- 23g/ha<br>5. Indoxacarb - 15.8% SC- 333 ml/ ha<br>6. Endosulphan 35 EC - 2ml/ litre of water<br>1. Monocrotophos 36S L- 2ml/ litre of water |

**Sterility Mosaic Disease**

This disease can be caused by viruses and mycoplasm, a single eriophyid mite vector is adequate to broadcast the disease. The mites are very minute in addition to it can be easily identify underneath the microscope, they can be wind borne up to two km from the source of inoculum. Both pathogen plus the mite vector are specific to pigeon pea and its wild relative *C. scarabaeoides var. scarabaeoides*.

**Damage**

In the crop it can identify by spotting patches of bushy on pale green plants.

The infection when reaches upto 45 days plants starts to show symptoms on the leaves while the remaining parts tend to be same. Some sp. of *C. cajan* like ICP2376 shows right spot leaf symptoms (Green surface surrounded by chlorotic areas) this shows localized site, this disease is mainly seen in Bihar at the time of vegetation and pre flowering stage.

**Management**

- Crop rotation with non-host crop like tobacco, millet, sorghum and cotton
- Field sanitation

**Table 5. Control measure from sterility mosaic disease**

| Disease | Control Measures and Chemicals used |
|---|---|
| Sterility Mosaic Disease | 1. Grow varieties like Asha sharad (DA11), Bahar,BSMR-736, Pussa-885, narendra arhar1, BSMR-853, Rajeev lochan and BDN-708<br>2. Spray Fenazaquin 10EC (Magister) 1ml/ l of water |

**Wilt**
**Damage**

This disease is soil borne and seed borne, symptoms are mainly seen during podding and flowering stage. Patches on dead plants spread on the field is the first indication of the wilt. Main symptom is purple band which is appeared at the base and extend upward as well as browning and blackening of the xylem also the stem starts to split open.

**Management**

- Mixed cropping with sorghum
- Uproot wilted plants

**Table 6. Control measure from wilt disease**

| Disease | Control measure and chemical used |
|---|---|
| Wilt | 1. Seed treatment by trichoderma viride-10g/kg<br>2. Thiram-2g+ Carbendazim -1g/kg of seed<br>3. Apply grace element like zinc, boron and mag Grow different varieties like BSMR-736, Amar, BSMR-853, Azad, JKM-7, Asha (IPCL-87119), C-11, Maruthi, BDN1&2, C-11.nesium |

**Conclusion**

Pigeon pea (*Cajanus cajan*) is one of the significant crop of India with major production of 80% respectively. There are five major states like Maharashtra, Karnataka, M.P, Andhra Pradesh and Jharkhand which cultivate the crop. But it contain five main insect pathogens and diseases which effect the crop yield at different developing stage like Pathogens- Pod borers, Tur pod fly, plume moth, Diseases- sterility mosaic disease and wilt. All these pathogens and diseases damage the plant therefore, different measures can be taken to avoid damaging for example treatment with varieties of chemicals like *Trichoderma*, Thiram, Fenazaquin, Endosulphan, Monocrotophos, Emamectin etc. As well as crop rotation and field sanitation is also a control measure.

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