Today's Important Topic for UPSC CSE Aspirants (Pink Bollworm)

Comprehensive Explanation for Questions :

Inside Story of the News (Pink Bollworm) :

- The Pink Bollworm (Pectinophora gossypiella)is more widespread and serious than ever before in the states of Rajasthan and Haryana which is affecting cotton crop.

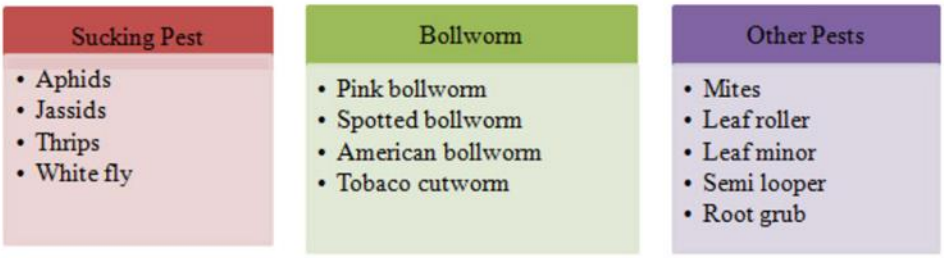
Kahani Ander Ki : After the above-mentioned incidents, it becomes necessary for us to get detailed information about Pink Bollworm . Since this effect is also related to the Cotton , then it becomes necessary for us to know about Cotton also. We know that at the Cotton is related to the textile industry, hence it will be very important for us to know the importance and achievement of India in the textile industry relative to the world.

About Pink ballworm (PBW):

- **Pink ballworm (PBW) is one of the most destructive pests of cotton.**
- **Originally native to India, it is now recorded in nearly all the cotton-growing countries of the world.**
- **Description :**
  - **The adults are small moths about 3/8 inch long and are dark brown with markings on the fore wing.**
  - The larval stage is the destructive and identifiable stage.
  - **As the name implies, the larvae have distinctive pink bands and can reach a length of ½ inches right before they pupate.**
  - **Pupae are a shiny brown.**
- **Ecological Threat:**
  - Pink bollworms are major pests of cotton.
  - The larvae feed on the seeds and destroy the fibers of cotton, reducing quality and crop yield.
  - **It has also been observed to attack hibiscus, okra and hollyhock.**
  - **Adults lay eggs on cotton bolls; once hatched, the larvae eat the seeds and damage the fibers of the cotton, reducing the yield and quality (Henneberry and Naranjo 1998).**
  - **When the larvae mature, they cut out the boll and drop to the ground and cocoon near the soil surface.**

- **The PBW larvae burrow into the developing fruits (bolls) of cotton plants, and the damage affects both the weight and quality of the harvested bolls containing the lint fibre and seeds inside.**
- **Pink Bollworm Life Cycle:**
- The pink bollworm Pectinophora gossypiella (Lepidoptera: Gelechiidae), has two different life cycles, unlike many other pests.
- Each life cycle has four stages including egg, larval, pupal and adult.
- The pink bollworm lays eggs, which mature into larvae and then pupae before developing into full grown adult moths.
- It generally takes 4-6 weeks to complete the life cycle.

Figure 1. Cotton pest dynamics in India

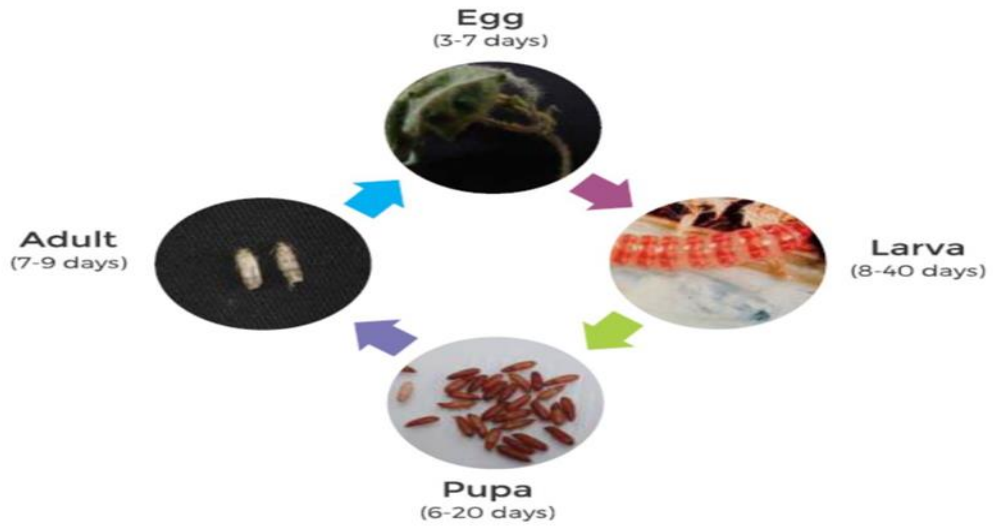


Source: Analysed by South Asia Biotechnology Centre, 2021

- The adult male lives for 20 days whereas the female for 50 days.
- During early part of the cotton growing season, the larva grows to full size and become pupa, or the larva goes into diapause (normally seen in Central and South India).
- The pink bollworm can adopt to different climatic conditions.
- During unfavourable times, the larva hides inside the seed and/or debris and can live for many months.
- It has unique ability to survive and multiply during off season also, when the seed cotton, is stored in gins for a longer time.

History of Indian Cotton :

- Cotton belongs to family Malvaceae, Tribe: Gossypieae, Genus: Gossypium.



- **The Genus Gossypium consists of 50 species. Four of these are cultivated viz., Gossypium arboreum, Gossypium herbaceum, Gossypium hirsutum and Gossypium barbadense.**
- **The first two species are diploid and are confined to the old world, indigenous to Asia and Africa.**
- **The other two species are amphidiploids with centres of variability in Mexico- Central America and South America.**
- **The remaining 46 species are wild and are not cultivated.**
- **Of the species identified across the world, 45 are diploid (Deshi Cotton) and other five are tetraploid (American cotton).**
- **These species are distributed in Africa, Middle East, Asia, South America, Central America, North America, Australia and Hawaii.**
- **Composition:**
  - Cotton fibre is basically cellulosic polymers.
  - Raw unpurified cotton as such is hydrophobic in nature, i.e., it does not absorb water and on the contrary, it repels water.
  - **This hydrophobic property of the cotton is due to the presence of non-cellulosic substances such as waxes, pectin, proteins etc. on the fibre.**
  - **A typical chemical composition of cotton fibres is (%): Cellulose: 94, Waxes: 0.6, Pectin: 0.9, Protein: 1.3, Mineral matters: 1.2, Organic compounds: 0.8, total Sugars: 0.3 and other substances 0.90.**
- **Origin:**
  - Scientists found bits of cotton bolls and pieces of cotton cloth in caves in Mexico.
  - These bits and pieces may be of around 7000 years old.
  - From time immemorial, India was the only country known for its cotton fabrics, the rest of the world being clad mostly in wool.
  - India has been the producer of cotton and also of the finest and most beautiful cotton fabrics since the Indus - Valley -Civilization which flourished in the Indian sub-continent some 5000 years ago.
  - Practically, till the end of 18th Century, no source of supply of cotton other than India was known to the World.

Bollworms	Nature	Refuge availability
American bollworm	Polyphagous	Pigeon pea, Chickpea, Sunflower, Maize, Sorghum, Tomato [Nearly 40% availability in Central India, dry land agriculture].
Spotted bollworm	Oligophagous	Cotton and Okra
Pink bollworm	Monophagous (Mostly)	No natural refuge but Okra is alternate host [natural refuge not available].
Tobacco cutworm	Polyphagous	Several vegetables, green grams [natural refuge available].

Source: South Asia Biotechnology Centre, 2021

- The Gossypium herbaceum (Deshi cotton- very short fibre cotton) is found from the coastal strip Northwest of Karachi, Northern Baluchistan to South Yemen, Ethiopia, and Sudan.
- The Gossipium arboreum was found in Kathiawar, Khandesh and Deccan in India.
- In Indus River valley in Pakistan, cotton fibres were woven into cloth which might be 3000 BC.
- At about the same time, Natives of Egypt's Nile valley were making & wearing cotton cloth.
- It is likely that Gujarat & Sindh are places where arboreum cotton was in cultivation.
- Arab merchants brought cotton cloth to Europe about 800 A.D.Gossypium hirsutum and Gossypium barbadense existed as distinct species in the wild, in Central America.

Geographical Conditions of Cotton :

- **Soils And Climate :**
  - Cotton is grown on a variety of soils across the world. Deep, fertile soil with adequate humus and high water holding capacity and good internal drainage is best suited for growing cotton.
  - **Cotton is sensitive to excessive moisture and water logging.**
  - Under rainfed conditions, it is generally grown on soils with high water holding capacity provide better internal drainage and greater productivity.
  - Where irrigation is available it is cultivated on a variety of soils ranging from sandy-to-sandy loam and clay looms.
  - Cotton being a deep-rooted crop, soil depth of less than 60 cm is considered unfavourable.
  - **Cotton grows best on neutral to slightly alkaline soils and a pH of 7.0 to 8.0 is considered optimum.**
  - **The minimum pH for successful cotton cultivation is 5.3.** Cotton is sensitive to salinity only during germination and early crop establishment.
  - The predominant cotton growing soils of India are sandy to sandy looms (Entisols and Inceptisols) in the north zone, black soils (vertisols) in central India and in a variety of red (Alfisols), alluvial (Inceptisols) and mixed red and black soil in the southern zone.
- **Temperature :**
  - Cotton can be grown in places wherever, at least 180-200 frost free days are available.
  - Optimum temperature for germination 20–30-degree C.
  - Germination will be delayed if the temperature is <18-degree C.
  - For vegetative growth, mean daily temperature of 21-27oC is optimum.
  - Optimum temperature for peak flowering ranges from 29–34-degree C.
  - Under adequate soil moisture, cotton withstand high temperatures of 43-45 degree C for short periods.
- **Rainfall :**
  - Cotton being a tropical plant of arid origin requires at least or 500 mm of mean annual rainfall with uniform distribution.
  - During the vegetative phase, moderate rainfall is good whereas in later stages heavy rains will affect the quality of cotton.
  - Rains at night and light in daytime is congenial for its growth.
  - Heavy rains or moisture stress during flowering and fruiting accentuates bud and boll shedding.
  - High air humidity causes infection of fungus.
  - Dry period during ripening and boll bursting phases ensures good quality lint.
- **Light and photoperiod :**

- Abundant sunshine is ideal for cotton production and cloudiness adversely affects boll setting and growth.
- Cloudy weather lasting 2 to 8 days causes heavy bud and boll shedding.
- Cotton exhibits day neutralism. Decrease in light decreases growth and fruiting and increases anthocyanin content in leaf resulting in low photosynthetic efficiency.
- The climatic conditions in the cotton growing regions of India show considerable variations.
- High temperature of about 45 degree C during sowing and seeding emergence and low temperature accompanied by occasional frost coinciding with the picking period and moderate rainfall ranging from 300-700 mm are the features of the north zone.
- In the Southern and Central zones, the climate is equal.
- The maximum temperature ranges from 32 – 40 degree C and the minimum temperature from 10 – 20-degree C.
- Rainfall ranges from 500-1250 mm, predominantly through the southwest monsoon from June to September.

Textile Industry of India :

- India's textiles sector is one of the oldest industries in the Indian economy, dating back to several centuries.
- The industry is extremely varied, with hand-spun and hand-woven textiles sectors at one end of the spectrum, with the capital-intensive sophisticated mills sector at the other end.
- The fundamental strength of the textile industry in India is its strong production base of a wide range of fibre/yarns from natural fibres like cotton, jute, silk and wool, to synthetic/man-made fibres like polyester, viscose, nylon and acrylic.
- In order to attract private equity and employee more people, the government introduced various schemes such as the Scheme for Integrated Textile Parks (SITP), Technology Upgradation Fund Scheme (TUFS) and Mega Integrated Textile Region and Apparel (MITRA) Park scheme.
- **Market Size :**
  - The Indian textile and apparel industry is expected to grow at 10% CAGR from 2019-20 to reach US$ 190 billion by 2025-26. India has a 4% share of the global trade in textiles and apparel.
  - India is the world's largest producer of cotton. Estimated production stood at 362.18 lakh bales during cotton season 2021-22.
  - Domestic consumption for the 2021-22 cotton season is estimated to be at 338 lakh bales.
  - Cotton production in India is projected to reach 7.2 million tonnes (~43 million bales of 170 kg each) by 2030, driven by increasing demand from consumers.
  - In FY23, exports of readymade garments (RMG) including accessories stood at US$ 16.2 billion.
  - It is expected to surpass US$ 30 billion by 2027, with an estimated 4.6-4.9% share globally.
  - The Textile industry in India is one of the largest in the world with a large raw material base and manufacturing strength across the value chain.
- **Significance Features :**
  - **The Indian textile industry is the 2nd largest producer of MMF Fibre after China in the world.**
  - **India is the 3rd largest exporter of Textiles & Apparel in the world.**
  - India is the 6th largest producer of Technical Textiles with a 6% Global Share (12% CAGR), the largest producer of cotton & jute in the world.
  - **The largest producers, consumers and exporters of cotton in the World.**

- **India is the largest producer as well as largest consumer of jute products in the world.**
- India with the production of 34,903 MTs of silk is the second largest producer of silk in the world after China.
- India is also the largest consumer of silk in the world.
- India is the only country, which is producing all the four commercial varieties of silk, namely Mulberry, Tropical & Oak Tasar, Muga and Eri.
- Indian sericulture industry has the unique distinction of high employment potential, low capital requirement and provides remunerative income to silk growers.
- India is the second largest producer of manmade fibres after China.
- Cotton is the backbone of textile industry, which consumes 59 % of the country's total fibre production.
- It accounts for 34% of the country's export and fetches about Rs.50, 000 crores annually to the exchequer.
- Along with the industry, which it sustains, it touches the country's economy at several points including employment and export earnings.
- India annually cultivates more than eleven million hectares, the largest in the world.
- In fact, one out of every four hectares of land under cotton in the world is in India.
- Around 6 to 6.5 million farmers grow the crop in about 10 States (Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu).
- Around 60 million people are estimated to depend on it one way or the other to make out their living.
- **Cotton Producing Countries :** China , India , United States , Brazil , Australia , Turkey , Pakistan , Uzbekistan , Argentina & Mali .

- **Cotton Exporting Countries:** United States, Brazil , Australia , Greece , India , Benin , Turkey , Burkina Faso ,Mali & Cameroon .
- **Cotton Importing Countries :** Bangladesh ,Vietnam , China ,Pakistan , Turkey , India , Indonesia, Thailand & Mexico .
- **State wise behaviour of cotton area 2015-16 (Area in lakh hectare) :** Maharashtra (38.27), Gujarat (27.19) , Telangana (17.73), Andhra Pradesh (6.66), Karnataka (6.33), Haryana (6.03), Madhya Pradesh (5.47), Rajasthan (4.48), Punjab, (3.39), Tamil Nadu (1.42) & Odisha (1.25).
- **State wise behaviour of cotton production 2015-16 (Production in lakh bales (170 kg/bale)) :** Gujarat (97.00) , Maharashtra (65.00), Telangana (38.60), Andhra Pradesh (24.00), Madhya Pradesh (20.98), Karnataka (16.00), Haryana (13.50) , Rajasthan (13.20), Punjab (4.50), Odisha (4.00) & Tamil Nadu (3.69).
- **State wise behaviour of productivity of cotton 2015-16 (Yield in Kg/hectare) :** Madhya Pradesh (652), Andhra Pradesh (613) , Gujarat (606), Odisha (544), Rajasthan (501), Tamil Nadu (442), Karnataka (430), Haryana (381), Telangana (370) , Maharashtra (289) , Punjab (226).

Source : file:///C:/Users/aniksingh/Downloads/636990420200358183-d6fe6a24-6bfd-463f-b1e3-f3505913aa8822.1._Publication-Status_Paper_of_Indian_Cotton-compressed.pdf

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& Directorate of Economics and Statistics, DAC & FW, Ministry of Agriculture and Farmers Welfare, GOI, Krishi Bhavan, New Delhi.

*: 4th advanced estimates.