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A Review Paper on Jute Crop and their Pests

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Abstract: India is one of the world's largest jute producing country. Among all States West Bengal is alone contributes 77% of the Indian jute. Jute crop requires humid tropical climates. It well distributed in areas with rainfall of 2,500 mm spread over vegetative growth period of the crop with no cloudiness. It requires alluvial soils of good depth, receiving silt from the annual floods are the best for jute cultivation. Insect pests are one of the main constrains for underscoring jute production. The jute crop was damaged by various pest like jute semilooper (*Anomis sabulifera* Guen) accounts for 90% of losses of leaves, whereas beetarmy worm accounting yearly 20% yield loss of jute fiber, yellow mite (*Polyphagotarsonemus latus* Banks) and root-knot nematode (*Meloidogyne incognita* Chitwood) were recorded as the major pests of jute. To ensure and to stabilize production, farmers generally apply huge amount of insecticides of different newer brands. insect pest population evolved resistance to chemical pesticides due to producing large number of offspring with highest degree of mutation, variation, co-evolution and natural selection. Therefore, emphasize on biological control in modern IPM practice to control insect pest population, by their natural enemy, predator and parasitoids is a time-needed programme. The current review is a gross view on the processes of effective management of major insect pest of jute by biological agents under modern IPM Practices which broadly covers different scientific publication in different journals and contemporary works of the scientists.
Keywords: Jute, Insect pest, Management

Introduction:

Jute is an important natural fibre crop in India next to cotton, and it is extensively cultivated in eastern India almost throughout the country as a cash crop. India is ranked in 1st position in jute production and accounting for about 62.2 percent of world production and 59.3 per cent of the total area in the World (Gupta et al., 2009). In India Jute is cultivated on 0.71 million hectares with an annual production of 9.98 million bales. West Bengal, Assam and Bihar are the major jute growing states in the country, which accounts for about 98 percent of the country's jute area and production (State of Indian Agriculture, 2013-2014).In trade and industry, jute and mesta crop together known as raw jute as their uses are almost same. Raw jute plays an important role in the country's economy. But raw jute is used for diverse applications, such as, textile industries, paper industries, building and automotive industries, use as soil saver, use as decorative and furnishing materials, etc. Raw jute is biodegradable and annually renewable source, it is considered as an environment friendly crop and it helps in the maintenance of the environment and ecological balance. Further attraction of Jute lies in its easy availability, inexhaustible quantity at a comparatively cheaper rate. There are around **94 composite jute mills** out of which the state of West Bengal has 70 jute mills, Andhra Pradesh 10

mills, Uttar Pradesh 3 mills, Bihar 3 mills, Orissa 3 mills, Assam 2 mills, Chhattisgarh 2 mills and Tripura 1 Jute Mill.

Among all the states West Bengal is alone contributes 77% of the Indian jute (Sinha *et al*. 2004). Though two species of jute viz. *Corchorus olitorius* and *C. capsularis* are cultivated, the first one is more popular because of its higher productivity. The Area, production and yield of jute in major States during (2014-2015) is at **Table 1.**

Table1:State-wise average Area, Production and Yield of Jute

State	Area ('000ha)	Production (bales)	Yield (tonnes)
West Bengal	576.10	8453.70	2781
Bihar	111.20	1637.10	2651
Assam	75.0	793.20	1904

Jute is a crop of humid tropical climates and distributed in areas with rainfall of 2,500 mm spread over vegetative growth period of the crop with no cloudiness. Locations with a mean rainfall of <1,000 mm, incessant rainfall and water logging are not suitable for its cultivation. For better growth, a mean maximum and minimum temperature of 34oC and 15oC and a mean relative humidity of 65% are required. *Corchorus olitorius (Tossa jute)* cannot withstand water logging, however, *C. capsularis (White jute)* can withstand water logging but its not support the fibre quality is impaired with prolonged water stagnation.

Jute can be raised on all kinds of soils from clay to sandy loam, but loamy alluvial are best suited. The new grey alluvial soils of good depth, receiving silt from the annual floods are the best for jute cultivation. Laterite and gravel soils are not suitable for this crop. A soil pH of 5.0-7.4 is within the tolerable limit of soil reaction. The crop is raised successfully on old alluvial soils of Bihar, mild acidic soils of Assam, Orissa, and light alkaline soils of tarai districts of Uttar Pradesh. It has been observed that clay loam for *C. capsularis* and sandy loam for *C.olitorius* are most suitable soil types.

Sowing time of jute may differ from area to area on the basis of the receipt of pre-monsoon showers, availability of residual moisture and variety. In Bihar and Uttar Pradesh, sowing is done up to mid-June or some time upto end June as per the onset of monsoon.

Generally, sowing in middle of March is optimum for all *Capsularis* varieties and the *Olitorius* varieties like JRO524, JRO878 and JRO7835 while JRO632 should be sown only after middle of April. *Olitorius* sowing may be staggered upto May. The recommended sowing for mesta crop is May-June for main season crop. A minimum of 21 per cent soil moisture content is required for germination. Sowing of jute can be done either by broadcast method or by line sowing method. For line sowing, the land is prepared well and sowing is done with row to row spacing of: *Capsularis* – 30 cm, *Olitorius*– 25 cm and plant to plant spacing is maintained at 5 to

7 cm and this is done by mechanical means i.e. seed drill. The depth of sowing is maintained at 2.5 to 3 cm. Line sowing has got certain advantages over broadcasting method such as i) Plant growth is uniform since uniform spacing is maintained, ii) Intercultural operation like weeding, hoeing, etc. become easier and cheaper. iii) Application of pesticides and top dressing of fertilizer is easier, iv) Yield is higher by about 15-20%, v) Requirement of seed is less etc.

Depending upon the species of jute and method of sowing, the seed rate of the *C. capsularis* for Borad casting and Line sowing is 10 and 7 kg/ha respectively whereas for *C.olitorius* for broad casting seed rate was 7kg/ha and for line sowing 5kg/ha.

Jute requires about 50 cm water for its growth and development. In India about 15% jute area is irrigated and the remaining area is rainfed. If the rainfall is not sufficient, the water requirement has to be supplemented through irrigation. For germination of jute seed, about 18-20% soil moisture is required. At sowing time, if the soil moisture is not sufficient, then one pre-sowing irrigation is to be given. After sowing, usually one or two irrigations at an interval of about 20 days is required at the initial stages of growth. Jute is sensitive to both drought and water logging. At germination and knee-high stages, adequate soil moisture must be ensured by irrigation. During rainy season, the crop experiences water logging that adversely affects fibre quality. Provision of quick drainage in uplands will be beneficial to the crop. However, in lowlands, it may not be feasible.

Jute crop suffers from heavy weed infestation in the initial 6-8 weeks after sowing. Two-three hand weedings or mechanical hoeings are required to arrest weed menace. The first 2 manual weedings are combined with thinning operations at 20 and 35 DAS. The third weeding should be done 55-60 DAS. Due to continuous rains, sometimes manual weeding may not be possible. In such a situation, herbicide integrated with manual weeding is promising. Butachlor 50% EC or Pretilachlor 50% EC (preemergence, applied during sowing) @ 0.9-1.0 kg ai/ha combined with one hand weeding at 35DAS may effectively control the weeds. Recommended postemergence herbicides for weed control include Quitalofop ethyl 5% @ 40-60g ai/ha and should be applied 20 days after sowing.

Jute is a bast fibre crop and can be harvested at any stage after a certain period of vegetative growth, usually between 100 to 150 days. Harvesting of jute crop at pre-bud or bud stage gives best quality fibre; however, the yields are low and older crop yields more quantity of fibre but the fibre becomes coarse and the stem does not ret properly. Hence, as a compromise between quality and quantity, early pod formation stage has been found best for harvesting. Harvesting is done by cutting the plants at or close to the ground level with sharp sickles. In flooded lands, the plants are uprooted. The harvested plants are left in the field for 2-3 days for the leaves to shed. Next, the plants are tied into bundles 20-25cm of diameter and the branching tops are lipped off to rot in the field.

Retting is one of the important operations governing the quality of fibre as prevailed at present. The bundles are kept in 30 cm deep water, and later placed side by side in retting water, usually in 23 layers and tied together. They are covered with water-hyacinth or any other weed that does not release tannin and iron. The float is then weighed down with seasoned logs or with concrete blocks or are kept emerged (at least 10 cm below the surface of water) with bamboo-crating. Clods of earth used as a covering material or as weighing agent produce dark fibre of low value. Retting is best done in slow moving large volume of clean water. The optimum temperature is around 34oC. If fibre comes out easily from the wood on pressure from the thumb and fingers, retting is considered complete.

The traditional method of retting is commonly known as Steep method of retting as described above and the same method is being followed widely. Some of the other and improved methods have been developed or are in the stage of development like Ribbon Retting, Dry Retting, Use of Microbial Consortium in retting, etc but these methods are yet to be standardized and to make cost effective for adoption by the farmers.

Two methods of fibre extraction are practiced – single plant extraction method and beat-break-jerk method. In single plant extraction method, four or five reeds are taken out and stripping started from the bottom; the fibre of each of the reeds is slipped out free from the stick up to 8-10 cm, then gripped and pulled out slowly from the rest of the stick. Extracted strips of the bundles are washed in clean water. In beat-break-jerk method, a handful retted stems in left hand are gently beaten at the base with a mallet, then the woody core is broken and the extractor twist the bundles at the middle, grips the fibre where the bundle is broken and shakes the bundles vigorously to and fro in water. The broken sticks slip out and water wrung out of the fibre. The fibre is then washed in clean water, rung and eventually spread to dry, preferably in shade or mild sun. The beat-break-jerk method often leaves the broken sticks and make fibre somewhat entangled resulting in sticky fibre. Single plant extraction method is better and recommended for extraction of fibre as it gives better quality fibre. On the other hand, in beat-break-jerk method, the fibre become entangled and as a result the quality of fibre is affected.

Grading of fibre is done based on six parameters namely, strength, defect, root content, colour, fineness and density. As per BIS specification there are eight grade classification of jute, i.e., W1/TD1 to W8/TD8 (W indicates white jute and TD indicates Tossa jute).

This crop was facing attack by various pests including insects, mites and nematodes, from seedling stage to harvest. All the parts, from the roots to the tip of the plant are ravaged by various pests. The pests cause loss in yield and quality of fibres. Rahman *et al.* (2006) in West Bengal, India has estimated at about 31–34% fibre loss due to multiple insect pest attack. Das *et al.* (1986) and Rahaman *et al.* (2012) had enlisted a profile of insect pests in relation to the growth stage of the jute plant damaging jute crop. In general, 40 species of insects and mites attack jute in Bangladesh as reported by Kabir, (1966). In Bihar, jute semilooper (*Anomis*

sabulifera Guen), bihar hairy caterpillar (*Spilarctia obliqua* Wlk.), stem weevil (*Apion corchori* Marshall), grey weevil (*Myllocerus discolor* Bohemus), yellow mite (*Polyphagotarsonemus latus* Banks) and root-knot nematode (*Meloidogyne incognita* Chitwood) were recorded as the major pests of jute.

The jute semilooper, *Anomis sabulifera* (Noctuidae: Lepidoptera): A cosmopolitan pest, is reported from the entire jute growing region all over the world and has estimated to damage up to 90% of the leaves of jute plant in some cases [Tripathi *et al.* 1964].. The attack is severe on half-grown plants which are one metre high. They camouflage but are easily noticed when they crawl by producing a loop in the middle. Larvae damage to jute foliage results in poor plant growth and ultimately low fiber quantity [Sing *et al.* 1979; Das *et al.* 1976; Tripathi *et al,*1964; Das *et al.* 1995].In general the pest of second generation is the most damaging and sometimes up to 90 per cent of the leaves may be eaten up. Generally, the top 7-9 leaves are damaged and plant growth is adversely affected, resulting in a considerable reduction in the yield of fibre, Sing *et al.* 1979. Dutta, (1958) had recorded that in 81% cases the 7-9 leaves of upper part of the standing crop are damaged.In some cases, the extent of damage may extend up to 91% covering 9th position of the leaf of the tiller. Pre monsoon rains followed by drought condition are congenial for the outbreak of semilooper and may lead up to 50% loss of crop as reported by Dutta (1958). Both the nymph and adult of Jute mealy bug, *Phenacoccurs hirsutus* attack jute plant. Nymphs and female adult feed on the apical parts of the plant and result in stunted and bushytop symptoms of the plant. The petiole of the fiber crop becomes shortened, the lamina crumples and inter-nodal length reduced which ultimately results in the deterioration of the fiber and reduction of the yield. [Das *et al.* 1976].

Beet Armyworm, Spodoptera exigua(Noctuidae: Lepidoptera): though earlier was considered as minor pest, but it had changed its status to major accounting yearly 20% yield loss of jute fiber. [Dutta, 1958]. It is specific pest of jute and is the most destructive at one time, it was a major pest of indigo (*Indigofera errecta*) and hence also called indigo caterpillar. Plants planted at early season are more prone to damage by this pest. Mostly, *S. exigua* feeds on jute plant that are less them two months of age [http://nac./ac.in/eagri50/ENTO331/Lecture-14/Jute-002]. *Apion corchori* preferably feed on *C.olitorius* than on *C.capsularis*. Damage to the quality of fiber is mainly caused due to the 'oviposition holes' caused by the weevils. Female make a number of such holes in stem before egg laying and accordingly damager numerous stems. Effective control of the pest is very crucial as because the insect passes there most of the life inside the stew and thus escapes from the direct contact of the applied pesticides [Das *et al.* 1986].

Jute stew girdle *Nupserah bicolor* once was considered as a sporadic pest on jute [Dutta, 1958], but become a major threat to jute plant and gain the status of major pest from last two decades.

The main damage occurs because of oviposition of stem girdle, resulting in the breakage of fibre length at several places. Thus, both the quality of fibre and the yield suffer. The damage (6-30%) is more in younger plants than in the older ones. Not much damage is caused by the feeding of larvae or adults.

Jute Mealy-bug: *Phenacoccus hirsutus* (Pseudococcidae: Hemiptera): though earlier was considered as minor pest, but it had changed its status to major loss of jute fiber and yield reduction [Dutta, 1958]. The nymphs and females feed on the apical parts of a plant which becomes stunted and shows bushy-top symptoms. The petiole becomes shortened, the lamina crumples and the internodal length is reduced. The mated females lay pink cylindrical eggs on plants inside the ovisacs Egg period varies from 7 to 14 days. Nymphs emerge from the ovisacs in batches, corresponding with the sequence of egg-laying. The tiny nymphs crawl out on the host and select a suitable spot to settle down. They are light pinkish and secrete both a white mealy powder and honey-dew. The full-grown nymph secretes fine white mealy fibres with which it forms a cocoon and then pupates in it. The females remain wingless, and on maturity, they develop ovisacs in which eggs are laid. The female is a rotund, sac like, light pink creature and measures about 3 mm in length. The males are slender and have a pair of delicate wings.

Yellow Mite, *Polyphagotarsonemus latus* is destructive for jute production [Das *et al.* 1979]. They sucks sap from younger leaves results in foliage discoloration; natural green colour of leaves turn into brown with change of shape due to curling [Das *et al.* 1985]. Loss of nutrition in young plant due to sucking, height of the plant becomes stunted and significant yield loss occurs [Nair, 1986, Pradhan et al. 1997].

Management: Most of the previous efforts to combat the pest problem associated with jute were based on pesticide approaches. Chemical pesticides not only cause environmental and health hazards but also encourage pest resurgence and secondary pest outbreak. Banerjee *et al*. (2000) reported that integration of improved cultural management practices, use of biopesticides and conservation of natural enemies and a need-based use of chemicals could effectively control the insect and mite pest complex problem associated with jute. Efforts were also made for integrated management of insect, mite and diseases of olitorius jute (Prasad *et al*. 2002; Hath and Chakraborty 2004). Such management included: using seed treatment with carbosulfan 25 DS at 3% w/w (Khan 2004) and through soil application of neem cake at 1500 kg/ha, carbofuran 3 G at 3 kg active substance (a.s.)/ha and neem coated urea at 88 kg/ha was also used for controlling root-knot nematode on jute (Bibha and Bora 2005). Rachel Carson (1962) in her book "*Silent Spring*" proclaim the devastating effect of pesticide and advocate to more reliable and eco-friendly approach to control the pest population.

Application of Biological Agents for Pest Control: A large number of Natural enemies is supported by jute agro-ecosystem and their importance in integrated approach for management of pests of jute has been developed (Rahman et al. 2010). Srivastava, 2004 reported that

Mechanical method, trap method, seasonal culture method and biological method are considered as the constituent in integrated pest management. Out of this, control of pest by biological means is given prominence control because of its utility and effectiveness (Waterhouse, 1998). In any biological control program it is essential that appropriate procedures are adopted in relation to the selection of suitability host-specific natural authorities and shape procedure for eliminating unwanted fellow travelers. Parasites: *Beuveria bassiana*, a fungal antagonist and entomopathogen could be introduced into jute as an endophyte through seed treatment. Colonization of entomopathogen in leaf, stem and pod was confirmed through culturing of plant tissues on selective medium. Under field condition the spore suspension of B.bassiana considerably reduces the damage caused by Bihar hairy caterpeller and semilooper, and performed better than the commercial formulation [Hong, 2003]. Many commercial insectaries rare & market a variety of natural enemies' including predaceous mites, lady beetles, lacewings, praying mantids & several species of parasitoids. Success with such releases requires appropriate timing (the host must be present or the natural enemies will simply die or leave the area) & release of the correct number of natural enemies per unit area [Hoffmann *et al.* 1993]. Parasitoids: Tricogramma sp. and Podisus sp. from USA was introduced in China for control of Anomies sp [Wang *et al.* 1987]. In Mysore 70% of Anomies sp in cotton field were parasitized with Apantenes spp and tachnid flies. In laboratory condition eggs and pupae of Anomies sp were attacked by Trichogramma minutus and Tetrastichus howardi (Eulophidae) respectively [Maheswariah *et al*, 1956]. Isyropa sp and Carcelia kockiana (Diptera), Apanteles sp (Hymenoptera) from India.

Predators: *Scymnus pallidicollis* (Coccinellidae) is the most efficient predator and feed vigorously on the egg, nymphs and adult females of jute mealy-bug, *Phenacocus hirsutus* [http://nac./ac.in/eagri-50/ENTO331/Lecture-14/Jute-002]. Jute Stem-girdler, Nupserha bicolor attacked by Neocatolaccus sp and Norbanus sp (Chalicidde) in larval condition [http://nac./ac.in/eagri-50/ENTO331/Lecture14/Jute-002]. In India, during the serious outbreak of Anomies in Hyderabad, large number of common Mynah was reported to eat the larva (Khan, 1956).

Conclusion:

Jute is a renewable source of bio-mass and the products are bio-degradable, reusable, easily-disposable. After green revolution due to useof vigorous fertilizer, pesticides and intensive crop pests are breakout around the country & damage our crop. The jute crop was damaged by various pest like jute semilooper (*Anomis sabulifera* Guen), bihar hairy caterpillar (*Spilarctia obliqua* Wlk.), stem weevil (*Apion corchori* Marshall), grey weevil (*Myllocerus discolor* Bohemus), yellow mite (*Polyphagotarsonemus latus* Banks) and root-knot nematode (*Meloidogyne incognita* Chitwood) were recorded as the major pests of jute. Though we are using chemical insecticides to control the pest but continuous use of those pesticides make the

pest more resistant to these. Also, pesticides attack other animals and causes health hazards & habitat degradation. So, it is time to think about this serious problem & have to reduce use of those chemical. Therefore, biological pest control program introduced into IPM. The parasitoids are unlikely to be specific to *Anomis* sp, but also attack other lepidopteronlarval feeds on same plants. Most of the other insect hosts are themselves larval feeds on same plants, whose abundance is also desirable to lower. Specifically, in these circumstances is rather to lepidopteron larvae in a particular habitat & the parasitoid may thus be sufficiently restricted in their attack on non-target species to be seriously considered as agents for classical biological control. Therefore, through this modern IPM practices we can lead to the eco-friendly opportunity for a sustainable future of jute.

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