Insect pests of *Jatropha curcas* L. and the potential for their management

With the exponential rise in petroleum prices and increase in demand for petroleum products around the world, it appears that the price of crude oil would remain high for a long time. This is the reason why governments and researchers are looking for alternate means of fuel. Biodiesel is one such option and many countries are taking initiatives in this direction. USA and several European countries are already working towards substituting petroleum fuel. Europe is targetting to reduce the consumption of petroleum fuel at least by around 5%, by substituting with biofuel by the year 2010. In India, *Jatropha curcas* is gaining importance commercially as a biodiesel plant and is being advocated for development of wastelands and dry lands. It is popularly called energy plantation. India has 146 m ha of wasteland (NBSSLUP, 2004), of which 33 m ha can be reclaimed for Jatropha plantation, in addition to arable land that is being used for plantation. The Indian government's US $300 million national biofuels programme has the potential to create the world's first large-scale national biodiesel industry. Currently, Jatropha appears to be one of the most promising feedstocks upon which the industry will be built. India has the available land and the scientific know-how in planting and cultivation to rapidly develop Jatropha plantations on a large scale. The Planning Commission had indicated that Rs 1400 crores should be allocated for the promotion of biodiesel in three years. This includes research efforts, popularization and providing financial support to entrepreneurs.

J. curcas belongs to the family Euphorbiaceae and is thus closely related to other important cultivated plants like rubber, castor, etc. It is believed to be a native of South America and Africa. Since its introduction by Portuguese traders in the 16th century in India, Jatropha has been grown as a medicinal plant and hedge crop. Nine species of Jatropha now thrive in India's varied regional climates. It is found in almost all the states and is generally grown as a live fence for protection of agricultural fields from damage by livestock, as it is not eaten by cattle or goat. The seed oil is also reported to possess insecticidal[1], molluscicidal[2], fungicidal[3] and nematicidal properties.

Contrary to popular belief that toxicity and insecticidal properties of *J. curcas* are a sufficient deterrent for insects that cause economic damage in plantations, several groups of insects have overcome this barrier. Particularly noteworthy is the insect order Heteroptera that has at least 15 species in Nicaragua, which can extract nutrients from physic nut[4]. The key pest in Nicaragua was identified as *Pachycoris klugii* Burmeister (Scutellaridae: Heteroptera), occurring at a density of 1234 to 3455 insects per hectare[5]. A global list of phytophagous insects consisting of 60 species in 21 families and four orders has been compiled in Australia, where it is considered as a weed. The insect that caused maximum damage proved to be the seed-feeding Scutelleridae, *Agonosoma trilineatum*[6].

The crop is projected to have less pest damage and hence minimum requirement for plant protection. However, in reality, even in India when *J. curcas* is grown in continuous stretches as a monocrop, it is devastated by two pests that are emerging as a major problem in *Jatropha* cultivation – the scutellarid bug *Scutellera nobilis* Fabr. which causes flower fall (Figure 1 *a*), fruit abortion (Figure 1 *b*) and malformation of seeds. In Jhansi, it was observed to occur at an average of

Figure 1. Pests and natural enemies of *Jatropha curcas*. ***a***, *Scutellera nobilis* inserting stylet into flowers; ***b***, Fruits; ***c***, Bunch. ***d***, *Pempelia morosalis* webbing inflorescence. ***e***, Larvae; ***f***, Adult; ***g***, Capsule damage. ***h***, Parasite of *Pempelia*. ***i***, Spider, *Stegodyphus* sp. ***j***, Bugs ensnared in web. ***k***, *Stomphastis thraustica*. ***l***, *O. versicolor*; ***m***, *Archaea janata*.

five per bunch, with a maximum of 15 bugs per bunch (Figure 1 *c*).

The inflorescence and capsule-borer, *Pempelia morosalis* also causes economic damage by webbing and feeding on inflorescences (Figure 1 *d–f*) and in later stages boring into the capsules (Figure 1 *g*). However, in Jhansi, it has been observed to be parasitized by the dipteran (Figure 1 *h*) to an extent of 85%. Another natural control agent was the spider, *Stegodyphus* sp. (Eresidae: Arachnida), which snared these bugs in its web (Figure 1 *i*). Elsewhere, capsule-borer and the bark-eating caterpillar have been recorded as key pests for which a spray of endosulfan is advocated[7]. Other pests that have caused noticeable damage are *Stomphastis* (*Acrocercops*) *thraustica* Meyerick, the blister miner (Figure 1 *k*), the semi-looper *Achaea janata* (Figure 1 *m*) and to a small extent, the flower beetle *Oxycetonia versicolor* (Figure 1 *l*).

According to the Indian government's Vision 2020 document, cultivating 10 m ha with Jatropha would generate 7.5 million tonnes of fuel a year, creating year-round jobs for five million people. As the situation stands today, biodiesel produced especially from plants such as *J. curcus* and *Pongamia* work out to Rs 30 per litre, according to studies. This is more or less equal to the current price of commercially sold diesel, though the Ministry of Petroleum has approved a price of Rs 25 per litre for the biodiesel to be sold through 20 outlets in different parts of the country from January 2006. If the production costs are further aggravated by pests, there would be an impact on the economics of the crop. Therefore, the dire need of the day is to include resistance to insects and diseases in the varietal improvement programme. Monitoring and timely control measures can also help reduce pest impact. Biological control avenues must be explored completely. Scelionids like *Pseudotelenomus pachycoris* were found to be effective egg parasitoids of the scutellarid *P. klugii* in Nicaragua[8]. In India, the dipteran parasitoid of *Pempelia* also offers promise. The entomopathogenous fungi, *Beauveria bassiana* (Bals.) Vuill. and *Metarhizium anisopliae* (Metsch.) Sorok. (Deuteromycotina: Hyphomycetes) were found to cause 64–99% mortality of the true bugs. *Leptoglossus zonatus* (Dallas) and *Pachycoris klugii* Burmeister[9] can also be used against the scutellarid bug in India. Indepth studies on the ecological aspects as well as control measures are being carried out at the National Research Centre for Agroforestry (NRCAF), Jhansi.

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ACKNOWLEDGEMENT. I acknowledge the facilities provided at NRCAF, Jhansi for the study and thank Dr R. V. Kumar whose germplasm collections were utilized for the observations.

Received 2 January 2006; accepted 30 April 2006

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