

SOME OBSERVATIONS ON INSECT SPECIES OF *PAULOWNIA* SPECIES AT PAKISTAN FOREST INSTITUTE CAMPUS, PESHAWAR

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Abstract

Exotic *Paulownia* fast growing tree species of Chinese origin were introduced in different ecological zones of Pakistan. Studies conducted by recording the observations fortnightly on nurseries and plantations at the Pakistan Forest Institute Campus, Peshawar showed that the *Paulownia* spp. fell prey to the attack of fourteen insect species like *Agrotis ypsilon* Rott. (Noctuidae), *Aleuroplatus pectiniferus* Quiint. (Aleyrodidae), *Catopsilia crocale* Cram. (Pieridae), *Cyrtopeltis tenuis* Reut. (Miridae), *Drosicha stebbingii* Gr. (Margarodidae), *Heliothis armigera* Hueb. (Noctuidae), *H. peltigera* Hueb. (Noctuidae), *Lymantria* sp. Walk. (Lymantriidae), *Myzus persicae* Sul. (Aphididae), *Odontotermes obesus* Ram. (Termitidae), *Plusia orichalcea* Fab. (Noctuidae), *P. nigrisigna* Fab. (Noctuidae), *Phycodes radiata* Ochs. (Glyphipterygidae) and *Precis orithya* Marsh. (Nymphalidae). Among these insect species *D. stebbingii* appeared in epidemic form on *Paulownia tomentosa* and *P. fortunei*. The pest was managed by adopting integrated control strategy in which practices like destruction of eggs by soil working, banding of tree trunks and application of insecticides were combined together. All the components of integrated control strategy proved effective. Among the chemicals Buldock 25EC, Meptra 50EC and Endon 35EC @ 0.2% were the most effective insecticides against the pest.

Key words: Insect species, *Paulownia* spp., IPM, Pesticides

Introduction

Paulownia, commonly known as "Pan Dong" in China is the only arborescent genus of the family Scrophulariaceae, found widely distributed in China. The genus *Paulownia* has nine species growing from 1000 to 2000m elevation above sea level in mountain area (Zhaohya, *et al.*, 1992). These species are fast growing, multipurpose trees, suitable for agro-forestry because of their deep tap root system that can very well utilize the sub-soil moisture, nutrients and do not compete with the shallow rooted field crops. Therefore, different species of this genus are being grown in many other countries such as USA, Brazil and Paraguay (Neil, 1990). *Paulownia* spp. are being introduced in different ecological zones for their suitability to fulfil the high demands of timber and fuelwood.

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The fast growing, multipurpose tree species like *Paulownia* were introduced in Pakistan during 1989-95 at 13 different sites in NWFP, Punjab and Azad Kashmir. It has been found that these species bear a vast insect pests complex. In China the recorded insect pests of *Paulownia* species are; *Agrotis ypsilon* (Rott), *A. toxionis* Butler, *Euxoa segetum* Schiff, *Serica orientalis* Matsch, *Anomala corpulenta* Matsch, *Holotrichia diomphalia*, *Gryllotalpa unispina* Sauss, *G. africana* P. & B., *Empoasca flavescens* Fab., *Cicadalla viridis* L., *Cryptotothlea variegata* Snell., *Psilogramma menephron* Cram., *Batocera horsfieldi* Hope, *Megopis sinica* White and *Basiprionota bisignata* Boh. (Anonymous, 1986). Similarly, Lanterer, (1980) found *Empoasca vitis* Goethe feeding on leaves of *P. tomentosa* in Czechoslovakia. Yang, (1982) has reported two species of stilt bugs *Gampsocoris pulchellus* (Dall) and *Yemma signatus* (Hsiao) feeding on young buds, leaves and stems of *Paulownia* spp. in China. Verma, *et al.*, (1997) observed that some known polyphagous crop pests such as *Heliothis armigera* Hueb. and *Myabris pustulata* Thunb. defoliated the foliage and affected the sapling growth of *P. tomentosa* in India.

As these species have a complex of insect pests and they are exotic in the country, therefore a study was carried out to record their insect pests at the Pakistan Forest Institute Campus, Peshawar for the management of insect species for successful introduction and establishment of this valuable multipurpose tree species.

Materials and Methods

i. Record of insect species

Five species of *Paulownia*, i.e. *P. elongated*, *P. fargesii*, *P. fortunei*, *P. kawakamii* and *P. tomentosa* in nurseries as well as plantations at the Pakistan Forest Institute research Garden were surveyed. The survey was carried out after every fortnight through out the year. Insects, both adults and immature stages feeding on different stages of *Paulownia* were collected. Immature stages were reared in the laboratory upto imago level. The insect species were identified with the help of reference collection in the Insect Museum, Entomology Branch, Pakistan Forest Institute. Some of the species were also got identified from International Institute of Entomology-UK. Seasonal history as well as host specificity was also noted.

ii. Control of *D. stebbingii*

Among the fourteen insect species *D. stebbingii* appeared in the epidemic form which was managed through integrated pest management strategy comprising the following practices.

- Cultural practices

Trees with heavy infestation of *D. stebbingii* were marked during May - June. The soil around these marked trees were hoed in preceding December-January in 1.0 to 1.5 meter radius upto 10cm depth.

- Mechanical Practices

Sticky bands were applied (8-10cm) wide around tree stems at breast height for protecting upward movement of the pest during March -April.

- Application of Pesticides

The chemical pesticides including Buldock 25EC, Endon 35EC, Fenvelrate 20EC, Mepa 50EC and Sherpa 5EC were sprayed around and below the sticky bands on tree stems at the rate of 0.2% concentration of the given formulations with the help of Pneumatic knapsack sprayer during April - May. There were six treatments including control which were replicated three times in randomized complete block design keeping two trees in each replication. The pest population was counted from 225 cm² bark area five times per tree below the sticky bands. Mean population was calculated and the data were statistically analyzed through analysis of variance (ANOVA) and least significant difference test (LSD).

Results and Discussion

i. Record of insect species

Agrotis ypsilon Rott. greasy cutworm, (Noctuidae; Lepidoptera)

Previous record: A polyphagous pest of agricultural, garden crops, nurseries and regeneration (artificial and natural) in forests. Recorded in Britain, Canada, Fiji, Hong Kong, India, Kenya, Malawi, New Zealand, Pakistan, Sri Lanka and Zimbabwe. It is a serious pest on young plantation of *Cedrus deodara* and *Pinus radiata* and other *Pinus* spp (Beeson, 1941; Browne, 1968; Chaudhry, *et al.*, 1966; Chaudhry, *et al.*, 1970).

Present record: It was found defoliating *P. elongata*, *P. fargesii*, *P. fortunei*, *P. kawakamii* and *P. tomentosa* in nurseries and young plantations during April - May.

Aleuroplatus pectiniferus Q.& B. white fly (Aleyrodidae; Homoptera)

Previous record: A white fly of India and Pakistan found on *Morus* spp. and

Euphorbiaceae (Beeson, 1941; Browne, 1968).

Present record: Found on young plantation of *P. fortunei* and *P. tomentosa* from September to December.

***Catopsilia Crocale* Cram. lemon migrant butterfly, (Pieridae; Lepidoptera).**

Previous record: Widely distributed pest in Andamen Islands, Australia, Borneo, Burma, China India, Pakistan, Philippines, Sumatra, Java, Sri Lanka and Thailand. Main host tree species of this pest were *Bauhinia variegata*, *Butea monosperma*, *Cassia auriculata*, *C. fistula*, *C. grandis*, *C. javanica*, *C. nodosa* and *C. siamea*, (Beeson, 1941; Browne, 1968; Chaudhry, *et al.*, 1970; Bajwa & Gul, 1998)

Present record: The species found feeding on fresh leaves of *P. elongata*, *P. fortunei* and *P. tomentosa* at plantation stage. The pest remained active from March to October.

***Cyrtopeltis tenuis* Reut. (Miridae; Hemiptera)**

Previous record: Widely distributed in warm temperate and tropical regions and occurring primarily of plants belonging to the Cleomaceae and Solanaceae families.

Present record: Nymphs and adults were sucking cell sap during March – May and September – November both on nursery as well as plantation stage. The host species were, *P. elongata*, *P. fargesii*, *P. fortunei*, *P. kawakamii* and *P. tomentosa*.

***Drosicha Stebbingii* Green, mango mealy bug (Margarodidae; Homoptera)**

Previous record: Geographically appeared in India and Pakistan. Mango mealy bug has a vast range of host trees, e.g. *Acacia nilotica*, *Achras zapota*, *Albizia lebbek*, *Artocarpus integra*, *Butea frondosa*, *B. monosperma*, *Cupressus sempervirens*, *Dalbergia sissoo*, *Eucalyptus spp.*, *Ficus glomerata*, *Hollarhena antidysentrica*, *Jackranda mymosipholia*, *Juglans regia*, *Mallotus philippinensis*, *Mangifera indica*, *Mimusops elengi*, *Morus alba*, *Pongamia pinnata*, *Prosopis spicigera*, *Shorea robusta*, *Syzygium cuminii*, *Tamarindus indica*, *Terminalia arjuna*, *Toona ciliata* and *Zizyphus mauritiana*. (Beeson, 1941; Browne, 1968; Chaudhry *et al.*, 1970; Gul *et al.*, 1997).

Present Record: Very severe infestation of *D. stebbingii* prevailed on the nurseries and plantation of *P. fortunei* and *P. tomentosa*. The pest remained active from mid February to mid June.

***Heliothis armigera* Hueb., army worm (Noctuidae; Lepidoptera)**

Previous Record: Only an occasional visitor in northern latitudes but widely spread and common in climates of Australia, Britain, the Cocos keeling Islands, Cyprus, Fiji, Gambia, Ghana, India, Kenya, Malawi, Malaya, Mauritius, New Zealand, Nigeria, Pakistan, Papua, Seychelles, Sierra Leone, Sri lanka, St. Helena, Tanzania, Uganda, Zambia and Zimbabwe. The larvae are injurious to cultivated plants and also turn carnivorous when they find themselves on unpalatable plants. Common host tree species were: *Albizia procera*, *Dalbergia sissoo*, *Eucalyptus torrelliana*, *Larix decidua*, *L. leptolepis*, *Pinus khasya*, *P. radiata*, *Platanus orientalis*, *Populus euphratica*, *Pseudotsuga menziensis*, *Salix tetrasperma* and *Schleichera oleosa* (Beeson, 1941; Browne, 1968; Chaudhry *et al.*, 1970).

Present Record: The recent results revealed *H. armigera* as a serious pest of nurseries and young plantations from March to May. All the five species of *Paulownia*, i.e. *P. elongata*, *P. fargesii*, *P. fortunei*, *P. kawakamii* and *P. tomentosa* were defoliated by the pest larvae.

***H. Peltigera* Schiff. (Noctuidae; Lepidoptera)**

Previous Record: Distributed in Europe, India, Iran, New Zealand, Pakistan and South Africa (Chaudhry, *et al.*, 1966; Chaudhry, *et al.*, 1970).

Present Record: The pest was active during March - May in nurseries and young plantations of *P. fortunei* and *P. tomentosa*.

***Lymantria* sp. hairy caterpillar (Lymantriidae; Lepidoptera)**

Previous Record: Two species *L. concolor* and *L. obfuscata* were found in Pakistan. The common host tree species of these two hairy caterpillars in various countries were *Alnus nitida*, *Populus* spp., *Quercus incana*, *Q. olulata*, *Q. serrata*, *Salix alba*, *Salix babylonica* and *S. fragilis* (Beeson, 1941; Browne, 1968; Chaudhry, *et al.*, 1970).

Present Record: Caterpillars of *Lymantria* sp. were found feeding on *P. fortunei* trees during October - December.

***Myzus persicae* Sulzer, green peach aphid (Aphididae; Homoptera)**

Previous Record: This highly polyphagous species occurs almost worldwide, namely Australia, Bermuda, Britain, Northern Ireland, Canada, Fiji, India, Kenya, Malawi, Mauritius, New Zealand, Nigeria, Pakistan, Sri lanka, Tanzania, Uganda, West

Indies and Zimbabwe. It is the most important aphid virus vector transmitting over 100 virus diseases of economical important plants. It was found infested peach, *Cassia fistula*, *Dalbergia sissoo* and *Langerstroemia indica*, *Salix acmophylla* (Beeson, 1941; Browne, 1968; Ghani *et al.*, 1969).

Present record: *M. persicae* was noted on *P. elongated*, *P. fargesii*, *P. fortunei* and *P. tomentosa* during March – May and September – November on young plantations, sucked cell sap due to which leaves crippled at nursery stage. *Odontotermes obesus* Ram. Termite (Termitidae; Isoptera)

Previous Record: Widely distributed in India, Iran and Pakistan. This is a general pest of nursery stock of *Acacia arabica*, *Casurina equisetifolia*, bark of *Zizyphus mauritiana*, *Dalbergia sissoo* *Tamarix aphylla* and *Eucalyptus spp.* The pest is particularly severe in arid regions. (Beeson, 1941; Browne, 1968; Chaudhry and Ahmad, 1980; Parihar, 1981).

Present Record: *O. obesus* attacked, *P. elongated*, *P. fortunei* and *P. tomentosa* plantations from July to October.

***Phycodes radiata* Ochs (Glyphipterygidae; Lepidoptera)**

Previous record: Occurred in the plains of India, Pakistan and Sri Lanka. Rolls the leaves and feed inside of *Ficus religiosa* and other *Ficus spp.* (Beeson, 1941; Browne, 1968; Chaudhry *et al.*, 1966; Chaudhry, *et al.*, 1970)

Present Record: From April to June, larvae of *P. radiata* folded leaves of *P. fortunei* and *P. tomentosa* bound them with silken strands and fed on the epidermis leaving behind vein skeleton.

***Plusia orichalcea* Fab. golden wing moth (Noctuidae; Lepidoptera)**

Previous Record: Recorded in Britain, China, Ghana, India, Japan, Kenya, Malawi, Pakistan, Sri Lanka, Tanzania, Zimbabwe and Uganda on *Alnus nitida*, *Butea monosperma*, *Cupressus lusitanica*, *Dalbergia sissoo*, *Entandrophragma angolense*, *Leucaena glauca*, *Melia azedarach*, *Syzygium cumini* and *Tamarix spp.* (Browne, 1968; Chaudhry *et al.*, 1966; Chaudhry, *et al.*, 1970)

Present Record: Larvae of *P. orichalcea* defoliated leaves in nurseries and young plantations of *P. elongated*, *P. fortunei* and *P. tomentosa* from April to June.

***Plusia nigrisigna* Walk. (Noctuidae; Lepidoptera)**

Previous record: Was present in India and Pakistan. The larvae were found feeding on leaves of wild mint and *Ficus* spp (Chaudhry, *et al.*, 1966; Chaudhry, *et al.*, 1979).

Present record: It was found on *P. elongated* and *P. tomentosa* in nurseries and young plantations during April – May.

***Precis orithya* Doub. blue pansy (Nymphalidae; Lepidoptera)**

Previous record: Distributed in Burma, China, Malayan region, India, Sri Lanka and Tenasserim (Chaudhry, *et al.*, 1970).

Present Record: Nurseries of *P. elongated*, *P. fortunei*, and *P. tomentosa* were attacked severely by the pest larvae in April – May.

Among these fourteen insect species recorded at the Pakistan Forest Institute Campus, Peshawar, *A. ypsilon* and *H. armigera* have also been recorded on *Paulownia* species in China and India, respectively (Anonymous, 1986; Verma, *et al.*, 1997). These are cosmopolitan, polyphagous pests as hazardous to agricultural and garden crops as to the forests. Most of the insect species are defoliators while rest are cell sap sucker except termites. Furthermore, on set of the spring season and early summer (March – June) are vulnerable periods for nurseries and young plantations of different *Paulownia* spp. *Paulownia*, therefore, being exotic and recent introduction in the country should be grown under strict supervision and surveillance of Entomologists and Pathologists for timely detection and control of insect pests and diseases for avoiding the losses and establishment of new insect pests and diseases.

ii. Control of *D. stebbingii*

As already mentioned among the recorded insect species an outbreak of mango mealy bug, *D. stebbingii* was observed on *P. tomentosa* and *P. fortunei* in epidemic form at the Pakistan Forest Institute during 1996-97. An integrated approach was adopted comprising cultural, mechanical and chemical measures which were combined together for controlling the pest.

- Cultural practices

By this practice controlled the hatchability of eggs consequently the pest population was reduced.

Mechanical control

As the female bugs ascent to the top shoots for feeding and mating with the winged male. The application of the sticky bands prevented them from ascending as the majority of the bugs stuck up themselves in the sticky band and died. This practice not only reduced the bug population but also disturbed the reproductive process.

Chemical control

The population data of *D. stebbingii* recorded on *Paulownia* spp. treated with synthetic pyrethroid pesticides are presented in table 1.

Table 1. Mean population of *D. stebbingii* per 225 cm² area of bark of *Paulownia* spp. treated with different pesticides.

Treatments	D o s e (%)	Observation time after treatment				
		B.Treat.	24 hrs	48 hrs	72 hrs	1 week
Buldock 25EC	0.2	106.9 ^{n.s}	3.1 ^{*c}	5.0 ^{*c}	9.2 ^{*b}	21.2 ^{*c}
Endon 35EC	0.2	109.6	16.1 ^b	12.6 ^b	7.8 ^b	18.7 ^c
Fenvelrate 20EC	0.2	102.2	4.7 ^c	8.9 ^b	5.4 ^b	25.0 ^b
Mepra 50EC	0.2	97.4	2.4 ^c	2.0 ^c	5.0 ^b	20.0 ^c
Sherpa 5EC	0.2	94.3	5.4 ^c	3.4 ^c	12.7 ^b	45.8 ^b
Control	-	96.6	148.2 ^a	151.6 ^a	246.4 ^a	266.2 ^a
LSD	-	-	7.61	7.53	16.27	22.11

* Significant at 99% level; B. treat. = Before treatment

- Figures in a column sharing same alphabets are non-significant at 5% level among themselves

All the five pesticides reduced pest population significantly. After 24 hours of spray maximum 148.2 individuals/225cm² of *D. stebbingii* were counted in control which were significantly high than other test treatments. However, there was non-significant difference among Buldock, Mepra, Fenvelrate and Sherpa. After 48 hours the difference between Endon and Fenvelrate became non-significant. Similarly, Buldock, Mepra and Sherpa were statistically non-significant among themselves. After 72 hours and one week, Buldock, Endon, Fenvelrate, Mepra, Sherpa; and Buldock, Endon, Mepra, were non-significant, respectively. Mepra at the rate of 0.2% afforded minimum population

throughout the observation period though it was statistically non-significant with Endon and Buldock. Likewise Endon harboured minimum population after one week. Buldock also showed persistent and effective impact. Thus Mepra 50EC, Buldock 25EC and Endon 35EC were the most effective pesticides against the mango mealy bug.

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