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ORIGINAL ARTICLE

Effectiveness of Different Extracts of *Calotropis procera* for the Control of Poplar Defoliator- *Clostera cupreata* (Lepidoptera: Notodontidae)

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ABSTRACT

Clostera cupreata (Lepidoptera: Notodontidae) is serious defoliator of poplar. Out of four extracts (CPPE, CPA, CPM and CPW) of Calotropis procera, two extracts, CPM and CPA were found effective at 1% concentration after 72 hrs for the control of poplar defoliator. Bioassay experiments of effective extracts were carried out using seven concentrations viz- 0.0625, 0.125, 0.25, 0.50, 1.00, 1.50 and 2.00%. It was found that extracts, CPM and CPA caused 60.00 and 56.67% larval mortality at 2.00% concentration after 72 hrs of exposure.

Key words: *Clostera cupreata, Calotropis procera, Lepidoptera, Notodontidae*

NTRODUCTION

Populas spp. are deciduous trees commonly known as aspen, poplars, Green Gold and cottonwood etc. about 32 species are recognized under the genus *Populus* (family Salicaceae). *Populus* spp. is distributed in the states of Jammu and Kashmir, Punjab, Haryana, Uttar Pradesh, Himachal Pradesh and Arunachal Pradesh (Mathur and Sharma, 1983). There are six species of poplars viz. *Populus alba, P. ciliata, P. euphratica, P. gamblei, P. jacquemontiana varglauca* and *P. aurifolia,* indigenous to Himalayan region of India. *P. deltoides* is a fast growing exotic tree species which has been extensively planted in India (Lohani, 1979). Poplar is very susceptible for insects attack. Over 108 insect species of varying nature of damage have so far been recorded causing infestation to the poplar of different dimensions (Beeson, 1941; Chaterjee and Thapa, 1964; Tiwari 1993). Poplar defoliator- *Clostera cupreata* is a serious defoliator of poplar, which appears in out breaks and caused loss of MAI and CAI, reduced the productivity and also quality of the timber. In northern India, poplar defoliator is controlled by unlimited use of insecticides leading to several health and environmental hazards. These insecticides are not target specific, broad spectrum and develop resistance to insecticides.With a greater awareness of hazards associated with the use of synthetic organic insecticides, there has been an urgent need to explore suitable alternative products for pest control. Therefore, the present work was initiated to study the effectiveness of different extracts of *Calotropis procera* for the control of poplar defoliator.

MATERIAL AND METHODS

SURVEY AND COLLECTION:

Field surveys of different forest areas were conducted for the collection of different stages of *C. cupreata* a major defoliator of poplar. The areas visited, include Barkot, Lachhiwala, Jhajra, Kalsi ranges of Dehradun Forest Division; Chhichrauli Yamunanagar (Haryana); Bahadrabad, Biharigarh (Haridwar) and FRI campus Dehradun. Collection of larvae was carried in the morning hours by hand picking in plastic containers, open end covered with muslin cloth tied with rubber band. The collected immature and mature stages of defoliator brought from the field in the laboratory for rearing and to maintain the laboratory culture to lay down a series of experiments.

REARING OF INSECT:

Larvae of *C. cupreata* were reared in glass chimney and wooden cages with fresh leaves of poplar. The pupae when formed were sorted out and kept separately in glass jars covered with muslin cloth till the emergence occurred. The emerged moths of *C. cupreata* were released in wooden glass

cages (60x60x90 cm) having fresh foliage of poplar for egg laying. Cotton soaked in water solution of honey/sugar was supplied as a food.

COLLECTION, DRYING AND GRINDING OF PLANTS MATERIAL:

The leaves of *Calotropis procera* were collected from Shakumbari range, Saharanpur (U.P). The collected leaves were air dried and powdered for extraction in different solvents. Powdered plant material of *C. procera* was extracted with different solvents. The yield percentage was determined on moisture free basis. The extracted extracts were coded as CPPE, CPA, CPM and CPW. CPPE mean leaves of *C. procera* extracted in petroleum ether, CPA stands for leaves of *C. procera* extracted in acetone, CPM means leaves of *C. procera* extracted in methanol while CPW means leaves of *C. procera* extracted in distilled water.

PREPARATION OF EXTRACTS:

Shade dried and powdered material of leaves (340 g) of *C. procera* was extracted with the solvents of elutropic series petroleum ether, acetone, methanol, and distilled water. These extracts were concentrated on rotatory evaporator under reduced pressure. The yield of the extracts and procedure is given below:

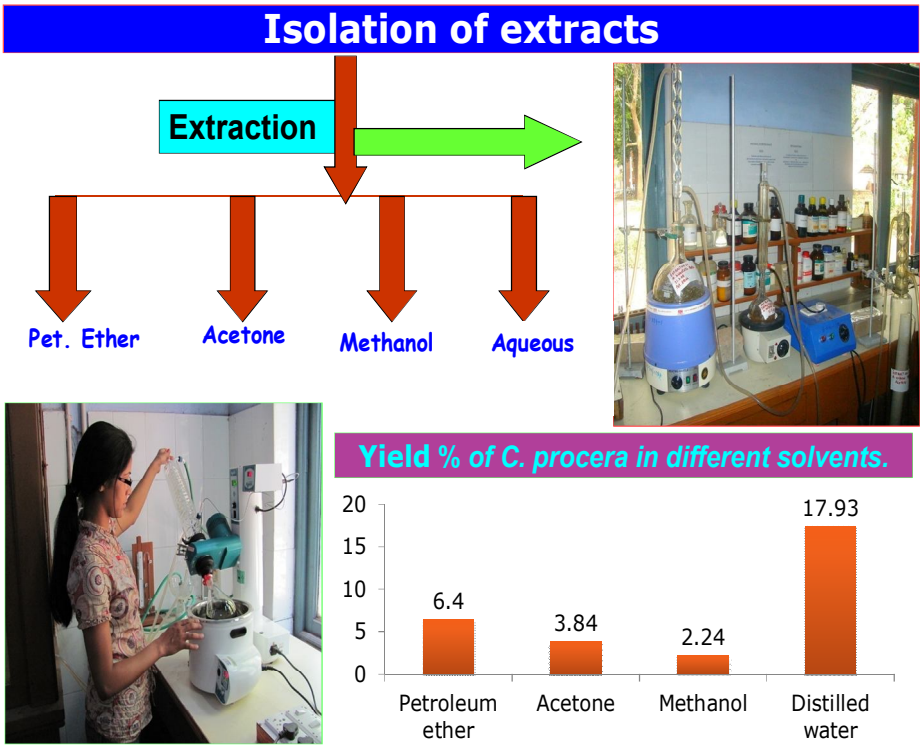

Fig. 1: Isolation of Extracts

TESTING OF EXTRACTS:

Experiments were carried out to evaluate the larval mortality of different extracts- CPPE, CPA, CPM and CPW on the 3rd instar larvae of *C.cupreata* at 1% concentration. Ten number of 3rd instar larvae of *C. cupreata* were taken from the culture and released in glass jars and fresh leaves of poplar treated with 1% of above extracts were given for feeding. Observations on the mortality of larvae were recorded after 24, 48 and 72 hrs. of exposure. The moribund larvae were considered as dead. The percent mortality of larvae was calculated by using the formula.

$$\text{Percent Mortality} = \frac{\text{No. of larvae dead}}{\text{No. of larvae released}} \times 100$$

Fig. (2): Collection of plants material of *C.procera* **(3):** Collected plant materials **(4):** Collection of mature and immature stages of poplar defoliator **(5):** Rearing of poplar defoliator **(6):** Exposure of different concentrations of extracts

RESULTS AND DISCUSSION

Observations recorded in Table 1 showed that 1% concentration of CPPE (*Calotropis procera* extracted in Petroleum ether) extract caused 10, 20 and 20% larval mortality of *C.cupreata* in R1, R2 and R3 respectively after 24 hrs. and the larval mortality level was the same after 48 and 72 hrs. The average larval mortality was 16.67%. CPPE extract provided less mortality as compared to LC50, hence taken as not effective. There was no larval mortality in the control.

1% concentration of CPA (*Calotropis procera* extracted in acetone) extract caused 40, 30 and 50% larval mortality of *C. cupreata* in R1, R2 and R3 respectively after 24 hrs and the larval mortality level was the same after 48 and 72 hrs. The average mortality was 40.00% and considered as effective extract. There was no larval mortality in control.

1% concentration of CPM (*Calotropis procera* extracted in methanol) extract gave 50 % larval mortality of *C. cupreata* in R1, R2 and R3 respectively after 24 hrs, whereas after 48 and 72 hrs the larval mortality remained the same. The average mortality after 72 hrs was 50.00% and taken as effective extract. No larval mortality occurred in control.

Table 1: Larval mortality of *Clostera cupreata* at 1% concentration of *Calotropis procera* extracts

Sl.No	Chemical extract	Replication	No. of larvae	Mortality			% Mortality after 72 hrs	Average mortality	Effective or not effective
				After 24 hrs	After 48 hrs	After 72 hrs			
1	CPPE	R1	10	1/10	1/10	1/10	10.00	16.67	not effective
		R2	10	2/10	2/10	2/10	20.00		
		R3	10	2/10	2/10	2/10	20.00		
		Control	10	Nil	Nil	Nil	Nil		
2	CPA	R1	10	4/10	4/10	4/10	40.00	40.00	effective
		R2	10	3/10	3/10	3/10	30.00		
		R3	10	5/10	5/10	5/10	50.00		
		Control	10	Nil	Nil	Nil	Nil		
3	CPM	R1	10	5/10	5/10	5/10	50.00	50.00	effective
		R2	10	5/10	5/10	5/10	50.00		
		R3	10	5/10	5/10	5/10	50.00		
		Control	10	Nil	Nil	Nil	Nil		
4	CPW	R1	10	1/10	1/10	1/10	10.00	6.67	not effective
		R2	10	0/10	0/10	0/10	Nil		
		R3	10	1/10	1/10	1/10	10.00		
		Control	10	Nil	Nil	Nil	Nil		

CPPE= leaves of *C. procera* extracted in petroleum ether, **CPA**= leaves of *C. procera* extracted in acetone, **CPM**= leaves of *C. procera* extracted in methanol and **CPW**= leaves of *C. procera* extracted in distilled water

Table 2: Bioassay of effective extracts of *C. procera* against the larvae of *C. cupreata*

Sl.No	Effective extracts			Doses						
	Type	Replication	No. of Larvae	0.062 %	0.125 %	0.25 %	0.50 %	1.00 %	1.50 %	2.00 %
1.	CPM	R1	10	0	1	1	2	4	5	6
		R2	10	0	0	0	2	6	6	6
		R3	10	0 =0.0	1 = 6.67	2 =10.00	2 =20.00	5 =50.00	6 =56.67	6 =60.00
		Control	10	0	0	0	0	0	0	0
2.	CPA	R1	10	0	1	1	2	4	5	6
		R2	10	0	0	1	2	5	5	6
		R3	10	0 =0.0	1 = 6.67	1 =10.00	1 =16.67	4 =43.33	5 = 50.0	5 =56.67
		Control	10	0	0	0	0	0	0	0

1% concentration of extract CPW (*Calotropis procera* extracted in water) caused 10% larval mortality of *C. cupreata* in R1 and R3 after 24 hrs, whereas no larval mortality observed in R2 and no further larval mortality observed after 48 and 72 hrs. The average larval mortality after 72 hrs was 6.67% and taken as not effective extract. No larval mortality occurred in control.

It is observed from the table 1 that out of the four extracts of *C. procera* only two extracts- CPA and CPM were considered as effective extract. Therefore, the bioassay of these extracts was carried out by using seven concentrations *viz*: 0.0625, 0.125, 0.25, 0.5, 1.0, 1.5 and 2 per cent.

Bioassay observations in Table 2 showed that CPM and CPA extracts at 0.0625, 0.125, 0.25 and 0.50% in 3-replications caused less larval mortality in *C. cupreata* after 72 hrs as compared to LC50. At 1% concentration CPM extract caused 40.00, 60.00 and 50.00% larval mortality after 72 hrs with an average of 50.00% mortality. At 1.5% concentration 50.00, 60.00 and 60.00% larval mortality with an average of 56.67% were observed after 72 hrs. At 2% concentration the extract caused 60.00, 60.00, and 60.00% larval mortality in each replication with an average of 60.00%.

In case of CPA extract, 1% concentration provided 40.00, 50.00 and 40.00% larval mortality in 3-replications with an average of 43.33% after 72 hrs. 1.5% concentration of CPA extract caused 50.00% larval mortality in each replication with an average of 50.00%. 2% concentration of CPA extract caused 60.00, 60.00 and 50.00% larval mortality in 3-replications with an average of 56.67% after 72 hrs. No larval mortality was observed in control. It is observed that extracts of *C. procera* extracted in methanol (CPM) and acetone (CPA) were found effective at 1% concentration for the control of *C. cupreata* under laboratory conditions. The bioassay of effective extract showed that 2% concentration of CPM and CPA extracts caused 60.00% and 56.67% larval mortality after 72 hrs,

respectively. It is concluded that the extract of *C. procera* extracted in methanol (CPM) was considered as most effective for the control of larvae of *C. cupreata*.

Similar type of work was carried out by various workers. Singh K.P. and Yousuf M. (2015) also tested the efficacy of different extracts of *T. minuta* against *Plecoptera reflexa*, a major defoliator of shisham. It was observed that the acetone and methanol extracts (TMA and TMM) provided 50 and 60% larval mortality at 2% concentration after 72 hrs under laboratory condition, respectively. Singh K.P. and Yousuf M. (2016) tested the different extracts of *Tagetes minuta* for the control of *Clostera cupreata* and it was found that out of the four extracts, the extract (TMM), extracted in methanol caused 50% larval mortality at 2% concentration after 72 hrs whereas the extracts (TMA), extracted in acetone provided 46.66% larval mortality. Singh *et.al.* (2016) also tested the efficacy of different extracts of *Calotropis procera* against *Plecoptera reflexa*, a major defoliator of shisham. It was observed that the acetone and methanol extracts (TMA and TMM) provided 56.67 and 60.00% larval mortality at 2% concentration after 72 hrs under laboratory condition, respectively. Gupta and Joshi (1995) tested seed extracts of neem and *Pongamia pinnata*, leaf extracts of *Aloe vera, Annona squamosa, Calotropis* and *Vitex negundo* for their feeding inhibition properties against the leaf defoliators of Shisham, Bamboo, Teak and *Ailanthus indica.* Extracts of *Aloe vera*, *Azadirachta indica* (neem), seed extracts of *A. indica* and *P. pinnata* were found to be effective against above defoliators. Bhandari, *et.al.* 1988 observed that methanol extractives of neem seed found effective against poplar defoliator, *P. cupreata* for their antifeedant activity. Ahmad, *et.al.* (1991) recorded that extract of *Acorus calamus*, *Lantana camara* var. *aculeata, Adhatoda vesica* and *Melia azedarach* were effective in killing *Ailanthus* web worm, *Atteva fabriciella.* Meshram, (2000) tested crude extracts fresh leaves of 14 plants against larvae of *Dalbergia sissoo* to evaluate their antifeedent and insecticidal activity and it was observed that *Melia azadarach* followed by *Eucalyptus hybrid* and *Pongamia pinnata* were found effective in decreasing order to control the damage due to larvae of *Plecoptera reflexa*.

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