

Investigation of the effects of two different biopesticides on the mortality of *Holotrichia serrata* F. adults (Coleoptera: Scarabaeidae)*

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Abstract

The scarab adults are called as 'May- June beetles' or 'Chaffer beetles' which are National pest and it causing serious damages to the economical crops as well as medicinal plants. The synthetic chemical pesticides are hazardous to the environment and human being. Recently, use of the Biopesticides are the alternative to the chemical or synthetic insecticides and the plant extractives are use for manage the pest is gaining importance. The effects of plant extractives and efficacy of biopesticides viz. *Thevetia peruviana* (Pers) and *Datura innoxia* (Mills) were studied against the mortality of *Holotrichia serrata* (Fab). Bioassay was tested and to determine the effects of varying concentrations. The *Thevetia peruviana* (Pers) were more efficient than *Datura innoxia* (Mills); 50% mortality was occurred after 48 and 96 hours at the concentration of 0.025% and 0.20% respectively. It revealed that both plant extract concentrations were effective against *Holotrichia serrata* (Fab) adults. The toxicity of *Thevetia peruviana* (Pers) leaves > *Datura innoxia* (Mills) seeds to minimize the infestation of scarab species, *Holotrichia serrata* (Fab) beetles. In addition, the effects of biopesticide on oviposition were investigated and adults laid lowest numbers of eggs.

Key words: Biopesticide, efficacy, mortality, plant extract, toxicity

1. Introduction

The chemical insecticides have not effective result of the white grub management system and these chemical pesticides have hazardous effects occur on the human being and other organisms. The plant toxins have tested in experiments for the use of pest control as a biopesticide. Also, the green plants represents a reservoir of effective and provide valuable natural source of pesticide^[1, 2]. The biopesticides have been recommended for control^[3, 4]. The *Ariseama murrayi* (Hook) plant parts are poisoning to *Swiss albino* mice which observed that liver, intestine and kidney were severally damaged. Forensic study proved that these organs were damaged by poison of *Ariseama murrayi* (Hook) plant of tuber^[5]. The *Thevetia peruviana* (Pers) is called as Yellow oleander, used as ornamental plant in garden and roadside. A dark green leaves of *Thevetia peruviana* (Pers) contains polyhydroxy- dimono- terpinoides and dimonoterpenoid apiosyglucosides^[6].

The *Datura innoxia* (Mills) is a species Solanaceae family which is known as thorn apple or moon flower among widely distributed in Sudan^[7]. It is an annual shrub plant. The fruit of *Datura innoxia* (Mill.) is an egg shaped spiny capsule. The phytochemical studies showed that *Datura* chemical species are rich in alkanoids, flavonoids, essential oils, phenols, saponins, and cardiac glycolysides^[8, 9]. Its has been reported as halluniogen activity^[10, 11]. It plays an insecticidal activities against some pests in different parts of the world^[12, 13]. The toxic effect of synthetic chemicals can be overcome, only by persistant search for new and safer pesticides accomanied by wide use of pest control method, which are eco- friendly and effective^[14].

White grub is a larva of Melolonthidae. The Scarabaeidae is most important family of order Coleoptera. The world fauna of white grub exceeds 30,000 species, and there are about 1300 North American species^[15, 16]. White grub is a National pest. Several species of white grubs or scarabs are root feeding pests such as turf grass, forage grass, corn, small grains, sugarcane, strawberry, potato tubers, and young nursery trees^[17]. In which Scarabaeidae species, *Holotrichia serrata* (Fab) is one of harmful to the commercial crops as well as medicinal important plants. In the part of Northern Western Ghats, scarab species were occurred in the groundnut, potato, sugarcane, maize, pea growing areas of Khed Taluka during at the time of first monsoon rainy season^[18]. *Holotricha serrata* (Fab) was most abundant species found in that region collected at dusk time from the leaves of host plants such as *Azadirachta indica*, *Acacia arabica*, *Ziziphus zizyphus* and *Acacia catechu*^[19].

2. Materials and Method

2.1 Selection of plants for biopesticide-

On the basis of natural control, two Biopesticides were selected as the focus of this research study. The *Datura*, *Datura innoxia* (Mills) and Bitti, *Thevetia peruviana* (Pers) plant extractives were used for experimental study. These both Biopesticides shows variation in toxicological, chemical properties and exhibit different biological impacts. These both plants are easily available in whole year.

2.2 Plant Extract preparation-

The fresh leaves of *Thevetia peruviana* (Pers) and fruits of *Datura innoxia* (Mills) were collected from various regions. The fruits of *Datura innoxia* (Mills) were air dried at the room temperature and weighted on electronic balance. The air dried *Datura innoxia* (Mills) seeds and fresh leaves of *Thevetia peruviana* (Pers) were crush into the Mortar- Pestle separately and again weighted on electronic balance for biopesticide preparation. The extracts was sterilized into distilled water at room temperature at different concentrations and placed overnight. The *Thevetia peruviana* (Pers) and *Datura innoxia* (Mills) extracts solution were prepared on 0.015g, 0.020g, 0.025g, 0.030g, 0.035g and 10g, 15g, 20g, 25g, 30g in 100ml distill water respectively. Both prepared extracts were shaken manually and kept in refrigerator. After few minutes the Biopesticides were filtered through filter paper no 1 and then ready to use for treatment.

2.3 Selection of animals-

The experiment of biopesticidal impact on *Holotrichia serrata* (Fab) adults was carried out in the laboratory. The scarab beetles were collected, identified and cultured in the earthen pots^[20]. Fresh *Azadirachta indica* leaves were supplied to the *Holotrichia serrata* (Fab) adults up to the experimental date. Before one day of the treatment, *Holotrichia serrata* (Fab) adults were separated into the hollow earthen pot for starvation.

2.4 The LC₅₀ determination-

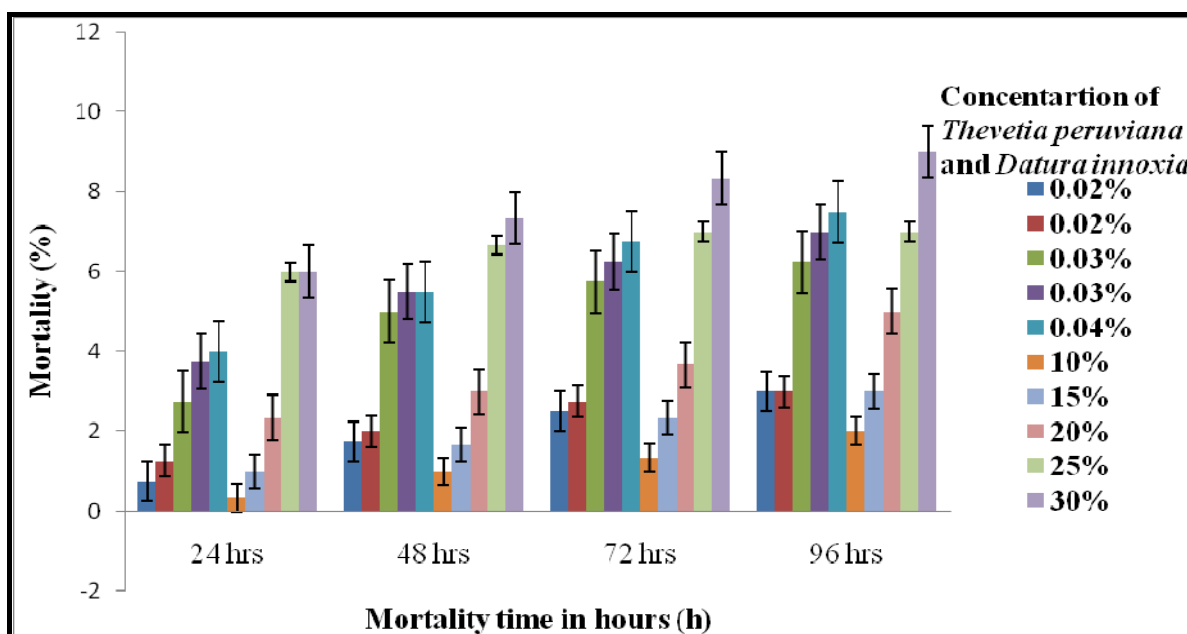
The dried *Azadirachta indica* leaves were filled into the experimental pots for feeding propose and record the mortality after 24, 48, 72 and 96 hours exposure of both group. The control batch of male and female adults was maintained both group in separate earthen pots. The experimental as well as control group was conducted at room temperature. In the experimental pots, movement and behavior of the beetles was monitored for over 24 hours of both groups. Mortality of the *Holotrichia serrata* (Fab) adults were observed, recorded and dead adults was removed immediately and preserve in 30% formalin. Evaluation of the toxicity and mortality was analyzed by statistical method (Mean) and represented by graphical method.

3. Results and Discussion

The present work were evaluated that the aqueous leaf extract of *Thevetia peruviana* (Pers) and seed extract of *Datura innoxia* (Mills) seeds were toxic effects against the mortality of *Holotrichia serrata* (Fab) adults. The different concentration of *Thevetia peruviana* (Pers), 0.015g, 0.020g, 0.025g, 0.030g and 0.035 in 100ml distilled water in which 0.025g/100ml concentration were screened out the 50% mortality against the *Holotrichia serrata* (Fab) adults after 48 hours. The *Thevetia peruviana* (Pers) leaf extract were toxic to the scarab beetle on 0.025% concentration. *Datura innoxia* (Mills) seed extract concentrations are 10g, 15g, 20g, 25g and 30g per 100ml distilled water concentration in which 20g/100ml were screened out 50% mortality against the *Holotrichia serrata* (Fab) adults. The toxicity of *Datura innoxia* (Mills) seeds on the mortality of *Holotrichia serrata* (Fab) adults were monitored on 20g/100ml concentration after 96 hours exposure. 20% concentration of *Datura innoxia* (Mills) seeds was toxic to the scarab beetle, *Holotrichia serrata* (Fab).

Table: Toxicity of aqueous extract of *Thevetia peruviana* (Pers) and *Datura innoxia* (Mills) against the mortality of *Holotrichia serrata* (Fab) adults

Mortality time in hours	Concentrations of <i>Thevetia peruviana</i> (Pers) in mean (\pm S.E.)					Concentration of <i>Datura innoxia</i> (Mills) in mean (\pm S.E.)				
	0.015 %	0.020 %	0.025 %	0.030 %	0.035 %	10%	15%	20%	25%	30%
24 hrs	7.50 \pm 0.4	12.5 \pm 0.5	27.5 \pm 0.8	37.5 \pm 0.9	40.0 \pm 1.0	3.40 \pm 0.4	10.0 \pm 0.5	23.4 \pm 0.9	60.0 \pm 1.4	60.0 \pm 1.4
48 hrs	17.5 \pm 0.6	20.0 \pm 0.7	50.0 \pm 1.1	55.0 \pm 1.2	55.0 \pm 1.2	10.0 \pm 0.5	16.7 \pm 0.7	30.0 \pm 1.0	66.7 \pm 1.5	73.4 \pm 1.5
72 hrs	25.0 \pm 0.8	27.5 \pm 0.8	57.5 \pm 1.2	62.5 \pm 1.2	67.5 \pm 1.3	13.4 \pm 0.7	23.4 \pm 0.9	36.7 \pm 1.1	70.0 \pm 1.5	83.4 \pm 1.6
96 hrs	30.0 \pm 0.8	30.0 \pm 0.8	62.5 \pm 1.2	70.0 \pm 1.3	75.0 \pm 1.3	20.0 \pm 0.8	30.0 \pm 1.0	50.0 \pm 1.2	70.0 \pm 1.5	90.0 \pm 1.7
Control	00	00	00	00	00	00	00	00	00	00

Figure: Determination of 50% mortality of *Holotrichia serrata* (Fab) adults in different concentrations of *Thevetia peruviana* (Pers) and *Datura innoxia* (Mills)

The botanical sources are promising natural alternatives to the chemical pesticides or synthetic chemicals which is hazardous to the environment and human being. The *Thevetia peruviana* (Pers) leaf extract was more toxic than *Datura innoxia* (Mills) seeds on the *Holotrichia serrata* (Fab) adults. The resistant to plant extract of *Datura innoxia* (Mills) used against to the *Holotrichia serrata* (Fab) adults were controlled; it means the integrated pest management schedule two to four times spraying of Biopesticide is effective during pre-monsoon season be practiced for exposing adults for predation by natural enemies ^[21].

Seeds, leaves, fruits and roots of *Thevetia peruviana* (Pers) are considered as potential sources of biologically active compounds, such as insecticides, rodenticide, fungicide and bactericides used as antifungal, antibacterial and antitermite property ^[22, 23, 24, 25, 26, 27, 28, 29]. Acute toxicity of *Datura* was observed less in 24 hours and it describes the adverse effects from a single exposure or from multiple exposures in a short space of time ^[30]. Also, the test of aqueous leaf extract effectively produced the mortality against the *Holotrichia serrata* (Fab). Biopesticide of *Thevetia peruviana* (Pers) aqueous leaf extract were affected on weigh, behavioral movements of *Holotrichia serrata* (Fab) adults. Biopesticide of *Thevetia peruviana* (Pers) is acts as excellent broad spectrum control of white grub adults on commercial growing or economical crops as well as medical important host plants ^[31].

4. Conclusion

The present result shows that the *Thevetia peruviana* (Pers) and *Datura innoxia* (Mills) are toxicant or biopesticidal property and growth regulating agent against the scarab beetles. The management strategy of white grub the most eco friendly approaches can be used for biopesticides or plant products like *Datura innoxia* (Mills) seeds and *Thevetia peruviana* (Pers) leaf extract. Both plants play an important role of biopesticidal activity against the *Holotrichia serrata* (Fab) adults or scarab beetles. The *Thevetia peruviana* (Pers) and *Datura innoxia* (Mills), both plant parts are toxic to the mortality and growth of *Holotrichia serrata* (Fab) adults but *Thevetia peruviana* (Pers) leaf were more efficient effects than *Datura innoxia* (Mills) seeds. These pesticides are harmless to the environment and human being or other organisms. There is no toxic pollutants may occurred the pollution by use of said biopesticides in the ecosystem or nature. So, outcome of the present research work is more beneficial to the farmers, prevention of agricultural pests and helps to increase the crop production as well as saving the medically important host plants.

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