

Records of Lepidopteron Borers (Lepidoptera) on Stored Seeds of Indian Himalayan Conifers

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Abstract—Many of the regeneration failures in conifers are often being attributed to heavy insect attack and pathogens during the period of seed formation and under storage conditions. Conifer berries and seed insects occur throughout the known range of the hosts and also limit the production of seed for nursery stock. On occasion, even entire seed crops are lost due to insect attacks. The berry and seeds of both the species have been found to be infested with insects. Recently, heavy damage to the berry and seeds of Juniper and Chilgoza Pine was observed in the field as well as in stored conditions, leading to reduction in the viability of seeds to germinate. Both the species are under great threat and regeneration of the species is very low. Due to lack of adequate literature, the study on the damage potential of seed insects was urgently required to know the exact status of the insect-pests attacking seeds/berries of both the pine species so as to develop pest management practices against the insect pests attack. As both the species are also under threat and are fighting for survival, so the study is important to develop management practices for the insect-pests of seeds/berries of Juniper and Chilgoza pine so as to evaluate in the nursery, as these species form major vegetation of their distribution zones. A six-year study on the management of insect pests of seeds of Chilgoza revealed that seeds of this species are prone to insect pests mainly borers. During present investigations, it was recorded that cones of are heavily attacked only by *Dioryctria abietella* (Lepidoptera: Pyralidae) in natural conditions, but seeds which are economically important are heavily infested, (sometimes up to 100% damage was also recorded) by insect borer, *Plodia interpunctella* (Lepidoptera: Pyralidae) and is recorded for the first time 'to author's best knowledge' infesting the stored Chilgoza seeds. Similarly, Juniper berries and seeds were heavily attacked only by a single borer, *Homaloxestis cholopis* (Lepidoptera: Lecithoceridae) recorded as a new report in natural habitat as well as in stored conditions. During the present investigation details of insect pest attack on Juniper and Chilgoza pine seeds and berries was observed and suitable management practices were also developed to contain the insect-pests attack.

Keywords—Borer, conifer, cones, chilgoza pine, lepidoptera, juniper, management, seed.

I. INTRODUCTION

ALL conifers are susceptible to cone and seed insects. The increased emphasis on production forestry had necessitated the availability of seeds not only of good quality but also whenever it is needed. Long-term storage is, therefore, inescapable. Many of regeneration failures in conifers have often been attributed to heavy insect attacks during the period of flowering, seed formation and under storage conditions. Juniper (*Juniperus polycarpus*) and Chilgoza pine (*Pinus gerardiana*) are very important species

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of their zone of distribution and serve multipurpose requirement of the region. Cones/berries and seeds of both the species are highly prone to insect attacks, weather in field or in stored conditions. The study on the insect prevalence on these species revealed that seed borers are major insect-pests which attack the cones and berries in the natural forests as well as stored seeds. The seed and cone insects of pines are two seed-bugs (*Leptoglossus corculus* and *Tetyra bipunctata*) and five species of coneworms in the genus *Dioryctria* are most damaging. Some of other insect species which causes potential damage are *Gnophothrips fuscus*, pine seedworms (*Cydia* spp.), pine conelet looper (*Nepytiasemiclularia*), cone borers (*Eucosma* spp.), cone beetles (*Conophthorus* spp.), and tip moths (*Rhyacionia* spp.). Two more conifer pests i.e. *Dioryctria abietella* and *Cateremna cedrella* (Lepidoptera: Pyralidae) [1]. It is a well-known fact that seed and cone insects have their presence throughout the known distribution range of the hosts. Various practices were examined during present study to control the damage of stored seeds of Chilgoza pine and Juniper. This study has produced encouraging results and can be effectively applied to control the borer attack on these seeds.

Studies on insect borers in the cones of pines in Pakistan was studied and samples of cones of *Pinus griffithii* infested by *Dioryctria abietella* (Schiff.), *Cateremna cedrella* (Hmps.), *Cydia ethelinda* (Meyr.) or *Eucosma pylonitis* [2]-[7] had earlier worked on conifer insects and their management. Earlier [8] also studied the taxonomy of *Plodia interpunctella* infesting the seeds of Chilgoza pine. The study on the lepidopteron borer, *Plodia interpunctella*, on seeds of Chilgoza pine (the only edible pine nut species found in India) and another berries/seed borer *Homaloxestis cholopis* has helped in identifying the damage potential of both these species, leading to development of effective management practices. The study had helped in developing effective management of insect borers attacking the cones, berries and seeds of *Pinus gerardiana* and *Juniperus polycarpus* for the long-term storage of seeds of these species.

II. METHODOLOGY

Study Area

- a) **Juniper Forests of Himachal Pradesh:**
 - i. Pooh, Namgia, Shipki La in Dist. Kinnaur
 - ii. Gypsa and Keylong in Dist. Lahaul and Spiti
- b) **Chilgoza Pine Forests of Himachal Pradesh:**
 - i. Kinnaur
 - ii. Lahaul
 - iii. **Isolation of larvae from infected samples and study of**

their pathogenicity: The larvae were isolated from the infected samples for the study on impact of different controlling treatments.

iv. **Efficiency of different containers such as Cotton bag, poly bag, paper bag, Gunny bag, Air tight containers and Polysac container:** These containers were used to test their efficiency in controlling the seed borers in stored conditions. These containers was also be given freezing treatments to study the impact of freezing treatment in controlling the seed borers of both the pine species. Effect of predominant storage insect-pest on the i.e. seed and kernel weight of Juniper and Chilgoza seeds.

v. **Studies on safer biochemical treatments in containing the insect pests of the stored seeds:** The commercial biopesticides and safer pesticides were tested against the seed borers are detailed below:

TABLE I
 MAJOR PESTICIDE TREATMENTS GIVEN TO STORED SEEDS WITH THEIR COMPOSITION

Treatments (Trade names)	Major components
Robust (0.5%)	Chloropyrophos
Praghat+ (2%)	<i>Neriumodorum, Bombaxmalabaricum</i>
Fursa (1%)	Alphamethrin
Neem (2gms)	Neem powder



Fig. 1 Google Earth map of the Juniper inhabited area of Lahaul (India)



Fig. 2 Google Earth map of the Juniper inhabited area of Kinnaur



Fig. 3 Study sites of Juniper Forest at Kinnaur and Keylong

III. RESULTS

The seeds/berries of Juniper are heavily attacked by only one major pest i.e. *Homaloxestischolopsis* (Lepidoptera: Lecithoceridae) a lepidopteron borer was recorded feeding on stored Juniper seeds. Minor attack of *Plodia interpunctella* (Lepidoptera: Pyralidae) was also recorded during the present study. No fungal attack was observed in stored seeds of Juniper. *Homaloxestischolopsis* (Lepidoptera: Lecithoceridae) a lepidopteron borer was recorded for the first time feeding on stored Juniper seeds was responsible for both pre-harvest and post-harvest damage to the berries and seeds of the Juniper. This is the first report of the insect borer damaging stored Juniper seeds. This insect borer starts its activity on fresh and young berries, continues its life cycle inside the berries and completes full lifecycle on seed maturation. The insect attack in the stored seeds was of main concern and needed management. During the nursery trials, five treatments including control, Fursa, Praghat+, Robust and Neem were selected for containing the insect pest attack in raising the nursery of Juniper. Seed sowing was done during the winters in the month of February and March after proper pre showing treatments were applied [9], [10]. The seed germination was observed periodically in the nursery and it was observed that nursery trails conducted with the collected from Kinnaur have shown maximum germination with the treatment Fursa (81) Followed by Robust (78.67), Neem (72), Praghat+ (70) and Control (67.33). When similar trials were conducted for the seeds collected from Lahaul, Maximum Germination in Juniper nursery was recorded with treatment Fursa (81) followed by Robust (78.67), Neem (71), Praghat+ (68) and Control (64.33). During the present study it was observed that

there was no significant effect on seed germination from seed collected from Kinnaur and Lahaul. Seed collected from both location shows similar response to the treatment. Data revealed that Fursa as most effective treatment for Juniper seed germination.



Fig. 4 Infected Juniper seeds and Emerged Lepidoptera Adults

Study on the management of insect pests of Chilgoza seeds reveals that the freezing treatments are very successful against insect pests attack on Chilgoza seeds of both the sites i.e. Jhangi and Kilba, as no insect attack was found in the seeds when stored at 0°C and 5°C in all stored conditions. Neem powder is most effective in control of Chilgoza seed damage with a mean value of 25.22 (1.363) followed by Robust 29.33 (1.423), Fursa 36.11 (1.423) and Praghat+ 40.22 (1.556), respectively, when stored in cotton bags for the seeds stored for three years collected from Kilba (Kinnaur). The same treatments on Chilgoza seeds collected from Kilba (Kinnaur) when applied in plastic jars show that Robust 28.33 (1.396),

Fursa 27.89 (1.383) and Neem 28.0 (1.390) have almost the same impact, while Praghat+ 41.089 (1.573) has shown lowest impact. It is advised to apply the most suitable treatment for effective storage of Chilgoza seeds.

IV. CONCLUSION

Study on management of insect pests of Juniper and Chilgoza seeds, reveals that seeds of these species are prone to insect pest attacks. *Homaloxestischolopis* (Lepidoptera: Lecithoceridae) a lepidopteron borer was recorded feeding on stored Juniper seeds was responsible for both pre-harvest and post-harvest damage to the berries and seeds of the Juniper. The study on management of insect-pests of Juniper seeds revealed that Fursa (0.5%) treatment was most appropriate in the effective control of seed borers of Juniper, followed by Robust, Neem and Praghat+, both in insect pest management in stored seeds as well as in nursery raising.

Freezing treatments are very successful against insect pest attacks on Chilgoza seeds, and if the facility to preserve the seeds is available, this should be applied, as insect-pests remains dormant and are unable to attack so seeds can be stored safely. Small quantities of seeds can be stored in deep-fridges or in-house fridges. Safe chemicals or biopesticides should be used to protect and preserve the seeds. Neem powder has proven to be most effective in control of Chilgoza seed damage, and seeds stored for edible purposes should be treated only with this or other biopesticides. Safer chemicals should be used to protect the Chilgoza seeds for long-term storage. Robust has proven to be very effective measure for long-term storage of the seeds. These pesticides should only be used after the consultation of experts in the related field.

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