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Studies on biology of a field bruchid, *Bruchidius albizziae* (Coleoptera: Bruchidae) infesting seeds of *Acacia Catechu* Willd

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ABSTRACT: Bruchids are seed borers and attack on wild leguminous hosts in field and the edible legumes in stores. All the known beetles of family Bruchidae feed on seeds of 34 families of kingdom Plantae and about 80% of them feed on the seeds belonging to family Fabaceae. Bruchids attacking green pods of wild legumes are usually univoltine, has specific but long developmental period and life span. These are generally referred as field bruchids. Field studies on the biology of *Bruchidius albizziae* Arora (Coleoptera: Bruchidae) on the pods of *Acacia catechu* Willd revealed that the heavy seed infestation occurred from early March to second week of April, 2014. The study on biology of *B. albizziae* on seed pods indicated 7.0±1.49 days oviposition period, 6.5±1.08 days incubation period, larval period 39.7±2.33 days while pupal period was 6.4±1.17 days. The adult longevity for male was 10.9 ± 1.66 days where as for female 12.7 ± 2.49 days. The total developmental period was 48.2 ± 4.15 days. Along with the emergence of adult bruchids, a larval parasitoid, *Entedon albiziarum* Rasplus (Hymenoptera: Eulophidae: Entedontinae) has also been recorded. This bio-controlling agent plays an important role in the suppression of pest population in the field.

Keywords: *Bruchidius albizziae;* biology; biocontrol; fecundity; longevity and seasonal abundance.

INTRODUCTION: *A. catechu* (L.F.) Willd is a deciduous tree with a feathery crown and dark brown glabaous, slender, thorny, shining branch lets, usually crooked. *A. catechu* is widely distributed throughout the greater part of India except the most humid, cold and the driest region. It is common in the sub-Himalayan tract and outer Himalayas ascending from 350 to 1600 meter above mean sea level from Jammu and Kashmir to Assam. *A. catechu* is the most economically important plant due to its medicinal and other important values. Most important product obtained from *A. catechu* is katha which is regarded as astringent, cooling and digestive and is useful in sore throat, cough and diarrhoea. Other products are timber, poles, pulp, paper, fuel and as fodder etc. About 63,000 tonnes of *A. catechu* is annually consumed for the manufacturing of cutch and catechu in India (Singh and Lal, 2006) [12]. Order Coleoptera of class Insecta has the largest number of described species worldwide. Family Bruchidae of order Coleoptera is a small but economically important. Bruchids are small sized mostly dimorphic insects but most of them are injurious pests of green pods, ripe pods and stored seeds of family Leguminousae. Under the present investigation *B. albizziae* has been found infesting the seeds of *A. catechu* in different regions of Himachal Pradesh. *B. albizziae* is one of the most destructive and cosmopolitan pests of field legume. It not only causes qualitative and quantitative losses but also reduce germination ability of seeds. Due to infestation, seeds undergo biochemical alterations which results in the loss of various constituents of the seeds. The bruchid completes its entire immature life in individual legume seeds, where they cause reduced germination potential, weight loss, seed infestation and thus diminish the natural propagation of the economically important plant. A larval parasitoid, *E. albiziarum* has also been found in the developing 2nd and 3rd larvae of *B. albizziae*. This bio-controlling agent plays an important role in the suppression of pest population in the field. Earlier, the taxonomic study of *B. albizziae* has been studied by renowned taxonomist Arora, 1977 [1] and it is essential to control this pest at right stage of its infestation. Hence, a study has been carried out to understand the biology of *B. albizziae* on *A. Catechu.*

MATERIALS AND METHODS:

Collection of pods: Pods of *Acacia catechu* (Fabaceae), were collected from different districts of Himachal Pradesh viz. Bilaspur (Ghumarwin), Hamirpur (Kathulag), Kangra (Nurpur), Solan (Bhrarighat), Una (Bhera) and adjoining areas of Himachal Pradesh with other states. Biology of *Bruchidius albizziae* was carried in the field under natural conditions of environment. Bunches of green pods of *A. catechu* were covered with muslin cloth to record the developmental period of insect pest in the field. The seed pods containing the eggs were collected and developmental stages have been observed to assess the biology of *B. albizziae.* Collected pods were kept in Petridishes (90 mm diameter, Tarson or 105 mm diameter, Borosil) and wire mesh cages of 12×8×10cm³ to study the emergence of adult bruchids.

Observations: About 50 samples of infested pods have been taken for recording incubation period, larval and pupal periods. After hatching, larva bore into the seed making egg shell empty and passed its larval and pupal stages inside the seeds only. Observations on total developmental period, longevity of males and females, mating and oviposition period were worked out on 50 infested pod samples. For hatchability and sex ratio (female: male) 50 eggs and 50 adults have been observed respectively. Fecundity of females has been observed by exposing 100 green mature pods of *A. catechu*.

Illustrations: Illustrations were drawn with the help of graph eyepiece fitted in stereoscopic binocular microscope. Photographs of insect and pods both in field and laboratory were taken with help of Nikon D-80 and Leica DFC 295 stereo zoom binocular microscope.

RESULTS AND DISCUSSION: During the studies on various aspects of biology of *B. albizziae* under field condition, the duration of different stages recorded and described below. The study on biology of *B. albizziae* was carried out on seed pods of *A. catechu* in natural condition during March, 2014 to May, 2014. The average field temperature was 25.16 ± 1° C to 30.16 ± 1° C, while the relative humidity was 15.97 ± 2 to 20.23 ± 2 percent during the study period and the duration of different stages were recorded (Table 1) and discussed below:

Incubation period and hatchability: In the present study incubation period of *B. albizziae* varied from 4 to 9 days with an average oviposition period of 6.7±1.88 days in the seeds of *A. catechu*. This result is in accordance with the findings obtained by Vyas (2004) [16] and Raina (1970) [5] who observed the incubation period of *C. chinensis* as 3.98 and 3.50 days, respectively. Singal and Borah (2001) [10] also observed the mean incubation period of 6.8±0.13 days in *C. chinensis*.

In the present study the hatchability of eggs of *B. albizziae* was 73.65 % in the seeds of *A. catechu*. This result is in close association with the findings of Pokharkar and Mehta (2011) [4] and Raina (1970) [5] also reported the hatchability of *C. chinensis* as 92.00% and 94.00% respectively; these are more or less similar with present findings.

Larval period: In the present study the larval period varied from 30-40 days and the mean duration of larval stage was 39.40 ± 4.06 days in the seeds of *A. catechu*. This result is in close accordance with the findings obtained by Moreno *et al.* (2000) [3] and Venkate gowda (1984) [14] also reported the larval period of *C. chinensis* as 31.84 and 32.80 days, respectively, these are more or less similar with present findings. Development of first, second, third and fourth instars was completed in an average of 9.0±1.82, 10.5±2.01, 10.9±2.23 and 10.7±1.33 days respectively. Prior to pupation, the final instar excavated a perfectly circular 'emergence window' which was forced to open by emerging adults. Almost all seeds and pods of *A. catechu* were infested by larvae of *B. albizziae.*

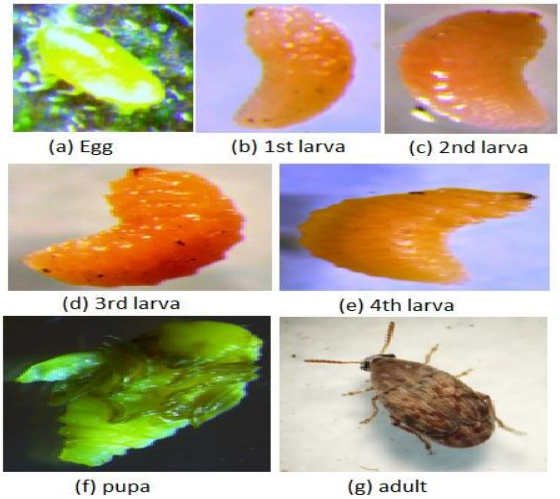

Figure 1: Different developmental stages (egg-adult) of *B. albizziae* on the seeds of *A. catechu*.

Pupal period: In the present study the pupal period ranged from 5-8 days with an average of 6.4 ± 1.17 days in the seeds of *A. catechu*. Ramesh (1993) [6] and Siddaraju (1994) [14] also recorded the pupal period of *C. chinensis* as 7.40 and 8.68 days, respectively, these are more or less similar with present findings.

Total Development period: In the present investigations, it has been observed that life cycle was completed in 48.2±4.15 days under natural conditions of temperature and relative humidity. According to Shoba and Olckers (2010) [8] in *A. macrophthalmus*, the egg to adult emergence lasted 27-59 days at 28°C. According to Singal and Borah (2001) [10] total developmental period of *C. chinensis* was 30.4±0.62 days. Similarly, Effowe *et al.* (2010) [2] studied the reproductive capacities and development of seed beetle *A. macrophthalmus.*

Oviposition period: Minimum oviposition period lasted for 4 days and maximum for 9 days with an average oviposition period of 6.7±1.88 days. Similarly, oviposition period of 4.8±0.25 days has been recorded in *C. chinensis* (Singal and Borah, 2001) [10]. Vyas (2004) [16] and Verma and Anandhi (2010) [15] also reported the oviposition period of *C. chinensis* as 7.88, 8.00 days, respectively; it is more or less similar with present findings.

Table 1: Biology of a field bruchid, *B. albizziae* on *A. catechu.*

Stage	Number of pod sample observed	Duration in days (Average ± S.D.)
Oviposition period	40	6.7±1.88
Incubation period	35	6.5±1.08
Larval period	30	39.40 ± 4.06
Pupal period	20	6.4±1.17
Total developmental period	24	48.2±4.15
Adult longevity (Male)	20	10.9±2.49
Adult longevity (Female)	20	12.7±1.66
Fecundity	30	6.7±1.88

Figure 2: (a) & (b) Showing seed damage of *A. catech* by larva of *B. albizziae.*

Adult longevity: Longevity of adult female was longer than male. Average longevity of adult male and female was 10.9±1.66 and 12.7±2.49 days respectively. This result is in strong accordance with the findings obtained by Venkategowda (1984) [14], Moreno *et al.* (2000) [3] and Sharma *et al.* (2016) [7] also reported the life span (female) of *C. chinensis* as 9.89, 11.45 and 12.00 days, respectively; it is more or less similar with present findings.

Fecundity: A single female produced an average of 24.6±5.54 offspring, consisting of 13.8±3.48 females and 10.7±2.45 males of the total number of eggs laid. It has been observed that in the total numbers of egg laid by a female, the number of adult females emerged were more as compared to the adult male with the total emergence rate of 73.65%. This result is more or less similar accordance with the findings obtained by Solanki and Mittal (2018) [13], Vyas (2004) [16] and Pokharkar and Mehta (2011) [4] who stated fecundity as 85.60, 80.60 and 77.80 eggs per female respectively.

Sex ratio: The result showed that chickpea produced more females as compared to males, resulted in 1:0.77. This result is in close proximity with the findings of Pokharkar and Mehta (2011) [4] who stated sex ratio as 1:0.96. Raina (1970) [5] and Siddaraju (1994) [9] also reported the sex ratio of *C. chinensis* as 1:1.16 and1:1.16, respectively; it is more or less similar with present findings.

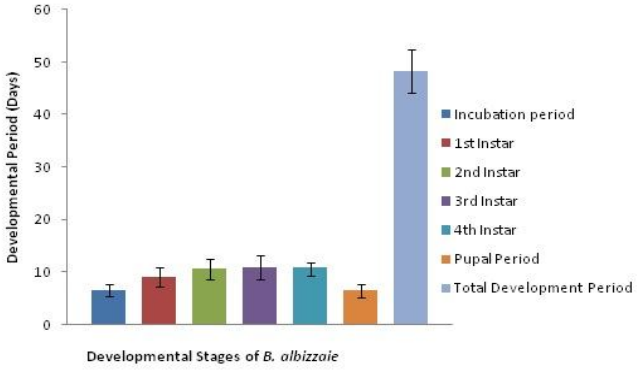

Figure 3: Histogram showing life cycle of *B. albbizziae.*

CONCLUSION: The study of biology provides information that *B. albizziae* is a multivoltine species and lays eggs on the green mature pods of *Acacia catechu.* There was no sexual dimorphism among adult bruchids and male generally mates once in their life cycle. Egg laying starts in the month of September-November. Eggs were laid singly on the outgrowth of the seed in the pod and one egg deposited and manipulated in about 25 – 35 seconds. First instar larva penetrate into the seed and start eating the cotyledons and embryo of seeds. Whole seed is damaged or consumed by the larval stages of the pest and made unfit for propagation of the plant (Figure 2). Little emergence of adults may occurs before winters during the month of October but maximum emergence of adults starts after winter generally during month of

March and April next year. Adults make a circular hole in the pod wall after completing the life cycle. The study reveals that developmental period of the egg to adult was around more than a month and less than two month. During optimum period of growth the total developmental period is more than a month thus causing huge damage to seeds. During unfavourable conditions depending on temperature and humidity duration of developmental period may increase or decrease. Biological studies of *B. albizziae* have been explored for the first time and a detailed life stages and their developmental duration have been recorded. The present investigation reveals the rate of infestation of seeds and pods of *A. catechu* by the bruchid that causing a major threat to this medicinally important plant throughout the state of Himachal Pradesh and adjoining areas. It has been unveiled from the present study that *B. albizziae* is a serious pest of *A. catechu* responsible for destroying the large number of seeds in fields. During the biological studies, A hymenoptern parasitiod, *Entedon albiziarum* has been found attacking the larvae of *B. albizziae*. Genus *Entedon* plays an important role in biological control of the pest. It is one of the natural enemies of bruchid pests in the field. More work on the biology and morphology of the parasitoid will be useful because the species is considered important from the biological control point of view.

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