FIELD INFESTATION OF *CARYEDON SERRATUS* OLIVIER [COLEOPTERA: BRUCHIDAE] ON THE PODS AND SEEDS OF *ACACIA NILOTICA* IN THE THAR DESERT OF INDIA

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VIR, S. & JINDAL, S.K. 1996. Field infestation of *Caryedon serratus* Olivier (Coleoptera: Bruchidae) on the pods and seeds of *Acacia nilotica* in the Thar desert of India. *Caryedon serratus* Olivier has been recorded as a serious pest on pods and seeds of *Acacia nilotica* in the Thar desert of India. Pest infestation on developing pods and its relationship with morphological traits is reported. Bruchid infestation was recorded in April and the insect continued to multiply in the field as the pods remained on the tree when ripe. Infestation of pods varied from 10 to 30 % with 1.2 to 1.8 % infestation of seeds. Insect infestation resulted in a loss of 22.51% in seed weight and 1.18% loss in seed biomass of the tree. Infestation of pods was directly related to infestation of seed ($r = 0.81^{**}$). Infestation of seed was directly correlated with loss in seed weight ($r = 0.83^{**}$) and loss in seed biomass from the tree ($r = 0.76^{*}$). The insect remained in the field during the hottest months of May and June and was also reported to infest pods and seeds of *Prosopis cineraria* and *P. juliflora*. These trees thus act as the secondary host, for population buildup of *C. serratus*, from where it spreads to its primary host, the groundnut, *Arachis hypogea*, which is becoming a common crop of this region with the introduction of the Indira Gandhi Canal in the Thar desert.

Key words: *Caryedon serratus* - *Acacia nilotica* - pod and seed infestation - quantitative losses

VIR, S. & JINDAL, S.K. 1996. Serangan lapangan *Caryedon serratus* Olivier (Coleoptera: Bruchidae) ke atas lenggai dan biji benih *Acacia nilotica* di padang pasir Thar, India. *Caryedon serratus* Olivier telah direkodkan sebagai serangan perosak yang serius ke atas lenggai dan biji benih *Acacia nilotica* di padang pasir Thar, India. Serangan serangga ke atas lenggai yang sedang membesar dan kaitannya dengan sifat-sifat morfologinya telah dilaporkan. Serangan bruchid telah direkodkan pada bulan April dan serangga ini terus bertambah di lapangan sementara lenggai terus berada pada pokok apabila masak. Serangan ke atas lenggai berkisar antara 10 hingga 30% dengan 1.2 hingga 1.8 serangan ke atas biji benih. Serangan serangga menyebabkan kehilangan berat biji benih sebanyak 22 - 51% dan kehilangan biojisim biji benih pokok tersebut sebanyak 1.18%. Serangan ke atas lenggai berkaitan secara langsung dengan serangan ke atas biji benih ($r = 0.81^{**}$). Serangan biji benih ($r = 0.83^{**}$) dan kehilangan biojisim biji benih daripada pokok ($r = 0.76^{*}$). Serangga terus berada di lapangan pada musim-musim paling panas pada bulan Mei dan Jun. Ia dilaporkan juga menyerang lenggai dan biji benih *Prosopis cineraria* dan *P. juliflora*. Pokok-pokok ini bertindak sebagai perumah sekunder, bagi perkembangan populasi *C. serratus* dari mana ia tersebar

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kepada perumah utama, iaitu kacang tanah, *Arachis hypogea*, yang merupakan tanaman utama di rantau ini dengan pembinaan Terusan Indira Gandhi di gurun Thar.

Introduction

Acacia nilotica (L.) Willd. is a fast growing, evergreen, spiny tree growing on a wide variety of soils in the Thar desert of India. It has also become a popular and promising tree species for reclamation of dry wastelands under afforestation programmes. During regular surveys of insect pests of leguminous trees of the Thar desert, *Caryedon serratus* Olivier was found to infest the pods and seeds of *A. nilotica* during the hottest months of April and May. *C. serratus* primarily is a storage pest of unshelled groundnut (*Arachis hypogea*) and imli (*Tamarindus indica*) and has also been reported on the seeds of *Bauhimia* spp., *Cassia* spp. and *Acacia tortilis* (Prevett 1967, Decelle 1969, Arora 1977). This insect has also been reported as a field pest on fruits of *Prosopis cineraria* and *P. juliflora* in the Thar desert (Vir & Jindal 1993). No information, however, is available on the field status of this pest on *A. nilotica*, degree of pod and seed infestation, quantitative losses and its transmission to stored seeds. These are reported in this paper.

Materials and methods

Experimental material comprised 20 vigorous trees from different locations at the Central Research Farm, Jodhpur, India. One hundred pods from the canopy of each selected tree were collected from January for five months at monthly intervals in 1993 and 1994. *Caryedon serratus* in the field was recorded by examining exit holes on the pod walls. However, under laboratory conditions the adults emerged directly from the cocoons. Data on all selected trees for pod length, number of seeds per pod, and infestation of pods and seeds were taken. From each tree ten pods were taken randomly for measurement of pod length and number of seeds per pod. Mean, coefficient of variation and correlation coefficient were calculated following Snedecor and Cochran (1967),

$$\text{Mean } \bar{X} = \frac{\sum^{n} x}{n}$$

$$\text{Coefficient of variation } CV = \frac{\sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n\text{-}1}}}{\bar{x}}$$

$$\text{Correlation coefficient } r = \frac{\sum^{n} XY - \left(\dfrac{\sum^{n} X \sum^{n} Y}{n}\right)}{\sqrt{\sum^{n} X^2 - \dfrac{(\sum X)^2}{n}} \times \sqrt{\sum^{n} Y^2 - \dfrac{(\sum Y)^2}{n}}}$$

where X : Variable 1
Y : Variable 2
n : number of observations

Loss in seed biomass was calculated following Vir and Jindal (1994)

$$\text{Loss in seed biomass} = \frac{W_1 - W_2}{n} \times \frac{Z}{W_1} \times 100$$

where W_1 is the weight of n healthy seeds, W_2 is the weight of n infested seeds, Z is the percentage of infested seeds per tree and n is a constant.

The said equation was simplified as

$$\text{Loss in seed biomass} = Z \left(1 - \frac{W_2}{W_1}\right)$$

Both infested and healthy seeds were tested for germination (ISTA 1985) after scarification with concentrated sulphuric acid.

Results and discussion

The means, ranges and coefficients of variation of eight characters of the pods and seeds of *A. nilotica* studied are presented in Table 1. Length of pod varied from 4.84 to 7.80 cm with average of 60.3 seeds per 10 pods. Infestation of pods ranged from 10 to 30 % and infestation of seeds varied between 1.2 and 8.3 %. Average weight of infested seeds was 6.56 g per 100 seeds as compared to 8.46 g of 100 healthy seeds. Loss in seed weight varied from 16.3 to 31.5 % with overall loss of 0.19 to 2.37 % seed biomass of the tree.

Table 1. Means ranges and coefficients of variation of eight characters of the pods and seeds of *A. nilotica*

Character	No. of trees examined	Mean	S.D.	Range	Coefficient of variation (C.V.) (%)
Average pod length (cm)	20	6.53	0.89	4.84 - 7.80	13.64
Seeds/10 pods	20	60.3	4.42	54 - 67	7.34
Infestation of pods (%)	20	19.5	7.24	10 - 30	37.16
Infestation of seeds (%)	20	4.71	2.23	1.2 - 8.3	47.45
Wt. of 100 infested seeds (g)	20	6.56	1.03	5.35 - 8.32	15.76
Wt. of 100 healthy seeds (g)	20	8.46	0.96	6.75 - 10.22	11.43
Loss in seed weight (%)	20	22.51	6.65	16.33 - 31.56	29.57
Loss in seed biomass (%)	20	1.18	0.75	0.19 - 2.37	63.29

The coefficient of variation (CV) was highest for loss in seed biomass followed by infestation of seeds, infestation of pods and loss in seed weight indicating maximum variability in these characters due to bruchid attack. The coefficient of variation was less than 20 % for pod length, number of seeds per pod and weight of healthy seeds which support the data for interaction of samples and time of sample collection at uniform intervals. Similar results have previously been reported on bruchid infestation in *Acacia tortilis* and *Albizia lebbek* (Vir & Jindal 1994, Vir *et al.* 1994).

The coefficients of correlation between different characters studied are given in Table 2. Pod length was directly related to the number of seeds per pod ($r = 0.69$, $p < 0.05$, $n = 10$). Infestation of pods was directly related to infestation of seeds ($r = 0.81$, $p < 0.01$, $n = 10$) and infestation of seeds was directly related to weight of infested seeds ($r = 0.65$, $p < 0.05$, $n = 10$), loss in seed weight ($r = 0.83$, $p < 0.01$, $n = 10$) and loss in seed biomass of the tree ($r = 0.76$, $p < 0.05$, $n = 10$). The study thus revealed that loss in seed weight and seed biomass increases with the increase in seed infestation of the tree. Loss in seed biomass of tree also increases with the increase in loss of seed weight ($r = 0.76$, $p < 0.05$, $n = 10$). Weight of infested seeds is directly related to weight of healthy seeds ($r = 0.85$, $p < 0.01$, $n = 10$) and loss in seed weight ($r = 0.66$, $p < 0.05$, $n = 10$).

Table 2. Correlation matrix of eight characters of *A. nilotica*

Character	1	2	3	4	5	6	7	8
Average pod length	-	0.69*	0.13	0.23	0.47	0.59	- 0.03	- 0.06
Seeds/10 pods			0.23	0.54	0.68*	0.82**	- 0.12	0.10
Infestation of pods				0.81**	0.07	0.23	0.23	0.63*
Infestation of seeds					0.65*	0.55	0.83**	0.76*
Wt. of 100 infested seeds						0.85**	0.66*	- 0.26
Wt. of 100 healthy seeds							- 0.18	0.18
Loss in seed weight								0.76*
Loss in seed biomass								-

* $p < 0.05$, ** $p < 0.01$.

The observations recorded from pod setting to pod maturation (Table 3) reveal that infestation of pods starts from the month of March and the insects multiply faster with the maturation of pods in the field. Infestation of pods and seeds increases with time. Normally a single opening for escape of the beetle was recorded. The insect was found to multiply fast on the seeds stored for laboratory studies. The infested seeds did not germinate at all as the embryo and a part of endosperm were eaten away. In the case of non-infested seeds a germination of 68 % of seeds was recorded.

Table 3. Infestation (%) of pods and seeds of *A. nilotica* with *C. serratus* in different months

		January	February	March	April	May
1993						
	Pods	-	-	5.8	17.0	20.5
	Seeds	-	-	1.2	2.4	4.9
1994						
	Pods	-	-	6.2	13.5	18.5
	Seeds	-	-	1.8	2.7	4.5

These observations thus indicate that the field infestation of pods and seeds of *A. nilotica* and also of *Prosopis* spp. will provide potential hosts for multiplication and carry-over of population of *C. serratus* both in the field and store. Since the area under groundnut cultivation is increasing day by day with the introduction of the Indira Gandhi Canal in the Thar desert, *C. serratus* will pose a serious threat to it. Owing to the difficulties involved in the application of insecticidal spray to these large trees, detailed studies on the mode of infestation, biology, life history, natural enemies and ecology of seed bruchids are underway at CAZRI, Jodhpur, India to develop effective and economic control measures.

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References

ARORA, G.L. 1977. Taxonomy of the Bruchidae (Coleoptera) of northwest India. Part 1. Adults. *Oriental Insects Supplement* 7 : 1 - 132.

DECELLE, J. 1969. *Le Parc National du Nikolo-Koba (Senegal Fascicula III XVII, Coleoptera, Bruchidae* IFAN-DAKAR.

ISTA 1985. International rules for seed testing. Rules annexes. International Seed Testing Association. *Seed Science and Technology* 13 : 299 - 355.

PREVETT, P.F. 1967. Note on the biology, food plants and distribution of Nigerian Bruchidae (Coleoptera) with particular reference to the Northern Region. *Bulletin of Entomology Society* 1: 3 - 6. Nigeria.

SNEDECOR, G.W. & COCHRAN, W.G. 1967. *Statistical Methods.* The Iowa State University Press, Ames, Iowa; Oxford & IBH Publishing Co., New Delhi. 593 pp.

VIR, S. & JINDAL, S.K. 1993. Studies on pod and seed infestation of *Prosopis juliflora* with *Caryedon serratus* Olivier in the Thar desert of India. Paper presented at the Workshop on "Potential of *Prosopis* spp. in Arid and Semi-Arid Region of India", Central Arid Zone Research Institute, Jodhpur, 21-23 Nov. 1993.

VIR, S. & JINDAL, S.K. 1994. Fruit infestation of *Acacia tortilis* (Forsk) Hyne by *Bruchidius andrewesi* Pic (Coleoptera : Bruchidae) in the Thar desert. *Forest Ecology and Management* 70 : 349 - 352.

VIR, S., PARIHAR, D.R. & JINDAL, S.K. 1994. Studies on *Bruchus bilineatopygus* Pic (Bruchidae) infestation on pod/seeds of *Albizia lebbek* (L.) Benth in the Thar desert of India. *Journal of Tropical Forestry* 10(1) : 78 - 81.