SOME OBSERVATIONS ON NATURAL ENEMIES OF POPLAR BORERS IN PAKISTAN

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ABSTRACT

Three Braconids and one Eulophid parasitizing poplar bark borer, *Indarbela quadrinotata* (Pseuderbelidae, Lepidopteral) larvae and pupae, were recorded. *Aeolesthes sarta* (Cerambycidae, Coleoptera) grubs were found predated by a mite predator. Entomopathogenic fungus attacking all stages of *I. quadrinotata* and Elaterid predator of *A. sarta*, pith borer *Apriona cinerea* (Lamiidae, Coleoptera) were recorded.

Observations on the biology of Elaterid predator of *A. sarta* and *A. cinerea* in the laboratory showed that a predator larvae consumed 2 host grubs of 1-2 months age in 4 days. On an average single predatory larvae killed 61 and consumed 24 host grubs in 14 months of its

predatory larval life. Due to predation by mites on *A. cinerea* a mortality of 8-18% was recorded.

Predation by formicids on larvae of *I. quadrinotata* was studied at Islamabad and 8 to 35% larval galleries were observed to contain formacids. The maximum predation occurred in the month of December.

Natural enemies comprising of predators and macro and micro parasites have a considerable importance as biocontrol agents for combating pests. They are most effective in suppressing the pest populations and are the safest instruments for dealing with pest invasions.

Bacilus thuringiensis a disease causing bacterium extracted from various lepidopterous pests, has been developed into commercial microbial insecticides.

Many worker such as Smirnoff (1963), Sider, (1965), Mihalache et al (1972), Podgwaite and Cambell (1972), Jaque (1972), Yendal et al (1973) and Arru (1975) tried *Bacilus thuringiensis* in the form of Thuricide, Entobacterin, Dendrobacillus and Dipel against different forest defoliators with good results.

Smirnoff et al (1972) tried *B. thuringiensis* and Chitinase against spruce budworm on small scale in 1972 and as aerial spray on large scale in 1974 with considerable success. Mihalache et al (1972) found Dipel very effective against *lymantria dispar, Malacosma anectri* and *Tertix viridama.* Insect Pathogenic bacterium *B. popillae* developed to control successfully infestation of Japanese beetles in U.S.A. in 1942. The bacterium *B. thuringiensis* on a wide range of lepidopterous caterpillars formed basis for development of commercial insecticides.

The potential use of nematodes as natural regulators of insect populations has been discussed by Glasser and Wilcox as early as 1918. Zwalurvenburg (1928) and La Rivers (1949) presented early lists of nematodes insect associations. Theodorides (1950) cited over 100 species and sub-species of nematode associated with insects in France. Ruhm (1956) listed a similar number of nematodes associated with Scolytide in Germany. Masey (160) recorded several nematods parasites considerably reducing reproductive potential of bark beetles by causing sterility and in some cases killing the host. Couturier (1963) described two species of mermithids parasitic in common chafer, *Melolontha melolontha.* Artyukhovskii (1955) described nematode association with forest Lepidoptera in Voronezhskoblest.

Poplars are among the fast growing species introduced for high wood yield but unfortunately they are subjected to the attack of defoliators and borers. The control of defoliators is easily possible with the use of chemical insecticides but the borers being concealed feeders pose a great threat to poplar culture. Studies on natural enemies of different borers were carried out with a view to control poplar borers safely and economically as no work on the bio-control of poplar borers and their natural enemies has been carried out in Pakistan.

MATERIALS AND METHOD

Poplar growing areas were surveyed and collection of infested wood pieces of poplars containing various stages of *Aeolesthes sarta* Solosky, *A. cinerea* Chev. *Melanophila picta* Pall. *I. quadrinotata* walk and *Aegeria* sp. was made from Peshawar, Parachinar, Islamabad and Mingora at different times of the year to recover parasites, predators.

Results and Discussion

Natural enemies recorded from the field collected borers in the laboratory are:

Natural enemies of Poplar Borers

Name	Family/Group	Host/Stage Insect	Locality
a. Alaus sp.	Elaterid	*A.sarta grubs*	Peshawar
		A.cinerea grubs	Mingora
b. Proctolaelops sp.	Acarina	*A.cinerea grubs*	Parachinar and
		A.sarta grubs	Mingora
c. Tapinoma sp.	Formacids	*A.cinerea eggs and grubs*	Mingora and
		I. quadrinotata larvae	Islamabad
d.Apanteles sp	Braconidae	*M.picta grubs*	Islamabad
	Hymenoptera	*M.picta grubs*	Islamabad
	Braconid	*Aegerial sp larvae.*	Parachinar
	Braconid	*I.quadrinotata larvae*	
	Eulophid	*-do-*	Islamabad
			Islamabad
e.Beauveria bassiana	Fungus	*M.picta adults pupae and*	Islamabad
	Fungus	*larvae*	Parachinar
		A.cineria grubs	
f.B.bassiana		*I. quadrinotata larvae*	Islamabad
g.Neoaplictana sp.	Parasitic Nematode	*A.cinerea grubs*	Swat

The larvae of elaterid predator *Alaus* sp. collected from field were reared in the laboratory on grubs of *A. cinerea* released in the artificially made galleries in poplar billets. The predator larvae consumed 2 host grubs of 1-2 months age in 4 days. In case of full grown host grubs the predator larvae did not consume the whole body of host larvae and lived don the host for a period of 25 days without fresh food. However the full grown host larvae was attacked by the predator immediately after release and killed within 2 to 6 hours. Observations were recorded on mortality of host larvae and complete consumption by the predator in the laboratory. The data on food consumption by 3 predator larvae are as follows:

Consumption of *A. cinerea grubs* by 3 *Alaus* sp. grubs in 14 months in the laboratory

No. of host grubs

Month	Provided	Killed	Consumed	Percentage Mortality	Consumption
March,1979	15	10	4	66	27
April	12	8	6	66	50
May	18	12	5	66	28
June	25	20	4	80	16
July	16	13	5	81	31
August	11	8	6	72	54
September	16	8	5	50	31
October	15	9	6	60	40
November	15	15	4	100	26
December	15	15	6	100	40
January, 1980	18	15	4	83	22
February	20	12	6	60	30
March	20	20	5	100	25
April	21	18	6	86	29
Total	237	183	72	1070	

It may be noted that in 14 months 3 predator larvae killed 183 *A. cinerea* grubs out of 237 grubs released but only 72 host grubs were consumed completely. On average a single predator larvae killed 61 and consumed 24 grubs in 14 months from March, 1979 to April, 1980.

Studying the habits it was observed that predator, did not come out of their galleries so long as a part of host body is present in the gallery. Pupation occurred from 15th to 20th June, and adults emerged on 20th, 25th, 30th July and 12th and 15th August. Out of 9 predator grubs reared in the laboratory 8 successfully pupated and 5 adults emerged. The adults however died within 10 to 18 days of emergence without laying eggs.

Mites:

Proctolaellaps sp. (Family laelaptidae,

Acarina) observations on the extent of predation by mites *Proctolaelaps* sp. on *A. cinerea* larvae was recorded at Mingora and Parachinar. The data collected are as follows:

Incidence of mite predation on *A. cinerea* at Mingora and Parachinar

Period	Mingora			Parachinar		
	A. cinerea grubs					
	Examined	Attacked	% predation	Examined	Attacked	% predation
March	109	12	11	82	8	10
September	81	9	11	98	9	9
October	87	13	15	93	19	20
December	104	19	18	101	8	8

The extent of predation by mites at both the places was almost equal as it was 11 to 18% at Mingora and 8-20% at Parachinar.

Braconids

Species of braconid Apanteles sp. *Iphiaulax* sp. were recorded attacking larvae and pupae of *I. quadrinotata* and *M. picta* at Islamabad. The extent of parasitism by these braconids was recorded in the months of March, April, June and December. The data collected are:

Extent of parasitism by braconids on *M. picta* and *I. quadrinotata* at Islamabad

Period	No. Examined		No. Parasitised		Percentage Parasitism	
	Larvae	Pupae	Larvae	Pupae	Larvae	Pupae
Melanophila picta						
March	10	8	1	1	10	13
April	5	15	-	2	-	13
June	36	-	1	-	3	-
December	27	-	1	-	4	-
I. quadrinotata						
March	52	-	1	-	2	-
April	38	-	1	-	3	-
June	-	42	-	1	-	2
December	112	-	4	-	4	-

It was found that upto 10% larvae and 13% pupae of *M. picta* were parasitised by braconids. In case of *I. quadrinotata* the extent of parasitism varied from 2- 4% larvae/pupae. The braconid adults emerged in the laboratory and died within 8 to 10 days without laying eggs.

Two species of formacids *Tainoma* sp. and *Crematogaster* sp. were found as predators of *I. quadrinotata*. In order to find out the extent of predation by formacids 100 galleries of the borer were examined monthly at Islamabad. The number of galleries containing formacid and healthy larvae was ascertained in each observation:

Field observation on percentage predation of *I. quadrinotata larvae* by formicids at Rawalpindi

Period	Galleries with			
	Host	Healthy larvae	Formacids	Empty galleries
March	*P. x.euramericana*	18	8	74
	Terminalis arjuna	19	10	71
April	*P. x.euramericana*	22	11	67
	T. arjuna	18	9	73
August	*P. x.euramericana*	52	7	41
	T. arjuna	40	20	40
Sept.	*P. x. euramericana*	30	21	49
	T. arjuna	22	25	53
October	*P. x. euramericana*	23	17	60
	T. arjuna	20	23	57
Nov.	*P. x. euramericana*	18	19	63
	T. arjuna	17	27	56
December	*P. x. euramericana*	20	25	55
	T. arjuna	18	35	47

The predation of *I. quadrinotata* by formacids was found in 7 - 35% galleries at Rawalpindi through out the year. The predation increased in the later part of the year, maximum of 35% being in December.

Beauveria bassiana

The incidence of this pathogenic organism causing mortality of *I. quadrinotata* larvae was studied at Rawalpindi. Observation on 100 galleries each of *P. x. euramericana* and *T. arjuna* were examined monthly to determine the extent of disease and mortality of larvae cause by *B. bassiana*. The data are tabulated below:

Incidence of *B. bassiana* on *I. quadrinotata* in 100 galleries at Rawalpindi

Period	Host plant	No. of galleries				
		Health	Diseased	Dead	Empty	% infection
March	*P. x. euramericana*	18	5	25	52	30
	T. arjuna	19	6	28	47	34
April	*P. x. euramericana*	22	8	24	46	32
	T. arjuna	18	10	25	47	35
August	*P. x. euramericana*	52	2	9	37	11
	T. arjuna	40	4	12	44	16
Sept.	*P. x. euramericana*	30	6	16	48	22
	T. arjuna	22	8	18	52	26
October	*P. x. euramericana*	23	10	11	49	28
	T. arjuna	20	8	21	51	29
November	*P. x. euramericana*	18	11	22	49	33
	T. arjuna	17	6	25	57	31
December	*P. x. euramerciana*	20	4	20	56	24
	T. arjuna	18	4	21	57	25

It was noticed that 11 to 33% larval galleries of *I. quadrinotata* in *P. x. euramericana* and 16 to 35% larval galleries in *I. arjuna* contained dead and diseased larvae due to *B. bassiana* infection in at Rawalpindi/Islamabad area. The fungus attack was severer in case of full grown caterpillars as compared to younger stages. The fungal infection was recorded to be more in

Rawalpindi due to humid conditions and was much less at Faisalabad because of drier climate.

Incidence of Neoaplactana on *Apriona cinerea* in Swat

Year	No.of grubs studied	Infected grubs	Percentage Infection
1979	115	2	1.74
1980	81	1	1.23
1981	400	1	0.25

As seen from the table the natural incidence of Neoaplactana on the borer grub was very low as only 0.25 to 1.74% borer population was infected during the year 1979-1981.

CONCLUSION

Study of natural enemies has showed that biocontrol agents other than formicids and fungus not playing an effective part individually but are doing quite a bit collectively to suppress borer population.

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