

Population Dynamics of Chrysomelid Beetle, *Zygogramma bicolorata* Ballister and Its Role in Management of Congress Grass, *Parthenium hysterophorus* L.

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SUMMARY

For management of Parthenium weed a study was undertaken to know the population dynamics of *Zygogramma* and its role in management of congress grass. The highest number of *Zygogramma bicolorata* were observed in month of May and August in year 2005 and 2006. Temperature, relative humidity and rainfall showed significant positive, whereas maximum temperature showed significant negative influence on grub and adult activity of this insect. Biocontrol efficacy of this predator was tested with ten treatments in caged pots which comprised of release of 1 adult/plant (T_1), 2 adult/plant (T_2), 3 adult/plant (T_3), 4 adult/plant (T_4), 5 adult/plant (T_5), 6 adult/plant (T_6), 7 adult/plant (T_7), 8 adult/plant (T_8) and 9 adult/plant (T_9) and 0 adult/plant i.e control (T_{10}). The studies indicated that the release of *Zygogramma* 9 adult/plant (T_9) effectively reduced the no. of leaves (2.66), number of flowers (85.5) and plant height (39.36 cm) after 15 days of release of *Zygogramma bicolorata* and plant showed, bushy appearance and stunted growth.

Key words :

Zygogramma bicolorata,
Congress grass,
Parthenium hysterophorus,
Management.

Parthenium hysterophorus is commonly known as congress grass, carrot weed or hydra headed grass. It is widely distributed in India. It causes contamination of seed produce and change in total habitat in native vegetation. It also poses a series of human health problems causing fever, skin problem and asthma (Jayanath and Bali, 1993; Jayanath and Bali, 1994 and David, 1998). Use of chemical herbicides has been effective in controlling the weeds, but the excessive use of the chemical lead to various problems like degradation in the fertility of soil, environmental pollution and water contamination. The herbicides are not able to control the weed, so it is essential to manage this weed by bioagents. Keeping this in view, the present study has been undertaken to control the Parthenium weed by its natural enemy.

MATERIALS AND METHODS

Study on population dynamics of *Zygogramma bicolorata* on *Parthenium hysterophorus* weed was undertaken at Students Instructional Farm, C.S. Azad University of Agriculture and Technology, Kanpur during two consecutive years 2005 and 2006. The grub and adult population of *Zygogramma bicolorata* on Parthenium weed was recorded on 2 randomly selected congress grass plants at weekly interval starting from the appearances of *Zygogramma bicolorata* till

October. To study its biocontrol efficacy, the healthy and almost same aged plant of *Parthenium hysterophorus* were selected and caged. Such ten cages were used which comprised and release of 1 adult/plant (T_1), 2 adults/plant (T_2), 3 adults/plant (T_3), 4 adults/plant (T_4), 5 adults/plant (T_5), 6 adults/plant (T_6), 7 adults/plant (T_7), 8 adults/plant (T_8), 9 adults/plant (T_9) and 0 adult/plant i.e. control (T_{10}). The damage caused by grubs and adults were recorded after 8 and 15 days intervals. The biocontrol efficacy of *Zygogramma bicolorata* was defined as the number of leaves, number of flowers and height of the congress grass.

RESULTS AND DISCUSSION

The study carried out on incidence of *Zygogramma bicolorata* on Parthenium (Fig. 1 and 2) revealed that the activity of the insect started from 1st week of March on three week old plant and continued till 2nd week of October during both years viz; 2005 and 2006 (Table 1 and 2). As regard the seasonal abundance of *Zygogramma bicolorata*, it was observed that the adult population gradually increased until it reached the peak in month of May (60 adult/2 plant in 2005 and 105 adult/2 plant in 2006) and thereafter the incidence declined. Further, its maximum population was found in month of August (135 adult/2 plant in 2005 and 80 adult/2 plant in 2006). Correlation with weather

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Table 1: Seasonal abundance of *Zygotogramma bicolorata* Ballister on congress grass, *Parthenium hysterophorus* L. (2005)

Date of observation	Average temperature		Rainfall (mm)	Relative humidity (%)	Chrysomelid beetle/plant
	Maximum	Minimum			
06.03.05	30.00	15.6	0.0	60.1	10.0
13.03.05	29.40	16.8	11.2	68.7	8.0
20.03.05	31.60	16.6	0.0	64.4	11.0
27.03.05	34.40	17.6	0.0	31.0	25.0
03.04.05	37.10	17.8	0.5	39.1	30.0
10.04.05	36.00	19.3	0.0	31.2	28.0
17.04.05	40.10	18.8	0.0	41.8	26.0
24.04.05	38.80	19.2	0.0	47.7	30.0
01.05.05	35.10	24.3	0.0	52.1	42.0
08.05.05	40.10	22.1	7.0	49.4	45.0
15.05.05	42.20	23.1	0.0	36.6	44.0
22.05.05	42.50	24.0	0.0	44.8	20.0
29.05.05	42.10	26.1	0.0	45.3	60.0
05.06.05	41.50	26.7	6.0	39.6	40.0
12.06.05	42.90	27.4	0.0	50.2	45.0
19.06.05	40.50	28.9	14.0	45.7	20.0
03.07.05	35.00	28.7	26.5	52.2	25.0
10.07.05	31.30	26.2	78.5	72.6	60.0
17.07.05	30.50	25.0	196.0	82.1	70.0
24.07.05	31.70	25.3	37.0	88.9	80.0
31.07.05	34.10	25.7	17.0	79.4	90.0
07.08.05	32.70	25.7	1.0	77.8	80.0
14.08.05	33.9	25.8	48.0	69.9	130.0
21.08.05	31.5	26.3	61.6	76.5	120.0
28.08.05	32.4	24.8	0.6	78.3	135.0
04.09.05	33.5	26.2	0.6	66.6	80.0
11.09.05	33.6	25.9	51.8	84.9	65.0
18.09.05	33.8	24.9	79.0	80.6	50.0
25.09.05	30.8	25.0	4.4	79.1	40.0
02.10.05	30.5	24.0	0.4	70.1	25.0
09.10.05	30.0	21.9	15.2	65.9	10.0
16.10.05	28.0	20.4	0.0	68.4	2.0

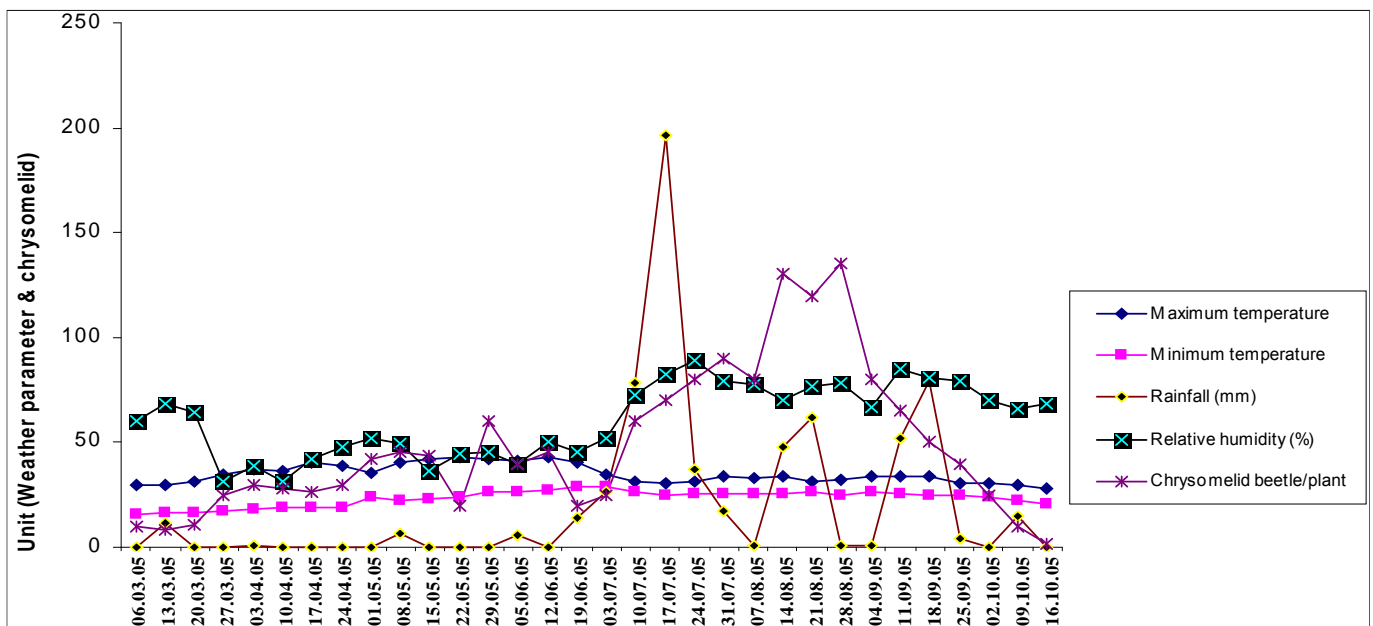


Fig. 1 : Seasonal abundance of *Zygotogramma bicolorata* Ballister on congress grass, *Parthenium hysterophorus* L. (2005)

Table 2: Seasonal abundance of *Zygotogramma bicolorata* Ballister on congress grass, *Parthenium Hysterophorus* L. (2006)

Date of observation	Average temperature		Rainfall (mm)	Relative humidity (%)	Chrysomelid beetle/plant
	Maximum	Minimum			
05.03.06	28.9	15.3	6.0	63.7	7.0
12.03.06	27.9	14.5	9.0	63.8	10.0
19.03.06	32.9	14.9	0.0	47.6	10.0
26.03.06	33.9	15.6	0.0	43.1	15.0
02.04.06	30.5	18.6	0.0	31.6	30.0
09.04.06	38.9	19.8	0.0	35.8	45.0
16.04.06	35.7	20.2	24.5	46.4	60.
23.04.06	39.4	22.9	0.5	44.8	80.0
30.04.06	41.9	24.8	0.0	33.9	90.0
07.05.06	38.7	26.4	14.0	59.1	110.0
15.05.06	36.9	25.9	0.2	56.4	117.0
21.05.06	39.9	26.8	1.4	58.9	100.0
28.05.06	37.8	26.8	30.7	57.6	105.0
04.06.06	38.3	27.0	0.4	57.6	90.0
11.06.06	40.6	28.6	95.9	34.7	85.0
18.06.06	38.5	27.7	107.4	51.4	90.0
25.06.06	33.9	26.3	10.9	78.1	80.0
02.07.06	36.6	28.4	13.0	63.1	75.0
09.07.06	30.9	25.7	0.0	85.2	80.0
16.07.06	32.6	26.4	0.5	81.6	70.0
23.07.06	31.9	26.2	29.2	86.0	65.0
30.07.06	32.1	26.2	15.3	77.4	70.0
06.08.06	32.7	25.7	25.5	73.3	70.0
13.08.06	34.7	27.4	0.0	71.0	75.0
20.08.06	33.3	26.6	4.6	76.5	80.0
27.08.06	31.6	25.2	0.0	79.4	65.0
03.09.06	33.9	25.4	0.0	71.6	60.0
10.09.06	36.1	26.4	0.0	63.2	50.0
17.09.06	34.8	25.0	0.0	68.7	45.0
24.09.06	35.1	22.4	14.0	62.6	40.0
01.10.06	36.4	23.2	22.0	61.5	35.0
08.10.06	36.1	21.8	1.5	51.1	15.0
15.10.06	31.6	19.2	0.0	60.9	5.0

Correlation matrix: Effect of weather parameters on the population of *Zygotogramma bicolorata*

Years	Insect	Observation No.	Av. temperature ($^{\circ}$ C)		Av. Relative humidity (%)	Av. Rainfall (mm)
			Maximum	Minimum		
2005	Chrysomelid beetle	33	- 0.0212	0.6420	0.4527	0.4008
2006	Chrysomelid beetle	33	0.5208	0.8246	0.1289	0.1977

parameter revealed that the population of chrysomelid beetle with temperatures, relative humidity and rainfall, positively but negatively correlated with maximum temperature in 2005 whereas, chrysomelid population with weather parameters was positively correlated in 2006. This finding upheld the view of Bhan *et al.* (1997) who reported its occurrence only during July to September in Jabalpur (M.P.).

The study on influence of *Zygotogramma* on plant attributes like number of leaves, number of flowers and height of *Parthenium* weed revealed that the treatment 9 (nine adult of *Zygotogramma* released per plant) was most effective in reducing number of leaves, 3.66 and 1.66 per plant in 2005 and 2006, respectively. The treatments T₇ and T₆ were statistically at par in reducing 6.66, 7.66 and 7.00, 7.00, leaves per plant after 15 days of releases of

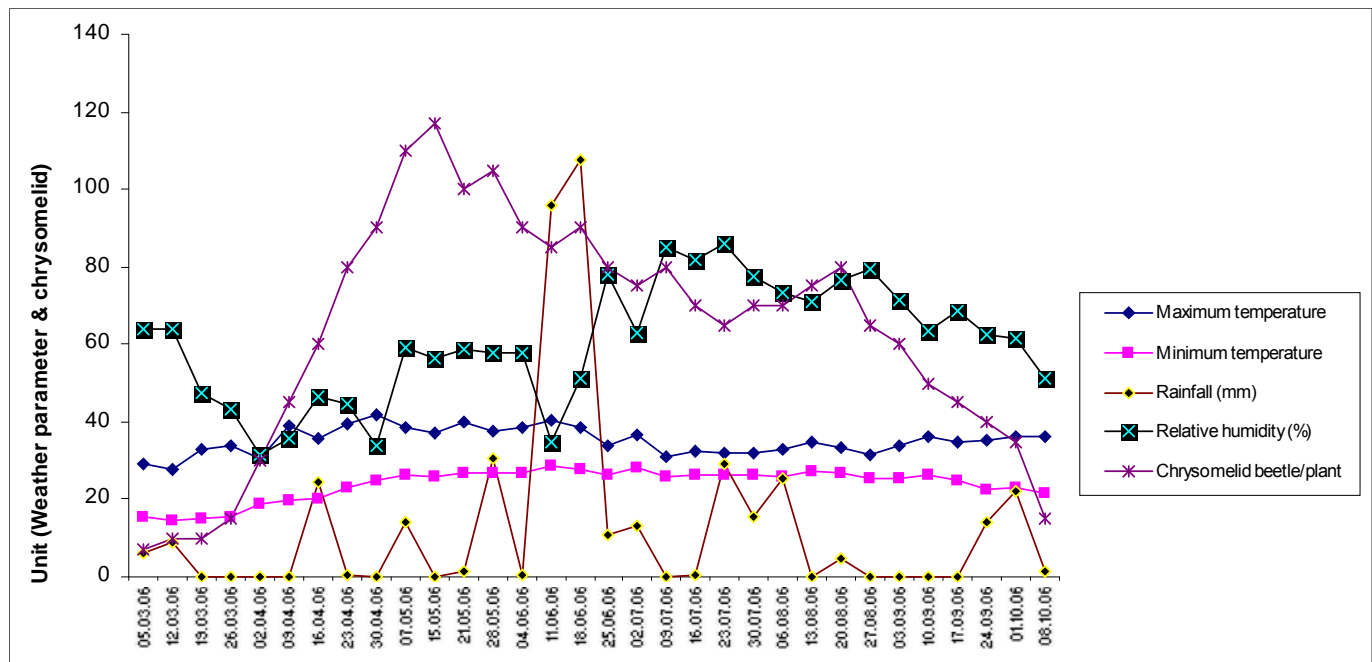


Fig. 2 : Seasonal abundance of *Zygotogramma bicolorata* Ballister on congress grass, *Parthenium hysterophorus* L. (2006)

Zygotogramma in both year, respectively. The other treatments had minimum effect in reducing the leaves of weed but statistically superior than control (15.0 and 17.33). The effect of treatments on number of flowers varied from 81.00 to 105.53 and 90 to 101.0 per plant after 15 days of chrysomeiid adults released in both the years (2006 and 2006), respectively. The treatments T_9 ,

T_8 and T_7 were most effective in reducing the flowers per plant after 15 days of chrysomeiid release (Table 3). In 2005 and 2006, the effect of *Zygotogramma* on plant height significantly varied from 30.50 to 42.33 and 28.22 to 50.86 cm. after 15 days, respectively. T_9 and T_8 were most effective in reducing the *Parthenium* weed height 30.50, 28.22 and 31.10, 30.66 cm after 15 days of

Table 3 : Effect of Chrysomeiid beetle on physical attributes of congress grass

Treatments	No. of Chrysomeiid released	2005						2006					
		No. of leaves		No. of flowers		Height (cm)		No. of leaves		No. of flowers		Height (cm)	
		8 days	15 days	8 days	15 days	8 days	15 days	8 days	15 days	8 days	15 days	8 days	15 days
T_1	01	13.66	12.00	96.33	105.53	34.66	42.33	15.00	11.00	101.00	101.66	43.20	50.86
T_2	02	12.00	10.33	91.00	101.0	32.23	40.50	13.00	10.33	97.33	98.00	43.26	35.53
T_3	03	10.00	9.66	90.33	96.66	32.26	40.50	11.00	8.33	96.66	98.00	40.93	33.83
T_4	04	10.33	8.66	75.66	94.00	32.23	39.83	39.83	8.00	95.66	97.66	40.60	33.60
T_5	05	9.33	8.66	71.66	91.00	31.70	37.63	37.63	7.00	95.00	96.66	40.23	32.66
T_6	06	8.66	7.66	70.33	87.00	31.70	36.00	36.00	7.00	91.00	95.66	39.50	31.26
T_7	07	8.00	6.66	70.66	85.33	31.33	34.00	34.00	7.00	91.00	94.33	36.66	31.23
T_8	08	5.33	6.66	62.00	81.00	24.50	31.10	31.10	3.33	89.00	93.66	34.40	30.60
T_9	09	3.33	3.66	42.00	81.00	28.13	30.50	30.56	1.66	76.66	90.00	33.83	28.22
T_{10}	00	20.33	15.00	150.00	144.00	43.06	25.00	55.00	1.33	155.00	85.63	45.90	50.06
S.E.±		0.799	0.738	1.843	4.067	1.228	0.926	0.926	0.980	4.341	3.890	1.168	1.083
C.D. (P=0.05)		1.680	1.551	3.873	8.545	2.581	1.946	1.946	2.059	2.059	8.173	2.454	2.276

Correlation matrix: Effect of weather parameters on the population of *Zygotogramma bicolorata*

Years	Insect	Observation No.	Av. temperature ($^{\circ}$ C)		Av. relative humidity (%)	Av. rainfall (mm)
			Maximum	Minimum		
2005	Chrysomeiid beetle	33	- 0.0212	0.6420	0.4527	0.4008
2006	Chrysomeiid beetle	33	0.5208	0.8246	0.1289	0.1977

Zygogramma release in 2005 and 2006, respectively. Overall effect of chrysomelid on plant attributes revealed that T₉ treatments (9 *Zygogramma* adult/plant) was most effective in reducing the leaves, flowers and plant height which lead to stunted plant growth and finally drying of plant. These findings are also supported by Dhiman and Bhargava (2005) who reported that the release of *Zygogramma* after 15 days lead to 90 per cent drying of plants. *Zygogramma bicolorata* proved having a potential bio-control efficacy for the management of this noxious weed, which is an eco-friendly management (Khan, 1994).

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