

A Survey on Molluscs Pests in Karnataka, India

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ABSTRACT

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The present survey on molluscs pests was conducted at Dharwad and Haveri districts in Karnataka from June, 2015 to January, 2016. During that the major snail noticed was giant African snail (GAS), *Achatina fulica* Ferussac damaging both forest and horticultural nurseries. The activity of snails in the forest and horticultural nurseries was started during 24th standard week (June 3rd week) of 2015 and persisted up to 2nd standard week of 2016 with peak infestation during 41st standard week (Oct. 2nd week) to 45th standard week (Nov. 2nd week). The highest snail population was recorded in moringa nursery (5.54/4m²) followed by mango (4.79/4m²) in High-Tech Horticulture Unit (HHU) of Dharwad. But in other places the highest number of snail population observed on mango (4.69/4m²) followed by papaya (3.66/4m²) and teak (3.53/4m²). Whereas, the slug incidence was not noticed during the study period. The incidence of snail was positively and significantly correlated with rainfall, relative humidity and minimum temperature irrespective of the nursery plants.

Introduction

Mollusca is the second largest phylum of the animal kingdom, forming a major part of the world fauna (Serb and Lydeard, 2003). The snails and slugs belong to the class Gastropoda and is the only class of molluscs which have successfully invaded land. Slugs are often described as snails without a shell, while snail bodies are enclosed in calcareous shells (Ramzy, 2009). Many species of land snails and slugs are among the important pests of agriculture, horticulture and garden crops in different parts of the world. Invasive species are recognized globally as a major threat to biodiversity and ecosystem health. Globally, about 35,000 species of land snails have been described and there may be 30,000

to 60,000 additional species yet to be described (Lydeard *et al.*, 2004). Within modern India's boundaries 1129 species belonging to 140 genera and 26 families of land snails have been recorded (Ramakrishna *et al.*, 2010).

Ravikumara *et al.*, (2007) recorded the population of GAS throughout the year ranging from 1.00 to 91.25 snails/10 m² in arecanut at Shimoga district of Karnataka. Mallappa and Patil (2014) reported that population of giant African snail, *A. fulica* in betelvine garden in Belagutti village of Davanagere district occurred throughout the year ranging from 3.41 to 114.71 snails per 5

m² during 2011-12. The information regarding the incidence of molluscs pests in forest and horticulture nurseries are lacking. Hence, the study was undertaken with the following objective, “survey for snails and slugs infesting forest and horticulture nurseries”.

Materials and Methods

Fixed plot survey was under taken in 10 locations of two districts (Dharwad and Haveri) in Karnataka from June, 2015 to January, 2016. During survey at each nursery the following observations were made on different types of seedlings/saplings.

No. of snails and slugs/ 4m² nursery saplings at 10 spots.

Foliar damage (%) caused by snails/slugs on 10 different saplings/seedlings.

$$\text{Per cent leaf damage} = \frac{\text{Number of damaged leaves/ plant}}{\text{Total number of leaves/plant}} \times 100$$

Places

Hi-Tech Horticulture Unit, Dharwad; Forest Nursery (FN) MARS, Dharwad; FN, KC Park, Dharwad; FN, Sanjeevini Park; FN near kelager; FN, Gungargatti; FN, Sirsi; ARS, Malagi; ZHRS, Kumbhapur and medical/ aromatic nursery- Saidpur Farm.

Correlation studies with weather parameter

The fixed plot survey data on the incidence of GAS/slugs on different nurseries were subjected to correlation to know the relationship between pest incidence and weather parameters prevailed in Dharwad by using SPSS (Statistical Package for Social Sciences) software.

Collection, identification of snail and slug species

Snails and slugs were collected from the infested fields/nurseries from various localities and brought to the laboratory, reared in the cages and specimens were preserved in 70 per cent alcohol.

Only the shells of the snails and entire slugs were sent for identification to Dr. Venkitesan, Scientist C, Zoological Survey of India, Southern Regional Centre, Chennai.

Results and Discussion

The fixed plot survey was made once in a week from June, 2015 to January, 2016 and results are presented in tables 1 and 2. During survey the mean number of snail population per 4 m² field inside the nursery was recorded on different saplings like mango, papaya, jamun, curry leaf, moringa, silver oak, teak, neem, pongamia, citrus and guava.

The incidence of snails and their damage on seedlings was observed from 24rd standard week on different saplings grown in forest and horticultural nurseries of Dharwad district.

Survey at Hi-Tech Horticulture Unit (HHU), UAS, Dharwad

The snail population and per cent leaf damage was recorded on different forest/ horticulture seedlings at HHU, Dharwad from 24th standard week to 4th standered week is presented in the table 1. Among the different nurseries surveyed at HHU during 2015, the mean population of snails varied from 2.01 to 5.54 per 4 m².

The higher snail population was recorded in moringa (5.54/4 m²) followed by mango (4.79/4 m²), jamun (2.40/4 m²) and lower

snail population observed in curry leaf (2.01/4 m²). Whereas, maximum per cent leaf damage observed in moringa (23.35%) followed by mango (12.89%), curry leaf (10.25%) and minimum in jamun (7.27%).

On moringa

The incidence of *A. fulica* on moringa (4-5 months) revealed, that the first appearance of snail was noticed during 24th standard week (2.40/ 4m²) and persisted in nursery up to 51st standard weeks (Dec. 4th week).

Population density of snail found inside the nursery was ranged from 0.00 to 13.70 per 4m² with a mean population of 5.54/4m². Whereas, the maximum snail damage (55.82%) was at 42nd standard week. The mean per cent leaf damage inflicted by snail on moringa nursery was 23.35 per cent.

On mango

The maximum snail population on mango nursery (12.90/ 4m²) was recorded more during 37th standard week with average population of 4.79 per 4m².

The maximum leaf damage of 27.32 per cent was recorded at 44th std week with a mean leaf damage of 12.89 per cent by the giant African snail on mango nursery.

On jamun

The first appearance of snails was started during 24th standard week and persisted in nursery up to 46th standard week.

The population density on jamun seedlings varied from 0.00 to 6.90 per 4m² with the mean population 2.40. Maximum leaf damage of was recorded 21.82 per cent at 41st std week. The mean leaf damage caused by the giant African snail on jamun nursery was 7.27 per cent.

Curry leaf

The first appearance of snails was noticed during 25th standard week and persisted in nursery up to 49th standard week. The average population ranged from 0.00 to 6.30 per 4m² with a seasonal mean of 2.01/4m².

Maximum leaf damage of 30.56 per cent was recorded at 42nd std week with average of 10.25 per cent. After 52nd std week onwards there was no leaf damage.

Survey in forest Nursery, MARS, Dharwad

On mango

The incidence of *A. fulica* on mango nursery revealed that, the first appearance of snails was noticed during 24th standard week and persisted up to 49th standard week in nursery.

The snail population inside the field was ranged from 0.00 to 11.40 per 4 m² with average of 4.69/4m².

Whereas, the maximum damage of 35.10 per cent was recorded in 41st standard week which coincided with the highest snail population (11.40/4m²).

The mean leaf damage by the population of snail on mango nursery was 12.29 per cent and no damage was found after 49th std week (Table 2).

On silver oak

The population density of giant African snail in silver oak nursery ranged from 0.00 to 5.20/4m² with mean of 2.15/ 4m². The first appearance of snails was noticed during 25th standard week and persisted in nursery up to 50th standard week in silver oak nursery. The maximum leaf damage (13.55%) was recorded at 45th std week with seasonal mean damage of 4.95 per cent.

Table.1 Incidence of *Achatina fulica* on different crops in Hi-Tech Horticulture Unit, Dharwad

Period	SM W	Hi –Tech Horticulture Unit							
		Moringa (4 to 5 months)		Mango (6 to 8 months)		Jamun (10 to12 months)		Curry leaf (6 to 8 months)	
		No. of snails/4m ²	Leaf damage (%)	No. of snails/4m ²	Leaf damage (%)	No. of snails/4m ²	Leaf damage (%)	No. of snails/4m ²	Leaf damage (%)
June 3 rd week	24	2.40	3.80	4.50	3.43	1.50	2.23	0.00	0.00
June 4 th week	25	5.40	6.65	6.20	4.32	3.30	2.50	0.60	0.00
June 5 th week	26	5.80	8.93	3.60	5.48	1.60	2.76	1.20	3.50
July 1 st week	27	4.20	11.85	3.10	5.90	1.50	2.85	0.80	4.20
July 2 nd week	28	3.80	13.16	2.90	6.52	2.10	3.30	0.60	5.43
July 3 rd week	29	3.40	16.33	3.80	6.68	2.40	4.35	1.30	6.85
July 4 th week	30	6.50	18.67	2.90	7.30	3.50	5.50	2.20	6.97
Aug. 1 st week	31	7.20	20.17	4.50	8.56	2.60	7.68	3.40	7.68
Aug. 2 nd week	32	8.40	25.60	6.90	8.95	3.10	8.85	4.70	9.75
Aug. 3 rd week	33	9.800	28.55	4.50	9.05	3.80	9.06	3.90	10.89
Aug. 4 th week	34	5.30	30.50	4.20	12.20	4.10	11.08	2.10	11.10
Sept. 1 st week	35	8.50	34.85	5.40	13.35	3.70	11.15	3.30	13.32
Sept. 2 nd week	36	10.20	37.16	3.70	15.86	4.50	11.96	2.90	14.65
Sept. 3 rd week	37	8.70	39.32	12.90	16.50	4.60	13.35	5.60	15.98

SMW-Standard Meteorological Weeks

Table.1 Contd.

Period	SM W	Moringa (4 to 5 months)		Mango (6 to 8 months)		Jamun (10 to12 months)		Curry leaf (6 to 8 months)	
		No. of snails/4m ²	Leaf damage (%)	No. of snails/4m ²	Leaf damage (%)	No. of snails/4m ²	Leaf damage (%)	No. of snails/4m ²	Leaf damage (%)
Sept. 4 th week	38	12.30	43.76	11.40	16.80	5.50	16.66	5.50	17.05
Sept. 5 th week	39	6.60	45.25	6.70	17.30	3.10	16.85	3.10	22.08
Oct. 1 st week	40	13.70	48.85	12.10	18.63	6.70	18.38	6.30	25.15
Oct. 2 nd week	41	12.70	49.60	9.60	19.85	6.90	21.82	5.70	28.32
Oct. 3 rd week	42	9.50	55.82	7.50	20.96	5.10	19.02	3.30	30.56
Oct. 4 th week	43	7.20	52.30	6.10	24.60	4.20	17.13	2.20	26.63
Nov. 1 st week	44	11.50	45.00	5.80	27.32	3.20	14.50	2.70	22.92
Nov. 2 nd week	45	7.60	35.45	5.20	23.30	1.50	11.65	2.20	18.75
Nov. 3 rd week	46	3.20	29.02	4.70	22.46	0.60	7.14	0.60	13.08
Nov. 4 th week	47	4.90	24.17	5.10	19.56	0.00	0.00	1.30	9.50
Dec. 1 st week	48	2.40	17.33	4.40	17.52	0.00	0.00	0.50	7.44
Dec. 2 nd week	49	1.20	13.50	3.90	14.16	0.00	0.00	0.20	6.53
Dec. 3 rd week	50	00	9.05	2.70	11.25	0.00	0.00	0.00	0.00
Dec. 4 th week	51	0.40	5.86	1.50	8.63	0.00	0.00	0.00	0.00
Dec. 5 th week	52	0.00	0.00	1.10	7.50	0.00	0.00	0.00	0.00
Jan. 1 st week	1	0.00	0.00	0.70	3.58	0.00	0.00	0.00	00
Jan. 2 nd week	2	0.00	0.00	0.50	2.10	0.00	0.00	0.00	00
Jan. 3 rd week	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	00
Jan. 4 th week	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	00
Mean		5.54	23.35	4.79	12.89	2.40	7.27	2.01	10.25

Table.2 Incidence of *Achatina fulica* forest/horticulture seedlings in different forest nurseries (FN) located in and Dharwad (2015-16)

Period	S M W	FN, MARS, Dharwad				FN, KC Park				FN, Sanjeevini Park			
		Mango (4-5 months)		Silver oak (10-11 months)		Teak (9-10 months)		Neem (1 year)		Papaya (4-5 months)		Teak (5-6 months)	
		Snails/ 4m ²	Leaf damage (%)	Snail s/4m ²	Leaf damage (%)	Snail s/4m ²	Leaf damage (%)	Snails/ 4m ²	Leaf damage (%)	Snails/ 4m ²	Leaf Damage (%)	Snails/ 4m ²	Leaf Damage (%)
June 3 rd week	24	1.40	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.75	1.8	2.56
June 4 th week	25	2.40	3.19	1.80	1.04	0.00	0.00	0.50	0.00	3.90	3.5	2.4	3.45
June 5 th week	26	3.80	4.20	1.50	1.65	0.00	0.00	1.20	0.60	2.50	5.68	2.8	4.90
July 1 st week	27	5.20	5.33	1.30	1.86	1.10	1.50	0.40	0.70	1.20	5.8	3.5	5.85
July 2 nd week	28	4.80	5.67	2.20	2.25	1.40	2.50	0.60	0.90	3.80	7.1	3.8	6.65
July 3 rd week	29	3.40	7.10	2.40	2.57	1.20	2.80	0.00	1.20	2.50	8.5	4.2	7.85
July 4 th week	30	5.50	7.50	3.60	2.75	1.40	3.20	0.90	1.60	3.10	10.4	3.7	8.52
Aug. 1 st week	31	5.80	8.30	3.90	3.15	2.50	3.50	0.70	1.80	6.40	13.5	4.3	8.78
Aug. 2 nd week	32	6.30	8.50	2.80	3.37	2.70	3.90	1.40	2.10	8.70	14.5	6.5	9.95
Aug. 3 rd week	33	6.50	10.60	3.70	3.62	0.70	4.50	0.50	2.90	5.00	15.7	4.6	10.05
Aug. 4 th week	34	7.20	13.30	4.20	3.50	0.60	4.80	0.40	3.20	5.30	16.64	4.3	12.45
Sept. 1 st week	35	7.70	13.80	2.60	3.80	0.50	4.90	0.90	3.80	7.40	18.8	3.4	13.67
Sept. 2 nd week	36	8.30	19.90	3.90	4.20	0.70	5.10	1.60	3.50	10.30	22.4	3.9	15.40
Sept. 3 rd week	37	8.60	22.10	2.20	5.55	1.90	5.30	1.90	2.70	6.40	24.5	4.8	16.50
Sept. 4 th week	38	9.30	25.30	4.10	6.90	2.30	5.60	1.10	2.15	9.50	26.85	4.3	17.50
Sept. 5 th week	39	8.70	28.50	2.20	8.01	1.20	6.80	0.70	2.40	6.70	30.4	6.6	18.00
Oct. 1 st week	40	10.80	31.80	5.20	9.50	3.50	6.90	1.80	3.50	12.90	35.7	7.5	19.36
Oct. 2 nd week	41	11.40	35.10	4.20	10.20	4.10	7.80	2.10	4.30	9.40	37.2	8.2	20.56
Oct. 3 rd week	42	9.50	33.50	3.80	10.64	1.50	9.60	1.70	2.90	6.20	36.2	9.6	25.85

SMW-Standard Meteorological Weeks, FN: Forest Nursery

Table.2 Contd.

Period	S M W	FN, MARS, Dharwad				FN, KC Park				FN, Sanjeevini Park			
		Mango (4-5 months)		Silver oak (10-11 months)		Teak (9-10 months)		Neem (1 year)		Papaya (4-5 months)		Teak (5-6 months)	
		Snails/4m ²	Leaf damage (%)	Snails/4m ²	Leaf damage (%)	Snails/4m ²	Leaf damage (%)	Snails/4m ²	Leaf damage (%)	Snails/4m ²	Leaf damage (%)	Snails/4m ²	Leaf damage (%)
Oct. 4 th week	43	7.20	29.50	2.90	11.35	1.40	11.50	1.30	2.10	3.60	31.56	7.5	26.60
Nov. 1 st week	44	5.50	25.65	3.20	11.45	0.80	10.13	0.60	1.40	2.40	28.03	5.8	27.32
Nov. 2 nd week	45	4.60	21.30	2.30	13.55	0.50	8.30	0.00	0.00	1.30	25.05	4.4	24.30
Nov. 3 rd week	46	3.20	15.20	1.90	10.67	0.40	7.74	0.00	0.00	1.20	19.02	3.2	22.46
Nov. 4 th week	47	3.90	13.80	2.30	9.64	1.30	6.05	0.00	0.00	0.60	13.54	2.9	19.56
Dec. 1 st week	48	2.40	8.01	1.40	7.57	0.50	3.95	0.00	0.00	0.00	0.00	1.8	17.52
Dec. 2 nd week	49	1.20	6.16	0.90	7.45	0.00	0.00	0.00	0.00	0.00	0.00	0.9	14.16
Dec. 3 rd week	50	0.00	0.00	0.40	6.83	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Dec. 4 th week	51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Dec. 5 th week	52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Jan. 1 st week	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Jan. 2 nd week	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Jan. 3 rd week	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Jan. 4 th week	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
Mean		4.69	12.29	2.15	4.95	0.97	3.83	0.62	1.33	3.66	13.68	3.53	11.51

Table.3 Correlation coefficient between snail population and weather parameters on different saplings

Parameters	Moringa (HHU)	Mango	Jamun	Curry Leaf	Silver oak	Teak (KC park)	Neem	Papaya
Max. Temp.	-0.022	-0.004	-0.010	-0.013	-0.027	-0.028	-0.013	-0.017
Min. Temp.	0.654**	0.547**	0.635**	0.514**	0.653**	0.466**	0.514**	0.586**
RH	0.669**	0.665**	0.578**	0.604**	0.647**	0.504**	0.481**	0.616**
Rain fall	0.457**	0.481**	0.454**	0.441*	0.452**	0.461**	0.380*	0.544**

** Significant at 0.01 level (2-tailed)

*. Significant at 0.05 level (2-tailed)

Table.4 Meteorological data recorded for the year 2015-16 at main Agricultural Research Station, Dharwad (June 2015 to January, 2016)

Months	Standard Meteorological Weeks (SMW)	Max Temp.(°C)	Min Temp. (°C)	Humidity (%)	Total Rainfall (mm)
June 3 rd week	24	28.4	20.9	67.9	4
June 4 th week	25	26.1	21	87.1	51
June 5 th week	26	28	21.5	82.5	22.2
July 1 st week	27	29.2	20.9	77.9	12.6
July 2 nd week	28	29.6	22.2	78.1	7.6
July 3 rd week	29	28.8	21.3	76.6	4.8
July 4 th week	30	27.7	20.7	76.8	8.6
Aug. 1 st week	31	28.4	20.4	82.1	27.7
Aug. 2 nd week	32	27.7	20.8	85.1	4.2
Aug. 3 rd week	33	29	20.7	78	2.8
Aug. 4 th week	34	29.9	20.6	77.3	6.2
Sept. 1 st week	35	28.6	20.3	86.1	14
Sept. 2 nd week	36	30.1	20.4	83.5	17.8
Sept. 3 rd week	37	28.4	20.6	92.4	4.2
Sept. 4 th week	38	28.8	20.6	86.9	28.4
Sept. 5 th week	39	36.7	20.9	80.9	0.2
Oct. 1 st week	40	29.7	20.4	95.3	165.8
Oct. 2 nd week	41	30.2	20.5	81.6	11.6
Oct. 3 rd week	42	32.4	19.3	51.4	0
Oct. 4 th week	43	32.2	17.9	44.8	0
Nov. 1 st week	44	30.9	20	79.5	7.6
Nov. 2 nd week	45	30.8	18.3	68.9	0
Nov. 3 rd week	46	30.3	17.9	71.1	0
Nov. 4 th week	47	28.6	19.6	76.6	23.4
Dec. 1 st week	48	30.6	16.8	67.3	0
Dec. 2 nd week	49	29.4	14.6	59.5	0
Dec. 3 rd week	50	31.7	18.1	66	0
Dec. 4 th week	51	31.5	17	62.1	0
Dec. 5 th week	52	29.8	13	44.2	0
Jan. 1 st week	1	30.7	14.4	37.2	0
Jan. 2 nd week	2	29.4	12.2	34.7	0
Jan. 3 rd week	3	28.5	14.2	13.3	0.4
Jan. 4 th week	4	30.2	15.9	14.2	0

In forest nursery near KC Park, Dharwad

On teak

The average snail population in teak nursery ranged from 0.00 to 4.10 per 4m² with average of 0.97 snails per 4m² (Table 2).

The first incidence of snail was noticed at 27th std week and it persisted up to 48th std week. The maximum leaf damage was recorded at 43rd std week *i.e.*, 11.50 per cent with average damage of 3.83 per cent.

On neem

From table 2 it is clear that, during 41st std week the mean maximum number of snails were recorded 2.10/4m². The mean snail population was ranged from 0.00 to 2.10 per 4 m² nursery with mean of 0.62/4m².

The average leaf damage from June 2015 to January 2016 was 1.33 per cent per 4 m² inside the neem nursery. While during 41st std week, the maximum damage was 4.30 per cent which coincided with the highest snail population.

In forest nursery at Sanjeevini Park, Dharwad

On papaya

The incidence of *A. fulica* on papaya revealed that, the first appearance of snails was noticed during 24th standard week and persisted in nursery up to 47th standard week.

The snail population inside the nursery was ranged from 0.00 to 12.90 per 4 m² with average of 3.66. Whereas, the maximum leaf damage of snails was (37.20%) was noticed in 41st standard week. The mean leaf damage by the population of snail on papaya nursery was 13.68 per cent.

On teak

The activity of snails on teak nursery was recorded from 24th std week to 49th std week. The average population ranges from 0.00 to 9.60 per 4m² with a seasonal mean of 3.53/4m². The highest leaf damage of 27.32 per cent was recorded at 44nd std week with average of 11.51 per cent.

Other places

Survey was also conducted in other nurseries like forest nurseries near kelageri; forest nurseries of Gungargatti; forest nurseries of Sirsi; ARS, Malagi; ZHRS, Kumbhapur; medical/aromatic nursery- Saidpur Farm on different seedlings *viz.* guava, papaya, pongamia, *Myristica* sp., *Beilschmiedia* sp. and citrus. But there was no infestation of snails during *kharif*, 2015. Similarly, the incidence of slugs was also not noticed in different nurseries surveyed during June to January, 2015-16.

Correlation Co-efficient between population of snails and weather parameters during *kharif*, 2015

The data on population of snails collected in Dharwad was correlated with the prevailing climatic weather parameters the results are given in the table 3. Data revealed that, snail population was positive and significantly correlated with rainfall, relative humidity and maximum temperature irrespective of the nurseries where it was negatively correlated with maximum temperature.

Collection and identification of snail and slug species

Snails/ slugs were collected from the infested fields from various localities of Hangal and Ranebennur taluks of Haveri district and identified by Dr. Venkitesan, Sr. Scientist,

Zoological Survey of India, Southern Regional Centre and Chennai. During the survey four species of snails viz., *Allopeas gracile*, *Rachis punctatus*, *Macrochlamys pedina*, *Macrochlamys indica* and three species of slugs viz., *Pseudaustenia ater*, *Laevicaulis alte* and *Mariaella beddomei* were collected from farmers field in Dharwad and Haveri district were identified from ZSI, Chennai.

The present investigation is in line with Basavaraju *et al.*, (2000) who opined that the infestation of giant African snail on biofuel nursery, vegetable nursery, arecanut nursery and mulberry garden ranged from 8 to 15 per cent in Hassan district of Karnataka. The activity of giant African snail, *A. fulica* started during 24th standard is an agreement with the work of Mallappa. Further, Rafee *et al.*, (2013) stated that the number of snails recorded in different agriculture and horticultural crops was higher during September due to receipt of high rainfall. The present study damage to various nursery seedlings (1.33 to 23.35 %) in close agreement with the studies of Mallappa (2014) who registered that three to four months old seedlings were severely damaged by giant African snail on forest nursery in Bealgavi district during August 2011.

Maximum temperature exerted negative and significant relationship, but highly significant and positive relationship was noticed with rainfall. Likewise, highly significant and positive correlation was with relative humidity. This finding corroborates with Mallappa (2014) who reported correlation between snail incidence and weather factor indicated that the highly significant and positive relationship with rainfall ($r = 0.652^{**}$). During the year 1998 as high as 1006 mm of annual rainfall was received which was second highest in the century and thus recorded highest population of 257.2

snails/100 m² area (Balikai, 2008). This corroborates with Thakur (2003) from Bihar who opined positive and significant relationship between snail population and relative humidity. On the basis of present investigation it is concluded that the infestation of giant African snail was found more on horticulture nurseries (moringa, papaya etc.) than the forest nurseries (silver oak, jamun etc). Rainfall and relative humidity are the important weather factor in population build-up of giant African snail in forest and horticulture ecosystem.

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