

# Study of Snail, *Macrochlamys indica* and slug, *Filicaulis alte* in relation to damage inflicted by them in different Ornamental Plant Nurseries near Buddha Nullah, Ludhiana.

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## ABSTRACT

From the present study it is concluded slug, *Filicaulis alte* and *Macrochlamys indica* was found in all the four plant nurseries namely PAU Plant nursery, Prabhakar nursery, Laxmi nursery and Tulsigaurd nursery. These gastropods carved irregular holes within the leaves of different plants from the month of April till October but no damage was recorded from November to February as animals were in hibernation. Maximum mean percent plants affected by gastropods was recorded in the month of August in all plant nurseries, when the population density of gastropods was maximum. So maximum damage was recorded in the month of August.

**Key words:** *Filicaulis alte*, *Macrochlamys indica*, Nurseries, Plants

Land Snail, Pulmonate molluscs are the members of the molluscan class, Gastropod, which have a coiled shell on their back into which they retract themselves unlike the slugs which lack shell. These terrestrial molluscs are destructive agricultural pests causing economic damage to field crops, vegetables, fruits trees and ornamental plants (Barker 2002). Snails and slugs are important components of detritivorous and herbivorous fauna in most of the ecosystems (Russell-Hunter 1983). Damage caused by them to ornamental plants in the field, nursery or greenhouse has been a perennial problem. They are gregarious feeders that are active at night on cloudy days and causes damage. The damage which they cause not only depends on their activity and population density but also on their feeding habits which may differ from one species to another (Okda 1981).

Terrestrial snails are mostly nocturnal but following rain they come out of their hiding places even during the day time. Moisture and temperature rather than light are the main factors that account for their nocturnal habits. Native snails may be found everywhere but they prefer habitats offering adequate moisture, shelter, an abundant food supply and an available source of lime etc. The forested river valleys generally provide such kind of habitats and those with outcrops of limestone that show the most abundant and varied mollusc faunas (Grim *et al* 2000). Snails can remain in the dormant state (aestivation) for years, and break dormancy when climatic conditions are favourable again. Some ecological observations such as survey, population movement and dynamic, daily activity and dispersal of land snails have been studied by many of the researchers (Deebet *et al* 2001, Daoud 2004, Ramzy 2009). Commercial nurseries have been serving the farmer community by providing planting material of wide range of crops like vegetables, flowers, fruits, plantations and ornamentals. These crops are the source of farm income and fit well in crop diversification (Anonymous 2003). Damp and shady conditions prevailing in plant nurseries are ideal habitat for slugs and snails, the prevalence of which needs to be assessed (Kaur and Kaur 2004). Land Molluscan pests, causes considerable financial losses. They attack raw succulent vegetables and prefer soggy parts of potatoes, vegetables, lettuce, cabbage, carrots, clover, maize, cereal as well as other horticultural and agricultural crops. They eat roots, leaves and tuber of nearly all fields crops, vegetables, ornamental plants as well as fruits in field, garden and greenhouse. When land molluscs

become abundant, they attack heavily on succulent raw leaves, vegetables, fruits, buds and attack flowers. Also, these land molluscs leave unpleasant slimy tracks on the injured parts (Okda 1981). They cause irregular holes with smooth edges on the flowers and leaves and can clip succulent parts of the plant. They also chew fruit and young plant bark (Mrowczynski and Wachowiak 2002). Therefore, the growers of ornamental plants commonly apply molluscicides during periods of high slug and snail activity.

## MATERIALS AND METHODS

The present studies were conducted at four commercial ornamental plant nurseries viz. Tulsigaurd nursery, Prabhakar nursery, Laxmi nursery, PAU Campus nursery at Ludhiana and the laboratories of Department of Zoology and Soil Science at PAU, Ludhiana.

### Gastropod damage to Nursery plants

Selected nurseries viz., Tulsigaurd nursery, Prabhakar nursery, Laxmi nursery and PAU Campus nursery were surveyed and plants observed carefully to study the nature and extent of damage inflicted by gastropods to plant saplings. Plants in rows with respect to each type of damage were counted.

Three replicates for each nursery plant were taken. Total plants in rows along with damaged ones were counted in each replicate. Plants were observed carefully for gastropods damage at fortnightly intervals. Per cent plant damage was calculated by the formula:

$$\text{Per cent damage per replicate} = \frac{\text{Number of damaged plants}}{\text{Total no. of plants}} \times 100$$

## RESULTS AND DISCUSSION

### Surveillance:

During present studies, damage prevailing in all the four ornamental plant nurseries viz., Prabhakar, Laxmi and Tulsigaurd plant nurseries near Buddha nullah, Ludhiana and in one reference site i.e. PAU nursery was also recorded.

### Damage:

Results of assessment of damage inflicted by snails and slugs to plants in four nurseries viz, PAU Plant nursery, Prabhakar nursery, Laxmi nursery and Tulsigaurd nursery are presented in Table 1,2,3 and 4 respectively. Gastropods carved irregular holes within the leaves of different plants (Plate1) from April-October but no damage was recorded from November to February as animals were in hibernation. Earlier studies also reported gastropods attack on ornamental plants from April to October by excavating holes on leaf lamina (Kaur 2011, Kaur and Chhabra 2011, Kaur and Panjgotra 2012).

#### 1 *Dieffenbachia* spp.

In PAU Plant nursery, no damage to *Dieffenbachia* was seen from May to July. In August, mean percent plants affected was  $23.43 \pm 3.44$ , when gastropod population density increased. In September and October, mean percent plants affected was reduced to  $17.18 \pm 4.38$  and  $4.68 \pm 3.07$  respectively (Table 1 and Fig 1).

In *Dieffenbachia* spp., snails and slugs excavated holes within leaves. The results of damage inflicted by snails and slugs to saplings of *Dieffenbachia* spp. in Prabhakar nursery are presented in (Table 2 and Fig 2). Mean per cent plants affected was  $8.3 \pm 4.15$  in last week of May and infestation increased afterwards. In the month of June and July, it was  $29.12 \pm 16.00$  and  $37.48 \pm 14.8$  respectively. Maximum mean percent plants affected by gastropods were recorded

in the month of August ( $43.7 \pm 8.81$ ) when overall population density of gastropods was maximum. (Percent plants affected declined in the month of September ( $33.3 \pm 10.21$ ) with decrease in surface active gastropod population density and after hibernation period, percent plants affected by gastropods again increased to  $16.62 \pm 5.88$  in the month of April.

In Laxmi nursery, mean percent plants affected was  $17.8 \pm 11.20$  in May (Table 3 and Fig 3), which increased to  $21.35 \pm 3.57$  and  $24.95 \pm 9.27$  in June and July respectively. In August, mean percent damage was  $35.82 \pm 19.1$  due to highest surface active gastropod population density. Afterwards damage decreased to nil and recorded again in March 2014 ( $14.25 \pm 7.12$ ) after hibernation of gastropods.

In Tulsigaurd nursery, mean percent plants affected was  $15.62 \pm 11.96$  in the month of May (Table 4 and Fig 4). In June and July, it was  $7.81 \pm 4.38$  and  $18.75 \pm 3.12$  respectively. Maximum plants affected were recorded in August ( $37.5 \pm 6.25$ ) due to increased surface active gastropod population density. Present study revealed that *Dieffenbachia* plant was affected by gastropods mainly from May to August. Kaur and Chhabra (2011) reported damage to *Dieffenbachia* by snails and slugs from April to September in plant nurseries at Ludhiana. Control measures against gastropoda are therefore essential during these months to minimize damage inflicted by these gastropods.

## 2 *Dracaena* (green) spp.

The results of damage inflicted by snails and slugs to saplings of *Dracaena* green in plant nursery at PAU are presented in (Table 1 and Fig 1). No damage on *Dracaena* green was found in months of May to July. Maximum mean percent plants affected was recorded in August ( $26.56 \pm 6.41$ ) when overall active gastropod population was maximum. Afterwards mean percent plants affected by gastropods decreased and were  $25 \pm 3.84$  in September (Table 2 and Fig 2) and  $6.25 \pm 3.12$  in October. No damage to *Dracaena* was seen from November to February but in March the Mean percent damage was  $9.37 \pm 5.18$ .

Damage inflicted by snails and slugs to saplings of *Dracaena* green in Laxmi nursery are presented in Table 3 and Fig 3. Minimum mean percent plants affected was found in the month of May ( $17.81 \pm 5.14$ ), which increased thereafter from June to August. Maximum mean percent plants were affected in August ( $48.16 \pm 3.51$ ) coinciding with highest population density. Afterwards mean percent damage decreased to  $28.52 \pm 19.3$  in September and no damage was found in October.

Present study revealed damage to *Dracena* by gastropods from May to August. Kaur and Chhabra (2011) reported slug and snail attack on *Dracena* green plant from April to July in three plant nurseries in Ludhiana.

## 3 *Bougainvillea* (*Bougainvillea* spp.)

In *Bougainvillea* snails and slugs excavated holes within leaves. In PAU plant nursery, no plants were affected by snails and slugs from May to July (Table 1 and Fig 1). Maximum plants affected was recorded ( $20.31 \pm 3.78$ ) in August because population density was maximum in the month of August. Afterwards mean percent damage decreased to  $14.06 \pm 6.41$  and  $9.37 \pm 2.70$  in September and October respectively (Table 1 and Fig 1).

In Prabhakar nursery, mean percent plants affected in month of May was  $16.63 \pm 9.31$ , which increased in the month of June and July to  $27.06 \pm 10.17$  and  $33.26 \pm 14.40$  respectively. Maximum mean percent plants affected by gastropods in the month of August was  $41.62 \pm 7.20$  (Table 2 and Fig 2). In the end of September mean percent plants affected was reduced to  $29.1 \pm 10.83$ . No damage was recorded in the month of October due to decrease in gastropod population.

In Laxmi nursery, mean percent plants affected in the month of May was  $17.8 \pm 6.05$ , which increased to  $24.95 \pm 10.56$  in June (Table 3 and Fig 3) and was  $28.52 \pm 10.00$  in the month of July. In August, the mean percent plants affected increased to  $35.65 \pm 7$  when maximum population of gastropods was recorded. The mean percent plants affected recorded in October was  $28.52 \pm 5.64$ . In the month of March it was  $7.25 \pm 3.65$  and was  $10.32 \pm 5.64$  in the month of April.

Results of damage inflicted by snails and slugs to saplings of *Bougainvillea* in Tulsigaurd nursery are presented in (Table 4 and Fig 4). Plants were not affected by gastropods in the month of May. Mean percent plants affected was  $15.6 \pm 5.17$  in end of June. Afterwards, mean percent plants affected in July was  $18.75 \pm 6.98$  and in the month of August, it was maximum ( $28.5 \pm 5.05$ ) when overall population density was also maximum ( $1.25 \pm 0.48$  snails  $m^{-2}$  and  $0.3 \pm 0.20$  slugs  $m^{-2}$ ). In month of September infestation of gastropods decreased to  $19.6 \pm 9.98$ . In month of October, mean percent plants affected again decreased ( $14.06 \pm 5.60$ ) with decrease in gastropod population density at the surface. Present study revealed that damage to *Bougainvillea* occurred from May-October with maximum being in August.

#### 4 *Syngonium podophyllum* spp.

In Prabhakar nursery, minimum mean percent plants were affected in May ( $12.45 \pm 3.59$ ). In July, mean percent plants affected were  $31.22 \pm 5.46$  (Table 2 Fig 2). Maximum mean percent plants affected was observed in August ( $47.88 \pm 10.38$ ) coinciding with active population density. In Tulsigaurd nursery, minimum mean percent plants affected was observed in May  $18.75 \pm 6.98$  (Table 4 Fig 4). Afterwards damage started increasing as conditions become favourable for gastropods like high soil moisture and soil temperature. Mean percent plants affected in the month of July was  $25 \pm 3.82$ . Maximum mean percent plants affected was observed in the month of August ( $28.12 \pm 6.15$ ) when population of gastropods was maximum. Mean percent plants affected in the month of September and October was  $21.87 \pm 6.81$  and  $15.62 \pm 2.70$  respectively.

So maximum damage on *Syngonium podophyllum* by gastropods occurred in August.

#### 5 *Dahlia* spp.

In Prabhakar nursery, mean percent plants affected in May was  $12.48 \pm 6.90$ . In the month of June and July, the damage appeared in the form of holes on leaves and mean percent plants affected was  $12.47 \pm 4.87$  and  $29.12 \pm 11.31$  respectively (Table 2 and Fig 2). Maximum mean percent plants were affected in the month of August ( $49.96 \pm 9.31$ ) because of increase in gastropod population active at surface. Afterwards the mean percent plants affected decreased. In September, mean percent plants affected was  $24.95 \pm 7.23$ . No plants were affected in the month of October and damage was again recorded in the month of April ( $12.5 \pm 10.8$ ).

In Tulsigaurd plant nursery, minimum mean percent plants affected in the month of May was  $16.87 \pm 7.57$  (Table 4 and Fig 4). In month of July, mean percent plants affected was  $23.43 \pm 5.60$  which further increased to  $34.4 \pm 5.18$  in the month of August when population density of gastropods was maximum. Mean percent plants affected in September and October reduced to  $25 \pm 8.83$  and  $9.37 \pm 5.1$  respectively with decrease in population density of gastropods.

So damage to *Dahlia* occurred from May to October. Control strategies must be applied in these months to reduce the damage.

#### 6 Money plant (*Scindapsis* spp.)

In PAU plant nursery, no damage was found in May. Minimum mean percent plants affected in the month of June and July was  $15.62 \pm 2.7$  and  $18.75 \pm 3.12$  respectively (Table 2 and Fig 2). Afterward maximum mean percent plants affected was recorded in the month of August ( $26.56 \pm 6.78$ ) and no plants were affected in the month of

September. In October, mean percent plants affected was  $21.8 \pm 15.5$ .

In Tulsigaurd nursery, maximum mean percent plants ( $19.6 \pm 9.98$ ) affected (Table 4 Fig 4) was recorded in August which decreased to  $18.75 \pm 3.12$  in September and was  $9.3 \pm 5.18$  in October.

Present study revealed that damage to Money plant (*Scindapsis* spp.) occurred from June to October. Kaur and Chhabra (2011) reported attack by gastropods on money plant from April to September in three plant nurseries at Ludhiana. Proper control measures should be adopted during these months to control pestiferous gastropods.

#### 7 *Croton tiglium* spp.

In Laxmi nursery, damage in form of holes was found on plant saplings. The mean percent plants affected in May was  $10.67 \pm 5.90$  (Table 3 and Fig 3). Mean percent plants affected in July increased to  $23.13 \pm 3.51$  and was maximum ( $32.15 \pm 5.18$ ) in August due to increase in slug and snail population. No plants were affected in September but the mean percent plants affected in October was  $21.38 \pm 7.97$ . Mean percent plants affected in March and April was  $14.2 \pm 8.73$  and  $7.12 \pm 6.17$  respectively.

From the present study it is concluded that damage caused by gastropodslug, *F. alte* and snail *M. indica* was recorded from April to October and maximum damage was recorded in the month of August when their population density was also maximum. Gastropods carved irregular holes within the leaves of different plants from April-October but no damage was recorded from November to February as animals were in hibernation. Maximum mean percent plants affected by gastropods was recorded in the month of August in all plant nurseries, when overall population density of gastropods was maximum.

**Table 1: Mean percent ornamental plants affected by snail, *M. indica* and slug, *F. alte* at PAU nursery.**

Month-year	<i>Dieffenbachia</i> spp.	<i>Dracaena (green)</i> spp.	<i>Bougainvillea</i> spp.	Money plant ( <i>Scindapsis</i> ) spp.
May/2013	-	-	-	-
Jun/2013	-	-	-	$15.62 \pm 2.7$
Jul/2013	-	-	-	$18.75 \pm 3.12$
Aug/2013	$23.43 \pm 3.44$	$26.56 \pm 6.41$	$20.31 \pm 3.78$	$26.56 \pm 6.78$
Sept/2013	$17.18 \pm 4.38$	$25 \pm 3.84$	$14.06 \pm 6.41$	-
Oct/2013	$4.68 \pm 3.07$	$6.25 \pm 3.12$	$9.37 \pm 2.70$	$21.8 \pm 15.5$
Nov/2013	-	-	-	-
Dec/2013	-	-	-	-
Jan/2014	-	-	-	-
Feb/2014	-	-	-	-
Mar/2014	-	$9.37 \pm 5.18$	-	-
Apr/2014	-	-	-	-

Values are Mean $\pm$ SE

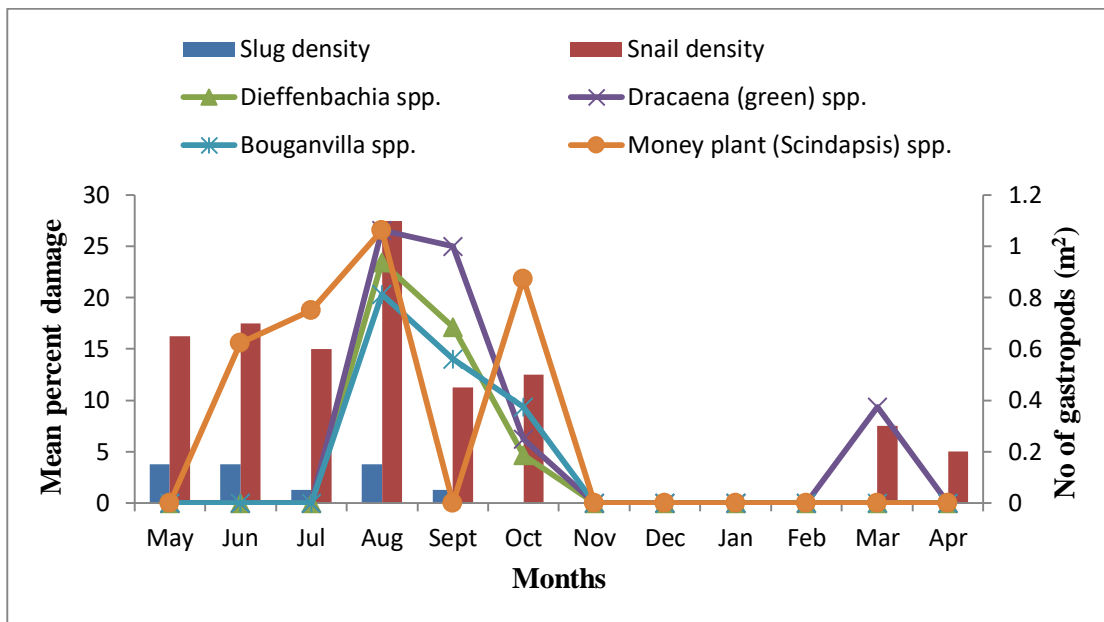


Fig 1: Comparison of slug and snail density with mean percent damage to different plants in PAU nursery

Table 2: Mean percent ornamental plants affected by snail, *M. indica* and slug, *F. alte* at Prabhakar nursery

Month-Year	<i>Dieffenbachia</i> spp.	<i>Syngonium podophyllum</i> spp.	<i>Dahlia</i> spp.	<i>Bouganvillea</i> spp.
May/2013	8.35±4.15	12.45±3.59	12.48±6.90	16.63±9.31
Jun/2013	29.12±16.00	-	12.47±4.87	27.06±10.17
Jul/2013	37.48±14.8	31.22±5.46	29.12±11.31	33.26±14.40
Aug/2013	43.7±8.81	47.88±10.38	49.96±9.31	41.62±7.20
Sept/2013	33.3±10.21	-	24.95±7.23	29.1±10.83
Oct/2013	-	25±12.5	-	-
Nov/2013	-	-	-	-
Dec/2013	-	-	-	-
Jan/2014	-	-	-	-
Feb/2014	-	-	-	-
Mar/2014	-	-	16.65±10.20	-
Apr/2014	16.62±5.88	8.32±7.20	12.5±10.8	-

Values are Mean±SE

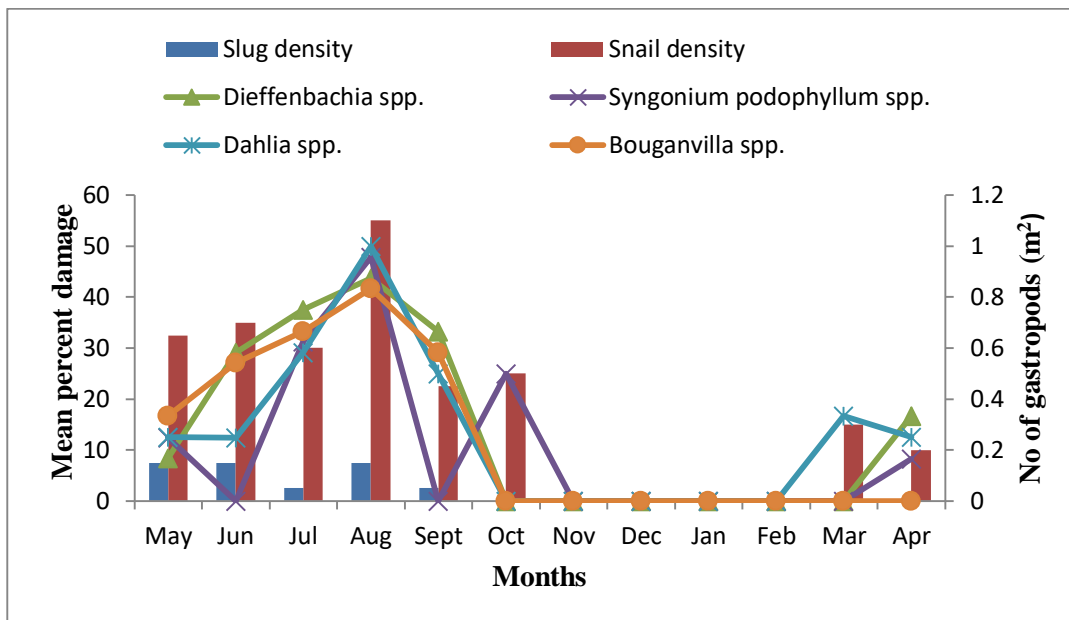


Fig 2: Comparison of slug and snail density with mean percent damage to different plants in Prabhakar nursery

Table 3: Mean per cent ornamental plants affected by snail, *M. indica* and slug, *F. alte* at Laxmi nursery.

Month-Year	<i>Dieffenbachia</i> spp.	<i>Dracaena (green)</i> spp.	<i>Croton tiglium</i> spp.	<i>Bouganvilla</i> spp.
May/2013	17.8±11.20	17.81±5.14	10.67±5.90	17.8±6.05
Jun/2013	21.35±3.57	25±21.6	-	24.95±10.56
Jul/2013	24.95±9.27	28.55±20.82	23.13±3.51	28.52±10.00
Aug/2013	35.82±19.1	48.16±3.51	32.15±5.87	35.65±7.99
Sept/2013	-	28.52±19.3	-	-
Oct/2013	-	-	21.38±7.97	28.52±5.64
Nov/2013	-	-	-	-
Dec/2013	-	-	-	-
Jan/2014	-	-	-	-
Feb/2014	-	-	-	-
Mar/2014	14.25±7.12	17.71±1.54	14.2±8.73	7.25±3.65
Apr/2014	-	-	7.12±6.17	10.32±5.64

Values are Mean±SE

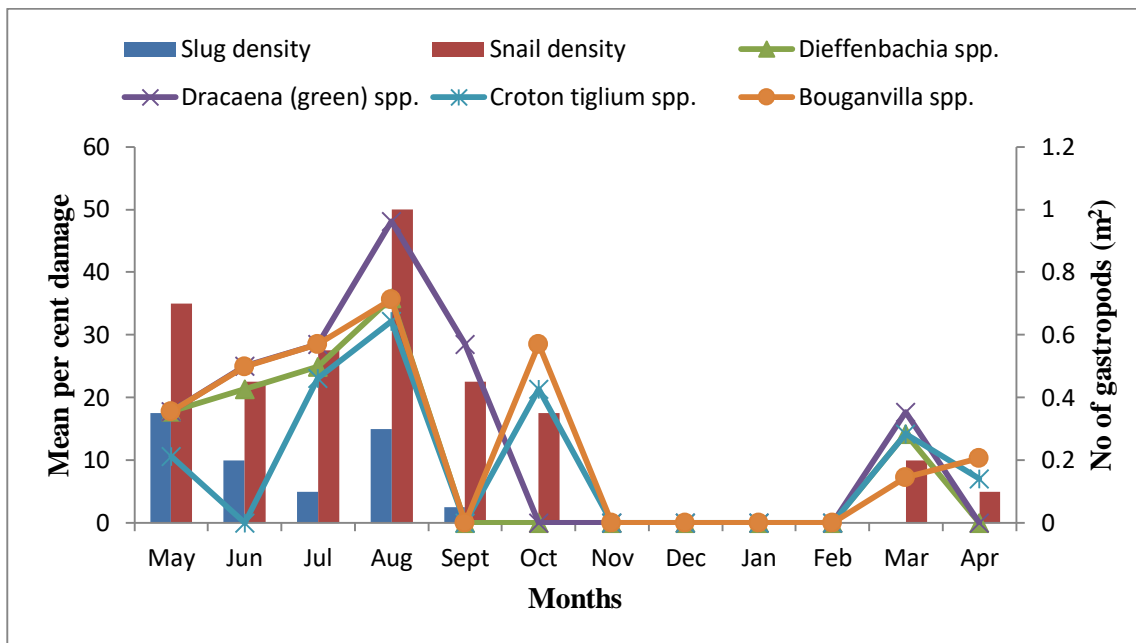


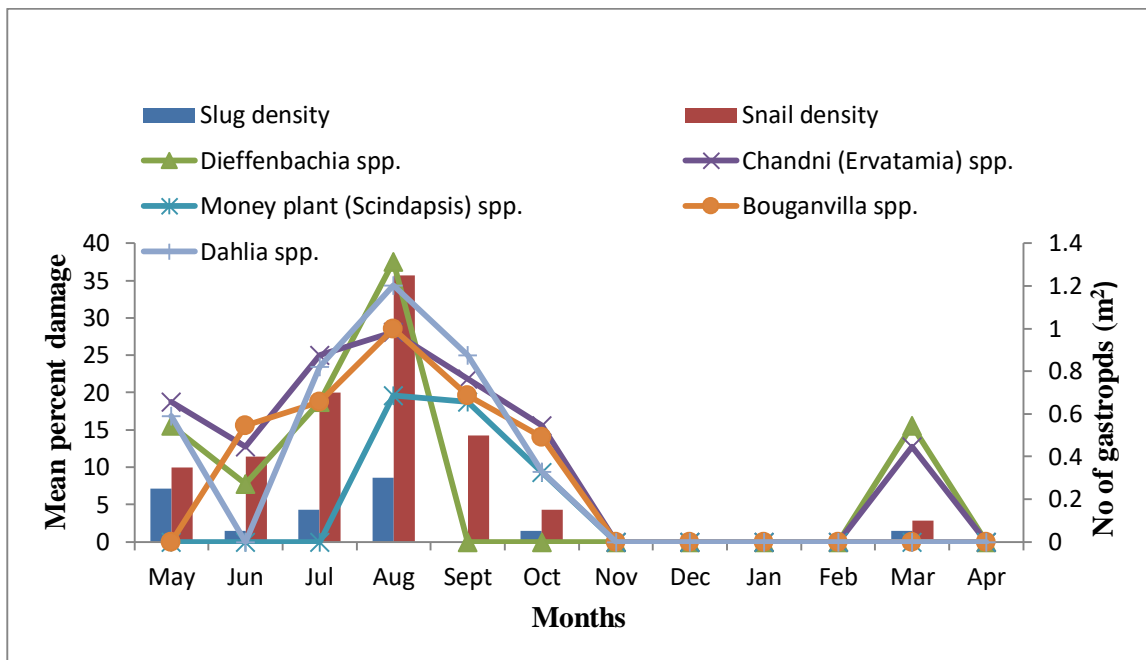
Fig 3: Comparison of slug and snail density with mean percent damage to different plants in Laxmi nursery

Table 4: Mean percent ornamental plants affected by snail, *M. indica* and slug, *F. alte* at Tulsigaurd nursery

Month-Year	<i>Dieffenbachia</i> spp.	<i>Syngonium podophyllum</i> spp.	Money plant ( <i>Scindapsis</i> spp.)	<i>Bouganvilla</i> spp.	<i>Dahlia</i> spp.
May/2013	15.62±11.96	18.75±6.98	-	-	16.87±7.57
Jun/2013	7.81±4.38	12.75 ± 4.41	-	15.6±5.17	-
Jul/2013	18.75±3.12	25±3.82	-	18.75±6.48	23.43±5.60
Aug/2013	37.5 ± 6.25	28.12± 6.15	19.6±9.98	28.5±5.05	34.4±5.18
Sept/2013	-	21.87±6.81	18.75 ± 3.12	19.6± 9.98	25 ± 8.83
Oct/2013	-	15.62± 2.70	9.3±5.18	14.06±5.60	9.37±5.18
Nov/2013	-	-	-	-	-
Dec/2013	-	-	-	-	-
Jan/2014	-	-	-	-	-
Feb/2014	-	-	-	-	-
Mar/2014	15.62±2.70	12.75±4.41	-	-	-
Apr/2014	-	-	-	-	-

Values are Mean±SE





**Fig 4: Comparison of slug and snail density with mean percent damage to different plants in Tulsigaurd nursery**

#### References:

- Anonymous (2003) *Protected cultivation of ornamental crops*. *Floricult Today* **7**: 10-7. Applied Science, New York.
- Barker G M (2002) *Molluscs As Crop Pest*. CABI, Walling Forti Oxon 10 DE. UK. Pp 468.
- Daoud M I A (2004) *Ecological and morphological studies on some terrestrial snails in Dakahlia governorate*. M.Sc. Thesis Agriculture Faculty Al-Azhar University. Egypt.
- Deeb H I, Foda M E, Zedan H and Edress N M (2001) Bait preference and food consumption of some land snails in Egyptian new reclaimed lands. *J Environ Sci* **3**: 90-104.
- Grim B, Pail W and Koiser H (2000) Daily activity of the pest, *Arionlusiferousmabile*. *J Mollusc Study* **66**: 125-29.
- Kaur H (2011) *Gastropods infestation in plant nurseries at different locations and their management with latex of some plants*. M.Sc thesis, Punjab Agricultural University, Ludhiana, India.
- Kaur H and Chhabra E (2011) Nature and extent of damage inflicted by gastropods to saplings of some ornamental plants in plant nurseries at Ludhiana (Punjab). *Indian J Ecol* **38**: 173-77.
- Kaur H and Kaur A (2004) Impact of weather factors on population fluctuation of slug, *Filicaulisalte* Ferussac on plant nurseries at Ludhiana, Punjab. *Pest Mgmt Econ Zoo* **12**: 43-48.
- Kaur H and Panjgotra S (2012) Study of snail and slug damage in plant nurseries and adjoining fodder and vegetable crops in Jalandhar Distt *Proc Nat Conf "Man and Environment"* Punjab University, Patiala, India.
- Mrowezynski M and Wachowiak H (2002) Pest on agricultural crops in 2001/2002 season. *Ochron a- Roslin* **46**: 6-7.
- Okda M K (1981) Locomotion activity and infestation abundance of certain terrestrial molluscs in fruit orchard, Alexandria province, ARE. *Proc 4th Arab PesConf* **2**: 279-87. Tanta University, Egypt.
- Ramzy R (2009) Biological and ecological studies on land snails at Assiut, Egypt. M.Sc. Thesis, Faculty of

Science, Assiut University, Egypt.

Russell-Hunter W D (1983) Overview: Planetary distribution of and ecological constraints upon the Mollusca. In:  
(Russell-Hunter W D, (ed) *The Mollusca, Ecology 6*: 1-27. Academic Press, London



**Plate 1: Damage to (a) *Croton tiglium* spp. (b) *Dieffenbachia* spp. (c) *Dracaena (Green)* spp. (d) *Money Plant* spp. (e) *Bougainvillea* spp. (f) *Dahlia imperlias* spp. (g) *Syngonium podophyllum* spp.**