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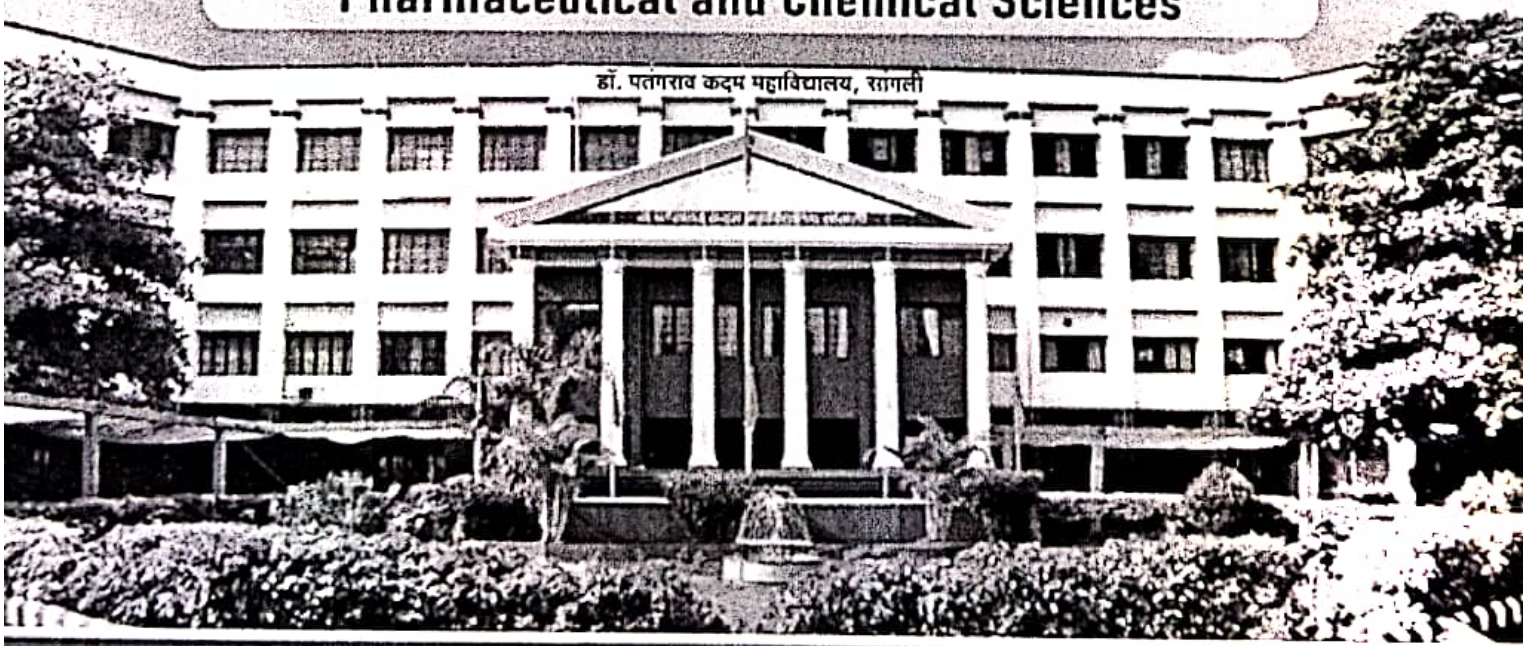

GIANT AFRICAN SNAIL - *ACHATINA FULICA* (BOWDICH, 1822), A NURSERY PEST FROM KOLHAPUR DISTRICT (M.S.)

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ABSTRACT: *Achatina fulica* is invasive terrestrial snail can cause serious economic damage to different agricultural crops as well as nursery and garden plants. The extensive rasping, defoliation, slime trails, or ribbon like excrement is signs of infestation. The study was carried out in different nurseries from Kolhapur district. In recent times, severe outbreak of this pest has been noticed due to some desirable agricultural and gardening practices like minimum tillage practices and straw retention techniques which help in survival of snails and make seedlings more susceptible to damage. Present investigation aims to enlighten on taxonomy, appearance, behavior and habitat, dispersal, diet, reproduction pattern, nature of damage and to suggest management strategies.

KEY WORDS: Giant African Snail, *Achatina fulica*, Nursery plants, Management practices.

1. INTRODUCTION

Phylum *mollusca* is the second largest phylum of the animal kingdom [1]. Several species of snails and slugs are considered as notorious pests in agro-ecosystem in different parts of the world due to their rasping feeding behaviors [2]. The Giant African Snail (GAS) *Achatina fulica* (Bowdich, 1822) belongs to the Phylum Mollusca, Class Gastropoda, subclass–Pulmonata, and family– Achatinidae of order–Stylommatophora. This is the biggest and most damaging land snail pests having a protective shell, measuring about 19 cm. in length.

It is an exotic invasive pest introduced from East Africa to India in 1847. Now it is reported from all continents [3]. The World Conservation Union (IUCN) has listed *A. fulica* as one of the world's 100 most invasive species [4]. According to Nelson [5] it is very active during monsoon, nocturnal in behavior and damage 500 different crops like papaya, banana,

brinjal, beans, okra, cucumber, cabbage, cauliflower, pumpkin, ground nut, melon, areca nut, rubber buds, coffee seedlings, orchids, marigold etc.

In India, Reddy and Sreedharan [6] recorded *A. fulica* on coffee in Andhra Pradesh. Sridhar *et. al.,* [7]; Ravikumara *et. al.,* [8] and Mallappa and Patil [9] reported severe occurrence of the GAS in various districts of Karnataka. Badal *et. al.,* [10] focused on Bio ecology and management of GAS *A. fulica.* Avhad *et. al.,* [11] and Jadhav *et. al.,* [12] reported GAS as mulberry pest in Aurngabad district and Kolhapur district of Maharashtra respectively. More recently Pinku and Rafee [13] surveyed molluscan pests in Karnataka. Lenin and Ummer [14] enlightened GAS menace in crops and management in Kerala. Bishal *et. al.,* [15] studied population density and damage in organic farm in east Sikkim. Pradeep Kumar [16] suggested some management strategies for control of GAS in Uttar Pradesh.

GAS is now widely distributed and no longer limited to their region of origin due to several factors viz., high reproductive capacity, voracious feeding habit, inadequate quarantine management and human aided dispersal. It is known for its destructive nature on cultivated crops and garden plants wherever it occurs. The information regarding incidence of molluscan pests in nurseries are lacking. There is little information available on the management of the Giant African Snail at Kolhapur district. The present investigation will help to take steps to eradicate or control snail infestations from Kolhapur district as early as possible.

2. MATERIAL AND METHODS

Survey was carried out for the collection and observation on infestation of *Achatina fulica* in nurseries. Several visits were made to 22 nurseries viz Sajiv Nursery (Kolhapur City), Shinde Nursery (Kolhapur City), Sai Prasad Biotech (Karvir Tahsil), Rushi & Kunal Nursery, Kasaba Bawda (Karvir Tahsil), Kamddhenu Ropvatika , Kothali (Karvir Tahsil), Om Agro Services (Karvir Tahsil), Green Earth Services (Karvir Tahsil), Yashraj Nursery (Karvir Tahsil), Akshay Nursery, Kagal (Kagal Tahsil)Plant library Nursery, Kagal (Kagal Tahsil), Palavi Nursery, Shiye (Hatkanagle Tahsil), Shetkari Nursery, Minache (Hatkanagle Tahsil), Shri Ambika Nursery, Kondigre (Shirol Tahsil), Warana Nursery, Warananagar (Panhala Tahsil) and Ankur Nursery (Radhanagari Tahsil).

Distribution and abundance of *Achatina fulica* were recorded in various nurseries from in and around Kolhapur city. On the basis of infestation four categories of nursery plants like

Ornamental, Flowering, Vegetable and Fruit were made. The data obtained and management strategies are discussed in detail in result.

3. RESULTS AND DISCUSSION

The occurrence and infestation of GAS *Achatina fulica* was observed in various nurseries in Kolhapur district. The infestation was observed on total 22 plants from all four categories of nursery plants like Ornamental, Flowering, Vegetable and Fruit. The list of plants is provided in Table no. 1. In ornamental category maximum infestation was observed on *Syngonium, Spathyphyllum* and *Diefenbachia*; in Flowering plants Hibiscus was infested mostly, in Vegetable category infestation was observed on 6 plants out of these Cabbage and Cauliflower were infested badly. In fruit plant category Banana and Papaya were infested mostly. Nature of infestation, feeding nature, excrement pattern, clinging behavior is as shown in Plate 1.

GAS feeds on leaves, stems, fruits, flowers of the host plants and leafy vegetables causing severe damage especially in nurseries as well as plants of horticultural and medicinal value [17], [18], [13]. It affects the aesthetic value of kitchen garden and roof gardens and nurseries too. Snails and slugs (molluscs) are hermaphrodites, but there is reciprocal exchange of spermatozoa as they mature before development of eggs [19]. Due to the high reproductive potential, a single snail can multiply in the field and it is very difficult to control their population.

a. Appearance: Adults usually around 7-8 cm tall, but may reach 20 cm or more. Shell has rounded conical shape, being about twice as high as it is broad. Shell is generally brown in color with irregular darker streaks running transversely across the whorls [20]. Adult size is reached in 4 months, but may continue slowly up to 1 ½ years. It is cross-fertilizing, egg-laying hermaphrodite [17]. Number of eggs per clutch averages around 200 with 5-6 clutches per year. Hatching viability is about 90%. Locally, the eggs and snails are readily transported in garden waste.

b. Behavior & Habitat: The giant African snail commonly is found in warm, humid climates. They can be found in coastal areas, shrub lands, plantation habitats and forests. The snail prefers temperatures that are well above freezing [21], [22]. It is nocturnal and spends most of

the day underground. These snails produce a slime that reduces friction and allows them to move along many ground surfaces.

c. Diet: GASs are herbivores. They typically feed on leaves, wood, bark, seeds, grains and nuts. Older snails can become carnivorous, however, also feed on living plants or other snails, fungi or animal matter. Their tongue having radula that allows to scrape or cut food.

d. Reproduction: The typical life span of the GAS is 3-5 years, but they have been known to live as long as 9 years. They are hermaphrodites. Young African snails only produce sperm, but adults are able to produce both sperm and eggs. Even though they have both male and female reproductive parts, they still have to mate with another snail because their sperm cannot fertilize their own eggs.

When two snails mate, they exchange sperm. The sperm may immediately fertilize the eggs, or it can be stored inside the body for up to two years before fertilizing any eggs. Once fertilized, the snail does not lay the eggs for 8 to 20 days. They typically hatch 11 to 15 days later. The snail can lay up to 100 eggs in its first year and up to 500 in the second year. After six months, the young reach adult size.

MANAGEMENT STRATEGIES:

Eradication of GAS is difficult and costly. It is literally impossible for well established populations in agricultural field. The effective control of pests involves a combination of measures, including physical, cultural, biological and chemical methods so it is best not to rely on just one method. The different management practices are discussed below:

a. Physical Method: Hand picking of snails and eggs on daily basis after sunset and destroy or incinerate them with a flame proves best eradication practice in heavily infested areas. Food baits (over-ripe papaya fruit pieces) can be used for easy collection and removal of snails from any field. International quarantine and surveillance practices are necessary to avoid their entry in any new geographical area.

b. Cultural control: One can reduce the infestation and population of GAS by practicing good field sanitation. Good hygiene, weed control and removal of refuges can reduce the problem over time. Regular Monitoring is essential for the pest in the nursery or in garden. Abundant ground cover and vegetation growth provide favorable conditions like ideal moisture levels,

shelter and harborage where snails thrive and can be a problem. Avoidant of minimum tillage and straw-retention techniques in *A. fulica* endemic areas are effective since these practices not only help the snails to survive but also make the seedlings more susceptible to damage. Soils with more organic matter content are more attractive to the snails.

Unnecessary growing of plants between trees and vines can also act as shelter belt for the snails. Sprinkling of table salt around the crop-base in dry season is one of the best preventive measures. Prasad *et.al.*,[3] suggested and experimentally proved *Annona glabra* softwood cutting fence is a feasible and practical alternative to protect nursery beds from *Achatina fulica*.

c. Biological control: Since *A. fulica* is an alien pest therefore there are limited natural enemies that control this pest. Some predatory beetles, lizards, birds and rats can feed on them. Ducks and chickens can provide effective, long-term control in orchards and vineyards, if an appropriate breed is chosen and properly cared for. Khaki Campbell or Indian runner ducks are best breed to be used in snail control [23], [24], [25] and [26].

Use of predatory snails and worms in *A. fulica* management has also been implicated in the decline of native snails in many countries. Some of the predatory snails which can predate and feed on *A. fulica* include *Euglandina rosea, Gonaxis kibweziensis, Gonaxis quadrilateralis, Edentulina ovoidea and Edentulina affinis. Platydemus manokwari, a turbellarian* flat worm, has also been used to control the GAS in Guam, Philippines and Maldives.

d. Chemical control: Some of the chemicals are effective to control this species. However, it should be advisable to use the chemicals judiciously. Lime or bleaching powder may be sprinkled in the infested area was effective. Common salt may also be spread on the snail infested area.

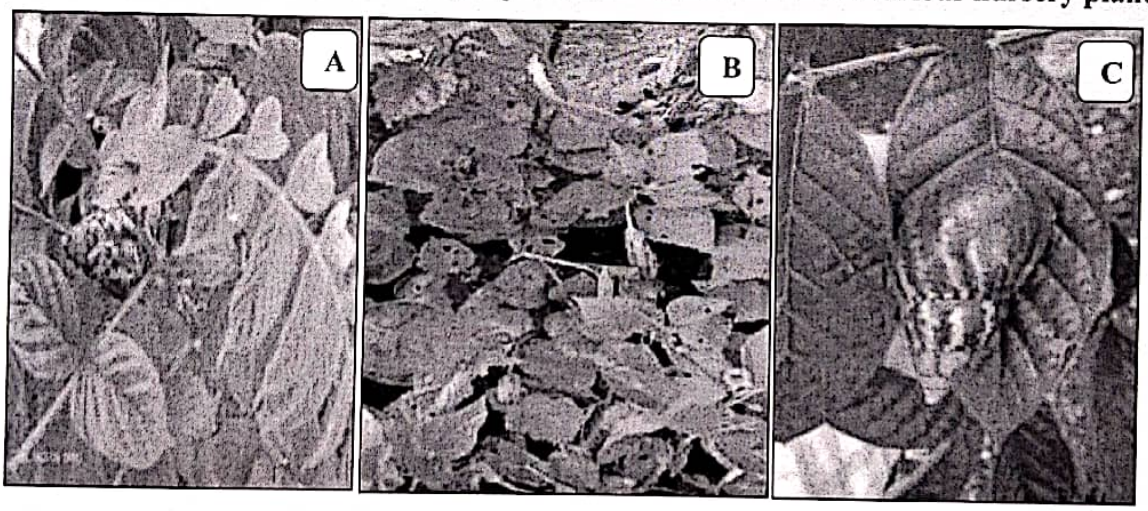
Few chemicals which are effective to control the snails are methiocarb, metaldehyde and EDTA. The bait materials such as dicholorvos bait (Wheat flour- 1kg + Jaggery- 0.2 kg + Dicholorvos 76EC- 250ml) and methomyl bait (Rice bran 1kg + Jaggery 0.2 kg + Methomyl 40 SP- 100 g) are suitable to control the infestation of the species. The bait preparation should be carried out prior to application of molluscicides. The bait should be prepared by heating the

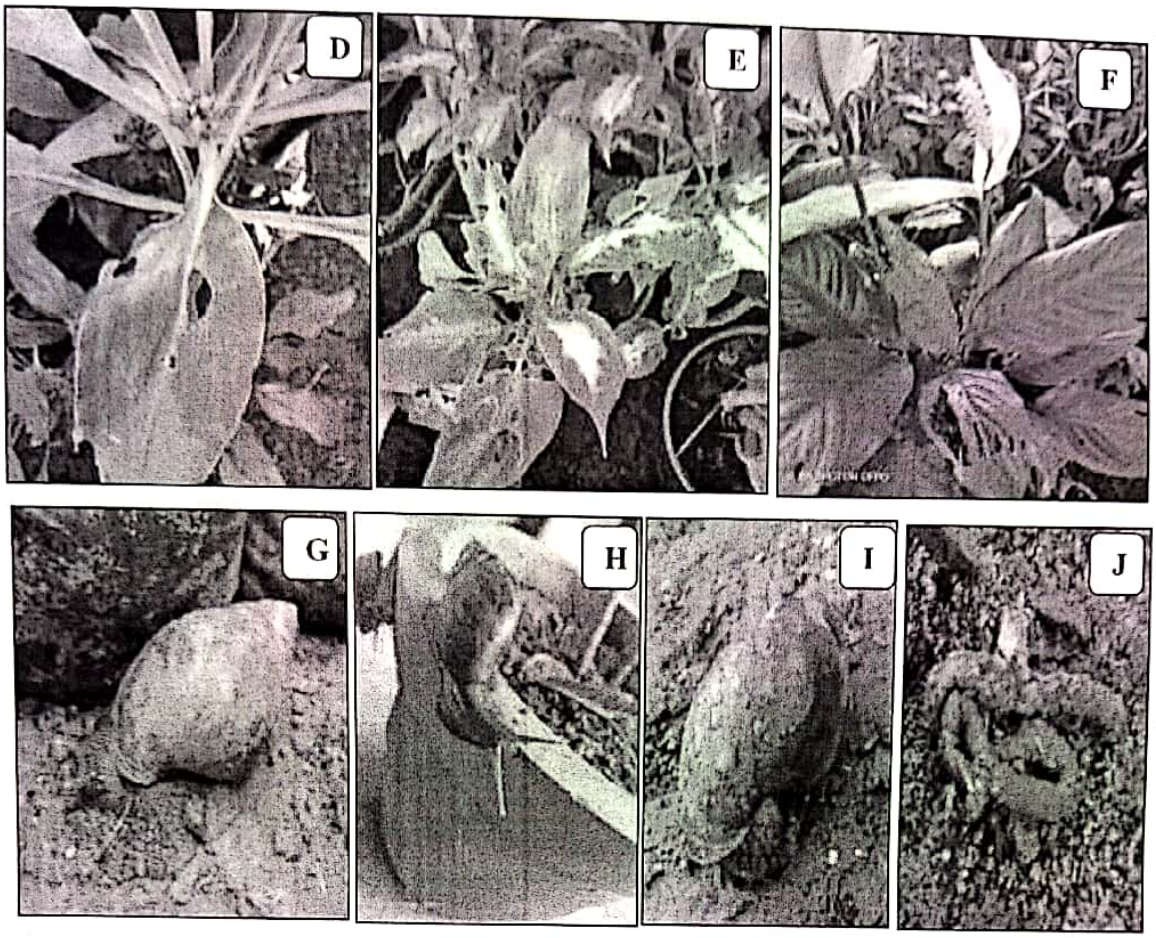
jaggery with wheat flour/ rice bran along with the poison. Hand gloves should be used to make small balls and keep it in 10 places in the field.

Table No. 1. List of Nursery Plants infested by *A. fulica.*

	Ornamental		**Flowering**		**Vegetable**		**Fruit**
1.	*Aglonema*	1.	Hibiscus	1.	Brinjal	1.	Banana
2.	*Syngonium*	2.	Marigold	2.	Tomato	2.	Jamun
3.	*Spathiphyllum*	3.	Aster	3.	Cauliflower	3.	Papaya
4.	*Dieffenbachia*	4.	Petunia	4.	Cabbage	4.	Mango
5.	*Chlorophytum*			5.	Capsicum	5.	Moringa
6.	Bird Cherry			6.	Curry Leaf	6.	Pumpkin

Plate 1. Giant African Snail *Achatina fulica* and its infestation on various nursery plants





A- GAS on Bird cherry plant **B- Infestation on Hibiscus** **C- GAS clinging to host plant**
D- Infestation on *Chlorophytum* **E- Infestation on *Dieffenbachia*** **F- Infestation on *Spathiphyllum***
G- GAS hiding under bags **H- GAS on Nursery Pots** **I- GAS in moist places**
J- Excrement of GAS

4. CONCLUSION

Invasive species are one of the top threats to biodiversity. Once an invasive species establishes its population in a new vulnerable area, it is very difficult to check its growth, spread and damages. In case of Giant African Snails, several eradication measures have already been found unsuccessful. Some of the management options also have lots of indirect issues related to environment, biodiversity and health hazards. Biological control in the form of introducing the rosy wolf snail proved disastrous and caused even more damage, razing of an entire ecosystem in the pursuit of eradicating only one species. Use of toxic baits targeted for *A. fulica* also victimized indigenous as well as other invasive snails. As regards to chemical control,

various molluscicides like metaldehyde are non-selective, thus their use has a chance of endangering the survival of non-target organisms.

However, some easy techniques like collection and destruction of the snails and their eggs are recommended as a form of physical control. Guarding pathways through which Giant African Snails can pass is much cheaper than pursuing them through biological or chemical control. Moreover, to be effective, the molluscicides should be such that it may not get dissolved and washed away by rain because snails are normally active during the rainy season. Therefore, an effective eco-friendly management strategy is needed to keep the pest below economic injury level. Holistic efforts in and around Kolhapur city at the regional level are not only needed to prevent further spread of *A. fulica* but also required to formulate an effective and environmentally sustainable management strategy.

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