Achatina fulica (Giant African Land Snail) Impacts Information

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1.0 Introduction

Achatina fulica is considered one of the worst snail pests of tropic and subtropic regions. It consumes large volumes of native plants, modifies habitats and out-competes native snails (Moore 2005). While its small size limits the quantity of plant material consumed per animal the aggregated nature of the infestations can lead to severe damage in infested plants (Raut & Barker 2002). Under optimal field conditions *A. fulica* can reach high densities and biomass (Raut & Barker 2002). Tillier (1982, in Raut & Barker 2002) recorded a biomass of up to 780 kg ha-1 in New Caledonia. Raut and Ghose (1984, in Raut & Barker 2002) recorded population densities of up to 46 m-2 in mainland India and up to 56 m-2 in Andaman and Nicobar. On the Philippine island of Bugsuk, Maniappan and colleagues (1986, in Raut & Barker 2002) estimated that 45 million *A. fulica* were collected and destroyed on 1600 hectares over a seven month period. In the Maldives Maniappen (1987, in Raut & Barker 2002) reported population densities of *A. fulica* 73 m-2 for the island of Male. On Christmas Island, Lake and O'Dowd (1991, in Raut & Barker 2002) recorded a mean of 10m-2 individuals in the heavily infested areas.

The emergence of *A. fulica* as an important crop pest within a decade or two of establishment has been reported over much of its introduced range. The process of naturalisation may ameliorate the impacts of this invasive species. Mead (1979a) expressed the opinion that:

> "*…the phenomenon of decline in populations of Achatina fulica appears to be inevitable*".

It is evident that in some areas of India *A. fulica* has been thriving for over 150 years with no clear evidence of abatement in its pest status (Raut & Ghose 1984, in Raut & Barker 2002). In contrast there are cases in which *A. fulica* populations have decreased following remarkable abundance and environmental impacts. For example, *A. fulica* became a lesser problem after only 20 years on Moorea in French Polynesia (Clarke et al. 1984, in Raut & Barker 2002) and after some 60 years in Hawaii, USA (Cowie 1992, in Raut & Barker 2002), and Ogasawara, Japan (K. Takeuchi pers comm. 2000, in Raut & Barker 2002).

2.0 Agricultural

In tropical agriculture the cost of *A. fulica* is fourfold. First there is the loss of crop yield caused by herbivory (either directly through crop damage or indirectly through damage to key plants which enrich the soil for crop plants). Secondly, damage may be caused by the spread of disease through the transmission of plant pathogens. Thirdly, there is the cost associated with the control of the pest and, finally, there are the opportunities lost with enforced changes in agricultural practice such as limiting crops to be grown in a region to those crops resistant to snail infestation (Raut & Barker 2002).

However, in a review of the economic importance of infestations Mead (1979a, in Raut & Barker 2002) makes little mention of *A. fulica* as a crop pest. Civeyrel and Simberloff (1996) suggest that the apparent inevitable population decline that occurs in the wake of the invasion argues against a long-term threat to agricultural production.

The list of "*Economically important plants recorded as being subject to losses through damage by Achatina fulica Bowdich (Achatinidae) in regions outside of Africa*" is significantly long and includes the following groups of plants: amaranth (Amaranthaceae), banana (Muscaceae), basella (Basellaceae), beans and peas (Fabaceae), blimbi (Oxalidaceae), breadfruits (Moraceae), brinjal/aubergine (Solanaceae), brassicas (Brassicaceae), cacao (Sterculiaceae), carrot (Apiaceae), cassava (Euphorbiaceae), castor (Euphorbiaceae), chillis and peppers (Solanaceae), citus (Rutaceae), coffee (Rubiaceae), corm (Araceae), cotton (Malvaceae), drum stick (Moringaceae), erythrina (Fabaceae), eucalyptus (Myrtaceae), figs (Moraceae), gourd/pumpkins/cucumber/melons (Cucurbitaceae), jute (Tiliaceae), kokko (Fabaceae), lettuce (Asteraceae), mahogany (Meliaceae), mulberries (Moraceae), okra (Malvaceae), onion (Liliaceae), palm nuts (Arecaceae), Papaya (Caricaceae), passion-fruit (Passifloraceae), potato (Solanaceae), rubber (Euphorbiaceae), shishu (Fabaceae), soursop (Annonaceae), spinach (Chenopodiaceae) Sunflower (Asteraceae), sweet potato (Convolvulaceae), taro (Araceae), tea (Theaceae), teak (Verbenaceae), tobacco (Solanaceae), tomato (Solanaceae), vanilla (Orchidaceae) and yam (Diascoreaceae).

Economic crops that generally suffer little damage from *A. fulica* include sugar cane (*Saccharum officinarum*), maize (*Zea mays*), rice (*Oryza sativa*; but see Economic Impacts), coconut (*Cocos nucifera*), pineapple (*Ananas comosus*) and screw pine (*Pandanus tectorius*). Onion (*Allium cepa*), garlic (*Allium sativum*), yam-beans (*Pachyrhizus tuberosus*) and betel (*Piper betel*) are particularly resistant to damage from *A. fulica* (Godan 1983, Srivastava 1992, in Raut & Barker 2002).

Irrespective of crop the seedling or nursery stage is the most vulnerable stage. In some cases infestations of the seedling stage are so severe that different crops must be planted (Raut & Barker 2002). In more mature plants the nature of the damage varies with the species, sometimes involving defoliation and in others involving damage to the stems, flowers or fruits (Raut & Barker 2002). Conflicting reports of damage from different regions occur for yams, bitter gourd (*Momordica charantia*), tea coffee (*Coffea* spp.) and various taro species (*Alocasia macrorrhizos*, *Colocasia esculenta*, *Xanthosoma brasiliense*) (Raut & Barker 2002).

3.0 Economic/Livelihoods

A. fulica is a major agricultural pest, feeding on a variety of crops and causing significant economic losses. In the US state of Florida it has been estimated that *A. fulica* would have caused an annual loss of USD 11 million in 1969 if its population had not been controlled (USDA 1982). In India it attained serious pest status, particularly in 1946/1947, when it appeared in epidemic proportions in Orissa and caused severe damage to vegetable crops and rice paddies (Pallewatta *et al*. 2002).

4.0 Disease Transmission

A. fulica distributes in its faeces spores of *Phytophthora palmivora* in Ghana; P. palmivora is the cause of black pod disease of cacao (*Theobroma cacao*); the fungus which also infects black pepper, coconut, papaya and vanilla (Raut & Barker 2002). A. fulica spreads *P. colocasiae* in taro and *P. parasitica* in aubergine (*Solanum melongena*) and tangerine (*Citrus reticulata*) (Mead 1961 1979a, Turner 1964 1967, Muniappan 1983, Schotman 1989).

While the importance of these diseases is well established the importance of *A. fulica* as a vector for the spread of these diseases has not been well established (Raut & Barker 2002).

5.0 Ecosystem Change

Costs to the natural environment may include (Raut & Barker 2002): herbivory on native plants; altered nutrient cycling associated with large volumes of plant material that pass through the achatinid gut; the adverse effects on indigenous gastropods that may arise through competition; and the indirect adverse effects on indigenous gastropods that may arise through control of the snail (eg: biological control with the rosy wolfsnail *Euglandina rosea* or use of chemical pesticides applied against achatinids).

The introduction of *A. fulica* has often lead to secondary or indirect impacts such as the purposeful subsequent introduction of predatory snails and flatworms as biological control agents. These agents usually have a devastating effect on the environment. For example, a particularly important cause of the demise of the endemic snails in forested habitats in Tahiti and Hawaii has been the deliberate introduction of *E. rosea* and the predatory flatworm *Platydemus manokwari* to control *A. fulica*.

A. fulica may also alter ecosystems by providing an alternative food source for predators and thereby changing the food chain (Mead 1961). This can have unfortunate consequences if the predator species is also invasive. For example, in the Bonin Islands, Japan, the introduced invasive cane toad (*Bufo marinus*) was found to prey predominantly on *A. fulica* (Matsumoto *et al*. 1984). However, natural predation may alternatively help keep populations of *A. fulica* in check. For example, on the Christmas Islands *A. fulica* has not established in undisturbed rainforests; this is thought to be due to native red crabs consuming significant numbers of the snail (Lake & O'Dowd 1991).

6.0 Human nuisance

A. fulica are also a general nuisance when found near human habitations and can be hazardous to drivers, causing cars to skid. Their decaying bodies release a bad odor and the calcium carbonate in their shells neutralises acid soils, altering soil properties and the types of plants that can grow in the soil (Mead 1961).

7.0 Human health

In many Asian, Pacific and American societies *A. fulica* may play a role in the transmission of the metastrongylus causative agents of eosinophilic meningoencephalitis (*Angiostrongulus cantonensis* and *A. costaricensis*). *A. fulica* is a vector for the bacterium *Aeromonas hydrophila* (also found in shellfish in New Zealand) (Kliks & Palumbo 1992). The parasites carried by the snail are usually passed to humans through the consumption of raw or improperly cooked snails (Moore 2005). In American Samoa an outbreak of eosinophilic radiculomye-loencephalitis related to eating *A. fulica* infected with *A. cantonensis* occurred in 1982 (Kliks *et al*. 1982). Albuquerque and colleagues believe that *A. fulica* could represent a threat to human health in Brazil.

8.0 References

Please see the GISD Species Profile for: *Achatina fulica* (References Section).