INVASIVES

Newsletter of the Asia-Pacific Forest Invasive Species Network (APFISN)

Volume 7 January 2007

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New publications

- Studies on the rust *Prospodium tuberculatum*, a new classical biological control agent released against the invasive alien weed *Lantana camara* in Australia.
- Optimal eradication: when to stop looking for an invasive plant.
- Metabolic mobilization into the stem galls of *Parthenium hysterophorus* (Asteraceae) induced by *Epiblema strenuana* (Lepidoptera: Tortricidae) inferred from signatures of isotopic carbon and nitrogen, and total nonstructural carbohydrates

Recent books

- Species invasions: Insights into ecology, evolution, and biogeography.
- Biological invasions in New Zealand (Ecological Studies).
- Nature out of place: Biological invasions in the global age

Forthcoming Symposia/Workshops

- 12 - 16 March 2007. 18th Session of the Committee on Forestry (COFO, 2007), FAO Headquarters, Rome, Italy.
- 23 - 27 September 2007. 15th International Conference on Aquatic Invasive Species, Nijmegen, The Netherlands.
- 15 - 18 October 2007. XVI Plant Protection Congress, Glasgow, Scotland.

The Asia-Pacific Forest Invasive Species Network (APFISN) has been established as a response to the immense costs and dangers posed by invasive species to the sustainable management of forests in the Asia-Pacific region. APFISN is a cooperative alliance of the 32 member countries in the Asia-Pacific Forestry Commission (APFC). The network focuses on inter-country cooperation that helps to detect, prevent, monitor, eradicate and/or control forest invasive species in the Asia-Pacific region. Specific objectives of the network are: 1) raise awareness of invasive species throughout the Asia-Pacific region; 2) define and develop organizational structures; 3) build capacity within member countries and 4) develop and share databases and information.

Threats

Rubber vine (*Cryptostegia grandiflora*)

Rubber vine (*Cryptostegia grandiflora*), a native of Madagascar, is a self-supporting, scrambling, many stemmed, rapidly growing perennial vine that grows to 2 m tall (when unsupported) with long trailing whips. It is also an aggressive woody climber capable of climbing trees up to 30 m high. A milky sap oozes from stems, leaves and seedpods when cut or broken. The leaves are a glossy, dark green with a pink to purple midrib, 6-10 cm long, 3-5 cm wide, elliptic or oblong in shape and arranged in opposite pairs; petioles are 0.5-1.5 cm long. The funnel-shaped flower consists of 5 petals fused at the bottom two-thirds, which are pale pink at the extremities, gradually changing to a dark pink at the center. Flowering can occur throughout the

Rubber vine - habit

INVASIVES, monthly newsletter of the Asia-Pacific Forest Invasive Species Network (AFPISN) is intended to share information among countries in the Asia-Pacific region on Forest Invasive Species(FIS) and the threats they pose in the region. If you have any items of news value on FIS to share between national focal points of APFISN and more widely among foresters, agriculturists, quarantine personnel and policy makers, please pass them on to the editor - Dr. K. V. Sankaran, APFISN Coordinator, Kerala Forest Research Institute, Peechi-680 653, Kerala , India (sankaran@kfri.org).

year, except for June or July in certain areas. The seedpods are rigid, 10-12 cm long, 3-4 cm wide, and grow in pairs at the end of a short stalk. Each pod produces 340-840 seeds (5.2-9.7 mm long and 1.6-2.8mm wide), which are brown in colour and have a tuft of long white silky hairs. Seeds can float in water for up to 40 days and still remain viable. More than 90% of the seeds will germinate within 10 days if moisture is available. Seed dispersal is through wind and water. Local dispersal of seeds is accomplished by contact with vehicles, movement of machinery and other equipment, and by livestock. Roots of rubber vine have been found at depths of up to 13 m in mine shafts.

Rubber vine was introduced either for ornamental purposes or for cultivation (for its latex) in several countries. It is now considered to be a widespread weed in Fiji, French Polynesia, Guam, Cook Islands, Ecuador, Hawaiian Islands, Northern Mariana Islands, Marshall Islands, Solomon Islands, New Caledonia, Australia, Mexico, Mauritius and India. The most common habitats of rubber vine are agricultural areas, disturbed areas, natural forests, plantations, grasslands, riparian zones, scrub/shrublands, roadsides, watercourses and wetlands. It is especially common in disturbed situations where there is a temporary or permanent water source, such as along gullies, rivers, creeks, waterholes and salt marsh areas. Rubber vine damages the environment by forming impenetrable thickets and smothering and pulling down other vegetation. This results in loss of native biodiversity and unique ecosystems such as gallery forest and dry rain forest and reduces productivity of pastures, causes changes to the water flow and watercourses. The plant is poisonous and browsing can lead to cattle deaths. In Queensland, Australia, it impacts on four vulnerable animal species, thirteen threatened plant communities, one Ramsar site, thirteen important wetlands and a total of forty-eight reserves. Infestation of the vine in the Big Mitchell Creek gallery (Queensland) led to the disappearance of the rufous owl *Ninox rufa*, and Bower's Shrike- thrush *Colluricincla boeri*.

Burning can control rubber vine infestations and two successive annual burns are usually carried out. Chemical control of the vine has been attempted using ester 2,4-D, dicamba in the form of dimethylamine salt or picloram plus 2,4-D (tri-isopropanolamine salts) sprayed on the foliage and stems. Basal bark treatments (after cutting the stems about 50 cm above the ground) with ester 2,4-D, picloram and triclopyr or mixtures of these herbicides, or with hexazinone or metasulfuron alone have also proved effective. In cut stump treatments, the stems are severed at ground level and the cut surfaces swabbed by any of the above herbicides. Stem injections with picloram or hexazinone also give good results. The vine requires more than one herbicidal treatment and may take up to two years to die.

Gypsy moth (*Lymantria dispar*)

Lymantria dispar, commonly known as the Asian gypsy moth (AGM), is native to southern Europe, northern Africa, central and southern Asia and Japan. It is one of the most destructive pests of shade, fruit and ornamental trees throughout the northern hemisphere. AGM feeds on approximately 500 species of trees and shrubs, including oaks, aspen, apple, sweetgum, poplar, willow, hawthorn, basswood and gray and paper birch. Broad-leaved trees are preferred over other types. It avoids trees such as ash, tulip-tree, American sycamore, butternut, black walnut, balsam fir, flowering dogwood and rhododendron, but will feed on these in the late instar stage when densities of the larvae are extremely

Biological control of the vine using the rust fungus *Maravalia cryptostegiae* has been successful in Australia. Continued heavy infection by the rust causes defoliation, reduces seed production, kills small seedlings and causes dieback of the whip-like stems. Larva of the moth species *Euclasta whalleyi*, which feeds on leaves of the vine, is also being considered as a potential biocontrol agent. The moth prefers stressed plants, either from limited soil moisture or high levels of rust infection. It is active during the dry season.

Rubber vine - seed pod and seeds

The status of rubber vine as a weed is apparently restricted to parts of Australia (mainly Queensland and Western Australia) and a few countries in the Pacific region. Although rubber vine is grown as a garden plant in several parts of India, it has not attained weed status in that country. However, the

Rubber vine - infestation

introduction of rubber vine into other parts of the Asia- Pacific region where it doesn't currently occur needs be done with caution.

Asian gypsy moth - male

high. The main impact on trees is defoliation and resultant weakening, reduction in growth, dieback of twigs and branches, and eventual death. Trees defoliated by the moth larvae often become more susceptible to attacks by insects and pathogens. An example is attack by the two-line chestnut borer or Armillaria root rot in oak trees. Defoliation can also reduce seed production and root sprouting, resulting in poor regeneration. In addition, the diversity or species composition of native insects, birds and animals may be altered during outbreaks of gypsy moth attacks. Each outbreak can last from 1 to 5 years. The European strain of the moth was accidentally introduced into the United States in 1868, and the first outbreak occurred in 1889. It is now widespread in northeast USA and eastern Canada. The discovery of the Asian strain of the moth in Canada, in 1991, has raised new concerns.

The gypsy moth (so named because of its ability to travel by attaching itself to various objects) passes through four stages in its life cycle: eggs, larva, pupa and adult (moth) stage. Only the larvae damage trees and shrubs. The life cycle of the Asian strain of the gypsy moth is similar to that of the European strain. However, some notable differences exist. The Asian strain prefers coniferous trees, is better adapted to colder climates and the female is able to fly. These differences make the Asian strain a serious threat to Canadian forests. The adult female of the European strain is a large, creamy white flightless moth with a 5 cm wingspan and a dark, saw-toothed pattern on the wings. She will deposit an egg mass some time during early July to mid-August, depending on the weather conditions. The female moth emits a chemical odor (pheromone) to attract the nearest male for mating. After mating, the female spends about a day depositing her egg mass, falls to the ground, and dies. The life span is about a week. The male moth is smaller than the female (with about a 4 cm wing span), and is brown in colour with black mottling. Soon after emergence, it will fly in rapid zigzag patterns searching for females. After mating, the male flies off to mate several more times before dying. Its life span is also about one week. Neither the male or female moths feed.


Gypsy moth - larvae


First instar gypsy moth larvae chewing small holes in leaves.

The egg mass is buff to tan in colour, usually the size of a one-dollar coin, and can contain 50 - 1,500 eggs, intertwined in a matting of hair from the body of the female. The hair is a good water repellant and insulator. The egg masses are laid on branches and trunks of trees, or in any sheltered location (fences, firewood, swing sets, boats, etc.). Large egg masses are a sign of stable or growing populations. The hatching of eggs takes place from early spring to mid May lasting up to seven weeks, and coincides with the budding of most hardwood trees. Gypsy moths are dispersed in two ways. Natural dispersal occurs when newly hatched larvae hanging from host trees by silken threads are carried by the wind for a distance of up to 1.6 km. Artificial dispersal occurs when people carry eggs for longer distances while transporting firewood, household goods, etc. Larvae develop into adults by going through a series of progressive moults, through which they increase in size. Male larvae normally go through five instars and females six, before entering the pupal stage. Newly hatched larvae are black with long hair-like setae. Older larvae have five pairs of raised blue spots and six pairs of raised brick-red spots along their backs and have a sprinkling of setae.


Asian gypsy moth - female

During the first three instars, larvae remain in the top branches or crowns of host trees. The first instar larvae chews small holes in the leaves. The second and third instars feed from the outer edge of the leaf toward the center. When population numbers are sparse, the movement of larvae up and down the tree coincides with light intensity. Larvae in the fourth instar feed in the top branches or the crown at night. At daybreak, the larvae crawl down the trunk to rest during daylight hours. They hide under flaps of bark, in crevices, under branches or under leaf litter where mice, shrews and beetles can prey on them. At dusk, the larvae climb back up to the branches of the host tree to feed. The larvae reach maturity between mid-June and early July and enter the pupal stage, which lasts for 7-14 days. Pupation can take place in both sheltered and non-sheltered locations, or even exposed on the tree trunk or foliage of non-host trees. Sometimes the caterpillars create flimsy cocoons made of silk strands holding the leaf together, while others do not cover the pupae in cocoons, but hang from a twig or bark instead.


A tree stripped by gypsy moth larvae

Predation by around 15 species of small mammals including mice, shrews, squirrels and parasitic and predatory insects, spiders and birds is critical in preventing AGM outbreaks. Diseases caused by bacteria, fungi and viruses also contribute to the decline of gypsy moth populations, especially when populations are dense and stressed by the

lack of preferred foliage. Infection by the nucleopolyhedrosis virus (NPV) causes a dramatic collapse of the moth population by killing both the larvae and pupae. Also, the fungus *Entomophaga maimaiga* has a large impact on AGM populations in North America. The influence of weather conditions is also critical in regulating populations of the moth. Low temperatures (-29ºC) lasting from 48-72 hours can kill exposed eggs; alternate periods of freezing and thawing may prevent the over-wintering eggs from hatching.

A number of tactics have been employed from time to time to manage gypsy moth populations and minimize damage due to infestations. Tactics suggested for home gardens include: removing objects in the home garden that provide shelter for gypsy moth larvae and pupae; not planting any tree species preferred by the gypsy moth; destroying egg masses found on buildings, fences and wood piles by scraping off the egg mass with a knife and burning the eggs or soaking them in kerosene, soapy water or household bleach; placing burlap on trees to provide shade and shelter for older larvae and then pick off the larvae curled under the burlap in the evening and destroy them; and using barrier bands (sticky tapes, petroleum jelly or grease) to prevent the larvae from crawling up the trunks. However, these tactics do not guarantee a significant reduction in AGM populations.

Larvae infected by the nucleo polyhedrosis virus (NPV) hanging in an inverted "V" position

Maintaining and enhancing the health of trees by improving growth conditions, watering the trees, applying fertilizer and carrying out thinning operations may help avoid infestations. Microbial and biological pesticides are widely used to control the gypsy moth. A microbial pesticide developed by NPV (Gypcheck), which is specific to the moth, is available in the USA. Another such pesticide is developed from *Bacillus thuringiensis* which, when ingested by the caterpillar, will paralyze and kill it in 7-10 days. Chemical pesticides commonly used against gypsy moth include carbaryl, diflubenzuron, pyrethrin, tebufenocide and acephate. Tree stands that are predominantly oak and growing on poor and dry sites are more vulnerable to gypsy moth attacks. Some of the silvicultural treatments to avoid gypsy moth infestation in a stand include: pre-defoliation thinning; pre-salvage thinning (removal of unhealthy trees that are most likely to die); and sanitation thinning (reducing the number of gypsy moth-preferred hosts from a given stand).

Gypsy moth larvae and pupae under burlap

To date, infestations by gypsy moths are restricted to parts of the United States and Canada, although it is expanding its range within these countries. However, the chances of its spreading to other countries in the Asia-Pacific region and Europe (or wherever it is non-native) are very high. Suitable quarantine methods, early warning on possible incursions and early detection and rapid response should help to keep the moth away from the non-infested areas/ countries.

Hyptis suaveolens - a threat to the flora of the Vindhyan Highlands, India

Hyptis suaveolens, native to tropical America, is an annual herb that occupies roadsides, rail tracks, wastelands, watercourses, pastures and open forests where the soil is well drained. It can form dense thickets in all areas of growth and poses a threat to the native flora and livestock. *Hyptis* is widespread in Australia (northern territory and Queensland), China, Indonesia, Papua New Guinea, Solomon Islands, French Polynesia, Federated States of Micronesia (Chuuk and Yap Islands), Niue Islands, and Guam and the Hawaiian Islands in the USA.

Hyptis is a strong-scented herb, which grows up to 2 m in height, with quadrate hairy stems and ovate to obovate leaves (3-5 cm long and 2-4 cm wide). The margins of the leaves are serrulate and the lower surface is densely hairy. The petioles are up to 3 cm long. The flowers grow in small cymes along branch ends with reduced leaves. The calyx is 5 mm long in flower and 10 mm long in fruit and is ribbed; corolla blue in colour. Nutlets about 1.2-1.5 mm long and slightly notched at the end. Seeds are dispersed through the movement of water, animals, humans and vehicles. It has a wide range of pollinators and, hence, seed production is enormous. The seed can remain dormant for many years and the plant can sprout vigorously from rootstocks following rains.

Hyptis suaveolens - habit

During the course of its establishment, *Hyptis* can interfere with the recruitment of nearby herb and shrub individuals. The biological attributes of the plant include vegetative reproduction, fire-tolerant, and high competitive ability. *Hyptis* is now spreading at an alarming rate in the tropical dry deciduous forests of the Vindhyan highlands, which lies between the Gangetic plains and Narmada valley in north India (21°29´ 25°11´ N latitude and 78° 15´ 84°15´ E longitude). It poses a serious threat to the flora of the natural forests in this area. It is cautioned that *Hyptis* can also become invasive in other areas where it has spread.

Mechanical control of *Hyptis* is possible through grubbing and burning, especially in small areas. Chemical control involves spraying of herbicides like 2,4-D ester or amine, dicamba, picloram, etc. All sprays should be applied before the onset of flowering.

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New publications

Thomas, S. E., Ellison, C. A., Tomley, A. J. 2006. Studies on the rust *Prospodium tuberculatum*, a new classical biological control agent released against the invasive alien weed *Lantana camara* in Australia. 2. Host range. Australasian Plant Pathology, 35: 321-328.

Regan, T. J., McCarthy, M. A., Baxter, P. W. J., Panetta, F. D., Possingham, H. P. 2006. Optimal eradication: when to stop looking for an invasive plant. Ecology Letters, 9: 759- 66.

Raman, A., Madhavan, S., Florentine, S. K., Dhileepan, K. 2006. Metabolic mobilization into the stem galls of *Parthenium hysterophorus* (Asteraceae) induced by *Epiblema strenuana* (Lepidoptera: Tortricidae) inferred from signatures of isotopic carbon and nitrogen, and total nonstructural carbohydrates. Entomologia Experimentalis et Applicata 119: 101-107.

Recent Books

Species invasions: Insights into ecology, evolution, and biogeography. Eds. Dov F. Sax, John J. Stachowicz and Steven D. Gaines. Published by Sinauer Associates Inc, 2005. In this book, experts from the fields of ecology, evolution, and biogeography explore the unique insights that species invasions provide. Several key advances emerge in each discipline, and collectively they provide a template for new research that transforms invasion biology into a powerful tool for basic research in ecology, evolution, and biogeography.

Biological invasions in New Zealand (Ecological Studies). Eds. Robert B. Allen and William G. Lee. Published by Springer, 2006. Man's recent colonization of New Zealand has dramatically altered the resident biota and resulted in the introduction of numerous alien organisms to these once remote islands. In reverse, there is increasing evidence of a lesser-known export of species to other regions of the world. This volume presents an in-depth review of the level and rate of such invasions, and investigates what controls the success of invaders and the consequences for ecosystems both on land and offshore

Nature out of place: Biological invasions in the global age: By Roy G. Van Driesche, and Jason Van Driesche, Published by Island Press, 2004.Though the forests are still green and the lakes full of water, an unending stream of invasions is changing many ecosystems around the world from productive, tightly integrated webs of native species to loose assemblages of stressed native species and aggressive invaders. This book brings this devastating, but overlooked, crisis to the forefront of public consciousness by offering a fascinating exploration of its causes and consequences, along with a thoughtful and practical consideration of what can be done about it. The book also provides a number of specific suggestions for ways in which individuals can help reduce the impacts of invasive species, and offers resources for further information

Forthcoming Symposia / Workshops

12 - 16 March 2007. 18th Session of the Committee on Forestry (COFO, 2007), FAO Headquarters, Rome, Italy. Topics for discussion include: state of the world's forests, national forest programmes, forests and energy, forest protection, putting forestry to work at the local level, progressing towards sustainable forest management, forest tenure, small and medium scale forest enterprises, national and global forest assessments, voluntary guidelines for sustainable forest management, new generation of watershed management programmes, interface between forestry and agriculture, avoided deforestation, shaping an action program for FAO in forestry etc. Contact: douglas.kneeland@fao.org Website: http://www.fao.org/forestry/site/cofo/en/

23 - 27 September 2007. 15th International Conference on Aquatic Invasive Species, Nijmegen, The Netherlands. The conference will involve over 400 participants from 30 countries representing academia, industry, government agencies, NGOs and other stakeholders who are involved in the issues of invasive species in fresh water and marine environments and are seeking opportunities for cooperation and collaboration to address them. Contact: profedge@renc.igs.net

15-18 October 2007. XVI Plant Protection Congress, Glasgow, Scotland. The Congress topics include: assessing and managing the risks posed by invasive alien species; bioterrorism identifying the threats and preventing damage; efficacy of biological control, using living organisms and natural products; advances in the diagnosis and forecasting of plant diseases and other related topics. Contact: md@bcpc.org

Compiled and edited by Dr. K. V. Sankaran, APFISN Co-ordinator on behalf of the Asia-Pacific Forest Invasive Species Network. For more information on the APFISN, please contact your national focal point or the APFISN Co-ordinator or Mr. Patrick Durst, Senior Forestry Officer, FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok. Email: patrick.durst@fao.org