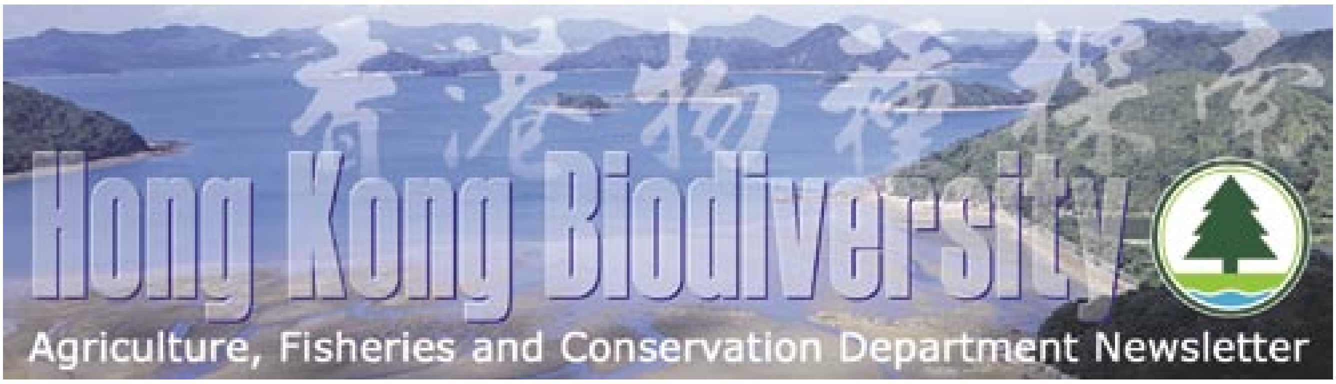

Issue No. 9 September 2005

Feature Article

An Introduction to Common Sesarmine Crabs of Hong Kong
香港相手蟹的簡介

Winnie P.W. Kwok and Wing-sze Tang
Coastal Community Working Group

漁農自然護理署海岸生態工作小組於2002年開始進行全港性的紅樹林調查，蒐集及更新紅樹林植物及動物的資料，研究範圍包括紅樹林的蟹類、螺貝類、紅樹植物群落及海草床的分布與監察，從而客觀評價各個紅樹林的生態價值。在本港紅樹林紀錄到的方蟹亞科有24種，其中較常見為雙齒近相手蟹(學名*Perisesarma bidens*)，香港亦有3種特有蟹類物種-米埔近相手蟹(學名*Perisesarma maipoensis*)、*Chiromantes sereni*及*Pseudosesarma patshuni*。本文介紹了方蟹亞科的蟹類在紅樹林內的角色、分布及其分類索引。

Introduction of the Subfamily Sesarminae:

Sesarmine crabs refer to the members of the Subfamily Sesarminae (相手蟹亞科) of Family Grapsidae (方蟹科). Like all other Grapsid crabs, they also have the characteristic square-shaped carapace. They have a wide range of sizes, from less than 5 mm in carapace width (CW) in *Nanosesarma minutum* (小相手蟹) up to 5 cm in *Episesarma vesicolor* (泡粒新相手蟹).

Sesarmine crabs are considered to be a specialized and advanced brachyuran group. Their tolerance to a wide range of salinity is reflected from the large variety of habitats and tidal heights where they are found: from the lowland stream banks to mangroves and marshes, from supralittoral to shallow subtidal, though the majority of them inhabit high intertidal regions (backshore) and coastal lowlands (abandoned fields). They have many adaptations for living in the semi-terrestrial environments. Most sesarmines have a net-like arrangement of setae, on the pterygostomian region (the side of the carapace next to the mouth parts), where water is stored. The water can then be re-circulated into the gill chamber. In this way, the gills are kept moist even when they are away from water for a long time (e.g. during the low tide period), so they can take in atmospheric oxygen. Sesarmine crabs are also good at constructing burrows which can extend to the water table. In fact, some of their burrows are in the form of a complex matrix which may be extended more than 1.5 m below the surface. Burrows are not

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only useful as refuges against avian (waterbird) and terrestrial predators (e.g Crab-eating Mongoose), but they also provide temperature regulation and water source to combat desiccation. Collection of sesarmine crabs is very difficult because they are very alert, with very swift action, often retrieve to burrows or tree root lattices when disturbed.

Close Association with Mangrove Forest

Sesarmine crabs have received more attention than other brachyuran groups in Hong Kong and their roles in the mangrove ecosystem have been studied in detail (Poovachiranon, 1986; Lee, 1989; Kwok, 1995). It is interesting to note that where mangrove diversity is highest in the Indo-Malalyan area, sesarmine crabs also seem to have the greatest diversity (Kwok, 1995). In Malaysia and Singapore, 44 species of sesarmine crabs have been documented (Tan & Ng, 1994). Sesarmine crabs are less common in eastern America, e.g. three species have been reported by Warner (1969) in Jamaica, six species has been reported by Abele (1973) in Florida while in Australia, only 14 species have been reported (Macnae, 1968).

Sesarmine crabs and mangrove forests are important components of the tropical ecosystems and they have strong interactions. Since mangrove forests provide the crabs with substrate and food in the form of leaf litter, an increase in the mangrove diversity will probably increase the number of niches available to the crabs and thus increase crab diversity (Kwok, 1995). On the other hand, the sesarmine crabs play an important role in mangrove forests. It is reported that they are very effective in helping the re-cycling of nutrients back to the mangrove forest. They can egest up to 70 % of the original weight of the decaying *Kandelia obovata* consumed in the form of faecal pellet (Kwok, 1995) which helps the microbial degradation of mangrove leaves. Their food preference helps to trap energy stored in the leaves before the tides carry them away (Lee, 1998), so benefitting the whole mangrove community.

Despite their role in litter consumption, these crabs are more adequately classified as omnivores because apart from consuming mangrove leaf litter or fruits, it is known that they practise cannibalism when confined together in containers (personal observation) and they are also easily attracted by fish baits in the field.

Endemic Sesarmine Crabs in Hong Kong

In an article on sesarmine crabs of Hong Kong, Soh (1978) reported 15 species including three species new to science namely *Perisesarma maipoensis* (米埔近相手蟹), (previously known as *Chiromantes maipoensis*), *Chiromantes sereni* (previously known as *Holometopus sereni*) and *Pseudosesarma patshuni*.

From a more recent publication by Lee & Leung (1993) on the sesarmine crabs in the Deep Bay area, and the discovery of *Episesarma vesicolor* (泡粒新相手蟹), which was not reported in Hong Kong before (Lai, 1998), a total of 24 species of sesarmine crabs have been reported in Hong Kong.

The two species first found in Hong Kong by Soh, i.e. *C. sereni* (type locality in Tai Po) and *P. patshuni* (type locality in Shui Hau, Lantau) had very limited records since their discovery. The second published records of these two species were not present until 1995 by Lee and the recorded locations were close to the type localities. They were therefore previously considered having very limited distributions as the habitat type in which they were first found (i.e. supralittoral freshwater paddy fields) was "becoming very rare in Hong Kong" (Lee, 1995), and in fact disappeared now. However, during our survey, *C. sereni* and *P. patshuni* were found at two (Lai Chi Chong and Sham Chung) and four sites (Tai Tan, Siu Tan, Sham Chung and To Kwa Peng) respectively, all away from their type localities. The results showed that these two species might have a wider distribution than previously thought.

Survey Results:

Among the 24 species of sesarmine crabs reported in Hong Kong, Coastal Community Working Group found 17 species which constitutes more than 70% of all the sesarmine crabs recorded in Hong Kong. They are listed in Table 1.

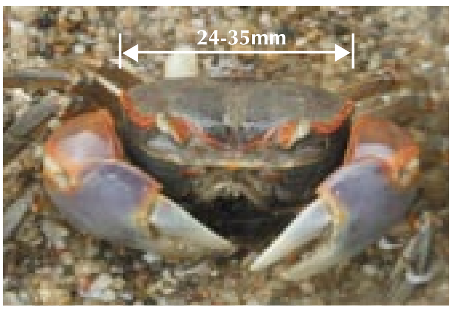

Fig 1. *Chasmagnathus convexus* 隆脊張口蟹

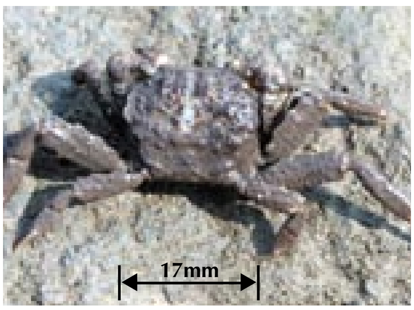

Fig 2. *Clistocoeloma* sp. 泥毛蟹

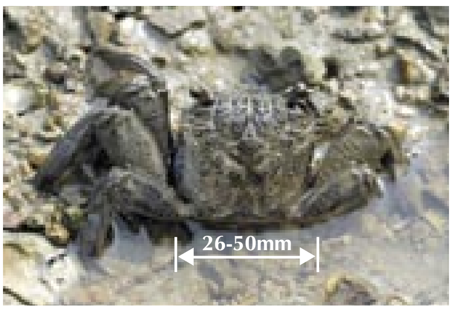

Fig 3. *Episesarma versicolor* 泡粒新相手蟹

Table 1. List of sesarmine crabs in Hong Kong

	Reported Sesarminae in Hong Kong	Records from AFCD Surveys
Sub-family Sesarminae		
Genus *Chasmagnathus*		
	Chasmagnathus convexus 隆脊張口蟹 (Fig. 1)	✔
Genus *Clistocoeloma*		
	Clistocoeloma sp. 泥毛蟹 (Fig. 2)	✔
Genus *Episesarma*		
	Episesarma versicolor 泡粒新相手蟹 (Fig. 3)	✔
Genus *Helice*		
	Helice latimera 側足厚蟹	NOT RECORDED
	Helice sp.	✔
Genus *Metaplax*		
	Metaplax elegans 秀麗長方蟹 (Fig. 4)	✔
	Metaplax longipes 長足長方蟹 (Fig. 5)	✔
	Metaplax takahasii 少疣長方蟹	NOT RECORDED
Genus *Nanosesarma*		
	Nanosesarma minutum 小相手蟹	NOT RECORDED
Genus *Neosarmatium*		
	Neosarmatium punctatum 斑點新脹蟹	NOT RECORDED
	Neosarmatium smithi 粗壯新脹蟹 (Fig. 6)	✔
Genus *Sarmatium*		
	Sarmatium germaini	NOT RECORDED
Genus *Sesarma*		
Chiromantes		
	Chiromantes dehaani 無齒螳臂蟹 (Fig. 7)	✔
	Chiromantes haematocheir 紅螯螳臂蟹 (Fig. 8)	✔
	**Chiromantes sereni* (Fig. 9)	✔
	Chiromantes tangi 明顯相手蟹 (Fig. 10)	✔
Parasesarma		
	Parasesarma pictum 斑點相手蟹 (Fig. 11)	✔
	Parasesarma plicata 摺痕相手蟹	NOT RECORDED
	Parasesarma affinis (Fig. 12)	✔
Perisesarma		
	Perisesarma bidens 雙齒近相手蟹 (Fig. 13)	✔
	Perisesarma fasciata 帶紋近相手蟹 (Fig. 14)	✔
	**Perisesarma maipoensis* 米埔近相手蟹	NOT RECORDED
Sesarmops		
	Sesarmops sinensis 中華相手蟹 (Fig. 15)	✔
Psuedosesarma		
	**Pseudosesarma patshuni* (Fig. 16)	✔
Total no. of records	24	17

* Endemic species

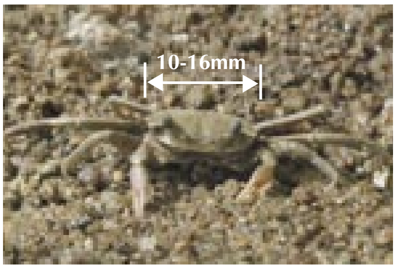

Fig 4. ***Metaplax elegans***
秀麗長方蟹

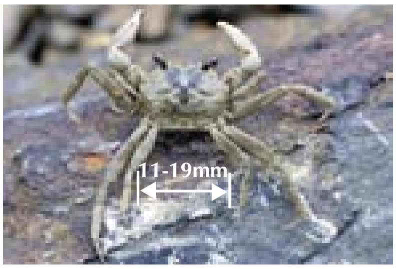

Fig 5. ***Metaplax longipes***
長足長方蟹

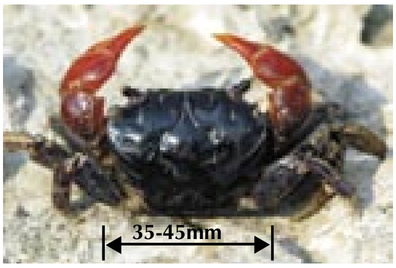

Fig 6. ***Neosarmatium smithi***
粗壯新脹蟹

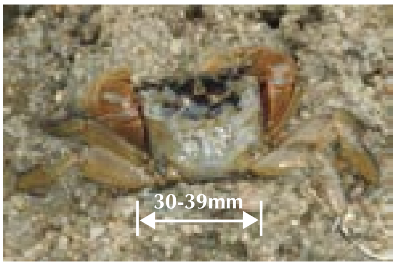

Fig 7. ***Chiromantes dehaani***
無齒螳臂蟹

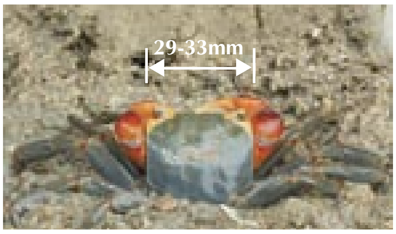

Fig 8. ***Chiromantes haematocheir***
紅螯螳臂蟹

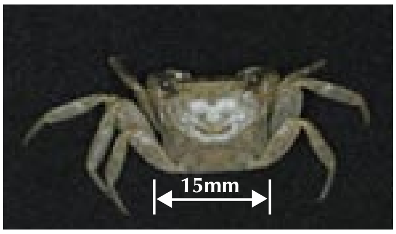

Fig 9. ***Chiromantes sereni****

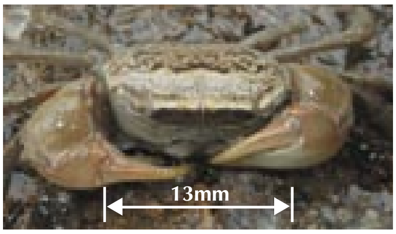

Fig 10. ***Chiromantes tangi***
明顯相手蟹

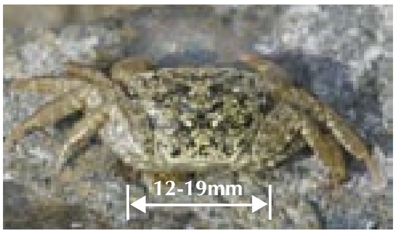

Fig 11. ***Parasesarma pictum***
斑點相手蟹

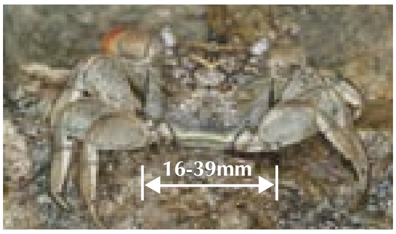

Fig 12. ***Parasesarma affinis***

Fig 13. ***Perisesarma bidens***
雙齒近相手蟹

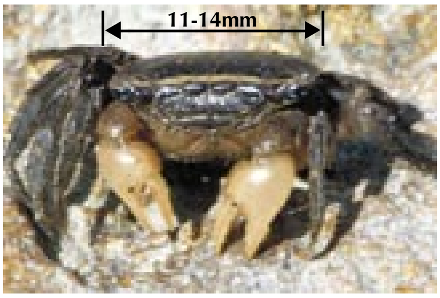

Fig 14. *Perisesarma fasciata*
帶紋近相手蟹

Fig 15. *Sesarmops sinensis*
中華相手蟹

Fig 16. *Pseudosesarma patshuni**

Table 2. Distribution of sesarmine crabs at six highlighted mangrove sites which have the highest diversities of sesarmine crabs.

Subfamily Sesarminae	Mangrove Sites					
Scientific Name	Sham Chung	Kei Ling Ha Hoi	Tai Tan	To Kwa Peng	Shuen Wan	Tai Wan
Chasmagnathus convexus				✔	✔	
Clistocoeloma sp.			✔	✔		✔
Episesarma versicolor						✔
Helice sp.						
Metaplax elegans		✔				
Metaplax longipes	✔	✔	✔	✔	✔	✔
Neosarmatium smithi	✔					✔
*Pseudosesarma patshuni**	✔		✔	✔		
Chiromantes dehaani	✔	✔			✔	
Chiromantes haematocheir	✔	✔	✔	✔	✔	
*Chiromantes sereni**	✔					
Chiromantes tangi						
Parasesarma pictum	✔	✔	✔	✔	✔	✔
Parasesarma affinis					✔	
Perisesarma bidens	✔	✔	✔	✔	✔	✔
Perisesarma fasciata	✔	✔	✔	✔		✔
Sesarmops sinensis		✔	✔			
Number of species	9	8	8	8	7	7

* Endemic species

It was noted from our surveys that *Perisesarma bidens* (雙齒近相手蟹) and *Parasesarma pictum* (斑點相手蟹) were the most common sesarmine crabs, with the former virtually found in all mangrove sites. On the other hand, *Episesarma versicolor* (泡粒新相手蟹), *Neosarmatium smithi* (粗壯新脹蟹), *Sesarmops sinensis* (中華相手蟹), *Pseudosesarma patshuni*, *Chiromantes sereni*, *Chiromantes tangi* (明顯相手蟹) and *Helice* sp. were considered uncommon as they only occurred in ≤5 mangrove sites during our survey. In particular, *Chiromantes tangi* (明顯相手蟹) was only recorded in the mangrove forest (outside border fence) within the Mai Po Nature Reserve. As for *Metaplax elegans* (秀麗長方蟹), since they look like *Metaplax longipes* (長足長方蟹) and are not readily identified on site, may account for their low occurrence in our survey.

Table 2 highlighted that Sham Chung, To Kwa Ping, Tai Tan and Kei Ling Ha Hoi had the most diverse sesarmine crabs species (>8 species) while Shuen Wan and Tai Wan also had 7 species. Apart from Sham Chung and Shuen Wan, these mangrove sites were ranked as either very important or important mangrove sites according to the comprehensive mangrove survey conducted by Tam & Wong (2000). It was interesting to note that the high diversity of sesarmine crabs at Sham Chung were found mainly in the banks of the stream and at the backshore of the mangrove rather than inside the mangrove forest. In fact, species like *Neosarmatium smithi* (粗壯新脹蟹), *Pseudosesarma patshuni*, *Chiromantes sereni*, *Chiromantes haematocheir* (紅螯螳臂蟹) and *Chiromantes dehanni* (無齒螳臂蟹) which were less commonly found in our surveys are inhabitants of the high intertidal to supralittoral zones of a mangroves where seasonal marshes, streams or rivers are usually found. These backshore habitats are in rapid decline in Hong Kong due to development. For example, it is not difficult to find houses abutting mangrove sites in Sai Kung, where the backshore marshes have been developed for houses or carriageway. While backshore habitats were more intact in To Kwa Ping and Kei Ling Ha Hoi, only patchy marshes were found at Tai Tan.

Discussion:

As shown above, sesarmine crabs occur in a variety of different coastal habitats (e.g. lowland sections of streams, estuaries, marshes, mangroves and backshore), all are important components of a mangrove community. Therefore, a high diversity of sesarmine crabs recorded in a mangrove is somehow an indicator of the 'intactness' of a mangrove habitat, in particular the presence of those species that occur in the high intertidal zone. It is proposed that the number of uncommon crab species is considered as one of the factors that determine the ecological values of a mangrove site in our surveys.

Classification:

Based on classification, sesarmine crabs belong to the Family Grapsidae (Dana, 1851), meaning all the crabs in this Family are having a subquadrate carapace with a broad front.

For the Subfamily Sesarminae, the third maxillipeds have an oblique hairy crest transversed from the antero-external angle of ischium toward the antero-internal angle of merus and their carapaces are strongly deflexed (Figure 17a & b).

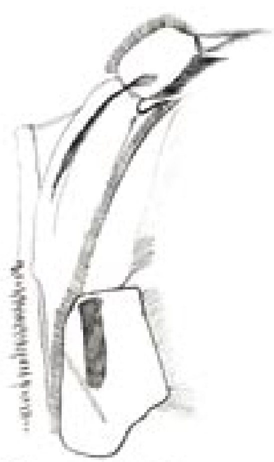

Fig 17a. Diagram of crab showing structure of the third maxilliped

Fig 17b. Third maxilliped of *Chasmagnathus convexus* 隆脊張口蟹

The Key to Some Common Genera:

(1)
Pterygostomian region and ventral lateral surface of carapace covered with short setae (Figure 18a)............(2)
Pterygostomian region without short setae (Figure 18b) ....(3)

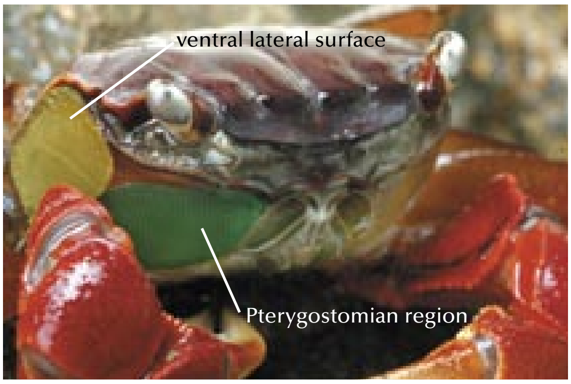

Fig 18a. Pterygostomian region and ventral lateral surface of *Sesarmops sinensis* 中華相手蟹

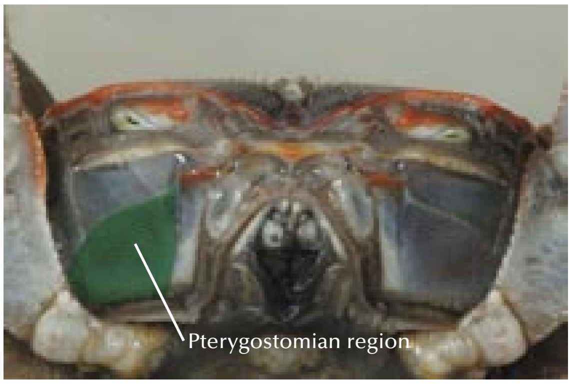

Fig 18b. Pterygostomian region of *Chasmagnathus convexus* 隆脊張口蟹

(2)
Antennal peduncles not excluded from orbit..............(4)
Antennal peduncles entirely excluded from orbit............ ....*Clistocoeloma*

(3)
Carapace elongate quadrate, broader than long. Eyestalk as broad as front (Figure 19a).........*Metaplax*
Carapace rounded quadrate, slightly broader than long. Eyestalk narrower than front (Figure 19b)...........(9)

Fig 19a. Elongate quadrate carapace of *Metaplax longipes* 長足長方蟹

Fig 19b. Round quadrate carapace of *Chasmagnathus convexus* 隆脊張口蟹

(4)
Merus of third and fourth ambulatory legs with 2-3 serrates on post anterodistal angle.............*Nanosesarma*
Merus of third and fourth ambulatory legs with only 1 subdistal tooth (Figure 20)..(5)

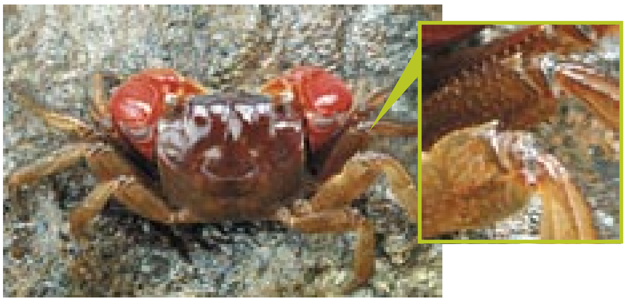

Fig 20. 3rd and 4th ambulatory legs with 1 subdistal tooth of *Searmops sinensis* 中華相手蟹

(5)
Movable fingers of male chela furnished with a row of less than 20 tubercles or smooth. Merus of ambulatory legs without subdistal tooth on anterior border (Figure 21)..(6)

Fig 21. Tubercles on movable fingers of *Parasesarma affinis*

Movable fingers of male chela furnished with more than 30 tubercles or dorsal surface. Merus of ambulatory legs with a subdistal tooth on anterior margin ....*Episesarma*
(6)
Antero-lateral teeth present..(7)
Antero-lateral teeth not present.....................................(8)
(7)
Transverse pectinated crests on dorsal surface of cheliped manus..*Perisesarma*
No transverse pectinated crests on dorsal surface of cheliped manus ....*Sesarmops*
(8)
Transverse pectinated crests on dorsal surface of cheliped manus...*Parasesarma*
No transverse pectinated crests on dorsal surface of cheliped manus...*Chiromantes*
(9)
Lateral margin of carapace arched. Merus of third maxillepeds narrowly elongate(Figure 22)................. ....*Chasmagnathus*
Lateral margin of carapace almost straight. Merus of third maxillipeds broad and short...........................*Helice*

Fig 22. Narrow merus of third maxillipeds of *Chasmagnathus convexus* 隆脊張口蟹

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Working Group Column

Rediscovery of the Locally Rare Seagrass *Ruppia maritima* in Hong Kong

Barry L.H. Kwok and Chun-pong Lam
Coastal Community Working Group

本署職員於2005年4月21日在西貢鹹田發現已絕跡香港近15年的本地稀有海草品種 —— 川蔓藻。此品種只曾於1905年及1988–1990年分別在石澳的瀉湖及米埔基圍內被發現。

On 21 April 2005, a patch of distinctive grass-like plant was found growing underwater alongside a patch of Dwarf Eel Grass* (*Zostera japonica* 矮大葉藻) at the river mouth in Ham Tin, Sai Kung by Barry L.H. Kwok and Wing-sze Tang. Subsequent examination of the samples by the Hong Kong Herbarium confirmed that it was the locally rare seagrass species – Widgeon Grass (*Ruppia maritima* 川蔓藻)(Figure 23).

Widgeon Grass is characterized by its thread-like blade leaf (3–11 cm long, 0.3–0.6 mm wide) and broad-ovoid fruits (2 mm long, 1 mm wide) that grow on stalk with 5–6 stalks connected to a peduncle (Figure 24). It is widely distributed in temperate and subtropical regions. Its wide distribution may be best explained by adaptations of the species to diverse aquatic habitats with fluctuating salinity, from coastal areas to estuaries, lagoons and ponds. In addition, its two distinctive means of reproduction facilitate its dispersal and colonization – sexually by germination of its seeds, and asexually by colonization with its rhizomes.

Fig 23. *Ruppia maritima*

Despite of its wide worldwide distribution, the seagrass is locally rare as it had only been recorded twice in Hong Kong previously. The first record was a specimen collected in Shek O Lagoon in 1905 (Dunn and Tutcher, 1912). After decades, the species was recorded again in Mai Po *Gei Wais* during 1988–1990 (Melville and Chan, 1992). Until now, no record has been made in the last 15 years.

The seagrass was observed again at the same site on 9th May 2005 but was not observed during recent visits in June and August 2005.

* The seagrass recorded in Ham Tim was Dwarf Eel Grass, not Oval Halophila (*Halophila ovalis* 喜鹽草) as reported in Table 2 of Issue No.8.

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Fig 24. Fruits of *Ruppia maritima*

Two Moth Species New to Hong Kong Discovered in AFCD's Ecological Surveys香港蛾類新品種記錄

Alfred K.C. Wong and Pak-chung Leung
Butterfly Working Group

漁護署在2004年的蛾類生態調查發現了兩個新品種的蛾類，分別是於大埔滘瞭望台附近和於大帽山山頂發現的柞蠶和綠絨雙斑尺蛾。

The Butterfly Working Group has now extended its horizons to explore Hong Kong's moth biodiversity, with the assistance of Dr. Roger Kendrick of C&R Wildlife. Using Robinson and Skinner Traps with 125W MV bulbs (Figure 25), evening and overnight surveys were made for 20 localities in Hong Kong, from March to November 2004.

While some collected specimens are still pending for identification, 1186 species were recorded, and 746 species of voucher specimens were prepared and stored in the AFCD headquarters. Amongst them, two moth species new to Hong Kong have been confirmed.

Fig 25. Robinson (left) and Skinner (right) Traps.

Antheraea pernyi 柞蠶

On 4 March 2004, a large silk moth was attracted to the trap and collected near the Tai Po Kau Fire Lookout. This silk moth was confirmed to be *Antheraea pernyi* (Chinese Oak Silkmoth柞蠶), the eighth member of the family Saturniidae seen in Hong Kong. This brownish specimen (Figure 26) has a wingspan of 125 mm, and is a male of which the forewings are distinctly falcate. The solid black outline on the outer margin of the hindwing eyespot distinguishes this species from its close relatives.

Antheraea pernyi is a nocturnal species, readily attracted to light and having two generations a year. Its polyphagus larvae feeds on Xylosmas, Oaks and Camphor, etc and the adults frequent well-wooded areas. The species range is within the Palaearctic region, with Hong Kong thus presumably near its southern limit. In mainland China, this species has a long history of being used for silk production and was introduced to Japan for the same purpose.

Gasterocome pannosaria 綠絨雙斑尺蛾

On 21 May 2004, a Geometrid moth of medium size (wingspan = 32 mm) was collected in a light

Figure 26. The specimen of *Antheraea pernyi*.

trap on Tai Mo Shan, and subsequently identified as *Gasterocome pannosaria* (綠絨雙斑尺蛾)(Figure 27). It has a pale discal spot in the centre of the forewing, and distinct dark border with a straight interior edge on the hindwing. Generally, this species prefers habitats at high elevations and its geographical range covers north India, the Southeast Asia as well as Taiwan.

Fig 27. The specimen of *Gasterocome pannsaria*.

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New Bat Species for Hong Kong - Greater Bamboo Bat (*Tylonycteris robustula* 褐扁顱蝠)

Chung-tong Shek and Cynthia S.M. Chan
Mammal Working Group

On 21 July 2005, a live bat specimen was caught by a double height 6m mist net at So Lo Pun in Plover Cove Country Park. On careful examination of the body features and measurements, the specimen was confirmed to be the Greater Bamboo Bat (*Tylonycteris robustula* 褐扁顱蝠)(Figure 28), a member of the Vespertilionidae. This is the first record of this species in Hong Kong, and discovery raised the total number of bat species in Hong Kong to 23.

Fig 28. Greater Bamboo Bat (*Tylonycteris robustula*)
褐扁顱蝠
Forearm: 26-30 mm

There are now two species of *Tylonycteris* in Hong Kong. The other is the Lesser Bamboo Bat (*T. pachypus* 扁顱蝠)(Figure 29) which was firstly recorded in Hong Kong in 1996 (Ades, 1996). Both species have the greatly flattened skull and the presence of cushions or pads on their thumbs and feet. Such features are remarkably adapted for gaining access to and roosting in the hollow joints of bamboo stems. It is likely that the captured specimen roosted in the Chinese Thorny Bamboo (*Bambusa sinospinosa* 車筒竹) near the mist netting site.

Fig 29. Lesser Bamboo Bat (*Tylonycteris pachypus*)
扁顱蝠
Forearm: 24-28 mm

Although these two species overlap in forearm length, it is easy to distinguish them by the features of the pelage and colour of the pads on thumbs and feet. The identification key published in Issue No. 7 (Shek, 2004) can be revised with the following additions to separate these two species:

11.
A. Thumb and feet with pads......................................(11a)
B. Thumb and feet without pads ....(12)
11a.
A. Fur is smooth and sleek, dark brown to dark grayish brown, with dark brown pads on thumbs and feet (Figures 30&31)................................*Tylonycteris robustula*

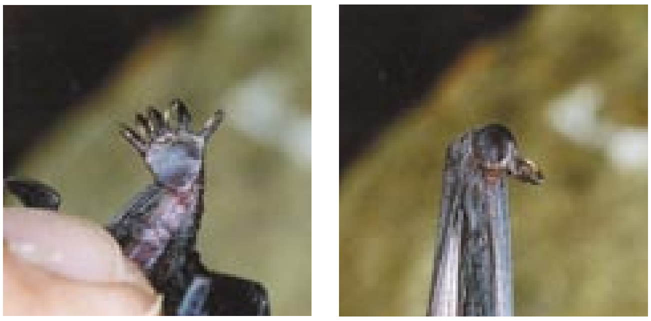

Fig 30&31. Foot and thumb of *T. robustula.*

B. Fur is short and fluffy, light brown to brown in juvenile, yellowish brown to reddish brown and an orange tinge to the belly in adult, with pink pads on thumbs and feet (Figures 32&33)....................*T. pachypus*

Fig 32&33. Foot and thumb of *T. pachypus.*

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A Note on the Pit Vipers of Hong Kong

Simon K.F. Chan, Ka-shing Cheung, Ching-yee Ho, Fung-ngai Lam and Wing-sze Tang
Herpetofauna Working Group

Introduction

Pit vipers are venomous snakes that belong to the family Viperidae (蝰蛇科). Over 150 species are known to occur throughout the world except Australia. They are found in a variety of habitats including forests, shrublands, grasslands, cultivated fields and even deserts.

Pit vipers are characterized by a triangular-shaped head with a pit situated between the eye and the nostril. They are crepuscular and nocturnal. The heat-sensing pits help detect temperature variations and are used to locate warm-blooded prey, allowing the pit viper to strike at their prey with pinpoint accuracy even in the dark.

Pit vipers possess long, movable fangs that can be fully erected and plunged into a victim to inject a substantial quantity of venom. Vipers generally possess haemotoxic venom – venom with enzymes that could destroy the linings of blood vessels, resulting in both internal and external haemorrhage. The venom of the Point-scaled Pit Viper, however, is also neurotoxic. Neurotoxic venom will attack the nervous system, leading to muscle paralysis and death by respiratory failure if untreated.

Pit Vipers of Hong Kong

There are three species of pit vipers in Hong Kong – the commonest Bamboo Pit Viper (*Trimeresurus albolabris*), the locally restricted Mountain Pit Viper (*Trimeresurus monticola makazayazaya*) and the newly recorded Point-scaled Pit Viper (*Protobothrops mucrosquamatus*). Although they share some common morphological and behavioural features, they are easily distinguished from one another by their different colour and appearance.

Bamboo Pit Viper 白唇竹葉青

The Bamboo Pit Viper (Figure 34) (or more commonly called the Bamboo Snake) is a medium-sized snake, readily identified by its bright green back [Note] and strongly triangular head with orange-red eyes. There is also a reddish brown streak on the tail. It is the most common and widely distributed pit viper in Hong Kong.

The Bamboo Pit Viper is frequently seen in the central New Territories and is usually found among bushes and grasses but rarely inside dense forests. It is more active at night, feeding on small terrestrial vertebrates. It gives birth to young snakes and about twelve can be born at a time.

The species usually remain stationary when approached but would strike readily if the intruder comes closer. In fact, Bamboo Pit Viper accounts for the great majority of snake bites locally. Bite from a Bamboo Pit Viper would cause intense pain and severe swelling, but fatalities resulting from bites are rare if medical treatment is sought in time.

Note: The non-venomous Greater Green Snake (*Cyclophiops major*), which is common in Hong Kong, is also bright green in colour but it can be readily distinguished from the Bamboo Pit Viper by its oval-shaped head, black eyes and absence of reddish brown streak on the tail.

Fig 34. Bamboo Pit Viper (*Trimeresurus albolabris*) 白唇竹葉青

Mountain Pit Viper 山烙鐵頭

The Mountain Pit Viper (Figure 35) is a medium-sized pit viper with a stout body. The anterior half of its back is covered with large, squarish, chocolate-brown, H-shaped blotches. This species has only been recorded in the upland areas of Tai Mo Shan, Ng Tung Chai and Lantau Peak, and occurs in forests, shrublands as well as grasslands.

The Mountain Pit Viper is not as aggressive as the other two local pit vipers and rarely strikes even when approached closely, although one still has to stay alert due to its venomous nature. Bites could be fatal if not treated in time, but report of snake bites by this species is rare in Hong Kong.

Fig 35. Mountain Pit Viper (*Trimeresurus monticola makazayazaya*) 山烙鐵頭

Point-scaled Pit Viper 烙鐵頭

The Point-scaled Pit Viper (Figure 36) is locally rare with only two records. It was first reported in 2002 by David Willott, who found four dead specimens on a road between Ma On Shan and Sai Kung near Kei Ling Ha. As the species had never been reported in the wild before, the possibility that the individuals found were strayed or escaped ones could not be ruled out.

On 8 December 2004, Cynthia S.M. Chan and Shek Chun-tong of AFCD discovered a live adult in Sai Kung during an ecological survey of the department. The discovery supported the presence of this species in the wild of Hong Kong, as evidenced by the two distant localities where they have been found. However, further surveys would be needed to confirm its local status.

Similar to the Mountain Pit Viper, the body of the Point-scaled Pit Viper is also covered with large, dark blotches but is readily distinguished from the former by its longer and slimmer body (Figure 37). The Point-scaled Pit Viper is very aggressive and it is able to strike from a rather long distance. Reports of bites resulting from this pit viper are common in Taiwan. Bites could be fatal if not treated in time.

Fig 36. Point-scaled Pit Viper (*Protobothrops mucrosquamatus*) 烙鐵頭

Fig 37. Point-scaled Pit Viper 烙鐵頭 (left) and Mountain Pit Viper 山烙鐵頭 (right)

Table 3. Distribution of Pit Vipers in Hong Kong

Species	*Trimeresurus albolabris*	*Trimeresurus monticola makazayazaya* [1]	*Protobothrops mucrosquamatus* [2]
Synonyms	*Trimeresurus septentrionalis*	*Ovophis monticola makazayazaya*	*Trimeresurus mucrosquamatus*
Common Name	Bamboo Pit Viper	Mountain Pit Viper	Point-scaled Pit Viper
Chinese name	白唇竹葉青、青竹蛇	山烙鐵頭	烙鐵頭、原矛頭蝮
Maximum length	~ 90 cm	~ 95 cm	~ 150 cm
Habitat	Shrublands, grasslands, edges of cultivated fields	Forests, shrublands and grasslands	Hillside areas and near cultivated fields
Diet	Frogs, lizards, birds and small rodents	Frogs, snakes, lizards, birds and small rodents	Frogs, lizards, small rodents
Reproduction	Viviparous	Oviparous	Oviparous
Local Distribution	Widely distributed throughout the territory	Tai Mo Shan, Ng Tung Chai, Lantau Peak	Ko Tong, Kei Ling Ha
Regional Distribution	Central and southern China, northern India, Burma, Thailand, Vietnam, Indonesia	Southern China, Taiwan, Vietnam	Central and southern China, Taiwan, India, Burma, Vietnam. Also introduced and established in Okinawa, Japan

[1] The Mountain Pit Viper had been proposed to be classified under a different genus *Ovophis*, but molecular evidence did not support this new classification.

[2] The Point-scaled Pit Viper was formerly classified under the genus *Trimeresurus*, but was later placed under the genus Protobothrops based on skull characteristics and molecular evidence.

Acknowledgements

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Division Column

Potential Applications of Tree Guards in Enhancing Afforestation Effort

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Technical Services Division

Introduction

Tree guards, also referred as tree shelters, have been applied in forestry worldwide as a means largely for controlling damage imposed by browsing animals. However, it has seldom been applied in Hong Kong for afforestation or ecological restoration as damage by browsing animals to seedlings is not considered as a major threat locally. Recent researches on the use of tree guards showed that they could also improve microclimate in ways that enhance survival and growth of the seedlings.

An experiment was set up to investigate the effectiveness of tree guards in enhancing survival and growth of native seedlings planted for afforestation on an exposed hill slope in Hong Kong (Lai and Wong, 2005). The selected site was a steep hill slope in Tung Chung, Lantau. The vegetation type of the site was predominately fernland dominated by Dichotomy Forked Fern (*Dicranopteris pedata* 芒萁). This species, which typically occurs at sites frequently disturbed by hill fires, forms a dense groundcover on hill slopes and is considered a major factor suppressing the natural regeneration of tree seedlings. Thick-leaved Oak (*Cyclobalanopsis edithiae* 華南青岡) seedlings were used in the experiment. This species, once the major component of the local primary forests, has a restricted distribution locally at present, perhaps due to the lack of dispersal agents for its large acorns. Moreover, the acorns of Fagaceae (殼斗科) species in general have been found to be heavily consumed by seed predators in hillside grasslands, thus restricting their natural recruitment. Therefore, Fagaceae species are targeted for forest restoration in Hong Kong and Think-leaved Oak was chosen in the study as a model for restoring native species that have relatively poor natural recruitment.

Setup of Tree Guards

The tree guard was made of tough UV-resistant and transparent polyethylene in form of a sleeve with openings at the top and bottom. At the time of planting, the guards were installed upright and supported by three thin bamboos sticks erected on the ground on the inner side of the sleeve forming an equilateral triangle enclosing the seedlings in the middle. The tree guard was 45 cm tall and 30 cm on each side of the triangle (Figure 38). In addition, the ground around the seedlings was covered with Hessian cloth as a weed mat to suppress weed growth. The tree guards were removed at the end of the experiment when the seedlings grew well above them and the Hessian cloth was disintegrated naturally in about two years.

Fig 38. Tree guards set up on the exposed hill slope at Tung Chung, Lantau.

The absolute growth in height, basal diameter and crown diameter (i.e. the increases in these parameters of individual seedlings recorded at the time of measurement relative to the data recorded at the time of planting) of each seedling of the treatment group and the control (without any treatment) were monitored for four years. The survivorships were also noted.

Results

Details of the results are presented in Lai and Wong (2005). In brief, the treatment group survived better (58%) than the control (17%) at the end of the experiment. Although the exact causes of death in the control are unknown, damage by rodents or other herbivores could not have been the major cause as the dead seedlings were mostly found withered at the site rather than bitten off at the stem. The seedlings of the treatment group had larger absolute growth in height than the control particularly in the initial period when the seedlings were still surrounded by the tree guards. However, it should be noted that the increase in basal and crown diameter for the seedlings of the treatment group were in fact less than that of the control initially. When the seedlings grew above the tree guards, the basal diameter and crown diameter of the treatment group increased rapidly and were larger than those of the control.

Tree Guards Provided Favourable Conditions

The results of the experiment have clearly demonstrated the advantage of using tree guards in combination with weed mats to enhance the establishment, survival and early growth of seedlings on exposed hillsides, even impact due to browsing herbivores is not apparent. Enhanced growth in height was obvious in the initial phase when the seedlings were still surrounded by the tree guards. This could partly be attributed to the shelter and greenhouse effects inside the tree guards, which provided a favourable microclimate for the seedlings. Indeed, the confining effect of tree guards on all sides but the top could have promoted the seedlings to allocate more resources for apical growth instead of secondary growth of the stem and lateral growth of the shoot. The results of the study (i.e. faster height growth but slower lateral growth in terms of the basal and crown diameters in seedlings surrounded by trees guards when compared with the control) support this hypothesis. After the seedlings grew above the tree guards, the basal and crown diameter increased rapidly. This effect of tree guards on the early growth pattern of seedlings, especially promoting the rapid growth in height, will benefit their establishment in the tropics where weed competition is very intense. This is particularly important for the establishment of native tree species, which have relatively slower growth rates. The clear difference in height (over 20 cm) between seedlings of the treatment group and the control in the initial phase of the experiment could have contributed to the large difference in the survivorship recorded at the end of the experiment (Figure 39).

Potential Applications

Forest managers could use the results of survivorship and the costs of different items in tree planting and establishment techniques to compare the cost-effectiveness of various treatments. By way of an example, based on the term-contract price in 1999 when the plots of the above experiment were set up, the cost of planting each seedling in this experiment in the control was $8, while that of the treatment group was $19. However, the actual cost for the control increased up to $47 for each surviving seedling at the end of the experiment taking into account the low survival rate. Meanwhile, with higher survivorship, the treatment group was just $32 per surviving seedlings. The treatment group was demonstrated to be more cost-effective by 30%.

Previously, successful mass plantings on eroded hill slopes in Hong Kong had been limited to mostly exotic species such as *Eucalyptus* spp. (桉屬), *Acacia* spp. (金合歡屬), Brisbane Box (*Lophostemon confertus* 紅膠木), Chinese Red Pine (*Pinus massoniana* 馬尾松) and a few native species such as Castanopsis (*Castanopsis fissa* 黧蒴錐) and Schima (*Schima superba* 木荷). The results of the experiment are encouraging and more trials could be done using a wider variety of native species with a view to applying the technique in mass planting programs for forest restoration. However, the plastic tree guards could be seen as visually intrusive and may be prone to fire hazard. Therefore, careful planning on their applications is essential. Moreover, the technique could also be applied in species conservation programs for rare plants. After the seedlings of rare species have been raised in the nursery, tree guards could be used to protect the seedlings that are reintroduced to the wild.

Fig 39. An individual of the treatment group at the end of the experiment with more than 2 meters in height.

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Control of *Mikania micrantha* and Habitat Management at Sites of Special Scientific Interest

Eric Y.H. Wong

Introduction

Mikania or Mile-a-minute Weed (*Mikania micrantha* 薇甘菊) is an exotic perennial herbaceous vine of the family Asteraceae (Compositae 菊科) (Figure 40). It is native to tropical South and Central America, but is now distributed from West Africa to Southeast Asia and South China including Guangdong and Hong Kong. As its name "Mile-a-minute Weed" implies, it grows rapidly and reproduces vigorously by both vegetative and sexual reproduction. It affects the growth of other plants by covering the plants and reducing the sunlight reaching the plants underneath.

Fig 40. *Mikania micrantha*

In Hong Kong, Mikania is commoner on open and disturbed grounds with ample sunlight and damp soil, e.g. abandoned agricultural land, fishpond bund, derelict land, roadside and woodland edge around village environs. It grows much slower in shaded environment and is unlikely to flower there.

Mikania at Sites of Special Scientific Interest (SSSI)

In 2001, surveys to 17 SSSIs were carried out to assess the impacts of Mikania in these ecologically sensitive areas. It was noted that Mikania infested about 10 hectares of the SSSIs, and was commonest at SSSIs with egretries or *fung shui* woods. Mikania was found entangling trees and shrubs at some egretries and might have rendered the sites unfavourable to the ardeids (egrets and herons) as roosting or breeding sites. Despite the fact that shaded understorey of woodlands will limit the growth of Mikania and the weed is mostly limited to the periphery of *fung shui* woods, the landscape and the integrity of some *fung shui* woods have been affected by the weed.

Clearance of Mikania in SSSIs

To enhance the ecological value of the SSSIs infested by Mikania, contractors were hired to clear the weed from the SSSIs between late 2001 and 2004. Following the clearance work, effectiveness of the work was monitored at some SSSIs including She Shan *Fung Shui* Woodland, Fung Yuen Valley and Centre Island SSSIs.

Since Mikania is deep-rooted, it is almost impossible to remove the whole root system of the plant and prevent it from regeneration. As it was believed that clearance of Mikania together with its underground parts might help minimizing the extent of its regeneration, attempt was made in 2001 at some SSSIs such as She Shan *Fung Shui* Woodland and Fung Yuen Valley SSSIs to remove the underground parts as far as practicable during the clearance exercise. However, not all underground parts of Mikania on Centre Island were removed due to the difficult terrain on parts of the Island.

Site monitoring following the clearance work revealed that the regeneration rate of Mikania was minimal during the dry season no matter its underground parts were removed or not, probably because the dry and cold conditions do not favour the growth of Mikania. At the onset of wet season, the weed was found regenerating, but was better curbed at the sites with its underground parts removed. However, proliferation of the weed was equally vigorous at all monitoring sites in the late wet season, no matter its underground parts had been removed or not (Figures 41 & 42). Considering that manual removal of the underground parts of Mikania is highly labour intensive, this is not a cost effective method in Mikania control.

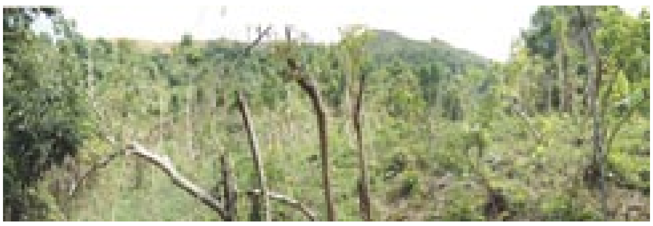

Fig 41. Part of Fung Yuen Valley SSSI cleared of Mikania in Mar 2002.

Fig 42. The same area was infested by regenerated Mikania in Jun 2002.

Nevertheless, Mikania clearance work has been proven effective in improving the conditions of trees previously entangled by the weed. For instance, a rare tree Long-leaved Xylosma (*Xylosma longifolium* 長葉柞木) in She Shan *Fung Shui* Woodland SSSI, which was once seriously entangled by Mikania, has well recuperated after the clearance work in 2001 and the subsequent maintenance of the tree (Figures 43 &44).

Fig 43. Long-leaved Xylosma at She Shan *Fung Shui* Woodland SSSI after Mikania clearance in Sep 2001.

Fig 44. The Long-leaved Xylosma had well recuperated in Jun 2005.

Long-term Control of Mikania and Habitat Management at SSSIs

Manual clearance of Mikania was not a feasible measure to control impacts of Mikania in the long run. A holistic approach was therefore adopted in formulating a long-term control measure of Mikania at SSSIs. Since Mikania grows slowly in shaded environment, planting trees and shrubs at the infested sites would better prevent the weed from proliferation, where the plantings compete with Mikania for, not only sunlight, but also space, water and nutrients.

In addition to consecutive cutting of Mikania, the holistic approach adopted included a planting programme with respect to the conservation interest of the respective SSSIs. The selected planting species are preferably native and able to enhance the conservation value of the sites. For instance, about 4,500 seedlings of butterfly larval foodplants and nectar plants including India Birthwort (*Aristolochia tagala* 印度馬兜鈴), Illigera (*Illigera celebica* 寬藥青藤), Pond Spice (*Litsea glutinosa* 潺槁樹) and Yellow Bramble (*Vitex negundo* 黃荊) were planted at Fung Yuen Valley SSSI (Figure 45), and 3,200 tree seedlings suitable for ardeid nesting (e.g. Chinese Banyan (*Ficus microcarpa*, 榕樹/細葉榕) and Camphor Tree (*Cinnamomum camphora* 樟) were planted at Centre Island SSSI between 2001 and 2004.

Fig 45. India Birthwort was planted at Fung Yuen Valley SSSI. The vine is protected under Cap. 96, and is the larval foodplant of the Golden Birdwing (*Troides aeacus* 金裳鳳蝶) and Common Birdwing (*T. helena* 裳鳳蝶).

Intensive management particularly weeding of the new planting sites during the establishment period is essential to the success of the plantings. Field observations showed that growth of the seedlings, particularly those of smaller size, would be adversely affected by Mikania. Apart from consecutive cutting of Mikania entangling the seedlings, Hessians and plastic sleeve tree guards were used to increase the survival rate of the seedlings (Figure 46). Beating up was also carried out where necessary. The regeneration rate of Mikania at the sites with tree canopy formed was much lower than that of the sites without planting (Figures 47 to 49).

Fig 46. Seedlings with Hessian and plastic sleeve tree guards at Fung Yuen Valley SSSI in Apr 2003.

Fig 47. Centre Island was seriously infested by Mikania in Oct 2001.

Fig 48. Mikania was under control at areas on Centre Island under plantings in Dec 2004.

Fig 49. Plantings at part of Fung Yuen Valley SSSI which was infested by Mikania in Nov 2004.

Discussion

Considering the habit of vigorous regeneration of Mikania, it is not practicable to eliminate Mikania by merely manual clearance, no matter the underground parts of the weed is removed or not. In appropriate circumstances, it is more effective to control the proliferation of Mikania by tree/shrub planting at the sites cleared of Mikania. With continuous management, particularly weeding, of the planting sites during the establishment period, the canopy formed by the plantings will retard the growth of Mikania. In ecologically sensitive areas such as SSSIs, a holistic approach should be adopted that the planting species are selected taking the conservation interest of the sites into consideration. The plantings would help curbing the proliferation of Mikania as well as enhancing the conservation value of the sites.

Technical Guidelines

Technical guidelines are prepared to assist other departments and members of the public to identify and remove Mikania. These guidelines can be obtained at the website – http://www.afcd.gov.hk/conservation; under the heading of Nature Conservation Practice Note No. 01/2003.

Exploration of other Mikania Control Methods

Apart from manual clearance, there are at present a number of possible methods for removing Mikania, including chemical control and biological control methods.

Biological control of Mikania has been investigated worldwide though no natural enemies have been demonstrated to be effective. Controversial issues such as the potential ecological impacts and risks of biological control have yet to be resolved.

Chemical control seems to be more cost-effective in controlling Mikania despite its potential environmental impacts. The joint study carried out by the Country Parks Divisions and the Guangdong Forestry Bureau on control of Mikania identified the herbicide "Sulfometuron-methyl" (森草淨) as specific and effective in killing Mikania. Large scale field trials on the application of this herbicide are being carried out in country park areas. The joint study recommended the following constraints on its application in the field:

- Application of the herbicide nearby active agricultural fields, water sources and residential areas is not recommended.

- Application in areas with plant species [Note] that are sensitive to the herbicide should also be avoided. Specific spraying methods, such as root application (根施法) should be used if necessary.

These constraints limit the herbicide application at SSSIs to those sites which are far from active agricultural fields, water sources and residential areas.

Note: Sulfometuron-methyl sensitive species include Two-spiked Signal-grass (*Brachiaria subquadripara*, 四生臂形草), Lantana (*Lantana camara*, 馬纓丹), Shining-fruit Nightshade (*Solanum americanum*, 少花龍葵), Field Sow-Thistle (*Sonchus arvensis*, 苣蕒菜), Opposite-leaved Fig (*Ficus hispida*, 對葉榕), Boehmeria (*Boehmeria nivea*, 苧麻), Asteraceae/Compositae (菊科), Brassicaceae/Cruciferae (十字花科) and Poaceae (禾本科).

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