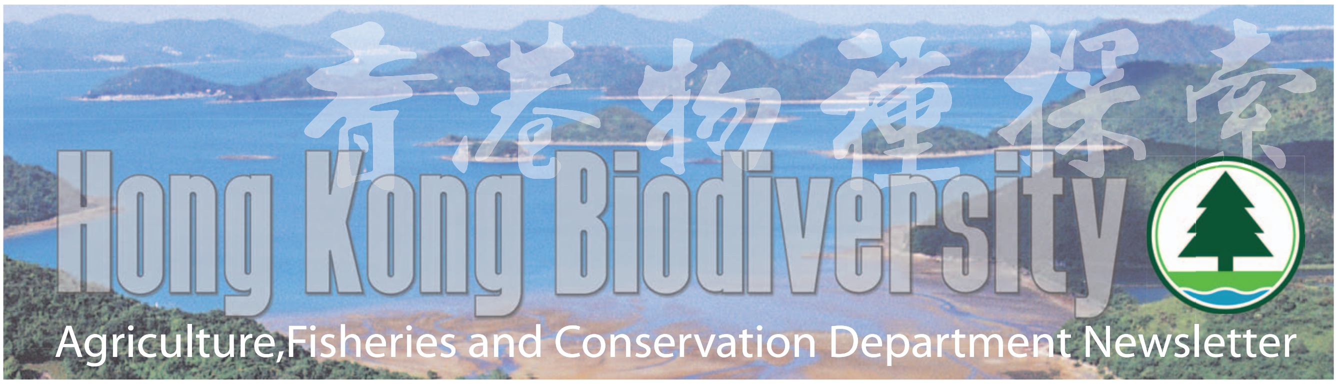

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Message from the Editor

Welcome back to the **Hong Kong Biodiversity**! After a break, **Hong Kong Biodiversity** returns with some interesting articles on the results of our biodiversity surveys. Hong Kong is rich in biodiversity and new records or even new species are discovered from time to time. In this issue, other than sharing the findings of a pilot study on the conservation management of rhododendrons, we report on a number of first records of species in Hong Kong. To step up biodiversity conservation and support the sustainable development in Hong Kong, the Government is developing the first city-level Biodiversity Strategy and Action Plan (BSAP) which will provide administrative and planning guidance on the conservation of biodiversity in Hong Kong. The process of developing our BSAP includes a comprehensive stocktaking on the existing biodiversity status and the measures in place for conserving our biodiversity, as well as formulating the biodiversity strategy and priority actions to maintain and further enhance our conservation efforts. During the process, many experts and others outside the Government have contributed their data and efforts which lead to a better understanding of our biodiversity. There are, however, more waiting for us to study and discover. It is hoped that the BSAP will help further develop and strengthen the collaborative efforts between the Government and other concerned parties in conserving our rich biodiversity. For more information of the BSAP, please visit the BSAP webpage at www.afcd.gov.hk/bsap.

Thank you for your continued support to the **Hong Kong Biodiversity**.

Simon CHAN
Chief Editor

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Working Group Column

A Pilot Study on Conservation Management on Rhododendrons in Ma On Shan

Jackie Y. Yip, Patrick C.C. Lai and Colette K.L. Yan
Plant Working Group

漁農自然護理署於2008年委託顧問，試驗以生境管理措施保育馬鞍山的杜鵑。試驗於2010年結束後，植物工作小組於2011-12年繼續進行監察。本文詳細介紹及分析試驗結果，結果顯示在試驗地點的三種原生杜鵑均在減少周邊樹冠遮蔽後增加開花，改善程度以毛葉杜鵑以及原本鬱閉的地點較為顯著。由於馬鞍山擁有豐富的生物多樣性，實施生境管理措施時須加以審慎考慮。

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Introduction

Currently, six species of native rhododendrons have been found in Hong Kong. Among them, four species are considered rare or restricted in distribution. A previous study suggested that shading by vegetation might have a negative effect on the reproduction and growth of three native rhododendrons (*Rhododendron championiae, R. hongkongense,* and *R. moulmainense*) (Ng and Corlett 2002). Moreover, many populations of these three species are in the process of being overtopped by other native trees, as part of natural succession. Flowers could only be found on individuals that were tall enough to reach above the canopy or grew near the edge of the population. Ng and Corlett (2002) suggested that experiments with selective cutting of competing vegetation could be conducted in order to investigate the effectiveness of such measures in slowing down or halting the decline of the existing population of these species, particularly the globally rare *R. hongkongense*. Since then, no further studies on this issue have been conducted.

In 2008, the Agriculture, Fisheries and Conservation Department (AFCD) commissioned a consultancy study on the conservation management of *Rhododendron* species in Ma On Shan. The main objectives of the study were to identify the distribution of the rare native *Rhododendron* species in Ma On Shan, to recommend measures to enhance the growth, survival and reproductive success of the three species listed above, and to monitor the effectiveness of the measures. As shading was identified as the key factor affecting the flowering of rhododendrons, selective cutting of the surrounding vegetation was the main conservation measure tested. The study was conducted between February 2008 and November 2010. In March 2011 and March 2012, the Plant Working Group of the AFCD continued the monitoring work to collect more data to evaluate the results of the conservation management work.

Methods

Phase 1 (2008 – 2010)

The distribution of four *Rhododendron* species (*R. championiae* Hook. f. (毛葉杜鵑) , *R. hongkongense* Hutch. (香港杜鵑), *R. moulmainense* Hook. f. (羊角杜鵑) and *R. simiarum* Hance (南華杜鵑)) in Ma On Shan was mapped in 2008 (Ecosystems 2008). A total of 830 individuals were recorded. It was estimated that the recorded individuals represented the major groups or colonies, representing about 30-80% (*R. championiae* - 80%; *R. hongkongense* - 30%; *R. moulmainense* - 50%; *R. simiarum* - 60%) of the total rhododendron population in the Ma On Shan Site of Special Scientific Interest. In the mapping exercise, a total of 91 individuals of three *Rhododendron* species (*R. championiae* (Fig. 1), *R. hongkongense* (Fig. 2a&b), and *R. moulmainense* (Fig. 3)) were tagged and identified for potential management trials (Table 1). Trial management work was implemented at three sites (Fig. 4) by the AFCD in consultation with the study team in March and April 2009. Three types of treatment were implemented on 77 individuals of trees/shrubs/climbers (mostly *Acronychia pedunculata, Diospyros morrisiana, Polyspora axillaris, Machilus chekiangensis* and *Pentaphylax euryoides*) adjacent to the tagged rhododendron individuals, to open up the canopy. The treatments included the application of glyphosate, felling, and the trimming of selected branches. Careful examinations were conducted to ensure that no rare plant species were affected by the treatments.

Fig. 1. *R. championiae.*

Fig. 2a. *R. hongkongense.*

Fig. 2b. *R. hongkongense.*

Fig. 3. *R. moulmainense.*

Table 1. Total number of rhododendron individuals tagged for management work.

	Treatment	Control
R. championiae	8	10
R. hongkongense	17	19
R. moulmainense	19	18
Total	**44**	**47**

The height, maximum canopy width, basal circumference, number of stems, circumference of stems, and number of flower buds on each individual were measured before (2009) and after (2010 – 2012) the treatment. The height was measured using an inclinometer. The maximum canopy width was visually estimated. The basal circumference was measured with a metre tape. Due to the growth habit of the species of forming multiple branches near the ground, the circumference of major stems was also tagged and measured at 10cm above the base/branching point or where the trunk diameter became uniform. The number of flower buds or flowers was determined visually using binoculars. The effects of the treatment on the trees/shrubs/climbers (e.g. leaf falling, climber regeneration, resprouting from dead trunks) were visually inspected. Attempts were also made to quantify the percentage of canopy cover using a lux meter and densitometer.

In the data analysis, the incremental changes in the size-variables (i.e. height, canopy width, basal circumference, number of stems, circumference of the largest stem and average stem circumference) were tested for deviation from zero by one-sample t-test. Treatment and control differences were tested for significance by ANOVA using Minitab 15.

In addition, regression analyses were conducted for the 2009 and 2010 data to look for regression models that explained the variation in the flower number of the three species using Minitab 15. The treatment effect

Fig. 4. Locations of sites for trial management work.

was included in the regression analyses by setting the dummy variable "1" for treatment and "0" for control. The selection of regression models was conducted by reverse elimination of variables with a p-value less than 0.1, except for the 2010 data of *R. hongkongense*, for which a stepwise selection was used, as the reverse selection yielded no significant model ($p<0.1$).

Phase 2 (2011 – 2012)

Following the recommendation in the final report of the consultancy study (Ecosystems 2010), in 2011, we measured the circumference of the stems, and the number of flower buds and flowers on each individual. In 2012, however, we measured only the flower buds and flowers, since when we inspected the data collected from 2009 to 2011, we noted considerable variation in the stem circumferences measured over the years. We also took the GPS readings and a photo record of each tree during the surveys, and visually assessed and recorded the conditions (e.g. defoliation, death, decay, broken trunk) of the trees and shrubs that received treatment.

To test the hypothesis that the proportion of flowering individuals in the treatment group would be higher than that of the control group, a one-tailed Fisher's Exact Test was performed for all three species, annually from 2010 to 2012. In addition, a two-tailed Fisher's Exact Test was performed on the 2009 data to test whether the proportion of flowering individuals in the treatment and control groups was significantly different before the application of any treatment. A Fisher's Exact Test, rather than the commonly-used Chi-squared test, was used because it is a better test for independence when the sample size is small (Sokal and Rohlf 1995).

A non-parametric Mann-Whitney Rank Sum Test (using SigmaPlot 12) was performed to test the difference in the incremental change in the number of flowers (i.e. increase or decrease in the number of flowers recorded in a particular year compared with that of 2009) for each plant in the treatment and control groups. A non-parametric test was performed because the data did not follow a normal distribution.

Results

(a) Factors associated with flowering number

Regression analyses were conducted for the 2009 and 2010 data to look for factors that best explained the variation in the number of flowers of the three species. It was found that number of stems and average stem circumference were the most significant variables in determining the number of flowers for *R. moulmainense* in 2009 and 2010 (Table 2), suggesting that plants with more stems bear more flowers. The coefficient of understorey shading was negative in the 2010 model, suggesting an inverse relationship with the number of flowers (Table 2).

The 2010 data on the number of flowers on *R. championiae* could be explained by basal circumference, the number of stems, average stem circumference, or understorey shading (which was only marginally significant) (Table 2). Most the size-variables had positive coefficients, while understorey shading had a negative coefficient.

(b) Effect of treatment on flowering

Table 3 lists the total number of individuals recorded for the three species from 2009 to 2012. It should be noted that the sample sizes varied among the years, as some of the tagged individuals could not be located in 2011 and 2012. The figures shown in Table 3 exclude three samples of *R. hongkongense* (control) under exceptionally sunny conditions which were considered unrepresentative, and one sample of *R. moulmainense* (treatment), which was dead.

Generally speaking, the proportion of flowering individuals was relatively higher in 2010 and 2012, and lower in 2009 and 2011 (Fig. 5). This pattern of alternate 'good year' and 'bad year' flowering was observed for all three species, in both control and treatment groups. The proportion of flowering individuals and the mean number of flowers recorded on each plant were both exceptionally high in 2012 for all three species (Fig. 5 and Table 4).

Fig. 5 indicates that prior to the application of treatment in 2009, the proportion of flowering individuals in the treatment groups was lower than, or similar to, that of the control groups. Subsequent to the treatment, the proportion of flowering individuals for treated plants was generally higher than, or similar to, that of the control plants. According to the result of Fisher's Exact Test, *R. championiae* (in 2010 and 2012) and *R. moulmainense* (in 2011) in the treatment group had a higher proportion of flowering individuals than those in the control group, but the statistical significance was weak ($p<0.1$)(Table 3). In other cases, the proportion of flowering individuals in the treatments was not significantly higher than that of the control group. In summary, while the treatment groups appeared to have higher flowering rates than the control groups after the application of treatment, the difference was not statistically significant.

A comparison of the number of flowers borne by each individual showed that the rhododendrons in the treatment groups appeared to bear more flowers on average (Table 4). However, the Mann-Whitney Rank Sum Test indicated no significant difference in the incremental change in the number of flowers in the treatment and the control groups compared with that recorded in 2009, except in *R. hongkongense* (2011), in which a significantly higher number of flowers was recorded in the treatment group. Nonetheless, it should be noted that the proportion of flowering individuals was very low in 2011.

Table 2. Multiple regression models relating the number of flower buds to all independent variables using 2009 and 2010 data. The upper figures are the regression coefficient, and the lower figures are their corresponding p-values.

		R. championiae	*R. hongkongense*	*R. moulmainense*
2009				
Model	Adjusted R-square p-value	n.a.	n.a.	28.8% ***0.001
Number of stems				2.490 ***0.002
Average stem circumference				0.494 **0.015
2010				
Model	Adjusted R-square p-value	63.8% ***0.000	14.6% **0.016	50.7% ***0.000
Height			6.488 **0.016	
Basal circumference		-0.981 **0.028		
Number of stems		23.80 ***0.003		14.20 ***0.000
Average stem circumference		2.845 ***0.00		2.382 **0.007
Understorey shading		-0.873 *0.072		-4.106 ***0.000

Note: * 0.1> p >0.05; ** 0.05> p >0.005; *** p <0.005
n.a. – multiple regression not performed for 2009 data due to infrequent flowering events.

Table 3. Number of individuals tagged and the number of flowering individuals recorded for each species.

		R. championiae		*R. hongkongense*		*R. moulmainense*	
		n	fl	n	fl	n	fl
Control	2009	10	0	16	3	18	9
	2010	10	4*	16	5	18	15
	2011	8	2	15	1	14	7*
	2012	7	4*	13	9	12	12
Treatment	2009	8	0	17	0	18	8
	2010	8	7*	17	10	18	17
	2011	7	1	16	4	12	10*
	2012	7	7*	16	12	11	11

* p<0.1 for Fisher's Exact Test of the proportion of flowering individuals in treatment and control groups.

Note: n = no. of individuals recorded; fl = no. of flowering individuals

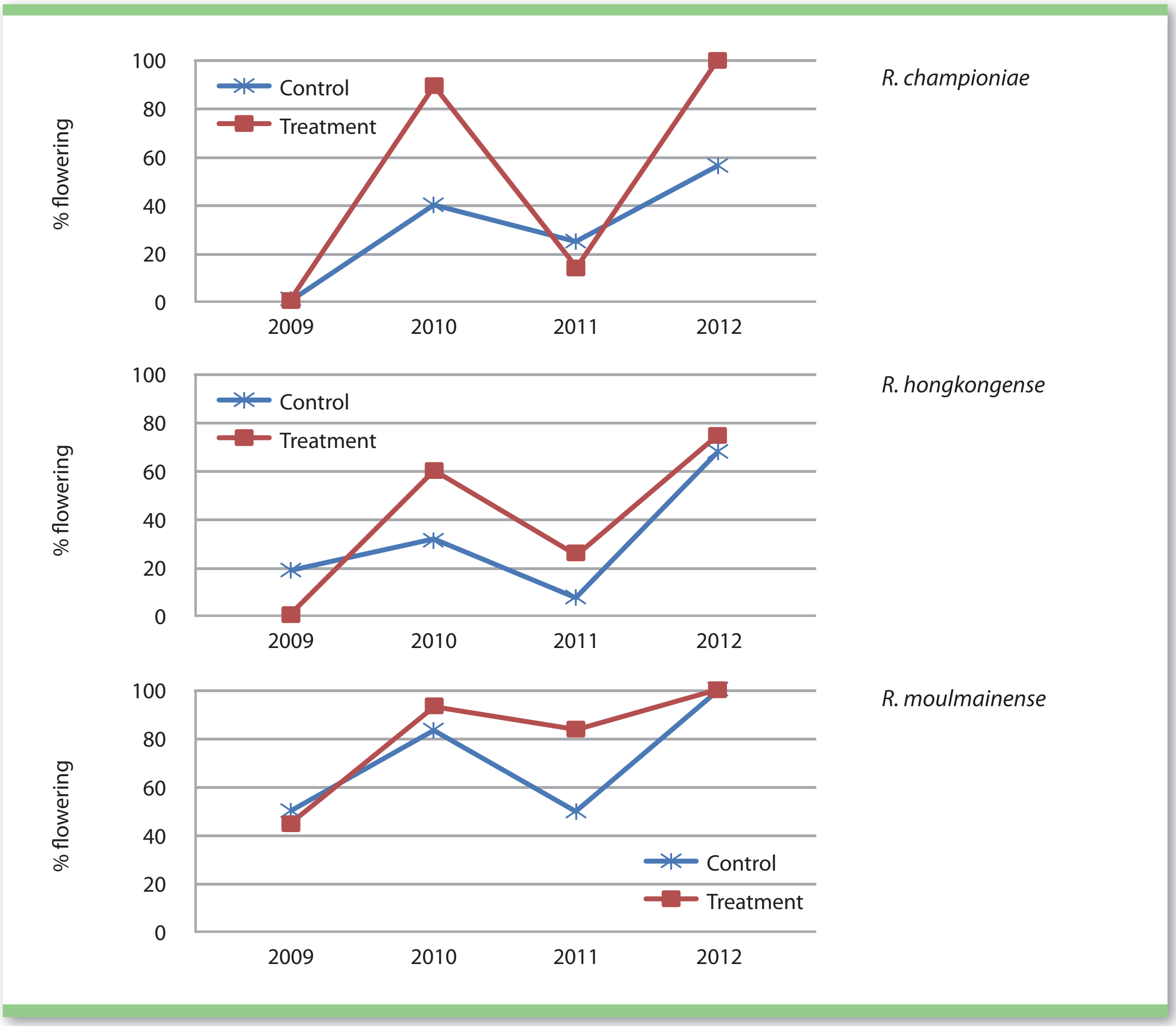
A two-tailed test was performed for the 2009 data (H_0: no difference between treatment and control), and a one-tailed test was performed for the 2010-2012 data (H_0: the proportion of flowering plants in the treatment group was lower than, or equal to, that of the control group).

Table 4. Mean number of flowers recorded for each plant.

		R. championiae	*R. hongkongense*	*R. moulmainense*
Control	2009	0.0	5.0	6.8
	2010	7.8	25.8	38.5
	2011	0.9	8.1*	6.9
	2012	7.1	49.8	89.3
Treatment	2009	0.0	0.0	3.7
	2010	15.9	17.9	53.8
	2011	3.4	15.3*	10.9
	2012	17.7	92.8	147.1

* p<0.1 for Mann-Whitney test of the incremental change in the number of flowers observed in each individual compared with that of 2009, in both treatment and control groups.

Fig. 5. Percentage of flowering individuals before (2009) and after (2010-2012) treatment.



(c) Effect of treatment on growth

Attempts were made as part of the study to determine the effect of treatment on the growth of rhododendrons. The effect of treatment on mean incremental changes in the variables (i.e. height, canopy width, basal circumference, number of stems, circumference of the largest stem and average stem circumference) was analysed by comparing the 2009 and 2010 data (Table 5). The differences between the treatment and control groups were mostly insignificant, and even where there were significant differences, the effect of treatment was equivocal. This could possibly be attributed to a problem with the survey method, which will be examined in the Discussion section.

Discussion

(a) Evaluation of the effectiveness of the recommended conservation management approach

The key question in this study was whether the recommended conservation management work could improve the growth and reproductive success of the rhododendrons. The study indicated that in some cases, the plants receiving treatment were more likely to bear flowers (and to bear more flowers in some cases) than those which did not receive treatment.

It appeared that the extent of improvement differed among species. The treatment group was shown to have higher proportion of flowering individuals than the control group in *R. championiae* (2010 and 2012) and *R. moulmainense* (in 2011 only). The enhanced flowering in these two cases might be related to the following factors:

(i). All tagged *R. championiae* were located in shaded ravine forests in Site 2. This species flowered infrequently in Ma On Shan over the years (Ng and Corlett 2002; authors' field observations), and none of the tagged individuals flowered prior to the application of treatment (i.e. 2009). Given the original shady condition of the site, it is possible that the treatment boosted the flowering success in 2010 and 2012 by removing the shading effect.

(ii). All tagged *R. moulmainense* were located in Site 3, in which a greater amount of canopy had been opened up subsequent to the treatment (based on site observation) (Fig. 6). The higher flowering rate for the treatment group of *R. moulmainense* in Site 3 might be related to the significant reduction of shading.

Fig. 6. Canopy opened up after treatment.

Table 5. Incremental change in variables one year after the application of treatment.

	Treatment	Control	ANOVA p-value
		R. championiae	
Height	-0.71	-1.047	0.845
Canopy width	-0.438	-0.360	0.845
Basal circumference	**3.350	2.870	0.835
Number of stems	-0.125	0.000	0.276
Circumference of the largest stem	-0.025	-0.070	0.963
Average stem circumference	-1.011	*-0.565	0.488
		R. hongkongense	
Height	0.563	-0.015	0.374
Canopy width	**-0.357	0.031	*0.055
Basal circumference	**1.286	**2.410	0.363
Number of stems	0.000	-0.125	0.537
Circumference of the largest stem	0.054	***-1.331	**0.040
Average stem circumference	-0.526	***-1.145	0.199
		R. moulmainense	
Height	0.074	0.226	0.768
Canopy width	-0.094	-0.100	0.980
Basal circumference	*1.541	-2.24	*0.082
Number of stems	-0.118	0.111	0.166
Circumference of the largest stem	0.182	-0.130	0.861
Average stem circumference	0.498	-0.391	0.361

Note: * 0.1> p >0.05; ** 0.05> p >0.005; *** p <0.005

The study also attempted to investigate the effect of the treatment on the growth of rhododendrons, but no conclusive result was obtained. Among the size-variables tested, canopy width and height showed considerable variation, and seemed to lack accuracy and consistency because of the particular methods used. Even for the measurement of stem circumference, it was difficult to take consistent long-term measurements for the basal and stem circumference without marking exactly where the initial measurements had been taken. In the current experimental setup, variations in survey methods, as well as experimental errors, were likely to account for much of the variation observed, thus making it difficult to quantify the natural growth of the plants.

To obtain information on the treatment effect on shading, an attempt was made to quantify the percentage of canopy cover using a lux meter and densitometer. However, this did not yield satisfactory results since the densitometer and lux meter were placed at the level of the observer (i.e. about 1-1.5m), and not at the level of the subject plants, with canopies at 2-6m. The measurements thus included self-shading caused by the subject plant, making the results unsatisfactory. Moreover, the effects of the application of glyphosate and the extent of tree trimming varied among individual trees and sites, which might have rendered the treatment effect on shading inconsistent.

(b) Inter-year variation of flowering success

The earlier consultancy study (Ecosystems 2010) noted considerable variation in size-variables and flower numbers between years, and suggested that this might be related to a combination of seasonal temperature and weather condition changes over the years, and also possibly connected with intrinsic changes that affected flower numbers in the previous year. Monitoring data from 2009 to 2012 revealed a pattern of good flowering success in alternate years (Fig. 5).

With a view of understanding the effect of environmental factors on reproduction, we extracted from the Hong Kong Observatory website (http://www.hko.gov.hk) climatic data, including variation in minimum daily temperature averaged by month, total monthly rainfall and duration of bright sunshine from 2008-2012. This data was analysed in relation to the proportion of flowering individuals of the three rhododendron species (Table 6).

Studies of *R. moulmainense* in Shenzhen revealed that high water content in the soil inhibits flowering during the critical period of flower bud differentiation, which lasts from mid-July to late September (Kang et al. 2009; Sun et al. 2009). Sharp et al. (2009) also demonstrated that *Rhododendron* flowering is promoted under water deficit treatments through separate developmental responses. In this study, flowering rates were higher when there had been lower rainfall in the preceding year, immediately before and during the period of flower bud differentiation (Table 6). Given that 2011 was an exceptionally dry year, the mass flowering in 2012 might have been related to the drought in the preceding growing season (Table 6). The mass flowering of *Rhododendron buxifolium* was also observed at the summit region of Mt. Kinabalu in Borneo when drought stress had been very severe due to an El Niño event (Kudo and Suzuki 2004).

In this study, a high flowering proportion was also shown to be associated with a shorter photoperiod in winter (i.e. fewer total hours of bright sunshine from December in the preceding year to February), and was not apparently related to the average winter temperature (Table 6). Meijón et al. (2011) stated that the change of long-day to short-day photoperiod is the primary factor responsible for floral induction in rhododendrons, and that the occurrence of a previous cold period and physiological memory are factors which improve floral production.

Table 6. Summary of climatic data and the percentage of flowering individuals.

	2009	2010 (good year)	2011	2012 (good year)
Total rainfall in the preceding summer (Jun - Sep) /mm	2293	1552	1878	943
Mean daily minimum temperature in winter (Dec - Feb) /°C	15.9	15.7	13.8	14.0
Total bright sunshine in winter (Dec - Feb) / Hour	556	265	472	318
Percentage of flowering individuals /%				
- *R. championiae*	0	61	20	79
- *R. hongkongense*	9	45	16	72
- *R. moulmainense*	47	89	65	100

(c) Implication on conservation management

The study indicated that rhododendrons with their surrounding trees/shrubs substantially cut back showed improvement in flowering success, at least for *R. championiae*, although the significance of improvement could not be readily concluded. However, as most areas in Ma On Shan are densely vegetated, drastic clearance of the surrounding vegetation may affect the community structure of the forest, alter the microclimate and disturb the forest ecosystem. Therefore, prudence should be exercised in expanding the scope of the pilot study in the future. When identifying a particular area for selective clearance or trimming of vegetation to enhance the reproductive success of a particular colony of *Rhododendron* species, we need to avoid areas where rare species have been recorded, and be sensitive to the presence of other taxa groups which form part of the forest ecosystem (e.g. butterflies associated with host plants).

Other than the selective cutting of vegetation shading the rhododendrons, *in-situ* or *ex-situ* methods of conservation management, such as propagation trials to enhance the recruitment of the species, were explored in the consultancy study (Ecosystems 2008). Zhang et al. (2004) reviewed the conservation status of rhododendrons in China and found that the genus had been poorly studied in terms of population ecology, identification of threatened species and conservation strategies. The authors proposed long-term ecological monitoring to determine threatened populations and factors causing their rarity before determining the conservation objectives and the approach for *in-situ* and *ex-situ* conservation management projects (*ibid.*). A similar conclusion was drawn by Tiwari and Chauhan (2006) for wild rhododendrons in Sikkim Himalaya, India. While information on *in-situ* conservation of rhododendrons is scanty, a germination study of wild *Rhododendron* species in Guangdong was conducted by Liu et al. (2007). In the past, success for vegetation propagation using cutting was low. In recent years, the success in the propagation of *R. moulmainense* in Guangdong province (Kang et al. 2009) implies that seeding and air-layering methods could be potentially effective in propagating some *Rhododendron* species of conservation concern. However, care must be taken in choosing the founding propagation material so as to preserve the existing genetic structure (Ng and Corlett 2000).

Conclusion

The four-year study indicated that the removal of surrounding vegetation enhanced flowering for all three species of rhododendrons, although the effects of treatment on flowering success were only weakly statistically significant. The extent of improvement in flowering differed among species and individuals, and appeared to be more significant for those that had been under shade, and for those which had their surrounding canopy more effectively opened up.

A pattern of alternate-year flowering was recorded for the rhododendrons in Ma On Shan from 2009 to 2012. The likelihood of flowering and the number of flowers were higher when there had been a dry growing season in the previous year and after a winter with a short photoperiod. Mass flowering might be the plant's response to limited resources under stressed conditions.

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First Record of Scarab Beetles in Hong Kong

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於2012年4月及2013年4月，漁農自然護理署甲蟲工作小組與中國科學院動物研究所就香港甲蟲多樣性進行聯合考察，並發現在香港屬首次記錄的黄鰓金龜屬 (*Pseudosymmachia* species)、短凱蜣螂 (*Caccobius brevis*)、密點糞蜣螂 (*Copris punctatus*)、端刻小糞蜣螂 (*Microcopris apicepunctatus*)、媒凹蜣螂 (*Onitis intermedius*)、笨重喻蜣螂 (*Onthophagus brutus*) 及闊脛瑪絹金龜 (*Maladera verticalis*)。本文就上述金龜子的主要鑒別特徵作出簡短的描述。

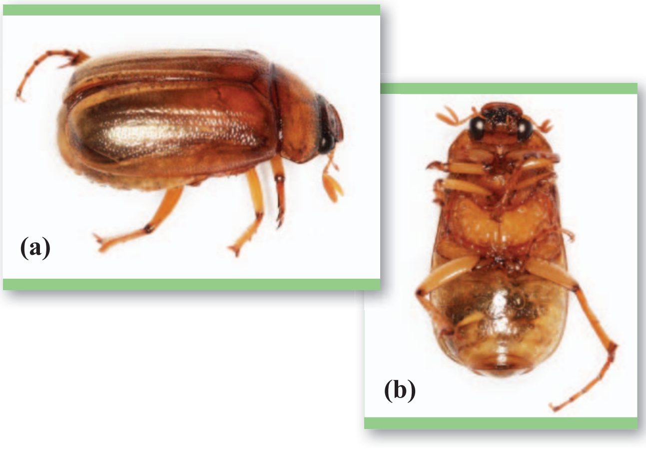
Introduction

In April 2012 and April 2013, the Beetle Working Group of the Agriculture, Fisheries and Conservation Department, and the Institute of Zoology of the Chinese Academy of Sciences conducted joint beetle biodiversity surveys in Hong Kong. Among the scarab beetles identified and upon checking with the relevant literature, the Group recorded the first identification in Hong Kong of scarab beetles of the Genus *Pseudosymmachia* Dalla Torre, 1913 (黃鰓金龜屬) and the species *Caccobius brevis* Waterhouse, 1875 (短凱蜣螂), *Copris punctatus* Gillet, 1910 (密點糞蜣螂), *Microcopris apicepunctatus* Balthasar, 1942 (端刻小糞蜣螂), *Onitis intermedius* Frivaldszky, 1892 (媒凹蜣螂), *Onthophagus brutus* Arrow, 1931 (笨重喻蜣螂) and *Maladera verticalis* Fairmaire, 1888 (闊脛瑪絹金龜).

Pseudosymmachia species (黃鰓金龜屬)

The Genus *Pseudosymmachia* Dalla Torre, 1913 belongs to the Subfamily Melolonthinae (鰓金龜亞科) (Fig. 7). The larvae of the Genus *Pseudosymmachia*, which are also commonly called grubs, are mainly phytophagous, feeding on roots and other parts of plants growing in topsoil, which may be of economic concern. The *Pseudosymmachia* species found in Hong Kong was a light brown adult, about 12.5 mm long. It possessed the typical features of the Genus *Pseudosymmachia*, with a nine-segment antennae, straight clypeus (唇基) slightly emarginated at the anterior fringe, and hairy thorax on the ventral side.

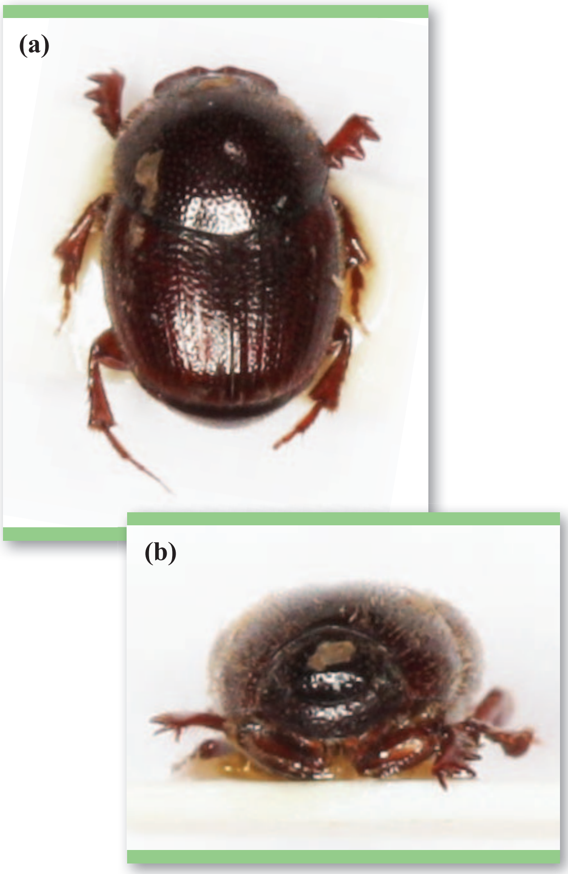
Fig. 7. *Pseudosymmachia* species (a) side view; and (b) ventral view.



Caccobius brevis (短凱蜣螂)

Caccobius brevis belongs to the Subfamily Scarabaeinae (蜣螂亞科) and Genus *Caccobius* (凱蜣螂屬) (Fig. 8). It lives in open fields and is a dung feeder in both the larval and adult stages. Like other *Caccobius* species, *Caccobius brevis* has deep antennal fossae (觸角窩) with well-defined edges on the pronotum (前胸背板), and the apical teeth of its front tibae are directed sideward. It has an oval, dark brown body, about 3.5 mm in length. It has two distinct carinae (横脊) on its head and two reddish patches on the posterior end of the elytra (鞘翅). It can be distinguished from other *Caccobius* species by its striated elytra, with granulated surfaces in rows.

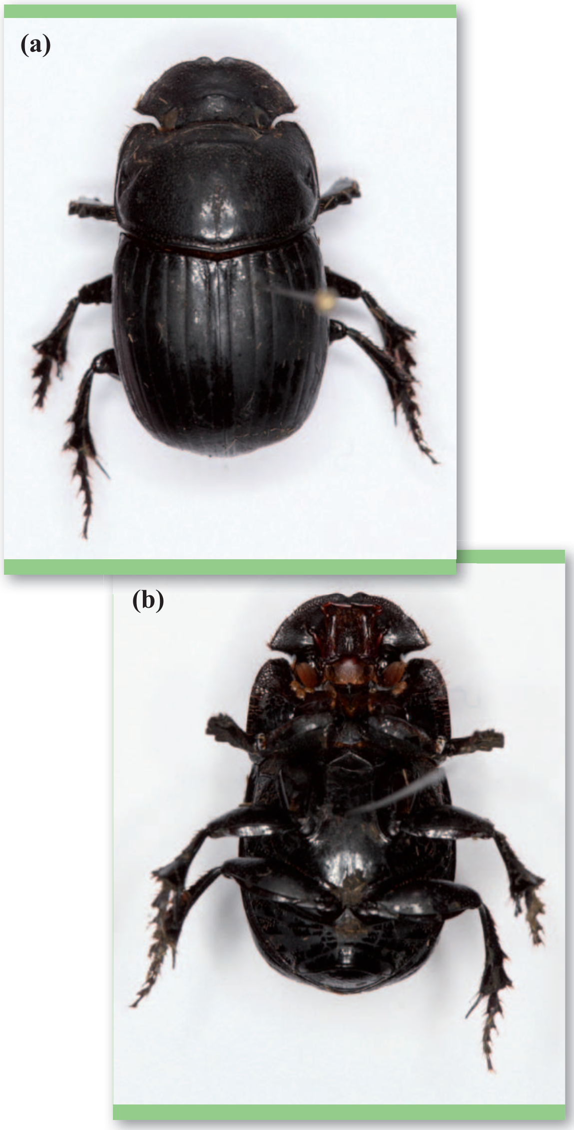
Fig. 8. *Caccobius brevis* (a) dorsal view; and (b) anterior view.



Copris punctatus (密點糞蜣螂)

Copris punctatus belongs to the Subfamily Scarabaeinae and Genus *Copris* (糞蜣螂屬) (Fig. 9). As with other *Copris* species, *Copris punctatus* has paracoprid or tunneling nesting behaviour, in which it buries dung down into the brood chamber dug beneath a dung pat for larval development. It has an elongated, black body about 16 mm in length, but its antennae and limbs are deep red. The striae on its elytra are deep and closely punctured. The elytral intervals are barely convex and also finely punctured. While the male *Copris punctatus* has four prominences (角突) on the pronotum, the female possesses a distinctive transverse carina on the pronotum and a weak prominence on the forehead.

Fig. 9. Female *Copris punctatus* (a) dorsal view; and (b) ventral view.



Microcopris apicepunctatus (端刻小糞蜣螂)

Microcopris apicepunctatus belongs to the Subfamily Scarabaeinae and Genus *Microcopris* (小糞蜣螂屬) (Fig. 10). It inhabits forested areas, and possesses the typical features of the *Microcopris* species, with deep antennal fossae with well-defined edges that differentiate this genus from the *Copris* species. *Microcopris apicepunctatus* has an elongated, shiny black body about 10 mm in length. Its pronotum has a posterior median groove. Its elytral intervals are densely punctured, with the 2^{nd} and 9^{th} striae connected at the posterior end near the pygidium (臀板). Another notable feature of this species is the inwardly curved apical teeth of its front tarsi.

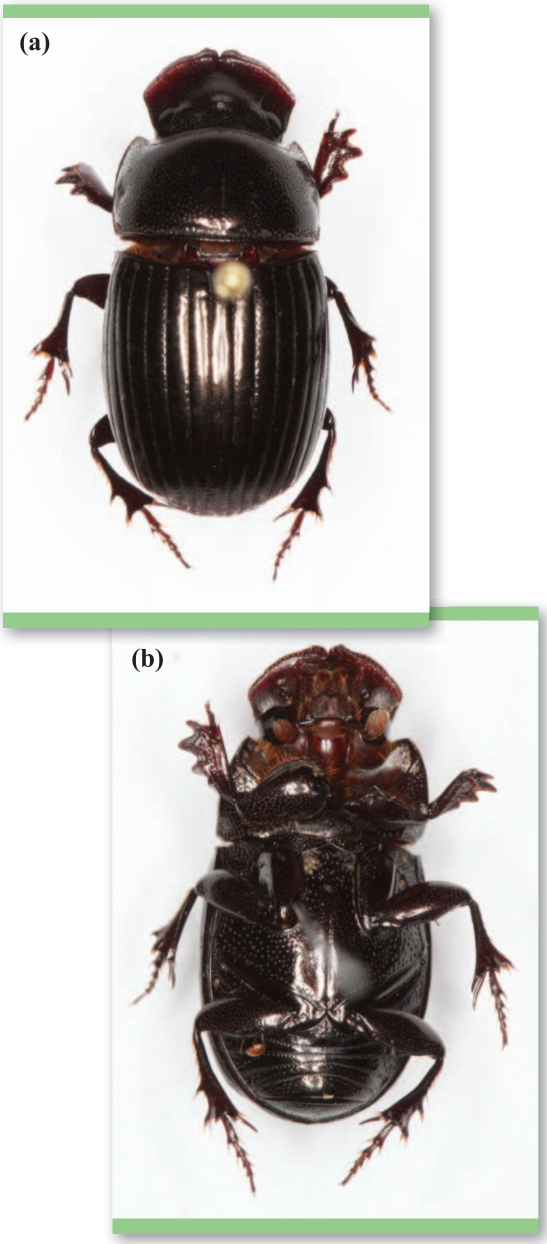


Fig. 10. ***Microcopris apicepunctatus*** **(a) dorsal view; and (b) ventral view.**

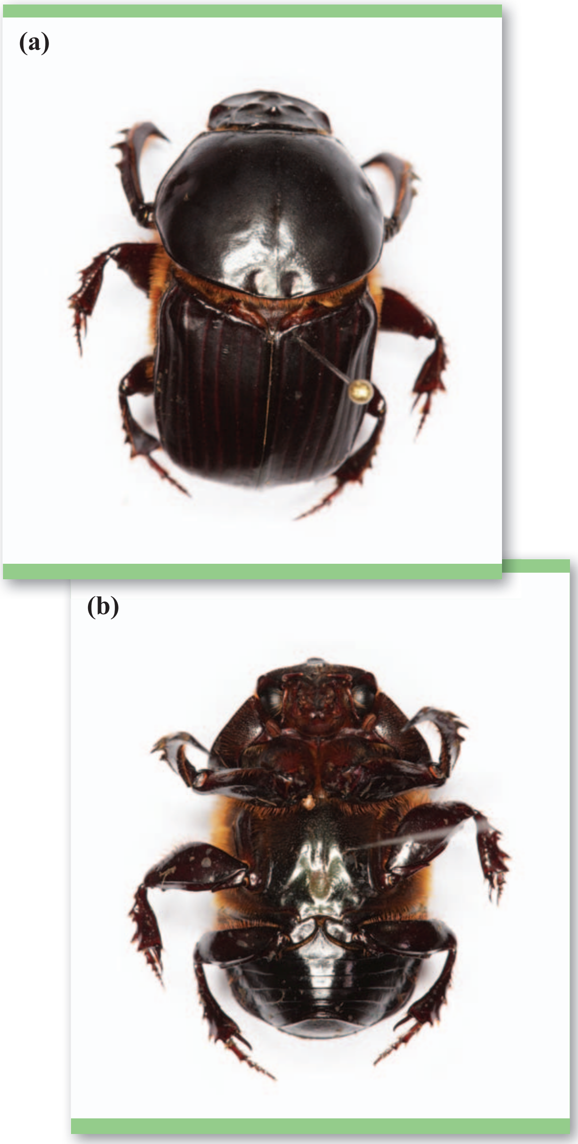


Fig. 11. ***Onitis intermedius*** **(a) dorsal view; and (b) ventral view.**

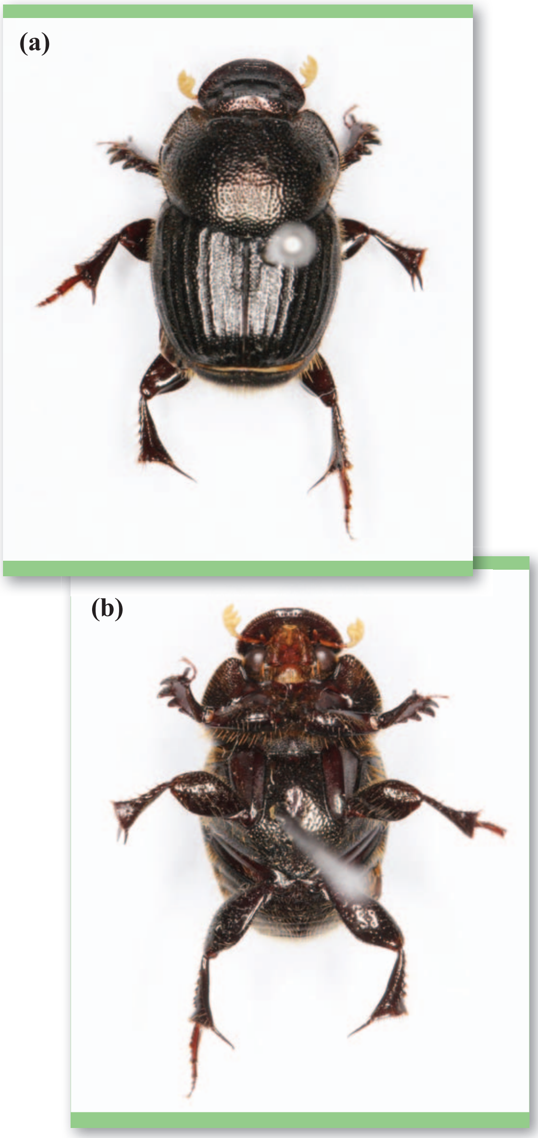
Onitis intermedius (媒凹蜣螂)

Onitis intermedius belongs to the Subfamily Scarabaeinae and Genus *Onitis* (凹蜣螂屬) (Fig. 11). As with other *Onitis* species, *Onitis intermedius* displays paracoprid or tunneling nesting behaviour and bears two distinctive basal impressions on its pronotum. *Onitis intermedius* is about 20 mm in length, and its body is rather oblong and moderately convex. Its pygidium is smooth and hairless, its metasternum (後胸腹板) has a longitudinal groove, and its pronotum is well punctured and basally fringed, which differentiates it from *Onitis falcatus*, commonly found in Hong Kong .

Onthophagus brutus (笨重嗡蜣螂)

Onthophagus brutus belongs to the Subfamily Scarabaeinae and Genus *Onthophagus* (嗡蜣螂屬)(Fig. 12), which is one of the largest coleopteran genera in terms of the number of species recorded. Like most other *Onthophagus* species, *Onthophagus brutus* is a dung feeder in both the larval and adult stages. It has a body length of about 8 mm. Its body is elongated, moderately convex and metallic black. Its antennae are yellow, its forehead has an erected carina, its pronotum has a bituberculated prominence, and the elytral intervals are barely convex. Unlike the cepthalic carina of the male *Onthophagus brutus*, which points upward, forming a pair of short, parallel horns at both ends, the carina of the female is weakly toothed along the edge.

Fig. 12. Female *Onthophagus brutus* (a) dorsal view; and (b) ventral view.



Maladera verticalis (闊脛瑪絹金龜)

Maladera verticalis belongs to the Subfamily Melolonthinae and Genus *Maladera* (瑪絹金龜屬) (Fig. 13). Both larvae and adults of *Maladera verticalis* are phytophagous, feeding on roots and shoots, respectively, with older plants more vulnerable to this species than the younger ones. The adults of the species are nocturnal and fairly attracted to light. It has a rufous, oval body about 9 mm in length. Its body surface is weakly punctured and has a silky appearance. It has a trapezoidal clypeus with a carina. Its scutellum (小盾片) is large and elongated, and the femurs of its hind limbs are fairly broad and flat.

Further Studies

Further taxonomic studies are being undertaken to identify the *Pseudosymmachia* species at the species-to-species level. Another scarab beetle collected in a survey conducted by the Beetle Working Group in 2010 has recently been identified as *Onthophagus convexicollis* Boheman, 1858 (凸喙蜣螂). A check of the relevant literature showed that *Onthophagus convexicollis* had not been recorded elsewhere in Hong Kong since its discovery here in the 19th century. Further studies are underway to verify the taxonomy of the species and its endemism to Hong Kong (Fig. 14).

Fig. 13. *Maladera verticalis* (a) dorsal view; and (b) ventral view.

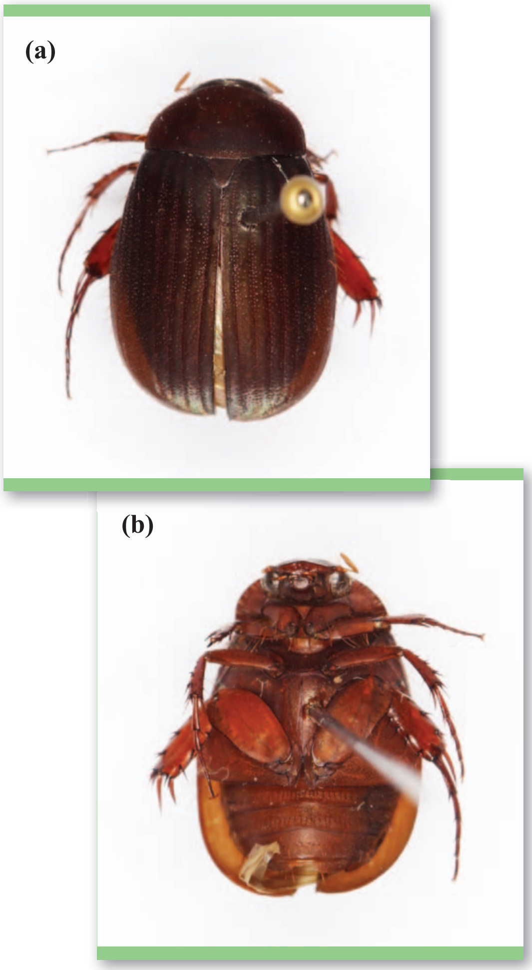


Fig. 14. *Onthophagus convexicollis*, pending further studies on its taxonomy and endemism.

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First Record of Checkered Beetles *Clerus rufiventris* (紅腹郭公甲) and *Orthrius sinensis* (中華曉郭公甲) in Hong Kong

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本文旨在簡介郭公甲蟲的生態及鑒別特徵，並就在香港屬首次記錄的紅腹郭公甲 (*Clerus rufiventris*) 和中華曉郭公甲 (*Orthrius sinensis*) 作出簡短的描述。

Introduction

Beetles of the Family Cleridae, commonly known as 'checkered beetles' (郭公甲蟲) because of the elaborate colour patterns in most species, belong to the Order Coleoptera, Sub-order Polyphaga, Series Cucujiformia and Super-family Cleroidea. There are about 3,500 species of checkered beetles worldwide, and over 150 species have been recorded in China. Little was known about checkered beetles in Hong Kong, but recently, several species of checkered beetles have been recorded locally, such as *Necrobia rufipes* (赤足郭公甲), *N. ruficollis* (赤頸郭公甲) and *Xenorthrius simplex* (簡番郭公甲).

In April and May 2012, two species of checkered beetles, namely *Clerus rufiventris* Westwood, 1849 (紅腹郭公甲) and *Orthrius sinensis* Gorham, 1876 (中華曉郭公甲), were recorded in Hong Kong for the first time by the Beetle Working Group of the Agriculture, Fisheries and Conservation Department, and the Institute of Zoology of the Chinese Academy of Sciences.

Morphology and Ecology

Checkered beetles are recognised by their elongated, almost parallel-sided elytra (鞘翅), with setose (剛毛) covering the entire body surface. Their head is wide, with laterally prominent compound eyes, and their pronotum (前胸背板) is often cylindrical and constricted at the base (i.e. narrower than the elytra). Another distinctive feature of this family is their well-developed limbs with lobed tarsi (跗節). Most checkered beetles are diurnal and prey on insects, including other beetles, associated with timber and bark. Adults are commonly found on trees and flowers inhabited by their prey. Mimicry of other insects, like the appearance and movement patterns of wasps and ants, can also be observed in some species of checkered beetles.

Species Account

Clerus rufiventris (紅腹郭公甲)

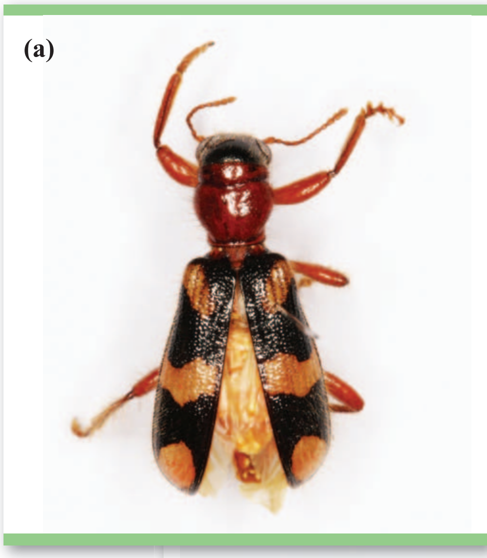
C. rufiventris displays the typical features of checkered beetles. Its body is about 10 mm in length and 3 mm in width. While its elytra and other parts of its body are generally black, it has a red abdomen, which gives the name of this species ("*rufus*" and "*ventris*" refers to reddish and abdominal, respectively, in Latin). Long, greyish white hairs are present along both sides of its pronotum, and the crescent-shaped creamy white band in the middle of each elytron is intercepted to form a distinguishing broken band (Fig. 15). *C. rufiventris* has a wide distribution in China and other southeast Asian countries.

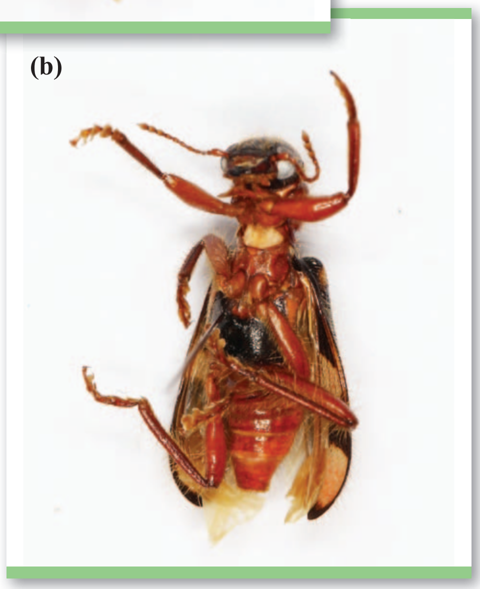
Fig. 15. *Clerus rufiventris* (a) dorsal view; and (b) ventral view.

Orthrius sinensis (中華曉郭公甲)

O. sinensis possesses the typical features of checkered beetles described above. Its body is approximately 9 mm in length and 3 mm in width. The head and thorax of this species are reddish brown, and the elytra are black. An easily recognisable characteristic of this species is the presence of two pale yellowish bands in the front and middle of each elytron, as well as a pale yellowish spot in the apical region (Fig. 16). Apart from Hong Kong, *O. sinensis* has been recorded in Vietnam and other places in China, including Guangxi, Fujian and Shanghai.

Fig. 16. *Orthrius sinensis* (a) dorsal view; and (b) ventral view.





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We would like to express our sincere gratitude to Prof. Yang Xing-ke (楊星科教授), Dr. Bai Ming (白明博士) and Dr. Yang gan-yan (楊干燕博士) of the Chinese Academy of Sciences for their support throughout the survey and advice on the identification of checkered beetles. We also wish to give our special thanks to Mr. Paul Aston for reviewing this article.

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What's New

First Record of Slaty Bunting (*Emberiza siemsseni* 藍鵐) in Hong Kong

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漁農自然護理署職員於2013年2月8日在大埔滘自然保護區記錄到一隻雌性藍鵐 (*Emberiza siemsseni*)，為香港的首次記錄。本文就藍鵐的特徵、分布、生態及其保育狀況作簡短的介紹。

Introduction

At around 3:30 pm on 8 February 2013, a bunting was heard calling in a bamboo thicket on the Blue Trail in Tai Po Kau Nature Reserve. The bird then flew out and foraged actively on the footpath. It was subsequently identified as a female Slaty Bunting (*Emberiza siemsseni* 藍鵐), a member of the Family Emberizidae (鵐科). This is the first record of this species in Hong Kong. The site was re-visited on 10 February 2013, and presumably the same female was seen and photographed (Fig. 17) on the Red Trail, about 400 m away from the first site.

Identification

The Slaty Bunting is small, with a length of 12-13 cm. The female has dark brown wings, flanks and tail. Its forehead, crown, nape and breast are rufous brown, with paler ear coverts. Its mantle is streaked and the outer tail feathers are white. The male is distinctive, with a slate blue head, upperparts, wings, breast and flanks. The tail is slightly darker than the body, and it has a contrasting white belly, vent and outer tail feathers (Brazil 2009; del Hoyo et al. 2011). Both sexes have a small, dark grey bill, black eyes and pink legs.

Fig. 17. Photograph of a Slaty Bunting taken in Tai Po Kau Nature Reserve on 10 February 2013.

Distribution and habitats

The Slaty Bunting is an endemic species in China. It has a restricted range, breeding in subtropical secondary forests in the mountains of central China in southern Gansu (甘肅) and southern Shaanxi (陝西), as well as southern to western Sichuan (四川), mainly between 1500 m and 2100 m. It prefers bamboo thickets in the vicinity of secondary forests (Brazil 2009; del Hoyo et al. 2011). It is an altitudinal migrant and spends the winter at lower elevations between 500 m and 1700 m in southern China, including Sichuan (四川), western Hubei (湖北), Anhui (安徽), Yunnan (雲南), Guizhou (貴州), Zhejiang (浙江), Fujian (福建), northern Guangdong (廣東) and Che Ba Lang (車八嶺) (del Hoyo et al. 2011; Viney et al. 2005). Outside China, there has been only one unconfirmed record, from Penghu Island (澎湖), Taiwan (Brazil 2009). The present finding represents the southernmost distribution of this species.

It feeds mainly on small insects (e.g. wasps, bees, ants, small beetles and cicadas) and grass seeds (Li et al. 1993; del Hoyo et al. 2011).

Conservation Status

Despite the restricted distribution, the Slaty Bunting is not considered to be globally threatened. The wild population in China is estimated to be up to 10,000 breeding pairs (Brazil 2009). The future population is expected to be stable due to the lack of evidence of decline or threats. For these reasons, it is classified as 'Least Concern' (BirdLife International 2014).

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