For Discussion on **NCSC 3/09**
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Advisory Council on the Environment
Nature Conservation Subcommittee

Field Study on the Effectiveness of Using *Cuscuta* (菟絲子) Species in Control of *Mikania micrantha* (薇甘菊)

Purpose

This paper briefs Members on the findings of the field study on the effectiveness of using *Cuscuta* (菟絲子) species in control of *Mikania micrantha* (薇甘菊) carried out by the Chinese University of Hong Kong under a service tender of Agriculture, Fisheries and Conservation Department (AFCD). This paper also discusses the potential application of *Cuscuta* as the biological control agent of *Mikania micrantha* and suggests the way forward for further studies.

Background

2. In Hong Kong, Mikania is usually found in low-lying, moist and disturbed areas with ample sunlight such as derelict fields, fishpond bunds, roadside areas, and woodland edges around village environs. This exotic perennial herbaceous vine would climb up on other plants to reach the canopy for better sunlight, and often cover up other plants and eventually causing damage to or even killing other plants. As Mikania has a high spreading rate, there is a growing concern about the potential impacts of Mikania to natural vegetation, especially at the woodland edges.

3. There are different approaches in Mikania control. They can be cleared with physical means by cutting off their stems but there will be re-growth from lower and underground portions and repeated clearing may be needed. Chemical control with herbicide could kill the entire plants, but the application has side-effects to nearby vegetation and is therefore not suitable for sites near water sources, active agricultural land,

gardens and residential areas.

4. Biological control has been considered as an alternative solution to control invasive species as its action is supposed to be long-lasting and specific, thus other non-target species would not be adversely affected. However, no conclusive result in field application of suitable biological control agent for Mikania is available at this stage. *Cuscuta* species, commonly known as dodders, are a group of parasitic plants with very low levels of chlorophyll to carry out photosynthesis themselves and thus are entirely dependent on the host plants for nutrition. There are several species of dodders in Hong Kong and preliminary field observations revealed that *Cuscuta campestris* (田野菟絲子) often infests Mikania naturally in abandoned field. There have been a few studies in South China showing that dodder is potentially an effective biological agent in controlling Mikania by suppressing the growth and inhibiting the reproduction of Mikania through its parasitic action. However, the effectiveness of its field application has not been studied in detail.

Field studies

Methodology

5. The early part of the field experiments studied three different ways of delivering dodders to Mikania, including (1) sowing of seeds, (2) transfer of fresh stem cuttings, and (3) transfer through an intermediary host. All of the three methods provided some degrees of success, but the best results were achieved through transferring fresh cuttings which has been used for the later part of field experiments.

6. Cut shoots from terminal branches of *C. campestris* were collected from wild populations. The cut ends of the dodder shoots were immersed in a plastic bag filled with water. The dodder cuttings were then hooked on the stems of Mikania. Site investigations were made on experimental beds constructed at Tai Tong Nursery and at selected sites of different habitats in the New Territories, supplemented with observations on natural interactions between Mikania and *C. campestris* in the field. Besides, Centre Island at Tolo Harbour was chosen as a field study site for a comprehensive field trial due to its

prevailing Mikania problem, free from human disturbance and physical isolation from the rest of the territory.

Major findings

7. *C. campestris* was found to effectively inhibit the growth of Mikania in both the experimental plots and the field, particularly on abandoned fields and slopes that are humid with ample sunlight. In some cases, dodder has reduced the biomass of Mikania as much as 75% and allowed other plants to take over the space previously occupied by Mikania. *C. campestris* also demonstrated its potency in killing Mikania. However, after the dodder killed the Mikania branches it infested, it also flowered, set fruits and then became withered. Hence, the impact was only topical and further control on Mikania would depend on the ability of vegetative and sexual reproduction of the dodder remained at the site.

8. In addition, *C. campestris* demonstrated its potency in suppressing the flowering of Mikania. In one of the experimental sites, the mean number of flowers of Mikania infested by dodder in a $1m^2$ quadrat was only 1,400 while that of the control plot was as high as 190,000 which was more than 100 times higher. This result indicated that *C. campestris* can significantly reduce the reproductive ability of Mikania. The reduction of seed production could limit the dispersal of Mikania and thus diminish its spreading.

9. Hence, a sensible approach would be to apply *C. campestris* in spring to lessen the virulence of Mikania in summer while a mid-summer application would help reduce flowering of Mikania in the later part of the year. However, *C. campestris* did not do well in dry, windy and shaded sites. Moreover, temperatures higher than 30^oC or lower than 10^oC are generally less favourable for dodder application. The high temperature in summer might thus be a limiting factor for the mid-summer application.

10. Apart from Mikania, preliminary results demonstrated that *C. campestris* could infest and grow on many other plants including trees, horticulture plants and crops. However, damages on trees have been observed to be minor and very localized. It is also concluded in the

study that the potential damages by *C. campestris* to agriculture and horticulture industries in Hong Kong would be minimal, as local agricultural fields are normally under intensive management and any weeds (including dodders, if present) will be cleared by farmers promptly. It should also be noted that *C. campestris* is already widely distributed locally.

Way forward

11. Although there are still some limitations in the application of *C. campestris* in certain habitats and seasons, it is recommended to continue the trial of using *C. campestris* as a potential biological control agent of Mikania in small-scale at various sites under the management of AFCD and monitor its effectiveness. A standardized monitoring form will be developed for recording the coverage and flowering of Mikania as well as the growth performance of *C. campestris*. The results of the monitoring should be used to refine the protocol of such application, to further assess the possible side effects on local ecology and to review if *C. campestris* is suitable for large-scale application for Mikania control.

12. The experimental beds at Tai Tong and the field study sites on Centre Island should be retained for further observations in order to fill in the information gaps regarding the growth of *C. campestris* in the wet season and at high temperature and to try out different approaches of applying dodders together with the introduction of other plant species that could take over the space vacated by Mikania right after it is weakened or killed by dodders.

13. Further study should be carried out on the effectiveness of using other dodder species (e.g. *C. japonica*, 金燈藤) as the biological control agent of Mikania. The initial field observation showed that C. japonica appears to be potent in killing Mikania and would be a more effective biological control agent than *C. campestris*. Nevertheless, as this dodder species is relatively more aggressive in infesting its host plants and is less common in distribution, further study is needed to ascertain its side effect and safety as a biological agent for Mikania in Hong Kong.

Advice Sought

14. Members are invited to note and comment on the findings of this study on the effectiveness of using *Cuscuta* species in control of Mikania and the proposed way forward.

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