

FA1203: Sustainable management of *Ambrosia artemisiifolia* in Europe
(SMARTER)

STSM Report - China 2013

Strengthening our research collaboration with China within SMARTER

Tuesday 23 July – Tuesday 6 August, by Heinz Müller-Schärer

Purpose of the STSM

In China, ragweed has been recorded since 1930 and several insect species have been introduced around 1990 for classical biological control of ragweed, others have been introduced accidentally. Two institutions from China, the Chinese Academy of Agricultural Science, CAAS Wuhan and the Chinese Academy of Science, CAS Beijing are participants of SMARTER. The main objective of this STSM was to **Strengthening our research collaboration with China within SMARTER** by initiating and establishing joint experiments on host-specificity and impact studies of biological control (BC) candidates, to gain knowledge on mass rearing and field releasing BC agents and to arrange for shipments of selected BC candidates into quarantines in Europe. The two main target BC organisms are *Ophraella communa* (*Ophco*) and *Epiblema strenuana* (*Epist*).

Description of the work carried out during the STSM

As planned, Yan Sun (cf. her separate STSM trip report) and myself did most of our trip, especially the field survey in Hubei, Jiangxi and Hunan province together. This was necessary and most rewarding as I often needed translations by Yan (discussions with most researchers could not be done satisfactorily in English) and I could support Yan with driving (more than 2000km with a rented car) and for discussing local arrangements for seed collections and other collaborative work in the framework of SMARTER. Our separate trip reports cover the originally planned and also successfully performed individual missions.

My two main counterparts were:

Jianqing Ding Ph.D., Research scientist and program leader, Invasion Ecology and Biocontrol Lab, Wuhan Botanical Garden/Institute, Chinese Academy of Sciences, Moshan, Wuhan, Hubei Province, 430074 China, dingjianqing@yahoo.com

JianYing Guo, Ph.D., IPMnet of China, Institute of Plant Protection, CAAS, Beijing, 100094, China, guojy406@163.com

Further collaboration between Chinese research teams/authorities with the SMARTER framework were discussed while visiting researchers of local Agricultural Academies and regional and community authorities in Hunan, Jiangxi and Hubei provinces (cf. list of researchers in Yan Sun's report).

Itinerary

- 24 -26 July Discuss collaborative studies with Dr. Jianqing Ding at CAS, Wuhan
- 27-31 July Field trip to Hunan, Jiangxi and Hubei provinces, visit field release sites, discuss release procedures, monitoring protocols, host specificity and host impact studies of the two biocontrol agents *Ophraella communa* (*Ophco*) and *Epiblema strenuana* (*Epist*)..
- 2-5 August Visit the CAAS field station at Langfang (outside Beijing). Visit and discuss with Dr. Zhou and his students ongoing and future joint experiments with *Ophco*.
- Visit CAAS Headquarter (South Campus), transfer to CAAS North Campus to visit research facilities of CABI; discuss with the group of Dr. Guo (CAAS) and Dr. Feng Zhang (CABI China) ongoing and future joint research studies on ragweed biocontrol agents and of shipments of biocontrol agents from China to Switzerland.
- Meet with Dr. Fanghao Wan, head of Laboratory of biological invasion, Institute of Plant Protection (IPP), CAAS, discuss past, ongoing and future ragweed biocontrol activities in China and possibilities for collaborations with SMARTER.

Description of the main results obtained and of future collaboration with the host institutions

Discussion with Dr. Jianqing Ding at CAS, Wuhan

In 2014, I arranged to do field plot experiments for **host specificity testing** by growing various test plants at the research plots within Wuhan Botanical Garden naturally infested by both *Ophco* and *Epist*. We will have to arrange for introducing European sunflower varieties (cf. below), European rare and endangered plants taxonomically related to ragweed, and other critical plants from the SMARTER test plant list (yet to be established) to be grown together or singly with ragweed. Alternatively, congeneric plants of the European test plants that naturally occur in China could be used. Experimental **impact studies** of these two biocontrol organisms on ragweed performance and population dynamics could also be initiated in 2013 in these garden plots starting from initial artificial populations using seeds from the local populations. Moreover, ragweed from European and North American origin could be grown from seeds at the same site to monitor oviposition preference, larval performance and host impact of *Ophco* and *Epist* as compared to Chinese ragweed sources. Also potential parasitism and predation of *Ophco* and *Epist* could be studied at this location.

Unfortunately, the MSc student involved in ragweed research has moved to Beijing for her PhD and it seems to be unlikely that CAS funding could be attributed to a MSc or PhD student working on ragweed in the next years to come. We therefore agreed that we try to recruit a MSc student at the University of Fribourg to work on biosafety

and host impact of *Ophco* and *Epist* and that would spend c. 1-2 month in China (Wuhan and Langfang, cf. below) in summer 2014 to be involved in the peak activity period of July and August for such studies. A call for potential MSc students has been launched in the meantime at the University of Fribourg. Alternatively or jointly, the foreseen SERI granted PhD student from CABI Switzerland could become involved in these studies. Both CAS and CAAS (cf. below) would be willing to contribute to such studies, but would need some funding for local expenses.

I have also contacted Dr. Maio Su Chen, Program Manager, Sino Swiss Science and Technology Cooperation (SSTC; <http://www.global.ethz.ch/stc/china>) about potential funding for our envisaged collaborative projects. According to her information, "the best way we can continue Sino Swiss collaboration is through joint conferences and personnel exchange. On CAS side, they can declare annually certain topics to be "priority areas" and have some modest sum of research support for the Chinese partner and the SSSTC can similarly support it. The scope of the support will be for personnel exchange (6-12 months) and some consumable (undefined yet, but max CHF 1000 per month of exchange). Beyond that, we have been talking to the Chinese Scholarship Council, which might also support the SSSTC program with scholarship for Chinese professors to send students and postdocs (from universities and not CAS) to Switzerland. If this deal goes through, the terms could be quite generous with regard to personnel money". Dr. Ding and myself will follow-up the future development for this collaboration from both sides.

Discussions with Dr. Zhou and Dr. Fanghao Wan (CAAS Beijing)

Dr. Zhou and MSc student Zhibang Liu both exclusively work with ragweed biocontrol at the Langfang research station. Ongoing lab and field experiments include work with *Ophco* on mating behavior, biology of morphotypes (three types have been distinguished based coloration of elytra), mate choice and assortative mating within and among morphotypes). *Ophco* has 5-6 generations in the South of China (south of the Yellow River) and 3-4 generations in northern China. Time to egg hatch (7d), of the three larval stages (each 7d) pupation (7d) and adult longevity (3-4 months) have been identified in the lab. The studies aim at selecting a beetle strain to be best adapted for release in Northern China.

In garden plots at Langfang, ragweed (from seeds collected at Changsha region) is grown jointly with seven sunflower varieties and maize crops. Both *Ophco* and *Epist* spread naturally to the site. The impact of both biocontrol organisms were very high, with especially *Ophco* being able to directly kill heavily attacked plants (Fig. 2). *Epist* as a shoot tip miner prevented growth and thus flowering of the attacked shoot, but side branches grew out and if not attacked again were able to produce flowers and seeds. *Epist* also has 5-6 generations at the study site. According to Dr. Zhou, *Ophco* is far more efficient as heavy attack will kill the plant before flowering and population build-up at the study site is impressive with all plants expected to be heavily attacked by late August/early September.



Fig 1. Insights into the lab studies with *Ophraella communa* at the Langfang research station (CAAS Beijing).



Fig 2. Insights into the garden field plot experiments with *Ophraella communa* at the Langfang research station (CAAS Beijing). Top left: attack by *Epiblema strenuana*; top right: attack by *Ophraella communa*, bottom left: interview to the CCTV-7, bottom right: the ragweed research group (from left to right: MSc student Rao Wang, Dr. Zhou, Zhibang Liu, Haiyun Xu, Yan Sun).

The studies outlined above at CAS Wuhan could also be carried out with CAAS Beijing (mainly at Langfang), in parallel or as complementary experiments. Again, financial support is needed from us, but infrastructure and help would be provided by CAAS.

Shipments of bc insects from China to Switzerland have been discussed with Drs. Guo, Zhou and Zhang. We will first have to arrange for an import permit into quarantine facilities in Switzerland (more precisely to work with these insects in quarantine), then our Chinese counterparts (Drs. Zhou and Zhang) will arrange for an export permit from the respective Chinese authorities, which is expected to take c. 2 months. The import permit for Switzerland will be submitted in September.

The discussion with Dr. Fanghao Wan was most helpful as he is the coordinator of many research programmes on invasive species, specifically also for ragweed. He outlined many past (with various deliberately introduced potential biocontrol agents) and ongoing host specificity and impact experiments (including joint effects of a rust pathogen with attack by *Ophco* in Northern China). According to both Dr. Wan and Dr. Zhou, *Ophco* is THE biocontrol agent of choice due to its huge effect on plant performance killing both young and well established plants caused through heavy attack rates (severity of attack, number of larvae/adults per plant) and the population build-up over the growing season of ragweed leaving basically no plant without attack (high level of incidence, i.e. percent of plants attacked). The late growing period of ragweed as compared to the accompanying flora allows the beetle to produce several generations on a ragweed population, with repeated attack of single plants and covering the whole growth period of ragweed including also late germinating plants and regrowth of attacked plants. Extensive host specificity monitoring at the experimental field populations have been done, using several sunflower varieties, different proportions of target vs. non-target plants and releases of larvae and adults on both the target and non-target plants. According to both Drs. Wan and Zhou, sunflower is absolutely safe from attack of *Ophco*, which we could confirm through our observations at the field plots in Langfang.

With the help of our Chinese partners, we are presently collecting all black and grey literature on ragweed from China and this will later be made available on our SMARTER website.

Discussion with Dr. Feng Zhang (CABI China)

We visited Dr. Feng Zhang's office at the South Campus of CAAS Beijing, where all international organizations linked to CAAS are hosted, as well as the new lab facilities at the North Campus (cf. Fig 3) discussed potential export permits for shipping bc agents from China to Switzerland, and got informed about the presently ongoing research projects at CABI China.

Further discussions with Chinese research teams/authorities

We discussed further aspects of the ragweed biocontrol programme in China with the researchers of local Agricultural Academies and regional and community authorities in Hunan, Jiangxi and Hubei provinces (cf. list of researchers in Yan Sun's report). Releases of *Ophco* and *Epist* have been made by simply distributing freshly cut shoots

of ragweed infected with larvae and pupae of the two species that have been shipped from the rearing facilities (ragweed grown in greenhouses).

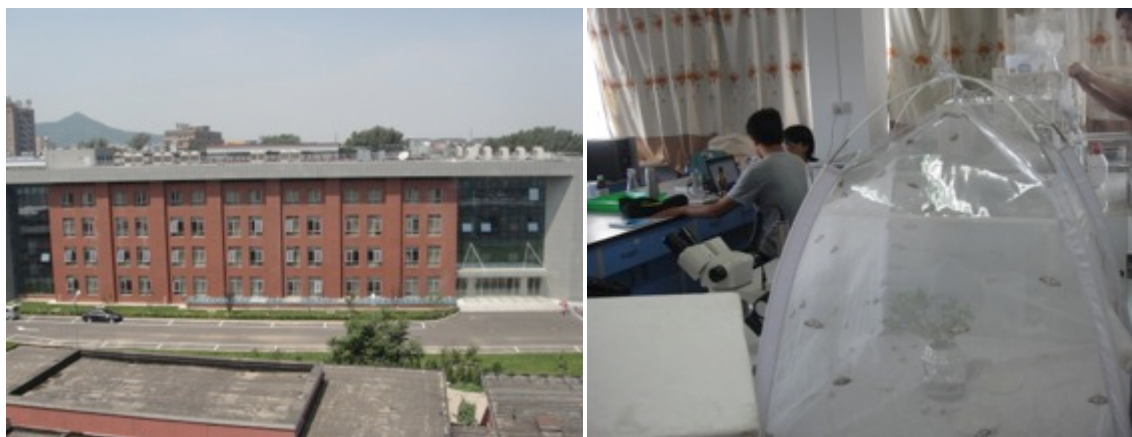


Fig. 3. Left: the new CAAS Biosafety Laboratory (Dr. Wan's group) and right: the new lab facility of CABI China, both at the North Campus of CAAS Beijing.

Foreseen publications/articles resulting from the STSM

Joint studies with our Chinese partners will result in joint publications.

Confirmation by the host institution of the successful execution of the STSM

cf. attached email from Dr. Ding, CAS Wuhan

We greatly acknowledge the warm-hearted, most helpful and efficient support by the many Chinese colleagues that we had the opportunity to meet during our trip. Your commitment was crucial for our successful completion of this mission.

Fribourg, 21 August 2013

Heinz Müller-Schärer

Approved by the SMARTER STSM coordinator

Bari,

Maurizio Vurro