ESTABLISHMENT OF DIADEGMA SEMICLAUSUM (HELLEN) (HYMENOPTERA: ICHNEUMONIDAE) IN THE PHILIPPINE CORDILLERA: STATUS IN 1992 AND 1993¹

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ABSTRACT

In 1992 and 1993 surveys were undertaken to assess the establishment of *Diadegma semiclausum*, a larval parasitoid of *Plutella xylostella*, in Benguet and Mountain Province. From 1990 to 1992 a total of 161179 adult wasps and cocoons were released in these two provinces. In 1992 in all places visited the beneficial could be found indicating a successful establishment. One year later, in November 1993, both the pest and the beneficial were found but in very low numbers.

INTRODUCTION

Cruciferous crops play an important role in the Philippine agriculture. Regarding volume and value of all planted vegetables cabbage was in third place after tomato and eggplant in 1988 (CENTER FOR RESEARCH AND COMMUNICATION 1990). The cultivation of crucifers in the Philippines is concentrated in Benguet and Mountain Province in the Philippine Cordillera in Northern Luzon. In 1980, from a total area of 7830 ha planted to cabbage in the Philippines

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3372 ha or 43% were located in these 2 provinces. If all cultivated crucifers are summed up the area increases to 4359 ha (CENTER FOR RESEARCH AND COMMUNICATION 1990, NATIONAL CENSUS AND STATISTICS OFFICE 1986). While cabbage (Brassica oleracea var. capitata), Chinese cabbage (Brassica pekinensis), mustard (Sinapis alba), radish (Raphanus sativus var. niger), cauliflower (Brassica oleracea convar. botrytis var. botrytis) and broccoli (Brassica oleracea convar. botrytis var. italica) are usually cultivated in higher elevations, petchay (Brassica chinensis) can be found both in low and high elevations.

However, the production of crucifers is hampered by various pests attacking these crops. The severest problem is caused by Plutella xylostella (L.) (Lepidoptera: Yponomeutidae), the Diamondback moth (DBM). Farmers are usually applying insecticides every 5-7 days and even this cannot ensure sufficient control of DBM because of its resistance against a wide range of insecticides. During the dry season of 1989 cabbage farmers spent as much as 18.5% of their total cash cost (13600. - Pesos/ha) on insecticides as an economic study by VENTURA et al. (1993) indicates. To make pest control more affordable and to counter the rapidly increasing resistance of DBM against chemical insecticides two groups of researchers started in 1989 and 1990 to evaluate the feasibility of biological control of DBM with the larval parasitoid Diadegma semiclausum (Hellen) (Hymenoptera: Ichneumonidae): one, the Philippine-German Biological Plant Protection Project (PGBPPP) and the other, the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) in cooperation with the Asian Vegetable Research and Development Center (AVRDC) and the Benguet State While the PGBPPP and the University (BSU). PCARRD/AVRDC/BSU group were involved both in rearing and releasing of D. semiclausum, two other parties, the Department of Agriculture-Cordillera Administrative Region (DA-CAR) and the Highland Agricultural Development Project (HADP), a project under the DA, were supplied with the parasitoid by the PCARRD/AVRDC/BSU group for field releases on their own (AMEND & MANGALI 1992, CARDONA 1992, PÖLKING 1992).

Until 1992 no survey was conducted to pinpoint the areas where the parasitoid has already been established and to review the efforts of these groups. Amend, et al.: Establishment of Diadegma semiclausum (Ilellen) (Hymenoptera: Ichneumonidae) in the Philippine Cordillera: Status in 1992 and 1993

Survey 1992

MATERIALS AND METHODS

Data about the various release sites and the corresponding numbers of released Diadegma cocoons or adults were collected. Between July and November 1992 crucifer fields in 7 out of 13 municipalities in Benguet, namely Atok, Buguias, Kapangan, 13 municipalities in Mountain Province namely Besao, Bauko and of 9 municipalities in Mountain Province namely Besao, Bauko and Sagada were surveyed. The selection of survey areas was based on the importance of its crucifer cultivation and accessibility of the area during rainy season. Plants in sample fields were thoroughly searched for cocoons of *D. semiclausum*. If one or more cocoons were found in a field presence of *D. semiclausum* was noted and marked in a map.

RESULTS AND DISCUSSION

In Figure 1 data about release sites and released Diadegma are summarized. It also shows the location of the survey in 1992 and 1993.

In all places visited cocoons of *D. semiclausum* were found. The time the survey was carried out was during the rainy season and early dry season 1992. This particular time is usually characterized by a low DBM population. Rain and fungal infections may often lead to a high mortality of DBM (RIETHMACHER 1991, POLKING 1992). The presence of *D. semiclausum* in all survey fields implies the ability of the parasitoid to survive times of low host population and adverse weather conditions. Comparing the original release sites from 1990 to 1992 with the occurrence of *D. semiclausum* during the survey in 1992 conclusions may be drawn about the dispersal ability of this insect. Although no releases at all were carried out in Tublay, Kapangan, Kibungan, Bauko and Besao cocoons of *D. semiclausum* were found in these municipalities. From these sites the nearest release sites were several kilometers away.

The PGBPPP preferred to release adults of *D. semiclausum* in a ratio of two females to one male (AMEND & MANGALI 1992). Release of adults instead of cocoons was practiced because the sex ratio of the released beneficials can be manipulated and furthermore adult insects in the field cannot be attacked as easily as cocoons by predators. In contrast PCARRD/AVRDC/BSU, DA-CAR and HADP released cocoons of *D. semiclausum* because cocoons are easier to transport and handle than adults (CARDONA 1992).

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The PGBPPP released the parasitoids weekly at particular release sites over a period of several weeks until a population of *D. semiclausum* appeared to be established. The number of adults released varied depending on the output of the rearing. Results of AMEND & MANGALI (1992) suggest that weekly releases are covering the different development stages of DBM better than single ones and are leading therefore to a faster establishment of the beneficial. The PCARRD/AVRDC/BSU team released cocoons at least three to four times in the fields of its cooperators. The number of cocoons released per site was depending on the area planted with cabbage: for every 500 plants 200 cocoons were recommended (CARDONA 1992). No information was available on the frequencies of releases of DA-CAR and HADP.

Survey 1993

MATERIALS AND METHODS

In November 1993 only fields along the Mountain Trail in the municipalities of La Trinidad, Atok and Buguias in Benguet and Bauko, Sagada and Besao in Mountain Province were visited.

RESULTS

Hardly any larvae of *P. xylostella* could be found. Only in fields which were unsprayed and already harvested the larval population exceeded 0.05 larvae/plant. Accordingly, the Diadegma population was low.

In most cases where DBM larvae were detected on plants also Diadegma cocoons could be found.

DISCUSSION

Experiences from surveys in 1991 and 1992 showed that the population of DBM increased right after the rainy season. In these years it was not possible to find fields with no larvae at all. The authors' opinion is that the low population of DBM in 1993 is contributed to *D. semiclausum* but, unfortunately, not sufficient data were collected during dry and rainy season 1993 to prove this assumption.

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Figure 1. Municipalities included in the survey, release sites of the different agencies and number of cocoons or adult wasps of *D. semiclausum*

The close association of DBM larvae with Diadegma $coc_{00n_{\delta}}$ seems to indicate the ability of the beneficial to search for and find the pest even in times of a very low population level.

Further surveys are necessary to follow the population dynamics of both *P. xylostella* and *D. semiclausum*. The effectiveness of the wasp will greatly depend on its ability to keep pace with a fast increase of the pest population starting from a low population level.

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