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THE ROLE OF *HALTICA* SP. (COLEOPTERA: HALTICIDAE) AS BIOLOGICAL CONTROL AGENT OF *POLYGONUM CHINENSE*

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ABSTRACT

The role of *Haltica* sp. (Coleoptera: Halticidae) with emphasis on host specificity and damage potential in controlling *Polygonum chinense* was evaluated under laboratory condition.

Starvation test of the weevil on 33 weeds and 14 crop plant species indicated that only 6 weed species were attacked: *Polygonum chinense, P. nepalense, P. barbatum, P. longisetum, Ludwigia octovalvis* and *L. parennis* with *P. chinense* as the most preferred host plant.

Preliminary damage potential test indicated that a population of 0, 1,2 and 3 pairs of adult weevil reduced the percentage of fresh weight increment *of P. chinense* by 0; 46.2; 74.7 and 75.5% respectively. Field observations indicated that the larvae as well as adult weevils are potential biological control agents of *P. chinense*. Further studies are, however, on the host-range of this weevil.

INTRODUCTION

Polygonum chinense L. is one of the weeds growing amongst tea plantations in West Java but it has never been reported as a serious problem in the area. Locally it is known as "titiwuan" (Backer & Slooten 1924) and in Thailand it is called "phayaadong" (Harada *et al.* 1987). It was reported to be distributed also from India eastward to Japan and it grows mostly on highland or open forest, coffee and tea plantations (Harada *et al.* 1987).

Although West Java is classified as a populated province, the utilization of labour to control weeds manually in large tea plantations is considered costly. Chemical control with herbicides is considered cheaper and more practical. On the other hand there is a strong demand to save the environment from any pollutant for better living. Therefore, it is necessary to develop other control methods in line with minimizing the side effects of herbicides and lowering the cost.

In the tea producing areas of West Java, there are many kinds of insects associated with *P. chinense. Haltica* sp. (Coleoptera: Halticidae) seems to be one of the most common and it causes considerable damage to the weed. A study on the potential role of the insect as biological control agent is needed.

MATERIALS AND METHODS

Haltica sp. was collected from a tea plantation of PTP XII, Gunung Mas located about 30 km on the way from Bogor to Bandung. They were brought to BIOTROP Laboratory at Bogor for rearing and further observations on its life cycle, host specificity and damage potential. Some behavioural aspects of *Haltica* sp. were casually observed in the field.

The insects were reared in petri dishes and fed with fresh cut leaves of *Polygonum chinense.* The room temperature and relative humidity of the laboratory varied from 24-31°C and 48-82% respectively.

Starvation test of newly hatched larvae and newly emerged weevil of *Haltica* sp. was done against 14 species of crop plants and 33 species of weeds (Appendix 1). Five heads of larvae and adult weevils in separate petri dishes were reared with a single fresh cut leaf of test plants. Replacement of fresh cut leaves of the test plants was done every day during the test. *P. chinense* was used as the control. The response parameter of the insect on the test plants was mainly the presence of feeding scars. Observation was done every 24 hours till most of the test insects died. When the test insects produced feeding scars, the test was continued till the sixth day to make sure that they can survive by consuming the cut leaves of the test plants. The positive test plants were tested further for food preference.

Preferential test using larvae of the insect was carried out against six species of weeds namely *Polygonum chinense, P. longisetum, P. barbatum, P. nepalense, Ludwigia octovalvis* and *L. parennis.* Six heads of *Haltica* larvae were released in petri dish containing six arranged pieces of the weed species. The inner space of each petri dish was equally divided into six radial sectors (Figure 1) and each piece of fresh cut leaves of test plants was put into each sector. Six heads of test weevil were released at the center of the petri dish to allow them to select freely the test leaves. The response parameter of the preferential test was the level of feeding scars on each test leaf.

Preliminary damage potential test of the weevils against *P. chinense* was carried out by releasing various numbers of adult weevils on 20 day-old plants. The average fresh weight of newly cut *P. chinense* before being transplanted into plastic pots was 14.30±2.27 gram and the average leaf number was 11.85 ± 1.59 pieces. The pots were 15 cm in height, 10 cm and 15 cm in bottom and upper diameters, respectively. The pots were fully filled with light soil. The potted plants were allowed to grow for 20 days. Watering was done daily with tap water. To avoid attack of any insect, the potted plants were covered singly with screen cage. Various numbers of weevils e.g. 0, 1, 2 and 3 pairs were released on a single pot plant and kept for ten days. The test was run following Complete Randomized Design with

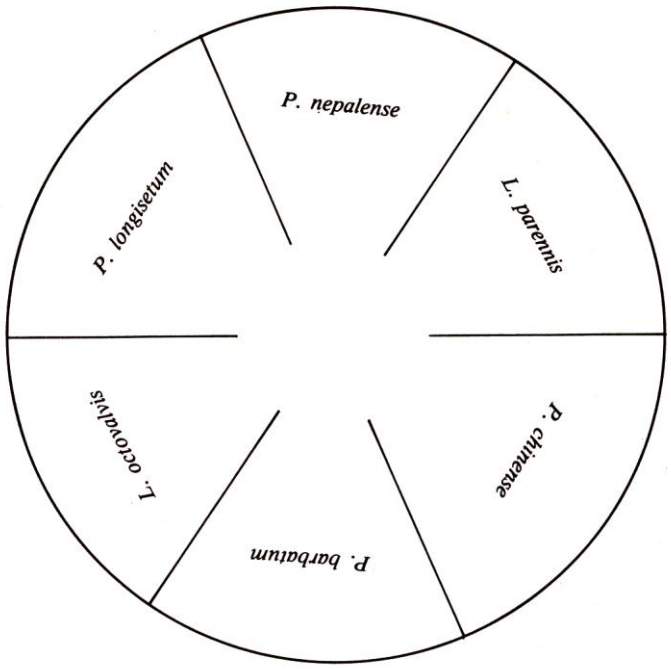

Figure 1. Six radial sectors of the petri dish used for preferential test.

5 (five) replications. The response parameter of the test was mainly based on the percentage of reduction of fresh weight compared with the control at the end of the test.

RESULTS AND DISCUSSION

Under laboratory conditions of 24 - 31 °C temperature and 48 - 82% relative humidity, respectively, the life cycle of the insect varied from 26 to 28 days. The incubation, larval and pupal periods were 5-6, 13-15 and 7 days, respectively. During the larval period, it molted three times, i.e. it had four larval instars. Other biological data such as adult longevity and egg production of an adult female have not been precisely observed. However, it seemed that the adult longevity was more than a month and egg production of a female was more than a hundred.

The adult females laid their eggs in groups of ten on the abaxial surface of the leaves of *P. chinense.* Usually the early larvae feed on the outer tissues of the leaf where the adult female oviposited but when they have developed bigger, they feed on most of the leaf tissues.

The adult weevils feed mostly on leaves and soft stem tissues of *P. chinense.* The adults feed randomly but the larvae produced local spot symptom. Both larvae and adults caused defoliation of *P. chinense.*

Starvation test of both larvae and weevils of *Haltica* sp. against 14 crop species and 33 weed species showed that the insects feed on six of the test weeds: *P. chinense, P. barbatum, P. nepalense, P. longisetum, Ludwigia octovalvis* and *L. parennis. P. chinense* was the most preferred by the larvae. The rank of preference of the larvae is presented in Appendix 2. It seemed that the insect is polygophagous but feeds especially on *Polygonum* spp.

It is strongly suspected that *P. chinense, P. barbatum, P. nepalense* and *P. longisetum* contain the key feeding stimulant for *Haltica* sp.

Biological control using insects has a risk of changing from control agent to pest of crop plants in the future. Luckily in Indonesia, there is no known crop plant belonging to *Polygonum* sp. and *Ludwigia* sp. There are some closely related insects to *Haltica* sp. namely *H. caerulea* Oliv, *H. cyanea* (Weber) and *H. caerulea* which were reported as promising biological control agents of water primrose *(Ludwigia* spp.). A total of 123 plant species have been tested by CIBC (Sankaran *et al.* 1967 cited by Mangoendihardjo *et al.* 1977) which reported that these insects feed on *Nicotiana tabacum* under laboratory condition (Rao *et al.* 1977).

H. cyanea has also been reported to feed on leaves of some forest trees such as *Ammonia baccifera, A. rotundifolia, Terminalia myriocarpa* in India (Beeson 1941), and some food crops in Indonesia (Kalshoven 1981).

Haltica sp. that was observed in this study was formerly suspected as *H. caerulea* but due to the supporting data on its host range, the authors of this paper name it *Haltica* sp. for the moment. The correct name of the insect will be confirmed later.

Preliminary damage potential test using weevils on *P. chinense* grown in plastic pots indicated that the insect produced serious damage on the weed. Populations of 1, 2 and 3 pairs of adult weevil caused a reduction on the fresh weight increment of 46.19, 74.33 and 75.53%, respectively within the last 10 days of the 30-day experiment.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Haltica sp. (Coleoptera: Halticidae) is a promising candidate as biological control agent of *Polygonum chinense.*

Recommendations

1. Further studies are needed especially on its host range before deciding to recommend it as a biological control agent of *P. chinense.*
2. Confirmation of the correct identification of the insect is necessary.

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Appendix 1. Response of the larvae and adults of *Haltica* sp. on several test plants during starvation test

No.	Plant species	Response
	AMARANTHACEAE	
1.	*Amaranthus spinosus L.*	-
	ASTERACEAE	
2.	*Ageratum conyzoides* L.	-
3.	*Bidens pilosa* L.	-
4.	*Crassocephalum crepidioides* (Benth.) S. Moore	-
5.	*Chromolaena odorata* (L.) R.M. King & H. Robinson	-
6.	*Eupatorium riparium* Reg.	-
7.	*Eleutheranthera ruderalis* Poit.	-
8.	*Mikania micrantha* H.B.K.	-
9.	*Tridax procumbens* L.	-
	BALSAMINACEAE	
10.	*Impatiens platypetala* Lindl.	-
	CARPARACEAE	
11.	*Cleome rutidosperma* DC	-
	CRUCIFERACEAE	
12.	*Nasturtium heterophyllum* BL.	-
	CYPERACEAE	
13.	*Cyperus rotundus*	-
	UPHORBIACEAE	
14.	*Phyllanthus niruri* L.	-
	GRAMINEAE	
15.	*Imperata cylindrica* (L.) Raeuschel	-
16.	*Paspalum conjugatum* Berg.	-
17.	*Sporobulus berteroanus* Trin.	-
	MELASTOMATACEAE	
18.	*Oxalis barrelieri* L.	-
19.	*Oxalis corniculata* L.	-
	ONAGRACEAE	
20.	*Ludwigia octovalvis* (Jacq.) Raven	+
21.	*Ludwigia perennis* L.	+
22.	*Ludwigia peruviana* (L.)	-
	POLYGONACEAE	
23.	*Polygonum barbatum* L.	+
24.	*Polygonum chinense* L.	++++
25.	*Polygonum longisetum* De Br.	++
26.	*Polygonum nepalense* Meissn.	+++

Appendix 1. (Continued).

No.	Plant species	Response
	RUBIACEAE	
27.	*Borreria data* (Aubl) DC	
28.	*Borreria laevis* Griseb.	-
29.	*Diodia sarmentosa* Swartz.	-
	VERBENACEAE	
30.	*Lantana camara* L.	-
31.	*Stachytarpheta indica* (L.)	-
	CROP SPECIES	
	AMARYLLIDACEAE	
1.	*A Ilium cepa* L.	-
2.	*Allium fistulosum L.*	-
	ARACEAE	
3.	*Colocasia esculenta* (L.)	-
	BRASSICACEAE	
4.	*Brassica oleraceae* L.	-
	CONVOLVULACEAE	
5.	*Ipomoea batatas* Poir.	-
	GRAMINEAE	
6.	*Oryza sativa* L.	-
7.	*Zea mays* L.	-
	LEGUMINOSAE	
8.	*Arachys hypogea* L.	-
9.	*Glycine max* (L.)	-
10.	*Phaseolus vulgaris* L.	-
	MUSACEAE	
11.	*Musa paradisiaca* L.	-
	SOLANACEAE	
12.	*Capsicum annuum* L.	-
13.	*Solarium lycopersicum* L.	-
	THEACEAE	
14.	*Cammelia sinensis* (L.) O.K.	-

Note: — No feeding scars
+ Feeding scars present.

Appendix 2. Response of larvae of *Haltica* sp. on several weed species during preferential test

No.	Weed species	Response
1.	*Polygonum chinense*	+ + + +
2.	*P. nepalense* L.	+ + +
3.	*P. longisetum* De Br.	+ +
4.	*P. barbatum* L.	+
5.	*Ludwigia octovalvis* (Jacq.) Raven	+
6.	*L. perennis* L.	+