Weeds as hosts of the rice water weevil (*Lissorhoptrus oryzophilus* Kuschel) in Italy

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ABSTRACT - ***The rice water weevil (RWW) Lissorhoptrus oryzophilus Kuschel, recently detected in Italy, lives and develops, in both the larval and adult stages, on rice and some spontaneous weeds. Many weeds co-exist with rice in agroecosystem, but little is known about the life cycle of the pests on them. RWW hosts have been listed only in the United States and Mainland China. The present study aimed at listing the commonest weeds (monocotyledons and dicotyledons) in the rice areas in Northern Italy, on which the insect is able to feed and develop. Fields where the insect was previously detected were surveyed in May, before rice emergence and in September, before and after the harvest. A total of 19 monocotyledonous spontaneous plants (14 belonging to Graminaceae, 5 to Cyperaceae) with many longitudinal scars (typical adult damage) were detected. Some adults were even observed on five dicotyledons where, however, no evident scar was observed, probably because they were used as refuge. Adults of RWW were inserted in cages previously seeded with*** *Echinochloa* ***spp.,*** *Leersia oryzoides* ***(L.) SW,*** *Alopecurus geniculatus* ***L.,*** *Bolboschoenus maritimus* ***(L.) Palla,*** *Heteranthera reniformis* ***Ruiz et Pavon. and*** *Schoenoplectus mucronatus* ***(L.) Palla. The ability of development was evaluated detecting larvae, pupae, and new emerging adults from root/soil core samples. The study allowed us to establish that RWW was able to complete its life cycle on three species.***

KEY WORDS - *Coleoptera; Erirhinidae; host preference; weeds; life cycle.*

I. INTRODUCTION

THE rice water weevil (RWW) *Lissorhoptrus oryzophilus* Kuschel, recently detected in Italy [1], [2], lives and develops, in both the larval and adult stage, on rice and some spontaneous weeds. Larvae are acquatic root herbivores while adults are semiacquatic folivores. Adults leave longitudinal scars on leaves but their feeding has not economic importance. Many weeds co-exist with rice in agroecosystem [3], [4], but little is known about the life cycle of the pests on them. Some Authors listed RWW hosts only in the United States [5], [6] and Mainland China [7]. According to these Authors the host range of the insect primarily consist of monocotyledonous plants (Poaceae and Cyperaceae). Probably its native hosts were poaceous and cyperaceous weeds, but the insect has been associated with rice from the time the crop had been introduced in the United States, where it is now the primary pest of the culture. However it seems that the rice water weevil prefers, if present, *Echinocloa crus-galli* (L.) Beauv to rice for feeding and oviposition [5]. Laboratory test gave evidence that they can also feed on dicotyledonous plants (Onagraceae; Amaranthaceae; Fabaceae Euphorbiaceae; Asteraceae, Pontederiaceae, Convolvulaceae.) [6].

Weeds are not equally suitable for RWW, as the insect is able to complete its development only on some hosts. Plants with aerenchyma are necessary for larvae to acquire oxygen. Larvae insert the hooks on their back (from the second to the seventh abdominal segment), which are modified spiracles, [8] in the root aerenchyma.

Some weeds are used only for adult feeding. In particular, they provide food to adults especially in spring, before the emergence of rice from water, and in late summer when rice reaches its physiological maturity [5], [8].

The present study primarily aimed at listing the most common weeds, monocotyledons and dicotyledons in the rice areas in Northern Italy, on which the adult is able to feed. Some of them were made the object of a long monitoring process to evaluate if the insect was able to complete its development.

II. MATERIALS AND METHODS

A. *Field observations*

Fields where the insect had been previously detected were surveyed in May, before rice emergence, and in September, before and after the harvest. Plants on which the adults had been observed feeding were listed.

B. *Determination of RWW cicle on different weeds*

To evaluate the ability of RWW to complete the cycle on weeds, 18 test tanks were prepared. Each tank (100cm width; 50cm lenght; 40cm height) was filled with soil and watered. The test was executed on the following weeds: *Echinochloa* spp, *Leersia oryzoides* (L.) SW., *Alopecurus geniculatus* L., *Bolboschoenus maritimus* (L.) Palla, *Heteranthera reniformis* Ruiz et Pavon, and *Schoenoplectus mucronatus* (L.) Palla.

Each weed was transplanted in 3 tanks at the beginning of May and permanently flooded. 20 adults of RWW, previously

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caught in rice fieds, were inserted in each tanks, covered with a structure of plastic and net to avoid adult escaping. Larval and pupal presence were determined by taking root/soil core samples with a metal sampler (10.0 cm in diameter by 10.0 cm deep) weekly from the end of June until September. When a pupa was detected, it was isolated to evaluate adult emergence.

III. RESULTS AND DISCUSSION

A. Field observations

Two families in the class of monocotyledons and four in dicotyledons were detected (Table I). In spring, adults were observed on both monocotyledons and dicotyledons but scars were detected only on the first ones. Further studies are necessary to evaluate if dicotyledons are used only as refuge.

B. Determination of RWW cicle on different weeds

Trials allowed to establish that the insect could complete the development (from eggs to adults) only on *L. oryzoides*, *Echinochloa* spp. and *B. maritimus*. Neither larvae nor pupae were detected on *A. geniculatus*, *H. reniformis*, and *S. mucronatus*.

A total of 125 larvae were detected: 33 on *L. oryzoides*, 59 on *Echinochloa* spp., and 34 on *B. maritimus*. These values are not indicative of differences in weeds susceptibility because the age of the adults inserted in the tanks was not homogeneous. Data acquired from this trial can only be qualitative and not quantitative and can only be a first recommendation for further analysis.

IV. CONCLUSION

The presence of weeds, allowing the RWW life cycle, could be used as a pathway for insect diffusion. In a proper management of RWW for developing an IPM program, it would be important to control weeds as they provide food and shelter to the pest out of the period of rice cultivation or when rice is unsuited for insect feeding because of its physiological maturity.

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Table I. List of weeds on which RWW was detected and month of detection (M= May; S bh= September before harvest; S ah = September after harvest).

Plants		Month	Scars
MONOCOTYLEDONS			
Cyperaceae	*Carex hirta* L.	M	yes
	Cyperus difformis L.	S bh	yes
	Cyperus esculentus L.	S bh	yes
	Cyperus glomeratus L.	S ah	yes
	Cyperus strigosus L.	S ah	yes
Poaceae	*Agropyron repens* (L.) Beauv.	S ah	yes
	Arrhenatherum elatius L.	M	yes
	Bromus sterilis L.	M	yes
	Cynodon dactylon (L.) Pers.	S bh	yes
	Dactylis glomerata L.	M	yes
	Digitaria sanguinalis (L.) Scop.	S bh	yes
	Echinochloa crus-galli (L.) Beauv.	S bh	yes
	Glyceria maxima (Hartman) Holmb.	S ah	yes
	Holcus spp.	M	yes
	Panicum capillare L.	S ah	yes
	Panicum dichotomiflorum Michx	S bh	yes
	Poa trivialis L.	M	yes
	Setaria viridis (L.) Beauv.	S bh	yes
	Sorghum halepense (L.) Pers.	S bh	yes
DICOTYLEDONS			
Compositae	*Artemisia vulgaris* L.	M	no
Poligonaceae	*Rumex acetosa* L.	M	no
Rubiaceae	*Gallium aparine* L.	M	no
	Gallium tricorne L.	M	no
Valerianaceae	*Valerianella* spp.	M	no