The Rice Leaf Bug, *Trigonotylus caelestialium* Kirkaldy, on Rice in Italy

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ABSTRACT - *Trigonotylus caelestialium* ***Kirkaldy*** **(***Heteroptera, Miridae, Mirinae, Stenodemini***), the rice leaf bug, was first reported on rice in Italy (first report also for Europe) in 2006. It was detected while trying to discover which pest caused particular leaf symptoms on rice seedlings.** *Trigonotylus caelestialium* ***is well studied in Japan as a major species of bugs causing pecky rice.***

Both leaf symptoms and pecky rice have increased in Italy since 1990, probably because of the recent frequent hot and dry summers with temperatures favourable to the mirid outbreak.

The life cycle of the rice leaf bug and the knowledge in Japan are related with first evidences of its occurrence and biology in Italian rice fields.

KEY WORDS - *Trigonotylus caelestialium* ***Kirkaldy, rice leaf bug, pecky rice, Oryza sativa L., rice.***

I. INTRODUCTION

THE rice leaf bug, *Trigonotylus caelestialium* Kirkaldy (*Heteroptera*, *Miridae*, *Mirinae*, *Stenodemini*) was first reported on rice in Italy (first report also for Europe) in 2006 [1] and is widespread all over Europe, Asia and North America. This mirid feeds preferably on *Poaceae*, damages wheat, maize and forage grasses, and is one of the major pests causing pecky rice in Japan [2]. Pecky rice is a qualitative injury due to the introduction of pathogens into the kernels by bugs feeding, which results in grain discoloration. In Italy pecky rice is caused also by the pentatomids *Nezara viridula* and *Carpocoris pudicus* [3].

The rice leaf bug's slender adult is 5-6 mm long and 1 mm wide, light green with long red antennae, long rostrum reaching the middle coxas and translucent membranous wing overlapping abdomen. *Trigonotylus caelestialium* is difficult to be seen in the rice crop because of its colour and its quickness.

II. *TRIGONOTYLUS CAELESTIALIUM* IN JAPAN

In Japan *Trigonotylus caelestialium* has three generations a year and overwinters as egg on weeds. Eggs are inserted between sheath and culm, frequently near the ligula. Dormant eggs hatch when accumulate 122 degree days (threshold 10.4 °C) and daylight exceeds 14 h. Nymphs of the first generation feed and reach the adult stage on weeds on which dormant eggs were laid. Adults of the first generation move on rice only to feed and lay eggs on spontaneous plants on levees, whereas adults of the second generation lay eggs also on rice. The third generation emerges both in rice field and on levees and lays overwintering eggs. Also a part of the eggs laid by the second generation can overwinter, becoming dormant as the day light decreases [4], [5].

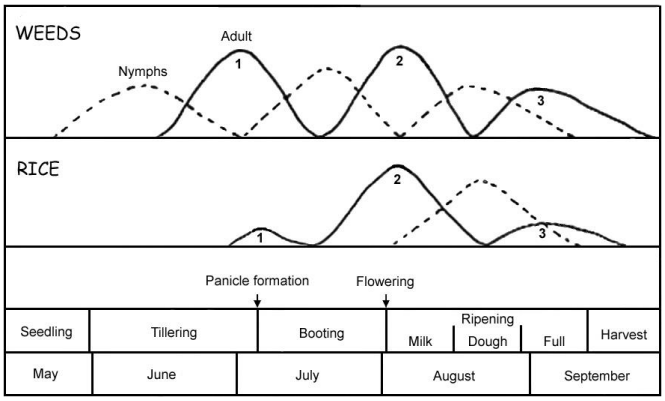

Fig. 1. Dynamics of the 3 generations per year of *T. caelestialium*, in Japan, relative to weeds and rice stages. From [4]

The rice leaf bug population in rice fields is largest between July and September, from flowering to ripening (Fig. 1), and causes more pecky rice at flowering to milk-ripening stage, feeding on individual grains as the panicle develops. Discoloration at the top part of the grain is typical of *Trigonotylus caelestialium*, because it inserts its stylets trough the glume junction mostly on the top part of the spikelet, but it also feeds on the side of the grain in the case of split hull or hull-cracked rice. In Japan, the bacterium *Pantoea agglomerans* (*Enterobacter agglomerans*) was isolated from the black spot caused by this mirid [6].

High temperature, heavy rain, abundant dew, and strong wind reduce the rice leaf bug population whereas mild winters seem to increase the mirid number. Japanese Prefectures inform farmers about the result of *Trigonotylus caelestialium* population monitoring and suggest measures to control this pest. The importance is stressed of the presence of grasses nearby rice fields in affecting the rice leaf bug population [7]. Grasses around the field borders should be mowed throughout the season, stopping two weeks before heading to avoid that mirids move in large numbers into the much more attractive and tender milky panicles. Eventual chemical treatments should be applied both on levees and on rice field, preferably

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on large areas at the same time.

In order to improve the control of the rice leaf bug, many studies are carried out in Japan on several topics such as the light traps for monitoring, the sex pheromone for mating disruption, the resistance to this pest conferred by endophyte fungal infection of grasses.

III. *TRIGONOTYLUS CAELESTIALIUM* IN ITALY

In Italy *Trigonotylus caelestialium* was detected on rice while trying to discover which pest caused the following symptoms: the leaf blade of rice seedlings shows one or more parallel series of small windowing, with intact epidermis, in lines across the width of the leaf (Fig. 2); the lower part of the leaf blade is unrolled whereas the upper is first rolled then discoloured and dry; the leaf blade is rolled in the middle; the leaf blade dries before unrolling; the upper part of the leaf blade drops. The rice leaf bug induces all these symptoms during feeding, by piercing with its sharp mouthparts through the tightly wrapped young leaves and releasing a chemical, called pectinase, which destroys the plant cells in the feeding zone. Both leaf symptoms and pecky rice were reproduced by artificial infestation in our laboratory [1].

Fig. 2. Typical leaf symptoms caused by *Trigonotylus caelestialium*.

In the past, leaf symptoms were sporadic but their frequency has increased suddenly in the last six years. On the other hand pecky rice has increased both in Japan and in Italy since 1990 [3], but particularly since 1999, probably because of the recent frequent hot and dry summers with temperatures favourable to the mirid outbreak [8]. Actually, monthly mean temperatures recorded, at Castello d'Agogna (PV), from 1991 to 2006 compared with the monthly mean of the previous 17 years in the period of May - August were higher, with differences up to 6 °C.

In the years 2005 and 2006, from May to October, *Trigonotylus caelestialium* was found in almost all the places visited in the Italian rice growing area (provinces of Alessandria, Ferrara, Milan, Novara, Pavia, Vercelli, Verona), with larger population in the presence of *Poaceae* weeds on levees. Besides it was always present on *Cynodon dactylon* L., the Bermudagrass, which showed the same leaf symptoms. It has to be pointed out that a greater number of rice leaf bugs was always found on rice when levees or farm roads had just been mowed.

First evidences seem to indicate that the life cycle of the rice leaf bug in Italy is quite similar to its life cycle in Japan, but there such kind of leaf symptoms are not described. On the other hand rice seedling damage by another mirid, *Trigonotylus tenuis* Reuter, was reported in Venezuela [9].

Although, in general, damage on seedlings does not seem to affect sensibly rice yield, in some cases the huge number of injured leaf blades could have had some influence. But without doubt pecky rice is more important because it entails quality losses and reduction in grade. Moreover during the early heading stages, *Trigonotylus caelestialium* feeding on panicles can cause malformation of the grain and yield losses. The inspection of discoloured grains reveals the preponderance of black spot at the top part of the grain, confirming that the rice leaf bug feeds preferably through the glume junction at the apex of spikelets and that the split hull is not essential for it to succeed in sucking the developing grain.

In 2006 many rice fields showed widespread leaf symptoms, but pecky rice did not occur as expected, probably owing to summer drought that affected the mirid population also by killing weeds on levees.

IV. CONCLUSION

In Italy further research is needed on *Trigonotylus caelestialium* and its relationship to pecky rice in order to keep this pest below the economic injury level, but it is already clear that weed management on levees is fundamental.

REFERENCES

[1] Giudici M L and Villa B 2006 *Trigonotylus caelestialium Kirkaldy (Heteroptera, Miridae, Mirinae, Stenodemini) su riso in Italia*. *Informatore Fitopatologico*, **6** 18-23.

[2] Kakizaki M 2004 *The sex pheromone components for mating disruption of the rice leaf bug, Trigonotylus caelestialium (Heteroptera: Miridae)*. *Applied Entomology and Zoology*, **39 (2)** 221-228.

[3] Moletti M 2005 *Le macchie sulle cariossidi di riso*. *L'Informatore Agrario*, **15** 87-90.

[4] http://www.agri.pref.hokkaido.jp/center/kenkyuseika/gaiyosho/S52gaiyo/1976141.htm.

[5] http://www.agri.pref.hokkaido.jp/chuo/byochu/musi/k_akahi.htm.

[6] Iwata T 1995 *Physiology of insect injuries*. In: Science of the rice plant Vol.2, Physiology. Matsuo *et al*. ed. Food and Agriculture Policy Research Center: 868-886.

[7] Shiba T and Sugawara K 2005 *Resistance to the rice leaf bug, Trigonotylus caelestialium, is conferred by Neotyphodium endophyte infection of perennial ryegrass, Lolium perenne*. *Entomologia Experimentalis et Applicata* **115 (3)** 387-392.

[8] Kiritani K 2006 *Predicting impacts of global warming on population dynamics and distribution of arthropods in Japan*. *Popul. Ecol*., **48** 5-12.

[9] Vivas C L E, Cermeli M., Godoy F. 2005 *Trigonotylus tenuis Reuter 1893 (Hemiptera: Miridae) nueva plaga del arroz Oryza Sativa L. en Venezuela*. XIX Congreso Venezolano de Entomología "Dr. Carlos Pereira Núñez", San Felipe, 4-7 julio 2005. In: (http://www.guaquira.com/ArchivosAnexos/MemoriasXIXCongrEntomol.pdf).