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Host plants for oviposition in *Rhynocoris albopilosus* Signoret (Heteroptera: Reduviidae) in southern Côte d'Ivoire

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Abstract

Conservation of natural enemies is one of the most important concepts in practice of biological control. The experiment was carried out to know the noncultivated host plants on which the predator *Rhynocoris albopilosus* could establish and reproduce. Three different types of vegetation were identified and all plants in a given plot were carefully examined for the presence of any batch of eggs of *R. albopilosus*. As result, four plant species have been identified as host plants for laying in *R. albopilosus* in all plots surveyed: *Passiflora foetida*, *Pueraria phaseoloides*, *Laportea aestuans* and *Erigeron floribundus*. More batches (75%) were detected in vegetable crops and most *R. albopilosus* eggs were laidon *P. foetida*. Females lay eggs usually on the underside of leaves and predator males were observed keeping 56 (73.68%) egg batches individually. So, the conservation *R. albopilosus* in areas of crop production in Côte d'Ivoire is possible, by using *P. foetida*, its main host plant for oviposition.

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Introduction

Conservation of natural enemies is one of the most important concept in practice of biological control. Conservation of natural enemies means avoiding practices that are harmful to them and implementing practices that benefit them. Natural enemies require more than just pests to eat to complete their life cycles. Predators and parasitoids may need overwintering sites, protection from heat and dessication, plant food sources and early-season prey to sustain themselves if pests are not present (Lee et Landis, 2001).

Among the factors that affect the conservation of natural enemies of insects in agricultural habitats is the presence of noncultivated host plants that naturally grow near the fields.

The enhancement by non-crop plants may occur by providing alternative food resources (pollen, nectar, prey or host) that support the reproduction, fecundity and longevity of natural enemies, as well as supplying them with refuges and places for courtship (van Emden, 1990; Landis *et al.*, 2000; Altieri and Nicholls, 2004 ; Lykouressis *et al.*, 2008).

Information regarding the relationships between non-cultivated plants and natural enemies must be understood before effective habitat manipulation to enhance predator persistence in the agro ecosystem.
In Côte d'Ivoire, one of the common native natural enemies is *Rhynocoris albopilosus* Signoret (Heteroptera, Reduviidae, Harpactorinae) (Kwadjo *et al.*, 2008). Different studies on this predator show that it could be used as a biological control agent against crop pests (Kwadjo *et al.*, 2010, 2012, 2013; Sahayaraj *et al.*, 2015). So, to ensure the conservation of *R. albopilosus* in areas of crop production, it would be interesting to know the noncultivated host plants on which it could establish and to reproduce.

Through this study, we intended to target the plants on which *R. albopilosus* frequently lays its eggs, in order touse them as indicators to locate the assassin bug during surveys and for their conservation in field.

Materials and methods

Study site

This work was carried out at a dozen kilometers of Grand-Lahou, along the Bandama River (5° 17' North latitude 4° 57' West longitude). Vegetation of Grand-Lahouis that of coastal wetlands of Côte d'Ivoire. It ischaracterized by swampyforests and vegetationassociatedwithlagoons and estuaries as mangroves and water meadows. Our study site is bordered to the south by an oil palm plantation and cocoaflap; to the west by the Bandama River having on board a banana belt; north and east by marshy areas with mainly raffia. The vegetation of the study site is essentially composed of *Imperata cylindrica* (L.), *Chromoleana odorata* (L.) and *Pueraria phaseloides* (Roxb.).

Host plants for oviposition

Three different types of vegetation were identified in our study site at Grand-Lahou. They were Fabaceae, Gramineae and Vegetable crops. Five 25 m^2 plots were selected for each type of vegetation cover. These plots were chosen and randomly distributed. All plants in a given plot were carefully examined for the presence of any batch of eggs of *R. albopilosus*. The following information was noted: number and species of plants carrying batch of eggs; number of batch per plant; the number of eggs per batch; position of the batch on the plant (limb, petiole, stem, flower or inflorescence); presence of an individual on eggs (male, female, couple). Apart from the areas defined for observations, we examined the plants on which a male was detected to have a broader view of the host plants for laying.

Statistical analysis

The collected data on various parameters under study were statistically analyzed using STATISTICA 7.1 package program. The means for all treatments were calculated and analyses of variance of all the characters were performed by F-test.

Results

Four plant species have been identified as host plants for laying in *R. albopilosus* on all plots surveyed in this study.

They are: *Passiflora foetida* L. (Violales: Passifloraceae), *Pueraria phaseoloides* (Roxb.) (Fabales: Fabaceae), *Laportea aestuans* (L.) (Urticales: Urticaceae) and *Erigeron floribundus* (Kunth) Schultz-Bip (Asterales: Asteraceae).

Four other plant species were recorded wearing *R. albopilosus*egg batches outside plant coverage areas defined for thisstudy. They were 2 Cyperales Gramineae: *Rottboellia cochinchinensis* (Lour.) and *Zea mays* L.; and 2 Asterales Asteraceae: *Ageratum conyzoides* L. and *C. odorata* (L.) (Table 1). Females lay eggs usually on the underside of leaves, on the stem and on the upper leaf surface. This latter case was observed on Gramineae. The only case of laying on the inflorescences was found on *L. aestuans*.

Table 1. Synthesis of host plants for oviposition in *R. albopilosus*.

Plant species	Families	Oviposition sites			
		Stem	Underside of leaves	Upperside of leaves	Inflorescence
Ageratum conyzoides L.	Asteraceae	–	+	–	–
Chromolaena odorata L.	Asteraceae	+	–	–	–
Erigeron floribundus (Kunth) Schultz-Bip	Asteraceae	–	+	–	–
*Laporteaaestuans*L.	Urticaceae	–	–	–	+
Passiflora foetida L.	Passifloraceae	+	+	–	–
Pueraria phaseoloides (Roxb.)	Fabaceae	–	+	–	–
Rottboellia cochinchinensis (Lour.)	Gramineae	–	–	+	–
Zea mais L.	Gramineae	–	–	+	–

+ :Presence ; - :Absence

Distribution of eggs according to vegetation type

A total of 76 egg batches were detected. They were distributed as follows: 57 batches (75%) in vegetable crops and 19 (25%) in Gramineae. No eggbatches were found in Fabaceae, although some adults and larvae were observed on leaves.

In vegetable growing plots, 52 egg batches were found on *P. foetida*, 1 on *P. phaseoloides* and 4 on *L. aestuans*. For Gramineae plots, 12 batches were observed on *P. foetida* and 7 on *E. floribundus*.

The number of eggbatches collected in vegetable crops and grasses did not differ significantly ($p = 0.478$). This was the same trend for the number of in those two plant coverings ($p = 0.365$). There was a significant correlation between the number of batches and the number of eggs in a given plot ($r = 0.99$, $p < 0.05$) (Fig. 1).

Distribution of eggs according to plant species

Most *R. albopilosus* eggs were detected *P. foetida* (Fig. 2 and Fig. 3.).

Distribution of eggs according to plant organs

Females of *A. albopilosus* preferablylay their eggs on the underside of leaves (Fig. 4. 5.).

On the erected plant species (*L. aestuans* and *E. floribundus*), of the 11 eggbatches recorded, 10 (91%) were located at the upper third of plants and 1 in the middle part.

Egg Protection

Predator males were observed keeping 56 (73.68%) egg batches individually. No female was seen alone on a batch. However, a couple was seen, the female being laying.

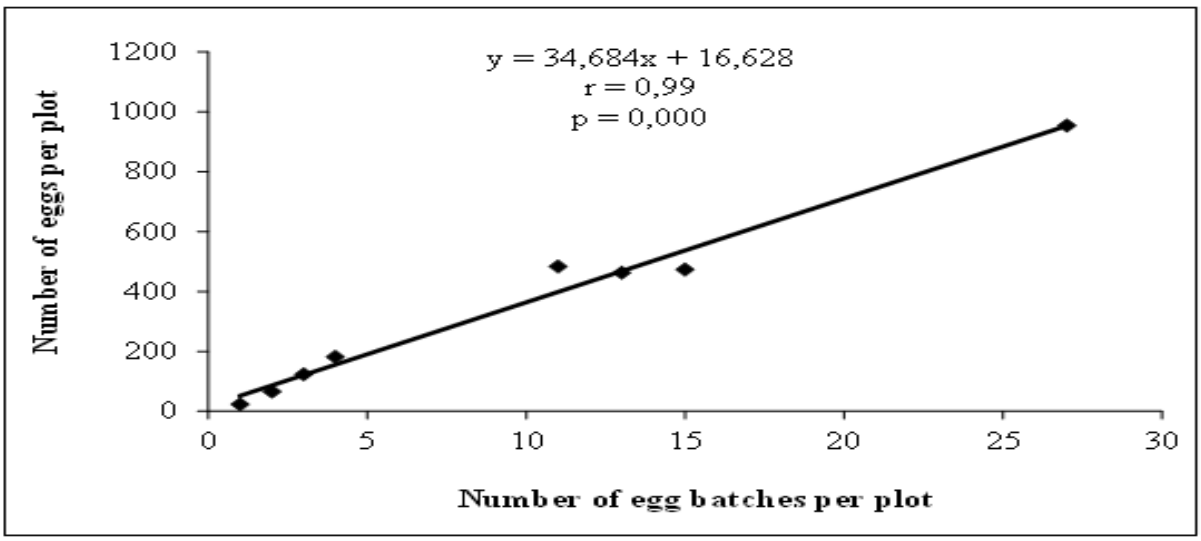

Fig. 1. Relationship between the number of batches and the number of eggs in *R. albopilosus* per plot.

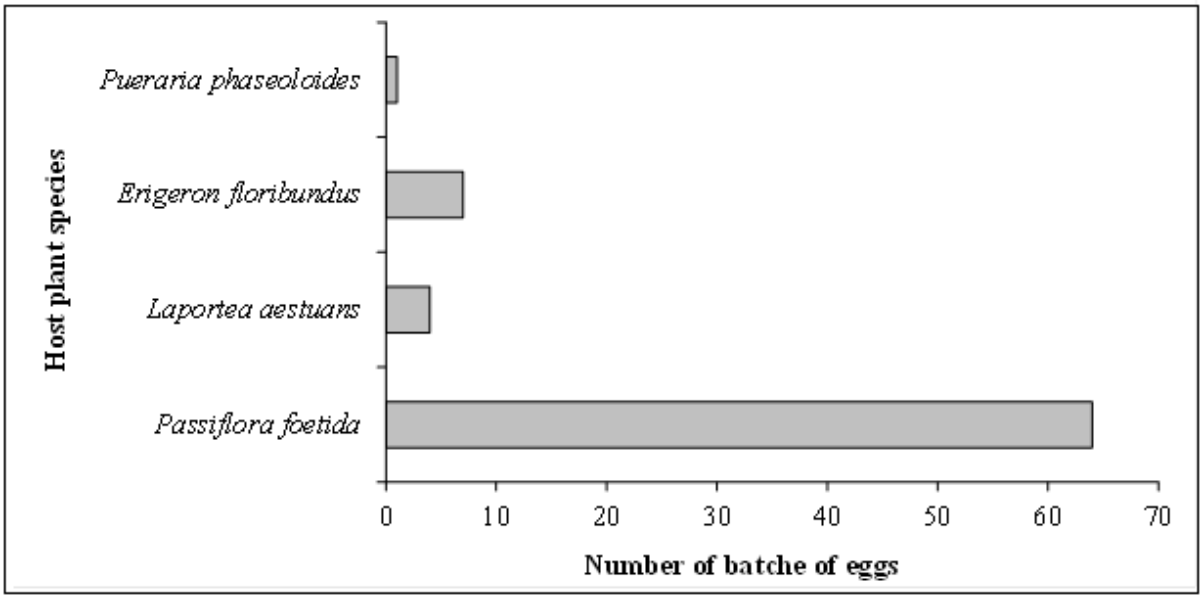

Fig. 2. Distribution of *R. albopilosus* eggbatches according to host plants for oviposition.

The rest of the recorded egg batches (19) were abandoned. The abandoned batches with eggs that had not yet hatched were 12 (15.79% of the total number of batches).

Discussion

Plants identified as hosts for oviposition in *R. albopilosus* are characterized by a more or less dense coating of hair. In *P. foetida*, the main host plant, this coat of hair is more important. In fact, the leaves and stems of many plants are covered with small hairs, hooks, thorns or scales. These epidermal or trichome markings, which may give a plant a characteristic pubescent appearance or abrasive sensation, are generally thought to be defensive (Eisner *et al.*, 1998; Fordyce and Agrawal 2005; Styrsky *et al.*, 2006; Horgan *et al.,* 2007 and Júnior *et al.*, 2007). In addition to the deterrent action against herbivorous insects, trichomes can also inhibit the activity of natural enemies, mainly by reducing their mobility on the one hand (Belcher and Thurston, 1982; Treacy *et al.*, 1986; Treacy *et al.*, 1987; Sutterlin and Van Lenteren, 1997; Krips *et al.*, 1999 and Lovinger *et al.*, 2000), and secondly their potential as a biological agent (Treacy *et al.*, 1985; Barbour *et al.*, 1993, Mc Auslane *et al.*, 1995).

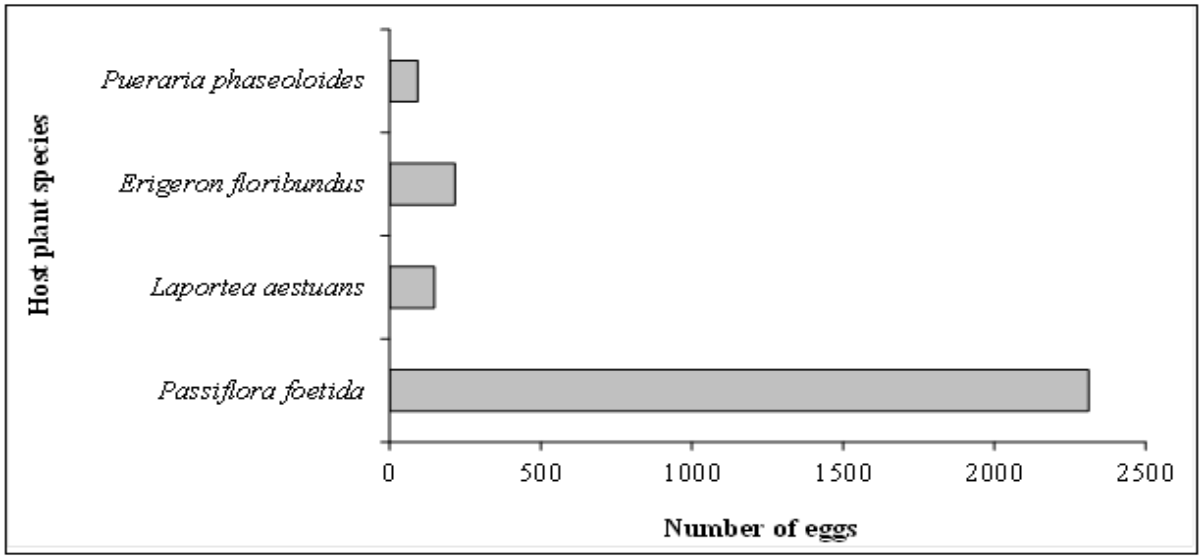

Fig. 3. Distribution of *R. Albopilosus* eggs according to host plants for oviposition.

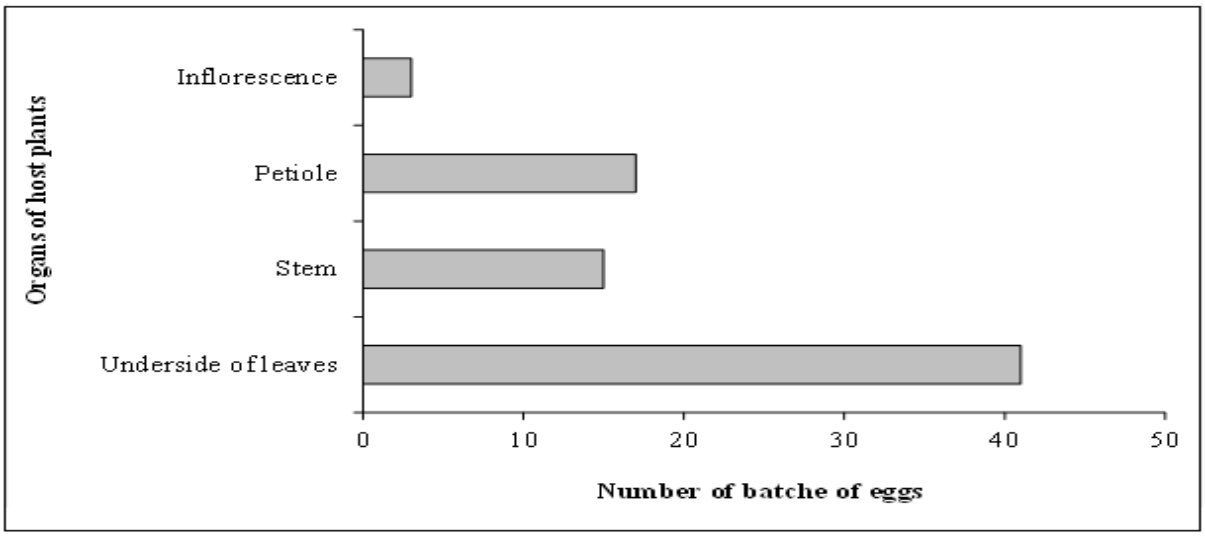

Fig. 4. Distribution of *R. albopilosus* eggbatches according to oviposition sites.

Taking into account the characteristics mentioned above and associated with the pubescent plants could explain the choice of this type of plants by the females of *R. albopilosus* for egg-laying.

According to Sharma and Singh (2002), the presence and abundance of bristles on plant organs influence the choice of a nesting site for several insects.

The choice of the underside of the leaves and the upper part of the plant for egg-laying would be motivated by the concern of the female to put her offspring in a safe environment with prey.

The work of Wheeler *et al.* (1998) and those of Al-Wahaibi and Walker (2000) reveal that the choice of a host plant and the location of eggs on it is of paramount importance for the success of the offspring of laying females, especially against predators and parasitoids.

According to Styrsky *et al.* (2006) and Vasconcellos-Neto *et al.* (2007), in some predators, trichomes increase the ability for the search and predation on prey.

The knowledge of the main host plants for oviposition in *R. albopilosus* is essential for the implementation

of an in situ conservation strategy for this predator, as indicated by several authors (Francis *et al.* 2000, Landis *et al.*, 2000, Francis 2001, Mignon *et al.*, 2003, Colignon *et al.*, 2004, Corrales and Campos 2004, Francis *et al.*, 2005). In fact, the identification of host plants for oviposition makes it possible to consider the establishment of the phenology of an insect. In fact, the interpretation of the ecology of a predatory insect requires a good knowledge of its host plants, in particular those on which it lays (Chinajariyawong and Walter, 1990).

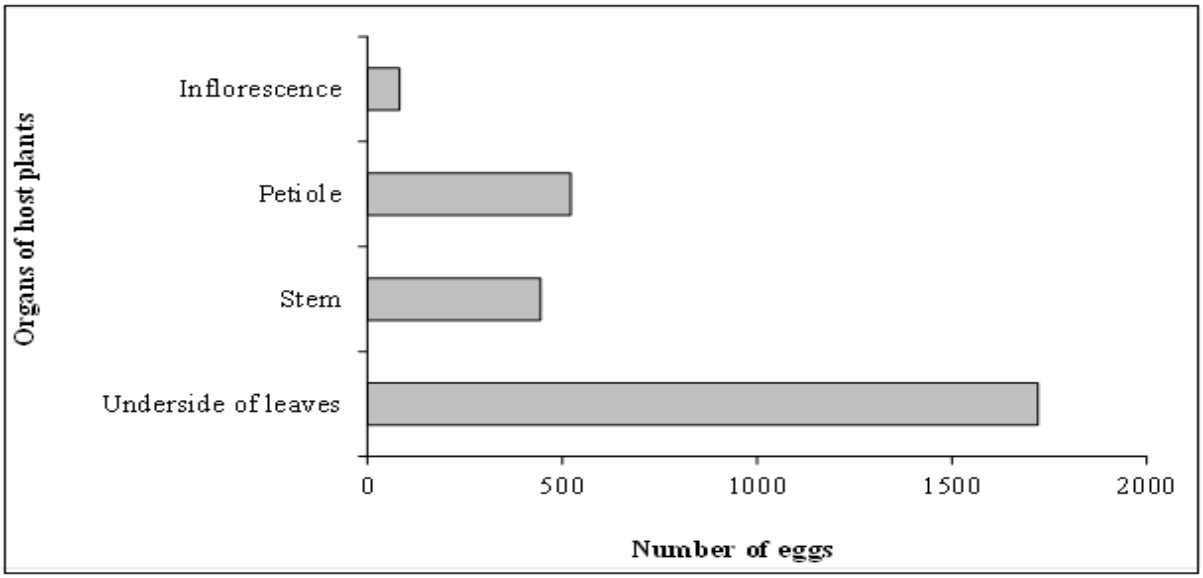

Fig. 5. Distribution *R. albopilosus* eggs according to oviposition sites.

Conclusion

Through this study, we intended to target the plants on which *R. albopilosus* frequently lays its eggs, in order to use them as indicators to locate the assassin bug during surveys and for their conservation in field. Then, it has been showed that *R. albopilosus* females lay their eggs on four plant species, preferentialy on *P. foetida*. Moreover, batches of eggs were distributed in vegetable crops. On those plants, females lay eggs usually on the underside of leaves and only the male protected the eggs.

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