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First record of *Moissonia importunitas* as a pest of rattle box (*Crotalaria spp.*) in Réunion Island (Hemiptera, Miridae)

Alain Ratnadass[1,6 *], Alain Soler[2,7], André Chabanne[3,8], Raymond-Georget Tullus[4,7], Patrick Techer[4,8], Fabrice Le Bellec[1,6], Pascal Marnotte[3,8], Jean-Claude Streito[5,9] & Armand Matocq[10]

[1] CIRAD, UPR HortSys, Station de Bassin-Plat, B. P. 180, F – 97455 Saint-Pierre, La Réunion
<alain.ratnadass@cirad.fr> <fabrice.le_bellec@cirad.fr>
[2] CIRAD, UPR Geco, F – 97455 Saint-Pierre, LaRéunion <alain.soler@cirad.fr> <raymond-georget.tullus@cirad.fr>
[3] CIRAD, UPR Aïda, F – 97743 Saint-Denis, La Réunion <andre.chabanne@cirad.fr> <pascal.marnotte@cirad.fr >
[4] CIRAD, UPR Aïda, F – 97455 Saint-Pierre, La Réunion <patrick.techer@cirad.fr>
[5] INRA, UMR CBGP, F – 34988 Montferrier-sur-Lez <jean-claude.streito@inra.fr>
[6] HortSys, Univ Montpellier, CIRAD, Montpellier, France
[7] Geco, Univ Montpellier, CIRAD, Montpellier, France
[8] Aïda, Univ Montpellier, CIRAD, Montpellier, France
[9] CBGP, INRA, CIRAD, IRD, Montpellier SupAgro, Univ Montpellier, Montpellier, France
[10] Muséum national d'Histoire naturelle, UMR CNRS 7205, C. P. 50, 57 rue Cuvier, F – 75231 Paris cedex 05
<matocq.armand@wanadoo.fr>

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Abstract. – The plant bug *Moissonia importunitas* (Distant, 1910) is reported for the first time from Réunion Island, where it severely damages rattle box (*Crotalaria*) species currently evaluated as potential service plants (particularly for soil fertility enhancement and nematode management) to be included in pineapple, sugarcane and fruit tree cropping systems, in an agroecological transition perspective. This pest was found at high population levels both in the south (Saint-Pierre) and the north (Sainte-Marie) of the island. The effects of some technical levers (*e.g.* choice of rattle box species, planting date, crop mixture, application of non-chemical plant protection products) as potential control options against this pest must be assessed before *Crotalaria spp*. are either promoted or ruled out as service plants in Reunionese cropping systems.

Résumé. – **Premier signalement de *Moissonia importunitas* en tant que ravageur de la Crotalaire (*Crotalaria spp.*) sur l'île de La Réunion (Hemiptera, Miridae)**. La Punaise Miride *Moissonia importunitas* (Distant, 1910) est signalée pour la première fois de l'île de La Réunion, où elle occasionne des dégâts sévères aux espèces de Crotalaires actuellement évaluées en tant que plantes de service potentielles (particulièrement pour l'amélioration de la fertilité du sol et la gestion des nématodes) pour les systèmes de culture à base d'ananas, de canne à sucre et d'arbres fruitiers, dans une perspective de transition agroécologique. Ce ravageur a été trouvé à des niveaux de populations élevés à la fois dans le sud (Saint-Pierre) et dans le nord (Sainte-Marie) de l'île. Les effets de leviers techniques (*i. e.* choix de l'espèce de Crotalaire, date de semis, associations d'espèces de plantes de service, traitement avec des produits non chimiques de protection des plantes) comme moyens potentiels de lutte contre ce ravageur, doivent être évalués avant de promouvoir ou au contraire d'écarter les Crotalaires comme plantes de service dans les systèmes de culture réunionnais.

Keywords. – Service plants, cropping systems, agroecological management, sunnhemp, plant bug.

In Réunion Island, several rattle-box (*Crotalaria*) species are currently evaluated as service plants to be potentially included in pineapple or sugarcane-based cropping systems, particularly as green manure and for soil sanitation against soil-dwelling pests, notably nematodes (Wang *et al.,* 2002), in an agroecological transition perspective. Species encompassed are mainly *Crotalaria juncea* L. (sunnhemp) and *C. spectabilis* Roth, with *C. trichotoma* Bojer (syn. *C. zanzibarica* Benth) being also subject to preliminary evaluation. On the other hand, *C. retusa* L. is commonly found as a ruderal plant species on the island. Actually, *Crotalaria spp.*,

due to their extrafloral nectaries (Guimaraes *et al*., 2006) and good quality pollens (Venzon *et al.*, 2006), are also potential candidates for weed cover/flower strips supporting conservation biological control in perennial cropping systems, *e.g.* citrus and mango orchards.

However, severe damage symptoms (whitening/yellowing as a result of foliar chlorosis) to an extent that had not been noticed before have been observed since 2016 on *Crotalaria juncea* and *C. spectabilis* plants that were evaluated at CIRAD research stations in the South and the North of the island. Our observations of the arthropod fauna on seedlings of both rattle-box species revealed tiny plant bugs (Heteroptera, Miridae) to be abundant. We therefore made further observations at different sites, aiming at identifying the pest species involved, as well as some potential control methods.

Materials and methods

Observations were made from March-September 2017 at Saint-Pierre (Bassin-Plat CIRAD research station: 20.322°S - 55.389°E, 150 m asl; and pineapple producer's field at Bassin-Martin: 21.325°S - 55.499°E, 186 m asl), at Sainte-Marie (La Mare CIRAD experiment station: 20.902°S - 55.530°E, 65 m asl) and at Saint-Paul [*Centre de production et d'expérimentation agricole* (CPEA): 20.974°S - 55.324°E, 179 m asl].

In view of identifying pest species and some potential natural enemies, arthropod populations were sampled by suction, using a modified leaf blower (STIHL BG56 with oval nozzle: 14.5 cm × 10 cm). At Bassin-Martin on March 27th, 1 m² quadrats of both *Crotalaria juncea* and *C. spectabilis* [date of planting (DOP): March 3rd] were thus sampled, while at La Mare on June 13th, a whole 16 m² plot of *C. juncea* (DOP April 14th) was thus sampled. At Bassin-Plat on August 22nd, 10 *C. juncea* plants (DOP May 22nd) were also thus sampled. Suction sampling was also conducted on September 7th in a weedy mango orchard at CPEA (Saint-Paul) on 10 spontaneous *C. retusa* plants.

In addition, at La Mare on June 13th, a whole 16 m² plot of white lupin (*Lupinus albus* L., the only other plant species in a collection of more than 60 that was found to be infested) (DOP April 12th) was also sampled by suction. Suction sampling was also conducted on August 22nd at Bassin-Plat on 10 pigeon pea plants (*Cajanus cajan* L.) (DOP May 22nd).

Keys and/or diagnoses were used for identifying plant bug species (e.g. Schuh, 1984; Linnavuori, 1993; Stonedahl, 1995; Yasunaga, 1999; Duwal *et al*., 2010; Yeshwanth, 2013; Atiama, 2016).

Results

The pest was identified as *Moissonia importunitas* (Distant, 1910) [syn. *Moissonia unicolor* (Poppius, 1914), *M. hyalinus* (Lindberg, 1958), *M. impictum* Odhiambo, 1960, *M. pallidula* (Yasunaga, 1999)] (fig. 1-2). At all sites and on all sampling occasions, adults and all five nymphal instars were observed, particularly on the underside of leaves [as depicted by Gopalan & Basheer (1966), and Banerjee & Kokati (1968)], as well as eggs inserted in leaves, with their tip (*operculum*) protruding outside. The damage symptoms corresponded to those reported elsewhere for this pest: yellow spots coalescing, leaf distortion and eventual plant death (fig. 3) (Gopalan & Basheer, 1966; Gopalan, 1976a, b).

At all sites and on all three rattle-box species, plant bugs (Hemiptera, Miridae) were by far the dominant arthropod family, with adult mirids representing on average 69% of all adult arthropods sampled. *Moissonia importunitas* was by far the dominating mirid species, representing on average 98% of adult plant bugs sampled, among a total of eight species (table I).

On the other hand, on white lupin (*Lupinus albus*) at La Mare, *M. importunitas* accounted for 68.2% of 556 mirid bugs sampled (which themselves accounted for 56% of all arthropods sampled), the second mirid species in order of importance being *Campylomma leucochila* (Reuter,

1905) (representing 29.1%). At Bassin-Plat, on pigeon pea (*Cajanus cajan*), *M. importunitas* accounted only for 1.2% of 83 mirid bugs sampled (which themselves accounted for only 18% of all arthropods sampled), the *Orthops-Taylorilygus* complex representing 79.5%, and *C. leucochila* 13.3%.

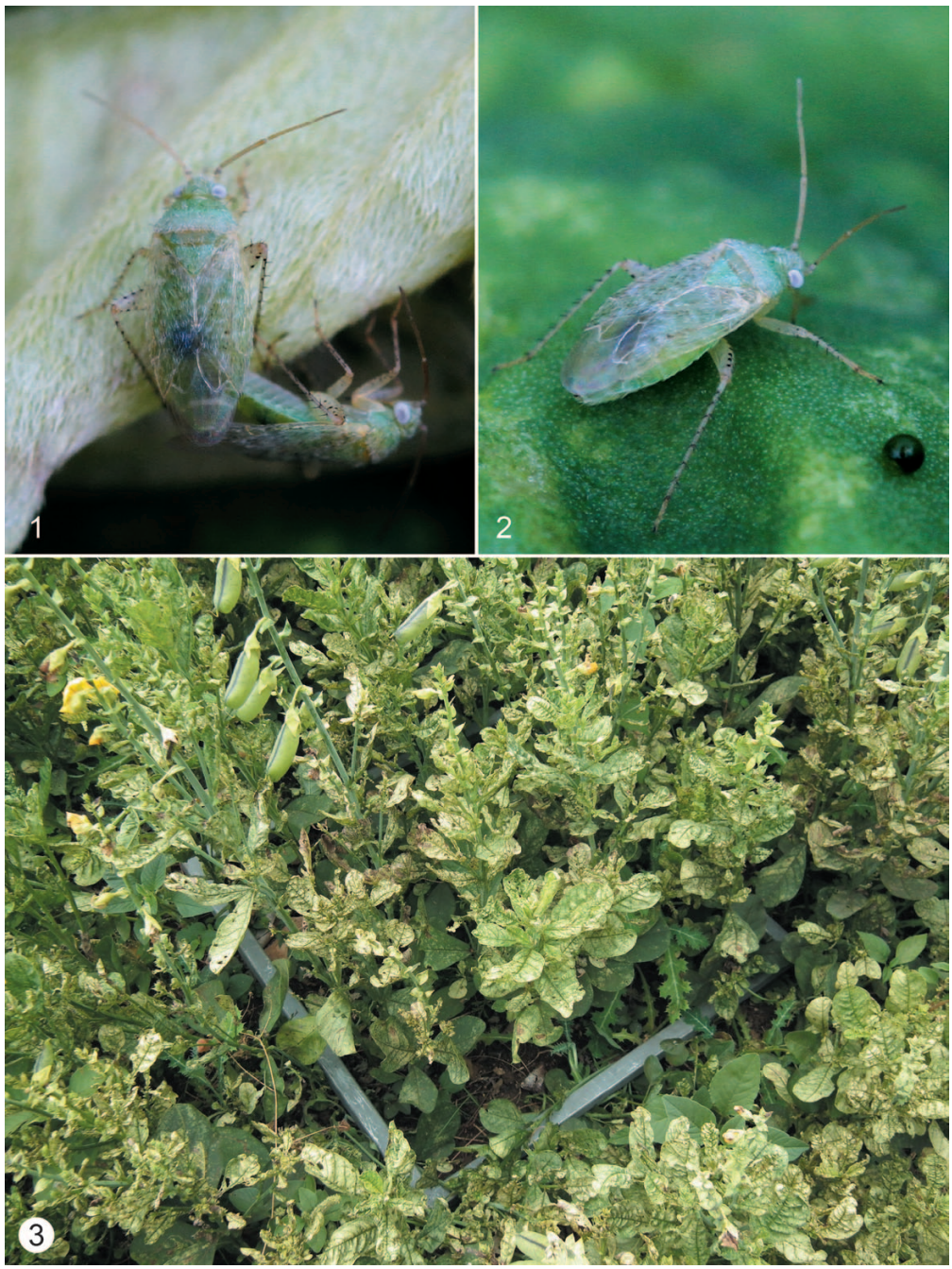

Fig. 1-3. – *Moissonia importunitas* (Distant) on *Crotalaria spectabilis* Roth. – **1-2**, Adults on a leaf. – **3**, Symptoms of damage.

Table I. – List and relative abundance of plant bugs (Hemiptera, Miridae) collected from March to September 2017 on rattle box plants in Reunion island.

Sampling Site	**Bassin-Martin**	**Bassin-Martin**	**La Mare**	**Bassin-Plat**	**CPEA**
Date of sampling	**27/03**	**27/03**	**13/06**	**22/08**	**07/09**
***Crotalaria* species**	***C. spectabilis***	***C. juncea***	***C. juncea***	***C. juncea***	***C. retusa***
Total number of mirid bugs (% of all arthropods)	110 (54%)	204 (75%)	225 (83%)	343 (93%)	27 (41%)
Campylomma leucochila (Reuter, 1905)	0.9%	7.8%	0.4%	0.9%	0%
Campylomma sp. A[1]	0%	0%	0%	0.6%	0%
Deraeocoris indianus Carvalho, 1957	0.9%	0%	0%	0%	0%
Eurystylus bellevoyei (Reuter, 1879)	0%	0%	0%	0.3%	0%
Moissonia importunitas (Distant, 1910)	98.2%	92.2%	99.1%	98.0%	100%
Nesidiocoris sp.[2]	0%	0%	0.4%	0%	0%
Orthops palus (Taylor, 1947)	0%	0%	0%	0.3%	0%

[1] According to Atiama (2016). [2] Only one female specimen collected, while only observation of male genitalia allows differentiation between *N. volucer* Kirkaldy, 1902, and *N. tenuis* (Reuter, 1895): e.g. Lindberg (1958).

Discussion

Moissonia importunitas is a major pest of rattle-box species in Asia, particularly sunnhemp (*Crotalaria juncea*), and *C. anagyroides* Kunth (syn. *C. micans* Link). It was also reported under its synonym *Psallus impictus* from East Africa, notably Uganda (Mwakodi *et al.*, 2014), and Kenya on *Crotalaria agatiflora* Schweinf., but not as a pest (Schmutterer, 1974). This is however the first record of this species in Réunion Island, although another species of *Moissonia*, namely *M. nigripunctata* (Poppius, 1910), had already been mentioned (Vayssières *et al.*, 2001; Legros *et al.*, 2017). On the other hand, the mirid bug recorded from 2012-2014 in mango orchards (including on *Crotalaria sp*.) and tentatively identified as *Campylomma cf. angustior* (Poppius, 1914) by Atiama (2016) turned out to be *M. importunitas*, based on morphological re-identification and on barcoding data (S. Nibouche & J. Sadeyen, pers. comm.). In addition, a specimen of this species was found as early as February 1999 in the South-East of the island (Saint-Philippe, Takamaka: 21.308°S - 55.806°E; 80 m asl), on weeds along the road. In any case, the pest seems to be well established in the island, and it is neither known when and how the pest was introduced (although its introduction via seeds is unlikely, since it breeds only on fresh plant parts), nor why it just recently emerged as a pest.

In Réunion Island, except *Eurystylus bellevoyei* (Reuter, 1879) and *Orthops palus* (Taylor, 1947), which are recognized as crop pests (Ratnadass *et al.*, 2012; Atiama, 2016), all other mirid species have been mainly reported as predators, notably of Hemipteran (Sternoryncha) pests (Cadou, 1994; Vayssières *et al.*, 2001; Atiama, 2016). In this respect, the function/status of the second most abundant plant bug, namely *Campylomma leucochila,* as a potential predator (Vayssières *et al.*, 2001; Atiama, 2016) should particularly be further investigated.

On the other hand, qualitative observations on *Crotalaria trichotoma* at La Mare, showed that this rattle-box species was barely infested/damaged. *C. trichotoma* has actually been reported as resistant to *M. importunitas*, although occasionally ravaged by another mirid bug species, namely *Helopeltis antonii* Signoret, 1858. *Crotalaria pallida* Aiton is also said not to be attacked by *M. importunitas*. However, *C. pallida* was observed to be infested by *Eurystylus oldi* Poppius, 1912, in a trap cropping experiment in Niger (Ratnadass, unpublished data). This latter mirid was also

found to infest *C. juncea* in Mozambique (Maldes & Ratnadass, 1998) and *C. naragutensis* Hutch. in Nigeria (Ajayi & Ajiboye, 1997). Also, *Crotalaria goreensis* Guillemin & Perrottet and *C. retusa* were found to be host plants of *Campylomma angustior* in Mali (Ratnadass *et al.*, 1997).

In any case, further evaluation of resistance/susceptibility to *Moissonia importunitas* of *Crotalaria trichotoma* and possibly *C. pallida* should be conducted. Regarding *C. retusa*, as an indigenous and virtually ubiquitous rattle-box, along probably with some other legume species (*e.g.* white lupin), it could serve as a "relay host", thus explaining the population outbreaks observed on preferred hosts *C. juncea* and *C. spectabilis*. In this respect, studies on the effect of the date of planting on the infestation of these latter hosts by *M. importunitas* should be conducted so as to determine when damage level allows enough biomass production for rattle-box to fulfill expected soil pest regulation services (Wang *et al.*, 2002). Intercropping (= associational resistance) with other service plants, and some plant protection products, preferably those allowed in organic agriculture, should also be tested.

In any case, the establishment of this pest in Réunion Island should definitely be taken into account now, and trade-offs should be sought between rattle-box nitrogen-fixing and nematode-sanitizing effects, as well as their potential as alternate food source and refuge for natural enemies on the one hand, and their susceptibility to *M. importunitas* on the other hand.

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