First Record of an exotic and invasive crops pest: *Amrasca biguttula* on cotton *Gossypium horsutum* L. in North Cameroon.

Abstract

Cotton is a cash crop that actively contributes to the socio-economic development of the entire northern region of Cameroon. However, the production of this crop faces many constraints, including the pressure of bio-aggressors that cause significant damage and generate considerable losses for many producers. *Amrasca biguttula* is a leaf-eating pest that was first reported in 2022 in a leafhopper sample collected in Djalingo, Benoue department, North region. The attacks of this atypical pest caused major damage on several cotton fields during the 2023 crop year. As a result, several other outbreaks have been reported throughout most of the cotton zone. Leafhopper samples collected at several sites showed the presence of *Amrasca biguttula* and this species alone represented 22 % to 84 % of the diversity of leafhopper populations on cotton. The month of August seems to be the propitious time for the invasion of this new species, because it is during this period that it was mainly represented in the different leafhopper samples collected.

Keywords: Exotic crop pest, *Amrasca biguttula*, *Gossypium horsutum*, North Cameroon.

1. Introduction

Cotton (*Gossypium hirsutum*) is an economically profitable crop and the cotton sector alone represents 1.5% of Cameroon's gross domestic product (GDP) (CT, 2020). This crop therefore actively participates in the socio-economic development of the entire cotton area which extends across the entire northern area of the country. However, the cotton sector faces many challenges such as declining soil fertility, high input costs and pest pressure that directly affect production (Badiane *et al.*, 2015). The cotton plant is one of the plants that hosts the most pests in the world (Miranda et al., 2013). Pest populations are made up of around a hundred arthropods, the most important of which in recent years can be grouped into three large groups: carpophagous caterpillars (*Helicoverpa armigera* Hübner, *Diparopsis watersi* Rothshild, *Earias biplaga* Walker and *Earias insulana* Boisduval), leaf-eating caterpillars (*Spodoptera littoralis* Boisduval, *Haritalodes derogata* Fabricius, *Anomis flava* Fabricius) and sucking biters (*Bemisia tabaci* Gennadius, *Aphis gossypii* Glover, *Jacobiella fascialis* Jacobi and *Dysdercus sp*.) (Badiane *et al.*, 2015). Crop losses caused by these predatory arthropods can be up to 55% in the absence of phytosanitary protection (Badiane *et al.*, 2018). This makes this crop entirely dependent on appropriate plant protection to have a satisfactory

quantity and quality production. The 2022 crop year was particularly marked by severe infestations of a new species of leafhopper *Amrasca biguttula* on cotton, with a yield drop of 10-50% compared to the previous season in several West African countries: Burkina Faso, Ivory Coast, Mali, Senegal and Togo (PR-PICA, 2022). In Cameroon, during the same season, no infestation of *Amrasca biguttula* was reported throughout the cotton zone. Today, several outbreaks of infestations have been observed with significant damage on the cotton, okra and sorrel parcels that concern all actors in the cotton sector in particular and all agricultural sectors in the area in general, who encounter this atypical pest for the first time. It is in this context, that this preliminary study was initiated with the objective of reporting the presence of an exotic pest *Amrasca biguttula* for the first time on cotton in Cameroon and to follow its behavior to take into account in the development of a future cotton phytosanitary treatment program, the search for strategies and solutions for effective management of this dangerous crop pest.

2. Materials and Methods

2.1. Study area

The collection of leafhopper samples was carried out on several sites in the cotton-growing zone of Far North and North Cameroon region as illustrated in Table 1.

Table 1: Sample collection sites and dates.

Region	Departement	Commune	Village	Collect dates
Far North	Mayo Tsanaga	Mokolo	Zamalao	06/07/2023
		Gazawa	Katoual	23/09/2022
	Mayo sava	Mora	Mora	07/07/2023
North	Mayo-Louti	Guider	Soukoundou	30/11/2022
	Benoue	Pitoa	Badjouma	19/07/2023
		Gaschiga	Gaschiga	08/09/2022
			Hamahoussou	21/08/2023
			Gaschiga	11/07/2023
		Garoua 3	Kismatari	01/09/2022
			Djalingo	02/09/2022
			Bibol	05/09/2022
			Bibol	24/07/2023
			Djalingo	08/08/2023
			Mayo Dadi	09/08/2023
		Ngong	Ngong	18/11/2022
			Ngong	15/08/2023
	Mayo-Rey	Touboro	Touboro	14/07/2023
			Djiporde	14/09/2022

2.2. Leafhopper collection and partial identification

Leafhopper collections were made in three to four cotton farmers fields in the same village and constituted a composite sample of each site. In each cotton farmer's fields, the collection was done with a mouth vacuum and the leafhoppers were stuck in a small transparent bottle. On each bottle the following information was mentioned: the name of the collection site, the host plant, the date of collection and the GPS coordinates of the site.

The partial identification of leafhoppers was carried out at the cotton entomology and crop protection laboratory against pests of the Institute of Agricultural Research for Development (IRAD) and the Cameroon Cotton Development Company (SODECOTON) of Garoua-North Cameroon. Under a binocular magnifying glass, the nymphs, impurities and other insects sucked up during the collections were separated to retain only adult of leafhoppers that constituted a sample. Similarly, *Amrasca biguttula* specie differed from other leafhoppers mainly by the following morphological characters: the green color of adult individuals and the presence of a distal black spot at each end of the anterior or tegmina wings (Koadio *et al.,* 2022). The percentage or proportions of *Amrasca biguttula* specie were assessed in each sample and retained for molecular identification latter.

3. Results and discussions

3.1. Description of *Amrasca biguttula* attacks on the cotton plant

The main damage was observed on the leaves and the general appearance of the cotton plants in several farmer's fields as illustrated in figures 1 & 2. The nymphs and adults of *Amrasca biguttula* feed directly on the leaves and tender parts of the cotton plants. Infested leaves gradually turn yellowish, then brownish, from the edges toward the midrib and show signs of gradual winding before completely drying out in the form of a burn as shown in Figure 2. Severely affected seedling cotton stop their growing and lose leaves. This pest feeds by injects toxic saliva into the plant which disrupt chlorophyll activity, cause deformation of the leaves and subsequently their discoloration in the form of phytotoxicity symptoms. Razaq *et al*., 2014 and Koadio *et al.,* 2022 observed similar symptoms on okra and eggplant plants. Denis *et al.,* 2018 note that the burns observed on the leaves are typical and characterized symptoms of serious attacks of *Amrasca biguttula*.

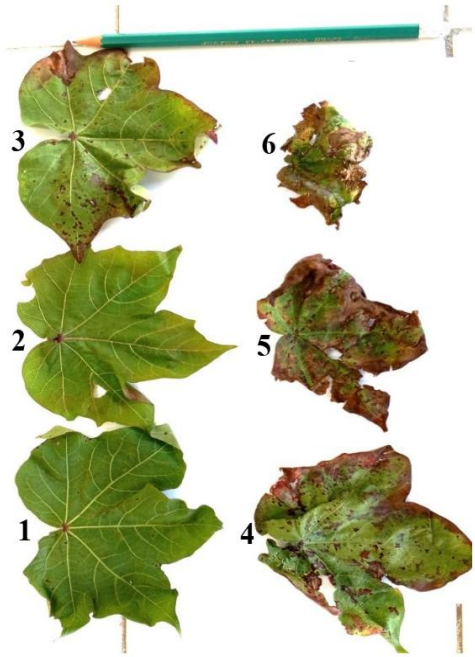

Fig. 1: Cotton plant attacked by *Amrasca biguttula.*

Fig. 2: Gradual evolution of symptoms of attacks on leaves by *Amrasca biguttula*.

Amrasca biguttula, commonly known as cotton jassid, is a phytophagous pest belonging to the leafhopper family (Hasnain *et al.,* 2015). The adults observed in different sample are green in color, with a clearly visible black spot on each side of the ends of the front wings or tegmina illustrated in Figure 3. The same morphological characters were observed in jassids by Singh *et al.*, 2014 on Bt cotton. This pest has sucking type mouthparts, are very mobile and move at the slightest disturbance. The nymphs are wingless, also mobile and under the surface of the young leaves on which they are generally strongly attached. A similar description was made by Jayasimha *et al.*, 2012 and specifies that the insect tends to move diagonally.

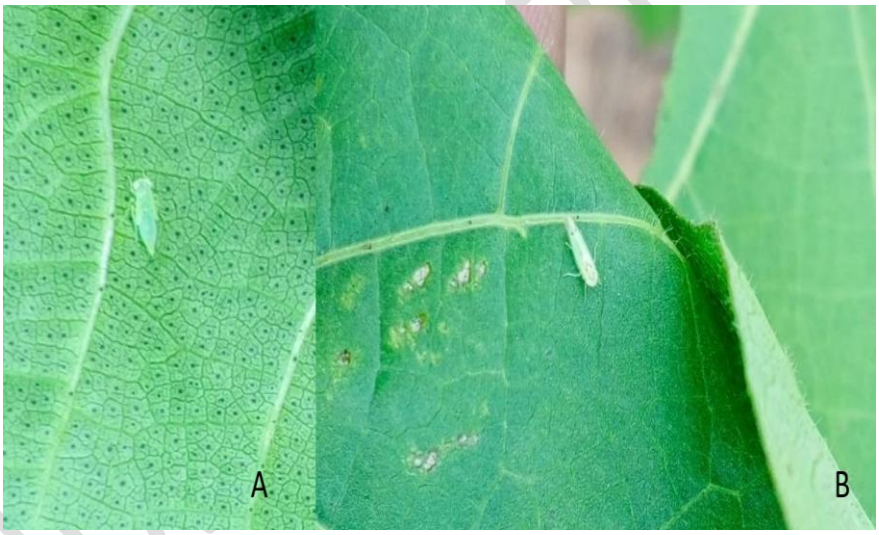

Fig. 3: Nymph (A) and adult of *Amrasca biguttula* on cotton leaves (B).

3.3. Percentage of *Amrasca biguttula* species in the samples collected on cotton at different sites during the 2022 and 2023 seasons

Figure 4shows the percentage of *Amrasca biguttula* in samples collected from cotton fields at different locations during the 2022 and 2023 seasons. During the 2022 collection season, *Amrasca biguttula* specie was detected in the Djaligno sample and represented 3 % of all leafhoppers collected at this site. However, during the 2023 collection season, with the exception of the Touboro sample, all other samples recorded the presence of this newly

identified pest. The samples from Ngong, Mayo Dadi, Hamakoussou, Gaschiga and Djalingo revealed the highest proportions of *Amrasca biguttula*, ranging from 73 % to 84 %. Leafhopper samples collected at the Bibol and Badjouma sites showed relatively low levels of *Amrasca biguttula* species at 22 % and 35 %. The populations of *Amrasca biguttula* experienced exponential growth in the samples collected in 2023 at the same sites, despite the almost zero presence of this pest in the 2022 season in the sample from the same sites (Ngong, Gaschiga and Djalingo). The same pest had already been identified in several West African countries: Ivory Coast, Burkina Faso, Mali, Senegal, Togo and Benin on cotton and several other crops in the 2022 and 2023 seasons. *Amrasca biguttula* was the majority species and accounted for 50-90 % of the leafhopper population diversity collected in these different countries (PR-PICA 2022).

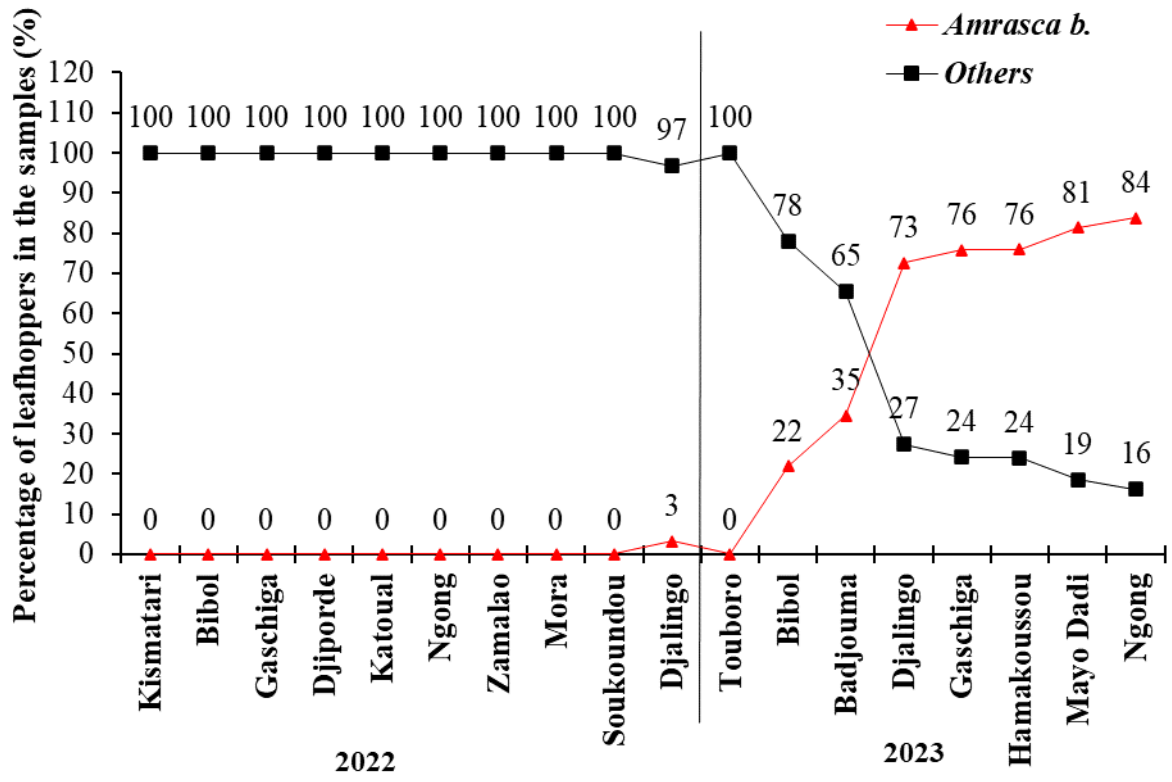

Fig. 4: Percentage of the species *Amrasca biguttula* in the samples collected in 2022 and 2023 seasons.

3.4. Evolution of the proportions of the species *Amrasca biguttula* in the leafhopper samples depending on the collection dates

In Figure 5, we can see the evolution of the percentages of *Amrasca biguttula* specie in the samples collected at all sites according to the collection dates for the 2023 season. The cotton jassids were collected from 06 July 2023 to 21 August 2023. In all samples collected between 06 July 2023 and 18 July 2023, no individuals of the *Amrasca biguttula* species were identified. During the period from 19 July 2023 to 21 August 2023, there was a gradual increase in the presence of this new pest species in the collected samples. In samples collected around 08-15 August, *Amrasca biguttula* populations alone accounted for 81-84 % of the diversity of leafhoppers collected. This new species observed on cotton in Cameroon has an invasive character over time, as evidenced by the trend curve of the regression line R2 = 0.86. Similar results were observed by Dhaka and Pareek in 2008 who found that the incidence of *Amrasca biguttula* on cotton started from the second and third week of June and reached its peak also in August. Several authors such as Ghulam *et al.*, 2019 and Khating *et al.*, 2016 found that the impact of leafhoppers on cotton peaked rather in the second week of September.

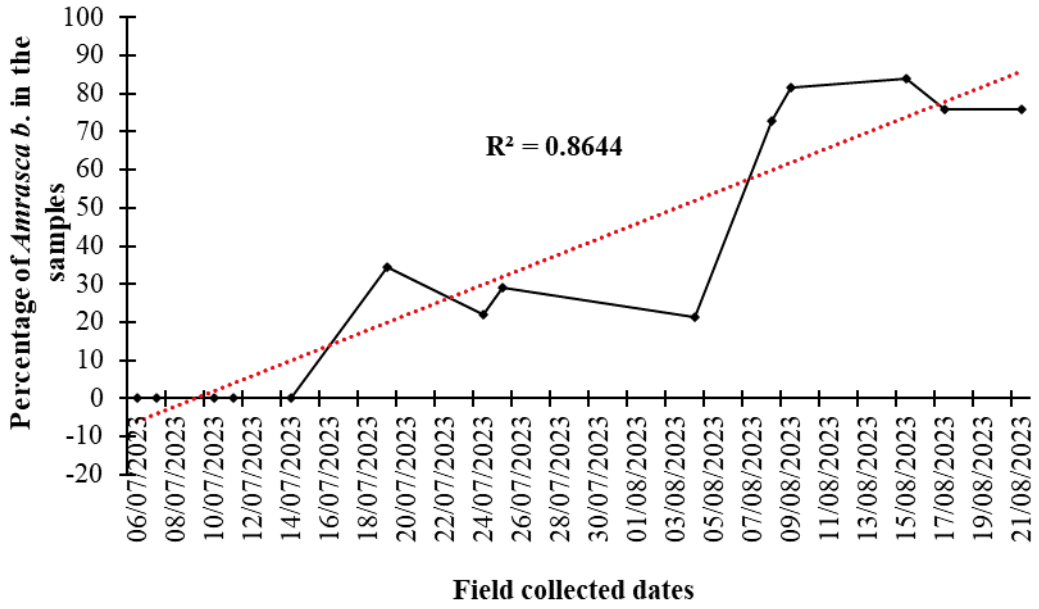

Fig. 5: Evolution of *Amrasca biguttula* populations in samples according to collection dates.

4. Conclusion

Amrasca biguttula specie was identified for the first time in samples of leafhoppers collected in 2022 on cotton in Djalingo department of Benoue, North region Cameroon. The same year

this new species of jassid was poorly represented in the diversity of the leafhoppers populations collected. In the 2023 season, at the beginning of August, several outbreaks with significant damage on the famer fields were reported throughout the cotton zone and the *Amrasca biguttula* specie was the majority. This situation requires the entire sector to review the phytosanitary protection program, to take into account this new exotic and invasive pest. It is therefore necessary and urgent to search for solutions to effectively control this pest and ensure satisfactory cotton production.

5. References

- - Badiane D, Gueye MT, Coly EV and Faye O. Integrated management of the main cotton pests in Senegal and West Africa. Int. J. Biol. Chem. Sci., 2015; 9(5): 2654-2667.
- - CT. Cameroon Tribune: Development of the cotton sector, a boost from the European Union. July 2020 edition.
- - Badiane D. Sané B. Annual activity report on integrated management strategies for cotton pests in Senegal during the 2017-2018 campaign, ISRA/CRA Tambacounda; 2018.
- - Devi YK., Pal S., Seram D. Okra jassid, Amrasca biguttula biguttula (Ishida)
- (Hemiptera: Cicadellidae) Biology, ecology and management in okra cultivation,
- Journal of Emerging Technologies and Innovative Research 5 (10) (2018, October)
- 332–343.
- - Dhaka SR and Pareek BL. Weather factors influencing population dynamics of major insect pests of cotton under semi-arid agro-ecosystem. Indian Journal of Entomology. 2008; 70:157-163.
- - Ghulam M., Muhammad R., Unsar N., Mirza AQ., Ahmad N., Umair RA. and Muhammad A. Population Dynamics of Cotton Jassid (Amrassica Biguttula) in Relation to Weather Parameters in Multan. Acta Scientific Agriculture. 2019; 3.8 (2019): 212-215.
- - Hasnain M., Aslam MN., Sangi MR. and Khan S. Jassid Cotton: CABI PlantwisePlus Knowledge Bank. Fact sheet for farmers. 2015.
- - Jayasimha GT., Rachana RR., Manjunatha M. and Rajkumar VB. Biology and seasonal incidence of leafhopper, Amrasca biguttula biguttula (Ishida) (Hemiptera:

Cicadellidae) on okra. Pest Management in Horticultural Ecosystems.2012; 18 (2): 149–153.

- - Khating SS., Kabre GB. and Dhainje AA. Seasonal incidence of sucking pests of okra along with natural enemies in Khandesh region of Maharashtra. Asian Journal of Biological Sciences. 2016; 11(2): 269-272.
- - Miranda JE, Rodrigues SMM, Almeida RP, Sylva CAD, Togola M, Hema SAO, Somé NH, Boni G, Adegnika MO, Doyam AN, Diambo B.. Recognition of pests and natural enemies for C-4 countries. Embrapa, Brazil. 2013; 70 p.
- - PR-PICA. Report of the 15th review meeting of the regional integrated cotton production program in Africa, Grand Bassam/Côte d'Ivoire. 2022.
- - Razaq, M., Q. Haneef, H. R. Athar, M. Nasir, and M. Afzal. Interactive effect of nitrogen and insecticide on jassid, Amrasca devastans (Dist.) population and photosynthetic capacity of okra Abelmoschus esculentus (L.) Moench. Pak. J. Zool. 2014; 46:577–579.
- - Singh SB., Choudhary RK, Upadhyay SN. and Sharma M. Biological study of cotton jassid, Amarasca biguttula biguttula (ishida) on bt cotton under invivo conditions Annals of Plant and Soil Research. 2014; 16(1): 29-31.