Short communication

First Report of the Crapemertyle aphid,*Tinocallis kahawaluokalani*(Hemiptera : Aphididae) and ~~it~~ its local predaceous insectsin Gabon

ABSTRACT

A study was carried out among some green spaces in Gabon, mainly in Libreville, Lambarene, Mouila, Franceville and Mitzic, from Aaugust 2019 to October 2021. The aim was to assess the presence and impact of the japanese ~~japan~~aphid *Tinocallis kahawaluokalani* Kirkaldy (Hemiptera : Aphididae), and its relate natural enemies, using one time visual observations on Crapemyrtle shrubs. This ornemental plant insect pest was recorded, occurring on leaves of *Lagerstroemia indica*(L.) Pers. (Lythraceae). Seven local beneficial insect species were observed predating on this aphid, mainly three hoverflies *Ischiodon aegyptius* Wiedemann, *Paragus borbonicus* Macquart, *Asarkina* sp. (Diptera : Syrphidae), three ladybird species *Platynaspis capicola*Crotch, *Scymnus interruptus* Goeze and *Chilochorusnigritus*Fabricus(Coleoptera : Coccinellidae), and the brown lacewing*Micromus*sp.(Neuroptera :Hemerobiidae),as natural enemies of *T. kahawaluokalani*, hilighting a local promizing way for biocontrol of this pest. These findings are a new record for this insect pest from the Gabon and Africa.

Keywords: *Tinocallis kahawaluokalani, leaf infestation, Lagerstroemia indica, Natural ennemies, biocontrol*

1. INTRODUCTION

Ornamental plants are widely present in all of the human artificially green spaces because of their beautifull flowers and ability to be managed in various aesthetic shape within home and public gardens. Some of them are frequentlly attacked by insect pest species comprising aphids (Hemiptera : Aphididae) [1]. The crape myrtles, represented by *Lagerstroemia* spp (Lythraceae)are among the commonly woody plants cultivated for it ornamental attractiveness [2]. The major insect pest species reported as infesting this plant belong to sap sucking group, which major foliage pest is the Crapemyrtle aphid (CMA) *Tinocallis kahawaluokalani* Kirkaldy (Hemiptera : Aphididae) [1,3, 4, 5], followed by the Crapemyrtle Bark Scale *Acanthococcus Lagerstroemiae* (Kuwana) (Hemiptera : Eriococcidae) [6]. The main damages resulting from their attacks consist on black sooty mold on leaves due to their honey-dew excretions [6]. Heavy infestations may conduct to aesthetic alteration and reduce visual appeal or leadto leaf drop. The plant health could decline in case of heavy attacks of the CMA [5]. Further works on this aphid species reported it occurrence in some Asian countries as China, Japan, Thailand [2], India [7], Taiwan, some of North America as USA [4, 6], Hawaii [2], Central America as Mexico [6], Latine America as Argentina [8], Brazil [9], Eastern South of Europa[10,11], and middle Orient as Iran [12]. For long time the CMA *T. kahawaluokalani*was an exotic pest species for Africa, for it has only been cited in Cameroon[13] but not in any other region nor country of this continent. The CMA impact and role in this continent are not yet known, especially favourable condition areas.This first report in Gabon aims to highlight main Knowledge on its ~~it~~ distribution and some of local its ~~it~~ natural predators.

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2. MATERIALS AND METHODS

Field surveys were conducted within shrubs of cultivated *Lagerstroemia indica* (L.) Pers. (Lythraceae) from avenue sides from 30 sampling sites of respective localities of Libreville, Lambarene, Mouila, Franceville and Mitzic, from august 2019 to October 2021 (Table 1).

Table1. Sampling sites of survey from august, 2019 to october, 2021, in Gabon.

No.	Locality (Province)	City location	Coordinates (latitude, longitude)
1	**Libreville** (Estuaire)	Carrefour Démocratie	0°25′33″N ; 9°27′24″E
2		Carrefour Awendje	0°23′12″N ; 9°28′26″E
3		Carrefour Sogatol	0°22′38″N ; 9°28′19″E
4		Oloumi	0°22′26″N ; 9°27′49″E
5		Nzeng Ayong	0°25′46″N ; 9°29′06″E
6	**Franceville** (Haut-Ogooué)	Yéné	1°38′24″S;13°34′21″E
7		Gare ferroviaire	1°37′54″S;13°34′49″E
8		Carrefour Sogafric	1°37′51″S ;13°35′11″E
9		Echangeur	1°37′46″S ;13°34′57″E
10		Avenue tribunal	1°37′35″S ;13°36′00″E
11		Hôtel Evoula Palace	1°38′28″S ;13°36′17″E
12		Ngobounda	1°37′20″S ;13°36′09″E
13		Potos	1°37′54″S ;13°34′49″E
14		Ngoungoulou	1°36′24″S ;13°36′13″E
15		Mega mall	1°35′43″S ;13°36′13″E
16		Djamiti	1°35′43″S ;13°36′13″E
17		Ondzei	1°37′28″S ;13°36′50″E
18		Ongali	1°37′19″S ;13°36′55″E
19		IDA**	1°38′09″S ;13°34′19″E
20		Makana	1°38′02″S ;13°33′34″E
21		USTM	1°38′24″S ;13°34′21″E
22	**Mouila** (Ngounié)	Carrefour Ecole St Martin	1°51′58″S ;11°03′34″E
23		Complexe administratif	1°58′24″S ; 13°03′37″E
24		Hôtel Lac Bleu	1°52′18″S ; 11°03′34″E
25		Palais de Justice	1°52′05″S ; 11°03′25″E
26		Place indépendance	1°51′54″S ; 11°03′25″E
27	**Lambaréné** (Moyen-Ogooué)	Lycée Adiwa	0°41′31″S ; 10°13′42″E
28		Hôtel de Ville	0°42′30″S ; 10°13′21″E
29	**Mitzic** (Woleu Ntem)	Hôpital Général	0°46′31″N ;13°34′21″E
30		Village Afia	1°04′12″S ;11°41′31″E

With the purpose of recording the CMA occurrence on other host plants, complementary observations were carried out on *Largestroemia speciosa* (L) Pers and *Lawsonia alba* L. (Lythraceae) at Franceville, Okondja andOnguia village, because litterature reported these speciesasother host plants of CMA[5,7]. All the visible trees were examinated for observation of the CMA*T. kahawaluokalani* and relate predators. All the infested plants were taken into consideration basing on presence of the crapemyrtle aphid and predators, and the aphids infestation levels were established on five twigs per tree, and per site using followingbasic formula :

$$\boldsymbol{Infestation} = \frac{\text{Number of infested stools}}{\text{Total of infested stools}} \times 100[\%]$$

After some authors [21], since the total number of stools in a sampling unit was 100, any stool infested with the aphid species was counted as 1% infestation.

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Five twigs were randomly chosen per tree, and aphids and enemies were counted on five leaves from tip of each twig, following OILB/SROP recommended method [14]and used inthis area [15].The CMAcolonies**A**bundance **r**ate on **f**ive **l**eaves per **t**wig (ARFLT) were evaluated from a free scale of 1 to 10, 10 to 30 (weak), 30 to 100, and 100 to 200individual insects, corresponding respectively to very weak, weak, middle and high levels of aphid infestation. The impact on infested twigs was observed according litterature levels pointing out honey-dew, black sooty mold and plant decline [5].

The earliest aphid samples were collected with the help of fine paintbrush and preseved in 70% ethyl alcohol in 15ml glass vials for later identification at laboratories, as well for some larvae or adults of natural enemies keptin rearing plastic boxes on twigs bearing their preys (CMA). To confirm the field direct identification, the collected insects (CMA and predators)from Franceville, Lambarene, Mitzic and Mouila were brought at the Crop Plants Protection Laboratory (CPPL) of the Institut National Supérieur d'Agronomie et Biotechnologies (INSAB) from the University of Sciences and Technologies of Masuku (USTM) (Haut-Ogooué Province), whereas those collected from Libreville were analyzed at the Institut des Recherches Agronomiques et Forestières (IRAF) from the Centre National de la Recherche Scientifique et Technologique (CNAREST) (Estuaire Province).

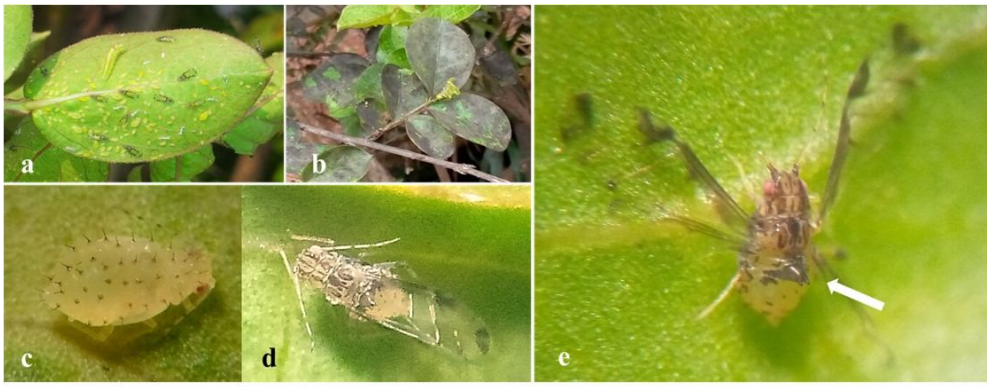

Figure 1. *Tinocallis kahawaluokalani* observed in Gabon *:* heavy infestation of the CMA on a young leaf of *Largestroemia indcia* showing a green syrphid larva (**a**), upper side of leaves covered with black sooty mold growing of aphid honeydew (**b**), nymph (**c**) and adult (**d**), typical tubercules on abdomen (**e**).

The hoverfly, coccinellid and the brown lacewing larvae observed feeding on the aphid *T. kahawaluokalani* were collected and reared into plastic rearing vials at the CPPL of INSAB still the imagos hatching, for identification. All the CMA and relate natural predators were identfied following systematic keys provided by some available literature references [4,5,9, 23, 24, 25, 26]. Real nature and manifying pictures (under a Binocular stereoscopic microscope Leica SZB 200) were taken with a Techno park4® camera.

Descriptive statistics, such as frequency tables, charts, simple means and percentages was used to describe and present data generated.

3. RESULTS AND DISCUSSION

3.1 The pest prevalence

The assessment of the crapemertyle aphid troughout 30 sites of five gabonese localities showed presence of *Tinocallis kahawaluokalani*(Fig. 1)on 75% of *Largestoemia indica* of all theinvestigated provinces (table 2). The major observed crape mertyles were highly infested, as for the western province (Estuaire), the center (Moyen-Ogooué and Ngounié), the eastern (Haut-Ogooué) and te northen (Woleu-Ntem).The insect was presen in all the sampling regions of the country The earliest infestations were recorded on august 2019 at Libreville (infested trees were 85,71%), july 2020 at Lamabaréné (60%) and Mouila (83,33%), whereas latest records occurred on october 2021 at Franceville (84,09%) and Mitzic (71,43 %) (table 2). Observations on potential hosts at Franceville *nd surrounding localities*, as ten individuals of Largestroemia speciosa (L) Pers and tw*elve* Lawsonia alba L. (Lythraceae) showed any CMA infestation, certainly because the CMA host preference in this town goes exclusively on L. indica. Weak, heavy and very heavy infestation were recorded, inducing presence of honey-dew, black sooty mold, and plant decline (table 2). Seven beneficial predaceous species were also recorded (table 3) from Franceville, Libreville and Mitzic.

Table 2. Occurrence and distribution of *Tinocallis kahawaluokalani* Kirkaldy (1906)(Hemiptera : Aphididae) (on 5 twigs per tree)

Locality (Province)	City location	Tree samples		Aphidpest		
		N	% infested trees	ARFLT*	Infestation level	Damage level
Libreville (Estuaire)	Carrefour Démocratie	2	100	500 - 1000	+++++	Much honey-dew, Leaves drop
	Carrefour Awendje	8	100	30 - 100	+++	Little honey-dew
	Carrefour Sogatol	3	100	30 - 100	+++	Little honey-dew
	Oloumi	3	100	30 - 100	+++	Little honey-dew
	Nzeng Ayong	2	0	0	-	No damage
Franceville (Haut-Ogooué)	Yéné	3	0	0	-	No damage
	Gare ferroviaire	2	100	500 - 1000	+++++	Black sooty mold
	Carrefour Sogafric	2	0	0	-	Green leaves
	Echangeur	7	62,5	150 - 500	++++	Much honey-dew,
	Avenue tribunal	1	100	50 - 150	+++	Little honey-dew
	Evoula Palace	12	100	50 - 150	+++	Little honey-dew
	Ngobounda	4	100	30 - 100	+++	Honey-dew
	Potos	1	100	50 - 150	+++	Very little honey-dew
	Ngoungoulou	2	100	30 - 100	+++	Honey-dew
	Mega mall	2	0	0	-	No damage
	Djamiti	3	100	5 - 50	++	Very little honey-dew
	Ondzei	1	100	30 - 100	+++	Little honey-dew, Black sooty mold
	Ongali	3	100	150 - 500	++++	Black sooty mold
	IDA**	3	0	0	-	No damage
	Makana	3	66,67	5 - 50	++	No damage
	USTM	10	66,67	1-10	+	No damage
Mouila (Ngounié)	Ecole St Martin	3	66,67	30 -100	+++	Little honey-dew
	Complexe administratif	2	100	30 - 100	+++	Little honey-dew
	Hôtel Lac Bleu	3	66,67	30 - 100	+++	Little honey-dew
	Palais de Justice	2	100	30 - 100	+++	Little honey-dew
	Place indépendance	2	100	30 - 100	+++	Little honey-dew
Lambaréné (Moyen-Ogooué)	Lycée Adiwa	2	0	0	-	No damage
	Hôtel de Ville	3	100	30 - 100	+++	Little honey-dew
Mitzic (Woleu Ntem)	Hôpital Général	5	100	50 - 150	+++	Black sooty mold
	Village Afia	2	0	0	-	No damage
TOTAL	**30**	**104**	**75**			

Legend : *ARFLT =Abundance rate on five leaves per twig ; **IDA= Inspection Déléguée d'Académie

3.2 The predators' occurrence

The predominant hoverlfly species were respecively *Asarkina* sp present on 20 to 25% of twigs, *Ischidon aegyptius* (50 to 100%), and *Paragus borbonicus* (10 to 100%) (Fig. 2) ; coccinellid species were *Platynapsis capicola* (20%), *Chilochrus nigritus* (20 to 80%) and *Scymnus interruptus* (20%), and the hemerobiid brown lacewing *Micromus* sp. (8 to 20%)(Fig. 3). In addition, numerous individuals of a *Deraeocoris* sp. (Hemiptera : Miridae) and *Orius* sp. (Hemiptera : Anthocoridae) were found associated with the CMA populations.

Table3. Occurrence of beneficials (on 5 twigs per tree) according to the pest aphid level

		Pestaphid	**Beneficials'*insects* (natural enemies of CMA)**														**Assocated *insects***			
		Tinocallis kahawaluokalani Kirkaldy(1906) (Hemiptera : aphidae)	*Asarkina* sp (Diptera : Syrphidae)		*Ischidon aegyptius*Wiedemann (1830) (Diptera : Syrphidae)		*Paragus borbonicus*(Macquart (1482) (Diptera : Syrphidae)		*Platynaspis capicola*Crotch (1874) (Coleoptera : coccinellidae)		*Chilochorus nigritus*Fabrcus (1798) (Coleoptera : coccinellidae)		*Scymnus interruptus*Goeze(1885) (Coleoptera : coccinellidae)		*Micromus* sp (Neuroptera : Hemerobiidae)		*Deraeocoris* sp (Hemptera : Miridae)		*Orius* sp (Hemptera : Anthocoridae)	
Localities (Province)	**City location**		*n*	% tb*	*n*	% tb	*n*	% tb	*n*	% tb	*n*	% tb	*n*	% tb	*n*	% tb	*n*	% tb	*n*	% tb
Libreville(**Estuaire**)	Carrefour Démocratie	+++++	-	-	6	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Franceville(**Haut-Ogooué**)	Gare ferroviaire	+++++	1	20	10	100	1	10	-	-	1	20	-	-	-	-	3	30	3	20
	Echangeur	++++	2	25	9	60	5	100	1	20			3	20	2	8	-	-	-	-
	Ngobounda	+++	-	-	7	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Quartier sable	+++	-	-	6	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ongali	++++	-	-	6	80	-	-	-	-	11	80	-	-	-	-	-	-	-	-
Mitzic (**Woleu Ntem**)	Hôpital Général	+++	-	-	-	-	-	-	-	-	-	-	-	-	1	20	-	-	-	-
TOTAL			3	**23,08**	44	**69**	6	**15**	1	**20**	12	**63,16**	3	**20**	3	**12**	3	**30**	3	**20**

Legend : *tb= twigs bearing beneficial or associated insects

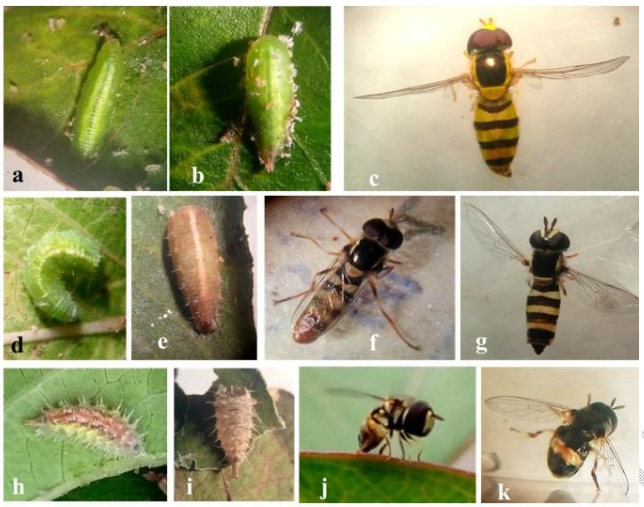

Figure 2.Hoverflies (Diptera : Syrphidae) predating in CMA *: Asarkina* sp. (***a*** : larval instar, **b** : pupae, ***c*** :adult) ; *Ischidon aegyptius*(d : larval instar**,e**, pupae, ***f*** :male,**g** : female), *Paragus borbonicus* (**h** : larval instar, **i** :pupae,**j** :laying female,**k** :male).

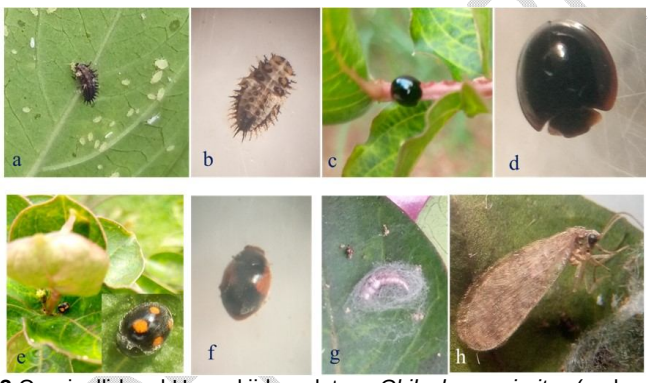

Figure 3.Coccinellid and Hemrobiid predators: *Chilochorus nigritus* (**a** :larva, **b** : nymph, **c** : adulte on twig , **d** : 3.5x magnifying adult), *Platynaspis capicola* (**e** : minute and 5x magnifying adult), *Scymnus interruptus* (**f** : adult), *Micromus sp.* (**g**: nymp, **h**: adult)

3.4 Discussion

Among prospected localties, Franceville revealed highest natural enemies abundance and diversity because of deeper sampling effort. This study is a first time report of the *T. kahawaluokalani* occurrence and relate aphidophagous species in Gabon, and certainly a second recordin Africa, because within litteratures studying CMA, only one mention notices observations of the CMA at Younde and Douala in Cameroon [13], at our knowledge. Any other study was found emphasing on this pest occurrence in Africa. Moreover, the latest entomofaunic studies in inhabting localties of Gabon [15, 18] did not report any infestation of the CMA. Nevertheless, monitoring of this pest at Franceville provided unsuccessfull results from 2019to 2020. The record of CMA that very 2021 year is to indicate it's newly arrival and expansion in this locality. Furthermore, the introduction of the CMA in Gabon seems to be recent, and could have been occured from Cameroon, or another neiboring or farway country, in the context of global fast world and incrising exchanges. Heavy infestations on shrubs of the train station site (Gare ferroviaire) could lead to suspect the train as having been a transport mean that facilitates that insect occurrence and outspread from Libreville to Franceville.Elsewhere, whithin the local ennemies observed, the syrphid species were the major predator beneficial group, frequently seing predating on the crapemertyle colonies, whereas the other predators occurred occasionally in some sites. The species *Orius* sp, possibly *Orius*

*insidiosus,*observed on blossoming crape mertyles is an interresting case needing deeper scientfic investigations because, as known as predator of the crape mertyle aphid in USA[19].This presumable predator, recognizedas an omnivore predilecting small hemipterans and flower resources, withbehaviour to aggregate in areas with high concentrations of pollen [20]. Their synergist aphidophagous predation on CMA allowed to record very few presence of the Aphid one month later after first observatons.The study did not found momified aphids, as to confirm unsuccessfull assessment from former authors pointing out the lack of parasitoids attacking CMA [13]. Some of these predators previously had been recorded by local former authors [15, 18], and are potential biological candidatsfor mass rearing to reinforce their effectiveness as an IMP promizing way. Considering current observations, efforts are to bemade to develop deeper nowledge and efficient strategies to control the CMA in this environment.

4. CONCLUSIONS

The Japan aphid is well established and spreading in Gabon. From the Estuaire western province, the Ngounie center province, the Haut-Ogooué eastern province, and the Woleu-Ntem northen provinece, the crape mertyle aphid occurrence is recorded, with local natural enemis belonging to syrphids, coccinellids, hemerobiids and minute pirate bugs (anthocorid). Regular monitoring is recommended and control measures might to take in account rearing, release and preservation of natural enemies of *T. kahawaluokalani*. Neverthless, since this insect pest is newly recorded in Gabon and now reported from the African continent, assessment efforts are needed to state on it economic threshold of infestation, in order to develop global management strategies against this ornamental threat.

COMPETING INTERESTS

All authors disclose any financial and personal relationships with other people or organizations that could inappropriately influence their work. This work was performed without funding, consultancies or other potential involvelment thn could ed to conflicts of interest. Authors declare that no competing interests exist.

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