

# First Report of the Crapemyrtle aphid *Tinocallis kahawaluokalani* (Hemiptera : Aphididae) and its relate natural enemies in Gabon

## ABSTRACT

A study was carried out among some green spaces in Gabon, mainly in Libreville, Lambarene, Mouila, Franceville and Mitzic, from August 2019 to October 2021. The aim was to assess the presence and impact of the Japanese aphid *Tinocallis kahawaluokalani* Kirkaldy (Hemiptera : Aphididae), and its relate natural enemies, using one time visual observations on Crapemyrtle shrubs. This ornamental plant pest was recorded, occurring on leaves of *Lagerstroemia indica* (L.) Pers. (Lythraceae). Seven local beneficial insect species were observed preying 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 *Chilocorus nigritus* Fabricus (Coleoptera : Coccinellidae), and the brown lacewing *Micromus* sp. (Neuroptera : Hemerobiidae), as natural enemies of *T. kahawaluokalani*, highlighting a local promising 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 enemies, biocontrol

## 1. INTRODUCTION

Ornamental plants are widely present in all of the human artificially green spaces because of their beautiful flowers and ability to be managed in various aesthetic shape within home and public gardens. Some of them are frequently attacked by insect pest species such as aphids (Hemiptera : Aphididae) [1]. The crape myrtles are common woody plants cultivated as shrubs with aesthetically pleasing design, particularly *Lagerstroemia* spp (Lythraceae) which contribute to urban landscape beautification [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 lead to leaf drop. The plant health could decline in cases of heavy attacks of the CMA [5]. This aphid species is reported to 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. Therefore, its favourable condition areas, impact and role in this continent are not well known. This first report in Gabon highlights main Knowledge on its distribution and the presence of its natural enemies.

## 2. MATERIAL AND METHODS

### 2.1 Sampling data

Field surveys were conducted within shrubs of cultivated *Lagerstroemia indica* (L.) Pers. (Lythraceae), in five provinces. The number of sites and shrubs varied according to the ornamental plants population per locality. The data were based on a global number of 30 sampling sites (avenue sides) from localities of Libreville, Lambarene, Mouila, Franceville and Mitzic, from August 2019 to October 2021 (Table 1).

**Table 1.** Sampling sites of survey from August, 2019 to October, 2021, in Gabon.

| No. | Locality (Province)          | City location             | Coordinates (latitude, longitude) |
|-----|------------------------------|---------------------------|-----------------------------------|
| 1   | Libreville<br>(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<br>(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<br>(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<br>(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<br>(Woleu Ntem)       | Hôpital Général           | 0°46'31"N ; 13°34'21"E            |
| 30  |                              | Village Afia              | 1°04'12"S ; 11°41'31"E            |

### 2.2 Pest and enemies identification

The earliest aphid samples were collected with the help of fine paintbrush and preserved in 70% ethyl alcohol in 15ml glass vials for later identification at laboratories, as well for some larvae or adults of natural enemies kept in 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).

### 2.3 Pest distribution

With the purpose of recording the CMA occurrence on other host plants, complementary observations were carried out on *Lagerstroemia speciosa* (L.) Pers and *Lawsonia alba* L. (Lythraceae) at Franceville, Okondja and Onguia village, because literatures reported these species as other host plants of CMA [5,7]. All the visible trees were examined for observation of the CMA *T. kahawaluokalani* and relate natural enemies. All the infested plants were taken into consideration basing on presence of the Crapemyrtle aphid and enemies.

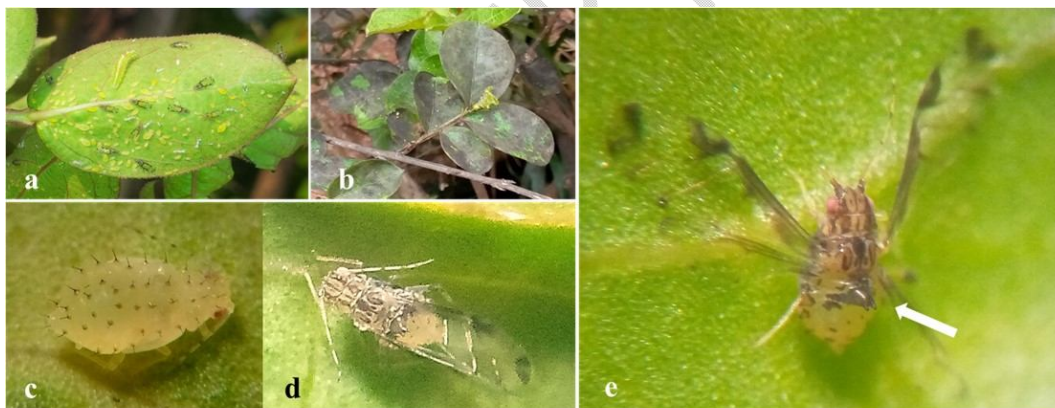
#### 2.4 Pest infestation level and impact

The assessment of the **pest infestation** was based on evaluating individuals rate of aphids per plant tools. Therefore, five twigs were randomly chosen per tree, and aphids and relate enemies were counted on five leaves from tip of each twig, following OILB/SROP recommended method [14] and used in this area [15]. This method consist on selecting a same representative number of tools per observed tree, and recording tools with aphids and their natural enemies, and the aphid's infestation levels were established on five twigs per tree, and per site using following basic formula:

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

Infested tools in this study correspond to a number of plants, twigs or leaves bearing aphids. Therefore, total number of stools represent all the sampling plants, twigs or leaves. The CMA colonies were evaluated by calculating Abundance rate of individuals per twig. Five twigs were randomly selected within the shrub canopy, at the human height [15], and for each twig, five leaves were observed from it tip. As some leaves were abundantly infested, the Aphid Rate Level per twig (ARFLT) was calculated from a free scale with rates ranging from 1 to 10 aphids (very weak level), 10 to 30 (weak level), 30 to 100 (middle level), and 100 to 200 individual insects (high level).

The **impact on infested twigs** was observed according litterature levels pointing out honey-dew, black sooty mold and plant decline [5]. Honey dew is Honeydew is a clear, sticky liquid on upper side of leaves left by many insect species, namely aphids, scale insects, whitefly and cochineals. This honey-dew is damageable for plant because often turning on a black sooty mold (Fig.1, b) altering the plant photosynthesis. From this alteration, Therefore, our scale of *T. kahawaluokalani* to measure impact resulting from it honey-dew consisted on recording attacked shrubs according to five damage levels, as level 1 (no damage, no honey-dew, green leaves), level 2 (little honey-dew), level 3 (much honey-dew), level 4 (black sooty mold), and level 5 (leaves dropping-off).



**Figure 1.** *Tinocallis kahawaluokalani* observed in Gabon : heavy infestation of the CMA on a young leaf of *Largestroemia indicia* 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).

#### 2.5 Occurrence of natural enemies

The occurrence of natural enemies was determined simultaneously than the pest assessment. Then, on the same five twigs randomly selected per tree, the enemies were counted on five leaves from tip of each twig, following the OILB/SROP recommended method [14]. The hoverfly, coccinellid and the brown lacewing larvae observed feeding on the aphid *T. kahawaluokalani* were collected and bought to the Crops Plant Protection Laboratory of INSAB, for conservation and/or rearing into plastic rearing vials, still the imagos hatching, for identification. All the CMA and relate natural enemies were identified following systematic keys provided by some available litterature references [4,5,9, 23, 24, 25, 26]. Real nature and manifesting pictures (under a Binocular stereoscopic microscope Leica SZB 200) were taken with a Techno park4@ camera.

#### 2.6 Data analysis

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

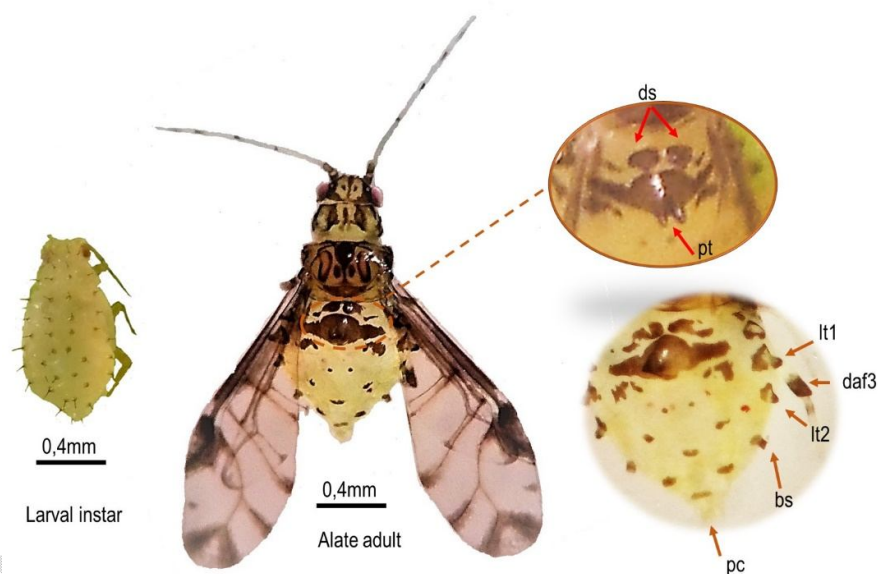
UNDER PEER REVIEW

### 3. RESULTS AND DISCUSSION

#### 3.1 Insect identification

##### Pest diagnosis :

*Tinocallis kahawaluokalani* Kirkaldy (Hemiptera : Aphididae) is small aphid of about 1.6 mm long, and known as the major aphid pest of *Largestroemia indcia* (Lythraceae). It can easily be recognized with regard of its alate adults broad-bodied shape, and wings held roof-like over the back of the body. Alive alate **adults** are pale yellow or yellow-green color, with black spots and body markings. **Head** possess black patterns and pinkish eyes (Fig.2). The **antennae**, shorter than the body are pale and compound with six segments having each one a darkened apex. **Thorax** has dark longitudinal strips (Fig.2). **Forwings** are especially characterized by dark markings along the main vein (pterostigma fully dark pigmented) ; media branches are also dark or dusky color. **Abdomen** is yellow, with two dark spots on tergite I, large and transversal dark satch on tergite II bearing a spiny paired tubercle (double-pronged hump) (Fig.2). Foreleg is yellow pale, the media and hind legs are yellow brownish, with dark apex of femorae , and dark base of tibia. **Siphunculi** are smooth, small and dark color, with equal length and width. **Cauda** is pale and knobbed. **Immature instars** are yellow pale with pinkish to red eyes. The body is spotted covered with greyish tubercles bearing each one a black bristle. The prominent paired tubercle observed on the adult abdominal tergite II is absent (Fig.2), and the cauda and the siphunculi are pale.



**Figure 2.** *Tinocallis kahawaluokalani* and its characteristic abdominal organs (**ds**: dark spots ; **pt** : paired tubercle ; **lt1,2** : lateral tubercles 1,2, **daf3** : dark apex of femora 3 ; **bs** : brown siphunculi ; **pc** : pale cauda).

##### The Natural enemies

Seven beneficial species were recorded preying on the crapemyrtle aphid, namely predatory hoverflies, coccinellids, and hemerobiid species (Fig.3, 4), from Franceville, Libreville and Mitzi.

**Predatory hoverflies** (Diptera : Syrphidae) preying in CMA were *Asarkina* sp., *Ischiodon aegyptius* and *Paragus borbonicus*.

*Asarkina* sp. (Macquart ,1842) was characterized by glabrous green larva and pupa with thin paired apex, and a yellow adult with transversal black bold stripes (Fig.3 a to c). *Ischiodon aegyptius* (Wiedemann, 1830) has spiny green larval instars and pupae, and adults both male and female with yellow pale body. Abdominal transverse stripes and eye and thorax are dark color (Fig.3 d to g). *Paragus borbonicus* (Macquart ,1842) has small very thin brown larva and pupa. Broad body with a large transversal orange stripe in abdominal mid tergum (Fig.3 h to k).



**Figure 3.** Hoverflies (Diptera : Syrphidae) predated in CMA : *Asarkina* sp. ( **a** : larval instar, **b** : pupae, **c** : adult ) ; *Ischiodon aegyptius* ( **d** : larval instar, **e**, pupae, **f** : male, **g** : female), *Paragus borbonicus* ( **h** : larval instar, **i** : pupae, **j** : laying female, **k** : male).

**Predatory coccinellids** (Coleoptera : Coccinellidae) observed predated in CMA were *Chilocorus nigritus* (Fabricius, 1798), *Platynaspis capicola* (Crotch, 1874), *Scymnus interruptus* (Goeze, 1777). *Chilocorus nigritus* has greyish yellow to brown larvae with spiny hair-covered their dorsal surface. The adults have a semi-spherical, black and brightening elytra with orange areas between the eyes and on the antero-lateral tips of the pronotum (Fig.4 a to d).



**Figure 4.** Coccinellid and Hemerobiid predators: *Chilocorus 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)

*Platynaspis capicola* is a very small ladybeetle of large ovale shape (2.7 mm long) covered with short hairiness. Elythrae are black color and marked each one by two orange spots (Fig.4 e).

*Scymnus interruptus* is as small ovale ladybeetle with about 2mm length. The common design of this species features is a black body with a lateral orange or reddish spot on the anterolateral half of the elytra, not touching the base or the suture (Fig.4, f).

*Micromus* sp. is Neuropteran belonging to family of Hemerobiidae, also called lacewings with weakly hairy campodeiform larvae and brown adults. Both insect instars are CMA predatory (Fig.4, g, h).

### 3.2 Pest distribution

The assessment of the Crapemyrtle aphid throughout 30 sites of five gabonese localities showed presence of *Tinocallis kahawaluokalani* (Fig. 1) on 75% of *Largestoemia indica* of all the investigated 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 the

**Northern** (Woleu-Ntem). The insect was present 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 and surrounding localities, as ten individuals of *Largestroemia speciosa* (L) Pers and twelve *Lawsonia alba* L. (Lythraceae) showed any CMA infestation, certainly because the CMA host preference in this town goes exclusively on *L. indica*.

### 3.3 Infestation and impact level

Weak, heavy and very heavy infestation were recorded, inducing presence of honey-dew, black sooty mold, and plant decline (table 2).

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

| Locality (Province)       | Sites (& N shrubs)           | Infested trees (%) | Prevalence of <i>Tinocallis kahawaluokalani</i> |                   |                                    |
|---------------------------|------------------------------|--------------------|---|-------------------|------------------------------------|
|                           |                              |                    | Infestation rate (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 de l'indépendance (2)  | 100                | 30 - 100  | +++               | Little honey-dew                   |
| Lambaréné (Moyen-Ogooué)  | Lycée Adiwa (2)              | 0                  | 0   | -                 | No damage                          |
|                           | Hôtel de Ville (1)           | 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                          |
| <b>TOTAL</b>              | <b>30 sites (104 shrubs)</b> | <b>75</b>          |   |                   |                                    |

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

### 3.4 Occurrence of natural enemies

The predominant hoverfly species were respectively *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%), *Chilocrus nigrinus* (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

| Pest aphid | Beneficials' insects (natural enemies of CMA) | Associated insects |
|------------|---|--------------------|
|------------|---|--------------------|

| Localities<br>(Province)         | City<br>location            | <i>Tinocalis kahawaluokalani</i><br>Kirkaldy (1906) (Hemiptera :<br>aphididae) | <i>Asarkina</i> sp (Diptera :<br>Syrphidae) |       | <i>Ischidon aegyptius</i> Wiedemann<br>(1830) (Diptera : Syrphidae) |      | <i>Paragus borbonicus</i> (Macquait<br>(1482) (Diptera : Syrphidae) |      | <i>Platynaspis capicola</i> Crotch<br>(1874) (Coleoptera :<br>coccinellidae) |      | <i>Chilocorus nigrinus</i> Fabrcus<br>(1798) (Coleoptera :<br>coccinellidae) |       | <i>Scymnus interruptus</i> Goeze<br>(1885) (Coleoptera :<br>coccinellidae) |      | <i>Micromus</i> sp (Neuroptera :<br>Hemerobiidae) |      | <i>Deraeocoris</i> sp (Hemiptera :<br>Miridae) |      | <i>Orius</i> sp (Hemiptera :<br>Anthocoridae) |      |
|----------------------------------|-----------------------------|--|---|-------|---|------|---|------|--|------|--|-------|--|------|---|------|--|------|---|------|
|                                  |                             |  | n   | % tb* | n   | % tb | n   | % tb | n  | % tb | n  | % tb  | n  | % tb | n   | % tb | n  | % tb | n   | % tb |
| Libreville<br>(Estuaire)         | Carrefour<br>Démocratie     | +++++  | -   | -     | 6   | 80   | -   | -    | -  | -    | -  | -     | -  | -    | -   | -    | -  | -    | -   | -    |
| Franceville<br>(Haut-<br>Ogooué) | Gare<br>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<br>sable<br>Ongali | +++  | -   | -     | 6   | 80   | -   | -    | -  | -    | -  | -     | -  | -    | -   | -    | -  | -    | -   | -    |
| Mitzié<br>(Woleu Ntem)           | Hôpital<br>Général          | +++  | -   | -     | -   | -    | -   | -    | -  | -    | -  | -     | -  | -    | 1   | 20   | -  | -    | -   | -    |
| <b>TOTAL</b>                     |                             |  | 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

### 3.5 Discussion

Among prospected localities, 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 record in Africa, because within literatures 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 emphasizing on this pest occurrence in Africa. Moreover, the latest entomofaunic studies in inhabting localities of Gabon [15, 18] did not report any infestation of the CMA. Nevertheless, monitoring of this pest at Franceville provided unsuccessful results from 2019 to 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 occurred from Cameroon, or another neighboring 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, within the local enemies observed, the syrphid species group, namely *Asarkina* sp., *Ischiodon aegyptius* and *Paragus borbonicus* were the major predator beneficial, frequently being predated on the Crapemyrtle colonies, whereas the other predators occurred occasionally in some sites. The predatory coccinellids, and Anthocorid *Orius* sp, possibly *Orius insidiosus*, observed on blossoming crape mertyles are other interesting cases needing deeper scientific investigations because, known as predatory enemies of the crape mertyle aphid [19]. This presumable anthocorid predator is recognized as an omnivorous insect predilecting small hemipterans and flower resources, with behaviour to aggregate in areas with high concentrations of pollen [20]. The synergist aphidophagous predation on CMA allowed to record very few presence of the CMA one month later after first observations. The study did not found momified aphids, as to confirm unsuccessful 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 candidates for mass rearing to reinforce their effectiveness as an IMP promising way. Considering current observations, efforts are to be made to develop deeper knowledge and efficient strategies to control the CMA in this environment.

### 4. CONCLUSIONS

The Japanese 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 Northern province, the crape mertyle aphid occurrence is recorded, with local natural enemies 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*. Nevertheless, 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 involvement that could lead to conflicts of interest. Authors declare that no competing interests exist.

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