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Biodiversity of diaspididae scale insects (homoptera), their host plants and natural enemies in Algeria

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Abstract

Our inventory of Algerian Diaspididae realized from 2003 to 2005 permuted to us to know the existence of 118 species that infested 488 plants. 18 new species were identified belonging to the genera of *Aspidaspis*, *Diaspidiotus*, *diaspidiotu*, *Carulaspis*, *Chionaspisplatani*, *Diaspis*, *Parlatoria*, *Parlatoresopsis*, *Leucaspis*, *Discodiaspis*, and *Froggattiella*. The Diaspidini and Aspidiotini tribes were the most represented in general (80%) and in species (80%). They infested 254 and 172 plants respectively. Parlatorini and Odonaspidini host plants stilled the less important with 72 and 13 respectively. Most of the Diaspididae host plants were Rosaceae (7, 3 %), Poaceae (6,5 %) and Fabaceae (6 %). The inventory of their Predators makes to sand out 3 families: Coccinellidae, Nitidullidae and Coniopterygidae, included 14 species, which the first contained 5 genus *Rhysobius*, *Chilocorus*, *Exochomus*, *Pharoscyrmus* and *Mimopullus*. The parasitoids included 23 Hymenoptera species: 14 ectophage (who *Aphytis* is the most common) and 9 endophage whit 3 genera (*Encarcia*, *Comperiella*, *Chiloneurium*). The most representative species were *Encarsia citrina*, *Aphytishis hispanicus* and *A. chilensis*.

Keywords: Algeria, Diaspididae, Diversity, Host-plant, Parasites, Predators.

1. Introduction

The recognition works and the inventory of the Diaspididae invertebrate fauna had begun in 1867 by Boisduval and some authors^[1-7], and pursued by Balachowsky at 1926 to 1958,^[8 - 22]. These works have been followed by several authors from 1960 by Piguat^[16] until 2003 by Merahi^[51]. These authors have worked on Bioecology of few species in particularly *Parlatoria olea*^[35, 33, 34, 35], *P. blanchardi*^[27, 41], *Lepidosaphes beckii*^[28, 38, 40], *Diaspidiotus perniciosus*^[32, 34, 37, 46].

With the advent of national and international commercial exchanges, another group of species was introduced, among which some of theme caused damages in the cultivated plants as *Parlatoria ziziphi*^[30,43] and *Aonieilla aurantii*^[40, 42, 51]. This has permuted for us to try these investigation inventory researches and recognises of scales insect, their predators and parasites and their geographic repartition.

2. Material and Methods

This bio-systematic work was realized during period going from September, 2003 till September, 2005 in the laboratory of zoology, situated in the National School of agronomy of Algiers. To lead well this study it was important to adopt the method of sampling in the field of Vasseur and Schvester^[23], based on the periodic enumeration of the individuals in different stage evolutionary, and determination method in the laboratory based on the morphological study of the shield, prosoma, pygidium and pygidium lobes of the female^[24, 26]. We have beginning by to choose the infested trees and taken the samples of branches (leaves and fruit) then we put them in the plastic bags with etiquettes that showed the site, the date and host plant. In the laboratory the individuals were isolated from the organs, observed at the same day under stereomicroscope and binocular microscope photonic with 10 to 100× after technical mounting for the morphological study.

This technical mounting contained three phases:

1. To make clear the scale insect by KOH at 10% for 5-10 mn, then in hot alcohol at 70° or in distillate water and then in Chlorophenol from 12 to 24 ours.

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2. Coloration and dehydration with alcohol 90° during 5-10 mn, then we rinsed it in alcohol 100% to eliminate trace of Chlorophenol and to make the scale insect transparent. Then we put theme in red of magenta for 5-10 mn, then in alcohol to decrease the exec red colouring agent.
3. The cochineal was placed and displayed between blades; then we put on one drop of the Canada balm product (Terebenthine of balsam fir tree) and put them in a steam room in 37 ° during 12 in 24 days, for the definitive preservation of cups.
4. These blades are going to be ready in the observation of scale insect and the determination according to the form and the color of the body, the pygidial structure of the adult female. The endophage and ectophage parasites and predators are determined thanks to the study of exit holes, eggs and morphology of the body by means the specialists and the key of hymenoptera determination.

3. Results and Discussion

• History study

The results of the historic research revealed that, before 1850 the Diaspididae was not known in Algeria, the reason could be attributed to the absence of the farm produces imports. It was only after 1850 until 1910 when 12 species were indicated by several authors, in 1867 by Boisduval until 1910 by Lindinger and Trabu. This was due to insufficiency of the investigations, or for the misunderstanding of Diapididae, or for the low infestation on plants. The advent of the commercial exchanges from 1901 till 1950 favoured the introduction of several Diaspididae species that the rate reached 46,61% according to

the works of the other authors those of Trabut in 1911 until those of Ballachowsky in 1950 [3-18]. Other species were discovered from 1951 to 2005 thanks to the agricultural development and the interest of the entomologists for this family such as the work of Balachowsky (1951) until that of Merahi (2002) and this work. (Fig. 1).

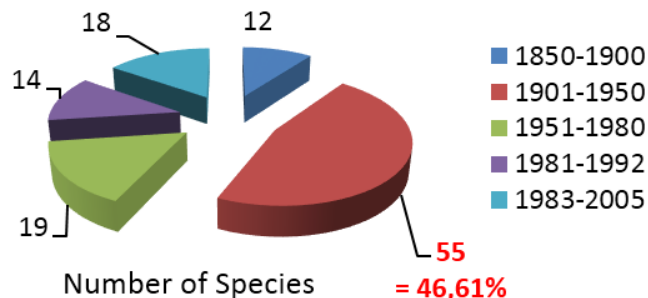


Fig 1: Diaspididae chronologic signalisations in Alegria

• The inventory of Diapididae

The results of the inventory indicate that the family of Diaspididae represents 118 species in Algeria, belonging to 47 genera that we found in 4 tribes, ¹Aspidiotini represented 41,55% species, ²Diaspidini 42,37%, ³Parlatorini 15,95% and ⁴Odonaspidini 5.32 %. (Fig. 2), this tribes are already signalled by Balachowsky [8-21], Piguet [25] and Benassy [16].

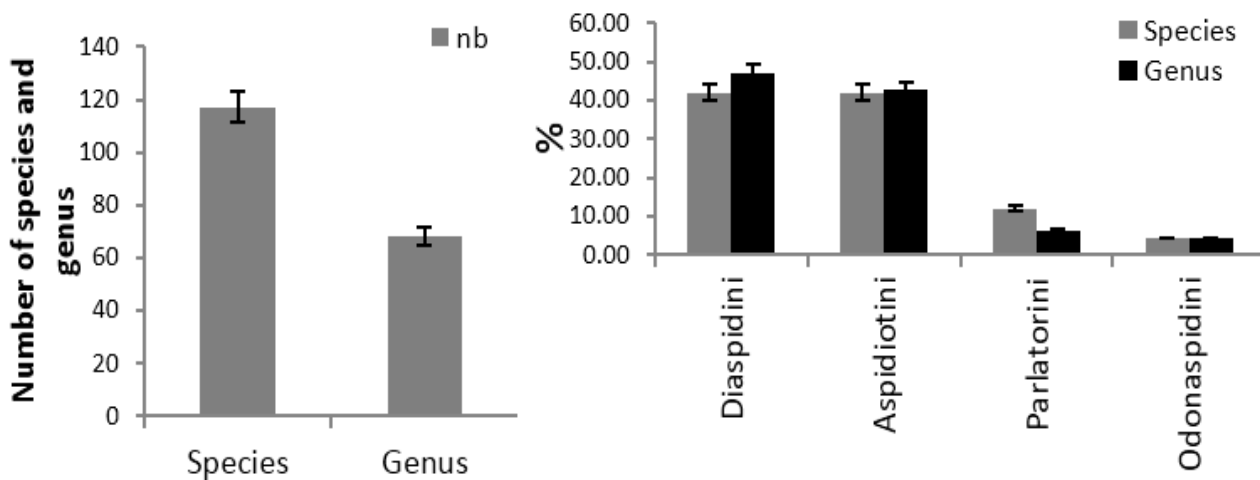


Fig 2: Genera and species proportion of different Diaspididae tribes inventories

The Diaspidini was represented more than the others, by the genus of *Lepidosaphes* that counted 7 species, *Duplachionaspis* with 6 species, *Carulaspis* (that signaled for

the first by Biche [35]) and *Diaspis* with 5 species, *Chionaspis* with 4 species (that removed on *C. platani* species for the first by Biche at 1991) (Fig.3).

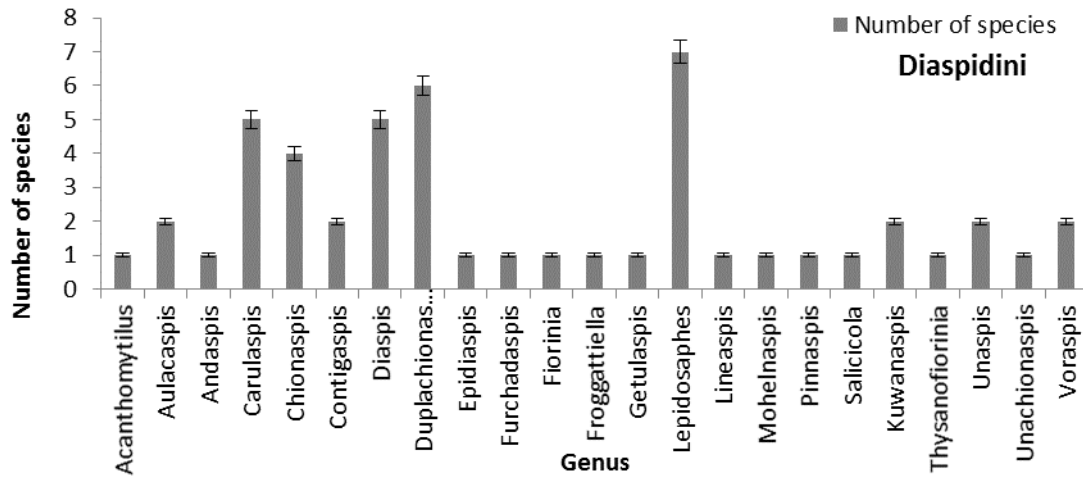


Fig 3: Different genus proportion of Diaspidini.

Aspidiotini was more represented by Diaspidiotus genus who contained 17 species (that *Diaspidiotus forbesi*, *Diaspidiotus*

lenticularis and *Diaspidiotus lepineyi* were removed by Biche in 1983, 1985, 1990 respectively) (Fig. 4).

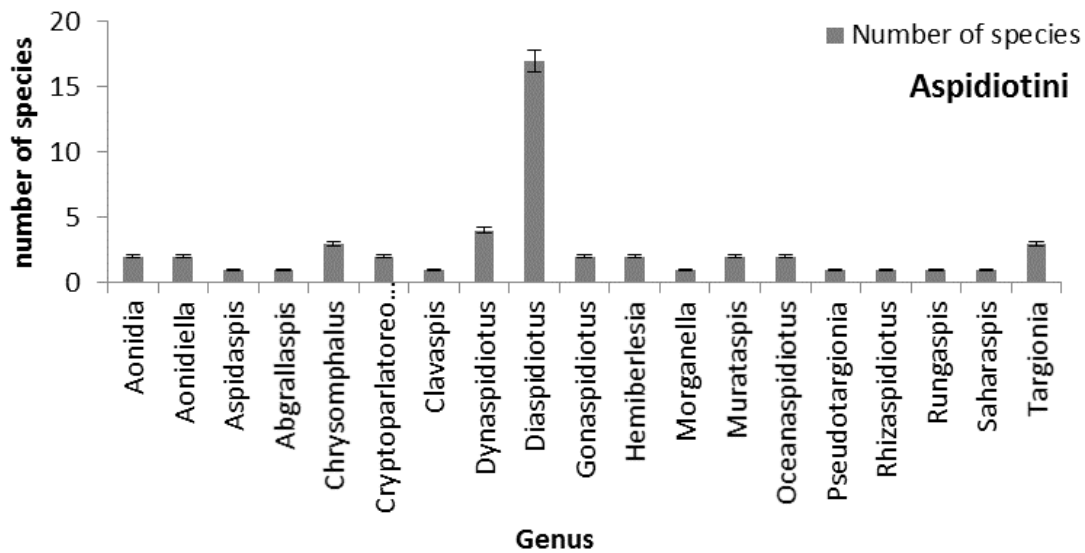


Fig 4: Different genus proportion of Aspidiotini.

Parlatorini was more represented by *Parlatoria* genus with counted 6 species (that *P. Camelliae*, *Parlatoriopsis thea* and *Leucaspis pini* were removed in Algeria for the first by Biche 1983, 1987, and 1988 respectively) and Odonaspidini by

Discodiaspis genus with 3 species (that *D. salicornia*, *D. suadae* and *Odonaspis penicillata* are removed for the first by Biche at 1988, 1984) (Fig.5).

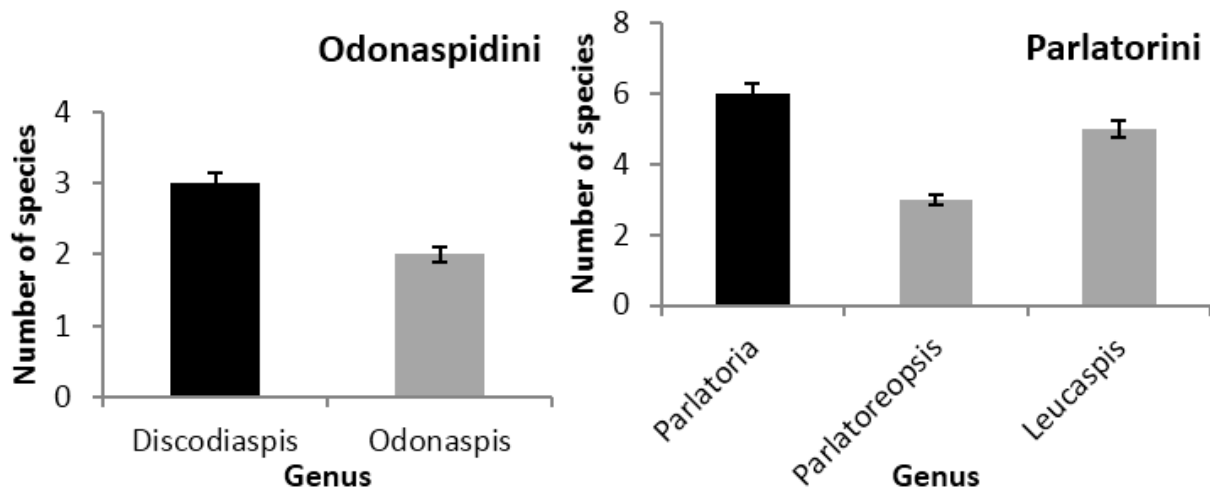


Fig 5: Different genus proportion of Parlatorini and Odonaspidini.

For all the family of Diaspididae, the genus of *Diaspidiotus* was the most represented by 17 species, *Lepidosaphes* with 7 species, *Duplachionaspis* and *Parlatoria* with 6 species each one, *Diaspis* and *Carulaspis* with 5 species each one (Fig. 6).

We signalled for the first 18 new species of the Algerian coccidologic fauna in the end of 2005:

8 species of the Aspidiotini tribe which were: *Aspidaspis*

longiloba, *Diaspidiotus wuenni*, *D. lenticularis*, *D. lepineyi*, *D. branschivigi*, *D. zonatus*, *D. armeniacus* and *D. Forbesi*.

4 species of the tribes of Odonaspidini: *Discodiaspis suadae*, *D. salicornia*, *D. numidica* and *Froggattiella penicillata*.

3 species of Diaspidini tribu wich were: *Carulaspis atlantica*, *Chionaspis platani*, *Diaspis asparagi*.

3 species of Parlatorini tribe which were: *Parlatoria camelliae*, *Parlatoreopsis theae* and *Leucaspis pini*.

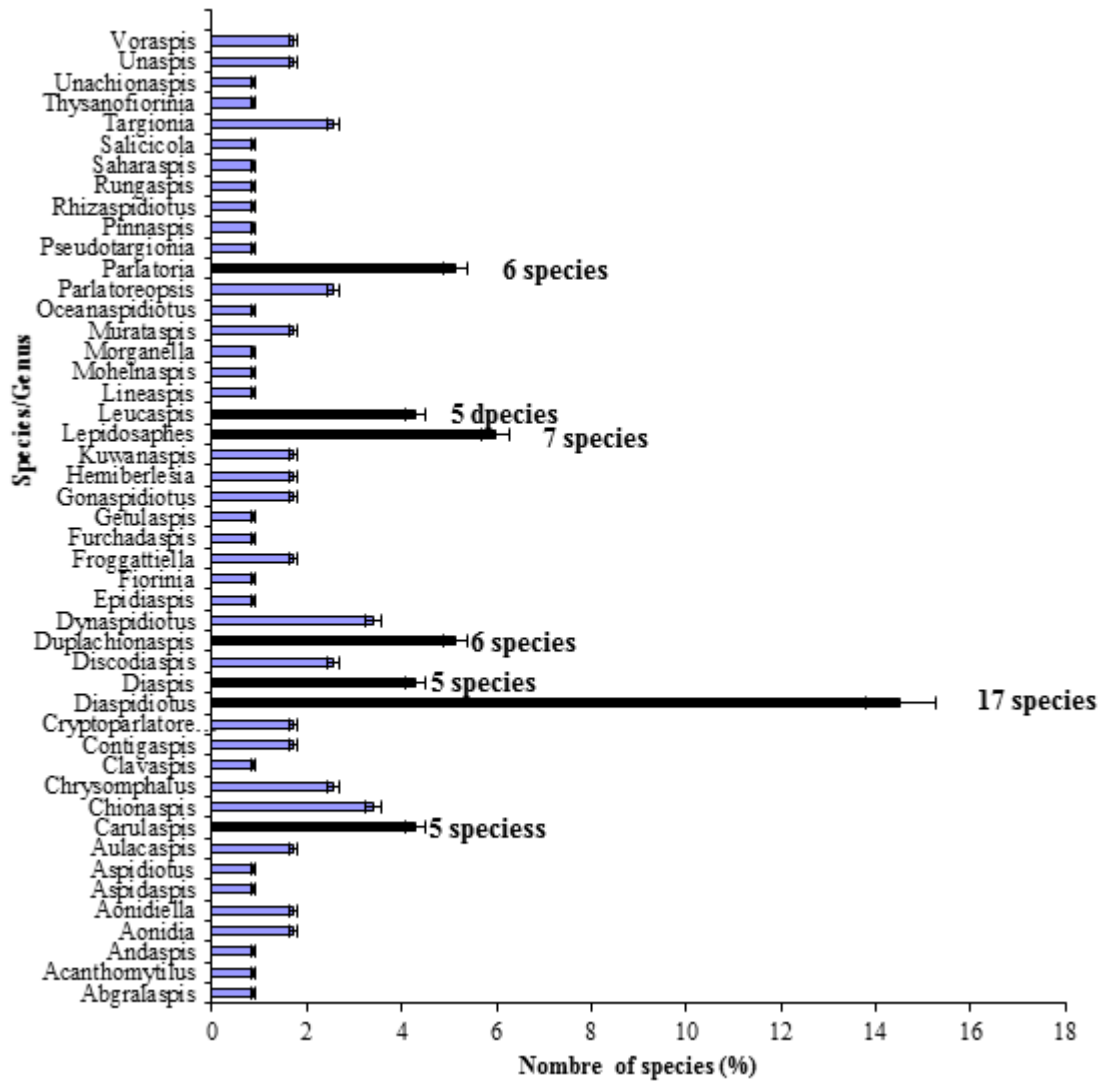


Fig 6: Different genus and species proportion of the Diaspididae family.

• **The diversity of Diaspididae host plants**

The infested plants by Diaspididae belong to 84 botanical families that were represented by 488 species in total. Diaspidini infested 172 plant species and Aspidiotini 254 plant species. Both tribes are divided into three groups:

- *Group of frequent, ubiquitous with high ecological plasticity and polyphagous.
- * Group of oligophagous and monophous species

* Group of rare and typical forest species

The Parlatorini tribe infest 72 plant species and Odonaspidini infest 13 plant species. The two tribes include the specific species and monophages.

The representative botanical families are 10; the number of species varies from 14 to 15 per family. The most represented are Rosaceae (7,36%), Poaceae (6,54%) and Fabaceae (6,13%)family (Fig. 7).

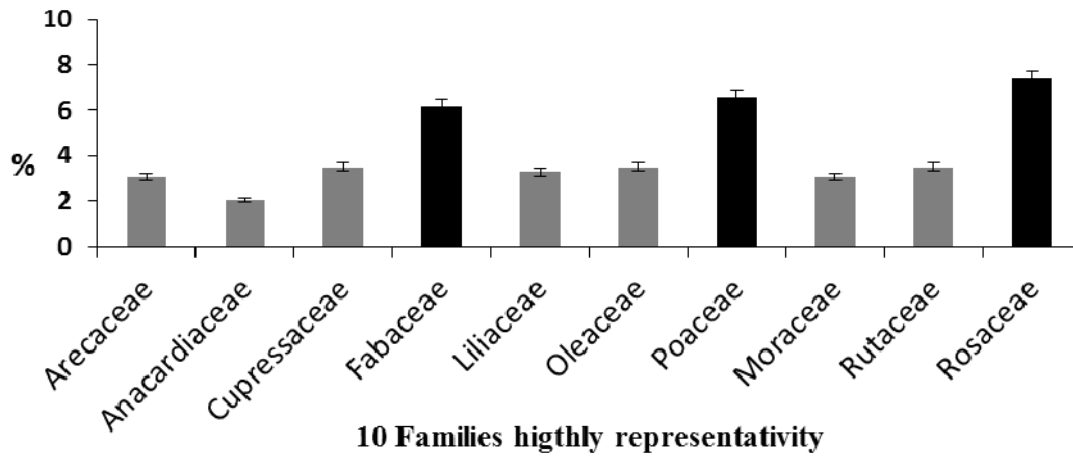


Fig 7: Different genus and species proportion of the Diaspididae family.

Moderately representative families are among 20 families with 36 to 15 species per family (Fig. 8).

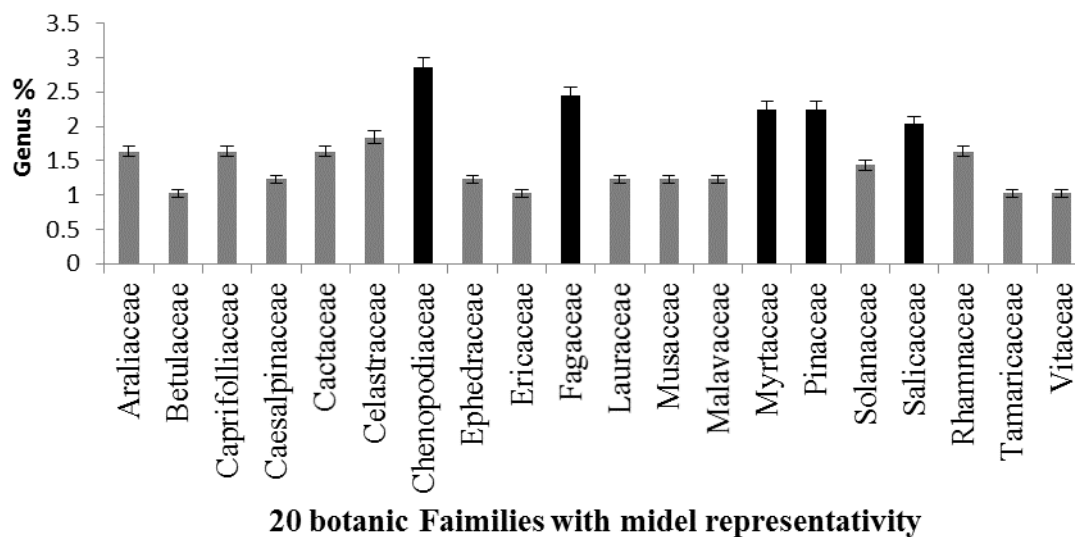


Fig 8: Different genus and species proportion of the Diaspididae family.

The other 64 families were poorly represented with 4 species per family.

• Diversity of Diaspididae predators and parasites

Our research has revealed the presence of three predatory families representing 14 species, Coccinellidae lives upon 71 species, Nitidulidae 4 species and Coniopterygidae 1 specie). (Fig. 9). The most active on Diaspididae are *R. lophantae* lived upon 19 diaspine in Algeria that it concords with Balachowsky (1932) who announced 20 species, *Chilocorus* distributed in northern Algeria lived upon 13 species, *Exochomus quadripustulatus* 11 species and *Mimopullus mediterraneus* and *Pharoscygnus setulosus* 7 species. *Pharoscygnus ovoideus* and *P. numidicus* were particularly lived upon *Parlatoria blanchardi* that infested date palm in the south of the country. (Fig.10).

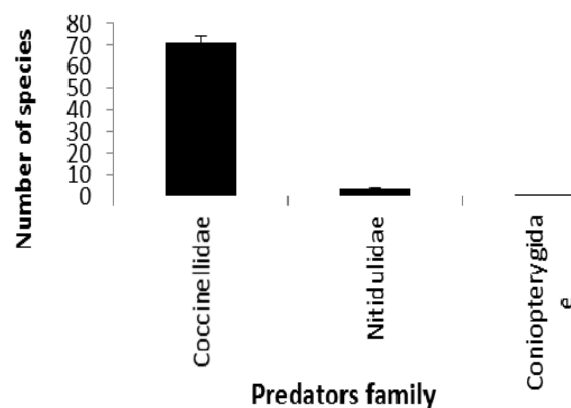


Fig 9: Family species predator numbers

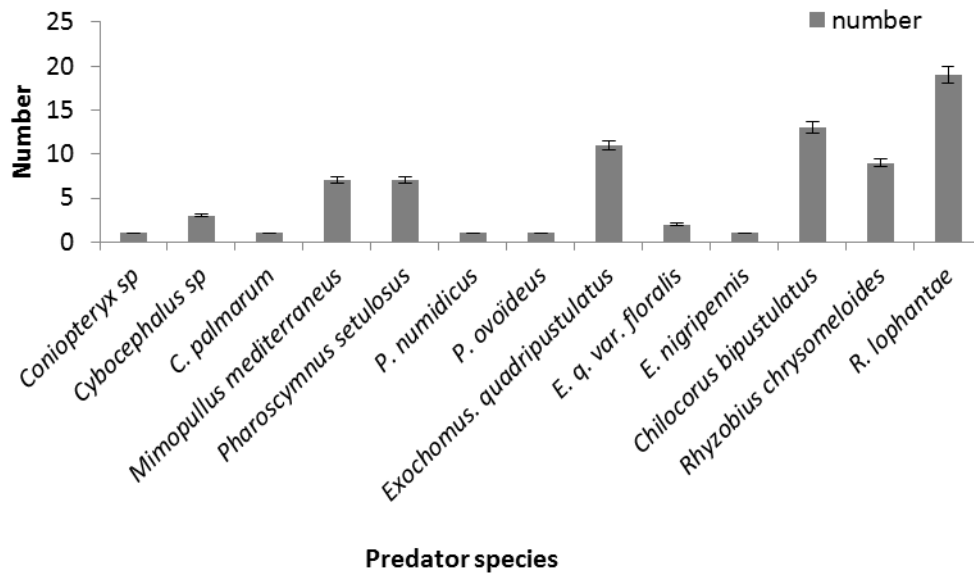


Fig 10: Specie predator numbers

The most parasited species was *A. aurantii* with 10 *Aphytis* and 3 *Encarcia* species, followed by *Oceanaspidiotus nerii* by 5 *Aphytis* and 2 *Encarcia* species, and *Lepidosaphes conchyformis* and *diaspidiotus perniciosus* species with 4

species. (Fig. 11 and 12). The rarity of some parasites scales may be conditioned by their monophagy, ecological conditions and their acclimatization to the environment.

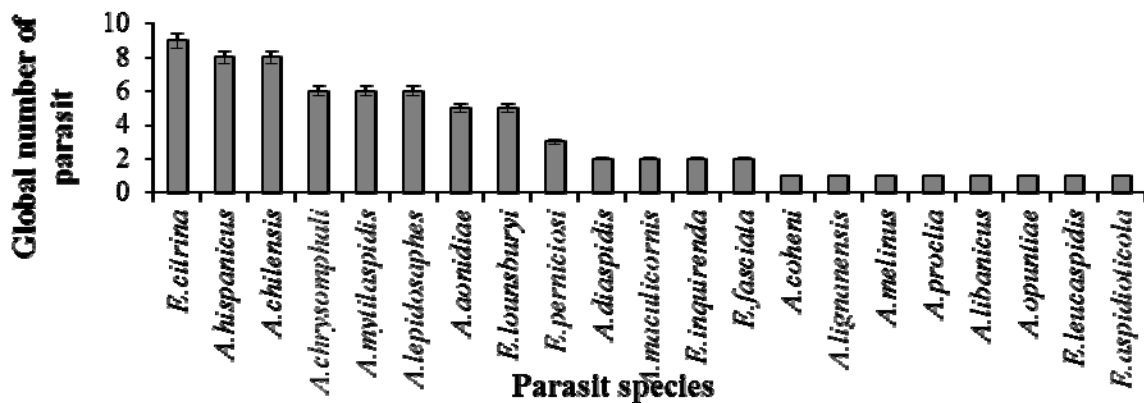


Fig 11: Spices parasite number

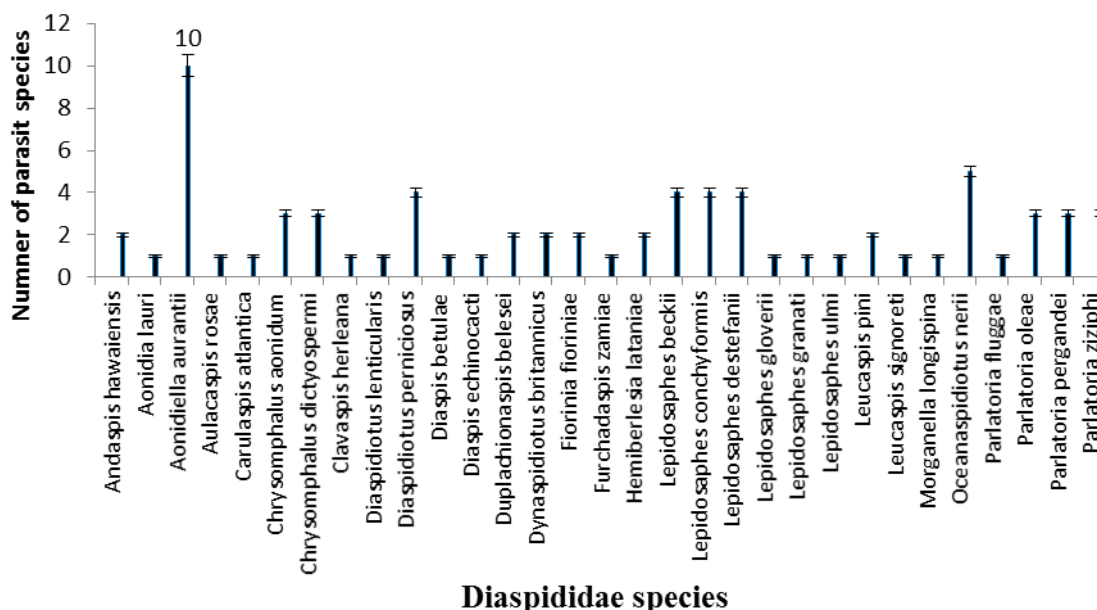


Fig 12: Number of parasite for each Diaspididae species

4. Conclusion

This inventory of mealybugs diaspidines allowed us to know the Algerian Diaspididae species, their host plants and their natural enemies. 118 species were identified and belonging to 47 genus and four tribes, who 18 new species were identified for the first and signalled in Algeria in 2005. These Diaspididae species infested 488 host plants. The first group of common and ubiquitous species had a high ecological plasticity and extensive polyphagia. The second group contained the specific species that attacked a single family, genus, or botanical species. The preferred host group was specific to a plant species or genus. In the absence of its host, they infected other plants. The last group contained rare species that were exacting in food and environment. So, we signalled that *Duplacionaspis berlese* was observed for the first time on *Asparagus sp.*, *Asparagus acutifolius* and *Pistacia lentiscus* in Algeria and in the world.

For the Predators, we have identified 18 species, belonging to the order of Coleoptera. Most of them were the Coccinellidae species how were most active (*Rhizobius lophantae* and *Chilocorus bipustulatus*). Parasitoids contained 23 species, whose 14 were ectophagic (*Aphytis* species) and 9 endophagic (*Encarsia*, *Comperiella*, *Chiloneurium*). Further investigations may reveal the presence of other species of Diaspididae in some localities of Algeria difficult to access especially in mountains and in the South of the country (Sahara).

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