

Role of pteromalid parasitoid *Scutellista caerulea* (Fonscolombe) (Hymenoptera: Pteromalidae) for biological control of the soft scale insects (Hemiptera: Coccidae) in Egypt

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ABSTRACT

The pteromalid parasitoid, *Scutellista caerulea* (Fonscolombe) (Hymenoptera: Pteromalidae) is one of the most effective parasitoid associated with soft scale insects. This work dealt with the biological role of this parasitoid during 2009 and 2010 in Egypt. The results indicated that the parasitoid, *S. caerulea* was emerged from 8 species of soft scale insects. The host soft scale insects were *Ceroplastes floridensis* Comstock, *Ceroplastes rusci* (L.), *Coccus hesperidum* L., *Kilifia acuminata* (Signoret), *Parasaissetia nigra* (Nietner), *Saissetia coffee* (Walker), *Saissetia oleae* (Olivier) and *Waxiella mimosae* (Signoret) (Hemiptera: Coccidae). Population abundance studies of *S. caerulea* were carried out on the aforementioned soft scale insects in eight locations in Egypt, being Beni Seuf, Gharbiya, Giza, Ismailia, Marsa Matruh, Northern Coast, Qena and Sharqiya. The highest rate of parasitism attained with *S. oleae* was found to be 38.2 and 40.9 % during the first and second years, respectively. While average parasitism rates was 21.3 and 23.5 % during the two years under consideration, respectively. The results indicated that *S. caerulea* was the effective parasitoid attacking some soft scale insects in Egypt.

Key words: Pteromalidae, *Scutellista caerulea*, Coccidae, soft scale insect and distribution.

INTRODUCTION

Soft scale insects (Hemiptera: Coccidae) are one of the largest families of scale insects classified together with armored scales and mealybugs. There are 1000 species distributed worldwide and these comprise 100 genera approximately (Hamon and Williams, 1984). Of which Egyptian Coccidae comprise about 23 species included in 10 genera (Abd-Rabou, 2003). Soft scales occur in all geographic regions of the world (Ben-Dov, 1993). The severity of damage caused by soft scales is graded according to the level of infestation. At the lowest level, sucking the sap is the only damage. This is followed by the appearance of honey dew on the leaves, resulting in spread of sooty mould. Then, more serious symptoms appear, such as the fall of leaves extending gradually to an almost complete defoliation and entire branches dryness on the tree. Severe infestation do not result in the tree death, but cause the reduction or even absence of yield for a number of years (Ben-Dov and Hodgson, 1997). The parasitoid, *Scutellista caerulea* (Fonscolombe) (Hymenoptera: Pteromalidae) is a gregarious endoparasitoid and prefers pre-ovipositing females, also it parasitizes other stages from the third instar larva to an ovipositing and is one of the most important parasitoid attacking different soft scale insects in different countries of the world. The aim of this work is to study the role of the parasitoid, *S. caerulea* in controlling soft scale insects in different localities in Egypt.

MATERIAL AND METHODS

Samples of soft scale insects were collected from different host plants in Egypt throughout the period of study 2009 and 2010. As this parasitoid was found to exist in

eight locations a incidence was conducted on different stages of *Ceroplastes floridensis* Comstock on citrus (*Citrus* sp.) in Gharbiya, *Ceroplastes rusci* (Linnaeus) on citrus (*Citrus* sp.) in Beni Seuf, *Coccus hesperidum* L. on guava (*Psidium guajava*) in Giza, *Kilifa acuminata* (Signoret) on mango (*Mangifera indica*) in Sharqiya, *Parasaissetia nigra* (Nietner) on mango in Ismailia and *Saissetia coffeae* (Walker) on olive (*Olea europaea*) in Marsa Matruh, *Saissetia oleae* (Oliver) on olive (*Olea europaea*) in Northern Coast, *Waxiella mimosae* (Signoret) on sunt (*Acacia tortilis*) in Qena. Gravid females of soft scale insects (as well as insect species other than these soft scales) were eliminated through stereoscopic examination.

Thirty leaves inches of citrus and mango, thirty leaves of olive and thirty leaflet of sunt from different locations were stored in well-ventilated glass tubes for one week for emergence the adult parasitoid and for identification and counted. Rate of parasitism was determined by dividing the number of emerging parasitoid from each by the number of hosts existing. Simple correlation and regression values were calculated to obtain information about the relationships between the three tested weather factors and percent parasitism by parasitoid.

RESULTS AND DISCUSSION

Eight soft scale insects were collected associated with the parasitoid, *S. caerulea*. These are:

- a. *Ceroplastes floridensis* Comstock
- b. *Ceroplastes rusci* (Linnaeus)
- c. *Coccus hesperidum* L.
- d. *Kilifa acuminata* (Signoret)
- e. *Parasaissetia nigra* (Nietner)
- f. *Saissetia coffeae* (Walker)
- g. *Saissetia oleae* (Oliver)
- h. *Waxiella mimosae* (Signoret)

1- On *Ceroplastes floridensis* Comstock

The parasitoid, *S. caerulea* was recorded for the first time associated with *Ceroplastes floridensis* by Priesner and Hosny (1940). The parasitoid *S. caerulea* which associated with *C. floridensis* infested citrus in Gharbiya. The maximum parasitism rate reached 4.1 and 3.1 % during the first and second years, respectively (Fig.1). While average parasitism rates was 1.2 and 0.7 % during the first and second years, respectively.

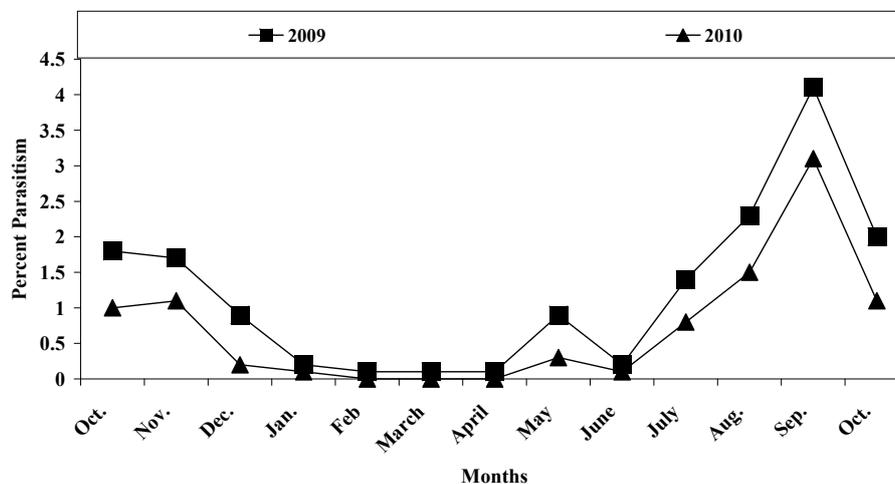


Fig.(1): Percent parasitism by *Scutellista caerulea* associated with *Ceroplastes floridensis* on citrus in Gharbiya during 2009 and 2010.

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid, minimum temperature and percent of relative humidity and the mean number of *C. floridensis* were non-significant ($r = 0.33, 0.28$ and 0.21), while significant between maximum temperature and the population of *C. floridensis* ($r = 0.78$). Also, Statistical analysis showed that the simple regression for changing the population of parasitoid, minimum temperature and %relative humidity and the mean number of *C. floridensis* were non-significant ($b = 0.21, 0.37$ and 0.26), while significant between maximum temperature and the population of *C. floridensis* ($b = 0.75$). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid, minimum temperature and %of relative humidity and the mean number of *Ceroplastes floridensis* were non-significant ($r = 0.33, 0.31$ and 0.35), while significant between maximum temperature and the population of *C. floridensis* ($r = 0.75$). Also, statistical analysis showed that the simple regression for changing the population of parasitoid, minimum temperature and %relative humidity and the mean number of *Ceroplastes floridensis* were non-significant ($b = 0.41, 0.42,$ and 0.39), while significant between maximum temperature and the population of *C. floridensis* ($b = 0.79$).

2. On *Ceroplastes rusci* (Linnaeus)

The parasitoid, *S. caerulea* was recorded for the first time associated with *Ceroplastes rusci* by Morsi (1999). The parasitoid *S. caerulea* which associated with *C. rusci* infested citrus in Beni-Suef. The maximum parasitism rate reached 1.1 and 1.3 % during the first and second years, respectively (Fig.2). While average parasitism rates was 0.4 and 0.3 % during the first and second years, respectively.

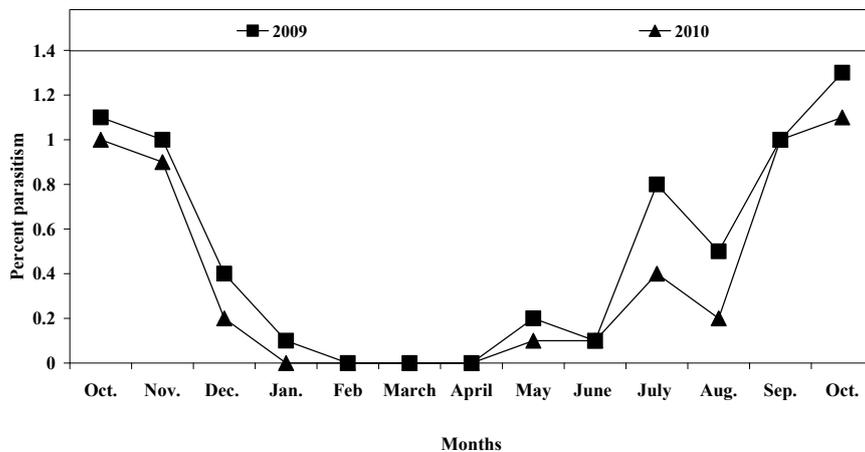


Fig.(2): Percent parasitism by *Scutellista caerulea* associated with *Ceroplastes rusci* on citrus in Beni-Suef during 2009 and 2010.

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid and the mean number of *Ceroplastes rusci* were non-significant ($r = 0.32$), while significant between maximum, minimum temperature and %relative humidity and the population of *Ceroplastes rusci* ($r = 0.83, 0.78$ and 0.79). Also, Statistical analysis showed that the simple regression for changing the population of parasitoid and the mean number of *Ceroplastes rusci* were non-significant ($b= 0.26$), while significant between maximum, minimum temperature and %relative humidity and the population of *Ceroplastes rusci* ($b = 0.81, 0.77$ and 0.75). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid and the mean number of *Ceroplastes rusci* were non-significant ($r = 0.19$), while significant between maximum, minimum

temperature and %relative humidity and the population of *Ceroplastes rusci* ($r = 0.75$, 0.71 and 0.72). Also, Statistical analysis showed that the simple regression for changing the population of parasitoid and the mean number of *Ceroplastes rusci* were non-significant ($b = 0.21$), while significant between maximum, minimum temperature and %relative humidity and the population of *C. floridensis* ($b = 0.79$, 0.72 and 0.74).

3. On *Coccus hesperidum* L.

The parasitoid *S. caerulea* was recorded for the first time associated with *C. hesperidum* by Abd-Rabou (2010). The parasitoid *S. caerulea* which associated with *C. hesperidum* infested guava in Giza. The maximum parasitism rate reached 4.1 and 2.1% during the first and second years, respectively (Fig.3). While average parasitism rates was 1.4 and 0.7 % during the first and second years, respectively.

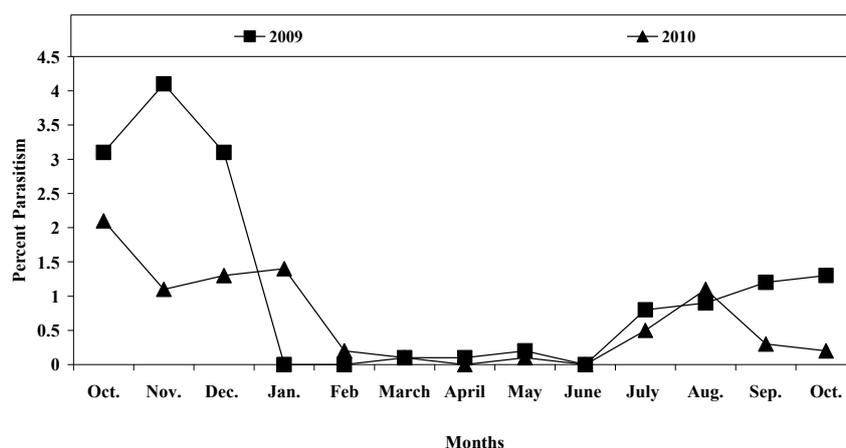


Fig.(3): Percent parasitism by *Scutellista caerulea* associated with *Coccus hesperidum* on guava in Giza during 2009 and 2010.

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid and %relative humidity and the mean number of *Coccus hesperidum* were non-significant ($r = 0.41$ and 0.32), while significant between maximum, minimum temperature and the population of *C. hesperidum* ($r = 0.80$ and 0.85). Also, Statistical analysis showed that the simple regression for changing the population of parasitoid, %relative humidity and the mean number of *C. hesperidum* were non-significant ($b = 0.40$, and 0.28), while significant between maximum, minimum temperature and the population of *C. hesperidum* ($b = 0.77$ and 0.75). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid, %relative humidity and the mean number of *Coccus hesperidum* were non-significant ($r = 0.21$, and 0.26), while significant between maximum, minimum temperature and the population of *C. hesperidum* ($r = 0.75$ and 0.78). Also Statistical analysis showed that the simple regression for changing the population of parasitoid, %relative humidity and the mean number of *C. hesperidum* were non-significant ($b = 0.31$ and 0.32), while significant between maximum, minimum temperature and the population of *C. hesperidum* ($b = 0.71$ and 0.74).

4. On *Kilifa acuminata* (Signoret)

The parasitoid, *S. caerulea* was recorded for the first time associated with *K. acuminata* by Abd-Rabou and Hafez, (2001). The parasitoid *S. caerulea* which associated with *K. acuminata* infested mango in Sharqiya. The maximum parasitism rate reached 1.1 and 0.9% during the first and second years, respectively (Fig.4). While average parasitism rates was 0.2% during the first and second years, respectively. In the first year 2008-2009, statistical analysis showed that the simple

correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Kilifa acuminata* were non-significant ($r = 0.37, 0.29, 0.38$ and 0.35).

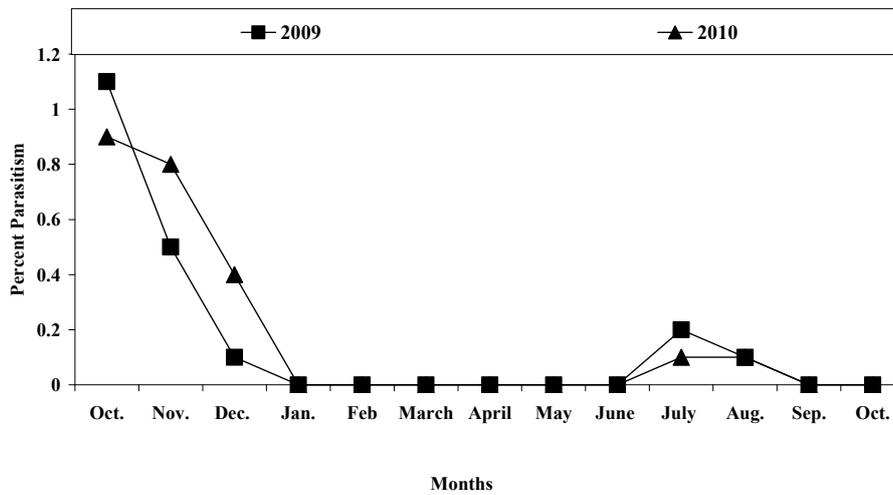


Fig.(4): Percent parasitism by *Scutellista caerulea* associated with *Kilifa acuminata* on mango in Sharqiyah during 2009 and 2010.

Also, Statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *K. acuminata* were ($b= 0.42, 0.32, 0.34$ and 0.28) . In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Kilifa acuminata* were non-significant ($r = 0.32, 0.21, 0.26,$ and 0.29). Also, Statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *K. acuminata* were ($b= 0.31, 0.24, 0.28$ and 0.32).

5. On *Parasaissetia nigra* (Nietner)

The parasitoid, *S. caerulea* was recorded for the first time associated with *P. nigra* by Priesner and Hosny (1940). The parasitoid *S. caerulea* which associated with *P. nigra* infested mango in Ismailia. The maximum parasitism rate reached 0.4 and 0.2% during the first and second years, respectively (Fig.5). While average parasitism rates was 0.8 and 0.4 % during the first and second years, respectively.

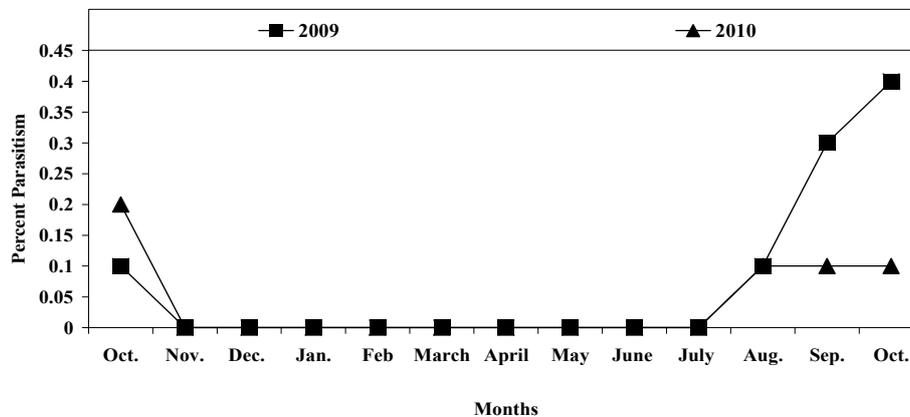


Fig.(5): Percent parasitism by *Scutellista caerulea* associated with *Parasaissetia nigra* on mango in Ismailia during 2009 and 2010.

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Parasaissetia nigra* were non-significant ($r = 0.25, 0.27, 0.26$ and 0.32). Also, statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Parasaissetia nigra* were ($b = 0.31, 0.27, 0.29$ and 0.26). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Parasaissetia nigra* were non-significant ($r = 0.44, 0.31, 0.29$ and 0.36). Also, statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Parasaissetia nigra* were ($b = 0.41, 0.36, 0.29$ and 0.31).

6. On *Saissetia coffeae* (Walker)

The parasitoid, *S. caerulea* was recorded for the first time associated with *S. coffeae* by Priesner and Hosny (1940). The parasitoid *S. caerulea* which associated with *S. coffeae* infested olive in Marsa Matruh. The maximum parasitism rate reached 6.4 and 7.1 % during the first and second years, respectively (Fig.6). While average parasitism rates was 1.6 and 1.9 % during the first and second years, respectively.

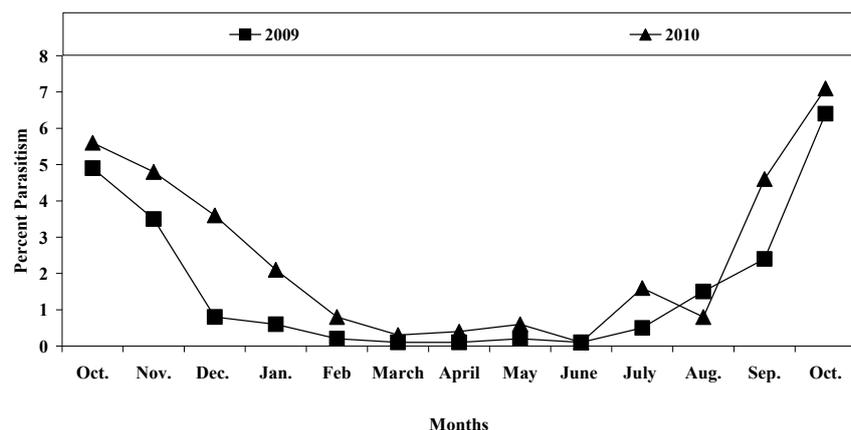


Fig.(6): Percent parasitism by *Scutellista caerulea* associated with *Saissetia coffeae* on olive in Marsa Matruh during 2009 and 2010.

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid, minimum temperature, %relative humidity and the mean number of *Saissetia coffeae* were non-significant ($r = 0.43, 0.31,$ and 0.27), respectively, while significant between maximum temperature and the population of *S. coffeae* ($r = 0.86$). Also, statistical analysis showed that the simple regression for changing the population of parasitoid, minimum temperature, %relative humidity and the mean number of *Saissetia coffeae* were ($b = 0.28, 0.47$ and 0.25), while significant between maximum temperature and the population of *S. coffeae* ($b = 0.81$). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid, minimum temperature, %relative humidity and the mean number of *Saissetia coffeae* were non-significant ($r = 0.37, 0.41$ and 0.29), respectively, while significant between maximum temperature and the population of *S. coffeae* ($r = 0.77$). Also, statistical analysis showed that the simple regression for changing the population of parasitoid, minimum temperature, %relative humidity and

the mean number of *Saissetia coffeae* were ($b = 0.33, 0.39$ and 0.28), while significant between maximum temperature and the population of *S. coffeae* ($b = 0.79$).

7. On *Saissetia oleae* (Oliver)

The parasitoid, *S. caerulea* was recorded for the first time associated with *S. oleae* by Abd-Rabou (2004). The parasitoid, *S. caerulea* which associated with *S. oleae* infested olive in Northern Coast. The maximum parasitism rate reached 38.2 and 40.9 % during the first and second years, respectively (Fig.7). While average parasitism rates was 21.3 and 23.5 % during the first and second years, respectively.

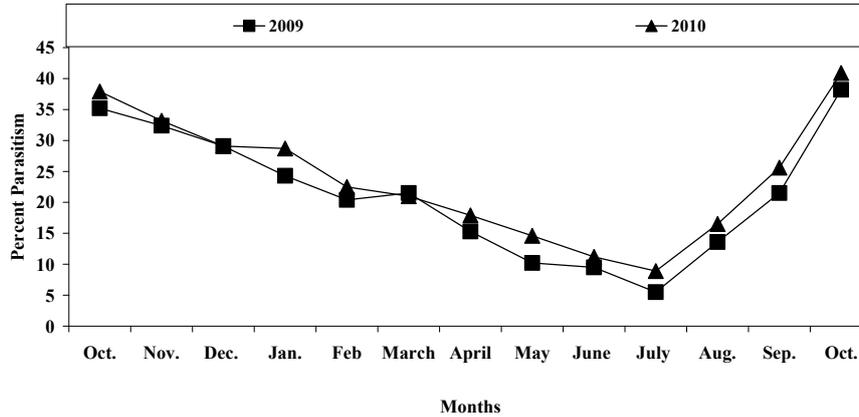


Fig.(7): Percent parasitism by *Scutellista caerulea* associated with *Saissetia oleae* on olive in Northern Coast during 2009 and 2010

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Saissetia oleae* were significant ($r = 0.79, 0.93, 0.77$ and 0.82), respectively. Also, statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Saissetia oleae* were ($b = 0.76, 0.89, 0.74$ and 0.81). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Saissetia oleae* were significant ($r = 0.79, 0.91, 0.76$ and 0.77), respectively. Also, statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *Saissetia oleae* were ($b = 0.72, 0.83, 0.79$ and 0.78).

8. On *Waxiella mimosae* (Signoret)

The parasitoid, *S. caerulea* was recorded for the first time associated with *W. mimosae* by Priesner and Hosny (1940). The parasitoid *S. caerulea* which associated with *W. mimosae* infested sunt in Qena. The maximum parasitism rate reached 0.6 and 1.1 % during the first and second years, respectively (Fig.8). While average parasitism rates was 0.1 during the first and second years, respectively.

In the first year 2008-2009, statistical analysis showed that the simple correlation between the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *W. mimosae* were non-significant ($r = 0.35, 0.29, 0.34$ and 0.26), respectively. Also, statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *W. mimosae* were non-significant ($b = 0.23, 0.37, 0.36$ and 0.29). In the second year 2009-2010, statistical analysis showed that the simple correlation between the population of parasitoid,

maximum, minimum temperature, %relative humidity and the mean number of *mimosae* were non-significant ($r = 0.31, 0.35, 0.34$ and 0.22), respectively. Also, statistical analysis showed that the simple regression for changing the population of parasitoid, maximum, minimum temperature, %relative humidity and the mean number of *mimosae* were non-significant ($b = 0.32, 0.39, 0.30$ and 0.24) during 2009 and 2010 years, respectively.

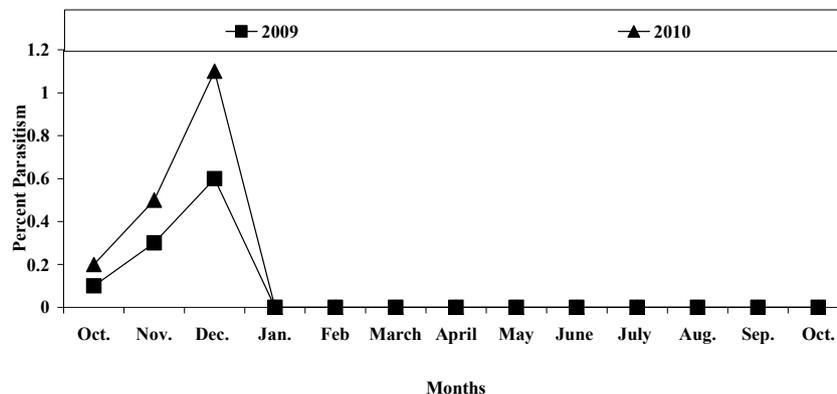


Fig.(8): Percent parasitism by *Scutellista caerulea* associated with *Waxiella mimosae* on sunt in Qena during 2009 and 2010

This parasitoid was recorded in Egypt by Priesner and Hosny (1940) associated with *W. mimosae* on *Acacia nilotica*, *Albizia lebbek*, *Ficus carica*, also *P. nigra* on *Ficus sycamorus* and *S. coffeae* on olive in Lower and Upper Egypt. El-Minshawy and Saad (1977) mentioned that *S. caerulea* (*Scutellista cyanea* Motsch) was the most important enemy attacking *S. coffeae* and recorded in 33.9, 42.0 and 30.5 during its peaks during the periods under investigation in Alexandria. Abu El-Khair (1978) stated that the activity of the parasitoid *S. caerulea* found to be associated with the occurrence of the gravid females of the first generation during the period from March to May and those of the second generation during October. The efficacy of the parasitoid *S. caerulea* on *S. coffeae*, *S. oleae* and *C. floridensis*. This parasitoid was present on *S. coffeae* and *S. oleae* from August to November and on *C. floridensis* in March and September (El-Minshawi *et al.*, 1978). The parasitoid, *S. caerulea* associated with different species of soft scale insects in Alexandria (Abou El-Khair, 1999). Abd-Rabou (2010) recorded *S. caerulea* with other parasitoids associated with *C. rusci* in Beni-Suef. *S. caerulea* was recorded attacking *C. floridensis* infested citrus trees in Beheira governorate with an average parasitism rate 4.5% and the maximum parasitism rate was 13% (Abd-Rabou, 2001a). Later Abd-Rabou *et al.* (2003) recorded average parasitism rate of 2.0 and 3.5% during the two years under considerations, respectively. Maximum rate of parasitism was estimated to be during mid June and early June as 5.5 and 11.1, respectively. This parasitoid was reared from *K. acuminata*, with an average parasitism rate 1.8% (Abd-Rabou and Hafez, 2001). Later, Abd-Rabou (2004) mass reared and released the parasitoid at monthly intervals in olive groves infested with *S. oleae* at three localities in Egypt and percentages of parasitism increased after releasing from 14 to 35%. Abd-Rabou (2001b) studied the dynamic of the hemispherical scale, *S. coffeae* in Alexandria. The abundance of the parasitoids attacking *C. floridensis*. He recorded eight primary parasitoids including *S. caerulea* (Abd-Rabou, 2001a). Abd-Rabou and Hafez (2001) recorded five parasitoid associated with *K. acuminata* including also, *S. caerulea*.

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ARABIC SUMMARY

دور طفيل أسكيوتيلستا كاريولى فى المكافحة البيولوجية للحشرات القشرية الرخوة فى مصر

هدى بدارى- شعبان عبد ربه
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة

يعتبر طفيل أسكيوتيلستا كاريولى من أهم الطفيليات المؤثرة فى المكافحة البيولوجية للحشرات القشرية الرخوة. تم فى هذا العمل دراسة دور هذا الطفيل فى المكافحة البيولوجية للحشرات القشرية الرخوة فى مصر أثناء الفترة من ٢٠٠٩-٢٠١٠. قد أظهرت النتائج أن طفيل أسكيوتيلستا كاريولى وجد مصاحب ل ٨ أنواع من الحشرات القشرية الرخوة وهى

Ceroplastes floridensis Comstock *Ceroplastes rusci* (Linnaeus), *Coccus hesperidum* L., *Coccus longulus* (Douglas), *Kilifa acuminata* (Signoret), *Parasaissetia nigra* (Nietner), *Saissetia coffeae* (Walker), *Saissetia oleae* (Oliver) and *Waxiella mimosae* (Signoret).

وقد تم دراسة التوزيع الموسمى لنفس الطفيل اثناء الفترة من ٢٠٠٩-٢٠١٠ على الأنواع سابقة الذكر فى ثمانية محافظات وهى بنى سويف و الغربية و الجيزة و الأسماعيلية و قنا و مرسى مطروح و الساحل الشمالى و الشرقية. وقد سجل أعلى درجة تطفل ٣٨.٢ و ٤٠.٩ % مصاحبة لحشرة الزيتون الرخوة وأن متوسط نسب التطفل قد وصلت الى ٢٣.٥ و ٢١.٣ % . ومن النتائج يتضح ان طفيل أسكيوتيلستا كاريولى من الطفيليات الهامة فى مكافحة الحشرات القشرية الرخوة مصر.