



**PRESENCE AND INFESTATION OF THE PARASITOID  
FLY, *SENOTAINIA TRICUSPIS* (MEIGEN) (DIPTERA,  
SARCOPHAGIDAE) OF HONEY BEES IN SULTANATE  
OF OMAN**

*Eshbah, H. M.<sup>(1)</sup>, A. A. Mohamed<sup>(1)</sup> and Q. R. Al Shmmaki<sup>(2)</sup>*

<sup>(1)</sup>Plant Prot. Dept., Fac. of Agric. Minia Univ. Egypt

<sup>(2)</sup>Res. Stat. of honeybees at Rostq, Oman

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**ABSTRACT**

Survey was conducted in all governorates of Oman Sultanate to indicate the existence of the endoparasitoid fly (*Senotainia tricuspis*) of the honeybee *Apis mellifera* in Oman. Samples were taken from all provinces of the eleven governorates of the country and examined in Agriculture Research of honey bee Institute of Oman. The study showed that the *S. tricuspis* was found in five governorates out of the eleven governorates examined. This endoparasitoid was recorded in AL Batinah south, AL Batinah north, Al Dakhiliyah, Muscat and Ad Dhahirah. Samples from Dhofar, Al Wasta, Ashariqiya north, Ashariqiya south, Musandam and Al Buraimi were negative for infestation. We confirmed the presence of *S. tricuspis* in the mountain areas of Oman and diagnosed its existence for the first time in Oman, (GBIF Global Biodiversity Information Facility, 2016). The presence of infestation in different provinces in each governorate was varied. The highest presence (100%) was recorded in Ad Dhahirah in the three provinces followed with Ad Dakhiliyah 87.5% from eight provinces, Al Batinah south, 66.7% from six provinces, Al Batinah north 66.7% from six provinces and the least presence was in Muscat governorate 16.7% from six provinces where the infestation was appeared in one province (Qurayyat). The first appearance of infestation was recorded in February and the last observation of infestation was recorded in June for all governorates. The highest peak of infestation was recorded in March. Therefore, awareness program will be very helpful for the beekeeper sector in these governorates.

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**Key words: Honey bee, Parasitoid, Oman**

## INTRODUCTION

The presence of parasitoid dipterans in the honey bee (*Apis mellifera* L.) has long been recognized. The first fly reported to cause apimyiasis was *Rondaniooestrus apivorus* (Villeneuve, 1916), that diagnosed on the African continent (Knutson, 1978). In Europe, the most well-known parasitoid dipterans that attack the bee are belong to the *Borophaga incrassata* species (Paillot et al., 1944) of which the most commonly identified is *Senotainia tricuspis* (Meigen) whose biology has been studied by Simintzis (1949), Giordani (1955), and Boiko (1958). *S. tricuspis* was distributed throughout central and southern Europe, and has been reported in Tunisia, Northern Africa (Mathis, 1957). In addition, it recorded in Portugal (Rocha and Delgado, 1986), In Spain, high infestation levels by Dipteran throughout 1940-1949 are well known in the island of Mallorca (Ramírez Gómez, 1949).

Recently it is recognized that *S. tricuspis* (Meigen) is an endoparasitoid of the adult honeybee (Felicoli et al., 2000); Morse and Flottum, (1997). *S. tricuspis* has a length of 5–8 mm and gray-black color. Morphologically it is similar to a domestic fly; it is characterized by a light strip between the reddish compound eyes (Bedini, et al., 2006). Females of *S. tricuspis* are larviparous and attack forager honey bees flying in front of the hive. When *S. tricuspis* reaches its host, it deposits

a first instar larva on the thorax of the honey bee. Thereafter, the larva enters the body of the honey bee and develops, feeding on hemolymph and wing muscles, until it kills its host in 2–4 days (Bedini, et al. 2006). At the third instar, the last larval stadium, the larva exits from the body of the dead host. Sometimes, it can also feed on the body of the dead host as a scavenger. Then the larva enters the soil for pupation. During the late spring or summer, the adult fly emerges 7–12 days after pupation and the new generation can go forward with its own parasitic behavior. Those larvae that pupate in late summer will undergo diapause until next spring when the adults emerge (Bailey & Ball, 1991). Attacks can be repeated every 10 sec. during the sunset hours of the day. Each female has 600–700 larvae in its uterus and thus has the potential to kill hundreds of honey bee (Bedini, et al., 2006). It causes apimyiasis which can sometimes be quite serious. This parasitoid is more frequent in sunny and warm regions. Recently, Haddad et al. (2015) showed that *S. tricuspis* was present in four out of the seven countries sampled i.e. Jordan, Algeria, Italy and was recorded in Egypt for the first time. Whereas, samples from Iraq, Lebanon, and Palestine were negative. They concluded the presence of *S. tricuspis* in the southern and western areas of the Mediterranean regions. Also, it is recorded in Mediterranean countries (Spain, Rumania, Italy, Tunisia, etc.)

(Orantes and Fernández, 1996). This pest has not been recorded before in Oman (Gbif, 2016). The aim of this work was to survey the prevalence and existence of *S. tricuspis*. (Diptera, Sarcophagidae) and to estimate its infestation percent and potential danger peaks in apiaries in Al Batinah south governorate through two successive years.

#### MATERIALS AND METHODS

Larvae of the honeybee parasitoid were reared and the adults were identified in the Lander Institute fur Bienkune Hoben Neuendorf (Prof. Dr. Kaspar Bienfeld) as *Senotainia tricuspis* (Meigen). However, for the monitoring of *S. tricuspis*, 732 samples were collected from 61 provinces that belong to eleven governorates in February, March, April and June during 2015 season. Honeybee worker samples were collected from three randomly chosen hives of each apiary. Each sample represented one apiary and contained at least 30 foraging bees. Also the same number was taken from the house bees. Three hives / province were selected according to the beekeepers complaints of unexplained colony depopulation. The bees were kept in a closed glass jar of 500 ml volume. The jar was closed with a net to allow air exchange for the breathing of the bees and each Jar was furnished with a small amount of wet sandy soil. Then, the collected honey bees were observed for 72hr and eventual specimens of *S. tricuspis* larvae were counted and removed.

Removal of *S. tricuspis* larvae is necessary to avoid the behavior of cannibalism, which is known with *S. tricuspis* larvae (Pinzauti and Santini, 1995). The infestation rate among samples was calculated according to the formula: (number of positive samples/ total number of samples in each provinces) x100. Samples were taken from all provinces of all governorates and examined in the laboratory where the samples that contained larvae of the fly were considered as positive samples. From the province Al Rustaq and from Al Batinah south, samples were taken weekly from January 2015 until December 2016 to determine the percent of infestations and the peaks of infestation through the year. The percent of infestation were determined in eight apiaries. Samples of honey bee workers were collected from each apiary from three randomly chosen hives. Each sample represented one apiary and contained 30 foraging bees and transferred to laboratory. Bees were examined individually in search of dipteran larvae. The thorax of each bee was cut and pressing on the thorax area and the haemolymph was examined (Astolfi, 2001). The percent of infestation from each bee sample was then calculated according to the formula: (number of infested bees which contain *S. tricuspis* larvae / number of collected bees) x100. (Pinzauti and Santini, 1995). Statistical analysis, L.S.D. between means (Keppel, 1991).

## RESULTS AND DISCUSSION

The survey conducted in 61 provinces during 2015 season indicated that infestations with the fly were distributed throughout five regions in Oman out of the eleven governorates examined. This endoparasite was recorded in Al Batinah south (in the provinces Nakhal, Wadi Al Maawil, AL Awabi and AL Rustaq), Al Batinah north (in the provinces Sohar, Saham, Al Kahaburah, As Suwayq), Al Dakhiliyah (in the provinces Nizwa, Samail, Bahla, Adam, Al Hamra, Izki, and Bidbid), Muscat (in only one province Qurayyat) and Ad Dhahirah (in provinces Ibri, Yanqul and Dhank). Samples from governorates Dhofar, Al Wusta, Ashariqiyah north, Ashariqiyah south, Musandam and Al Buraimi were negative for infestation in the two years of study. In Table (1) the highest infestation rate (100%) was observed in Ad Dhahirah Governorate where infestation appeared in all samples, whereas, the Muscat governorate presented the lowest rate of prevalence (16.7%) where infestation was recorded in only one province through the two successive years. Considering the month effect, the higher prevalence was found in March (90.27 and 86.35%) and in April (85.28 and 80.81% of the positive samples) in 2015 and 2016 seasons, respectively. The least infestation percentages were appeared in May and February while the infestation was disappeared in all apiaries from June until January. This disappearance in months of summer and autumn may be due to the high

temperature (40-55C°), therefore, the biology of this parasite in Oman should be studied in the future.

Statistical analysis as shown in Tables (2 and 3) showed that there were highly significant differences between months infestation thus the infestation percent of this parasite affected with weather factors in Oman. No infestations were observed in all samples taken from house bees as shown in Table (1). This parasite was recorded in different countries worldwide (Pires *et al.* 2011) where the flies were distributed throughout all Portuguese regions, Azores region presented the lowest rate of prevalence (2.1%) and the higher prevalence was found in July (30%) and in September (31%). The same author indicated that increase of the fertilized females coinciding with the height of summer (last ten days of July -The end of August) our results in March and April. (Piazza, and Marinelli, 2000) investigated the presence of the endoparasitoid fly (*S. tricuspis*) of honey bees in Latium, Italy, during 1997-99 in 5 provinces with 28 stations distributed in littoral and inland zones. Their study showed that the presence of *S. tricuspis* was observed in all the apiaries situated in littoral areas with significantly higher percentage than the inland ones. In addition, they indicated that *S. tricuspis* prefers sunny places with sandy soil wet which are more suitable for pupation and overwintering of the larvae. This parasitoid also appeared on the African countries (Knutson, 1978). In Europe, the most commonly

flies identified was *tricuspis* (Meigen), 1841, whose biology has been studied by Simintzis (1949), Giordani (1955), and Boiko (1958). Also, *S. tricuspis* is distributed throughout central and southern Europe, and had been reported in Tunisia, Northern Africa (Mathis, 1957). It was also recorded in Portugal (Rocha and Mira Delgado,

1986), where it appeared during September, in contrast to France, where the highest levels of parasitization occur during August (Simintzis and Fiasson, 1951). The appearance of the fly differed from one country to other thus it should be study the effect of weather factors on the infestation percent.

Table (1): Survey of the parasitoid fly *Senotainia tricuspis* (Meigen) infesting honeybee (*Apis mellifera yemenitica*) in Sultanate of Oman during 2015 season.

| Governorate       | Provinces                | Infestation in |               | Infested provinces % |
|-------------------|--------------------------|----------------|---------------|----------------------|
|                   |                          | House bees     | Foraging bees |                      |
| Al Batinah South  | Nakhla                   | -              | +             | 66.7                 |
|                   | Wadi Al Maawil           | -              | +             |                      |
|                   | Al Awabi                 | -              | +             |                      |
|                   | Al Musaanaah             | -              | -             |                      |
|                   | Barka                    | -              | -             |                      |
| Dhofar            | Al Rustaq                | -              | +             | 0                    |
|                   | Salalah                  | -              | -             |                      |
|                   | Taqah                    | -              | -             |                      |
|                   | Mirbat                   | -              | -             |                      |
|                   | Thumarit                 | -              | -             |                      |
|                   | Sadha                    | -              | -             |                      |
|                   | Rakhyut                  | -              | -             |                      |
|                   | Dhalkut                  | -              | -             |                      |
|                   | Muqshin                  | -              | -             |                      |
|                   | Shaalim an the Halaniyat | -              | -             |                      |
| Al Mazyona        | -                        | -              |               |                      |
| Al Wusta          | Haima                    | -              | -             | 0                    |
|                   | Duqim                    | -              | -             |                      |
|                   | Mahout                   | -              | -             |                      |
|                   | Aljazar                  | -              | -             |                      |
| Ashariqiyah north | Ibra                     | -              | -             | 0                    |
|                   | Al Mudhaibi              | -              | -             |                      |
|                   | Bidiyah                  | -              | -             |                      |
|                   | Wadi Bani Khled          | -              | -             |                      |
|                   | Dema WaThaieen           | -              | -             |                      |
|                   | AlQabil                  | -              | -             |                      |

Table (1): Continue

| Governorate       | Provinces        | Infestation in |               | Infested provinces % |
|-------------------|------------------|----------------|---------------|----------------------|
|                   |                  | House bees     | Foraging bees |                      |
| Ashariqiyah South | Masirah          | -              | -             | 0                    |
|                   | Sur              | -              | -             |                      |
|                   | JalanBani Bu Ali | -              | -             |                      |
|                   | AlKamil Wal      | -              | -             |                      |
|                   | Wafi             | -              | -             |                      |
| Musandam          | Khassab          | -              | -             | 0                    |
|                   | Bukha            | -              | -             |                      |
|                   | Daba AlBayah     | -              | -             |                      |
|                   | Madha            | -              | -             |                      |
| Muscat            | Muscat           | -              | -             | 16.7                 |
|                   | Muttrah          | -              | -             |                      |
|                   | Bawshar          | -              | -             |                      |
|                   | Seeb             | -              | -             |                      |
|                   | AlAmerat         | -              | -             |                      |
|                   | Qurayyat         | -              | +             |                      |
| Ad Dakhiliyah     | Nizwa            | -              | +             | 87.5                 |
|                   | Samail           | -              | +             |                      |
|                   | Bahla            | -              | +             |                      |
|                   | Adam             | -              | +             |                      |
|                   | Al Hamra         | -              | +             |                      |
|                   | Manah            | -              | -             |                      |
|                   | Izki             | -              | +             |                      |
|                   | Bidbid           | -              | +             |                      |
| Ad Dhahirah       | Ibri             | -              | +             | 100                  |
|                   | Yanqul           | -              | +             |                      |
|                   | Dhank            | -              | +             |                      |
| Al Bhatinah North | Sohar            | -              | +             | 66.7                 |
|                   | Shinas           | -              | -             |                      |
|                   | Liwa             | -              | -             |                      |
|                   | Saham            | -              | +             |                      |
|                   | Al Kahaburah     | -              | +             |                      |
|                   | As Suwayq        | -              | +             |                      |
| AlBuraimi         | Al Buraimi       | -              | -             | 0                    |
|                   | Mahdah           | -              | -             |                      |
|                   | Al Sinaina       | -              | -             |                      |

Table (2): Infestation percentages of parasitoid fly (*Senotainia tricuspis*) in south Al Batinah governorate, Sultanate of Oman during 2015 season.

| Apiary No | Infestation % |                 |                 |                 |                 |      | *LSD |
|-----------|---------------|-----------------|-----------------|-----------------|-----------------|------|------|
|           | Jan.          | Feb.            | Mar.            | Apr.            | May             | Jun. |      |
| 1         | 0             | 74.03           | 93.98           | 88.96           | 76.08           | 0    | 9.97 |
| 2         | 0             | 79.23           | 87.68           | 85.83           | 62.96           | 0    | 9.97 |
| 3         | 0             | 66.55           | 95.77           | 89.21           | 73.39           | 0    | 9.97 |
| 4         | 0             | 59.19           | 93.33           | 90.57           | 64.93           | 0    | 9.97 |
| 5         | 0             | 59.99           | 96.66           | 78.61           | 61.35           | 0    | 9.97 |
| 6         | 0             | 62.94           | 91.26           | 88.40           | 72.08           | 0    | 9.97 |
| 7         | 0             | 61.54           | 86.87           | 82.15           | 52.29           | 0    | 9.97 |
| 8         | 0             | 79.04           | 76.66           | 78.55           | 56.26           | 0    | 9.97 |
| Mean      |               | 67.81 +<br>8.41 | 90.27 +<br>6.53 | 85.28 +<br>4.87 | 64.91 +<br>8.44 |      |      |

\*L.S.D. Least significant differences between means.

Table (3): Infestation percentages of parasitoid fly (*Senotainia tricuspis*) in south Al Batinah governorate, Sultanate of Oman during 2016 season.

| Apiary No | Infestation % |                 |                 |                 |                  |      | *LSD  |
|-----------|---------------|-----------------|-----------------|-----------------|------------------|------|-------|
|           | Jan.          | Feb.            | Mar.            | Apr.            | May              | Jun. |       |
| 1         | 0             | 77.94           | 85.69           | 75.63           | 82.64            | 0    | 24.68 |
| 2         | 0             | 88.33           | 97.5            | 90.5            | 33.39            | 0    | 24.68 |
| 3         | 0             | 63.60           | 94.16           | 70.11           | 75               | 0    | 24.68 |
| 4         | 0             | 18.26           | 60.41           | 66.74           | 20.83            | 0    | 24.68 |
| 5         | 0             | 64.49           | 95.83           | 88.33           | 31.66            | 0    | 24.68 |
| 6         | 0             | 44.91           | 84.01           | 86.90           | 62.42            | 0    | 24.68 |
| 7         | 0             | 78.90           | 85.83           | 81.66           | 73.30            | 0    | 24.68 |
| 8         | 0             | 64.49           | 87.44           | 86.66           | 74.04            | 0    | 24.68 |
| Mean      |               | 62.61 +<br>22.2 | 86.35 +<br>11.4 | 80.81 +<br>8.95 | 56.66 +<br>24.12 |      |       |

\*L.S.D. Least significant differences between means.

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تواجد وإصابة نحل العسل بالذبابة المتطفلة  
*Senotainia tricuspis* (Meigen) (Diptera, Sarcophagidae)  
في سلطنة عمان

حصافي محمد عشبة<sup>(1)</sup>، عبد السلام أنور محمد<sup>(1)</sup>، قاسم بن راشد بن حميد الشماخي<sup>(2)</sup>

<sup>(1)</sup> قسم وقاية النبات، كلية الزراعة، جامعة المنياو مصر  
<sup>(2)</sup> محطة بحوث النحل، سلطنة عمان

تم عمل حصر للذبابة المتطفلة (*Senotainia tricusps*) على نحل العسل في مناطق محافظات سلطنة عمان. تم اخذ العينات من جميع الولايات لكل محافظة من المحافظات الإحدى عشر وفحصت العينات في مختبر بحوث النحل بسلطنة عمان وبفحص العينات استخرجت يرقات الذبابة من اجسام النحل المصاب حيث تم تربيتها للوصول للطور الكامل والذي تم ارسالة للأستاذ الدكتور كاسبر بينفيلد في معهد Bienkune Hoben Neuendorf والذي قرر الاسم العلمي (*Senotainia tricuspis* (Meigen)). وضحت الدراسة تواجد هذه الذبابة في خمس محافظات من الإحدى عشر محافظة التي تم فحصها وهي جنوب الباطنة - شمال الباطنة - الداخليه - مسقط - الظاهره. ولقد اوضحت الدراسة وجود هذه الذبابة المتطفلة في المناطق الحجرية في عمان حيث تم تسجيلها لأول مرة. ولقد تباينت الإصابة بين ولايات كل محافظة حيث كانت أعلى نسبة إصابة (100%) في الولايات الثلاثة لمحافظة الظاهره وتبعها ولايات الداخليه بنسبة 87.5% وقد سجلت فيها إصابة في ثلاث ولايات من أربع ولايات من المحافظة. أما محافظتي جنوب الباطنة وشمال الباطنة قد سجلت الإصابة في أربع ولايات من ستة ولايات لكل محافظة بنسبة إصابة 66.7%. وكانت اقل نسبة إصابة في ولايات محافظة مسقط حيث بلغت 16.7% وكانت الإصابة في ولايه واحد فقط من ست ولايات وهو ولاية قريات. ولقد سجلت بداية الإصابة الفعلية في الولايات التابعة للمحافظات المذكوره اعلاه ابتداء من شهر فبراير واستمرت حتى نهاية يونيو وذلك في جميع المحافظات وكانت أعلى إصابة في شهر مارس. وبالتالي توعية النحالين في هذه الولايات ضروري جدا.

الكلمات المفتاحية: نحل العسل - طفيل - سلطنة عمان