

Distribution patterns of *Varroa jacobsoni* Oud on *Apis mellifera* L during winter in Argentina

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(Received 15 September 1991; accepted 10 March 1993)

Summary — The distribution of *Varroa jacobsoni* on *Apis mellifera* was determined during winter in Argentina. In contrast to previous reports, 98% of mites were localized on the ventral abdomen. *Varroa* mites showed a significant preference for the left side.

***Varroa jacobsoni* / phoretic behavior / host-parasite relationship / Argentina**

INTRODUCTION

The mite *Varroa jacobsoni* is an ectoparasite of the honey bee that remains on the adult bee during most of its life cycle and penetrates into the brood cells for reproduction. The localization of the parasite on the bee has been observed by Ritter (1981), who found the majority of mites among the first abdominal sternites, between the head and thorax or between the thorax and the abdomen. The distribution of the mite on pollen-collecting bees was investigated by Kraus *et al* (1986) who reported a preference for the dorsal region.

In the following study investigated the distribution we of *Varroa* on pollen-collecting honey bees from Buenos Aires Province, Argentina.

MATERIALS AND METHODS

Collections were made every fortnight during June, July and August 1988 at an apiary in Copetonas, Tres Arroyos County, Province of Buenos Aires.

Average temperatures during winter are 8.5°C, average minimum 4°C and average maximum 13°C. There are *Eucalyptus* spp and *Myoporum* spp blooms, which allow the bees to produce worker brood cells during the whole season.

Samples were taken from 5 hives. Entrances were closed and each bee that arrived carrying pollen was picked individually, selected and the number and localization of all mites were recorded. Following this, each bee was killed in a cyanide chamber and the parasites again counted (to verify the previous record). In a few cases, the mite dropped off the bees onto the bottom of the chamber. However, these mites were included in the total values since they had

been counted before falling off. This happened only occasionally with parasites which were in the dorsal position.

To determine the position of the mite on the host, the abdomen was divided into dorsal and ventral regions. Furthermore, each of these was divided into 3 zones: anterior, established by the 2nd and 3rd tergite/sternite; middle, by the 4th and 5th tergite/sternite and posterior, by the 6th and 7th tergite/sternite. The right side of the bee was also differentiated from the left side in the 3 zones.

Whenever the mites were between 2 sternites, their position was counted as being on the anterior of the sternites.

χ^2 test was used to determine significant differences in distribution patterns.

RESULTS

Of the 7 508 bees sampled, 951 were parasitized by *Varroa jacobsoni* females. Among the total number of bees recorded, the number of mites per host varied from 1 to 3. 92.7% of the infested bees had only 1 mite on their bodies, while 7% showed 2 mites. Three mites were rarely present on a single bee (0.3%) (fig 1).

On the bees with 2 or more mites, the latter were found in diverse positions, *ie*: one mite next to another on the same ventral zone and on the same side (7%); one in a ventral and the other in a dorsal position (15%); on different ventral zones (61%); and on the same zone, but with one on each side (17%).

All mites were found on the host's abdomen, and a marked preference was observed for the ventral position (98%). The mites that were in the dorsal position were always found in the anterior zone of the abdomen.

The mites found on ventral positions showed a significant preference for the middle and anterior zones (51 and 46%, respectively) compared to the posterior zone (3%) (χ^2 , $P < 0.05$) (fig 2). In these

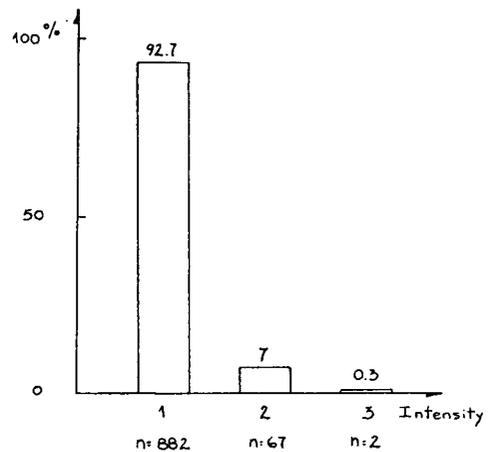


Fig 1. Relative frequencies of the different intensities of *Varroa jacobsoni* on pollen-collector bees.

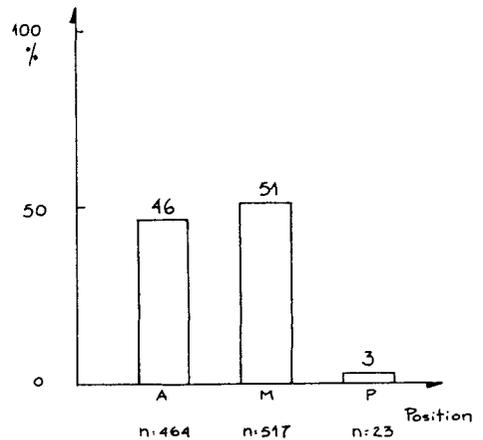


Fig 2. Relative frequencies of *Varroa jacobsoni* on the ventral abdomen of pollen collector bees. A: anterior zone; M: middle zone; P: posterior zone.

zones, the mites were distributed in a greater proportion on the left side of the bee (χ^2 , $P < 0.05$) (fig 3).

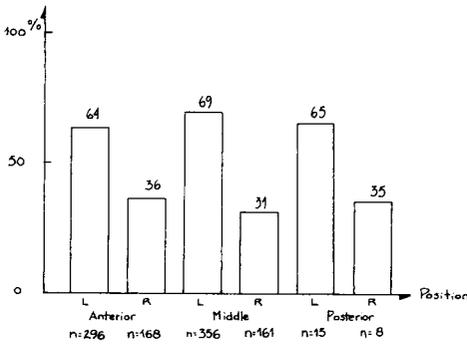


Fig 3. Relative frequencies of *Varroa jacobsoni* on anterior, middle and posterior zones. L: left side; R: right side.

DISCUSSION

It is known that *Varroa jacobsoni* is able to recognize bees of different ages and to adopt different positions on the bees. Kraus *et al* (1986) showed that during summertime *Varroa* is distributed on the dorsal region of the abdomen and thorax (51%), the zone between the thorax and abdomen (35%), with a lower proportion (14%) found on the ventral region of the abdomen.

In contrast to this diverse distribution, we found that during winter in temperate Argentina, mites were found exclusively on the abdomen of the bees. Furthermore, 98% occupied a ventral position.

According to Le Conte and Arnold (1988) the localization of *Varroa* on the bee is influenced by the ambient temperature. They found that at high temperatures < 3.5% *Varroa* were found on the thorax, a known heat-producing organ in the worker bee. When the temperature was low, the number of mites on the thorax was found to increase 7-fold. According to Hoppe and Ritter (1988), another factor which explains the different localization of mites on bees

is the strong repellent effect of the Nasanov secretion. Therefore the mite is found more frequently between the head and thorax of older bees, since they produce a high secretion from the gland. In nurse bees, however, the mite remains more frequently on the abdominal sternites.

In contrast, Kraus *et al* (1986) suggest that the position between the thorax and the abdomen and also between the head and the thorax seem to be specially protected and might represent a transport position which may be safe during the bees' flight, while the position on the thorax and abdomen may signify an imminent change of host. The position between the abdominal sternites may indicate a preferred position from a nutritional standpoint.

Our results are at variance to those previously reported, since we found that pollen-collector bees, old enough to have a strong secretion of the Nasanov glands, and under cool temperature-winter conditions had mites settled in abdominal positions in 98% of cases. The reasons for this discrepancy with previous reports is unknown; however, there may exist a seasonal difference in the position that *Varroa* occupies on the host. Concerning this fact Ritter *et al* (1989), found that in a winter cluster of *Apis mellifera carnica* most mites were present within the abdominal sclera of each bee. The latter authors suggest that continuous changes of host may signify a limitation in their own intake of nutrients and great waste of energy. These differences might reflect a change in the phoretic behavior of the mite in cold weather, resulting from a greater need for nutrition on the adult bee.

The selection of different-aged bees and the variation in positions which the mite adopts on them suggests a high selectivity on the part of the parasite during the important phase when the mite remains outside the brood cells. The mite's

preference for the left side of the host cannot be explained at present. We are currently continuing investigation in this area via morphological and histological analyses.

ACKNOWLEDGMENT

The investigation was supported by an International Foundation for Science Grant from Sweden, No B/1446-1 to NF.

Résumé — Répartition de *Varroa jacobsoni* Oud sur l'abeille *Apis mellifera* L durant l'hiver en Argentine. L'étude a eu lieu pendant l'hiver 1988 et a porté sur le nombre de varroas présents sur les abeilles et sur leur position. L'abdomen a été divisé en 3 parties, antérieure, moyenne et postérieure. Parmi les 7 508 butineuses de pollen prélevées individuellement, 951 étaient parasitées. Le nombre de varroas par abeille a varié de 1 à 3, mais 92% des abeilles n'en hébergeaient qu'un seul (fig 1). Les acariens ont montré une préférence significative pour les parties moyenne et postérieure de l'abdomen (51 et 46% respectivement, fig 2) et pour la partie gauche de l'hôte (fig 3). Nos résultats suggèrent l'existence de différences saisonnières dans la répartition du varroa sur l'abeille. Cette différence peut être due à une modification du comportement de l'acarien. Des prises de nourriture plus importantes en climat froid semblent avoir une influence sur son comportement phorétique.

***Varroa jacobsoni* / relation hôte parasite / comportement phorétique / Argentine**

Zusammenfassung — Verteilungsmuster von *Varroa jacobsoni* auf *Apis mel-*

***lifera* im Winter in Argentinien.** Die Versuche wurden in den Wintermonaten 1988 in Argentinien durchgeführt. Die Bienen wurden einzeln gefangen und, wenn sie von Milben befallen waren, wurden diese gezählt und ihre Position bestimmt. Der Hinterleib der Bienen wurde in 3 Zonen unterteilt: vorne, in der Mitte und hinten; 7 508 Bienen, die Pollen sammelten, wurden untersucht. Von diesen Bienen waren 951 parasitiert.

Die Anzahl der Milben variierte zwischen 1 und 3, aber 92% der Bienen hatten nur 1 Milbe (Abb 1).

Die Milben zeigten eine signifikante Bevorzugung für den vorderen und mittleren Teil des Hinterleibes (51 und 46%, Abb 2). Die meisten Milben befanden sich auf der linken Seite der Biene.

Unsere Ergebnisse weisen darauf hin, daß es saisonale Unterschiede in der Position der Milben auf Bienen gibt. Diese Unterschiede könnten durch eine Änderung des Verhaltens der Milben entstanden sein. Erhöhte Nahrungsaufnahme bei kühlem Wetter scheint ihr phoretisches Verhalten zu beeinflussen.

***Varroa jacobsoni* / phoretisches Verhalten / Wirt-Parasit Beziehung / Argentinien**

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