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ON THE IDENTITY OF THE TWO-SPOTTED SPIDER MITE

*TETRANYCHUS URTICAE KOCH* IN EGYPT

BY M. A. EL-ENANY 1, M. S. NAWAR 2 and M. A. ZAHER 2

**ABSTRACT**: Crossbreeding between *Tetranychus urticae* females and *T. arabicus* males as well as reversed crossing between males of the former and females of the latter resulted in giving average offspring of 77.9 and 82.8 individuals/female of which 80.2 % and 78.8 % were females in the two crossings respectively. Also crossmating between both sexes of F1 gave progeny averaging 84.7 F2 individuals/female of which 81.3 % were females. This normal number of progeny/female and egg fertilization percentage unfavoured the separation of the tested mites into two different species. In addition, morphological characters such as shape of lobes of the dorsum integumentary folds and setation of tarsus and tibia I, are similar in the two species. Size of aedeagus knob and its relation to dorsal margin of the shaft are usually similar except knob anterior projection being acute in *T. urticae* and usually narrow rounded in *T. arabicus*. This minute difference is not reliable for species separation.

**INTRODUCTION**

Members of the genus *Tetranychus* are world wide distributed and some of which are closely related species. However, several cases of confusion of two species because of close morphological agreement have been solved by biological demonstration of reproductive isolation.

In Egypt SAYED (1946) described the common spider mite as a new species *Eotetranychus cucurbitacearum* stating that it was dark to light red but sometimes greenish yellow. In 1967, ATTIAH restricted...
the name \textit{T. cucurbitacearum} (Sayed) to the red form and the name \textit{T. arabicus} n. sp. for the green form. He also mentioned that although some variations existed in the shape of the aedeagus within species, yet mating experiments showed that green mites collected from different localities in Egypt were compatible and similar result was obtained with the red mites. \textit{SABA} (1975) found that the green complex \textit{T. urticae} Koch of Morocco and Germany crossbred among themselves as well as with \textit{T. arabicus} Attiah. In Egypt, \textit{ZAHER et al.} (1981) carried out successful crossbreeding experiment between \textit{T. urticae} from Germany and the local \textit{T. arabicus} reporting to be conspecific. Yet, \textit{ATTIAH} (1986) tried to throw some doubts on the identification of the \textit{T. urticae} imported from Germany by \textit{ZAHER et al.} (1981) stating that its identity was uncertain and possibly it was \textit{T. arabicus} or else that replaced \textit{T. urticae} in that area. He claimed that the green Egyptian mite \textit{T. arabicus} is quite distinct from \textit{T. urticae} and based his suggestion on a minor morphological character.

Therefore, according to this confusion, cross-mating experiment was undertaken between identified \textit{T. urticae} Koch, from Holland and \textit{T. arabicus} Attiah from Egypt.

\section*{Methods}

The spider mite, \textit{T. arabicus} was collected from the farm of Faculty of agriculture, Cairo University in Giza, while \textit{T. urticae} was obtained from Holland through the courtesy of Dr. L. van der \textit{GEEST} and H. \textit{BOLLAND} of the Laboratory of Experimental Entomology, Amsterdam University. Members of both species were microscopically examined. An isolated culture of each was maintained in the laboratory on sweet potato leaves, cleaned carefully, examined under stereomicroscope before using and placed upside down on cotton wool soaked in water in Petri-dishes.

Twenty \textit{T. urticae} newly emerged females were confined singly to sweet potato leaves in Petri-dishes. One \textit{T. arabicus} male was introduced to each, and mating was observed in every case. This procedure was repeated twenty times in a reversed crossing scheme; males of the former with females of the latter. Copulated females were left to deposit eggs and leaves were changed whenever necessary. After hatching, the immature progeny of each female were kept in isolation till reaching adulthood then sexed and counted. Twenty individuals of each sex were employed for further mating in a reciprocal crossing scheme. This second set of matings was conducted between brothers and sisters of F$_1$.

\section*{Results and Discussion}

\textit{T. urticae} females copulated with \textit{T. arabicus} males produced both females and males in F$_1$ generation (Table 1). Of such twenty crosses the average number of females and males offspring produced per female was 68.4 and 15.5 respectively, i.e. 81.2\% of eggs gave females. The reversed twenty matings between \textit{T. urticae} males and \textit{T. arabicus} females gave both sexes in F$_1$ generation. In this case an average of 65.2 females and 17.6 males offspring was produced per female, i.e.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline
Couple & TU $\varnothing \times TA \delta$ & TU $\delta \times TA \varnothing$ & F$_1$ $\varnothing \times F_1$ $\delta$ & Offspring/\% & Sex ratio \\
\hline
\hline
1 & 54 & 16 & 73 & 18 & 62 & 14 & 80.2 \% & 4.0:1 \% \\
2 & 72 & 17 & 69 & 16 & 66 & 13 & 81.9 \% & 3.7:1 \% \\
3 & 58 & 14 & 64 & 15 & 78 & 19 & 78.8 \% & 4.3:1 \% \\
4 & 64 & 16 & 69 & 19 & 74 & 17 & 77.4 \% & 4.3:1 \% \\
5 & 66 & 17 & 67 & 21 & 68 & 17 & 78.8 \% & 4.3:1 \% \\
6 & 57 & 14 & 69 & 19 & 78 & 16 & 81.2 \% & 4.0:1 \% \\
7 & 69 & 14 & 61 & 14 & 60 & 16 & 81.9 \% & 3.7:1 \% \\
8 & 58 & 16 & 68 & 18 & 69 & 16 & 81.9 \% & 3.7:1 \% \\
9 & 58 & 16 & 76 & 21 & 66 & 14 & 80.2 \% & 4.0:1 \% \\
10 & 57 & 16 & 61 & 16 & 72 & 18 & 82.9 \% & 4.3:1 \% \\
11 & 57 & 15 & 59 & 17 & 69 & 14 & 81.3 \% & 4.0:1 \% \\
12 & 71 & 18 & 59 & 17 & 66 & 15 & 80.3 \% & 3.7:1 \% \\
13 & 59 & 13 & 62 & 17 & 66 & 17 & 81.3 \% & 4.0:1 \% \\
14 & 56 & 16 & 58 & 18 & 67 & 18 & 81.3 \% & 4.0:1 \% \\
15 & 66 & 14 & 63 & 17 & 87 & 19 & 82.9 \% & 4.3:1 \% \\
16 & 67 & 16 & 65 & 15 & 64 & 15 & 81.3 \% & 4.0:1 \% \\
17 & 57 & 15 & 70 & 20 & 67 & 15 & 81.9 \% & 3.7:1 \% \\
18 & 59 & 14 & 63 & 17 & 57 & 14 & 81.3 \% & 4.0:1 \% \\
19 & 76 & 18 & 68 & 19 & 76 & 14 & 81.9 \% & 3.7:1 \% \\
20 & 67 & 14 & 60 & 17 & 64 & 16 & 81.9 \% & 3.7:1 \% \\
\hline
\textbf{Mean} & \textbf{62.4} & \textbf{15.5} & \textbf{65.3} & \textbf{17.5} & \textbf{68.8} & \textbf{15.8} & \textbf{81.3} & \textbf{18.7} \\
\hline
\textbf{Variance} & 80.2 & 19.9 & 78.8 & 21.2 & 81.3 & 18.7 & \textbf{4.0} & \textbf{1} \\
\hline
\end{tabular}
\caption{Number of females and males offspring obtained by cross-breeding between \textit{T. urticae} Koch (TU) and \textit{T. arabicus} Attiah (TA).}
\end{table}
78.8% of obtained eggs gave females. The third set of matings, occurred between twenty pairs of F₁ of both crossings and showed similar results. The number of F₂ offspring per female averaged 68.8 females and 15.9 males, i.e. 81.3% of the eggs gave females. Thus number of eggs and sex ratio are quite normal. This complete and successful crossbreeding between Dutch *T. urticae* Koch and *T. arabicus* Attiah from Egypt proved to be conspecific. This agrees with the findings of SABA (1975) and ZAHER et al. (1981) who stated that the green complex *T. urticae* of Morocco and Germany crossbred among themselves as well as with *T. arabicus* of Egypt and gave fertilized eggs in F₂. This is contrary to taxonomic notes by ATTIAH (1986) who tried to throw some doubts on the work of ZAHER et al. (1981) mentioning that they did not identify their *T. urticae* from Germany and claimed that it was possibly *T. arabicus* or else replacing *T. urticae* in that area. In the same taxonomic notes, he reported that aedeagus of *T. arabicus* is very distinct from *T. urticae*; stating that according to BOUDREAUX (1956), and TUTTLE et al. (1976), the latter possesses a small knob one sixth the axis of the shaft and with both anterior and posterior projections acute; while that of *T. arabicus* is larger, about one fourth the axis of the shaft and its anterior projection is usually broad and narrowly rounded. However, neither BOUDREAUX (1956) nor TUTTLE et al. (1976) mentioned anything about the length of the knob and its ratio to the axis of the shaft; even ATTIAH (1967), in his description of *T. arabicus*, reported that the length of the knob is one fourth the dorsal margin of the shaft and not the axis.

Our examination showed that, in both *T. urticae* and *T. arabicus* the aedeagus is with a dorsally directed bend of about 90° but sometimes obtuse, knob upper surface broadly rounded or obtusely angulate, knob anterior projection usually acute in the former and narrowly rounded in the latter, acute in few cases (Fig. 1). This minute difference in the shape of the aedeagus knob has not been entirely reliable for species separation, especially if it is known that the knob is roughly a lenticular disc, and any slight tilt in this disc during specimen mounting results in misleading observation (DOSSE & BOUDREAUX, 1963). Moreover, ATTIAH (1967) declared the occurrence of some individual variations in the shape of the aedeagus of *T. arabicus*. Therefore, MEYER (1987) mentioned in her description of *T. urticae* that the development of aedeagus knob anterior projection varies while knob length in relation to dorsal margin of the shaft is not less than one fourth. In both examined *T. urticae* and *T. arabicus*, the length of the aedeagal knob to dorsal margin of shaft varies from 1:3 to 1:3.5 (Table 2). Also, great similarity occurs in morphological characters of female of both species; lobes of dorsal integumentary folds, semi-oblong; tarsus 1 with four tactile setae proximad to the proximal duplex setae; tibia 1 with nine tactile and one sensory setae. This similarity also appears in the description of *T. urticae* (=*telarius*) by BOUDREAUX (1956) and that of *T. arabicus* by ATTIAH (1967).

Finally, it could be concluded that separation of the two species based on a slight and not constant morphological trait in the shape of ante-
rior projection of the aedeagus knob is not reliable especially after the successful crossbreeding experiments between both *T. urticae* from Germany (Zahe f et al.) and from Holland (in this experiment) and *T. arabicus* from Egypt.

| Table 2: Ratio between length of aedeagus knob and dorsal margin of the shaft in *T. urticae* and *T. arabicus*. |
|---|---|---|---|---|---|---|
| No. | Dorsal margin | Knob | Ratio | Dorsal margin | Knob | Ratio |
| 1   | 8.6   | 2.9  | 1 : 3.0 | 10.0 | 2.9  | 1 : 3.5 |
| 2   | 8.6   | 2.9  | 1 : 3.0 | 10.0 | 2.9  | 1 : 3.5 |
| 3   | 10.0  | 2.9  | 1 : 3.5 | 10.0 | 2.9  | 1 : 3.5 |
| 4   | 8.6   | 2.9  | 1 : 3.0 | 10.0 | 2.9  | 1 : 3.5 |
| 5   | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |
| 6   | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |
| 7   | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |
| 8   | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |
| 9   | 10.0  | 2.9  | 1 : 3.5 | 10.0 | 2.9  | 1 : 3.5 |
| 10  | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |
| 11  | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |
| 12  | 8.6   | 2.9  | 1 : 3.0 | 8.6  | 2.9  | 1 : 3.0 |

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