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TAXONOMIC STUDIES OF FALSE SPIDER MITES (ACARI: TENUIPALPIDAE) IN CENTRAL IRAQ

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Ibrahim Al-Gboory

aus Baghdad, Irak

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Professor Dr.W.Kloft - Referent -

Direktor des Institutes für
Angewandte Zoologie der Universtät Bonn

and

Professor Dr.H.Bick - Korreferent -

Direktor des Institutes für Landwirtschaftliche
Zoologie und Bienenkunde der
Universität Bonn

This work is dedicated to my wife
Asmaa Al-Gboory

without whose encouragement and
patience I could not have finished it -

"Was
Bis jetzt ich von der Welt erkannte,
hat mir nur bewiesen, daß es Größ
und Kleinheit Darin nicht gibt,
und daß die Milb' so sonderbar
Erbaut ist, als der Elefant."

Grabbe

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Contents

List of Figures

Figure 14. *Dolichotetranychus babylonicus*, n.sp.

Figure 15. *Cenopalpus lanceolatisetae* (Attiah) (female).

Figure 16. *Cenopalpus lanceolatisetae* (Attiah) (male and nymph).

Figure 17. *Cenopalpus pulcher* (Canestrini & Fanzago) (female).

Figure 18. *Cenopalpus pulcher* (Canestrini & Fanzago) (nymph).

Figure 19. *Larvacarus transitans* (Ewing).

Figure 20. *Obdulia daadi*, n.sp. (female).

Figure 21. *Obdulia daadi*, n.sp. (male).

Figure 22. *Raoiella indica* Hirst (female).

Figure 23. *Aegyptobia trägårdhi* Sayed (female).

Figure 24. *Aegyptobia salicicola*, n.sp. (female).

Figure 25. *Aegyptobia euphratica*, n.sp. (female).

Figure 26. *Aegyptobia mesopotamiensis*, n.sp. (female).

Figure 27. *Brevipalpus iraquiensis*, n.sp. (female).

Figure 28. A. *Brevipalpus obovatus* Donnadieu (nymph).
B. *Brevipalpus iraquiensis*, n.sp. (nymph).

Figure 29. *Brevipalpus obovatus* Donnadieu (female).

Figure 30. *Tenuipalpus bagdadensis*, n.sp. (female).

Figure 31. *Tenuipalpus bagdadensis*, n.sp. (male).

Figure 32. *Tenuipalpus punicae* Pritchard & Baker (female).

Figure 33. *Tenuipalpus myrtus*, n.sp. (female).

Figure 34. *Tenuipalpus myrtus*, n.sp. (male and nymph).

Figure 35. *Tenuipalpus populi*, n.sp. (dorsal of female).

Figure 36. *Tenuipalpus populi*, n.sp. (ventral of female).

Figure 37. *Tenuipalpus populi*, n.sp. (male).

Figure 38. A. *Tenuipalpus populi*, n.sp. (nymph).
B. *Tenuipalpus myrtus*, n.sp. (nymph).

Figure 39. *Tenuipalpus viticola*, n.sp. (female).

Figure 40. *Tenuipalpus salicis*, n.sp. (female).

Figure 41. *Tenuipalpus lygodii* De Leon (male).

Figure 42. *Colopalpus eriophyoides* (Baker) (female).

Figure 43. *Colopalpus eriophyoides* (Baker) (male).

Introduction

The subclass Acari, which includes mites and ticks, forms an important part of the arthropodan class Arachnida, to which also belong scorpions, spiders, and harvestmen. Mites have a world-wide distribution; they rival insects in the extent of their habitation. They live in salt and fresh water, in organic debris of all kinds, and on plants and animals. They are among the dominant animals in pastures and in arable soils. In forests they greatly outnumber all other arthropods. Their associations with other animals include commensalism, predation, and true parasitism. Therefore, they may cause serious damage to livestock, agricultural crops, ornamental plants, and stored products (Jeppson et al., 1975).

The Tenuipalpidae Berlese, along with four other families namely Allochaetophoridae Reck, Linotetranidae Baker & Pritchard, Tuckerellidae Baker & Pritchard, Tetranychidae Donnadieu, constitute the superfamily Tetranychoidea of the order Acarina (Baker & Pritchard, 1960; Krantz, 1978). Tetranychidae and Tenuipalpidae contain most of the known species, which have an economic importance as plant pests.

Members of the superfamily Tetranychoidea are prostigmatic mites that are characterized by long and styletiform chelicerae that are strongly recurved proximally and arise within an eversible stylophore. Tenuipalpids differ from other families in the superfamily in having a simple palpus, which lacks a spur (claw) on the fourth segment (penultimate segment), and often with reduced segmentation (Pritchard & Baker, 1958). They are commonly known as "false spider mites" because of their close resemblance to the spider mites i.e. the family Tetranychidae; but unlike them they are comparatively smaller (from about 0.2 to 0.3 mm long), flat, slow-moving and usually red or orange in colour with an ornamentally sculptured integument and do not produce silken

strands, characteristic of most of the spider mites (Baker & Wharton, 1952; Ghai & Shenhmar, 1984).

The Tenuipalpidae, or false spider mites, are plant feeders of considerable economic importance. They feed on plant leaves, most commonly on the lower surfaces. Some species feed on the bark of plants, some in the floral heads or under the leaf sheaths of grasses, and the most specialized members of the family form plant galls within which they feed. They have needlelike cheliceral stylets that pierce the epidermis. Their feeding results in the removal of chlorophyll and causes the plant tissue to have a silvery appearence due to total light reflection in the air penetreted epidermal cells (Kloft & Kunkel, 1969). This appearence turns later to be rusty. Heavy infestations result in a blotching, stippling or bronzing of the leaves, sometimes accompanied by leaf fall and fruit may be scarred.

The tenuipalpid mites are now considered to be among the most important pests of the agricultural crops in many parts of the world. This is due to the extensive use of the synthetic organic chemicals in plant protection in recent years. Species that are unknown to science a few years ago now subject to chemical control. These very effective chemicals have also killed the predators which so far had been keeping the destructive mite populations in natural equilibrium, on one side, and they have caused the resistant strains of mites to occur, on the other side.

Knowledge of the false spider mites was until 1950 fragmentary although a number of investigators have made contributions to tenuipalpid classification, biology, importance to agricultural crops, and control. The lack of knowledge of this group could undoubtedly be explained by the minute size of its members, their obscure habits, and the comparatively few forms that were of economic importance at that time. During the second half of the 20th century, a real progress

of knowledge of this family was observed. The reasons of this development as mentioned by Sepasgosarian, 1983 were: increasing collaboration between acarologists, exchange of scientific information, national and international congresses, preserving of specimens from different parts of the world, improvement of optical equipment, increase in number of specialists and grants, economical importance of spider mites and false spider mites as a result of inadequate use of pesticides, growing interest in environmental ecology and the study of fauna and flora all over the world.

Economic importance of tenuipalpids

The family Tenuipalpidae has long been neglected as a mite group of economic importance. In recent years the tenuipalpids have been found to be a serious pest of vegetable and fruit crops, ornamental and weed plants all over the world. The reasons for this increase of damage are due to the use of pesticides, fertilizers, high yielding varieties and improved agricultural practices, besides the conmmercial transportation of live plants throughout the world.

The family Tenuipalpidae comprised twenty-seven genera and 584 species until October 1985. A number of these species are of economic importance such as, *Brevipalpus californicus* (Banks) which causes serious injury to a wide variety of ornamental plants and agricultural crops. It is well distributed throughout Asia (except USSR), Africa, Australia, Pacific Islands, Mexico, Hawaii, North, Central and South America and the West Indies. It is the cause of "Leprosis" of citrus in Argentina and Florida, and it is a serious pest of tea in Sri Lanka, India and Java. *B.phoenicis* (Geijskes) is another important pest of citrus and tea, but it has also been found on coffee, peach, papaya, loquat, coconut, apple, pear, guava, olive, fig, walnut, grape trees and more than 50 genera of ornamental plants. This species is widely distributed throughout the world.

B.chilensis Baker is a very destructive pest of grapevine in Chile. It also attacks many species of fruit, forest trees, ornamentals and even annual weeds. These include citrus, almonds, figs, chrysanthemus, geranium, morning-glory and bindweeds. *B.lewisi* McGregor is a pest of citrus, pomegranates, walnuts, grapes, and many ornamental plants. It is particularly recognized as a pest of citrus in Japan and California, and of grapes in Bulgaria. Most of the more than 30 hosts of this species are ornamental plants. *B.oleae* Baker and *B.olearius* Sayed feed on the bark of olive trees in Marocco and Egypt respectively. *B.obovatus* Donnadieu is a pest of privet and citrus, and also attacks more than 50 genera of ornamental plants in many parts of the world. *B.oncidii* Baker and *Tenuipalpus pacificus* Baker are pests of Orchids in greenhouses. *Tenuipalpus punicae* Pritchard & Baker and *T.granati* Sayed caused injury to pomegranates and vineyards in many countries. *Coenopalpus lanceolatisetae* (Atthia), along with *C.pulcher* (Canestrini and Fanzago) are major pests of deciduous fruit trees in Egypt and Cyprus. *C.lineola* (Canestrini & Fanzago) is a pest of pine trees in Holland, Italy and USSR. Wherever pineapples are cultivated, they are attacked by *Dolichotetranychus floridanus* (Banks). A related species *D.australianus* (Womersley) causes damage to lawngrass in parks, golf courses, and rugby fields. *Raoiella indica* Hirst is a serious pest of coconut in Mauritius and also lives on date palm and other palms (Jeppson et al., 1975). I have listed only some of the important species of the family, the others will be discussed in the review of literature.

As a consequence of the increasing use of pesticides in the last years several tenuipalpid species in Iraq resulted to build-up a high population density and to cause serious damage to their host. *Tenuipalpus punicae* Pritchard & Baker is regarded the key pest of pomegranate trees in Iraq, which are cultivated through the country and occupy the third position after date palms and citrus trees. Besides this

species *Tenuipalpus viticola,* n.sp. and *Coenopalpus pulcher* (Canestrini & Fanzago) play an important role for plantations of grapes and apples respectively.

Although the tenuipalpids have been reported from Iraq since 1952 when Baker described *Tenuipalpus eriophyoides* (=Colopalpus eriophyoides (Baker)) on date palm from Basrah, no taxonomic work has previously been attempted on tenuipalpids and other mites. There is very little published information concerning the phytophagous mites of Iraq. Most of the publications are no more than departmental reports or extension articles written in Arabic and published in popular non technical journals.

Because of the considerable economic importance of tenuipalpids to agriculture and the shortage of taxonomical work in Iraq, this comprehensive treatment was done on the family Tenuipalpidae in Central Iraq. The major function of this work is as follows:

a. to give a review of all the literature published between 1834 and 1987 concerning the creation of the family, genera and species.

b. to survey all the phytophagous and predator mite families on the cultivated and wild plants in Central Iraq.

c. to provide a practical guide to the external morphology, classification and identification of tenuipalpid mites of Central Iraq which includes the keys, descriptions, and host plants.

It is hoped that this study will serve as an impetus for further extensive exploration of our country on this group of mites and for an intensive investigation on the biological and ecological aspects of the species of economic importance.

Review of literature

A.Development of the family name

The present family concept has evolved gradually, and several different family names have been proposed to include different genera that are now regarded as belonging to the family Tenuipalpidae. These mites were included under the family Tetranychidae Donnadieu by many researchers until relatively recently.

The first record of the family Tenuipalpidae Berlese, dates back to 1834 when Duges described *Trombidium caudatus* on *Laurestinus* from France. This species was subsequently included in *Tenuipalpus* which was established by Donnadieu 1875 (Duges, 1834; Ghai, 1984).

Tenuipalpus Donnadieu, on which the family name is based, was placed under the family Tetranychidae until 1913 when Berlese separated a new group Tenuipalpini from Tetranychidae in an obscure, privately published paper in 1913 (Berlese, 1913; Donnadieu, 1875). This name, Tenuipalpini, remained unknown till Sayed (1950) changed the family name Phytoptipalpidae Ewing, 1922 and Trichadenidae Oudemans, 1938 to Tenuipalpidae.

Phytoptipalpus Trägårdh, an aberrant genus from the old world, was used by Ewing (1922) as the basis for establishing a supergeneric category, the Phytoptipalpidae. He apparently believed these to be distinct from the then known genera *Tenuipalpus* and *Brevipalpus* Donnadieu.

Oudemans (1928) proposed the creation of a new family for both genus *Pseudoleptus* Bruyant, 1911 and *Raoiella* Hirst, 1924, and called it Pseudoleptidae.

Oudemans (1938) referred to *Trichadenus* Rondani, 1870, and mentioned that *Trichadenus* is only represented by *T.sericariae* found first on cocoons of *Sericaria mori* L.1780, and later on the underside of mulberry leaves. In Oudeman's opinion *Trichadenus* is identical with *Pseudoleptus*, mainly, because the general shape of *T.sericariae* is similar to that of *Stigmaeus floridanus* Banks (= *Dolichotetranychus floridanus* (Banks)) which is synonymous with *Pseudoleptus floridanus*. Oudemans had rightly believed that old illustrations like Rondani's didn't usually represent all facts and hence he was under the impression that the striped invagination, which he described in 1927 from both *Pseudoleptus* and *Raoiella* , is in all probability found in *Trichadenus sericariae*. He proposed the name TRICHADENIDAE to replace Pseudoleptdidae. Trichadenidae comprised *Trichadenus* Rondani 1870 (= *Pseudoleptus* Bruyant, 1911) and *Raoiella* Hirst, 1924. The change of the name is due to the fact that *Trichadenus* is older than both *Pseudoleptus* and *Raoiella*.

Sayed (1938) erected two new genera *Phyllotetranychus* and *Dolichotetranychus* and created the subfamily Pseudotetranychinae in the family Tetranychidae comprising the genera *Raoiella* Hirst, 1924 and *Phyllotetranychus* Sayed, 1938.

Oudemans (1939) wrote to Sayed stating that Trichadenidae is synonymous with Pseudotetranychinae Sayed and that he included *Phyllotetranychus* in Trichadenidae. He also stated that *Pseudoleptus* and *Trichadenus* are synonym and that *Dolichotetranychus* Sayed, 1938 is a synonym of *Pseudoleptus*.

Sayed in the same year answered Oudemans pointing out the difference between *Pseudoleptus*, *Trichadenus* and *Dolichotetranychus* and stressed the fact that *Trichadenus* is a mite of no definite identity.

Oudemans in his letter dated 29th May 1939 to Sayed expressed his doubt that *Trichadenus* is different from *Pseudo-*

leptus, but later in 18th July 1939 he admitted in his letter that they are not synonyms but stand for two separate genera. He stated he was inclined to include *Trichadenus* in his family; and since the family bears the name of the oldest genus, Trichadenidae is the appropriate name and comprises the following genera:

Trichadenus Rondani	1870
Pseudoleptus Bruyant	1911
Raoiella Hirst	1924
Phyllotetranychus Sayed	1938

Sayed (1942) discussed the position of *Trichadenus* and suggested that *Tenuipalpus* Donnadieu, 1875, might be included in Pseudoleptidae. He also reported that *Phytoptipalpus* Trägårdh, 1905 offers to a great extend similar characters. Vitzthum (1943), however, continued to use the name Pseudoleptidae, not accepting the synonym of *Pseudoleptus* as *Trichadenus*.

Baker (1945) stated "the name *Brevipalpus* Donnadieu, 1875 which has been synonymized with *Tenuipalpus*, should be reinstated as a generic name for the *inornatus* group of mites". He proposed the following genera, *Trichadenus*, *Brevipalpus*, *Tenuipalpus*, *Raoiella* and *Tegopalpus* Womersley under the family Trichadenidae. Baker (1949) studied the family genera and admitted that *Pseudoleptus* is a distinct genus from *Trichadenus*, contrary to Oudemans' earlier belief that these genera are synonyms. Baker's conclusion supported Sayed's (1942) belief that the two genera are not identical.

Sayed (1950) stated "Oudemans 1938 admits that nobody has looked for acari in mulberry after Rondani". It seemed that such a statement held good in 1948. The identity or the exact position of *Trichadenus* remained uncertain and one could hardly find any correlation between this mite and the other genera, namely, *Pseudoleptus*, *Raoiella* and *Phyllotetranychus*. Only by collecting and the describing of acari on mulberry

from Italy the identity of *Trichadenus* became obvious. If *Trichadenus* was excluded from Trichadenidae, as it should be, the family should bear again the old name Pseudoleptidae, since *Pseudoleptus* is older than *Raoiella* and *Phyllotetranychus*.

Since *Trichadenus* is out of place because it's identity remains uncertain, the family should either bear the name of *Tenuipalpus* or *Brevipalpus*. Sayed (1950) proposed the family name Tenuipalpidae since *Tenuipalpus* has priority when compared to other tenuipalpid mites, and he considered the genus *Pseudoleptus* to be a typical of the group and therefore inappropriate as a type. He erected two subfamilies and gave keys to differentiate between these categories. Sayed's classification is as follows:

Family: Tenuipalpidae
Subfamily: Tenuipalpinae
Tenuipalpus Donn. 1875
Brevipalpus Donn. 1875
Pseudoleptus Bruyant 1911
Raoiella Hirst 1924
Phyllotetranychus Sayed 1938
Tegopalpus Womersley 1940
Aegyptobia Sayed 1950
Subfamily: Phytoptipalpinae
Phytoptipalpus Trägårdh 1905

Baker (1950) agreed with Sayed's opinion about the similarity between *Phytoptipalpus* and *Pseudoleptus*. The family name Tenuipalpidae, which is the correct name, has been in use since 1955 after the publishing of Cunliffe's paper on the classification of the Trombidiformes mites. Pritchard and Baker (1958) stated "the family name Trichadenidae is based on an erroneous identification of the genus *Trichadenus* Rondani and Pseudotetranychinae, is a name with no nomenclatural standing". They used the family name Tenuipalpidae for the first time.

The history of the family creation shows that the Tenuipalpidae had been known by several names Trichadenidae, Pseudoleptidae and Phytoptipalpidae before the correct name became valid.

B. Creation of the genera and species

Duges (1834) described *Trombidium caudatus* (= *Tenuipalpus caudatus* (Duges) on *Laurestinus* from France. He used the family name Trombidae. Boisduval (1867) described *Acarus tini* (= *Tenuipalpus caudatus*) on the same host and *Acarus russulus* (= *Brevipalpus russulus* (Boisduval)) on two different hosts from France.

Donnadieu (1875) created the genera *Tenuipalpus* and *Brevipalpus* and placed them under the family Tetranychidae. He described *Tenuipalpus palmatus* (= *T.caudatus*), *T.spinosus* (= *Brevipalpus spinosus* (Donn.) and *T.glaber* (= *Brevipalpus spinosus*). Canestrini and Fanzago (1876) described four species of the genus *Caligonus* namely *C.calyx* (= *Tenuipalpus caudatus*), C.pulcher (= *Cenopalpus pulcher* (Can. and Fanz.)), *C.cuneatus* (= *Brevipalpus cuneatus* (Can. & Fanz.)) and *C.coronatus* (= *Pentamerismus coronatus* (Can. & Fanz.)) from Italy. Haller (1877) described *Tenuipalpus taxi* (= *Pentamerismus taxi* (Haller)) on *Taxus* sp. from Switzerland.

Berlese (1886) proposed two new combinations and recorded *Tenuipalpus glaber* from Italy. In 1887, he proposed two more new combinations and recorded three more mites of the genus *Tenuipalpus* from the same country. Canestrini (1890) recorded and illustrated five species of the genus *Tenuipalpus* from Italy. Rübsaamen (1899) described *Pediculoides grewiae* (= *Brevipalpus grewiae* (Rübsaamen)) on *Grewia microsos* L. from India.

Banks (1900) described *Stigmaeus floridanus* (= *Dolichotetranychus floridanus* (Banks)) on pine-apple from Florida. In

1904, he described *Tenuipalpus californicus* (= *Brevipalpus californicus* (Banks)) on orange peel from California. He again in the same year described *Siteroptus carnea* (= *Dolichotetranychus carnea* (Banks)) on the deformed heads of certain grass *Spirobolus* in new Mexico and Utah. Trägårdh (1904) erected a new genus *Phytoptipalpus* on the basis of new type species *P.paradoxus* which cause galls on the cortex of *Acacia nilotica* Willd. in Egypt.

Rübsaamen (1910) described *Tenuipalpus geisenheyneri* (= *Brevipalpus spinosus*) on *Cornus sanguinea* L. from Germany. Ewing (1911) described *Stigmaeodes cinctus* (= *Dolichotetranychus carnea*) on wild grass from Colorado. Bruyant (1911) erected a new genus *Pseudoleptus* on the basis of a new type species *P.arechavaletae* on *Distichlis scoparia* Arech. from Uruguay. Banks (1912) described *Tenuipalpus cardinalis* (= *Brevipalpus cardinalis* (Banks)) on *Phoenix* and *Tenuipalpus inornatus* (= *Brevipalpus obovatus* Donn.) on golden-rod from USA. Ewing (1913) mentioned the general and basic informations about the Acari. He also explained the terminology, that each Acarogolist needs and he listed new mites from North America. Berlese (1913) proposed the name Tenuipalpini as a group to have all the described species of similar characters under this.

McGregor (1914) described *Tenuipalpus bioculatus* (= *Brevipalpus obovatus*) on privet from South Carolina. Banks (1915) recorded *Tenuipalpus cardinalis* Banks on *Phoenix* sp. from Arizona. McGregor (1916) studied the biological and ecological aspects of *Tenuipalpus bioculatus* McG. in the south of USA. He listed ten new host plants in addition to privet, *Ligustrum amurense* Carr. the main host. Ewing (1917) described *Tenuipalpus erythreus* (= *Pentamerismus erythreus* (Ewing)) on cedar from Ames, Iowa and on *Thuja* from Oregon.

Vitzthum (1920) described *Tenuipalpus palmatus simplex* (= *Tenuipalpus simplex* Vitzthum) on apple from Germany. Ewing

(1922) described *Phytoptipalpus transitans* (= *Larvacarus transitans* Ewing) on *Zizyphus jujuba* from India. Hirst (1924) proposed a new genus *Raoiella* on the basis of a new type species *R.indica* on coconut leaves from India. Miller (1925) gave first record of *Tenuipalpus lineola* Can. and Fanz. (= *Brevipalpus lineola* (Can. & Fanz.)) on *Sambucus canadensis* L. from Ohio. Tucker (1926) described *Tenuipalpus australis* (= *Brevipalpus californicus*) on citrus fruits from South Africa. Oudemans (1927) pointed out that the *Raoiella* Hirst has the same characters found in *Pseudoleptus* Bruyant. Lahille (1927) described *Tenuipalpus haumani* (= *Pseudoleptus arechavaletae* Bruyant) on *Distichlis spicata* (L.) Greene from Argentina. Oudemans in the same year described *Pseudoleptus vandergooti* (= *Dolichotetranychus vandergooti* (Oudemans)) on *Dendrobium* sp. from Java. Ross and Hedicke (1927) recorded *Tenuipalpus geisenheyneri* on *Cornus sanguinea* from Germany.

Oudemans (1928 a) proposed the creation of a new family for both genera *Pseudoleptus* and *Raoiella* and called it Pseudoleptidae. He in 1929 described *Tenuipalpus cactorum* (= *Brevipalpus russulus*) on cacti from Germany. Vitzthum (1929) mentioned nine species belonging to the genus *Tenuipalpus* viz. *T.palmatus* var.*simplex*, *T.glaber*, *T.coronatus*, *T.spinosus*, *T.pulcher*, *T.cuneatus*, *T.obovatus* (= *Brevipalpus obovatus*) and *T.pereger* Donn. (= *Brevipalpus obovatus*) from Middle Europe. Bodenheimer (1930) described *Tenuipalpus bodenheimeri* (= *Cenopalpus pulcher)* on apple trees from Palestine.

Oudemans (1931 a) recorded *Tenuipalpus* sp. on *Fagus sylvatica* L. from Holland. He in the same year gave the differences between *Tenuipalpus* and *Brevipalpus* (Pseudoleptidae) and *Bryobia* and *Neophyllobius* (Tetranychidae) based on the body chaetotaxy. Zacher (1932) listed fourteen different host plants, which were attacked by *Tenuipalpus* from different places in Germany. Oudemans (1938) proposed the name Trichadenidae to replace Pseudoleptidae. Trichadenidae comprised *Trichadenus* Rondani 1870 (= *Pseudoleptus* Bruyant, 1911)

and *Raoiella* Hirst 1924. He described *Flexipalpus donnadieu* (= *Brevipalpus spinosus)* from Germany.

Sayed (1938) erected two new genera *Phyllotetranychus* and *Dolichotetranychus* based on the types *Phyllotetranychus aegyptium* (= *P.aegyptiacus* Sayed) on date palms and *Stigmaeus floridanus* Banks (= *Dolichotetranychus floridanus* (Banks)) on *Cynodon dactylon* L. *Phragmites communis* L. and *Ananas sativus* Lindl. He also created the subfamily Pseudotetranychinae to include the genera *Raoieolla* and *Phyllotetranychus*.

Geijskes (1939) described *Tenuipalpus phoenicis* (= *Brevipalpus phoenicis (Geijskes))* on date palms and *T.oudemansi*

(= *Cenopalpus pulcher*) on apples and gave the first record of two other species and listed eight species on different host plants from Holland.

Lawrence (1940) described *Tenuipalpus micheli* on *Chaetachme aristata* and *T.quadrisetosus* on *Chryptocarya woodi* from South Africa. He reported that *T.ornatus* and *T.australis* were attacking citrus fruits in this region. Sayed in the same year changed *Phyllotetranychus aegypticum* Sayed to *P.aegyptiacus*. Blanchard (1940) described *Tenuipalpus pseudocuneatus* (= *Brevipalpus obovatus*) and noted it as a carrier of virus diseases of citrus in Argentina. Womersley (1940) erected a new genus *Tegopalpus* with a new species *Tegopalpus conicus* on *Casuarina* from New South Wales. He described *Tenuipalpus vitis* (= *Brevipalpus californicus*) on lemon and recorded *T.californicus* and *T.phoenicis* from Australia.

Womersley (1941) recorded *Tenuipalpus australis* on citrus from Australia and gave notes on *Tenuipalpus californicus.* In 1942, he described *Raoiella queenslandica* (= *Macfarlanniella queenslandica* (Womersley)) on *Eucalyptus micrantha* from Queensland. Sayed in the same year gave the first record of *Tenuipalpus oudemansi* on apples, pears, plums and apricots; *T. obovatus* on citrus, guava, plums and apricots and *T.orchidarum*

Parfitt on vineyards and pomegranates from Egypt. Sayed again in 1942 (c) redescribed and illustrated *Phytoptipalpus paradoxus* Trägårdh from *Acacia nilotica* Willd. (Sunt.) in the same region. He in the same year discussed the genus *Raoiella* Hirst in Egypt.

Womersley (1943) described *Trichadenus australianus* (= *Dolichotetranychus australianus* (womersley)) on *Cynodon dactylon* Rich from Queensland. Vitzthum in the same year included *Tenuipalpus* and *Brevipalpus* under the family Tetranychidae, but he included the genera *Pseudoleptus*, *Raoiella* and *Phyllotetranychus* in the family Pseudoleptidae. Lawrence (1943) described three species of the genus *Tenuipalpus* and recorded another three of the same genus on different host plants from South Africa.

Baker (1945) described four new species of the genus *Tenuipalpus* and recorded another two species from USA. He emphasized that the genus *Brevipalpus* is not synonymous with *Tenuipalpus*. Sayed (1946) described *Tenuipalpus granati* on pomegranates and *Brevipalpus pyri* on apples, pears, plums, apricots and others from all over Egypt. Cooreman (1947) proposed a new combination *Tenuipalpus russulus* (Boisduval) for *Acarus russulus* Boisduval (= *Brevipalpus russulus*) which attack cactus. He referred to *Tenuipalpus phoenicis* as mites which attack palm in Dutch greenhouses. Baker (1948) described *Tenuipalpus eriophyoides* (= *Colopalpus eriophyoides*) on date-palm from Iraq.

Baker (1949) studied the taxonomy of the genus *Brevipalpus*. He studied thirty-nine species including eighteen new to the science and provided keys for adult females, males and deutonymphs of this genus, and proposed one new combination. He indicated for the first time, that *Trichadenus* and *Pseudoleptus* were two distinct genera and used the name Pseudoleptidae instead of Trichadenidae. McGregor in the same year erected a new genus *Pentamerismus* based on an already described species *Tenuipalpus erythreus* Ewing which was collected

on cedar. He described six new species of the genera *Trichadenus, Tenuipalpus, Brevipalpus* and *Pentamerismus* besides four new combinations. Zacher (1949) surveyed twelve species of the genus *Tenuipalpus* all over the world and two species of the genus *Phytoptipalpus*. He placed them under the family Tetranychidae and used the genus *Brevipalpus* as a synonymous with *Tenuipalpus*. He also included *Raoiella indica* in the family Pseudoleptidae.

Sayed (1950 a) established for the first time the family name Tenuipalpidae and based his concept on the genus name *Tenuipalpus* which was described in 1875 by Donnadieu. He subdivided this family into two subfamilies namely Tenuipalpidae, that included eight genera, and Phytoptipalpidae which included one genus only. He provided a key to the family and gave the characteristics of all the categories. In the same year he erected the genus *Aegyptobia* based on the type species *Aegyptobia trâghârdhi* collected on *Thuja orientalis*, and described *Brevipalpus olearius* on *Olea europa* L. from Egypt.

Lombardini (1951) described two species of the genus *Brevipalpus*, besides three species under *Tenuipalpus* from different hosts. Reck (1952) proposed a new genus *Phytoptipalpoides* (= *Larvacarus Baker & Pritchard*). Baker and Wharton (1952) mentioned ten genera under the family Phytoptipalpidae Ewing: viz. *Phytoptipalpus, Brevipalpus, Dolichotetranychus, Pentamerismus, Phyllotetranychus, Raoiella, Pseudoleptus, Tegopalpus, Tenuipalpus* and *Trichadenus*. He considered the genus *Aegyptobia* as a synonym of *Pentamerismus*. Baker and Pritchard in the same year established two major groups in the genus *Brevipalpus*, namely, *Geisenheyneri* group which contain those species that possess one seta on the hysterosoma between the first dorsocentral and first lateral setae and the remaining species lack this seta referred to as *Inornatus* group. They described *Brevipalpus asyntactus* from pine forest litter from Holland.

Pritchard and Baker (1952) studied the false spider mites of California, they recorded forty species under the genera *Pseudoleptus, Pentamerismus, Brevipalpus, Tenuipalpus* and *Dolichotetranychus* on different host plants. In this publication, they described twenty four new species. Baker and Pritchard in the same year recharacterized the genus *Pseudoleptus* because the original description was inaccurate; they also redescribed *P.arechavaletae* obtaining the type species from Uruguay. In 1952 they erected a new genus *Larvacarus* on the basis of *Larvacarus transitans* which lives in the galls of *Zizyphus jujuba* from India.

Chalilova (1953) described *Tenuipalpus rodionovi* (= *T.granati*) on *Cydonia oblonge* from USSR. Reck in the same year described *Tenuipalpus zhizhilashviliae* (= *T.japonicus* Nishio) on *Diospyros kaki* and *Brevipalpoides xerophilus* (= *Aegyptobia xerophilus (Reck))* on *Acantholimon lepturoides* from USSR. André (1953) recorded *Tenuipalpus orchidarum* Parfitt on orchid plants, and described *T.orchidarum* var.*crassum* (= *Tenuipalpus crassus* (André)) on *Euphorbia echinus* and cactus plants from France. Baker and Pritchard (1953) reviewed the species of the genus *Tenuipalpus* of the world. They studied nineteen species five of which are new to science and provided a key for all species. They in the same year described *Pentamerismus pseudoleptoides, P.nomus* and *P.mccormicki* from the USA and gave a key to all known species of this genus in the states.

Manglitz and Cory (1953) studied the life cycle of *Brevipalpus australis,* which was collected on orchids at College Park, Maryland. Dosse (1953) recorded *Tenuipalpus oudemansi* on apple trees and studied the population density and some other biological aspects of this species in West Germany. Morishita (1954) studied the biology and control of *Brevipalpus inornatus* (= *B.obovatus)* which attacks thirty nine host plants in USA. Dosse (1954) recorded *Tenuipalpus orchidarum* (= *T.pacificus* Baker) on tropical orchids in glasshouses in Germany. He

mentioned notes on the biology and control of this species. He in 1955 recorded *Brevipalpus oudemansi* as a pest of apple trees in the southwest of Germany. He studied in detail the popu-lation dynamics, the biology and the control of this species.

Kadzhaja (1955) described *Tenuipalpus rosae* on *Rosa* sp. from USSR. Cunliffe in the same year established the new classification system of Trombidiforme mites, in which, Tenuipalpidae was mentioned as a single family. Reck (1956) described *Tenuipalpus baeri* on *Lagonychuium faractum* from USSR. Nishio in the same year described *Tenuipalpus japonicus* on *Diospyros kaki* from Japan. Ehara 1956(a) recorded *T.japonicus* and *Brevipal-pus lewisi* McGregor from orchards of Japan. In the same year he redescribed *Brevipalpus inornatus* and recorded it on five different hosts from Japan. De Leon (1956 a) described *Brevi-palpus floridanus* on sweet bay and recorded *B.phoenicis* and *B.linki* Baker from South Florida. The same year he described six new species of the genus *Tenuipalpus* from the same region.

Baker and Pritchard (1956) reviewed all species of the genus *Dolichotetranychus* all over the world and described four new species and one new combination. Attiah (1956) described *Brevipalpus lanceolatisetae* on prunes, apricots, pears and apples from lower and upper Egypt; he also redescribed another three species of the same genus and provided a key to the females and nymphs.

Haarlov (1957) reported *Tenuipalpus orchidarum* for the first time from Denmark. Elmer and Jeppson in the same year presented the results of two years study on the life history of citrus flat mite, *Brevipalpus lewisi* in California. They gave their suggestions on how to control this mite. Dosse (1957 a) gave a first record of *Brevipalpus inornatus* on ornamental plants in glasshouses from Austria, Netherlands and Germany. In another publication in the same year he reported

that *Brevipalpus oudemansi* attacks neglected apple trees in Hohenheim, Stuttgart. Again in 1957 (c) he gave the exact morphological characters of *Brevipalpus phoenicis* and *B.inornatus* which live together in European glasshouses. De Leon (1957) collected eighteen species of the genus *Tenuipalpus* from Mexico, thirteen of which were described as new; four other were new records for Mexico.

Pritchard and Baker (1958) reviewed the mite family Tenuipalpidae of the world. They agreed with Cunliff's classification and renamed the family as Tenuipalpidae and removed the genus *Trichadenus*. They listed 143 species under 14 genera and proposed the genera *Cenopalpus, Colopalpus* and *Obdulia* as new. They recognized the genus *Aegyptobia* Sayed as a valid genus. They described thirty-two new species and proposed fourteen new combinations and listed two generic and many specific synonyms. In the same year Wainstain described *Brevipalpus pennatisotis* on poplar from USSR. Moutia (1958) recorded *Brevipalpus phoenicis* on nineteen different host plants from Mauritius. He also collected *Raoiella indica* on coconut and date palm and *Phyllotetranychus* sp. on *Latania loddigessi* Mart.

Cromroy (1958) surveyed the plant feeding mites of Puerto Rico. He described three new species *Brevipalpus bakeri, Tenuipalpus frondosus* and *T.simplychus* besides the already four known species. Baker, Camin, Cunliffe, Wooley and Junker in the same year published a "Guide to the Families of Mites" and mentioned the general characters of the family Tenuipalpidae.

Meyer and Rijke (1959) described *Tenuipalpus ovalis* on wild shrub and recorded eight species of the genera *Cenopalpus, Brevipalpus, Tenuipalpus,* and *Dolichotetranychus* from South Africa. Dean (1959 a,b) reported *Brevipalpus australis* was much more common than *B.phoenicis* as a pest on Texas grapefruit. He studied also the quadrant distribution of different species of mites on grapefruit leaves in Texas. Bibby and Tuttle in the same year gave a first record of four species of

the genus *Brevipalpus* from Arizona. Hughes (1959) gave in her book "Mites or the Acari" a general information on the family Phytoptipalpidae (= Pseudoleptidae) and discussed *Pseudoleptus, Phytoptipalpus* and *Tenuipalpus eriophyoides* as genera having a modified life cycle.

Baker and Pritchard (1960) reported twenty-one species of tenuipalpid mites under eight genera from Africa. They described *Tenuipalpus attiahi* and *T.lawrencei* from Lubero and Belgian Congo, and provided a key to all African species. De Leon in the same year described twenty-four new species of the genus *Brevipalpus* from Mexico. Gomelauri (1960) described *Tenuipalpus cheladzeae* on *Taxus baccata* L. and recorded it on two more hosts from USSR. Wainstain (1960) described two species of the genus *Cenopalpus* and redescribed four more species of the genera *Cenopalpus, Brevipalpus* and *Tenuipalpus* from the USSR. Knorr, Webster and Malaguti (1960) discussed the citrus problem which resulted from the *Brevipalpus* infestation in USA. Carmona (1960) recorded *Brevipalpus obovatus* from Portugal.

Muma (1961) gave a first record of two tenuipalpid mites feeding on citrus in Florida, *Brevipalpus californicus* and *B.phoenicis*. De Leon (1961 a) erected a new genus *Priscapalpus* on the basis of *P.macropilis* for mites feeding underside of leaves of *Sapodilla* from Mexico. He in the same year described twelve species of the genus *Brevipalpus*, three species of *Tenuipalpus* and one of *Pentamerismus* from Tennessee, North Carolina, Georgia and Florida. In 1961 (c), he described thirteen new species of the genus *Brevipalpus*, and provided a key of the species of Mexico. Bailey and Dean (1961) considered the two species, *Brevipalpus australis* and *B.phoenicis* of the most common species on citrus in the lower Rio Grande Valley of Texas.

Baker and Pritchard (1962) proposed a new genus *Macfarlaniella* based on the type species *Raoiella queenslandica* on *Eu-*

calyptus micrantha from Queensland. Rimando (1962) recorded ten species from the Phillipines on different hosts. He described *Tenuipalpus orilloi* on citrus and *T.pagesae* on *Lagerstroemia speciosa* (L.) Pers. Ehara (1962 a) reported *Brevipalpus californicus* and *B.obovatus* on *Alpinia* for the first time from Japanese greenhouses. In another publication he recorded two species of the genus *Pentamerismus* on conifers from the same region. De Leon (1962) described *Aegyptobia ceibae* and *Tenuipalpus uvae* on *Ceiba* sp. and *Uva* trees respectively from Mexico. Bagdasarian (1962) described *Pentamerismus wainsteini* and surveyed 14 species of the family tenuipalpidae in Armenia.

Düzgünes (1963) gave the first record of *Brevipalpus lewisi, B.olearius, B.phoenicis, Tenuipalpus granati* and *Pentamerismus* sp. from Turkey. Tsalev (1963) recorded *Tenuipalpus granati* on pomegranates from Bulgaria. Manson in the same year described seven species under the genera *Colopalpus, Brevipalpus, Tenuipalpus* and *Cenopalpus* on different hosts from different countries.

Baker and Tuttle (1964) reported fourty tenuipalpid species of which ten were new to the science belonging to the genus *Aegyptobia* and ten to *Brevipalpus* and one species to *Tenuipalpus* from Arizona. Saba (1964) recorded *B.obovatus* on lemons and *Tenuipalpus* sp. on olives fom Jordan and Southern Turkey. Ehara in the same year reported six species of the genera *Pentamerismus, Brevipalpus* and *Tenuipalpus* from Japan. Alfaro (1964) noted that *Brevipalpus phoenicis* and *Cenopalpus pulcher* causing damage to citrus and apple trees in Spain. Fritsche (1964) reported the genera *Tenuipalpus, Cenopalpus* and *Brevipalpus* as the important tenuipalpids in Central Europe. Carmona (1964) gave the first record of *Brevipalpus oleae, Cenopalpus lineola, C.pulcher* and *C.spinosus* from Portugal.

Knorr (1964) gave the first record of two species of *Brevipalpus* on citrus trees in Syria. Collyer (1964) described five

new species of the genus *Tenuipalpus* and recorded *Tenuipalpus womersleyi* P. & B. from New Zealand. Boczek and Kropczynska (1964) gave the first record of *Cenopalpus lineola* on *Pinus* and *Brevipalpus phoenicis* on many different host plants from Poland. Balevski (1965) found all stages of *Cenopalpus pulcher* for the first time on fruit trees from Bulgaria. Muma (1965) studied the population density of *Brevipalpus phoenicis* and *B.californicus* on citrus trees in Florida. Düzgünes (1965 a) surveyed the tenuipalpid mites in Turkey. She recorded seven species belonging to four genera. In the same year she considered the phytophagous mites as a major pest in Turkey and suggested to use the integrated control to keep the mite populations under the economic injury level.

De Leon (1965 a) described *Brevipalpus bucerasae, B.absens. Tenuipalpus simaruba* and *T.panici* from Puerto Rico. He in the same year surveyed the false spider mites of Jamaica and the Dominican Republic. He recorded seven species of *Brevipalpus*, one of which was new and nineteen species of *Tenuipalpus*, eleven of which were new to science. De Leon (1965 c) described eight new species of *Tenuipalpus*, one *Priscapalpus* and one *Brevipalpus* from British Guiana.

Ehara (1966 a) recorded *Pentamerismus oregonensis* and *Brevipalpus phoenicis* from Brazil. He listed also twelve other species attacking crop plants in South America. He again in the same year listed twelve species of the genera *Pentamerismus, Brevipalpus, Cenopalpus* and *Dolichotetranychus* on various host plants from Okinawa Island. The genus *Cenopalpus* and *Dolichotetranychus* were recorded for the first time in this region. Carmona (1966) recorded *Brevipalpus lewisi* and *Cenopalpus lanceolatisetae* from Portugal.

De Leon (1967) described five new species of the genera *Tenuipalpus* and *Brevipalpus* from the Caribbean area. Thewke (1967) described *Brevipalpus columbiensis* on *Platanus occidentalis* L. and *B.ennsi* on *Antennaria plantaginifolia* (L.) Hook.

from Missouri. Livshits and Mitrofanov (1967) reported forty species of tenuipalpid mites, twelve of which were new species belonging to *Brevipalpus, Aegyptobia* and *Pentamerismus* from the USSR. They gave also a key for this species. Düzgünes (1967 a) studied the biology and population density of *Cenopalpus pulcher* on apple trees in Turkey. Dosse (1967) gave the first record of *Cenopalpus pulcher* on apples, *Brevipalpus obovatus, B.californicus* and *B.lewisi* on *Citrus* sp. from Lebanon. Sternlicht and Golan (1967) described briefly the life history, damage and control of *Tenuipalpus granati* of vineyards in Israel. Dean and Maxwell (1967) studied the association between *Brevipalpus californicus* and *B.phoenicis* which were a pest of grapefruit in Texas and the leprosis-like spotting. Düzgünes (1967 b) described *Cenopalpus pritchardi* on *Pyrus communis* L. and *C.bakeri* on *Crataegus oxyacantha* L. from Turkey.

Livshits and Mitrofanov (1968) described *Brevipalpus* on *Quercus* sp. from USSR. Carmona (1968) recorded *Brevipalpus californicus, B.obovatus* and *B.phoenicis* from Portugal. Gonzales (1968) described *Tenuipalpus austrocedri, T.charlini, T.canelae* and *T.acharis* from Chile and provided a key for all known tenuipalpids of this region. Knorr, Denmark and Burnett (1968) analyzed an 18-years survey of *Brevipalpus* mites and their association with the leprosis and false leprosis on citrus in Florida. El-Badry (1968) recorded *Brevipalpus inornatus* on citrus from Sudan. Ehara (1968) gave a first record of *Brevipalpus russulus* on cactus from Japan. In another publication (1969) he recorded *Pentamerismus oregonensis* on *Juniper* from Taiwan.

Hatzinikolis (1969) described *Cenopalpus eriobotryi* on loquat trees from Greece. Collyer (1969) described *Aegyptobia pomaderrisae* on *Pomaderris rugosa* from New Zealand. Bozai (1969) gave the first record of six species of the genera *Brevipalpus, Pentamerismus* and *Aegyptobia*. He illustrated and gave a description of each species. Talhouk (1969) recorded

Cenopalpus pulcher on apple trees in Lebanon. Zaher and Yousef (1969) surveyed the tenuipalpids of Egypt. They found eighteen species belonging to nine genera. They described *Aegyptobia salixi* on *Salix* sp., *Cenopalpus fewstrii* on *Pinus* sp. and *Phytoptipalpus aegyptotetrapodus* on *Acacia nilotica*. Zaher, Wafa and Yousef (1969) studied the damage and the life cycle of *Raoiella indica* and *Phyllotetranychus aegyptiacus* on date palms in Egypt. Wafa, Zaher and Yousef (1969) mentioned eighteen species of false spider mites attacking fruit trees, ornamentals, vegetables, grasses and wild plants in several localities from Egypt.

Bozai (1970) described *Tenuipalpus szarvasensis* on *Abies nordmanniana* Lk. from Hungary. Livshits and Mitrofanov (1970) described *Brevipalpus bagdasarini* on *Fraxinus* sp.; *Pentamerismus tauricus* on citrus and *Tenuipalpus ephedrae* on *Ephedra* sp. from USSR. Khan (1970) described *Tenuipalpus jasmini* on *Jasminum* sp. from Pakistan. Han (1970) recorded *Tenuipalpus japonicus* on different hosts from Korea. Zaher, Wafa and Yousef (1970) reared *Brevipalpus phoenicis* in the laboratory on the leaves, buds and fruits of citrus in order to study the life history and other biological aspects of this species in Egypt. Yousef (1970) reported *Tenuipalpus granati, Brevipalpus phoenicis* and *B.lewisi* on the vine trees in U.A.R. Sepasgosarian (1970) studied *Cenopalpus pulcher* which attack the apple trees in Iran. He discussed the taxonomy, hosts, synonymous names and control of this species.

Hatzinikolis (1970) surveyed the tenuipalpid mites of Greece. He found twenty species, fifteen of which were new discoveries to this region. Carmona (1970) gave the first record of *Tenuipalpus caudatus* on *Laurus nobilis* L. from Portugal. Thewke and Enns (1970) surveyed the tenuipalpids of Missouri. They found eleven species belonging to the genera *Aegyptobia, Pentamerismus* and *Brevipalpus*. In 1971 they described *Brevipalpus edurensis* on *Tilia americana* L. and *Pentamerismus ossianensis* on *Thuja* sp. from New York. Findlay (1971) collected *Brevipalpus obovatus* and *B.phoenicis* on tea

from Central Africa.

Ehara and Lawrence (1971) gave the first record of *Pentamerismus oregonensis* on *Chamacyparis* sp. and *Brevipalpus obovatus* on wild *Chrysanthemum* from Hong Kong. Attiah, Soliman and Wahab (1971) reported five species of the genus *Cenopalpus* and *Brevipalpus* on pome fruit trees in Egypt. Yousef (1971) described *Aegyptobia sayedi* on *Cupressus sempervirens* from Egypt. He provided a key to the known species. Zaher, Rasmy and Abou-Awad (1971) surveyed the tenuipalpid mites and their predators on decidous fruit trees in lower Egypt.

Rivero (1971) gave the first record of *Tenuiopalpus punicae* P. & B. from Spain. Pegazzano (1971 b) recorded *Brevipalpus lineola* and *B.wainsteini* on pine from Italy. She in the same year collected *Brevipalpus olearius* on *Olea europaea* L. from Toscana and Umbria, Italy. Menon, Ghai and Katiyar (1971) gave the first record of *Cenopalpus pulcher* on apple trees and *Tenuipalpus granati* on pomegranate from India. Dosse (1971) described *Cenopalpus irani* on apples and *C.crataegi* on Crataegus from Iran. He recorded other twelve species of the genera *Cenopalpus, Brevipalpus, Tenuipalpus* and *Colopalpus*. Bozai (1971) gave the first record of *Brevipalpus mespili* Liv. & Mitr., *B.thelycraniea* Liv. & Mitr., *B.lewisi* on *Crataegus monogyna Jacq., Cotoneaster* sp. and *Vitis vinifera* L. from Hungary respectively.

Chaudhri (1971 a) described *Tenuipalpus erasus, T.dimensis, T.lustrabilis, T.hornotinus* and *T.placitus* from Pakistan. He provided a key to the Pakistan species. In the same year he described another four new species of the genus *Cenopalpus* from the same region. In 1972 he described five species of the genus *Tenuipalpus* from Pakistan. In the same year he described six species and redescribed one species of *Brevipalpus* on different host plants from Pakistan. He provided a key to the *Brevipalpus* species of this region. Chaudhri (1972) described five species of the *Aegyptobia* in Pakistan. Siddiqui and

Chaudrhi (1972) described three new species of the genus *Tenuipalpus* on *Morus alba* L., *Vitis vinifera* L. and *Phoenix dactylifera* L. from Pakistan. Kazimi (1972) described *Tenuipalpus ghanii* on six different host plants. He studied the distribution, biology and the natural enemies of this species in Pakistan. Prieto and Diaz (1972) studied the life cycle of *Brevipalpus phoenicis* which attacks citrus trees in Cuba.

Baker and Tuttle (1972) proposed a new genus *Raoiellana* based on *Raoiellana allium* collected on the bulbs of *Allium pulchellum* Don., from Turkey at New York Quarantine. They studied the tenuipalpid fauna of southwestern United States and found thirty-five species, twenty of which were new described belonging to the genera *Aegyptobia, Pentamerismus, Pseudoleptus, Tenuipalpus, Raoiellana, Dolichotetranychus* and *Colopalpus.* Collyer (1972) described *Colopalpus elegans* on *Senecio hectoris* J.Buchan from New Zealand and *C.mansoni* on *Pomaderris* from Australia. Abdel-Shaheed, Hammad and El-Sawaf (1972) gave a key to the tenuipalpid mites which are to be found in Alexandria region in Egypt. Zaher and Yousef (1972) studied the life history of *Tenuipalpus punicae* on pomegranate in Egypt. Helle and Bolland (1972) studied the parthenogenesis in *Brevipalpus obovatus.* Helle, Bolland and Gutierrez (1972) counted the number of chromosomes in three species of *Brevipalpus.* Pegazzano and Castagnoli described *Brevipalpus olivicola* on olive trees along the coast of Toscany, Italy. Dosse (1972) described *Brevipalpus jordani* on lemons from Jordan. He discussed *Cenopalpus pulcher* and *C.bakeri* Düzgünes as a pest in Central Europe and Lebanon. Sepasgosarian (1972) listed thirteen tenuipalpid species belonging to the genera *Cenopalpus, Brevipalpus* and *Tenuipalpus.* He mentioned six of these species are of economic importance in Iran.

Mitrofanov (1973 a) established a new taxonomic system of Tenuipalpidae. He proposed the subfamily Tenuipalpinae Sayed and subdivided this subfamily into four tribes viz. Phytoptipalpini Ewing 1922; Pseudoleptini Oud. 1928; Dolichotetrany-

chini, Sayed 1938 and Tenuipalpini Berlese, 1913, which embrace nineteen genera. In the same year he established the subfamily Brevipalpinae Reck which included four tribes namely Phyllotetranychini Mitrofanov, Pentamerismini Mitrofanov, Colopalpini Mitrofanov and Brevipalpini Reck. He mentioned fourteen genera belonging to this subfamily. Collyer (1973 a) described *Dolichotetranychus alpinus* on *Cionochloa* sp. from New Zealand. In another publication in 1973 (b) she provided a key to one hundred and five species of the genus *Tenuipalpus* known from the world besides a separate key to the eighteen species of the same genus found in New Zealand. She also described twelve new species and gave additional data for some others from the same region. Saba (1973) recorded *Brevipalpus phoenicis, B.obovatus* and *Cenopalpus pulcher* on citrus and apple trees from Marocco.Khalil-Manesh (1973) surveyed 19 species belonging to six genera of tenuipalpid mites on different host plants from Iran. Anwarullah and Khan (1973) erected a new genus *Terminalicus* with *T.charachiensis* as type species on *Terminalia catappa* L. from Karachi, West Pakistan. Dhooria and Sandhu (1973) recorded *Tenuipalpus punicae* on pomegranate from Punjab, India.

Prasad (1974) listed five species of the genus *Brevipalpus* and one species of each *Larvacarus, Phytoptipalpus, Raoiella* and *Tenuipalpus* from India. Chaudhri, Akbar and Rasool (1974) surveyed the tenuipalpid mites of Pakistan and reported forty-five species under the genera *Aegyptobia, Raoiella, Cenopalpus, Pentamerismus, Brevipalpus, Tenuipalpus* and *Colopalpus*. In this publication they described thirteen new species and erected a new genus *Amissus* on the basis of the type species *Amissus ochaliensis* on *Adhota vesica*. *Flechtmann (1974)* recorded *Brevipalpus phoenicis, Dolichotetranychus floridanus, Tenuipalpus cedrellae* and *T.pacificus* as important mite pests on plants in Brazil. Dosse (1974) studied a species of *Cenopalpus* and two of *Brevipalpus* on *Pinus* sp. from the countries surrounding the Mediterranean Sea. He mentioned that the three species were synonyms and should hold the name *Cenopalpus ka-*

landadzei (Reck). Castagnoli (1974) investigated the presence of spermatheca in the Brevipalpini species. Zaher, Soliman and El-Safi (1974) reared *Cenopalpus pulcher* in the laboratory to study the life cycle and other aspects in Egypt. Wahab, Yousef and Hemeda studied in the same year the life history of *Brevipalpus obovatus* in Egypt. Janezic (1974) studied the distribution, importance and some biological aspects of *Cenopalpus pulcher* which causes damage to the apple trees in Yugoslavia.

Baker and Tuttle (1975) erected a new genus *Obuloides* with *O.rajamohani* as a type species from *Hibiscus* sp. galls caused by *Eriophyes hibisci* Nalepa from India. Baker, Tuttle and Abbatiello (1975) reported seventy-one tenuipalpid mites representing five genera viz. *Pseudoleptus, Aegyptobia, Tenuipalpus, Brevipalpus* and *Priscapalpus* from Northwestern and North Central Mexico. They described twenty-one new species from this region. Jeppson, Keifer and Baker (1975) published a book "Mites Injurious to Economic Plants". They mentioned the general description of the family, and gave a key to fifteen genera and dicussed many tenuipalpid mites injourious to plants. Mitchell (1975) described *Brevipalpus grandis* collected under the bark of grand fir, *Abies grandis* (Dougl.) Lindl. from Oregon. Pegazzano (1975) described *Tauripalpoides mitrofanovi* (= *Brevipalpus mitrofanovi* (Pegazzano)) and recorded *Tauripalpus recki* Livsh. & Mitr. (= *Brevipalpus recki* (Livsh. & Mitr.)) on *Quercus* from Italy. Sepasgosarian (1975) discussed thirteen species of the genera *Cenopalpus, Brevipalpus* and *Tenuipalpus* from the dry regions of Iran. Rivero (1975) carried out field and laboratory trials to control the false spider mite *Tenuipalpus punicae* on pomegranate in Valencia, Spain. Gonzales (1975) described three new species pertaining to the *Phoenicis*-group on wild host plants in Chile. He described *Brevipalpus phoenicoides* on *Citrus* and *Pandanus* from Thailand. Dosse (1975) described *Cenopalpus musai* on *Rubus, Viburnum tinus* L. and *Morus nigra* L. from Lebanon. He dicussed *Cenopalpus spinosus* on Rubus in West Germany.

Flechtmann (1976) gave a notated list of eleven species of tenuipalpid mites of the genera *Pentamerismus*, *Brevipalpus*, *Tenuipalpus*, *Dolichotetranychus* and *Colopalpus* from Brazil and Paraguay. Hislop and Jeppson (1976) studied the mouthparts of *Brevipalpus obovatus* in USA. Pegazzano (1976) conducted a series of investigations on *Cenopalpus lineola* and *C.wainsteini* which infested pine trees in Italy. Sadana and Joshi (1976) tested eighty-five host plants to study the host range of the mite *Brevipalpus californicus* in India. Banerjee (1976) studied the life history of *Brevipalpus phoenicis* on two different hosts, coffee and tea in Kenya. Chiavegato (1976) mentioned the severe damage of *Cactus* sp. caused by *Brevipalpus russulus* in Brazil. Gerling, Kugler and Lupo (1976) studied the *Tamarix* galls caused by *Obdulia tamaricis* in Israel.

Bury and Krantz (1977) described *Aegyptobia montana* on *Penstemon davidsonii* Greene, Pitt from Oregon. Channabasavanna and Lakkundi (1977) described *Tenuipalpus lalbaghensis* on jak *(Artocarpus integrifolia)* from Bangalore, India. He provided a key to the known Indian species of this genus. Sepasgosarian (1977) listed twenty-one tenuipalpid mites on different plants from Iran. Maninder and Ghai (1978 a) described *Colopalpus punjabensis* on *Nerium indi-cum* Mill. from India. They in the same year described nine new species of the genus *Tenuipalpus* and recorded two known species on different host plants. They gave a key to the *Tenuipalpus* species of India. They again in 1978 (c) described *Terminalicus panajiensis* and *T.delhiensis* on *Terminalia* spp. and gave first record of *T.karachiensis* on *Terminalia catappa* from India. Lal (1978) reared *Brevipalpus phoenicis* on two different host plants in order to study the biology and time to complete the life cycle of this mite in India.

Mitrofanov and Strunkova (1978) erected a new genus *Amblypalpus* on the basis of the type species *Amblypalpus narsikulovi* and described *Dolichotetranychus gramineae*, *Zaheria rosae* (= *Phytoptipalpus rosae* (Mitr. & Str.)) and *Gnathopalpus tau-*

Krantz (1978) published "A Manual of Acarology" in which the general classification of the family and other important aspects were discussed. Hatzinikolis (1978) described *Hystripalpus atalantae* (= *Brevipalpus atalantae* (Hatz.)) on olive trees from Greece. Carpenter and Elmer (1978) surveyed the pests and diseases of the date palms. They mentioned *Raoiella indica* and *Phyllotetranychus aegyptiacus* as the most significant pests on date and other palm leaves in Egypt, Sudan and India. Corpus-Raros (1978) described six new species and a new genus *Philippipalpus* of the family Tenuipalpidae. The new species are *Colopalpus philippinensis, Obuloides rimandoi, Philippipalpus agohoi, Tenuipalpus banahawensis, T.ilocanus* and *T.palosapis.* The author recorded also *Tenuipalpus meekeri* as a new species to the Philippine fauna. Denmark (1978) discussed the distribution, hosts, importance, control and description of *Brevipalpus russulus* as a pest in Florida.

Meyer (1979) published a general review of the distribution, classification and external morphology of the tenuipalpid mites of Africa. She surveyed in this publication one hundred thirteen species, seventy-four of which are new to the science. She established four new genera, namely *Afronychus, Krugeria, Capedulia* and *Coleacarus* and amalgamated others. She recognized twenty-one genera and provided a key to the world genera. Mitrofanov and Strunkova (1979) published a key to the world fauna of the false spider mites comprising three hundred sixty-five species belonging to thirty-five genera. They established their key based on the world literature which had been published up to 1975. Castagnoli and Pegazzano (1979) described *Hystripalpus rotai* (= *Brevipalpus rotai* (Cast. & Peg.)) on olive trees in Italy. Baker (1979) gave a note on the paedogenesis in *Brevipalpus* sp. collected on citrus from the Dominican Republic. Sadana and Joshi (1979) compared the susceptibility of twenty-five citrus varieties to the attack of *Brevipalpus californicus* in India. Yousef, Zaher and Abd El-Hafiez (1979) studied the life span of *Tenuipalpus granati* and described the immature stages of this species in Egypt.

Wang (1980) described *Tenuipalpus hainanensis* on *Lygodium japonicum (Thunb.)* SW. from Hainan Island, China. Tseng (1980) described *Aegyptobia changi* on *Juniperus chinensis* L. and *Chamecyparis obtusa* from Taiwan. Ma and Yuan (1980 a) described four new species of the genus *Tenuipalpus* from China viz. *T.lulinicus, T.jianfengesis, T.muguanicus* and *T.taonicus*. In the same year they described *Pentamerismus kunmingensis* and recorded *P.oregonensis* on *Biota orientalis* (L.) from China. Sadana and Chhabra (1980) described *Tenuipalpus aboharensis* and *T.ludhianaensis* on *Punica granatum* and *Pyrus communis* respectively. They gave the first record of *T.mustus* Chaudhri and *T.caudatus* from India. Maninder and Ghai (1980) described *Aegyptobia menoni* on the leaves of *Cupressus* sp.and recorded *A.nummulus* Chaudhri on the same host from India. Meyer and Gerson (1980) described *Tenuipalpus cupressoides, T. pareriophyoides* and *Aegyptobia eremia* from Israel. They gave the first record of other eight species. Gerson and Meyer in the same year described *Capedulia maritima* from the roots of *Limonium meyeri* (Boiss.) from Israel. Helle, Bolland and Heitmans (1980) assessed the chromosome numbers and the type of parthenogenesis for 19 species of 6 genera of tenuipalpid mites. Buchanan, Bengston and Exley (1980) studied the seasonal abundance and distribution of *Brevipalpus lewisi* on grapevines in the Mildura district of Victoria, Australia.

Gutierrez and Bolland (1981) described *Tenuipalpus inophylli* on *Codiaeum inophyllum* Muell. Arg. from New Caledonia. They studied the biology of this species and the effect of irradiation on the females. Hatzinikolis and Kolovos (1981) described *Hystripalpus hellenicus* (= *Brevipalpus hellenicus* (Hatz & Kol.) on olive trees from Greece. Sadana, Chhabra and Kumari (1981) reported ten species of the genera *Aegyptobia, Brevipalpus* and *Tenuipalpus* on ornamental and medical plants from India. They recorded *Tenuipalpus pernicis* Chaudhri, Akbar and Rasool for the first time. Nassar and Ghai (1981) studied the tetranychoid mites associated with vegetable and fruit

crops in Delhi. They recorded ten species of the genera *Terminalicus, Tenuipalpus* and *Brevipalpus* and described *Terminalicus serratus* and *Tenuipalpus yousefi* on *Pisidium gujava* L. Mohanasundaram (1981) described *Tenuipalpus tectonae, T.malligai, T.coimbatorensis, T.laminasetae* and *T. ghaii* from South India. Crocker, Knoop and Owens (1981) recorded *Aegyptobia nomus* (Baker & Pritchard) for the first time on buffalograss *Buchloe dactyloides* (Nutt.) from Texas. Pijnacker, Ferwerda and Helle (1981) described the female and male genitalia, the oogenesis and spermatogenesis of *Brevipalpus obovatus*. Hanna et al. (1981) tested in the laboratory the effect of four different hosts on the development of *Cenopalpus pulcher* and *C.lanceolatisetae* which consider major pests of decidous fruit trees in Egypt. Rice and Weinberger (1981) described the pistachios damage caused by *Brevipalpus lewisi* and mentioned some ecological and biological observations on this mite in California.

Hatzinikolis (1982) recorded four species of the genera *Cenopalpus* and *Hystripalpus* from Greece. Gutierrez and Schicha (1982) described *Tenuipalpus banksiae* on *Banksia spinulosa* Sm. and *T.grevilleae* on *Grevillea sericae* (Sm.) from New South Wales. Ehara (1982) described *Aegyptobia arenaria* on *Artemisia capillaris* Thunb. in Honshu, and *Tenuipalpus boninensis* on *Morinda boniniensis* Ohwi from Chichi-jima Island. Chhabra and Gupta (1982) described *Tenuipalpus persicae* on *Prunus persica* (L.) from India. Sadana and Gupta (1982) collected seven species of the genera *Brevipalpus* and *Tenuipalpus* on different hosts from India. Mohanasundaram (1982) described *Brevipalpus cucurbitae* on *Cucurbita maxima* and *B.euphorbiae* on *Croton* sp. from India. Chiavegato, Mischan and Silva (1982) reported on the leprosis disease of citrus trees in Brazil. Lehmann (1982) surveyed the mite fauna of Pennsylvania and recorded four species of *Pentamerismus*, namely *P.canadensis, P.taxi, P.oregonensis* and *P.canadensis*. Oomen (1982) studied the population density of *Brevipalpus phoenicis* which is considered as a pest of tea in Indonesia.

Mohanasundaram (1983 a) described *Dolichotetranychus elatariae*, *D.repenae*, *D.tenellae*, *Tenuipalpus trifoliatae* and *T.vriddagiriensis*. He in 1983 (b) again described *Tenuipalpus acuminatae* on *Teliacora acuminata* and *T.mallotae* on *Mallotus* sp. from India. In another publication he described *Tenuipalpus psidi* on *Psidium guajava* L. from the same region. Mitrofanov and Sharonov (1983) described *Tenuipalpus arbuti* and *Pseudoleptus graminicola* from Crimea, USSR. Wang (1983) described eight new species of the genus *Tenuipalpus* from China. Sepasgosarian (1983) published an alphabetical list of 541 tenuipalpid species with authors, dates and synonyms from all over the world. Gerson, Venezian and Blumberg (1983) gave the first record of *Raoiella indica*, *Phyllotetranychus aegyptiacus*, and *Tenuipalpus pareriophyoides* on date palms from Israel. Hatzinikolis (1983) described *Hystripalpus macedonicus* (= *Brevipalpus macedonicus* (Hatz.)) on olive trees from Macedonia, Greece. Flechtmann(1983) reported in his book the general taxonomical characters of the family Tenuipalpidae.

Ghai and Wadhi (1983) mentioned *Raoiella indica* and *Brevipalpus phoenicis* as pests of coconut trees in India.They investigated the control of this mite. Sadana and Gupta (1983) described *Brevipalpus assamensis*, *B.gauhatensis* and *B.tinsukiaensis* and recorded *Ultratenuipalpus meekeri* (De Leon) for the first time in India. Sadana, Gupta and Chopra (1983) surveyed seven tenuipalpid species of the genera *Brevipalpus* and *Tenuipalpus* attacking crop weeds in Punjab, India. Goyal and Sadana (1983) investigated the effect of mite infestation, *Brevipalpus obovatus* on *Coleus* sp. and the biochemical changes which happened after this infestation. Mitrofanov (1983) studied the evolution of Tetranychoidea which includes more than 1000 species of the 106 genera.

Gerson and Collyer (1984) described *Tenuipalpus cyantheae* on *Cyanthea medullaris* (G.Forst.) Sw. from New Zealand and recorded *T.guamensis* Baker on two ferns (Pteridophyta) from the

corded *T.guamensis* Baker on two ferns (Pteridophyta) from the Cook Island. Meyer and Bolland (1984) described *Tenuipalpus gracinae* on *Gracinia* sp. and *T.raphiae* on *Raphia* sp. from Cameroun. Sepasgosarian (1984) published the first addendum to the list of the tenuipalpids of the world. He added eleven new species and therefore the species number was 552. Sadana and Gupta (1984) described *Tenuipalpus solanensis, T.sharmai* and *T.jagatkhanaensis.* They provided a key to the Indian species of this genus. Ghai and Shenhmar (1984) reviewed 562 tenuipalpid species under twenty-two genera and supplied the hosts, distribution and the synonyms of all species in the world. Goyal, Sadana and Sharma (1984 a) tested one hundred eight plants to survey the host range of *Brevipalpus obovatus* in India. They in the same year studied the population fluctuations of *Brevipalpus obovatus* on golden rod, *Solidago canadensis* L. in the same region. Ma and Li (1984) described *Cenopalpus xini* on *Populus nigra* L. from China. Khosroshahi (1984) studied the life history, ecology and control of pomegranate false spider mite, *Tenuipalpus punicae* in Iran. Zaher et al. (1984) surveyed the phytophagous mites of Egypt. Concerning the family Tenuipalpidae, they found twenty-three species belonging to nine genera. Prieto (1984) studied the damage of citrus crops caused by *Brevipalpus phoenicis* in Cuba and the morphological transformation during postembryonal development of this mites.

Akbar and Chaudhri (1985) described eight new species of the genus *Cenopalpus* from Pakistan. Hatzinikolis (1985) described *Hystripalpus chalkidicus* (= *Brevipalpus chalkidicus* (Hatz.)) on olive trees from Greece. Sadana, Gupta and Goyal (1985) described *Tenuipalpus kesari* on *Brassica oleracea* var. *botrytis* L. from India. Goyal, Sadana and Sharma (1985) studied the effect of temperature on the life history of *Brevipalpus obovatus* in India. Gupta (1985) published a book "Handbook, Plant Mites of India" in which ten genera were mentioned. Sepasgosarian (1985) published the second addendum with thirty-two new species and one genus. He mentioned that the family Tenuipalpidae comprised 584 species under 23 genera

until October, 1985. Quiros-Gonzales (1985) studied the taxonomy and phylogeny of 27 genera of the family Tenuipalpidae. This study was done by using the computer to show the phylogenetic analysis of 196 characters and 56 taxa. Salas and Ochoa (1985) described *Tenuipalpus chamaedorea* on *Chamedorea* sp. from Costa Rica.

Charanasari, Saringkhapaibul and Kongchuensin (1986) recorded four tenuipalpid species damaging orchids in Thailand, namely, *Tenuipalpus pacificus* Baker, *Dolichotetranychus vandergooti* (Oud.), *Brevipalpus californicus* and *B.phoenicis*. They studied the biology of *T.pacificus*. Ghai and Baker (1986) investigated some ecological and biological aspects of *Larvacarus transitans* (Ewing) on *Ziziphus muritiana* Lam. in India. Sarkar and Somchoudhury (1986) studied the effect of temperature, relative humidity and rainfall on the population density of *Raoiella indica* and *Tetranychus fijiensis* on coconut from India. Sadana and Sharma (1986) reared *Brevipalpus rugulosus* Chaudhri, Akbar and Rasool on the leaves of *Luffa acutangula* (L.) Roxb. in order to study the effect of different temperature levels on the development of this mite. Sharma and Kushwaha (1986) studied the differences between seven *Ziziphus* varieties to the infestation of *Larvacarus transitans* in India. Ochoa (1986) described *Brevipalpus salasi* on *Spondias purpurea* L. from Costa Rica.

Baker and Tuttle (1987) surveyed the false spider mites of Mexico. They found 164 species of these 67 species are described as new to science. Approximately one-third (48) of the Mexican tenuipalpids are distributed in eight genera viz. *Aegyptobia, Dolichotetranychus, Pentamerismus, Phytoptipalpus, Priscapalpus, Pseudoleptus, Tenuipalpus* and *Ultratenuipalpus*. Over two-thirds (116) are in the genus *Brevipalpus*. Denmark (1987) discussed the economic importance of *Tenuipalpus pacificus* as a pest of Florida orchids.

C.Tenuipalpids of Iraq

The first mention of phytophagous mites in Iraq was made by Buxton (1918) who was employed by the British Occupation Government, 1918-1921, in Iraq. He reported on the failure of the date crop of Mesopotamia in 1918. In his report he stated "minor pests of dates were mites that spun webs over the cluster in early July. Dates so affected, develop a scaly irregular skin and did not rippen. They are used as cattle food". In another publication, 1920, he recorded *Oligonychus (Paratetranyhus) simplex* Banks as a very important pest of date palm in Iraq. Wimshurst (1919) mentioned *Tetranychus* sp. as a pest of cotton and date palms. Rao (1921, 1922) and Dowson (1921, 1934) referred to the same problem of date palms in Iraq. André (1932) reported *Paratetranychus simplex* Banks as a pest of date palm in the same region. Walker and El-Haidari (1954) found that a build-up of *Tetranychus* sp. developed after the spraying of insecticides to control the spiny bollworm on cotton in Iraq.

Baker (1952) described *Tenuipalpus eriophyoides* from an immature stage collected from an unknown host in Iraq. El-Haidari (1965) published "a preliminary list of mites of Iraq" in which he listed eight families, nineteen genera and thirty-seven species. Mohammed and El-Haidari (1965) provided a supplementary list of the phytophagous mites of Iraq. They recorded *Tenuipalpus punicae* on pomegranates, *T.granati* on grapes and *Cenopalpus pulcher* on apples, besides *T.eriophyoides* and some other species which I will refer in the dicussion. Hussain (1967) gave general notes on the biology and damage of *Tenuipalpus eriophyoides*. El Mosa (1971) studied the seasonal cycle of the flat mite, *Cenopalpus pulcher* on apples. Abid and El-Haidari (1972) studied some aspects of the biology and control of *Tenuipalpus punicae* on pomegranate.

Baker and Tuttle (1972) reported a new combination of *Te-*

nuipalpus eriophyoides (= *Colopalpus eriophyoides* (Baker)) and described the female and the male of this species on date palms from Iraq. Al-Gboory (1979) conducted some investigations on the biological and ecological aspects of *Tenuipalpus punicae* which is regarded to be the most serious pest of pomegranate trees in Iraq. Abul-Hab (1982) stated that in the early fifties the mite population on crops increased to very high peaks after the use of insecticides against insect pests on plants of economic importance, especially cotton, and the situation became critical. Thus in the late sixties, the Directorate General of Plant Protection established an Acarology Section within the Department of Entomology. The aims were to carry out surveys on the mite fauna of Iraq, biological and ecological investigations. Al-Gboory (1984) and (1986 a, b) published the results of his three year investigations on *Tenuipalpus punicae* which damages more than 50 per cent of pomegranate fruits in Central Iraq. He discussed in detail the ecological and biological aspects of this mite and gave the suggestions to control it.

Geographical an ecological remarks about Iraq

Location:

The Republic of Iraq occupies the land of old Mesopotamia. It lies between longitudes 38° 42' E., and 48° 23' E. and between latitudes 29° 27' N. and 37° 23' N. Iraq covers an area of 438,446 sq.km. The boundaries of Iraq face generally in three major and three minor directions (Fig.1) as follows:

1. To the north-east- the long persian frontier, extending over some 1200 km., in the general direction N.W. to S.E.

2. To the south-east- the short Kuwaiti frontier, extending over some 200 km. in the general direction N.E. to S.W.

3. To the south-west- the long Saudi Arabian frontier, extending over some 900 km. in the general direction W.N.W. to E.S.E.

4. To the west the short Jordanien frontier, extending over some 150 km. in the general direction N. by W.to S. by E.

5. To the north-west- the long Syrian frontier, extending over some 600 km. in the general direction N.E. to S.W.

6. To the north the relatively short Turkish frontier, extending over some 300 km. in the general direction W. to E.

The two great rivers of Iraq are the Tigris and the Euphrates, both of which arise from the mountains of Turkey and flow in a south-east direction. In the lower basin of Iraq

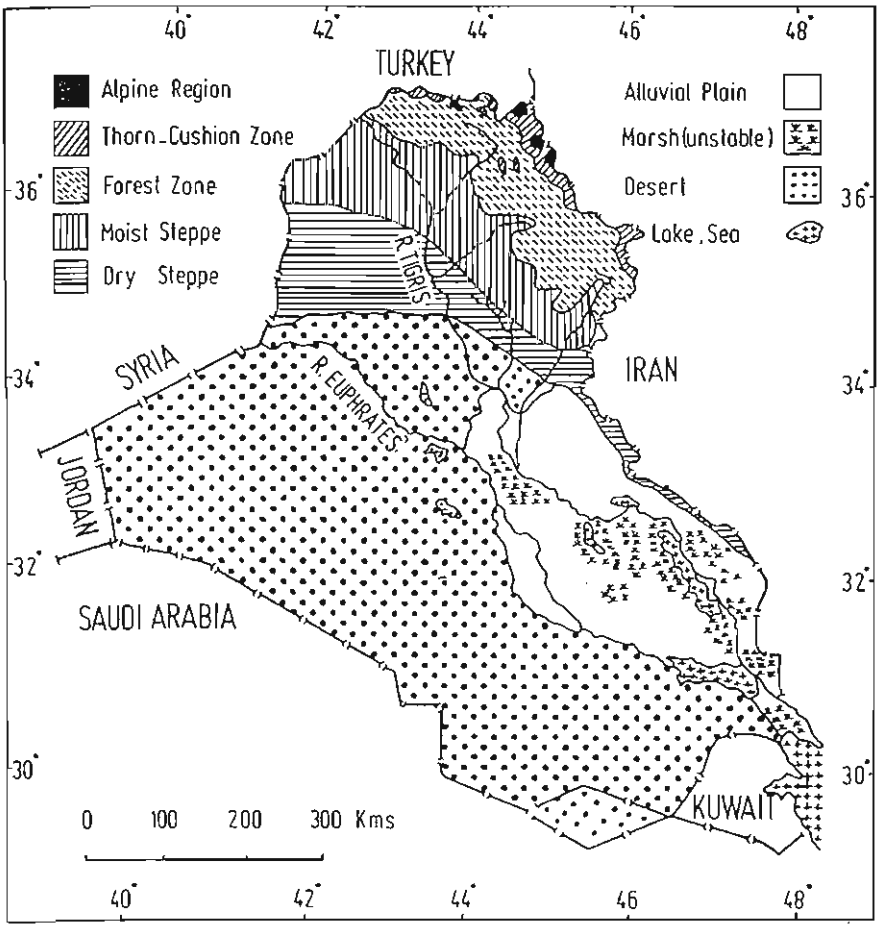

Fig. 1 . Map of the vegetation and physiographic regions of Iraq

they flow through flooded areas, constituting the permanent marshes; then, they converge together at Qurna, about 65 km above Basra to form the Shatt Al-Arab (The Arab river) which flows to the Arabian Gulf. Four tributaries run through the east of the Tigris and empty their water in it. These are the Great Zab, the Little Zab, the Adhaim and Diyala just south of Baghdad. The Euphrates, on the other hand, has no tributaries except the wadis (temporary water-shed) of the western desert.

The importance of the river system in the economy of Iraq is immense. On the lower plains practically no crops can be grown without irrigation. On the upper plains and foothills rainfall is generally sufficient for winter crops, but summer crops cannot be grown without irrigation, which is also necessary for the maintenance of gardens and orchards. Even in the mountains the inhabitants are obliged to resort to irrigation during the summer month.

Climate:

The climate of Iraq is of the semi-arid type, designated as "continental, sub-tropical", chiefly characterized by wide diurnal and annual ranges of temperature, Guest (1953) summerized the main features of the climate as:

a. a high mean annual air temperature (due to the latitude);

b. large differences in temperature between day and night and between winter and summer, i.e. large diurnal and annual ranges of temperature. In lower Iraq the maximum temperature recorded is 51° centigrade (123° Fahrenheit) and the minimum -8° C (18° F.). The diurnal range in temperature often exceeds 15-20° C (30° F.) and has on occasion been known to be as greatas 35° C (60° F.), or even more. In the mountain region, where accurate data are scarce, the absolute

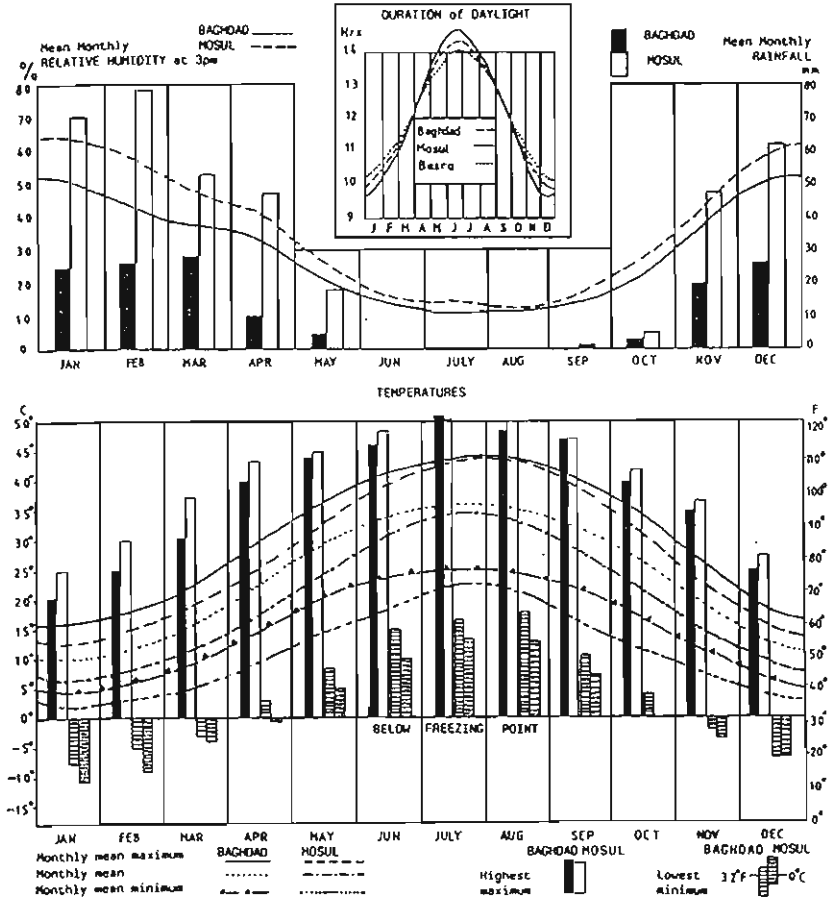

Fig. 2 . Temperature,relative humidity,rainfall,duration of daylight in Iraq

maximum recorded is 41° C (105° F.). No minimum records are available from the mountains but at Mosul the lowest recorded minimum is -11° C.

c. low atmospheric humidity. During the summer months the relative humidity at 3 p.m. at Baghdad averages about 16 %. In the lower plains the dryness and heat result in a large capacity of evaporation, the rate of which greatly exceeds the annual rainfall, being 20-40 times as great;

d. scanty rainfall. Over the greater part of lower Iraq the average annual rainfall does not much exceed 150 millimeters (6 ins.) while in most of the Southern Desert it is well below 100 mm. (3 ins. or less). Moreover the rainfall is extremely variable, both seasonally from year to year and in distribution during any given winter season. On the Upper Plains there is two to three times as much rain as at Baghdad, the average annual rainfall rising from about 300 mm, in the drier part to 500 mm or more in the sub-mountaine foothills (12 - 20 ins.). In the forest zone of the mountains the rainfall varies from about 600 mm to over 1200 mm, in the north-east corner of the frontier (25 - 55 ins.). (Fig.2)

Natural Vegetation

The natural vegetation of Iraq may be classified under five categories (Al-Ali, 1977):

1. Desert vegetation: The western and Southern Deserts lie west of the Euphrates and extend to the Syrian, Jordanian and Saudi Arabian borders. Desert plants are annual herbs and herbaceous or woody perennials and biennials.

2. Steppe vegetation: The steppe lies north of the Western Desert. It extends from the Syrian borders across the Tigris to cover the foothills. The vegetation is practically continuous with that of the desert, but is favoured by better climatic conditions, having: a. more rainfall and higher humidity, b. higher altitude and lower temperature. Consequently, the steppe has a higher density of plant population.

3. Alluvial and Marsh vegetation: Many species of alluvial plants are characterized by having succulent or spinose organs. *Phragmites communis* and *Thypha angustata* may be mentioned as examples of marsh plants. In general, the alluvial land is utilized for the cultivation of date-palms, fruit trees and seed crops.

4. Forest vegetation: The plants are confined to altitudes between 700 and 1800 meters. *Quercus* species are dominant, while *Pinus*, *Pistacia* and *Juniperus* come second to *Quercus*. Many other species of trees such as *Platanus*, *Juglans*, *Crataegus* and *Tamarix* grow by water streams along with fruit trees. Annual and perennial plants grow on the slopes among these trees.

5. Alpine vegetation: The plants thrive at altitudes above 1800 meters, beyond the timber line. Plants like *Medicago sativa* and *Taraxacum leavigatum* grow in a belt lying between 1800 and 2000 meters high. On tops of mountains perennials like *Astragalus*, *Coarduchorum* and *Acantholimon* grow (Fig.1).

Materials and Methods

Collecting Methods

The collection of the mites included in the present study were made by the author himself as a result of extensive field surveys carried out in different areas of seven provinces in Central Iraq, namely, Baghdad, Diyala, Wasit, Ramadi, Salahuddin, Babil and Kerbala (Fig.3). Various crops, fruit trees, vegetables, ornamentals and weed plants were examined during 1985 and 1986 to collect the phytophagous and predatory mites and to determine the degree of mite infestation. Since tenuipalpid mites are minute in size (200 µ - 300 µ), the majority are hardly visible even with the aid of a pocket lens (10x) and it was a difficult task to collect plant materials in the field and examine it in the laboratory. The plant material was collected in paper bags labelled with data collection slips and closed with rubber bands to prevent contamination from other plant specimens collected at the same time. The mites were picked up efficiently from the infested plants with a micropin (No. 00) snugly fastened to a wood handle or with a help of a fine camel's hair brush (No. 00). The collections of mites have been done under stereoscopic binocular microscope. Wherever there was a heavy infestation, small sized leaves were put as such into vials containing 75% alcohol for five minutes and the leaves were removed after the mites fell down in alcohol. This methods assured the collection of both sexes of mites and offered better selection of specimens for study.

Mounting Techniques

Hoyer's modification of Berlese's mounting medium, as recommended by Baker and Wharton (1952) was used successfully for the mounting of all the mites described in this work. The constituents of this medium are given below:

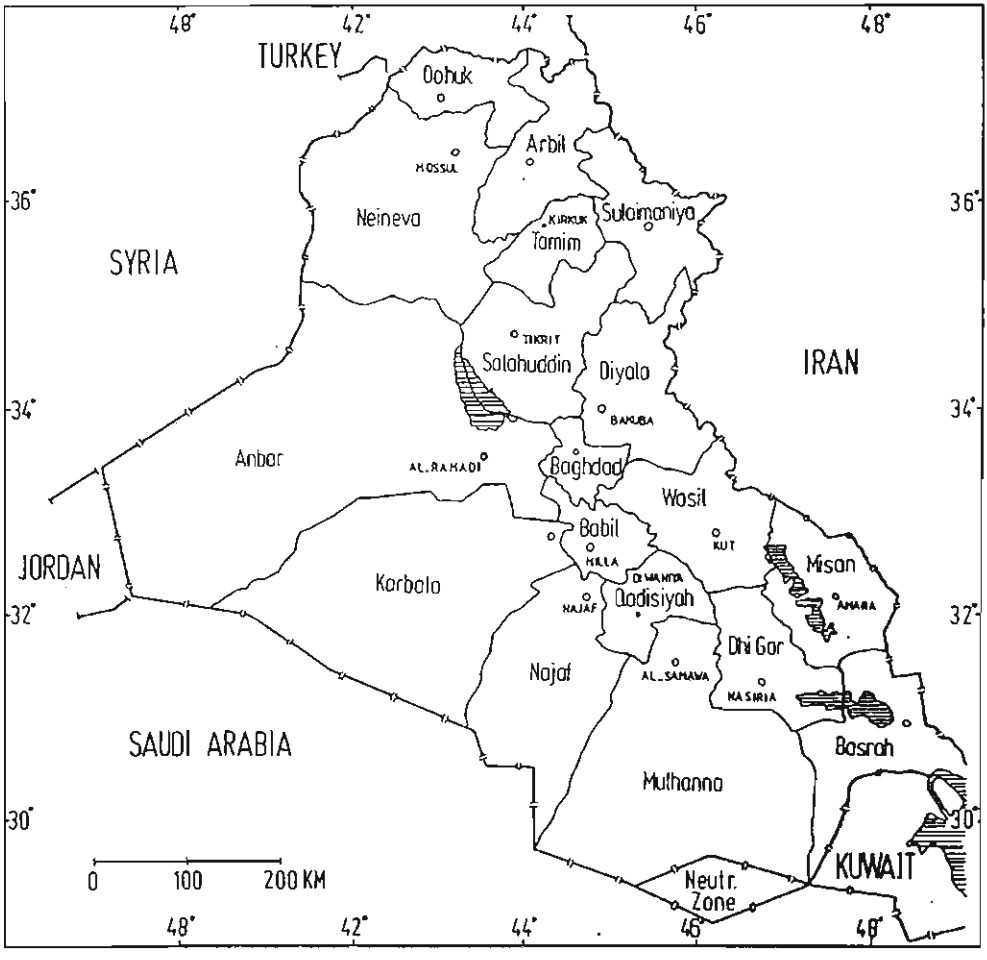

Fig.3.A map shows the provinces of Iraq.

Distilled Water	50 ml
Gum Arabic (clear crystals)	30 g
Chloral Hydrate	200 g
Glycerine	20 ml

Chloral hydrate and glycerine were mixed in distilled water and the mixture was added to the thin paste of gum-arabic made separately in distilled water. The mixture thus formed was heated in water-bath to dissolve the solid portion in the solution. This solution was then passed through glass wool so that it was free of impurities or dust particles.

A drop of mountant was placed in the center of glass slide and the mite specimens were then transferred by a needle from alcohol or plant surface on it. A ringed cover glass was placed over the drop mountant after orientation of the mite specimens. The transfer and orientation of mites had to be done under a stereoscopic binocular microscope. Generally several specimens were mounted on each slide. The specimens were heated for one hour to relax the appendages and then placed in an oven for one week or more at 40°C temperature. This hastened the clearing of specimens. When the slides were well dried, the cover glasses were ringed with finger nail varnish to prevent the medium from coming out on glass and to avoid the absorption of moisture. Specimens mounted on glass slide were fully labelled with the data including host plant, locality, date of collection, number of slides besides the taxonomical informations on the right side of the slides.

The detail study of mounted material was made with the help of phase contrast microscope model Universal, produced by Carl Zeiss Company and the diagrams were drawn by using a drawing attachment tube equipped specially for this purpose from the same company. Measurements were made with an ocular micrometer calibrated with stage micrometer.

Results

Ecological Aspects

In the course of the field work which has been done for this dissertation a survey of 156 plants during 1985 and 1986 could be conducted for mite infestation in Central Iraq. The results presented in Table 1 show 69.87 % of all surveyed plants are inhabited by mites. Within the inhabited plants 46.80 % are light infested (without considerable damage) and 23.07 % have a heavy infestation (with visible damage of the hosts). The most important mite families which cause damage to their hosts in Central Iraq are Tetranychidae (55.12 %) Tenuipalpidae (20.51 %) and Eriophyidae (7.7 %).

In order to give a clear and comprehensive survey it was necessary to work out a table which contains a list of scientific and common names of the plants arranged according to their families. The degree of infestation and the mite families are indicated.

Table 1: Phytophagous and predacious mites inhabiting plants in Central Iraq.

Examined plant	Common name	Infestation	Mite family
Anacardiaceae			
1. *Mangifera indica* L.	Mango	+	Tenuipalpidae
2. *Pistacia vera* L.	Pistachia	+	Tenuipalpidae
Apiaceae			
3. *Ammi majus* L.	Common Bishop's weed	+	Tenuipalpidae
4. *Apium graveolens* L.	Celery	+	Tenuipalpidae
5. *Daucus carota* L.	Carrot	-	
Apocynaceae			
6. *Nerium oleander* L.	Oleander	-	

\+ light infested plant
++ heavy infested plant
\- not infested plant

Predacious mites: Phytoseiidae
Tydeidae
Cheyletidae

Examined plant	Common name	Infestation	Mite family
Arecaceae			
7. *Phoenix dactylifera* L.	Date palm	++	Tenuipalpidae Tetranychidae Eriophyidae Phytoseiidae Cheyletidae
Asclepiadaceae			
8. *Cynanchum acutum* L.	Cynanchum	+	Tetranychidae
Asteraceae			
9. *Aster subulatus* Michx.	Starwort	++	Tenuipalpidae Tetranychidae
10. *Aster tripolium* L.	Aster	++	Tenuipalpidae Tetranychidae
11. *Carthamus oxycanthus* M.B.	Wild safflower	+	Tetranychidae
12. *Carthamus tinctorius* L.	Safflower	+	Tetranychidae
13. *Centaurea cyanus* L.	Cornflower	+	Tetranychidae
14. *Chrysanthemum coronarium* L.	Chrysanthemum	-	
15. *Gazania splendens* hort. angl. ex E.G. et A.Henders	Treasure flower	+	Tetranychidae
16. *Helianthus annuus* L.	Sunflower	+	Tetranychidae
17. *Silybum marianum* (L.) Gaerth	Milk thistle	+	Tetranychidae
18. *Xanthium strumarium* L.	Clotbur	+	Tetranychidae
19. *Zinnea elegans* L.	Zinnea	+	Tetranychidae
Brassicaceae			
20. *Brassica oleracea* var. *capitata* (L.) Alef.	Cabbage	-	
21. *Brassica oleracea* var. *botrytis* (L.) Alef.	Cauliflower	-	
22. *Cardaria draba* (L.) Desv.	White top	+	Tetranychidae
23. *Lepidium sativum* L.	Garden cress	-	
24. *Lobularia maritima* (L.) Lam.	Madwart	-	
25. *Raphanus sativus* L.	Radish	-	

Examined plant	Common name	Infestation	Mite family
Caesalpiniaceae			
26. *Bauhinia purpurea* Wall.	Orchid tree	+	Tetranychidae
27. *Cassia artemisoides* Gaudich.	Senna	-	
28. *Cercis siliquastrum* L.	Judas tree	+	Tetranychidae
Capparaceae			
29. *Capparis spinosa* L.	Common caper	-	
Caryophyllaceae			
30. *Dianthus barbatus* L.	Carnation	-	
Casuarinaceae			
31. *Casuarina equisetifolia* J.R. et G.Forst.	Beef wood	-	
Chenopodiaceae			
32. *Atriplex tatarica* L.	Tatarian orache	-	
33. *Beta vulgaris* L.	Wild beets	-	
34. *Beta vulgaris* L.	Table beets	-	
35. *Beta vulgaris* var. *cicla* L.	Chard	-	
36. *Chenopodium album* L.	Pigweed	-	
37. *Schanginia aegyptiaca* (Hasselq.) Aellen	Suwad	-	
38. *Spinacia oleracea* L.	Spinach	-	
Cichoriaceae			
39. *Lactuca sativa* L.	Lettuce	-	
40. *Sonchus oleraceus* L.	Common sawthistle	+	Tetranychidae Tenuipalpidae

Examined plant	Common name	Infestation	Mite family
Convolvulaceae			
41. *Convolvulus arvensis* L.	Field bindweed	++	Tetranychidae Tenuipalpidae
42. *Cressa cretica* L.	Alkali weed	+	Tetranychidae
43. *Ipomoea batates* (L.) Poir.	Sweet potato	+	Tetranychidae
Cucurbitaceae			
44. *Citrullus lanatus* (Thunb.) Mastum. et Nakai	Water melon	++	Tetranychidae Phytoseiidae
45. *Cucumis melo* L.	Melon	++	Tetranychidae Phytoseiidae
46. *Cucumis melo* var. *flexuosus* L.	Snake cucumber	++	Tetranychidae
47. *Cucumis sativus* L.	Cucumber	++	Tetranychidae Phytoseiidae Tydeidae
48. *Cucurbita maxima* Duch.	Pumpkin	++	Tetranychidae
49. *Cucurbita pepo* L.	Squash	++	Tetranychidae Phytoseiidae
50. *Lagenaria siceraria* (Md.) Standl.	Bottle gourd	++	Tetranychidae
Cupressaceae			
51. *Cupressus sempervirens* L.	Cypress	++	Tenuipalpidae
52. *Thuja orientalis* L.	Thuja	++	Tenuipalpidae
Cuscutaceae			
53. *Cuscuta palaestina* Boiss.	Palestine dodder	-	
Ebenaceae			
54. *Diospyros kaki* L.	Kaki	-	
Euphorbiaceae			
55. *Croton variegatus* L.	Croton	+	Tenuipalpidae Tetranychidae

Examined plant	Common name	Infestation	Mite family
56. *Ricinus communis* L.	Castor bean	++	Tetranychidae Eriophyidae Phytoseiidae Tydeidae
Fabaceae			
57. *Alhagi maurorum* Medic.	Prickly alhagi	+	Tetranychidae
58. *Glycine max* Merr.	Soybean	+	Tetranychidae Phytoseiidae
59. *Glycyrhiza glabra* L.	Common liquorice	+	Tetranychidae
60. *Medicago hispida* Gaertn.	Toothed medic	-	
61. *Medicago sativa* L.	Alfalfa	+	Tetranychidae
62. *Phaseolus vulgaris* L.	Bean	+	Tetranychidae
63. *Pisum sativum* L.	Peas	+	Tetranychidae
64. *Sesbania aegyptiaca* Pers.	Sesbania	+	Tetranychidae
65. *Spartium junceum* L.	Spanish broom	-	
66. *Vicia faba* L.	Broad bean	+	Tetranychidae
67. *Vigna unguiculata* (L.) Walp.	Cowpea	+	Tetranychidae
Geraniaceae			
68. *Pelargonium odoratissimum* (L.) L'Herit.ex Ait.	Geraniums	-	
69. *Pelargonium zonale* (L.) L'Herit.ex Ait.	Geraniums	-	
Juncaceae			
70. *Juncus maritimus* Lam.	Sea hard rush	-	
Lamiaceae			
71. *Coleus blumei* Benth.	Coleus	-	
72. *Salvia splendens* Sello ex Roem. et Schult.	Sage	-	

Examined plant	Common name	Infestation	Mite family
Liliaceae			
73. *Allium cepa* L.	Onion (bulb)	+	Acaridae
74. *Allium sativum* L.	Garlic (bulb)	+	Acaridae
75. *Asparagus plumosus* Bak.	Asparagus	+	Tetranychidae
Lythraceae			
76. *Lagerstroemia indica* L.	Crape myrtle	+	Tetranychidae
Malvaceae			
77. *Althaea rosea* (L.) Cav.	Hollyhock	++	Tetranychidae Phytoseiidae
78. *Gossypium hirsutum* L.	Cotton	++	Tetranychidae Phytoseiidae
79. *Hibiscus esculentus* L.	Okra	++	Tetranychidae
80. *Hibiscus rosa-sinensis* L.	Shrub althaea	+	Tetranychidae
81. *Malva parviflora* L.	Cheese weed	++	Tetranychidae Phytoseiidae
Meliaceae			
82. *Melia azedarach* L.	Persian Lilac	+	Tetranychidae
Mimosaceae			
83. *Acacia cyanophylla* Lindl.	Blue leaved wattle	+	Tetranychidae
84. *Albizia lebbeck* (L.) Benth.	Women's tongue tree	++	Tetranychidae
85. *Lagonychium farctum* (Banks et Soland.) Babr.	Prosopis	++	Tetranychidae
86. *Prosopis juliflora* (Sw.) DC.	Prosopis	-	
Moraceae			
87. *Ficus carica* L.	Fig	++	Tetranychidae Eriophyidae Phytoseiidae Tydeidae
88. *Ficus religiosa* L.	Pepul tree	-	
89. *Morus alba* L.	White mulberry	+	Tetranychidae

Examined plant	Common name	Infestation	Mite family
Myrtaceae			
90. *Callistemon lanceolata* (Sm) DC.	Bottle brush	-	Tetranychidae
91. *Eucalyptus rostrata* Schlechtend. non. Cav.	Gum tree	-	
92. *Myrtus communis* L.	Myrtle	+	Tenuipalpidae
Oleaceae			
93. *Fraxinus rotundifolia* Mill.	Ash	-	
94. *Jasminum sambac* Ait.	Jasmin	+	Tetranychidae
95. *Olea europea* L.	Olive	++	Eriophyidae
Oxalidaceae			
96. *Oxalis comiculata* L.	Sheep sorrel	+	Tenuipalpidae
Pinaceae			
97. *Pinus brutia* Ten.	Pine	-	
98. *Pinus halepensis* Hill.	Pine	-	
Plantaginaceae			
99. *Plantago lanceolata* L.	Buckorn plantain	+	Tetranychidae Tenuipalpidae
100. *Plantago ovata* Forssk.	Plantain	+	Tenuipalpidae
Poaceae			
101. *Avena fatua* L.	Wild oats	-	
102. *Cynodon dactylon* (L.) Pers.	Bermuda grass	+	Acaridae Orbatidae
103. *Dichantium annulatum* (Forssk.) Stapf.	Hairy node bear grass	-	
104. *Hordeum sativum* Jess.	Barly	-	
105. *Imperata cylindrica* (L.) P.Beauv.	Blady grass	+	Tetranychidae Orbatidae Acaridae

Examined plant	Common name	Infestation	Mite family
106. *Lolium rigidum* Gaud.	Rigid rye grass	-	
107. *Oryza sativa* L.	Rice	-	
108. *Phragmites australis* L.	Common reed	++	Tenuipalpidae Tarsonemidae
109. *Saccharum officinarum* L,.	Sugarcane	+	Tetranychidae
110. *Sorghum halepense* (L.) Pers.	Johnson grass	-	
111. *Sorghum vulgare* Pers.	Sorghum	+	Tetranychidae
112. *Triticum aestivum* L.	Wheat	-	
113. *Zea mays* L.	Corn	+	Tetranychidae
Polygonaceae			
114. *Rumex dentatus* L.	Dentated dock	+	Tenuipalpidae
Punicaceae			
115. *Punica granatum* L.	Pomegranate	++	Tenuipalpidae Eriophyidae Phytoseiidae Tydeidae Cheyletidae
116. *Punica granatum* L. cv. Nana	Pomegranate	+	Tenuipalpidae
117. *Punica granatum* L. cv. Pleniflora	Pomegranate	+	Tenuipalpidae Phytoseiidae
Rhamnaceae			
118. *Ziziphus nummularia* (Burm.) Walk.	Ziziphus	+	Tetranychidae
119. *Ziziphus spina-christi* (L.) Willd.	Ziziphus	+	Tetranychidae Tenuipalpidae Phytoseiidae
Rosaceae			
120. *Crataegus azarolus* L.	Hawthorn	-	
121. *Cydonia oblonga* Mill.	Quince	+	Tenuipalpidae
122. *Fragaria vesca* L.	Strawberry	+	Tetranychidae
123. *Malus domestica* Borkh.	Apple	++	Tenuipalpidae Tetranychidae Eriophyidae Phytoseiidae

Examined plant	Common name	Infestation	Mite family
124. *Prunus armeniaca* L.	Apricot	+	Tetranychidae
125. *Prunus domestica* L.	European plum	+	Tetranychidae
126. *Prunus marianna* L.	Marianna plum	+	Tetranychidae
127. *Prunus persica* (L.) Batsch.	Peach	+	Tetranychidae Eriophyidae Phytoseiidae
128. *Pyrus communis* L.	Pear	++	Tenuipalpidae Tetranychidae Eriophyidae Phytoseiidae
129. *Rosa canina* L.	Dog rose	++	Tetranychidae Phytoseiidae
Rubiaceae			
130. *Gardenia florida* L.	Cape Jasmine	+	Tetranychidae
Rutaceae			
131. *Citrus aurantia-um* L.	Soure orange	+	Tetranychidae
132. *Citrus limetta* Risso	Sweet lime	+	Tetranychidae
133. *Citrus limon* (L.) Burm.	Lemon	+	Tetranychidae
134. *Citrus paradisi* Macfad.	Grape-fruit	+	Tetranychidae
135. *Citrus reticulata* Blanco	Mandarin	+	Tetranychidae
136. *Citrus sinensis* (L.) Pers.	Sweet orange	++	Tetranychidae Phytoseiidae
Salicaceae			
137. *Populus alba* L.	White poplar	++	Tenuipalpidae Tetranychidae
138. *Populus euphra-tica* Oliv.	Poplar	++	Tenuipalpidae Tetranychidae
139. *Populus nigra* L.	Black poplar	++	Tenuipalpidae Tetranychidae Phytoseiidae
140. *Salix acmophylla* Boiss.	Willow	++	Tenuipalpidae Tetranychidae Phytoseiidae Eriophyidae

Examined plant	Common name	Infestation	Mite family
141. *Salix alba* L.	White willow	++	Tenuipalpidae Tetranychidae Phytoseiidae Tydeidae
Scrophulariaceae			
142. *Russelia juncee* Zucc.	Russelia	-	
Solanaceae			
143. *Capsicum annuum*	Pepper	+	Tetranychidae
144. *Cestrum nocturnum* L.	Night queen	-	
145. *Datura stramonium* L.	Jimson Weed	+	Tetranychidae
146. *Lycopersicum esculantum* Mill.	Tomato	+	Eriophyidae
147. *Solanum melogena* L.	Eggplant	++	Tetranychidae Eriophyidae
148. *Solanum nigrum* L.	Black nightshade	-	
149. *Solanum tuberosum* L.	Potato	+	Tetranychidae
Sterculiaceae			
150. *Sterculia diversifolia* G.Don.	Bottle tree	+	Tetranychidae
Tamariaceae			
151. *Tamarix pentandra* Pall.	Tamarisk	+	Tenuipalpidae Tarsonemidae
Verbenaceae			
152. *Duranta plumieri* Jacq.	Skyflower	+	Tetranychidae
153. *Lantana camara* L.	Lantana	+	Tetranychidae
154. *Verbena supina* L.	Verbena	++	Tenuipalpidae Phytoseiidae
155. *Vitex agnus-castus* L.	Chaste-tree	+	Tetranychidae

Examined plant	Common name	Infestation	Mite family
Vitaceae			
156. *Vitis vinifera* L.	Grape	++	Tenuipalpidae Tetranychidae Eriophyidae Phytoseiidae Cheyletidae

Taxonomical Aspects

A. General characteristics of the family Tenuipalpidae

The classification of tenuipalpid mites is mainly based on the external morphology. Therefore a thorough basic knowledge of the general morphological characters of the family Tenuipalpidae is of fundamental importance to start with taxonomic identities.

Before starting to give an account of the external and internal morphological characters of this family it is also necessary to point out its location within the arthropods, and how to separate it from other groups of Tetranychoidea.

Phylum:	Arthropoda
Class:	Arachnida
Subclass:	Acari
Order:	Acariformes
Suborder:	Actinedida
Superfamily:	Tetranychoidea
Family:	Tenuipalpidae, Berlese, 1913

Tenuipalpini	Berlese,	1913,	Acaroth.Ital., p. 17
Tenuipalpinae	Sayed,	1950,	Proc. 8th Intern. Congr. Entomol., p.1016
Tenuipalpidae	Sayed,	1950,	Proc. 8th Intern. Congr. Entomol., p.1015
Phytoptipalpidae	Ewing,	1922,	Proc. Ent. Soc. Wash., 24:107
Phytoptipalpinae	Sayed,	1950,	Proc. 8th Intern. Congr. Entomol., p.1016
Pseudoleptidae	Oudemans,	1928,	Ent. Ber., 7: 287
Trichadenidae	Oudemans,	1938,	Tijdschr. Ent., 81: 75
Pseudotetranychinae	Sayed,	1938,	Bull. Mus. Hist. Nat. Paris (Ser.2), 10: 602

Diagnosis:

The members of the family Tenuipalpidae are reddish obligate plant parasites of very small size (from about 200 μ to 300 μ in length), dorsoventrally flattened and slow moving. This family can be readily differentiated from the other members of the Tetranychoidea by having cylindrical, small and simple palpi without a spur or clawlike appendage (thumbclaw complex) on the penultimate segment. The palpus possesses from 1 to 5 segments, the terminal segment (distal segment) with a rod-like sensory process and generally with 1 or 2 setae. The false spider mites possess an extrudable stylophore as in the Tetranychidae, and from this arise the long, slender, U-shaped, needle-like chelicerae. A suture may or may not separate the propodosoma and hysterosoma. The skin is frequently sculptured, either with striations or reticulations and is rarely smooth. There are two pairs of lenslike eyes on the propodosoma. The propodosoma always possesses three pairs of setae and the number of setae on hysterosoma varies from 9 to 13 pairs.

External Morphology

The body of a tenuipalpid mite is composed of an anterior gnathostoma and a posterior idiosoma (Figs. 4 and 5).

GNATHOSOMA :

Gnathosoma is the anterior portion of the body carrying the mouthparts, chelicerae and palpi. The mouth opening is hidden by the chelicerae and palpi and it opens into the pharynx (Fig. 5).

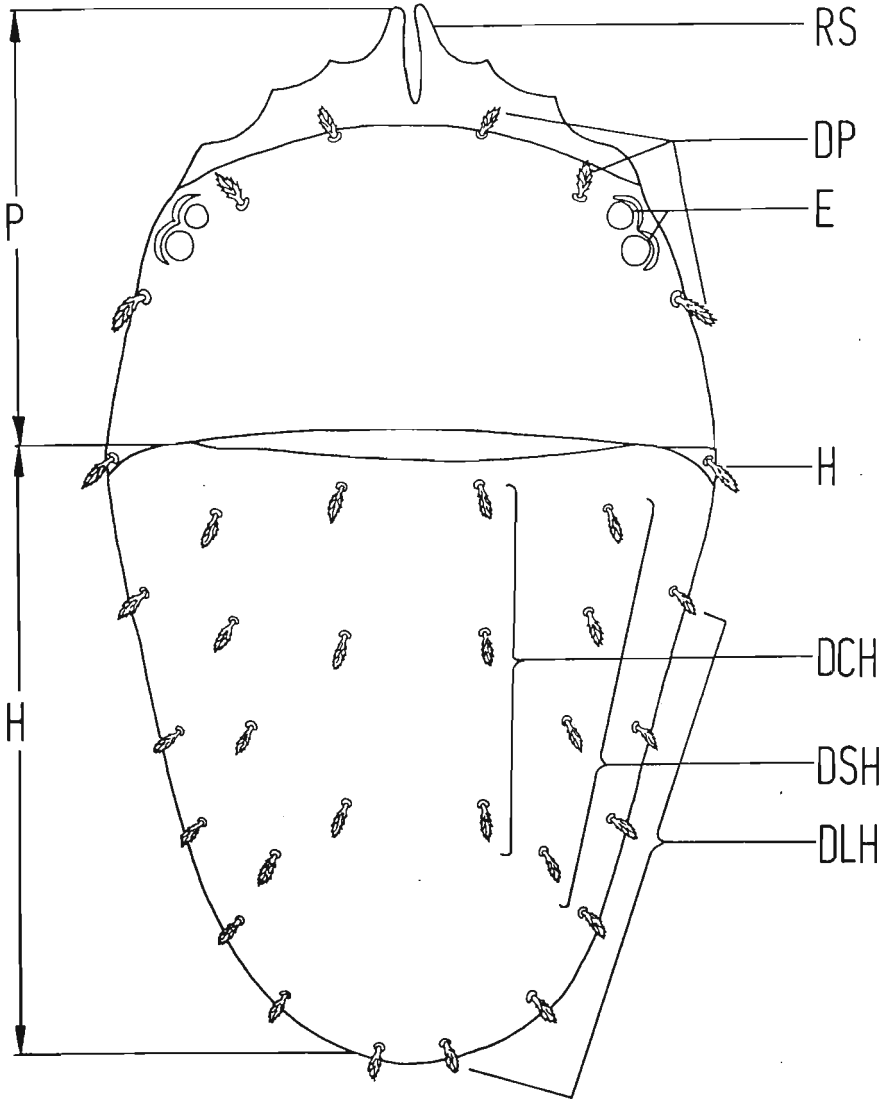

Fig. 4 . Dorsum of a tenuipalpid mite (female)

P.,propodosoma;H.,hysterosoma;R.S.,rostral shield;D.P.,dorsal propodosomals; E.,eyes;H.,humerals;D.C.H.,dorsocentral hysterosomals;D.S.H.,dorsosublateral hysterosomals;D.L.H.dorsolateral hysterosomals.

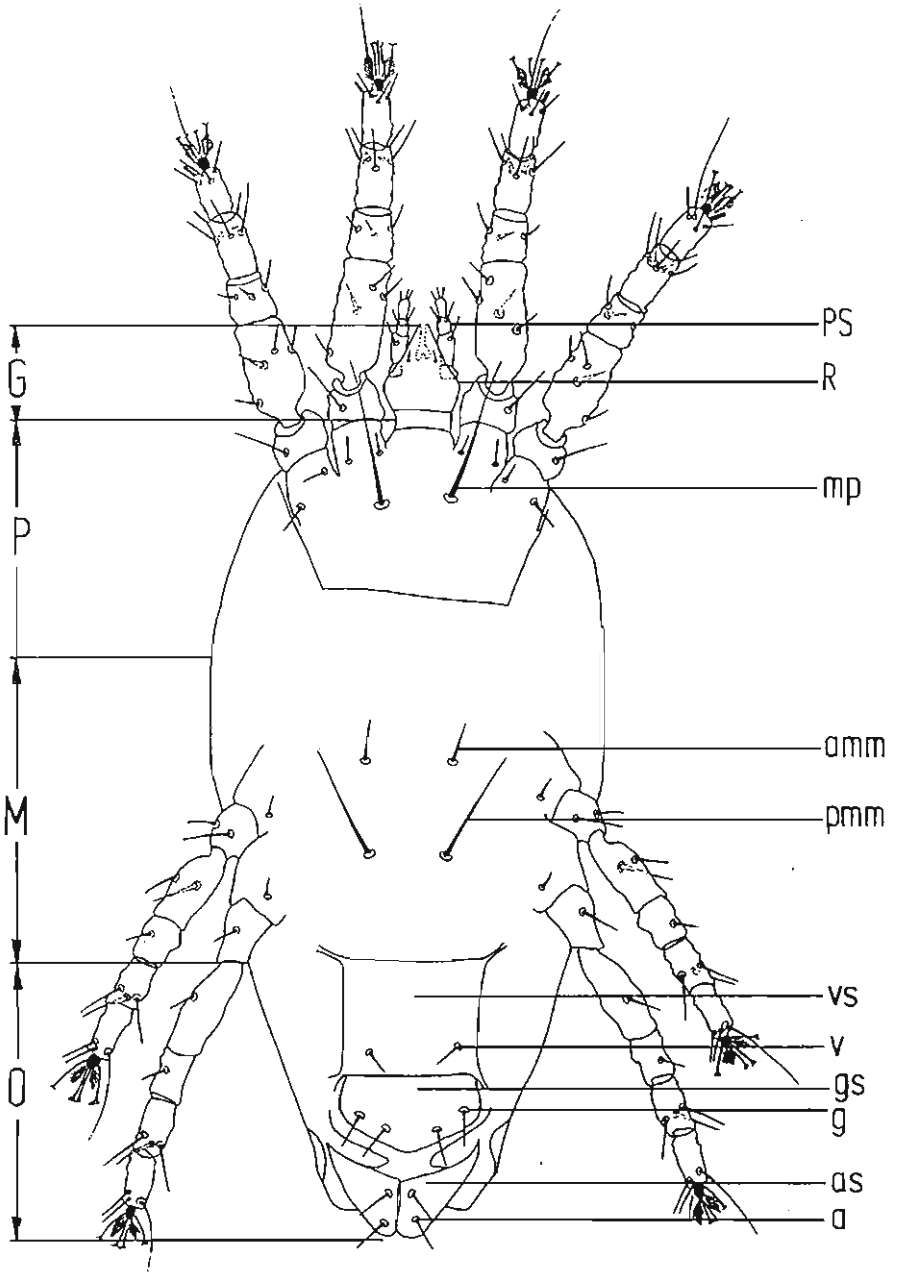

Fig. 5 . Venter of tenuipalpid mite (female)

G.,gnathosoma;P.,propodosoma;M.,metapodosoma;O.,opisthosoma;P.S.,palpus; R.,rostrum;m.p.,medioventral propodosomals;a.m.m.,anterior medioventral metapodosomals;p.m.m.,posterior medioventral metapodosomals;v.s.,ventral shield;v.,ventral setae;g.s.,genital shield;g.,genital setae;a.s.,anal shield;a.,anal setae.

Chelicerae:

The chelicerae involve a fusion of the fixed digits into stylophore and a development of the movable digits into stylets for piercing plant tissues. The cheliceral stylet is long, whiplike, curved proximally and anchored within an elongate-oval, U-shaped stylophore. The stylophore is deeply retractable and extrudable, independently of the infracapitulum (= rostrum), in a manner that is unique to this superfamily Tetranychoidea (Fig. 11).

Palpi:

The palpi are simple without a clawlike appendage. The number of palpus segments varies from 1 to 5 but sometimes the palpus may be completely reduced and represented only by a seta and a solenidion. The shape, size and number of segments is not always constant within a genus of this family. The terminal palpal segment bears a solenidion and one or two setae. Various types of palpi found in 9 genera collected from Iraq are presented in Fig. 6.

IDIOSOMA :

Dorsum:

The idiosoma of tenuipalpid mites are of different shape (Fig. 7) and ornamentation. The dorsum may be provided with striations, reticulations or without any sculpture (Fig. 8). The dorsal chaetotaxy of the idiosoma besides the skin pattern is most valuable for the classification of this family. The idiosoma includes a rostral shield, propodosoma, and hysterosoma (Fig. 4).

Rostral shield:

The rostral shield may be developed anteriorly as lobed projections of the propodosoma, or it may be simple or entirely absent. The anterior margin of the propodosoma may likewise be unevenly angular and convergent medially to form the rostral shield. Its upper surface may be pebbled or fine-

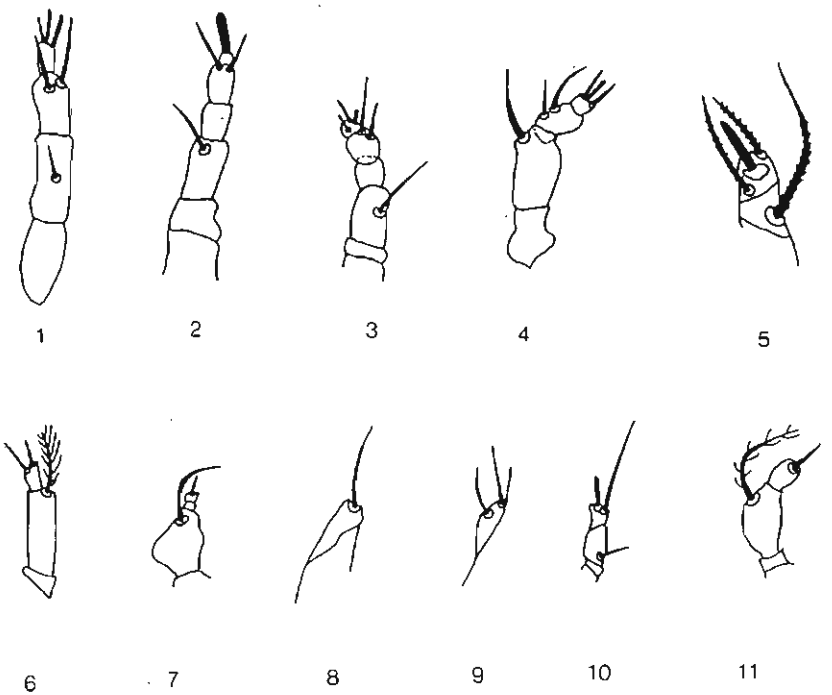

Fig. 6 . Different types of palpi of tenuipalpid mites of Iraq.

1=Cenopalpus ; 2,3=Aegyptobia ; 4=Brevipalpus ; 5=Raoiella ; 6,7=Tenuipalpus ; 8=Obdulia ; 9=Larvacarus ; 10=Dolichotetranychus ; 11=Colopalpus.

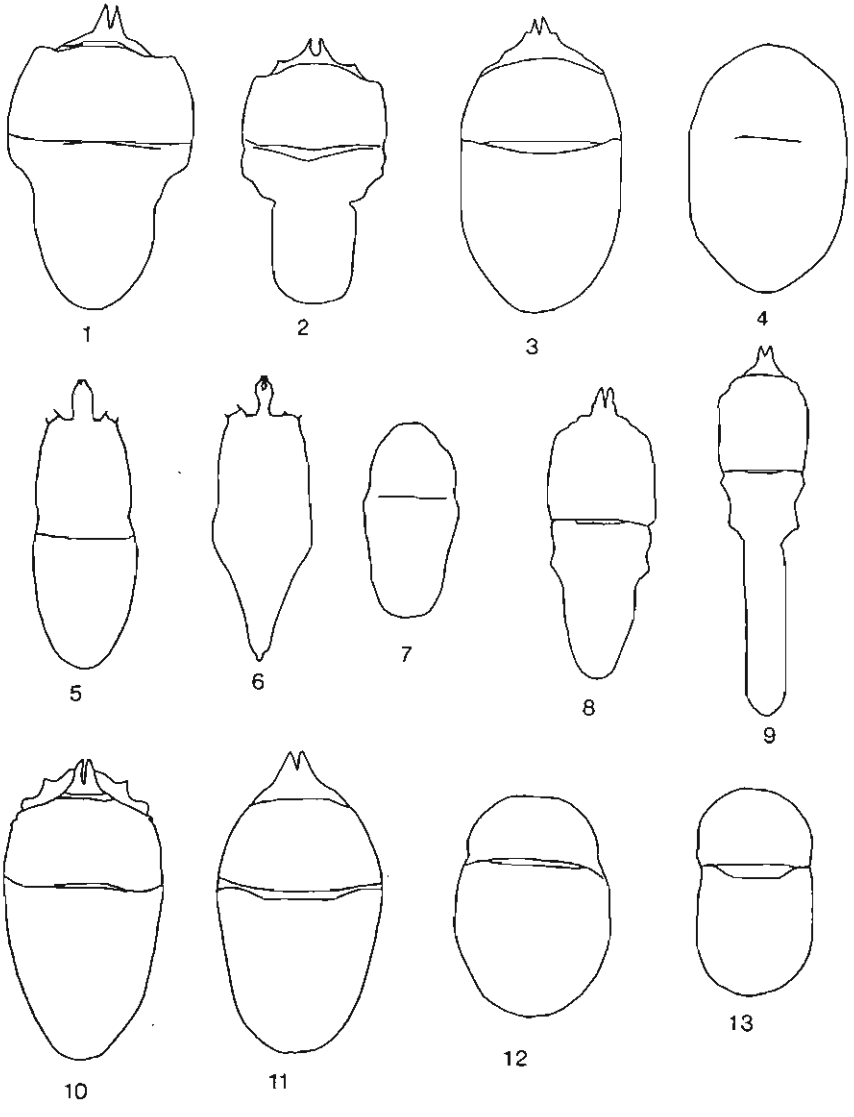

Fig. 7 . Different shapes of idiosoma of tenuipalpid mites of Iraq.

1,2,11=Tenuipalpus ; 3=Cenopalpus ; 4,7=Obdulia ; 5,6=Dolichotetranychus ; 8,9=Colopalpus ; 10=Brevipalpus ; 12=Larvacarus ; 13=Aegyptobia.

ly stippled. The rostral shield is of different shape and this character is of great importance to separate the tenuipalpid genera and species.

Propodosoma:

This is the anterior portion of the idiosoma possessing one pair of unequal eyes on each side and three pairs of dorsal propodosomal setae. The third pair is usually longer than the others.

Hysterosoma:

This is the posterior portion of the idiosoma and is separated from the propodosoma by a furrow or suture. Sometimes it is subdivided into a metapodosoma (the zone of legs III-IV) and opisthosoma (the portion of hysterosoma posterior to legs IV). The hysterosoma bears from one to three pairs of dorsocentral setae, one pair of humeral setae and five to seven pairs of dorsolateral setae. There may be from one to four pairs of dorsosublateral hysterosomal setae or they may be absent. The dorsosublateral setae are usually in a longtudinal line, but may be displaced . The different types of the tenuipalpid mite setae are presented in Fig. 9.

Venter:

The venter of the body is furnished with striations or reticulations, or it may be smooth. A pair of long medioventral propodosomal setae are always found on the base of the first leg coxa. The metapodosoma bears one pair of anterior medioventral metapodosomal setae and one pair of posterior medioventral metapodosomal setae. The number of metapodosomal setae may vary in different species. The venter of the opisthosoma of the adult female bears one pair of medioventral setae usually set in a ventral shield which may be striated, reticulated or smooth, two pairs of setae in the genital flap, and two or three pairs of setae in the anal shield.

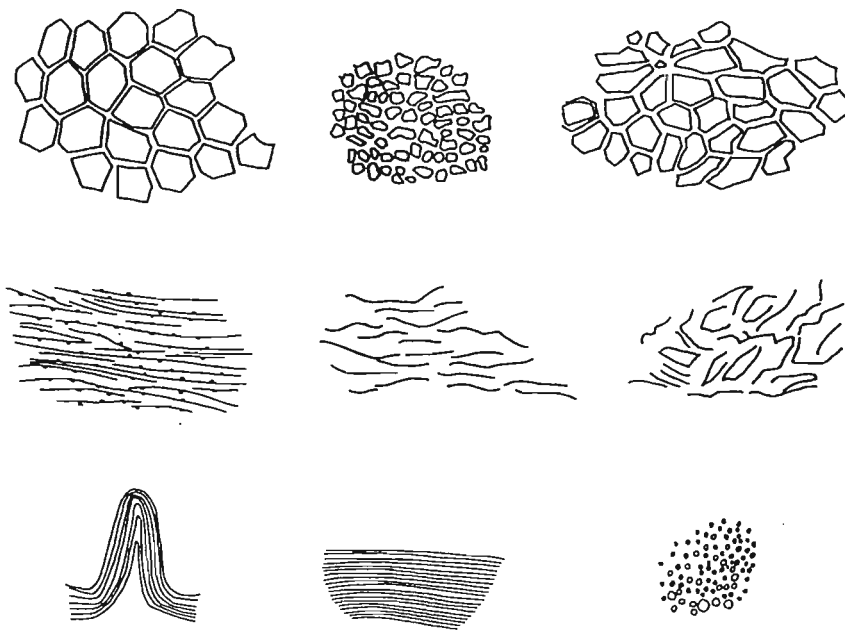

Fig. 8 . Different types of sculpture of tenuipalpid mites of Iraq.

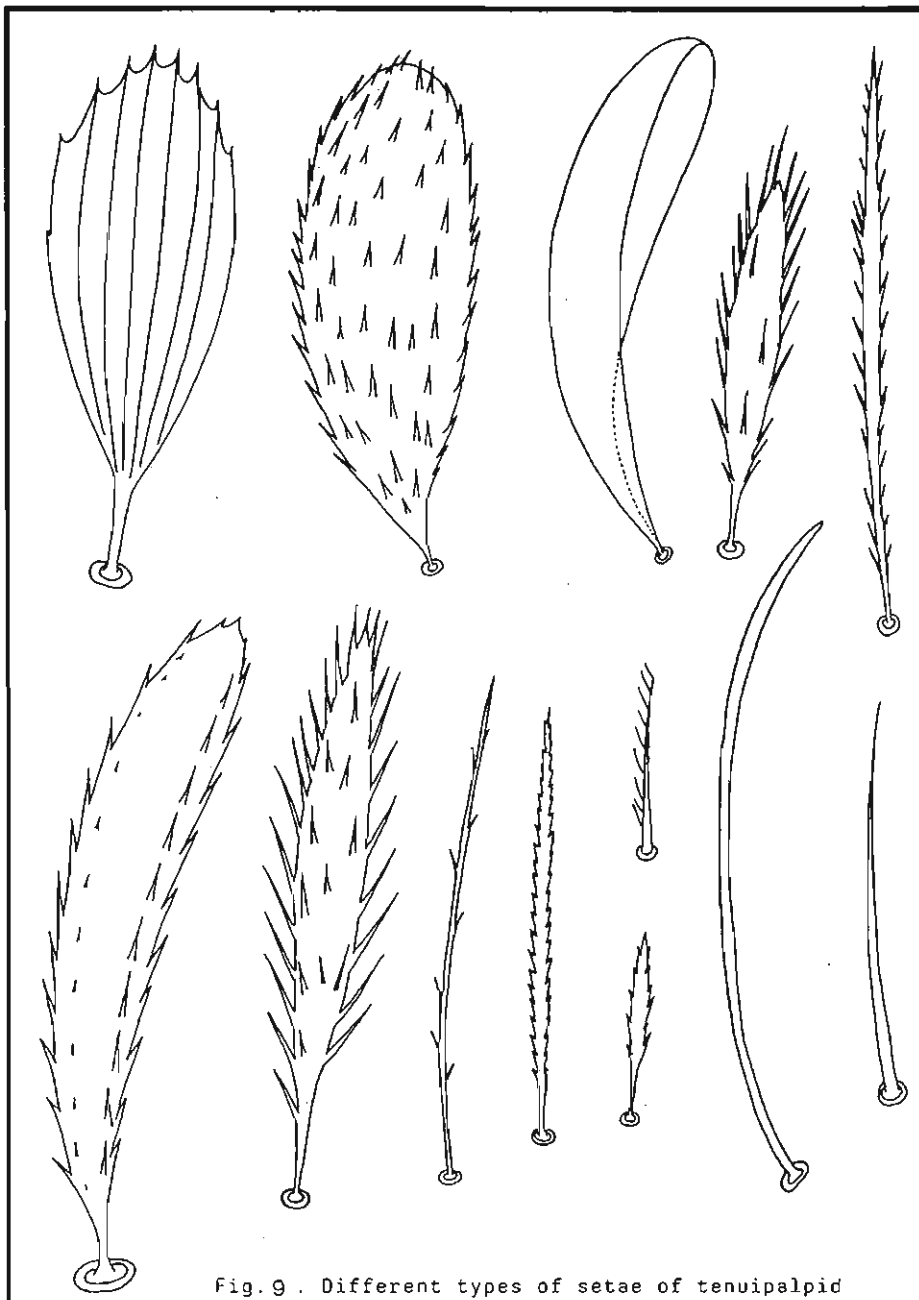

Fig. 9 . Different types of setae of tenuipalpid mites of Iraq.

In the male, the venter of the opisthosoma bears one pair of setae medioventrally and three or four pairs of genitoanal setae situated along the genito-anal opening. The ventral plate may or may not be distinct from genital plate (Fig. 5).

Legs:

There are four pairs of legs generally present in the adult of tenuipalpid mites or there may be only three pairs as in the genus *Larvacarus*. In all active instars, each leg has 5 articulating segments, namely the trochanter, femur, genu, tibia and tarsus, none of these is subdivided , or secondarily fused or reduced. The trochanter attaches basally to a coxisternal plate, or epimeral region, which are well delimited laterally, but not medially, from the rest of the podosomal surface. The legs have a more or less constant setal pattern or chaetotaxy (Pritchard & Baker, 1952). A single sensory rod (= solenidion) is always present at the distal end of tarsi I and II, but two such rods are sometimes present on one or both of these tarsi in the adults.
The claw is padlike or hooked and bears several pairs of long outer so called "Hafthaare" (= tenent hairs) (Anwarullah, 1963) which are special structures used by mites to adhere on the plant surface. These Hafthaare are usually united distally with a row of shorter inner Hafthaare. The distal hook of the claw may be strong, reduced or lacking. The empodium consists of an elongate pad, bearing two rows of Hafthaare (Fig. 10).

Internal Morphology

Little is known concerning the internal anatomy of tenuipalpid mites. The general internal morphology of respiratory, genital and digestive systems can well be seen through the mounted specimens. This three systems will be discussed briefly.

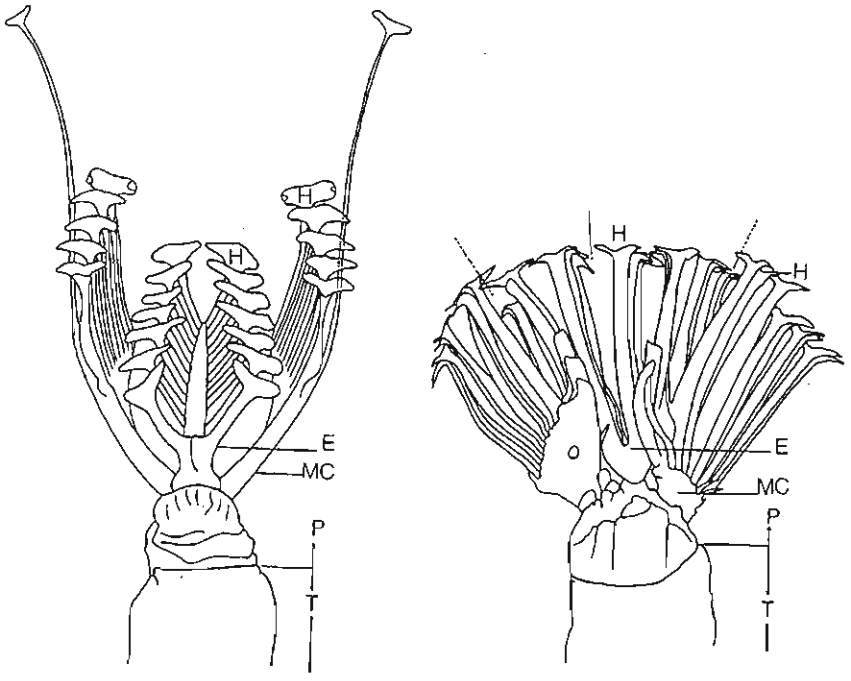

Fig.10 .Pretarsi of two different tenuipalpid genera: 1.Dolichotetranychus;2.Larvacarus(diagrammatic from SEM photo). E=Empodium ; H=Hafthaare ; MC=modified claw ; T=tarsus

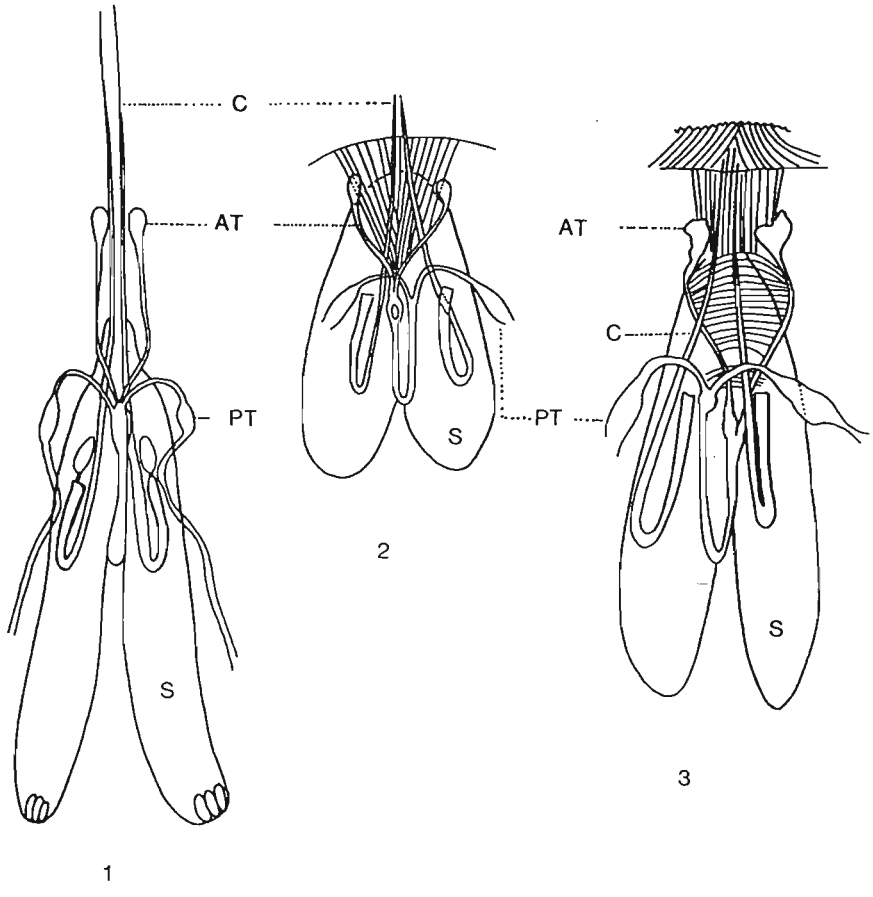

Fig. 11 . Tracheal systems of some tenuipalpid mites.

1=Tenuipalpus ; 2=Aegyptobia ; 3=Cenopalpus
AT=anterior tracheal tube; C=chelicerae ; PT=posterior tracheal tube; S=stylophore.

Respiratory system:

The exchange of oxygen and carbon dioxide in mites accomplishes in several diverse ways. The presence or abscence of stigmata, spiracular openings, and their relative position, provides a major diagnostic feature for the separation of orders within the Acari. Where stigmata occur, they open internally into a tracheal system that ramifies throughout the body to the various organ systems. In tenuipalpid mites, the tracheae are located in the propodosoma and consist of two pairs of tubes directed anteriorly. The dorsal pairs separate as divergent, anteriorly directed branches that are associated with the transverse or longtudinal ribs at the anterior end of the stylophore. The ventral pairs of tubes separate into divergent branches that curve caudally and bear secondary arms (Fig. 11). Anwarullah (1963) studied the respiratory system of some tetranychid mites and stated that the respiratory organs consist of the following parts: 2 peritremes, 2 main tracheal trunks and many slender tracheae. At the end of the peritremes we found a slitlike stigma in all cases. The form of peritremes is species specific.

Genital system:

Reproduction in the Acari follows the usual form of fertilization and subsequent production of male and female progeny. This normal way of of reproduction is rare in tenuipalpid mites, because parthenogenesis is usually the pattern within this group. Thelytoky (the production of females from unfertilized eggs) is very common among the false spider mites, therefore very few males were described in the taxonomic papers concerning this family.

The female reproductive system consists of a fused pair of ovaries, a single oviduct, a vagina and genital pore. The ovary is single, elongate or round, sack-like, smooth or with folds. The oviduct is a long single tube leading from the ovary to the genital pore. The oviduct extends downward to form the vagina which is mostly a short tube leading from the posterior region of the oviduct to the genital opening (Fig.

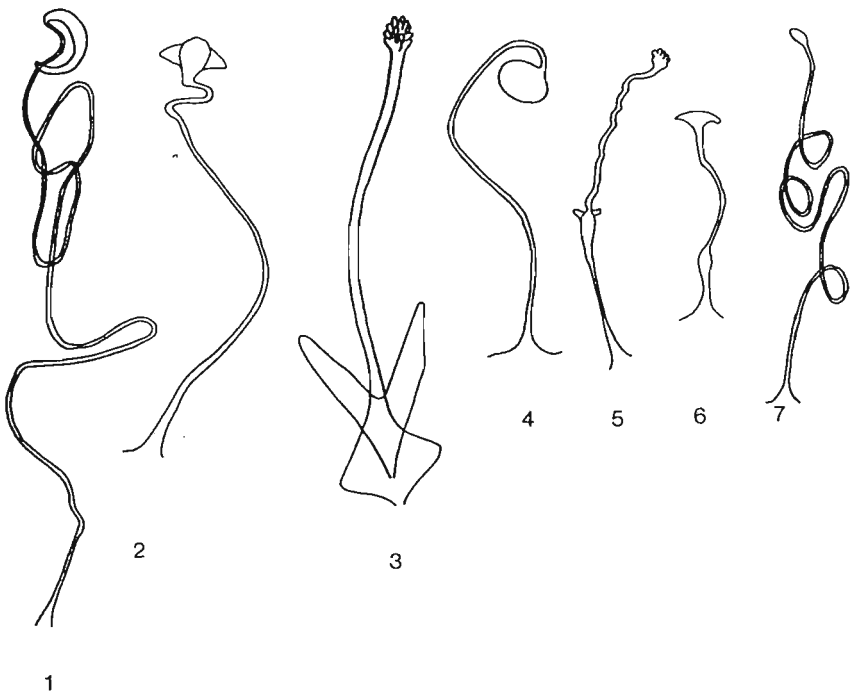

Fig. 12. Different types of female genital system of some tenuipalpid mites.

1=Colopalpus ; 2=Dolichotetranychus ; 3=Larvacarus ; 4=Cenopalpus ; 5=Obdulia ; 6,7=Tenuipalpus.

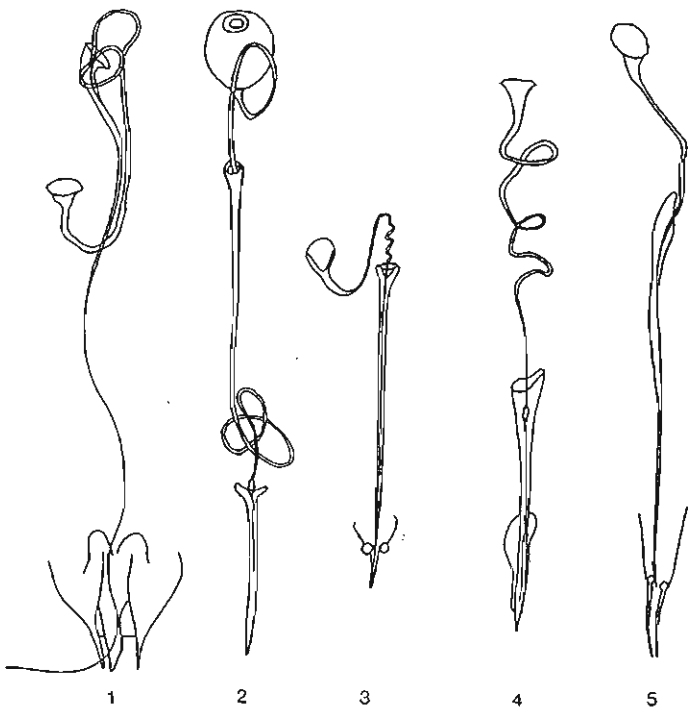

Fig.13. Different types of male genital system of some tenuipalped mites.

1,4=Tenuipalpus ; 2=Cenopalpus ; 3=Obdulia ; 5=Dolichotetranychus.

12). Pijnacker et al. (1981) reported that the internal genital system of *Brevipalpus obovatus* consists of an ovary, an oviduct, a vagina and a receptaculum seminis. In the present study the receptaculum seminis was not seen in the species which are presented in Fig. 12. In the genus *Larvacarus* such structure seemed to be present. Anwarullah (1963) stated that the genital system of tetranychid mites consists of an unpaired ovary, a divided oviduct and a vagina.

The male genital system consists of a fused pair of testes, a single sperm duct which enters in the anterior part of aedeagus which has a funnel-like shape. The aedeagus is very long and tapering posteriorly to form the penis. A pair of terminal rodlike genital stylets are present. (Fig. 13). Pijnacker et al. (1981) stated that the male internal genitalia of *Brevipalpus obovatus* consists of a pair of testes, a pair of vesiculae seminales, a sperm pump, a ductus ejaculatorius and an aedeagus. The diagram which was shown by Pijnacker et al. for the male genitalia is nearly identic to that of *Cenopalpus* (Fig. 13.2). The difference between them is that the *Cenopalpus* has only one testis.

Digestive system:

The digestive system of tenuipalpid mites is composed of the anterior or foregut which consists of a mouth, a muscular pharynx and tubular esophagus. The midgut or ventriculus is characterized by a large lumen. The hindgut is a small tubular intestine which opens to the outside through the anus. Alberti and Crooker (1985) studied the digestive system of spider mites and stated that the digestive system consists of the foregut (mouth, pharynx, esophagus), midgut (ventriculus and coecae) and a hindgut (excretory organ, rectum and anus). The organs of the digestive system occupy the largest volume of any body system.

B. Taxonomic Studies of tenuipalpid mites in Central Iraq

The present investigation revealed the occurence of twenty species of tenuipalpid mites belonging to nine genera on different host plants from Central Iraq. Out of the species studied, eleven species are new to science which are described herein with adequate figures. Six genera and 4 species are recorded for the first time from Iraq. Many host plants are newly recorded for some of the species from the world.

Twenty species reported here belong to nine genera namely, *Brevipalpus* Donnadieu, *Tenuipalpus* Donnadieu, *Cenopalpus* Pritchard & Baker, *Raoiella* Hirst, *Aegyptobia* Sayed, *Dolichotetranychus* Sayed, *Obdulia* Pritchard & Baker, *Colopalpus* Pritchard & Baker and *Larvacarus* Baker & Pritchard. The following key is to separate these genera.

Key to the genera of Tenuipalpidae in Central Iraq.[1]

1. Dorsosublateral hysterosomal setae present.....2
- Dorsosublateral hysterosomal setae absent.....7

2. Dorsosublateral setae, one pair.....3
- Dorsosublateral setae, more than one pair.....5

3. Dorsocentral hysterosomal setae, 2 pairs, rostral shield absent, Dorsosublateral setae, one pair. *Dolichotetranychus*
- Dorsocentral hysterosomal setae, 3 pairs.....4

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[1] All listed species have been carefully checked by Dr. E.W. Baker, Systematic Entomology Laboratory, USDA-ARS, Maryland, and compared with the type species of the U.S. National Museum Collection. As expressed in my acknowledgements I want here to say my special thanks to Dr. E.W. Baker for this wonderful co-operation.

4. Palpus with 4 segments, one pair dorsosublateral setae.....*Cenopalpus*
- Palpus with one segment fused together with the rostrum, one pair of dorsosublateral setae, gall-forming species, with three pair legs.....*Larvacarus*

5. Dorsosublateral hysterosomal setae, 2 pairs, palpus reduced with one segment, rostral shield absent.....*Obdulia*
- Dorsosublateral hysterosomal setae, 4 pairs.....6

6. Palpus with 2 segments, rostral shield absent, dorsolateral hysterosomal setae, 4 pairs.....*Raoiella*
- Palpus with 5 segments, rostral shield absent...*Aegyptobia*

7. Palpus with 4 segments, rostral shield present.*Brevipalpus*
- Palpus with 1-3 segments.....8

8. Palpus with 1-3 segments, genital and ventral shields separated.....*Tenuipalpus*
- Palpus with 2-3 segments, genital and ventral shields not separated.....*Colopalpus*

GENUS *DOLICHOTETRANYCHUS* SAYED

Dolichotetranychus Sayed, 1938: 606
Type-species: *Stigmaeus floridanus* Banks

The genus *Dolichotetranychus* Sayed was defined by Baker & Pritchard (1956), when ten species were known, as having a tiny, slender, brightred colour body; 3-segmented palpus, the rostral shield absent. The hysterosoma is provided with two pairs of dorsocentral, one pair of dorsosublateral, one pair of humeral and 5 pairs of dorsolateral setae. The opisthosoma is provided with one or two pairs of anal and one or two pairs of genital setae. The body surface, both dorsal and ventral, is covered with striae which are often tuberculate.

Baker and Pritchard (1956) mentioned that Sayed (1942) and McGregor (1949) regarded all the species which were collected on various hosts from different parts of the world as representative of a single species. It is not true that all the species collected belong to the same species, but they are closely related morphologically and it is hard to separate them without a good experience.

Dolichotetranychus babylonicus, new species

Female (Fig. 14)

Body slender, brightred, length of the body including rostrum 345.6 µ, rostrum 54 µ, greatest body width 138 µ.

Gnathostoma: With one pair of gnathostomal setae, rostrum reaches to the distal part of femur I. Palpus with 3 segments, the first (= basal) small, the second being the longest and bearing one dorsal simple seta, the third segment (= terminal) bears one solenidion and one seta.

Dorsum: Rostral shield absent, propodosoma with longitudinal striae and transverse striae anterior to the first pair of dorsal propodosomal setae. The entire dorsum is covered with tubercles. Eyes two pairs, separated from each other and located between the second and the third propodosomal setae. Dorsal propodosomal setae, 3 pairs, simple, setiform, (18 µ), (26.4 µ) and (18 µ). There are no conspicuous transverse striae in the waist position (= humeral suture). Hysterosoma with only longitudinal striae and totally tuberculated, Dorsocentral hysterosomal setae, 2 pairs, setiform, (8.4 µ) and (7.2 µ). Humeral setae, one pair, setiform, (14.4 µ). Dorsosublateral hysterosomal setae, 5 pairs, setiform, (10.8 µ), (8.2 µ), (12.0 µ), (15.6 µ) and (12.0 µ). The posterior three pairs of dorsolateral setae are stouter than the other body setae.

Venter: The anterior part of ventral propodosomal with tuberculated longitudinal striae and the posterior part is provided with a band of transverse striae. The venter of hysterosoma with tuberculated longitudinal parallel stria-

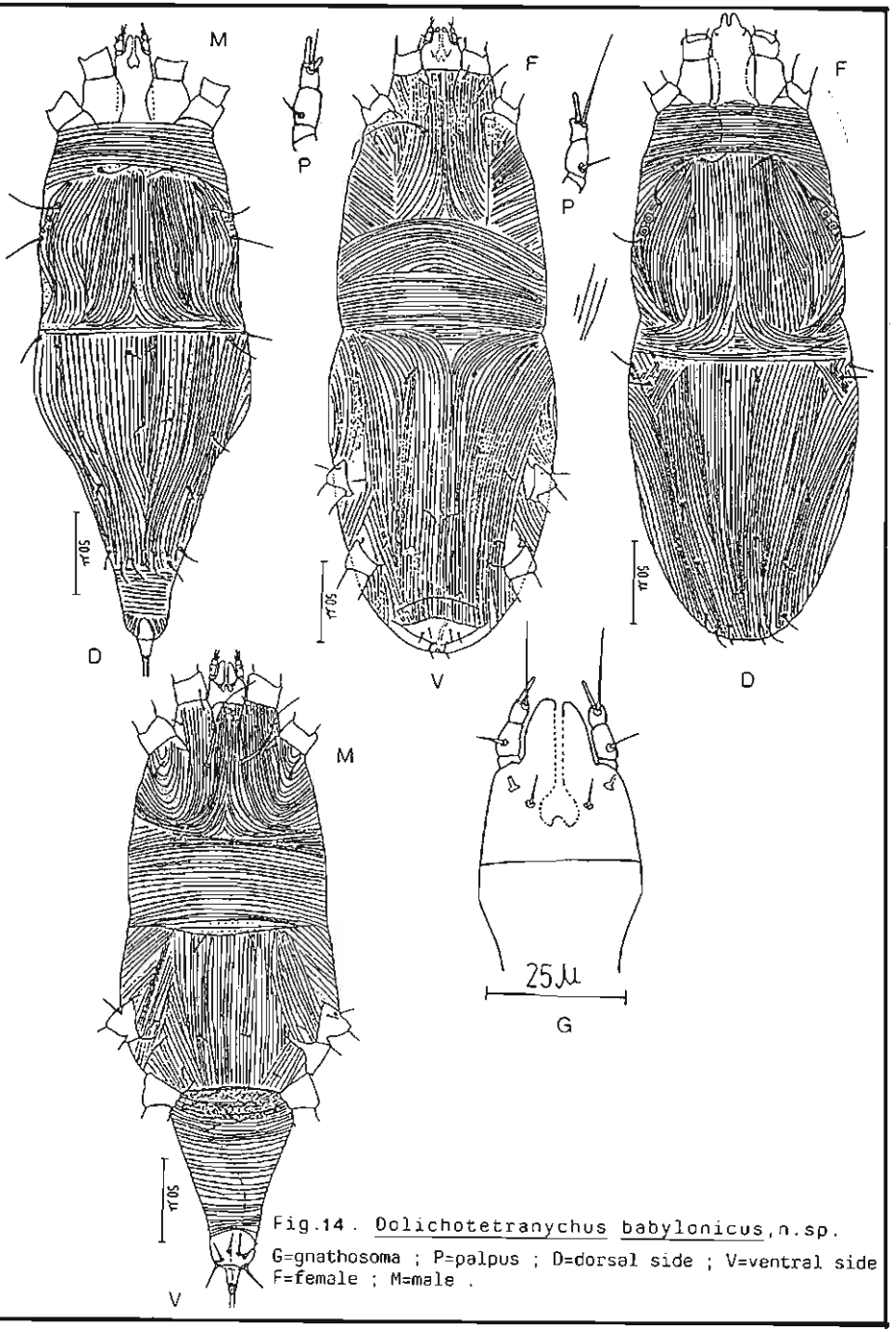


Fig.14. Dolichotetranychus babylonicus, n.sp.
G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side
F=female ; M=male .

tions. Medioventral propodosomal setae, one pair, flagelliform (90 µ). Anterior medioventral metapodosomal setae, one pair, (18 µ). Posterior medioventral metapodosomal setae, one pair, (12 µ). Pregenital setae (= ventral setae), one pair, (6 µ), genital plate with longitudinal striae, genital setae, 2 pairs, (8.4 µ). Anal plate, distinct, with 2 pairs of anal setae, (6 µ).

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	0	0	2	0
Femora	3	3	2	1
Genua	1	1	0	0
Tibiae	3	3	3	3

Tarsus I and II each with a single solenidion. Tibiae I-IV each with a very long whiplike setae.

Male (Fig. 14)

Body slender, brightred, tapers towards the rear margin. Length of the body including rostrum 384 µ, rostrum 30 µ, greatest body width 138 µ.

Gnathostoma: With one pair of ventral gnathosomal setae, rostrum reaches to the distal part of femur I. Palpus with 3 segments, the first (= basal) segment small, the second bearing a dorsal simple seta, the terminal segment with two, unequal sensory rods (= solenidia) and one seta.

Dorsum: Rostral shield absent, propodosoma with longitudinal striae, and transverse striae anterior to the first pair of dorsal propodosomal setae. The entire dorsum is covered with tubercles. Eyes two pairs, separated from each other and located between the second and the third propodosomal setae. Dorsal propodosomal setae, 3 pairs, setiform, (21.6 µ), (33 µ) and (27.6 µ). Humeral suture as in the female. Metapodosoma with longitudinal, tuberculated striae running up to the

base of the last 3 lateral setae, the area just after is provided with transverse striae. The dorsal hysterosomal setal pattern and measurements resemble to that of the female.

Venter: Venter of propodosoma with a whorl of tuberculated longitudinal and transverse striations. Metapodosoma with longitudinal, tuberculated striae, the opisthosoma with transverse striae. The ventral setal pattern and measurements of the male are resemble to that of female except that the male has 3 pairs of genitoanal setae and one pair of genital stylets.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	0	0	2	0
Femora	3	3	2	1
Genua	2	1	0	0
Tibiae	3	3	3	3

Holotype: Female, Abu-Ghraib, Baghdad, Iraq. June 1985, on common reed, *Phragmites australis* L. Holotype no. TA-107, deposited in the Entomology Museum, College of Agriculture, Department of Plant Protection, Abu-Ghraib, Baghdad, Iraq.

Paratype: 10 males, 25 females with same data as holotype. One paratype was deposited in the Biosystematics Research Institute, Ottawa, Canada.

Remarks: The female of this new species when checked against the key of Pritchard and Baker (1956, 1958), and the key of Meyer (1979) agreed with *Dolichotetranychus floridanus* (Banks), which is only known to occur on pineapple. When *D.babylonicus*, n.sp. compared to the type species of *D.floridanus*, the new species can be distinguished from the other by the following characters:

1. The dorsal propodosomal setae in *D.floridanus* are strong, serrate, of equal length, while the propodosomals in the new species are simple setiform, and unequal in the length.

2. Propodosoma in *D.floridanus* with short striae dorsally, in against to the new species which bears long tuberculated striae.
3. The anterior medioventral metapodosomal setae in *D.floridanus* are very long as against very short (18 µ) in the new species.
4. The hysterosomal setae are strong and serrate in *D.floridanus* but simple, setiform in the new species.
5. Tarsus I and II of *D.floridanus* each with a pair of solenidia whereas in the new species only one solenidion on tarsus I and II.

Habitat and locality: *Dolichotetranychus babylonicus* n.sp. has been collected by the author from Baghdad, Diyala and Babil. This mite is found in masses under the leaf sheath of reed, *Phragmites australis* L. The leaf sheath takes a brown to black colour on the area in which this mite lives. This species does not cause considerable damage to its host in Iraq.

GENUS *CENOPALPUS* PRITCHARD & BAKER

Cenopalpus Pritchard & Baker, 1958: 190
Type-species: *Brevipalpus spinosus* Donnadieu

This genus *Cenopalpus* is proposed as a segregate from the genus *Brevipalpus* for those species in which the palpus has four segments; rostral shield present; propodosoma reticulated or striated with two pairs of eyes and three pairs of dorsal propodosomal setae. Hysterosoma with one pair of humerals, five to six pairs of dorsolaterals, one pair of dorsosublaterals and three pairs of dorsocentrals. Venter with a pair of medioventral propodosomals, one pair of anterior medioventral metapodosomals, one pair of posterior medioventral metapodosomals, one pair of ventrals, two pairs of genitals and two pairs of anals. Male with three pairs of

genitoanal setae.

Key to the collected species

1. Dorsal body setae of the female and the dorsal setae of femur I broadly lanceolate serrate.
   Nymph with body setae broadly lanceolate, the third pair of dorsocentral and sixth pair of dorsolateral hysterosomal setae the shortest.....*Cenopalpus lanceolatisetae* (Attiah)

2. Dorsal body setae of the female and the dorsal setae of femur I narrowly lanceolate serrate.
   Nymph with marginal setae similar in length except for minute third, fifth and sixth pairs of dorsolateral hysterosomal setae.....*Cenopalpus pulcher* (Canestrini & Fanzango)

Cenopalpus lanceolatisetae (Attiah)

Brevipalpus lanceolatisetae Attiah, 1956: 436
Cenopalpus lanceolatisetae Pritchard & Baker, 1958: 192

Female (Fig. 15)

Body elliptical, brightred colour, length of the body including rostrum 318.27 µ, rostrum 78.12 µ, hysterosoma 156 µ, greatest body width 148.8 µ.

Gnathosoma: With a pair of ventral gnathosomal setae, rostrum reaching almost middle of genu I; palpus with 4 segments, second segment bears one simple seta dorsally, the third segment with two setiform setae and the terminal segment bears 3 rodlike solenidia.

Dorsum: Rostral shield bifurcate, with irregular reticulations, the propodosoma is entirely reticulate, the reticulation elements in the median area are thickwalled and more well defined than the lateral elements. Dorsal propodosomal setae, 3 pairs, broadly lanceolate and serrate, (26.04 µ),

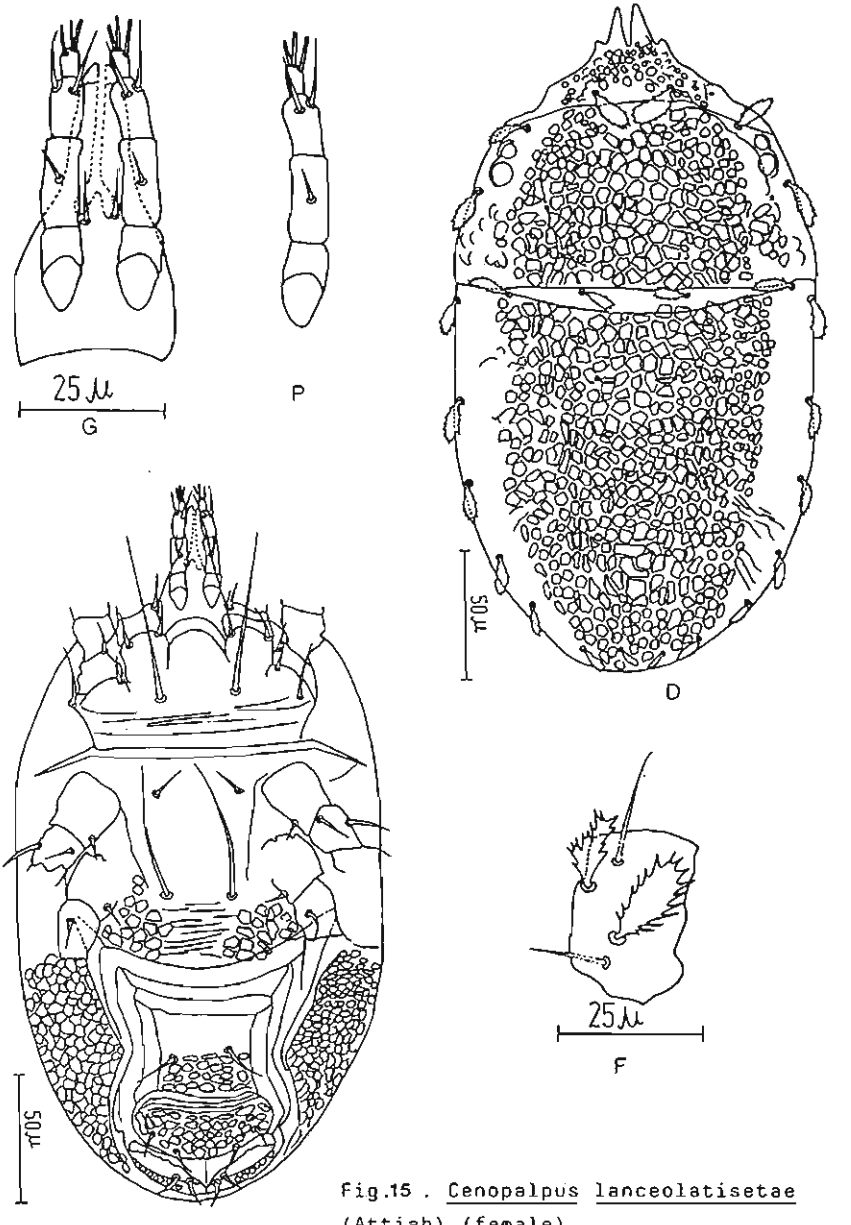


Fig.15 . Cenopalpus lanceolatisetae (Attiah) (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I .

(22.32 µ) and (20.46 µ). Humeral suture is well defined separating the propodosoma from the hysterosoma. The reticulation elements on the anterior mediodorsal part of hysterosoma are larger than on the posterior part, the lateral reticulations are incomplete, dorsal pores absent on hysterosoma. Dorsocentral hysterosomal setae, 3 pairs, narrowly lanceolate, serrate, (16.74 µ), (11.16 µ) and (7.44 µ). Dorsosublateral hysterosomal setae, one pair, broadly lanceolate, serrate, (18.6 µ). Humeral setae, one pair, lanceolate, serrate, (14.88 µ). Dorsolateral hysterosomal setae, 6 pairs, broadly lanceolate, serrate, decreasing in length posteriorly, (16.74 µ), (14.88 µ), (14.88 µ), (13.02 µ), (11.16 µ) and (7.44 µ).

Venter: The venter of propodosoma almost smooth except few transverse striations. Medioventral propodosomal setae, one pair, long, simple, (65.1 µ). Anterior medioventral metapodosomal setae, one pair, (13.02 µ). Posterior medioventral metapodosomal setae, one pair much longer than the anterior, (61.38 µ). The last part of metapodosoma behind coxae IV with reticulations and faint transverse striae. The opisthosoma, ventral, genital and anal shields are reticulated. Ventral setae, one pair, (18.06 µ). Genital setae, 2 pairs, (9.3 µ). The opisthosomal shields (= plates) are well defined. All the setae on the venter are simple, setiform.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1
Genua	3	3	1	1
Tibiae	5	5	3	3

Femur I (Fig. 15), with 2 pairs, broadly lanceolate serrate setae dorsally and 2 simple ventrally. Tarsi I and II each with a single sensory rod reaching to the end of the "Haft-

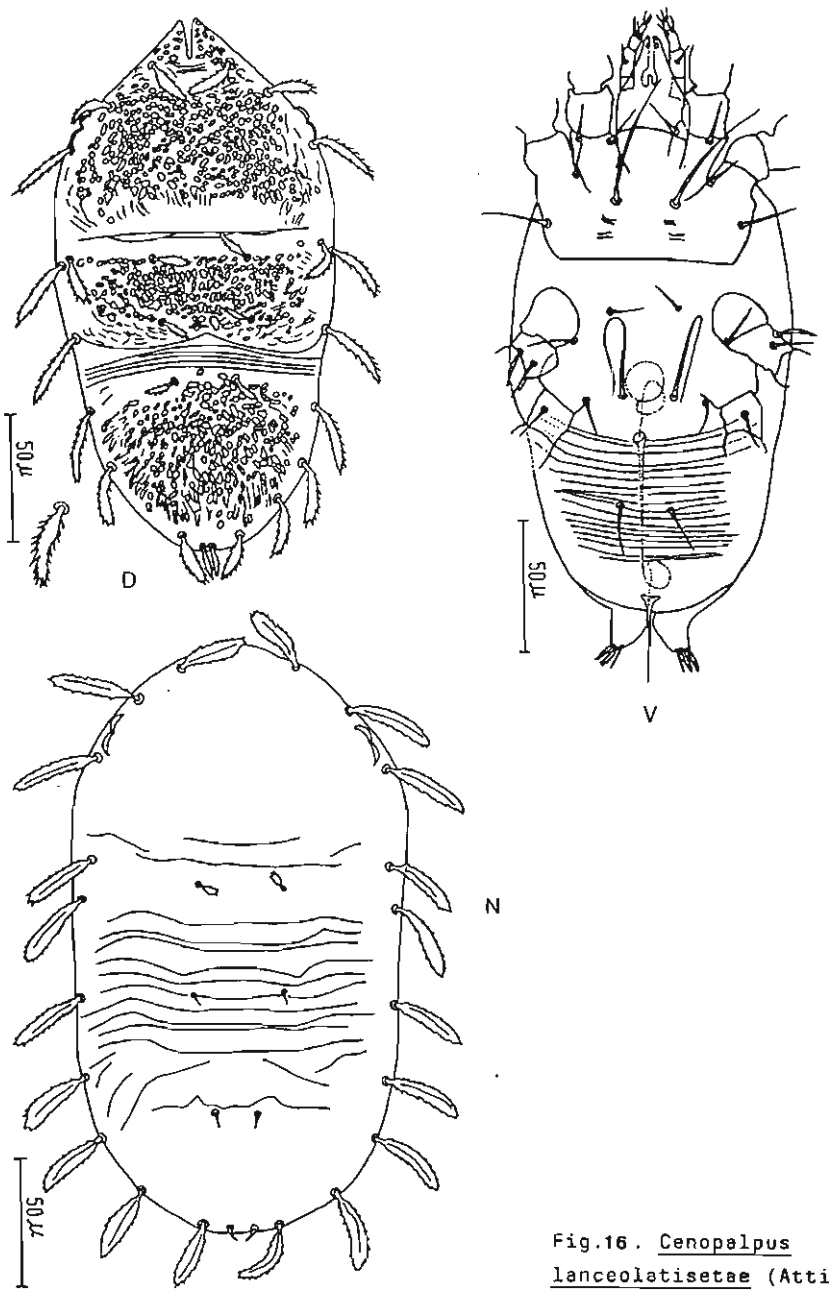


Fig.16. Cenopalpus lanceolatisetae (Attiah)

D=dorsal side (male) ; V=ventral side (male) ; N=dorsal side (nymph).

haare" (= tenent hairs), claw with a well-developed hook terminally.

Male (Fig. 16)

Body oval, the length of the body including rostrum 241.80 µ, rostrum 40.92 µ, hysterosoma 126.48 µ, greatest body width 115.32 µ.

Gnathostoma: With one pair of ventral gnathostomal setae, rostrum and palpus similar to that of female.

Dorsum: The dorsal ornamentations resemble those of the female except that the reticulate elements are small, the hysterosoma is divided into two parts by a transverse band of striations. The dorsal body setae are more longer and serrate than those of the female.

Venter: The venter of propodosoma and the metapodosoma is smooth, the opisthosoma with transverse striations. The ventral setal pattern resemble those of the female except that the male has 3 pairs of genitoanal setae terminally. The legs cheatotaxy is similar to that of the female.

Nymph (Fig. 16)

The body is oval-shaped, body length including rostrum 292.02 µ, greatest body width 143.22 µ. The dorsum of the nymph is with few transverse striations. The propodosomal, humeral and dorsosublateral setae are broadly lanceolate and much longer than those of the female. The first dorsocentral hysterosomal seta is lanceolate and bigger than the last two pairs which are minute and simple setae. The first five dorsolateral setae are broadly lanceolate, the sixth pair is minute and setiform.

Holotype: Attiah (1956) who described this species, did not refer to the holotype and paratype in the original description of this species. Pritchard and Baker (1958) stated that "Cotypes: female, male, nymph, lower and upper Egypt, on prune, apricot, pear and apple."

Remarks: The female and nymph of *Brevipalpus lanceolatisetae* may be recognized by the broadly lanceolate, serrate body

setae, the hysterosoma of the female and nymph bears one pair of humeral, one pair of dorsosublateral, 3 pairs of dorsocentral and 6 pairs of dorsolateral setae. The dorsum of the female and male is provided with reticulations. This species was compared to the specimen, which is deposited in the U.S. National Museum.

Habitat and locality: *Cenopalpus lanceolatisetae* is considered one of the important pests which attacks apple and pear trees in Central Iraq. The author collected this mite from Baghdad, Diyala, Kerbala and Ramadi. This mite builds up a high population density between July and September in Central Iraq, therefore one or two acaricide sprays have to be done to keep its population under the economic injury level.

Cenopalpus pulcher (Canestrini & Fanzago)

Caligonus pulcher Canestrini & Fanzago, 1876: 134
Tenuipapus pulcher, Berlese, 1887: 72
Brevipalpus pulcher Baker, 1949: 360
Caligonus glaber Canestrini and Fanzago, 1878: 154
Tenuipalpus glaber, Berlese, 1886: 18
Tenuipalpus bodenheimeri Bodenheimer, 1930: 240
Tenuipalpus oudemansi Geijskes, 1939: 25
Brevipalpus oudemansi, Sayed, 1946: 99
Brevipalpus pyri Sayed, 1946: 99
Brevipalpus ciferri Lombardini, 1951: 249
Brevipalpus geisenheyneri, Baker and Pritchard, 1952: 609
Cenopalpus pulcher, Pritchard and Baker, 1958: 194

Female (Fig. 17)

Body elliptical to oval shaped, brightred in colour, length of the body including rostrum 353.4 µ, rostrum 59.52 µ, hysterosoma 171.12 µ, greatest body width 174.84 µ.

Gnathosoma: With one pair of ventral gnathosomal setae, rostrum triangular reaching to the anterior part of femur I, palpus with 4 segments, second segment long with a simple seta dorsally, the third segment with two setiform setae, the

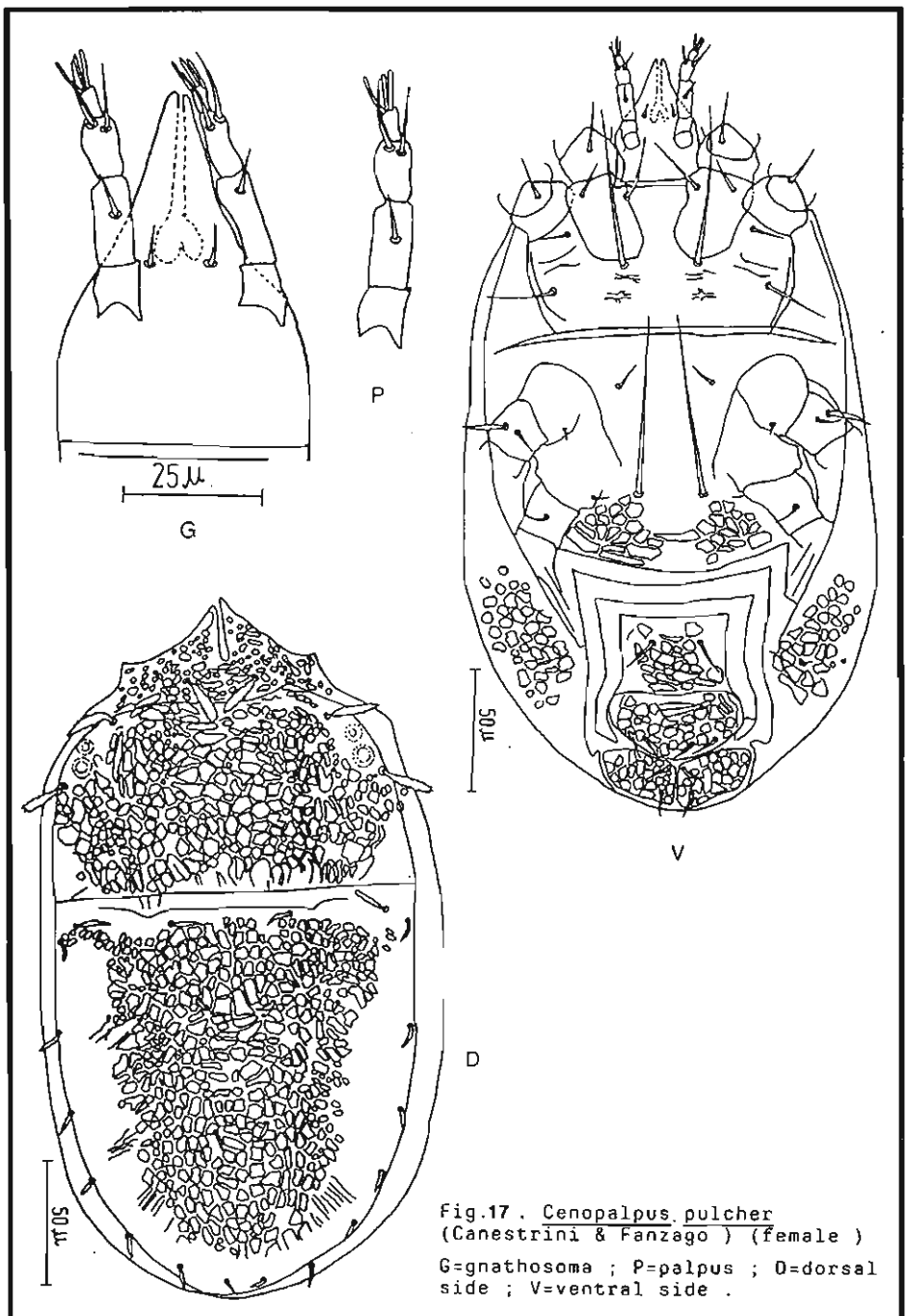


Fig.17 . Cenopalpus pulcher (Canestrini & Fanzago) (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side .

terminal segment with three rodlike sensory setae.

Dorsum: Rostral shield bifurcate, reticulated with small irregular elements, propodosoma is entirely reticulate, the reticulate elements in the median area are thickwalled and more developed than the lateral elements. Eyes 2 pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, lanceolate, serrate, (20.46 μ) (18.6 μ) and (22.32 μ). Humeral suture is well distinct; the hysterosoma ornamentations similar to that on the propodosoma. Dorsocentral hysterosomal setae, 3 pairs, narrowly lanceolate, (14.88 μ), (13.02 μ) and (11.16 μ). Dorsosublateral hysterosomal setae, one pair, lanceolate, longer than the first dorsocentral and humeral setae, (22.32 μ). Humeral setae, one pair, narrowly lanceolate, slightly serrate, (9.3 μ). Dorsolateral hysterosomal setae, 6 pairs, narrowly lanceolate, minutely serrate, decreasing in length posteriorly, (11.16 μ), (11.16 μ), (11.16 μ), (11.16 μ), (9.3 μ) and (7.4 μ).

Venter: The venter of propodosoma almost smooth except transverse striae. Medioventral propodosomal setae, one pair, setiform, (66.96 μ). Anterior medioventral metapodosomal setae, one pair, (14.88 μ). Posterior medioventral metapodosomal setae, one pair, (70.68 μ). The last part of metapodosoma behind coxae IV with reticulations (Polygonal elements). The lateral side of the opisthosoma, the ventral, genital and anal shields are provided with reticulations. Ventral setae, one pair, (18.6 μ). Genital setae, 2 pairs, (11.16 μ). Anal setae, 2 pairs, (11.16 μ). The opisthosomal shields (= plates) are well defined. All the setae on the venter are simple, setiform.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1
Genua	2	2	1	0

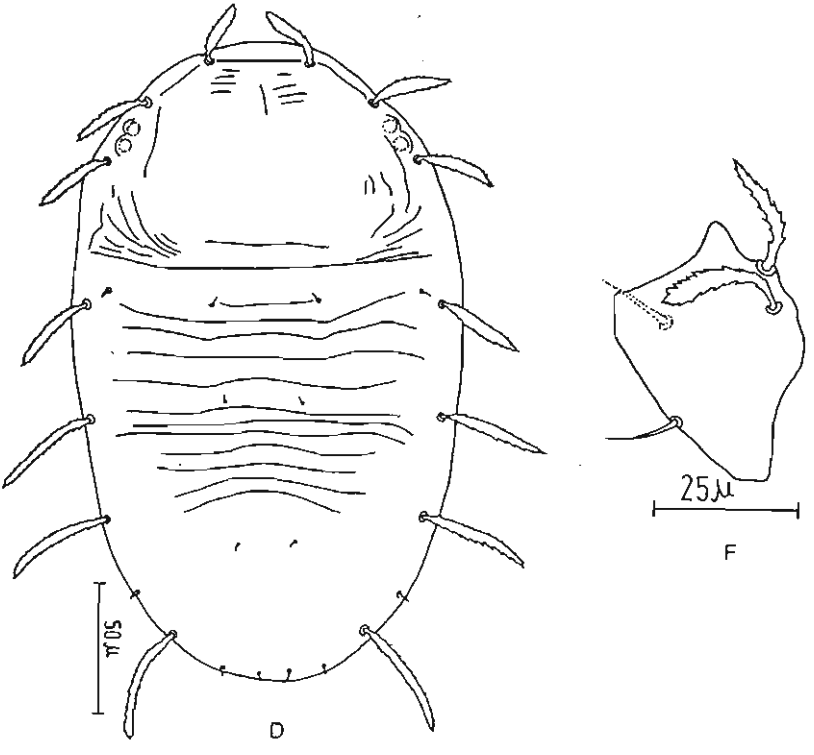


Fig.18 . Cenopalpus pulcher (Canestrini & Fanzago) (nymph)
D=dorsal side ; F=femur I .

Tibiae	4	4	3	3

Femur I (Fig. 18), with two pairs, lanceolate, serrate, setae laterally and 2 pairs of setiform setae ventrally and laterally. Tarsi I and II each with a single solenidion, claw with a well developed hook terminally.

Male: Unknown

Nymph (Fig. 18)

The body is oval-shaped, body length including rostrum 301.32 µ, greatest body width 174.84 µ. The dorsum of the nymph is provided with few transverse striations. Dorsal propodosomal setae, 3 pairs, narrowly lanceolate. Dorsocentral hysterosomal setae, 3 pairs, minute. Dorsosublateral hysterosomal setae, one pair, minute. Dorsolateral hysterosomal setae, 6 pairs, the 1st, 2nd and 4th are narrowly lanceolate, long, while the 3rd, 5th and 6th are minute.

Holotype: Pritchard & Baker, 1958 stated that "the figure of the male of *pulcher* that was presented by Canestrini (1889) is quite diagnostic of this species, particularly when taken with his redescription of the nymph (considered to be the female). Canestrini and other Italian workers of his time believed the adult female to be a separate species, *glaber*". There is no point about the place in which the type species was deposited.

Remarks: The females of *Cenopalpus pulcher* are distinctive in that the dorsal body setae are narrowly lanceolate and serrate. The propodosoma has three pairs of lanceolate dorsal propodosomal setae. The hysterosoma has one pair of humeral, one pair of dorsosublateral, 6 pairs of dorsolateral and 3 pairs of dorsocentral setae. The dorsum of the body has a reticulate pattern. The third, fifth and sixth pairs of dorsolateral hysterosomal, the dorsosublateral and the 3 pairs of dorsocentral setae of the nymph are minute, while the others are lanceolate of equal length. This is the first time in which *C.pulcher* is described in this detail.

Habitat and locality: *Cenopalpus pulcher* is considered one of the serious pests which attacks apple trees in Iraq. Heavy infestations of these mites, which appear between July and September, result in a blotching, bronzing of the leaves which is generally followed by leaf fall. Some acaricides are recommanded by the Ministry of Agriculture in order to keep this species under the economic injury level.

GENUS *LARVACARUS* BAKER AND PRITCHARD

Larvacarus Baker and Pritchard, 1958: 130
Type-species: *Phytoptipalpus transitans* Ewing

The genus *Larvacarus* is based on a single gall-forming species collected from India. This genus has a rudimentary palpus with one segment. The dorsal setal pattern of *Larvacarus* bears 3 pairs of dorsal propodosomal, one pair of humeral, 3 pairs of dorsal hysterosomal, one pair of dorsosublateral hysterosomal and 5 pairs of dorsolateral hysterosomal setae. The presence of only one pair of medioventral metapodosomals is distinctive for this genus. The adult has only three pairs of legs.

Larvacarus transitans (Ewing)

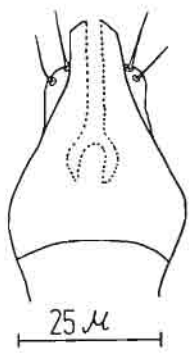
Phytoptipalpus transitans Ewing, 1922: 108
Larvacarus transitans Baker & Pritchard, 1952: 130
Phytoptipalpoides transitans Reck, 1952: 422

Female (Fig. 19)

Colour orange to yellow, length of the body including rostrum 344.1 µ, rostrum 65.1 µ,hysterosoma 204.6 µ, greatest body width 213.9 µ.

Gnathosoma: Without ventral gnathosomal setae, rostrum long reaching beyond femur I, palpus one segmented fused to the rostrum, with two long simple setae.

Dorsum: Rostral shield absent, body subelliptical, propo-



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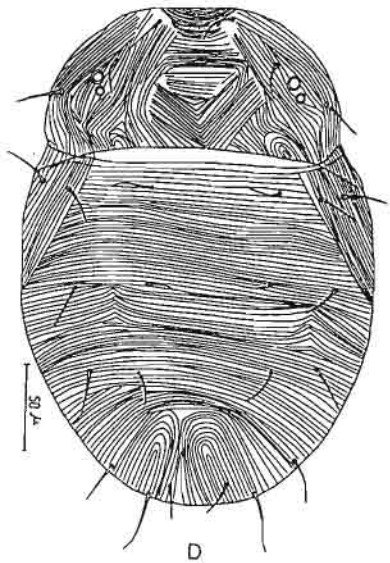

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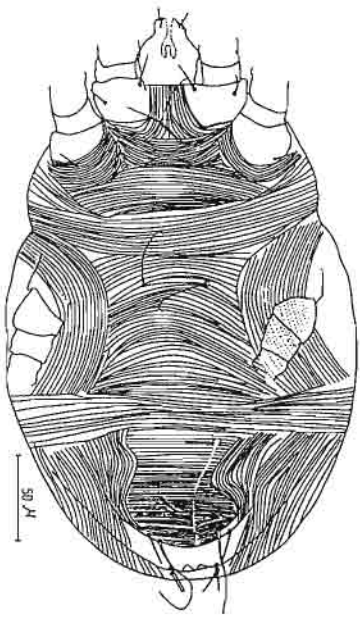

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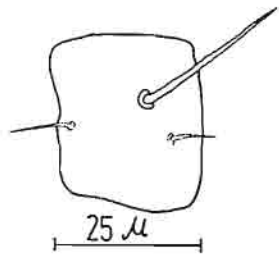


F

Fig.**19** . Larvacarus transitans (Ewing)

G=gnathosoma ; P=palpus ; D=dorsal side ;
V=ventral side ; F=femur I .

dosoma with parallel lnogitudinal and transverse finely striations. Eyes two pairs, one pair on each side, anterior eye bigger than the posterior. Dorsal propodosomal setae, 3 pairs, slender, serrate, (26.04 µ), (24.40 µ) and (29.76 µ). Humeral suture distinct separating the propodosoma from hysterosoma. Hysterosoma with transverse and longitudinal striations, dorsal pores absent. Dorsocentral hysterosomal setae, 3 pairs, slender, serrate, (26.04 µ), (26.04 µ) and (24.18 µ). Dorsosublateral hysterosomal setae, one pair, serrate, (24.18 µ), located between the first dorsocentral hysterosomal and the humeral seta. Humeral setae, one pair, serrate, (27.9 µ). Dorsolateral hysterosomal setae, 5 pairs, serrate, slender, (24.18 µ), (27.9 µ), (27.9 µ), (37.2 µ) and (20.46 µ).

Venter: Propodosoma and hysterosoma with irregular transverse and longitudinal striations. Medioventral propodosomal setae, one pair, simple, (50.22 µ). Medioventral metapodosomal setae, one pair, simple (37.2 µ). Ventral, genital and anal shields not well defined. Ventral setae, one pair, (13.02 µ). Genital setae, 2 pairs, (22.32 µ) and (50.22 µ). Anal setae, 2 pairs, (16.74 µ).

Legs: 3 pairs, setae on legs I-III as follows:

Podomers	L_1	L_2	L_3
Coxae	2	1	0
Trochanters	0	0	0
Femora	3	3	2
Genua	2	2	0
Tibiae	4	4	3

Tarsus I and II each with long rodlike solenidion.

Male: Unknown

Holotype: Baker (1952) stated that "this species is redescribed on a basis of cotype material, Pusa, India, in galls

on *Ziziphus jujuba*; deposited in the U.S. National Museum."

Remarks: This species has a rudimentary palpus, consisting only one segment; 3 pairs of legs, one pair dorsosublateral hysterosomal setae, one pair medioventral hysterosomal setae. The specimens collected from Iraq were compared to the cotype deposited in the U.S. National Museum and also with Indian materials.

Habitat and locality: This species is known formerly from India. Now it is collected for the first time on *Ziziphus* sp. from Baghdad causing small galls on the branches and stem of the tree. This species was studied in detail in the last two years in India, because it is one of the important pests which attacks *Ziziphus jujuba* in this region.

GENUS *OBDULIA* PRITCHARD AND BAKER

Obdulia Pritchard and Baker, 1958: 260

Type-species: *Obdulia tamaricis* Pritchard and Baker

This genus is monotypic collected in twig galls of *Tamarix maris-mortui* from Israel. The adult has 4 pairs of legs; palpus one-segmented fused to the rostrum; rostral shield absent. Propodosoma with 3 pairs of dorsal propodosomal setae, 3 pairs of dorsocentral hysterosomal setae, 2 pairs of dorsosublateral hysterosomal setae, one pair of humeral setae, 5 pairs of dorsolateral hysterosomal setae. Opisthosoma of the female with genital plate, 2 pairs of genital setae, ventral setae one pair, anal setae 2 pairs. Male with 3 pairs of genitoanal setae and one genital stylet.

Obdulia daadi, new species

Female (Fig. 20)

Colour orange, body oval, length of the body including rostrum 278.52 µ, rostrum 33.48 µ, hysterosoma 158.1 µ, greatest body width 153.66 µ.

Gnathosoma: Without a pair of ventral gnathosomal setae,

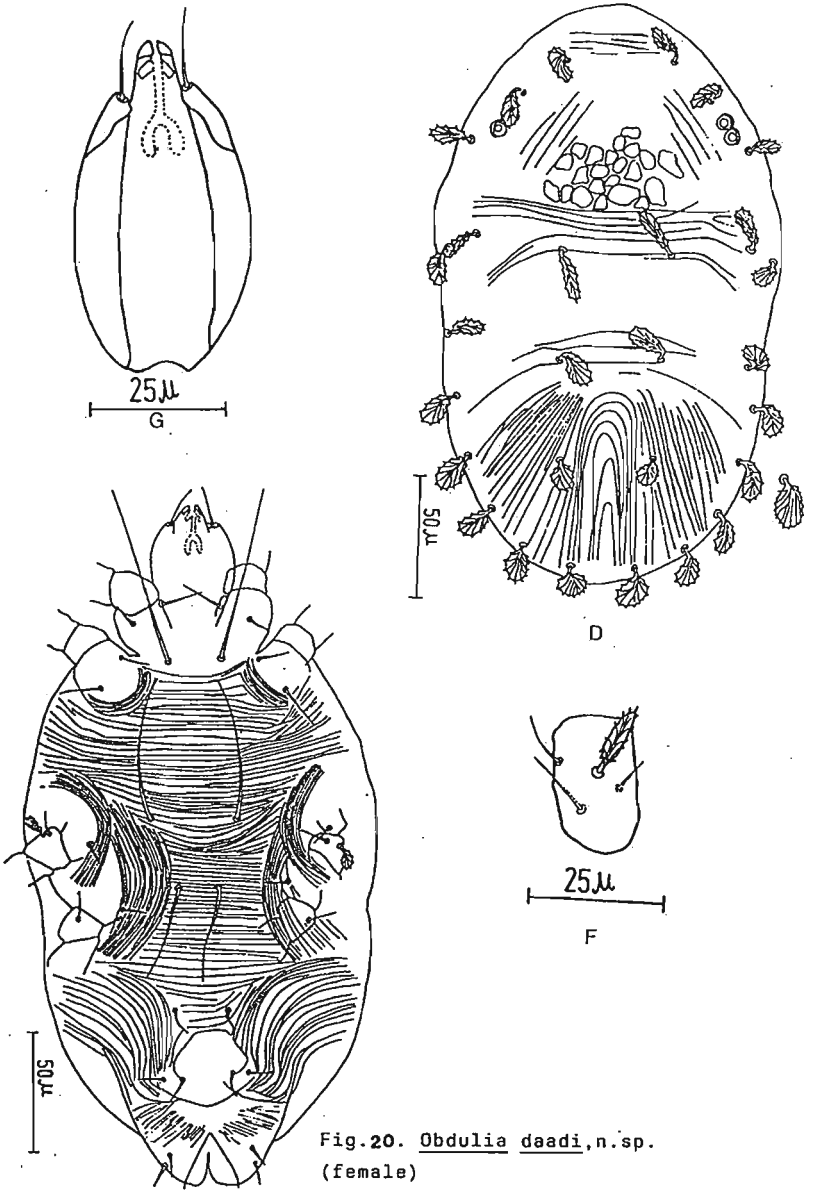


Fig.20. Obdulia daadi,n.sp.
(female)
G=gnathosoma ; D=dorsal ; V=ventral side
F=femur I .

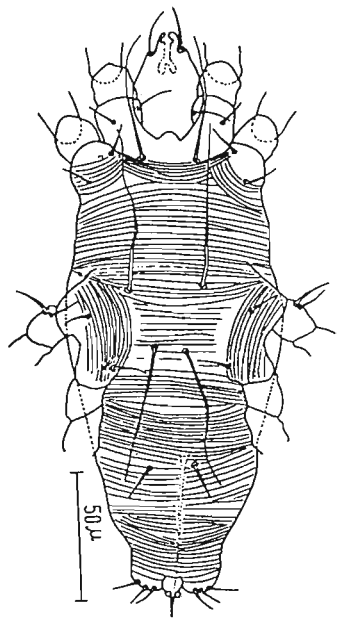
rostrum oval, reaching beyond the middle of genua I, palpus with one segment, fused to the rostrum, bearing a single, simple seta terminally.

Dorsum: Rostral shield absent, propodosoma with few longitudinal and transverse striations. The posterior area of propodosoma bears a reticulated pattern. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, broadly spatulate, serrate, measuring, I (9.6 µ), II and III (12.0 µ). Humeral suture not well developed laterally, the constriction between the propodosoma and hysterosoma absent. Hysterosoma with longitudinal, parallel striations caudally; the area between the first and the second dorsocentral hysterosomal setae without sculpture. Dorsocentral hysterosomal setae, 3 pairs, broadly spatulate, serrate, I (18.0 µ), II, III (12.0 µ). Dorsosublateral hysterosomal setae, 2 pairs, spatulate, serrate, (12.0 µ) and (9.6 µ). Humeral setae, one pair, broadly spatulate, (8.4 µ). Dorsolateral hysterosomal setae, 5 pairs, serrate, broadly spatulate, measuring I (12.0 µ), II and III (15.6 µ), IV and V (12.0 µ).

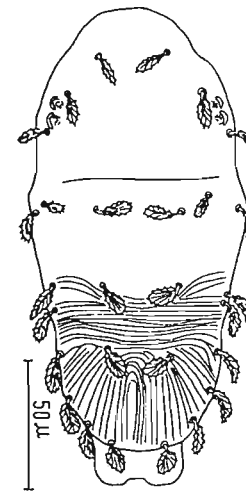
Venter: The podosoma is provided with longitudinal striae in the intercoxal areas while the remainder of the venter has transverse, smooth striae. Medioventral propodosomal setae, one pair, (54.4 µ). Anterior medioventral metapodosomal setae, one pair, (12.0 µ). Posterior medioventral metapodosomal setae, one pair, (40.0 µ). Ventral shield indistinct, with transverse striae, ventral setae, one pair, (12.0 µ). Genital shield smooth with 2 pairs of genital setae (12.0 µ). Anal shield with few striae and 2 anal setae (10.0 µ). All the ventral setae are simple.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1



V



D

Fig.21 .Obdulia daadi,n.sp.(male)

D=dorsal side;V=ventral side

Genua	3	3	1	0
Tibiae	4	4	3	3

Tarsus I and II each with a simple sensory rod or solenidion; claw well developed, uncinate; femur I and II, genua I and II each with a single, serrate, spatulate setae dorsally.

Male (Fig. 21)

Body elongate, its length including rostrum 232.92 µ, rostrum 43.2 µ, hysterosoma 122.8 µ, greatest body width 90.0 µ. The number and arrangement of the dorsal body setae are similar to those of the female. In contrast to the condition in the female, the propodosoma of the male is smooth and the hysterosoma is divided by a transverse striae into two parts. The venter of the male resembles that of the female in the body striations, the measurements of the setae and the chaetotaxy of the legs, but differs in that the male has 3 pairs of genitoanal setae caudally (12.0 µ) and one genital stylet.

Holotype: Female, Baghdad, Iraq, June 1985, on the leaves of *Tamarix pentandra* Pall. Holotype no TA-108, deposited in the Entomology Museum, College of Agriculture, Abu-Ghraib, Baghdad.

Paratypes: 8 females, 2 males, 12 nymphs, one larvae with the same data as holotype. One paratype is deposited in the Biosystematic Research Institute, Ottawa, Canada.

Remarks: *Obdulia daadi* n.sp. when compared to the type species of *O.tamaricis* can be distinguished by the following characters:

1. Palpus with one segment, bears only one seta in *daadi* and 2 setae and one solenidion in *tamaricis*.
2. Dorsal setae are broadly spatulate, serrate in *daadi* as against setiform, minutely serrate in *tamaricis*.
3. Genua I and II each with lanceolate dorsal seta in *daadi* as against the dorsal setae on genua I and II absent in *tamaricis*.

There are many other differences between these two species show in the original description of both species.

Habitat and locality: *Obdulia daadi* is collected from the leaf base of *Tamarix pendandra* near Baghdad and Diyala. It causes no damage on the host plant.

This species is named in honor of "Deutscher Akademischer Austauschdienst (DAAD)" (= German Academic Exchange Service) which supports the author to do this research.

Genus *Raoiella* Hirst

Raoiella, Hirst, 1924: 522
Type-species: *Raoiella indica* Hirst

These rounded, four-legged mites have the following diagnostic characters: the dorsum is provided with 3 pairs of propodosomal and 13 pairs of hysterosomal setae; hysterosoma has more or less the following pattern: one pair of humeral, 5 pairs of dorsolateral, 4 pairs of dorsosublateral and 3 pairs of dorsocentral setae; the palpus has 2 segments; the true claws are uncinate and each bears a pair of "Hafthaare" (= tenent hairs); the empodium is padlike and bears 2 rows of Hafthaare.

Raoiella indica Hirst

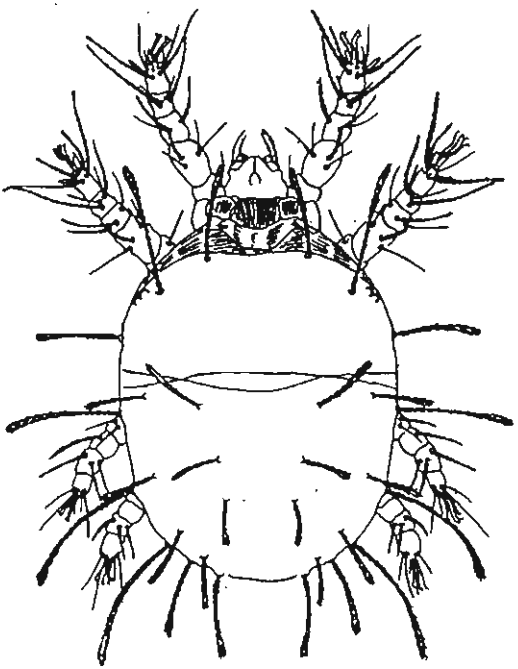
Raoiella indica Hirst, 1924: 522; Chaudhri, Akbar and Rasool, 1974: 17; Meyer, 1979: 114.

Female (Fig. 22)

Body ovate, 242 µ long (without rostrum shield), 200 µ wide. Palpus 2 segmented, 1st segment with a long, barbed seta, terminal segment with a long, barbed seta and a lobe. Eyes 2 pairs, 1 pair on each side.

Dorsum: smooth, propodosomal setae, 3 pairs, measuring (70 µ), (91 µ), (60 µ) in length. Humeral setae, one pair, (94.0 µ) long. Hysterosomal setae: central setae, 3 pairs, wide

P



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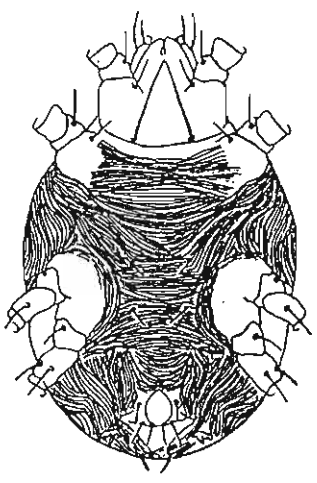


V

Fig.22. Raoiella indica Hirst (female)
P=palpus ; D=dorsal side ; V=ventral side

apart, (47 μ), (36 μ), (26 μ) long; sublateral setae, 4 pairs, (44 μ), (42 μ), (42 μ) and (36 μ) long; lateral setae, 4 pairs, (96 μ), (96 μ), (57 μ), (52 μ) long. All setae plumose, serrate.

Venter: Striated entirely as shown in figure 22 . Striations transverse medially, semi-longitudinal laterally. Ventral propodosomal setae, one pair. Anterior medioventral metapodosomal setae, one pair, (13 μ) long. Posterior medioventral metapodosomal setae, one pair, (16 μ) long. Genital shield setae, 3 pairs. Anal setae, one pair, minutely serrate, All other ventral setae simple.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	1	1	1	0
Trochanters	1	1	1	1
Femora	4	4	2	2
Genua	3	3	1	1
Tibiae	4	4	3	3

Male: Unknown

Holotype: Pritchard and Baker,(1958) stated that "Types: males and females, Coimbatore, India, on coconut leaves; in the British Museum (Natural History)"

Remarks: This species was described from Coimbatore, India, on coconut leaves. It has also been recorded from Egypt, Sudan and Pakistan on *Areca* sp., *Cocus* sp., *Ocimum basilikum, Phoenix* sp. and *Phoenix dactylifera.*

In Iraq this species had been recorded on date palm in 1965 by Mohammed and El-Haidari from Kanaqeen (Diyala) which is on the border of Iran. In the present study the author could not visit this place because it is closed for military purposes. Since that the description of this species, which published by Chaudhri, Akbar and Rasool, 1974 was used.

GENUS *AEGYPTOBIA* SAYED

Aegyptobia Sayed, 1950: 1018

Type-species: *Aegyptobia trägårdhi* Sayed

Oval elongate shape; propodosoma nearly as broad as hysterosoma; dorsum striated or reticulated without frontal projections (= rostral shield). Palpus with five segments, usually with a solenidion and two simple setae on the terminal segment. Dorsal propodosomal setae, 3 pairs. Dorsocentral hysterosomal setae, 3 pairs. Dorsosublateral hysterosomal setae, 4 pairs. Humeral setae, one pair. Dorsolateral hysterosomal setae, 5 pairs. Venter with one pair of medioventral propodosomals, one pair of anterior medioventral metapodosomals, one pair of posterior medioventral metapodosomals, one pair of ventral setae, two pairs of genital setae and two to three pairs of anal setae.

The genus *Aegyptobia* is closely related to *Phytoptipalpus* Trägårdh. The dorsal chaetotaxy is similar and both have five segmented palpus and 4 pairs of dorsosublateral setae. The only character on which they can be separated is the number of legs in the female: the former has 4 pairs and the later 3 pairs.

Key to the collected species

1. Anal setae, 3 pairs.....2
- Anal setae, 2 pairs.....3

2. Anal setae, 3 pairs, simple setiform. The 1st and 2nd pairs of dorsocentral hysterosomal setae and dorsosublateral setae besides the humeral are setiform whereas the other hysterosomal setae are lanceolate.....
Aegyptobia trägårdhi Sayed
- Anal setae, 3 pairs, lanceolate serrate, the dorsal body setae slender lanceolate.....
Aegyptobia mesopotamiensis, n.sp.

3. Palpus with only one solenidion on the terminal segment, dorsal body setae broadly lanceolate, coarsly serrate..... *Aegyptobia salicicola*, n.sp.

- Palpus with one solenidion and two simple setae on the terminal segment, dorsal body setae narrowly lanceolate... *Aegyptobia euphratica*, n.sp.

Aegyptobia trägårdhi Sayed

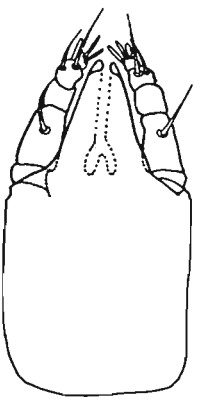
Aegyptobia trägårdhi Sayed, 1950: 1018
Pentamerismus trägårdhi (Sayed), Pritchard & Baker, 1958: 355

Female (Fig. 23)

Red in colour, length of the body including rostrum 265.98 µ, rostrum 55.8 µ, hysterosoma 137.64 µ, greatest body width 146.94 µ.

Gnathosoma: The rostrum extends to the distal end of tibia I; palpus with five segments, first or basal segment small, second the longest with a seta anteriorly, third and fourth short, almost equal in size, fourth with two simple setae, terminal segment the smallest with a solenidion and two setae.

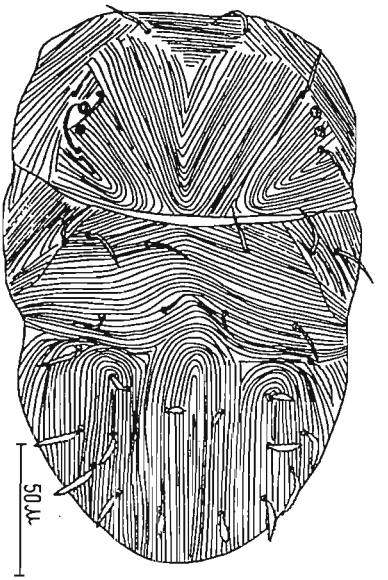
Dorsum: Rostral shield or frontal projection absent, propodosoma with transverse striations between the first pair of dorsal propodosomal setae and with three bands of longitudinal striations posteriorly. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, narrowly lanceolate and serrate, (22.32 µ), (20.46 µ) and (20.46 µ). Humeral suture well defined medially. Hysterosoma with transverse, anteriorly arched striations mediodorsally and striations represent three longitudinal bands in the posterior part of hysterosoma. Dorsocentral hysterosomal setae, 3 pairs, the first and second, narrowly lanceolate, serrate, (20.46 µ), (11.16 µ), the third broadly lanceolate, serrate (9.3 µ). Dorsosublateral hysterosomal setae, 4 pairs, first and second, narrowly lanceolate, serrate, (22.32 µ), (20.46 µ), third and fourth, broadly lanceolate, serrate, (11.16 µ),



P

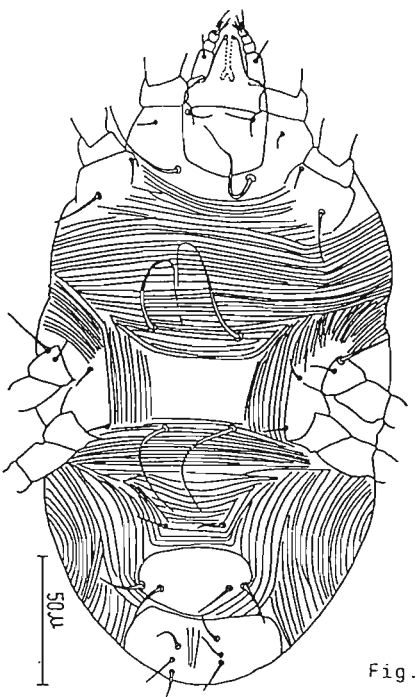
25µ

G



50µ

D



50µ

V

Fig.23. Aegyptobia trägårdhi Sayed (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side

(14.88 µ). Humeral setae, one pair, narrowly lanceolate, serrate, (22.32 µ). Dorsolateral hysterosomal setae, 5 pairs, broadly lanceolate and serrate, measuring (18.6 µ), (22.32 µ), (23.25 µ), (19.53 µ) and (13.02 µ) respectively.

Venter: Ventral propodosomal with transverse striations. Areas anterior to apodemes of coxae III, in front of coxa III and IV with longitudinal striations. The anterior part of ventral shield and the ventral shield with transverse striations. The lateral part of opisthosoma with longitudinal striae. The genital and anal shield smooth. Medioventral propodosomal setae, one pair, (37.20 µ). Anterior medioventral metapodosomal setae, one pair, (52.08 µ). Posterior medioventral metapodosomal setae, one pair (42.78 µ). Ventral setae, one pair (11.16 µ). Genital setae, 2 pairs, (18.06 µ). Anal setae 3 pairs (16.74 µ). All the ventral setae are simple setiform.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	3	3	2	1
Genua	1	1	1	0
Tibiae	4	4	3	3

Tarsus I and II each with a single solenidion, the claw well developed.

Male: Unknown

Holotype: No informations are available about the type species and the place in which it deposited. This species was described from a female, from Doki and Giza, Egypt, on *Thuja orientalis* L.

Remarks: *Aegyptobia trägårdhi* Sayed may be recognized by the presence of 3 pairs of dorsal propodosomals and the first

two transverse rows of hysterosomal setae which are narrowly lanceolate and serrate whereas the rest of dorsal hysterosomals are broadly lanceolate and serrate. The dorsum and venter are striate. The specimens collected from Iraq are checked with the paratypes deposited in the U.S. National Museum.

Habitat and locality: *Aegyptobia trägårdhi* is collected on *Thuja orientalis* L. from Baghdad and Babil, in June 1985. This genus and species are new records to the Iraqian fauna.

Aegyptobia salicicola, new species

Female (Fig. 24)

Red in colour, length of the body including rostrum 282.66 µ, rostrum 70.68 µ, hysterosoma 159.96 µ, greatest body width 154.38 µ.

Gnathosoma: The rostrum elongate extends to the basal part of genu I, palpus 5 segmented, first and third segments without setae, second the largest with a seta anteriorly, fourth segment with two simple setae anteriorly, the terminal segment smaller than the others with a big rodlike solenidion.

Dorsum: Rostral shield absent, the anterior portion of the body resembles to the posterior, propodosoma with a reticulated area dorsomedially and with irregular broken longitudinal and transverse striations. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, broadly lanceolate, coarsely serrate, (20.06 µ), (20.06 µ), (23.60 µ). Humeral suture indistinct. Hysterosoma almost smooth in the anterior part, the posterior part with transverse and longitudinal, irregular striations. Dorsocentral hysterosomal setae, 3 pairs, broadly lanceolate, coarsely serrate, (28.32 µ), (20.06 µ), (23.60 µ). Dorsosublateral hysterosomal setae, 4 pairs, broadly lanceolate, coarsely serrate, I (29.05 µ), II, III, and IV (25.96 µ). Humeral setae, one pair, broadly lanceolate, coarsely serrate, (23.60 µ). Dorsolateral hysterosomal setae, 5 pairs, broadly lanceolate, coarsely serrate of the same length (23.60 µ).

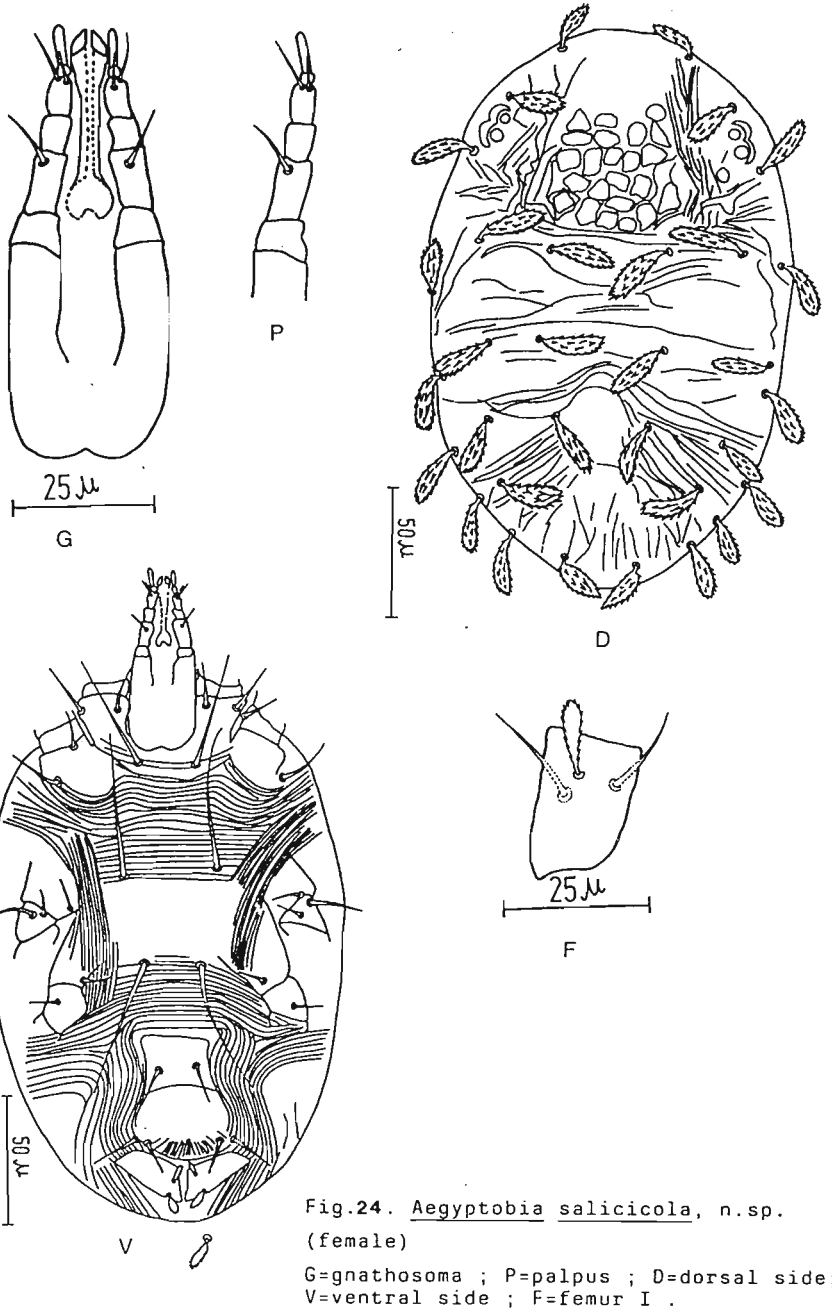


Fig.24. Aegyptobia salicicola, n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side; V=ventral side ; F=femur I .

Venter: Ventral propodosomal with transverse striations. Areas anterior to coxa III, in front of coxae III and IV with longitudinal striations. The anterior part of ventral shield with transverse striations. The opisthosoma with longitudinal striations laterally and caudally. The ventral, genital and anal shields are smooth. Medioventral propodosomal setae, one pair, (48.36 µ). Anterior medioventral metapodosomal setae, one pair, (65.1 µ). Posterior medioventral metapodosomal setae, one pair, (46.50 µ). Ventral setae, one pair, (18.60 µ). Genital setae, 2 pairs (18.60 µ). Anal setae, 2 pairs lanceolate and serrate, (9.3 µ), (14.88 µ). All the ventral setae except the anal are simple.

Legs: 4 pairs, setae on the legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	3	3	2	1
Genua	1	1	0	0
Tibiae	4	4	3	3

Femur I, II, III each with a broadly lanceolate setae. Tarsus I and II each with a large rodlike solenidion, and well developed claw.

Male: Unknown

Holotype: Female, Abu-Ghraib, Baghdad, Iraq. June 1985 on willow, *Salix alba* L. Holotype no. TA-106, deposited in the Entomology Museum, College of Agriculture, Plant Protection Department, Abu Ghraib, Baghdad, Iraq.

Paratype: One female, the same data of the holotype.

Remarks: This species is close to *Aegyptobia salixi* Zaher and Yousef but the following characters separate these two species:

1. The shape of the body in *salixi* ovate, while in the new species the propodosoma and the hysterosoma have the same width.
2. The dorsum ornamentation in *salixi* shows a reticulated area on propodosoma whereas a smaller reticulated area and transverse striations in the new species.
3. The venter of *salixi* smooth, while in the new species striated.
4. The fourth palpus segment of *salixi* with one seta whereas with 2 setae in this new species. The terminal segment of palpus of *salixi* with one solenidion and two setae while in the new species only one solenidion.
5. Coxa I in *salixi* with one seta as against 2 setae in *salicicola*.
6. Anal setae 3 pairs in *salixi* as against 2 pairs of lanceolate setae in *salicicola*.
7. Ventral setae of the new species are much longer than in *salixi*.

Habitat and locality: This mite together with *Tenuipalpus salicis* attack *Salix alba* L. and *Salix acmophylla* Boiss. in all the provinces of Central Iraq. A silvery appearence on the leaves is resulted from feeding of this two species. No considerable damage was noticed on willow trees in Iraq.

Aegyptobia euphratica, new species

Female (Fig. 25)

Red to orange in colour, length of the body including rostrum 265.98 µ, rostrum 46.5 µ, hysterosoma 143.22 µ, greatest body width 125.55 µ.

Gnathosoma: The rostrum reaches to the middle of genu I, palpus 5 segmented, first and third without setae, second the largest with long simple seta dorsally, the fourth segment with two unequal simple setae, the terminal being very small, bearing one short solenidion and two setae.

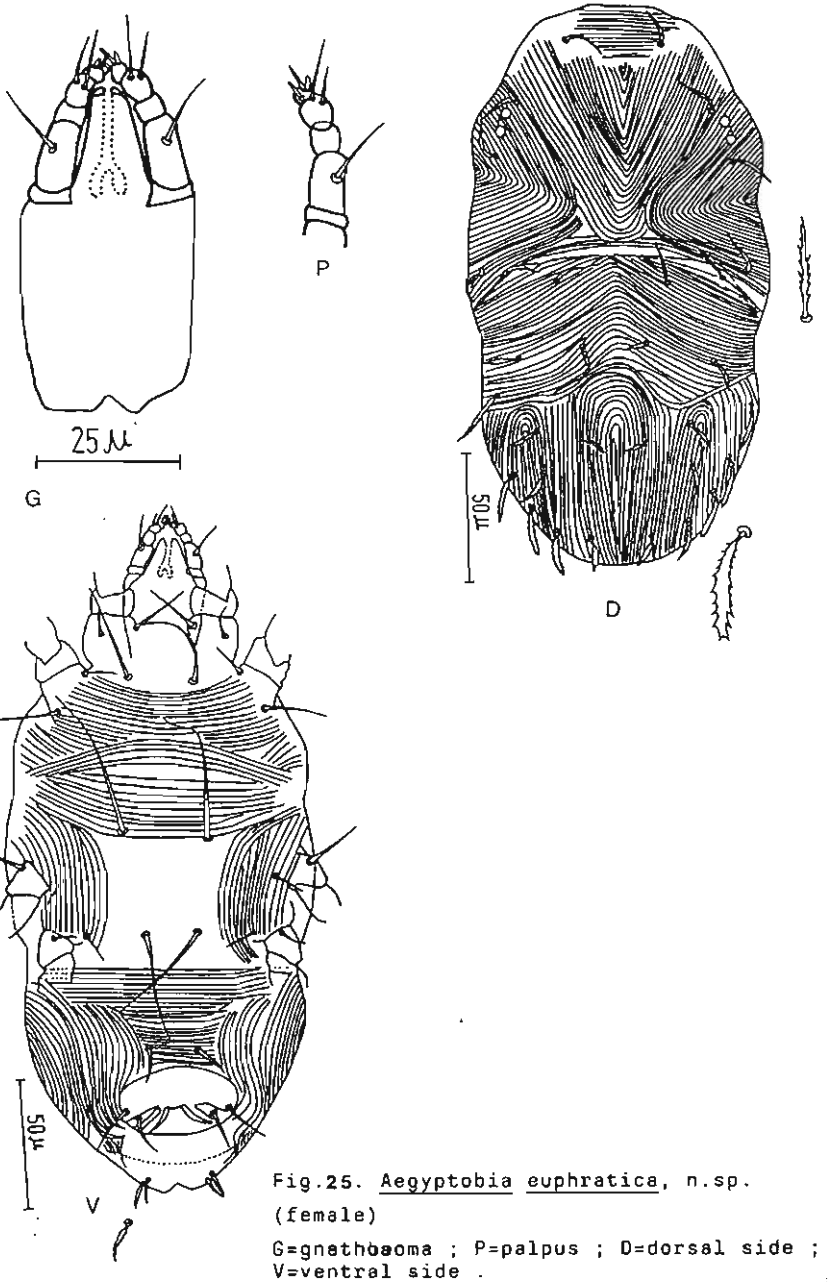


Fig.25. Aegyptobia euphratica, n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side .

Dorsum: Rostral shield absent, the body shape elongate, propodosoma with transverse striae anterior to the first pair of dorsal propodosomals and with three bands of longitudinal striations directed to the center of humeral suture forming a V-shape pattern. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, narrowly lanceolate, coarsely serrate, (18.60 µ), (18.60 µ), (20.46 µ). Humeral suture not well defined dorsolaterally. Hysterosoma with transverse, anteriorly arched striations mediodorsally, the posterior part of hysterosoma with swirl striation pattern. Dorsocentral hysterosomal setae, 3 pairs, the first two pairs, narrowly lanceolate, coarsely serrate, (18.60 µ), (11.16 µ), the third pair, lanceolate, serrate, (8.37 µ). Dorsosublateral hysterosomal setae, 4 pairs, lanceolate, serrate, I (16.74 µ), II, III, IV (13.02 µ). Humeral setae, one pair, narrowly lanceolate, serrate, (18.60 µ). Dorsolateral hysterosomal setae, 5 pairs, broadly lanceolate, coarsely serrate, I, II, III, (22.32 µ), IV (18.60 µ), V (14.88 µ).

Venter: Ventral propodosomal with transverse striations. Area in front of coxae III and IV with longitudinal striations. The area between the anterior and posterior medioventral metapodosomal setae smooth. The anterior part of ventral shield and the ventral shield with transverse striations. The lateral part of opisthosoma with longitudinal striations. Genital and anal shield smooth. Medioventral and propodosomal setae, one pair (37.20 µ). Anterior medioventral metapodosomal setae, one pair,(55.80 µ). Posterior medioventral metapodosomal setae, one pair, (40.92 µ). Ventral setae, one pair, (11.16 µ). Genital setae, 2 pairs (18.6 µ) and (16.74 µ). Anal setae, 2 pairs, the outer pair, narrowly lanceolate, (12.09 µ), the inner pair, simple, (9.30 µ). All the ventral setae are simple, setiform except the lanceolate anal setae.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	1	1
Femora	3	3	2	1
Genua	1	1	1	0
Tibiae	3	3	3	3

Tarsus I and II each with a rodlike solenidion. Tarsi I-IV with well developed claw.

Male: Unknown

Holotype: Female, Abu-Ghraib, Baghdad, Iraq, June 1985 on *Cupressus sempervirens* L. type no TA-105, deposited in the Entomology Museum, College of Agriculture, Abu-Ghraib, Baghdad, Iraq.

Paratype: 6 females, the same data as in the holotype.

Remarks: *Aegyptobia euphratica* n.sp. is closely related to *Aegyptobia trägårdhi* Sayed, which attacks *Thuja orientalis* in Iraq, due to the shape of dorsal setae and the striations pattern of both dorsum and venter. The following characters separate these two species.

1. Trochanter II with one seta in the *euphratica* whereas 2 setae in *trägårdhi*.
2. Tibiae III,IV each with 3 setae in the new species as against 4 setae in *trägårdhi*.
3. Anal setae, 2 pairs, one lanceolate and one simple in the new species whereas in *trägårdhi* 3 pairs simple setiform setae.

Habitat and locality: This species is collected from Baghdad, Kerbala, Wasit and Salahuddin on *Cupressus sempervirens*.

Aegyptobia mesopotamiensis, new species

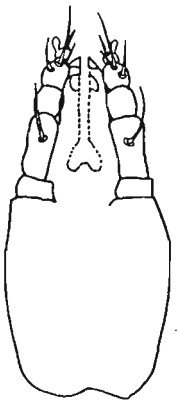
Female (Fig. 26)

Body elongate-elliptical, red in colour, length of the body including rostrum 221.34 µ, rostrum 55.8 µ, hysterosoma 119.04 µ, greatest body width 107.88 µ.

Gnathosoma: Rostrum prominent, broad reaching the anterior end of genu I, palpus 5 segmented, first and third segment without setae, second the longest with simple seta, fourth segment with two unequal setae, the terminal being very small, bearing one short solenidion and two setae.

Dorsum: Rostral shield absent, propodosoma with striations forming a V-shape pattern. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, slender, lanceolate serrate, I, II (16.74 µ), III (22.32 µ). Humeral suture distinct. Hysterosoma with transverse anteriorly arched striations mediodorsally, the posterior part of hysterosoma with swirl striation pattern dorsomedially and dorsolaterally. Dorsocentral hysterosomal setae, 3 pairs, slender, lanceolate, serrate, decreasing in length posteriorly (16.74 µ), (10.23 µ) and (9.3 µ). Dorsosublateral hysterosomal setae, 4 pairs, slender, lanceolate and serrate, I, II (13.02 µ), III (9.30 µ), IV (10.23 µ). Humeral setae, one pair, slender, lanceolate serrate, (13.02 µ). Dorsolateral hysterosomal setae, 5 pairs, slender, lanceolate and serrate, decreasing in length posteriorly, (24.18 µ), (22.32 µ), (20.46 µ), (20.46 µ) and (13.95 µ)

Venter: Ventral propodosomal with transverse striae. Area in front of coxae III and IV with arched striations, the area between anterior and posterior medioventral metapodosomal setae smooth. The anterior part of ventral shield with transverse striations. The lateral part of opisthosoma with longitudinal arched striations. Genital and anal shields smooth. Medioventral propodosomal setae, one pair, (46.5 µ). Anterior medioventral metapodosomal setae, one pair,(46.50 µ).Posterior medioventral metapodosomal setae, one pair,



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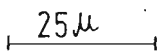

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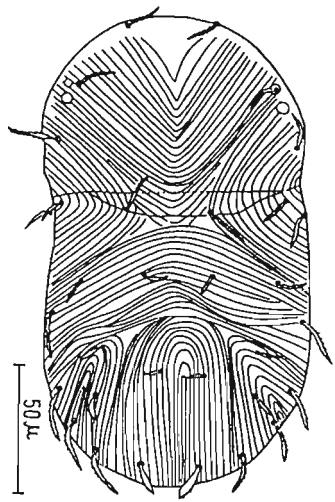

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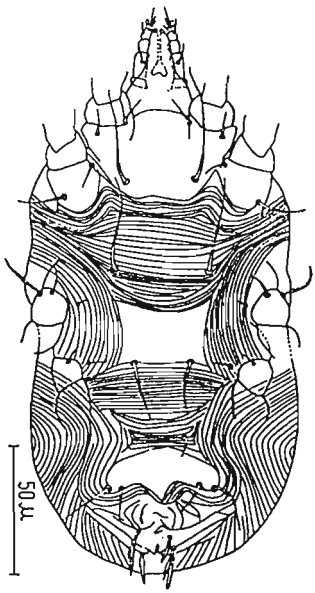


V

Fig.**26**. Aegyptobia mesopotamiensis, n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side .

(27.90 µ). Ventral setae, one pair, (7.44 µ). Genital setae, 2 pairs, unequal, (18.60 µ) and (11.16 µ). Anal setae, 3 pairs, slender, lanceolate and serrate, (13.02 µ). All the ventral setae, except the anal are setiform.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	3	3	2	1
Genua	1	1	1	0
Tibiae	4	4	3	3

Tarsus I and II each with single solenidion. Tarsi I-IV with well developed claw.

Male: Unknown

Holotype: Female, Abu-Ghraib, Baghdad, Iraq, June 1985, on *Cupressus* sp. Holotype no TA-104, deposited in the Entomology Museum, College of Agriculture, Abu-Ghraib, Baghdad, Iraq.

Paratype: 6 females, 1 nymph with the same data as in the holotype.

Remarks: *Aegyptobia mesopotamiensis*, new species is closely related to *Aegyptobia salubris* Chaudhri due to the similarity of dorsal and ventral striations and setae. The following characters separate these two species.

1. The second palpus segment of *salubris* with serrate seta, the fourth only with one seta whereas a simple seta and 2 setae on the second and fourth segment respectively in the new species.
2. The genital setae in *salubris* are serrate as against simple setae in the new species.
3. Trochanter III with only one seta in *salubris* whereas in the new species two setae, one slender, lanceolate serrate and the other simple.

4. Femur III in *salubris* with only one seta whereas in the new species with two setae.
5. The ventral setae of the new species are much longer than in *salubris*.

This species was also checked to the type species of *Aegyptobia campris* Baker & Tuttle, *A.destortum* Baker & Tuttle and *A.cupressus* Baker & Tuttle.

Habitat and locality: This species is collected on *Copressus* spp. from Baghdad, Wasit, Diyala and Babil. It does not cause any economic damage.

GENUS *BREVIPALPUS* DONNADIEU

Brevipalpus Donnadieu, 1875: 116

Type-species: *Brevipalpus obovatus* Donnadieu

Brevipalpus is a large genus and contains many species of economic importance. Of these the most important are found on a variety of host plants and have been transported to many parts of the world. Because of the variation in the dorsal setal pattern and the number of solenidia on tarsus II, a number of new genera were separated from it in recent years. The genus is recognized by a palpus with four segments, presence of rostral shield, body with reticulate skin pattern, 3 pairs of dorsal propodosomal setae, 3 pairs of dorsocentral hysterosomal setae, one pair humeral setae, 5 or 6 pairs of dorsolateral hysterosomal setae; dorsosublateral hysterosomal setae absent. The ventral and genital shields are distinct.

Key to the collected species:

1. Dorsolateral hysterosomal setae 6 pairs, palpus with four segments, terminal segment with one solenidion and two simple setae.....*Brevipalpus iraquiensis* n.sp.
2. Dorsolateral hysterosomal setae 5 pairs, palpus with four segments, terminal segment with two solenidia and one simple seta.....*Brevipalpus obovatus* Donnadieu

Brevipalpus iraquiensis, new species

Female (Fig. 27)

Body ovate with orange colour, length of body including rostrum 299.46 µ, rostrum 42.78 µ, hysterosoma 172.50 µ, greatest body width 165.54 µ.

Gnathosoma: Without ventral gnathosomal setae, rostrum triangular shape reaching the middle of femur I; palpus with 4 segments, the second longer than the others with a simple setiform seta dorsally, the third segment with one short and one long simple seta, the terminal segment small with two simple setae and one solenidion.

Dorsum: Rostral shield deeply bifurcate with long median lobes and two pairs of smaller lateral lobes, smooth reaching to the anterior end of genu I. Propodosoma with reticulations and few crenulations, reticulate pattern not well defined on anterior central portion of propodosoma, the lateral reticulate elements much longer than wide. Eyes 2 pairs of equal size, one pair on each side. Dorsal propodosomal setae, 3 pairs, narrowly lanceolate and slightly serrate, I,II (8.25 µ), III (9.44 µ). Humeral suture well distinct medially and laterally separating the propodosoma from hysterosoma. Hysterosoma with a smooth area, and few crenulations dorsomedially, the reticulate elements longer than wide. Dorsocentral hysterosomal setae, 3 pairs, minute, setiform, having the same length (7.08 µ). Dorsosublateral setae absent. Humeral setae, one pair, narrowly lanceolate, slightly serrate, (5.9 µ). Dorsolateral hysterosomal setae, 6

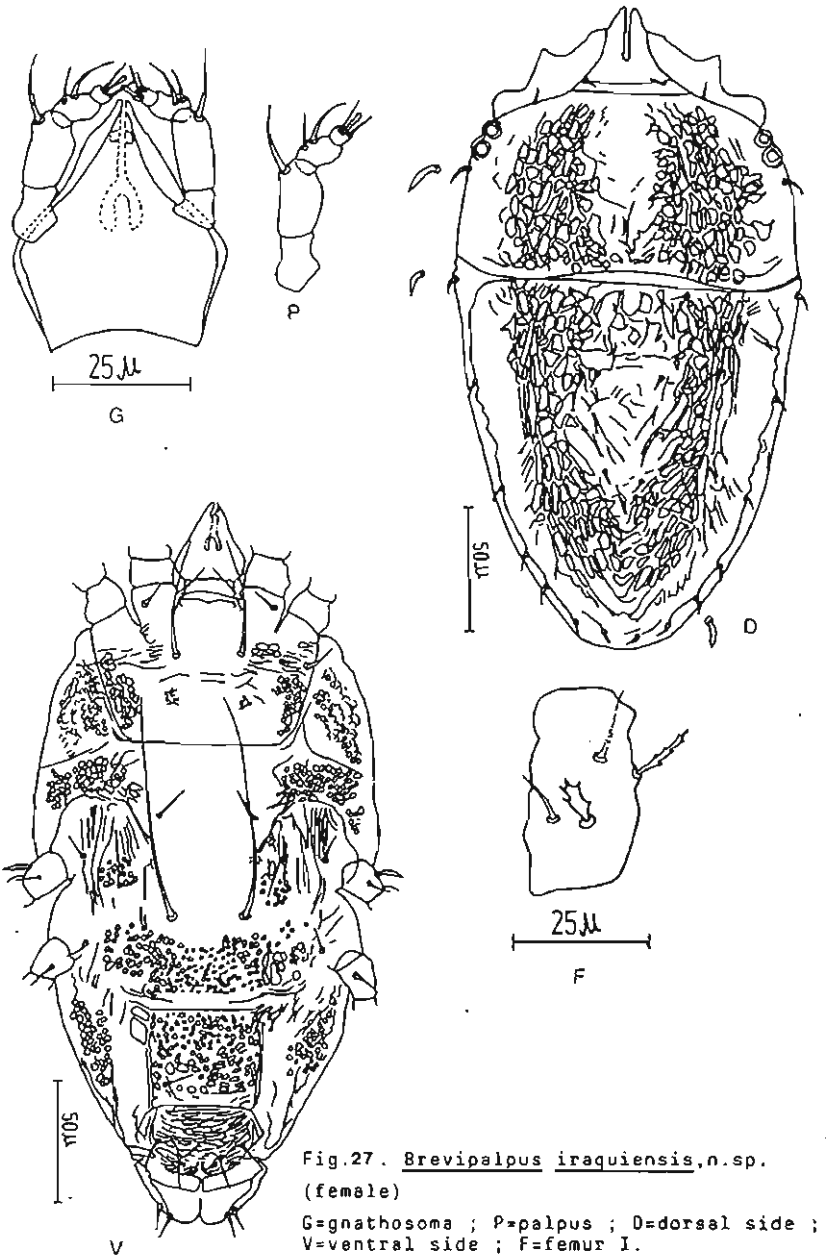


Fig.27. Brevipalpus iraquiensis,n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I.

pairs, narrowly lanceolate, serrate, measuring I (5.9 μ), II, III, IV (7.08 μ), V, VI (5.9 μ).

Venter: The venter of propodosoma with irregular transverse striations near the bases of coxae I and II; reticulations inner and lateral to the posterior apodemes of coxae II. Areas anterior and lateral to apodemes of coxae III, in front of coxae III and IV, having reticulations small and as long as wide. Reticulations also present anterior to ventral shield up to the bases of posterior medioventral metapodosomal setae. Opisthosoma with reticulations laterally. Medioventral propodosomal setae, one pair, (47.2 μ). Anterior medioventral metapodosomal setae, one pair, (11.18 μ). Posterior medioventral metapodosomal setae, one pair, (94.4 μ). Ventral shield with reticulations, ventral setae one pair, (11.8 μ). Genital shield with reticulations, the reticulate elements coalescing transversely, genital setae, 2 pairs, (11.8 μ). Anal shield smooth, with two pairs of anal setae, (8.26 μ).

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	1	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1
Genua	3	3	1	1
Tibiae	5	5	3	3

Femur I with one broadly lanceolate, serrate seta dorsally and one narrowly lanceolate, serrate laterally, and two simple setae ventrally. Tarsus I and II, each with one solenidion.

Male: Unknown

Nymph (Fig. 28)

Body ovate, with longitudinal and transverse striae, dor-

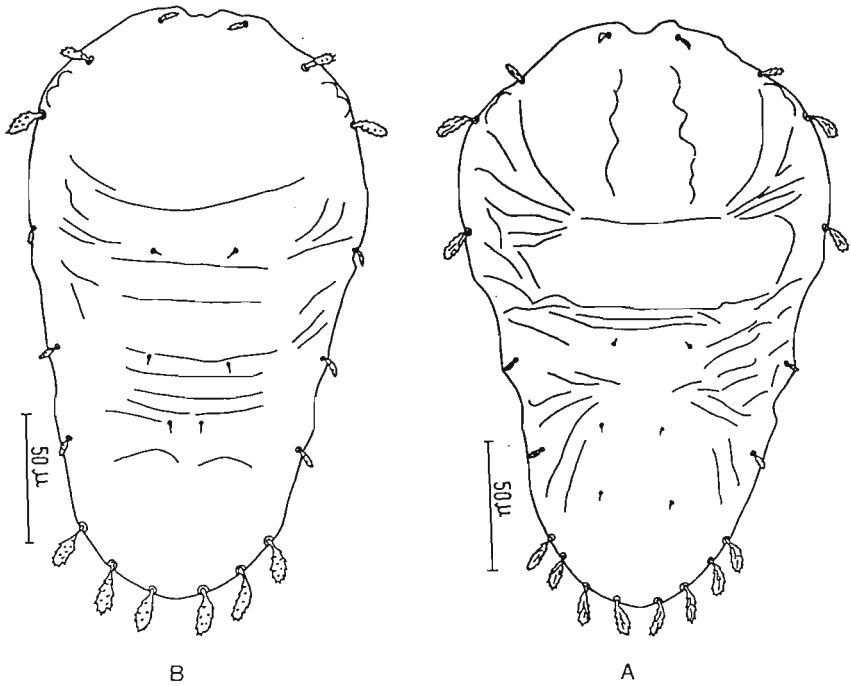


Fig.28. A=Brevipalpus obovatus Donnadieu
B=Brevipalpus iraquiensis,n.sp.
Dorsal side of nymph

somedian area smooth. Dorsal propodosomal setae, 3 pairs, broadly lanceolate, serrate. Humeral suture absent. Dorsocentral hysterosomal setae 3 pairs, minute, setiform. Humeral setae one pair, broadly lanceolate. Dorsolateral hysterosomal setae, 6 pairs, the first and second narrowly lanceolate, serrate while the III, IV, V and VI, broadly lanceolate, serrate.

Holotype: Female, Abu-Ghraib, Baghdad, Iraq, June 1985 on *Croton variegatus* L. in greenhouses. Holotype no. TA-109, deposited in the Entomology Museum, College of Agriculture, Department of Plant Protection, Abu-Ghraib, Baghdad, Iraq.

Paratypes: 23 females, 8 nymphs with the same data as holotype.

Remarks: This species belongs to the *cuneatus* group which contains those *Brevipalpus* with one short solenidion on tarsus II of the female, 6 pairs of dorsolateral and 3 pairs of dorsocentral hysterosomal setae, one pair of anterior and one pair of posterior medioventral setae. This species was checked by E.W.Baker himself against the type species and the taxonomical keys of Pritchard & Baker (1958) and Meyer (1979). He found that this species is closely related to *Brevipalpus californicus* (Banks) but the main differences between this species and the new species are as follows:

1. Tarsus II of *iraquiensis* has only one solenidion distally whereas two solenidia in *californicus.*
2. The rostrum of *californicus* has one pair of ventral gnathosomal setae in comparison with no setae in *iraquiensis.*
3. Propodosoma without reticulations mediodorsally and on the anterior part of hysterosoma as against totally reticulated in *californicus.*
4. The marginal setae of *iraquiensis* are almost broadly lanceolate, serrate but narrowly lanceolate in *californicus.*
5. The marginal setae of nymphs are subequal in both species but in *californicus,* setae 7-10 largest lanceolate serrate of equal size, setae 1, 2, 4, 5 and 6

small, short lanceolate, seta 3 about twice as large as 1, as against in *iraquiensis*, setae 1, 5 and 6 short lanceolate, setae, 2, 3, 4 and 7-10 broadly lanceolate and serrate.

Habitat and locality: This species was collected on *Croton variegatus* L. and *Punica granatum* cv. Nana in greenhouses from Baghdad. *B.iraquensis* causes a considerable damage to these hosts.

Brevipalpus obovatus Donnadieu

Brevipalpus obovatus Donnadieu, 1875: 116
Brevipalpus preger Donnadieu, 1875: 116
Tenuipalpus inornatus Banks, 1912: 97
Tenuipalpus bioculatus McGregor, 1914: 354
Tenuipalpus pseudocuneatus Blanchard, 1940: 11
Brevipalpus inornatus Baker, 1945: 33
Brevipalpus bioculatus Reck, 1952: 290

Female (Fig. 29)

Body ovate, brightred in colour, length of the body including rostrum 308.76 µ, rostrum 40.92 µ, hysterosoma 180.44 µ, greatest body width 165.54 µ.

Gnathosoma: Without ventral gnathosomal setae, rostrum triangular shaped reaching to the middle of femur I, palpus with 4 segments, the basal segment small, the second segment being the longest, bearing lanceolate, serrate seta dorsally, the third segment with two setiform setae, the terminal segment with one simple seta and two sensory rods (= solenidia) distally.

Dorsum: Rostral shield, smooth, with strongly bilobed median projections and five pair lobes laterally, propodosoma with irregular reticulations dorsolaterally, the median area smooth. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, narrowly lanceolate, minutely serrate, (5.2 µ), (5.2 µ) and(8.85 µ). Humeral suture well

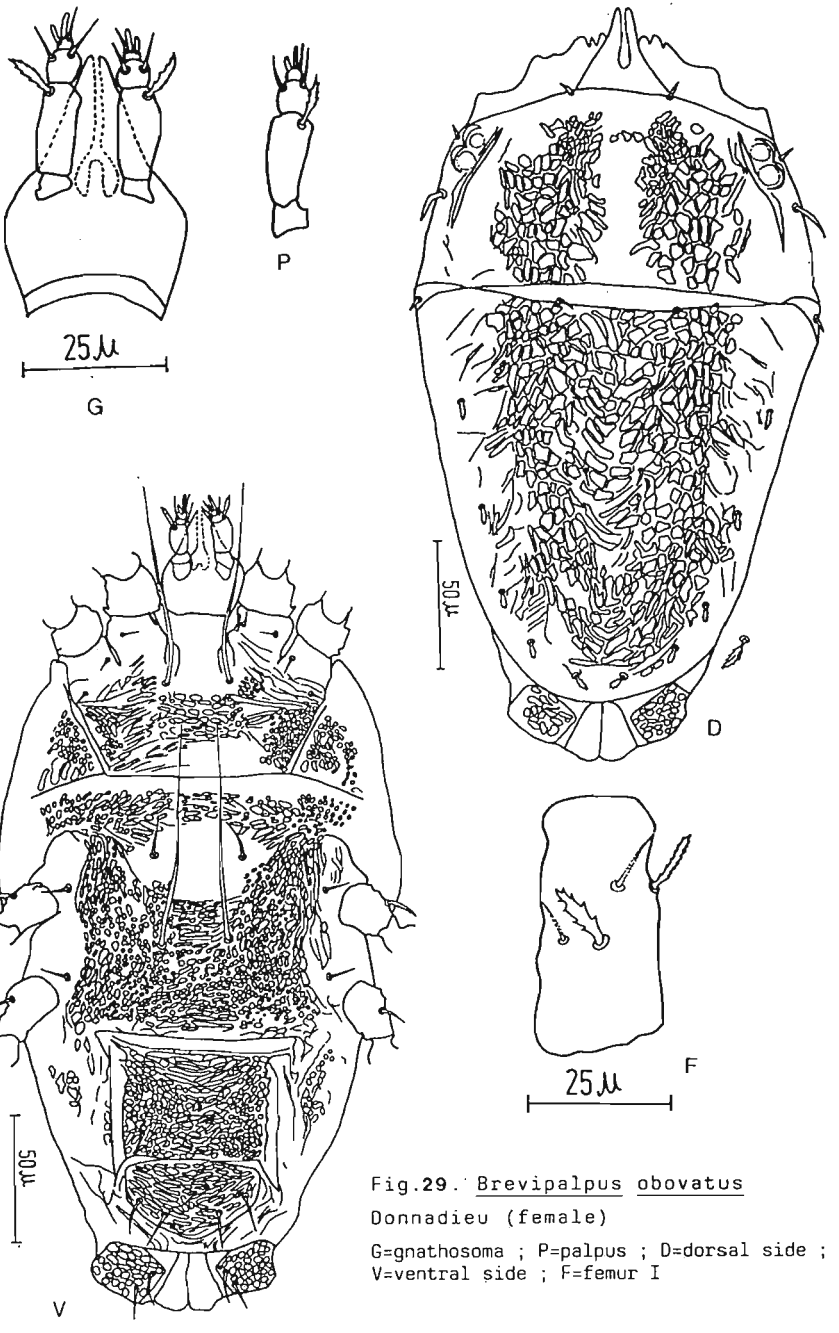


Fig.29. Brevipalpus obovatus Donnadieu (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I

distinct separating propodosoma from hysterosoma. The hysterosoma with reticulations, the reticulate elements longer than wide, no smooth area mediodorsally. Dorsocentral hysterosomal setae, 3 pairs, minute, narrowly lanceolate and serrate, I (7.08 µ), II, III (5.9 µ). Dorsosublateral hysterosomal setae absent. Humeral setae, one pair, narrowly lanceolate and serrate (6.49 µ). Dorsolateral hysterosomal setae, 5 pairs, broadly lanceolate, serrate, with the same length, (8.26 µ).

Venter: Ventral propodosomal part with few transverse striations near the bases of coxae I and II. Reticulations inner and lateral to the posterior apodemes of coxa II and also behind the medioventral propodosomal setae. Areas anterior to apodemes of coxae III, in front of coxae III and IV having unequal reticulations. Reticulations also present anterior to ventral shield up to anterior of posterior medioventral metapodosomal setae and beyond the anterior medioventral metapodosomal setae. Opisthosoma with few reticulate elements laterally, ventral and genital shields reticulate with tendency of transverse coalescence. Anal shield with two reticulated parts laterally. Medioventral propodosomal setae, one pair, (64.9 µ). Posterior medioventral metapodosomal setae, one pair, (10.62 µ). Posterior medioventral metapodosomal setae, one pair, (84.96). Ventral setae, one pair, (8.26 µ), genital setae, 2 pairs, (12.98 µ), anal setae, 2 pairs, (8.26 µ). All the ventral setae are simple.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	1	1
Femora	4	4	2	1
Genua	3	3	1	1
Tibiae	5	5	3	3

Femur I with one broadly lanceolate serrate seta dorsally and one narrowly lanceolate serrate seta laterally, 2 simple setae ventrally. Tarsus I and II each with single solenidion.

Male: Unknown

Nymph (Fig. 28)

Body elongate ovate with transverse striations. Dorsal propodosomal setae, 3 pairs, lanceolate serrate, the first seta smaller than the II and III. Dorsocentral hysterosomal setae, 3 pairs, minute, simple. Humeral setae, one pair, narrowly lanceolate and serrate, Dorsolateral hysterosomal setae, 5 pairs, the first and the second pair of the same length, narrowly lanceolate serrate. The third, fourth and fifth pair of setae are broadly lanceolate and serrate.

Remarks: *Brevipalpus obovatus* Donnadieu is characterized by the presence of 5 pairs of dorsolateral hysterosomal setae and a single solenidion on tarsus II. Laterally the propodosoma is provided with reticulate elements while dorsomedially it is devoid of reticulations.

Habitat and locality: This species was collected on different host plants namely *Verbena supina* L., *Rumex dentatus* L., *Plantago ovata* Forssk., *P.lanceolata* L., *Punica granatum* L., *Oxalis corniculata* L.,*Convovulus arvensis* L., *Ammi majus* L., *Aster subulatus* Michx., *Aster tripolium* L. *Sonchus oleraceus* L. and *Apium graveolens* L. In May, 1985 and September, 1986 from Behadilia, Kerbala. All these above mentioned hosts except *P.lanceolata* are new records to this species from the world.

GENUS *TENUIPALPUS* DONNADIEU

Tenuipalpus Donnadieu, 1875: 105-117

Type-species: *Tenuipalpus caudatus* (Dugés), 1834: 5-46
(= *Tenuipalpus palmatus* Donnadieu)

Donnadieu described *T.palmatus* as a type species of this

genus and mentioned that the body of this species being constricted in the middle, the posterior part (opisthosoma) is very narrow, especially in the male but slightly more tapering in the female; the rostrum as being not very prominent.

Baker (1945) proposed the characters of this genus as follows: Species with broad propodosoma and a narrow hysterosoma; presence of a few striations on the skin instead of reticulations; the ventral hysterosomal plate not plain as in *Brevipalpus* and the marginal body hairs large, lanceolate; presence of 4 pairs of broadly lanceolate posterior marginal hairs and a single pair of long, whip like posterior hairs; the palpus consisting of 3 segments, the penultimate segment provided with a long semiplumose hair and the last with one or 2 simple hairs; presence of a pair of semiplumose ventral rostral hairs and flat body. Baker (1953) reported that mites belonging to the genus *Tenuipalpus* may be readily recognized by the broad propodosoma and narrow opisthosoma. The palpi are three-segmented, the venter of the rostrum possesses a pair of feathered setae; the anterior end of stylophore lacks or nearly lacks transverse ribs; the fifth dorsolateral hysterosomal seta is flagilliform, and in one species lacking; one or both pairs of medioventral podosomals may be doubled and the anterior setae displaced to the podosoma.

This genus is worldwide in its distribution therefore more species were described in the last years from different parts of the world. The taxonomic characteras of the genus *Tenuipalpus* can be summarized as follows:

Body flat with broad propodosoma and narrow hysterosoma; dorsal integument variously sculptured or punctate; palpus one to three segmented; propodosoma with two pairs of eyes and three pairs of dorsal setae; hysterosoma with one to three pairs of dorsocentrals, one pair humerals, five to six pairs of dorsolaterals. Venter with a pair of medioventral propodosomals, one to three pairs of anterior medioventral metapodosomals, one to four pairs of posterior medioventral metapodosomals, one pair of ventrals, two pairs of genitals

and two pairs of anal setae. The venter may be striated or smooth. The male with 3 pairs of genitoanal setae and genital stylets.

Key to the collected species

1. Dorsocentral hysterosomal setae, 3 pairs.....2
- Dorsocentral hysterosomal setae, one pair.....4

2. Anterior medioventral metapodosomal setae, one pair.....3
- Anterior medioventral metapodosomal setae, two pairs; palpus with 3 segments, the terminal segment bears only one seta..... *Tenuipalpus lygodii* DeLeon

3. Palpus 3 segments, the terminal segment with two simple setae; dorsum pitted, with longitudinal and transverse striations.....*Tenuipalpus bagdadensis*, n.sp.
- Palpus 3 segments, the terminal with two solenidia; dorsum reticulated.....*Tenuipalpus punicae* Pritchard & Baker

4. Dorsolateral hysterosomal setae, 6 pairs.....5
- Dorsolateral hysterosomal setae, 5 pairs; rostral shield with one pair lateral lobes.....*Tenuipalpus salicis*, n.sp.

5. Dorsum smooth; gnathosoma without one pair ventral setae 6
- Dorsum with longitudinal and transverse broken striations; gnathosoma with one pair of ventral setae.....*Tenuipalpus populi*, n.sp.

6. Femur IV with one seta, genu III without setae; palpus with 4 segments, the terminal segment with two setae.....*Tenuipalpus viticola*, n.sp.
- Femur IV with 2 setae, genu III with one seta; palpus 3 segmented, the terminal segment with one seta..*Tenuipalpus myrtus*, n.sp.

Tenuipalpus bagdadensis, new species

Female (Fig. 30)

Body ovate, brightred, length of the body including rostrum 264.84 µ, rostrum 42.78 µ, hysterosoma 150 µ, greatest body width 150.66 µ.

Gnathosoma: With one pair of ventral gnathosomal setae, rostrum reaching the middle of femur I, palpus with three segments, second the longest with a plumose seta anteriorly, the terminal segments, small with two unequal simple setae distally.

Dorsum: Rostral shield deeply notched, reaching the anterior part of femur I, propodosoma totally punctate with broken longitudinal striations. Eyes 2 pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, setiform, coarsely serrate, (26.4 µ), (45.6 µ), (39.6 µ). Humeral suture well defined separating the propodosoma from hysterosoma. Hysterosoma totally punctate with broken longitudinal and transverse striations, two pores present dorsolaterally. Dorsocentral hysterosomal setae, 3 pairs, setiform, coarsely serrate, the first pair being the longest, (63.6 µ), second (48.0 µ), the third (37.2 µ). Humeral setae, one pair, setiform, serrate, (26.40 µ). Dorsolateral hysterosomal setae, 6 pairs, setiform, coarsely serrate, I,III (25.20 µ), II (27.8 µ), IV, VI (15.6 µ), V (174.0 µ).

Venter: The venter of propodosoma with longitudinal striations laterally and transverse striations forming a V-shaped medially. Metapodosoma with faint longitudinal striae in front of coxae III and IV. The opisthosoma with lateral striations, and transverse striations on the ventral and genital shields, anal shield smooth. Medioventral propodosomal setae, one pair, (57.6 µ). Anterior medioventral metapodosomal setae, one pair, (18.0 µ) Posterior medioventral metapodosomal setae, one pair, (42.0 µ). Ventral setae, one pair, (30.0 µ). Genital setae, two pairs, (19.2 µ). Anal setae, two pairs, (18.0 µ). All the ventral setae are simple.

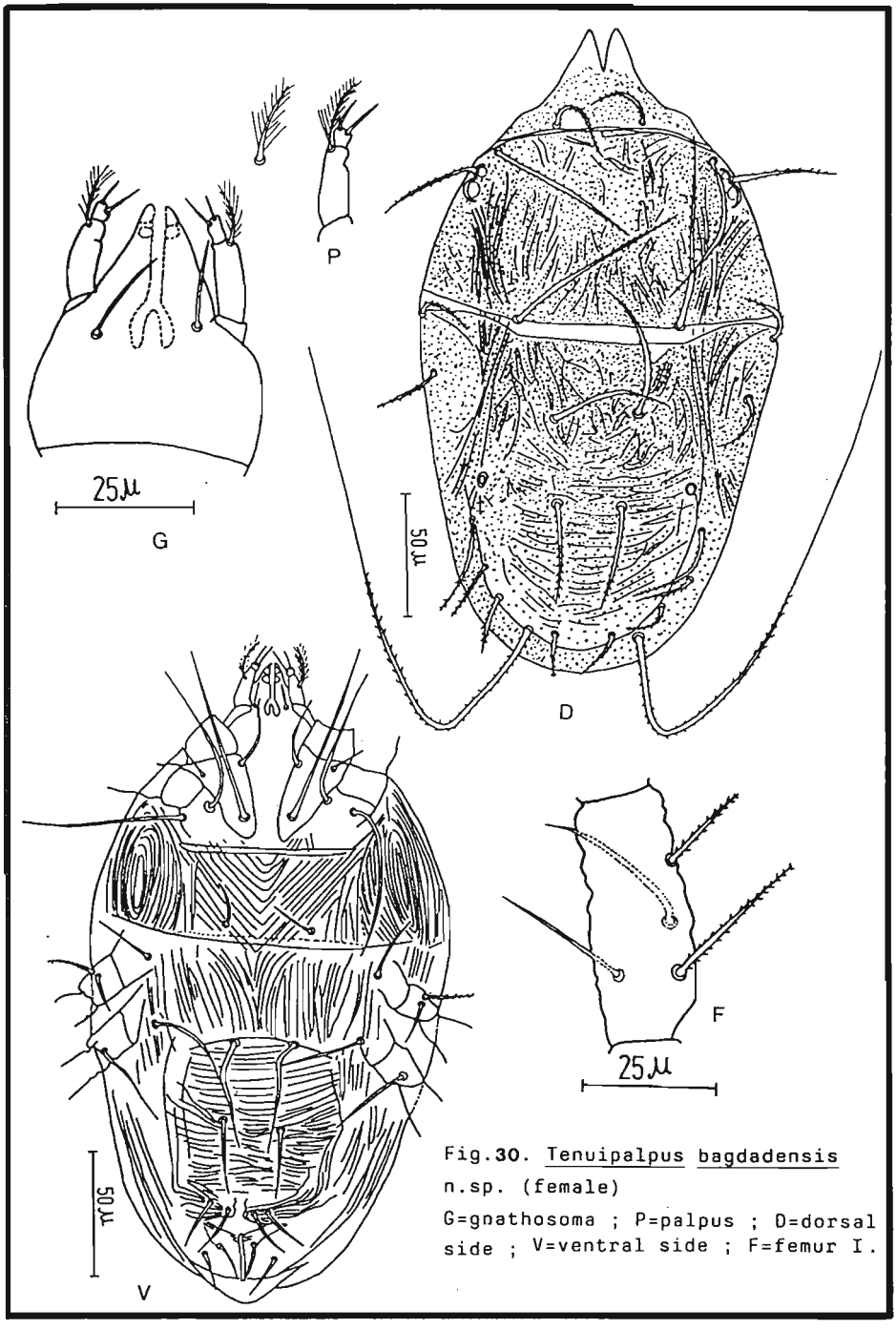


Fig.30. Tenuipalpus bagdadensis n.sp. (female)
G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	2
Genua	3	3	1	0
Tibiae	5	5	3	3

Femur I, with 2 setiform coarsely serrate setae dorsally and 2 simple setae ventrally. Tibiae I-IV each with 2 pulmose setae dorsally.

Male (Fig. 31)

Body elongate, brightred in colour, length of the body including rostrum 223.2 µ, rostrum 32.8 µ, hysterosoma 130.2 µ, greatest body width 124.8 µ.

The male is similar to female in all details except the hysterosoma is divided into two parts by a band of transverse striations. The venter is almost smooth, with a ventral shield and genitoanal plate; 3 pairs genitoanal setae and one pair of genital supports (stylets) caudally.

Holotype: Female, Abu-Ghraib, Baghdad, Iraq, June 1984 on *Lagonychium farctum* L. Holotype no TA-100 deposited in the Entomology Museum, College of Agriculture, Plant Protection Department, Abu-Ghraib, Baghdad, Iraq.

Paratype: 22 females, 2 males , 2 larvae, 6 nymphs, collected from Baghdad, Babil and Ramadi, June 1985, and October 1986 on *Lagonychium farctum* L. One paratype is deposited in the Biosystematics Research Institute, Ottawa, Canada.

Remarks: This species recognized by having ovate body shape, the dorsum punctate, palpus with 3 segments, the second bearing plumose seta, propodosoma with 3 pairs of setiform, coarsely serrate setae, hysterosoma with 3 pairs dorsocentrals, one pair humerals, 6 pairs dorsolaterals. The

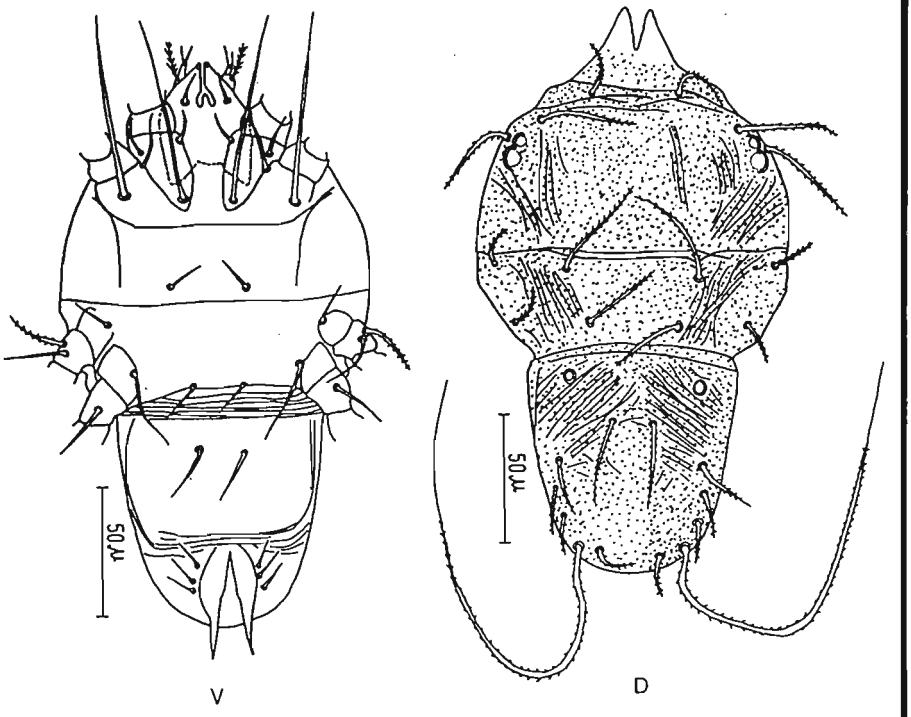


Fig.31. Tenuipalpus bagdadensis,n.sp. (male)
D=dorsal side ; V=ventral side .

dorsal setae long, coarsely serrate and dim. Reck (1956) described *Tenuipalpus baeri* Reck from a female collected on the same host *Lagonychium farctum* L. from Georgia SSR. The author ordered the type species from USSR but he did not get any answer. Therefore the original description of *Tenuipalpus baeri* which published in Russian was used for the comparison of these two species.

The following characters distinguish *T.baeri* from *T.bagdanensis*, n.sp.:

1. The body shape of the new species is ovate without a distinct constriction posterior to humeral suture as against to a narrow posterior hysterosoma in *baeri*.
2. The dorsum is totally punctate and with more transverse striations posteriorly whereas no pitted area in *baeri*.
3. The dorsal setae in the new species three times longer than in *baeri* and more serrated.
4. Coxae I and II with very long whiplike setae in the new species whereas shorter in *baeri*.
5. The venter in the new species is totally striated with longitudinal and transverse striations, as against smooth in the species *baeri*.

Reck (1956) did not describe the male of this species in order to compare it with the species collected from Iraq. E.W. Baker looked after this species and confirmed that *Tenuipalpus bagdadensis* is new to science.

Habitat and locality: *Tenuipalpus bagdadensis* new species attacks prosops plant, *Lagonychium farctum* L. in all provinces in which this study was conducted.

Tenuipalpus punicae Pritchard and Baker

Tenuipalpus punicae, Pritchard and Baker, 1958: 240

Female (Fig. 32)

Red in colour, length of the body including rostrum 275 µ, rostrum 26.4 µ, hysterosoma 156 µ, greatest body width 168 µ.

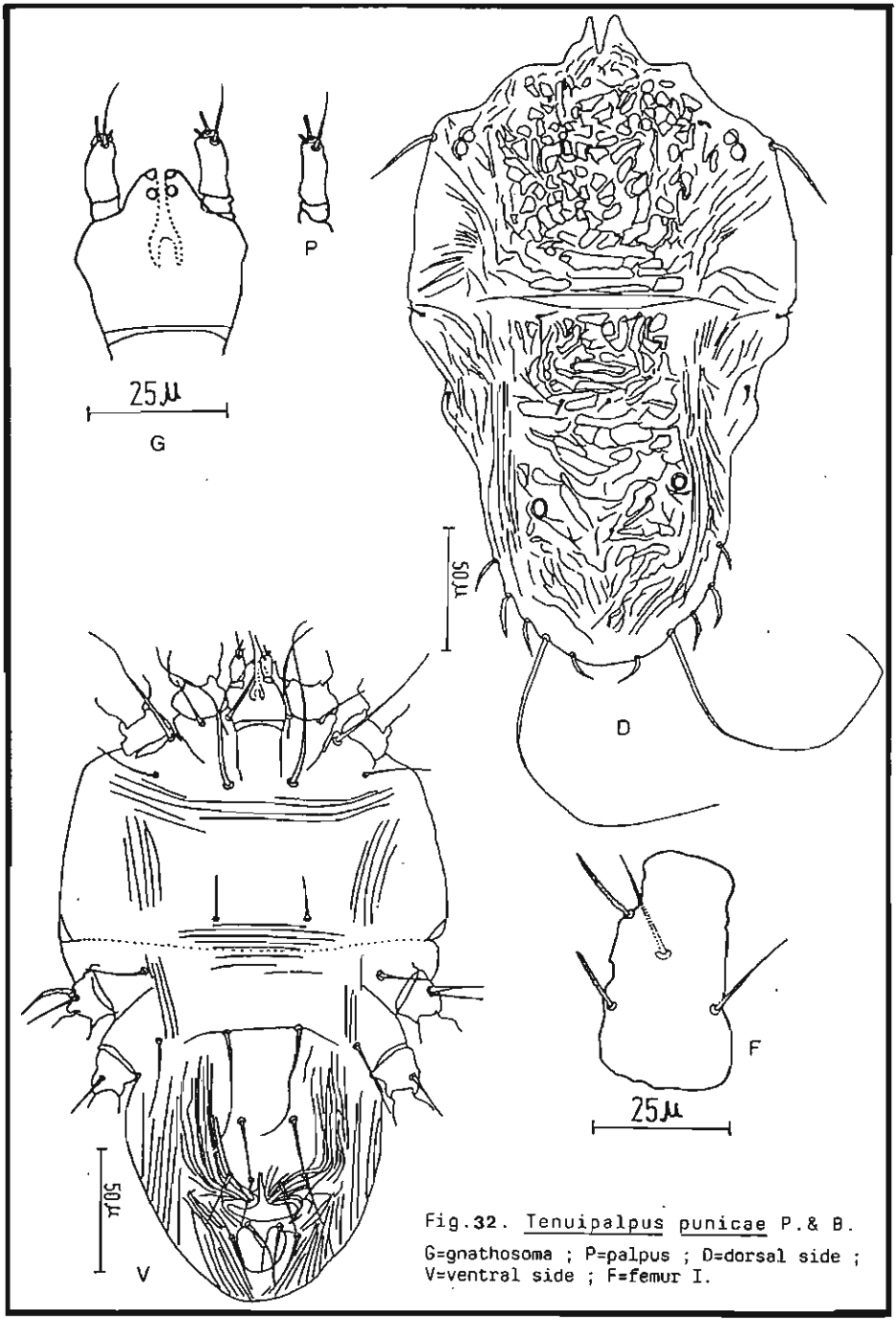


Fig.32. Tenuipalpus punicae P.& B.
G=gnathosoma ; P=palpus ; D=dorsal side ;
V=ventral side ; F=femur I.

Gnathosoma: Without a pair of ventral gnathosomal setae; rostrum reaching half the length of femur I; palpus with 3 segments, the first (= basal) segment small, the second segment being the longest and bearing a long seta anteriorly, the third segment with one long and one short solenidion terminally.

Dorsum: Rostral shield deeply notched nmedially; propodosoma with reticulations medially and irregular striations laterally. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, I, II minute (5 µ) and (6 µ), the third seta lanceolate, minutely serrate (26.4 µ). Humeral suture well defined. Hysterosoma with reticulations medially and longitudinal striations laterally and caudally; two pores present dorsally. Dorsocentral hysterosomal setae, 3 pairs, setiform, slightly serrate, I,II (7.2 µ), III (9.6 µ). Humeral setae, one pair, (9.6 µ), narrowly lanceolate. Dorsolateral hysterosomal setae, 6 pairs, I setiform slightly serrate (8.8 µ), II, III, IV, VI narrowly lanceolate coarsely serrate, (10.8 µ), (13.2 µ), (13.2 µ), (13.2 µ), V flagelliform, (120 µ).

Venter: Ventral propodosomal with few transverse and longitudinal striations, opisthosoma with longitudinal striae. Medioventral propodosomal setae, 1 pair, (60 µ). Anterior medioventral metapodosomal setae, one pair, (14.4 µ). Posterior medioventral metapodosomal setae, one pair, (42 µ). Ventral setae, one pair (24.4 µ). Genital setae, 2 pairs, (20 µ). Anal setae, 2 pairs, (24 µ). Ventral, anal and genital shields well distinct. All setae on venter, simple and smooth.

Legs: 4 pairs, segments wrinkled, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1

Genua	2	2	0	0
Tibiae	5	5	3	3

Male: Unknown

Holotype: Pritchard and Baker, (1958) stated that "Female, Bet Maskita, Palestine, July 31, 1951, on *Punica granatum*; type No.2206 in the U.S. National Museum."

Remarks: *Tenuipalpus punicae* belongs to that group of species having a single pair of anterior medioventral metapodosomals, a single pair of posterior medioventral metapodosomals and minute dorsocentral hysterosomals. It differs from the other members of this group in that most of the dorsum of the body bears very strong irregular reticulations. This species was checked with the holotype deposited in the U.S. National Museum.

Habitat and locality: This species was recorded from Palestine, India, Pakistan, Spain, Egypt and USSR. The author has been able in the present study to collect this species on two new hosts, which are new records from the world.

Punica granatum cv. Nana

Punica granatum cv. Pleniflora

These two ornamental plants are attacked severly by this mite in Baghdad. Because of the economic damage of *T.punicae* to the pomegranate trees in Iraq, this species was studied in detail by the author for his MSc.thesis.

Tenuipalpus myrtus, new species

Female (Fig. 33)

Colour red to orange, length of body including rostrum 279.14 µ, rostrum 31.62 µ, hysterosoma 156 µ, greatest body width 169.68 µ.

Gnathosoma: Without a pair of ventral setae; rostrum reaching beyond the middle of femur I; palpus with 3 segments, the first (= basal) segment long and bearing a plumose long seta dorsally, the second segment very small, the

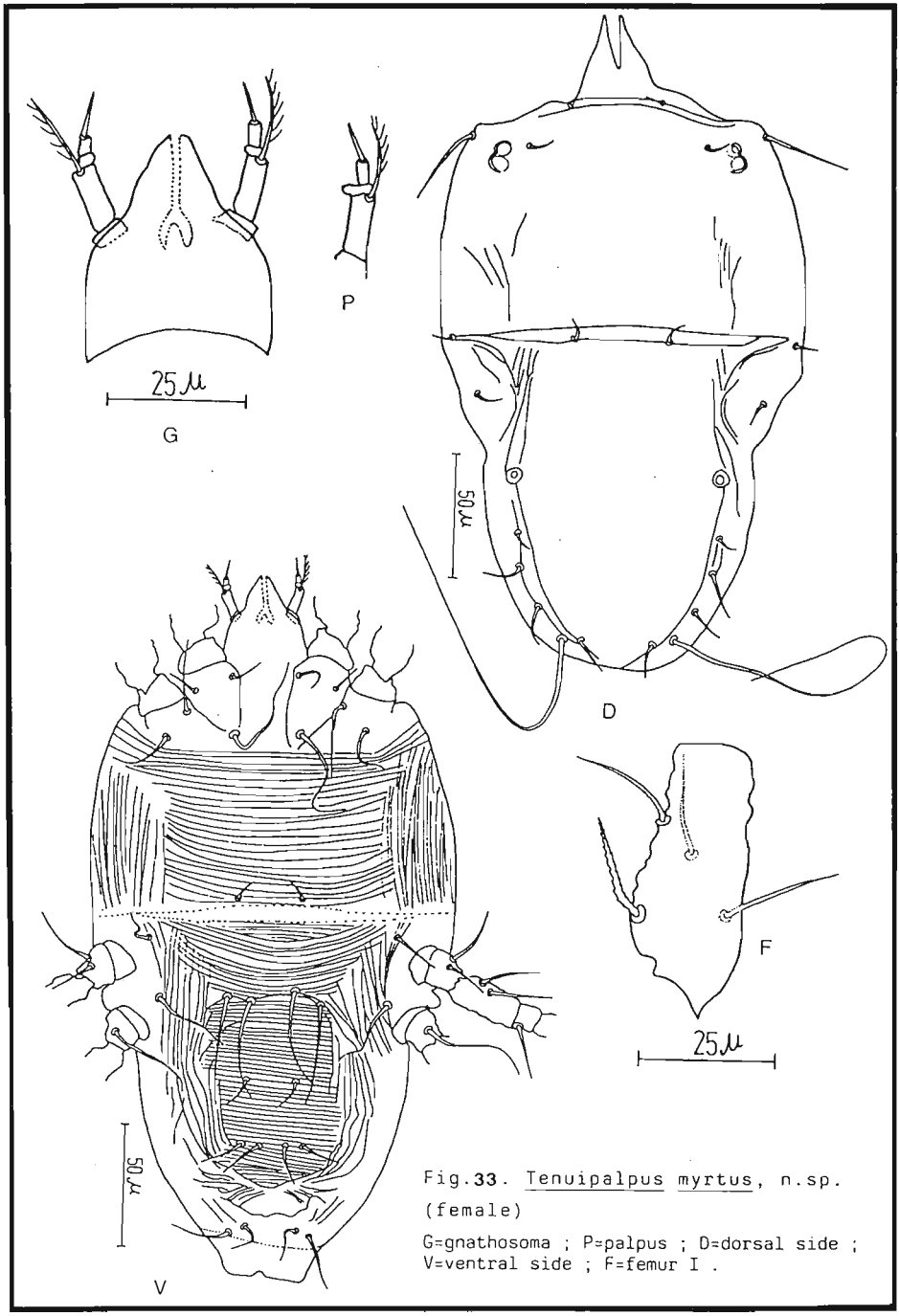


Fig.**33**. Tenuipalpus myrtus, n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I .

third segment small and narrow with a single terminal seta.

Dorsum: Rostral shield deeply notched, reaching beyond the middle of femur I; propodosoma smooth. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, slightly serrate, I, II, minute (7.0 µ) and (8.4 µ), the third seta long, (30.4 µ), arrising not from the apex of the propodosoma. Humeral suture well defined, separating the propodosoma from the hysterosoma . Hysterosoma smooth medially, with an irregular lateral furrow all along its length, starting from third coxa and converging slightly towards the humeral suture; two pores present dorsally on the lateral furrow. Dorsocentral hysterosomal setae one pair, serrate, (14.4 µ). Dorsolateral hysterosomal setae, 6 pairs, slightly serrate, I, II measuring (9.6 µ), III, IV, VI (20.4 µ), (18.3 µ) and (14.4 µ) respectively, V, whip-like seta, (132 µ).

Venter: Ventral propodosoma and metapodosoma with regular transverse striations, opisthosoma with transverse and longitudinal striations. Medioventral propodosomal setae, one pair, simple setiform (37.2 µ). Anterior medioventral metapodosomal setae, one pair, simple(14.88 µ). Posterior medioventral metapodosomal setae, 2 pairs, long, simple (62.4 µ). Ventral shield well developed with transverse striations, ventral setae, one pair, simple (30 µ). Genital shield distinct with transverse, broken striations, genital setae, 2 pairs, simple (25.2 µ). Anal shield distinct with 2 pairs simple setae (24 µ).

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	2
Genua	2	2	1	0
Tibiae	5	5	3	3

Tarsus I and II each with a single rodlike solenidion.

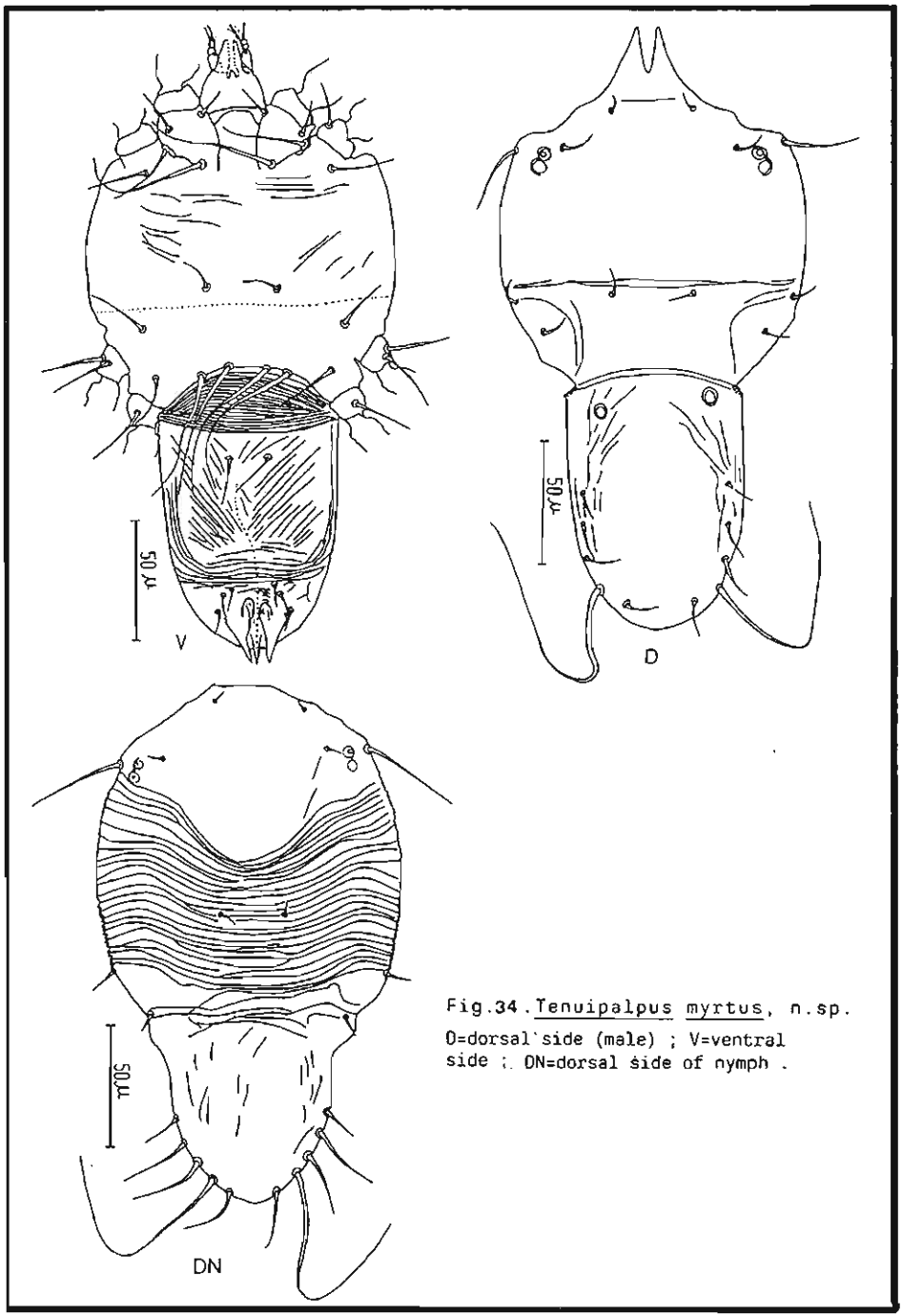


Fig.34. Tenuipalpus myrtus, n.sp.
D=dorsal side (male) ; V=ventral side ; DN=dorsal side of nymph .

Male (Fig. 34)

Colour yellow, length of the body including rostrum 260.4 µ, rostrum 31.62 µ, hysterosoma 146.94 µ, greatest body width 132.06 µ.

The male is similar to female in most of the body characters except the hysterosoma is divided into two parts by a band of transverse striations. The venter of propodosoma is almost smooth except a few irregular transverse striae. The opisthosoma striated longitudinally and transversely. The ventral shield well known with one pair of ventral setae. Genitoanal shield, distinct, with 3 pairs genitoanal setae (14.4 µ). Two genital stylets are well developed terminally.

Nymph (Fig. 34, 38)

Oval-shape, the dorsal setal pattern as in the female. The dorsum with transverse striations anterior and posterior to dorsocentral hysterosomal setae. The area posterior to humeral setae is almost smooth. The lateral hysterosomal setae are more longer than these in female and male.

Holotype: Female, Abu-Ghraib, Baghdad, Iraq, June 1985, on *Myrtus communis* L. Holotype no.TA-102, deposited in the Entomology Museum, College of Agriculture, Plant Protection Department, Abu-Ghraib, Baghdad, Iraq.

Paratypes: 10 females, 3 males, 4 nymphs, collected on *Myrtus communis* L.

Remarks: This species is recognized by presence of one pair of dorsocentral hysterosomal setae, and 3-segmented palpus, the distal segment with one simple seta. When this species checked against the key of Pritchard and Baker (1958) and Meyer (1979), it was closely related to *Tenuipalpus granati* Sayed on the base of that *T.granati* has one pair dorsocentral setae. It seems to me that there was a misidentification to the original description of *T.granati* Sayed which characterized by the presence of 3 pairs of dorsocentral hysterosomal setae and 6 pairs of dorsolateral setae. Moreover, the last taxonomical survey of phytophagous mites

of Egypt which published in 1984 referred to the presence of only two *Tenuipalpus* species namely *T.punicae* Pritchard & Baker on pomegranate and *T.granati* Sayed on grape. The authors redescribed *T.granati* and showed presence of three pairs dosocentral hysterosomal setae. That means, the species *granati* which treated in the literature was used wrong in all the former time. The new species *Tenuipalpus myrtus* is a correct representative to that group which contains one pair of dorsocentral hysterosomal setae instead of *T.granati*.

Habitat and locality: This species is collected on *Myrtus communis* L.from Baghdad, Kerbala, Diyala and Ramadi. *T.myrtus* causes a silvery appearence to the leaves especially in July and August.

Tenuipalpus populi, new species

Female (Fig. 35, 36)

Body ovate, pale yellow in colour, length of the body including rostrum 298.4 µ, rostrum 42.92 µ, hysterosoma 164.4 µ, greatest body width 170.4 µ.

Gnathosoma: With one pair of ventral gnathosomal setae, rostrum reaching to the middle of femur I, palpus 3 segments, the first being the largest, with a pectinate seta, the second small, the terminal with a setiform seta distally.

Dorsum: Rostral shield broadly bifurcate with distinctive mediolateral lobes reaching to the base of genu I, propodosoma with irregular broken transverse and longitudinal striations. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs (16.8 µ), (14.4 µ) and (44.4 µ). Humeral suture well pronounced separating the propodosoma from the hysterosoma. Hysterosoma with broken, irregular transverse and longitudinal striations, two hysterosomal pores present laterally. Dorsocentral hysterosomal setae, one pair, setiform (10.8 µ). Humeral setae one pair, setiform (14.4 µ). Dorsolateral hysterosomal setae 6 pairs, setiform measuring (15.6 µ), (14.4 µ), (20.4 µ), (180 µ) and (18.0 µ) respectively.

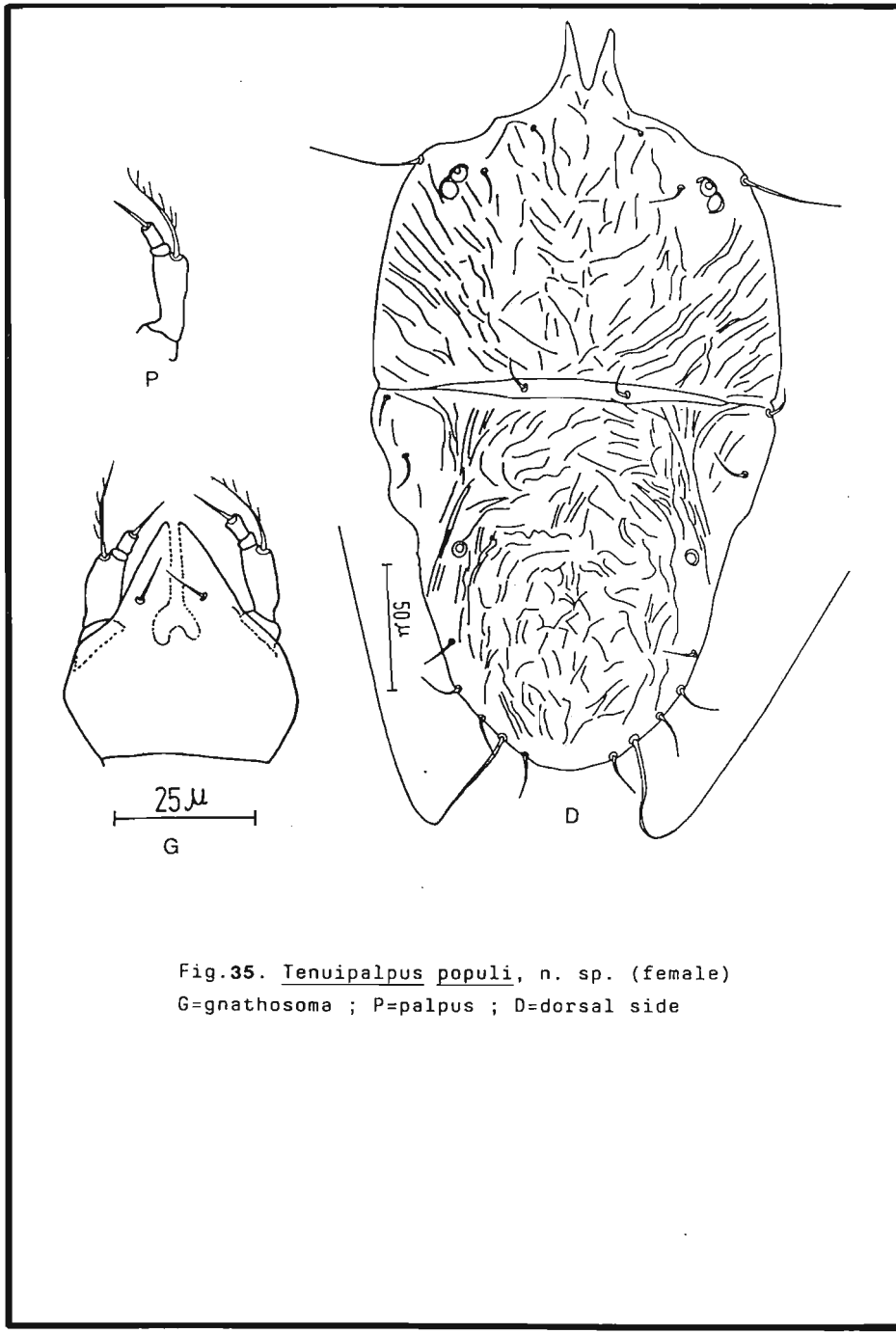


Fig.**35**. Tenuipalpus populi, n. sp. (female)
G=gnathosoma ; P=palpus ; D=dorsal side

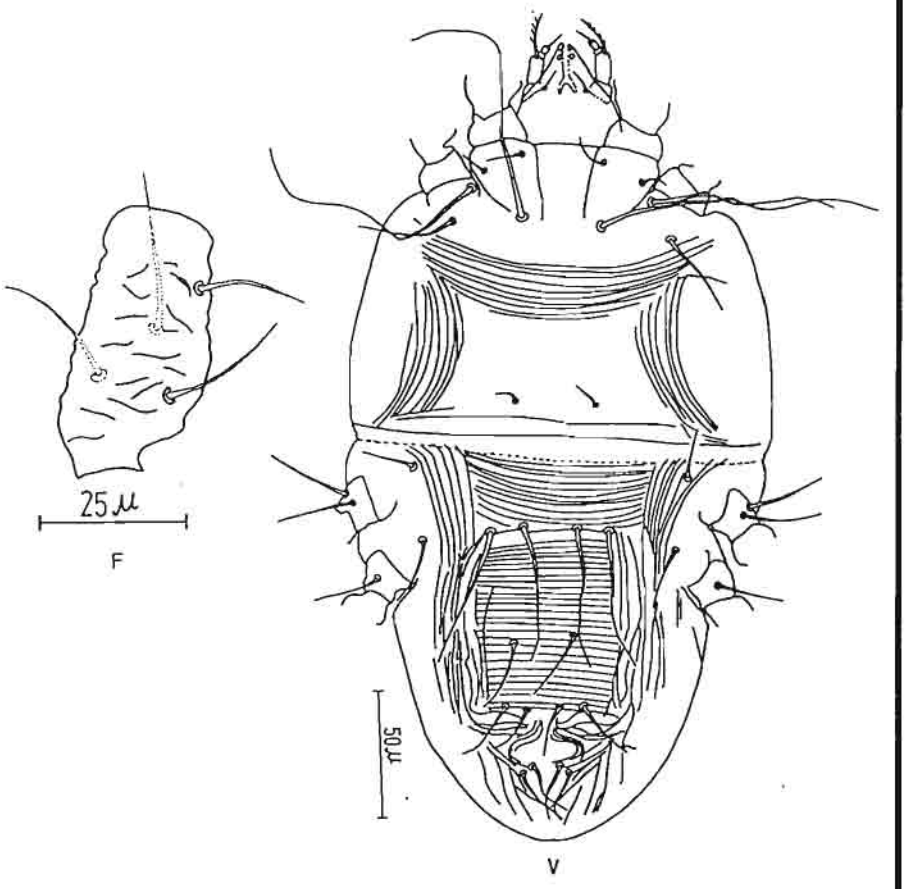


Fig.36. Tenuipalpus populi, n.sp. (female)
V=ventral side ; F=femur I .

Venter: The venter of the propodosoma with longitudinal striations laterally and arched transverse striations under the coxae I and II. The areas in front of coxae III and IV and the lateral part of opisthosoma with longitudinal striations. Anterior part of ventral shield and the ventral shield with transverse striations. Genital and anal shield smooth. Medioventral propodosomal setae one pair (66.0 µ). Anterior medioventral metapodosomal setae one pair (12.0 µ). Posterior medioventral metapodosomal setae 2 pairs (48.0 µ). Ventral setae one pair (30.0 µ). Genital setae 2 pairs, inner (24.0 µ), outer (38.4 µ). Anal setae 2 pairs (24.0 µ). All the ventral setae are simple.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1
Genua	2	2	0	0
Tibiae	5	5	3	3

Femur I and II each with two setiform, slightly serrate setae dorsally and two simple setae ventrally. Coxa II with a very long whiplike seta as long as the medioventral propodosomal seta.

Male (Fig. 37)

Body length including rostrum 230.4 µ, rostrum 38.4 µ, hysterosoma 150 µ, greatest body width 126 µ. The male is similar to the female in the dorsal setal pattern and measurements. Dorsum is almost smooth except of a few lateral broken striations. Propodosoma covered with transverse and lateral longitudinal striations ventrally. Ventral shield smooth. Hysterosoma is divided into two parts by a band of transverse striations. Genitoanal setae 3 pairs, setiform (19.2 µ). Genital stylets, one pair. Legs chaetotaxy as in

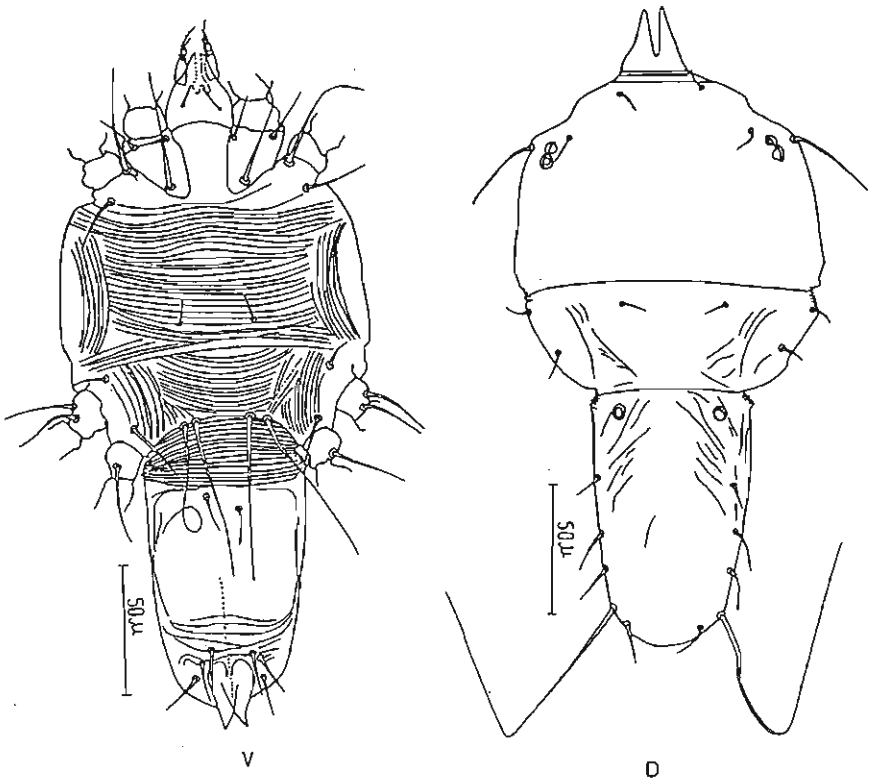


Fig.37. Tenuipalpus populi , n.sp. (male)
D=dorsal side ; V=ventral side .

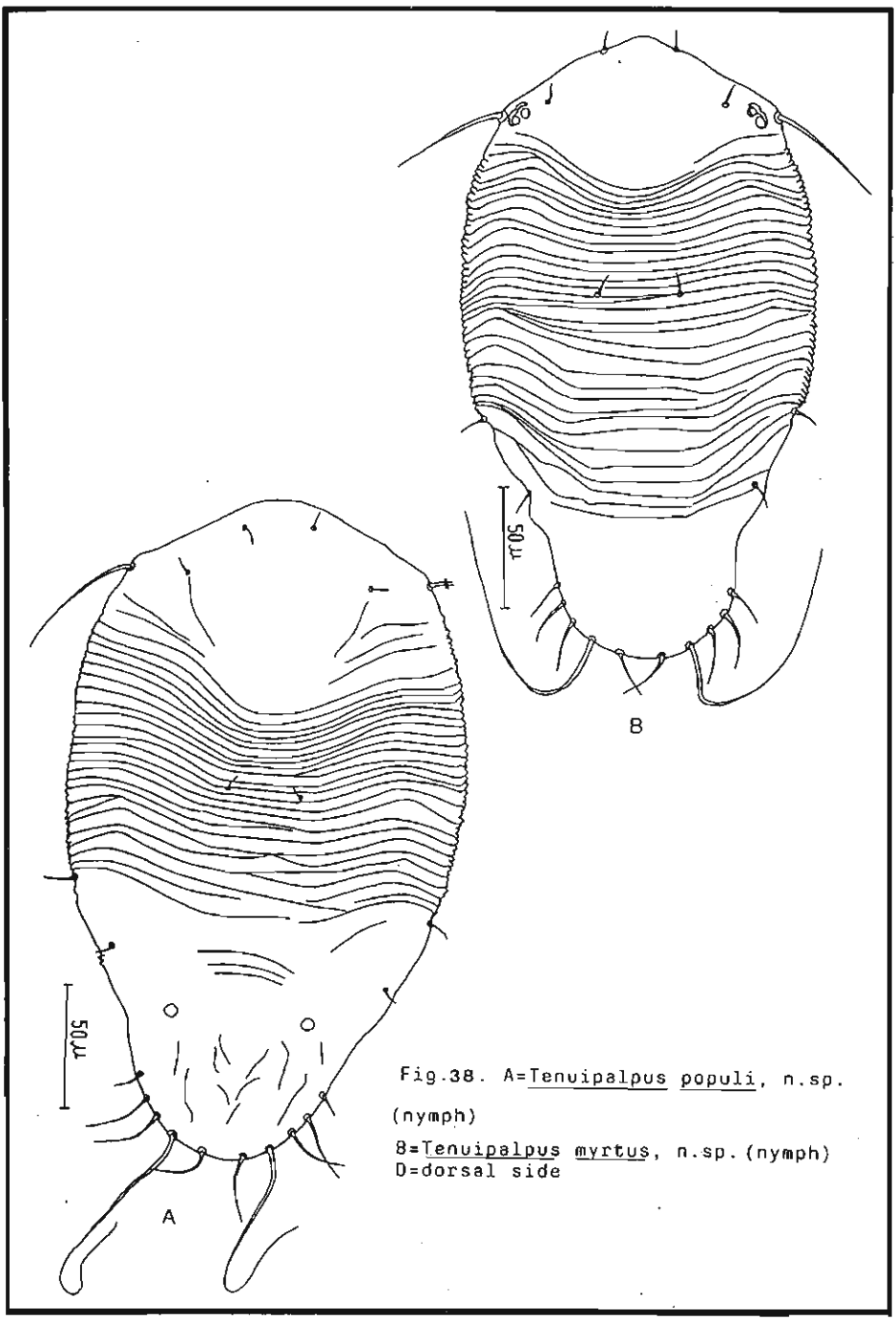


Fig.38. A=Tenuipalpus populi, n.sp. (nymph)
B=Tenuipalpus myrtus, n.sp. (nymph)
D=dorsal side

female.

Nymph (Fig.38)

Body ovate, propodosoma without rostral shield, dorsum with transverse, arched striations more anteriorly, posterior part almost smooth with one pair of dorsal hysterosomal pores. The dorsum chaetotaxy as in female.

Holotype: Female, Baghdad, Iraq, June 1985, on poplar, *Populus nigra* L. Holotype no TA-103, deposited in the Entomology Museum, College of Agriculture, Plant Protection Department, Abu-Ghraib, Baghdad, Iraq.

Paratypes: 19 females, 5 males, 4 nymphs, collected on *Populus nigra* L., *P.alba* L. and *Populus* sp. from Baghdad, Ramadi, Babil and Diyala, June 1985, October 1986.

Remarks: *Tenuipalpus populi* n.sp. belongs to that group of tenuipalpid mites having one pair of dorsocentral hysterosomal setae, one pair of anterior medioventral metapodosomal setae and 2 pairs of posterior medioventral metapodosomal setae. The following characters differentiate it from *Tenuipalpus myrtus* n.sp. to which it is closely related.

1. Dorsum of *myrtus* smooth whereas in the new species totally striated.
2. Dorsal and ventral setae of *myrtus* are shorter than in the new species.
3. Coxa II in the new species with a very long whiplike seta as compared to the short seta in *myrtus*.
4. Rostrum without ventral setae in *myrtus* whereas with one pair in the *populi*.
5. Femur IV and genu III has two and one setae in *myrtus* respectively in compare to one seta on femur IV and no seta on genu III in *populi*.

Habitat and locality: *Populus* spp. are attacked by *Brevipalpus populi* Livshitz and Mitrofanov (USSR), *B.obovatus* Donnadieu (Egypt), *Aegyptobia neobaptus* Meyer (South Africa) and *Tenuipalpus lineosetus* Wang (China). *T.lineosetus* belongs

to that group having 3 pairs of dorsocentral hysterosomal setae in compare to one pair in the new species. *Tenuipalpus populi* attacks all *Populus* spp. in Iraq and causes a significant damage especially in the summer season when the temperature reached between 35° C and 45° C.

Tenuipalpus viticola, new species

Female (Fig. 39)

Colour orange to yellow, length of the body including rostrum 273.42 µ, rostrum 33.48 µ, hysterosoma 135.78 µ, greatest body width 150.66 µ.

Gnathosoma: Without a pair of ventral gnathosomal setae, rostrum reaching up to the middle of femur I, palpus with 4 segments, the first and third small without setae, the second being the longest with one plumose seta anteriorly, the terminal segment bears two unequal setae.

Dorsum: Rostral shield deeply bifurcate with prominent mediolateral lobes and reaching up to the anterior part of genu I, propodosoma completely smooth with one pair of eyes on each side. Dorsal propodosomal setae, 3 pairs, setiform (11.16 µ), (11.16 µ), (35.34 µ). Humeral suture well defined. Humeral setae, one pair, simple (11.16 µ). Hysterosoma smooth medially with a lateral furrow and two dorsal pores. Dorsocentral hysterosomal setae one pair (13.02 µ). Dorsolateral hysterosomal setae 6 pairs, minutely serrate measuring (11.16 µ), (9.3 µ), (14.88 µ), (14.88 µ), (130.2 µ) and (13.02 µ) respectively.

Venter: The venter of propodosoma with transverse striations medially and longitudinal striations laterally. The area in front of coxae III and IV and the lateral part of opisthosoma, smooth. Ventral and genital shields with transverse striations and without a line between them.
Genital shield, smooth. Medioventral propodosomal setae one pair (45.5 µ). Anterior medioventral metapodosomal setae one pair (7.44 µ). Posterior medioventral metapodosomal setae two pairs (55.8 µ). Ventral setae one pair (24.18 µ). Genital

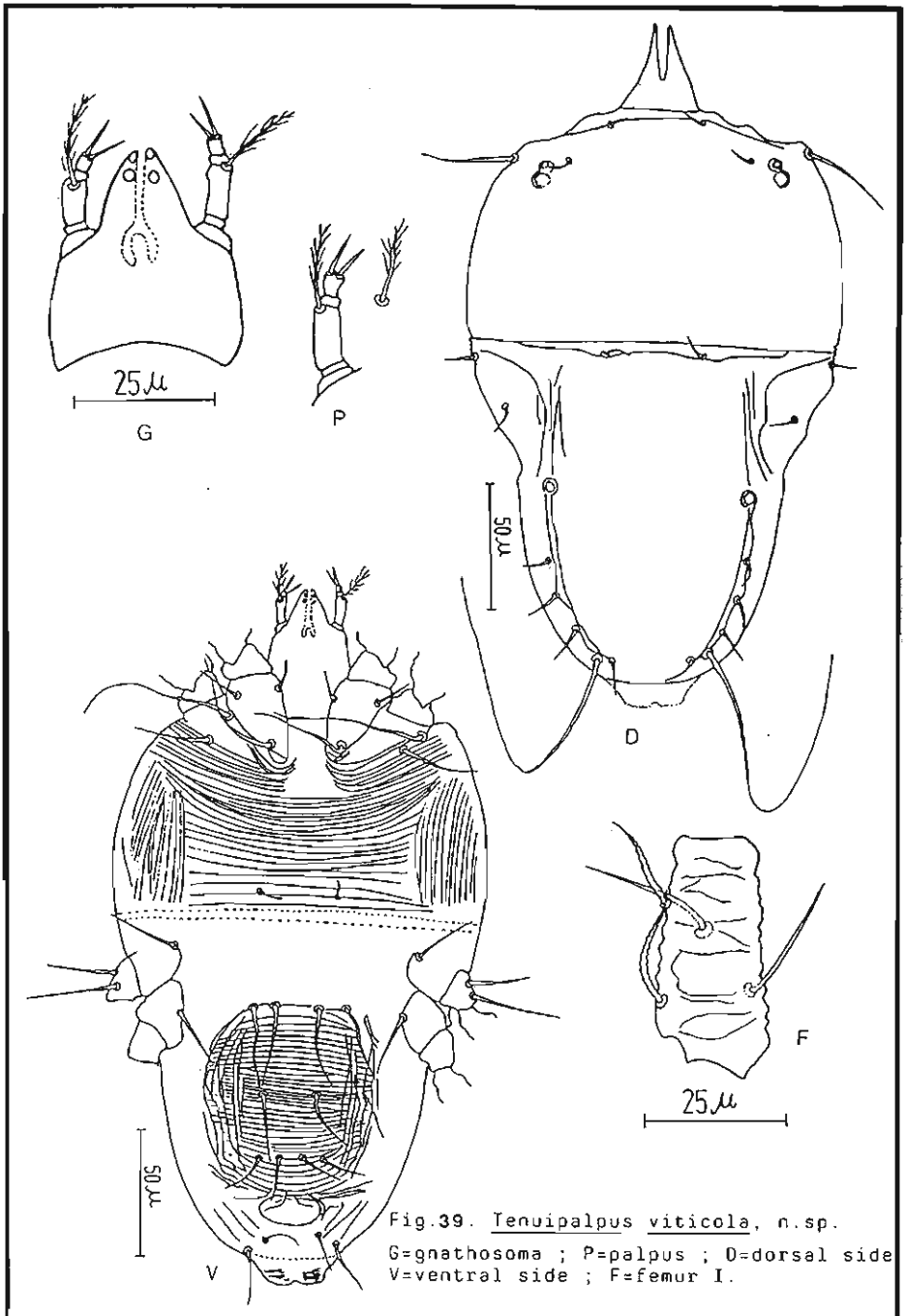


Fig.39. Tenuipalpus viticola, n.sp.
G=gnathosoma ; P=palpus ; D=dorsal side
V=ventral side ; F=femur I.

setae 2 pairs (27.9 µ). Anal setae 2 pairs (26.18 µ). All the ventral setae are simple.

Legs: 4 pairs, setae on the legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1
Genua	2	2	0	0
Tibiae	5	5	3	3

Male: Unknown

Holotype: Female, Abu-Ghraib, Baghdad, Iraq, June 1985 on *Vitis vinifera* L. Holotype no TA-110, deposited in the Entomology Museum, College of Agriculture, Plant Protection Department, Abu-Ghraib, Baghdad, Iraq.

Paratypes: 2 females with the same data of holotype.

Remarks: This species is closely related to *T.myrtus* by having one pair of dorsocentral setae and other body characters. The following characters separate these two species:

1. The palpus of *T.myrtus* has three segments, the terminal segment has one simple seta, whereas in *T.viticola*, the palpus has four segments and the terminal with two simple, unequal setae.
2. Femur IV in *myrtus* has 2 setae, whereas one setae in *viticola*.
3. Genu II in *myrtus* has one seta as against to the species *viticola* which has no seta on genu III.
4. The ventral striations are covered almost the ventral side in *myrtus* but less in *vinicola*.

Habitat and locality: *T.viticola* was collected on grape, *Vitis vinifera* L. from Baghdad. This species does not cause an ecomomic damage to grapevine in Iraq.

Tenuipalpus salicis, new species

Female (Fig. 40)

Colour orange to yellow, length of the body including rostrum 279. µ, rostrum 33.48 µ, hysterosoma 137.64 µ, greatest body width 148.8 µ.

Gnathosoma: Without a pair of ventral gnathosomal setae, palpus 3 segments, the first segment being the longest and bears a setiform seta anterodorsally, the second small, the terminal segment two times bigger than the second with one seta distally.

Dorsum: Rostral shield is deeply bifurcate with two lobes mediolaterally and two prominent lobes laterally, propodosoma completely smooth. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, the first and second, minute, setiform (7.0 µ), the third long, slightly serrate (41.3 µ). Humeral suture not well distinct laterally. Hysterosoma smooth with only a lateral furrow on which situated one pair of dorsal pores. Dorsocentral hysterosomal setae one pair (11.16 µ). Humeral setae one pair (9.3 µ). Dorsolateral hysterosomal setae 5 pairs, slightly serrate, measuring (11.16 µ), (14.88 µ), (14.88 µ), (144.8 µ) and (13.02 µ) respectively.

Venter: The venter of propodosoma with transverse striations posterior to coxae I and II and a few longitudinal striae laterally. Metapodosoma with transverse striae. Opisthosoma with few lateral striae, the ventral and genital shields with transverse striations. Medioventral propodosomal setae one pair (44.8 µ). Anterior medioventral metapodosomal setae one pair(14.88 µ). Posterior medioventral metapodosomal setae 2 pairs (62.4 µ). Ventral setae, one pair (30. µ). Genital setae 2 pairs (25.2 µ). Anal setae 2 pairs (28. µ). All the ventral setae are simple.

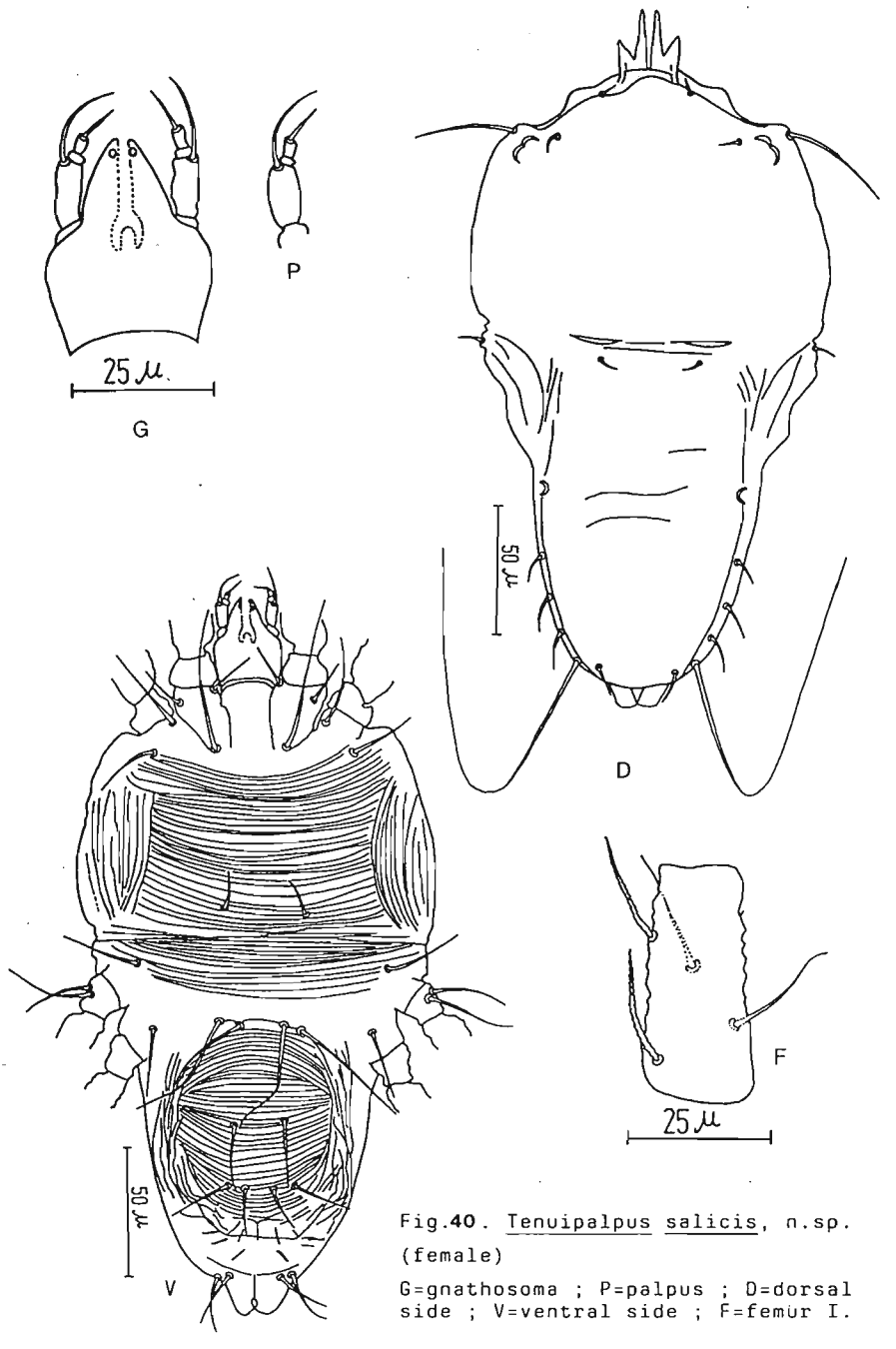


Fig.40. Tenuipalpus salicis, n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I.

Legs: 4 pairs, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1
Genua	2	2	0	0
Tibiae	5	5	3	3

Male: Unknown

Holotype: Female, Kerbala, Iraq, August 1986, on *Salix alba* L. Holotype no TA-101, deposited in the Entomology Museum, College of Agriculture, Plant Plant Protection Department, Abu-Ghraib, Baghdad, Iraq.

Paratypes: 3 females on the same slide of the holotype with the same data.

Remarks: This species is closely related to *Tenuipalpus myrtus* and *T.viticola* but the presence of one pair of lateral lobes on rostral shield, five pairs of dorsolateral setae, less ventral striations and the humeral suture almost absent are the main characters separating these species.

Habitat and locality: *Tenuipalpus salicis*, n.sp. was collected on *Salix alba* L. from Kerbala. This species together with *Aegyptobia salicicola* considered one of the *Salix* spp. pests in Central Iraq.

Tenuipalpus lygodii De Leon

Male (Fig. 41)

Length of the body including rostrum 247.38 µ, rostrum 28.2 µ, hysterosoma 140.4 µ, greatest body width 128.4 µ.

Gnathosoma: Without a pair of ventral gnathosomal setae, rostrum reaching to the middle of femur I, palpus with 3 segments, the first being the largest segment with simple setiform seta dorsally, the second very small, the terminal

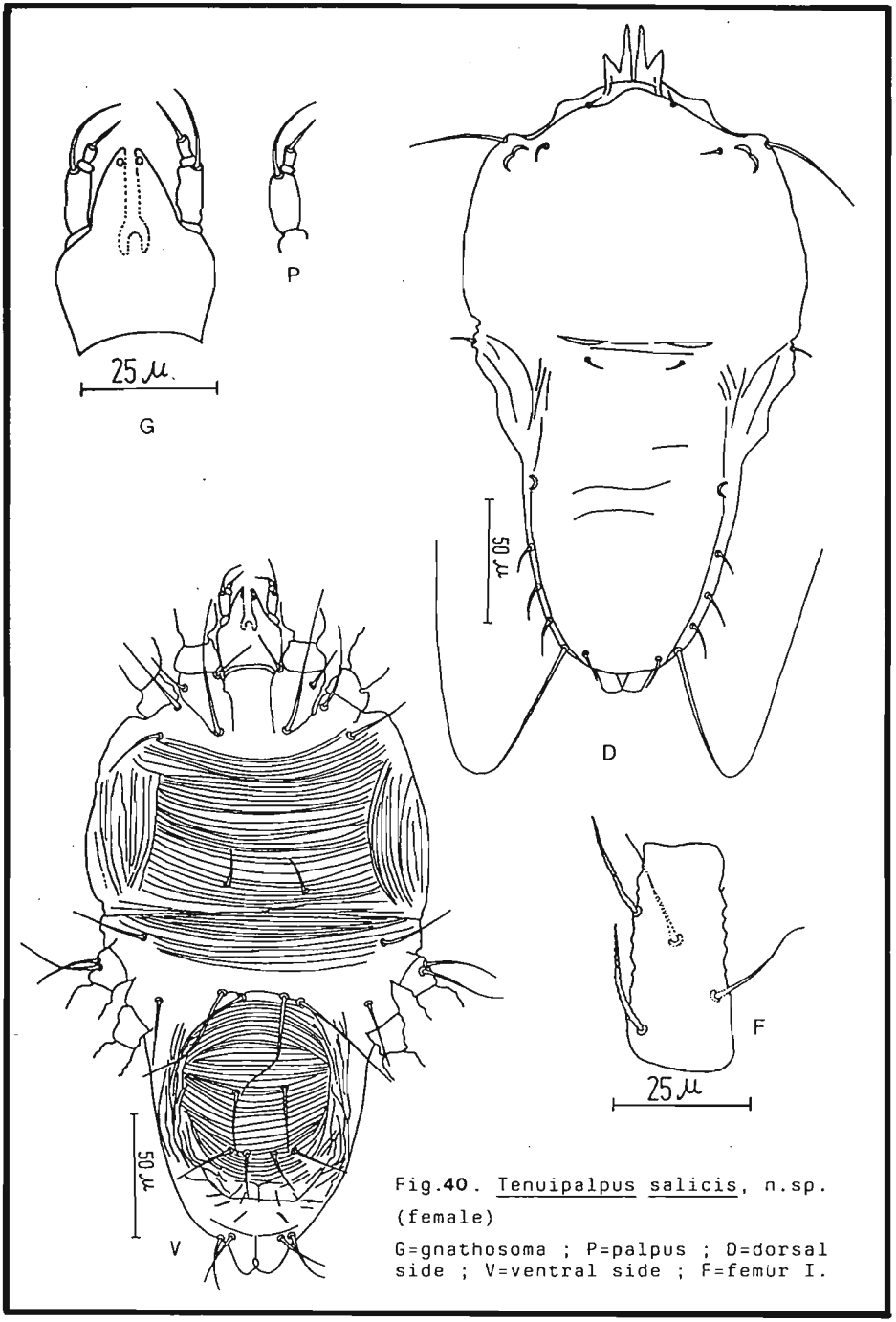


Fig.40. Tenuipalpus salicis, n.sp. (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side ; F=femur I.

segment with a single seta distally.

Dorsum: Rostral shield broadly cleft; the mediolateral lobe pronounced and lateral lobe angulated and reaching to the basal of femur I, the median part of propodosoma bordered by longitudinal and transverse broken striations and exhibits a few longitudinal and transverse broken striations inside this area. Eyes two pairs, one pair on each side. Dorsal propodosomal setae, 3 pairs, the first and second setiform minute (7.2 µ), the third seta, setiform, (16.8 µ). Humeral suture well defined separating the propodosoma from hysterosoma. Hysterosoma with irregular longitudinal broken striations and divided into two parts, two pores present dorsally on the posterior part. Dorsocentral hysterosomal setae, 3 pairs, setiform, minute, I (8.4 µ), II, III (6.0 µ). Humeral setae, one pair, setiform, (8.4 µ). Dorsolateral hysterosomal setae, 6 pairs, setiform, first (10.8 µ), II, III, IV and VI have the same length (8.4 µ), V flagelliform, (144 µ).

Venter: The venter of propodosoma and metapodosoma smooth, the area beyond ventral setae and below the posterior medioventral metapodosomal setae with a band of transverse striations. The ventral shield with transverse broken striations forming semi-spherical area posteriorly. Medioventral propodosomal setae one pair (24.0 µ). Anterior medioventral metapodosomal setae 2 pairs, the inner pair minute, setiform (8.4 µ), outer pair, long, (48.0 µ). Posterior medioventral metapodosomal setae one pair (38.4 µ). Ventral setae one pair (18. µ). Genitoanal setae, 3 pairs of the same length (24.0 µ). Genital stylets, one pair, minute located on an triangular structure distally.

Legs: 4 pairs, setae on the legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	1	1	1	1
Trochanters	1	1	2	1
Femora	4	4	2	1

Genua	2	2	1	1
Tibiae	5	5	3	3

Femur I and II each with a lanceolate and coarsely serrate seta dorsally and three other setiform setae.

Female:

The author could not collect the female of this species from Iraq. The female was described by DeLeon in 1965 from Jamaica.

Holotype: "Female, Ipswich, St.Elizabeth Parish, Jamaica, Nov.23, 1963, on *Lygodium volubile*, D.DeLeon. Paratypes-2 females, 2 nymphs collected with holotype."

Remarks: *T.lygodii* belongs to the species group with two pairs of anterior and one pair of posterior medioventral metapodosomal setae. Hysterosoma with three pairs of dorsocentral hysterosomal setae. The male of this species is described for the first time in this investigation.

Habitat and locality: *T.lygodii* DeLeon was collected on mango, *Mangifera indica* L. from Central Iraq. This species is very rare, because the mango is not often cultivated in Iraq.

GENUS *COLOPALPUS* PRITCHARD & BAKER

Colopalpus, Pritchard & Baker, 1958: 258

Type-species: *Colopalpus mattyssei* Pritchard & Baker

The genus *Colopalpus* resembles the genus *Brevipalpus* in dorsal chaetotaxy and the genus *Tenuipalpus* in having a long flagellate dorsolateral hysterosomal seta. The genus is characterized by having the gnathosoma not covered by a rostral shield. Palpus 2-segmented, terminal segment with 2 long setae. Rostral shield well developed, incised medially. Propodosoma with 3 pairs of dorsal propodosomal setae. Hysterosoma with 3 pairs of dorsocentral hysterosomal, one pair of humeral and 6 pairs of dorsolateral hysterosomal

setae. Dorsosublateral hysterosomal setae absent. Female with a single large genito-ventral plate, bearing 2 pairs of genital setae and one pair of medioventral opisthosomal and two pairs of anal setae. Male with three pairs of genitoanal setae.

Colopalpus eriophyoides (Baker)

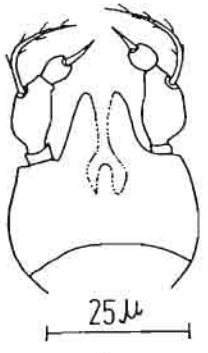
Tenuipalpus eriophyoides Baker, 1948: 59
Colopalpus eriophyoides Baker & Tuttle, 1972: 35
Tenuipalpus labidosus Siddiqui & Chaudhri, 1972: 331

Female (Fig. 42)

Colour dark red, length of body including rostrum 376.8 µ, rostrum 31.62 µ, hysterosoma 156 µ, greatest body width 169.68 µ.

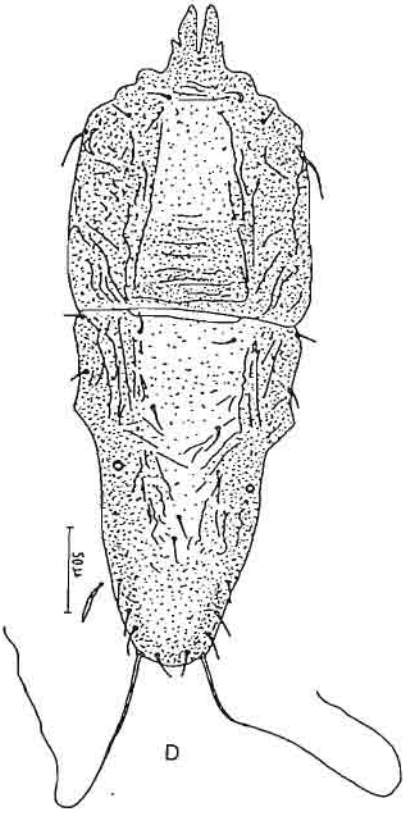
Gnathosoma: Without a pair of ventral gnathosomal setae, rostrum reaching above the first quarter of femur I; palpus with 3 segments, the first (= basal) segment very small, the second segment being the longest and bearing dorsally a pectinate seta, the third segment with a single sensory seta.

Dorsum: The rostral shield acutely and deeply bifurcate and does not cover the rostrum, propodosoma with a few transverse striations medially and posteriorly, remaining propodosomal area with a few irregular longitudinal and transverse striations. Eyes two pairs, one pair on each side. Dorsal propodosomal setae 3 pairs, serrate, narrowly lanceolate (8.4 µ), (12 µ), (27.6 µ). Humeral suture well defined medially and laterally. Hysterosoma with a few longitudinal striations laterally in front of areas of legs III and IV, the dorsomedial area of hysterosoma without striations, two pores present dorsally, one on each side. Dorsocentral hysterosomal setae 3 pairs, serrate, narrowly lanceolate, (12 µ), (13.2 µ), (15.6 µ). Humeral setae one pair, serrate (12 µ). Dorsolateral hysterosomal setae, 6 pairs, serrate, I, II, III, IV and VI (12 µ), (14.0 µ), (19.2



G

P



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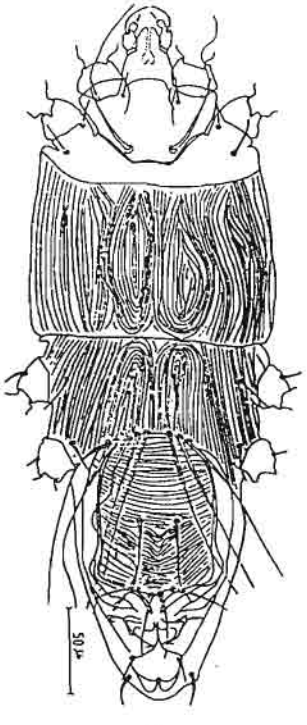

V

Fig.**42**. Colopalpus eriophyoides Baker (female)

G=gnathosoma ; P=palpus ; D=dorsal side ; V=ventral side .

μ), (18.0 μ) and (18 μ) respectively, V flagelliform, (240 μ). Dorsum has pitted appearence.

Venter: Venter of propodosoma and metapodosoma with regular, longitudinal striations up to the bases of posterior medioventral metapodosomal setae. Medioventral propodosomal setae one pair, whip-like, simple, (92 μ). Anterior medioventral metapodosomal setae one pair, simple (24 μ). Posterior medioventral metapodosomal setae 4 pairs, simple, having the same length (120 μ), and reaching bases of the genital setae. The genito-ventral (= ventrigenital) shield with transverse striations, ventral setae one pair, simple (36 μ). Genital setae 2 pairs, simple, the outer setae(22 μ), inner setae (30 μ). Anal shield distinct, anal setae, 2 pairs, simple, measuring (18.0 μ).

Legs: 4 pairs, wrinkled and pitted segments, setae on legs I-IV as follows:

Podomers	L_1	L_2	L_3	L_4
Coxae	2	2	1	1
Trochanters	1	1	1	1
Femora	4	4	2	1
Genua	2	2	1	1
Tibiae	5	5	3	3

Tarsus I and II, each with a single solenidion.

Male (Fig.43)

The male is very distinctive in having an elongate body, especially the opisthosoma. Length of body including rostrum 504 μ, rostrum 33.6 μ, hysterosoma 35.4 μ, greatest body width 169.68 μ.

Gnathosoma as in the female.

Dorsum: Rostral shield, deeply cleft and covers the rostrum, propodosoma, pitted, without striations, the posterior part of propodosoma, smooth medially. Hysterosoma pitted

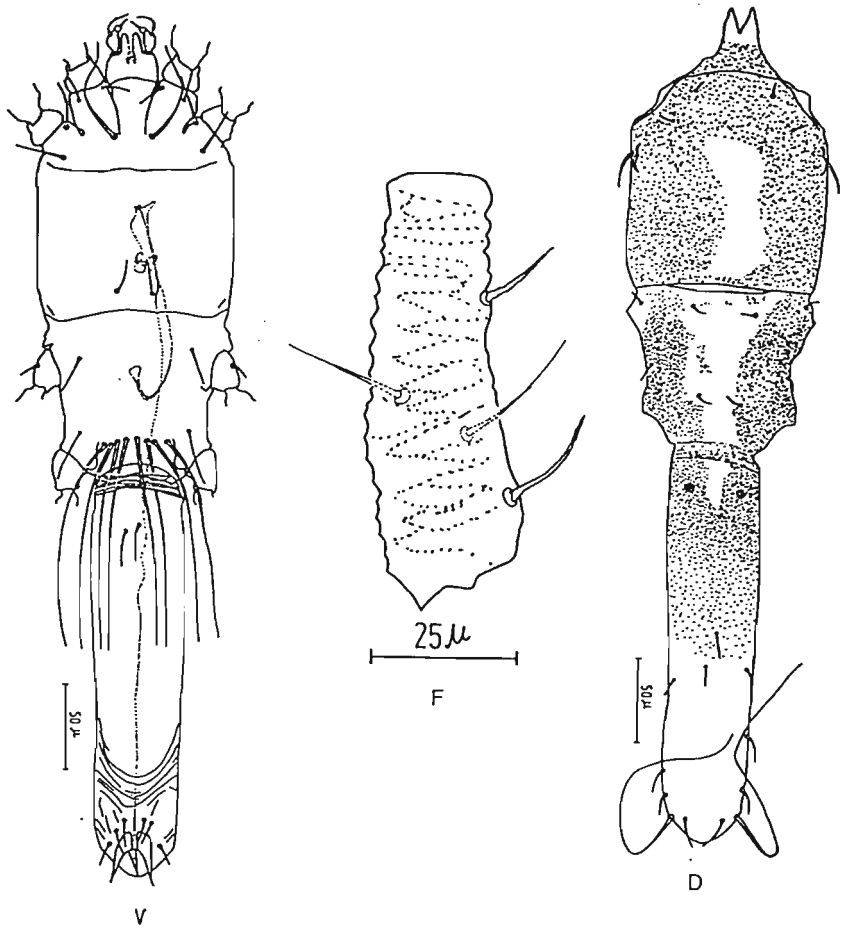

Fig.43. Colopalpus eriophyoides Baker
D=dorsal side (male) ; V=ventral side (male) ; F=femur I (female) .

except smooth area between the first dorsocentral hysterosomal setae and the end of opisthosoma. Hysterosoma is divided into 2 parts with a transverse striae, two pores present dorsally. The dorsal body setae are similar to those of the female.

Venter: With a few transverse striations mostly between the metapodosoma and opisthosoma. Medioventral propodosomals, anterior medioventral metapodosomals and posterior medioventral metapodosomals similar to that in the female. Ventral shield, not well distinct, with one pair ventral setae. Genitoanal shield with 3 pairs of genitoanal, simple setae (10.8 µ). The end of the body with one pair of terminal genital stylets.

Legs: The legs chaetotaxy resemble that of the female, except that the tarsi I-IV each with two solenidia.

Holotype: Baker (1948) stated that "type-nymph, Margil, Basra, Iraq, on unknown host, in the U.S.National Museum". Baker and Tuttle (1972) described the female and male of this species from Iraq.

Remarks: This species is easy to identify, because it has a big size and a long opisthosoma, besides the presence of genitoventral plate. This species is checked with the type species deposited in the National Museum, USA.

Habitat and locality: This mite has been collected from Kerbala, Wasit, Diyala, Salahuddin, Ramadi, Babil and Baghdad. *C.eriophyoides* has a high host specifity, living on both sides of date palm leaves. It may be started to cause in the next years a considerable damage to the date palm trees in Iraq, because the increasing use of pesticides against other pests inhabited palm trees.

Discussion

This dissertation is considered to be the first careful and comprehensive study on the taxonomy of plant mites in Middle East and the neighbour countries. A thorough survey of the mite fauna had not been tried before in all the Arabian countries except Egypt. The lack of such studies is due to the shortage of the acarologists in these regions.

It is a well known fact that a pest species should be identified accurately before the control measures are recommanded, therefore, this attempt has been made to study the mite fauna inhabited plants in Central Iraq.

The discussion of these results got from the present investigation can be divided into three topics as follows:

1. Review of literature 2. Ecological Aspects
3. Taxonomical Aspects

1. Review of literature:

It was a very hard task to collect all the literature published on the family Tenuipalpidae. The good international contacts with most of the acarologists through the world had helped to do this job and to present a complete and up to date review. This is the first time in which such review has been done in this chronological form. Almost all the literature which is published in other languages was translated and added here.

In the last 10 years, two Acarology schools are appeared in the literature dealing with the family Tenuipalpidae. The Russian school which represents by Mitrofanov, Strunkova and Livshits inclined to split the family into many other small subunits. The second school represents by many workers from different parts of the world who inclined to keep using Pritchard and Baker's system, e.g. Baker (USA), Meyer (South Africa); Ghai; Manander and Sadana (India); Collyer (New Zealand); Chaudhri (Pakistan) and Zaher and Yousef (Egypt).

The summary of the main papers dealing with this conflict

will be very useful to mention in this dissertation.

Mitrofanov (1973 a, 1973 b) presented a system of classification for the family Tenuipalpidae, recognizing 2 subfamilies, namely Brevipalpinae and Tenuipalpinae, as well as including 4 tribes in each subfamily, with 14 and 19 genera respectively. In general his groupings are based on a single character. For example he defined the subfamily Brevipalpinae by the presence of a ventral plate and the Tenuipalpinae by the absence of such a plate. Mitrofanov and Strunkova (1979) recognized two subfamilies different to those proposed by the above, these are Phytoptipalpinae and Tenuipalpinae with 3 and 4 tribes respectively.

Meyer (1979) preferred to use the species groups within the large genera rather than splitting them into many genera. She stated that "in the present state of knowledge of the Tenuipalpidae, subdivision into subfamilies and tribes seems to be neither useful nor convenient". A key to the genera on a world wide basis is presented in her revision, which included 21 genera. Two valid genera *Terminalicus* and *Philippipalpus* were not considered in this study.

Ghai and Shenhmar (1984) stated that "they agree with Meyer's superspecific concept but not with Mitrofanov's fine splitting". Quiros-Gonzalez (1985) mentioned 27 genera of the family Tenuipalpidae, again she does not follow the Russian school concept.

I agree with the generic classification of Pritchard and Baker (1958) and Meyer's superspecific concept but not with Mitrofanov's fine splitting, because Mitrofanov took in consideration usually only one character for splitting of the groups. This was not sufficient to justify the erection of subfamilies, tribes and genera and a number of other supporting characters were necessary.

The second important topic which the author wants to treate in this study is the misidentification of *Tenuipalpus granati* Sayed.Sayed (1946) stated in his description to the hysterosoma of *T.granati* that "...Hairs, three median small ones on hysterosoma (= dorsocentral hysterosomal setae),

seven pairs on its lateral and posterior margins (Humeral and dorsolateral setae), the long whiplike hair included."

Baker and Pritchard (1953) stated that "*Granati* differs from all other species of *Tenuipalpus* that have been described in detail, except *T.eriophyoides*, by having one pair of anterior medioventral podosomals and two pairs of posterior medioventrals. The posterior two pairs of dorsocentral hysterosomals cannot be found in the female, males, nymphs or larvae examined". They in 1958 referred to the occurence of *T.granati* on grape and pomegranate in Egypt.

Livschitz and Mitrofanov (1967) stated that "*T.granati* has 11 pairs of dorsal setae of which seven are lateral and one pair of dorsocentral setae."

Collyer (1973) in her key to the *Tenuipalpus* fauna of the world included *T.granati* with the group having only one pair dorsocentral hysterosomal setae.

Chaudhri (1974) compared one new species of *Tenuipalpus* collected from Pakistan to *T.granati*. He stated that "this new species is very much closely related to *T.granati* by having one pair of central setae and other body characters".

Meyer (1979) in her key to the world fauna of Tenuipalpidae stated that "*T.granati* group has 3 pairs of propodosomal, one pair of dorsocentral hysterosomal setae."

Zaher et al. (1984) stated that "genus *Tenuipalpus* is represented in Egypt by two species, *T.granati* Sayed on grapevine and *T.punicae* Pritchard and Baker on pomegranate." They redescribed this species in the final report of the extensive survey to the mite fauna of Egypt which had been conducted as a cooperative program between USA and Egypt. They stated in the description of *T.granati* that "..., hysterosoma with straight irregular striations covering metapodosoma and irregular longitudinal and transverse striae on opisthosoma; humeral and six pairs of dorsolaterals, lanceolate and serrate, except penultimate setae long and whiplike; three pairs of dorsocentrals, small and pilose."

From the above mentioned publications which deal with the

tenuipalpid fauna of the world, it seems to me that the name *Tenuipalpus granati* which used by Baker and Pritchard (1953), Livschitz and Mitrofanov (1967), Collyer (1973), Chaudhri (1974) and Meyer (1979) was misidentified. They described the hysterosoma of *T.granati* as bearing only one pair of dorsocentral hysterosomal setae, while the original description of Sayed (1946) and the redescription of Zaher et al. (1984) pointed out that the hysterosoma bears 3 pairs of dorsocentral hysterosomal setae. Therefore the species which has one pair of dorsocentral hysterosomal setae has to have a new name. In the present investigation the author was able to collect four new species belonging to the mite group which has one pair of dorsocentral hysterosomal setae.

In the last three years some of the acarologists who are working with the taxonomy of the superfamily Tetranychoidea are starting to use the new setal notation which was established by Grandjean (1939, 1947). Quiros-Gonzalez and Baker (1984) used this system for the family Tuckerellidae. Lindquist (1985) applied this setal notation to the family Tetranychidae which is closely related in the chaetotaxy to the Tenuipalpidae.

Although the old system of setal nomenclature which established by Pritchard and Baker (1955) is used in this disserta-tion, it is useful to present table 2 which published by Lind-quist (1985) to show the differences between all the setal notation systems. This new setal notation may be used for the family Tenuipalpidae in the next years.

Table 2: Comparison of systems of notation applied to equivalent setae of opisthosoma of tetranychid mites (all setae larval excepting aggenitals and genitals, as indicated)*

Grandjean (1939, 1947)	Pritchard and Baker (1955)		Oudemans (1928) Geijskes (1939) Rekk (1947, 1959)	
C c_1	1st Dorsocentrals	DC1	Inner humerals	Humerals
C c_2	1st (Dorso)laterals	L1	Middle humerals	Humerals
C c_3	Humerals or 1st Sublaterals	H	Outer humerals	Humerals
D d_1	2nd Dorsocentrals	DC2	Inner dorsals or prelumbars	Dorsals or prelumbars
D d_2	2nd (Dorso)laterals	L2	Middle dorsals or prelumbars	Dorsals or prelumbars
D d_3	2nd Sublaterals	—	Outer dorsals or prelumbars	Dorsals or prelumbars
E e_1	3rd Dorsocentrals	DC3	Inner lumbals or lumbars	Lumbars
E e_2	3rd (Dorso)laterals	L3	Middle lumbals or lumbars	Lumbars
E e_3	3rd Sublaterals	—	Outer lumbals or lumbars	Lumbars
F f_1	Inner sacrals or 4th dorsocentrals	DC4	Inner sacrals	Sacrals
F f_2	Outer sacrals or 4th (dorso)laterals	L4	Outer sacrals	Sacrals
H h_1 (?f_3)	Clunals or 5th dorsocentrals	DC5	Clunals or caudals	
H h_2	Postanals or Posterior para-anals	—	Posterior postanals	
H h_3	Anterior para-anals	—	Anterior postanals	
PS ps_{1-3}	Anals	—	Anals	
g_1(Dn)	1st Genitals (anteromedial)	—	Epigynials	
g_2(Ad)	2nd Genitals (posterolateral)	—	Intermedials	
ag(Pn)	Pregenitals	—	Pre-epigynials	

*The symbols C,D,E,F,H, and PS indicate the 6 larval opisthosomal segments.

2. Ecological Aspects:

The survey of phytophagous and predatory mites presented in Table 1 shows a very clear idea on the occurence and the degree of infestation of mites in Central Iraq. During the course of this survey more than 150 cultivated and wild plants were examined. Nine mite families are identified namely Tetranychidae, Tenuipalpidae, Eriophyidae, Tarsonemidae, Acaridae, Oribatidae, Phytoseiidae, Tydeidae and Cheyletidae. Of the nine families of mites which feed solely on plants, three of the more important ones are the Tetranychidae, Tenuipalpidae and Eriophyidae. They usually feed on the leaves injuring the epidermis and resulting in blotching, stippling or bronzing and some times even accompanied by leaf fall. However, some species are known to feed on the bark, floral heads or under the leaf sheaths of grasses and the most specialized members such as some species of Tenuipalpidae and the majority of Eriophyidae form galls within which they feed. The families Tarsonemidae, Acaridae and Oribatidae are associated with plants because they feed on fungi. Phytoseiidae, Cheyletidae and Tydeidae are very important predacious mites which are used in the present time against plant mites in the biological control programs through the world.

Predatory mites, most notably the Phytoseiidae, are dominant with the mite fauna of Iraq. This may help prevent serious plant damage by reducing the population of phytophagous species.

Host specificity:

The phytophagous mites show different degree of host specificity. It is very high in the superfamily Eriophyoidea and in the majority of tenuipalpid species. The tetranychid mites show a low host specificity. Jeppson, Keifer and Baker (1975) reported that present taxonomical studies utilizing comparative anatomy indicate that many phytophagous mites are host specific, or will breed only on host plant species that are closely related to each other. This is particularly true

for the great majority of eriophyoids that inhabit broad-leaved plants. They added in the same year that while some of the tetranychid mites are now known to infest only one host plant, the more indiscriminate species have no intimate relations with any of their hosts. They damage the plants they feed upon, and then crawl, or balloon away in search of feeding sites. It is very little known from the literature concerning the host specificity of tenuipalpid mites. During this survey to the tenuipalpid mites which conducted in Central Iraq, the author have seen that the majority of tenuipalpid mites are highly host-specific. The genus *Obdulia* collected only on *Tamarix pentandra* from Central Iraq, on *T.maris-mortui* from Israel and on *T.aphylla* from Egypt. The genus *Larvacarus* was found only in the galls of *Zizyphus* spp. in Iraq and India. *Colopalpus eriophyoides* attacks only date palm trees in Iraq and Israel. *Tenuipalpus punicae* collected on pomegranate and other relatives which belong to the family Punicaceae from Iraq, India, Israel, Egypt, Spain, Bulgaria, Pakistan, Japan and USSR. The genus *Dolichotetranychus* infested mainly the graminae plants through the world. I have listed above some examples for high host specific tenuipalpid mites. In the opposite of these highly host specific indicate the genus *Brevipalpus* very broad host preference, e.g. *B.obovatus* was collected on ten different host plants from Central Iraq. Goyal, Sadana and Sharna (1984) recorded one hundred and eight host plants for *B.obovatus* from India. *B.californicus* and *B.phoenicis* infested more than 50 host plants.

Economic importance:

Table 1 indicates 3 different infestation levels of plants by mites. 69.87 % of all examined plants are inhabited by mites. Out of this are 46.80 % light infested, that means the mite has no considerable damage on its host and 23.07 % are with heavy infestation which show visible damage done by mites. It seems to me that some potential mites which are now not known as pests to our crop plants in Iraq may be start in the near future to be an important pest because of the

high usage of pesticide which results in killing the natural enemies and building up a high resistant species. A good example for this problem is *Tenuipalpus punicae* P. & B. which was before 10 years only an occasional species. This species now considers to be the key pest of 8 million pome-granate trees in Iraq, because of the Ministry of Agriculture recommended to spray an insecticide to control pomegranate fruit borer, *Ectomyelois ceratoniae* Zell. As a result of this process, a high population density of *T.punicae* was built up and started to effect the pomegranate trees severely. Other examples of the same problem above was happened with *Cenopalpus pulcher* on apple trees and *C.lanceolatisetae* on pear trees.

Taxonomical Aspects:

This part includes two subunits, the first concerning the general morphology of the family Tenuipalpidae and the second subunit treats the identification of false spider mite in Iraq. In this study the author discussed in detail the external characters which are used mainly in the taxonomy of genera and species. The basis for the separation of some of the genera and species has not been uniform and different workers have attributed varying amounts of strength to the characters they have chosen for this purpose. At specific levels the characters that have been repeatedly used by the various workers like Sayed, Baker, Pritchard and Baker, Baker and Tuttle, Collyer, Ghai and Manander, Mitrofanov and Strunkova, and Meyer are:

1. dorsal sculpture (reticulation, striation)
2. number of segments and setae of the palpi
3. shape and size of setae
4. the chaetotaxy of the legs
5. number of the solenidia on tarsi I and II
7. presence or absence of rostral shield and its shape
8. presence or absence of ventral shield

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9. the chaetotaxy of the nymphal stage
10. the opisthosoma of the male

Chaudhri (1971, 1972), Siddiqui and Chaudhri (1972), and Chaudhri, Akbar and Rasool (1974) have given much importance to even minor variations in the dorsal sculpture, setae size and rostral shield. They have erected many species on the basis of these variations.

In the present work an equal weightage has been given to almost all the above mentioned characters in order to describe the new species of Iraq. The taxonomic studies of tenuipalpid mites in Central Iraq revealed the occurence of twenty species belonging to nine genera on different host plants. Eleven of which are new to science. Keys to the genera and species are presented for the mites collected in this survey, and representative illustrations are included for all species. The new species with their host plants are as follows:

Dolichotetranychus babylonicus collected on *Phragmites australis* L.
Obdulia daadi collected on *Tamarix pentandra* Pall.
Aegyptobia salicicola collected on *Salix alba* L. and *Salix acmophylla* Boiss.
Aegyptobia euphratica collected on *Cupressus sempervirens* L.
Aegyptobia mesopotamiensis collected on *Cupressus* sp.
Brevipalpus iraquiensis collected on *Croton variegatis* L. and *Punica granatum* cv. Nana L.
Tenuipalpus bagdadensis collected on *Lagonychium farctum* L.
Tenuipalpus myrtus collected on *Myrtus communis* L.
Tenuipalpus populi collected on *Populus* spp.
Tenuipalpus viticola collected on *Vitis vinifera* L.
Tenuipalpus salicis collected on *Salix alba* L.

Almost all the new species were compared to the type species and the paratype as which are deposited in the U.S. National Museum to ensure the identification of these new mites.

The following species are new records to the Iraqi fauna, namely, *Aegyptobia trägårdi* Sayed collected on *Thuja orientalis* L., *Brevipalpus obo-vatus* Donnadieu collected on **Ammi majus* L.,**Apium graveolens* L., **Aster subulatus* Michx., **Aster tripolium* L., **Sonchus oleraceus* L., **Convolvulus arvensis* L., **Oxalis corniculata* L., **Plantago ovata* Forssk., *Plantago lanceolata* L., **Rumex dentatus* L., **Punica granatum* L. and **Verbena supina* L., *Larvacarus transitans* (Ewing) collected on *Ziziphus* sp. and *Tenuipalpus lygodii* DeLeon collected on *Mangifera indica* L.[1]
The already known species from Iraq, namely *Cenopalpus pulcher* (Can. & Fanz.), *C.lanceolatisetae* (Attiah), *Colopalpus eriophyoi-des* (Baker), *Raoiella indica* Hirst and *Tenuipalpus punicae* P. & B. are redescribed to ensure their taxonomic position in the family.

During this investigation the author has noticed that much of the mite fauna of Iraq still remains to be discovered. This work should provide an outline for field workers and students in Iraq to have a foundation on which to base their study of other mite groups. The pecularity of Iraq and the surrounding regions in their climate, soil structure and the plant vegetation give a special interesting to the taxonomists to study their fauna. Baker, Lindquist and Kethley (private communication, 1987) expect more new species from Iraq and the surrounding areas.

As a conclusion from this dissertation, the following suggestions have to be done in the future to establish a complete catalogue for the mite fauna of Iraq.

1. In the present survey which was conducted in Central Iraq, only the family Tenuipalpidae is treated taxonomically. The same research has to be done on the other fami-

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[1]The host plants with an asterisk on their names indicate that they have not been recorded before from the world as hosts for *B.obovatus*.

lies. Table 1 which presented in this work is a good guide to do this job.

2. Study the biological and ecological aspects of species which cause an economic damage to the cultivated plants. The purpose is to increase the current knowledge about their distribution, seasonal occurence, host plants and the life cycle.
3. Find out within the predacious mites the efficient species which can be reared easy in the laboratory in order to use them in the biological control programs.
4. Investigate the internal morphology of the family Tenuipalpidae by using transmission electron microscope (TEM).
5. Survey the mites inhabited plants in North and South of Iraq as well as the desert to get a complete idea on the phytophagous, predacious and fungivorous mites.
6. Attention has to be given to other groups e.g. stored product mites, soil mites, parasitic mites, mites associated with insects and house dust mites.
7. Encourage such post graduate "Sandwich Programs" which give the oppurtunity to the students to use the facilities which may be not available in Iraq to do this research.

It is hoped that this work will serve the acarologists, pest management specialists and the students.

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Summary

Title of dissertation: "Taxonomic Studies of false spider mites (Acari: Tenuipalpidae) in Central Iraq".
Author: Ibrahim J. Al-Gboory, Baghdad, Iraq, 1987.
Dissertation directed by: Professor Dr. W.Kloft and Professor Dr. H.Bick, Bonn Universität.

This work was done by the author on the mites associated with cultivated and wild plants and especially the family Tenuipalpidae in Central Iraq. The results are presented in this dissertation in eight parts.

The first part, "Introduction", includes the importance of mites to agriculture, general characters of the superfamily Tetranychoidea, distribution and the economic importance of plant mites as well as the functions of this research.

The second part treats the "Review of literature" published on the family Tenuipalpidae since 1834. This unit includes the development of the family name and creation of genera and species. This review contains not only the taxonomic papers but also the papers dealing with the ecology, biology, control, genetics and other aspects.

The third and fourth parts include some geographical and ecological informations about the location, climate and natural vegetation of Iraq, the source of material that formed the basis of this investigation and the procedure of collecting, preserving, mounting and drawing of mites.

Studies of the tenuipalpid mites of Central Iraq, which form the main part of this dissertation, are presented in part five and six. During the course of an extensive survey conducted in seven provinces in Central Iraq, viz.Baghdad, Babil, Diyala, Kerbala, Salahuddin, Ramadi and Wasit, more than 150 cultivated and wild plants were examined. Nine families are recognized, namely Tetranychidae, Tenuipalpidae, Eriophyidae, Tarsonemidae, Acaridae, Oribatidae, Phytoseiidae, Tydeidae and Cheyletidae.

Out of these 9 families, the first three are mainly

phytophagous mites which feed on the plants and cause an economic damage in some countries. Tarsonemidae, Acaridae and Oribatidae are mainly fungivorous. The last three families are predatory mites which can be used in the future for biological control programs. The external and internal morphological structure of the family Tenuipalpidae with special emphasis on the characters of taxonomic importance, illustrating the same with suitable diagrams are also presented in this part.

The taxonomic studies of the Iraqian tenuipalpids revealed the occurence of twenty species belonging to nine genera viz. *Dolichotetranychus* Sayed, *Cenopalpus* Pritchard and Baker, *Larvacarus* Baker and Pritchard, *Obdulia* Pritchard and Baker, *Raoiella* Hirst, *Aegyptobia* Sayed, *Brevipalpus* Donnadieu, *Tenuipalpus* Donnadieu and *Colopalpus* Pritchard and Baker. Out of the genera and species studied eleven species viz. *Dolichotetranychus babylonicus,* n.sp., *Obdulia daadi,* n.sp., *Aegyptobia salicicola,* n.sp., *Aegyptobia euphratica,* n.sp., *Aegyptobia mesopotamiensis,* n.sp., *Brevipalpus iraquiensis,* n.sp., *Tenuipalpus bagdadensis,* n.sp., *Tenuipalpus myrtus,* n.sp., *Tenuipalpus populi,* n.sp., *Tenuipalpus viticola,* n.sp. and *Tenuipalpus salicis,* n.sp. are new to science, which are fully described with adequate illustriations pointing out their relationship with other related species. Keys to the genera and species are presented for the mites collected in this survey. Almost all new species were checked to the type species and paratypes which were deposited in the U.S.National Museum. Conformation for the new species has been done by Dr. E.W. Baker(USA). Four species, namely *Aegyptobia trägårdhi* Sayed, *Brevipalpus obovatus* Donnadieu, *Larvacarus transitans* (Ewing) and *Tenuipalpus lygodii* De Leon are recorded for the first time from Iraq.

The already known species from Iraq viz. *Cenopalpus pulcher* (Canestrini and Fanzago), *Cenopalpus lanceolatiseatae* (Attiah), *Colopalpus eriophyoides* (Baker), *Raoiella indica* Hirst and *Tenuipalpus punicae* Pritchard and Baker are redescribed to ensure their taxonomic position in the family.

Many of the host plants are new records for some of the species from the world.

The seventh unit includes the discussion of the different point of view between the Russian taxonomists and other workers from the world concerning splitting out the family in small subunits. Discussions also have been given to the misidentification of *Tenuipalpus granati* Sayed. This is followed by a brief discussion of the results obtained from this survey.

Finally, 363 references to the literature cited under the various parts mentioned above have been alphabetically listed.

Zusammenfassung

Titel der Dissertation: "Taxonomic Studies of false spider mites (Acari: Tenuipalpidae) in Central Iraq".
Autor: Ibrahim J. Al-Gboory, Baghdad, Irak, 1987.
Dissertation betreut durch: Professor Dr. W.Kloft und Professor Dr. H.Bick, Universität Bonn.

Die Untersuchungen wurden an Milben vorgenommen, die auf Kultur- und Wildpflanzen in Mittel-Irak leben. Dabei wurde besonders die Familie Tenuipalpidae berücksichtigt. Die Ergebnisse werden in 8 Kapiteln dargelegt:

1. Die Einführung stellt die Bedeutung dieser Milben für die Landwirtschaft, die allgemeinen Merkmale der Überfamilie Tetranychoidea, die Verbreitung und die wirtschaftliche Bedeutung von Pflanzenmilben heraus. Ferner werden die Ziele dieser Untersuchungen dargelegt.

2. Die seit 1834 vorhandene Literatur über die Familie Tenuipalpidae wird diskutiert. Es werden die taxonomische Entwicklung der Gattungen und Arten und die Synonymie der Tenuipalpidae aufgezeigt. Dieser Literaturüberblick behandelt nicht nur taxonomische, sondern auch ökologische, biologische, schädlingskundliche, genetische und andere Aspekte.

3. Geographische und ökologische Angaben zur Lage, Klima und natürlicher Vegetation werden gegeben.

4. Darlegung der Herkunft des Materials für diese Untersuchungen und der Methoden beim Sammeln, Konservieren, Präparieren und Zeichnen der untersuchten Milben

5. Darlegung der äußeren und inneren morphologischen Strukturen der Tenuipalpidae, insbesonders Berücksichtigung der taxonomisch bedeutsamen Merkmale, illustriert durch entsprechende Abbildungen.

6. Folgende Untersuchungen an den Tenuipalpidae des Mittel-Irak bilden den Hauptteil dieser Dissertation:

a. Während des Untersuchungszeitraumes wurden in folgenden sieben Provinzen des Mittel-Irak reichhaltiges Material gesammelt: Bagdad, Babil, Diyala, Kerbala, Salahuddin, Ramadi und Wasit. Der Autor untersuchte mehr als 150 verschiedene Kultur- und Wildpflanzenarten. Dabei wurden Vertreter von 9 Milbenfamilien (Tetranychidae, Tenuipalpidae, Eriophyidae, Tarsonemidae, Acaridae, Oribatidae, Phytoseiidae, Tydeidae und Cheyletidae) nachgewiesen. Von diesen enthalten die drei ersten Familien hauptsächlich phytophage Milbenarten die häufig als Schädlinge auftreten. Dagegen sind die Tarsonemidae, Acaridae und Oribatidae hauptsächlich fungivor oder detritophag. Die 3 letzten der 9 Familien sind Prädatoren, die sich für eine zukünftige biologische Schädlingsbekämpfung anbieten.

b. Die taxonomischen Untersuchungen der irakischen Tenuipalpidae erbrachte die neun folgenden Gattungen: *Dolichotetranychus* Sayed, *Cenopalpus* Pritchard and Baker, *Larvacarus* Baker and Pritchard, *Obdulia* Pritchard and Baker, *Raoiella* Hirst, *Aegyptobia* Sayed, *Brevipalpus* Donnadieu, *Tenuipalpus* Donnadieu and *Colopalpus* Pritchard and Baker. Innerhalb dieser Gattungen wurden 20 Arten, von denen 11 für die Wissenschaft neu sind, vorgefunden: *Dolichotetranychus babylonicus*, n.sp., *Obdulia daadi*, n.sp., *Aegyptobia salicicola*, n.sp., *Aegyptobia euphratica*, n.sp., *Aegyptobia mesopotamiensis*, n.sp., *Brevipalpus iraquiensis*, n.sp., *Tenuipalpus bagdadensis*, n.sp., *Tenuipalpus myrtus*, n.sp., *Tenuipalpus populi*, n.sp., *Tenuipalpus viticola*, n.sp. und *Tenuipalpus salicis*, n.sp.

Die Taxa werden ausführlich beschrieben. Jede Art wird durch Habitus und in Einzelzeichnungen dargestellt. Die Aufbewahrungsorte der Holotypen und Paratypen werden genannt. Abschließend wird ein Bestimmungsschlüssel der untersuchten Gattungen und Arten gegeben. Die Determination der Arten wurde von Dr. E.W. Baker,U.S.National Museum, Maryland geprüft. Durch dessen freundliche Vermittlung konnte der Autor seine Tiere mit dem Material aus dem U.S.National Museum vergleichen.

C. Bei vier Arten der Tenuipalpidae handelt es sich um Erstnachweise für den Irak, und zwar *Aegyptobia trägårdhi* Sayed, *Brevipalpus obovatus* Donnadieu, *Larvacarus transitans* (Ewing) and *Tenuipalpus lygodii* De Leon.

D. Die 5 bereits aus dem Irak bekannten Tenuipalpidae Arten *Cenopalpus pulcher* (Canestrini & Fanzago), *Cenopalpus lanceolatisetae* (Attiah), *Colopalpus eriophyoides* (Baker), *Raoiella indica* Hirst und *Tenuipalpus punicae* Pritchard & Baker, werden wiederbeschrieben und ihre systematische Stellung innerhalb der Tenuipalpidae wird dargelegt. Viele neue Wirtspflanzen werden angegeben.

7. Die verschiedenen Ansichten zwischen den sowjetischen und den übrigen Taxonomen in Bezug auf die Zersplitterung der Familie wird ausführlich diskutiert. Die Mißdeutung der Art *Tenuipalpus granati* Sayed wird korrigiert. Die taxonomischen Ergebnisse der Untersuchungen wird diskutiert.

8. Die Literaturübersicht enthält 363 einschlägige Zitate in alphabetischer Anordnung.

Curriculum Vitae

Ibrahim Jodou Al.Gboory was born on the 5.September 1953 in Thee-Qar, Iraq. He attended Refai Secondary School, Refai, where he graduated in 1972. He entered the College of Agriculture, University of Baghdad (UB) and graduated with B.Sc. in Plant Protection in 1976. In 1978 he participated in a short training course in USDA, Maryland by Dr. E.W. Baker. In 1979 he obtained M.Sc. in Acarology. He is the first student to obtain his M.Sc. degree in Acarology in Iraq. After he got the M.Sc., he was appointed as a teaching assistant in the College of Agriculture, UB. From Sept. 5, 1981 to Oct. 4, 1983, he worked as a Manager of Relations and Administrative Services of the College of Agriculture, UB.

In 1983, he was awarded a scholarship by the German Academic Exchange Service (DAAD). From Oct. 6, 1983 to April. 2, 1984, he joined the German Language Course, in Göttingen. On Feb. 7, 1985, he passed the "Kenntnisprüfung" at the University of Bonn and got the official admission to work on his Dr.agr. degree at the Applied Zoology Institute under the supervision of Professor Dr. Werner Kloft.

On July 23, 1985 he married Asmaa Omer in Bonn and on April 15, 1986 their daughter Jasmin was born in Bonn. He participated in many International Congresses namely:

V Int. Congress of Acarology, Michigan, USA, 1978
VI Int. Congress of Acarology, Edinburgh, U.K., 1982
VII Int. Congress of Acarology, Bangalore, India, 1986
XVII Int. Congress of Entomology, Hamburg, FRG, 1984

He is a member of the Acarological Society of America (ASA), Acarological Society of India (ASI) and Biological Society of Iraq. He published a book "Non-Insects Animal Pests and their Control" in addition to many other scientific publications. From June 22 to July 10, 1987 he attended the Acarology Summer Program at Ohio State University, USA.