

4. Revision of the English Species of Red Spider (Genera *Tetranychus* and *Oligonychus*). By STANLEY HIRST.

(Published by permission of the Trustees of the British Museum.)

[Received December 8, 1919 : Read February 24, 1920.]

(Text-figures 1-5.)

The following note deals with the English species of mites commonly called Red Spiders, and is almost entirely based on material collected by the author, the coloration being described from living specimens. A good deal of confusion still exists in the classification of this group—for instance, the name *Tetranychus telarius* is not always used for the same species by recent authors, and several distinct species (*T. tiliarium*, *T. lintearius*, *T. populi*, and *Oligonychus quercinus*) are wrongly considered as synonyms of that species. Three new species are described in the present note, but one of them (*T. talisiæ*) is undoubtedly an introduced form.

My best thanks are due to Lieut.-Col. Sir David Prain (Kew Gardens), Prof. W. Bateson (John Innes Horticultural Station, Merton), and to the authorities of the Royal Horticultural Society's Gardens, Regent's Park, for kindly allowing me to collect material in the gardens under their charge.

The drawings illustrating this note have been made by Mr. Percy Highley and Mr. A. J. Engel Terzi.

Order PROSTIGMATA.

Superfamily Trombidioidea.

Family TETRANYCHIDÆ.

The two principal genera *Tetranychus* and *Oligonychus* can be readily distinguished from one another by the following characteristics:—

Claw of legs always simple and unmodified (never bifurcated nor furnished with teeth); it has a slight protuberance near the base bearing minute hairs Genus *Oligonychus* Berlese.
First claw of male either ending in minute teeth or bifurcated. Claw of the other legs in both sexes usually either ending in fine hairs or bifurcated Genus *Tetranychus* Dufour.

Genus TETRANYCHUS Dufour, 1832.

Key to the species of *Tetranychus* (males) occurring in England:—

- | | | | |
|----|--|--|---|
| 1. | { | Terminal finger of palp minute and inconspicuous or absent | 1. |
| | | Terminal finger well developed | 4. |
| | { | Terminal finger of palp absent. | <i>Tetranychus schizopus</i>
[Zacher.] |
| | | All the claws of the legs bifurcated | |
| { | Terminal finger present, but minute. | 2. | |
| | Claw of first leg alone bifurcated | | |

- | | | | |
|----|---|--|---|
| 2. | { | Penis strongly curved and furnished with a spine and tubercle at the end | <i>T. cratægi</i> , sp. n. |
| | | Penis straight or only slightly curved, the end unarmed | 3. |
| 3. | { | Penis fairly long, the end blunt | <i>T. populi</i> C. L. Koch. |
| | | Penis shorter and pointed at the end..... | <i>T. talisiæ</i> , sp. n.
(introduced species). |
| 4. | { | Penis with barbs at the end | 5. |
| | | Penis without barbs | 6. |
| 5. | { | Claw of first leg armed with short teeth or spines | <i>T. telarius</i> , L. |
| | | Claws of both first and second leg with teeth | <i>T. lintearius</i> Dufour. |
| 6. | { | Penis strongly sinuous. Offshoots of claw of first leg weak | <i>T. carpini</i> Oudemans. |
| | | Penis straighter. Offshoots of claw of first leg stronger, spiniform | <i>T. tiliarium</i> Hermann. |

1. TETRANYCHUS SCHIZOPUS Zacher, 1913.

Tetranychus schizopus Zacher, Berlin, Mitt. biol. Anst. 1913, heft 14, pp. 38 & 40, text-fig. 4.

? *T. salicis* C. L. Koch, Deutsch. Crust., Myr., Arachn. 1838, heft 17, no. 18.

Schizotetranychus schizopus Trägårdh, Stockholm Medd. Centralanst. Försöksv. Jordbruksomr. 1915, vol. 109, p. 19.

♂. *Penis* of the same type as in the species found on the hawthorn (*T. cratægi*), being curved when viewed laterally, and with one of the terminal barbs greatly elongated so as to form a spine, whilst the other is in the form of a minute inconspicuous tubercle.

Palp. Terminal finger or cone of palp apparently absent in the male of this species. Dorsal sensory finger well developed (see text-fig. 3 a, 1 & 2, for the explanation of these terms).

Claws of all the legs bifurcated, the two branches into which the first leg is divided being in this sex split again for a short distance at the tip.

♀. *Palp.* Terminal finger of palp well developed and fairly stout, being about as long as or longer than the neighbouring rod-like setæ. Dorsal sensory finger normal in appearance.

The *claws* of the legs do not end as fine hairs as in the female of *T. telarius* (and all other species of the genus seen by the author), being divided to form two prongs or claws as in the male, but the prongs of the first legs are entire instead of being split again at the extreme tip as in the male sex.

Colour rather variable, greenish, pale yellow, reddish, and orange-red specimens being met with. Small dark patches are sometimes present on the dorsum.

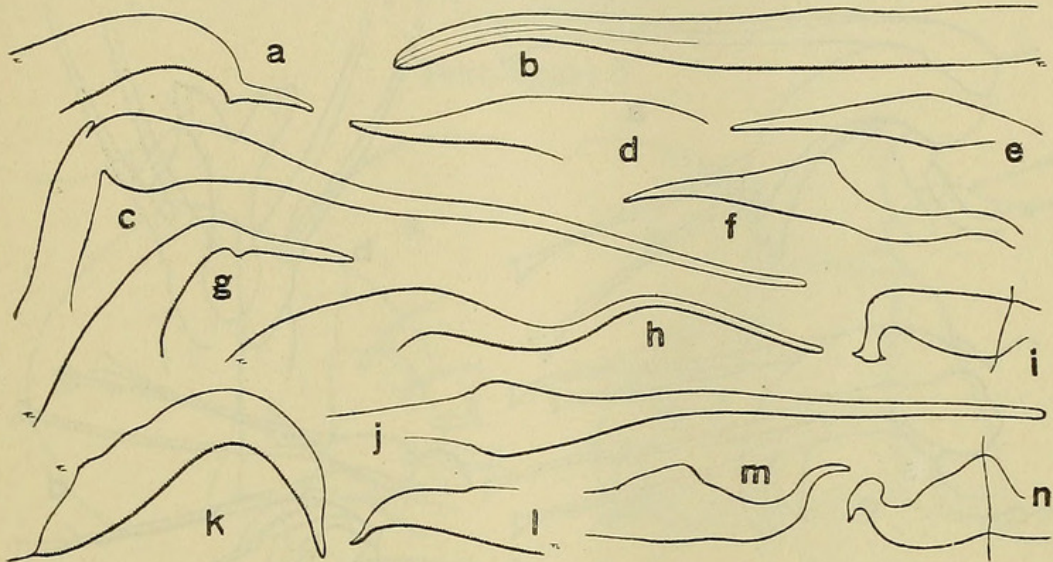
Eggs sometimes pale amber in colour, sometimes reddish.

Length of male (including mandibular plate) 340 μ , of female 350–535 μ .

Host plants. Various species of willows.

NOTE.—Trägårdh has created a new genus (*Schizotetranychus*) for this species, which certainly is very peculiar in having all the claws bifid in both sexes. The penis is, however, very like that of *T. crataegi*. Moreover, the male of *T. populi* has the first leg shaped like that of *T. schizopus*. On the whole, I think it is not necessary to place this species in a separate genus.

Text-figure 1.



a. Lateral view of penis of *Tetranychus schizopus*. b. Ditto of *T. populi*. c & j. Ditto of *T. tiliarium*. d, e, f. Ditto of *T. talisiae*. g. Ditto of *T. crataegi*. h. Ditto of *T. carpini*. i. Ditto of *T. telarius*. k. Ditto of *Oligonychus ununguis*. l. Ditto of *O. quercinus*. m. Ditto of *O. ulmi*. n. Ditto of *O. simplex*.

2. TETRANYCHUS CRATÆGI, sp. n.

♂. *Penis* very like that of *T. schizopus* in shape, being strongly curved and with a long spiniform process at the end, also a very minute and inconspicuous tubercle which no doubt represents the barb of the other side.

Palp. Terminal finger in the form of a very minute and inconspicuous cone or tooth. Dorsal sensory finger apparently variable in length.

Claw of first leg in this sex distinctly bifid, being divided into two strong prongs; one or two frail hairs are present on these prongs, and no doubt correspond to the spines present in *T. tiliarium*.

♀. *Palp*. Terminal finger somewhat short but very wide, being rather conical in shape; it seems to be a little shorter than the two rod-like setæ near it. Dorsal sensory finger moderately developed.

Claws of legs ending in long hairs as in *T. telarius*.

Measurements. ♂, length 340 μ ; ♀, 335–460 μ .

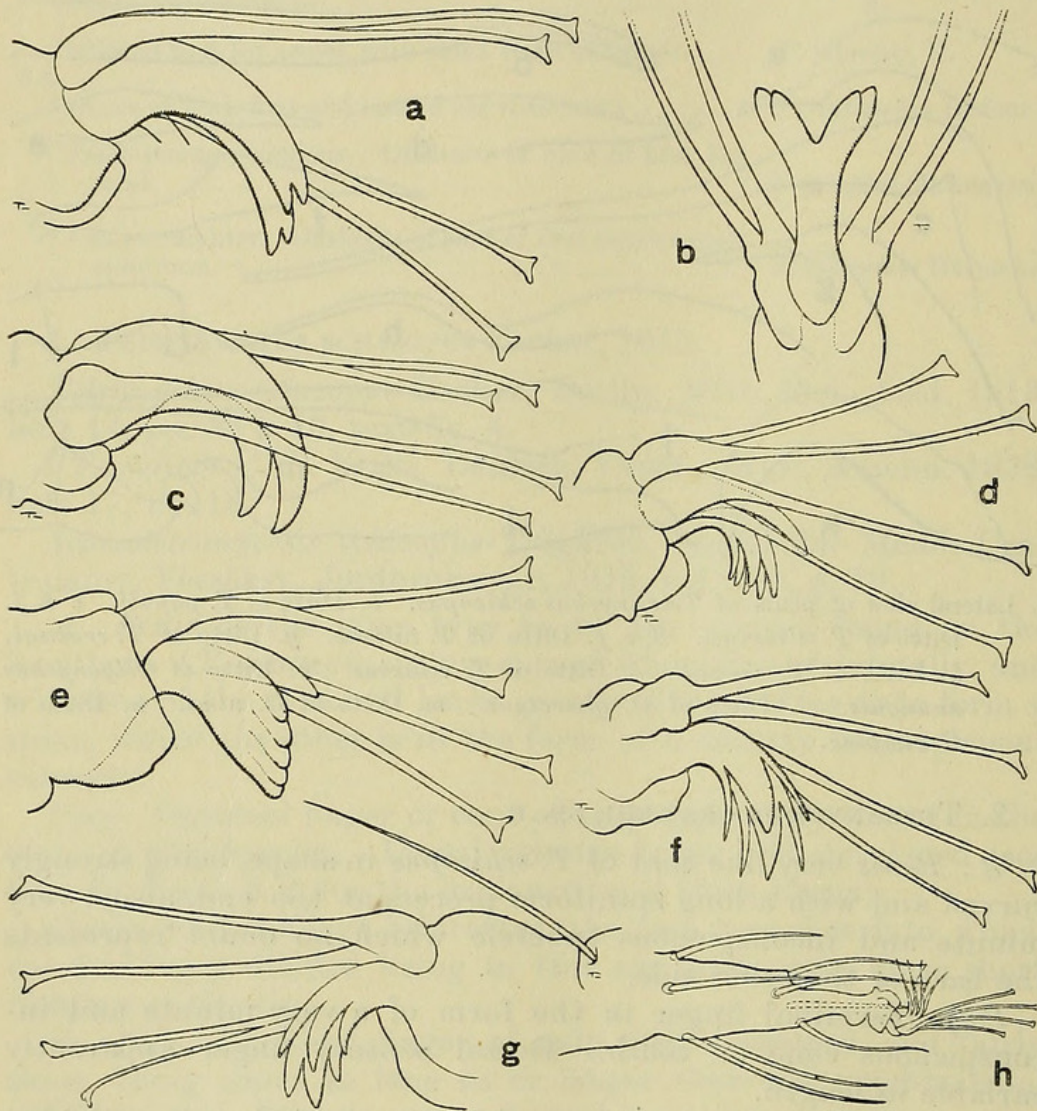
Host plant. Hawthorn hedges in the outskirts of Salisbury, Wilts.

3. TETRANYCHUS POPULI C. L. Koch, 1838.

Tetranychus populi C. L. Koch, Deutsch. Crust., Myr., Arachn. 1838, heft 17, no. 14.

T. telarius (ad part.) Canestrini, Prospett. Acarof. Ital. 1890, p. 434; Berlese, Acari, Myr., etc. in Ital. reperta, 1889, fasc. lvi. no. 5.

Text-figure 2.



- a. Claws (empodia) of first leg of *Tetranychus schizopus* ♂, lateral view of same. b. Ditto. Ventral view. c. Claws of posterior leg of *T. schizopus*. d. Ditto of first leg of *T. telarius* ♂. e. Ditto of second leg of *T. lintearius* ♂. f. Ditto of first leg of *T. carpini* ♂. g. Ditto of *T. tiliarium* ♂. h. Ditto of *T. tiliarium* ♀.

♂. *Penis* rather like that of *T. tiliarium*, being only slightly curved; it is much longer than in *T. talisæ*, sp. n., and also differs in having the end blunt.

Palp. Terminal finger or cone very minute as in *T. talisæ*; dorsal sensory finger long.

First claw of male bifurcated exactly as in *T. schizopus*, each

prong being again split for a short distance at the extreme tip. Claws of posterior legs, as in *T. telarius*, ending in hairs.

♀. *Palp*. Terminal cone rather short but wide.

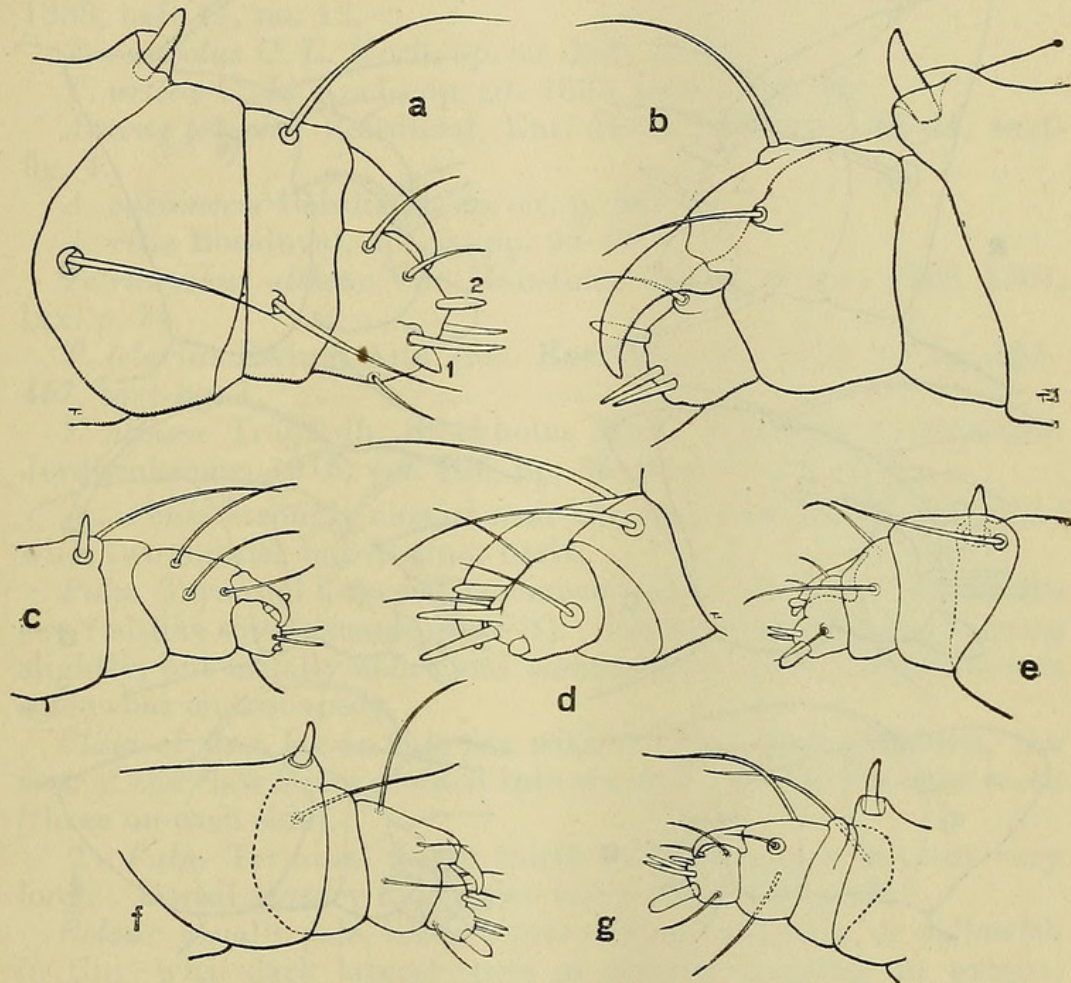
Claws of legs as in *T. telarius*.

Eggs whitish.

Measurements. ♂, length $320\ \mu$; ♀, $380\ \mu$. Strongly chitinated part of penis about $43\ \mu$ in length, but, if the more weakly chitinated part is included, it measures altogether about $65\ \mu$.

Host plant. Lombardy poplars, Regent's Park, London.

Text-figure 3.



a. Terminal segments of palp of *T. crataegi* ♂. b. Ditto of *T. schizopus* ♂. c. Ditto of *T. talisiae* ♂. d. Ditto of *T. populi* ♂. e. Ditto of *T. lintearius* ♂. f. Ditto of *T. telarius* ♂. g. Ditto of *T. tiliarium* ♂. 1. Terminal finger or cone. 2. Dorsal sensory finger.

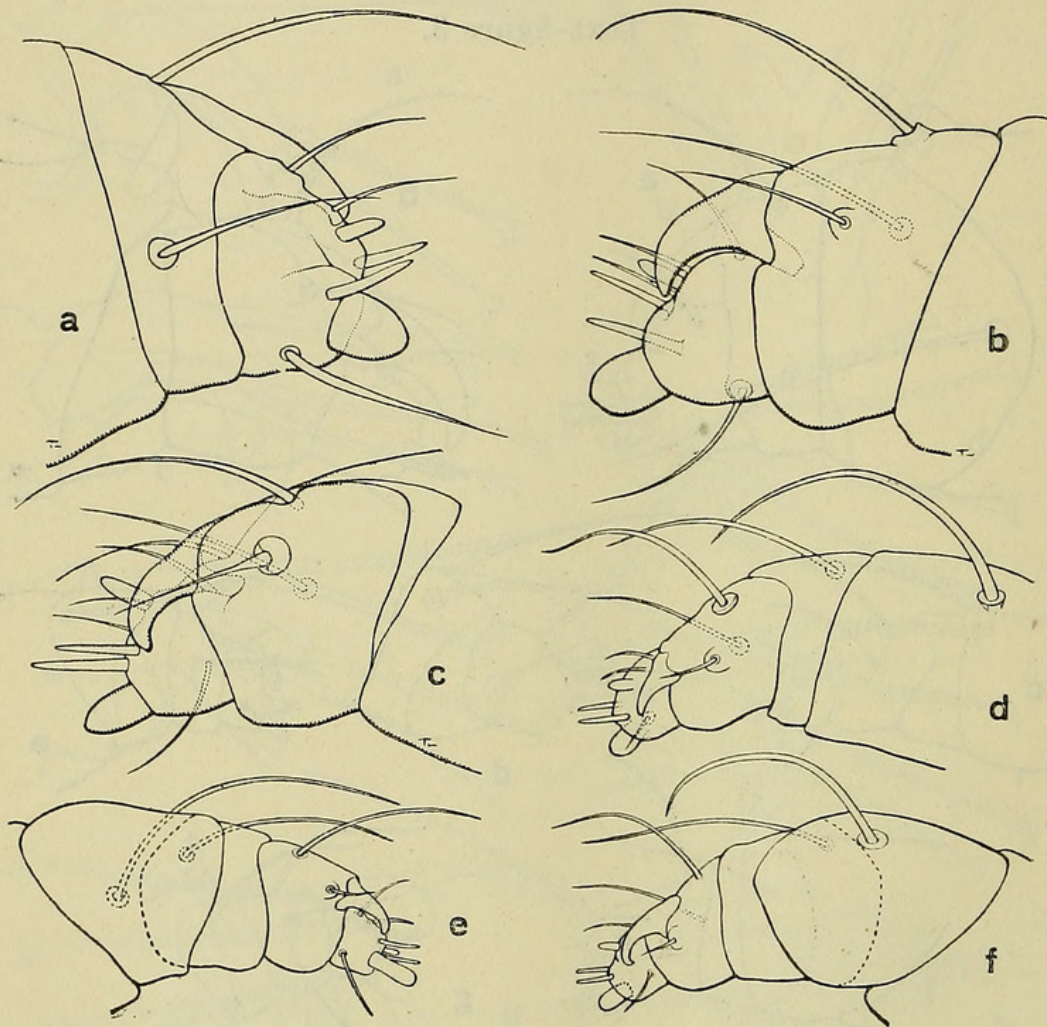
NOTE.—C. L. Koch described his *T. populi* from Lombardy poplars ("italienischen Pappel"), so that there can be little doubt as to the correctness of my identification of this species. The Common Red Spider (*T. telarius*) is sometimes also present on Lombardy poplars and also on ordinary poplars, but the males of the two species of mites are very unlike one another.

4. *TETRANYCHUS TALISIÆ*, sp. n.

♂. *Penis* short and straight, the terminal half slender and ending in a sharp point; there is no trace of barb at the end; it is very much shorter than that of *T. tiliarium* or *T. populi*.

Palp. Terminal finger or cone very minute, but usually longer than wide, being conical and pointed. Dorsal sensory finger short and slender, but the width seems to vary in different specimens.

Text-figure 4.



a. Terminal segments of palp of *T. cratægi* ♀. b. Ditto of *T. populi* ♀. c. Ditto of *T. talisiæ* ♀. d. Ditto of *T. lintearius* ♀. e. Ditto of *T. tiliarium* ♀. f. Ditto of *T. telarius* ♀.

Claw of first leg bifid when seen from above; when viewed laterally, each fork bears two hairs (one dorsal, the other ventral) as in *T. carpini*, but they are still more inconspicuous and difficult to see, being very fine. The claws of the three posterior legs end in hairs as in *T. telarius*.

♀. *Palp.* Terminal finger or cone fairly well developed and rather stout, being about equal to the length of the neighbouring rod-like setæ. Dorsal sensory finger slightly club-shaped.

Colour. Body pale yellowish green; sometimes minute dark specks, arranged in four small clusters, are present at the sides and posterior end of the dorsum.

Measurements. ♂, length 220–250 μ ; ♀, 340–380 μ .

Host plant. South American tree (*Talisia princeps*), growing in Tropical Greenhouse, Kew Gardens.

5. TETRANYCHUS TELARIUS L.

Acarus telarius (ad part.) Linnaeus, Syst. Nat. 1758, Ed. 10, p. 616.

Tetranychus telarius C. L. Koch, Deutsch. Crust., Myr., Arachn. 1838, heft 17, no. 12.

T. russeolus C. L. Koch, op. cit. heft 17, no. 15.

T. urticae C. L. Koch, op. cit. 1835, heft 1, no. 10.

Acarus telarius Boisduval, Ent. Hort. 1867, pp. 82–84, text-fig. 4.

A. cucumeris Boisduval, op. cit. p. 84.

A. vitis Boisduval, op. cit. pp. 92–93.

Tetranychus althææ Von Hanstein, Zeitschr. wiss. Zool. 1901, lxx. p. 74.

T. telarius Ewing, Ann. Soc. Ent. America, 1913, vi. pp. 455–457, text-fig. 1.

T. althææ Trägårdh, Stockholm Medd. Centralanst. Försöksv. Jordbruksomr. 1915, vol. 109, pp. 36–40 & 57.

♂. *Penis* strongly curved near the end, and the tip furnished with two minute but distinct barbs.

Palp. Terminal finger of moderate length (about as long as the two rod-like setæ situated near it). Dorsal sensory finger varying slightly, but usually short and slender (sometimes, however, it is somewhat club-shaped).

Claw of first leg in this sex with a little dorsal offshoot, the rest of the claw being divided into six short slender forks or teeth (three on each side).

♀. *Palp.* Terminal finger fairly well developed, but not very long. Dorsal sensory finger also fairly well developed.

Colour usually pale, being either whitish, greenish, or yellowish in tint, with dark lateral spots or patches varying in extent, sometimes quite extensive. More rarely pink or reddish individuals are met with.

This species occurs on many plants, and was confused by Linnaeus, and later by Hermann, with the form occurring on the lime-tree (the latter creates the name *tiliarium*, but says that the species occurring on the lime-tree is also found on *Althæa*, a typical plant host for *T. telarius* proper). This mistake is followed by many other authors, including recent authors of great repute, and several other quite distinct species—viz., *T. lintearius* Dufour (from gorse), *T. populi* C. L. Koch (from poplar trees), and the species living on the oak (*Oligonychus quercinus*)—have also wrongly been regarded as synonyms of *T. telarius*.

T. telarius is our Common Red Spider, being found on many plants, both in the open and in greenhouses. It is especially fond of hollyhocks (*Althæa*), but attacks numerous other cultivated flowers and also weeds. It often infests strawberries, beans, mint, peaches, cucumbers, and melons (in hothouses), also grape-vines. The hop-gardens in Kent and elsewhere are often greatly damaged by this pest. It sometimes attacks bushes and trees—for instance, elders, rose-trees, laburnum, poplars, etc.

6. *TETRANYCHUS LINTEARIUS* Duf., 1832.

Tetranychus lintearius L. Dufour, 1832, Ann. Sci. Nat. (1) xxv. pp. 276–283, pl. ix. figs. 4 & 5.

T. lintearius Lucas, Ann. Soc. Ent. France, 1868, (4) viii. pp. 741–743.

T. telarius (ad part.) Canestrini, Prospett. Acarof. Ital. 1890, iv. p. 434.

T. telarius (ad part.) Berlese, Acari etc. in Ital. reperta, 1889, fasc. lvi. no. 5.

T. telarius Berlese, Gli Insetti, 1912, ii. p. 95.

♂. *Penis* very like that of *T. telarius*, but wider and shorter.

Palp. Terminal peg-shaped, sensory bristle comparatively short and of moderate width. Dorsal sensory finger short and club-shaped.

Legs. Both the first and second legs of the male have the claw modified so as to form a kind of comb of minute teeth, whereas in *T. telarius* the claw of the second leg ends in the usual six fine hairs.

♀. *Palp.* Terminal finger rather short and wide, being shorter than in *T. telarius*. Dorsal sensory finger rather short but not slender.

Measurements. ♀ 450–530 μ .

Host plant. Gorse (*Ulex europæus*); many hundreds of specimens collected by the author from infected bushes on Malvern Hills in 1917; unfortunately only one male example was present in this material. The masses of white web formed by this species are very obvious, and at once attract attention. Considerable damage is done to the gorse by this mite in certain areas on the Malvern Hills, and it is sometimes necessary to fire the bushes to get rid of it.

7. *TETRANYCHUS CARPINI* Oudemans.

♂. *Penis* very like that of *T. tiliarium*, but always strongly sinuous, instead of being practically straight as in that species.

Palp. Terminal finger very like that of *T. tiliarium*, being long and slender. Dorsal sensory finger very slender.

Claw of first leg bifid; each of the two prongs consists of a fairly strong middle tooth or spine, from which spring a dorsal and a ventral hair or seta (in *T. tiliarium* the dorsal and ventral offshoots are much stronger, being spiniform like the middle one).

♀. *Palp.* Terminal finger very like that of *T. tiliarium*, being well developed and of moderate stoutness. Dorsal sensory finger quite slender.

Colour pale greenish or yellowish, sometimes with dark lateral spots.

Measurements. ♂, length 215 μ ; ♀, 340 μ .

Host plant. Hornbeam (*Carpinus betulus*); a number of specimens from a tree of this species growing in London.

8. TETRANYCHUS TILIARIUM (Herm.), Koch 1838.

Trombidium tiliarium (ad part.) Hermann, Mem. Apt. 1804, pp. 42, 43, pl. ii. fig. 12.

„ *telarius* (ad part.) Hermann, op. cit. pp. 40, 41.

„ *socium* Hermann, op. cit. p. 43, pl. ii. fig. 13.

Tetranychus tiliarium Koch, Deutsch. Crust., Myr., Arachn. 1838, heft 17, no. 12.

„ *socius* Koch, op. cit. heft 17, no. 16.

„ *telarius* (ad part.) Canestrini, Prospett. Acarof. Ital. 1890, iv. p. 434.

„ *telarius* (ad part.) Berlese, Acari etc. in Ital. reperta, 1889, fasc. lvi. no. 5.

„ *telarius* Von Hanstein, Zeitschr. wiss. Zool. 1901, lxx. p. 74.

♂. *Penis* very long and slender, being in the form of an almost straight (only slightly sinuous) style.

Palp. Terminal finger long and slender, being more slender than in the female. Dorsal sensory finger short but slender.

Claw of first leg bifurcated, each fork bearing three minute but sharp denticles; claws of the other legs ending, as in *T. telarius*, in six fine hairs.

♀. *Palp.* Terminal finger well developed, being fairly long and of moderate width. Dorsal sensory finger short and slender.

Colour. Pale green, yellowish, or whitish, with minute dark markings, chiefly lateral in position, but occasionally there are one or two minute dark specks in the centre of the dorsum as well.

Egg whitish.

Measurements. ♂, length 260–305 μ ; ♀, length 420–490 μ : penis about 57 μ in length.

Host plant. Lime-tree (*Tilia europæa*). I have also found specimens of this mite on a hawthorn and on a willow, also in abundance on hazels near Exeter.

NOTE.—Hermann was the first author to use the name *tiliarium* as a specific name, but he mentions it as occurring also on *Alcea* [*Althæa*] *rosea*, and his specimens from this plant are probably referable to *T. telarius*. Fortunately, C. L. Koch limits the species to examples from lime-trees only, and there is a good deal of reason in this, for it occurs on very few other plants.

Genus OLIGONYCHUS* Berlese, 1886.

It is difficult to separate the species of *Oligonychus* by means of a key. The principal differences between the species of this genus are in the structure of the penis and terminal finger of the palp (see accompanying figures).

1. OLIGONYCHUS ULMI C. L. Koch, 1835.

Tetranychus ulmi C. L. Koch, Deutsch. Crust., Myr., Arachn. 1835, heft 1, no. 11.

T. pilosus Canestrini & Fanzago, Atti Soc. Ven. Trent. 1876, v. pp. 133-134.

T. ulmi Berlese, Acari dann. piant. coltiv. 1886, p. 22.

T. pilosus Berlese, Acari etc. in Ital. reperta, 1889, fasc. lvi. no. 6.

Paratetranychus pilosus Zacher, Berlin Mitt. biol. Anst. 1913, heft 14, pp. 38-39, text-fig. 1.

P. pilosus Trägårdh, Stockholm Medd. Centralanst. Försöksv. Jordbruksomr. 1915, vol. 109, no. 20, pp. 21-29 etc., text-figs.

♂. *Penis* strongly curved, being shaped as figured.

Palp. Terminal finger short, being less than half the length of the two neighbouring rod-like setæ near it. Dorsal sensory finger also short.

♀. *Palp.* Terminal finger quite short but very stout, being much shorter than the rod-like setæ near it. Dorsal sensory finger short and slender.

Another characteristic point is that the hairs of the body in this species spring from slight tubercles.

Colour. Dorsum dark reddish at the sides, and usually with a paler reddish central band, the anterior end of the body also pale red. Very minute whitish specks arranged in longitudinal series (one at the base of each hair) are also present on the dorsum, the hairs themselves being pale; appendages flavous. Some specimens are dark (almost blackish), brown, and the central pale reddish band may be absent.

Eggs reddish.

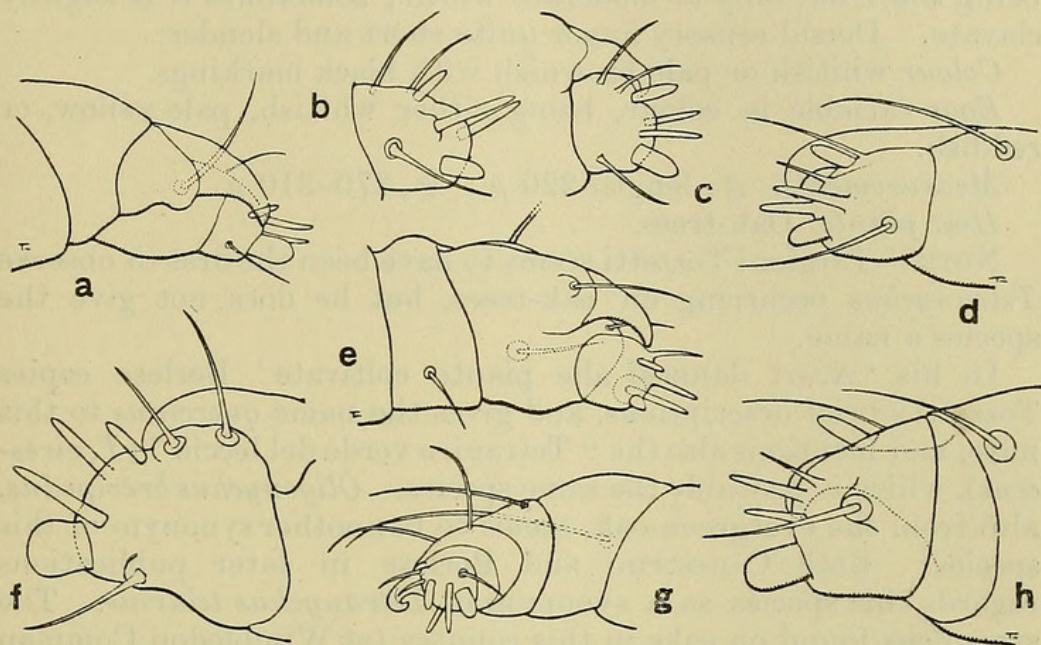
Measurements. ♂, length 260-310 μ ; ♀, 380-470 μ .

Host plants, etc. This species is frequently met with on elms in this country, causing a characteristic discoloration of the leaves. It is obviously the species described by C. L. Koch under the name *ulmi*, as being not uncommon on that tree in Regensburg. His figure is quite good and recognisable, and it is a great pity that the later name *pilosus* has been used instead of his name. The species sometimes attacks roses, especially rambler roses, discolouring the leaves greatly and obviously weakening the plants. Various fruit trees—such as pear-trees, apple-trees, plum-trees, etc.—are also affected by this species, but the damage is usually very slight. It also occurs on the service

* The name *Paratetranychus* has been used by recent authors for this genus, but, as Banks points out (Ent. News Philad. 1917, vol. xxviii. p. 197), it should be replaced by the earlier name *Oligonychus*.

tree, horse-chestnut, copper-beech, Scotch laburnum (Kew Gardens), and American flowering currant. Although usually found in the open, in one case I discovered acacias (*Acacia longifolia* etc.) and a *Sapindus saponaria* under glass infested with numerous specimens of this mite.

Text-figure 5.



a. Terminal part of palp of *Oligonychus quercinus* ♀. b. Ditto of *O. ulmi* ♂. c. Ditto of *O. simplex* ♂. d. Ditto of *O. ununguis* ♂. e. Ditto of *O. quercinus* ♂. f. Ditto of *O. ulmi* ♀. g. Ditto of *O. simplex* ♀. h. Ditto of *O. ununguis* ♀.

2. OLIGONYCHUS UNUNGUIS Jacobi, 1905.

♂. *Penis* very strongly curved, being very like that of *O. ulmi* in shape.

Palp. Terminal finger small, but much longer than wide; it is shorter than the dorsal sensory finger.

♀. *Palp*. Terminal finger very like that of *O. ulmi*, being short but not so wide and almost truncate when viewed laterally, whereas in *O. ulmi* it is somewhat narrowed or compressed near the base, the distal half being wider, so that it is knob-shaped.

Colour. This species is deeply pigmented, the abdomen being blackish, but there is usually a pale brownish central streak posteriorly; cephalothorax ochraceous or red; legs ochraceous.

Measurements. ♂, length 260 μ ; ♀, 370 μ .

Host plant. *Pinus sylvestris*; Oxshott, Surrey.

3. OLIGONYCHUS QUERCINUS Berlese?, 1886.

Tetranychus quercinus Berlese, *Acari dann. piant. coltiv.*, Padua, 1886, p. 23.

T. telarius Berlese, *Acari etc. in Ital. reperta*, Ordo Prostigmata, p. 58.

? *Tetranychus yothersi* McGregor, Ann. Soc. Ent. Amer. 1914, vii. pp. 355-357, pl. xliii. figs. 1-8.

♂. *Penis* very like that of *O. simplex* Banks (from date-palms), being small and curved at the end.

Palp. Terminal finger absent or very minute and inconspicuous. Dorsal sensory finger short and very slender.

♀. *Palp.* Terminal finger not nearly so wide as in *O. ulmi*, being short but only of moderate width; sometimes it is slightly clavate. Dorsal sensory finger quite short and slender.

Colour whitish or pale brownish with black markings.

Eggs variable in colour, being either whitish, pale yellow, or reddish.

Measurements. ♂, length 220 μ ; ♀, 270-310 μ .

Host plants. Oak-trees.

NOTE.—Targioni Tozzetti seems to have been the first to observe *Tetranychus* occurring on oak-trees, but he does not give the species a name.

In his 'Acari dannosi alle piante coltivate' Berlese copies Tozzetti's brief descriptions, and gives the name *quercinus* to this mite, and mentions also the "Tetranico verde del leccio" (*T. virescens*), which is probably the same species. *Oligonychus brevipodus*, also from the evergreen-oak, seems to be another synonym of this species. Both Canestrini and Berlese in later publications regards this species as a synonym of *Tetranychus telarius*. The specimens found on oaks in this country (at Wimbledon Common and Kew) belong, however, to the very distinct species of *Paratetranychus* (= *Oligonychus*) described above, which is easily recognised by the structure of the palp.

I take the opportunity to include the diagnosis of a species of *Oligonychus* from date-palms in Mesopotamia:—

4. OLIGONYCHUS SIMPLEX Banks?, 1914.

? *Tetranychus simplex* Banks, J. Ent. Zool. Claremont, Cal. 1914, vi. p. 57.

♂. *Penis*. Chitinsed part of penis very short, and it terminates as a very minute curved hook.

Palp. Terminal finger very like that present in *O. ulmi*, being rather short, but it is slightly blunter. Dorsal sensory finger spindle-shaped, being rather short and slender. Spine on upper surface of palp borne on a distinct angular projection.

♀. *Palp.* Terminal finger more slender than in *O. ulmi*, but still it is fairly stout. Dorsal sensory finger fairly long.

Measurements. ♂, length 275-290 μ ; ♀, 280-385 μ .

Host plant. Date-palm, Basra, Mesopotamia; numerous specimens collected by Capt. P. A. Buxton.



1920. "Revision of the English species of Red Spider (genera Tetranychus and Oligonychus)." *Proceedings of the Zoological Society of London* 1920, 49–60.
<https://doi.org/10.1111/j.1469-7998.1920.tb07633.x>.

View This Item Online: <https://www.biodiversitylibrary.org/item/97660>

DOI: <https://doi.org/10.1111/j.1469-7998.1920.tb07633.x>

Permalink: <https://www.biodiversitylibrary.org/partpdf/69862>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.