

**IMPORTANCE OF SOME TAXONOMIC CHARACTERS IN THE FAMILY
PHYTOSEIIDAE BERL., 1916, (PREDATORY MITES) WITH NEW
RECORDS AND DESCRIPTIONS OF SPECIES**

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ABSTRACT

The paper deals with the importance of some characters, the number, the arrangement, the nature, the position and the relative length of setae together with some anatomical characters in the taxonomy of mites.

Notes on six species of mites belonging to family Phytoseiidae not recorded in the Indian Union before have been given. Three new species of predatory mites belonging to the family Phytoseiidae have also been described.

For more than five decades, many species of the family Phytoseiidae have attracted the attention of economic entomologists all over the world for the biological control of Phytophagous mites infesting agricultural and horticultural crops. It must, however, be emphasized that this early interest was purely of an academic nature. Only within recent years, these beneficial mites have attracted the attention of entomologists all over the world. In the main, the reason for this has been the destruction of predatory species that maintained the population of phytophagous mites in a condition of equilibrium by the widespread use of organic insecticides especially, chlorinated hydrocarbons, over very large areas of agricultural tracts. As Thompson (1930) observes, "Since organisms increase in geometrical progression, the survival in each generation of even two or three females above the number necessary to maintain the population at an even level, may produce in a relatively short time disastrous results." So in this context, the role of predatory mites assumes particular significance.

With the recognition by economic entomologists of the importance of these predaceous species in the population balance in nature, the taxonomy of this family has received considerable attention and has been critically discussed and studied in a number of recent contributions and no where more ably than by Nesbitt (1951) in his excellent review of the European species, including the many previously described by Oudemans (1929). The basis of specific separation adopted by him was based on that devised by Garman (1948) and this has since been widely used and referred to by other workers in America and England. It is mainly concerned with the setation of the dorsal and ventral surfaces.

As the first reviewer of the group, Nesbitt (1951) had to exercise a certain amount of choice in the fixing of genotypes and hence genera. Great care was taken because he realised that in doing so he was "adopting a somewhat arbitrary taxonomic position". As he himself observes, "It is my belief, however, that the exigencies of the situation warranted such an action and that is preferable to maintain taxonomic names, which in the past have expressed a true biological relationship than to discard them, because the type specimens on which they are based are no longer available".

For a long time, the taxonomy of the species of Phytoseiinae remained in a state of confusion, as very few older type specimens were available for study and the characters on which the descriptions were based were so insufficient and vague that it was impossible to come to any definite conclusion based on proper identification.

Classification in Acarina is chiefly based upon the chaetotaxy and the number and position of stigmatal openings. The family Phytoseiidae can be readily separated from all other families of Mesostigmata in having less than twenty pairs of setae on the dorsal shield in the proto-, deuto-nymphal and adult stages. The genera comprising this family are separated by the chaetotaxy of the dorsal shield. But here again some confusion has arisen as various workers (Nesbitt 1951, Womersly, Evans, Bernhard and Chant) have taken different aspects of setal characters into consideration and we have yet to decide which one is more rational and reliable and least open to errors of observation and misinterpretation, namely, number, arrangement, nature, position or relative length.

Now we shall take up these characters one by one and discuss their importance in the classification of Phytoseiinae.

1. Number of setae

Number of setae is a character, which helps not only to determine a particular species but also its genus and family. The gross number determines the family when we say that Phytoseiids are characterized by having less than 20 pairs of setae on the dorsal shield; with not more than 18 pairs of dorsal setae in the genus *Typhlodromus* Sch. and likewise some number is fixed for other genera too. But again, the number may vary within the genus and this helps us in determining a species. Thus we see that this character need not be necessarily fixed but may vary within certain limits. This variation within limits should be allowed and it is unwise to have restriction as to its being very specific. We have observed during the course of our studies that the number of setae on the female ventri-anal plate may vary within a species but the sum-total of all that are present on and surrounding the shield always remains constant. This is what we have seen in the case of *Phytoseius macropilis* (Banks) and *Phytoseius minutus* sp.n. Chant (1957) observed this variation in the progeny of a single female and thus ascribed it to intraspecific variation.

2. Arrangement of setae

The arrangement of setae on the dorsal shield is an important character. The number of rows of setae i.e., lateral, dorsal and median, on the dorsum is fixed within the family and thus is of great familial value.

3. Nature of setae

This is a character of generic value only. Setae may be simple or slightly serrated as in *Typhlodromus* or distinctly serrated and thickened as in *Phytoseius* or thick and thorn-like as in *Seiulus*.

4. Position of setae

Position of setae is of generic as well as of specific value. The scapular seta (S_1) is on the dorsal shield in both the adult forms of *Phytoseius* Ribaga, whereas it is on the interscutal membrane in the females of *Typhlodromus* Sch. Thus the two genera can be readily separated on the basis of the position of S_1 .

The position of M_1 with respect to L_7 and L_8 and the position of the setae on the ventri-anal plate may vary within a genus and thus help in an easy determination of a species.

5. Relative length of setae

This is a character of only specific value. It is a relative term and should not be relied upon for any generic or subgeneric determinations, as some workers have done it. The various genera comprising Phytoseiinae can be separated on

the basis of nature, position and number of the dorsal setae regardless of their relative lengths. In *Amblyseius* as described by Berlese (1914), L_4 , L_9 and M_2 are longer than other dorsal setae, whereas in *Typhlodromus* as defined by Nesbitt (1951) they are not. However, in *Typhlodromus* all dorsal setae may be of extreme length, as in *T. longipilus* Nesbitt and *T. occidentalis* Nesb., and this clearly shows that length is not a character of generic value but is the most valid criteria for specific determinations.

6. Some anatomical and other minor characters

There are some anatomical and other minor characters which may help in an easy determination of a species. These are the shape of spermatophoral process in males, shape of coxal glands, number of macrosetae on leg IV and the number of dorsal pores. Out of these, the shape of "coxal glands" alone may afford a good difference between the two closely allied species. This is what has been observed in the case of *T. (A.) marinus* (Willman) and *T. (A.) delhiensis* sp. nov. (Narayanan and Kaur, 1960). These two species are very closely related except for the shape of their "coxal glands" which clearly separate the two. Unfortunately, this character has not been given the importance it deserves and there is almost no mention of this interesting structure in most of the older descriptions. These structures, though internal, can be clearly seen when properly cleared and mounted. In our opinion, these characters should be thoroughly examined so as to bring out the morphological differences between the closely related species.

The recent publication of Chant (1958) deserves special mention as he has brought in his study a wider sweep of taxonomic characters based on the morphological studies of immature stages. This will lead to a most satisfactory, rational and natural system of classification. As Evans (1955) states, "Our present conception of familial and generic divisions is, however, most unsatisfactory, but investigations on the developmental stages may result in a more natural classification than at present in use."

The basis for all applied research is the taxonomy of the group concerned, even as the basis of the successful introduction and establishment of a parasite or predator, to control a particular pest is a thorough knowledge of the biology and ecology of the species.

Practically no work has been carried out so far in India on the taxonomy of this interesting group of predatory mites. In this paper some new records and descriptions of species belonging to Phytoseiidae and Cheyletidae are given. The species now recorded are refigured from Indian material.

Family Phytoseiidae

Genus *Phytoseius* Ribaga

Phytoseius macropilis (Banks, 1909) Type species

(Text-fig. 1, Fig. 2a-d)

Nesbitt, 1951, *Zool. Verh. Leiden* 12.

Cunliffe and Baker, 1953, *Pinellas Biol. Lab. Pub.*, I.

Womersley, 1954, *Aust. J. Zool.*, Vol. 2.

Chant, 1958, *J. Linn. Soc. Lond. Zool.*, XLIII (294).

Chant, 1959, *Canad. Ent. Supplement* 12, XCI, 5-165.

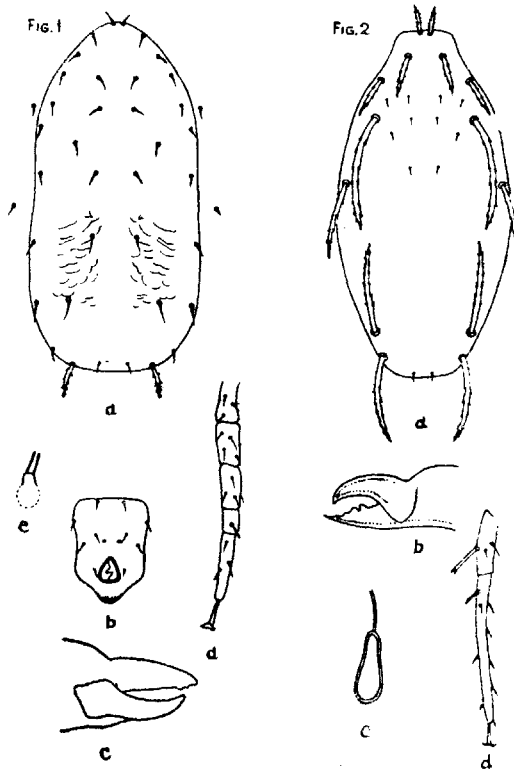
Host:—Tetranychid mites

Host plants:—Leaves of Fig, Mulberry, Compositae (unidentified) and *Lantana camara*.

Loc:—New Delhi.

Coll:—R. B. Kaur.

This is a very common species found almost all through the year on one or the other above mentioned host plants. It is very wide in its distribution and has been recorded from almost all the European countries as a predator of Tetranychidae and Eriophyidae on leaves of Salix, fig and grapevine.



TEXT-FIG. 1.

Fig. 1. *Typhlodromus (Typhlodromus) bakeri* (a) Adult female (dorsal view, 6.3x40x); (b) Ventri-anal plate Female (6.3x40x); (c) Chelicera female (10x100x); (d) IV leg (6.3x40x); (e) Coxal gland (10x100x).

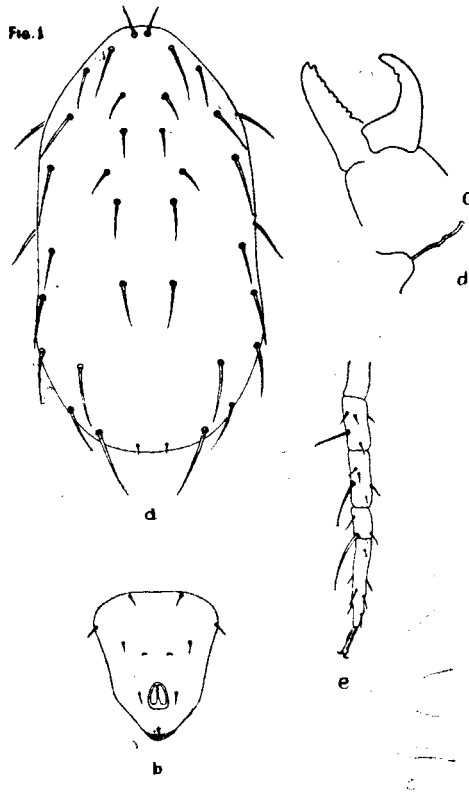
Fig. 2. *Phytoseius macropilis* (a) Adult female (dorsal view, 6.3x40x); (b) Chelicera female (10x100x); (c) Coxal gland (10x100x); (d) leg (6.3x40x).

As to its identification, a careful examination reveals that there are only two macrosetae on leg IV, on tibia and basitarsus. Of these two, the tibial is longer and blunt (Text-fig. 1, Fig. 2d). Chant (1957) while comparing this species with *P. plumifer*, mentions that there are three macrosetae on leg IV. Nesbitt (1951) shows three in his drawing of the female and two in the male, whereas we have observed only two in both the sexes. Hence, we feel that this may also be an intraspecific character like the number of setae on the ventri-anal plate of female.

Typhlodromus (Amblyseius) fallacis (Garman)
(Text-fig 2, Fig. 1a-c)

Garman, 1948, *Connecticut Agric. Expt. Sta. Bull.*, 520 : 13.
Nesbitt, 1951, *Zool. Verh. Leiden*, 12.

Gunliffe and Baker, 1952, *Pinellas Biol. Lab. Pub. No. 1:3*.
Womersely, 1954, *Aust. J. Zool.*, Vol. 2, (174).



TEXT-FIG. 2.

Fig. 1. *Typhlodromus (Amblyseius) fallacis* (a) Adult female (dorsal view, 6.3x×40x). (b) Ventri-anal plate female (6.3x×40x); (c) Chelicera female (10x×100x); (d) Coxal gland (10x×100x); (e) IV leg (6.3x×40x).

Collected by means of Berlese funnel from seeds of "Sowank" (*Echinichloa-Crusgalli*).

Loc:—Karnal.

Coll:—Roshan Lal, 4-9-1959.

This species has been recorded in N.S.W. from "Thrips infested banana"; in Connecticut, U.S.A., from apple leaves and in Canada from a number of orchard trees as feeding on Tetranychids.

Typhlodromus (Amblyseius) ovalis Evans
(Text-fig. 3, Fig. 1a-f)

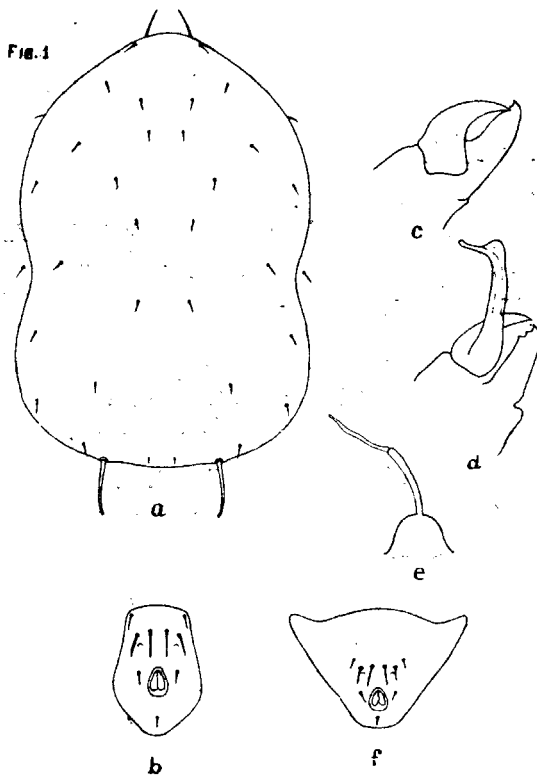
Evans, 1953, *Ann. Mag. Nat. Hist.* (12), VI, 449.

This species has so far been recorded only from Malaya as feeding on Tetranychids on rubber at Kuala. In our country, it appears to be a common species

and has been collected from the leaves of *Ficus* sp., *Terminalia arjuna* (both infested with Tetranychid mites) and Banana in Bombay and from an unidentified plant in Mysore.

Loc :—Aarey Milk Colony, Bombay.

Coll :—R. B. Kaur, 5-12-1959.



TEXT-FIG. 3.

Fig. 1. *Typhlodromus (Amblyseius) ovalis* (a) Adult female (dorsal view, 6.3x×40x); (b) Ventri-anal plate female (6.3x×40x); (c) Chelicera female (10x×100x); (d) Chelicera male (10x×100x); (e) Coxal gland (10x×100x); (f) Ventri-anal plate male (6.3x×40x).

Typhlodromus (Amblyseius) asiaticus Evans

Evans, 1953, *Ann. Mag. Nat. Hist* (12), VI.

On leaves of arecanut seedlings, Mysore.

This species has so far been recorded only from Malaya and Indonesia from some unidentified leaves.

Typhlodromus (Typhlodromus) bakeri (Garman)
(Text-fig. 1, Fig. 1a-e)

Garman, 1948, *Bull. Conn. Agric. Exp. Sta.*, 520 : 15.

Nesbitt, 1951, *Zool. Verh. Leiden*, 12 : 36.

Cunliffe & Baker, 1953, *Panellas Biol. Lab. Pub.* 1 : 10.

Womersely, 1954, *Aust. J. Zool.* 2 (169-191).

Chant, 1956, *Canad. Ent.* 87 (496-503).

Chant, 1958, *J. Linn. Soc. Lond. Zool.* XLIII, No. 295 (599-643).

Female: Dorsum rugose of .273 mm. in length and 0.15 mm. in breadth bearing 18 pairs of setae, in 10 in the lateral, 6 in the dorsal and 2 in the median rows. Posterior lateral setae distinctly and M_2 slightly serrated. Ventrianal shield with 4 pairs of pre-anal setae and without any creases or folds encircling the anus as has been mentioned in all the previous descriptions. Fixed digit of chelicera with 5 teeth and pilus dentilis and movable with 3 minute teeth. Leg IV with only one short and blunt macroseta on basitarsus. Peritreme almost meeting medially anteriorly.

On leaves of Grapevine.

Loc:—I.A.R.I., New Delhi.

Coll:—R. B. Kaur, 25-8-1959.

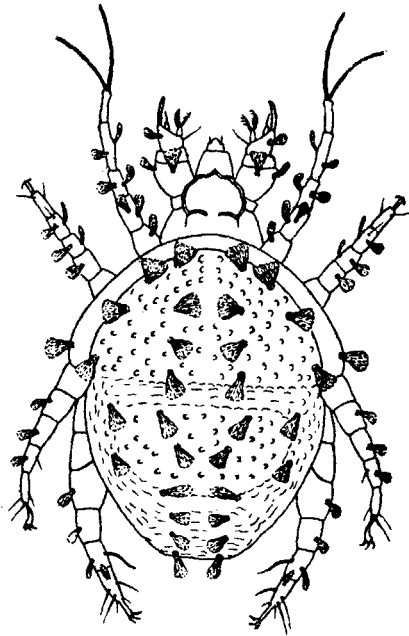
The species has been collected from apple bark in U.S.A. and Canada from "Twigs of Peach bearing eggs and Green Peach Aphis" and from "Pear twigs", N.S.W. In England it has been recorded by Chant from the bark of a number of orchard trees in Kent and Essex.

Family Cheyletidae
Genus *Cheletogenes* Oudemans
Cheletogenes ornatus (Can. & Fan.)

Oudemans, 1905, *Ent. Ber. Nederl. Ver.*, Vol. I (21), p. 208.

Womersley, 1942, *Trans. Roy. Soc. South Aust.*, Vol. 66(1): 85.

FIG. 1



TEXT-FIG. 4.

Cheletogenes ornatus (a) Adult female (dorsal view, 6.3x × 40x).

Baker, 1949, *Proc. U. S. Nat. Mus.*, Vol. 99, No. 3238, pp. 268-320.

Host :—Tetranychid mites.

Host Plant :—Leaves of fig.

Habitat :—New Delhi.

Coll :—R. B. Kaur, 10-7-1959.

It is a small, yellow species with squamiform serrate dorsal, formal and genual setae (Text-fig. 4).

During the rainy season i.e., in the months of July and August, it is commonly found on the leaves of fig. It has been recorded from California in lemon buds with *Aceria sheldoni* (Ewing). It has also been recorded from Italy, China, Hawaiian Islands, West Indies and Australia, associated with scale insects or with eriophid mites on which it preys.

Phytoseius minutus sp. nov.
(Text-fig. 5, Fig. a-h)

Female : Length 0.26 mm.; breadth 0.14 mm.; dorsum rugose, shield single with 16 pairs of setae (including S_1 , which is associated with L_4 and L_5), arranged in a lateral row of seven, a dorsal of six and a median of two pairs (Text-fig. 5, Fig. 1a). S_1 on the dorsal shield, S_2 present. All lateral setae (except L_2 and L_4), D_1 , S_1 and M_2 thickened and distinctly serrated; and all dorsal setae (except D_1) M_1 , S_2 , L_2 and L_4 short and smooth. The relative length of these setae is as below :

(L_1-L_7) 19 : 4 : 15 : 4 : 28 : 25 : 22 : (D_1-D_6) 8 : 15 : 1 : 1 : 1.5 : 1.5
 (M_1-M_2) 1 : 21 : (S_1-S_2) 14 : 4.

There are four pairs of dorsal pores as shown in Text-fig. 5, Fig. 1a, of which the 2nd pair is well-developed and covers the setae M_1 almost completely.

Peritrema with its stigmata, opening between coxae III and IV and anteriorly extending on to dorsum and almost meeting in the mid-line.

Ventrally, body covered by the usual shields. Ventri-anal plate longer than broad, 0.085 mm. in length and 0.065 mm. in width; shaped as in figure (Text-fig. 5, Fig. 1b), with 3 pairs of setae in addition to para-and post-anals. Parapodal plates absent.

Gnathosoma and maxillary palps normal for the group. Fixed digit of chelicera with two prominent and well separated teeth; movable digit with one weak tooth (Text-fig. 5, Fig. 1c).

Coxal glands as figured (8). (Text-fig. 5, Fig. 1d).

Leg IV with three macrosetae, on genu, tibia and basitarsus. Setae blunt (Text-fig. 5, Fig. 1e).

Male : Length .12 mm., width .12 mm. Dorsal chaetotaxy resembling that of female, relative lengths of the dorsal setae are the same, though they are smaller comparatively (Text-fig. 5, Fig. 1f).

Ventri-anal shield with three pairs of setae in addition to para and post-anals, arranged as in *P. macropilis* (Banks) (Text-fig. 5, Fig. 1g).

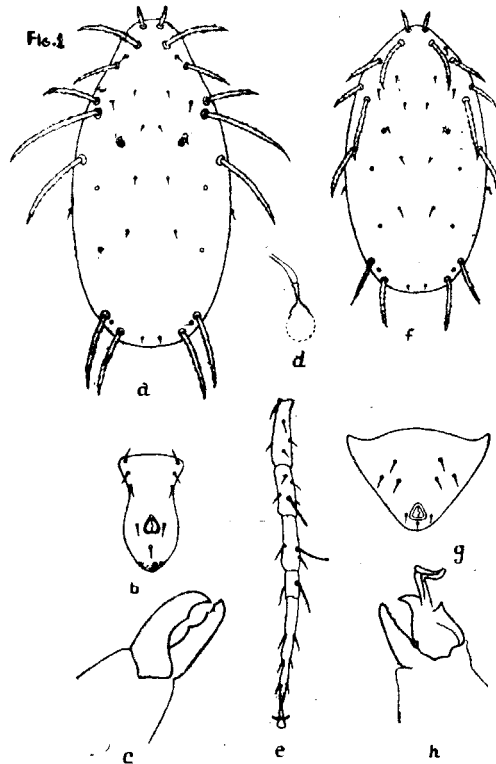
Fixed digit of chelicera with three teeth; movable digit with one tooth and a hammer-shaped spermatophoral process. (Text-fig. 5, Fig. 1h).

This species may be distinguished from *P. plumifer* by the presence of three macrosetae on leg IV and by the absence of para-podal plates. It is also very close to *P. nahuatlensis* DeLeon from which it differs in the relative length of setae on the dorsal shield.

Described from 7 females and 5 males, collected from Tetranychid infested leaves of *Hibiscus esculentus* H. at Indian Agricultural Research Institute, New Delhi.

Holo-, allo- and para-types deposited in National Pusa Collection, I.A.R.I., New Delhi.

Coll.:—R. B. Kaur, 7th March, 1959.



TEXT-FIG. 5.

Fig. 1. *Phytoseius minutus* sp. nov. (a) Adult female (dorsal view, 6.3x40x); (b) Ventriana¹ plate female (6.3x40x); (c) Chelicera female (10x100x); (d) Coxal gland (10x100x) (e) IV leg (6.3x40x); (f) adult male (dorsal view, 6.3x40x); (g) Ventri-anal plate male (6.3x40x); (h) Chelicera male (10x100x).

Typhlodromus (Typhlodromus) confusus, new species
(Text-fig. 6, Fig. 1a-d)

Female: Dorsal shield faintly reticulated, .273 mm. in length and .15 mm. in breadth; with 17 pairs of setae, nine in the lateral, six in the dorsal and two in the median rows. (Text-fig. 6, Fig. 1a). All setae smooth except M_2 and L_9 which are slightly serrated. Relative length of the setae as follows:

(L_1-L_9) 7 : 5 : 7 : 8 : 9 : 12 : 13 : 13 : 13 : (D_1-D_6) 5 : 5 : 5 : 8 : 10 : 2,

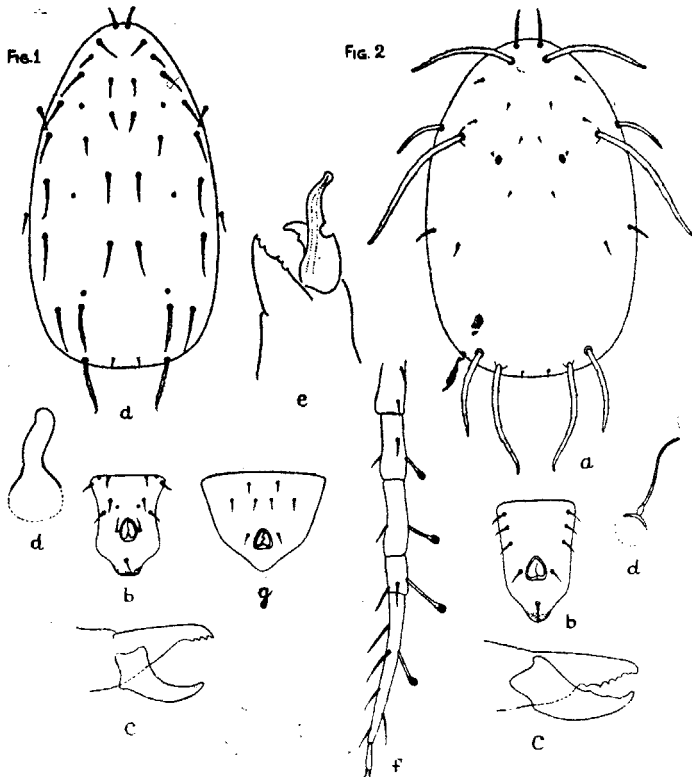
(M_1-M_2) 5 : 14.

Except D_6 , all other setae in the posterior half of the dorsal shield are comparatively longer than those in the anterior half. Three pairs of pores present on dorsum as shown in Text-fig. 6, Fig. 1a.

Setae S_1 and S_2 on interscutal membrane. Peritreme almost meeting in the mid-line anteriorly. Sternal shield normal. Ventri-anal shield longer than broad.

length .085 mm., breadth .052 mm. with 4 pairs of pre-anal setae and a pair of pores. Parapodal plates present, one pair long and narrow, the other minute.

Coxal glands with thick and short duct (Text-fig. 6, Fig. 1d). Gnathosoma and maxillary palps normal. Movable digit of chelicera toothless, fixed with three minute teeth. Pilus dentilis not seen. Leg IV without any macrosetae.



TEXT-FIG. 6.

Fig. 1. *Typhlodromus (Typhlodromus) confusus* sp. nov. (a) Adult female (dorsal view, 6.3x × 40x); (b) Ventri-anal plate female (6.3x × 40x); (c) Chelicera female (10x × 100x) (d) Coxal gland (10x × 100x).

Fig. 2. *Typhlodromus (Amblyseius) orientalis* sp. nov. (a) Adult female (dorsal view, 6.3x × 40x); (b) Ventri-anal plate female, (6.3x × 40x); (c) Chelicera female (10x × 100x); (d) Coxal gland (10x × 100x); (e) Chelicera male (10x × 100x); (f) IV leg (6.3x × 40x); (g) Ventri-anal plate male (6.3x × 40x).

This species comes closer to *T.(T.) tilae* with which it was confused in the beginning and hence the name *confusus* but differs from it chiefly in the length of setae and dentition of the chelicera.

Male: Unknown.

Described from a single female specimen collected from the leaves of sunflower, Delhi.

Holo-type deposited in the National Pusa Collection, I.A.R.I., New Delhi. Coll.:—R. B. Kaur, 14.7-1959.

Typhlodromus (Amblyseius) orientalis, new species
(Text-fig. 6, Fig. 2s-g)

Female: Dorsal shield .3 mm. in length and .178 mm. in breadth; with thirteen pairs of setae, five in the dorsal, six in the lateral and two in the median rows. (Text-fig. 6, Fig. 2a). S_1 and S_2 on interscutal membrane. Setae L_1 , L_4 , L_6 and D_1 and M_2 thickened and slightly serrated (as in *Phytoseius* Ribaga) and measure .107 mm., .143 mm., .118 mm., .035 mm. and .078 mm. in length respectively. The rest of the setae are simple and minute. A pair of prominent dorsal pores situated in close proximity to setae M_1 as shown in Text-fig. 6, Fig. 2a.

Peritreme with stigmata, opening between coxae III & IV and anteriorly extending on to dorsum beyond coxae I.

Ventri-anal plate longer than broad, shaped as in Text-fig. 6, Fig. 2b with three pairs of setae in addition to para-anals and post-anals.

Gnathosoma and maxillary palps normal. Fixed digit of chelicera with a row of about six teeth and movable with two (Text-fig. 6, Fig. 2c). "Coxal glands" as figured. (Text-fig. 6, Fig. 2d).

Leg IV with four macrosetae, on genu, tibia, basitarsus and tarsus. Setae spatulate (Text-fig. 6, Fig. 2f).

Male: Length .208 mm., breadth .13 mm.; chaetotactic pattern similar to that of female.

Ventri-anal shield with three pairs of setae arranged as in Text-fig. 6, Fig. 2g. Fixed digit of chelicera with 5 teeth, movable with one and spur shaped spermatophoral process (Text-fig. 6, Fig. 2e).

Described from 6 females and 2 males. Collected from leaves of *Ipomea* and cotton.

Loc.:—Chembur, Bombay.

Coll.:—R. B. Kaur, 3-12-1959.

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*Original not seen.

†It refers to the date of issue of separates of this work and is therefore the date of publication of the new genus.