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Research on the mosquitoes of Portugal *(Diptera, Culicidae)*

III — Further five new mosquito records (1)

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In this paper, based on material collected during 1976 and 1977 in central Portugal (provinces of the Beiras) and in the Setúbal area, the writers add five species to the mosquito fauna of the country: *Anopheles (A.) claviger* (Meigen) *sensu stricto, Aedes (O.) berlandi* Séguy, *Culiseta (C.) subochrea* (Schrank), *Culex (C.) mimeticus* Noé and *Culex (C.) torrentium* Martini. With these five new records, the list of Portuguese mosquitoes is assumed to include now 33 distinct taxa. Under each of the species here dealt with, the material examined by the writers and its distribution are given and some taxonomic notes are added. Finally, the medical importance of these five mosquitoes is briefly considered.

Neste trabalho, baseado em material colhido em 1976 e 1977 no Centro de Portugal (províncias das Beiras) e na área de Setúbal, os autores acrescentam cinco espécies à fauna culicideológica do nosso país: *Anopheles (A.) claviger* Meigen *sensu stricto, Aedes (O.) berlandi* Séguy, *Culiseta (C.) subochrea* (Schrank), *Culex (C.) mimeticus* Noé e *Culex (C.) torrentium* Martini. Com estes cinco novos achados, julga-se que a lista dos mosquitos portugueses passa a incluir 33 taxa distintos. Para cada uma das espécies aqui tratadas, indica-se qual o material examinado pelos autores e a sua distribuição, juntando-se algumas notas taxonómicas e bioecológicas. Finalmente, a importância médica destes cinco mosquitos é sucintamente considerada.

1 — *INTRODUCTION*

In the course of the field work carried out by the writers in the province of Beira Baixa during the Summer of 1977, three culicine mosquitoes were found which had not been previously recorded from Portugal. Besides these ones, two other unrecorded species found during 1976 in the Setúbal area (Serra da Arrábida and Águas de Moura — Station) are dealt with in the present paper.

With these new five additions, the list of Portuguese mosquitoes is thought to comprise now 33 names (1).

(1) The two preceding papers of this series appeared in the *An. Inst. Hig. Med. Trop.* (Lisboa).

2 — *THE COLLECTING LOCALITIES*

The approximate coordinates and altitudes of the collecting localities cited in the text are given in the list below. These localities are also marked on map 1.

Localities	Latitude N.	Longitude W.	Altitude (m)
1 — Águas de Moura (village)	38° 35′	8° 41′	25
2 — Águas de Moura (railway station)	38 34	8 44	25
3 — Alvito river (Froia)	39 48	7 41	400
4 — Fajão	40 09	7 57	600
5 — Lisboa	38 41	9 10	50
6 — Nisa	39 30	7 37	200
7 — Penacova	40 15	8 17	200
8 — Ponsul river	39 46	7 27	150
9 — Portoleiros	39 48	7 53	400
10 — Rosmaninhal	39 43	7 05	200
11 — S. Romão (Alva river)	40 24	7 40	1 000
12 — Serra da Arrábida	38 30	9 03	200
13 — Vale do Urso	39 45	7 55	500

3 — *THE NEW MOSQUITO RECORDS*

3.1 — **Anopheles (Anopheles) claviger** (Meigen, 1804), *Klass. Beschr. Eur. Zweifl. Inst.*, **1**, 1804, 4 (as *Culex*).

Anopheles villosus. Rob.-Desvoisy, *Mém. Soc. Hist. nat. Paris*, 3, 1827, 411.
Anopheles grisescens. Stephens, *Zool. J. London*, 3, 1828, 503.
Anopheles turkestani. Shingarev, *Russ. J. trop. Med.*, 2, 1926, 47 (as *algeriensis* var.).
Anopheles amaurus. Martini, *Flieg. Pal. Reg. Cul.*, **1929**, 135.
Anopheles missiroli. Del Vecchio, *Riv. Parasitol.*, **3**, 1939, 34.
Anopheles pollutus. Torres Cañamares, *Eos, Madr.*, **20**, 1945, 233.
Anopheles bifurcatus auctorum.

Type-locality: [Germany], Europe.

Though *An. claviger sensu lato* was recorded from Portugal as early as 1901 by Sarmento & França (2), only relatively recently it was realized that under the name *claviger* we were dealing with a complex of sibling species [Sicart (3); Coluzzi (4); Coluzzi, Sacca & Feliciangeli (5, 6)], namely *An. claviger* (Meigen) *sensu stricto* and *An. petragnanii* Del Vecchio. Though several Portuguese locality records are already known for *An. petragnanii* [Coluzzi *et al.* (6); Ramos *et al.* (7)], the occurence of *An. claviger* (Meigen) *sensu stricto* in our country had not yet been established.

MATERIAL EXAMINED: Serra da Arrábida: about 4 km west of Vila Nogueira de Azeitão, 1 ♀ 1 ♂ *ex larva* plus 1 pupal pelt and 6 whole larvae, 11-IX-1976.

DISTRIBUTION: *An. claviger sensu stricto* is a Western Palaearctic species known to occur from England, Spain and Marocco to Turkey, Palestine and Iran. Sympatric with *An. petragnanii* in the Western Mediterranean Subregion, *An. claviger s. s.* was expected to occur also in Portugal, though it seems to be there a much less common species than is *An. petragnanii* [Ramos *et al.* (7) and unpublished data].

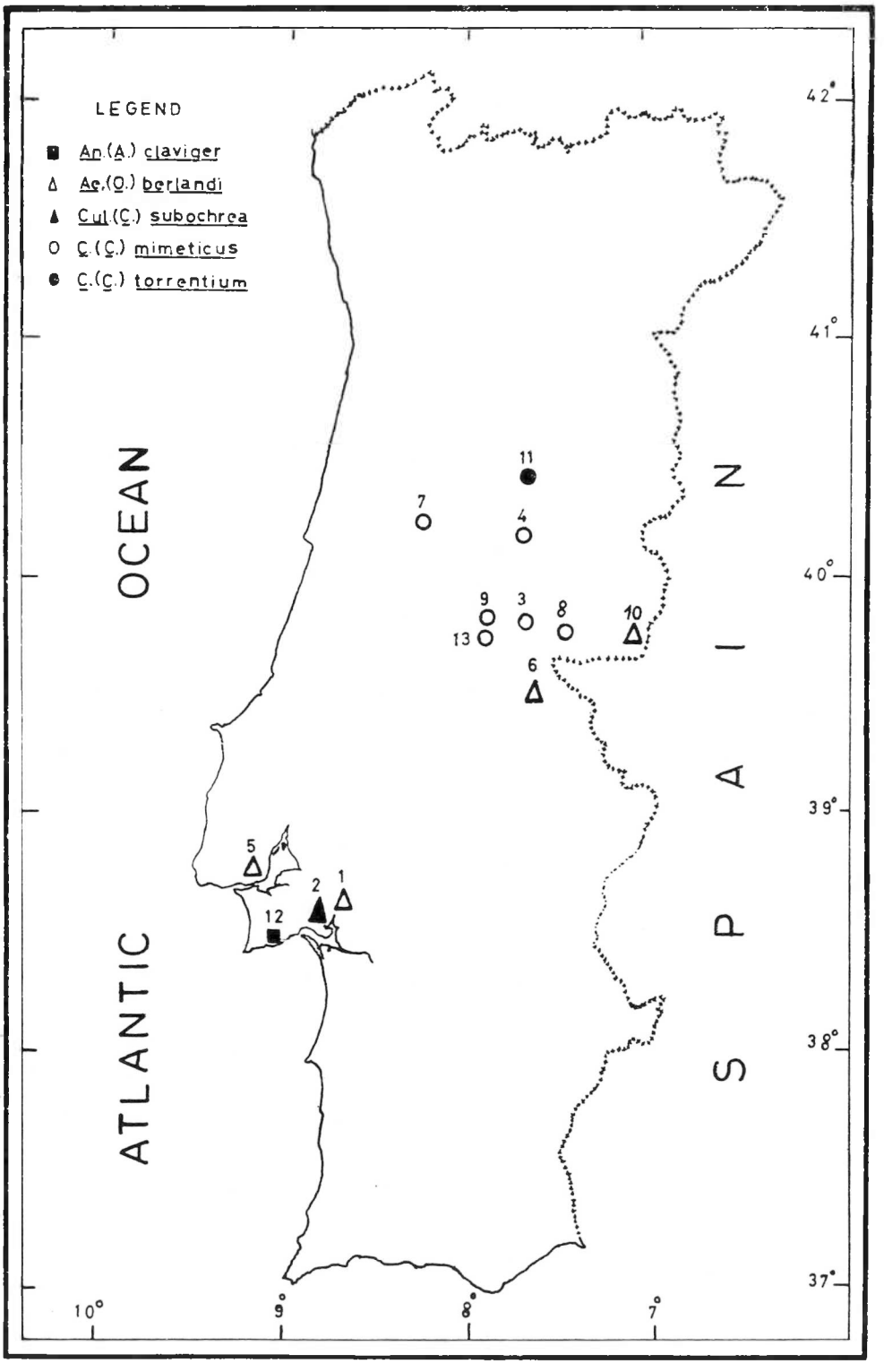
Map 1 shows the only known Portuguese record of *An. claviger s. s.*

TAXONOMIC NOTES: In our six larvae, the figures for the diagnostic characters proposed by Coluzzi, Sacca & Feliciangeli (5, 6) were as follows: postclipeal hairs with 2-5 branches (mean 3.75); palmate hairs on abdominal segment II with 10-15 folioles (mean 12.2); antepalmate setae on abd. segts. IV and V with 3-5 branches (mean 4.1) and, when trifid, with the branches of the same length. In the pupa (plate I, fig. 1), spine A of segment IV is small and weakly sclerotized, similar to the corresponding spine on seg. III [see also Senevet & Andarelli (8); Coluzzi, *op. cit.* and Coluzzi *et al.*, *op. cit.*]. In the male terminalia, the inner (posterior) parabasal spine is single, not duplicated, and the outer (anterior) lobe of harpagone has three pointed spines (not two, as usual).

BIOECOLOGICAL NOTES: Larval *An. claviger* was found among the aquatic vegetation (*Lemna* sp., etc.) of the margins of a small mountain stream strongly shaded by willows and poplars. The breeding water was clean and limpid, with a $pH = 6.5$. Larvae of *An. (A.) atroparvus* Van Thiel, *Culiseta (C.) annulata* (Schrank), *Culex (N.) impudicus* Ficalbi, *C. (C.) p. pipiens* L. and *C. (C.) theileri* Theo. were found breeding in association with those of *claviger* in the same

MAP 1

Known distribution in Portugal of «Anopheles (A.) claviger» (Meigen), «Aedes (O.) berlandi» Séguy, «Culiseta (C.) subochrea» (Schrank), «Culex (C.) mimeticus» Noé and «Culex (C.) torrentium» Martini



biotope. Plate I, fig. 2, shows the now recorded breeding place for the nominal member of the *claviger* complex.

3.2 — **Aedes (Ochlerotatus) berlandi** Séguy, 1921, *Bull. Soc. ent. France,* **1921**, 192.

Aedes praeteritus. Séguy, *Ann. Soc. ent. Fr.*, **92**, 1923, 207.
Aedes heracleensis. Callot, *Bull. Soc. Pat. exot.*, **37**, 1944, 56-59.

Type locality: Paris and Asnières, France.

MATERIAL EXAMINED: Águas de Moura, 4 ♀ 11 ♂ 2 larvae plus 1 pupal pelt, 12-VI-1977; Lisboa, 9 larvae, 1-XII-1976 and 5-III-1977; Nisa, 11 ♀ 9 ♂ 18 larvae plus many pupal pelts (all laboratory-reared *ex ovo*), 3-IX-1976; Rosmaninhal, 1 ♀, 20-VIII-1977.

DISTRIBUTION: *Ae. berlandi* is a Western Mediterranean mosquito known to occur in France, Spain, Corsica, Sardinia, Tunisia, Algeria and Morocco.

TAXONOMIC NOTES: *Ae. berlandi* is the third member of the *pulchritarsis* group of species to be recorded from Portugal after the nominate species, recorded by Braga (9), and *Ae. longitubus*, described by Cambournac (10). Adult specimens of both *Ae. berlandi* and *Ae. longitubus* are distinguishable from those of *Ae. pulchritarsis* Rondani by the presence of more or less extensive areas of dark-brown scales in the mesonotum of the first two mosquitoes. In the larva, the comb of the abdominal segment VIII has a greater mean number of spines in *berlandi* (11) and *longitubus* (10) than in *pulchritarsis*.

On the other hand, the terminalic characters of males are the surest ones for distinguishing between the adults of the otherwise rather variable species *Ae. berlandi* and *Ae. longitubus*. In fact, according to Cambournac (*op. cit.*, p. 75), «[...] the differences in the male hypopygium are decisive. In *A. pulchritarsis* and its var. *berlandi* there is only one differentiated spine on the basal lobe of the side-piece, while in the new form [*A. longitubus*] there are 3 differentiated spines, 2 of them approximately equal and a little shorter than the other», such differentiated spines being described as «[...] 3 distinct spines with recurved tips» (*ibidem*, p. 79). Plate II, fig. 3. illustrates the basal lobe of coxite in two *berlandi* specimens, one of them from Nisa (Upper Alentejo) and the other from Águas de Moura (village at about 20 km east of Setúbal). Other terminalic details in males of the Portuguese population of *Ae. berlandi* are also shown in plate II, fig. 2. In that concerns the external morphology of our adults specimens, the observed variation in the mesonotal markings seems to fall within the limits of the wide variation already known to occur in *Ae. berlandi* (11).

The most important characteristics of the Portuguese larval *berlandi* (25 larvae examined) are as follows: head setae *A, B, C* and *d* with 9-14 (mean 11.5), 5-9 (7.5), 7-12 (9.0) and 9.17 (12.0) branches, respectively; comb of abdominal segment VIII (plate II, fig. 3) with 9-20 (mean 14.8) spines, usually arranged in a triangular patch but sometimes making a single irregular row; each of the comb spines with a prominent, usually sharply pointed central tooth; siphon index 3.5-7.5 (mean 5.6); subventral tuft with 3-5 branches, inserted at a distance from the base equal to 0.28-0.40 (mean 0.34) the total length of siphon; pecten composed of 15-32 (mean 22.5) elements which reach to 0.16-0.30 (mean 0.24) the siphon length; pecten elements subrectangular, mostly weakly sclerotized scales with a very delicate and somewhat variable fringe on the anterior and apical borders (plate II, fig. 3); saddle incomplete, moderately spiculate; saddle hair always single, about 2 or 3 times the length of saddle; upper caudal seta with 3-5 branches, lower one single; 2 or 3 tufts outside the barred area; anal papillae 2-4 times as long as saddle, the ventral pair ⅔-¾ the length of the dorsal pair.

As to the question of the taxonomic status of *longitubus*, this name is treated as a recent synonim of *berlandi* by Rioux (11), as well as by Stone, Knight & Starke (12) in their authoritative *Catalogue*. Though it is, in fact, somewhat surprising that during our survey we have found *Ae. berlandi* and not *Ae. longitubus*, in this paper we are still assuming that *Ae. longitubus* is a full species of its own within the *pulchritarsis* complex.

BIOECOLOGICAL NOTES: Immature specimens of *Ae. berlandi* were found in 3 breeding-sites, all of them tree holes: one in the exotic tree *Sophora japonica* L. and the other two in *Quercus suber* L.

(plate III, figs. 1, 2 and 3). In one instance, *berlandi* larvae were obtained in the laboratory after immersion of detritus from a dry hole in one of the *Quercus* trees. In the other two instances, there were actually larvae breeding in a dark-brown water with a *pH* of 7.0 and 8.5. *Aedes (F.) geniculatus* Olivier (twice), *Orthopodomyia (B.) pulchripalpis* (Rondani) and *Anopheles (A.) plumbeus* Stephens (once each) were the associated mosquito species we found in the breeding-places of *Ae. berlandi.*

The eggs of *Ae. berlandi* seem to remain viable in the dried up tree holes since May until October. After immersion in the tap water of the laboratory, at 22-24°C, the first larvae appeared the following day, the first pupae were seen the 13th day and the first adults emmerged 3 days later.

Several adult specimens of *Ae. berlandi,* both males and unfed, fed and gravid females, were caught resting on the inner walls of tree holes, while in another instance a freshly-fed female was caught in a goat stable. The writers have not seen *Ae. berlandi* attempting to bite man nor resting indoor human habitation.

3.3 — **Culiseta (Culiseta) subochrea** (Edwards, 1921), *in* Wesenberg-Lund, K. Danske. Selsk., *Nat. Math. Afd.,* 8 (7), 1921, 198 (*Theobaldia annulata* var.).

Theobaldia annulata var. *ferruginata.* Martini, *Z. angew. Ent.,* **10**, 1924, 438.
Culiseta (Culiseta) annulata subochrea. Maslov, *Ent. Obozr.,* **43**, 1964, 193-217.

Type locality: Amager, Copenhagen, Denmark.

MATERIAL EXAMINED: Águas de Moura (railway station), 2 larvae plus 1 ♂ and the associated pupal pelt, 26-VI-1976.

DISTRIBUTION: *C. subochrea* is a Western Palaearctic species which occurs all over Europe, in the Near East and in North Africa [Edwards (13); Martini (14); Marshall (15) and Stone *et al.* (12)].

Map 1 shows the only known Portuguese record of *C. subochrea.*

TAXONOMIC NOTES: In his revision of the Palaearctic species of the genus *Culiseta,* Maslov (16) regards *subochrea* as a subspecies of *C. annulata* (Schrank) returning, thus, to the original taxonomic treatment given by Edwards (13) to that taxon. Indeed, this view was adopted by Stone (17). However, as both forms, *annulata* s. str. and *subochrea,* are largely sympatric, we are treating them as two good, distinct species. *Subochrea* adults of both sexes can be separated from those of *C. annulata* by the less distinct wingspots of the former, as well as by the presence of some pale scales scattered both over the 5th wing vein and over the dark areas of the abdominal tergites. Besides, the integument of scutum is brown and the scutal scales are creamy-white in *annulata* while the scutal integument and most of the scutal scales are yellowish in *subochrea.* In the male terminalia, also, the number of spines of the basal lobe of coxite is diagnostic (plate IV, fig. 1). Larvae of both species are very similar. Of our 2 *subochrea* larvae, the distance between head setae *d* was less than that between setae *C* in one of them, while in the other both distances were about the same. Of 20 *annulata* larvae examined from this point of view, distance between *d* was greater than that between *C* in 14 larvae, while both distances were about the same in the other 6 larvae. On the other hand, the length of the subventral tuft of siphon seem to be an useful character for separting larvae of *annulata* from those of *subochrea:* while in the former, this tuft is always about as long as the diameter of the siphon, in our 2 *subochrea* larvae the subventral tuft is distinctly shorter than width of siphon at base. In that concerns pupae, the distinction between both species in this fase is quite easy if the spicules along the border of paddles are examined (plate IV, fig. 2).

BIOECOLOGICAL NOTES: Larval *subochrea* was found in the rice fields along the margin of the Sado river. The breeding water was clean, with a *pH* 5.6 and a salt content of 0.40 g/l (*NaCl*). *Culex pipiens* and *Anopheles atroparvus* were associated mosquito larvae in the same breeding place.

3.4 — **Culex (Culex) mimeticus** Noé, 1899, *Boll. Soc. ent. Ital.,* **31**, 1899, 240.

Aedes pseudomimeticus. Sergent, *Ann. Soc. ent. Fr.,* **78**, 1909, 445.

Type locality: Basilicata Italy.

MATERIAL EXAMINED: Alvito river (Froia, Serra do Muradal), 5 ♀ 2 ♂ plus 2 larvae, 26-

-VIII-1977; Fajão (Serra do Açor), 1 ♀, 2-IX-1977; Penacova (Serra do Buçaco), 4 ♀ 2 ♂ 13 larvae (most in alcohol), 9-IX-1977; Ponsul river (8 km S of Castelo Branco), 2 larvae, 20-VIII-1977; Portoleiros (Serra de Alvelos), 1 ♀ 1 ♂ 12 larvae (most in alcohol), 27-VIII-1977; Vale do Urso (Serra da Gardunha), 2 ♀ 5 larvae, 23-VIII-1977.

DISTRIBUTION: *C. mimeticus* is a relatively uncommon mosquito known to occur along the Southern Palaearctic Region, from Central and Southern Spain to China, across the Middle East and the Tibet. There are also some records from the Oriental Region.

Map 1 shows the now known Portuguese localities for *C. mimeticus*.

TAXONOMIC NOTES: *C. mimeticus* and *C. theileri* are the only two Portuguese species of the genus *Culex* in which the comb of the larval abd. seg. VIII is composed of spines and not of scales. Larvae of both species can be easily separated by the position of the subterminal setae of the antenna, as it was shown by Senevet & Andarelli (18) and others. While in *theileri* these setae are, as usual, adjacent to the terminal ones, in *mimeticus* they arise at ⅓ to ½ the distance between terminal bristles and antennal shaft tuft.

Adults of *C. mimeticus* are quite characteristic, as this is the only Palaearctic *Culex* with pale spots on wing veins. These spots give, in fact, to the *mimeticus* wing a general resemblance to that of one of the sympatric species of the anopheline subgenus *Cellia*. Our adult specimens are quite typical in most respects. However, it is worth to note that the pale rings at base of third tarsal segments 2, 3 and 4 are narrow, much less than ¼ the lenght of the segment, and that there are lateral patches of pale scales on the abdominal tergites. In the wing, the third vein is extensively white-scaled, dark only at the proximal and distal ends.

Plate IV, fig. 3, shows the phallosome of a Portuguese specimen of *C. mimeticus*.

BIOECOLOGICAL NOTES: *C. mimeticus* was recorded from 5 different larval biotopes, all of them associated with small mountain watercourses. In 4 instances, larvae bred among the aquatic vegetation of the shallow margins of mountain streams and torrents, while in the other instance they bred in a pool in the bed of a small drying up stream (plate V, figs. 1 and 2). The breeding-water was always clear, limpid water with a *pH*, measured in four biotopes, ranging from 5.2 to 6.7 (mean 5.7).

Larvae of other eight mosquito species were found as associates of *mimeticus* in the same biotopes: *Anopheles atroparvus* (in all 5 biotopes), *Culex hortensis* (3 times), *An. petragnanii* and *C. theileri* (twice each) and *C. impudicus, C. p. pipiens, C. territans* and *C. univittatus* (once).

With the only exception of one female that was caught resting in human habitation at about 9 a. m., all the other our adult specimens were reared in the laboratory. No *mimeticus* females were seen landing on man or on animals.

The association of *C. mimeticus* with mountainous regions was already emphasized by Edwards (13). According to Senevet & Andarelli (18), in North Africa, this is also the most common species in the Tell mountains, where it breeds in «Torrents de montagne à leur débuché dans la plaine». The approximate altitudes of the six localities here recorded for *C. mimeticus* are as follows: 150 m, 200 m, 400 m, 400 m, 500 m and 600 m.

3.5 — **Culex (Culex) torrentium** Martini, 1924, *Internat. Revue Hydrobiol.*, **12**, 1924, S. 336.

Culex pavlovsky. Shingarev, *Russ. J. trop. Med.*, **6**, 1928, 52.

Type locality: Schwartz river [Thüringia], Germany.

MATERIAL EXAMINED: S. Romão (Serra da Estrela), 8 ♀ 23 ♂ *ex larvae* plus many associated larval and pupal pelts and whole larvae, 1-IX-1977.

DISTRIBUTION: *Culex torrentium* is a species of the European Subregion of the Palaearctic, known to occur in Central and Northern Europe, from the Eastern Pyrenees to Saratov and Tomsk area. The present Portuguese record (map 1) is the sole known one of *C. torrentium* in the Iberian Peninsula. In fact, so far as we know, no Spanish records were yet published for *torrentium*, though this is a largely distributed and

relatively common mosquito in France. This scarcity of the data concerning *C. torrentium* is a particularly unfortunate one, as the knowledge of the distribution of the species in the area will be of much interest in ascertaining the boundaries of the European and the Mediterranean zoogeographical zones within the Peninsula.

TAXONOMIC NOTES: *C. torrentium* can be easily separated from *C. pipiens* by the examination of the male terminalia (plate VI, fig. 1). Separation of these two species on the basis of the adult's external morphology or in the immature stages, however, cannot always be accomplished with confidence.

Differently from the English material examined by Mattingly (19), the presence of scales on the prealar area of our *torrentium* adults is an inconstant one. Extremely variable is also the amount of pale scaling on the male palpi. Finally, in the wing of our 8 *torrentium* females, the ratio of the upper fork cell to its stem ranged from 3.8 to 5.1 (mean 4.6), this range being completely overlapped by that found for *pipiens* in Algarve (7).

In the larvae, both the siphon index and the branching of the saddle hair are useful statistical diagnostic characters, as it was pointed out by Noeldner (20), Callot (21) and others. In 24 larvae of *C. torrentium* examined, the siphon index was higher than in *C. pipiens* s. l., ranging from 5.1 to 7.1 (mean 6.6) and the saddle hair was branched, at least on one side, in about 90 % of the specimens: 1-2 in 18.0 %; 2-2 in 34.6 %; 2-3 in 29.1 % and 3-3 in 8.3 %. In the larvae of the members of the *pipiens* complex, the saddle hair is almost always single on both sides, only occasionally bifid.

Studying males from the Eastern Pyrenees, Sicart (22) found some differences between the appendages of the apical lobe of coxite of his specimens and the descriptions given by Martini and Natvig. In fact, in the males of Sicart there were modified setae *f* and *h*, the first being hooked and the second consisting in a narrow striated foliole. As this condition was also found by Callot (21) and by Doby & Rault (23) in specimens from the Vosges, Jura, Alpes and Central France, it is assumed that such modified setae are also present in the type material from Thüringia, which, according to the assumption, would have not been accurately described by Martini in this particular. Interestingly enough, as it is shown on plate VI, fig. 1, Portuguese specimens have setae *f* and *h* modified much as described and figured by Sicart and, we assume, as it will be found in topotypic specimens. But, if this is so and Portuguese *torrentium* turns to be «typical», than the question arises as to the taxonomic treatment to be given to the specimens from England (Middlesex), in which, according to Senevet & Andarelli (18), seta *h* is not foliolar and *f* is not hooked (2).

BIOECOLOGICAL NOTES: All our larvae of *C. torrentium* were caught at S. Romão, from four rock pools (granite) along the margins of the Alva river, a montain stream with a rocky bed and limpid, running waters. The breeding water in the rock pools positive for *torrentium* (plate VI, fig. 2), however, was always dark brown, with many fallen leaves and a characteristic smell much as in the case of the tree holes positive for larval *Ae. berlandi*. It is worth to note that other rock pools with limpid, clean water were also recorded where mosquito larvae were also breeding, though no larval *torrentium* was found there. These breeding preferences of *C. torrentium* are probably related to the low figure found for the trompet index (seven pupae examined) as defined by Sicart & Ruffie (24): range 3.4--5.1, mean 4.0. Larvae of other five mosquito species were found as associates of *C. torrentium* in its breeding-places: *Anopheles (A.) petragnanii* Del Vecchio, *Culiseta (C) annulata* (Schrank), *Culiseta (All.) longiarealata* (Macquart), *Culex (N.) hortensis* Ficalbi and *C. (C.) univittatus* Theobald.

Mattingly (19) states that «it is not known whether *C. torrentium* bites man; but many members of the *pipiens* group do so», though it seems that it is mainly a zoophilic mosquito.

4 — *RELATION TO DISEASE*

Until it was realized that *An. claviger* (Meigen, 1804) (=*An. bifurcatus* auct.) was a complex of at least two distinct taxa (the nominal species in the strict sense, and *An. petragnanii* Del Vecchio, 1939), the avalaible data on the

(2) Dr. Graham White, of the British Museum (Nat. Hist.), has kindly informed us that German and English specimens of *C. torrentium* in the Museum also have modified coxite appendages *f* and *h*, similar to those found in Portuguese males, and confirmed that the drawings published by Martini and Senevet & Andarelli are, in fact, quite misleading *(in litt.)*.

efficiency of *claviger* as a malaria vector was puzzling and contradictory. In fact, while *An. claviger* sensu lato was shown to be a vector in Mesopotamia (25), Taranto (Southeastern Italy) (26), Cyprus (27) and in other areas of the eastern Mediterranean Subregion (28, 29), it was thought to be of no epidemiological significance in the remainder of its range throughout the Palaearctic Region (5, 15), including Western Italy (30) and Portugal (31).

As the present mosquito survey of our country is being carried out, it becomes quite apparent that in Southern and Central Portugal, at least, *An. claviger* s. stricto is a rare and localized species, while *An. petragnanii,* certainly not a malaria vector, turns to be a relatively common and widespread mosquito all over the surveyed areas. If these data are, generally speaking, in accordance with the views of Cambournac (31) that *An. claviger* (sensu lato) was not a malaria vector in Portugal, it may not be so in those localized areas where *An. claviger* sensu stricto turns to be present or even dominant. As it was pointed out by Gramiccia (28), MacDonald (32) and Coluzzi *et al.* (5), in many areas and under favorable circumstances *claviger* may become either a secondary vector or even to be the sole vector of human plasmodia in the area.

According to Grassi and Noé (*fide* Séguy) (33), *An. claviger* s. l. can be experimentally infected with the dog heart worm, *Dirofilaria immitis.*

The coastal species *Culiseta subochrea* bites both men and domestic animals (11, 15), but it is not known as a carrier of disease.

In that concerns the tree hole breeder *Aedes berlandi,* it has been reported as biting man (33, 34, 35), though it seems also not to be a disease vector.

Culex mimeticus and *C. torrentium* are regarded as zoophilic mosquitoes (11, 18) even though *mimeticus* may bite man occasionally (36). Again, none of these two species is known to be involved in disease transmission.

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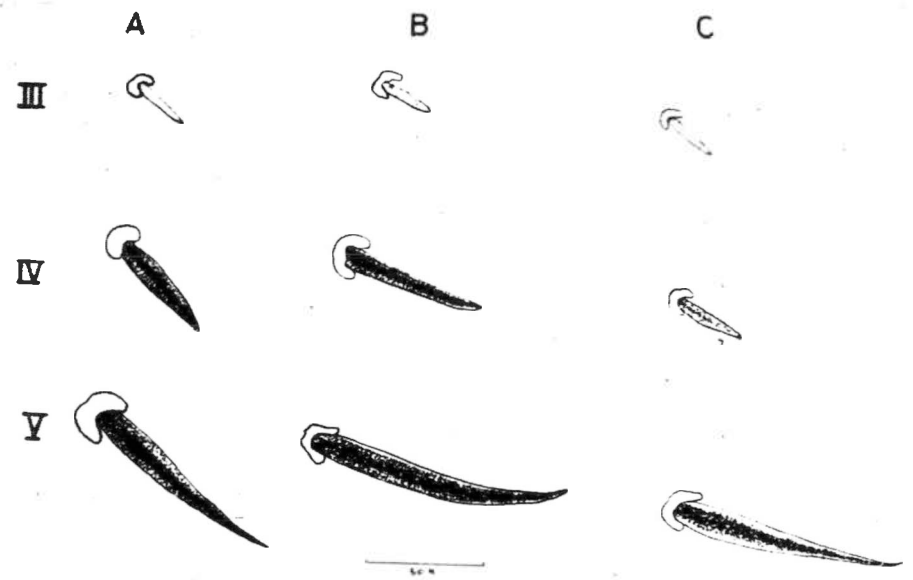

Fig. 1 — Spines of pupal abdominal segments III, IV and V: A, B — *Anopheles (A.) petragnanii* Del Vechio, Serra de Monchique, Algarve; C — *Anopheles (A.) claviger* (Meigen), Serra da Arrábida, Setúbal

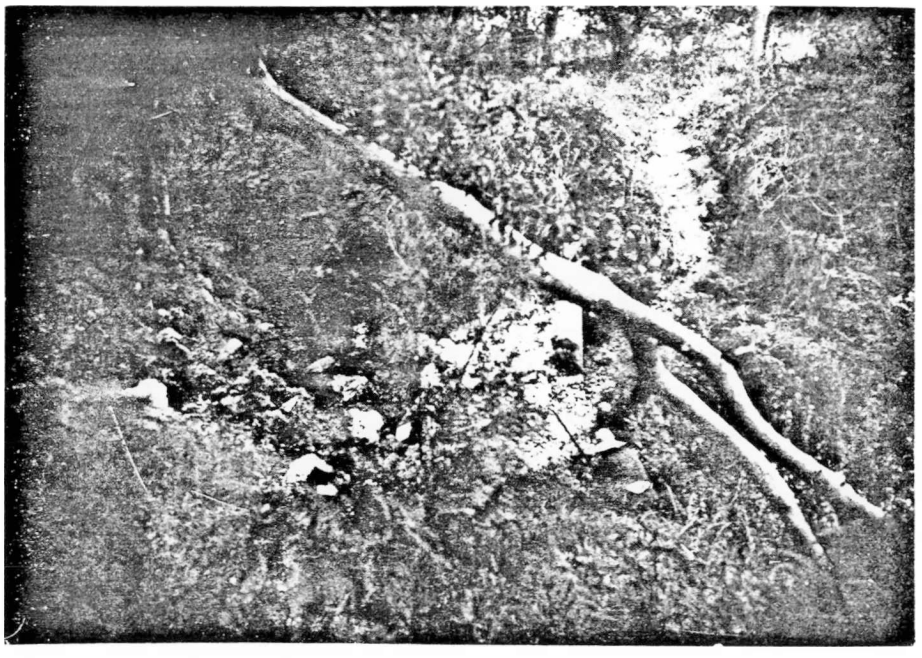

Fig. 2 — Collecting larvae of *Anopheles (A.) claviger* (Meigen) s. str. and other associated mosquito species from a small shaded stream in the Serra da Arrábida

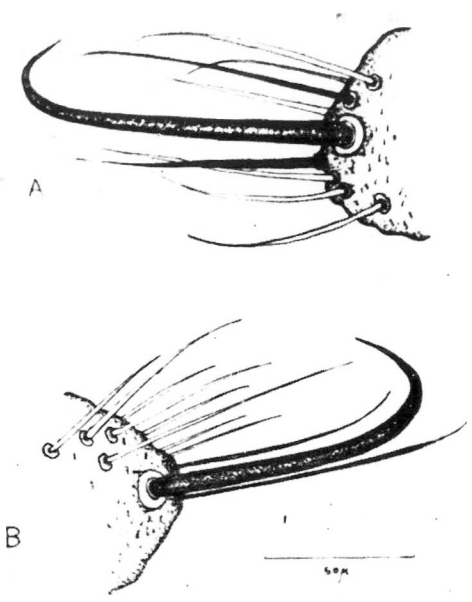

Fig. 1 — *Aedes (O.) berlandi* Séguy, male terminalia: A — basal lobe of coxite, from Nisa; B — basal lobe of coxite, from Águas de Moura

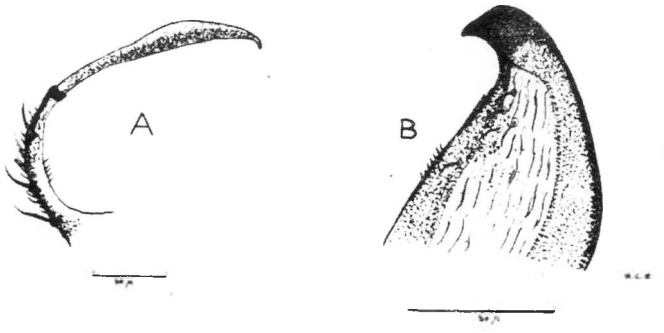

Fig. 2 — *Aedes (O.) berlandi* Séguy, male terminalia, from Nisa: A — claspette; B — paraproct

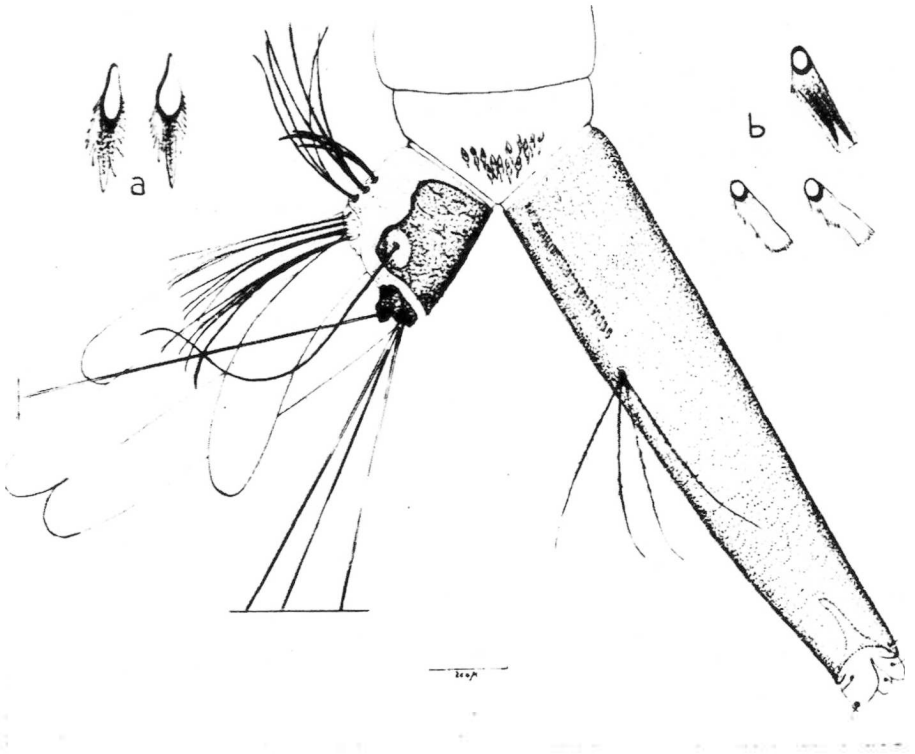

Fig. 3 — Posterior abdominal segments of the fourth instar larva of *Aedes (O.) berlandi* Séguy, from Nisa: a — comb spines; b — pecten scales

Fig. 1 — Collecting larvae of *Aedes (O.) berlandi* Séguy and other associated mosquitos from a hole in the tree *Sophora japonica* L., at Lisbon

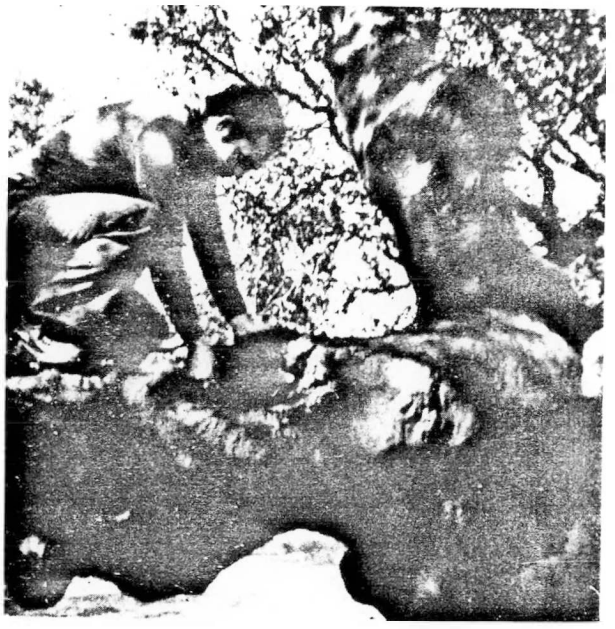

Fig. 2 — Pippeting larvae of *Aedes (O.) berlandi* Séguy from a hole in a branch of a cork-oak (*Quercus suber* L.,) at Águas de Moura

Fig. 3 — General view of a cork-oak grove at Águas de Moura, breeding area of *Aedes (O.) berlandi* Séguy

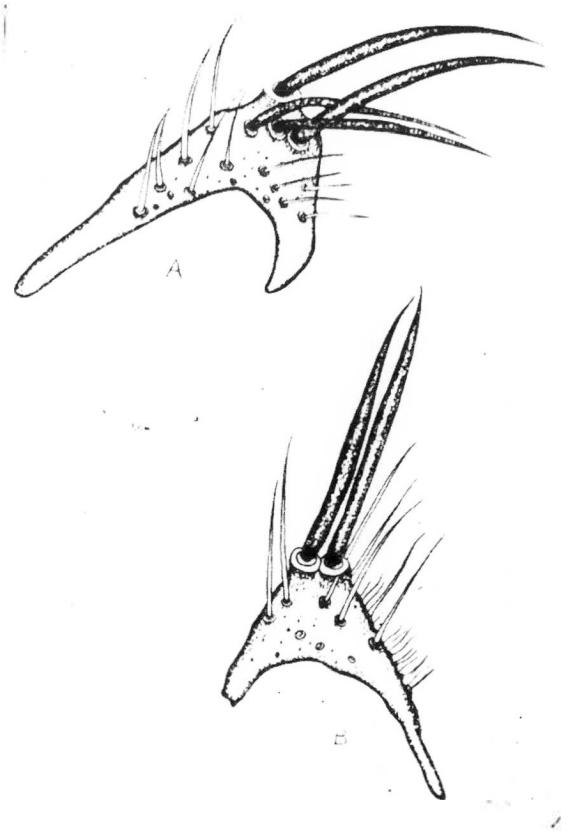

Fig. 1 — Male terminalia, basal lobe of coxite of: A — *Culiseta (C.) subochrea* (Edwards), from Águas de Moura (Railway Station); B — *Culiseta (C.) annulata* (Schrank), from Sintra

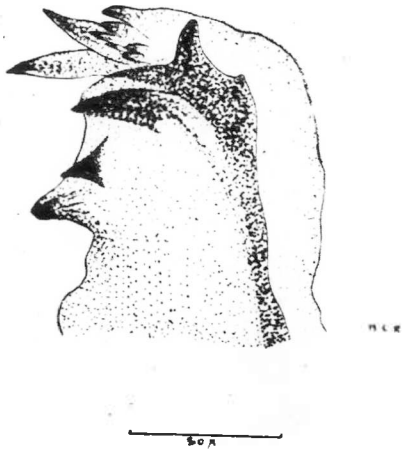

Fig. 3 — *Culex (C.) mimeticus* Noé, phallosome (lateral view), from Alvito river (Froia)

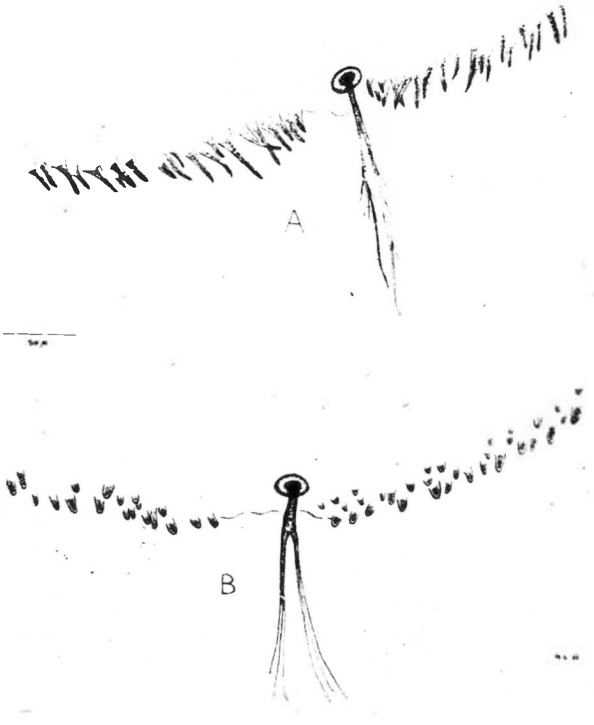

Fig. 2 — Posterior border of pupal paddle in: A — *Culiseta (C.) subochrea* (Edwards), from Águas de Moura (Railway Station); B — *Culiseta (C.) annulata* (Schrank), from Sintra

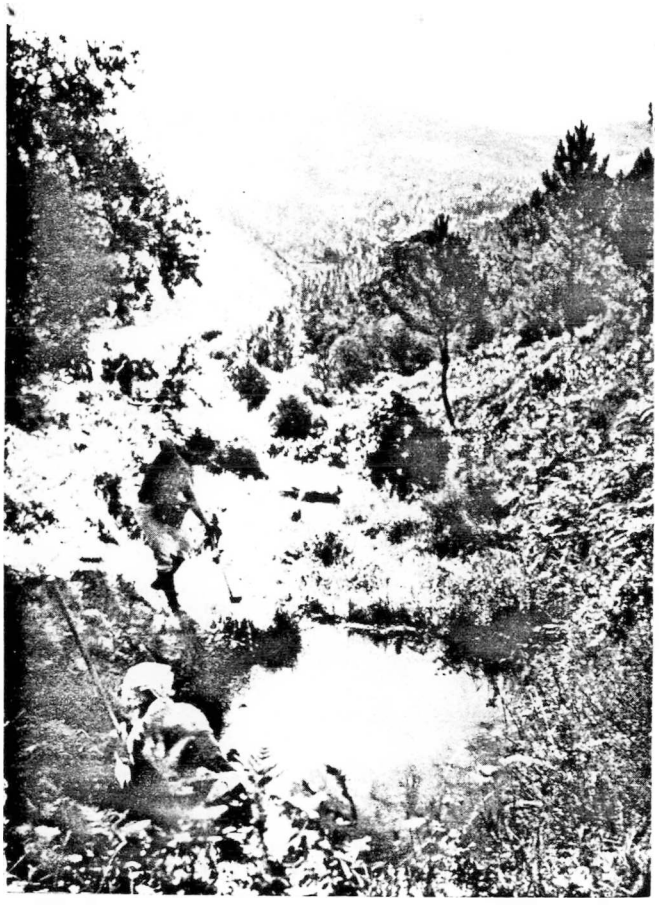

Fig. 1 — Collecting larvae of *Culex (C.) mimeticus* Noé and other associated mosquitoes from a stream at Vale do Urso, in the Serra da Gardunha

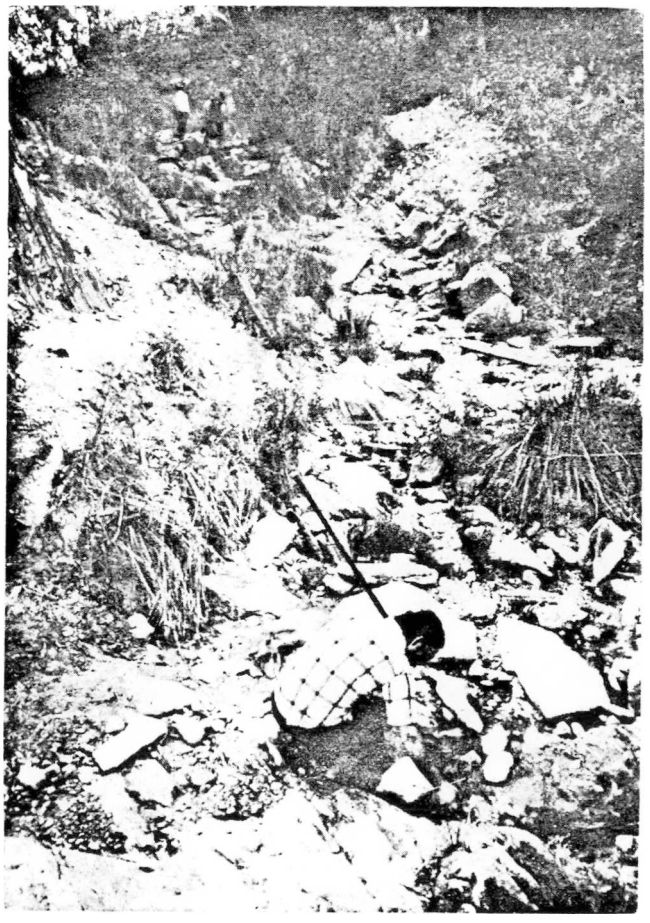

Fig. 2 — Pippeting larvae of *Culex (C.) mimeticus* Noé from a small pool in the margins of Ponsul river

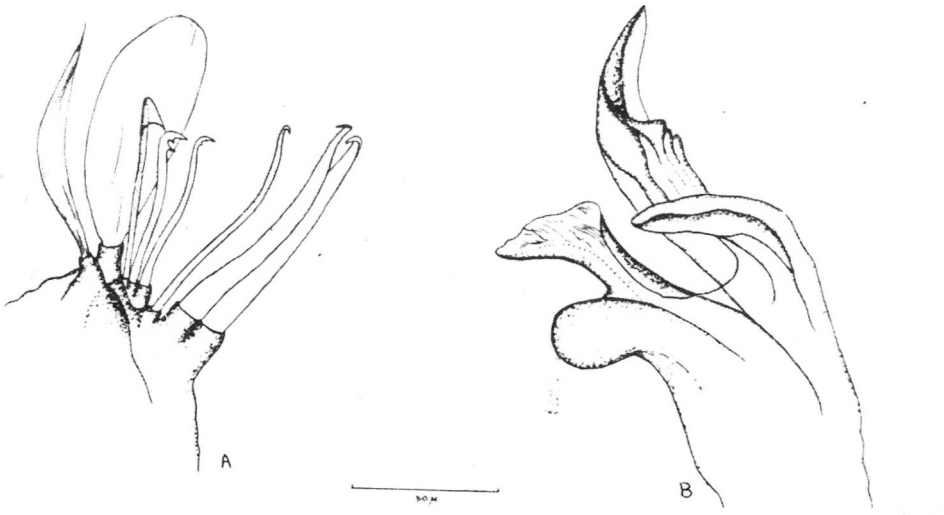

Fig. 1 — *Culex (C.) torrentium* Martini, male terminalia, from S. Romão, at Serra da Estrela: A — apical lobe of coxite; B — phallosome

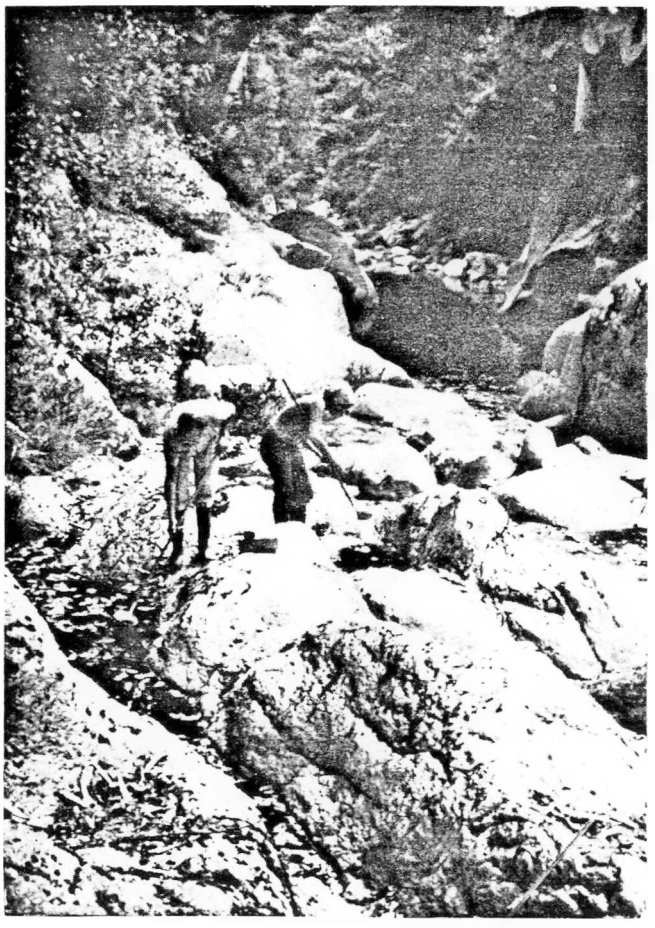

Fig. 2 — Collecting larvae of *C. torrentium* Martini and other associated mosquitoes from rock pools in the margins of the Alva river, at S. Romão (Serra da Estrela)