

Distribution of the genus *Anopheles* in Europe

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Abstract

Maps and distribution data are presented for the eighteen species of *Anopheles* currently recognised in Europe.

Introduction

Eighteen species of *Anopheles* are recognised in Europe: fourteen in the subgenus *Anopheles*, which is found throughout the continent, and four in the subgenus *Cellia*, which has a southerly distribution in Europe. In the past, *Anopheles* distribution in Europe has been the subject of many treatises at country level and has been the subject of reviews, most recently by Dahl & White (1978), White (1978), Stegnii (1991) and Jetten & Takken (1994). The present work aims to extend and update previous reviews by mapping distributions as precisely as is currently possible. To this end, maps have been produced showing the known distribution of all eighteen members of the genus. These are accompanied by details of the locations and the sources of the information, compiled from published records and personal communications. There are no records of any mosquito species from Iceland and there is only one record (*An. maculipennis* s.s.) from Luxembourg (Schaffner, 1999)

Records fall into five categories: 1. villages, towns and cities e.g. Frankfurt am Main, Barcelona; 2. administrative regions, e.g. Essex, Aude; 3. geographic areas e.g. Danube delta, Vardar valley; 4. sections of a country e.g. northern Italy, southern Sweden; 5. countries e.g. Switzerland, Estonia i.e. present in country with no further details.

These maps do not represent snapshots of current distribution as they are compiled from data accumulated over several decades. However they represent the best estimate of the current distribution of these species. It is fully appreciated that with very old records there have certainly been geographic changes since the records were collected and hence there must be doubt as to their current validity. In addition, some old records such as those relating to *An. maculipennis*/ *beklemishevi*, are almost impossible to unravel.

Clearly there is an urgent need for the production of more precise national records to allow European maps to be refined. A major aim of this article is therefore to stimulate further interest in the production of detailed country distribution maps for the whole of Europe. Utrio (1979) produced distribution maps for Finland using a 50km grid system but it is suggested that the more precise 10 km grid system, as used for Britain (Snow *et al.*, 1998) and Poland (Kubica-Biernat, 1999) be adopted.

Information on species distribution is dynamic and continuously changing and hence the authors would be grateful to have omissions and errors communicated to them either personally or through the pages of the *Bulletin*. Once these data have been refined, it is anticipated that they will allow comparisons and correlations to be made between the distribution of individual species and geographic features, and help in assessing the validity of outlying and discontinuous records. They will also permit prediction of the presence of species in countries where they are not currently located and allow monitoring of the effects of predicted climate change on the distribution of mosquitoes and of the human and animal diseases that they transmit.

It is clearly not possible to consider distribution without reference to taxonomy, as sound identification is required to make certain that distributional data is valid. For *Anopheles* there are still a number of concerns and these are highlighted in the sections on individual species. For example, in many countries there is a need to unravel the *Maculipennis* Complex. This is seen particularly in Ireland and Switzerland. It is most likely that the species in Ireland are *An. messeae* and *An. atroparvus* and in Switzerland it is these two species together with *An. maculipennis* s.s. However this needs further investigation. Such holes in our current knowledge are a barrier to the fuller understanding of the distribution of *Anopheles* mosquitoes in Europe.

In the following listings only those records pertaining to the European areas of Russia and Turkey are included.

***Anopheles (Anopheles) algeriensis* Theobald, 1903**

The main distribution encompasses the Mediterranean countries and Balkans, with an eastward extension into Iraq, Iran and, northwards through the Caucasus, into middle Asia, with some isolated populations outside this range. Within Europe there are records from **Albania** (Bates, 1941), **Austria** (Moog, 1995), **Britain** (Anglesey in Wales, Norfolk in England) (Snow *et al.*, 1998), **Bulgaria** (Gecheva, 1998), **Croatia** (Neretva Delta, Zadar area, northern Dalmatia and Island of Pag) (Adamović, 1983; 1984), **Estonia** (Saaremaa Island) (Remm, 1957), **France** (Aude, Bouche-de-Rhone, Charente-Maritime, Gard, Gironde, Hérault, Loire-Atlantique, Morbihan, Pyrénées-Orientales and Corsica) (Moussiegt, 1986; Schaffner, 1998), **Germany** (Krefeld and Frankfurt am Main areas) (Mohrig, 1969), **Greece** (Attica, Epirus, Lamia, Macedonia, Peloponnese, Drama River in Thrace, Kavalla, Vermion, Crete) (Waterston, 1918; Pandazis, 1935; Peus, 1954; Samanidou-Voyadjoglou & Darsie, 1993), **Hungary** (Balaton) (Mihályi, 1955; Tóth & Sáringer, 1997), **Ireland** (Clare) (Ashe *et al.*, 1991), **Italy** (northern and southern Italy, Sicily, Sardinia) (Sabatini *et al.*, 1981; Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Moldova** (Gutsevich *et al.*, 1971; Zubchuk, 1989), **Portugal** (Boca do Rio - Algarve) (Ramos *et al.*, 1982; Ribeiro *et al.*, 1988; Ribeiro & Ramos, 1999), **Russia** (Sulak River of Dagestan, Volga and Don basins, Caucasus) (Gutsevich *et al.*, 1971; Gornostaeva, 2000), **Spain** (Alicante, Almería, Granada, Murcia, Majorca, Balearics) (Encinas Grandes, 1982), **Ukraine** (south of about 51°N) (Gutsevich, 1989).

***Anopheles (Anopheles) atroparvus* van Thiel, 1927**

This species has been recorded from **Austria** (Moog, 1995), **Belgium** (Gosseries & Goddeeris, 1991), **Britain** (Essex Rivers, Thames Estuary, Romney Marsh, Pevensey Levels, lower reaches of Sussex rivers, Hayling Island, Dorset, Devon, Berkshire, Cheshire, Surrey, all in England and Anglesey in Wales) (Snow *et al.*, 1998), **Belarus** (generally west of the Dnieper River) (Sergeyeva, 1937; Artemiev, 1980; Stegnii, 1991), **Bulgaria** (Gecheva, 1998), **Boznia-Herzegovina** (Brčko, Mačva, Srem) (Adamović, 1979; 1982), **Croatia** (Istria, northern Dalmatia, Kvarne Island) (Adamović, 1986a; Adamović & Paulus, 1987), **Czech Republic** (Moravia) (Minár & Halgoš, 1997), **Denmark** (Jutland, Falster, Langeland, Lolland, Sjaelland) (Wesenberg-Lund, 1921; Bruce-Chwatt & de Zulueta, 1980; Nielsen & Pedersen, 1997), **France** (Allier, Aude, Bouche-du-Rhone, Calvados, Charente-Maritime, Corrèze, Finistère, Gard, Haute-Garonne, Hérault, Indre, Indre-et-Loire, Loire-Atlantique, Manche, Morbihan, Pyrénées-Orientales, Savoie, Var, Vendée) (Moussiegt, 1986; Schaffner, 1998), **Germany** (all coastal and estuarine plains and inland from Eisleben, Frankfurt-am-Main, Goslar, Leipzig, Magdeburg, Schwarzwald and Thuringian lakes) (Mohrig, 1969), **Hungary** (Balaton) (Mihályi, 1955; Tóth & Sáringer, 1997), **Ireland** (probable – see *maculipennis*), **Italy** (Po delta and peninsular as far south as the Volturno River; replaces *An. labranchiae* in the north) (Ramsdale & Coluzzi, 1975; Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Latvia** (Spungis, 2000), **Lithuania** (Pakalniškis, 1999), **Macedonia** (Skopje) (Weyer, 1942; Lepes & Vitanović, 1962), **Moldova** (Zubchuk, 1989; Stegnii, 1991), **Netherlands** (de Meijere, 1939; 1946; 1950), **Poland** (Bydgoszcz, Gdansk, Katowice, Koszalin, Szczecin, Wejherowo/ Darłowa) (Skierska, 1963; Okrój-Rysop *et al.*, 1991; Kubica-Biernat, 1997, 1999), **Portugal** (widespread in Algarve, Alentejo, Beira Alta, Arrábida, Beira Baixa, Esremadura) (Ramos *et al.*, 1977/78; Ribeiro *et al.*, 1989, 1996; Ribeiro & Ramos, 1999), **Romania** (Danube delta, Dobrudja plain, Wallachia) (Nicolescu, 1995), **Russia** (north of the Caucasus from the Caspian to the Black and Azov Seas) (Bates *et al.*, 1949; Gutsevich *et al.*, 1971; Artemiev, 1980; Stegnii, 1991; Gornostaeva, 2000), **Slovakia** (Plain of Morava and Danube rivers) (Jalili, 1995; Minár & Halgoš, 1997; Jalili *et al.*, 2000), **Slovenia** (Ljubljana) (Adamović & Paulus, 1988), **Spain** (Albacete, Alicante, Almería, Asturias, Avila, Badajoz, Balearics (uncertain) Barcelona, Burgos, Cáceres, Cádiz, Castellón, Ciudad Real, Córdoba, Cuenca, Granada, Huelva, Huesca, Jaén, León, Lérida, Madrid, Málaga, Murcia, Navarra, Orense, Palencia, Pontevedra, Salamanca, Santander, Segovia, Sevilla, Soria, Teruel, Toledo, Valencia, Valladolid, Zamora, Zaragoza) (Encinas Grandes, 1982; Lucientes, 1996; Eritja *et al.*, 1998), **Sweden** (Skåne, Blekinge, Götland, Västergötland) (Ekblom, 1938; Jaenson *et al.*, 1986; Dahl, 1997), **Ukraine**

(Dnepropetrovsk, Crimea) (Gutsevich *et al.*, 1971; Artemiev, 1980; Zarechnaya *et al.*, 1989), **Yugoslavia** (Tamnič area, Potisje, Karst area of East Serbia, Tisa, Zlatica and Tarnts rivers of Pannonian plain (Belgrade area) (Adamović, 1984, 1986b, 1987; Božičić, 1985, 1987; Srdić *et al.*, 1986; Adamović & Paulus, 1987).

There are no records from Albania, Greece, Malta, Turkey, Sardinia, Sicily, Norway, Finland, Estonia, northern Russia, Sweden north of about 57°N, and Switzerland. Briegel (1998) lists only *maculipennis* s.l. for Switzerland but Fouque *et al.* (1991) found three species of the *Maculipennis* Complex in the Magadino Plain, without putting names to them). A common mosquito in the Spanish south coastal Barbate and Tarifa areas, it has not been detected in Morocco on the other side of the 15-km wide Straits of Gibraltar.

Anopheles (Anopheles) beklemishevi Stegnii & Kabanova, 1976

The distribution of *An. beklemishevi* includes the boreal coniferous forest (taiga) region of Sweden and Finland (Jaenson *et al.*, 1986; Utrio, 1975; 1978; 1979) and extends through the taiga belt and northern plain of European Russia into Siberia (Novikov & Alekseev, 1989; Stegnii, 1991; Gornostaeva, 2000). The southern distribution boundary of *An. beklemishevi* in European Russia is at about 60°N (Stegnii, 1991).

Anopheles (Anopheles) claviger (Meigen, 1804)

This species and *Anopheles petragani* are sibling species and there may be confusion in identification, especially in older literature. *An. claviger* appears to be a northern mosquito which has penetrated into the Mediterranean by exploiting cold water issuing from springs or contained in underground cisterns and wells (Coluzzi *et al.*, 1965). The distribution of *An. claviger* covers virtually the whole of Europe, and extends east to Afghanistan, southeast into the Middle East and south and southwest into North Africa. It may be absent from the Balearics, Sardinia and Malta and has not been specifically reported from Moldova, Belarus (although Gutsevich *et al.* (1971) indicate its presence throughout the European region of the former USSR) and Luxembourg. European records are from:

Albania (Bates, 1941), **Austria** (Moog, 1995), **Belgium** (Gosseries & Goddeeris, 1991), **Boznia-Herzegovina** (border area with Croatia and Yugoslavia, Malovan, Kovači) (Paulus & Adamovic, 1983, 1985), **Britain** (throughout England, Scotland, Wales and Channel Isles) (Ramsdale, 1991; Snow *et al.*, 1998), **Belarus** (indicated by Gutsevich *et al.*, 1971), **Bulgaria** (Gecheva, 1998), **Croatia** (Neretva Delta, Lika, North Dalmatia and Island of Pag, Zagreb, Kamenmost, Istrian Peninsula [Livade, Cepic, Luka Plomion, Putera, Secovijel]) (Adamović, 1983, 1984; Adamović & Paulus, 1985a, 1985b, 1987; Paulus & Adamović, 1985), **Czech Republic** (Trebos Basin, Melnik, Hrade Kralove, Podebrady) (Rettich, 1973, 1979, 1982; Rettich *et al.*, 1978; Minár & Halgoš, 1997), **Denmark** (Nielsen & Pedersen, 1997), **Estonia** (Remm, 1957), **Finland** southern Finland, Lemland, (Utrio, 1975; 1976; 1979; Dahl, 1997), **France** (Ain, Aisne, Allier, Hautes-Alpes, Alpes Maritimes, Ardennes, Ariège, Aube, Aude, Aveyron, Bouche-du-Rhône, Calvados, Charente-Maritime, Cote-d'Or, Dordogne, Drôme, Eure-et-Loir, Gard, Haute-Garonne, Gironde, Hérault, Ile-et-Vilaine, Indre-et-Loire, Isère, Landes, Loire, Haute-Loire, Loire-Atlantique, Loiret, Lot, Maine-et-Loire, Manche, Marne, Meurthe-et-Moselle, Meuse, Morbihan, Moselle, Nord, Oise, Pas-de-Calais, Puy-de-Dôme, Pyrénées Atlantiques, Haut-Pyrénées, Pyrénées-Orientales, Bas-Rhin, Haut-Rhin, Rhône, Haute-Saône, Savoie, Seine-Maritime, Seine-et-Marne, Deux-Sèvres, Somme, Tarn, Var, Vaucluse, Vendée, Vienne, Yonne, Yvelines, territoire de Belfort, région parisienne and **Corsica** (Moussiegt, 1986; Schaffner, 1998), **Germany** (Frankfurt am Main, Krefeld, Munich, Mannheim, Black Forest, Meiningen, Bad Nauchheim, Erlangen, Sontheim, Leipzig, Halle, Oberschwaben, Nettegebiet, Nordhausen, Bavarian Alps, Maulbronn, Fichtelgebirge, Spessart, Erfurt, Neckarsulm, Schleiz, Wiermar, Plägfenn, Tiefenwerder, Göttingen, Greifswald, Bolter Kanal, Tübingen, Upper Rhine) (Mohrig, 1969; Becker & Kaiser, 1995; Becker, 1997), **Greece** (north, central and south Greece [Thrace, Macedonia, Phthiotis, Attiki, north-west and central Peloponnese] (Lividas & Sphangos, 1941; Samanidou-Voyadjoglou & Darsie, 1993; Samanidou-Voyadjoglou, 1997), **Hungary** (Near Homorúd/ Hóduna, Drava region, Lake Balaton) (Tóth, 1992, 1995; Tóth & Saringer, 1997), **Italy** (north, south, Sicily) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997; Zamburlini, 1998), **Ireland** (Carlow, Clare, Cork, Down, Dublin, Galway, Kerry, Kildare, Laois, Limerick, Mayo, Offaly, Westmeath, Wexford, Wicklow) (Ashe *et al.*, 1991), **Latvia**

(Spungis, 2000), **Lithuania** (Pakalniškis, 1989), **Macedonia** (Drachevo) (Weyer, 1942), **Moldova** (indicated by Gutsevich *et al.*, 1971), **Netherlands** (de Meijere, 1939, 1946, 1950), **Norway** (Trandum) (Mehl *et al.*, 1983; Dahl, 1997), **Poland** (common throughout country; Warsaw, Mazovia, Zarnowieckie Lake, Gdansk, Wilkowska valley, Wolin Island) (Skierska, 1963, 1974; Wegner, 1979, 1982, 1991; Okróy-Rysop *et al.*, 1991; Wegner *et al.*, 1993; Kubica-Biernat, 1997, 1999), **Portugal** (Serra da Arrábida, Beiras) (Ribeiro *et al.*, 1977, 1988, 1996; Ribeiro & Ramos, 1999), **Romania** (Salva) (Ciolpan *et al.*, 1988; Nicolescu, 1995), **Russia** (European Russia north to St. Petersburg region) (Gutsevich *et al.*, 1971; Gornostaeva, 2000), **Slovakia** (plain of Morava and Danube rivers, Moravia flood plain on Slovak-Austrian border, nr. Bratislava) (Jalili & Labuda, 1994; Jalili, 1995; Minár & Halgoš, 1997; Jalili & Degma, 1998; Jalili *et al.*, 2000), **Slovenia** (Ljubljana, close to border with Croatia and Italy) (Trpiš & Tovornik, 1958; Adamovic & Paulus, 1988; Tovornik, 1990), **Spain** (Asturias, Badajoz, Barcelona, Cáceres, Cádiz, Castellón, Ciudad Real, Córdoba, Cuenca, Granada, Jaén, Madrid, Málaga, Murcia, Salamanca, Santander, Segovia (Encinas Grandes, 1982; Lucientes, 1996; Eritja *et al.*, 1998), **Sweden** (Öland, Skåne, Halland, Dalarna) (Dahl, 1975, 1977a; Jaenson *et al.*, 1986), **Switzerland** (Briegel, 1973, 1998), **Turkey** (Tekirdag Province) (Postiglione *et al.*, 1973), **Ukraine** (Depropetrovsk region, Crimea) (Gutsevich *et al.*, 1971; Zarechnaya *et al.*, 1989), **Yugoslavia** (border area with Bosnia-Herzegovina and Croatia, Vojvodina, Karst area, Temnić, Potisje, Vitkovac, Belušić, Planinica, Selište, Bačina) (Paulus & Adamovic, 1983; Božičić, 1985; Adamovic, 1986b, 1987; Srdić *et al.*, 1986).

Anopheles (Anopheles) hyrcanus (Pallas, 1771)

The Hyrcanus Group comprises a large number of species, including the Far Eastern malaria vector *An. sinensis*, and has a wide Oriental and Palaearctic distribution. This Group has been intensively studied in the Oriental Region and the contiguous extreme eastern part of the Palaearctic, from where no less than 27 species have been described. Comparable studies have not been made elsewhere in the Palaearctic Region, where a number of forms differing in certain aspects of adult morphology and behaviour occur (Livadas & Sphangos, 1941; Ward, 1972; Postiglione *et al.*, 1973; Critescu *et al.*, 1975; Gutsevich, 1976). These include the named forms, *flerowi*, *mahmouti*, *marzinovski*, *mesopotamiae*, *pictus*, *popovi* and *pseudopictus*, treated by Knight & Stone (1977) as synonyms of the type form. *An. pseudopictus*, described in Europe from an unknown location in Italy (Grassi, in Grassi *et al.*, 1899), has since been elevated to species status by Glick (1992) based on a study outside Europe.

Laboratory crosses between *An. lesteri* (a member of the Hyrcanus Group) from the Philippines and '*An. hyrcanus*' from southern France, southern Turkey and Sri Lanka indicated that each population belonged to a different species (Ross Institute, unpublished reports to W.H.O., 1976, 1977). The same work showed a population of '*An. hyrcanus*' from southern France to be conspecific with another from southern Anatolia. At least two Anatolian populations are morphologically distinguishable (Postiglione *et al.*, 1973). Until it is more thoroughly investigated, '*An. hyrcanus*' in the western Palaearctic, including Europe, must necessarily continue to be treated as a single entity. However, it is already evident that existing biological information refers to an aggregate of species and not to a single polytypic species.

The European distribution of the western forms, '*An. hyrcanus*', includes **Albania** (Bates, 1941), **Bulgaria** (Gecheva, 1998), **Croatia** (Dalmatian coast) (Merdić, 1997), **France** (Ain, Bouches-du Rhone, Gard, Haut-Garonne, Herault, Corsica) (Moussiegt, 1986; Schaffner, 1998), **Greece** (Epirus, Lake Doira, Macedonia, Peloponnese, Thessaly, Kavalla in Thrace, Rhodes, Crete) (Pandazis, 1935; Peus, 1954; Samanidou-Voyadjoglou & Darsie, 1993), **Hungary** (Lake Balaton, Dráva) (Mihályi, 1955; Tóth, 1995; Tóth & Sáringer, 1997), **Italy** (north, south, Sicily, Sardinia) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Macedonia** (Lake Doiran) (Weyer, 1942), **Moldova** (Kishinev) (Gutsevich *et al.*, 1971), **Romania** (Tulcea, Danube Delta) (Critescu *et al.*, 1975; Nicolescu, 1995), **Russia** (lower Don and Volga basins, Caucasus up to 1600m) (Gutsevich *et al.*, 1971; Gornostaeva, 2000), **Spain** (Barcelona, Huesca, Teruel, Valencia) (Encinas Grandes, 1982; Eritja *et al.*, 1998), **Ukraine** (south of 50°N) (Gutsevich *et al.*, 1971), **Yugoslavia** (Durmitor Massif, Stara Planina, Novi Sad) (Božičić, 1987; Božičić-Luthrop & Vujić, 1996; Petrić, 1999).

Anopheles (Anopheles) labranchiae Falleroni, 1926

An. labranchiae is a North African species, abundant and widespread within, north and west of the Atlas mountain ranges. A few parts of southern Europe have been colonised, probably within historical times. This was made possible by climatic amelioration since the end of the last glaciation coupled with the more recent creation of suitable larval conditions by human activities, notably forest clearance (de Zulueta, 1973). The European distribution is principally coastal; with records from **Croatia** (Kvarneric Islands, Zadar area, north Dalmatia) (Adamović, 1984; 1986a), **France** (Corsica only according to Schaffner (1998) although Moussiegt (1986) lists a record from Haute-Garonne), **Italy** (Sardinia, Sicily, Italian Peninsula from Calabria north to Tuscany in a discontinuous manner along both coasts – replaced by *An. atroparvus* towards north) (Hackett & Missiroli, 1935; Coluzzi & Sabatini, 1995; Romi *et al.*, 1997; Romi, 1999).

Despite the proximity of Morocco, where it is abundant, it does not occur on the Spanish side of the 15-km wide Straights of Gibraltar, where *An. atroparvus* is common. It was previously recorded from the most arid regions of the provinces of Alicante and Murcia in Spain from which it was eradicated during the course of anti-malarial operations (Blazquez & de Zulueta, 1980; Encinas Grandes, 1982). Records from Bulgaria, (Gecheva, 1998), the Czech Republic and Slovakia (Minár & Kramár, 1987; Minár & Halgoš, 1997) are considered erroneous due to the former practices of considering *An. maculipennis* s.l. as a single polytypic species, and/or *atroparvus* being a subspecies of *labranchiae*.

Anopheles (Anopheles) maculipennis Meigen, 1818

At first thought to have a very wide European and Asian distribution, the discovery of the apparently allopatric *An. beklemishevi* led to the realisation that records of *An. maculipennis* from much of northern European Russia and Scandinavia, and northern and central Asia probably refer to the former species (White, 1978). As currently understood, the distribution of *An. maculipennis* covers the greater part of Europe. It has not been recorded in Britain (Cranston *et al.*, 1987), the southern part of the Iberian Peninsula (Encinas Grandes, 1982; Ribeiro *et al.*, 1989), Ireland (only *maculipennis* s.l. recorded – almost certainly *atroparvus* and/or *messeae* as in Britain) (Ashe *et al.*, 1991), Sardinia (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), much of Norway (Dahl, 1977a) and northern Sweden (Ekblom, 1938). A record from the Balearic Islands may have referred to specimens of *An. subalpinus*, which is present in eastern Spain (Romeo Viamonte, 1950).

An. maculipennis is widely distributed over most of the continent, being recorded from: **Albania** (Bates, 1941), **Austria** (Moog, 1995), **Belarus** (Mogilev region) (Trukhan *et al.*, 1988; Stegnii, 1991), **Belgium** (Gosseries & Goddeeris, 1991), **Bosnia-Herzegovina** (Malovan, Kovači, border area with Croatia and Yugoslavia) (Paulus & Adamović, 1983, 1985), **Bulgaria** (Gecheva, 1998), **Croatia** (Zagreb, Istrian Peninsula, border area with Bosnia-Herzegovina and Yugoslavia) (Adamović & Paulus, 1983, 1988; Paulus & Adamović, 1985), **Czech Republic** (Tržeban basin) (Rettich *et al.*, 1978; Minár & Halgoš, 1997), **Denmark** (Nielsen & Pedersen, 1997), **Estonia** (Remm, 1957), **Finland** (Vihanti) (Lumiaho & Itamies, 1981; Dahl, 1997), **France** (all départements except Cher, Doubs, Eure, Indre, Indre-et-Cher, Lozère, Haute-Marne, Mayenne, Nièvre, Orne, Sarthe, Vosges; present in Corsica) (Moussiegt, 1986; Schaffner, 1998), **Germany** (upper Rhine valley, Thuringia, southern Germany) (Mohrig, 1969; Becker & Kaiser, 1995), **Greece** (Boeotia, Epirus, Lamia Plain, Macedonia, Peloponese, Thessaly and Thrace, but recent information is sparse) (Barber, 1935; Hackett & Missiroli, 1935; Shannon, 1935; Sakellariou & Lane, 1977; Samanidou-Voyadjoglou & Darsie, 1993; Samanidou-Voyadjoglou, 1997), **Hungary** (Drava, Ortilos) (Mihályi, 1955; Tóth, 1995), **Italy** (widespread in peninsula, present but rare in Sicily and absent from Sardinia) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Latvia** (Stegnii, 1991; Spungis, 2000), **Lithuania** (Pakalniškis, 1989; Stegnii, 1991), **Luxembourg** (Schaffner, 1999), **Macedonia** (Skopje, Vor Matka, Katlanova, Drachova, Isdeklave, Longovarde) (Weyer, 1942), **Moldova** (Stegnii, 1991), **Netherlands** (de Meijere, 1939, 1946, 1950), **Norway** (Dahl, 1997), **Poland** (north-west Poland, Gdansk area, Wejherowo/ Darlowo area) (Lukasiak, 1959; Skierska, 1963; Okroy-Rysop *et al.*, 1991; Kubica-Biernat, 1997, 1999), **Portugal** (Beiras) (Ribeiro *et al.*, 1989; Ribeiro & Ramos, 1999), **Romania** (Nicolescu, 1995), **Russia** (south of about latitude 60°N) (Novikov & Alekseev, 1989; Stegnii, 1991; Gornostaeva, 2000), **Spain** (Asturias, Guadalajara, Guipúzcoa, León, Lérida, Lugo, Orense, Palencia, Santander, Tarragona) (Encinas Grandes, 1982; Eritja *et al.*, 1998), **Sweden** (south of about 60°N) (Jaenson *et al.*, 1986), **Switzerland**

(uncertain – see under *messeae*) (Briegel, 1973), **Slovakia** (Minár & Halgoš, 1997; Jalili *et al.*, 2000), **Slovenia** (Ljubljana, nr. San Dorligo della Valle on Italian border, nr. Lendava, nr. Križševci) (Trpiš & Tovornik, 1958; Tovornik, 1983; Adamović & Paulus, 1988), **Turkey** (Edirne, Kırklareli, Tekirdağ, Istanbul provinces) (Postiglione *et al.*, 1973), **Ukraine** (Zarechnaya *et al.*, 1989), **Yugoslavia** (border area with Croatia and Bosnia-Herzegovina, Potisje region and Vršac Mountains (Vojvodina), Morava river to Stara Planina (Niš, Pirot, Trnovac), Gruža, Požega, Ivanjica, Levač, Tamnič areas) (Paulus & Adamović, 1983; Adamović, 1986a 1987; Božičić, 1985, 1988).

Anopheles (Anopheles) marteri Senevet & Prunelle, 1927

This species is present in north-western Africa, southern Europe, Asia Minor, Cyprus, Middle East and Tadzhikistan. European records are from **Albania** (Shkumbini Valley) (Bates, 1941), **Bulgaria** (Mount Beles) (Bozkov, 1966; Gecheva 1998), **France (Corsica)** (Langeron & Galliard, 1933; Schaffner, 1998), **Greece** (Mount Pangeon, Ypati, Kallidromon, Mount Iti, Parnassos, Delphi) (Shannon, 1933; Hadjinicolaou, 1938; Livadas & Sphangos, 1941; Samanidou-Voyadjoglou & Darsie, 1993), **Italy** (Calabria, central-southern Apennines, Sicily, Sardinia) (Sabatini *et al.*, 1981; Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Portugal** (north-western Tras os Montes) (Ribeiro *et al.*, 1985; Ribeiro & Ramos, 1999), **Spain** (Cuenca, Granada, Jaen, Murcia) (Encinas Grandes, 1982; Eritja *et al.*, 1998).

Anopheles (Anopheles) melanoon Hackett, 1934

An. melanoon is known to occur in mainland **Italy** (most prevalent in the north and in hilly areas of central and southern Italy) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997). Records from Sardinia predate the 1950s and its existence there now is considered doubtful (Marchi & Munstermann, 1987; Romi, 1999).

First regarded as a variety of *messeae* and subsequently as con-specific with *subalpinus* (Hackett & Lewis, 1935), *melanoon* was regarded as having an extensive southern European distribution (White, 1978). The realisation that these taxa are all separate species (Bullini *et al.*, 1980; Cianchi *et al.*, 1987), leaves many records open to question.

An. melanoon was recorded in the south of continental **France** and in **Corsica** (Moussiegt, 1986; Schaffner, 1998) during the time when *subalpinus* was considered to be conspecific. It is unclear which records refer to *melanoon*, but Saliers *et al.* (1978) found *subalpinus* to be abundant in southern France. Amongst eggs laid by mosquitoes collected near Toulouse were some resembling *An. melanoon* (Suzzoni-Blatger, 1989); however isoenzyme analysis of this population detected *An. maculipennis*, *An. messeae* and *An. atroparvus* but not *An. melanoon* (Suzzoni-Blatger *et al.*, 1990). A unique record of *An. melanoon* from Switzerland is considered questionable by Briegel (1999). The situation is further complicated by the tendency of *An. subalpinus* to occasionally oviposit a dark, *melanoon*-like egg batch (Coluzzi, 2000).

There are two identifications from the Iberian Peninsula separated by 26 years and almost 600 km. One, from an inland rural area in **Portugal** (Serra do Barrosa) was made on six eggs laid by a dying captive female (Ribeiro *et al.*, 1980; Ribeiro & Ramos, 1999); the other, from the port of Valencia in **Spain**, was identified on chromosomal evidence from preserved material (Frizzi, 1953).

In the eastern Mediterranean, *melanoon* and *subalpinus* were not recorded separately in **Albania** and there is only a single report of the *melanoon* form during many years of mosquito collecting by entomologists of the Rockefeller Foundation and the Greek National Malaria Control Organisation in **Greece** (Lividas & Sphangos, 1941). Occasional reports of *melanoon* in **Asia Minor** were found to be due to examination of wetted eggs with obscured deck patterns (Postiglione *et al.*, 1973). It is included in the checklist of mosquitoes from **European Russia** from where *subalpinus* is also recorded (Gornostaeva, 2000).

***Anopheles (Anopheles) messeae* Falleroni, 1926**

Widespread in Europe with the south-eastern limits of the distribution passing through Bulgaria (Gecheva, 1998), Romania (Nicolescu, 1995), Moldova (Zubchuk, 1989) and along the Black Sea coast of Ukraine and Russia (Stegnii, 1991). Outside Europe, the range extends eastward into Asiatic Russia, where it has an extensive distribution (Stegnii, 1991).

This species is present in **Albania** (the vicinity of the mountain lakes Malik, Ohrid and Prespa, through which the frontiers with Greece and/or Macedonia run (Bates, 1941; Adamović, 1980), **Austria** (Moog, 1995), **Belarus** (Stegnii, 1991), **Belgium** (Gosseries & Goddeeris, 1991), **Bosnia-Herzegovina** (Malovan, Kovači, border area with Croatia and Yugoslavia) (Paulus & Adamović, 1983, 1985), **Britain** (England only - Devon, Cambridgeshire, Suffolk, Surrey, Sussex, Norfolk, Northumberland) (Snow *et al.*, 1998), **Bulgaria** (Gecheva, 1998), **Croatia** (Sava River, border area with Bosnia-Herzegovina and Yugoslavia, Locvicići, Kamenmost) (Paulus & Adamović, 1983, 1985; Adamović & Paulus, 1988; Merdić, 1997), **Czech Republic** (Třebon basin, Moravia flood plain) (Rettich *et al.*, 1978; Minár & Halgoš, 1997), **Denmark** (Nielsen & Pedersen, 1997), **Estonia** (Stegnii, 1991), **Finland** (Kumlinge, Tvarminne, Lohja, Joroinen, Rovaniemi, Sodankyla, Kittilä, Kolari) (Ulmanen & Brummer-Korvenkontio, 1971; Dahl, 1997), **France** (Ain, Bouches-du-Rhône, Haute-Garonne, Indre, Indre-et-Loire, Isère, Loire-Atlantique, Pyrénées-Orientales, Savoie, Vendée and Corsica (Rioux, 1958; Moussiegt, 1986; Schaffner, 1998), **Germany** (widely distributed, Upper Rhine valley) (Mohrig, 1969; Becker & Kaiser, 1995), **Greece** (limited to the vicinity of the mountain lakes Malik and Prespa. After the description of *subalpinus* (Hackett & Lewis, 1935) it was soon realised that *messeae* was confined to this small high altitude frontier area and, as pointed out by Lividas & Sphangos (1941), early records of *messeae* from elsewhere were, in reality, instances of *subalpinus* which is widespread in the country. More recently doubts were expressed about the absence of *An. messeae* and *An. atroparvus* (Samanidou-Voyadjoglou & Darsie, 1993; Samanidou-Voyadjoglou, 1997), but no evidence of the presence of either species has been found. **Hungary** (Dráva) (Mihályi, 1955; Tóth, 1995), **Ireland** (probable – see *maculipennis*), **Italy** (widespread in northern Italy and central Apennines) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Latvia** (Stegnii, 1991; Spungis, 2000), **Lithuania** (Stegnii, 1991), **Macedonia** (Skopje, Vor Matka, Katbarvo, Isdeklave, Longovade, Vardar Valley) (Weyer, 1942; Adamović, 1980), **Moldova** (Zubchuk, 1989), **Netherlands** (de Meijere 1939, 1946, 1950), **Norway** (Dahl, 1997), **Poland** (Wejherowo/ Darlowo area, northern Poland (Okroy-Rysop *et al.*, 1991; Kubica-Biernat, 1997, 1999), **Romania** (Danube Delta, Danube Plain, Dobrudja (references in Nicolescu, 1995), **Russia** (widespread from the plains bordering the Caucasus and Black Sea north to the White Sea) (Novikov & Alekseev, 1989; Stegnii, 1991; Gornostaeva, 2000), **Sweden** (Skåne, Blekinge, Småland, Gotland, Västergötland, Bohuslän, Närke, Södermanland, Värmland, Dalarna, Ångermanland, Västerbotten, Norrbotten) (Dahl, 1977a, b; Jaenson *et al.*, 1986; Jaenson & Ameneshewa, 1991), **Slovakia** (plain of Morava and Danube rivers) (Jalili & Labuda, 1994; Jalili, 1995; Minár & Halgoš, 1997; Jalili *et al.*, 2000), **Slovenia** (Ljubljana) (Tovornic, 1983), **Switzerland** (Briegel (1997) lists only *maculipennis* s.l. but Fouque *et al.* (1991) state that they found three species of the Maculipennis Complex in the Magadino Plain, without naming them.), **Ukraine** (Dnepropetrovsk) (Zarechnaya *et al.*, 1989; Stegnii, 1991), **Yugoslavia** (border area with Bosnia-Herzegovina and Croatia, Morava river to Stara Planina area (Niš, Pirot, Trnovac), Potisje region (Vojvodina), Gruža, Levač, Tamnič (Adamović, 1980, 1986b, 1987; Paulus & Adamović, 1983; Adamović & Paulus, 1984; Božičić, 1985).

***Anopheles (Anopheles) petragrani* Del Vecchio, 1939**

This species and *Anopheles claviger* are members of a Complex and there may be confusion in identification, especially in older literature.

An. petragrani is a Mediterranean species with larvae able to tolerate higher water temperatures than *An. claviger* (Coluzzi, 1962). For reasons not readily apparent, *An. petragrani* appears to be confined to the countries surrounding the western Mediterranean. In Europe it is recorded from **France** (southern provinces and Corsica only) (Coluzzi *et al.*, 1965; Schaffner, 1998), **Italy** (north [Liguria], central southern regions,

Sicily, Sardinia (Coluzzi *et al.*, 1965; Romi *et al.*, 1997), **Portugal** (Arrábida, north-western Alentejo, western Algarve, Beira Alto, Beira Baixo Provinces) (Ramos *et al.*, 1977/78; Pires *et al.*, 1982; Ribeiro *et al.*, 1988, 1996), **Spain** (Huesca, Salamanca, Balearic Islands) (Encinas Grandes, 1982; Eritja *et al.*, 1998).

Anopheles (Anopheles) plumbeus Stephens, 1828

An. plumbeus is widely distributed throughout Europe, with a range extending from Asiatic Russia and contiguous countries, and the Middle East as far south as Iraq and Saudi Arabia, to Europe and North Africa. Because of its larval habitats it is under-recorded throughout its wide distribution. European records are from:

Albania (Bates, 1941), **Austria** (Moog, 1995), **Belarus** (Trukhan & Pakholkina, 1984), **Belgium** (Gosseries & Goddeeris, 1991), **Boznia-Herzegovina** (near border with Croatia, Srednja Posavina and Bijeldina in Save Valley, Imotsko, Mostar) (Paulus & Adamović, 1983, 1985; Adamović & Paulus, 1984), **Britain** (widely distributed throughout England, Scotland and Wales) (Snow *et al.*, 1998), **Bulgaria** (Gecheva, 1998), **Croatia** (Hrvatska, Papuk highlands, Istrian peninsula, Zadar area, Osilek, Srednja Posavina in Save Valley, Velebit Planina, Zagreb) (Trpis & Tovornik, 1958; Adamović, 1984; Paulus & Adamović, 1983; Adamović & Paulus, 1984, 1985a, 1987; Merdić, 1995), **Czech Republic** (Melnik, Moravia flood plain, Podbrady, Trebon Basin) (Rettich *et al.*, 1978; Rettich, 1982; Minár & Halgoš, 1997) **Denmark** (Neilsen & Pedersen, 1997), **Estonia** (Remm, 1957), **France** (Ain, Aisne, Alpes Maritimes, Ardennes, Ariège, Aveyron, Bouche-du-Rhône, Calvados, Charente-Maritime, Cote-d'Or, Dordogne, Drôme, Gard, Haute-Garonne, Hérault, Indre-et-Loire, Isère, Loire, Loire-Atlantique, Marne, Haut-Marne, Oise, Puy-de-Dôme, Pyrénées Atlantiques, Haut-Pyrénées, Pyrénées-Orientales, Bas-Rhin, Haut-Rhin, Rhône, Savoie, Seine-et-Marne, Deux-Sèvres, Var, Vendée, Vienne, Yvelines, territoire de Belfort, région parisienne and **Corsica** (Moussiegt, 1986; Schaffner, 1998), **Germany** (Altmark, Lower and Upper Bavaria, Bodensee, Upper Danube valley, Hamburg, Harz, Hessen, Leipzig, Mecklenburg, Rhineland, Schleswig Holstein, Thuringenwald, Nord Rhein-Westfalen, Wurttemberg) (Mohrig, 1969; Becker & Kaiser, 1995), **Greece** (Corfu, Macedonia, Thrace) (Pandazis, 1935; Stephanides, 1938; Samanidou-Voyadjoglou & Darsie, 1993), **Hungary** (Balaton) (Mihályi, 1955; Tóth & Sáringer, 1997), **Italy** (North, South, Sicily, Sardinia) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Ireland** (Clare, Cork, Down, Dublin, Kerry, Kildare, Waterford, Wicklow) (Ashe *et al.*, 1991), **Lithuania** (Pakalniškis, 1989), **Macedonia** (Struma Valley, Kumanovo, Lešnica, Siševo, Skopje, Veles) (Martini, 1929-31; Weyer, 1942; Trpis & Tovornik, 1958), **Netherlands** (de Meijere, 1939, 1946, 1950), **Poland** (Bialowieza, Krakow) (Skierska, 1963, 1977; Kubica-Biernat, 1999), **Portugal** (scanty but general distribution; Beiras) (Ribeiro *et al.*, 1988, 1989; Ribeiro & Ramos, 1999), **Romania** (Danube delta, Danube plain, northern Moldova, Salva) (Ciolpan *et al.*, 1988; Nicolescu, 1995), **Russia** (Moscow, Caucasus) (Gutsevich *et al.*, 1971; Gornostaeva, 2000), **Slovakia** (nr. Bratislava: plains of Morava and Danube rivers) (Jalila & Labuda, 1994; Jalili, 1995; Minár & Halgoš, 1997; Jalili & Degma, 1998; Jalili *et al.*, 2000), **Slovenia** (Ljubljana) (Tovornik, 1983; Adamović & Paulus, 1988), **Spain** (Asturias, Barcelona, Cadiz, Cuenca, Madrid, Salamanca, Valencia, Zaragoza) (Encinas Grandes, 1982; Lucientes, 1996; Eritja *et al.*, 1998), **Sweden** (Skane) (Natvig, 1948; Dahl, 1997), **Switzerland** (Adlikon, Bern, Genf, Lausanne, Tessin, Wallisellen) (Briegel, 1973), **Turkey** (Postiglione *et al.*, 1973; Ramsdale, 1999), **Ukraine** (Crimea) (Gutsevich *et al.*, 1971), **Yugoslavia** (Vrsac highlands, Karst area, border area with Croatia and Boznia-Herzegovina, Stara Planina, Temnic area, Morova Valley to Stara Planina and the Bulgarian border, Vojvodina Plain, Drina/ Sava Plain, Decane) (Alković, 1949; Trpiš & Tovornik, 1958; Paulus & Adamović, 1983; Adamović, 1986b, 1987; Božičić, 1988; Srdić *et al.*, 1986; Božičić-Luthrop & Vujić (1996).

Anopheles (Anopheles) sacharovi Favre, 1903

Formerly the range of *An. sacharovi* was considered to extend from southern Europe to China. Since the recognition of the validity of *An. martinius* (Stegnii & Kabanova, 1976), and redefinition of the Maculipennis Complex (White, 1978), only the distribution west of the Caspian Sea is regarded as referring to *An. sacharovi* (Stegnii, 1991). This comprises the plains south of the Caucasus Mountains, Iran, the Middle East, Cyprus, Turkey and southern Europe. The European distribution includes **Albania** (coastal plains) (Bates, 1941),

Bulgaria (Gecheva, 1998), **Croatia** (south Dalmatian coast) (Simić & Zivković, 1958), **France** (Corsica only) (Aitken, 1954; Schaffner, 1998), **Greece** (coastal and inland plains in Attica, Epirus, Euboea, Macedonia, Peloponnese, Thessaly, Thrace, Cyclades and Crete; very abundant throughout country) (Livadas & Sphangos, 1941; Hadjinicolaou & Betzios, 1973; Samanidou-Voyadjoglou, 1997), **Macedonia** (villages in the Vardar Valley near the Greek border, Skopje, Gevgelija) (Weyer, 1942; Lepes & Vitanović, 1962), **Russia** (Dagestan) (Gutsevich *et al.*, 1971; Stegnii, 1991; Gornostaeva, 2000), **Turkey** (Edirne, Kirklareli and Tekirdag Provinces) (Gökberk, 1961; Postiglione *et al.*, 1973), **Yugoslavia** (Montenegro coast) (Simić & Zivković, 1958).

In Romania it was formerly found in Costanza, Tulcea and the Danube Delta but was eradicated during the anti-malaria campaigns (Lupascu & Duport, 1968; Nicolescu, 1995). Before the campaign of malaria control in Italy, it was present in several coastal areas of the peninsula and in Sardinia (Aitken, 1954; Coluzzi & Sabatini, 1995). It is now believed to have been eradicated from Italy (Romi *et al.*, 1997) although the presence of residual foci cannot be totally discounted (Romi, 1999).

Anopheles (Anopheles) subalpinus Hackett & Lewis, 1935

There is confusion in the literature regarding this species and *An. melanoon* which, for a long time, were considered to be con-specific. The discovery that these taxa are separate species (Bullini *et al.*, 1980; Cianchi *et al.*, 1987) leaves some records open to question. Further, many records of *messeae* prior to the description of *subalpinus* (Hackett & Lewis, 1935) actually refer to the latter species.

The distribution of *An. subalpinus* is thought to extend through southern Europe from Iberia to Asia Minor, where it is common on the central Plateau (Postiglione *et al.*, 1973), and the coastal plain of the Caspian Sea. **Albania** (old records indicate that it is widespread in the plains) (Hackett & Lewis, 1935; Bates, 1941), **Bulgaria** (as *maculipennis melanoon*) (Gecheva, 1998), **Croatia** (Dalmation coastal plains and islands; Kamenmost, Imotski) (Adamović, 1984; Paulus & Adamović, 1985), **France** (Ain, Bouche-de-Rhone, Gard, Herault, Indre-et-Loire, **Corsica**) (Moussiegt, 1986; Schaffner, 1998), **Greece** (Epirus, Macedonia, Thessaly, Thrace) (Livadas & Sphangos, 1941, as *melanoon subalpinus*; Samanidou-Voyadjoglou & Darsie, 1993, as *melanoon subalpinus*), **Italy** (uncertain, but probably north and south in peninsula; absent in Sicily and Sardinia) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), **Macedonia** (Skopje, Vor Matka, Katlanovo, Demin, Kapin, Orizari, Stojakova) (Weyer, 1942; Lepes & Vitanović, 1962; Adamović, 1984), **Portugal** (Escarigo in Serra da Marofa) (Ramos *et al.*, 1982; Ribeiro & Ramos, 1999), **Russia** (Gornostaeva, 2000), **Spain** (as *melanoon* and *melanoon subalpinus*) Alicante, Barcelona, Castellón, Tarragona, Valencia (Encinas Grandes, 1982), **Turkey** (Edirne, Kirklareli, Tekirdag, Istanbul Provinces) (Postiglione *et al.*, 1973), **Yugoslavia** (Montenegro coast) (Simić & Zivković, 1958).

Anopheles (Cellia) cinereus Theobald, 1901

An. cinereus is principally an Afrotropical species, with a distribution extending from the Cape Province of South Africa through the southern and eastern savannahs to the Horn of Africa and the south-western corner of the Arabian Peninsula (Gillies & de Meillon, 1968). There is one 1939-45 war-time record far to the north, from Jordan (Lumsden, 1944). Toward the north-eastern extremity of the East African distribution there is a north-western extension through the southern Sudan, the Saharan highlands and the western desert to the Mediterranean. It is the most widely distributed mosquito in the Maghreb countries of North Africa, being found from the southern desert to the Atlantic and Mediterranean coasts. It occurs in the Canary Islands (Baez & Fernandez, 1980) and the most easterly Mediterranean record is from Cyrenaica in Libya (Ramsdale, 1990). It does not occur in Egypt, or in the Middle East and south-eastern Europe, where the larval niche is filled by *An. superpictus*.

In Europe there are records from **Portugal** as *An. cinereus hispaniola* (Alto Douro) (Ribeiro *et al.*, 1980; Ribeiro & Ramos, 1999) and **Spain** (Alicante, Almeria, Avila, Badajoz, Caceres, Cadiz, Ciudad Real, Cordoba,

Cuenca, Granada, Huelva, Jaen, Madrid, Malaga, Murcia and Seville) (Encinas Grandes, 1982; Eritja *et al.*, 1998). Isolated records from Greece: Epirus (Lividas, 1931) and Drama (Pandazis, 1935) are considered erroneous and probably referred to *An. superpictus*. Variations in adult coloration of both species, and especially of the arrangement of banding of the female palps, have led to instances of confusion between *Anopheles cinereus* and *An. superpictus* (Ramsdale, 1990).

***Anopheles (Cellia) multicolor* Cambouliu, 1902**

A desertic species common in North Africa and with a distribution extending through the Sahara and the Arabian Peninsula to Pakistan. The only European records are from the Spanish Provinces of Murcia and Almeria (Encinas Grandes, 1982), the most arid region of the Iberian Peninsula. As in the case of *An. labranchiae*, *An. multicolor* may have been eradicated during the course of anti-malaria operations and its current status is uncertain.

***Anopheles (Cellia) sergentii* (Theobald, 1907)**

The distribution of the anthropophilic *An. sergentii sergentii* extends from Pakistan, through the Middle East, the Arabian Peninsula, the Sahara, Atlas and coastal regions of North Africa to the Atlantic and the Canary Islands. That of the zoophilic *An. sergentii macmahoni* extends from the Horn of Africa, through the savannah belt bordering the southern edges of the Sahara into Mali and northwards into the Saharan oases, where some morphological intergrading occurs (Gilles & de Meillon, 1968; Ramsdale & de Zulueta, 1983; Senevet & Andarelli, 1955). Apart from a single historical Bulgarian record reported by Markov & Morov (1929), the presence in Pantelleria (an island off the south coast of Sicily) of an apparently anthropophilic, but morphologically intermediate form (d'Alessandro & Sacca, 1967), is the sole record of *An. sergentii* north of the African coast.

***Anopheles (Cellia) superpictus* Grassi, 1899**

The distribution extends from northern Pakistan and Afghanistan, through the Caucasus into southern Tadzhikistan and middle Asia, and through the Middle East and Asia Minor to southeastern Europe. European records are from Albania (coastal valleys) (Bates, 1941), Bulgaria (Gecheva, 1998), Croatia (Neratva Delta, North Dalmatia and Island of Pag) (Adamović, 1983; 1984), France (Corsica only) (Moussiegt, 1986; Schaffner, 1998), Greece (Athens, Epirus, Etolia, Euboea, Macedonia, Peloponnese, Thessaly, Thrace, Corfu, Crete, Cyclades) (Waterston, 1918; Pandazis, 1935; Stephanides, 1937, 1938; Livadas & Sphangos, 1941; Peus, 1954; Samanidou-Voyadjoglou & Darsie, 1993), Italy (scattered foci in south and in Sicily, Calabria [Ionian and Tyrrhenian coasts]; not Sardinia) (Coluzzi & Sabatini, 1995; Romi *et al.*, 1997), Macedonia (Greek border area) (Lepes & Vitanović, 1962), Russia (Dagestan, Caucasus) (Gutsevich *et al.*, 1971; Gornostaeva, 2000), Turkey (Edirne, Kırklareli, Tekirdag Provinces) (Postiglione *et al.*, 1973), Yugoslavia (Karst area of East Serbia, Pukovat) (Adamović, 1987). There are four doubtful records from continental Spain (Cordoba, Huelva, Murcia) and the Canary Islands (Encinas Grandes, 1982).

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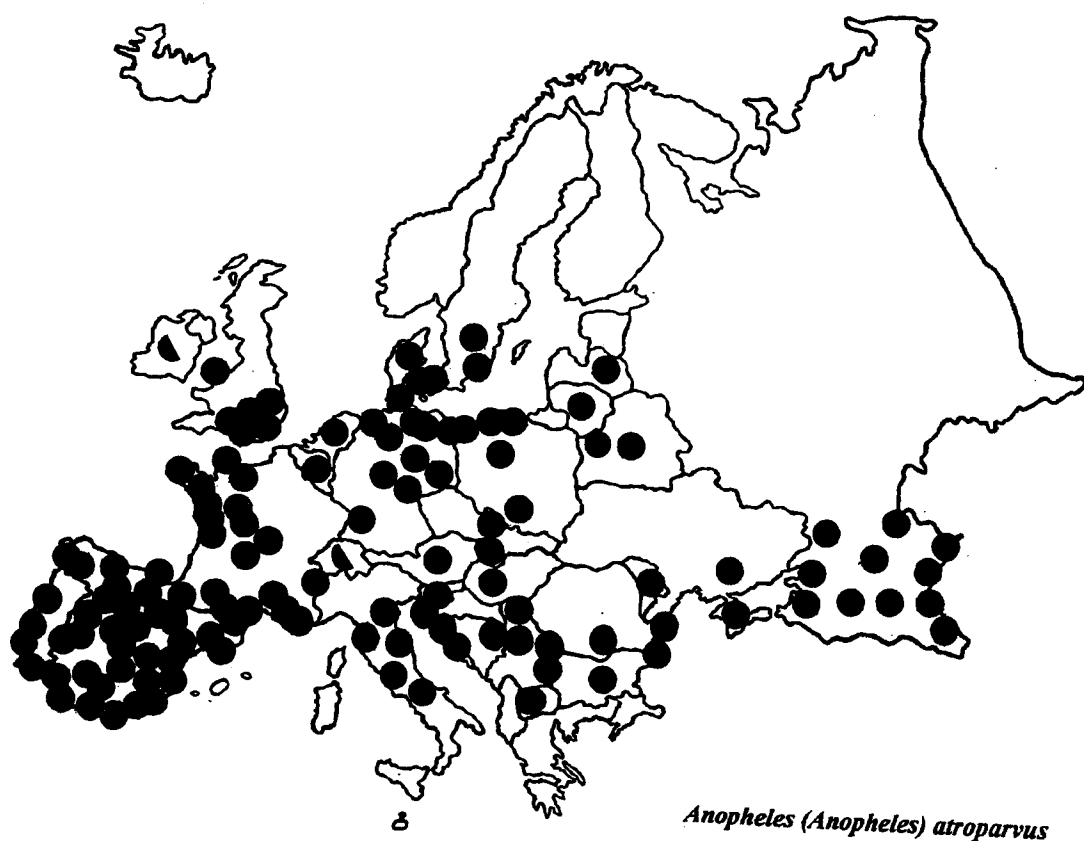
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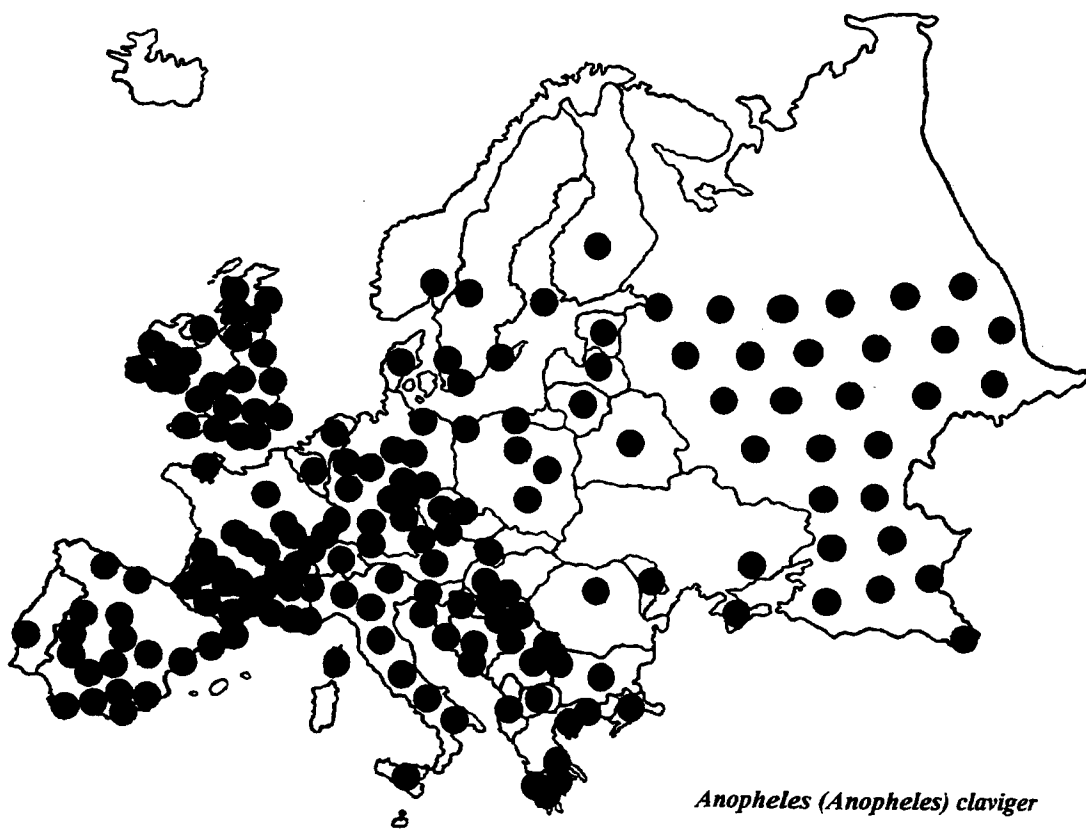
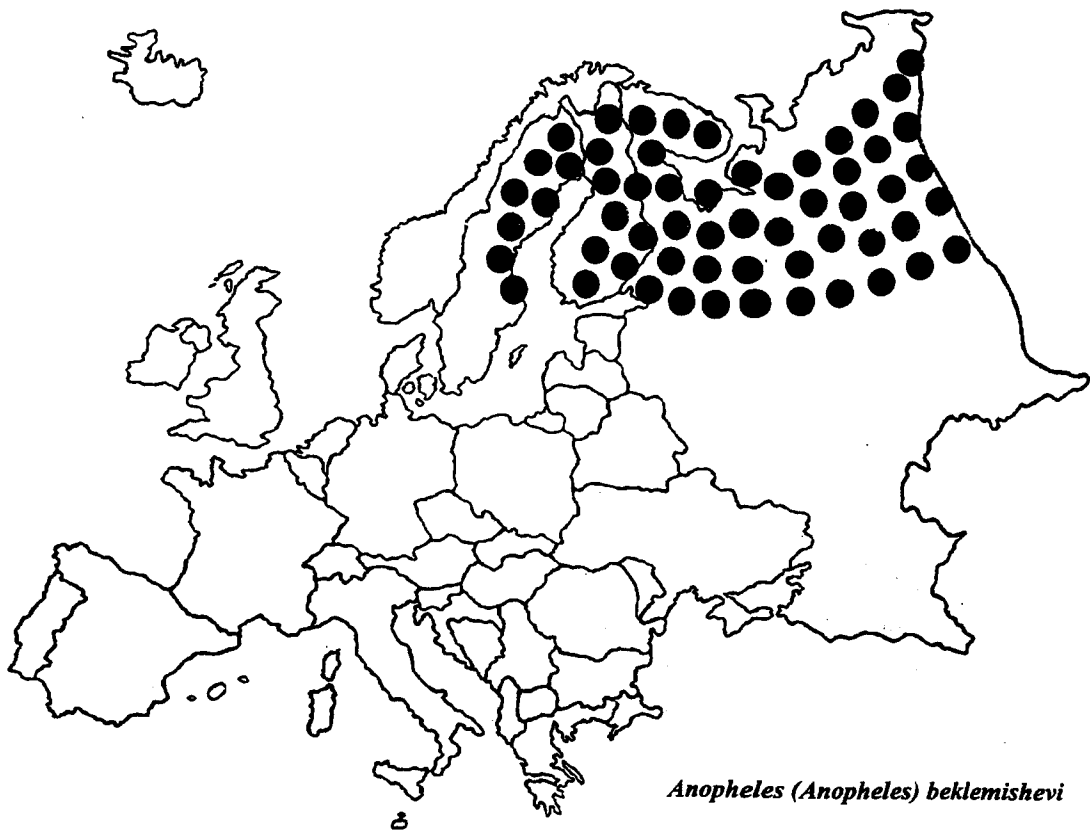
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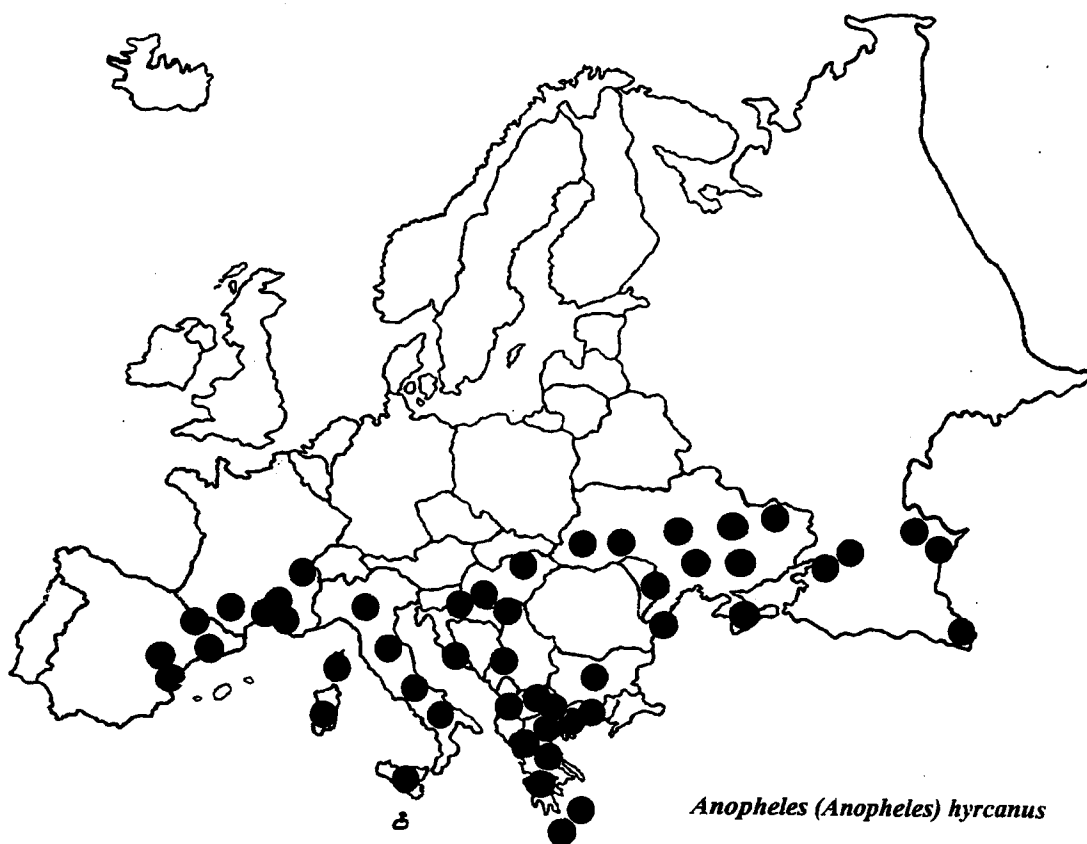
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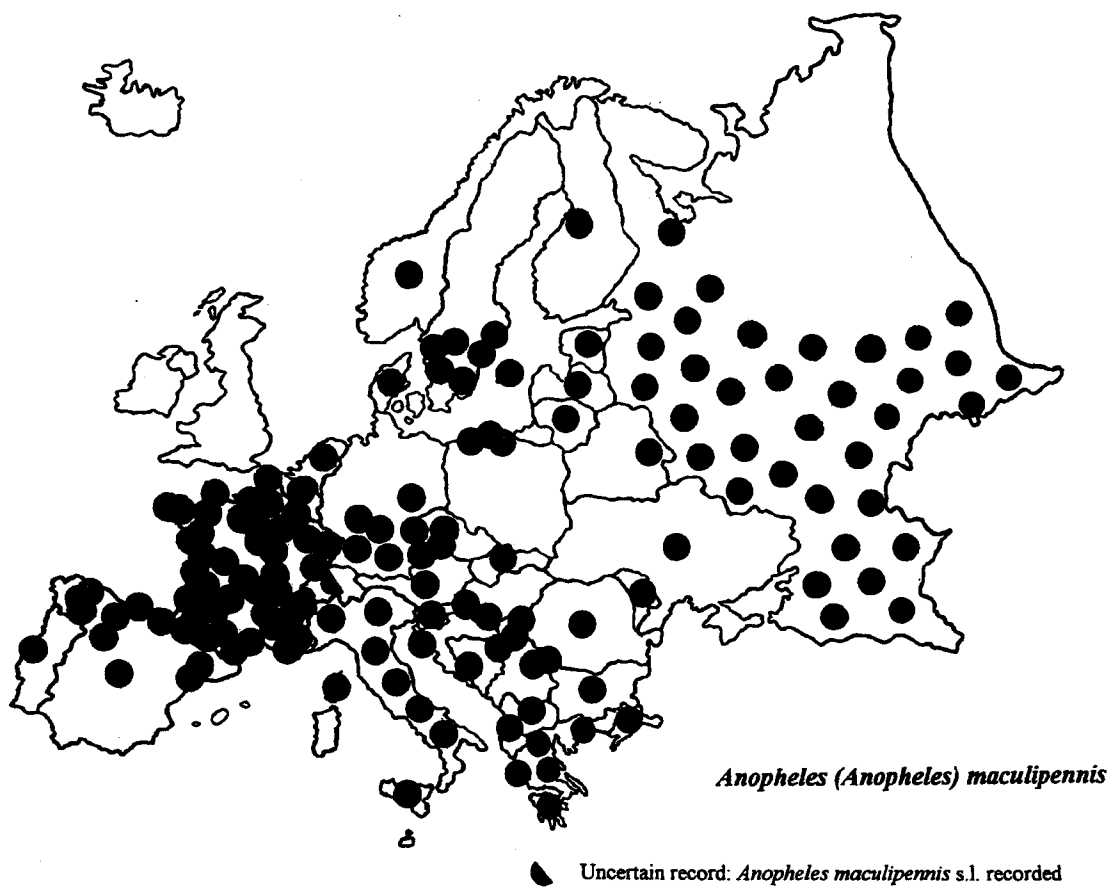
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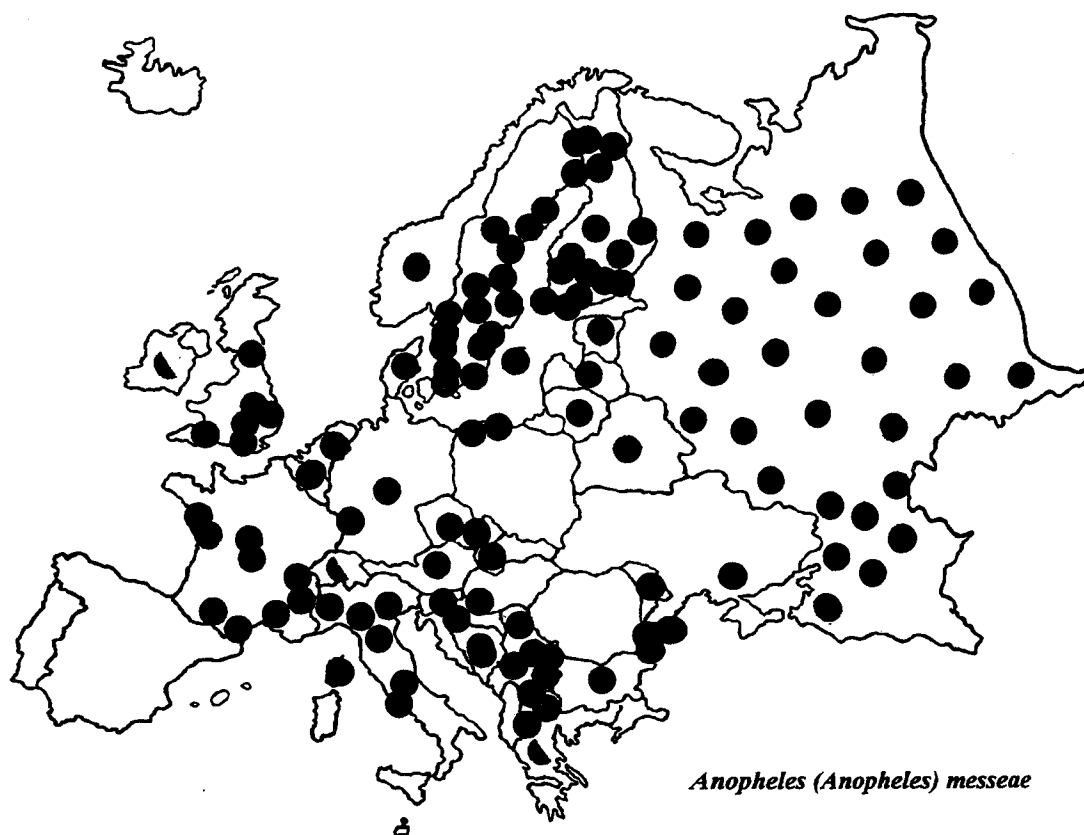
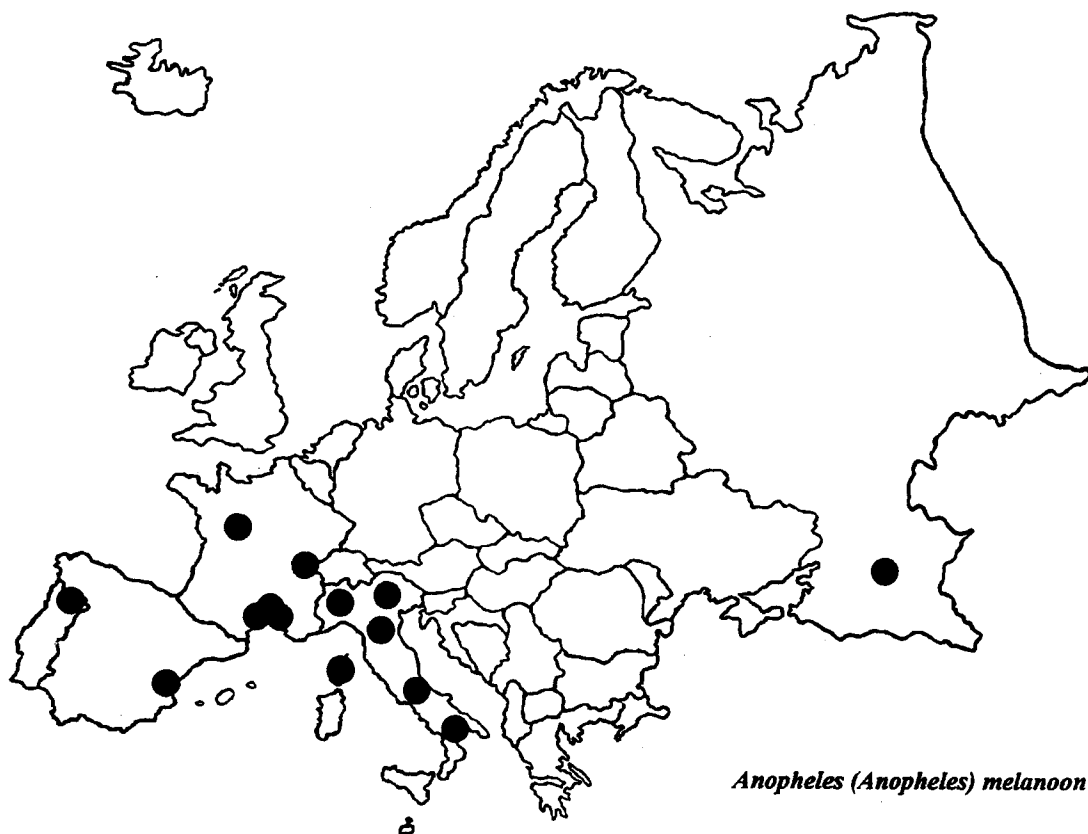


● Uncertain record: *Anopheles maculipennis* s.l. recorded





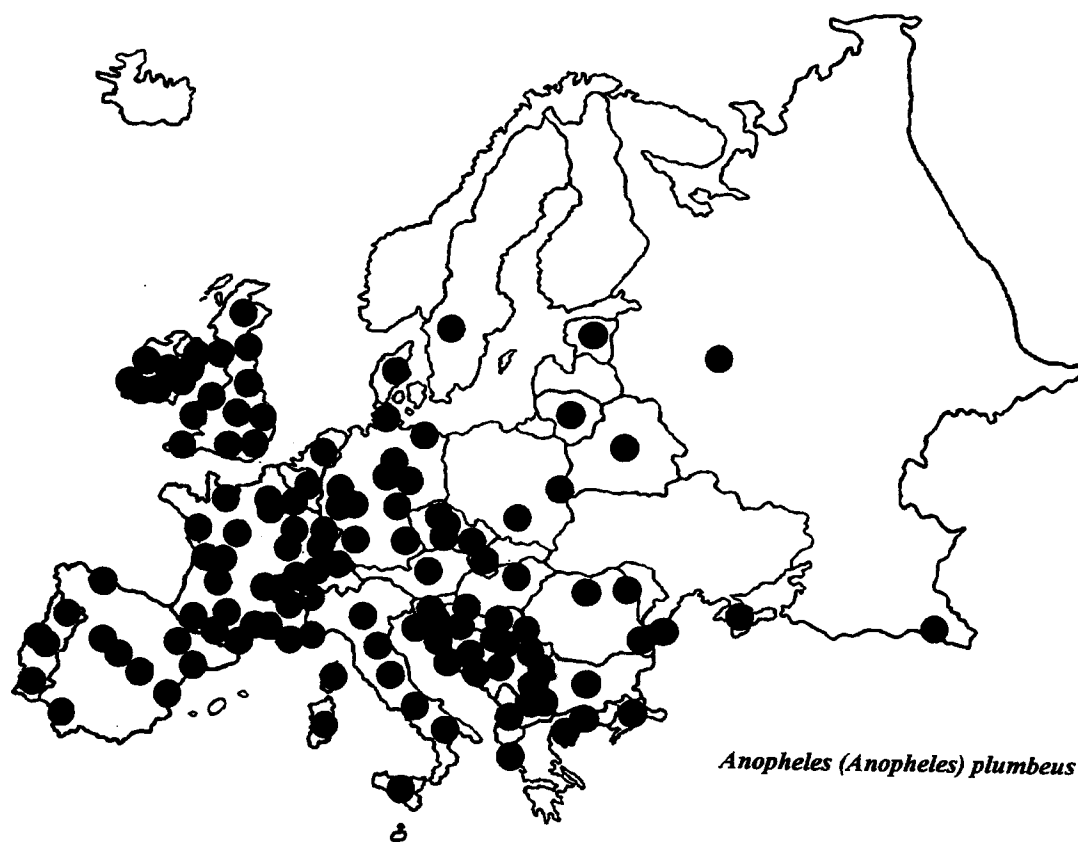




● Uncertain record: *Anopheles maculipennis* s.l. recorded



Anopheles (Anopheles) petragrani



Anopheles (Anopheles) plumbeus

