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Distribution of Orthoptera in Relation to the Anatolian Diagonal in Turkey

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Abstract

In this work, Turkey's Orthoptera fauna were evaluated in relation to a possible break due to the hypothetical Anatolian Diagonal. Among the total 480 taxa (species-subspecies) of the Asia Minor 27% were found only in the East, 44% only in the West, 6% over the Diagonal and lastly 23% on both sides. In conclusion, it was found that 71% of the Anatolian Orthoptera show the diagonal-specific distribution. The similarity between Eastern and the Western taxa is about 29%. The possible reasons for this break were discussed.

Introduction

Various subpopulations of insects were produced in Anatolia for all insect groups due to the fact that Anatolia (Asia Minor) is a mountainous land and for the presence of various climate types (DEMIRSOY & DUMONT 1988). This explains why Anatolia is a richer district than other palearctic subregions in relation to the faunal diversity. This fact makes it of course more difficult to determine the faunal structure of Anatolia clearly. The clear determination of the faunal structure of the Anatolia will contribute to a large extent the classification of species dispersed over palearctic both in the past and in the present as well.
If we consider paleogeological changes and the present topographical structure of Anatolia in order to understand Anatolian faunal structure we believe that it is neccessary to know another characteristic (ÇIPLAK & DEMIRSOY 1991): That is the topographical effect produced by the "Anatolian Diagonal Line" on the elements of flora and fauna of Turkey which were originally suggested by DAVIS (1971), and special importance paid recently on it by some botanists (EKIM & GÜNER 1986) and zoologists (DEMIRSOY & DUMONT 1988; ÇIPLAK & DEMIRSOY 1991).

Anatolia is divided by this diagonal belt which is a massive structure formed by continuous mountains from the Nort-East towards the South-West as well as from the East to the West. This line perfectly isolated many East and West Anatolia species of organisms just from the begining of geological origination since miocene-pliocene.
Especially in those species whose ability of motion is limited (immobile passively or actively) or in species with limited ecological valence, the isolation continued very effectively.

It is necessary to know the population of living organisms of both sides and the determination of the specific localities by which gene pools (if existed) could come in contact from both regions. All these will contribute a clear diagnosis of species in this region.

Turkey's Orthoptera fauna have been determined by various workers (in various periods) in more satisfactory level than other insect groups. Since there are rich and abundant references, the discussions of the effect of the Diagonal on the Orthoptera fauna will supply new data for the existing hypothesis concerning the Diagonal. Nevertheles, these should be evaluated in conjuction with the geological history of the Diogonal, the historical distribution and the present status of Orthoptera fauna.
During the period in which shrunken Tethys Sea connected the Indian Ocean with the present Mediterranea and the Atlantic Ocean through Central Europe, naturally the fauna of the Palearctic region were also existed in Anatolia. All the animals relic of that time are today accepted as endemic forms of Asia Minor (DEMIRSOY 1979). Some of the Orthoptera in this character are as following:

Acrididae
- Ebnerodes sp., Nocaracris sp., Tmethis sp. and Anothrotes (Pamphaginae);
- Dociostaurus cappadocicus and Gomphocerus sp. - Trydactylus irremipes (Trydactylidae)
- Isophya sp. and Poecilimon sp. (Tettigoniidae)

According to DELATTIN (1951), in addition to the elements of special fauna of Anatolia in this period, the elements of Mediterranean subregion of the Palearctic were also present and effective. In fact today, although the following are typical Mediterranean they are dispersed all over Anatolia (DEMIRSOY 1979).

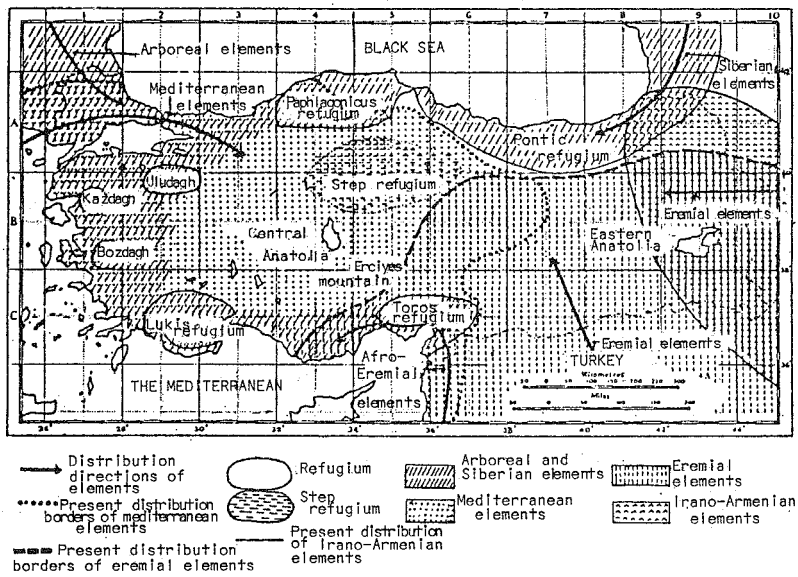
Acrididae
- Oedipoda germanica meridionalis (in Anatolia and Greece)
- Dociostaurus brevicollis (in all Mediterranean countries)
- Tripodopola longicornis greace (Western Anatolia and Greece)

Tettigoniidae
- Isophya, Poecilimon, Leptophyes, Platycleis and Drymedusa

When the glacial phases started, the faunal elements existed at the North migrated towards the South via two different ways (DELATTIN 1948; KOSSWIG 1975; DEMIRSOY 1973, 1977, 1979). The first was through Caucasia towards the Irano-Caspian Refugium, and the other was through Europe towards the Macedonia-Thrace Refugium, thus they spread all over Anatolia. For the presence of a lake in the Central Anatolia then, the elements of both refugium had a contact through Northern Anatolia and Southern Anatolia mountains. After the glacial period, some moved again to the North while some stayed in Anatolia. The migration routes to the Anatolia during the glacial period is represented on Map-1.

When we look at Map-1, the dispersal of the Siberian and Eremial elements entering Anatolia from the East side of Diagonal, and Arboreal and Mediterranean elements entering Anatolia from the West side, could be hindered by this Diagonal Line itself in Anatolia.

In this work, as much literature of Turkey's Orthoptera as possible have been collected and reviewed in the references numbered as 1-38. In the ligth of our own studies as well as the related literature the dispersal of the Orthoptera have been determined and they were evaluated in relation to the Anatolian Diagonal. The dispersal of the species whose diversity are specific to the East and West side of the Diagonal were compared with those of districts neighbouring Anatolia. In the end, it has been attempted to determine whether there has been gap or disruption of the Turkey's Orthoptera in relation to the hypothetical Diagonal in question.



Map-1. Zoogeographical map of Asia Minor (reprinted from Demirsoy,1979).

Results

Up to now 138 genera belonging to the order of Orthoptera have been determined by various authors. In our present work, it has been found that the taxa (species-subspecies) of 36 genera out of these 138 genera are present only in the West side of Diagonal, and the taxa of 23 genera are present only in the East side of Diagonal. The other taxa of remaining 79 genera are present in either the East or West, or both side of Diagonal.

According to the knowledge obtained from both references and from our studies, about 480 orthopteran taxa (species-subspecies) were published for Turkey. Their distribution and percentage are demonstrated in Table 1.

Table 1. The distribution and persentage of the species- subspecies of Turkey's Orthoptera in relation to the Diagonal.

	species-subspecies	%
East of Diagonal	131	27
West of Diagonal	210	44
Over the Diagonal	30	6
On the both sides	109	23
TOTAL	480	100

Those genera whose dispersal are specific to the Diagonal are generally monotypical. Nevertheless the polytypical genera are also present to some extent. The genus **Eupholidoptera** (Tettigoniidae) shows a typical Western distribution. However, only one species (E. tauricola) out of 17 has been found in the East of the Diagonal around Elazìg-Harput, (Map-2). In addition, the other species of Eupholidoptera were determined as shown in following:

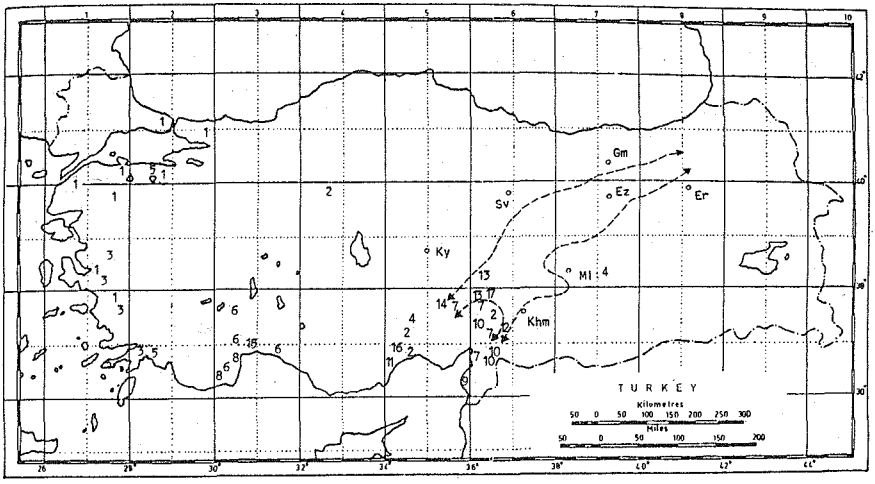
- E. smyrnensis, Aegean islands, Bulgaria and Western Anatolia
- E. werneri, Syria and South Anatolia
- E. parasina, Aegean Islands and West Anatolia
- E. cypria turcica, South Anatolia (one subspecies of this species was found in Cyprus)

The following species has not been found outside of Anatolia:

E. annulipes	E. sevketi	E. tahtalica
E. krueperi	E. anatolica	E. raggei
E. ummimaculata	E. karabagi	E. marashensis
E. mersinensis	E. demirsoyi	E. tauricola

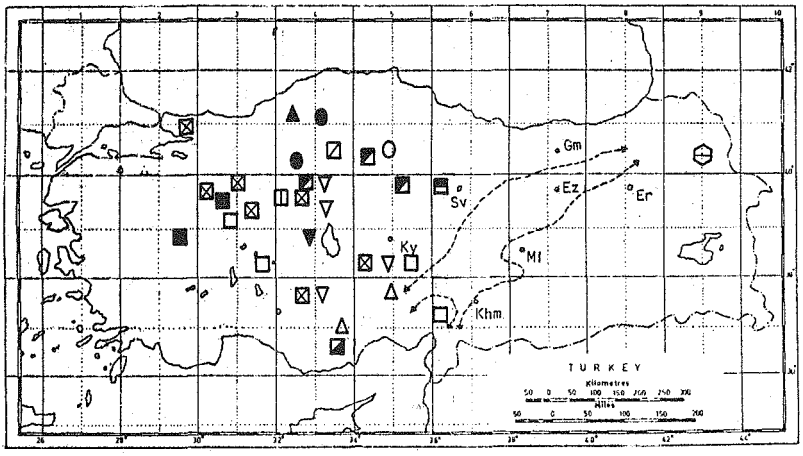
However, other Eupholidoptera species are found in Europe.

Similarly, G. arasi is the only species belonging to the total 16 **Glyphomethis** (Pamphagidae) species-subspecies given for the East - around Kars- (Map-3). The rest of Glyphomethis taxa show dispersal in the Central and Southern Anatolia. In Europe only G. heldrichi species exists. This species does not exist in Anatolia but other taxa are endemic for Anatolia.



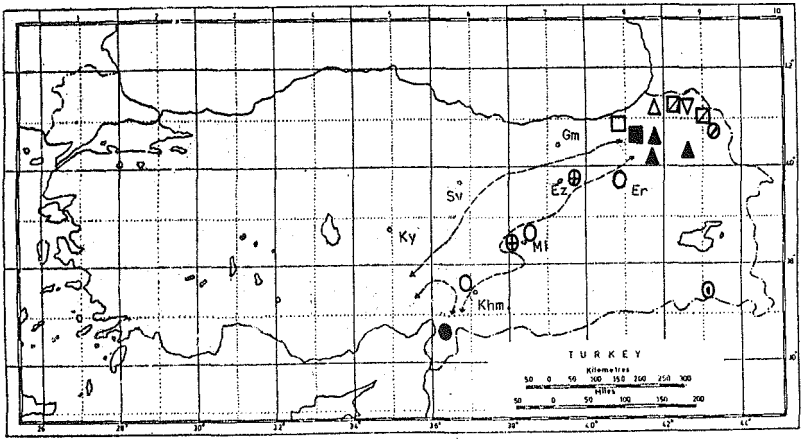
Map-2. Distribution of Eupholidoptera in Turkey. 1-E.symrnensis, 2-E.annulipes, 3-E. parasina, 4-E.tauricola, 5-E.krueperi, 6-E.anatolica, 7-E.sevketi, 8-E.tahtalica, 9-E. werneri, 10-E.excisa, 11-E.umimaculata, 12-E.cyprius turcicus, 13-E.marashensis, 14-E. raggei, 15-E.karabagi, 16-E.mersinensis, 17-E.demirsoyi (reprinted from Salman 1983).

Abb.: Ky.: Kayseri, Khm.: Kahramanmaraş, Ml.: Malatya, Sv.: Sivas, Er.: Erzurum, Ez.: Erzincan, Gm.: Gümüşhane



Map-3. Distribution of Glyphomethis in Turkey. △-G.holtzi holtzi, ▲-G.holtzi extimus, ▽-G.holtzi pulcripes, ▼-G.holtzi spinosus, □-G.dimorphus dimorphus, ■-G.dimorphus armenus, ◪-G.ovipennis- ⊠-G.escherichi escherichi, ◫-G.escherichi coloripes, ▩-G.escherichi elatior, ○-G.sevketi, ●-G.inermis, ◩-G.adaliae adaliae, ◪-G.adaliae angorensis, ⊖-G.arasi, G.raggei (locality is unknown).

On the other hand, of the genera showing polytipical spread on the East of the Diagonal, 3 species of the **Phonochorion** (Tettigoniidae) Ph. satunini, Ph. artvinensis and Ph. uvarovi have been determined at North-East Anatolia (Map-4). While Ph. satunini is spread in Armenia in addition to Anatolia. Again the 3 species of **Paradrymedusa** (Tettigoniidae) P. sordida, P. aksirayi and P. brevicerca are found at the same area (Map-4). Of the same family the Turkey species of the genus **Phytodrymedusa** excluding Ph. hakkarica are either present on the Diagonal in the Eastern part of Diagonal which are Ph. expugnata, Ph. armeniaca, Ph. demirsoyi and Ph. harzi (Map-4).



Map-4. Distributibution of Phonochorion, Paradrymedusa and Phytodrymedusa in Turkey. Phonochorion: □-Ph.satunini, ▨-Ph.artvinensis, ■-Ph.uvarovi; Paradrymedusa: Δ-P.sordida, ▲-P.aksirayi, ∇-P.brevicerca; Phytodrymedusa: ○-Ph.expugnata, ⓪-Ph.hakkarica, ∅-Ph.armeniaca, ⊕-Ph.demirsoyi, ●-Ph.harzi.

Very importantly, the dispersal of the genera of the subfamily Pamphaginae which includes typical endemic forms of Anatolia (DEMIRSOY 1973), such as

Eremopeza
- E. gibbera gibbera, E. festiva, E. gibbera lata, E. saussurei saussurei -

Paranothrotes
- P. asulcatus, P. *eximius eximius*, P. *eximius nigroloba*, P. kosswigi, P. levis, P. gotvendicus gotvendicus, P. opacus hakkaricana -

are westernly limited by the Diagonal (and there is no passage to the West) (Map- 5).

There is no species of Eremopeza in Europe. However, the following distribution of the same genus are observed:

- E. saussurei saussurei, Iran and Azerbaijan
- E. gibbera gibbera, Northern Syria
- E. gibbera lata, Nort-Western Iran
- E. festiva, Armenia

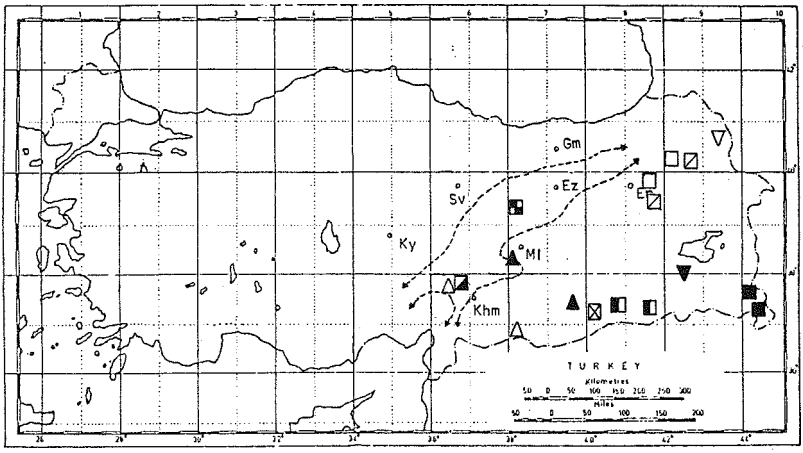
P. tölgi, a species of genus **Paranothrotes**, is found in Iran and Iraq not in Anatolia. The other Paranothrotes taxa determined in the East of Turkey have been found only in Anatolia. Where as other taxa of the same genus exist in Iran and Azerbaijan (BEI-BIENKO & MISTSHENKO 1963). The number of genera specific to the West of the Diagonal belt is more numerous.

The genus **Rhacocleis**, R. turcicus, R. anatolica, R. germanica, R. acutangula, is spread on the West and Central Anatolia (Map-6). R. germanica is wide-spread in all other parts of Europe except Northern Europe. In addition, R. graeca species, which is recorded for Greece, is not recorded in Anatolia. The genus **Anadolua** is endemic for Anatolia (Map-6). The species A. schwarzi, A. rammei, A. burri and A. davisi in this genus are observed in South-West and West Anatolia.

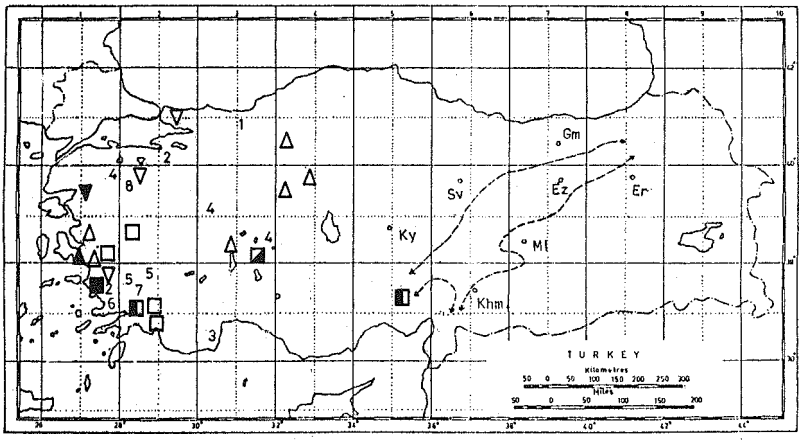
The genus **Anterastes** which has specific distribution to the West of the Diagonal, has 8 species determined for Turkey. These are spread on the West of the Tuz Gölü (Map-6). The species of this genus look like as if they are specific to the platoes of the Western Anatolia. While A. turcicus, A. burri, A. babadaghi, A. tolunayi, A. akdaghensis and A. uludaghensis exist only in the West Anatolia. A. serbicus is known in Yugoslavya, Bulgaria and Albenia.

Other example dispersed in the West is the genus **Paranocarodes** (Pamphaginae). The dispersion of the genus with 4 species and 8 subspecies is ended by the Diagonal on the East (Map-7). Among the species-subspecies which are inhabited on the Central and West Anatolia, only P. sulcatus determined in Syria. All others are endemic for Anatolia.

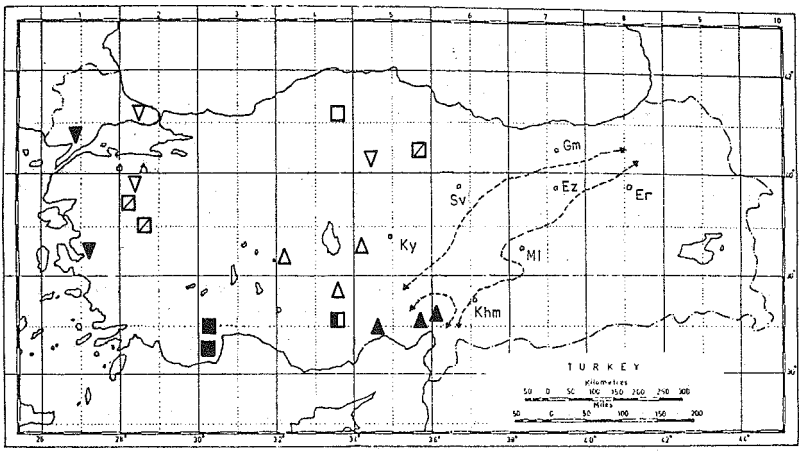
Some of genera have species existing on both sides of the Diagonal line. However, their Eastern and Western species are distinct. **Isophya** genus which has 28 species determined for Turkey, of which 6 species are seen only in the East, and 17 species only in the West of the Diagonal and 3 species are just on the Diagonal. However, it is not known what locality I. triangularis and I. hemiptera are collected (Map-8). I. retenbacheri which is specific to the East was also determined in Armenia and West Caucasia; I. zernovi at Batum. The species which are typically Eastern type of distribution I. sikorai, I. bicarinata and I. hakkarica have been determined only in Anatolia. I. savignyi which has a dispersion over the Diagonal can also be seen in Syria, Jordan and Palestine.



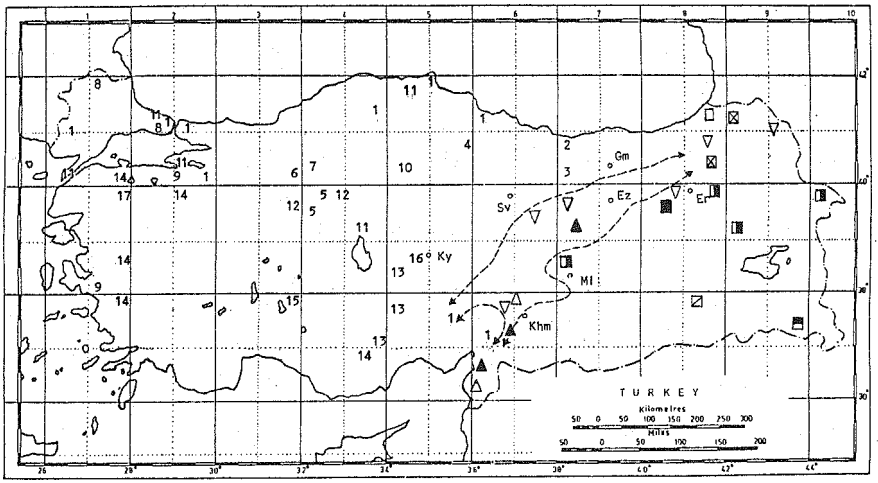
Map-5. Distribution of Eremopeza and Paranotrotes in Turkey. Eremopeza: △-E.gibbera gibbera, ▲-E.gibbera lata, ▽-E. festiva, ▼-E.saussurei saussurei; Paranotrotes: □-P.asulcatus, ◪-P.eximius eximius, ◪-P.eximius nigroloba, ◪-P.kosswigi, ◧-P.levis, ■-P.opacus hakkaricana, ☒-P.gotvendicus gotvendicus.



Map-6. Distribution of Rhacocleis, Anadolua and Anterastes in Turkey. Rhacocleis: △-R.turcicus, ▲-R.anatolica, ▽-R.germanica, ▼-R.acutangula; Anadolua: □-A.schwarzi, ◪-A.rammei, ◧-A.burri, ■-A.davisi, Anterastes: 1-A.serbicus, 2-A.anatolicus, 3-A.turcicus, 4-A.burri, 5-A.babadaghi, 6-A.tolunayi, 7-A.akdaghensis, 8-A.uludaghensis.



Map-7. Distribution of Paranocarodes in Turkey. △-P.beieri, ▲-P.sulcatus, ▽-P.straubei straubei, ▼-P.straubei serratus, □-P.straubei paphlagonicus, ▨-P.fieberi fieberi, ◧-P.fieberi tolunayi, ■-P.fieberi anatoliens.



Map-8. Distribution of Isophya in Turkey. □-I.retenbacheri, ▨-I.sikorai, ⊠-I.zernovi, ◧-I.bicarinata, ■-I.hakkarica, ■-I.kosswigi, △-I.savignyi, ▲-I.rodsjancovi, ▽-I.schneideri, 1-I.amplipennis, 2-I.reticulata, 3-I.sureyai, 4-I.acuminata, 5-I.nervosa, 6-I.ilkazi, 7-I.obtusidens, 8-I.tenuicerca, 9-I.rectipennis, 10-I.stenocauda, 11-I.pavelig, 12-I.karabagi, 13-I.major, 14-I.straubei, 15-I.anatolica, 16-I.pantheri, 17-I.cania, 18-I.triangularis, I.hemiptera (locality is unknown).

The following distribution was also recorded:

- I. rodsjancoi in Transcaucasia,
- I. schneideri in Northern-Caucasia, Southern Daghestan, Azarbaijan, Armenia and Nahcivan,
- I. amplipennis, I. rectipennis and I. tenuicerca which were found to be specifically spread to the West side of Diagonal, are also found in Balkans.

Other Western species are endemic for Anatolia.

Similarly, the **Poecilimon** genus with 49 Turkey species has typical distribution concerning the Diagonal belt. Ten species were determined only on the East, 38 species on the West and one species (P. zonatus) is wide spread (Map-9). The Eastern species:

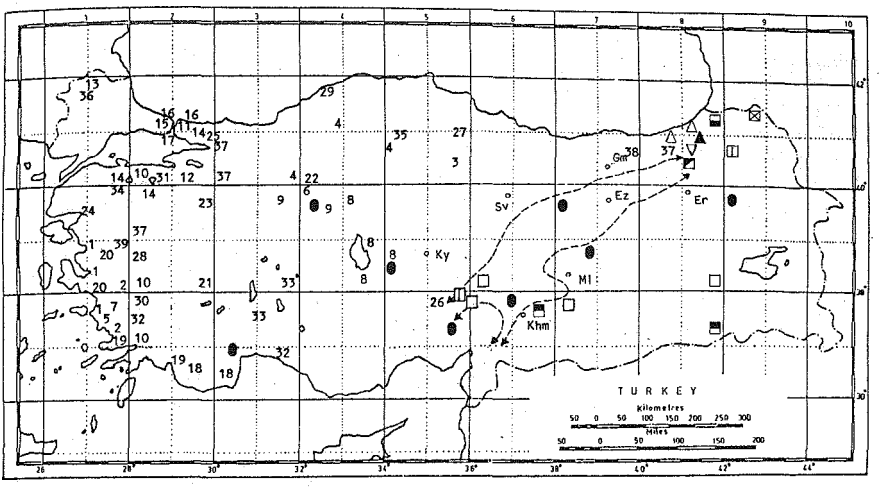
- P. schmidti was also recorded in the Caucasia, Azerbaijan Crimea, Hungary, Romania, Yugoslavia and Italy
- P. similis in Caucasia, Daghestan, Azerbaijan and Armenia;
- P. djaconovi in Caucasia;
- P. syriacus in Syria, Lebanon, Palestine and Israel. The other Eastern species P. rammei, P. tschorensis,
- P. variicercis, P. harveyi, P. tauricola and P. raggei are all endemic for Anatolia.

The species determined in the West including P. sanctipauli and P. hammatus are also found in some Aegean Islands. Again, while the western species, P. henrichi and P. mirammae are spread in the Bulgaria, P. brunneri in Ukrania, Romania, Bulgaria, Greece and Albenia all other species are endemic for Central and West Anatolia.

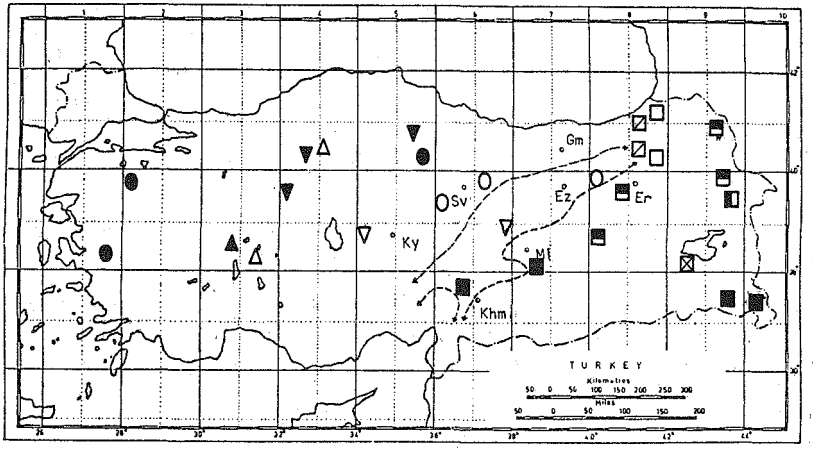
Another genus having different species on the East and West of the Diagonal is **Paranocaracris** (Pampaginae). The easternly spread subspecies of this genus:

- P. elegans elegans and P. elegans tridentatus are found only in Anatolia.
- P. rimonsonae kosswigi in Anatolia and Armenia
- P. rupripes rupripes including Anatolia is also spread in Azerbaijan, Nahcivan, Armenia and Iran
- P. citripes acinus subspecies which is specific to the Diagonal is found at the North and P. rupripes rijidus at the South.

Other subspecies are present at the Central and West Anatolia (Map-10).



Map-9. Distribution of Poecilimon in Turkey. Δ-P.schmidti, ▲-P.rammei, ◪-P.harveyi, ▽-P.tschorochensis, ▼-P.variicercis, □-P.syriacus, ⊠-P.djacanovi, ◫-P.tauricola, ▬-P. raggei, ■-P.similis, ●-P.zonatus, 1-P.sanctipauli, 2-P.hammatus, 3-P.conicus, 4-P.cervus, 5-P.tedereri, 6-P.luschani, 7-P.izmirnensis, 8-P.excisus, 9-P.uvarovi, 10-P.ammisus, 11-P. zimmeri, 12-P.turciae, 13-P.henrichi, 14-P.anatolicus, 15-P.mirammae, 16-P.bosphorus, 17-P.bidens, 18-P.birandi, 19-P.inflatus, 20-P.pulcher, 21-P.angulatus, 22-P.glandifer, 23-P.kutahiyensis, 24-P.pergamicus, 25-P.adentatus, 26-P.haydari, 27-P.neglatus, 28-P. unispinosus, 29-P.celebi, 30-P.tuncayi, 31-P.rammeanus, 32-P.bilgeri, 33-P.davisi, 34-P. turcicus, 35-P.xenocercus, 36-P.brunneri, 37-P.sureyyanus, 38-P.bischoffi, 39-P.minitus, P.incertus (locality unknown).



Map-10. Distribution of Paranocaracris in Turkey. Δ-P.citripes idrisi, ▲-P.citripes citripes, ▽-P.citripes bicoloripes, ▼-P.rupripes bodenheimeri, ●-P.rupripes burri, □-P.elegans elegans, ◪-P.elegans tridentatus, ⊠-P.rimonsonae kosswigi, ▬-P.rupripes rupripes, ◧-P.rupripes rigidus, ■-P.rupripes subrubrata, ○-P.rupripes acinosus.

Discussion and conclusion

Most of inner Anatolia East of Diagonal (but excluding Mesopotamia) is higher and more mountainous than it is to the West, with colder winters and snow-lie; in general the rocks are harder. However, according to DAVIS (1971), these physical and climatic differences do not seem adequate to explain such a major floral break at the specific and generic rank. In Davis's report the phenomenon probably stems from Anatolia's tertiary history. Changes in Anatolian paleogeography as explained by KOSSWIG (1967) might be the reason for the relevant distribution of the fauna and flora. Some of the physical characteristics are also dependent on the geomorphological structure of the region as well as the distance from the sea. Just as the Diagonal divides the East and the West, it looks as though the Eastern Taurus divides the East and the South-Eastern Anatolia. Generally, the South-East characteristic resemble those of the Diagonal (such as Central Anatolia).

While DAVIS (1971) points out the fact that this floral break in Anatolia is due to paleogeographical changes in tertiary, EKIM & GÜNER (1986) explain these differences with the ecological and climatic factors. However, this hypothetical Diagonal can be accepted as a high altitude forming a typical ecological barier in conjuction with other characteristics of this altitude. The distribution of species can be determined by the continuity and/or similarity of the habitat. If we consider this point together with the discontinuity (break) of the Diagonal, it may easily be possible to explain the differences between the Eastern and Western type of the distribution of the species as pointed out by DEMIRSOY (1979).

As we pointed out previously, the effect of the Diagonal must be more distinctive on those species with limited mobility and/or with restricted ecological valence. In fact, generally, the Orthoptera species specific to the East or West of the Diagonal are either wingless forms or westigial-winged forms and therefore with limited mobility. For instance, the fact that the Pamphaginae subfamily which includes the wingless taxons (species-subspecies) and most of which show diagonal-specific distribution, is typically in accordance with the above thought. Similarly, the other family Tettigoniidae is again diagonal-specific, have also wingless form in general.

In addition, if we look at the distribution outside Anatolia of those taxons which are diagonal-specific and not endemic, we will note the following observation: even though those which are specific to the West could be seen in Europe (especially Aegean Islands and Balkans), they could not be found in Caucasia, Iran and Iraq. The Eastern taxa on the other hand, are spread in Iraq, Iran and Asian part of C.I.S. (USSR), but could not be found in Europe at all. These observations can be accepted as proofs to support the view of faunal break due to the Diagonal line in Turkey.

As well as the Diagonal, it looks as though there may be a side-break between East and South-East Turkey due to the Eastern Taurus mountains. For example, while Eremopeza festiva is spread on the North of the

Eastern Taurus; E. gibbera gibbera, E. gibbera lata and E. saussurei saussurei are on the south of Taurus. The species of Paranocaracris and Paradrymedusa genera are distributed on various sides of Anatolia but they are not determined on the South of Eastern Taurus. The existence of such a break in this part of Turkey may require a special treatment with the other faunal data.

According to our present knowledge, about 71% of Orthoptera of Turkey show diagonal-specific distribution. Indeed, for the fact that many species are known from restricted localities, more detailed work is needed in order to arrive at a definite conclusion. After more detailed works the distribution of some species might be widened.

In order to know an exact distribution of a species (at least for invertabrates) we believe that something like the square system as it used for Turkey's flora (DAVIS 1965) is needed. To define the faunal break due to the Diagonal more clearly, some genetic and/or biochemical data (such as enzyme polymorphism), may be necessary as well as the knownledge on bridge points between the gene pools of some distinct populations of Orthoptera fauna if existed at all.

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References

ADELUNG, N. (1907): Beitrage zur Kenntnis der Orthopteren Fauna Transcaucasiens. Hor. Soc. Ent. Ross. 38: 32-82

BEI-BIENKO, G. J. (1954): Fauna USSR(Phaneropterinae). Zool. Inst. Akad. USSR, Nov. Ser., No: 59, II(2), 384 pp.

BEI-BIENKO G.J. & MISTSHENKO, L. L. (1951) The Grasshoppers of the fauna the USSR and Adjacent Countries. Akad. Nauk. USSR, Vol. I-II, 667 pp.

ÇIPLAK, B. & DEMIRSOY, A. (1991): Arguvan (Malatya) ve Çevresinde Orthoptera (Insecta) Faunasìnìn Incelenmesi. Tr. J. of Zool. 15: 98-114 p.

DAVIS, P. H. (1965): Flora of Turkey and East Aegean Islands I. Edinburg Univ. Press.

DAVIS, P. H. (1971): Distribution Patterns in Anatolia with Particular Reference to Endemism in Davis. Edit: Harper and Hedge, Plant Life of SW Asia, 15-27

DELATTIN, G. (1951): Über die Zoogeographischen Verhältnisse Vorderasien. Verh. Dtsch. Zool. Ges. Marburg, 206-214 p.

DEMIRSOY, A. (1973): Revision der Anatolischen Pamphaginae (Saltatoria, Caelifera, Pamphagidae). Entomol. Mitt. Zool. Mus. Hamburg 4(83): 404-427

DEMIRSOY, A. (1975): Erzurum Bölgesi Orthoptera (Insecta) Faunasînîn Tespiti ve Taksonomik ijncelen- mesi. Atatürk Üniv. Yay. 347: 122 pp.

DEMIRSOY, A. (1977): Türkiyenin Caelifera (Insecta) Faunasînîn Tespiti ve Taksonomik ijncelenmesi. Atatürk Üniv. Yay. No: 488: 352 pp.

DEMIRSOY, A. (1979): Zoocografya, Türkiye Faunasî, A-Ek Band, Hacettepe Üniv. Yay. 10: 53 pp.

DEMIRSOY, A. (1991): Calopteryx Leach, 1815 Species of Fore Asia and Some Considerations (Unpublished).

DOMONT, H. J., DEMIRSOY, A. & VERCHUREN, D. (1988): Breaking the Calopteryx-Botleneck: Taxonomy and Range of the Calopteryx splendens waterstoni Schneider, 1984 and of C. splendens Bartenet, 1909 (Zygoptera- Calopterygidae). Odonatologica 16(3): 139-247

EKIM, T. & GÜNER, A. (1986) The Anatolian Diagonal: Fact or Fiction? Proc. R. Soc. Edinburgh, 89B: 69-77

GÜMÜSSUYU, I. (1980): Türkiye Gryllidae (Orthoptera) Faunasî Üzerine Sistematik Çalîsmalar ile Türlerin Habitat ve Davranîslarîna ait Gözlemler. Temel Bilm. Cilt 4: 36-50

HARZ, K. (1969): The Orthoptera of Europe. Vol. I: 940 pp.

HARZ, K. (1975): The Orthoptera of Europe. Vol. II: 749 pp.

KARABAG, T. (1949): Ankara Vilayeti Dahilinde Mevcut Çekirgelerin Ekolojik, Cografi ve Sistematik Durumlarî Üzerine Arastîrmalar. Ank. Üniv. Z. Fak. Sayî: 4. 121 pp.

KARABAG, T. (1958): Türkiyenin Orthoptera Faunasî, Ank. Üniv. Fen. Fak. Yay. Un: 81, Zool. 4. 198 pp.

KARABAG, T. (1961): Revision of Drymedusa Stein and Related Genera. Bull. Brit. Museum, Vol. 11, No: 1.

KARABAG, T. (1962): Some New and Less Known Phaneropterinae, Proc. R. Ent. Soc. Lond. (B) 31: 1-2 p.

KARABAG, T. (1963-64): Some New Species and New Records of Tettigoniidae from Turkey. Comm. Fac.Sci. Univ. Ankara, Ser. C. Sciences Naturelles Tome XIII.

KARABAG, T. (1975): Studies in the Turkish Orthoptera (Insecta). I. New Species and Less Known Tettioniidae. Journ. Nat. History 9(3): 337-350 p.

KOSSWIG, C. (1951): Contributions to the Knowledge of the Zoogeographical Situation in the Near and Middle East. Experientia 7.

KOSSWIG, C. (1952): Zoogeography of the Near East. Syst. Zool. 4: 49-96

MISTSHENKO, L. L. (1941): Revision of the Genus Paranocarodes I. Bolivar and their Nearest Relieves. C. R. Acad. Sci. USSR, LXXVII: 517-520 p.

MISTSHENKO, L. L. (1942): Fauna SSSR (Catantopinae) Fauna of the USSR and its Immediate Neighbours Grasshoppers (Catantopinae). Zool. Inst. Acad. SSSR Nov, Serie, No: 54, Tom. IV, 608 pp.

MISTSHENKO, L. L. (1956): Revision of Palearctic Species of the Sphingonotus Fieber (Orth., Acrididae). EOS XII: 65-282

NADIG, A. (1968): Über die Bedeutung der Masifs de Refuge am Südlichen Alpenrand (Dargelegt am Beispiel einiger Orthopteren) Mitt. Schweiz. Ent. Ges. 41: 341-358 p.

RAMME, W. (1931): Beiträge zur Kenntnis der Palearktischen Orthoptera Fauna (Tett. et Acrid.) Mitt. Zool. Mus. Berlin, 17: 165-200 p.

RAMME, W. (1951): Zur Systematik, Faunistik und Biologie der Orthopteren von Südost-Europa und Vorderasien. Mitt. Zool. Mus. Berlin 27: 421 pp.

SALMAN, S. (1978): Agrì, Kars ve Artvin ijllerinin Orthoptera (Insecta) Faunasì Üzerine Taksonomik Arastìrmalar. Atatürk Üniv. Fen Fak. Yay. No: 82: 184 pp.

SALMAN, S. (1983): Turkish Bush-Crickets of the Genus Eupholidoptera (Decticinae). Syst. Ent. 8: 313-338.

UVAROV, B. P. (1921): The Geographical Distribution of Orthopterous Insects in the Caucasus and in Western Asia. Proc. Zool. Soc. Lond. XXXI: 447-472

UVAROV, B. P. (1929): Studies in the Iranien Orthoptera I. Some New or Less Known Tettigoniidae. Ann. Zool. Mus. Akad. Sci. USSR XXXI: 623-639

UVAROV, B. P. (1934): Studies in the Orthoptera of Turkey, Iraq and Syria. EOS X: 21-119

UVAROV, B. P. (1938): Studies in the Iranien Orthoptera, II. New and Less Known Acrididae from Southern and Balucistan. Ann. Mag. Nat Hist. Ser. 11, 371-381 p.

WEIDNER, H. (1969): Beiträge zur Kenntnis der Feldheuschreken (Caelifera) Anatoliens. Mitt. Hamburg Zool. Mus. Inst. 66: 146-226

List of Species and Genera (used in the text)

Fam. ACRIDIDAE
- Gomphocerus Thunberg, 1815
- Oedipoda germanica meridionalis Ramme, 1913
- Dociostaurus (Dociostaurus) brevicolis Eversman, 1848
- Dociostaurus (Stauronotulus) cappadocicus Azam, 1913
- Tripodopola longicornis Uvarov, 1934

Fam. TRYDACTYLIDAE
- Trydactylus irremipes Uvarov, 1934

Fam. TETTIGONIIDAE
- Leptophyes Fieber, 1853
- Platycleis Fieber, 1853
- Drymedusa Stein, 1860

Genus: Eupholidoptera Ramme, 1951
- E. anatolica (Ramme, 1930)
- E. annulipes (Brunner, 1882)
- E. cypria tucica Salman, 1983
- E. demirsoyi Salman, 1983
- E. karabagi Salman, 1983
- E. krueperi (Ramme, 1930)
- E. marashensis Salman, 1983
- E. smyrnensis (Brunner, 1882)
- E. prasina (Brunner, 1882)
- E. tauricola (Ramme, 1930)
- E. sevketi (Ramme, 1933)
- E. tahtalica (Uvarov, 1949)
- E. werneri Ramme, 1951
- E. umimaculata (Karabag, 1956)

- E. raggei Salman, 1983
- E. excisa (Karabag, 1952)

Genus Rhacocleis Fieber, 1853
- R. turcicus (Uvarov, 1930)
- R. anatolica Werner, 1933
- R. germanica (Herr.- Sac., 1840)
- R. acutangula Karabag, 1957

Genus Anadolua Ramme, 1939
- A. burri Karabag, 1952
- A. davisi Karabag, 1952
- A. rammei Karabag, 1952
- A. schwarzi Ramme, 1939

Genus Anterastes Br.-Wt., 1882
- A. serbicus Br.-Wt., 1882
- A. anatolicus Ramme, 1951
- A. turcicus Karabag, 1951
- A. burri Karabag, 1951
- A. babadaghi Uvarov, 1939
- A. tolunayi Karabag, 1951
- A. akdaghensis Ramme, 1951
- A. uludaghensis Karabag, 1950

Genus Phonochorion Uvarov, 1916
- Ph. satunini Uvarov, 1916
- Ph. artvinensis Bei-Bienko, 1954
- Ph. uvarovi Karabag, 1956

Genus Paradrymedusa Herman, 1874
- P. aksirayi Karabag, 1952
- P. brevicerca Karabag, 1956
- P. uvarovi Herman, 1874

Genus Phytodrymedusa Ramme, 1939
- Ph. armeniaca Ramme, 1939
- Ph. demirsoyi Karabag, 1956
- Ph. expugnata (Uvarov, 1916)
- Ph. hakkarica Karabag, 1956
- Ph. harzi Karabag, 1975

Genus Isophya Br.-Wt., 1878
- I. redtenbacheri Adelung, 1907
- I. sikorai Ramme, 1951
- I. zernovi Miram, 1938
- I. bicarinata karabag, 1957
- I. hakkarica Karabag, 1961
- I. kosswigi Demirsoy, 1975
- I. savignyi Br.-Wt., 1878
- I. rodsjankoi I. Bolivar, 1899

- I. schneideri Br.-Wt., 1878
- I. amplipennis Br.-Wt., 1878
- I. reticulata Ramme, 1951
- I. sureyai Ramme,1951
- I. acuminata Br.-Wt., 1878
- I. nervosa Ramme, 1951
- I. ilkazi Ramme, 1951
- I. obtusidens Ramme, 1951
- I. tenuicerca Ramme, 1951
- I. rectipennis Br.-Wt., 1878
- I. stenocauda Ramme, 1951
- I. paveli Br.-Wt., 1878
- I. karabagi Uvarov, 1940
- I. major Br.-Wt., 1878
- I. straubei (Fieber, 1853)
- I. anatolica Ramme, 1951
- I. pantheri Ramme, 1951
- I. cania Karabag, 1975
- I. triangularis Br.-Wt., 1891
- I. hemiptera Bei-Bienko, 1954

Genus Poecilimon Fischer, 1853
- P. schmidti (Fieber, 1853)
- P. rammei Miram, 1938
- P. harveyi Karabag, 1964
- P. tschorochensis Adelung, 1907
- P. variicercis Miram, 1938
- P. syriacus Br.-Wt., 1891
- P. djakonovi Miram, 1938
- P. tauricola Ramme, 1951
- P. raggei karabag, 1975
- P. similis Retowski, 1889
- P. zonatus I. Bolivar, 1899
- P. sanctipauli Br.-Wt., 1878
- P. hammatus Br.-Wt., 1878
- P. conicus Br.-Wt., 1878
- P. cervus Karabag, 1950
- P. ledereri Ramme, 1933
- P. luschani Ramme, 1933
- P. izmirnensis Ramme, 1933
- P. excisus Karabag, 1950
- P. uvarovi Ramme, 1933
- P. ammisus Br.-Wt., 1878
- P. zimmeri Ramme, 1933
- P. turciae (Ramme, 1951)
- P. henrichi Ramme, 1951
- P. anatolicus Ramme, 19332
- P. miramae Ramme, 1933
- P. bosphoricus Br.-Wt., 1878
- P. bidens Retowski, 1889

- P. birandi Karabag, 1950
- P. inflatus Br.-Wt., 1891
- P. pulcher Br.-Wt., 1891
- P. angulatus Uvarov, 1939
- P. glandifer Karabag, 1950
- P. kutahiyensis Werner, 1901
- P. pergamicus Br.-Wt., 1891
- P. adentatus Ramme, 1933
- P. haydari Ramme, 1951
- P. neglectus Ramme, 1931
- P. unispinosus Br.-Wt., 1878
- P. celebi Karabag, 1953
- P. tuncayi Karabag, 1953
- P. rammeanus Karabag, 1953
- P. bilgeri Karabag, 1953
- P. davisi Karabag, 1953
- P. turcicus Karabag, 1950
- P. xenocercus Karabag, 1956
- P. buruneri Frivaldski, 1867
- P. sureyanus Uvarov, 1930
- P. bischoffi Ramme, 1933
- P. minitus Karabag, 1975
- P. incertus Targioni, 1881

Fam. PAMPHAGINAE
- Ebnerodes Ramme, 1951
- Nocaracris Uvarov, 1928
- Tmethis Fieber, 1853

Genus Glyphomethis Bei-Bienko, 1851
- G. holtzi holtzi (Werner, 1901)
- G. holtzi extimus Bei-Bienko, 1951
- G. holtzi pulchripes (Uvarov, 1934)
- G. holtzi spinosus Karabag, 1956
- G. dimorphus dimorphus (Uvarov, 1934)
- G. dimorphus armenus (Ramme, 1951)
- G. ovipennis (Uvarov, 1934)
- G. escherichi escherichi (Krauss, 1896)
- G. escherichi coloripes (Cejchan, 1965)
- G. escherichi elatior (Ramme, 1951)
- G. sevketi (Ramme, 1951)
- G. inermis (Uvarov, 1934)
- G. adaliae adaliae (Uvarov, 1928)
- G. adaliae angorensis (Cejchan, 1968)
- G. raggei (Cejchan, 1965)
- G. helderichi (Brunner, 1882)
- G. arasi Salman, 1978

Genus Eremopeza Saussure, 1888
- E. gibbera gibbera (Stal, 1876)
- E. gibbera lata (Uvarov, 1934)
- E. festiva (Saussure, 1884)
- E. saussurei saussurei (Uvarov, 1918)

Genus Paranothrotes Mistshenko, 1951
- P. asulcatus Demirsoy, 1977
- P. eximius eximius Mistshenko, 1951
- P. eximius nigrogloba Demirsoy, 1977
- P. kosswigi Demirsoy, 1977
- P. levis Mistshenko, 1951
- P. opacus hakkaricana Demirsoy, 1977
- P. Ogotvendicus gotvendicus (I.Bolivar, 1912)
- P. tolgi (Ebner, 1919)

Genus Paranocarodes I. Bolivar, 1916
- P. beieri Ramme, 1951
- P. straubei straubei (Fieber, 1853)
- P. straubei serratus Uvarov, 1949
- P. straubei paphlagonicus Ramme, 1951
- P. fieberi fieberi (Brunner-Wattenwly, 1882)
- P. fieberi tolunayi Karabag, 1949
- P. fieberi anatoliensis Demirsoy, 1977
- P. sulcatus (I. Bolivar, 1912)

Genus Paranocaracris Mistshenko, 1951
- P. citripes citripes (Uvarov, 1949)
- P. citripes idrisi (Karabag, 1953)
- P. citripes bicoloripes (Uvarov, 1949)
- P. rupripes rupripes (Fischer-Waldheim, 1846)
- P. rupripes bodenheimeri (Uvarov, 1940)
- P. rupripes burri (Uvarov, 1943)
- P. rupripes rigidus Mistshenko, 1951
- P. rupripes subrubrata (Ramme, 1951)
- P. rupripes acinosus Mistshenko, 1951
- P. elegans elegans (Mistshenko, 1951)
- P. elegans tridentatus (Shcheltanoutsev, 1916)
- P. rimonsonae kosswigi (Karabag, 1953)