

ARTICLE VIII

REPORT ON TERRESTRIAL FAMILIES OF HEMIPTERA-HETEROPTERA

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The present paper is based on the collection of terrestrial Heteroptera made during the course of the Yale North India Expedition in Indian Tibet and the borders of Tibet proper in 1932. My very best thanks are due to Dr. Hellmut de Terra for the opportunity to make collections and observations in the little known territory traversed by the expedition and for his continued interest in the progress of the work after the return of the expedition. In a later paper I hope to discuss in detail the ecology and zoogeography of the various elements which compose the fauna of the highest inhabited zones of the Himalaya and Karakorum. I believe that it will be possible to correlate many of Dr. de Terra's geological findings with the results of such zoogeographic studies. Meanwhile a short zoogeographical account of the fauna of the highest localities is appended to the present contribution.

The taxonomic work here reported was begun at the British Museum in January, 1934. While working in London I received invaluable help from Mr. W. E. China, who is in charge of the unrivalled collections of Hemiptera at South Kensington. Mr. China spared himself no trouble in assisting me, and any merit that the present paper may possess is largely due to him. My thanks are also due to my friend Prof. A. Petrunkevitch for help with the Russian literature, and to Dr. E. D. Merrill and the staff of the New York Botanical Garden for determining specimens of food-plants.

The only previous work dealing with the Heteroptera of the region under discussion is Distant's report (1879) on the collections made by Stoliczka during the Second Yarkand Mission. Most of the Heteroptera in these collections were obtained at Murree and in the vicinity of Yarkand, but among terrestrial species *Lamprodema brevicolle* Fieb. is recorded from between Tangtse and Chagra (altitude c. 4,200 m.) in Indian Tibet. The specimen was determined by Edward Saunders and is presumably correctly named. The species is not represented in the present collection.

In Oshanin's catalogue (1912) several Heteroptera are recorded from Ladak, apparently on the authority of Horvath (1889), who enumerated a number of species collected by Pauli "in itinere suo e provincia Ladak in provinciam Pendshab." Since this collection contained a number of large brightly colored forms, some of which are known from other parts of the western Himalayas at comparatively low altitudes, it seems reasonable from the available data to suppose that the collection was made either in Kulu or in the Kashmir depression. As the present material consists exclusively of specimens from considerable altitudes, and contains no species present in Horvath's collection, the latter is not further discussed.

The material collected by the Yale North India Expedition comprises 76 specimens, representing thirteen species, of which one, a species of *Stictopleura*, is represented only by a female and a nymph; in the absence of a male it seems unwise to attempt a specific determina-

nation. Of the remaining twelve species, four appear to be already known, while two new genera, eight new species and one new subspecies are here described for the first time. It has also been necessary in the course of the work to re-examine some of the criteria used in the separation of the subfamilies and tribes of the *Lygaeidae*, and to study rather closely certain members of the genus *Nysius* allied to *N. ericae* (Schill.). The results of these studies are set out in the appropriate places below. All species in any way associated with aquatic localities will be described in a later paper.

In general Oshanin's catalogue (1912) has been followed as to nomenclature and classification. Bibliographic references are given for all specific names not included in that work, but otherwise only to papers to which actual reference is made in the text. A representative set of all species, including the types of those here described, has been incorporated in the collections of the Peabody Museum, Yale University; a first set of duplicates has been sent to Mr. China for the collections of the British Museum.

Family PENTATOMIDAE

Subfamily SCUTELLERINAE

Tribe Odontotarsaria

1. *Phimodera rupshuensis* sp. n.

Widely oval (Plate VIII, fig. 1), holotype 1.44 times as long as wide; moderately convex, opaque, covered with short, sparse pale pubescence; head, save for the raised parts of the jugae and clypeus and the regions at the bases of the eyes, pronotum, scutellum and exposed portions of the elytra, punctured, the distance between the punctures very irregular, averaging rather more than their diameter, under surface punctured but more sparsely so.

Color. Pale greyish yellow, puncturation black, head black, a narrow area round the eyes, jugae particularly in their raised part, and base of the clypeus largely yellow, a large spot on the anterior margin of the pronotum, and the base of the scutellum black; basal joints of antennae brown, the first and second narrowly yellow apically, terminal two joints black; anterior femora with a black ventral stripe and a less well defined posterior stripe fusing with the black puncturation dorsally, intermediate and posterior femora with black postero-ventral stripes, tibiae black apically and basally, on the dorsal surface the dark markings forming a stripe interrupted in its middle third, first and distal half of third tarsal joints dark brown.

Head. In front view (Plate VIII, fig. 2), about one-sixth longer than interocular width, subparallel and hardly constricted in front of the eyes, juga with outer angle widely rounded, anterior margin lightly curved from the external to the sub-obtuse inner angle, inner part of the juga in its basal half somewhat raised and encroaching on the clypeus; clypeus anteriorly subacute and projecting beyond juga, carinate in its anterior part, carina depressed posteriorly, becoming obsolete opposite the elevated part of the juga, vertex behind clypeus somewhat elevated. Ocelli separated from eye by a space subequal to the maximum diameter of the eye and rather greater than its width. Bucculae subprominent below clypeus, obtusely rounded behind (Plate VIII, fig. 3).

Antennae with first and second joints subequal, half as long again as third, fourth twice as long as the latter, fifth just over half as long again as fourth (0.27, 0.27, 0.18, 0.36, 0.58 mm.).

Rostrum reaching to posterior coxae.

Pronotum just over twice as wide as long (3.35, 1.53 mm.), with anterior margin evenly concave when seen from in front and practically straight when viewed from above, posterior margin almost straight centrally, laterally bent forward to the rounded posterior angles, lateral margins emarginate behind the subrectangular anterior angles, disc with a central impunctate carina, which in its posterior third is fragmented to form two irregular tubercles, and with a transverse depression, obsolete centrally, in front of which are two raised areas divided by transverse V-shaped depressions (probably apodeme bases) and falling off abruptly toward the lateral margins.

Scutellum with a longitudinal central carina, reaching to just beyond its centre. (The specimen also shows two folds running obliquely from the anterior angles to behind the middle of the disc, but these appear to be due to an injury that has also removed the right elytron and so buckled the scutellum on that side as to make measurement impossible.)

Marginal abdominal tubercles but moderately prominent (Plate VIII, fig. 4).

Length 4.8 m.; breadth 3.35 m.

INDIAN TIBET: 1 ♂ (*type*) Peldo-le, near N. end of Tso Moriri, altitude 4529 m. (14,855 ft.), among roots of short grass.

This species, as is indicated by its subparallel head, subrectangular anterior pronotal angles and the coloration of its antennae, clearly belongs in the fourth cohort of the key in Reuter's monograph of the genus (1908). It differs from the species placed in that group in its small size, unarmed trochanters, less conspicuous marginal tubercles, and apparently in the somewhat elevated center of the vertex behind the clypeus.

P. reuteri Kiritshenko (1910), the only species described since Reuter's monograph, belongs to first cohort. The present species appears to be the smallest member of the genus.

Family COREIDAE

Subfamily CORIZINAE

2. *Stictopleura* sp.

INDIAN TIBET: 1 ♀ and 1 nymph, between Tsak-shang and Tsak-ra, road from Tso Moriri to Tso Kar, altitude 4570 m. (c. 15,000 ft.), 1 Sept., 1932.

The single adult before me is a female in not very good condition. It is most closely allied to *nysioides* Kiritshenko, but since the genus contains several very similar species and since these probably cannot be satisfactorily determined without a study of the ♂ genitalia the present specimen is best left unnamed.

Family LYGAEIDAE

Subfamily LYGAEINAE

Tribe Orsillaria

3. *Nysius ericae* (Schill.)

The sixteen specimens of *Nysius* in the collection present so much diversity that at first it seemed as though several rather distinct species were represented. Before attempting to elucidate the present collection it appeared advisable to examine rather minutely certain of the described Palaearctic species. In particular, since Evans (1929) had shown that in discriminating between certain Australian species, the parameres of the male provide valuable characters, special attention was paid to these structures. As a result of these studies it became clear that all the Yale North India Expedition material was referable to *N. ericae* (Schill.), though it has seemed desirable to describe as a subspecies a rather distinct form from very high altitudes.

The Palaearctic species of *Nysius* have been studied by Horvath (1890) whose valuable key provides a satisfactory basis for further work. In this key a group of species of the restricted sub-genus *Nysius* (now to be regarded as a genus, cf. Evans, 1929) are characterised by having no well-marked pale longitudinal ruga on the scutellum and by the bucculae being distinctly lowered posteriorly and not quite reaching the posterior margin of the ventral surface of the head. This group includes *thymi* (Wolff), *ericae* (Schill.) and its var. *obscuratus* Horv., *cymoides* Spin., *graminicola* (Klti.), and *groenlandicus* (Zell.), the latter form, which Lindroth (1931) regards as a synonym of *obscuratus* Horv., being excluded by Horvath on geographical grounds. As pointed out below, *groenlandicus*, which is found in the N. of Europe and Iceland as well as in the Nearctic region, though undoubtedly a subspecies of *ericae*, differs in several characters from *obscuratus*. This group, which may be known as the *thymi*-group, appears to include most of the species described from the tropical regions of the world, but with the exception of the Australasian and African species described by Evans very few of these species can be recognised from descriptions alone. It seems therefore desirable to put on record the following notes, which, though they relate only to three of the most closely allied Palaearctic forms, may help to stabilise our conception of this difficult group of species and provide a point of reference for workers studying tropical and sub-tropical species.

a. *N. thymi* (Wolff). This species is distinguished externally by its oblong-ovate shape, the posterior corial margin being rounded and ampliate (Plate VIII, fig. 7). The genital segment of the male is black and the longitudinal veins of the corium are brown or blackish. According to Horvath the vertex is destitute of a pale immaculate basal spot, but this is actually often very feebly developed. Horvath also states that the ante-apical black line on the pronotum is oblique, curved forward and interrupted centrally. This refers to a pair of marks, of essentially the same form in all the species, presumably the bases of thoracic apodemes, which are black and surrounded by a dark suffusion. In *ericae*, however, this suffusion generally forms a straight uninterrupted transverse band so that the forward curve of the apodeme bases is less easily distinguishable.

The genitalia of two specimens from Britain were examined, one from Polzeath, Cornwall, the other from Kidwelly, Carmarthen. The parameres in lateral view (Plate VIII, fig. 14) are distinctly angulate dorsally, the angulation not being emarginate, and the ventral margin distinctly flanged. In dorsal view (Plate VIII, fig. 15) the angulate prominence hardly projects over the inner margin of the base of the shaft.

b. *N. ericae ericae* (Schill.). The typical subspecies of *ericae* is much narrower than *thymi*, the corial margins less ampliate, though very slightly curved from the widest point towards the membrane (Plate VIII, fig. 8). The genital segment is black and the corial nerves infuscated, but the basal immaculate spot on the vertex is much more strongly developed and the antiapical apodeme bases of the pronotum are normally included in a straight unbroken transverse band. Material from North America (North Haven, Conn.) appears to differ in no respect from a ♂ from Marburg, Germany, determined by Horvath and in the British Museum collection.

The genitalia were studied in two specimens from North Haven. The dorsal angle of the parameres is very prominent, setose, and distinctly emarginate, the ventral flange is obsolete (Plate VIII, fig. 16). In dorsal view the angular prominence projects over the inner margin of the base of the shaft (Plate VIII, fig. 17).

c. *N. e. obscuratus* Horvath. I have been unable to examine an authenticated specimen of this form. Horvath's (1899) description is as follows: Articulo primo antennarum, saepe etiam basi articuli secundi, femoribusque nigris, femoribus feminae interdum pallidis, nigro-maculatis; pronoto posterius fusco, angulis posticis maculaque parva media postica pallidioribus; hemelytris griseo-fuscibus, interstitiis vernarum corii fusconebulosis; ventre feminae magnam partem nigro; statura sexuum conformi. ♂. ♀. Long, 4½-4½ mill.

Apart from its size the first male from Renka-le appears to agree with this form but its smallness indicates a transition to *ericae ericae*. The genitalia are quite typical.

N. e. obscuratus was originally recorded from Turkestan, Siberia and China; in Ekblom's map it is indicated as co-occurring with the typical subspecies throughout its entire Central Asiatic range, but it is clear from Horvath (1904) and Kiritshenko (1931a) that it is the only form found in the Tian-shan and in the Pamirs so that it may justifiably be given subspecific status.

d. *N. e. groenlandicus* (Zett.). Lindroth (1931) synonymises this form with *obscuratus*. In *groenlandicus*, however, the corial margin has a peculiar shape well marked in a series of ♀♀ in the British Museum collection and also in a ♂ from Kugsuk, Godthaab Fjord, West Greenland, collected by Major Hingston and kindly sent me by Professor G. D. H. Carpenter of Oxford (Plate VIII, fig. 9). In *N. e. ericae* and in the Renka-le specimen, discussed above under *N. e. obscuratus*, the corial margin is slightly and very gently rounded from the straight basal part to the region of maximum dilatation, while in *groenlandicus* the dilatation is more sudden so that in this region the corial margin appears almost obtusely angulate. Moreover, in *groenlandicus* the pale portion of the elytra is more transparent than in the other forms so that when compared with *obscuratus* the color pattern of the former shows much more contrast than that of the latter. Ekblom (1931) records the Lapland form of *ericae* as *obscuratus* without description, and without indicating any Icelandic or Greenlandic records on his map. In the absence of specimens from this region it

is not possible to settle the matter finally but it seems more reasonable at present to refer all these boreal forms to *groenlandicus*. It is clear from Ekblom's map that the latter subspecies, as here understood, is separated from the other forms by a wide intervening subboreal zone in which the species is absent.

The parameres of the West Greenland specimen are identical in shape with those of the North Haven specimens, though the angular prominence is a little more setose, a character that varies in parameres of insects from the same locality in Indian Tibet. There can be no doubt therefore that *groenlandicus* is rightly referred to this species.

e. *N. graminicola* (Klti.). This species is easily distinguished by its coloration from the preceding, for the longitudinal veins of the corium are hardly, if at all, infuscated and the general coloration is paler. In shape *graminicola* is more elongate than *thymi*, but the corial margins are posteriorly more strongly and more regularly rounded than in *ericiae*. The pronotum is without a transverse black band obscuring the bases of the apodemes, which are at most surrounded with an interrupted black suffusion. The vertical margin spot is very feebly developed.

The genitalia of a specimen from Porto d' Ischia, on the island of Ischia, Italy, were studied. The dorsal angle is very feebly emarginate and the ventral keel moderately developed (Plate VIII, figs. 20, 21).

It is clear from the above that *thymi*, *ericiae*, and *graminicola*, three very closely allied but adequately defined species, all show differences in their genitalia, while the various forms here grouped under *ericiae* show no such differences, thus justifying the present arrangement. I have not been able to examine the genitalia of *cymoides*, a most distinct species with very long subparallel elytra.

The material collected by the Yale North India Expedition was obtained from five localities, as enumerated below. Measurements and notes on the individual specimens are also set out in Table I. It will be seen that the material from the lowest locality is practically identical in form and color with typical *N. e. ericae*, while from the highest a rather distinct new form was obtained which is described below as *alticola* subsp. n. From the intermediate localities series were obtained which appear to combine the characters of all the Central Asiatic forms known, viz., *ericiae* s. str., *obscuratus* and *alticola*.

A. Leh. 1 ♂ Residency Garden. 19 Sept., 1932, altitude 3506 m. Parameres typical of species. This specimen may be considered as a very slightly atypical member of *N. e. ericae* (Plate VIII, fig. 10).

B. Tsak-shang, N. of Tso Moriri. 2 ♀♀. 31 Aug., 1932, altitude 4872 m. These specimens are comparable to some of the ♀♀ from the next locality; they are probably nearer to *N. e. ericae* than any other form.

C. Renka-le, between Mitpal Tso and Yaye Tso. 3 ♂♂, 5 ♀♀. 18 Aug., 1932, altitude 5156 m. The specimens numbered 1 and 2 are very close to *obscuratus*. The third ♂ is practically typical *e. ericae*, though very small. Specimen 2 (Plate VIII, fig. 11) is slightly wider than the others, so approaching *alticola*. The females are rather variable in width, but none show the coloration of *obscuratus*.

D. Kyang-La, Koh Lungpa valley. 2 ♂♂. 9 July, 1932; altitude 5100-5200 m. These two specimens are both here referred to *alticola*; the darker one is rather similar to

TABLE I
Dimensions of and remarks on specimens of *Nysius* examined.

Locality	Sex	Length	Breadth	$\frac{L}{B}$ Ratio	Departure from Normal Coloration	Posterior Pronotal Angles
<i>N. ericae</i>						
LEH alt. 3506 m.	1♂	3.45	1.11	3.12	Femora black with testaceous apices	Very slightly reduced
TSAK-SHANG alt. 4872 m.	1♀	3.75	1.38	2.71	Femoral spots confluent	Slightly reduced
	2♀	4.25	1.56	2.72	Femoral spots confluent	Slightly reduced
RENKA-LE alt. 5156 m.	1♂	3.28	1.09	3.00	Femora save apices, pronotum largely, and inner part of elytra, very dark	Almost normal
	2♂	3.52	1.27	2.86	As above	Almost normal
	3♂	3.28	1.11	2.96	Femoral spots confluent	Slightly reduced
	4♀	3.88	1.34	2.89	Femoral spots strongly confluent	Slightly reduced
	5♀	3.82	1.40	2.73	Practically typical	Slightly reduced
	6♀	3.96	1.54	2.60	Femora black with pale apices	Slightly reduced
	7♀	4.00	1.42	2.82	Femoral spots somewhat confluent	Slightly reduced
	8♀	3.96	1.49	2.66	As above	Slightly reduced
KYANG-LA alt. 5100-5200 m. subsp. <i>alticola</i>	1♂	3.09	1.13	2.74	Femora black save at apex, pronotum very dark, elytra suffused with brown	Considerably reduced
	2♂	2.97	1.13	2.64	As above but lighter	As above
OROROTSE Tso alt. 5297 m. subsp. <i>alticola</i>	1♂	3.20	1.24	2.58	Femora black save apically, elytra and pronotum suffused with brown	Much reduced
	2♀	3.38	1.42	2.38	As above but some pale maculation on femora	As above
	3♀	3.65	1.45	2.50	As above but rather paler	As above
NORTH HAVEN, CONN., U.S.A. subsp. <i>ericae</i>	1♂	3.48	1.16	3.00		
EAST GREENLAND subsp. <i>groenlandicus</i>	1♂	4.15	1.42	2.92	Femora, inner part of elytra and most of pronotum black, outer part of elytra hyaline	Unreduced
<i>N. thymi</i>						
KIDWELLY, WALES	1♂	4.07	1.49	2.72		
<i>N. graminicola</i>						
ISCHIA	1♂	4.62	1.49	3.10		

the wide dark specimen from the previous locality, but the latter is larger, proportionately a little narrower, and has more prominent pronotal angles.

E. Ororotse Tso. 1 ♂, 2 ♀♀. 11 July, 1932, altitude 5297 m. These specimens (Plate VIII, figs. 12, 13) are very broad and have the posterior pronotal angles much reduced so that the posterior border is but little reflexed and the sides are straight. In color they are less dark than the *obscuratus* form from Renka-le. The present specimens constitute the typical series of *alticola* subsp. n., primarily characterised by its small size, wide form which is comparable to that of *thymi* rather than to *ericae* s. str., and straight lateral pronotal margins.

Nysius ericae alticola subsp. n.

♂ Robust (Plate VIII, fig. 12); dorsal surface covered with fine short adpressed hairs.

Color. Head black, mottled with testaceous yellow on the clypeus and juga, and with a conspicuous smooth spot on the posterior margin yellow; antennae dark brown, ventral surface of first joint and proximal half of first joint, save the extreme base, yellowish; bucculae grey. Pronotum yellowish-grey, with heavily black puncturation, save in the posterior angles and a spot on the posterior margin; transverse black line on the anterior part of the pronotal disc complete centrally and turned forward laterally; scutellum black. Dorsal surfaces of all femora black, save at their apices which are testaceous; anterior femora black ventrally save for the testaceous apices, intermediate and posterior femora testaceous ventrally, heavily spotted with black, tibiae testaceous with black spots apically, first tarsal joints testaceous darkening distally to brown, second joints brown, third joints black. Elytra opaque, yellowish-grey, with the inner margin of the clavus obscurely darkened, lateral margins of corium very narrowly black, indefinitely mottled with black along the outer corial vein (sub-costa) and less conspicuously on the disc, membrane hyaline with a large black spot on its corial border fading to brown at the edges and just invading the posterior angle of the corium. Thorax beneath black, posterior borders of pleurae and edges of articulations of legs yellowish-grey, outer part of lip of scent-gland yellowish. Abdomen black, with yellowish mottling on the edge of the connexivum.

Head about one-sixth narrower than the pronotum posteriorly; eyes relatively small, vertex moderately flat in profile, bucculae not quite reaching the posterior margin of the ventral surface of the head, slightly lowered in their posterior half and more abruptly terminated opposite the apex of the first rostral joint. First joint of antenna but little surpassing the apex of the head; second joint twice as long as first and very slightly shorter than the pronotum; third joint three-fourths the length of the second; and fourth joint slightly longer than the third (0.29, 0.58, 0.44, 0.51 mm.).

Pronotum trapeziform and moderately transverse, sides straight, posterior angles not prominent, posterior margin but little deflexed, transverse black lines on anterior part of disc incomplete centrally and turned forward laterally. Scutellum sub-equal in length to pronotum and about as long as its basal breadth.

Apex of abdomen not covered by elytra. Wings developed.

Genitalia as in the typical subspecies (Plate VIII, figs. 18, 19).

♀ Somewhat broader than the male (Plate VIII, fig. 13). Yellow mottling of the clypeus

extending back throughout the central region of the vertex. Antennae entirely black. Elytra just surpassing the apex of the abdomen. Otherwise as male in non-sexual characters.

Length ♂, 3.20 mm. (holotype); ♀, 3.38 mm. (allotype), 3.65 mm. (paratype).

INDIAN TIBET. ♂ (holotype), 2 ♀♀ (allotype and paratype) L 52, Ororotse Tso, altitude 5297 m. (17,381 ft.), near margin of lake, among short sparse grass in company with *Chlamydatus pachycerus* Kiritsh. 11 July, 1932; 2 ♂♂ L 48, Kyang-La, altitude 5100-5200 m. (16,700-17,100 ft.), among short sparse grass with *Pegaeophyton* prob. *scapifolium* Marq. and Skan., in company with *C. pachycerus*, 9 July, 1932.

In form this subspecies in its most extreme facies differs very widely from *N. e. ericae*, departing as much from the latter in its proportions as does *N. thymi* (cf. Table I). Were it not for the existence of intermediate specimens and the identity of the genitalia throughout the entire series it would have been regarded as a very distinct species. Though the feeble development of the posterior pronotal angles suggests brachyptery, the wings appear to be as well developed as in the North Haven specimens of the typical subspecies.

Key to the Subspecies of Nysius ericae (Schill.), applicable primarily to Male Specimens

1. About three times (♂ 2.92-3.12) as long as wide, lateral margins of the pronotum sinuate, posterior angles subprominent 2

Less than two and three-quarters (♂ 2.58-2.74) times as long as wide, lateral margins of pronotum straight, posterior angles reduced *N. e. alticola* subsp. n.
Koh massif, Chang Chenmo Range, from over 5100 m.

2. Posterior part of pronotum, femora and intervenal spaces of corium widely suffused with blackish-brown 3

Posterior part of pronotum and intervenal spaces of corium testaceous, femora testaceous with black spots *N. e. ericae* (Schill.)

Palaearctic from France to Siberia but absent in Britain, Scandinavia, Northern Germany and Northern Russia; Nearctic throughout U. S. A. and Southern Canada; locally wholly or in part replaced by other subspecies.

3. Corium evenly rounded to its maximum width, pale parts of elytra opaque.....
N. e. obscuratus Horv.

Central Asia from the Caspian to China, in part replacing
N. e. ericae.

Corium suddenly expanded to its maximum width, pale parts of elytra hyaline.....
N. e. groenlandicus (Zett.)

Lapland, Greenland, Iceland and Arctic and Sub-arctic America.

Subfamily OXYCARENINAE

4. *Microplax hissariensis* Kiritshenko*M. hissariensis* Kiritshenko (1913)

INDIAN TIBET 1 ♀. Between Tsak-shang and Tsak-ra, road from Tso Moriri to Tso Kar, altitude c. 4570 m. (c. 15,000 ft.), 1 September, 1932.

The single specimen which is here identified with *M. hissariensis* appears to agree in all essential points with the original description of this very distinct species. The only slight differences concern the coloration of the elytra, which seems to be more intense in the specimen now before me, the dark marks on the corial nerves appearing to extend outward farther onto the disc of the corium than is indicated in the original description, while the black base of the clavus fades to brown with black punctures apically. Since but a single specimen is known it seems unwise to describe the present form as a subspecies.

M. hissariensis is, as Kiritshenko points out, sharply distinguished from its congeners by its larger size (4.0-4.2 mm. in typical series, 3.94 mm. in the present specimen), the entirely black antennae, and the brown-black apical corial angle (Plate VIII, fig. 5). The typical series was taken in northern Buchara.

5. *Bianchiella adelungi* Reuter

INDIAN TIBET. 1 ♀ Igu, in the Indus Valley above Leh, on the bark on *Populus* sp., altitude 3417 m. (11,210 ft.).

The single brachypterous specimen obtained was one of several observed, but extremely difficult to capture owing to the rapidity of their movements. It has been compared with material determined by Kiritshenko in the British Museum and appears to be identical. Since this remarkable form has not been figured, a drawing is given in Plate VIII, fig. 6. The species is known from Siberia, Mongolia and Northern China (Oshanin, 1912) but curiously enough appears to be unrecorded from Russian Turkestan; a second species (*B. sarmatica* Kiritshenko, 1926) is, however, known from European Russia.

Subfamily APHANINAE

Tribe Gonionotaria

6. *Emblethis horvathiana* sp. n.

Ovate subparallel and rather robust, 2.25 times as long as wide.

Color, dark greyish-yellow heavily punctured with black, antennae and legs darker than head pronotum scutellum and elytra, eyes brown, apical joint of antennae, ocular margin of head, base of scutellum showing through the pronotum and some irregular spots joining punctures on the disc of the pronotum and the scutellum, black; thorax below black, margins of coxal articulations greyish-yellow, abdomen beneath brownish, darkening to piceous along the midline.

Head with eyes, seen from above, twice as wide as long (1.20, 0.58 mm.), antenniferous tubercles acutely rounded in lateral view, antennae 1.11 times as long as the maximum width

of the pronotum, basal joint sub-cylindrical, just over twice as long as wide (0.15 mm.), second joint just over twice as long as the first, third joint just over two-thirds as long as the second, fourth subequal to the latter (0.33, 0.76, 0.55, 0.74 mm.); basal three joints richly setose, the setae being slightly shorter than the maximum diameter of the first joint, apical joint with a few setae basally and with fine short hairs throughout; rostrum long, reaching almost to the center of the posterior coxae, second joint very slightly longer than the first, third subequal to second, fourth subequal to first.

Pronotum trapeziform (Plate X, fig. 1), not greatly narrowed anteriorly, rather under twice as wide as long (2.15, 1.16 mm.), sides moderately explanate, anterior margin slightly, evenly and roundly excavate, lateral margins neither reflexed or marginated, slightly converging anteriorly from just before the posterior angles, slightly emarginate behind middle, with about eight setae on their anterior portion, including the anterior angles.

Scutellum equal in length to the pronotum and basally slightly wider than its length (1.34, 1.16 mm.). *Mesosternum* with well-developed and closely approximated tubercles, disc of metasternum not very conspicuously impressed.

Elytra nearly reaching the apex of the abdomen.

Posterior tibia a little shorter than the posterior width of the pronotum, and just over twice as long as the basal tarsal joint, the latter two and a half times as long as the subequal second and third joints together, claws two-fifths as long as one of the latter (2.00, 0.91, 0.18, 0.18, 0.07 mm.).

Length ♀ (*type*) 5.45, breadth 2.43 mm.

INDIAN TIBET. 2 ♀ ♀ (*type* and *paratype*). L 77a. Renka-le, altitude 5136 m. (16,917 ft.), between Mitpal Tso and Yaye Tso, on grassy bank in valley, 18 Aug., 1932.

In the paratype the anterior margin of the pronotum is practically straight centrally and the elytra reach to the apex of the abdomen, the two specimens otherwise agree and are undoubtedly conspecific.

E. horvathiana is perhaps more closely allied to *E. verbasco*, than to any other species of the genus known to me. It differs conspicuously in having much more setose antennae, the fourth joints of which are subequal to the second, rather less explanate lateral pronotal margins, in being narrower and in its dark greyish coloration. At first I believed my material was to be referred to *brevicornis* Horv., but, on seeing a drawing of one of the present specimens, Dr. Horvath pointed out to me that in my species the form of the pronotum and antennae are very different. In *brevicornis* the lateral margins of the former are quite straight and converge more markedly anteriorly, while the fourth joint of the antenna is very much shorter than in the present species. I am greatly indebted to Dr. Horvath for calling my attention to these points and have much pleasure in associating this high-altitude species with his name.

Dolmacoris¹ gen. n.

Head bearing conspicuous bristles, ocelli set well on vertex, close to the inner margins of the eyes; antennae with first three joints and the extreme base of the fourth with well-

¹ Tibetan *sGroL-ma*, pronounced Dolma, the most popular goddess of the lamaistic pantheon, better known by the Sanskrit name of Tara. The specific name is in honor of my friend Dr. Hellmut de Terra, leader of the Yale North India Expedition.

developed bristles; bucculae well developed; rostrum short reaching but to the posterior margin of the prosternum; apex of second joint reaching but to the base of the head, the first joint the longest; sides of pronotum slightly explanate, pronotal disc with two large raised circular areas, and an ill-defined longitudinal carina; sutures between third and fourth and between fourth and fifth abdominal sternites almost straight, reaching almost to the connexivum where they become fragmented and obscure; glandular patches on fourth sternite apparently absent; abdominal spiracles all ventral save that of the fourth segment which is situated dorsally on the connexivum; anterior femora incrassated but unarmed, well-developed tarsal aroliae absent. Genotype:—*D. deterrana* sp. n.

7. *Dolmacoris deterrana* sp. n.

Color. Dull greyish-yellow, somewhat suffused with orange, eyes and ocelli reddish brown, punctures and bases of bristles very dark brown or black, posterior smooth part of vertex and central carina of pronotum slightly paler, elytra with two large tubercles reddish, abdomen dorsally obscurely mottled with brown, anterior margin of connexival portion of tergites and a small transverse stripe on the same on tergites five, six, and seven, black; abdomen ventrally black mottled with greyish-yellow laterally, antennae and legs greyish-yellow with large black spots at the bristle bases, fourth antennal joint uniformly blackish brown, femora with heavy black puncturation, apices of tarsi somewhat darkened.

Head. Dorsal surface, save for two areas immediately around the ocelli, a median area on the extreme posterior part of the vertex and the anterior three-quarters of the ventral surface lateral to the bucculae, coarsely and irregularly punctured; anterior and postero-central part of head dorsally with conspicuous sparsely set bristles, two being set on the labrum; width of head with eyes greater than length seen from above (0.98, 0.76 mm.); clypeus very distinctly separated by furrows from the jugae; antenniferous tubercles well developed, downwardly directed in lateral view (Plate IX, fig. 3), and giving the pre-ocular part of the head a very slightly constricted outline in front of the eyes; eyes very large and subpedunculate, situated behind the middle of the head; bucculae well developed and elevated, somewhat divergent, reaching practically to the posterior margin of the head, suddenly and obliquely lowered in the posterior eighth of the latter; rostrum short reaching but to the posterior margin of the prosternum, the first joint the longest, about one and one-half times as long as the second, which reaches to about the posterior margin of the head, the third subequal to the second and slightly longer than the fourth (Plate IX, fig. 5). Antennae rather short, basal joint cylindrical, reaching about to the apex of the head and stouter than the others, three basal joints and base of the fourth with strong bristles which are a little longer than the diameter of the second joint, the latter joint twice as long as the first, and just under twice as long as the third which is just under half the length of the fourth (0.25, 0.47, 0.22, 0.45 mm.).

Thorax. Pronotum (Plate IX, fig. 1) subequal in length to the head and one and two-thirds times as wide as long (1.18, 0.72 mm.), anteriorly narrower and posteriorly wider than the head, subtrapeziform, with all sides slightly and widely emarginate, anteriorly with an ill-defined collar behind which the lateral margins are slightly explanate, forming a cariniform expansion which is impunctate above and bears a row of five short bristles

just within the margin; disc with a few short bristles and two large circular raised areas with central depressions, behind which are a pair of ill-defined tubercles, between each raised area and continued behind between the tubercles a very ill-defined longitudinal carina. Propleuron punctured, its posterior margin distally bent back towards the posterior angle of the prothorax. Prosternum with a wide well-defined longitudinal rostral depression, the sides of which are raised posteriorly against the articulation of the anterior coxae, anterior part of prosternum forming a distinct collar which is coarsely punctured. Apertures of metathoracic scent-glands small and set a little obliquely, their margins hardly elevated. Legs with numerous well-developed bristles throughout. Anterior coxa with an inwardly projecting lamelliform tooth; anterior femur moderately incrassated, its maximum diameter being about twice that of the femora of the other legs, subequal in length to the anterior tibia; the latter slightly expanded apically, twice as long as the tarsus (0.84, 0.90 mm.), first tarsal joint twice the second which is about two-thirds the length of the third and equal in length to the claws (0.16, 0.09, 0.13, 0.09 mm.). Intermediate coxa acutely angulate interno-posteriorly but not produced into a definite tooth, femur subequal in length to tibia; the latter twice as long as the tarsi (0.84, 0.44 mm.), first tarsal joint three times as long as second, second about two-thirds as long as third and equal in length to the claws (0.18, 0.09, 0.16, 0.07 mm.). Posterior coxa obtusely angulate interno-posteriorly, femur very slightly shorter than tibia; the latter twice as long as the tarsus (1.24, 0.62 mm.), first tarsal joint equal in length to the others together, third one and two-thirds as long as second, claws a little shorter than the latter (0.29, 0.11, 0.18, 0.07 mm.). No aroliae can be made out on any tarsi.

Elytra (brachypterous) covering the proximal half of the abdomen; widely expanded in their proximal quarter so as to cover the base of the connexivum, in their distal three-fourths slightly narrowed exposing the connexivum; posteriorly obliquely truncate; claval vein (*cubitus*) well developed and tuberculate, inner corial vein (*media*) more or less obsolete, represented by a feebly developed carina bearing a single minute tubercle; *subcosta* + *radius* well developed, dividing behind the middle of the elytra to form two large tubercles, with the inner, more anterior, one of which, the inner corial vein appears to fuse, three longitudinal tuberculate carinae behind the tubercles apparently represent the *subcosta*, *radius* and *media* freely approaching the posterior margin of the elytron.

Abdomen. Broad, depressed centrally, coarsely and irregularly punctate, sutures between sternites two and three, three and four, and four and five, almost straight, very slightly turned forward at their distal ends, especially in the case of that between three and four, the latter and that between four and five not quite reaching the connexivum and irregularly fragmented at the ends; all spiracles small, those of the fourth segment dorsal, the rest ventral (Plate IX, fig. 2); opaque glandular patches not developed on the fourth or any other sternite; fourth and fifth tergites with their posterior margins produced backwards as obtuse angle, each angle enclosing a well-marked tubercle, the two tubercles subequal in size and rugose.

[♂] Seventh abdominal tergite evenly rounded behind, posterior margin of sternite straight (Plate IX, fig. 8); genitalia as in most *Aphaninae*, with a long spiral vesica (cf. Singh-Pruthi 1925), basal plates moderately large (Plate IX, fig. 6), parameres dilated sub-basally, narrower and slightly bent apically (Plate IX, fig. 7).

♀ Seventh abdominal tergite with a wide, deep semicircular emargination in its posterior border, seventh sternite cleft throughout. Eighth tergite with posterior margin sharply emarginate in the extreme centre. Gonapophyses unarmed (Plate IX, fig. 4).

Length ♂ (*holotype*) 4.15 mm., breadth 2.05 mm.

Length ♀ (*allotype*) 4.55 mm., breadth 2.15 mm.

INDIAN TIBET. 2 ♂♂ (*holotype* and *paratype*), 5 ♀♀ (*allotype* and *paratypes*). L 63, between Nying-ri and Chungang La, altitude 5100-5300 m. (16,800-17,400 ft.), under and between sparsely distributed plants of *Artemisia minor* Jacq., in company with *Tibetocoris margaretae* gen. n., sp. n., and Psyllids, on which forms it probably feeds, 18-19 July, 1932. The male paratype was taken on a slope just above the summit of the Chungang La, altitude 17,397 ft., on the boundary between Indian Tibet and Tibet proper.

In spite of its unarmoured femora and straight abdominal sternal sutures this remarkable insect is referred to the Aphanine tribe *Gonionotaria* on account of the disposition of the bristles on its head and antennae, and the position of the abdominal spiracles. *Dolmacoris* is clearly allied to *Diomphalus* Fieb., which also has straight abdominal sternal sutures, very similar brachypterous elytra, no conspicuous tarsal aroliae (Fieber, 1864, T. I., fig. IV f.) and a small spur on the anterior coxa. The structure of the rostrum, which in *Diomphalus* reaches to beyond the middle of the mesosternum, with a basal joint reaching almost to the base of the head, constitutes the most striking generic character of *Dolmacoris*. The short antennae and trapezoidal pronotum suggest comparison rather with the little known Transbaikalian *Diomphalus annulicornis* Jak., than with *D. hispidulus* Fieb., but Jakovleff (1889) makes no mention of his species differing from *hispidulus* in the structure of its rostrum so that it is presumably correctly placed in *Diomphalus*. *Dolmacoris* appears to have larger eyes than either species of *Diomphalus* and in the latter genus the anterior femora appear to bear spurs; the shape of the pronotal bosses probably furnishes a further generic character.

In the course of examining *Dolmacoris* it became apparent that no adequate information was available as to the position of the abdominal spiracles in the various tribes of the *Aphaninae* as well as in certain of the other subfamilies of the *Lygaeidae*. Mr. W. E. China most kindly offered to make preparations from representative species of each tribe of the *Aphaninae*, using as far as possible the typical genera and also of representatives of a number of other subfamilies. The results of these studies Mr. China most generously asked me to incorporate in the present paper (Table II). A few words may therefore be appropriately devoted to the problems of the classification of the *Lygaeidae* raised by these data. Omitting the *Aphaninae* it is clear that while there is a general progression from a dorsal to a ventral position when the subfamilies are considered in the order currently used in systematic works, yet this progression is not as regular as would appear from the keys that have been published, as, for instance, those given by Stal (1872) or in the excellent work of Barbour (1917, 1918). The following points require comment:

1. The *Lygaeinae* and *Cyminae* are generally stated to have entirely dorsal spiracles; this appears to be essentially correct, though the spiracles on the seventh segment of *Cymus* are almost lateral, being situated dorsally on the conjunctival membrane between the conhexivum and the sternite.

2. The *Henestarinae* are omitted from Barbour's key as the subfamily is unrepresented in the Nearctic Region. If it is to be included with the *Blissinae* and *Geocorinae*, as is done by Stal (1872), the key character defining this group of subfamilies must be emended

TABLE II
Position of Abdominal Spiracles in *Lygaeidae*

Species	Segment					
	2	3	4	5	6	7
Lygaeinae						
<i>Lygaeus pandurus</i>	D	D	D	D	D	D
Chauliopinae						
<i>Chauliops bisontula</i>	D	D	D	D	D	D
Cyminae						
<i>Cymus clavicornutus</i>	D	D	D	D	D	D-L
Metrarginae						
<i>Metrarga (Nesocryptias) villosa</i>	D	D	D	D	D	D
Geocorinae						
<i>Geocoris limbatus</i>	D	D	D	D	D	V
Henestariniae						
<i>Henestaris laticeps</i>	V	D	D	D	V	V
Blissinae						
<i>Blissus leucopterus</i>	D	D	D	V	V	V
Artheneinae						
<i>Chilacis typhae</i>	D	V	V	V	V	V
Oxycareninae						
<i>Oxycarenus hyalinipennis</i>	D	V	V	V	V	V
Heterogastrinae						
<i>Heterogaster urticae</i>	V	V	V	V	V	V
Pachygronthinae						
<i>Pachygrontha antennata</i>	V	V	V	V	V	V
Aphaninae-Cleradaria						
<i>Clerada apicornis</i>	V-L	V	V	V	V	V
<i>Myodocharia</i>						
<i>Orthaea pallicornis</i>	D	D	D	V	V	V
<i>Rhyparochromaria</i>						
<i>Rhyparochromus chiragra</i>	V	D-L	D	V	V	V
<i>Plinthicus brevipennis</i>	V	V	V	V	V	V
<i>Aphanaria</i>						
<i>Aphanus vulgaris</i>	V	D	D	V	V	V
<i>Gonionotaria</i>						
<i>Gonionotus marginipunctatus</i>	V	V	D	V	V	V
<i>Ischnopeza pallipes</i>	V	V	D	V	V	V
<i>Dolmacoris deterrana</i>	V	V	D	V	V	V
<i>Lethaearia</i>						
<i>Lethaeus longirostris</i>	V	V	V	V	V	V

D = dorsal, V = ventral, D-L = dorsal on conjunctival membrane, V-L = ventral on conjunctival membrane.

to "all of the abdominal spiracles not situated ventrally, at least those of the third and fourth segments dorsal"; for, as is indicated in the table, the spiracles on the second segment of *Henestaris* are ventral, so that the original statement that at most only the last three spiracles are ventral is incorrect.

3. In the *Heterogastrinae*, *Pachygronthinae*, *Artheneinae* and *Oxycareninae* all the spiracles are usually said to be ventral. In *Oxycarenus* and *Chilacis*, however, those of the second segment are dorsal. The emended key character defining this group of subfamilies should therefore run "all or at least the five posterior abdominal spiracles situated ventrally."

4. In the *Chauliopinae* and *Metrarginae*, subfamilies not examined by Stal or Barbour, all the abdominal spiracles are dorsal. The *Metrarginae* were stated by Kirkaldy (1902), in erecting the subfamily, to be allied to the *Cyminae*, but to have the last three abdominal spiracles placed ventrally. Later he concluded (1908) that the subfamily was more probably allied to the *Oxycareninae*. It is probable that Kirkaldy mistook three prominent pairs of trichobothria for ventrally placed spiracles in uncleared material. In reality the affinities of this peculiar Hawaiian subfamily with the *Cyminae* are great, the chief differential character being that in the *Metrarginae*, unlike any other member of the family, the hamus of the alar areole is "continuous, extending from the vena subtensa upwards to the upper vein" (Kirkaldy, 1902).

5. The *Aphaninae* (*Rhyparochrominae*) have never been separated on spiracular characters and show great diversity in this respect. The Myodocharian arrangement as exemplified by *Orthaea* is similar to that obtaining in the *Blissinae*, while in the *Lethaearia* and in *Plinthisus* an entirely ventral arrangement is found as in the *Heterogastrinae* and *Pachygronthinae*, and an almost identical pattern is found in *Clerada*. On the other hand the arrangements with the spiracles of the third and fourth segments alone dorsal or dorso-lateral as in *Aphanus* and *Rhyparochromus*, or with only those of the fourth segment dorsal as exemplified by the *Gonionotaria*, are not found outside the *Aphaninae*. In conclusion it would seem that although the position of the spiracles may be of great value in the construction of artificial keys and in determining the relationships of individual genera and tribes, too much stress must not be laid on so variable a character in determining the natural subdivisions of the family.

Family ANTHOCORIDAE

Tribe Anthocoraria

8. *Ectemnus paradoxus* sp. n.

Color. Head, pronotum, scutellum and ventral surface black; eyes and ocelli dark vinous; first antennal joint black, second yellow with a little black basally and the extreme apex greyish-black, third yellow, narrowly black apically, fourth black, slightly paler basally. Elytra with fine sparse pale golden pubescence, clavus brown, its inner margin paler and outer margin darker than the disc, corium and embolium basally lacteous, apically piceous, extreme apex of corio-embolial suture, in the neighbourhood of the anterior margin, hyaline, cuneus piceous black, membrane opaque lacteous with a large central and a still larger sub-apical spot greyish-black, the areas around and between the spots luteous; femora black, tibiae pale testaceous, their apices somewhat darker, tarsi greyish-black.

Head elongate (Plate X, fig. 3), just under one and a half times as long (0.53 mm.) as width, with eyes (0.36 mm.), anterior margin of eye inserted very slightly behind middle of lateral margin, head somewhat constricted in front of insertion of antennae and also before the posterior margin; rostrum reaching to posterior margin of anterior coxae; first antennal joint reaching just to apex of head, second three and a third times the length of the first, third twice the length of the first and very slightly shorter than fourth (0.11, 0.40, 0.24, 0.27 mm.), second joint slightly thickened baso-apically, third and fourth hardly narrower than the middle of the third.

Pronotum twice as wide posteriorly (0.73 mm.) as long (0.36 mm.) with a very distinct apical collar less than half the posterior width (0.31 mm.) and marked transverse impression, disc finely rugose and covered with very fine short pale hairs, lateral margins sinuate, somewhat raised and marginate, posterior angles sub-acute, directed backward and not projecting laterally.

Scutellum slightly shorter than pronotum, and one and a half times as wide (0.44 mm.) as long (0.29 mm.), disc with sparse, very short fine pale hairs, little raised anteriorly, remotely punctate and nitid, slightly depressed before apex which is rugulose.

Prosternum rugose, its disc flattened centrally, posterior margin produced to form an acute xyphus between the anterior coxae.

Mesosternum nitid, very finely and regularly rugulose, posterior margin narrowly emarginate, disc with a fine groove running forward from the emargination and becoming obsolete anteriorly.

Metasternum transverse, between the widely separated posterior coxae, but little raised, coarsely and irregularly rugose, posterior margin truncate.

Orifice of metathoracic scent-gland straight, produced rather prominently at the outer end (Plate X, fig. 7).

Tibiae of all legs but little longer than femora (ant. 0.51, 0.55; inter. 0.51, 0.55; post. 0.80, 0.87 mm.).

Elytra and wings macropterous, the latter without a hamus (Plate X, fig. 6).

Abdomen distinctly surpassed by the elytra.

♂ Left paramere short, broad and semicircular (Plate X, fig. 8), right paramere vestigial. Length 2.55 mm., breadth 0.80 mm.

INDIAN TIBET. 3 ♂♂ (*holotype* and *paratypes*) Igu, in the Indus Valley above Leh, on the bark of *Populus* sp.; altitude 3417 m. (11,210 ft.), Sept., 1932.

The present species is anomalous in that it lacks the hamus of the wing cell, a character which would remove it from the *Anthocoraria* and place it in the *Lyctocoraria* as defined by Poppius (1909). *Ectemnus paradoxus*, however, runs down perfectly to its genus in the key to the *Anthocoraria* given by this author, if once its membership in that tribe be admitted. Apart from the absence of the hamus it appears to be an entirely normal member of its genus. If, therefore, it is to be removed from the *Anthocoraria*, a new genus of the *Lyctocoraria* must be defined, isolated from all the other members of that tribe, and differing only from the Anthocorarian genus *Ectemnus* in the single character under discussion. This is clearly an unsatisfactory proceeding and the present species is therefore described as an *Ectemnus*. It is clear that the value of the presence and position of a hamus as a major taxonomic character is dubious, but I am not in a position to revise the tribal characters of the *Anthocoridae*,

nor to provide any new distinction between the two tribes. It may be pointed out that China (1933) also appears to be somewhat doubtful of the value of hamal characters for this purpose.

The genus *Ectemnus* at present contains four species. *E. longirostris* Horv. from the Balkans is sharply distinguished by its rostrum which reaches to the intermediate coxae. Of the remaining species the widespread Palaearctic *E. reduvinus* (H.-Sch.) is an insect of very different facies from *paradoxus*; it is usually brachypterous and the head and pronotum are ferruginous brown. *E. parilis* Horv. is known only in the brachypterous state, the head and anterior part of the pronotum are black as in *paradoxus*, but the posterior part of the latter fades to ferruginous, and the whole of the fourth, the apical half of the third and all of the second antennal joint save a yellow ring are black. *E. pictipennis* Esaki (1931) a macropterous species from Japan, in which, as in *paradoxus*, the head and pronotum are entirely black, differs from the latter, as is clear from Esaki's excellent description and figure, in having the fourth antennal joint yellow, the sides of the pronotum straight and the head unconstricted behind the eyes.

The species nearest geographically to *paradoxus* is *reduvinus*, which is recorded by Oshanin (1889, 1912) from Russian Turkestan, but it is possible that *Galchana* Distant (1910) is a synonym of *Ectemnus*, though the type and only species, *G. humeralis* from Simla, is clearly distinguished by its pointed posterior pronotal angles from *E. paradoxus*.

9. *Anthocoris gyalpo*² sp. n.

Moderately broad and robust, 2.85 times as long as wide.

Head, antennae, basal half of rostrum, pronotum, scutellum, dorsum abdominis and ventral surface black; apex of penultimate joint of rostrum testaceous, ultimate joint brown, posterior part of metapleuron behind scent-gland and apex of abdomen beneath, obscurely testaceous; legs testaceous, the bases of the coxae piceous, extreme bases of femora and tibiae slightly darkened, dorsal surface of anterior femora slightly infuscated subapically, posterior femora darkened along the posterior margin, tarsi brown, all these markings obscure, the legs being without any definite spots or annulations; elytra pale testaceous brown, practically unmarked, the base and internal margin of the clavus, the corial veins and the apex of the cuneus being very slightly darker, membrane grey, infuscated subapically.

Head with a few pale hairs anteriorly, one and a sixth times as long as wide (0.60, 0.51 mm.), suddenly and then more gradually narrowed in front of the eyes, postocular region constricted, antennae longer (1.44 mm.) than the length of the head and pronotum together (1.07 mm.), first joint not reaching the apex of the head, second joint subequal in length to the width of the head and eyes, and half as long again as the third which is subequal in length to the fourth (0.15, 0.55, 0.36, 0.38 mm.); second joint about half as thick basally as subapically, where it is very slightly thicker than the first joint, all joints clothed with fine pale hairs which are subequal in length to or a little shorter than the maximum thickness of the second joint, hairs more abundant and more closely adpressed on the apical half of the fourth joint; rostrum reaching to just beyond the centre of the anterior coxae, its first visible joint (damaged in unique type) apparently not quite reaching to the insertion of the antennae; second joint about twice as long as third (0.25, 0.47 mm.).

² Tibetan *rGyal-po*, a king; the garden in which the unique holotype was taken formerly surrounded a pavilion or summer residence of the Gyal-po of Leh.

Pronotum (Plate X, fig. 2) covered with fine short pale hairs, its maximum width about two and a quarter times the median length (1.06, 0.47 mm.), anterior collar moderately well developed, its width (0.38 mm.) just over one-third the maximum width of the pronotum, lateral margins immarginate feebly rounded from the collar and quite straight throughout the greater part of their length, posterior angles obtusely pointed, disc strongly rugose, save a longitudinally impressed raised transverse area immediately in front of the transverse fovea, which is set in the middle of the mid-line of the pronotum and occupies more than one-third of the width of the pronotum at that level, posterior part of disc with traces of a longitudinal central depression, posterior margin widely emarginate before the base of the scutellum. Scutellum covered with fine short pale hairs, longer (0.62 mm.) than the pronotum and about one and a quarter times as wide (0.77 mm.) as long, with a well-marked transverse fovea behind the middle, anteriorly somewhat swollen and remotely punctate, apex somewhat rugose.

Prosternum with its posterior margin somewhat marginated, except centrally where it is produced backwards as a short xyphus between the anterior coxae, its disc somewhat rugose, with an indistinct transverse carina behind the middle.

Mesosternum smooth, its posterior margin rounded and centrally a little emarginate, disc with a fine longitudinal groove running forward from the emargination almost to the anterior coxae.

Metasternum rounded posteriorly and elevated.

Orifices of metathoracic scent-glands curved slightly forward externally and with a very fine carina running forward from the outer end of the orifice (Plate X, fig. 4).

Legs with fine pale hairs on all joints, slightly sparser than those of the antennae, tibiae slightly incrassated apically, anterior femur very slightly shorter than the tibia, which is just over three times the length of the tarsus, the latter just under three times the length of the curved claws (0.73, 0.80, 0.25, 0.09 mm.), intermediate femur very slightly shorter than the tibia, which is just under three times the length of the tarsus, the latter just over three times the length of the curved claws (0.76, 0.84, 0.31, 0.09 mm.), posterior femur about five-sixths the length of the tibia, which is a little over three and a half times the length of the tarsus, the later about three times the length of the straight claws (1.02, 1.20, 0.33, 0.11), last tarsal joint of each leg just over half the length of the tarsus.

Elytra surpassing the apex of the abdomen, covered with fine short pale hairs, coarsely but obscurely punctured and sub-nitid throughout, cuneus entirely behind the apex of clavus, its marginal length (0.62 mm.) about three-fifths that of the embolium (1.16 mm.), embolial margins straight and subparallel, all membranal veins save the outer one more or less obsolete.

♂. Left paramere narrow, sickle-shaped, and angulate (Plate X, fig. 5).

Length 3.52 mm., maximum breadth 1.24 mm.

INDIAN TIBET. ♂ (*holotype*) Leh, Residency Garden, apparently blown from *Populus* sp., 19 September, 1932.

The present species, in its rostrum, metasternum, odoriferous glands, cuneus and pronotum agrees sufficiently well with *Anthocoris* to be included in that genus. It differs from its previously described congenus in its almost unicolorous elytra which are perhaps more clearly punctate than usual in *Anthocoris*. *A. gyalpo* appears to belong to that section of the genus in which the antennae are longer than the head and pronotum together, of which *A. sylvestris* (Linn.) is the best known member, but is easily distinguished from var. *nigri-*

cornis (Fieb.) of this species by its almost uniform elytral coloration and curved orifice of the odoriferous gland. From the other species included in this section it is also distinguished by the different proportions of the antennal joints. Poppius (1909) has described two members of this group, viz., *annulipes* and *indicus* from Darjeeling, but these appear to be normally coloured members of the genus with black or annulated femora (*vide* Distant, 1909, figs. 166, 167). The almost complete suppression of all but the outer membranal veins suggests *Compsobiella* Poppius (1909) but the present species shows none of the other characters of this Central African insect and a somewhat similar reduction is found in the species of the *sylvestris* group.

Family MIRIDAE

Subfamily DICYPHINAE

Tribe Dicypharia

10. *Dicyphus physochlaenae* sp. n.

Head black, the inner border of the eyes margined with yellow which spreads out towards the central black area of the vertex from the postero-internal angle of the eye, centre of frons with a longitudinal yellow stripe which spreads anteriorly to the bases of the antennae, vertex with two submarginal yellow spots posteriorly (Plate X, fig. 9). Pronotum grey, with a transverse stripe across the calli and subapical fossa piceous black, the stripe interrupted by a longitudinally elongated yellow spot between the calli but uninterrupted more anteriorly, grey part behind median fossa with an anterior median yellow spot narrowly connected with the spot between the calli, outer part of calli marked with brownish yellow. Scutellum black, basal angles narrowly orange, apical half of margins with greyish yellow vittae which become obsolete towards the posterior angle. Ventral surface black. Antennae with first joint black, very narrowly greyish yellow at the extreme base and apex, second joint black, very narrowly greyish yellow at the base and with a conspicuous yellow band occupying its central quarter, third joint black, a little paler basally, fourth joint brown. Rostrum yellow, base of second and third and whole of fourth joint black. Coxae yellow with black bases, femora yellow heavily spotted with black, dorsally tibiae yellow with the extreme base brown and with about five brown (anterior) or black (intermediate and posterior) spots on the postero-dorsal part of the proximal third, first and second tarsal joints yellow and the third black; all tibiae armed with fine black spines. Elytra hyaline, greyish, with the apex of the cuneus piceous, membrane very transparent, greyish, its nerves yellowish grey suffused with brown.

Head transverse, rather less than one and a half times as wide as long (0.60 mm., 0.44 mm.), evenly rounded and little produced anteriorly above clypeus, the latter in lateral view with its anterior margin straight ventrally, in its dorsal third rather suddenly rounded to meet its dorsal suture with the frons, gula longer than bucculae and slightly sinuate.

Antennae fairly thick, first joint surpassing apex of head by about three-quarters of its length, and about two-thirds the length of the head from above, second joint twice as long as the first, third joint just over two-thirds the length of the second, fourth about two-thirds the length of the third, second joint distally about twice as thick as proximally, but throughout slightly narrower than the first (head length 0.44 mm., antennae 0.25, 0.51, 0.36, 0.25 mm.).

Rostrum not quite reaching the middle of the intermediate coxae, first joint hardly surpassing the base of the head.

Pronotum anteriorly about three-quarters of the width of the head, posteriorly about one and three-quarters times as wide as head, two and one-third times as wide as the anterior breadth and twice as wide as long (head width 0.60 mm., pronotum, anterior width 0.45 mm., posterior width 1.02 mm., length 0.1 mm.), anterior collar well marked, its anterior margin very slightly sinuate, calli well marked, subconfluent centrally, posterior transverse fossa central, sides but little sinuate, posterior margin widely and deeply emarginate, posterior part of disc rather feebly rugose.

Elytra long, their length from the insertion to the level of the apex being five times the median length of the pronotum, and two and one-third times their greatest width, outer margin slightly explanate centrally. Anterior coxae reaching to the middle of the mesosternum, posterior tibia (1.58 mm.) 2.66 times as long as the width of the head and eyes, third tarsal joints of all legs slightly shorter than second.

♂ Left paramere as in Plate X, figs. 11, 12.

♂ (*holotype*) length 3.53 mm., breadth 1.13 mm.

♀ (*allotype*) length 3.75 mm., breadth 1.20 mm.

INDIAN TIBET. 2 ♂♂, 4 ♀♀ (*holotype*, *allotype* and *paratypes*) L 67. Dambu-guru, altitude 4603 m. (15,100 ft.), on *Physochlaena praealta* Hook. (Solenaceae), 31 July, 1932.

In the coloration of the head and legs this species closely resembles *D. orientalis* Reut. from Turkestan; it may ultimately have to be treated as a subspecies or form of that species. The posterior tibia is, however, proportionately shorter than is indicated in Reuter's description (1884) of *orientalis* and the coloration of the antenna is comparable to that of the widespread western Palaearctic species *D. annulatus* (Wolff.). In the latter species the black spots extend throughout the intermediate and posterior tibiae at the bases of the black spines. *D. montanus* Poppius (1912) from the Alexander Mts. is another closely allied species which, however, appears to have a longer basal antennal joint ("nur wenig kürzer als der Kopf von oben gesehen") and to have a rather different color pattern on the vertex.

These forms are all clearly closely allied and the coloration, which has been chiefly used in separating them, is undoubtedly variable. It is hoped that the present figures of the parameres of *D. physochlaenae* will make it possible for other workers to decide whether the present form is specifically distinct. There can meanwhile be little doubt of its Central Asiatic affinities.

11. *Dicyphus sengge*³ sp. n.

Head yellow, posterior margin black, centre of vertex with a large V-shaped black mark which tends to become somewhat diffuse at its posterior apical end (Plate X, fig. 10). Pronotum grey, with a transverse stripe across the calli black, centrally interrupted by a longitudinal yellow vitta, outer margin of calli yellowish, posterior part of pronotum grey. Scutellum black, basal angles dull orange, apical two-thirds of margins with broad greyish yellow vittae which do not quite reach the apical angle. Ventral surface brownish. Antennae with basal joint black, its apex very narrowly whitish, second joint yellow with the extreme base and apical third black, third joint black, fourth joint piceous black. Rostrum

³ Tibetan *Seng-ge*, a lion, the setose angle of the left paramere being suggestive of a mane.

brownish yellow, fourth joint black. Legs very pale greyish yellow, bases of coxae blackish, femora with small brown spots, tibiae immaculate, third tarsal joints black; tibiae with numerous fine black spines which do not arise from spots. Elytra hyaline grey throughout, apices of corial nerves suffused with black, covered throughout, but most strongly in the lateral (anterior) region with fine black hairs.

Head transverse, rather more than one and a half times as wide as long (0.60 mm., 0.37 mm.), evenly rounded and hardly produced anteriorly over the clypeus, the latter in lateral view with its anterior margin straight ventrally; bucculae shorter than gula.

Antennae moderately thick, the first joint surpassing the apex of the head by about three-quarters of its length, and about two-thirds the length of the vertex seen from above, second joint two and two-thirds times as long as first, third just under three-fourths as long as the second and fourth about three-fifths as long as third (0.25, 0.65, 0.45, 0.27 mm.).

Rostrum apparently reaching just beyond middle of intermediate coxae (somewhat damaged in unique type), basal joint distinctly shorter than head.

Pronotum anteriorly about four-fifths as wide as head with eyes, posteriorly about one and four-fifths as wide as the head, just over twice the anterior breadth and just over twice as wide as long (head width 0.60 mm., pronotum, anterior width 0.49 mm., posterior width 1.03 mm., length 0.49 mm.), anterior collar well marked, its anterior margin very slightly sinuate, calli well marked, subconfluent centrally, posterior transverse fossa lying just anterior to center, sides rather sinuate, posterior margin widely emarginate, posterior part of disc feebly rugose.

Elytra about six times as long as pronotum, and just over twice their greatest width, outer margin very slightly explanate. Anterior coxae reaching to middle of mesosternum, posterior tibiae (1.64 mm.) 2.75 times as long as width of head and eyes, third tarsal joints subequal to second.

♂ Left paramere as in Plate X, fig. 13, with very long hairs on the basal part of the shaft, and a small triangular projection, situated more apically than the corresponding projection in the preceding species and directed upwards.

Length ♂ (*type*) 3.69 mm., breadth 1.23 mm.

INDIAN TIBET. 1 ♂ (*type*) L 37, between Tangtse and Mugleb, altitude c. 4175 m., among grasses, 27 June, 1932.

This species is very close to the preceding, differing in the different coloration of the head, the more sinuate lateral margins of the pronotum and in the left paramere. Both species are allied to the above-mentioned Central Asiatic species and to *annulatus*. From the latter species *D. sengge* differs in the coloration of the head and tibiae, from *orientalis* in the coloration of the head and antennae, from *montanus* in the short basal joint of the latter.

Subfamily PLAGIOGNATHINAE

Tribe Plagiognatharia

12. *Chlamydatus pachycerus* Kiritsh.

C. pachycerus Kiritshenko. 1931.

INDIAN TIBET. 1 ♂ macr., 3 ♀ brachypt. L 33, Shakya La, south slope c. 5200 m. (c. 17,000 ft.), air temp. in shade 7.2 C. "jumping about in sun around moss and grass," 25

June, 1932. 3 ♀ ♀ brachypt. L 48 Kyang La, among sparse grass and *Pegaeophyton* prob. *scapifolium* Marq. and Skan., altitude 5100-5334 m. (16,800-17,500 ft.), 9 July, 1932. 1 ♂ macropt., 1 ♀ brachypt. Ororotse Tso, altitude 5297 m. (17,381 ft.), 11 July, 1932. 2 ♂ ♂ macropt., 3 ♀ ♀ brachypt. L 54a, north side of Marsimik La, altitude c. 5300 m. (17,400 ft.), grassy place, 16 July, 1932. 1 ♂ macropt., 1 ♀ brachypt. Kyam, altitude 4733 m. (15,530 ft.), grassy place, 20 July, 1932. 3 ♂ ♂, 1 ♀ all macropt. Nyagtzu, altitude 4671 m. (15,324 ft.), grassy place, 30 July, 1932; 1 ♂ macropt. Peldo-le, north end of Tso Moriri, altitude 4529 m. (14,835 ft.), mixed vegetation with grasses dominant, 31 Aug., 1932. 1 ♀ brachypt. Tsak-shang, 31 Aug., 1932.

This species was described from material taken between 13,500 and 16,500 feet in southern Tibet by Major R. W. G. Hingston on the Third Mount Everest Expedition. According to Kiritshenko both sexes may be brachypterous ("Hemelytra—magis minusve abbreviata"), while only males may be macropterous. In the present collection all the males and a single female appear to be macropterous. Hingston, at his highest locality, notes that the species was "common at the entrance to tunnels of mouse-hares"; in spite of much observation on this point I never found the slightest trace of such an association. Since short grass is the only plant, common to every locality, on the vegetation of which I have notes, there can be little doubt that this species is graminivorous.

Tibetocoris gen. n.

Elongate, clothed above with long irregular sparse, pale pubescence, which is somewhat tomentose on the head.

Head (Plate X, figs. 14, 15, 16) from above but little produced anteriorly, facial angle subrectangular, clypeus moderately prominent, wide, very slightly depressed dorsally, slightly compressed ventrally, subparallel in lateral view, dorsal suture indistinct, lying just above a line drawn across the insertions of the antennae, bucculae moderately well developed, gula distinct, rostrum reaching almost to the apex of the intermediate coxae, anterior joint short and thick, but little surpassing the posterior margin of the head, vertex unimpressed, its posterior margin convexly rounded centrally and feebly marginate laterally, eyes large, ommatidia granuliform, interocular distance less than twice the dorsal width of an eye, in lateral view eye elongate; loro-genal suture distinct; frons and anterior part of vertex feebly striate on each side. First antennal joint surpassing the head by about half its length. Pronotum very transverse, just over twice as wide as long, anterior border centrally emarginate, posterior margin very widely and lightly sinuate, lateral margins straight, anterior callosities poorly developed. Proxyphus flat, its margins obscurely marginate; mesosternum reaching a little beyond the apex of the anterior coxae, its posterior border emarginate centrally.

Tibiae with fine black spinous bristles; pseudarolia narrow, connate throughout its entire length, reaching about to the centre of the evenly and lightly curved claw, basal tooth obtuse, aroliae very fine, bristle-like and subparallel (Plate X, fig. 17). Hamus of wing cell arising opposite the base of the vena decurrents. *Genotype*: *T. margaretae* sp. n.

13. *Tibetocoris margaretae* sp. n.

Head, pronotum, scutellum and elytra clothed above with long irregular sparse pale pubescence, which is somewhat tomentose on the head; and with a few black hairs on the elytra. Pale greyish white, tinged with yellowish green, vertex near eyes minutely transversely striate with brown, pronotum, scutellum, elytra, and distal third of femora with minute brown spots, antennae greyish brown, basal joint paler, tarsi brown becoming almost black apically, mesosternum and apical joint of rostrum black, abdomen greenish grey. First joint of antenna with two subapical black bristles, second joint narrow proximally, somewhat widened apically but throughout narrower than the first, third and fourth subequal in width, and slightly narrower than the proximal end of the second; second joint just under three times as long as the first; third joint about three-fifths as long as the second and fourth three-fifths the third (0.33, 0.95, 0.58, 0.33 mm.).

Anterior femur with three conspicuous subapical and three small apical bristles, tibia with about nine black bristles; the tibia one and one-third times as long as the femur and twice the length of the tarsus (0.80, 0.98, 0.51 mm.), the tarsal joints overlapping at their articulations, the second a little longer than the first and a little shorter than the third which is twice as long as the claws (0.15, 0.18, 0.22, 0.11 mm.).

Intermediate femur with two apical and one conspicuous subapical bristle tibia with about 16 bristles, tibia just over one and one-third times the length of the femur and two and a half times the tarsus (0.90, 1.24, 0.51 mm.), second tarsal joint twice as long as first, third just longer than second and more than twice as long as claws (0.12, 0.24, 0.25, 0.11 mm.). Posterior femur with two conspicuous subapical bristles, tibia with about 16 bristles, tibia about one and a half times as long as femur and three times as long as the tarsus (1.34, 2.04, 0.69 mm.), second tarsal joint two and a half times as long as the first and slightly longer than the third which is just over twice as long as the claws (0.15, 0.36, 0.33, 0.15 mm.).

♂ Right paramere hook-shaped (Plate X, fig. 18), left paramere styliform (Plate X, fig. 19).

Length 3.75 mm., breadth 1.27 mm.

INDIAN TIBET. 5 ♂♂, L 57, Slope of mountain on south side of the valley of the Chang-chenmo River, near Pamzal, altitude c. 5220-5270 m. (c. 17,000-17,300 ft.), on *Artemisia minor* Jacq., 18 July, 1932. 3 ♂♂ (*type* and *paratypes*) L 62a, Nying-ri c. 5120 m. (c. 16,800 ft.), on *Artemisia minor* Jacq., 26 July, 1932. 6 ♂♂ L 63 Chungang La, just above top of pass which constitutes the boundary of India and the independent territories of Tibet, altitude 5305 m. (17,400 ft.), on *Artemisia minor* Jacq., 19 July, 1932. 1 ♂, 77 Kakstet La, altitude c. 5360 m. (c. 17,600 ft.), on *Artemisia minor* Jacq., 18 August, 1932.

The present genus is probably most closely allied to *Tuptonia* Reuter, from which it differs mainly in the longer pseudarolia. This character, if the feeble markings on the femora be neglected, would bring the genus into the neighbourhood of *Asciodesma* in Reuter's key (1884); *Asciodesma*, however, differs markedly from *Tibetocoris* in the structure of the head and legs. The specimens are all somewhat teneral and the prosternum therefore tends to be distorted, but in the best preserved of them it shows no trace whatever of being convex, in this rather resembling the series of genera originally separated by Reuter as the division *Oncotylaria*.

ZOOGEOGRAPHICAL NOTES ON THE HETEROPTEROUS FAUNA OF HIGH ALTITUDES

The zoogeographical problems raised by the present collection center around the existence of a number of endemic species, some belonging even to endemic genera, at high altitudes in a mountainous region which was undoubtedly subjected to intense glaciation during the Quaternary Ice Age.

Prior to the present investigation the highest recorded locality at which Heteropterous bugs had been collected was Rongbuk in South Tibet, where at an altitude of 16,500 ft. Hingston obtained much of his material of *Chlamydatus pachycerus* (Kiritshenko, 1931b). A hitherto unrecorded nymph of *Nysius* was also obtained by the same investigator at an altitude of 17,000 ft. In the Yale North India Expedition collections the following four species are represented from still greater elevations:

- Nysius ericae alticola* subsp. n., up to 5297 m. (17,381 ft.)
Dolmacoris deterrana gen. n., sp. n., up to 5300 m. (17,400 ft.)
Chlamydatus pachycerus Kiritsh., up to 5334 m. (17,500 ft.)
Tibetocoris margaretae gen. n., sp. n., up to c. 5360 m. (17,600 ft.)

These four species fall into two ecological and zoogeographical groups. *N. e. alticola* and *C. pachycerus* occur among grasses and small herbaceous plants, mostly *Cruciferae*, the dominant members of the mesophytic high-altitude vegetation. Both are probably widely distributed in the Himalayan and Karakorum ranges wherever the appropriate flora is developed, for, as has been pointed out, *C. pachycerus* and an undetermined species of *Nysius* are known from but slightly lower localities in the Everest region. It is also of interest to note, that of the three free-living species of Heteroptera inhabiting Greenland, two (cf. China, 1934) belong to the genera *Nysius* and *Chlamydatus*. It is therefore very probable that, during the Quaternary Glaciation, both these genera, and perhaps no others, could survive in the highest zone of vegetation, in the immediate vicinity of the ice. *D. deterrana* and *T. margaretae*, on the other hand, are apparently confined to a drier type of habitat, where the dominant plant is *Artemisia minor* Jacq. Both species belong to monotypic genera most closely related to groups that reach their highest development in Central Asia. The well-defined generic characters of *Dolmacoris* make it most improbable that it is a recent immigrant to the western Tibetan Plateau and strongly suggests that the fauna of the present region of xerophytic vegetation in this region has survived the Quaternary Glaciation in unglaciated parts of Western Central Tibet under semi-arid conditions.

The Pamirs are the only mountains of Central Asia of which the Heteropterous fauna is at all well known. Here from heights of over 4,000 m. Kiritshenko (1931a) records 27 species of which three belong to the *Acanthidae*, not treated in the present paper. Of the 24 truly terrestrial Heteroptera of the High Pamir only two are endemic species. Omitting three forms only recorded from the Indus valley from localities lying below 4,000 m. and in each case associated with poplar trees which do not grow above this height, the number of species at present known from Indian Tibet is 11. If to these are added two extremely doubtful records, a nymph of *Psallus* sp. (Dambu-guru) and *Teratocoris* sp. (Tukung, S. of the Panggong Tso), which I noted but of which no specimens were found when the collections were unpacked, the total number of species is increased to thirteen, just over half the number recorded from the High Pamir. Of these, however, six appear to be endemic

to Indian Tibet and one to Indian Tibet and the Southern Himalaya. Moreover, it is probable that were a male of the species of *Stictopleura* obtained available, this too would be found to be an endemic species. It therefore appears that at least half the species of the region are peculiar to the Himalayan and Karakorum ranges, and that the High Pamir though richer in species is much poorer in peculiar forms. This is probably to be explained by the fact that, while in the Pamirs after the Quaternary Glaciation a number of routes for recolonisation were open (Reinig, 1932), putting the high regions into easy communication with the richest Heteropterous fauna in the Palaearctic region (cf. Kiritshenko, 1931 a), in Indian Tibet the only migration routes were from the North over extensive mountain ranges and deserts, from the humid south and west where the Sub-Himalayan and Kashmirian forest fauna is apparently ecologically unsuited to penetrate into very elevated and semi-arid regions, and from the east where a restricted pre-glacial high-altitude fauna may have survived in the less glaciated parts of western Tibet proper. The material available suggests that certain forms such as *Nysius ericae obscuratus* and *Microplax hissariensis* belong to a Central Asiatic element that has entered by the northern route, while the endemic genera and perhaps some or all of the endemic species represent a migration from hypothetically unglaciated regions of the Tibetan plateau, where a fauna of undoubtedly Central Asiatic origin survived and differentiated at a time when the greater part of the Karakorum and Western Himalaya were heavily glaciated and quite uninhabitable. Without some such hypothesis it seems impossible to explain the large proportion of endemic forms in a region that has suffered so much glaciation in relatively recent times.

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