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Kybos FIEB., subgenus of *Empoasca* WALSH (*Auchenorrhyncha, Cicadellidae, Typhlocybinae*) in Palaearctic

(Pp. 387—464, with 398 text-fig.)

Kybos FIEB, podrodzaj *Empoasca* WALSH (*Auchenorrhyncha, Cicadellidae, Typhlocybinae*) w Palearktyce

Kybos FIEB., подрод рода *Empoasca* WALSH (*Auchenorrhyncha, Cicadellidae, Typhlocybinae*) в Палеарктике

Abstract. Review of all species of the subgenus *Kybos* FIEB. known in Palaearctic with notes on morphology, taxonomy, bionomy and distribution. Systematic position of *Kybos* FIEB. is discussed. Several groups of related species are distinguished and their supposed historical interrelations are described.

Among above 100 species of the subgenus *Kybos* FIEB. known in Holarctic, 35 belong to Palaearctic fauna. *Kybos* FIEB. is quite easily recognizable at the first sight. Careful comparison, however, shows great similarity with *Empoasca* s. str., its certain groups in particular. *Empoasca saopa* — group from northern part of savanna zone of Africa and *vitiensis* — group from Fiji and Niue I. resemble *Kybos* FIEB. very much. These two groups were described by me separately (1976). In spite of the great similarity and undoubtful relation, great disjunction between ranges of all groups in question and completely other adaptive zone reached by them during long period of time of independent evolution, *Kybos* FIEB. appeared to be much better separated from *Empoasca* s. str. than both groups mentioned above.

In comparison with Palaearctic *Empoascini Kybos* FIEB. can be described as follows: body robust (fig. 1); deep sutures on face (fig. 6, 9); vertex short and broad, its anterior margin only slightly curved; pronotum broad (fig. 10—12); 3rd apical cell in fore wing stalked (fig. 13, 364, 365); paramere with well

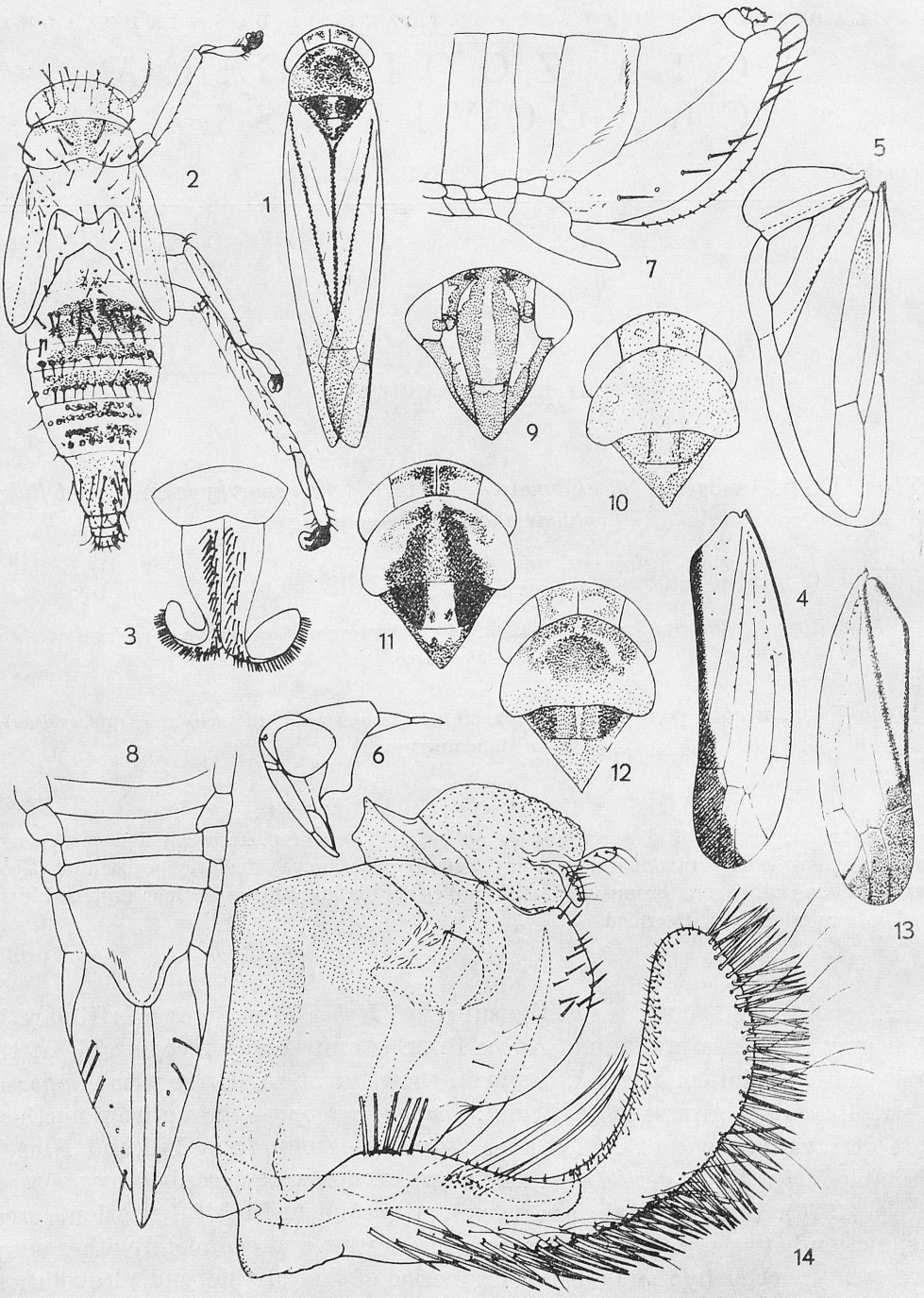

Fig. 1—14. 1 — *Empoasca* (*Kybos*) *perplexa* RIB., male from Poland; 2 — *E.* (*K.*) *lindbergi* LNV., last instar nymph; *E.* (*K.*) *rufescens rufescens* (MEL.), 3 — tip of male abdomen, ventral view, 4 — fore wing of the specimen from lowlands of Poland; *E.* (*K.*) *smaragdula* (FALL.), 5 — hind wing, 6 — head and tergites from side; *E.* (*K.*) *limpida* WAGN., 7 — end of female abdomen, side view, 8 — same, ventral view, 9 — face, 10 — head and thorax from above; 11 — *E.* (*K.*) *butleri* EDW.; *E.* (*K.*) *strobli* WAGN., 12—14

defined apical part devoid of setae, serrated on inner margin, terminated by apical hook, with distinct subapical broadening bearing hair-like setae which are one and half to two times longer than apical part of paramere (fig. 21); pygophore appendage ornamented with ledges and furrows (fig. 19, 33—35); two pairs of abdominal apodemes (fig. 56, 57, 311); anal tube appendage comparatively long, arcuated, directed cephalad, tapering, with thin apical process or broadened at tip (fig. 31, 176—178, 211), sensory pits at the end of broadened basal part (fig. 29); connective, penis structure and pygophore side setosity as in majority of groups of *Empoasca* WALSH.

The most characteristical feature of *Kybos* FIEB. in comparison with *Empoasca* s. str. is subgenital plate structure being strongly twisted outside. The plate is inclined down and mesad at base, then inclined stronger, later vertical and at the tip irregularly twisted to the same direction, thus being turned more than 180° (fig. 3). This is not well observable in macerated specimens in which the plate has been erected (fig. 14). All slender setae on subgenital plate comparatively short. Marginal microsetae being multiplied in upper half. Basal group of marginal setae in Palaearctic species (and in Nearctic groups „*copula*" and „*butleri*" by ROSS) consisting of several long, thick, pigmented, bluntly terminated rod-like setae (fig. 15). In Nearctic *trifasciata* group surface of subgenital plate is slightly less twisted than in groups mentioned previously and marginal setae forming „basal group" (fig. 16, 17) are similar to these of *Empoasca* s. str. In the Nearctic *gribisa* group marginal microsetae at base of plate are very numerous, thin and short.

When to compare *Kybos* FIEB. with *Empoasca* s. str. it becames clear that numerous differences are rather quantitative. Integration of sclerites of head is similar in two related groups of *Empoasca* s. str. and in subgenus *Distantasca* DWOR. Almost straight anterior margin of vertex occurs not only in *Kyboasca* ZACHV. but also in several not related tropical genera of *Empoascini* (e. g. *Sujitettix* MATS., *Dapitana* MAHM. and *Dialecticopteryx* KIRK.). Stalked 3rd apical cell in fore wing occurs in *Empoasca aino* group and in numerous tropical genera. Moreover, in the subgenus *Kybos* FIEB. specimens with apical *r* and *m* separate are spotted quite often (fig. 4, 363). Paramere of *Kybos* FIEB. is very characteristical but it shows great similarity to that of *Empoasca saopa* and *vitiensis* groups and also to *Empoasca barbistyla* group from Africa.

Nevertheless subgenus *Kybos* FIEB. can be separated from other subgenera by the complex of features, characteristical distribution, environmental requirements, common derivation and development independently from its relatives.

All morphological features mentioned above are better expressed in *Kybos* FIEB. than in separate groups of *Empoasca* s. str. and almost each feature in certain species occurs. The most similar to *Kybos* FIEB. groups of *Empoasca* s. str. live far from range of the subgenus and other groups or genera show only small similarity. So, in taxonomical practice in Europe and in greatest part of Palaearctic subgenous *Kybos* FIEB. is well distinguishable.

It is difficult to agree with ROSS (1963) concerning classification of certain

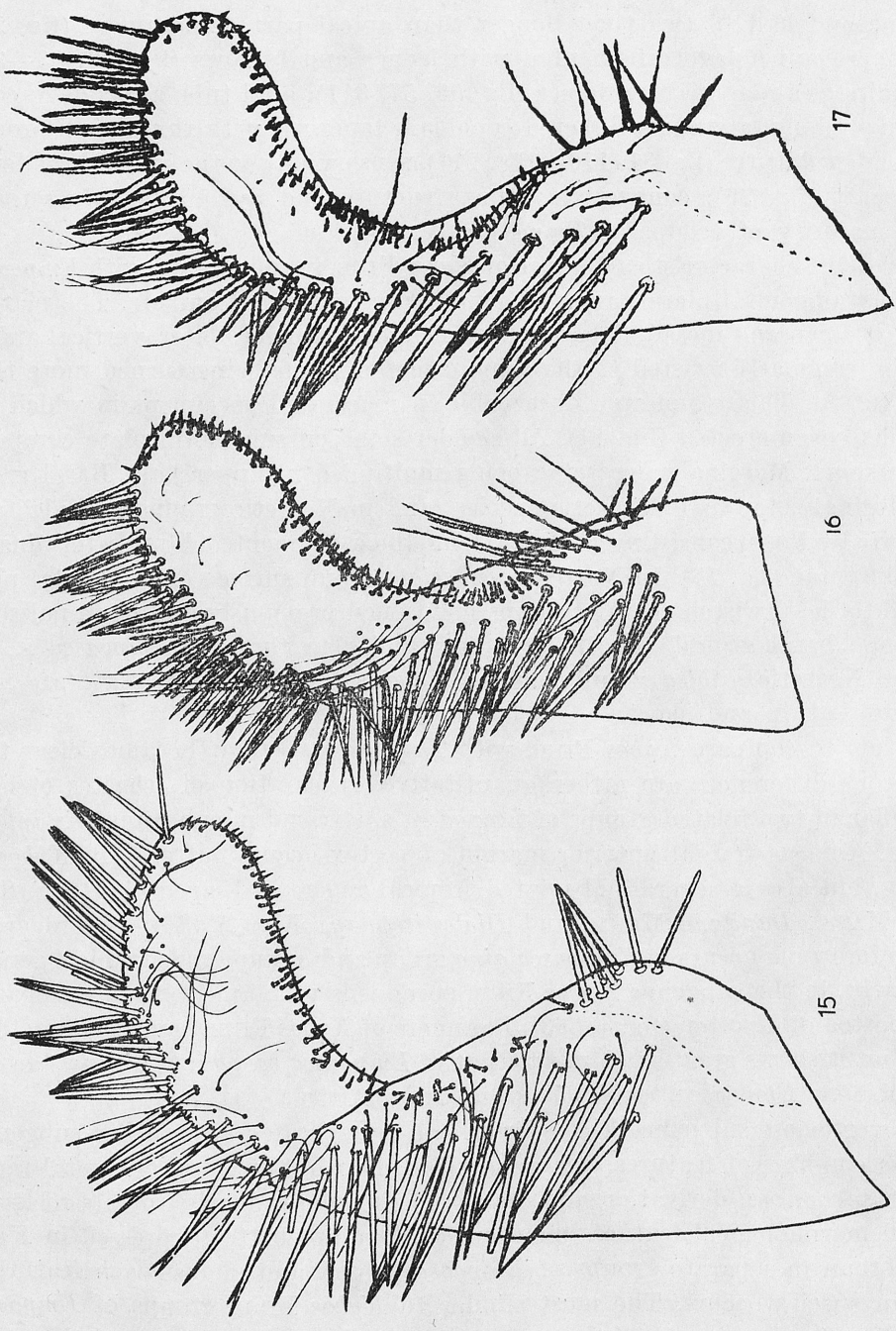

Fig. 15—17. Subgenital plates. 15— *E.* (*K.*) *smaragdula* (Fall.); 16 — *E.* (*K.*) sp. *trifasciata* — group, from Canada; 17 — *E.* (*K.*) *sordidula* Oss.

features on the base of their supposed evolutionary age. The base for such supposition is frequency of the structure and the most common ones are recognized as more primitive. Considerations concerning Palaearctic fauna are based on too incomplete information taken from only some publications. Structure of basal group of marginal setae on subgenital plate allowed Ross (1963) to distinguish groups of distinctly related species but further considerations on phylogeny based on structure of abdominal apodemes are unsound.

Sound producing apparatus and its function was studied by Ossiannilsson (1949) who described several kinds of sounds taking a part in mate behavior. As reproductive isolation is basal condition in speciation, structures included in this action are the most tractable to changes. This can cause greater differences of these structures or features in general between two the closest related species than between not related species. Abdominal apodemes are „resonance box" for sounds produced by „strings", that means they are the very structures belonging to the mate isolation action. According to the above mentioned Wallace's phenomenon such structures have very small value in phylogenetical considerations on the species level. Moreover, abdominal apodemes offer only a few very simple features for easy studies. As the result of his idea Ross (1963) placed *E.* (*K.*) *rufescens* (Mel.) in quite removed line from that with *E.* (*K.*) *butleri* Edw. while both these Palaearctic species appear to be the closest related to each other if more features is taken under consideration. On the other hand it was indicated in numerous publications that abdominal apodemes can be seriously mutilated if the specimen is infected by some parasites. The infection can be not easily detectable and it occurs quite commonly on some territories. This, together with simplicity of observable structures of abdominal apodemes can lead to serious mistakes. For example Hamilton (1972) suggests that *E.* (*K.*) *improcera* Ross described simultaneously with *E.* (*K.*) *exiguae* Ross is parasitated form of the later.

In the light of bringed forward arguments it seems to me to be better to consider complex of features and to distinguish rather bigger groups of related species than seemingly very detaily carry out phylogenetic tree. In the absence of fossil materials and very moderate our knowledge on the diversity of structures and their adaptive function such a perfect phylogenetic tree can be only illustration of philosophical views of the author.

Nearctic species are connected with *Salix* L. or *Populus* L. as food plants. Only two species, viz: *E.* (*K.*) *fontana* Ross and *E.* (*K.*) *incida* Del. are known as feeding on both these genera of plants.

Ross (1963) described four bigger groups of related species of *Kybos* Fieb. in Nearctic. In the matter of fact two of them (*copula-group* with 8 species and *butleri* — group including 11 species) do not differ from each other. *Copula* — group was characterised as having peg-like setae in basal group of marginal setae on subgenital plate. Setae of peg structure (fig. 20) gradually pass to typical rod-like form. Shape of apex of peg-like setae and their shortening is the result

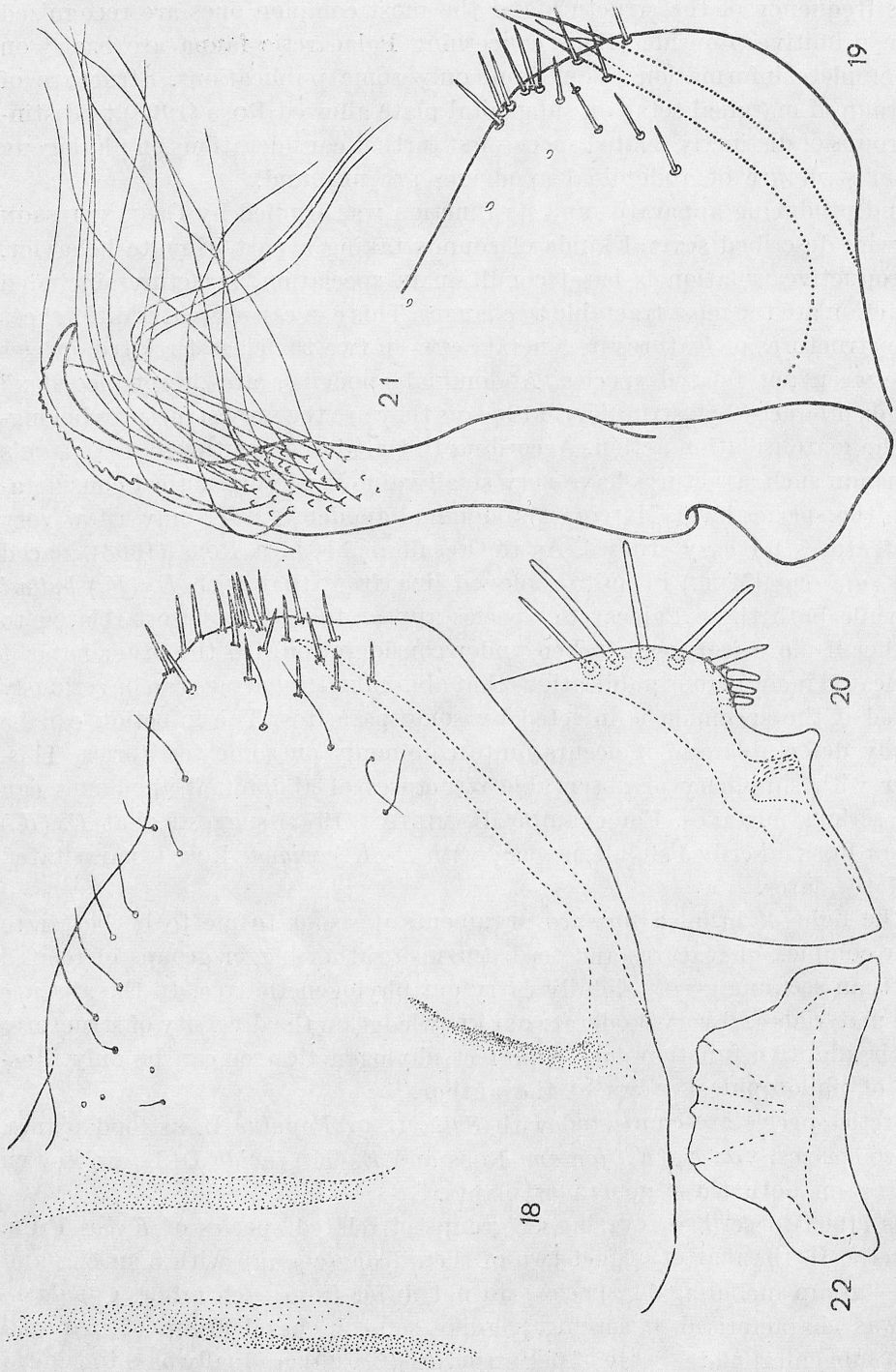

Fig. 18—22. *Empoasca* (*Kybos*) *sordidula* Oss., 18 — pygophore side; *E.* (*K.*) *smaragdula* (Fall.), 19 — hind part of pygophore side, 21 — paramere; *E.* (*K.*) *populi* Edw., 20 — basal part of subgenital plate, 22 — connective

of lost of their sensive function what is maybe connected with situation on concave part of subgenital plate margin.

Basing on reclassification by YOUNG (1952b), mentioned work by ROSS (1963) and the article by HAMILTON (1972) it is possible to state the following properties in Nearctic *Kybos* FIEB.

43 species belonging to *trifasciata* — group occupy chiefly zone of deciduous forests and steppes east of Rocky Mountains with only some of them distributed on the north of continent.

Butleri — group (ROSS' two groups together) including 19 species inhabit zone of mixed and coniferous forests, chiefly west of Rocky Mountains with numerous species distributed on the north of continent. This group is Holarctic in distribution but for the lack of good figures of male genital apparatus of the American species it is difficult to say what are interspecific relations between Nearctic and Palaearctic species.

Nearctic *gribisa* — group consisting of three species has west and northern distribution and shows some special morphological features.

Palaearctic species of *Kybos* FIEB. live either on *Salix* L. as on *Populus* L., *Alnus* MILL. and on *Betula* L. Food specialization does not seem to be very high and monophagy is rather exceptional. Majority of species feed only on related species within genus of plant (e.g. in *Salix* L. and *Populus* L. with interbreeding species) and in some cases one species can breed on different genera of plant (see *E.* (*K.*) *rufescens rufescens* (MEL.) and *E.* (*K.*) *perplexa* RIB. In Palaearctic subgenus *Kybos* FIEB. is known from European and Far East zone of deciduous forests, from steppes (also in mountains), from southern part of zone of coniferous forests in Central Asia, from north Japanese Islands, Mediterranean Subregion and Central China. *Kybos* FIEB. can be divided to three groups native for this Region.

Smaragdula — group.

Empoasca (*Kybos*) *smaragdula* (FALL.), *E.* (*K.*) *strobli* WAGN., *E.* (*K.*) *betulicola* WAGN., *E.* (*K.*) *lindbergi* LNV., *E.* (*K.*) *austriaca* WAGN., *E.* (*K.*) *digitata* RIB., *E.* (*K.*) *aetnicola* (WAGN.) and *E.* (*K.*) *calyculus* CER.

All species of this group have well sclerotized and pigmented abdominal sclerites. Penis stem tubular provided with well defined lateral appendages. Anal tube appendage comparatively short and broad. Dorsal abdominal apodemes well pigmented, distinct; sternal apodemes short or not developed. Colouration of body rather dark. Claval suture and hind margin of clavus infuscated, apical cells smoked. Vertex slightly longer in the middle than at eyes. The group is distributed chiefly in European zone of deciduous forests and in mountains. *Betula* L. or *Alnus* MILL. are the food plants.

Mucronata — group.

Empoasca (*Kybos*) *mucronata* RIB., (DWOR.), *E.* (*K.*) *verbae* (ZACHW.), *E.* (*K.*) *candelabrica* (DLAB.), *E.* (*K.*) *strigilifera* OSS., *E.* (*K.*) *virgator* RIB., *E.* (*K.*) *volgensis* (VILB.), *E.* (*K.*) *auricillata* (DLAB.) and *E.* (*K.*) *perplexa* RIB.

This group includes species with penis stem not strongly sclerotized, usually broad in lateral aspect and swollen basally at ventral margin. Lateral penis appendages well developed, their shape very variable. Anal tube appendage broad in basal part, usually longer than in *smaragdula* — group, with well developed thin apical part. *E.* (*K.*) *virgator* RIB. and *E.* (*K.*) *volgensis* (VILB.) have very long arcuated apical part of this appendage being similar to that in *populi* — group. *E.* (*K.*) *mucronata* RIB. has this structure similar to that of *smaragdula* — group. Abdominal apodemes well developed in all species being in study. Body form and colouration except of. *E.* (*K.*) *verbae* (ZACHV.) very similar to that of *smaragdula* — group, only slightly lighter. Species of *mucronata* — group live in almost whole Europe, either in north, in mountains or in steppes of southern countries. Some species are known also from Transcaucasia and Altai and *E.* (*K.*) *auricillata* (DLAB.) was described from Kirghizia. Majority of species of this group feed on *Salix* L., some on *Betula* L., two on *Alnus* MILL.

Limpida — group.

Empoasca (*Kybos*) *limpida* WAGN., *E.* (*K.*) *dlabolai* (DWOR.) and *E.* (*K.*) *cornuta* (DWOR.).

Penis stem of these species is semimembraneous, not pigmented. There is lamellate vertical process arising from ventral sclerotization behind the stem. This structure resembles ornamentation on ventral side of penis stem in *E.* (*K.*) *perplexa* RIB. and it suggests intermediate position of *limpida* — group. Paired processes absent. Anal tube appendage long sinuated. Abdominal apodemes very well developed. Body light green without distinct darkening. One species is known from centre, east and south-east of Europe, one from Mongolia and one from the Far East. All these species feed on *Salix* L.

Butleri — group.

Empoasca (*Kybos*) *populi* EDW., *E.* (*K.*) *rubrovenosa* (DWOR.), *E.* (*K.*) *abstrusa* LNV., *E.* (*K.*) *koreana* (MATS.), *E.* (*K.*) *pyramidalis* (MITJ.), *E.* (*K.*) *mitjaevi* nom. n., *E.* (*K.*) *niveicolor niveicolor* (ZACHV.), *E.* (*K.*) *niveicolor japonica* (DWOR.), *E.* (*K.*) *mesasiatica* (ZACHV.), *E.* (*K.*) *iliensis* (MITJ.), *E.* (*K.*) *butleri* EDW., *E.* (*K.*) *rufescens rufescens* (MEL.), *E.* (*K.*) *rufescens matsumurai* (DWOR.), *E.* (*K.*) *chadchalica* (DLAB.), *E.* (*K.*) *soosi* sp. n. and maybe *E.* (*K.*) *oshanini* (ZACHV.).

Subdividing of this group is very difficult as majority of species living in Central Asia are not available for study, some of Asiatic species are maybe identic with European ones. As it was mentioned previously basal group of marginal setae on subgenital plate contain peg-like unsensory setae if the margin is strongly incised as in *E.* (*K.*) *populi* EDW. Penis stem semimembraneous, not pigmented, without processes, with rather delicate papillous ornamentation on ventral side. Anal tube appendage arcuated, tapering. Pygophore process ornamented by sclerotized ledges. Abdominal apodemes very well developed. Majority of species light greenish or whitish. Some species green or emerald-green with darkenings on vertex and upper side of thorax. Fore wing semitransparent, often without smoking. If fore wing is dark, smoked or even brownish pattern situated

at hind margin. Species of *butleri*-group live in Central Asia, the exceptions are *E.* (*K.*) *rubrovenosa* (DWOR.) *from North* Africa and *E.* (*K.*) *koreana* MATS. from the Far East. *E.* (*K.*) *populi* EDW., *E.* (*K.*) *butleri* EDW., *E.* (*K.*) *rufescens* (MEL.) and *E.* (*K.*) *niveicolor* (ZACHV.) are widespread species, two last of them even differentiated geographically. About half of species of *butleri* — group live on *Populus* L., the others on *Salix* L.

Empoasca (*K.*) *sordidula* OSS. belongs to Nearctic *trifasciata* — group. This group was distinguished by ROSS (1963) as having thin pointed setae in basal group of marginal setae on subgenital plate. Also distinct sexual dimorphismus is observable in this group and colouring pattern of a male is always better expressed. For the time being this species is known from Southern Scandinavia, northern-east part of remaining area of Europe and from north-west of North America. *Salix* L. is the food-plant in Europe.

Studies on the life cycle and food specialization in the subgenus *Kybos* FIEB. are not complete. Bionomical differences between populations occuping different parts of ranges in widely distributed species are almost completely unknown.

According to NUORTEVA (1952a), *E.* (*K.*) *smaragdula* (FALL.) and *E.* (*K.*) *lindbergi* LNV. have one generation a year in Southern Finland with pick in July. Also *E.* (*K.*) *strigilifera* OSS., *E.* (*K.*) *rufescens rufescens* (MEB.) and *E.* (*K.*) *populi* EDW. occur once a year on this territory. ZACHVATKIN (1953a) mention about two generations of *E.* (*K.*) *lindbergi* LNV., *E.* (*K.*) *verbae* (ZACHV.) and *E.* (*K.*) *populi* EDW. in the centre of the European part of the U.S.S.R. My observations in south-east of Poland show that majority of these species develope two generations there. Probably the phenomenon is more complicated in the transitional zone of Northern Europe. *E.* (*K.*) *strigilifera* OSS. having two generations on lowlands of Poland have difficulties to interbreed with submontane *E.* (*K.*) *perplexa* RIB. which developes one generation and has other nuptial period.

Certain species seem to feed on a group of related species of plants. But if a small part of range is taken under consideration food specialization appears to be more restrict. *Empoasca* (*Kybos*) *perplexa* RIB. in Pieniny Mts. in Poland lives on *Salix caprea* L. while in Altai it breeds also on *Betula* L. Also ecological repleceable can be observed. In south-east part of Poland *E.* (*K.*) *populi* EDW. feeds chiefly on *Populus nigra* L., rarely on *P. alba* L. (on which no other species of *Kybos* FIEB. live in Poland) and I have never met it on *P. tremula* L. In the centre of the European part of the U.S.S.R. *Empoasca* (*K.*) *populi* EDW. occurs almost exclusively on *P. tremula* L. after ZACHVATKIN (1953a) while other species feed on *P. nigra* L. Also in Great Britain, Finland and some other West European countries this species has been collected on *P. tremula* L. It would be interesting if *E.* (*K.*) *populi* EDW. lives on *P. tremula* L. in these localities in Poland in which *E.* (*K.*) *abstrusa* LNV. occupies *P. nigra* L. Maybe also some behavioral interrelations could be observed concerning a pair *E.* (*K.*) *lindbergi* LNV. from north, centre and east of Europe and *E.* (*K.*) *betulicola* WAGN. known

from west of Europe (together with west of Scandinavia). These two species are hardly distinguishable from each other. If localities in Central Asia will be confirmed it is expected not interrupted range of *E.* (*K.*) *betulicola* WAGN. in Central and East Europe.

For the time being information on distribution of certain species of *Kybos* FIEB. is far from complete. Almost all old records should be revised. Nevertheless, already now it is quite clear that the subgenus is distributed in Northern Hemisphere and that majority of groups occupy cold temperate zone. Of course, the picture of to-day distribution of certain species is dependent on actual environmental conditions and it has been developed after last glacial period but relations among species are expressed in differentiation to six groups. Distribution of these groups allows to make the supposition on the ways of evolutional development of the subgenus. Presence of almost all groups in cold temperate zone indicates that their ancestors were also connected with rather cold climate. On the other hand differentiation to groups having centres of their distribution spread meridionally suggests coming of the common ancestor from the north. Isolation of the ancestors of certain groups must occur dependently on physical or ecological barriers and their differentiation took place in the periods when possibility of adaptive radiation have appeared. Small morphological discontinuity between numerous species in some groups contents young age of these species and suggests that the groups recently are also in the period of differentiation. Number of species in each group says however that the groups have developed during quite long period of time.

According to Asa GRAY hypothesis, recent differentiation of East American, East Asiatic and European trees result from migration of primarily uniform flora from north to the south during coolness of climate in Tertiary. ENGLER stated that this uniform arctic Tertiary flora covered in Eocene large areas of north Eurasia (to about 60°, N in Europe and more to south in Asia) and north of North America (to about 45° N). Subtropical floras occupied all areas to the south. In Oligocene coolness of the climate progressed but arctic Tertiary floras were still very similar on both hemispheres being only slightly removed to the south. There were land connection in the region of Alaska and cords of big islands on Atlantic Ocean. That time north part of present Eurasia was divided to Fenno-Sarmatia and Angara-Katasia subcontinents. Alpine orogenesis made origin to numerous mountain chains and savannas and steppes increased their areas. In Miocene floras migrated to the south and the ranges of numerous species of deciduous trees became interrupted by tree-less arid zone on both continents. In Miocene and in Pliocene land East Asiatic and island Atlantic connections between North America and Eurasia existed. Physical dividing of Eurasia has been replaced by the ecological barrier. During Pliocene coolness caused further removing plant formations to the south. Progressing Alpine orogenesis caused further continentalisation of some parts of continents and following expansion of steppes and savannas. Distribution of main plant

formations grew in similarity to the recent one. Ice Ages have caused other numerous changes of the borders of plant formations.

This picture of changes supplied by paleobotanic findings can help to understand history of the subgenus *Kybos* FIEB. It can be supposed that it was as follows.

Common ancestor of all groups of *Kybos* FIEB. inhabited arctic Tertiary flora areas in Eocene or the latest in Oligocene. That time *Empoasca* WALSH was probably differentiated to numerous chiefly tropical and subtropical forms. Some of them living in near subtropical zone were ancestors of recent *saopa* and *vitiensis* — groups. These two groups remained in more primary ecological conditions and they are less changed than *Kybos* FIEB. Following the changes connected with migration of floras to the south, common ancestor of *Kybos* FIEB. gave origin to some species. In Oligocene already ancestors of European *smaragdula-mucronata*, Asiatic *limpida-butleri* (one branch of it North America) and American *trifasciata-gribisa* groups have existed. They occupied isolated areas (two subcontinents in Eurasia and mountain chain situated meridionally in North America). Miocene was the period of intensive evolution of floras and it could cause speciation of insects which gave origin to the ancestors of all groups of *Kybos* FIEB. That time ancestor or ancestors of *mucronata* — group could arrive in Mediterranean zone and differentiate there to some species. Miocene was the most favourable period for adaptive radiation of this group. Certain species could originate on bigger islands in the area of recent Black Sea and northern part of branch of Tethis. Recent extreme localities of *Empoasca* (*Kybos*) *strigilifera* OSS. — Europe and *E.* (*K.*) *auricillata* (DLAB.) — Kirghizia show the area of expansion of this group. Some species have remainded in cooler environments later giving origin to sister species: *Empoasca* (*K.*) *mucronata* RIB. with rather northern and submontane distribution and *E.* (*K.*) *verbae* (ZACHV.). *Empoasca* (*Kybos*) *verbae* (ZACHV.) is descendant of more eastern line of the group. These species like *E.* (*K.*) *volgensis* (VILB.) (extremally steppose — sister species of *E.* (*K.*) *virgator* RIB.) the most probably have developed during Ice Ages. Rather eurybiotic *E.* (*K.*) *virgator* RIB. probably primarily was connected with steppes. It could easily expand to the eastern steppes during glaciations. Presence of *E.* (*K.*) *virgator* RIB. in Western Europe is probably more recent than in East Europe and its migration there could happen after last glacial period. The pair *Empoasca* (*K.*) *strigilifera* OSS. and its sister species *E.* (*K.*) *perplexa* RIB. could derive from a common ancestor also in Ice Ages. Montane species *E.* (*K.*) *perplexa* RIB. could develope is Asia Minor during glaciation. Periods just after glaciations were the most favourable for migration of this form to the east and to the west. Rather more termophilous *E.* (*K.*) *strigilifera* OSS. the most probably have originated from isolated populations of the common ancestor in West Europe. After escape of ice, ranges of both species met one another in the Central Europe. *Empoasca* (*Kybos*) *strigilifera* OSS. has however two generations a year on this territory and montane species only one generation and they can not

interbreed easily. It is quite possible that range of *E.* (*K.*) *strigilifera* Oss. follow area of deciduous forests to the east. *Empoasca* (*K.*) *perplexa* Rib. the most probably lives in Caucasus, in whole arch of Carpathians and in other Central Asiatic mountains. *Mucronata* — group includes 8 known species and its ecological centre are steppes of warm temperate zone; its centre of distribution is probably north-east of the Mediterranean.

Smaragdula — group including rather cool-tolerating species have several sister species. It seems to be the youngest group descending from the ancestor common also for *mucronata* — group but it has been developed partly in late Pliocene and chiefly during Pleistocene. The sister species inhabit different geographical areas discontinued also ecologically e.g. lowland *E.* (*K.*) *smaragdula* (Fall). and montane *E.* (*K.*) *strobli* Wagn., northern *E.* (*K.*) *calyculus* Cer. and southern *E.* (*K.*) *aetnicola* (Wagn.). Also western *E.* (*K.*) *betulicola* Wagn. and northern and eastern *E.* (*K.*) *lindbergi* Lnv. show distinct influence of glaciations to their origin and distribution. Judging after morphological features they both more differ from *E.* (*K.*) *austriaca* Wagn. than from each other. Quite possibly all of them derive from the common ancestor which south of Alps gave origin to *E.* (*K.*) *austriaca* Wagn. and have been differentiated to *E.* (*K.*) *betulicola* Wagn. in West Europe and to *E.* (*K.*) *lindbergi* Lnv. on the east. It is possible that two last species can interbreed at the borders of their ranges (e.g. near Poznań and Katowice in Poland). During interglacials two extreme species increased their ranges and *E.* (*K.*) *austriaca* Wagn. remained near place of its origin. After last glaciation *E.* (*K.*) *betulicola* Wagn. settled West Europe together with west of Scandinavia and *E.* (*K.*) *lindbergi* Lnv. have migrated far to the east reaching Central Asia. *Empoasca* (*K.*) *betulicola* Wagn. was introduced to British Columbia from West Europe. Now *smaragdula* — group contains 8 species, mixed and deciduous forests in cold temperate zone of Europe are its ecological centre and mountains of Central Europe are its centre of distribution.

Limpida — group consists of three very closely related species connected with arid environments. The most probably it has been developed from one ancestor which was in Pliocene dispatched in three isolated localities, Central Asia, south-east of Europe and Manchuria. During Pleistocene these populations have developed reproductive barrier what gave three species known at present. Termophilous *Empoasca* (*K.*) *limpida* Wagn. occupy all arid and warm habitats in Europe, more to the north and to the west from the place of its origin. Distribution of Asiatic species of this group will be recognized in the future.

Butleri — group derive from the ancestor coming from the north which gave the origin at first to montane species on both continents. When steppes have expanded to mountains these montane ancestors pass intensive speciation. Species connected with steppes the most probably strongly increased in number at the first time in Pliocene. Ancestors of this group in both continental centres pass their speciation independently what is supported by well defined centres of distribution. Recent American species of *butleri* — group have been developed

in montane mixed forests and in montane steppes. So, they were earlier ready to expand in the direction of newly formed northern habitats than representatives of *trifasciata* — group. Numerous species of *butleri* — group occur at present also on the north of American continent but as their localities to the north are rather late age they could not strongly influent to the Palaearctic fauna. On the other hand it is possibly that some species of this group (being slightly more cool-tolerating than Palaearctic species) have inhabited empty habitats of Siberia. Occurrence of *E.* (*K.*) *butleri* EDW. in Colorado (and maybe synonym of this species — *E.* (*K.*) *hartzeli* BAKER in California) can be explained as introduction from Europe together with willows. ROSS (1963) noticed that in western part of the U.S.A. European willows are quite common. Palaearctic centre of development of *butleri* — group was situated in Central Asiatic mountains, in montane steppes later. Expansion of steppes in Pliocene following Alpine orogenesis and changes of the climate in this period and in Pleistocene made favourable condition for speciation of this group. Those times majority of recent species have been developed. Migration of the ancestor of *E.* (*K.*) *rubrovenosa* (DWOR.) to the North Africa probably was also Pliocene age. *Empoasca* (*K.*) *rufescens* (MEL.) and *E.* (*K.*) *niveicolor* (ZACHV.) like the common ancestor of *E.* (*K.*) *abstrusa* LNV. and *E.* (*K.*) *koreana* (MATS.) and also ancestor of *E.* (*K.*) *soosi* sp. n. could have large ranges reaching the most eastern steppes. During following drying of some areas and changes of vegetation eastern steppose populations of mentioned species have been isolated from Central Asiatic ones and gave origin to the separate taxa. In the periods of dry climate (glacials) these East Asiatic species could increase their ranges reaching Japanese Islands. Central Asiatic species could also migrate that time following the expansion of their habitats. Settling of Europe by the members of *butleri* — group is comparatively no long age. Now *butleri* — group contains 15 or 16 species known in Palaearctic with centre of distribution in steppes of Central Asia. The ranges of only a few species are situated beyond this area and a few others overstep Central Asia. This supposts the supposition that all European species of this group are newcomers here and that *E.* (*K.*) *abstrusa* LNV. should be found in Central Asia. Absence of *butleri* — group in Asia Minor seems to result only from lack of investigations.

In North America ancestor of *trifasciata* and *gribisa* — groups pass adaptive radiation probably in Pliocene and gave origin to several species. Some of them, living on *Salix* L., occupied arid zone of southern steppes being in expansion that time and the others settled areas of deciduous forests more to the east of the continent. One branch could lead to the ancestor of northern *gribisa* — group. When cold climate maintained for a long time, probably in Pleistocene, some species of *trifasciata* — group have migrated to the north giving origin to further species of this group. Owing to reducing and increasing ranges of certain species the picture of their distribution is so complicated that it seems to be impossible to detect details of development of this group. But it remains clear that *trifasciata* — group is native for the North American continent.

Ancestors of cool-tolerating species have migrated to the north during decreasing of temperature in Ice Ages. One northern species of this group, subarctic *Empoasca* (*K.*) *sordidula* Oss. described from Scandinavia is newcomer in Europe and for the time being it is the only well known American species which dispersed to the west. Supposed way of migration of this species is air transport between continents in one of interglacials (maybe Eemian interglacial) and land migration to the west reaching Europe after last glaciation. Thus, this species should be found in Siberia. It can not be excluded that also some other species of *trifasciata*— group could pass to the Palaearctic.

Presence of *butleri* — group in Europe and in North America (also classified by Ross to *copula* — group) inclined Ross (1963) to the opinion that all European species of subgenous *Kybos* Fieb. exist here owing to dispersions from America. But as it was reasoned above that seems not be to supported by strong arguments.

It should be emphasised that the migration, especially in north direction, occurs very intensively at present. Also great changes of environments caused by acting of a man may have great importance enabling some species to occupy new areas. The last possibility is the most real for *mucronata*, *limpida* and *butleri* — groups in Palaearctic.

I have not the possibility to examinate specimens recorded as *Kybos betulicola* (Wagn.) from north of Mongolia by Dlabola 1967b. Figure of penis of *Kybos lindbergi* (Lnv.) in the work by Mitjaev (1971) resemble rather that of *Empoasca* (*K.*) *betulicola* Wagn. but examination of specimens confirm presence of the former species in Kazakhstan.

Practical remarks. Figures of male genital apparatus given in this work do not show the whole variability of certain species. It should be also remembered that thin process terminating anal tube appendage in smaragdula and mucronata — groups very often is broken. Parasites, especially *Dryinidae*, reduce size of ventral abdominal apodemes and change pigmentation and thickness of other structures. Colouration of sclerites of specimens attacked by parasites became rather grey-black instead of dark brown, pigmented areas decrease and often they are more contrastic. Structures usually symmetrical, in specimens mutilated by parasites lost their symmetry and often are much smaller than in normal specimens. Manubrium of penis often became thinner and membraneous parts is swollen.

References to the original descriptions omitted here are in Metcalf's Catalogue (1968) and in his bibliography (1964); index of names — Burnside (1971).

Empoasca (*Kybos*) *smaragdula* (Fallén, 1806)

Cicada smaragdula Fallén, 1806
Eupteryx viridipes Curtis, 1837
fig. 5, 6, 15, 19, 21, 23—35

Face. Frontoclypeus yellowish-green. Sides and lower part of face green. A narrow white streak on frontoclypeus, whitish upper part of anteclypeus,

upper parts of genae, patches above antennae at eyes and small patches at ocelli.

Vertex. Ochraceous with two subangulate brownish patches, coronal suture bordered with white.

Pronotum. Olivaceous-green, whitish spot in the centre at anterior margin, two light areas at sides. Hind margin broadly infuscated. There is large semicircular or triangular brownish patch in the centre. Often central whitish streak present.

Scutum. Brownish with a short whitish central streak.

Scutellum. Brownish with triangular whitish patch.

Fore wing. Emerald-green, especially at base and on clavus, semitransparent at costal margin. Apical cells, tip parts of longitudinal cu and m cells smoked. Distal part of costal margin infuscated. Inner and hind margins of wing, tip of clavus and claval suture bordered with brown. Often a brown streak in the centre of longitudinal r cell.

In newly hatched specimens which are not fully coloured there are two green patches on vertex. The patches are bordered with brown at anterior margin. In such specimens whitish hypodermal pattern is not distinct and borders of patches fluent with suppremation of green or even malachite-green.

Central lobe of VII female sternite produced and deeply incised in the middle.

Length ♂ 4.00—4.35, ♀ 4.10—4.65 mm. After RIBAUT (1936b) length ♂ 3.8—4.3, ♀ 4.1—4.6 mm.

Male genital apparatus. Anal tube appendage (fig. 29—31) arcuated, usually broadened before thin apical process. Pygophore appendage tapering, ornamented by low ledges (fig. 33—35). Paramere (fig. 23, 24) with upper part broadened near apical hook or at the middle-length of apical part. Penis stem (fig. 25—28) short, rather straight, with ornamentation on ventral side. Penis processes parallel to the stem.

Sternal apodemes reduced (fig. 32), dorsal apodemes of median size.

Type locality. Westrogothia, Sweden.

Type location. Lund University, Sweden.

Material studied. NW Poland: 1 ♂, Słupsk, Sep. 4, 1931, coll. O. KARL; 1 ♂, Szczecin, Aug. 21, 1921, coll. G. SCHROEDER; 1 ♂, Szczecin, June, coll. E. SCHMIDT. SW Poland: 1 ♂, Pelnik, July 14, 1947, coll. J. NAST; 2 ♂♂, Wisła, Sep. 3, 1952; 1 ♂, Świeradów Zdrój, *Alnus glutinosa* (L.), Aug. 30, 1947, coll. J. NAST; 1 ♂, Szczakowa, July 28, 1974, coll. team of the Institute of Forest Research. Central Poland: 1 ♂, Warszawa, Aug. 7, 1956, coll. S. NOWAKOWSKI; 2 ♂♂, Warszawa, Aug. 31, 1953, coll. B. BURAKOWSKI. NE Poland: 3 ♂♂, 1♀, Białowieża, July 17, 1974, *Alnus glutinosa* (L.), coll. I. DWORAKOWSKA. SE Poland: 1 ♂, Krasnystaw, Aug. 18, 1967; 1 ♂, Niemienice, July 22, 1968; 6 ♂♂, ♀♀, Chrupnik, Aug. 14, 1968; 2 ♂♂, 1 ♀, Nałęczów, July 3, 1968; 1 ♂, Grodysławice, June 25, 1968; 2 ♂♂, Horyniec, Sep. 4, 1967, all collected on *Alnus glutinosa* (L.) by I. DWORAKOWSKA. G. D. R.: 1 ♂, "Jungfernhde" Berlin, Apr. 28, 1884, coll. Tetens. G. F. R.: 1 ♂ Hamburg, *Salix* sp., Sep. 10, 1945; 1 ♂ Hamburg, *Alnus glutinosa* (L.), Aug. 25, 1945, coll. J. NAST. U.S.R.R.: 1 ♂, Leningrad, July 13, 1963, coll. W. BAZYLUK.

Distribution. Europe except mountains, Iberian Peninsula and steppes, the most to the east — Okskiy Zapovednik, after ZACHVATKIN (1953b); U.S.S.R.: Altai, after VILBASTE (1965) and northern Kazakhstan, after MITJAEV (1963).

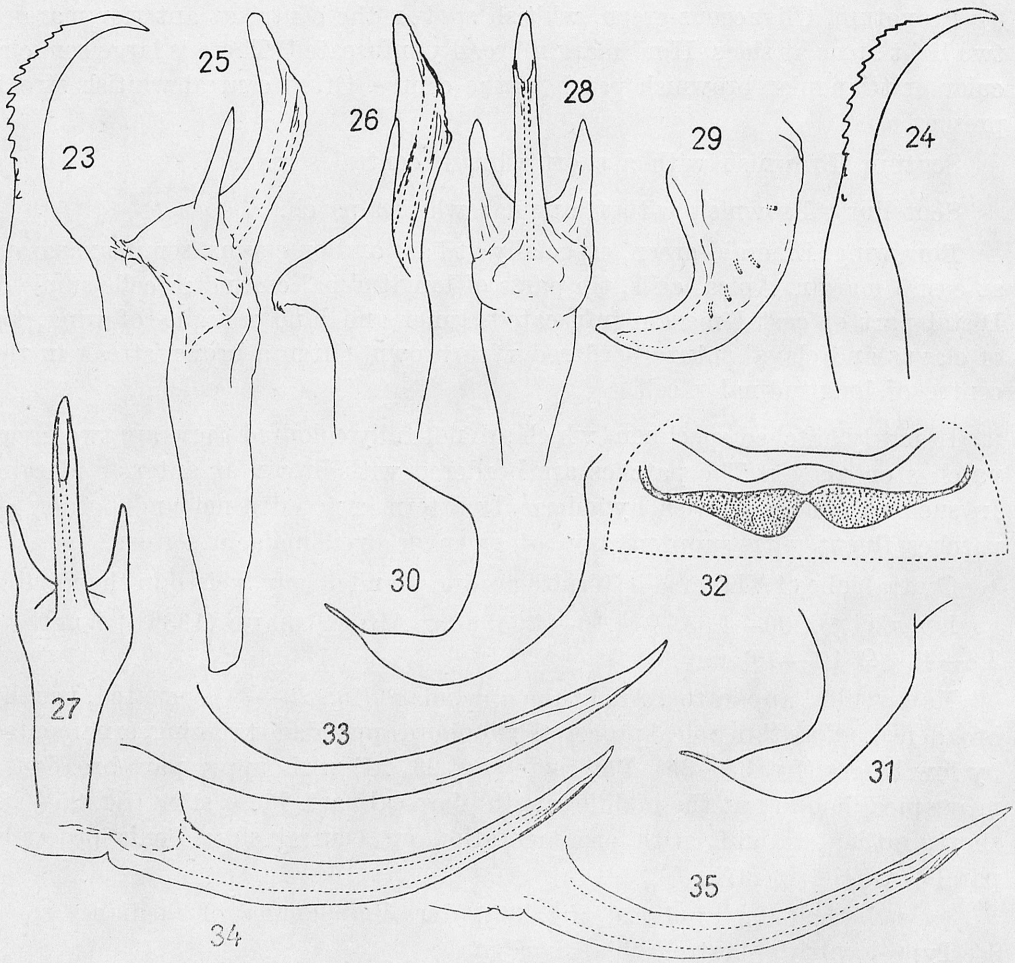

Fig. 23—35. *Empoasca* (*Kybos*) *smaragdula* (FALL.), 23, 25, 28, 29, 34 and 35 — specimens from Poland, Białowieża, other figures — specimens from SE of Poland; 25, 26 — penis from side, 27, 28 — penis from behind, 29—31 — anal tube appendage, 32 — abdominal apodemes, 33—35 — pygophore appendage

Bionomy. One generation in Scandinavia and in Central and northern Poland, maybe two generations in southern Poland. In some years in south of Poland adult specimens appear already in June but usually in July. The greatest number of males hatch in the second half of July, on trees on which lives also *E.* (*K.*) *mucronata* RIB. just after the maximum of occurrence of that species. The most probably in west of the Europe *E.* (*K.*) *smaragdula* (FALL.) developes

also second generation. In Poland and some west countries this species feeds on *Alnus glutinosa* (L.) NUORTEVA (1952a) however has recorded it in Finland as feeding on *Alnus incana* (L.).

Remarks. Localities in Asia as well as some records in older publications require confirmation.

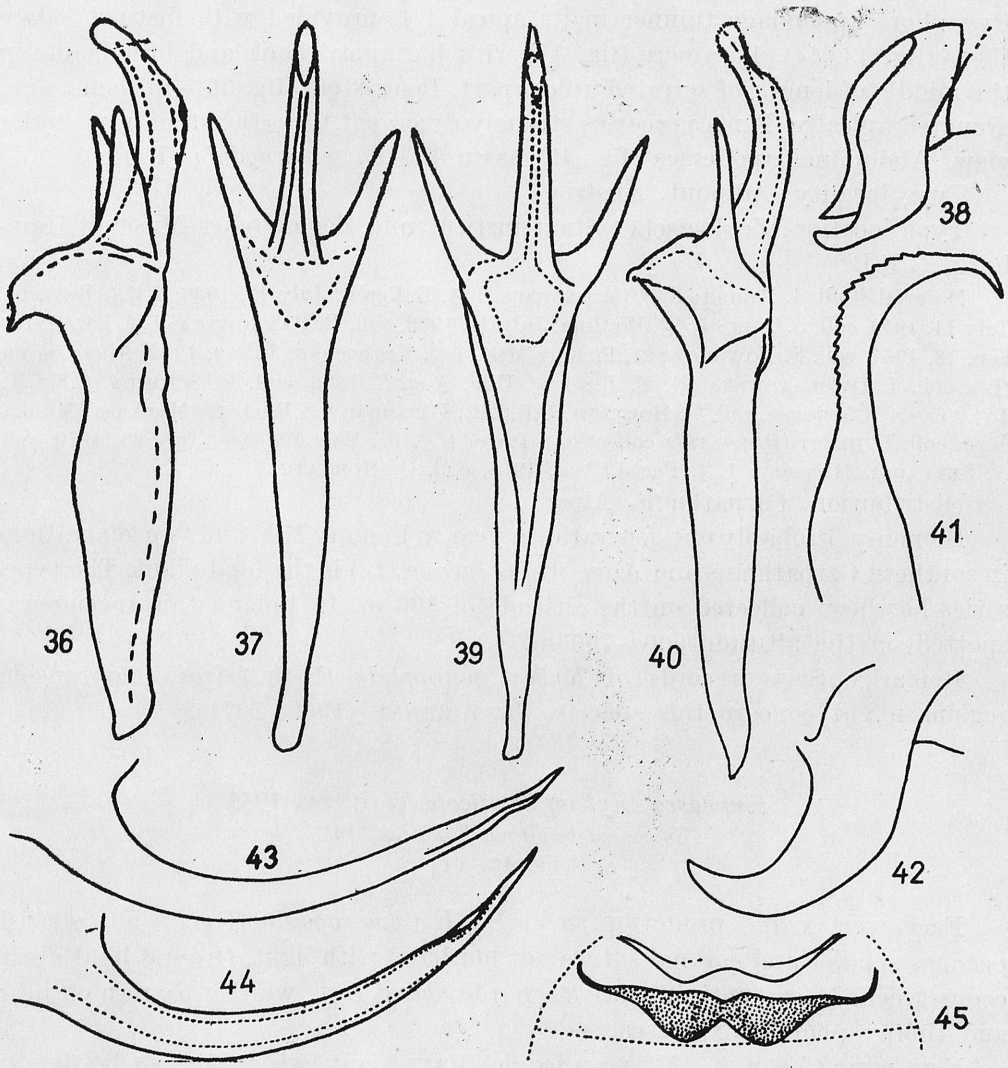

Fig. 36—45. *Empoasca* (*Kybos*) *strobli* WAGN.; 36—38 — after WAGNER (1949); 39—45 — specimen from Poland

Emposca (*Kybos*) *strobli* WAGNER, 1949

Empoasca strobli WAGNER, 1949
fig. 12—14, 36—45

Externally indistinguishable from *Empoasca* (*Kybos*) *smaragdula* (FALL.), only infuscated pattern on fore wing less developed and whitish marks on head and thorax better visible.

Length ♂ 4.00—4.20 mm. Length, after Wagner 1949 ♂ 4.50 mm.

Male genital apparatus. Anal tube appendage (fig. 42) arcuated, tapering. Pygophore appendage thinner in its apical 1/4, provided with distinct ledges there (fig. 43, 44). Paramere (fig. 41) with big apical hook and broadening in the middle of length of serrated apical part. Penis stem (fig. 36—40) long, slim, arcuated apically. Penis processes strongly divergent from the stem in posterior view. Abdominal apodemes (fig. 45) as in E. (*K.*) *smaragdula* (FALL.).

Type locality. Admont, Austria.

Type location. Zoologisches Staatsinstitut und Zoologisches Museum Hamburg, G.F.R.

Material studied. Poland: East Carpathians, 1 ♂, Baligród, July 11, 1958; 2 ♂♂, Baligród, July 11, 1959, coll. S. TOLL; 4 ♂♂, Wetlina, July 27, 1962, coll. R. BAŃKOWSKA; 1 ♂, DWERNIKI, Sep. 18, 1957, coll. S. NOWAKOWSKI; Pieniny Mts., 1 ♂, Krościenko, July 9, 1972, *Alnus incana* (L.), coll. I. DWORAKOWSKA. G. F. R.: 1 ♂, Ulm, Aug. 3, 1908, coll. E. SCHMIDT. Č.S.S.R.: 1 ♂, "Csecs" Čečejovce, coll. G. HORVÁTH. U.S.S.R., Ukrainian S.S.R.: 1 ♂, "Munkács" Munkačevo, coll. UJHELYI (HORVÁTH's collection). Italy: 1 ♂, 1♀, Vale Malenco, July 20, 1970, coll. A. SERVADEI. Hungary: 1 ♂, Parád, Aug. 1915, coll. G. HORVÁTH.

Distribution. Carpathians, Alps.

Bionomy. Probably one generation a year in Pieniny Mts. and two generations in southern Carpathians and Alps. *Alnus incana* (L.) is the food plant. The type-series has been collected on the altitude of 800 m. In Poland this species was spotted on the altitude 600—700 m.

Remarks. Some records of *Kybos smaragdula* (FALL.) from montaneous regions might concern this species, CANTOREANU (1969, 1971).

Empoasca (*Kybos*) *betulicola* WAGNER, 1955

Empoasca betulicola WAGNER, 1955
fig. 46—61

Face, vertex and pronotum as in *E.* (*K.*) *smaragdula* (FALL.) but whitish patches smaller and coronal suture not bordered with light. Ground light olivaceous-green. In comparison with *E.* (*K.*) *lindbergi* LNV. whitish pattern on head and thorax poorely expressed.

Fore wing. As in *E.* (*K.*) *smaragdula* (FALL.) but lighter. Brown borders of margins and claval suture narrow and light, apical cells only slightly smoked.

Central lobe of VII female sternite as in *E.* (*K.*) *smaragdula* (FALL.), slightly more incised in the middle than in *E.* (*K.*) *lindbergi* LNV.

Length ♂ 4.15—4.45, ♀ 4.35—4.70 mm.

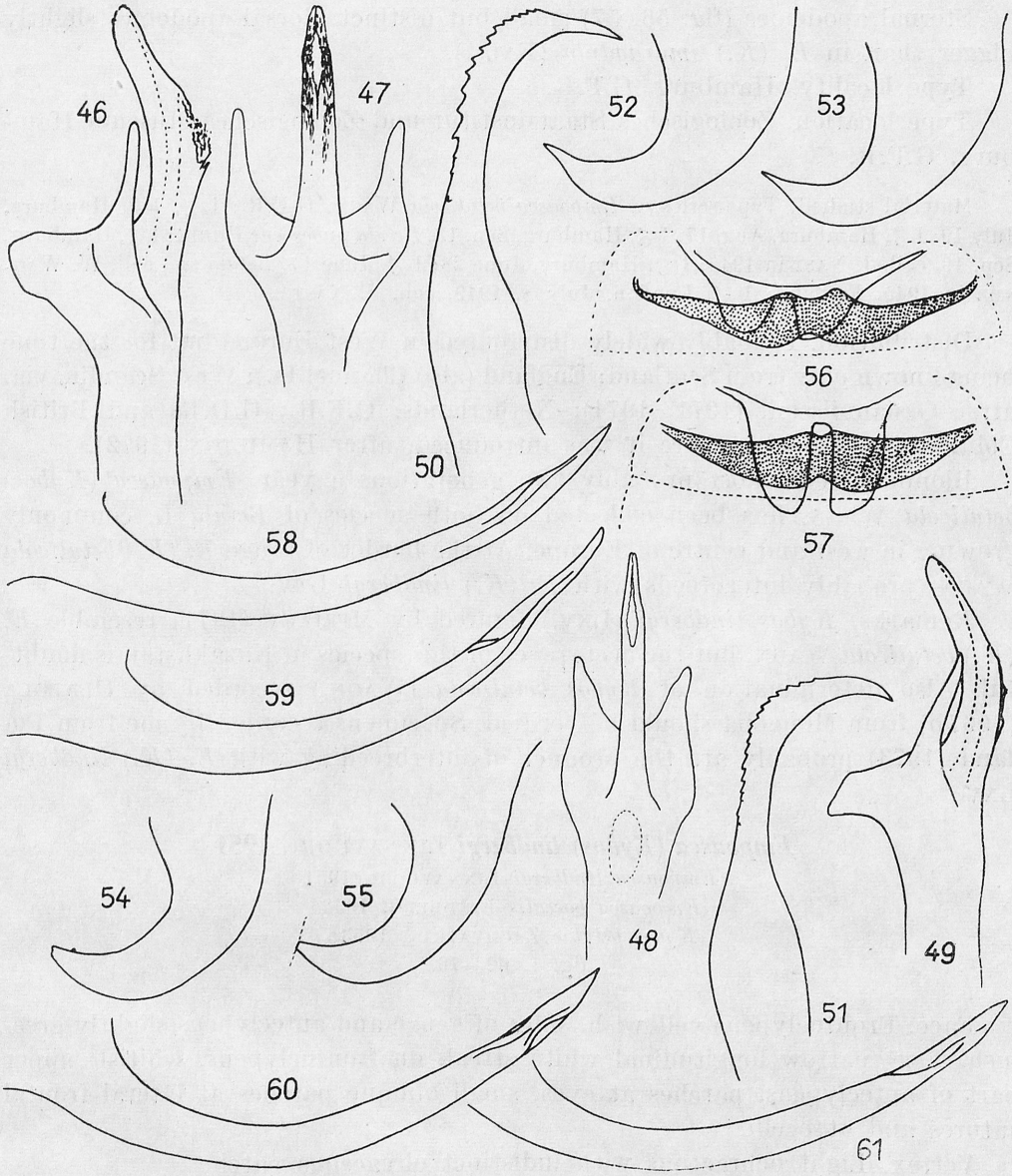

Fig. 46—61. *Empoasca* (*Kybos*) *betulicola* WAGN., 46, 47, 50—53, 56, 58, 59 — specimen from Hamburg; the others — specimen from London

Male genital apparatus. Anal tube appendage arcuate tapering, with a short thin termination (fig. 52—55). Pygophore appendage (fig. 58—61) ornamented with distinct ledges. Paramere (fig. 50, 51) broadened in the middle length of serrated part. Penis stem (fig. 46, 49) short, distinctly arcuate. Penis processes (fig. 47, 48) usually parallel to each other or slightly divergent, shorter in comparison with *E.* (*K.*) *lindbergi* LNV.

Sternal apodemes (fig. 56, 57) small but distinct, dorsal apodemes slightly bigger than in *E.* (*K.*) *smaragdula* (FALL.).

Type locality. Hamburg, G.F.R.

Type location. Zoologisches Staatsinstitut und Zoologisches Museum Hamburg, G.F.R.

Material studied. Type-series of *Empoasca betulicola* WAGN. G.F.R.: 1 ♂, 1 ♀, Hamburg, July 19; 1 ♂, Hamburg, Aug. 17; 1 ♂, Hamburg, Sep. 13, *Betula pubescens* EHRH.; 1 ♂, Hamburg, Sep. 19, coll. J. NAST in 1945; 1 ♂, Hamburg, June 28; 1 ♂, June 17, *Betula* sp., coll. W. WAGNER in 1945. England: 1 ♂, London, July 8, 1949, coll. J. NAST.

Distribution. Probably widely distributed in West Europe but for the time being known only from Scotland; England (also Channel Is.); West Scandinavia, after Ossiannilsson, (1971, 1974); Netherlands; G.F.R.; G.D.R. and British Columbia in Canada where it was introduced, after HAMILTON (1972).

Bionomy. The most probably two generations a year. *Empoasca* (*Kybos*) *betulicola* WAGN. has been collected on both species of *Betula* L. commonly growing in west and centre of Europe. At the border of range *E.* (*K.*) *betulicola* WAGN. probably interbreeds with *E.* (*K.*) *lindbergi* LNV.

Remarks. *Kybos lindbergi* (LNV.) figured by MITJAEV (1971) resemble *E.* (*K.*) *betulicola* WAGN. but the occurrence of this species in Kazakhstan is doubtful. Also determination of *Kybos betulicola* (WAGN.) recorded by DLABOLA (1967b) from Mongolia should be verified. Specimens recorded by me from Poland (1973) probably are the product of interbreeding with *E.* (*K.*) *lindbergi* LNV.

Empoasca (*Kybos*) *lindbergi* LINNAVUORI, 1951

Empoasca lindbergi LINNAVUORI, 1951
Empoasca borealis LINDBERG, 1952
Kybos betulae ZACHVATKIN, 1953a
fig. 1, 62—76

Face. Frontoclypeus yellowish, sides of genae and anteclypeus slightly greenish. Very narrow longitudinal white streak on frontoclypeus, whitish upper part of anteclypeus, patches at eyes, small oblique patches at lateral frontal sutures and at ocelli.

Vertex. Light ochraceous with indistinct olivaceous patches.

Pronotum. Olivaceous-yellow. Whitish spot in the centre at anterior margin and two light areas at eyes. Hind margin slightly infuscated, darker olivaceous semicircular or triangular patch at the centre often divided by milky longitudinal central streak.

Scutum. Dark ochraceous, in some cases with a narrow white central streak.

Scutellum. Ochraceous with triangular whitish patch.

Fore wing. Olivaceous-green, slightly lighter at costal margin. Apical part smoked like in *E.* (*K.*) *smaragdula* (FALL.) but lighter. Inner margin, hind margin of clavus and claval suture very narrowly bordered with brown, hind angle of clavus dark.

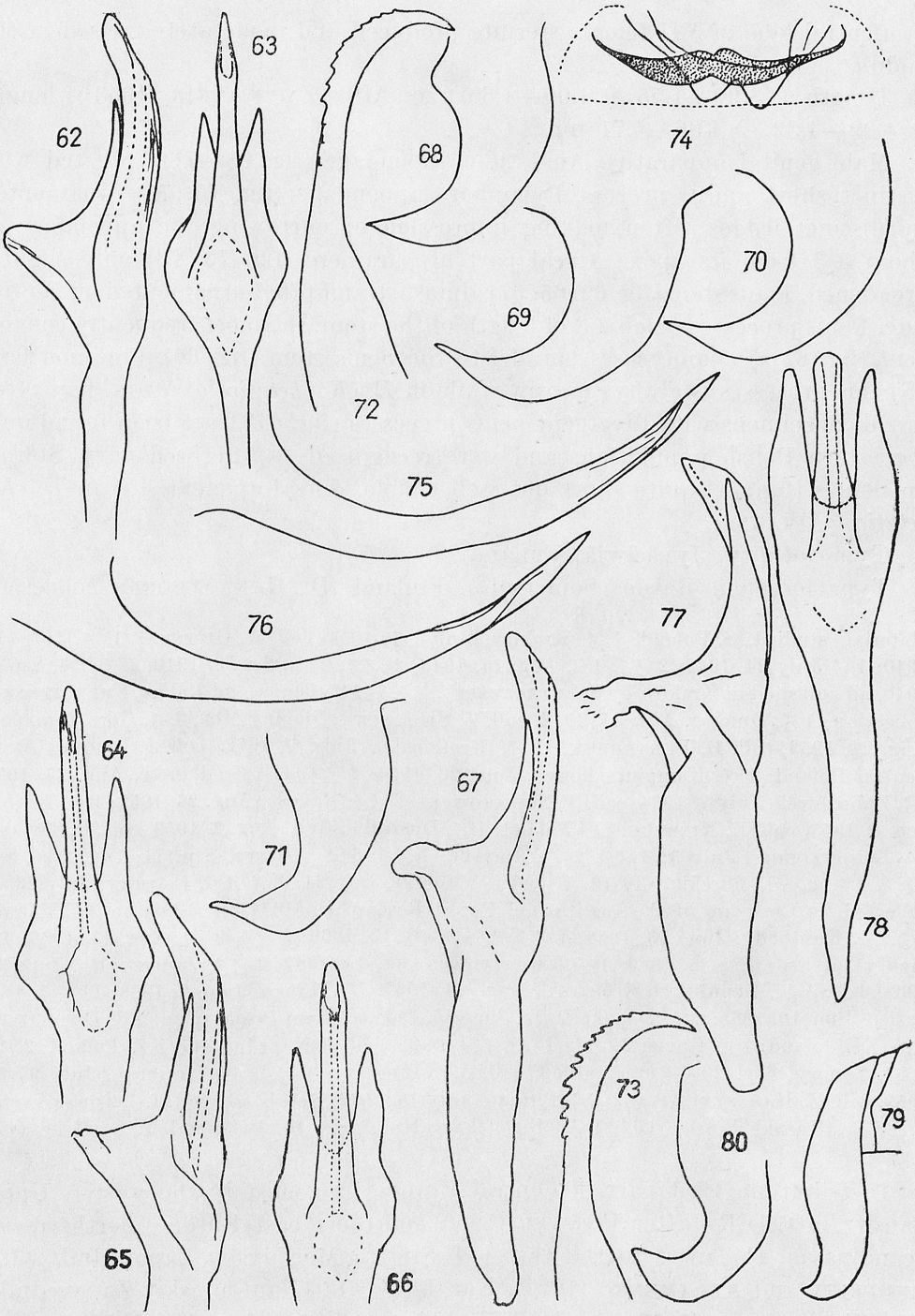

Fig. 62—80. *Empoasca* (*Kybos*) *lindbergi* LNV. — 62—76; *E.* (*K.*) *austriaca* WAGN., after WAGNER (1949a) — 77—79, anal tube appendage of the holotype — 80

Central lobe of VII female sternite produced and moderately incised in the middle.

Length ♂ 3.90—4.55, ♀ 4.00—4.60 mm. After ZACHVATKIN (1953b) length ♂ 4.09—4.32, ♀ 4.36—4.71 mm.

Male genital apparatus. Anal tube appendage (fig. 68—71) arcuated with distinct short apical process. Pygophore appendage (fig. 75, 76) ornamented by distinct ledges, often making impression of narrowing the appendage at about 1/3 from its apex. Apical part of paramere (fig. 72, 73) only slightly broadened. Penis stem (fig. 62, 65, 67) almost straight, not ornamented on ventral side. Penis processes reach 2/3 of length of the stem, the most frequently convergent (fig. 63), in some cases parallel to the penis stem (fig. 66). Common base of penis processes is always narrow while in *E.* (*K.*) *betulicola* WAGN. it is often broad. Specimens with divergent penis processes (fig. 64) have been found only in western Polish populations and were recognized as interbred ones. Sternal apodemes (fig. 74) quite short but well visible, dorsal apodemes as in *E.* (*K.*) *betulicola* WAGN.

Type locality. Jyväskylä, Finland.

Type location. Raisio (Somersoja), Finland. Dr. LINNAVUORI'S collection.

Material studied. S.,Poland: 1 ♂, Kraków, July 17, 1954, coll. A. GIŻYCKA; 1 ♂, July 17, 1940; 1 ♂ July 24, 1945; 2 ♂♂, 1 ♀, Aug. 14, 1943; 2 ♂♂, 2 ♀♀, Sep. 3, 1940; 1 ♂, 1 ♀, Sep. 2, 1940, all collected in Kraków by S. SMRECZYŃSKI; ♂♂, ♀♀, Myślenice and Rabka, SMRECZYŃSKI'S collection; 1 ♂, Dulowa, Aug. 15, 1972, coll. Z. STEBNICKA; Pieniny Mts., 1 ♂, Góra Zamkowa, Aug. 24, 1953, coll. B. BURAKOWSKI; 1 ♂, Krościenko, July 9, 1972, coll. I. DWORAKOWSKA Central Poland: 1 ♂, Kampinos Forest, June 20, 1954; 2 ♂♂, 1 ♀, Śródborów, Aug. 25, 1957; I♂, Zaborówek, July 7, 1954, coll. S. NOWAKOWSKI; 2 ♂♂, Radość, Aug. 26, 1957; 1 ♂, Radość, Sep. 5, 1957, coll. E. KIERYCH. SW Poland: 1 ♂, Duszniki Zdrój, Aug. 2, 1959, coll. R. TROJAN; 1 ♂, Świerklaniec, July 3; 3 ♂♂, 2 ♀♀, July 26; 7 ♂♂, 6 ♀♀, 1 larva, Sep. 11; 1 ♂, 2 ♀♀, Sep. 17; 8 ♂♂, 12 ♀♀, Murcki, July 19; 1 ♂, 3 ♀♀, Murcki, July 24; 1 ♂, 1 ♀, Ostrowy, July 23, all collected by the team of the Institute of Forest Research in 1974 on *Betula* sp. SE Poland: ♂♂, ♀♀, Kosobudy, June 13, 1968; 4 ♂♂, 6 ♀♀, July 12, 1966; 2 ♂♂, 9 ♀♀, Aug. 11, 1966; 1 ♂ (newly hatched), Sep. 8, 1966; 1 ♂, Zwierzyniec, Aug. 23, 1967; 3 ♂♂, Zwierzyniec, June 11, 1968; 1 ♂, 3 ♀♀, Depułtycze Królewskie, Sep. 14, 1967; 1 ♂, Lipka, June 6, 1968; 11 ♂♂, 4 ♀♀, Susiec, June 10, 1968; 2 ♂♂, Opoka Duża, June 15, 1968, all from *Betula* sp., coll. I. DWORAKOWSKA. NE Poland: 1 ♂, Gamerki, July 13; 1 ♂, July 28, coll. J. NAST in 1947. NW Poland: 2 ♂♂, 3 ♀♀, Jeziory, Sep. 20 — Oct. 3, 1952, coll. J. KARPIŃSKI; 1 ♂, 3 ♀♀, Jeziorny, July 9—30, 1953, coll. Z. HARASYMOWICZ; 2 ♂♂, Poznań, July 15, 1972, Betula sp., coll. I. DWORAKOWSKA. U.S.S.R., Kazakh S.S.R.: 1 ♂, 1 ♀, Mugodzhary Mts., July 10, 1969, coll. I. D. MITJAEV.

Distribution. East part of Central Europe, the most to the west — Upper Lausitz in G.D.R., after FÖRSTER (1960), northern-east Europe, northern-east Scandinavia, the most to the east — U.S.S.R.: Mordovsky Zapovednik, after ANUFRIEV and ABRAMENKO (1974), Kazakh S.S.R. (Naurzumskiy Zapovednik), after ZACHVATKIN (1953a) and W Kazakhstan, after MITJAEV (1971).

Bionomy. Two generations a year in SE and SW Poland. Adulf forms of the first generation appear in the first half of June, the second generation at the end of August. *Betula verrucosa* EHRH. and *B. pubescens* EHRH. are the food

plants in Central Europe, in Scandinavia also *B. nana* L. and *B. kirghisorum* SAWICZ in Kazakhstan.

Remarks. This is cool-tolerating species which range the most probably reaches the most eastern localities among smaragdula — group.

Empoasca (*Kybos*) *austriaca* WAGNER, 1949

Empoasca austriaca WAGNER, 1949
fig. 77—80

Face. Frons and frontoclypeus greyish ochre-yellow. Central streak on frontoclypeus, small patches at ocelli, streaks at eyes, upper margin of anteclypeus, upper parts of lorae and inner parts of genae, white. Sides of genae and tip of anteclypeus olivaceous-green.

Vertex. Light olivaceous with greenish tint, two darker patches at sides.

Pronotum. Light olivaceous with greenish tint. Centre and hind margin olivaceous-grey. Milky central streak in hind part.

Scutum. Olivaceous-brown. Basal triangles brownish. Narrow lingitudinal white streak in the centre.

Scutellum. Olivaceous-brown. White transverse streak at anterior margin with triangular broadening in the centre.

Fore wing. Semitransparent, emerald-green with very narrow brownish bordering of hind margin and claval suture. Smoking of apical part of wing hardly observable.

„VII female sternite suddenly narrowing, provided with round central lobe incised in the middle.

Length ♂ 4.20—4.50, ♀ 4.75—4.85 mm.", after WAGNER (1949a).

Male genital apparatus. Anal tube appendage (fig. 79) „very short, its solid apex curved cephalad". In holotype (fig. 80) this structure is stronger curved and slightly broadened before apex. Pygophore appendage similar to that of *E.* (*K.*) *betulicola* WAGN. Penis stem (fig. 77) according to the original description with „apical part curved cephalad, almost equally broad in the whole of its length. Basal penis processes lamellate, triangular, almost as long as the penis stem. In posterior view the processes become narrower more suddenly at outer margin than at inner one" (fig. 78). The figures at the original description do not show the holotype in which penis processes in posterior view touching the stem are broader in apical part and their apices are obliquely truncate inwards and basad.

Type locality. Kaiserau near Admont, Austria.

Type location. Zoologisches Staatsinstitut und Zoologisches Museum Hamburg, G.F.R.

Material studied. One male, holotype.

Distribution. Alps.

Bionomy. Montane species, the only known locality is on the altitude of 1100 m. *Betula* sp. is the food plant.

Remarks. Only the type-series (2 ♂♂, 3 ♀♀) is known.

Empoasca (*Kybos*) *digitata* Ribaut, 1936

Empoasca digitata Ribaut, 1936
fig. 90—93

„Colouration as in *E. smaragdula* but fore wings in some cases more uniformly green, hind margin of clavus and apical cells slightly smoked.

Length ♂ 3.30 mm."

Male genital apparatus. „Pygophore appendages as in *E. smaragdula* but without furrows in tip part (fig. 93). Anal tube appendages thin, pointed, without peak (fig. 90) ... Penis similar to that of *E. smaragdula* but its appendages in side view (fig. 92) are much more broad than the stem and their apices are truncate; dorsal side of manubrium is quite short, ventral margin of penis stem arcuate, its dorsal margin lamellate; tip part not compressed laterally".

Type locality. Gréoux in West Alps, France.

Type location. Muséum National d'Histoire Naturelle in Paris.

Remarks. Only holotype collected at feet of West Alps is known.

Empoasca (*Kybos*) *aetnicola* (Wagner, 1959)

Kybos aetnicola Wagner, 1959
fig. 81, 82

„Related to *K. mucronatus*. Claval suture brown".

Dimensions not given at the original description.

Male genital apparatus. „Anal tube appendages horn-like with a short narrow peak (it is not long, wiry-like as in *mucronatus*). Both basal penis processes compressed and bluntly rounded at apex. Penis stem devoid of ornamentation, in lateral view it is narrower than basal penis processes. Hind margin of penis stem straight in lower part. In posterior view penis stem is equally wide as its basal processes. The processes deviate from each other under the obtuse angle while in *K. mucronatus* the angle is smaller than 90°".

Type locality. Mt. Etna, Italy.

Type location. Instituto Nazionale di Entomologia Roma, Italy.

Remarks. For the time being only the type-series (2 ♂♂, 12 ♀♀) collected on the altitude 1500—1600 m. is known.

Empoasca (*Kybos*) *calyculus* Cerutti, 1939

Empoasca calyculus Cerutti, 1939
Kybos studzinskii Dworakowska, 1973 syn. n.
fig. 83—89, 156, 170—175

Face. As in *E.* (*K.*) *smaragdula* (Fall.) but frontoclypeus yellowish-green with only a sign of whitish longitudinal streak; no other white markings.

Vertex. Olivaceous-green with two brownish angular patches at anterior margin and green spots at sides.

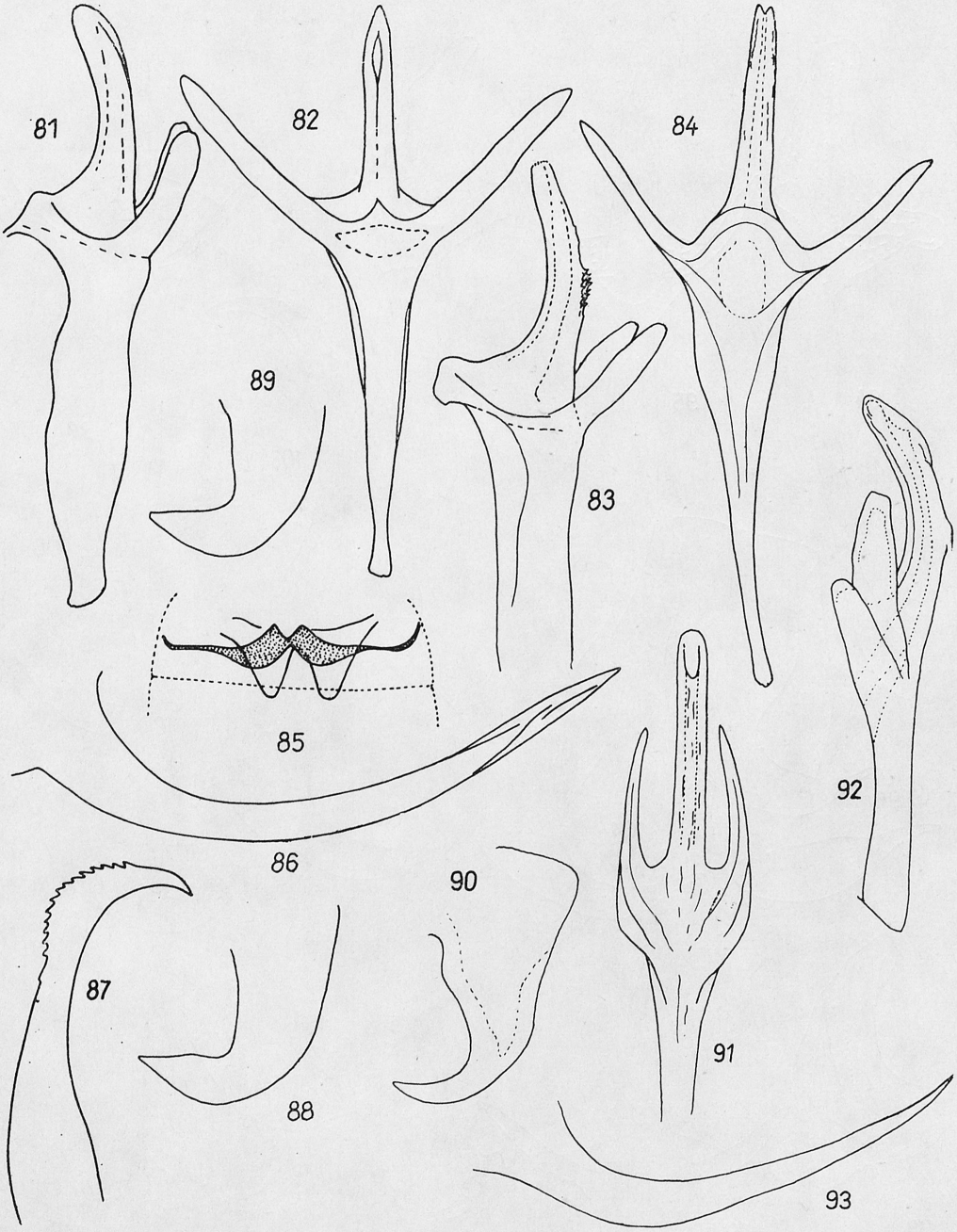

Fig. 81—93. *Empoasca* (*Kybos*) *aetnicola* (WAGN.), after WAGNER (1959) — 81, 82; *E.* (*K.*) *calyculus* CER. — 83—89; *E.* (*K.*) *digitata* RIB., after RIBAUT (1936b) — 90—93

Pronotum. Olivacous-green. Centre and hind margin olivaceous-brown. No whitish patches.

Scutum. Olivaceous-brown, basal triangles brown-ochraceous.

Scutellum. Greenish-olivaceous.

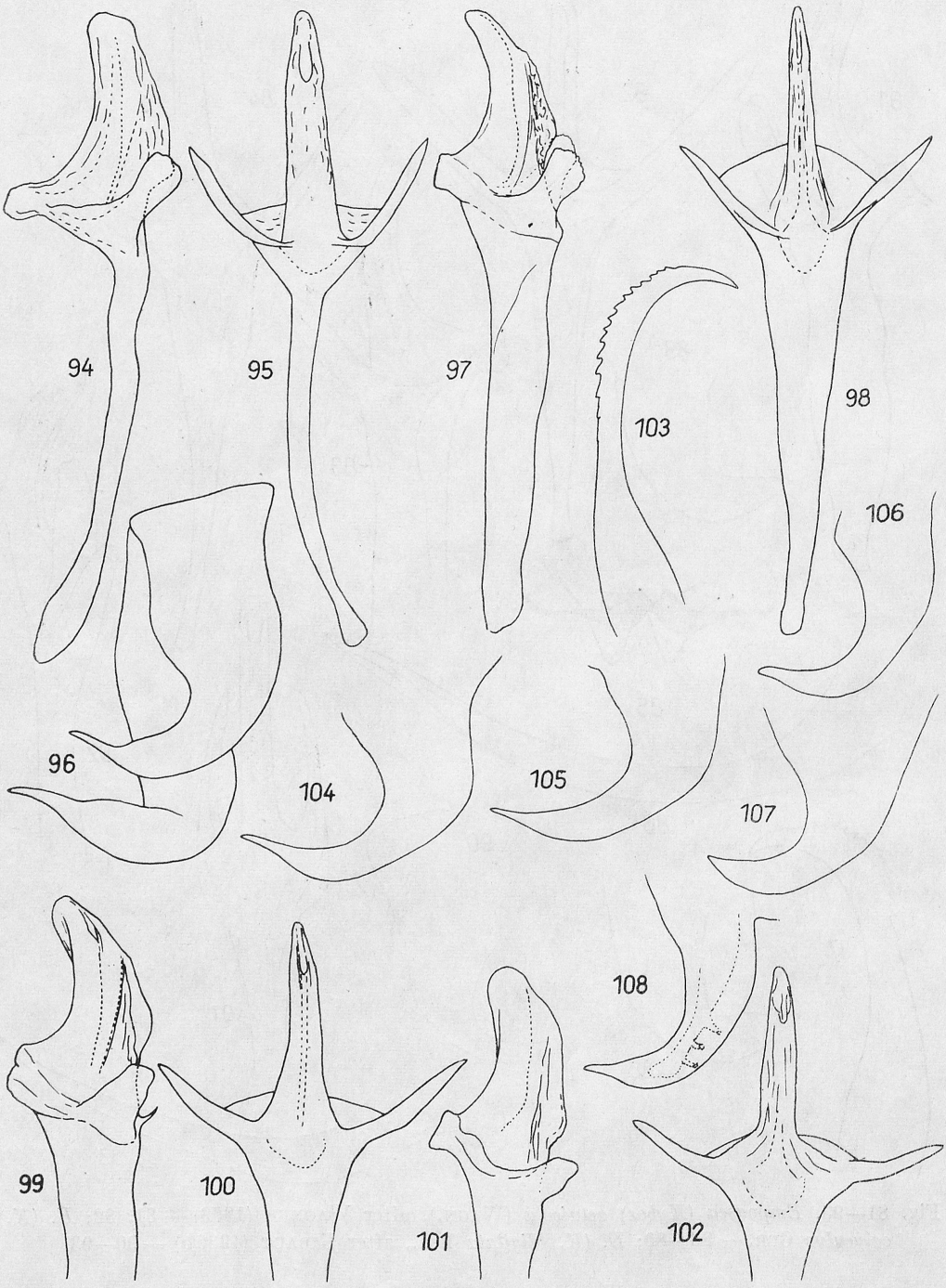

Fig. 94—108. *Empoasca* (*Kybos*) *mucronata* Rib., after Ribaut (1933) — 94—96; specimens from Poland — 97—108

Fore wing. Green or emerald-green. Brownish bordering of claval suture very narrow, that at hind margin indistinct. Apical part only slightly smoked but the pattern as in *E.* (*K.*) *smaragdula* (FALL.). Tip of clavus darkened.

Length ♂ 4.15—4.30, ♀ 4.20—4.40 mm., length of holotype 4.8 mm.

Male genital apparatus. Anal tube appendage (fig. 88, 89, 175) short arcuate, broadened before tip, acutely terminated or with short process. Pygophore appendage tapering, in tip part ornamented by several ledges (fig. 86, 172, 173). Paramere (fig. 87, 174) with very thick curved apex and apical part strongly broadened about middle length. Penis stem (fig. 83, 159, 171) almost straight, provided with small teeth at hind margin. Penis processes lamellate, pointed, truncate or rounded at apex, slightly broadened subapically and often with a distinct step at this region; in posterior view shorter and much thinner than the stem, deviate from each other (fig. 84, 170) under almost right angle.

Sternal apodemes quite short, tapering apically, dorsal apodemes short (fig. 85).

Type locality. Chippis, Switzerland.

Type location. Zoological Institue, University of Lausanne, Switzerland.

Material studied. The type-series of *Kybos studzinskii* DWOR. (4 ♂♂) from Poznań. England: 1 ♂, 4 ♀♀, London, July 8, 1949, coll. J. NAST [*K. strigilifer*: DWORAKOWSKA (1973)].

Bionomy. Maybe two generations a year. In Poland collected in the first half of July on *Betula pubescens* EHRH.

Remarks. The above nynonymy is based on a comparison of the type-series of *Kybos studzinskii* DWOR. with the drawing of the holotype kindly sent me by Dr. H. GÜNTHART (this holotype is parasitated).

Empoasca (*Kybos*) *mucronata* RIBAUT, 1933

Empoasca mucronata RIBAUT, 1933

Kybos cracoviensis DWORAKOWSKA, 1973 syn. n.

fig., 94—135

„The ground colour green-olivaceous, smoked fascia on claval suture as in *smaragdula*... Head, pronotum and scutellum without white patches... Light central fascia (streak) on pronotum bordered on both sides by smoked longitudinal patches passing to the basal triangles. Terminations of hind tibia white brown points... The biggest of all French species of the genus. Female unknown. If the relations of size of both sexes are similar to these of *E. smaragdula* and *E. butleri* the female should be 5.25 mm. long.

Length ♂ 4.65 or 4.70 mm."

Male genital apparatus. „Pygophore appendage as in *E. smaragdula*. Anal tube appendages short, suddenly narrowing apically (fig. 96). Penis of *E. butleri* type but at the border between penis stem and manubrium there are massive appendages truncate apically (fig. 94). The appendage seen from side covers ventral margin of the penis stem. Ventral margin of the penis stem ornamented

by papillae. Furrow with gonopore expanded more basal than in *E. butleri* (fig. 95)".

Face. Ochraceous above, yellowish below. Whitish pattern as in *E.* (*K.*) *smaragdula* (FALL.) but oblique patches at lateral frontal sutures more distinct and these at ocelli larger.

Vertex. Ochraceous with two indistinct transverse brownish patches along anterior margin.

Pronotum. Ochraceous, whitish pattern as in *E.* (*K.*) *smaragdula* (FALL.). A large semicircular or triangular infuscated patch at the centre often divided by whitish central streak.

Scutum. Ochraceous with a narrow central white streak.

Scutellum. Ochraceous, a small triangular whitish patch at its anterior margin.

Fore wing. Olivaceous-green. A narrow brownish bordering of inner and hind claval margin and the other more broad on the claval suture. Tip of clavus as well as apical margin of wing slightly infuscated.

Central lobe of VII female sternite distinctly produced and rounded at tip.

Length ♂ 3.85—4.30, ♀ 4.00—4.30 mm.

Male genital apparatus. Anal tube appendage (fig. 104—108, 115—119, 129, 130) arcuate with tapering tip part terminated by shorter or longer process. Pygophore appendage (fig. 121—123, 131, 132) ornamented by short but quite high ledges and deep furrows, its tip curved upwards. Paramere (fig. 103, 120, 133—135) with narrow almost straight and usually short apical hook, its apical part moderately broadened in the middle-length. Penis stem partly sclerotized, rather triangular in lateral view (fig. 97, 99, 101, 109, 112, 113, 125, 127) with a narrow rounded apex. Penis processes in lateral aspect deviated from the penis stem, their apices variously shaped. In majority of cases both penis processes form an obtuse angle in posterior view (fig. 100, 102, 110, 111, 114, 126, 128). In the specimens attacked by parasites penis processes are more irregular (fig. 102, 111, 128), penis stem in posterior view is thicker and in side view (fig. 101, 112, 127) its upper part is shorter.

Sternal apodemes short and broad, dorsal apodemes short but well developed (fig. 124).

Type locality. La Grave, High Alps, France.

Type location. Unknown.

Material studied. The type-series of *Kybos cracoviensis* DWOR. (14 ♂♂, 16 ♀♀).

Distribution. For the time being known only from Alps, SE Poland, uplands in Poland at feet of Carpathians, Moravia — from DLABOLA (1958b) and Switzerland — from GÜNTHART (1974).

Bionomy. In Poland *E.* (*K.*) *mucronata* RIB. was collected on the altitude 200 m., in Moravia on about 200—300 m. and in Switzerland (Dielsdorf) on the altitude 300—500 m. *Alnus glutinosa* (L.) is the food plant. This species

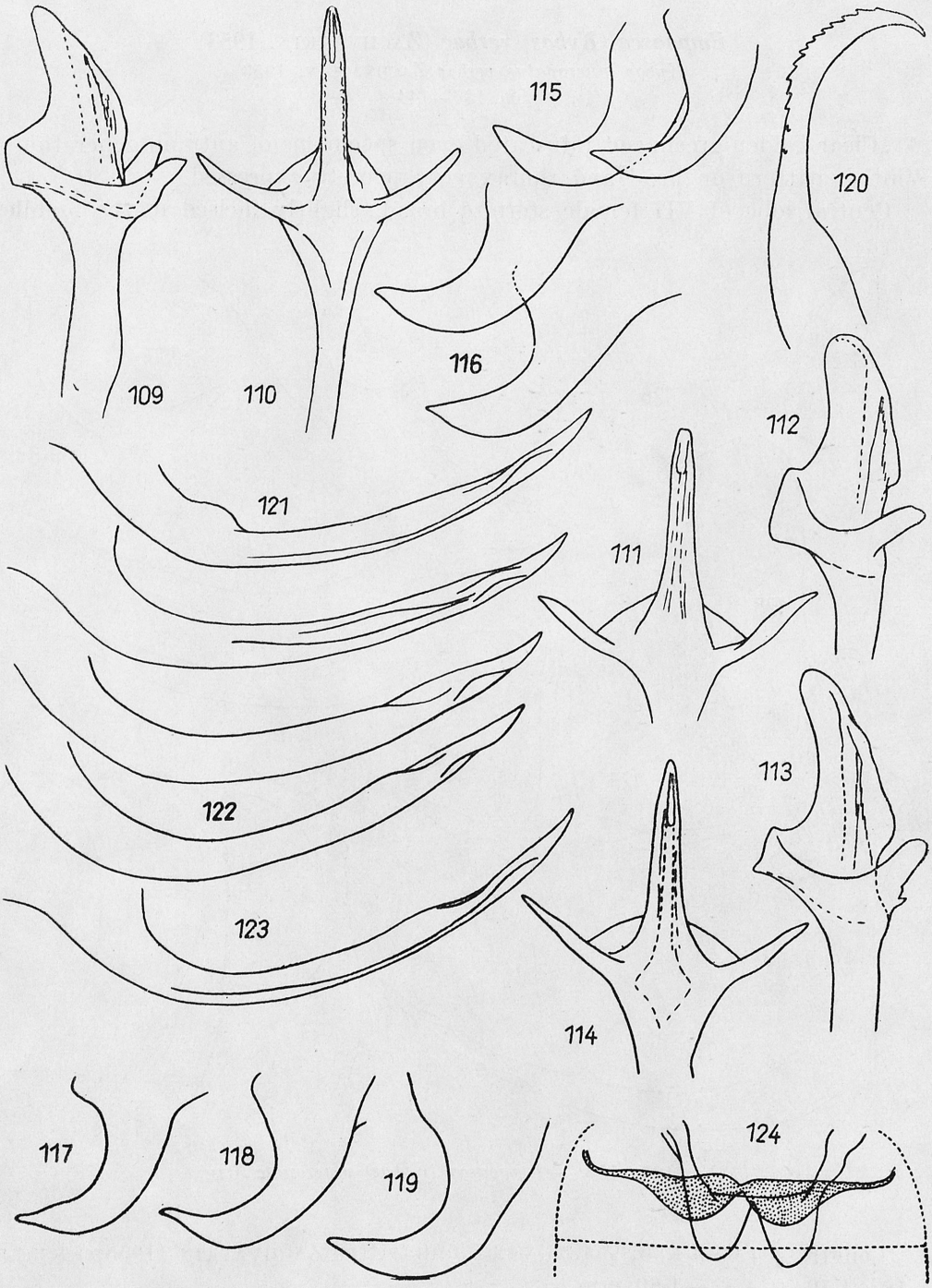

Fig. 109—124. — *Empoasca* (*Kybos*) *mucronata* Rib.

develops only one generation in Poland, the adult forms appear at the beginning of July. In 1972 the greatest number of exemplars have been spotted between 15 and 20 July.

Empoasca (*Kybos*) *verbae* (ZACHVATKIN, 1953)

Kybos mucronatus verbae ZACHVATKIN, 1953
fig. 136—144

„Clear golden-green, not infuscated even specimens of autumn generation". Whitish pattern on head and thorax very poorely expressed.

Central lobe of VII female sternite broad, slightly incised in the middle.

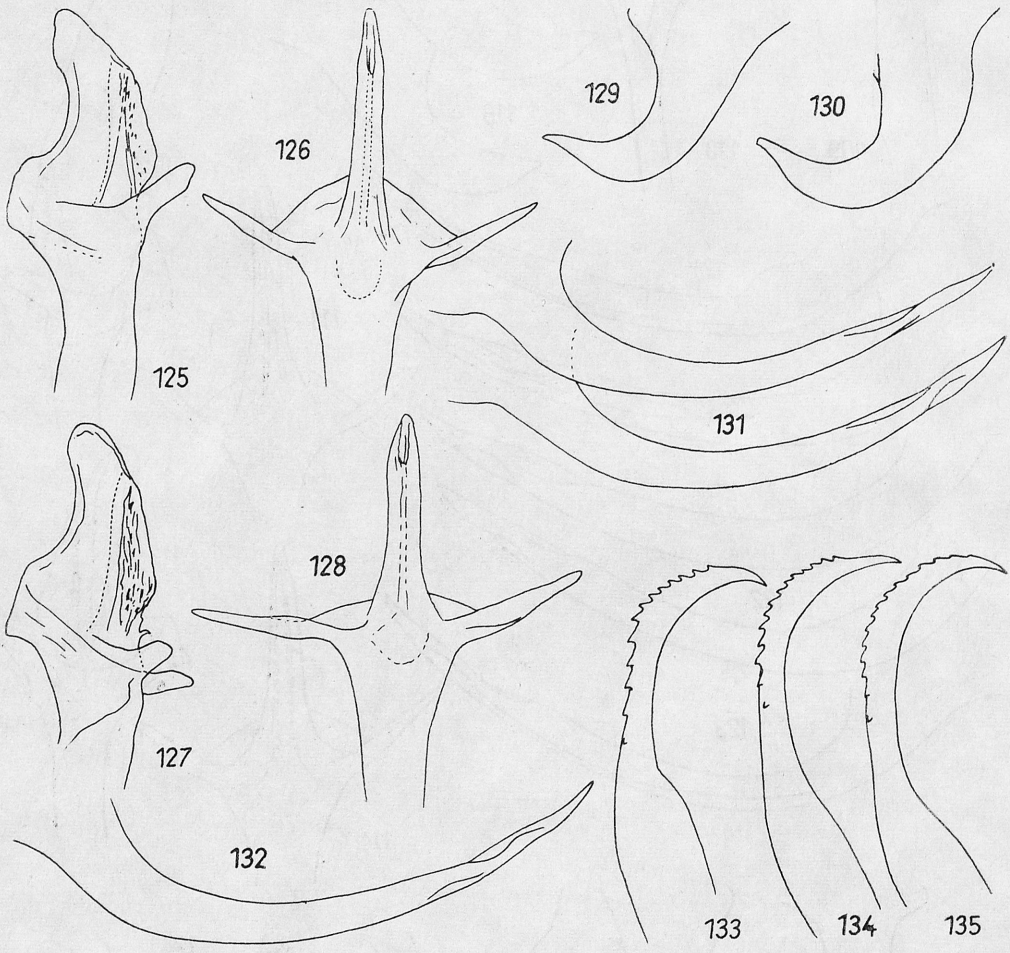

Fig. 125—135. — *Empoasca* (*Kybos*) *mucronata* RIB.

Length ♂ 4.05—4.30, ♀ 4.25—4.65 mm. After ZACHVATKIN (1953a) length 4.18—4.50, ♀ 4.53—4.80 mm.

Male genital apparatus. Anal tube appendage (fig. 137, 138) lamellate, broad at base then tapering, terminated on long thin process. Pygophore appendage (fig. 143, 144) with distinct ledges and furrows in apical part, its apex straight. Paramere (fig. 139, 140) with almost straight apical hook and almost not broa-

dened apical part. Penis stem (fig. 141, 142) less sclerotized than in *E.* (*K.*) *mucronata* RIB. and only slightly pigmented. Penis appendages lamellate, truncate at apices, not pigmented.

Sternal apodemes (fig. 136) very long and broad, dorsal apodemes very short.

Type locality. Okskiy Zapovednik, Moscow Distr., U.S.S.R.

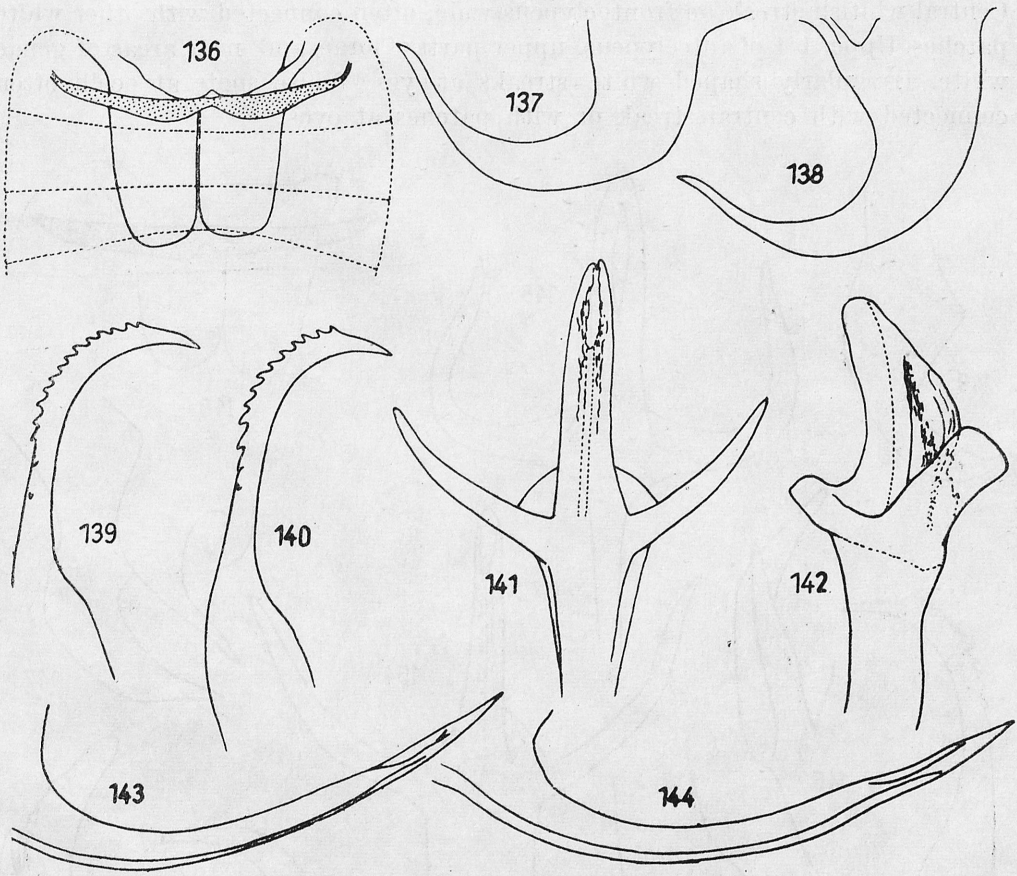

Fig. 136—144. — *Empoasca* (*Kybos*) *verbae* (ZACHV.)

Type location. Collection of Prof. A. A. ZACHVATKIN being in care of Mrs. ZACHVATKIN, Moscow, U.S.S.R.

Material studied. Poland: 1 ♂, 1♀, Warszawa—Miłosna, July 3, 1955, coll. S. NOWAKOWSKI; 1 ♂, 6 ♀♀, Warszawa—Młociny, Sep. 1958, coll. J. NAST.

Distribution. Central Europe, the most to the east — Okskiy Zapovednik, U.S.S.R., after ZACHVATKIN (1953a), northern Europe — Latvian S.S.R., after VILBASTE (1974).

Bionomy. Two generations a year in Poland and near Moscow. *Salix acutifolia* WILLD. is the food plant in Okskiy Zapovednik. In Poland the first generation appears at the end of June, the second one in September, food-plant in Poland unknown.

Empoasca (*Kybos*) *candelabrica* (Dlabola, 1958)

Kybos candelabricus Dlabola 1958
fig. 145—155

Face. Frontoclypeus and upper half of face light yellowish-green, lower half of face whitish-green. Irregular oblique whitish patches above antennae. Central whitish streak on frontoclypeus wide, often connected with other white patches. Upper 1/4 of anteclypeus, upper parts of lorae and near areas of genae white. Irregularly shaped white streaks at eyes. White spots at ocelli often connected with central streak or with patches at eyes.

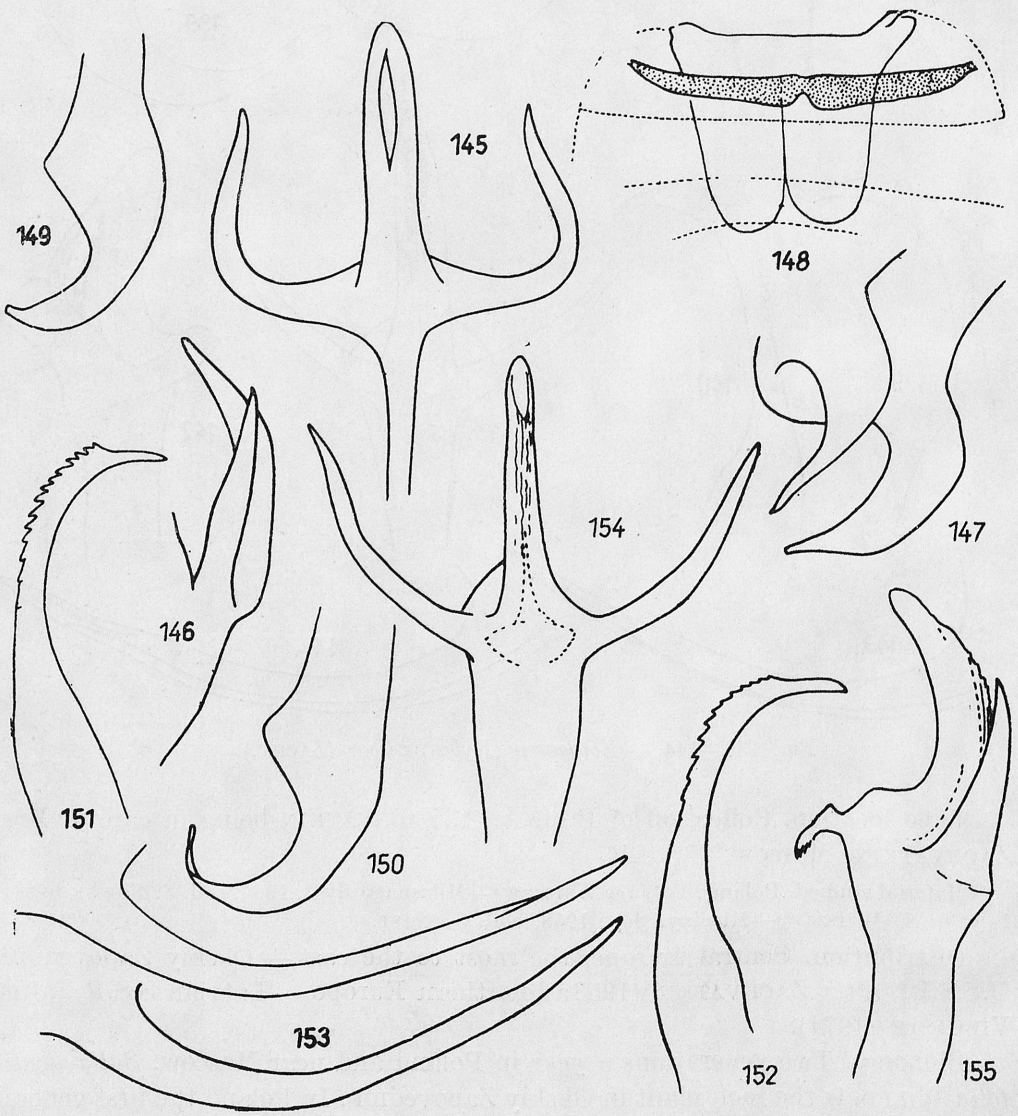

Fig. 145—155. *Empoasca* (*Kybos*) *candelabrica* (Dlab.), after Dlabola (1958a) — 145—147, specimen from Turkey — 148—155

Vertex. Greenish with two subangulate infuscated patches.

Pronotum. Olivaceous-green, indistinct light spot in the centre of anterior margin. There is large brownish patch in the centre divided by broad milky central stripe. Two small transverse white patches at eyes.

Scutum. Infuscated, with central white streak broader in its anterior part.

Scutellum. Infuscated with broad white triangle at anterior margin.

Fore wing. Green, especially at base. Comparatively wide brownish bordering of inner and hind margins of clavus and claval suture. Apical part of wing smoked like in *E.* (*K.*) *smaragdula* (FALL.).

VII female sternite strongly produced in the middle.

Length ♂ 4.40 mm., after DLABOLA (1958a).

Male genital apparatus. Anal tube appendage (fig. 147, 149, 150) lamellate, quite narrow with thin long termination. Pygophore appendage (fig. 153) thin, with not rich ornamentation. Paramere (fig. 151, 152) has quite thick apical hook and not broadened apical part. Penis stem (fig. 145, 146, 154, 155) slightly curved in thin apical part, ornamentation of ventral side of penis stem hardly visible. Penis appendages very long thin pointed at apex, curved and strongly deviated from the penis stem.

Sternal apodemes (fig. 148) well developed, dorsal apodemes very short.

Type locality. Borzhomi, Georgian S.S.R., U.S.S.R.

Type location. Dr. DLABOLA'S collection, Praha, Č.S.S.R.

Material studied. Turkey: ♂♂, ♀♀, nr. Ankara, Aug. 8—10; ♂♂, ♀♀, nr. Kizilkahamam, Aug. 11, *Salix* sp., coll. R. LINNAVUORI in 1963. Bulgaria: 1 ♂, Witosha, Sep. 3, 1959, coll. B. BURAKOWSKI.

Distribution. U.S.S.R.: Transcaucasia; Turkey: Anatolia, after LINNAVUORI (1965) and Bulgaria.

Remarks. The type-series consists of six exemplars.

Empoasca (*Kybos*) *strigilifera* OSSIANNILSSON, 1941

Empoasca strigilifera OSSIANNILSSON, 1941
fig. 176—183

Face. Frontoclypeus ochraceous. Anteclypeus greenish below. Lorae and genae whitish or partially greenish. White hypodermal pattern as in *E.* (*K.*) *smaragdula* (FALL.).

Vertex. Ochraceous with two angulate brownish patches, their sides parallel to the anterior margin of coronal suture.

Pronotum. Ochraceous with three whitish patches an in *E.* (*K.*) *mucronata* RIB. Brownish semicircular or triangular patch in the centre at anterior margin. Hind margin broadly infuscated. In the centre whitish longitudinal streak.

Scutum. Brown-ochraceous with a narrow white central streak.

Scutellum. Ochraceous-brown with small whitish triangular patch in the centre.

Fore wing. Green. Inner and hind margins, claval suture and apical part infuscated as in *E.* (*K.*) *smaragdula* (FALL.) but lighter. Infuscation inside longitudinal *r* cell very indistinct or absent.

Central lobe of VII female sternite moderately produced in the middle, slightly tapering, rounded and not deeply incised on hind margin.

Length ♂ 4.15—4.50, ♀ 4.20—4.65 mm.

Male genital apparatus. Anal tube appendage narrow, tapering, then broadened and suddenly narrowing to thin terminal process (fig. 176, 178). The process might be broken. Pygophore appendage tapering, almost straight at apex, provided with ledges (fig. 182, 183). Paramere (fig. 177) with long curved apex, apical part broadened at the middle of its length. Penis stem almost straight at base at ventral margin, triangular in upper part (fig. 180, 181) with very rich papillous ornamentation at gonopore. This part of penis distinctly broadened when to see from behind. Lateral penis processes long, strongly deviate from each other (fig. 181).

Sternal apodemes reach at most hind part of 4th abdominal sternite (fig. 179), often shorter.

Type locality. Småland, Flisby, Sweden.

Type location. Swedish State Museum of Natural History, Stockholm, Sweden.

Material studied. SE Poland: 1 ♂, 1 ♀, Lipka, Sep. 9, 1967; 1 ♂, June 6, 1968; 1 ♂, Depultycze Królewskie, Sep. 14, 1967; 1 ♂, Łabunie, Sep. 19, 1967; 1 ♂, Kosobudy, Sep. 20, 1967; 1 ♂, Bzowiec, Oct. 5, 1967; 1 ♂, June 20, 1968, all collected on *Salix caprea* L. by I. DWORAKOWSKA. U.S.S.R.: Ukrainian S.S.R., Munkačevo, Aug. 4, 1918, coll. G. HORVÁTH.

Distribution. Europe: France, after RIBAUT (1952); G.F.R. and Austria, after WAGNER (1955a), England, after LE QUESNE (1961); Scandinavia, after OSSIANNILSSON (1941) and LINNAVUORI (1969); Č.S.S.R., after DLABOLA (1959); Poland, after SMRECZYŃSKI (1954), Denmark, after TROLLE (1974) and U.S.S.R., the most to the east — Mordovsky Zapovednik, after ANUFRIEV and ABRAMENKO (1974).

Bionomy. Two generations a year, adult forms of the first generation have been collected in Poland from the beginning of June; the second generation occurs in August-September. *Salix caprea* L. is the food plant in European countries.

Remarks. Exemplars belonging to the autumn generation are darker and that generation is more abundant. Some records from montaneous regions of the Central Europe can concern the next species e.g. DLABOLA (1959). *Empoasca* (*K.*) *strigilifera* OSS. could be confused also with *E.* (*K.*) *calyculus* CER. The main differences between these species are in shape of the penis stem which in profile is broad and triangular in *E.* (*K.*) *strigilifera* OSS., broad and arcuate in *E.* (*K.*) *perplexa* RIB. and narrow and straight in *E.* (*K.*) *calyculus* CER.; the same in posterior view is distinctly broadened subapically in *E.* (*K.*) *strigilifera* OSS., provided with lateral lamellae in *E.* (*K.*) *perplexa* RIB. and almost tapering in *E.* (*K.*) *calyculus* CER.

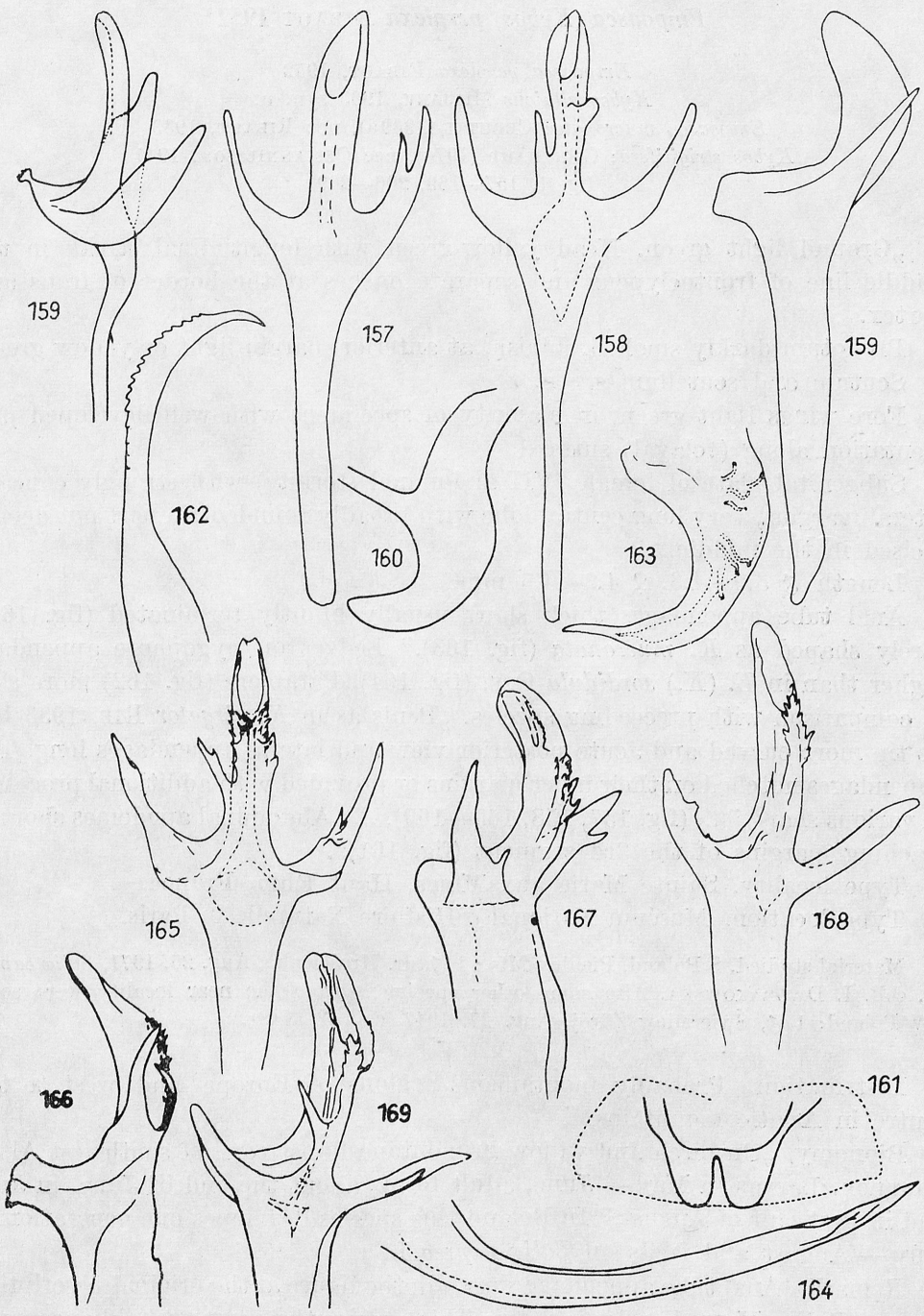

Fig. 156—169. *Empoasca* (*Kybos*) *calyculus* CER., the holotype, figure made by Dr. H. GÜNTHART — 156; *E.* (*K.*) *perplexa* RIB., after MITJAEV (1963) — 157—161, specimen from Poland (Pieniny Mts.) — 162—166, specimens from Switzerland, after GÜNTHART (1974) — 167—169

Empoasca (*Kybos*) *perplexa* RIBAUT 1952*

Empoasca perplexa RIBAUT, 1952
Kybos altaicus MITJAEV, 1963 syn. n.
Empoasca mucronata: CERUTTI (1939a), nec RIBAUT, 1933
Kybos strigilifera: GÜNTHART (1974), nec OSSIANNILSSON, 1941
fig. 1, 157—169, 206—209

„Ground light green. Head yellow-green with longitudinal streak in the middle line of frontoclypeus and separate dashes at the border of frons and vertex.

Pronotum darkly smoked, bluish, at anterior margin light or yellow green.

Scutum and scutellum green.

Fore wings light green, in maiority of specimens with well developed pigmentation along (?claval) suture...

Subgenital plate of female (VII abdominal sternite) with strongly concave lateral margins, very long central lobe with broadly rounded tip part not deeply incised in the middle...

Length ♂ 3.9—4.3, ♀ 4.2—4.5 mm.

Anal tube appendages thick short usually bluntly terminated (fig. 160), rarely shaped as *K. mucronata* (fig. 163)." Ledges on pygophore appendage higher than in *E.* (*K.*) *sordidula* Oss. (fig. 164). Paramere (fig. 162) more slim in comparison with preceeding species. „Penis as in *K. virgator* RIB. 1933 but its tip more curved and acute posterior view and lateral appendages long. The appendages notched on their inner margins or provided with additional processes of various shape." ... (fig. 157, 158, 165—169). ... „Abdominal apodemes short ... reaching margins of the 3rd segment (fig. 161)".

Type locality. Sainte Marie aux Mines, Haut Rhin, France.

Type location. Muséum National d'Histoire Naturelle in Paris.

Material studied. S Poland, Pieniny Mts.: 1 ♂, nr. Krościenko, Aug. 25, 1971, *Salix caprea* L., coll. I. DWORAKOWSKA. Also some other specimens from the near locality were seen. SW Poland: 1 ♂, Świeradów Zdrój, Aug. 27, 1947, coll. J. NAST.

Distribution. Probably montaneous regions of Europe and west to the centre in Asiatic mountains.

Bionomy. „On birch and willow in montane forest zone of southwest Altai. Common. Larvas in May — June, adult forms about the end of June, in July and in first half of August." In Poland this species developes one generation in July — August and feeds on *Salix caprea* L.

Remarks. Anal tube appendage shown in the figure at the original description *Kybos altaicus* MITJ. has broken tip. This species the most probably occurs in Caucasus, Pontian Mts. and Elburs.

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* The note on studies of the type-series of some RIBAUT's species will be published in Bull. Acad. Polon. Sci., Ser. Sci. Biol., 25, 1977.

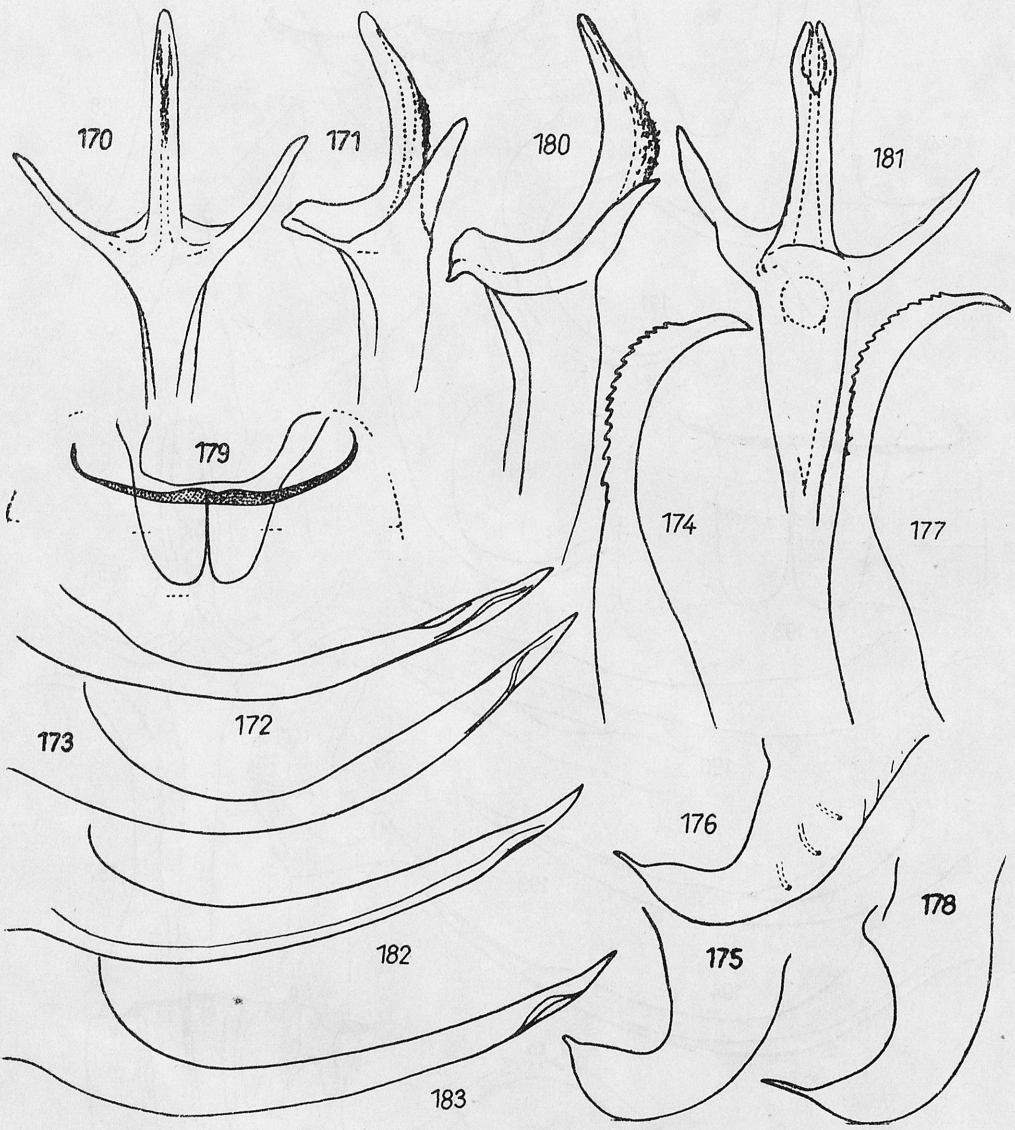

Fig. 170—183. *Empoasca* (*Kybos*) *calyculus* CER., specimen from London — 170—175; *E.* (*K.*) *strigilifera* OSS., specimen from SE Poland — 176—183

Empoasca (*Kybos*) *virgator* RIBAUT, 1933

Empoasca virgator RIBAUT, 1933
Empoasca virgator v. *saageri* WAGNER, 1935
fig. 191—200

Face. Frontoclypeus ochre apically, green in lower part. Genae, upper parts of lorae and upper part of anteclypeus, white. Lower parts of lorae and anteclypeus green. White medial streak along frontoclypeus is the widest in its lower part

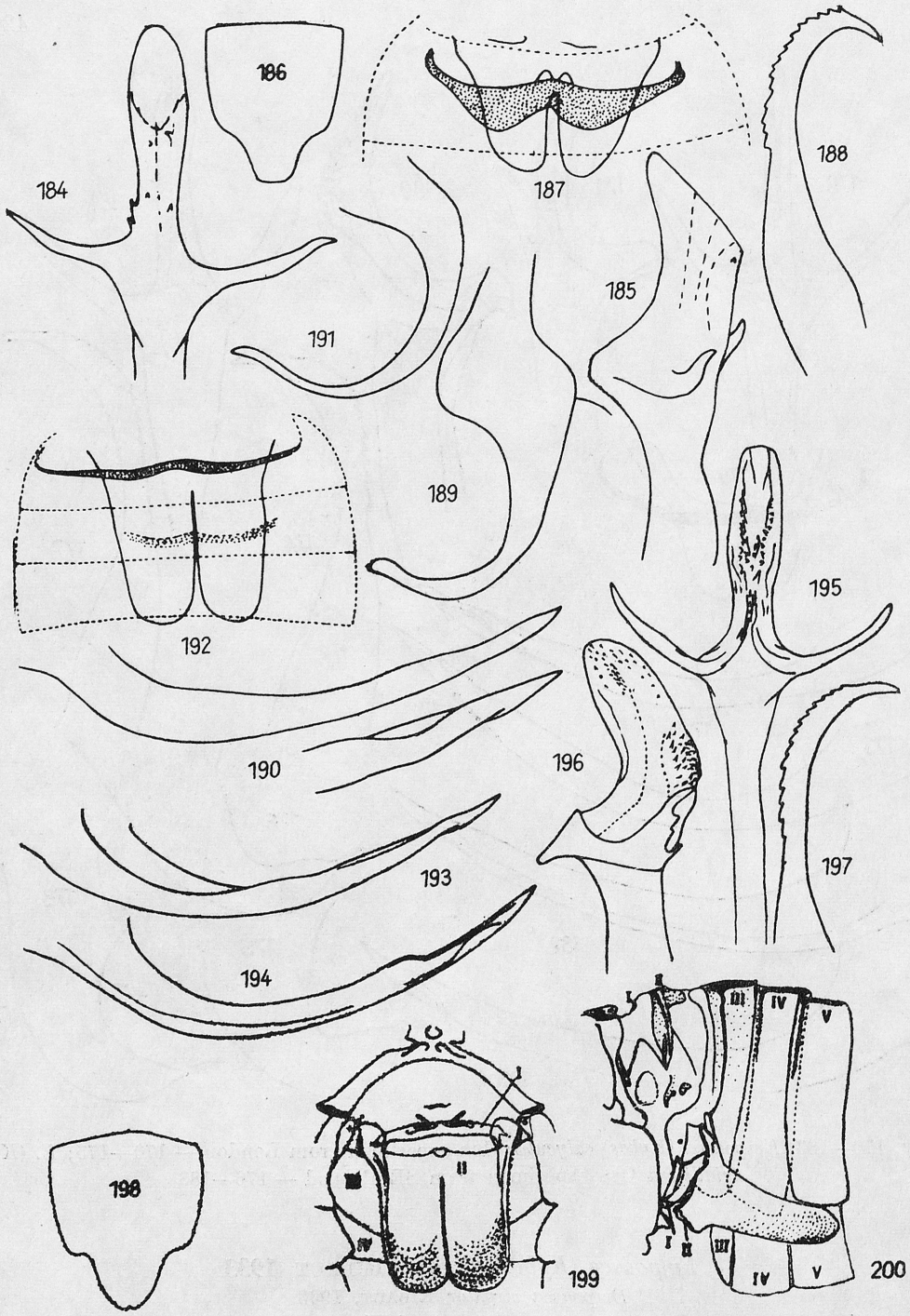

Fig. 184—200. *Empoasca* (*Kybos*) *volgensis* (VILB.), after VILBASTE (1961) — 184—190, 186 — VII female sternite; *E.* (*K.*) *virgator* RIB., specimen from Poland — 191—198, after OSSIANNILSSON (1949), modified — 199 and 200, 199 — hind part of metasternum and venter of abdominal basis from above, the apophysis of the second abdominal sternum is cut off, 200 — right half of integument and endoskeleton of metathorax and abdominal basis from inside certain segments marked by roman numbers

Small whitish patches at ocelli, large whitish patches at lateral frontal sutures and the others at eyes above the antennae.

Vertex. Olivaceous to ochraceous with indistinct brownish patches being similar to these in *E.* (*K.*) *smaragdula* (FALL.).

Pronotum. Olivaceous, often yellow-olivaceous along anterior margin. Central semicircular or triangular patch dark testaceous or brownish. There are three small whitish patches at anterior margin, these at eyes are bigger. In some exemplars there is milky longitudinal central stripe.

Scutum. Dark olivaceous with a narrow white streak in the middle line at anterior margin.

Scutellum. Dark olivaceous, white cordiform patch at its anterior margin.

Fore wing. Olivaceous-green. There are brownish borderings along inner and hind margins of clavus and at claval suture. Smoky pattern at hind part of wing resembles that of *E.* (*K.*) *rufescens* (MEL.) but borders of the patches not clear. Apical veins darker.

Central lobe of VII female sternite strongly produced and almost not incised in the middle (fig. 198).

Length ♂ 4.00—4.70, ♀ 4.25—5.00 mm. After RIBAUT (1936b) length ♂ 4.00—4.50, ♀ 4.20—4.65 mm.

Male genital apparatus. Anal tube appendage (fig. 191) thin, long, sinuated. Pygophore appendage (fig. 193, 194) provided with high ledges in terminal part. Paramere (fig. 197) with almost straight apical hook and almost not broadened apical part provided with short teeth. Penis stem not pigmented almost semimembraneous, ornamented with numerous papillae on ventral side and in tip part (fig. 195, 196). Lateral penis appendages variously shaped but always shorter than half of length of penis stem, their apices strongly deviate in posterior view.

Sternal apodemes well developed (fig. 192) dorsal apodemes very small.

Type locality. Galié, Haute-Garonne, France.

Type location. Muséum National d'Histoire Naturelle in Paris.

Material studied. NE Poland: 1 ♂, 1 ♀, Kaletnik, July 19, 1955, coll. H. SZELEGIEWICZ, S Poland: 1 ♂, Wola Zagojska nr. Pińczów, Aug. 12, 1954, coll. S. NOWAKOWSKI; 1 ♂, 1 ♀, Krzyżanowice, July 27; 1 ♀, July 26, coll. J. NAST in 1956; 1 ♂, Krajno nr. Kielce, Aug. 10, 1962, coll. M. MROCZKOWSKI; 1 ♂, 1 ♀, Pieniny Mts., Krościenko, Aug. 25, 1971, coll. I. DWORAKOWSKA. Central Poland: 1 ♂, Podkowa Leśna, Aug. 19; 1 ♀, Aug. 29, coll. J. GŁOWACKI in 1953; 1 ♂, 2 ♀♀, Warszawa-Gocławek, Aug. 7, 1956, coll. S. NOWAKOWSKI; 2 ♂♂, 2 ♀♀, Warszawa-Bielany, Aug. 11, 1956, coll. J. NAST and S. NOWAKOWSKI; 2 ♂♂, Aug. 5, 1959, coll. E. KIERYCH; 1 ♂, Aug. 6; 1 ♂, Aug. 24; 3 ♂♂, 10 ♀♀, Aug. 29, on *Salix* sp., coll. I. DWORAKOWSKA in 1973. SE Poland: ♂♂, ♀♀, Kornie, *Salix amygdalina* L. and *S. pentandra* L., July 21, 1966; 1 ♂, *S. purpurea* L., Aug. 21, 1966; ♂♂, ♀♀, *S. alba* L., Aug. 21, 1966; 1 ♂, 1 ♀, Sep. 19, 1966, *Salix* sp.; ♂♂, ♀♀, Hrebenne nr. Lubycza Królewska, Aug. 21, 1966, *Salix* sp.; ♂♂, ♀♀, Sep. 19, 1966, *Salix* sp.; ♂♂, ♀♀, Oct. 6, 1966, *Salix* sp.; ♂♂, ♀♀, Lubycza Królewska, Aug. 19, 1966; ♂♂, ♀♀, Sep. 13, 1966; 1 ♂, 1 ♀, Horyniec, June 8, 1967; ♂♂, Lipka, *S. fragilis* L., June 6, 1968; ♂♂, ♀♀, Ruda nr. Chełm Lubelski, *S. alba* L., Aug. 16, 1968, coll. I. DWORAKOWSKA. Č.S.S.R.: 2 ♂♂, 1 ♀, Hencin nr. Opava, Sep. 18, 1959, coll. R. BAŃKOWSKA; 1 ♂, "Varanno" Vranov, Aug. 7, 1878, coll. G. HORVÁTH. G.D.R.: 2 ♂♂, Meisen, Sep. 20, 1969, coll. R. BIELAWSKI; 1 ♂, Dresden, Sep. 19 ,1962, coll. R. BIELAWSKI; 1 ♂, "Jungsfehrnde" Berlin, Aug. 1888, coll.

TETENS. U.S.S.R., Ukrainian S.S.R.: 2 ♂♂, "Malmos" Bereg (Carpathians), July 9, 1916, coll. UJHELYI. Hungary: 1 ♂, Mt. Mecsek, Heltvehely, June 16, 1961, coll. J. NAST; 1 ♂, Zirc, coll. PAVEL; 2 ♂♂, 1 ♀, Budapest, June 1886, coll. BARTKÓ; 1 ♂, Bag (Pest), June 21, 1904, coll. UHL; 2 ♂♂, 3 ♀♀, Budafok, coll. UJHELYI; 1 ♂, Pest, June 1, 1882; 1 ♂, Szolnok; 1 ♂, Harkány, Aug. 3, 1926; 1 ♂, Buj, July 28, 1922, *Salix* sp.; 1 ♂, Tiszabercel, July 19, 1922; 2 ♂♂, 2 ♀♀ Balatonkenese; 1 ♂, Kisbalaton, 1909; 1 ♂, Szigetszentmiklós, 1914, coll. G. HORVATH; 1 ♂, 1 ♀, Keszthely, Aug. 7, 1904, coll. UHL; 1 ♂, Kétegyháza, 1909, coll. UJHELYI; 1 ♂, Szentlörinc, July 26, 1888, *Salix* sp.; 1 ♂, Szekszárd, June 16, 1887, HORVÁTH's collection. Romania: 1 ♂, Campina, June 30, 1959, coll. R. BAŃKOWSKA; 2 ♂♂, Orşova, 1908; 1 ♂, 1 ♀, Berzaska, 1908; 1 ♂, 1 ♀, 1 lar., Menyhaza, 1916; 2 ♂♂, 1 ♀, Ghiroda, coll. HORVÁTH; 1 ♂, 2 ♀♀, Caransebeş, 1909, coll. UJHELYI; 1 ♂, Gyergyószentmiklos (Transylvania), July 8, 1893; 1 ♀, Trebusa, Aug. 8, 1903, HORVÁTH's collection. Bulgaria 1 ♀, Stara Planina, Kurilo nr. Sofia, Oct. 10; 2 ♂♂, 2 ♀♀, Rodopi, Momcilgrad, Oct. 18, coll. R. BIELAWSKI in 1963. Yugoslavia, Serbia: 1 ♂, 1 ♀, Pirot, Sep., 1902; 3 ♀♀, Niš, Sep., 1902; 1 ♂, 1 ♀, Topolnica, Sep., 1902; 1 ♂, 1 ♀, Vranje, coll. G. HORVÁTH; Dalmatia, 1 ♂, Igalo, Aug., 1906, HORVATH's collection.

Distribution. Europe, the most to the east — Okskiy Zapovednik, after ZACHVATKIN (1953b), Turkey, after DLABOLA (1971), U.S.S.R. — East Kazakhstan, after MITJAEV (1963, 1968), North Mongolia, after DLABOLA (1967b).

Bionomy. In Poland *E.* (*K.*) *virgator* RIB. developed the first generation in June and the second one in August — September. The thirth generation can occur in localities more to the south and to the west in Europe. Numerous species of the genus *Salix* L. are the food plants, spotted also on *Alnus glutinosa* (L.).

Remarks. Some specimens have sternal apodemes reaching only half of 4th abdominal tergite. In ZACHVATKIN's opinion (1953a) specimens collected on *S. alba* L. differ from „typical form" from *S. fragilis* L. not only by features indicated by WAGNER (1935) at description of var. *saageri*, but also by some other features. These features, however, were not mentioned by ZACHVATKIN. In spite of that, ZACHVATKIN states that the form from *S. alba* should be treated as separate species. Among specimens collected on *S. alba* L. in SE Poland newly hatched males have had whitish spines on hind tibia but brownish seate on subgenital plate. These specimens do not differ from young individuals collected on other species of *Salix* L. ZACHVATKIN's remark was probably only a preliminary note like some others in his last book. This is explained later at *E.* (*K.*) *oshanini* (ZACHV.).

Empoasca (*Kybos*) *volgensis* (VILBASTE, 1961)

Kybos volgensis VILBASTE, 1961
fig. 184—190

„Comparatively light. Ground yellowish-green. At anterior margin of vertex yellowish patch. Anterior part of frons usually with five-branched white patch. The branch in the middle line extends downwards and pass to the anteclypeus, there are usually [two] shorter arcuated branches on its both sides. Genae and lorae white. Basal limbs of antennae bright green. Rostrum touches bases of coxae of the second pair of legs (it is bluish-grey with the tip marked blackish). Eyes lilac. Pronotum yellowish-green with not numerous whitish patches at

anterior margin. There are usually three patches, one at the centre and two others at hind angles of eyes; hind part of pronotum greyish. Scutum with wide whitish longitudinal stripe; scutellum and sides of scutum more yellowish. Fore wing semivitreous, greenish. Veins concolorous with the wing surface, only terminal veins at hind marginal tip of wing marked blackish. Apices of longitudinal veins also brownish. Claval suture usually light. Hind wings semivitreous, smoked, veins darker or narrowly bordered with dark what is well visible throught fore wings. Dorsal part of abdomen also visible under both pairs of wings. Legs green more bright toward apices, the hind feet the brightest. Claws brown. Thorax below and underside of abdomen green, partially bright green, especially at hind margins of the sclerites. Centres of anterior margins of abdominal tergites marked blackish. Genital segments bright green".

Length ♂ 3.75—3.97, ♀ 4.00—4.20 mm.

„This species is very closely related to *K. virgator* Ribaut, 1933, from which differs by smaller size and by male genital apparatus. In *K. virgator* angle between penis stem and its appendages is smaller about 45° while in the new species it is bigger (almost right angle). From *K. strigilifera* Ossiannilsson, 1941, the new species differs by longer and narrower anal tube appendages".

Type locality. Kutenko, Syr-Kata, U.S.S.R.

Type location. Institute of Zoology and Botany, Academy of Sciences of the Estonian S.S.R. Tartu, Estonian S.S.R., U.S.S.R.

Bionomy. The type-series collected in June probably represents first generation of this species.

Remarks. Only the type-series (14 ♂♂, 9 ♀♀) and specimens recorded by Anufriev (1968) from Astrakhan Reservation are known for the time being. All collected on willows.

Empoasca (*Kybos*) *auricillata* (Dlabola, 1963)

Kybos auricillata Dlabola, 1963

fig. 201—205

„Golden-yellow with vertex greenish and brown shades on dorsum (throughout pronotum and scutum with scutellum). Claval suture and inner margin of fore wing darker. Clavus golden-green, shining. Apical 1/3 of fore wing semitransparent, smoked. Face yellow with genae paler, whitish longitudinal fascia on postclypeus [frontoclypeus]. A short whitish dash at inner margin of ocellus and very indistinct patches above antennae at eyes. Legs golden-green, claws black".

Length „♂ 4.1—4.2, ♀ 4.4 mm".

Male genital apparatus. „Anal tube appendage quite thick, slightly narrowing, curved in an arch and with long sharp terminal process (fig. 204). Penis without detached appendages, irregularly semilunar, bluntly terminated. In lower part of dorsal (ventral) side lamellate broadenings with rised up tips what looks like pointed ears (fig. 201, 203). Pygophore appendage slightly exceeds pygophore

lobe, arcuated, almost straight subapically, without ledges and distinct broadenings (fig. 205)".

Type locality. Arslanbob in Fergana Mts., Kirghiz S.S.R., U.S.S.R.

Type location. Dr. DLABOLA's collection, Praha, Č.S.S.R.

Bionomy. The type-series has been collected in about half of July on *Betula turkestanica* LITW. on the altitude 2000 m.

Remarks. Only the type-series (2 ♂♂, 1 ♀) is known.

Empoasca (*Kybos*) *limpida* WAGNER, 1955

Empoasca limpida WAGNER, 1955

Kybos oshanini: VILBASTE (1968, concerning European fauna), nec ZACHVATKIN (1953a) fig. 7—10, 217—224

Face. Frontoclypeus yellowish-green. Frons greenish-ochraceous. White pattern consists of broad longitudinal streak on frontoclypeus (usually short lateral branches present), white upper 1/3—1/5 of anteclypeus, upper and lateral parts of lorae, inner parts of genae, often large central frontal patch joined with longitudinal streak and with two large patches at lateral frontal sutures, surface above the antennae at eyes and comma-like distinct patches at the ocelli (fig. 9).

Vertex. Ochraceous. Coronal suture often narrowly bordered with white.

Pronotum. Olivaceous or greenish-yellow. Hind margin widely milky. At anterior margin three whitish patches, the central one being usually the biggest often dash-shaped, lateral patches irregularly triangular.

Scutum. Olivaceous or greenish-yellow. Wide whitish stripe in the centre with two testaceous dots in its hind part. Anterior part of this stripe is visible through semitransparent hind part of pronotal tergite.

Scutellum. Greenish-yellow. Small cordiform white patch at its anterior margin, often small patches at anterior corners (fig. 10).

Fore wing. Semitransparent, greenish. Tip of clavus and 1st apical cell slightly smoked.

Central lobe of VII female sternite comparatively short with indistinct incision in the middle (fig. 8).

Length ♂ 4.00—4.50, ♀ 4.45—4.70 mm.

Male genital apparatus. Anal tube appendage long thin, sinuated or slightly broadened at tip (fig. 223). Pygophore appendage thick, ornamented by big ledges and deep furrows just near the tip (fig. 224). Paramere (fig. 221) with quite big, slightly curved apical hook and not broadened but deeply serrated apical part. Penis stem (fig. 217, 219) very narrow in side view especially in apical part, compressed laterally only in lower part. Lamella on ventral side of border between the stem and manubrium very variable in shape, not always triangular (fig. 218), deeply serrate (fig. 220), slightly sclerotized. It resembles two lamellae in this situation in *E.* (*K.*) *perplexa* RIB.

Sternal apodemes very well developed, the dorsal ones narrow (fig. 222).

Type locality. Hamburg, G.F.R.

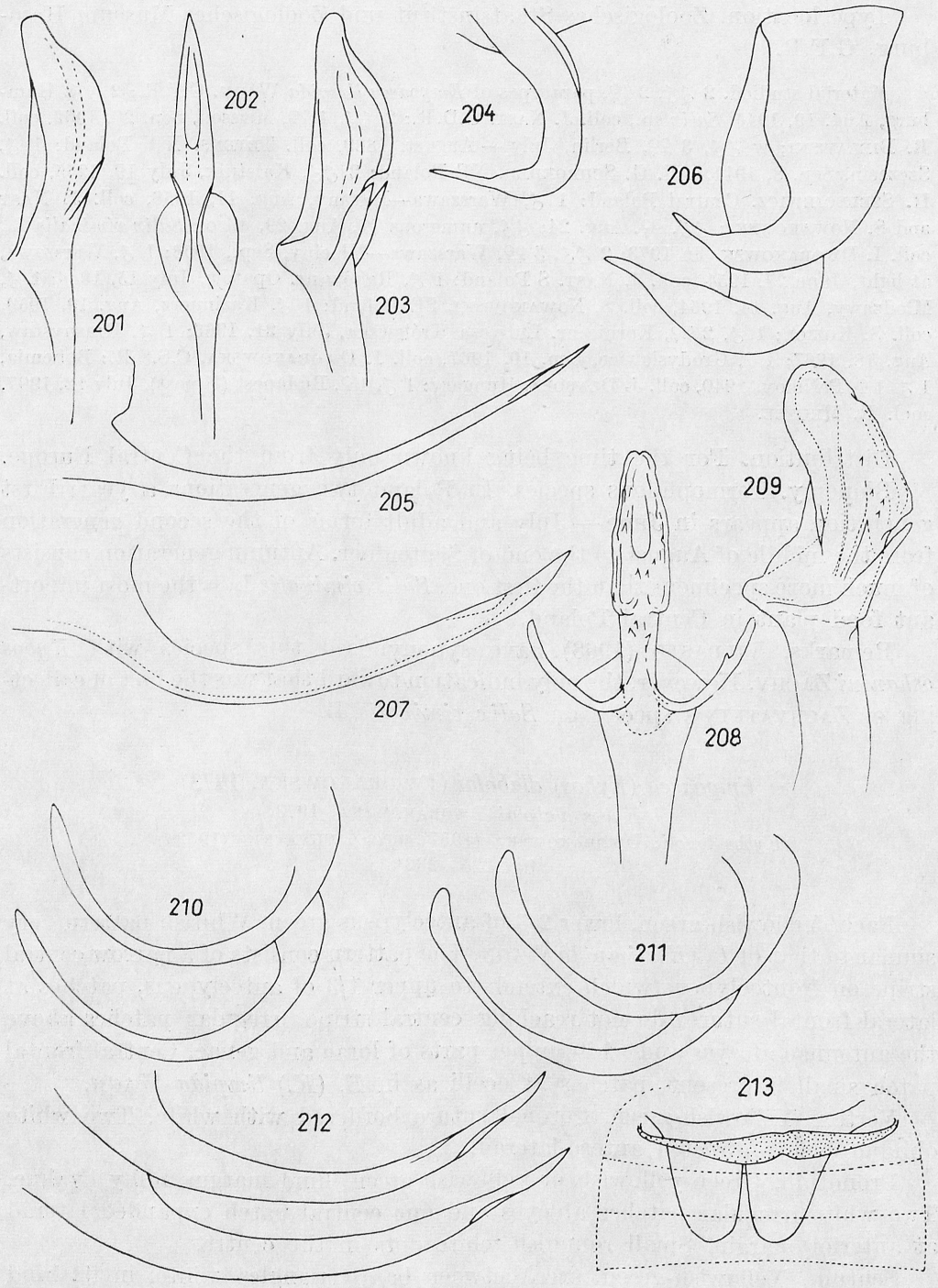

Fig. 201—213. *Empoasca* (*Kybos*) *auricillata* (Dlab.), after Dlabola (1963) — 201—205; *E.* (*K.*) *perplexa* Rib., picture composed of figures of other species (according to the original description), all after Ribaut (1936) — 206—209; *E.* (*K.*) *cornuta* (Dwor.) — 210—213

Type location. Zoologisches Staatsinstitut und Zoologisches Museum Hamburg, G.F.R.

Material studied. 2 ♂♂, 2 ♀♀, paratypes of *Empoasca limpida* WAGN. G.F.R.: 2 ♂♂, Hamburg, Aug. 19, 1945, *Salix* sp., coll. J. NAST. G.D.R.: 2 ♂♂, 4 ♀♀, Meissen, Sep. 20, 1962, coll. R. BIELAWSKI; w ♂♂, 3 ♀♀, Berlin, July — August, 1889, coll. TETENS. NW Poland: 1 ♂, Szczecin, Sep. 8, 1911, coll. G. SCHROEDER. NE Poland: 2 ♂♂, Kaletnik, July 19, 1955, coll. H. SZELEGIEWICZ. Central Poland: 1 ♂, Warszawa—Bielany, Aug. 11, 1956, coll. J. NAST and S. NOWAKOWSKI; ♂♂, ♀♀, Aug. 24; ♂♂, numerous ♀♀, Aug. 29, all on *Salix viminalis* L., coll. I. DWORAKOWSKA in 1973; 2 ♂♂, 3 ♀♀, Warszawa—Młociny, Sep., 1958; 1 ♂, Warszawa, at light, June 27, 1954, coll. J. NAST. S Poland: 1 ♂, Raków nr. Opatów, July 15, 1956; 1 ♂, Młodzawy, Aug. 14, 1954, coll. S. NOWAKOWSKI. SE Poland: 1 ♂, Kazimierz, Aug. 19, 1959, coll. S. KOZIOŁ; 1 ♂, 2 ♀♀, Kornie nr. Lubycza Królewska, July 21, 1966; 1 ♂, Krasnystaw, Aug. 18, 1967; 1 ♀, Grodysławice, Sep. 10, 1967, coll. I. DWORAKOWSKA. Č.S.S.R.: Bohemia, 1 ♂, 1 ♀, Peřimov, 1940, coll. J. DLABOLA. Hungary: 1 ♂, 1 ♀, Budapest (Ujpest), July 12, 1907, cool. R. MEUSEL.

Distribution. For the time being known only from the Central Europe.

Bionomy. Termophilous species. In Poland two generations a year. First generation appears in June — July and adult forms of the second generation from the middle of August to the end of September. Autumn generation consists of much more specimens than the first one. *Salix viminalis* L. is the most important food plant in Central Poland.

Remarks. VILBASTE (1968) have synonymised this species with *Kybos oshanini* ZACHV. However, the only indication toward that was the fact of collecting of ZACHVATKIN'S species on *Salix viminalis* L.

Empoasca* (*Kybos*) *dlabolai (DWORAKOWSKA, **1973**)

Kybos dlabolai DWORAKOWSKA, 1973

Kybos topoli: DWORAKOWSKA (1967), nec ZACHVATKIN (1953a)

fig. 225—232*

Face. Yellowish-green, lower 2/3 of anteclypeus green. Whitish pattern very similar to that of *E.* (*K.*) *limpida* WAGN. The pattern consists of a narrow central stripe on frontoclypeus which extends to upper 1/3 of anteclypeus, patches at lateral frontal sutures do not reaching central stripe, irregular patches above the antennae at eyes and white upper parts of lorae and genae. Central frontal patch small if present, patches at ocelli as in *E.* (*K.*) *limpida* WAGN.

Vertex. Yellowish-green. Coronal suture bordered with white. Two white oblique dashes directed antero-laterad.

Pronotum. Green-yellowish or yellowish-green, hind margin milky hyaline. Two white irregular patches at eyes and one central patch expanded laterad at anterior margin. Small roundish white dots in the centre.

Scutum. Yellowish-green, area between basal triangles white, in its hind part two yellowish-green dots.

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* Number 232 is erroneously repeated.

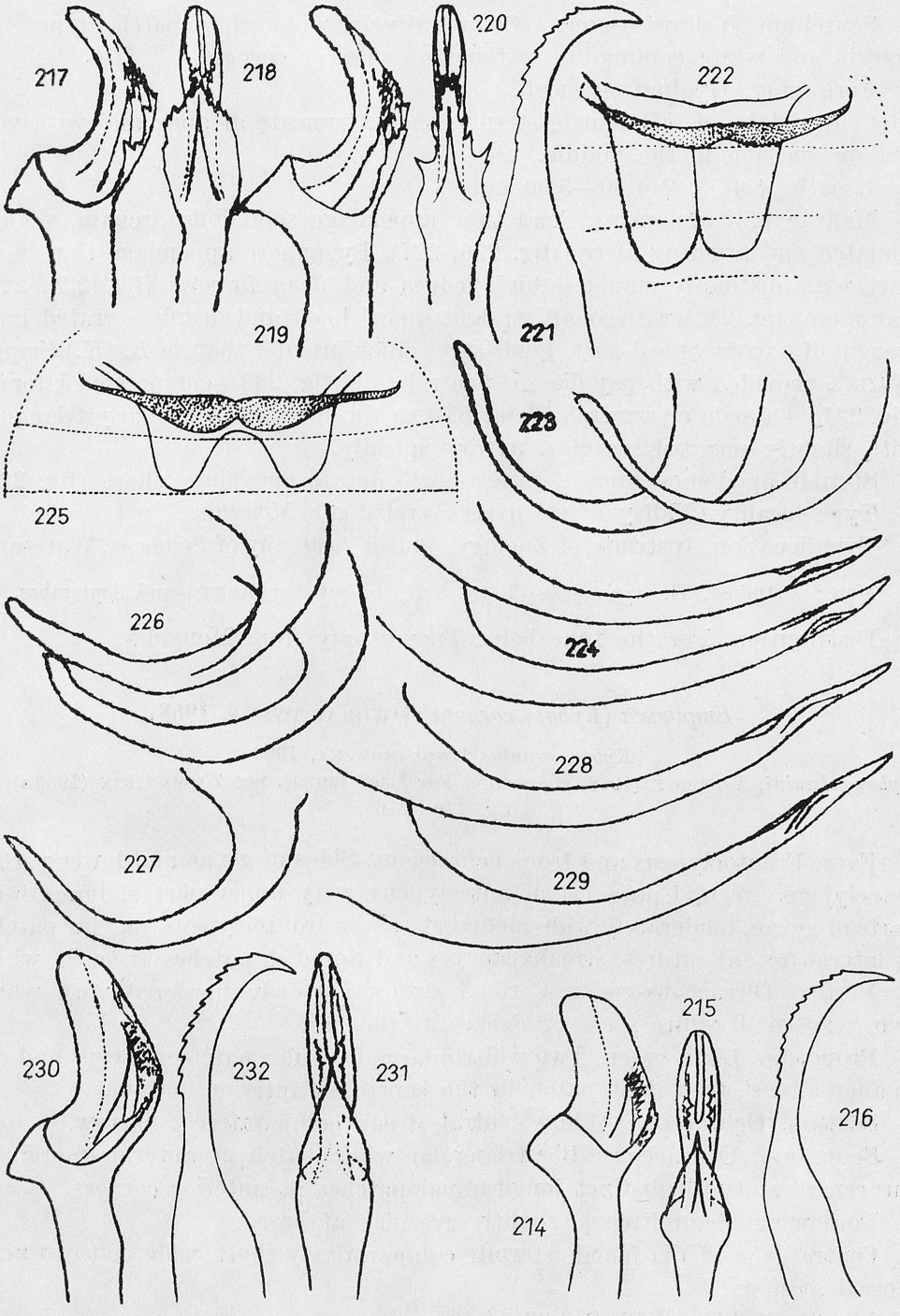

Fig. 214—232. *Empoasca* (*Kybos*) *cornuta* (Dwor.) — 214—216; *E.* (*K.*) *limpida* Wagn. — 217—224; *E.* (*K.*) *dlabolai* (Dwor.) — 225—232

Scutellum. Yellowish-green. Comparatively wide white patch at anterior margin and white comma-like patches at anterior corners.

Fore wing. Hyaline, greenish.

Central lobe of VII female sternite short, truncate at apex and with very shallow incision in the middle.

Length ♂ 4.55, ♀ 4.40—5.00 mm.

Male genital apparatus. Anal tube appendage solid long arcuate, slightly sinuated and tapering at tip (fig. 226, 227). Pygophore appendage thin in tip part with distinctly sinuated high ledges and deep furrows (fig. 228, 229). Paramere (fig. 232) with small straight apical hook and deeply serrated inner margin of narrow apical part. Penis stem much broader than in *E.* (*K.*) *limpida* WAGN., provided with papillae on ventral side (fig. 230), compressed laterally (fig. 231). Lamella on ventral side at base of the stem quite regularly triangular with slightly serrated margins, narrow spically.

Sternal apodemes broad, quite short, dorsal apodemes short (fig. 225).

Type locality. Valley of the river Terelzh-gol, Mongolia.

Type location. Institute of Zoology, Polish Academy of Sciences, Warszawa.

Material studied. The type-series (2 ♂♂, 8 ♀♀) collected in August and September.

Distribution. For the time being known only from Mongolia.

Empoasca (*Kybos*) *cornuta* (DWORAKOWSKA, 1968)

Kybos cornutus DWORAKOWSKA, 1968

Kybos oshanini: VILBASTE (1968, concerning Far East fauna), nec ZACHVATKIN (1953a)

fig. 210—216

Face. Frontoclypeus and frons ochraceous. Sides of genae and lower part of anteclypeus green. Upper 1/4 of anteclypeus, very upper part of lorae, inner parts of genae, moderately wide medial streak on frontoclypeus, narrow patches at lateral frontal sutures, streaks at eyes and roundish patches at ocelli, white.

Vertex. Olivaceous-green. Coronal suture narrowly bordered with white, two very small white spots or dashes at the base.

Pronotum. Light green. Two whitish large irregular patches at eyes and one smaller almost triangular patch in the centre at anterior margin.

Scutum. Ochraceous. White central streak comparatively narrow.

Scutellum. Ochraceous. Big triangular white patch at anterior margin in the centre and two distinct longitudinal patches at anterior corners.

Fore wing. Semivitreous, slightly greenish at base.

Central lobe of VII female sternite comparatively short, wide, not distinctly incised at apex.

Length ♂ 3.60—4.00, ♀ 3.80—4.40 mm.

Male genital apparatus. Anal tube appendage long thin arcuate, always distinctly more or less broadened at tip (fig. 210, 211). Pygophore appendage (fig. 212) with quite thin tip part provided with big slightly sinuated ledges. Para-

mere (fig. 216) with small straight apical hook and almost not broadened upper deeply serrated part. Penis stem (fig. 214) broad in lateral aspect, compressed laterally (fig. 215) ornamented with numerous papillae on ventral side. Lamellate ventral sclerotization triangular, serrated at margins, broad in tip part.

Sternal apodemes well developed, dorsal apodemes quite narrow (fig. 213).

Type locality. Pyongyan, Korean People's Republic.

Type location. Institute of Zoology, Polish Academy of Sciences, Warszawa.

Material studied. The type-series: 18 ♂♂, 31 ♀♀. Korean People's Republic: 10 ♂♂, 14 ♀♀, Pyongyan, Aug. 4—5; 1 ♂, 2 ♀♀, Aug. 5—6; 4 ♂♂, 1 ♀, Aug. 7—8; 3 ♂♂, 1 ♀; Aug. 9—10; 1 ♂, Aug. 12; 1 ♀, Aug. 19; 9 ♂♂, Sep. 2; 5 ♂♂, 1 ♀, Sep. 3; 4 ♂♂, Sep. 6—7, all collected by S. HORVATOVICH and J. PAPP in 1971.

Distribution. Known from north of Korean Peninsula and from the Maritime Territory of the U.S.S.R., after VILBASTE (1968).

Bionomy. At least two generations a year. From the first generation only one female (belonging to the type-series) has been studied. Probably the first generation appears in May — June. Majority of the specimens examined belong to the autumn generation.

Empoasca (*Kybos*) *populi* EDWARDS, 1908

Kybos populi tremulae ZACHVATKIN, 1953a syn. n.
Kybos zaisanensis MITJAEV, 1968 syn. n.
fig. 20, 22, 240—250, 268—271

Face. Frontoclypeus dark testaceous below, ochraceous above. Inner parts of genae and upper parts of lorae white. Sides and lower 2/3 of anteclypeus green. Upper 1/3 of anteclypeus and medial streak on frontoclypeus white. The frontoclypeal streak narrowing on its both ends. White patches at inner margins of eyes and at ocelli very small. Lateral frontal sutures without white patches. Frontoclypeus often with fuscous transverse striation.

Vertex. Olivaceous, slightly olivaceous-green in hind part.

Pronotum. Olivaceous, darker in central part. Three small whitish patches at anterior margin.

Scutum. Olivaceous-brown. A narrow central whitish streak.

Scutellum. Olivaceous-brown with a small cordiform white patch at anterior margin.

Fore wing. Light olivaceous. At hind margin of clavus broad fuscous streak with not distinct borders. Tips of apical veins dark, wing membrane smoked apically.

Central lobe of VII female sternite not distinct, the whole hind margin slightly produced, the most in the centre (fig. 246).

Length ♂ 4.15—4.45, ♀ 4.20—4.75 mm. After RIBAUT (1936b) length ♂ 3.8—4.3, ♀ 4.0—4.7 mm. After ZACHVATKIN (1953a) length ♂ 4.05—4.40, ♀ 4.30—4.53 mm.

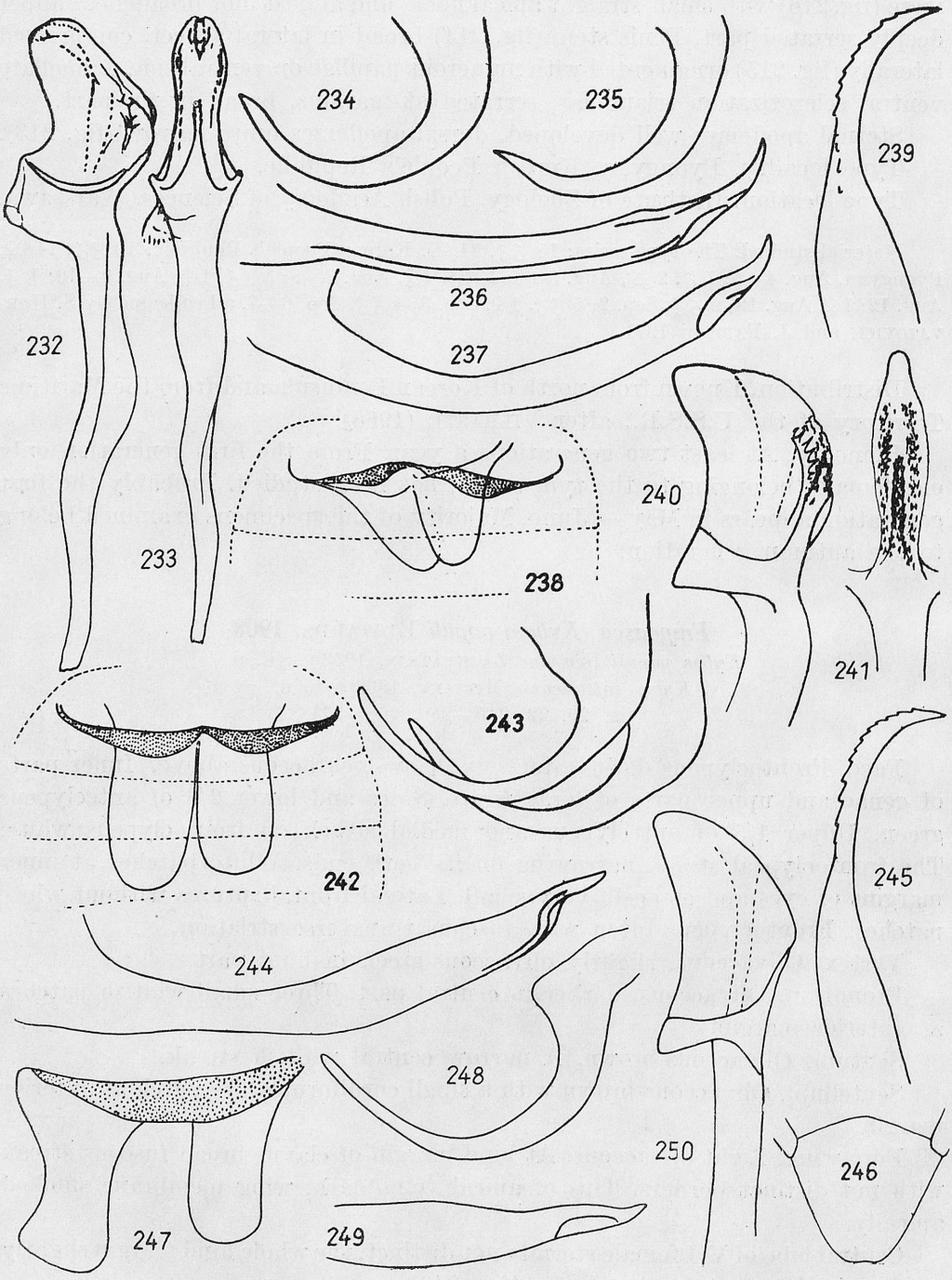

Fig. 232—250. *Empoasca* (*Kybos*) *rubrovenosa* (Dwor.) — 232—239; *E.* (*K.*) *populi* Edw., specimen from Poland — 240—246, after Mitjaev (1971) — 247—250

Male genital apparatus. Anal tube appendage long, thin, arcuate, slightly tapering apically (fig. 243). Pygophore appendage (fig. 244) almost lamellate, broadened in terminal half with strongly curved short ledge at deep incision before thin apex. Paramere (fig. 245) provided with very small straight apical hook and very low teeth on inner side of not broadened apical part. Penis stem (fig. 240, 241) very broad in upper part (seen from side), ornamented with rich papillation on ventral side.

Sternal apodemes very well developed (fig. 242), dorsal apodemes narrow.

Type locality. England, Gloucestershire, Colesborne.

Type location. British Museum (Nat. Hist.) in London.

Material studied. U.S.S.R., Kazakh S.S.R.: 1 ♂, 1 ♀ of the type-series of *Kybos zaisanensis* MITJ. (Zaisan Depression, Aigyr-Kum, June); Ukrainian S.S.R.: 1 ♂, Munkačevo, Aug. 4, 1918, coll. G. HORVÁTH. G.F.R.: ♂, Hamburg, Aug. 30; 1 ♀, Sep. 13, coll. J. NAST in 1945. G.D.R.: 1 ♂, 1 ♀, Berlin, Aug. 1888, coll. TETENS. NW Poland: 1 ♂, 1 ♀, Szczecin, Sep. 5, 1911, coll. E. SCHMIDT; 1 ♂, Karpin, Sep. 2, 1909, coll. E. SCHMIDT. N Poland: 1 ♂, Żukowo nr. Kartuzy, Sep. 1, 1954, coll. B. PISARSKI. Central Poland: 1 ♂, 1 ♀, Inowrocław, Sep. 5, 1946, coll. S. ADAMCZEWSKI; 1 ♂, 3 ♀♀, Krzyżanowice, June 30, 1957, coll. team of the Zoological Museum; 1 ♀, Warszawa, June 28, 1957; 2 ♀♀, Oct. 7, 1958, coll. H. SZELEGIEWICZ. SE Poland: 1 ♂, Grodysławice, *Populus nigra* L., June 7, 1967; 1 ♂, Aug. 10, 1967; 1 ♂, Sep. 10, 1967; 1 ♂, June 8, 1968; 1 ♂, Lipka, June 6, 1968; 1 ♀, Kazimierz, Aug. 27, 1967; 1 ♀, Łabunie nr. Zamość, Sep. 19, 1967; 1 ♀, Zwierzyniec, *Populus alba* L., Sep. 22, 1967; 1 ♀, June 11, 1968; 1 ♀, Bzowiec, June 20, 1968, coll. I. DWORAKOWSKA. Hungary: 1 ♂, "Buda", coll. S. MATSUMURA; 2 ♂♂, Budapest, 1914, coll. G. HORWÁTH; 1 ♂, Siofok, May 30, 1884, HORVÁTH'S collection. Yugoslavia, Serbia: 1 ♀, Sv. Petka, Sep., 1902, HORVATH'S collection.

Distribution. Europe, Central Asia, the most to the east — Irkutsk Distr., after ZACHVATKIN (1953a).

Bionomy. In Poland *E.* (*K.*) *populi* EDW. breeds chiefly on *Populus nigra* L. and on cultivated related species and on *P. alba* L. Two generations a year. The first generation appears in June and adult forms of the second one occur in August — September. *Populus tremula* L. was recorded as the food plant in West Europe and in the U.S.S.R.

Remarks. Description of *Kybos populi tremulae* by ZACHVATKIN (1953a was based on a sample collected on *Populus tremula* in centre of the European part of the U.S.S.R. (Sofrino, Moscow Distr.). The specimens were not compared with „typical" ones from England nor West Europe. All morphological features given at ZACHVATKIN'S description fit very well *E.* (*K.*) *populi* EDW. According to the original description by ZACHVATKIN only tip of pygophore appendage „distinctly longer, thinner and sharply S-shaped, thus [it] ... does not make impression of being truncate". It seems to me that misunderstanding has resulted from too literal interpretation of drawing by RIBAUT (1936b) showing this structure in one among the possible aspects. Food plant of ssp. *tremulae* can not be any distinguishing character as the type-series of *Empoasca* (*Kybos*) *populi* EDW. (9 ♂♂) from England was collected on „*Populus canescens* SM." (*P. alba* L. x *P. tremula* L.). Very purely expressed pigmentation along hind

margin of clavus and smaller size observed in the type-series of *Kybos zaisanensis* MITJ. can be explained by the rule that populations of certain species which live in arid conditions are usually smaller and lighter.

Empoasca (*Kybos*) *rubrovenosa* DWORAKOWSKA, 1973

Kybos rubrovenosus DWORAKOWSKA, 1973

fig. 232—239

Face. Olivaceous-green. Whitish colour covers lorae, genae and upper part of anteclypeus. Patches at ocelli, streaks at eyes and central longitudinal streak on frontoclypeus, white.

Vertex. Olivaceous-green witch brownish patches at anterior margin.

Pronotum. Olivaceous-green, anterior part slightly brownish.

Scutum and scutellum. Olivaceous-green. Basal triangles brownish. Central longitudinal streak on scutum whitish.

Fore wing. Olivaceous-green. Wax-field, longitudinal *m* vein, claval suture, inner and hind margins, brownish.

VII female sternite shaped similarly to that of *E.* (*K.*) *populi* EDW.

Length ♂ 4.00, ♀ 3.95—4.40 mm.

Male genital apparatus. Anal tube appendage arcuate, quite thick, slightly sinuate and tapering at tip (fig. 234, 235). Pygophore appendage thick, slightly broadened subapically. Tip part of the appendage ornamented with short ledges, apex quite long thin curved dorsad (fig. 236, 237). Paramere (fig. 239) with a small straight apical hook and slightly serrated not broadened apical part. The very apex shorter than in *E.* (*K.*) *populi* EDW. Penis stem short, triangular in side view and the apex of triangle directed caudad (fig. 232), it is slightly compressed laterally (chiefly in the middle part). Ventral side of the penis stem poorely ornamented with small folds, hind sclerotization provided with small teeth (fig. 233).

Sternal apodemes (fig. 238) well developed but in the only specimen at my disposal they are small, dorsal apodemes narrow.

Type locality. Tanger, Morocco.

Type location. Entomological Institute of Hokkaido University, Sapporo, Japan.

Material studied. The type-series (1 ♂, one specimen with abdomen lost, 10 ♀♀).

Distribution. For the time being known from Algieria and Morocco.

Remarks. Figures of *Kybos populi* EDW. by MITJAEV (1971) slightly resemble this species.

Empoasca (*Kybos*) *abstrusa* LINNAVUORI, 1951

Empoasca abstrusa LINNAVUORI, 1951

Kybos topoli ZACHVATKIN, 1953a

Empoasca taunica WAGNER, 1955a

fig. 251—256

Face. Frontoclypeus yellowish-green. Genae yellowish above, green in lower part. Lower parts of lorae and anteclypeus green. White pattern resembling

that of *E.* (*K.*) *virgator* RIB. but central streak on frontoclypeus wider and sides of genae above rather yellowish than white. Ocellar patches roundish, small.

Vertex. Ochraceous, often greenish. An distinct lighter streak along coronal suture. In some exemplars two whitish oblique patches at base.

Pronotum. Golden-green with hind margin milky. Three white patches at anterior margin. The central patch is comparatively large and expanded anteroposteriorly. Often milky streak in the middle line.

Scutum. Golden-olivaceous with large white area between basal triangles. Two olivaceous spots in hind part of this white area.

Scutellum. Golden-olivaceous. A big white triangular patch at anterior margin. Base of this triangle touch white area on scutum. Two smaller white triangles at anterior margin laterad.

Fore wing. Semitransparent, light green. Hind margin of clavus in some specimens olivaceous. Tips of apical veins and small adjacent areas infuscated.

Central lobe of VII female sternite produced and rounded at tip.

Length ♂ 4.20—4.70, ♀ 4.55—4.95 mm. After ZACHVATKIN (1953a) length ♂ 4.30—4.40, ♀ 4.40—4.75 mm.

Male genital apparatus. Anal tube appendage (fig. 254) arcuate, thin in upper part, broad in basal 2/3. Pygophore appendage (fig. 255) with very strongly twisted big and high ledges and with very deep furrows in apical part. Paramere (fig. 256) has straight small apical hook and well developed teeth on not broadened apical part. Penis stem (fig. 251, 252) semimembraneous with very rich papillation on sides at ventral margin and teeth on sclerotized ventral thickening.

Sternal apodemes (fig. 253) very short, quite broad, dorsal apodemes extremely narrow and almost not pigmented.

Type locality. Turku, Finland.

Type location. Collection of Dr. R. LINNAVUORI in Raisio, Finland.

Material studied. S Poland: 1 ♂, Kraków, July 4, 1941; 4 ♀♀, Aug. 7, 1942; 1 ♂, 1 ♀, Aug. 28, 1944; 1 ♂, 1 ♀, Oct. 13, 1944; 1 ♀, Oct. 19, 1940; 3 ♂♂, 2 ♀♀, Myślenice, Sep. 17, 1942, *Populus nigra* L., coll. S. SMRECZYŃSKI. Central Poland: 1 ♂, Warszawa (Saska Kępa), July 27, 1957, coll. M. MROCZKOWSKI; 1 ♂, Warszawa, June 27; 5 ♂♂, 4 ♀♀, Warszawa—Błota, Aug. 32, coll. J. NAST in 1954; 1 ♂, Warszawa, July 28—30, 1960, coll. H. SZELEGIEWICZ; 2 ♂♂, 4 ♀♀, Warszawa—Bielany, Aug. 11, 1956, coll. J. NAST and S. NOWAKOWSKI; 1 ♂, 1 ♀, Warszawa—Bielany, *Populus nigra* L., July 17, 1946, coll. J. NAST; 1 ♂, 2 ♀♀, Łomianki nr. Warszawa, Aug., 1947, coll. J. NAST; 1 ♀, Krzyżanowice nr. Pińczów, July 24; 1 ♀, July 26; 1 ♀, July 27, coll. J. NAST in 1956. Hungary: 1 ♂, Pest, June 27, 1895, HORVÁTH'S collection; 1 ♂, Budapest, July 5, 1961, coll. J. NAST. Austria: 1 ♂, Neusiedler See, Aug. 20, 1960, coll. J. NAST. Bulgaria: 1 ♂, 4 ♀♀, Rodopi, Momčilgrad, Oct. 18, 1963, coll. R. BIELAWSKI. Romania: 1 ♂, Valul Traian, June 19, 1959, coll. R. BAŃKOWSKA. Yugoslavia: 2 ♀♀, Belgrade, July 5, 1957, coll. R. BIELAWSKI.

Distribution. Central Europe, southern Finland, south-east of Europe, East Europe, the most to the east — Bashkir A.S.S.R., U.S.S.R., after ZACHVATKIN (1953a).

Bionomy. Two generations a year in Central Europe. In Moscow District the second generation appears in August, after ZACHVATKIN (1953a). In Poland

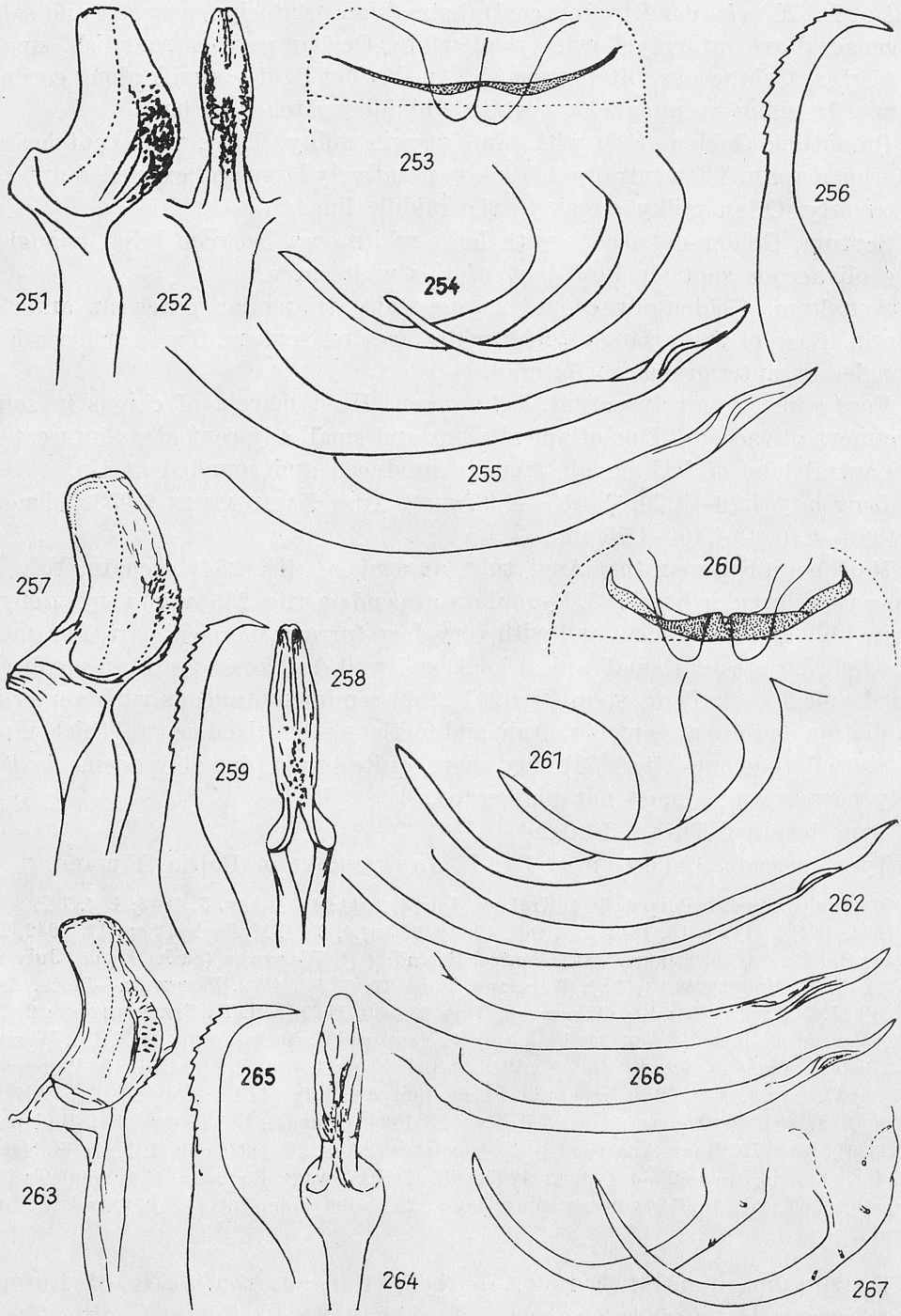

Fig. 251—267. *Empoasca* (*Kybos*) *abstrusa* Lnv. — 251—256; *E.* (*K.*) *koreana* (Mats.), specimen from Korea — 257—262, specimen from China — 263—267

the first generation has been collected in June, the second one in September. Maybe in the southern Europe also the third generation can develope. *Populus nigra* L. is mainly a natural host plant in Europe but this species can live also on related species of *Populus* L. as well as on cultivated hybrids.

Remarks. *Kybos topoli* ZACHV. was described from Luzhki in Moscow District, Voronege Reservation and Bashkir A.S.S.R. Very thick pygophore appendage mentioned by ZACHVATKIN (1953a) besides other features of this species allow to recognize *E.* (*K.*) *abstrusa* LNV. with full certainty. In this species the shape of penis stem is very variable. Size of specimens vary very much. In South Europe the specimens are smaller than these collected in Poland.

Empoasca (*Kybos*) *koreana* (MATSUMURA, 1931)

Chlorita koreana MATSUMURA, 1931
fig. 257—267

Face. Resembling that of *E.* (*K.*) *abstrusa* LNV. The only differences are smaller whitish patches at lateral frontal sutures and very large white areas at eyes above the antennae. In some specimens these white areas are joined with white ocellar patches.

Vertex, pronotum, scutum and scutellum as in *E.* (*K.*) *abstrusa* LNV.

Fore wing. Semivitreous, greenish, not distinctly smoked at tips of apical veins.

VII abdominal sternite of the female as in *E.* (*K.*) *abstrusa* LNV.

Length ♂ 4.00 and 4,15, ♀ 4.40 and 4.60 mm. Length of the holotype, female 5.00 mm.

Male genital apparatus. Anal tube appendage thin arcuate (fig. 261, 267) tapering or pointed only at the very tip. Pygophore appendage (fig. 262, 266) thin in apical part, ledges and furrows small. Paramere (fig. 259, 265) with small apical hook and distinct teeth on a narrow and almost straight apical part. Penis stem (fig. 257, 263) truncate at apex, semimembraneous, ornamented with papillae on sides at ventral margin near base. Sclerotized ventral thickening with small teeth (fig. 258—264).

Sternal apodemes (fig. 260) short and narrow, dorsal apodemes narrow almost not pigmented.

Type locality. Mt. Chohaku, Korean Peninsula.

Type location. Entomological Institute, Hokkaido University, Sapporo, Japan.

Material studied. Holotype, female specimen with abdomen lost labeled: "[unredeable text in Japanese] 88 1914", "*Chlorita koreana* n. sp. det. MATSUMURA", "Type MATSUMURA" and "30". Korean People's Republic: 1 ♂, 2 ♀♀, Onpho, Džuyr Distr., Sep. 6, 1970, coll. R. BIELAWSKI and M. MROCZKOWSKI; 1 ♂, Pyongyan, Aug. 4—5, 1971, coll. S. HORVATOVICH and J. PAPP. China: 1 ♂, Hupeh, Chi-Au-Shan to Wang-Chia-Ying, July 20, 1948, coll. CRESSITT and DIOU.

Distribution. For the time being known only from the Far East.

Bionomy. Judging after dates of collecting this species developes at least two generations a year.

Remarks. Bigger size of the holotype can be explained by the rule that exemplars belonging to the populations living in more humid environments are usually more shapely than these from arid environments.

Empoasca (*Kybos*) *pyramidalis* (Mitjaev, 1971)

Kybos pyramidalis Mitjaev, 1971

fig. 272—275

„Claval suture usually not infuscated... Pygophore appendage with a narrow incision before tip (fig. 274). Penis stem provided with a group of teeth on hind wall at base (fig. 272).

Dorsal apodemes reaching half of length of sternal apodemes (fig. 275), they are almost equally wide on whole of their length".

Length ♂ ♀ 4.00—4.40 mm.

Type locality. Kazakh S.S.R., U.S.S.R.

Type location. Institute of Zoology, Kazakh Academy of Sciences, Alma-Ata, Kazakh, S.S.R., U.S.S.R.

Remarks. The only note on this species is description by Mitjaev (1971). The type-series has been collected on pyramidal poplar.

Empoasca (*Kybos*) *mitjaevi* nom. n.

Kybos montanus Mitjaev, 1971, nec *Empoasca montana* Caldwell, 1952

fig. 276—279

„Light green. Claval suture usually not infuscated.

Pygophore appendage tapering toward tip (fig. 279). Tip of anal tube appendage straight (fig. 278).

Dorsal apodemes divergent from each other, longer than sternal apodemes (fig. 276)".

Length ♂ ♀ 4.30—4.80 mm.

Type locality. Kazakh S.S.R., U.S.S.R.

Type location. Institute of Zoology, Kazakh Academy of Sciences, Alma-Ata, Kazakh S.S.R., U.S.S.R.

Remarks. The only note on this species is description by Mitjaev (1971). The type-series has been collected on willows.

Empoasca (*Kybos*) *niveicolor niveicolor* (Zachvatkin, 1953)

Kybos niveicolor Zachvatkin, 1953

fig. 287—307

Head, thorax and abdomen light green dried specimens with no whitish markings, feet dark green. „Living specimens almost entirely white".

Central lobe of VII abdominal sternite of the female very short.

Length ♂ 3.60—3.80, ♀ 3.75—3.90 mm. After ZACHVATKIN (1953c) length ♀ 3.97—4.06 mm.

Male genital apparatus. Anal tube appendage (fig. 290—292, 306, 307) regularly arcuate, tapering on a long distance from apex, pointed. Pygophore appendage with thin tip part, provided with strongly sinuated distinct ledges

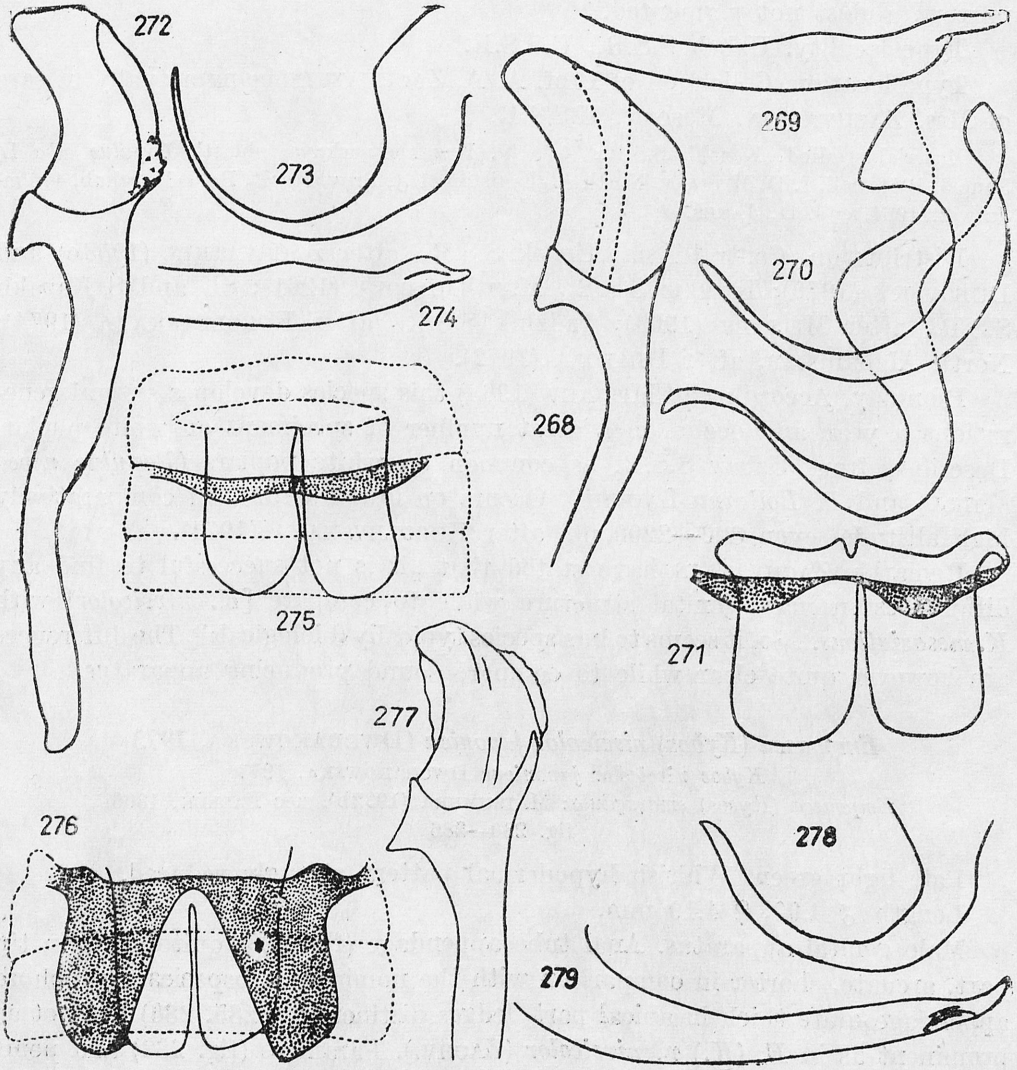

Fig. 268—279. *Empoasca* (*Kybos*) *zaisanensis* (MITJ.), after MITJAEV (1968) — 268—271; *E.* (*K.*) *pyramidalis* (MITJ.), after MITJAEV (1971) — 272—275; *E.* (*K.*) *mitjaevi* nom. n. — *K. montanus* by MITJAEV (1971) — 276—279

(fig. 297—299, 304, 305). Paramere (fig. 294, 295, 302) with a small straight apical hook. Apical part of paramere, in comparison with other species of the subgenus, very short and straight. Penis stem (fig. 287, 289) in lateral view has both margins strongly arcuated and rounded apex. Lateral sides of the

stem provided with papillae and teeth near ventral margin at base. Ventral sclerotization ornamented by small teeth (fig. 288, 301). The penis of one male from Afghanistan has quite different shape (fig. 300) but as other features are as individuals from Kazakhstan it should be treated as intraspecific variability.

Sternal apodemes long and broad (fig. 296, 303), dorsal apodemes quite narrow, almost not pigmented.

Type locality. Uzbek S.S.R., U.S.S.R.

Type location. Collection of Prof. A. A. ZACHVATKIN being actually in care of Mrs. ZACHVATKIN, Moscow, U.S.S.R.

Material studied. Kazakh S.S.R.: ♂♂, ♀♀, Kazakhstanskaya oblast', *Populus alba* L) June 3, 1958, coll. I. D. MITJAEV. North Afghanistan: 1 ♂, Prov. Herat, Bala Murghab, 470 m-July 2, 1964, coll. O. JAKEŠ.

Distribution. Central Asia: Uzbek S.S.R., after ZACHVATKIN (1953c) and DUBOVSKY (1970); Kirghiz S.S.R., after DLABOLA (1961); SE and S Kazakh S.S.R., after MITJAEV (1963); Tadzhik S.S.R., after KOROLEVSKAYA (1974); North Afghanistan, after DLABOLA (1972).

Bionomy. According to MITJAEV (1963) this species developes several generations a year and occurs in a great number of specimens on white poplar. Described from Uzbek S.S.R. as common on white poplars (*Populus nivea* WILLD. and *P. Bolleana* LAUCHE). Occurs on lowlands and on comparatively high altitude, even 800—2200 m., after KOROLEVSKAYA (1974).

Remarks. ZACHVATKIN have stated that „it is not successful to find any differences in male genital structure while to compare [*K. niveicolor*] with *K. mesasiaticus*... So, it seems to be a species typically «biological»". The differences are however quite clear while to compare sound producing apparatus.

Empoasca (*Kybos*) *niveicolor japonica* (DWORAKOWSKA, 1973)

Kybos niveicolor japonicus DWORAKOWSKA, 1973

Empoasca (*Kybos*) *smaragdula*: MATSUMURA (1932b), nec FALLÉN, 1806

fig. 280—286

Pale light green. Whitish hypodermal pattern strongly reduced.

Length ♂ 4.00, ♀ 4.10 mm.

Male genital apparatus. Anal tube appendage (fig. 283) quite thick in tip part, arcuate, shorter in comparison with the nominate subspecies. Pygophore appendage quite thick in apical part, ledges distinct (fig. 285, 286) but not as prominent as in *E.* (*K.*) *n. niveicolor* (ZACHV.). Paramere (fig. 282) and penis (fig. 280) as in nominate subspecies. Penis stem quite slim in posterior view (fig. 281).

Sternal apodemes (fig. 284) quite short and broad, dorsal apodemes narrow, not pigmented.

Type locality. Kogota nr. Sendai, Honshu, Japan.

Type location. Entomological Institute, Hokkaido University, Sapporo, Japan.

Material studied. The type-series (1 ♂, 2 ♀♀).

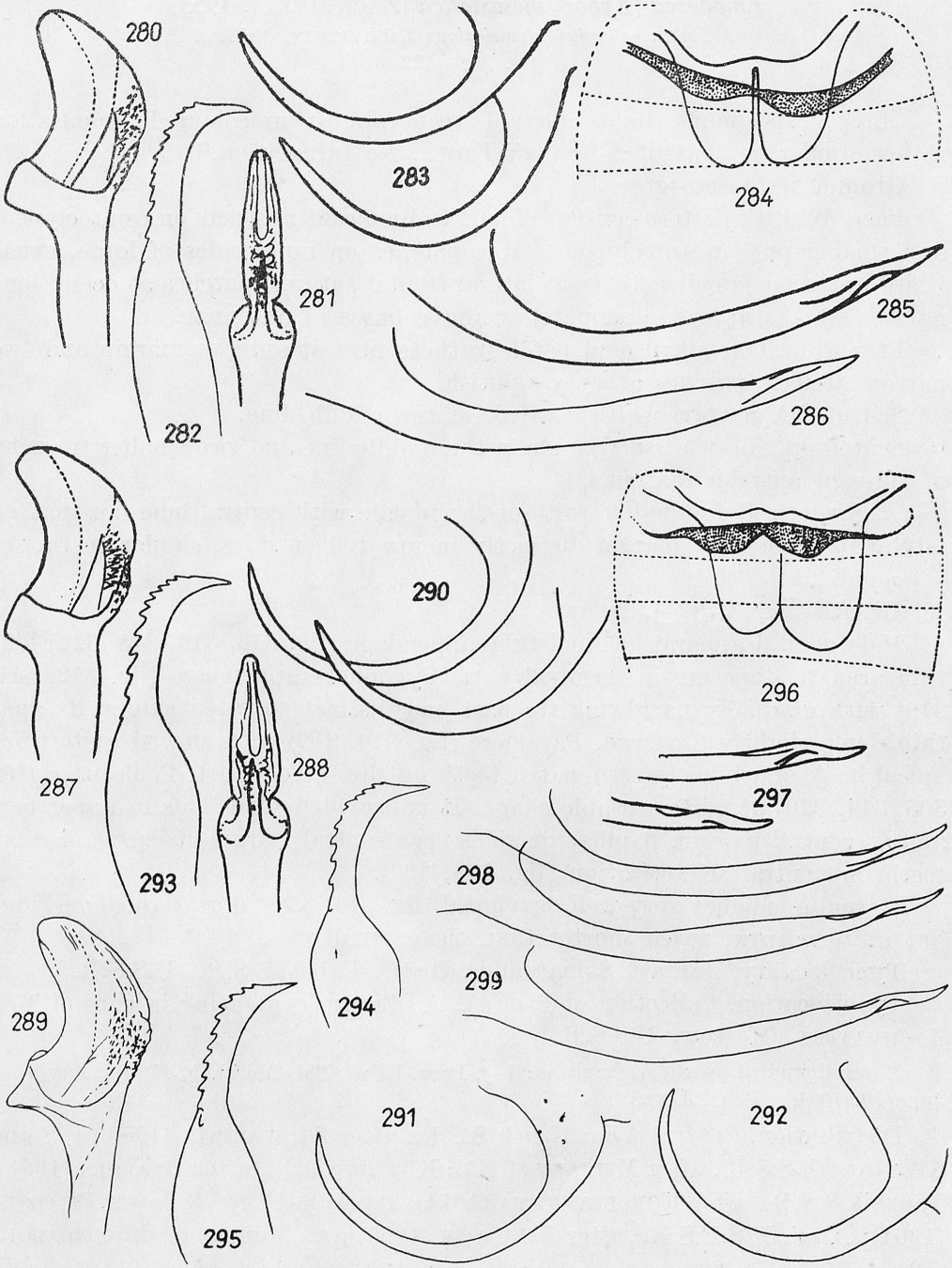

Fig. 280—299. *Empoasca* (*Kybos*) *niveicolor japonicus* (Dwor.) — 280—286; *E.* (*K.*) *n. niveicolor* (Zachv.), specimen from Kazakhstan — 287—299

Empoasca (*Kybos*) *mesasiatica* (ZACHVATKIN, 1953)

Kybos oshanini mesasiaticus ZACHVATKIN, 1953
fig. 308—322

„Living specimens light emerald-green, almost unicoloured, colouration rather similar to that of *K. populi* EDW... No infuscation."

Ground testaceous-grey.

Face. Whitish pattern consists of longitudinal central streak on frontoclypeus and smaller one on anteclypeus, large patches on inner sides of lorae, genae below antennae, small patches at lateral frontal sutures, patches at ocelli, long narrow streaks at eyes and patches above bases of antennae.

Pronotum. One small oval patch in the centre at anterior margin and two narrow arcuate patches at eyes, whitish.

Scutum. A narrow whitish streak in the middle line.

Scutellum. Big whitish triangle in the middle line and two smaller triangles at sides of anterior margin.

„...Seventh abdominal sternite of the female with central lobe not inat of, lateral parts of hind margin distinctly incurvated at sides, similar to thcised *populi*..."

K. Length ♂ ♀ 3.78—4.22 mm.

Male genital apparatus. Anal tube appendage (fig. 313, 316, 318, 322) long thin arcuate, tapering in terminal part. Pygophore appendage (fig. 312, 317, 319) with gradually narrowing tip part and distinct sinuated ledges, its apex thin, long, slightly S-curved. Paramere (fig. 310, 315) with curved quite thick apical hook and bluntly terminated teeth on slim apical part. Penis stem (fig. 308, 314, 320) of quite variable shape. It is provided with folds in upper part and at ventral margin, papillae on sides near ventral margin at base and small teeth on ventral sclerotization (fig. 308, 309).

Sternal apodemes very well developed (fig. 311, 321), dorsal apodemes long but quite narrow, twice shorter than the sternal ones.

Type locality. Jargak, Samarkanda Distr., Uzbek S.S.R., U.S.S.R.

Type location. Collection of Prof. A. A. ZACHVATKIN being in care of Mrs. ZACHVATKIN, Moscow, U.S.S.R.

Material studied. North Afghanistan: 1 ♂, Prov. Herat, Bala Murghab, 470 m., May 25 — June 10, 1964, coll. O. JAKEŠ.

Distribution. Central Asia: Uzbek S.S.R., after ZACHVATKIN (1953 a); S and SW Kazakh S.S.R., after MITJAEV (1963); Kirghiz S.S.R., after DLABOLA (1961); Tadzhik S.S.R., after KOROLEVSKAYA (1974); Dagestan A.S.S.R., after DLABOLA (1961); Altai, R.S.F.S.R., after VILBASTE (1965) and Mongolia, after DLABOLA (1967 c).

Bionomy. Described from oases in Central Asia where it lives on *Salix songorica* ANDRESS. According to the original description numerous exemplars occurred in July. Some samples have been collected on high altitude: Arslan-bob in Kirghiz S.S.R., Ghilarsky hrebt in Tadzhik S.S.R. — 1650 m. Spotted

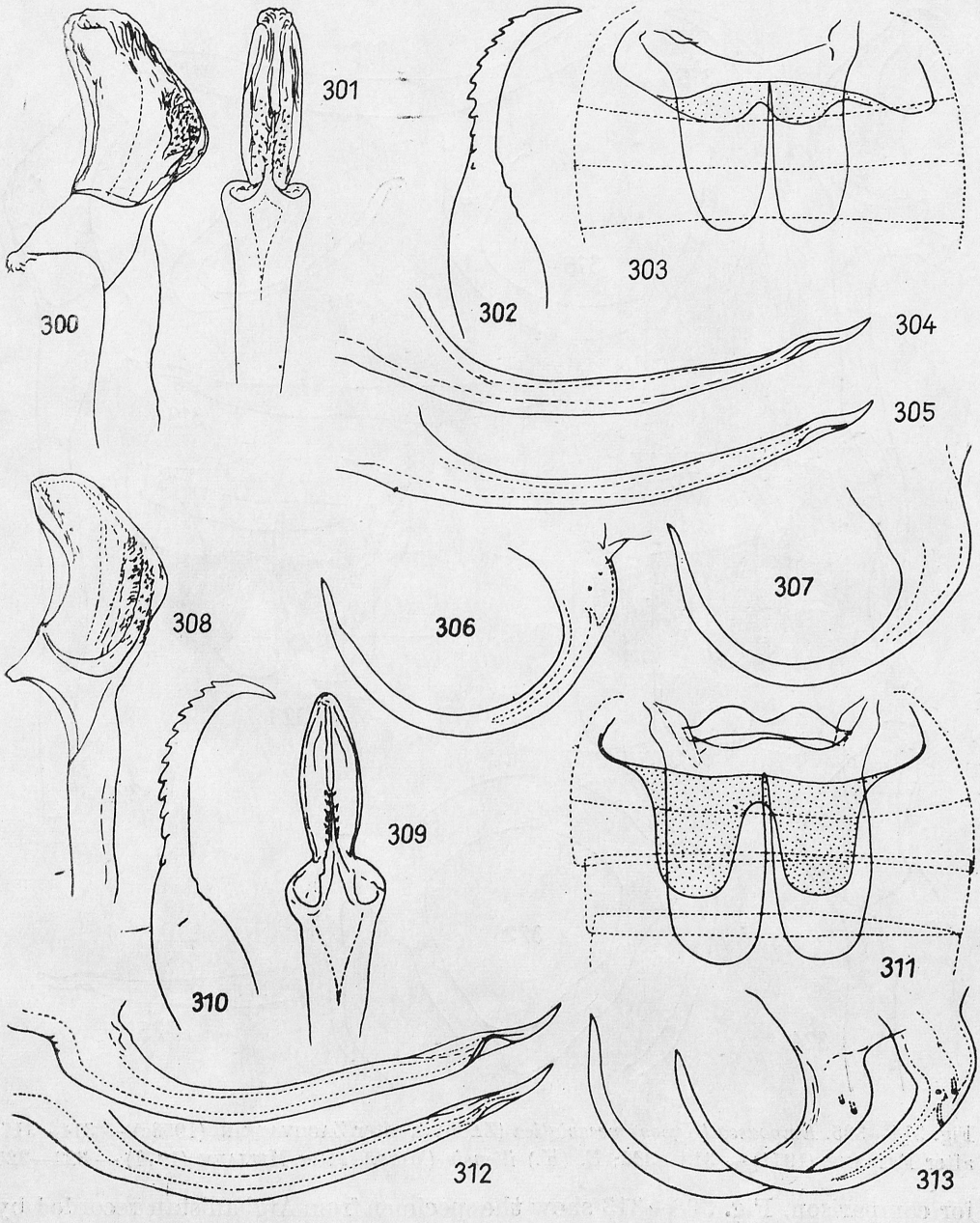

Fig. 300—313. *Empoasca* (*Kybos*) *niveicolor niveicolor* (ZACHV.) specimen from Afghanistan — 300—307; *E.* (*K.*) *mesasiatica* (ZACHV.), specimen from Afghanistan — 308—313

also on *Salix wilhelmsiana* M. B. and according to ZACHVATKIN (1953a) „on other willows with smooth laeves".

Remarks. The type-series was not studied since description. Fortunately it was the only species of the subgenus *Kybos* FIEB. among described by ZACHVATKIN in 1953 originally illustrated. Here are copied drawings by other authors

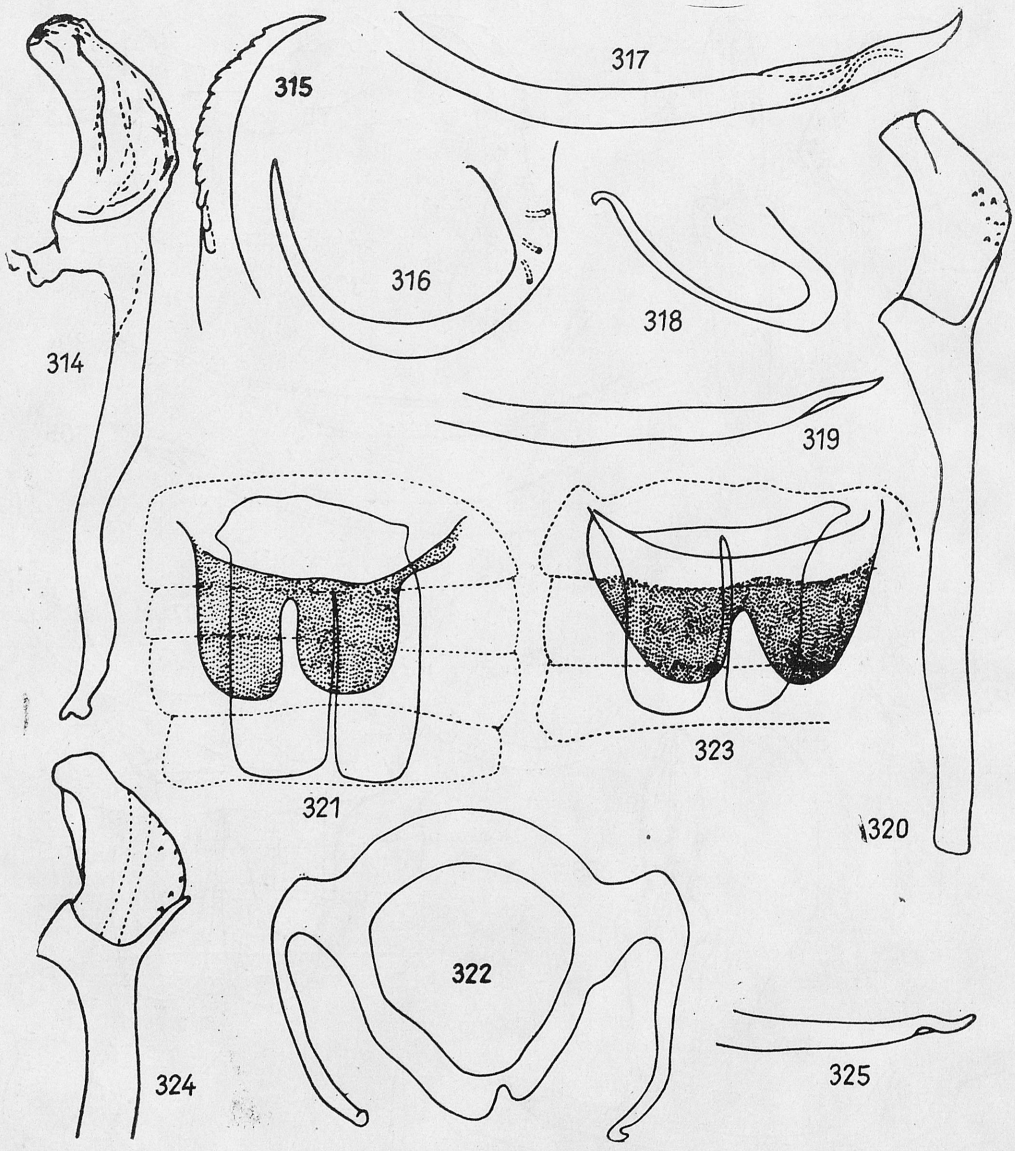

Fig. 314—325. *Empoasca* (*Kybos*) *mesasiatica* (ZACHV.), after ZACHVATKIN (1953c) — 314—317, after MITJAEV (1971) — 318—322; *E.* (*K.*) *iliensis* (MITJ.), after MITJAEV (1971) — 323—325

for comparison. Fig. 308—313 show the specimen from Afghanistan recorded by DLABOLA (1971). It was not properly preserved and lost its natural colouration, description of external features here is based on this specimen.

***Empoasca* (*Kybos*) *iliensis* (MITJAEV, 1971) stat. n.**

Kybos mesasiaticus iliensis MITJAEV, 1971

fig. 323—325

„Light green. Claval suture usually not infuscated".

Length ♂ ♀ 3.60—4.30 mm.

Male genital apparatus. Pygophore appendage (fig. 325) narrowing toward tip, with distinct sinuate ledge. Its apex short. Penis stem (fig. 324) broadened at base, truncate apically, ornamented by small teeth on sides at ventral margin.

Sternal apodemes well developed broad and long, narrowing apically, dorsal apodemes very broad and long, narrowing apically (fig. 323).

Type locality. Kazakh S.S.R., U.S.S.R.

Type location. Institute of Zoology, Kazakh Academy of Sciences, Alma-Ata, Kazakh S.S.R., U.S.S.R.

Remarks. The only note on this species is description by MITJAEV (1971). The type-series has been collected on willows.

Empoasca (*Kybos*) *oshanini* (ZACHVATKIN, 1953)

Kybos oshanini ZACHVATKIN, 1953

„Comparatively small light green species living on *Salix viminalis* or, more exactly on *S. rossica* NAZAR. Uniformly coloured, lighter than other willow species of *Kybos*, with slightly bluish tint, infuscation not developed. Comparatively robust, proportion of breadth to the length of body 4.2—4.3 (average for 10 females 4.24). Vertex is equally long to 45% of length of pronotum. Pronotum almost equally long to breadth of vertex between eyes, distinctly narrower than head, its hind part only slightly expanded laterad.

Length ♂ 3.80—3.98, ♀ 4.05—4.36 mm.

♂ Pygophore appendages with strongly sclerotized sharply S-shaped tip part. Anal tube appendages thin and long, helically arcuate, almost equally wide on their whole length, that means are almost as in *K. butleri*. Penis membraneous without lateral appendages, very broad in profile, truncate at apex, ornamented with not numerous small spines on hind margin. Upper part of parameres shorter and more curved than in other species of the genus..."

Type locality. Luzhki, Moscow Distr., U.S.S.R.

Type location. Collection of Prof. A. A. ZACHVATKIN being actually in care of Mrs. ZACHVATKIN, Moscow, U.S.S.R.

Remarks. „*K. oshanini* is the closest related to just before described from Sweden *K. sordidulus* OSSIANNILSSON, 1943 [sic!] but differs from it by light colouration, smaller size, details of male genital apparatus and by biological properties". There are also some other zoogeographical and systematical remarks at description of this species but they consist of quite mixed information being of any significance. Such parts of text occur in ZACHVATKIN'S works printed in 1953 because at least part of these articles was prepared by friends of the author after his death. It is evident that there have appeared also some remarks and preliminary notes which were not at all appropriated by ZACHVATKIN for printing.

VILBASTE (1968) stated that *Empoasca limpida* WAGN. is a younger synonym of *K. oshanini* ZACHV. Really, external features of *E. limpida* WAGN. fit very well these in description of *K. oshanini* ZACHV. as well as several other species.

But judging after description in paper by ZACHVATKIN (1953a) p. 207, anal tube appendage and especially penis structure are rather similar to these of *E.* (*K.*) *abstrusa* LNV. and are distinctly dissimilar to the features of *E. limpida* WAGN. For the respect of other features and completely other food plant *E.* (*K.*) *abstrusa* LNV. must be excluded from the considerations. Shape of paramere in *K. oshanini* ZACHV. is similar to that of *E.* (*K.*) *niveicolor* ZACHV. but the external features and food plant also indicate that they both are separate species. Thus, *Kybos oshanini* ZACHV. remains still enigmatic and for the time being it should be accepted its separatenes. It should be also expected that redescription of this species based on type material will be done by Russian homopterologists in the near future. Also ZACHVATKIN'S remark on the relationship of this species to *Empoasca sordidula* OSS. require confirmation.

***Empoasca* (*Kybos*) *butleri* EDWARDS, 1908**

Kybos oshanini occidentalis ZACHVATKIN, 1953 syn. n.
Empoasca smaragdula: HORVÁTH (1901a), nec FALLÉN, 1806
Empoasca (*Kybos*) *ovalis* ROSS, 1963 syn. n.
fig. 11, 326—344

Face. Yellowish-green, white hypodermal pattern not contrasting. Sides and lower part more green. Whitish are: inner parts of genae, upper parts of lorae, sometimes upper part of anteclypeus, narrow patches above antennae at eyes, small patches above and mesad of ocelli, sometimes very small patches at lateral frontal sutures and comparatively narrow medial streak on frontoclypeus (often disappearing in lower part). The white pattern is more distinct in females and often reduced in males.

Vertex. Olivaceous with two darker patches. Coronal suture bordered with light and often (especially in male) with brownish shades at anterior margin.

Pronotum. Olivaceous. One small whitish patch in the centre at anterior margin, two smaller patches at eyes. Hind margin often darkened but hind corners marked with green. There is a big semicircular or triangular dark brown patch in the centre (fig. 11) being often divided by pale central streak.

Scutum. Brownish. There is a narrow lighter streak in the middle.

Scutellum. Brownish at sides, dark olivaceous behind, wide light testaceous or whitish patch in the centre.

Fore wing. Emerald-green. A wide brown streak along hind margin of clavus. Brown are: 1st apical cell, greatest part of surface of the 2nd and 3rd apical cells, a small patch at the end of longitudinal m and almost rhomboidal patch at the end of longitudinal cu (fig. 337).

Central lobe of VII abdominal sternite of the female very wide, short, rounded at tip.

Length ♂ 3.90—4.30, ♀ 4.20—4.70 mm. Specimens from Siberia, length ♂ 4.36, ♀ 4.65 mm.

Male genital apparatus. Anal tube appendage thin arcuate (fig. 331, 333, 342) or slightly sinuate in apical half (fig. 332, 341). Often one appendage of the

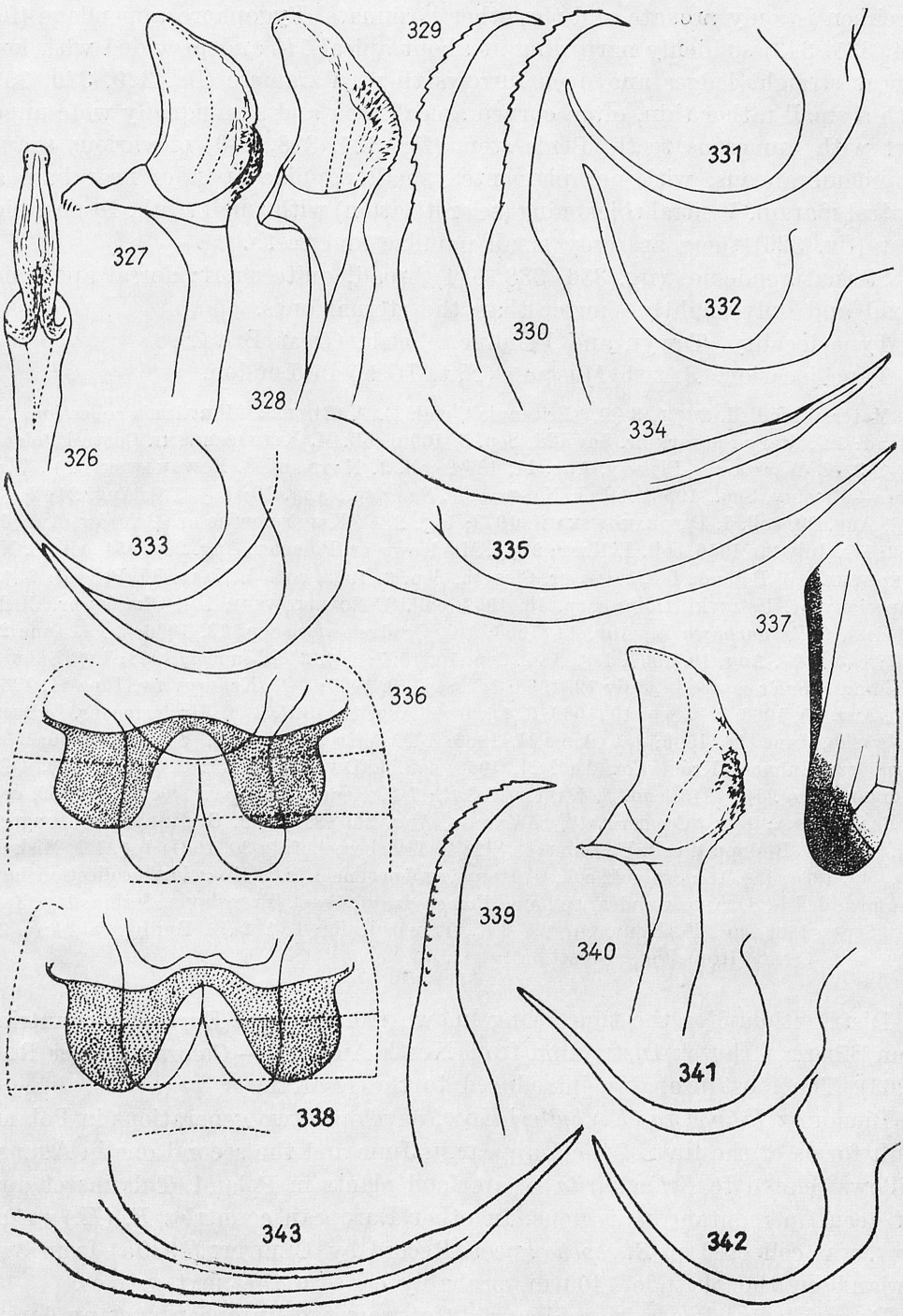

Fig. 326—343. *Empoasca (Kybos) butleri* EDW., specimen from Poland — 326—337, specimen from Siberia — 338—343

specimen is only arcuate and the other is sinuate. Pygophore appendage (fig. 334, 335, 343) suddenly narrowing at about apical 1/4 and provided with low, almost straight ledges and deep furrows there. Paramere (fig. 329, 330, 339) with a small rather thin, often curved apical hook and slim equally wide upper part with numerous teeth. Penis stem (fig. 327, 328, 340) of various shape, semimembraneous, with not pigmented small papillae at sides near base at ventral margin. Ventral thickening (sclerotization) with small teeth. In posterior view (fig. 326) there are only small papillae and teeth.

Sternal apodemes (fig. 336, 338, 344) broad, quite short; dorsal apodemes broad and only slightly shorter than the sternal ones.

Type locality. Towyn and Pendine, Welsh, Great Britain.

Type location. British Museum (Nat. Hist.) in London.

Material studied. 2 ♂♂, 3 ♀♀, "Britannia", coll. E. A. Butler, Horváth's collection. NE Poland: 1 ♀, Stary Folwark nr. Suwałki, Sep. 5, 1960, coll. M. Klimaszewski. Central Poland: 5 ♂♂, 3 ♀♀, Warszawa—Bielany, Aug. 11, 1956, coll. J. Nast and S. Nowakowski; 1 ♀, Warszawa—Młociny, Sep., 1958, coll. J. Nast; 2 ♀♀, *Salix* sp., Aug. 10; 1 ♂, 1 ♀, Aug. 24; 2 ♂♂, 9 ♀♀, Aug. 29, coll. I. Dworakowska in 1973; 1 ♂, 2 ♀♀, Krzyżanowice nr. Pińczów, Aug. 14, 1952; 1 ♀, July 26, 1956, coll. J. Nast; 2 ♂♂, Młodzawy nr. Pińczów, Aug. 20, 1954, coll. S. Nowakowski. SW Poland: 1 ♀, Wisła nr. Cieszyn, Sep. 3, 1952, coll. J. Nast. SE Poland: 2 ♂♂, Stuposiany nr. Ustrzyki Dolne, Sep. 16, 1957, coll. S. Nowakowski; 1 ♀, Okszów nr. Chełm Lubelski, *Salix purpurea* L., Aug. 14, 1966; 1 ♀, Grodysławice, Sep. 13, 1966; 2 ♀♀, June 27, 1967; 1 ♂, 4 ♀♀, Aug. 10, 1967; 1 ♂, 5 ♀♀, Sep. 10, 1967; 1 ♂, 2 ♀♀, June 7, 1968; 1 ♂, Łabunie nr. Zamość, *Salix caprea* L., July 12, 1966; 1 ♀, Sep. 19, 1967; 3 ♀♀, Krasnystaw, June 11, 1966; 3 ♀♀, Aug. 15, 1966; 1 ♀, Sep. 10, 1966; 3 ♂♂, 6 ♀♀, Aug. 18, 1967; 3 ♀♀, Hrebenne nr. Lubycza Królewska, June 16, 1966; 1 ♀, Aug. 21, 1966; 1 ♀, *Salix purpurea* L., Sep. 19, 1966; 2 ♀♀, Kornie nr. Lubycza Królewska, Aug. 21, 1966, coll. I. Dworakowska. G.F.R.: 4 ♂♂, 4 ♀♀, Hamburg, Aug. 19, 1945, coll. J. Nast. Č.S.S.R.: 1 ♀, Hencin nr. Opava, Sep. 18, 1959, coll. R. Bańkowska; 1 ♂, "Csemernye" nr. Vranov, Aug. 26, 1879, coll. G. Horváth. Hungary: 1 ♂, "Csepel" Budapest, coll. Ujhelyi; 1 ♂, 2 ♀♀, Tiszabercel, July 30, 1921; 1 ♂, 1 ♀, Miskolc, Aug. 17, 1925; 1 ♂, 1 ♀; Szolnok, coll. G. Horváth (specimens from Horváth's collection have been recorded by Dlabola under the name *Empoasca rufescens*). Yugoslavia, Serbia: 1 ♂, 3 ♀♀, Niš, Sept., 1902, coll. G. Horvath. U.S.S.R., Transbaicalia: 1 ♂, 2 ♀♀, Burdukova, Aug. 25, 1898, coll. Csiki (Horváth's collection).

Distribution. For the time being known from several European countries, from Siberia (Irkutsk Distr.) and from North America — Colorado, after Ross (1963). The most probably introduced to the Nearctic.

Bionomy. *Empoasca* (*K.*) *butleri* Edw. developes two generations in Poland, adult forms of the first of them appear in June and the second one in August. Willows related to *Salix aurita* L. are food plants in Poland. This insect does not occur in montaneous regions. In other European countries *E.* (*K.*) *butleri* Edw. was collected on *S. repens* aucct. Record by Cerutti (1939a) from Switzerland on the altitude 1400 m. probably concern the next species.

Remarks. Specimens from Siberia differ from the European ones by darker vertex and lighter face with more distinct white pattern, e.g. longitudinal streak on frontoclypeus almost joint with the patches at lateral frontal sutures. Drawings of abdominal apodemes and description of *E.* (*K.*) *ovalis* by Ross (1963)

allow to synonymize this species with *E.* (*K.*) *butleri* EDW. Differences in colouration emphasised by the author result from the comparison of his specimens with the drawing by WAGNER (1955). In WAGNER'S drawing, however, darkening of apical part of fore wing is just omitted. ZACHVATKIN (1953 a) only mention the name *Kybos oshanini* occidentalis for the West European populations of *E.* (*K.*) *butleri* EDW. This species is probably widely distributed in Europe but it was often confused with the next species.

Empoasca (*Kybos*) *rufescens rufescens* (MELICHAR, 1896)*

Kybos smaragdula rufescens MELICHAR, 1896
Empoasca butleri: auctt. partim, nec EDWARDS, 1908
fig. 3, 4, 345—350, 363, 364

Face. Ochraceous above, greenish below. White pattern better developed than in *E.* (*K.*) *butleri* EDW. At least inner parts of genae and often upper half of lorae, upper 1/3 of anteclypeus and distinct patches at eyes above the antennae, white. Central streak on frontoclypeus strongly broadened at base and tapering toward coronal suture. Patches at lateral frontal sutures small and these at ocelli often indistinct.

Vertex. Yellow-green or olivaceous-green, rarely with two darker patches.

Pronotum. Light yellow-green or light olivaceous-green. Three indistinct whitish patches at anterior margin, the central one being the smallest. Hind margin usually dark yellow-green. In the centre semicircular or triangular dark greyish patch, its hind part often suffused with brown. Central milky streak always present.

Scutum. Brown with central whitish streak having two distinct darker dots.

Scutellum. Brown, with a large cordiform white patch at anterior margin.

Fore wing. Light green, semitransparent. Brown pattern similar to that of *E.* (*K.*) *butleri* EDW. but stripe at hind margin of clavus narrower (fig. 4, 364), patch at the end of longitudinal *cu* cell triangular, infuscations inside 2nd and 3rd apical cells smaller and longitudinal *m* cell light in terminal part. Specimens from montaneous regions in Poland (fig. 363) are darker and the pattern of fore wing is more similar to that ot preceeding species.

Central lobe of VII abdominal sternite of the female wide, slightly longer than in *E.* (*K.*) *butleri* EDW., rounded at tip.

Length ♂ 3.90—4.50, ♀ 4.15—4.60 mm.

Male genital apparatus. Anal tube appendage arcuate, tapering in apical half, sinuated at tip (fig. 348). Pygophore appendage narrowing at apex, strongly sinuate on a long distance and provided with long and broad ledges in apical part (fig. 349). Paramere (fig. 347) with curved short apical hook and slightly

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* The note on studies of the type-series will be published in Bull. Acad. Polon. Sci., Ser. Sci. Biol., 25, 1977.

broadened slim apical part. Penis stem (fig. 345) narrowing apically, provided with numerous pappillae and teeth at sides and on ventral wall. There are long thin papillae directed horizontally, well visible in posterior view (fig. 346). Ventral sclerotization with small teeth.

Sternal apodemes (fig. 350) long and narrow; dorsal apodemes short, slightly pigmented.

Type locality. München, Bavaria, G.F.R.

Type location. Moravian Museum in Brno (Czechoslovakia).

Material studied. NE Poland: 1 ♂, 2 ♀♀, Orneta, July 9, 1952, coll. R. Bielawski. W Poland: 1 ♂, Wierzonka nr. Poznań, Apr. 15—19, 1947, coll. M. Węgrzecki. Central Poland: 4 ♂♂, 2 ♀♀, Wiązowna nr. Otwock, June 19, 1958, coll. R. Bielawski; 2 ♂♂, 2 ♀♀, Młodzawy nr. Pińczów, Aug. 14, 1954; 1 ♂, 2 ♀♀, Aug. 20, 1954, coll. S. Nowakowski; 3 ♂♂, 2 ♀♀, Krzyżanowice nr. Pińczów, July 25, 1956, coll. J. Nast. SW Poland: 2 ♀♀, Wisła nr. Cieszyn, Sep. 3, 1952, coll. J. Nast. S Poland: 1 ♀, Ojców, Aug. 11, 1946, coll. J. Nast; 2 ♂♂, 2 ♀♀, Tatra Mts. Zakopane, Oct. 8, 1965, coll. R. Bielawski; 1 ♂, Nowy Targ, June 27, 1958, coll. S. Nowakowski; ♂♂, ♀♀, Pieniny Mts., Krościenko, July, 1972, *Salix purpurea* L. and *Alnus glutinosa* (L.), coll. I. Dworakowska. SE Poland: 1 ♂, 1 ♀, East Carpathians, Ustrzyki Dolne, June 30, 1953, coll. B. Burakowski; 1 ♂, 1 ♀, Stuposiany nr. Ustrzyki Dolne, Sep. 16, 1957, coll. S. Nowakowski; ♂♂, ♀♀, Okszów, June 10, 1966; ♂♂, ♀♀, Sep. 9, 1966; 1 ♀, July 1, 1967; ♂♂, ♀♀, Sep. 12, 1967; 1 ♂, Krasnystaw, Aug. 15, 1966; ♂♂, ♀♀, Aug. 18, 1967; 1 ♀, Sep. 10, 1966; ♂♂, ♀♀, Kornie nr. Lubycza Królewska, June 16, 1966; 1 ♂, ♀♀, July 21, 1966; ♂♂, ♀♀, Hrebenne nr. Lubycza Królewska, Aug. 21, 1966; ♂♂, ♀♀, Sep. 19, 1966; 1 ♂, 1 ♀, Oct. 6, 1966; ♂♂, Lubycza Królewska, Sep. 13, 1966; 1 ♀, Zwierzyniec, July 31, 1966, all collected chiefly on *Salix purpurea* L. by I. Dworakowska. G.F.R.: 1 ♂, 4 ♀♀, Hamburg, Aug. 19, 1947, coll. J. Nast. C.S.S.R.: 1 ♂, 1 ♀, "Csemernye" nr. Vranov, Aug. 26, 1879; 1 ♂, "Pöstyén" Pieštany; 1 ♂, "Pelsöc" Plešivec, June 15, 1915, coll. Méhely. Hungary: 1 ♂, 3 ♀♀, "Mons Darabcs 589 m." nr. Budapest, Aug. 30, 1903, coll. R. Meusel; 3 ♂♂, 5 ♀♀, Rum, coll. Gyorffy; 3 ♂♂, 3 ♀♀, Rum, Aug. 14, 1909, *Salix* sp., Horváth's collection; 2 ♂♂, 1 ♀, "Budafok" Budapest, coll. Ujhelyi; 2 ♂♂, 1 ♀, Nágradveröce, Sep. 26, 1900, coll. G. Horváth; 1 ♂, 2 ♀♀, Simontornya, Oct. 8, 1891, *Salix* sp., Horváth's collection. Bulgaria: 1 ♂, Stara Planina, Kurilo nr. Sofia, Oct. 10, 1963, coll. R. Bielawski. Romania: 2 ♀♀, Campina, June 30, 1959, coll. R. Bańkowska. Yugoslavia: 1 ♂, Novi, 1898, coll. G. Horváth. Italy: ♂♂, ♀♀, Valle Lagarina, Aug. 15—18, 1958, coll. R. Linnavuori.

Distribution. Europe, known also from Mongolia, after Dlabola (1967 c) and Kazakh S.S.R., after Mitjaev (1971).

Bionomy. Two generations in Poland, the first appear in the beginning of June and the second one at the end of August. *Salix purpurea* L. is mainly the food plant but in Pieniny Mts. this species breeds also on *Alnus glutinosa* (L.). Probably in southern countries the third generation can develope. One finding in Poland in April and the other in November suggests that in favourable conditions even overwintering of adult forms is possible. *E.* (*K.*) *rufescens rufescens* (Mel.) is one of two the most eurybiotic species among all European representatives of subgenus *Kybos* Fieb.

Remarks. Probably some records of *E.* (*K.*) *butleri* Edw. from Europe concern this subspecies. Discontinuity of its range between Europe and Central Asia result from not complete exploration of this territory.

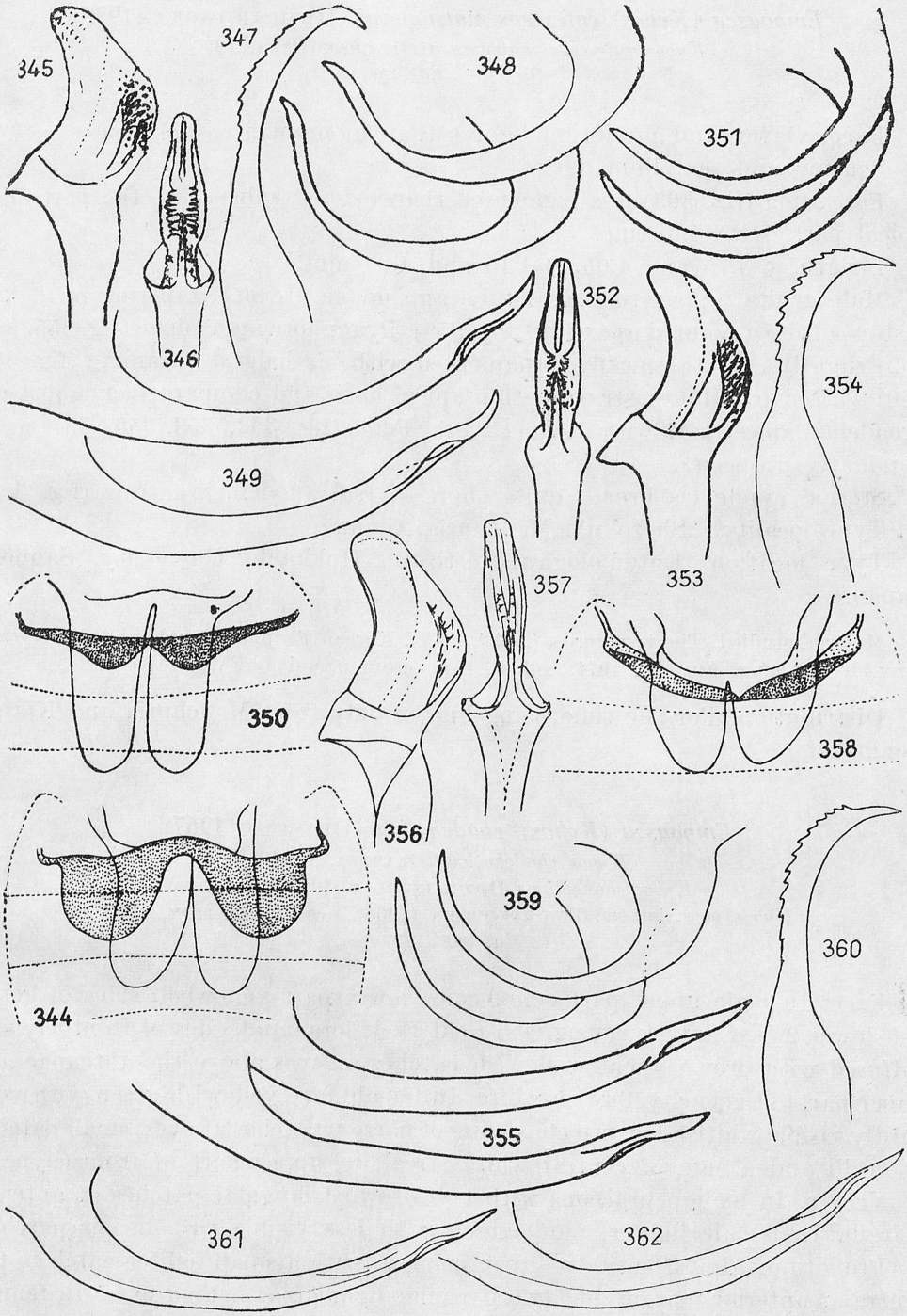

Fig. 344—362. *Empoasca* (*Kybos*) *butleri* EDW., specimen from Poland — 344; *E.* (*K.*) *rufescens rufescens* (MEL.) — 345—350; *E.* (*K.*) *r. matsumurai* (DWOR.), specimen from Manchuria — 351—355, specimen from Korea — 356—362

Empoasca (*Kybos*) *rufescens matsumurai* (Dworakowska, 1973)

Kybos rufescens matsumurai Dworakowska, 1973
fig. 351—362, 365

Face, vertex and pronotum lighter than in nominate subspecies.

Scutum and scutellum dark.

Fore wing (fig. 365) less pigmented than in west subspecies, the pattern in apical part quite indistinct.

Length ♂ 3.75 and 4.05, ♀ 4.15 and 4.20 mm.

Male genital apparatus. Anal tube appendage arcuate, tapering on a long distance from a pointed apex (fig. 351, 359). Pygophore appendage (fig. 355, 361, 362) slightly sinuate apically, ornamented with big ledges. Paramere (fig. 354, 360) with short, almost straight, thin apical hook and comparatively short not broadened apical part with distinct teeth. Penis (fig. 352, 353, 356, 357) as in nominate subspecies.

Sternal apodemes broad, quite short, dorsal apodemes narrow (fig. 358).

Type locality. „Shotoku", Manchuria, China.

Type location. Entomological Institute, Hokkaido University, Sapporo, Japan.

Material studied. The type-series (2 ♂♂, 2 ♀♀). Korean People's Republic: 2 ♀♀, Hyesan, Prov. Ryang-gang, Aug. 23, 1971, coll. S. Horvatovich and J. Papp.

Distribution. For the time being known only from Manchuria and Korean Peninsula.

Empoasca (*Kybos*) *chadchalica* (Dlabola, 1967)

Kybos chadchalicus Dlabola, 1967
Kybos mongolicus Dworakowska, 1973 syn. n.
Kybos mesasiaticus: Dworakowska (1968), nec Zachvatkin, 1953
fig. 366—377

Face. In male upper part ochraceous, lower part yellowish, sides of genae and lower 2/3 of anteclypeus green. Centres of lorae and sides of frontoclypeus suffused with brown. Small yellowish patches at eyes above the antennae and upper parts of genae, yellowish-white. In female face yellowish-green with very hardly visible whitish pattern consisting of narrow patches at eyes, small patches at ocelli and a sign of central white streak in upper part of frontoclypeus.

Vertex. In male ochraceous with two brown triangular patches at anterior margin. In female lighter, more green with less visible two darker patches.

Pronotum. Almost entirely brown in male, with a small lighter patch in the centre at anterior margin and two irregular light areas behind eyes. In female ground ochraceous with greenish tint at hind margin. Central area brown, sides lighter, three small whitish patches at anterior margin.

Scutum. In male brown, only corners lighter. In female brown, with lighter corners and whitish narrow central streak.

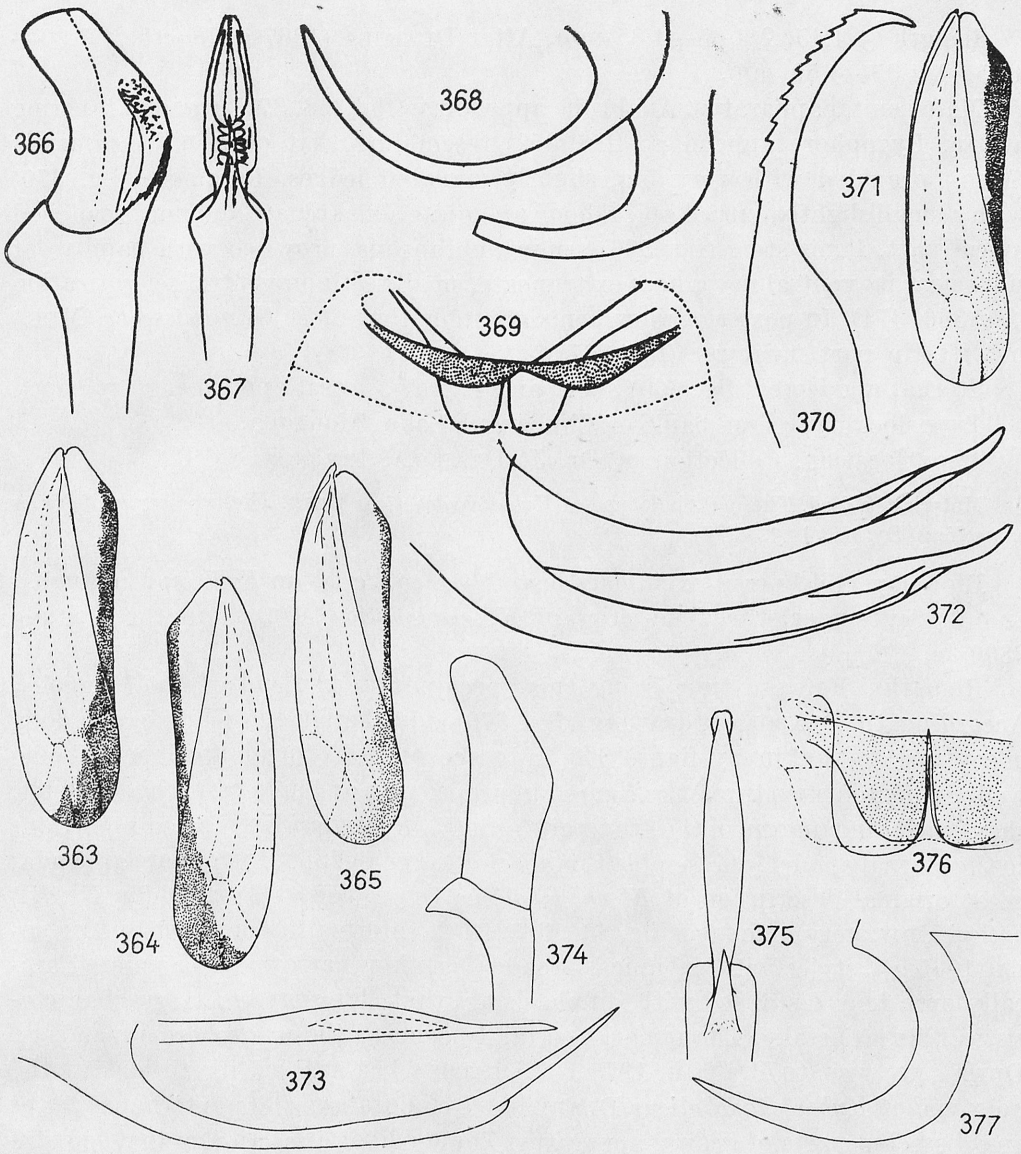

Fig. 363—377. *Empoasca* (*Kybos*) *rufescens rufescens* (MEL.), specimen from mountains in Poland — 363, specimen from lowlands in Poland — 364; *E.* (*K.*) *r. matsumurai* (DWOR.), female — 365; *E.* (*K.*) *chadchalica* (DLAB.), specimen from Polish collection — 366—372, 371 — female; after DLABOLA (1967), modified — 373—377

Scutellum. Brown in male, with corners and central part lighter. In female brown at sides, yellowish or whitish in the centre.

Fore wing. Light emerald-green, semivitreous. A wide brown streak at hind margin of clavus. Apical part with no distinct pattern, only slightly smoked (fig. 371).

Central lobe of VII abdominal sternite of female very short, truncate and with no visible incision at hind margin.

Length ♂ 4.45, ♀ 4.65—4.85 mm. After DLABOLA (1967 a) length ♂ 3.90—4.05, ♀ 4.35—4.50 mm.

Male genital apparatus. Anal tube appendage (fig. 368, 377) arcuate, tapering at tip. Pygophore appendage (fig. 372) resembling that of *E.* (*K.*) *rufescens* (MEL.) provided with very big, slightly sinuated ledges. Paramere (fig. 370) with a small slightly curved apical hook and quite slim arcuate and not broadened apical part. Penis stem (fig. 366) semimembraneous, provided with papillae at sides near its ventral margin, apex truncate, small teeth on ventral sclerotization (fig. 366, 374). In posterior view penis resemble that of *E.* (*K.*) *rufescens* (MEL.) but its tip part narrower (fig. 367).

Sternal apodemes (fig. 369) short and narrow, dorsal apodemes very short.

Type locality. West bank of Chubsugul Lake, Mongolia.

Type location. Collection of Dr. J. DLABOLA, Praha, Č.S.S.R.

Material studied. The male holotype of *Kybos chadchalicus* DLAB. The type-series of *Kybos mongolicus* DWOR. (1 ♂, 4 ♀♀).

Bionomy. All known exemplars have been collected on *Salix* sp. in August and in September, the type-series of *K. chadchalicus* DLAB. on the altitude 2800 m.

Remarks. For the time being this species is known only from Mongolia. According to DLABOLA's drawing (fig. 376) dorsal apodemes broad and long in contrast to that in my figure 369. If to accept that dorsal apodemes (being well pigmented structures) are figured in proper proportion in respect to tergites, they reach hind margin of the 4th tergite as in *E.* (*K.*) *butleri* EDW. also proportions to the sternal apodemes resemble this species — see fig. 388. Pygophore appendage at original description of *K. chadchalicus* DLAB. (fig. 373) resemble *E.* (*K.*) *butleri* EDW. very much (see fig. 334, 335, 343). Information in paper by DLABOLA (1967 a) „styles with subapical broadening, then narrowed and pointed apically on a long distance" with emphasising that this shape is „very characteristical" is a mistake. The remarks certainly concern the pygophore appendage. During my visit to Praha in 1973 Dr. DLABOLA has enabled me to look at the holotype of *Kybos chadchalicus* DLAB. and I could observe its external features and dissected parts of genital apparatus. The mode of dissection of male genital apparatus by Dr. DLABOLA is to put dry abdomen into a drop of water and divide it to the parts using pins. Certain details are then figured and at last all of them are glued on a card. Such a kind of preparation of the material has made me difficult to carry out any effective examination. Besides, Dr. DLABOLA does not borrow type material for study. Thus, for the time being, only data given at the original description can be taken under consideration. As result from the original DLABOLA's drawings, illustration of *Kybos chadchalicus* is composed of details of two species: abdominal apodemes and pygophore appendage belong to *E.* (*K.*) *butleri* EDW. and penis to the other species, being very probably identic with *Kybos mongolicus* DWOR. Shape of anal tube appendage is too artifical to belong it to any species. It is quite possible that among 22 exemplars of

the type-series of *Kybos chadchalicus* DLAB. also some other species exist. The synonymy is based on the colouration of the holotypes of both „species" having very characteristical broad brown band at hind margin of clavus and only slightly smoked apical part of fore wing.

Empoasca (*Kybos*) *soosi* sp. n.

fig. 378—389

Specimens at my disposal have lost their natural colouration.

Face. Testaceous. Whitish pattern consists of a narrow streaks along anterior margin of vertex just above or at ocelli, distinct broad streaks at margins of eyes, small oblique patches at lateral frontal sutures, longitudinal stripe in the middle line of frontoclypeus (much narrower on frons), upper 1/3 of anteclypeus, inner parts of genae and upper half of lorae.

Vertex. Testaceous with olivaceous-brown subangular marks at its anterior margin.

Pronotum. Testaceous, more olivaceous in the centre. Whitish markings rarely visible, there are three small patches at anterior margin.

Scutum. Brownish, in the centre quite narrow white longitudinal streak. Basal triangles olivaceous.

Scutellum. Olivaceous-brown with a small white patch in the centre at anterior margin and two very small light patches at sides.

Fore wing. Light olivaceous, hind margin slightly smoked, clavus dull. Apices of apical cells slightly infuscated, the 1st apical cell the darkest.

Central lobe of VII female sternite quite short and broad, slightly incised in the middle.

Length ♂ 3.60—4.00, ♀ 4.00—4.20 mm.

Male genital apparatus. Anal tube appendage (fig. 383, 384) arcuate long, tapering. Pygophore appendage (fig. 385—387) with strongly twisted broad ledges, tapering apically at about 1/5 from tip. Paramere (fig. 388, 389) with apical part almost equally broad on whole of its length, distinct serration and almost straight apical hook. Penis stem slightly swollen (fig. 380, 381), strongly broadened at about middle of its length (fig. 378, 379) with very well developed papillous ornamentation and ventral sclerotization provided with small teeth.

Sternal and dorsal apodemes well developed (fig. 382).

Holotype male: Korean People's Republic, Pyongyan, Hotel garden, Sep. 6—7. Paratypes: same locality, 2 ♀♀, Aug. 4—5; 1 ♂, 1 ♀, Aug. 5—6; 1 ♂, Aug. 7—8; 1 ♀, Aug. 12; 1 ♂, Sep. 1; 2 ♂♂, Sep. 2; 2 ♂♂, Sep. 3. All collected in 1971 by S. HORVATOVICH and J. PAPP.

The holotype and majority of the paratypes are kept at the Hungarian Natural History Museum in Budapest, some paratypes at the Institute of Systematic and Experimental Zoology, Polish Academy of Sciences in Kraków.

The new species is named in honour of Dr. Árpad Soós, the chief of the Department of Entomology, Hungarian Natural History Museum in Budapest.

Empoasca (*Kybos*) *sordidula* Ossiannilsson, 1941

Empoasca sordidula Ossiannilsson, 1941
Empoasca (*Kybos*) *alaskana* Ross, 1963 syn. n.
fig. 17, 18, 390—398

Face. In male frontoclypeus brown. Upper part of anteclypeus, upper parts of lorae and genae, brownish. Lower parts of anteclypeus green-olivaceous. Frons olivaceous-brown. Large areas at eyes and patches above the antennae yellowish-white. Light patches at ocelli. Face of female resembles that of light coloured specimens of *E.* (*K.*) *butleri* Edw., its upper 4/5 yellowish with olivaceous tint. Anteclypeus and lower parts of lorae greenish. Whitish are: small patches at eyes, patches at lateral frontal sutures and a short narrow central streak in upper part of frontoclypeus.

Vertex. Olivaceous in male, coronal suture bordered olivaceous-green. Large olivaceous-green patches at eyes. Vertex in female light olivaceous-green with a narrow whitish bordering of coronal suture.

Pronotum. In male olive-green with more green hind corners and large brown patch in the centre and at hind margin. Three white patches at anterior margin, the central one the smallest, two lateral ones large. Pronotum of female yellow-olivaceous with darkening in the centre and three small whitish patches at anterior margin.

Scutum. In male suffused with brown, basal triangles brown, central part white-yellowish. In female scutum olivaceous-yellow, anterior angles and central part yellowish or whitish.

Scutellum. In male brownish in hind part, at anterior margin a large broad ivory patch. In female scutellum olive-yellowish with similar white patch.

Fore wing. Grey-greenish in male, semitransparent. In hind part especially on clavus suffused with brown. In female fore wing light greenish, semitransparent in hind part, slightly more yellowish on clavus.

Central lobe of VII abdominal sternite of female slightly produced caudad, resembling that of *E.* (*K.*) *populi* Edw.

Length ♂ 4.00—4.20, ♀ 4.40—4.80 mm.

Male genital apparatus. Anal tube appendage (fig. 393, 394) arcuate, thin in basal half, its apex quite thick. Pygophore appendage (fig. 397, 398) thin almost straight, sinuate in apical half, ledges not well developed. Paramere (fig. 395, 396) with big apical hook. Apical part of paramere almost straight, not broadened. Penis stem (fig. 390, 391) pigmented, only slightly compressed laterally in lower part, provided with small papillae on ventral side and with numerous small folds in apical part. Ventral sclerotization with a wide base.

Sternal apodemes well developed, narrowing apically, dorsal apodemes broad, quite long (fig. 392). Both pairs of apodemes well pigmented, sternal apodemes lighter.

Type locality. Frösö, Jämtland, Sweden.

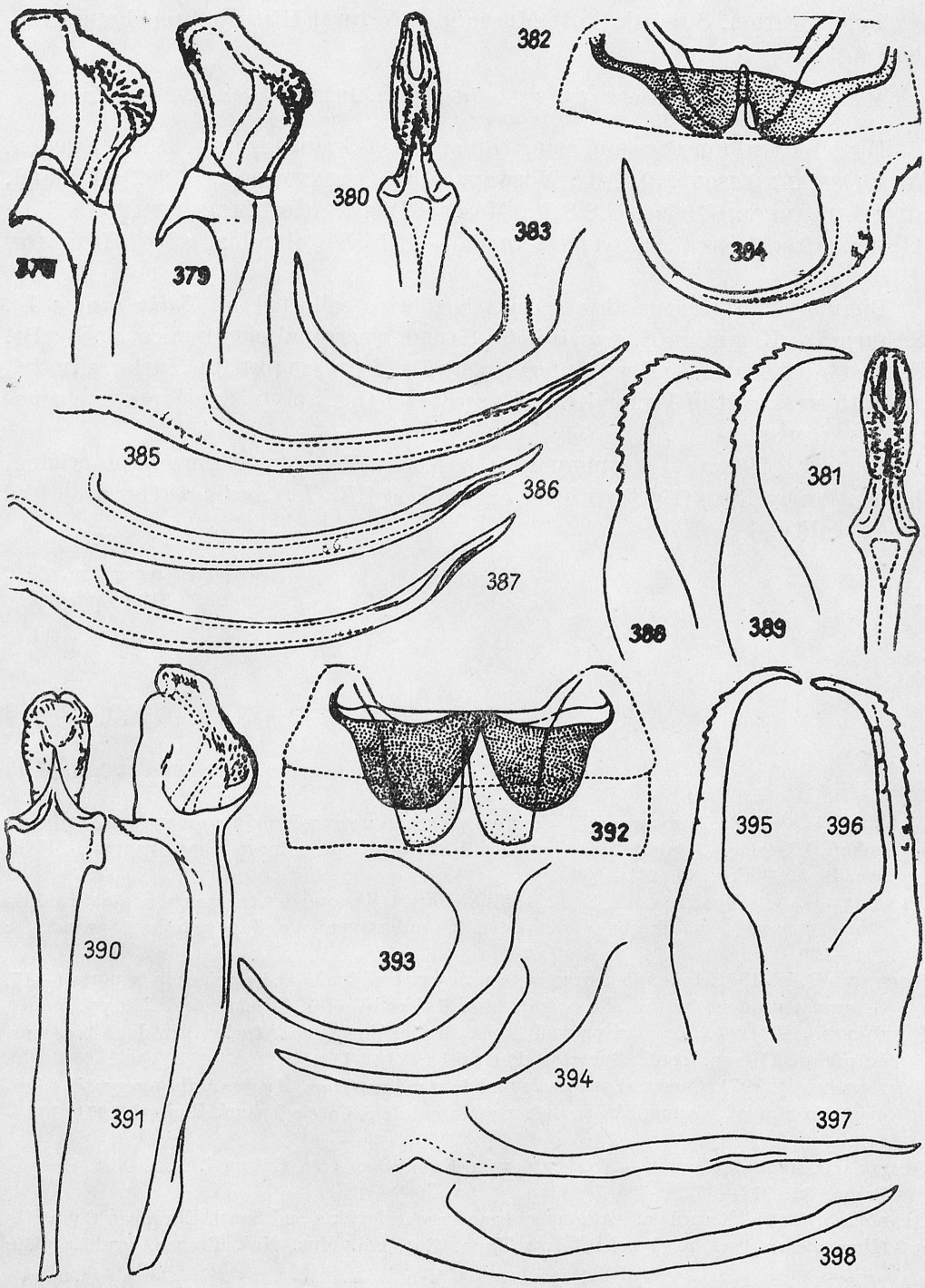

Fig. 378—398. *Empoasca* (*Kybos*) *soosi* sp. n. — 378—389; *E.* (*K.*) *sordidula* Oss. — 390—398

Type location. Swedish State Museum of Natural History, Stockholm, Sweden.

Material studied. Sweden: 2 ♂♂, 2 ♀♀, Frösö, Aug. 16, 1942, coll. F. Ossiannilsson.

Distribution. For the time being this species is known from southern Sweden, after Ossiannilsson (1941 d); Norway, after Ossiannilsson (1962); Finland, after Lillavuori (1969); U.S.S.R., Moscow Distr., after Zachvatkin (1953 a); Alaska, after Ross (1963) and Canada — British Columbia, after Hamilton (1972).

Bionomy. In Europe this species has been collected on *Salix caprea* L., *S. purpurea* L. and on *S. myrsinifolia* Salisb. (personal communication by Dr. F. Ossiannilsson). As I was informed by Dr. Linnavuori, in Turku situated in south-west part of Finland *E.* (*K.*) *sordidula* Oss. maybe developes two generations a year.

Remarks. The above synonymy is based on the comparison of the original description by Ross (1963) with the exemplars of *E.* (*K.*) *sordidula* Oss. from the type locality.

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STRESZCZENIE

Przegląd 35 gatunków podrodzaju *Kybos* Fieb. występujących w Palearktyce. Podane są ilustracje cech taksonomicznych i uwagi o wzajemnym pokrewieństwie, rozmieszczeniu i biologii poszczególnych gatunków. Rozważane są przypuszczalne drogi rozprzestrzeniania się tej grupy na Półkuli Północnej od Trzeciorzędu do chwili obecnej.

Opisywany jest *Empoasca* (*Kybos*) *soosi* sp. n. z Koreańskiej Republiki Ludowo-Demokratycznej i wprowadzane są następujące zmiany taksonomiczne: *Kybos oshanini occidentalis* Zaphw., 1953 i *Empoasca* (*Kybos*) *ovalis* Ross, 1963 to synonimy *E.* (*K.*) *butleri* Edw. 1908; *Kybos studzinskii* Dwor., 1973 synonimem *E.* (*K.*) *calyculus* Cer., 1939; *Kybos mongolicus* Dwor., 1973 synonimem *Kybos chadchalicus* Dlab., 1967; *Kybos altaicus* Mitj., 1963 synonimem *Empoasca perplexa* Rib., 1952; *Kybos cracoviensis* Dwor., 1973 synonimem *Empoasca mucronata* Rib., 1933; *Kybos populi tremulae* Zachv., 1953 i *Kybos zaisanensis* Mitj., 1968 są synonimami *Empoasca* (*Kybos*) *populi* Edw. a *Empoasca* (*K.*) *alaskana* Ross, 1963 rozpoznany jest jako synonim *E.* (*K.*) *sordidula* Oss., 1941. *Empoasca* (*Kybos*) *mitjaevi* nom. n. wprowadza się na miejsce *Kybos montanus* Mitj., 1971 nec *Empoasca montana* Caldwell, 1952.

РЕЗЮМЕ

Обзор 35 видов подрода *Kybos* Fieb. известных из Палеарктики, приводятся рисунки и заметки по их систематическим взаимноотношениям, распространении и биологических признаках. Рассмаривается возможные пути развития этой группы на всем северном полушаре Земли. Описывается *Empoasca* (*K.*) *soosi* sp. n. из Кореанской Народной Республики и приводятся следующие таксономические смены: *Kybos oshanini occidentalis* Zachv., 1953, и *Empoasca* (*K.*) *ovalis* Ross, 1963, считаются синонимами *E.* (*K.*) *butleri* Edw., 1908, *Kybos studzinskii* Dwor., 1973 считается синонимом *E.* (*K.*) *calyculus* Cer., 1939, *Kybos mongolicus* Dwor., 1973 синонимом *Kybos chadchalicus* Dlab., 1967, *Kybos altaicus* Mitj., 1963 синонимсм *Empoasca perplexa* Rib., 1952; *Kybos cracoviensis* Dwor., 1973 синонимом *Empoasca mucronata* Rib., 1933; *E.* (*K.*) *alaskana* Ross, 1963 синонимом *E.* (*K.*) *sordidula* Oss., 1941. *Empoasca* (*Kybos*) *mitjaevi* nom. n. формируется для *Kybos montanus* Mitj., 1971, nec *Empoasca montana* Caldwell, 1952.

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