A REVISION OF THE NEW WORLD SPECIES OF RICINUS (MALLOPHAGA) OCCURRING ON PASSERIFORMES (AVES)

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BERNARD C. NELSON

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INTRODUCTION

SPECIES of the genus *Ricinus* (suborder Amblycera: Ricinidae) are the largest Mallophaga found on the avian order Passeriformes. Statements in the literature shroud *Ricinus* with unusual atributes. Clay (1957) stated that species of *Riciuns* feed exclusively on blood, whereas most bird lice are thought to feed on feathers. According to Hopkins (1942) *Ricinus* has an anomalous distribution occurring on approximately one-third of the seventy families of Passeriformes. Usually a genus of Mallophaga is restricted to a narrow range of hosts, a genus or a few related genera or families, or is distributed more uniformly throughout an order or orders of birds where there is a wide host distribution. Carriker (1903, 1964) has described two species of *Ricinus* from the same host, and several workers have recorded two species from the same host. Although this is not unique among Mallophaga, it is uncommon. Several instances are reported of a species of *Ricinus* found on several host species. Although lice are usually thought of as being highly host-specific, it is not uncommon for one species of lice to be distributed on several related species of host (Clay, 1949*b;* Keler, 1958). One species distributed on hosts in unrelated families, as in the records of Kellogg (1896*a*, 1899), is highly unusual. Both Kellogg (1899) and Carriker (1964) have expressed concern over the distribution of *Ricinus*. Kellogg (1899) went so far as to question his ability to characterize and distinguish species.

As no revision or analysis of the distribution has appeared, I decided to revise the species of *Ricinus* occurring in the New World (see below) to determine the number and distribution of the species and to present keys for their identification. Since it has been postulated that Mallophaga can be used as an aid in classifying their hosts (Hopkins, 1942, 1949), the distribution of *Ricinus* will be analyzed to see to what extent it can be used to help settle problems of host phylogeny and classification.

Simultaneously with the commencement of this study, Dr. Goetz Rheinwald in Germany started his study on the revision of *Ricinus*. We agreed through correspondence that he would concentrate on the species in the Old World and I would concentrate on those in the New World. Correspondence was exchanged on the status of types and other information where it was pertinent to the other's work. Rheinwald's work was published in 1968. Since our results were attained independently, I refer to Rheinwald's work only when the nomenclatorial issues affect the status of New World species, and make limited comparisons regarding biology and distribution.

BIOLOGY OF RICINUS

Little is known about the biology of *Ricinus*. Attempts to obtain biological data have been largely unsuccessful because living specimens of *Ricinus* were not readily available. Limited information on the biology of *Ricinus* is available from the liter-

ature and from my investigations. Although incomplete, these observations allow a better understanding of the speciation and distribution of *Ricinus* and should aid future research into the biology and vector potential of *Ricinus*.

Life cycle.—The life cycle of species of *Ricinus* is similar to that of other Mallophaga, and consists of an egg stage, three nymphal instars, and the adult male and female. Baum (1968) has worked out the duration for each stage in *Ricinus ernstlangi* (now *R. elongatus*) by infesting parasite-free, caged birds and observing the development of lice every 12 hours. He reported that females lay one egg every 3.5 days, and average 12.5 eggs during their lifetime. The range or maximum number of eggs was not given. Egg development lasted 9 days; the nymphal development lasted 9, 9, and 12 days, respectively. Males appeared two days earlier than females. The maximum age of marked females was 54 days. Baum concluded that the life expectancy of females was on the order of 100 days, whereas that of males was about 76 days.

Sex ratio.—Eichler (1953) and Carriker (1964) both indicated that males of *Ricinus* were rare. Carriker stated that only 15 specimens were present in his collection. Eichler reported a male-to-female ratio from *Ricinus* (no species indicated) of 1 to 11 in the unpublished collection records of Pfleger. Baum (1968) reported a 1 to 9.47 ratio for *R. ernstlangi* (now *R. elongatus*). Although Eichler (1963) concluded that these figures point to the likelihood of a contingent parthenogenesis, other explanations for the unbalanced sex ratio seem more probable. Since specimens of *Ricinus* are difficult to detect except by a careful feather-by-feather search or by the washing technique reported below, the smaller males might easily be overlooked. Rothschild and Clay (1952) speculated that the unbalanced sex ratio in Mallophaga could result from differential mortality between the sexes. Indeed, Baum (1968) found that females of *R. elongatus* lived approximately 25 days longer than males. Since parthenogenesis is rare among Mallophaga (Rothschild and Clay, 1952) the latter explanations probably account for the observed unbalanced sex ratio.

Intensity of infestation.—Specimens of *Ricinus* are considered rare by Mjöberg (1910), Eichler (1953), and Carriker (1964). Carriker stated that only once had he taken more than one specimen from one bird. However, he collected birds for ornithological study and his collecting techniques for Mallophaga were probably superficial. I seldom found just a single specimen present on any one bird, and rarely are there more than 12 to 15 specimens on one bird. Rothschild and Clay (1952) found similar intensities of infestation, but did report 127 specimens from a bird with an injured beak. Baum (1968) recorded a maximum of 26 specimens, and Rheinwald (1968) and Emerson (pers. comm.) each collected 35 specimens from a single bird.

Rate of incidence.—Data on rates of incidence are scarce. Ash (1960) found in England a 61 percent incidence (105 of 172) of *Ricinus rubeculae* on *Erithacus rubecula;* a 43 percent incidence (106 of 249) of *R. irascens* on *Fringilla coelebs;* a 1.4 percent incidence (10 of 704) of *Ricinus* sp. on *Parus caeruleus;* 0.6 percent incidence (no numbers given) of *Ricinus* sp. on *Parus major;* and 6 percent incidence (no numbers given) of *R. elongatus* on *Turdus merula.* Ash also reported 1 of 79 Rock Pipits infested by *R. japonicus* in Sweden. Negru (1965) reported a 10.8 percent incidence of *R. phoenicuri* on *Phoenicurus ochruros* in Romania.

Foster (1969*a*) used the presence of egg cases to determine the rate of incidence of *R. picturatus* on museum study skins of *Vermivora celata.* She found 384 of 2,205 (19 percent) birds with egg cases. The rate of incidence of *Ricinus* on birds I have collected in California was less than 10 percent in groups of 20 or more birds. Although others have obtained specimens from these hosts, I have not collected *Ricinus* from *Turdus migratorius* or *Pipilo fuscus.* More than 50 specimens of each have been carefully examined. I have found only two specimens of *R. microcephalus* from more than 100 specimens of *Carpodacus mexicanus.* Figures for other hosts are similar: 3 positive out of 6 *Spizella passerina* examined; 3 positive out of 15 *Junco oreganus;* and 3 positive out of 24 *Zonotrichia atricapilla.* These data indicate that there is a contagious distribution (definition after Southwood, 1966) for various *Ricinus* spp. Baum (1968) found that the presence or absence and degree of incidence of lice, including *R. elongatus,* varied among the several local populations of *Turdus merula* that he investigated. The factor or factors that determine the observed contagious distribution of *Ricinus* spp. are not apparent.

Seasonal abundance.—Recent work has shown that there is a seasonal abundance in species of *Ricinus.* Ash (1960), who examined birds on a year-round basis, found that specimens of *Ricinus* spp. were present almost exclusively in the months of December through March with an increase prior to the hosts' breeding season. Rheinwald (1968) found a seasonal peak in the number of specimens of *R. fringillae* in March through May, the beginning of the breeding season of the hosts.

Foster (1969*b*) used the presence of unhatched eggs of *R. picturatus* on museum study skins of *Vermivora celata* as an indication of seasonal occurrence. Eggs were most abundant during the breeding season of the host and least abundant following the postnuptial molt. A few eggs were found in the autumn. Foster speculated that these data indicate a correlation between the breeding cycles of the louse and the host synchronized by the production of reproductive hormones of the host. Her evidence for this was circumstantial, but based on the following observations:

1. The timing of breeding in *R. picturatus* coincides with the timing of breeding in the subspecies of host. Peaks in the number of louse eggs differed by two to three weeks when the peak breeding time of two subspecies of host differed by two to three weeks.

2. No eggs were laid during the molt.

3. No eggs were found on juvenal birds, which do not produce great quantities of reproductive hormones.

4. Peak breeding in louse populations coincides with peak production of reproductive hormones.

5. Limited egg laying in late autumn may coincide with some reproductive behavior that frequently occurs at this time.

6. *Philopterus* sp., also found on this host, does not feed on blood and hence its life cycle shows little co-ordination with that of its host. Foster concluded that synchronization of the life cycles ensures a large population of lice to infest the offspring of the host.

Baum (1968) studied the life cycle of *R. elongatus* by examining dead, living, and recaptured banded specimens of *Turdus merula* for lice throughout the year over a three-year period. He found that the number of eggs and specimens of *R.*

elongatus followed a seasonal trend corresponding to that observed by Ash, Rheinwald, and Foster. However, his interpretation of the events differed from that of Foster (1969*b*). Baum concluded that large density fluctuations in spring and late summer are due exclusively to the breeding and molting periods. The breeding period has a modifying character that allows the exchange of lice between paired individuals. This results in an increase in the rate of incidence and intensity of infestation. The molting period has a drastic eliminating effect on the number of eggs, nymphs, and adults. After the postnuptial molt the population, which is at a low level, begins to build up, at first slowly, then faster, to reach its peak again before the next postnuptial molt. Baum stated that *R. elongatus* lags considerably behind other lice in its abundance values because of its large size and small microhabitat on the host. Presumably the preening efficiency of the host delays the increase in *Ricinus*.

Further investigations are necessary to determine which of these factors are responsible for seasonal abundance: dependency upon the host's hormones or the innate capacity for increase of the lice versus the preening efficiency of the host.

Sites of oviposition.—The large and identifiable eggs of *Ricinus* are attached to feathers in the gular area, jugulum, upper breast, sides of neck, and interscapular regions of the host (Foster, 1969*a*; Baum, 1968; and personal observations). The latter two regions appear to be used only when infestation is heavy. Usually eggs are found attached singly to the underside of the rachis of feathers in the regions listed above, although Eichler (1953) and Ash (1960) reported occurrences of two to eight eggs per feather in heavy infestations. Foster (1969*a*) found as many as six eggs on one feather, three on either side of the shaft.

Studies have not been made on competition for oviposition sites among lice. Apparently species in different genera of lice occurring on the same host avoid competition. I have observed that species of *Philopterus* and *Menacanthus* oviposit on the chin, gular area, and auricular feathers as well as the feathers on which *Ricinus* oviposit. When *Philopterus* and *Ricinus* occur on the same host, *Philopterus* eggs are not found below the gular region and *Ricinus* eggs are not found above it. Eggs of both species are present in the narrow zone across the lower gular or upper jugular region.

It would appear from these observations that there are "preferred" oviposition sites for various genera of lice within the areas on the host where preening is relatively ineffective.

Dispersion on the host.—Species of *Ricinus* are found on the body of their hosts, as opposed to the wings, tail, or head (Peters, 1928; Ash, 1960). Eichler (1953), Ash (1960), and Baum (1968) found specimens more often on the neck region. I found that *Ricinus* specimens tend to wander about the body, following the apterial regions of the neck, sides, and back. Movements of *Ricinus* have been reported to be slow (Piaget, 1880; Mjöberg, 1910), but it is my impression that they move faster than ischnocerans although slower than other amblycerans such as *Menacanthus*. *Ricinus* specimens appear to slide sideways between feathers when disturbed. This maneuver seems to have an advantage in avoiding the host's preening. Preferred sites for feeding, copulation, and resting are unknown.

Synoxenic distribution.—The presence of more than one species of the same genus on one host species has been termed synoxenia by Wenzel et al. (1966). Two

TABLE 1

SPECIES AND HOST ASSOCIATIONS OF SYNOXENIC SPECIES OF RICINUS

Synoxenic species of *Ricinus*	Families and genera of hosts with synoxenic species of *Ricinus*
arcuatus *marginatus*	Tyrannidae: *Tyrannus* *Muscivora*
leptosomus *marginatus*	Tyrannidae: *Myiarchus* *Myiozetetes*
sucinaceus *marginatus*	Tyrannidae: *Empidonax* *Sayornis*
invadens *pessimalis*	Pipridae: *Pipra* *Chiroxiphia*
fringillae *diffusus*	Fringillidae: Emberizinae: *Junco* *Spizella* *Zonotrichia* *Passerella* *Melospiza*
fringillae *subdiffusus*	Fringillidae: Emberizinae: *Amphispiza* *Spizella*
fringillae *subhastatus*	Fringillidae: Emberizinae: *Pipilo*
fringillae *thoracicus*	Fringillidae: Emberizinae: *Plectrophenax*

species of *Ricinus* are known to occur on the same host species in the families Tyrannidae, Pipridae, and Fringillidae, subfamily Emberizinae (table 1). One of the pair of synoxenic species of *Ricinus* belongs to a species group characterized by having dimorphic mandibles, whereas the other group has monomorphic mandibles. One or both species of a synoxenic pair has a polyxenic distribution, i.e., parasitizes several species of hosts (Sandground, 1929). The distribution of the synoxenic species does not follow any geographical or taxonomic pattern within the range of their host. Both members of synoxenic pairs of species of *Ricinus* have been collected from common localities and once from the same bird. Dr. Clay (*in litt.*) verified as fact that specimens of *R. fringillae* and *R. subhastatus* were taken from a single specimen of *Pipilo fuscus* from Arizona in 1939 by R. Meinertzhagen. Two males, one female, and one nymph of *R. marginatus* and one male of *R. arcuatus* were collected from *Tyrannus tyrannus* from North Dakota on July 19, 1929, by W. G. Bruce. The two species are mounted on separate slides and the labels do not indicate whether these specimens came from the same bird or two different birds.

I have collected three male Chipping Sparrows, *Spizella passerina*, 100 meters from each other at Hopland Field Station, Mendocino County, California, on

March 23, 1965. Two of these hosts were infested with *R. subdiffusus* n. sp. and the other with *R. fringillae*. A third species, *R. diffusus*, has been collected from *S. passerina* in Ohio and Washington, D.C. Since the occurrence of three species of the same genus on one host species is very rare in Mallophaga, I suspect the specimens of *diffusus* may be contaminants. It is, however, possible that *diffusus* replaces *subdiffusus* on Chipping Sparrows in the eastern United States. *R. subdiffusus* is currently known only from hosts collected in the western states of Arizona, California, and Utah. Further collection from *S. passerina* should clarify this situation. Slides of *R. diffusus* and *R. australis* from *Passerulus sandwichensis* and *Passerina amoena* collected in Nebraska in 1901 by M. A. Carriker, Jr., appear to have been mislabeled; *diffusus* does not occur on *P. amoena*, and *australis* is not found on *P. sandwichensis*.

Blood-feeding.—Blood-feeding in Mallophaga has been noted by earlier workers: DeGeer (1778), Denny (1842), Rudow (1870), and Nitzsch (in Giebel, 1874). However, Piaget (1880) found no evidence of blood-feeding in Mallophaga. According to Hopkins (1949) many of Piaget's specimens were obtained from skins of birds and mammals preserved in museums. A possible explanation for his negative findings may be that the last meal of the lice was digested and eliminated. All specimens of *Ricinus* that I have obtained from museum skins have intestines devoid of any material. Kellogg (1896*a*) thought that lice obtained blood only from dried clots around wounds rather than from actively piercing the skin of hosts. Authors of textbooks generally have reiterated the views of Piaget and Kellogg regarding blood-feeding in Mallophaga.

Several workers have observed red blood cells in the crops of lice (Crutchfield and Hixson, 1943; Kartman, 1949; Boyd, 1951; Blagoveshtchensky, 1959; Nelson, 1962). Wilson (1934) observed *Menachanthus stramineus* piercing the skin at the base of chicken feathers and feeding on blood. Dubinin (1947) found that *Piagetiella* sp., which lives in the pouch of pelicans, feeds on blood. He also observed the wounds made by these lice inside the pouch, and demonstrated that they would pierce the human skin and feed. Kalamarz (1963) detected blood in the crops of *M. stramineus* and *Menopon gallinae* by refined techniques. Employing the Teichmann method which is used in criminology as a positive test for blood, he observed hemoglobin crystals, indicating the presence of blood. Furthermore, he administered the isotope Fe^{59} to the host chicken and then examined five species of lice found on the hen for radioactivity by the contact autoradiographic method. He detected radioactive blood in the crops of *M. stramineus* and *Mn. gallinae*, but did not find radioactivity in the three species of Ischnocera which feed on feathers. Blagoveshtchensky (1959) has concluded that blood is part of the regular diet of lice of the suborder Amblycera.

Clay (1957) stated that *Ricinus* feed exclusively on blood and serum. Evidence for this statement is that red blood cells have been found in the dissected crops repeatedly by DeGeer (1778), Mjöberg (1910), Strindberg (1917), Blagoveshtchensky (1949, 1959), and Ash (1960). Feathers have never been found in the crops of *Ricinus* (Nitzsch, in Giebel, 1874; Blagoveshtchensky, 1949, 1959; personal observations).

I found a nymph of an acarine, *Syringophilus* sp., in one specimen of *R. marginatus* from *Tyrannus vociferans* (VLK 2267). This suggests that *Ricinus* may obtain food either as a predator of other ectoparasites or as a scavenger on cast skins. Rothschild and Clay (1952) reported that cast skins and parts of mites and other lice have been found in the crops of lice. By far the most common substance in the guts of *Ricinus* spp. is the red material presumed to be blood. This material was analyzed by the benzidine test which is used in criminology to detect blood (O'Hara and Osterburg, 1952). Nymphs of *R. fringillae* from *Pipilo erythrophthalmus* were tested and gave positive results. To determine the effect of the hemocytes and salivary secretions of lice upon this test, specimens of *Picicola snodgrassi*, an exclusive feather eater, were tested. The test for blood proved negative. Although the benzidine test is not specific for blood, it appears that *Ricinus* does not come into contact with any of the materials that would give false positives. This strongly suggests that the red substance is indeed blood. Both Clay (1949*a*) and Mjöberg (1910) demonstrated that species of *Ricinus* have piercing mandibles. Mjöberg described the arrangement of the pharyngeal muscles as modified for sucking. The observations of the gut contents and the anatomy of the mouthparts strongly suggest that *Ricinus* feeds on blood. Definitive evidence in the form of repeated observations of *Ricinus* spp. actually feeding on blood are necessary to place this contention beyond doubt.

Economic Importance

In the opinion of Rothschild and Clay (1952), the fact that Mallophaga have not been convicted as effective carriers of disease is a reflection of the small amount known about their biology compared with that of sucking lice and fleas. Mallophaga are considered economically important when they reach high population levels on domestic animals (Matthysse, 1946) and poultry (Kartman, 1949), although some of the data for poultry are conflicting (Warren et al., 1948; Edgar and King, 1950; Stockdale and Raun, 1960). Massive propagation of lice is usually accompanied by deterioration in the state of the host. However, reduction or cessation of grooming or preening by the host resulting from disease (Baum, 1968) or poor nutrition (Kartman, 1949; Utech et al., 1969) is the major factor that allows the increase of lice.

Some species of Mallophaga are vectors of helminths, and can harbor other pathogens. *Trichodectes canis* (DeGeer) has been incriminated as an intermediate host of the cestode *Dipylidium caninum*. The life cycles of two filarial worms involve Mallophaga as an intermediate host. Both Dutton (1905) and G. S. Nelson (1962) observed the development of *Eufilaria cypseli*, a parasite of African swifts, in *Dennyus* sp. Nelson, and Pennington and Phelps (1969) noted the development of *Dipetalonema reconditum* in *Heterodoxus spiniger*. Nelson speculated that other filarial worms of birds and mammals may have Mallophaga as intermediate hosts.

The virus of eastern equine encephalomyelitis has been isolated from *Menacanthus stramineus* by Hewitt et al. (1948), and has been reported from *Menopon gallinae* by Olitsky and Casals (1959). Bedsonia organisms have been isolated from *Mn. gallinae* (Eddie et al., 1962). Isolation of viruses and Bedsoniae does not necesarily indicate transmission. Currently no definite statement can be made that lice can or cannot transmit these agents. More knowledge of the biology of lice is necessary to determine if they are effective vectors or act only as mechanical or temporary receptacles for these agents.

To my knowledge *Ricinus* has not been investigated as a potential vector. Since members of this genus feed upon blood, *Ricinus* would be a prime suspect.

HISTORY

Clay and Hopkins (1950) stated that "No group of insects has suffered so much at the hands of authors who were ignorant of, or careless about, the Rules of Nomenclature as have Mallophaga." Although no formal set of rules was adopted internationally until 1901, certain personal codes had been formulated, one as early as 1751 by Linnaeus (Mayr et al., 1953). However, these codes were not universally accepted. On the contrary, acceptance of authoritarian decisions prevailed even when these were contrary to the codes. Nitzsch (1818) rejected nearly all previously published names of Mallophaga and replaced them with his own names, which were adopted by most of the nineteenth-century taxonomists. Likewise Piaget (1880) rejected the work of certain authors because he considered it to be inferior. Denny's work (1842) received particularly harsh treatment from Piaget. Unfortunately, Kellogg (1908) and others accepted Piaget as the final authority on nomenclatorial matters.

Additional confusion in mallophagan systematics has often resulted from inadequate descriptions and illustrations for new species as well as from failure of authors to record a type host or in some cases any host. Many of the earlier descriptions were given in such general terms that identification of the species is now possible only because the species name was applied to a population of lice on one particular host species. In many other instances authors listed several hosts for their species and, in view of the general nature of the description provided, it is now evident that some of the species are composites. This is true of *Nirmus pterocephalus* Olfers, 1816 (now *Ricinus*). Although the populations of *Ricinus* from two of the three hosts listed by Olfers superficially resemble each other, they are separable morphologically into two species.

Children (1836) failed to give a host for his new species, *Physostomum marginatum* (now *Ricinus*), and this species cannot be identified from the description. The name is available inasmuch as the type specimen is in existence. However, recent workers usually have been further handicapped by the lack of type specimens for the species described earlier. Except for the collections and types of Children and Denny, nearly all types of species described prior to 1880 have been lost, destroyed, or never did exist. For example, Linnaeus (1758) based many of his descriptions of lice on the published plates of Redi (1668) rather than on actual specimens.

In 1901 (published in 1905) the first International Rules of Zoological Nomenclature were adopted. The Rules clearly indicated that some decisions of early workers and their acceptance by subsequent workers were erroneous. Therefore the Rules were received with mixed feelings by mallophagan systematists, for it was necessary to restore valid names which had not been used for approximately a hundred years and to invalidate other names that had been in use for the same period. Durrant (1906*a*, 1906*b*), Kellogg (1908), Mjöberg (1910), and McGregor (1917) either were unaware of the Rules or ignored them, for they continued to regard Nitzsch's work and names as the basis of mallophagan taxonomy.

Neumann (1906) and Harrison (1916) initiated the restoration of mallophagan nomenclature in accordance with the Rules. The resulting debates over these and subsequent actions, especially those concerning Nitzsch's names (1818), have continued until recently (Clay and Hopkins, 1950, 1951, 1954, 1960; Hopkins and Clay, 1960).

Credit is due Clay and Hopkins for bringing a degree of stability to mallophagan nomenclature. They have made decisions on the availability and validity of all specific and generic names of Mallophaga proposed from 1758 through 1818. Each decision was made in accordance with the Rules of Zoological Nomenclature. Each specific name that was not considered either *nomen dubium* or *nomen nudum* was fixed by designation of a neotype with a description, illustrations, and a designation of type host. Confusion regarding some names was so great—or would become even greater if strict adherence to the law of priority was applied—that Clay and Hopkins appealed to the International Commission of Zoological Nomenclature to use the plenary powers to validate certain names and invalidate others. In the past other workers have made decisions on some of these names, but they either neglected to or did not properly establish their contentions in accordance with the Rules. Clay and Hopkins (1960) recognized that certain of their judgments were arbitrary. However, their decisions on the name *Ricinus* and that of several species therein appear to me as well founded.

The genus *Ricinus* DeGeer has suffered from misinterpretation of the Rules in regard to its availability and validity as well as from misunderstanding its applicability. Before 1778 all species of lice (both Mallophaga and Anoplura) were included in the genus *Pediculus* Linnaeus, 1758. DeGeer (1778) determined that two different forms were included in *Pediculus*. Therefore he defined *Ricinus* to include all species now placed in the order Mallophaga and retained *Pediculus* for species now placed in Anoplura. Seven species were described by DeGeer in *Ricinus sensu lato*, of which only one, *Ricinus fringillae*, is considered now as belonging to *Ricinus sensu stricto*. No type host was given for *fringillae* from the hosts listed by DeGeer.

In 1804 Hermann, noting that the name *Ricinus* was used in botany also, proposed *Nirmus* as a *nomen novum* for *Ricinus* DeGeer. Although Hermann cited no specific names in *Nirmus*, DeGeer's species automatically were included therein (Clay and Hopkins, 1954). Subsequent workers such as Olfers (1816) and Leach (1817) accepted *Nirmus* Hermann in place of *Ricinus* DeGeer, and the name *Ricinus* fell into disuse from 1804 to 1906, except by Barthelemy (1836).

However, the use of *Nirmus* Hermann also was short-lived, for this name and nearly all previously published generic and specific names of Mallophaga were replaced by Nitzsch (1818). His work was accepted by most nineteenth-century workers as the basis of mallophagan nomenclature. Nitzsch, who coined the name Mallophaga, divided this group into two unnamed families which now correspond to Kellogg's (1896*a*) suborders, Ischnocera and Amblycera. Each family included two genera: one genus in each family contained bird-infesting lice (*Philopterus* and *Liotheum*) and the other contained mammal-infesting lice (*Trichodectes* and *Gyropus*). Within each of the bird-infesting genera Nitzsch described several subgenera, merely listing under each the included names of species and their hosts. No species were included under *Liotheum*, for no subgenus *Liotheum* existed. The subgenus *Physostomum* was included in *Liotheum* with three species. Nitzsch

indicated that one of these species, *Physostomum nitidissimum,* was equivalent to *Ricinus fringillae* DeGeer. The host was given as *Emberiza citrinella,* one of the hosts listed by DeGeer (1778). The subgenera of Nitzsch were later raised to generic status by Rudow (1870), Giebel (1874), and Piaget (1880).

Nitzsch also included *Nirmus* as a subgenus under *Philopterus. Nirmus* Nitzsch does not appear to be a restriction of *Nirmus* Hermann, for Nitzsch credited to a previous author each specific and generic name that he replaced or retained. However, he did not credit his subgenus *Nirmus* to any author, but listed it in a manner similar to his other proposed subgeneric names. Since none of DeGeer's (1778) species are mentioned under *Nirmus* Nitzsch, this name is considered to be a new name and not a restriction of *Nirmus* Hermann.

Following the adoption of the Rules in 1901, Neumann (1906) restored the name *Ricinus* DeGeer, 1778, based on its priority and validity. Both the 1901 and the present Rules (1961) clearly indicate that the name of an animal taxon is not to be rejected because of the use of the same name as a taxon that does not belong to the animal kingdom. Since *Nirmus* Hermann, 1804, was an unnecessary *nomen novum* for *Ricinus* DeGeer, Neumann (1906) designated *Nirmus* Hermann as a junior objective synonym of *Ricinus.* Furthermore, Neumann designated the first species described by DeGeer, *Ricinus fringillae,* as the type species of the genus. This action restricted *Ricinus* from the *sensu lato* status of DeGeer (= Mallophaga) to *sensu stricto* status (= *Physostomum* Nitzsch), for Nitzsch (1818) had equated *Physostomum nitidissimum* with *Ricinus fringillae.* Neumann also designated *Physostomum* Nitzsch as a junior objective synonym of *Ricinus* DeGeer. Harrison (1916) gave further support for Neumann's contention by designating *Physostomum nitidissimum* as the type species of *Physostomum* Nitzsch. Clay and Hopkins (1960) agreed with the decisions of Neumann regarding *Ricinus* and its status, and further clarified the status of Nitzsch's names. Nitzsch (1818) had merely listed names of species in each of his subgenera, but had not described them. Thus his names have been assumed to be *nomina dubia.* However, Clay and Hopkins (1960) argued that some of Nitzch's names are valid, for they are based upon the descriptions of previous authors and are an indication as defined by the Rules. Thus *Physostomum nitidissimum* Nitzsch is a *nomen novum* and a junior objective synonym of *Ricinus fringillae.*

Neumann (1906) proposed the name *Degeeriella* as a *nomen novum* for *Nirmus* Nitzsch, which he designated as a junior homonym of *Nirmus* Hermann. Enderlein (1909) disagreed with Neumann's actions. He argued that *Nirmus* Nitzsch, 1818, was a restriction of *Nirmus* Hermann, 1804, and that therefore *Ricinus* should replace *Nirmus* rather than *Physostomum* Nitzsch. There is no evidence in Nitzsch's work that this is the case, for none of DeGeer's species are listed as equivalents of species under *Nirmus* Nitzsch. Harrison (1916) and Hopkins and Clay (1952) concluded that *Nirmus* Nitzsch is a totally different genus from *Nirmus* Hermann. Although Enderlein persisted in his contentions, they received little support, and currently no worker holds his views.

At first, authors seemed reluctant to accept *Ricinus* in place of *Physostomum.* In his checklist Kellogg (1908) used *Physostomum* and made no reference to Neumann's (1906) changes. Durrant (1906*a,* 1906*b*), Mjöberg (1910), Uchida (1915), and McGregor (1917) continued to refer species to *Physostomum.* Following the publication of the checklist by Harrison (1916), *Ricinus* DeGeer was accepted by nearly all mallophagan taxonomists. The major exception was the noted German worker, Keler (1957, 1958), who argued that no confusion had resulted in mallophagan nomenclature from the use of *Physostomum* during the hundred years of its existence, but that great confusion had resulted from the varying interpretations of the status of *Ricinus* since its exhumation by Neumann (1906). After the appeal of Clay and Hopkins (1960) to the International Commission (discussed below), Keler (1964) accepted *Ricinus* as defined by Neumann (1906).

Stability in mallophagan nomenclature was not reached during the first half of the twentieth century. This instability persisted because of failure to agree upon the status and applicability of pre-Nitzschian names and of many post-Nitzschian names where descriptions were inadequate for identification and types had been lost; and because some authors opposed changes that were necessary in accordance with the Rules. The most recent challenge to stability has come from Hottes (1954), who claimed that DeGeer (1778) was a nonbinomial author. Although mallophagan taxonomists have never doubted the availability of DeGeer's names for species of Mallophaga (Hopkins and Clay, 1960), the section containing names of Mallophaga technically was not published in a binomial manner. To clarify the situation Clay and Hopkins established the status of pre-Nitzschian names by designating a neotype for each name, and appealed to the International Commission of Zoological Nomenclature to officially accept or reject certain names when this procedure was necessary. Except for *Ricinus fringillae* DeGeer, their decisions on various species referred to *Ricinus sensu stricto* will be mentioned later. They (1954) described and figured a neotype for *Ricinus fringillae* DeGeer, 1778, and designated *Emberiza citrinella* Linnaeus as the type host.

In 1960 Hopkins and Clay appealed to the Commission for acceptance of the genus *Ricinus* DeGeer, 1778, with the type species *Ricinus fringillae* as designated by Neumann (1906) and the species *R. fringillae* DeGeer as defined by the neotype designated by Clay and Hopkins (1954). They also asked for the rejection of the genera *Nirmus* Hermann, 1804, and *Physostomum* Nitzsch, 1818, as junior objective synonyms of *Ricinus;* for the rejection of *Nirmus* Nitzsch, 1818, as junior objective homonym of *Nirmus* Hermann, 1804; and for the rejection of *Physostomum nitidissimum* Nitzsch, 1818, as junior objective synonym of *Ricinus fringillae* DeGeer, 1778. Hopkins and Clay (1960) did not wish the Commission to pass judgment at that time on the availability of DeGeer's work, in particular the section of volume 7 which contains all the names of Mallophaga. In other sections of DeGeer's volume the second word of insect names, obviously the specific names, was differentiated by being printed in Roman type and enclosed in brackets. In the Mallophaga section, however, the second word was neither enclosed in brackets nor printed in Roman type. Hopkins and Clay maintained that the second word here is in a form that suggests that DeGeer intended it for a specific name. The failure to differentiate the second word was assumed by them to be in the nature of a misprint, probably due to the fact that volume 7 was published after DeGeer's death. The Commission (1962) in Opinion 627 ruled as Hopkins and Clay (1960) had requested. *Ricinus* DeGeer and *R. fringillae* DeGeer are now on the Official Lists of Generic and Specific Names in Zoology, whereas *Nirmus* Hermann, 1804,

Physostomum Nitzsch, 1818, *Nirmus* Nitzsch, 1818, and *Physostomum nitidissimum* are on the Official Indices of Rejected and Invalid Generic and Specific Names in Zoology.

MATERIALS AND METHODS

Collection of Material.—Specimens of *Ricinus* were obtained from birds collected by myself and others, from museum study of skins, and from the entomological collections of various institutions and individuals. Collectors were supplied with polyethylene bags and were instructed to place only one bird per bag to prevent contamination. Contamination is defined herein as occurrence of lice on an abnormal host in which the occurrence is due to the direct intervention of man; the term straggling is used to denote natural occurrences of lice on abnormal hosts (Hopkins, 1949). Birds that were trapped alive were examined under a dissecting microscope for the presence of *Ricinus* and their egg cases, which are easily distinguished from the egg cases of other Mallophaga found on passerines (Blagoveshtchensky, 1949). Negative birds were released; positive birds were killed. A direct feather-by-feather search of some birds was made. Although this method is too tedious for general collecting, it enables one to obtain for experimental work living lice that have undergone minimal disturbance, and to locate areas of louse activity and oviposition sites on the host. Most birds were submerged individually and periodically shaken in liquid detergent solutions in water for 12 to 24 hours. Washings containing ectoparasites were examined directly by decanting a small portion of the solution into a petri dish and examining this directly under a dissecting microscope. As an alternate method, the solution was strained through a circle of filter paper placed in a Büchner funnel. Ectoparasites found by these methods were removed and stored in 70 to 80 percent ethyl alcohol. I identified the majority of the birds that were collected; but when I was in doubt concerning an identification, Larry L. Wolf and George E. Chaniot, Jr., of the Museum of Vertebrate Zoology, University of California, Berkeley, kindly identified the birds.

Museum study skins were not used routinely as a source of material for this study because of the probability of contamination. Hopkins (1949) imputed numerous erroneous host records in the work of Piaget (1880, 1885) to the fact that most of his material came from study skins. Included in these contaminants are three species of *Ricinus* described by Piaget. Hopkins repeatedly indicated that certain records of lice from mammals were contaminants when specimens were obtained from museum skins. In spite of this warning I have used specimens of *Ricinus* found by L. L. Wolf and Mercedes Foster on study skins of *Aimophila ruficeps* and *Vermivora celata*, respectively, during their studies on these birds, because of the high probability that these specimens were not contaminants. When I examined the skins from which specimens of *Ricinus* were taken I found egg cases of *Ricinus* in each, indicating that a species of *Ricinus* was present on those birds while they were alive and was not the result of subsequent contamination. The species of *Ricinus* taken from the skins proved to be the same species that had previously been collected from these hosts. Although Emerson (1954) stated that records obtained from museum skins should be considered questionable, these records appear to be valid.

Specimens of *Ricinus* were received mounted on slides, in vials of alcohol, or in a dried state on cotton in vials. The abbreviations listed below refer to the institution or individual providing the specimens.

BCN—Collection of Bernard C. Nelson
BMNH—British Museum of Natural History
CAS—California Academy of Sciences
CIS—California Insect Survey Collection
CU—Cornell University
INHS—Illinois Natural History Survey Collection
KCE—Collection of Dr. K. C. Emerson
LSU—Louisiana State University
OSU—Ohio State University
RCD—Collection of Robert C. Dalgleish
RSM—Collection of Rose S. Monroe
SMNH—Swedish Museum of Natural History
UK—University of Kansas
UM—University of Minnesota
UNH—University of New Hampshire
USNM—United States National Museum
UW—University of Wisconsin
VLK—Collection of the late Dr. V. L. Kellogg housed at CIS
YU—Yale University

Preparation of material.—Two percent and five percent cold KOH and Nesbitt's solution were used with equal success to clear specimens. Specimens were cleared in either reagent until nearly all solid matter had dissolved. What remained was then removed by exerting gentle pressure on the abdomen.

Nesbitt's solution was preferred for clearing, as specimens may then be transferred directly into Hoyer's mounting medium, whereas specimens cleared with KOH must be washed first in distilled water to remove all traces of KOH to prevent subsequent crystallization, and must then be returned to alcohol before being mounted. Cold KOH was used, since hot or boiling KOH alters and removes pigmentation of specimens, thus destroying a diagnostic character. It is true that overclearing makes setal patterns more evident; however, this also alters or destroys the pigmentation pattern, distorts the shape of some structures, and makes other structures difficult or impossible to see.

Staining of specimens proved to have little advantage over using properly cleared specimens. Staining usually masks the natural coloration and pigmentation pattern. Since stains are not selective, membranous and lightly sclerotized structures do not appear more conspicuous in stained than in unstained material.

Hoyer's mounting medium (Baker and Wharton, 1952) was used for all unmounted material. Most specimens were mounted ventral side up on glass microscope slides. When a series of specimens was available from one host, at least one specimen was mounted dorsal side up. A few specimens were mounted between two coverslips on Cobb metal slides (Cobb, 1917), which permit both dorsal and ventral surfaces of an organism to be observed at high magnification. Because *Ricinus* species are large, observation at high magnification is not necessary except for a few characters on the ventral side such as mandibles, hypopharyngeal apparatus, and setae along the antennal lappets, labium, and male genitalia. Slides were dried in an oven set between 45° and 55°C for a minimum period of ten days, and subsequently were ringed with a commercial ringing compound. Specimens

mounted in Hoyer's mountant proved to be far superior for taxonomic work than those mounted in resins, since the details of the structures are more perceptible in the former.

Examination of material.—Descriptions and types of the known species of *Ricinus* were examined to determine which species were valid and which occurred in the New World. Where types had been lost or destroyed or were not available to me, I have followed the precedent of Price and Beer (1963) and R. C. Nelson and Price (1965), relying on the study of specimens taken from the type host and assuming without evidence to the contrary that this material was conspecific with the original material.

The determination of the validity of the species of *Ricinus* is perplexing. Early authors generally used gross characters such as shape of the major body division, overall size, and coloration in their description. It is apparent in the work of Denny (1842) that identifications may not be made with certainty from his descriptions. Piaget (1880, 1885) used many characters in his descriptions of *Ricinus,* including measurements of the various body segments, detailed accounts of the shape of various structures, descriptions of the pigmentation pattern, and some mention of chaetotaxy. Subsequent descriptions of species of *Ricinus* have followed the pattern set by Piaget. However, in 1899 Kellogg indicated that he was in doubt as to which characters should be used to separate species of *Ricinus.*

No innovations were introduced until the appearance of the works of Clay and Hopkins (1951, 1954, 1960). These authors reported that the following had specific value throughout the genus: characters of the mandibles; shape of the head; color pattern of the body; characters of the male genitalia; and characters of the terminal segments of the female abdomen. Supplementary characters of taxonomic value were given in their 1960 paper. In addition to certain of the same characters mentioned by Clay and Hopkins, Carriker (1964) listed various carinae and incrassations of the head, thorax, and pleurities.

To further complicate the matter, of the seventy proposed names for species of *Ricinus,* at least sixty were described from a single specimen or a small series collected from a single host. Eichler and Carriker, among others, described as new species specimens of *Ricinus* taken from a previously unrecorded host, since they anticipated a high degree of host specificity. Although some of these species clearly differ from known species, many show few or no morphological distinctions upon which to base their identity.

To introduce greater objectivity into the systematics of *Ricinus* in the present study, each series of specimens from a host species was assigned a population status. Each specimen in each population was examined as to size and shape of various structures, pigmentation pattern, and chaetotaxy. The amount of variability in these characters was determined statistically for each population. Comparisons were then made between populations to determine similarities and differences. Upon this basis was determined the validity of characters at the species level. Artifacts (differences resulting from curatorial procedures) and intrapopulational distinctions were detectable subsequently with some degree of assurance.

The following sections deal with descriptions of external anatomy, chaetotaxy, and pigmentation patterns. The description of the characters was made mostly from adult specimens mounted on microscope slides. Several adult and nymphal

specimens were dissected in order to determine the topographic position and limits of certain structures, in particular the mouthparts. Each feature is described along with an indication of the amount of variability observed and the taxonomic value in *Ricinus.*

EXTERNAL MORPHOLOGY

Head.—The prognathus head of *Ricinus* is conical (pl. 2, fig. 1), subconical (pl. 18, fig. 1), or spatulate (pl. 4, fig. 1) and somewhat depressed. The shape of the head is one of the characteristic features of the genus and is useful at both the species group and specific level. Two features of the head are of particular interest, the pallettes and the antennae.

Pallettes.—The pallettes (pl. 2, fig. 1) are membranous lobelike extensions arising ventrally and laterally from the labrum. These structures probably have been derived from the epipharynx. They are enclosed in two fossae which are situated ventrolaterad to the labrum when it is closed. When the labrum is open the pallettes extend ventrally and laterally through an opening which is continuous with the fossae. Each pallette is supported by two or three small sclerites which articulate with the lateral tips of the labrum. It appears that the sclerites act as hinges during the extension and retraction of the pallettes. Since these structures are striated as are the acetabula of trematodes, Nitzsch (1874, in Giebel) and Mjöberg (1910) postulated that they were sucking or adhesive organs.

Antennae.—The antennae are four-segmented, situated in two capsules on the ventral side of the head. The antennal lappets, the ventral coverings of the capsules, overlie part of the second and all of the third and fourth antennal segments. The antennae appear to be quite similar throughout the genus.

Tentorium.—Symmons (1952) reviewed the literature and studied the tentorium throughout the Mallophaga. Within the order the tentorium occurs from well-developed to a greatly reduced form. In *Ricinus* the tentorium is greatly reduced. The tentorial bar consists of a ligament and is invisible in specimens mounted on slides. The anterior and posterior tentorial pits (pl. 2, fig. 1) and their connecting arms are present, but only the anterior pits are evident in certain species. The anterior tentorial pits emerge dorsally on the tentorial nodi; the posterior tentorial pits occur ventrally in the region between the antennae and the gular plate. The frontoclypeal and posterior occipital sutures are not evident. Thus the usual value of the tentorial pits as landmarks coupled with the modification of the head make it difficult to ascertain the exact boundaries and nature of certain elements. Muscle origins appear to have shifted from the tentorium to the various apodemes or to the margins of the head. Because of these changes, some of the elements may be misinterpreted herein.

Frons.—The anteriormost portion of the head, lying anterior to the labrum, was called the "frons" by Carriker (1960, 1964). Although the term may not be equivalent to the concept of the structure in other insects (Snodgrass, 1935), I have adopted it as a useful shorthand designation for the prelabral region. The frons (pl. 16, fig. 1) is part of the clypeus. The anterior margin, which varies interspecifically, is narrowly to broadly convex or truncate, with parallel, angulate, or rounded lateral margins. Frontal carinae border the sides of the frons but usually disappear medially. Two short finger-like frontal incrassations extend anteromedially for a short distance from the posterolateral corners of the frons.

A transverse carina extends across the frons but usually disappears near the apices of the frontal incrassations. The transverse carina may be straight, convex, or noticeably arched medially. It is absent in species of the *arcuatus* and *fringillae* species groups. In *R. serratus* (Durrant) the transverse carina is continuous with clypeal carinae. The marginal carina is a sclerotized marginal band (pl. 10, fig. 1) extending from the preocular region of the head anteriorly to merge insensibly with the frontal carina on the anterolateral area of the head; at the level of, or just anterior to, m1 the marginal carina fuses insensibly with the more medially situated clypeal carina.

Eyes.—Two facets are thought to be present in each eye. The eyes in the *fringillae* species group protrude from the head and are hemispherical in shape. In other groups the eyes are only slightly raised or reduced.

Temples.—The temples (pl. 13, fig. 1) are triangular or subtriangular in shape. The margin (postocular carinae) of the temples runs posteriad from the eye ending in a point and re-entering medially and anteriorly as the dorsal occipital margin and the occipital nodal margin. The shape of the temples varies interspecifically.

Occiput.—The occiput forms the posterior margin and walls of the head. Dorsally the occipital margin is continuous with the medial margins of the temples. The shape of the dorsal margin is concave, with the medial region rounded or straight, not fused medially with occipital nodus; or concave, with the medial margins fused with the occipital nodus; or biconcave, with a medially projecting convexity. The occipital nodus (pl. 2, fig. 1) is heavily sclerotized and pigmented. The margin of the nodus is invaginated from the dorsal margin of the occiput, forming a cavity which receives the anterior margin of the prothorax. The margin of the nodus usually parallels the dorsal margin of the occiput. Laterad to the gular plate the occipital nodus is covered by extensions of the ventral surface of the head which forms the articulations of the head with the prothorax. In the *fringillae* species group the medial part of this extension is shaped as a heavily sclerotized rod which forms the articulation process. In the *arcuatus* species group this structure is narrowly lobelike. In the other groups it is a broad, sclerotized lobe which has its origin near the level of the second antennal segment.

Nodi of the head.—The nodi of the head (pl. 16, fig. 1) are sclerotized, pigmented thickenings situated dorsally and internally. Two or three pairs are usually present. The first pair are called the lunar nodi, being quarter-moon-shaped. Lunar nodi are absent in the *fringillae, brevicapitis,* and *arcuatus* species groups. Posterior to and surrounding the anterior tentorial pits are the tentorial nodi. The third pair of nodi form the dorsomedial margin of the antennal fossae and are termed antennal nodi. In a few species there are sliver-like thickenings on the dorsolateral margin of the fossae. These nodi overlie and appear to be associated with two internal apodemes which are nearly parallel to the medial margins of the nodi. These apodemes end posteriorly coalesced with the posterior end of the antennal nodi and anteriorly forming cuplike depressions in which the mandibular condyles are situated.

Mouthparts.—The structures which surround or are associated with the oral cavity are the labrum, mandibles, maxillae, hypopharynx, and labium. The labrum has already been discussed in connection with the pallettes. Two structures on the labrum which have not been mentioned are the anteromedial lobe, seen only when the labrum is opened, and the two knoblike posterior extensions which form the inner point of attachment of the pallettes.

The mandibles are composed of the sclerotized tips, a dorsal membranous lobe which varies in shape, a medial ventral membranous lobe, and the articulations. The ventral condyle is always present in the form of a ball-and-socket articulation. The dorsal condyle occurs in some species, although it is nearly impossible to see without dissecting out the mandibles. Carriker (1960) stated that the dorsal condyles have been reduced in some species and are replaced by a ligamentous articulation.

Two types of mandibles are found in *Ricinus:* a dimorphic form characteristic of the *fringillae, brevicapitis,* and *arcuatus* species groups, and a monomorphic form characteristic of the other species groups. In the dimorphic form the left mandible is thickened dorsoventrally at the base of the tip, which is obtusely pointed. Below the base of the tip is a cavity which receives the tip of the right mandible. The right mandible is not so thick dorsoventrally as the left, and the tip is acutely pointed. The left medial ventral lobe bears a finger-like process that articulates in a slight depression on the right medial ventral lobe. In the monomorphic mandibles the blades and the medial ventral lobes are similar to each other. The lobes are entire, without a finger-like process. Two species, *R. invadens* and *R. mandibulatus,* have mandibles with monomorphic tips, but dimorphic lobes.

The elements of the maxillae present are the stipes, the palpi, the laciniae, and the galea. The cardo is absent throughout the Mallophaga (Matsuda, 1965). The stipes forms a large maxillary plate (pl. 16, fig. 1) which bears the maxillary setae. The size and shape of the plate have diagnostic value. The maxillary palpi (pl. 2, fig. 1) are four-segmented. The anterior and posterior sclerites of the first segment are nearly equal in length in the *brevicapitis, fringillae,* and *arcuatus* species groups; therefore the palpal segments extend in a straight line. The anterior sclerite of the first segment in other groups is much longer than the posterior sclerite. The distal three segments arise from the first segment at an angle, giving the palpi a genticuloid appearance. The laciniae, "maxillary forks" of Mjöberg (1910) or "maxillary picks" of Cope (1941), are nearly impossible to see in most specimens, for they are lightly sclerotized and usually obscured by other structures. Their presence is indicated by the cranial lacinial apodeme. The galeae are present as membranous lobes bearing tiny toothlike structures (pl. 34, fig. 2).

The hypopharyngeal apparatus is the most confusing element of the mouthparts. Except for *Trochiloecetes* Paine and Mann, where a sucking function is assumed (Clay, 1949*a*), the function of the hypopharynx is unknown in Mallophaga (Symmons, 1952). No comparative study of the whole apparatus has been made in *Ricinus* because all or parts of this structure cannot be seen. Only distinctive differences that can be observed in all specimens are compared. Cummings (1916) has described and labeled the parts of the apparatus in *Physostomum mystax* (now *Ricinus elongatus*). A scroll-like sitaphore sclerite appears to be quite similar throughout *Ricinus*. Only parts of the rami and anterior cornu of Cummings' figure can usually be seen. In the *fringillae* species group two plumose-like structures arise, probably from the tips of the anterior cornu. No such structure appears to be present in other species groups in *Ricinus*.

The only structures that can be compared throughout *Ricinus* are the ovoid

sclerites (= hypopharyngeal lobes, superlinguae, salivary reservoirs, lingual glands), a pair of ovoid structures lying medially and posteriad to the mandibles. The size, shape, and ornamentation of these sclerites have diagnostic value. In *fringillae* and *arcuatus* species groups these sclerites are small, rounded, and uniformly pigmented. In *R. serratus* (pl. 16, fig. 2) and the *subangulatus* species group the sclerites are deeply pitted. In the *diffusus* species group (pl. 41, fig. 3) they are finely pitted, resulting in a fuzzy appearance. In the *marginatus, invadens,* and *mandibulatus* species groups the sclerites are usually not evident. They are probably membranous and unornamented and hence are not visible.

The labium (pl. 2, fig. 2) is bordered laterally by a sclerotized margin. No division is apparent into palpi, glossae, or paraglossae. The figure given by Kellogg (1899) for the labium of *Physostomum angulatum* (now *R. marginatus*) is in error: the shape and the chaetotaxy of *R. marginatus* appear nothing like the figure. In fact, the figure does not resemble the labium of any known species of *Ricinus*. Posterior to the labium is an inverted triangular region herein called the mentum. A pigmented mental plate is usually evident only in the *fringillae* species group. The areas posteriad to the maxillary plates and mediad to the antennae are herein called the genae, although there may be some question about the homology of this area with genae in other insects.

Gular plate.—The gular plate (pl. 4, fig. 1) is an elongated triangular structure lying medially behind the mentum. The shape of the gular plate has been used by Eichler (1956) to differentiate his species. Eichler appears to have described the sclerotized pattern on the gular plate rather than the plate itself. Care must be taken in differentiating these elements. The shape of the pattern has diagnostic value. Posteriad the plate may or may not have two extensions which either point directly posteriad or are reflexed outwardly.

Prothorax.—The prothorax (pl. 3, fig. 1) is attached to the head in the manner described above. At the base of each articulation is an amoeboid cervical plate bearing two small setae. Laterad to each is a dumbbell-shaped sclerotized episternal I plate, which borders the coxae I. Behind the coxae is a lightly sclerotized epimeron I. These two structures are connected by the thin rodlike pleurosternal apophysis. The elements of the notum appear to be fused together with the ventral elements. The prosternal plate is relatively uniform in *Ricinus*, but the shape and the amount of sclerotization of the lateral nodi have diagnostic features.

The shape of the prothorax is an excellent diagnostic character (Carriker, 1964). The only general statements that can be made are the following: the anterior margin is biconvex, with a medial concavity, and the rest varies in shape. In closely related populations the shape is similar or varies slightly. This structure has value both as a character for separation of species and for determining relationships of species groups.

Pterothorax.—The fused meso-metathorax and first abdominal segment comprise the pterothorax (pl. 3, fig. 1) in *Ricinus* (Cope, 1941; Clay and Hopkins, 1960). This bell-shaped structure is quite uniform in *Ricinus*. There appears to be a loss or fusion of the dorsal notal plates. The anterior "shoulders" are pigmented and consist of the fused episterna II and pleural phragmata II. Epimera II appear to be fused with the episterna III and part of the pleural phragmata III. Epimera III appear to be fused with the ventral pleurites of the abdominal segments I and

are usually evident only in the *arcuatus* species group. Dorsally the pleural nodi of the abdominal segment I are present, and are similar to those found on the abdomen proper. These nodi continue as pigmented nodi across the fused meso-metanotum. The sternal plate covers the ventral surface between the second and third pair of legs. The shape of this plate has diagnostic value because of the differences in its contours and size that occur among the species.

All the chaetotaxy on the pterothorax is considered herein as belonging to the pterothorax. Perhaps the pairs of setae of the b series and q series (q2 – q5) are equivalent to the postspiraculars and their associated setae, and to the ventral pleural setae of the abdomen, respectively. However, in b2 the two tiny setae do not originate from the base of the alveolus as do the postspiracular setae. The small anterior setae associated with the postspiracular setae of the abdomen does not vary in length as b1 does. The q2 through q4 series are situated anteriad to the usual position of ventral pleural setae, although q5 is located terminally. Because of these differences, the two series of setae are considered pterothoracic for convenience. Clay and Hopkins (1960) include these setae with the abdominal setae.

Abdomen.—The abdomen is defined as that structure posterior to the pterothorax. The margin of the abdomen, which is continuous with the margins of the pterothorax, is elongated with the margins nearly parallel or slightly ovoid. Segments (pl. 43, fig. 5) are numbered in Roman numerals from II through IX (= apparent I through VIII). The terminal segment probably represents the fusion of tergite IX and X, although external evidence is not obvious as in other Amblycera (Cope, 1941). The dorsal pleural nodi of segment IX extend only partially along the margins of the terminal segment in females. Spiracles and their associated sensilla are present in tergites III to VIII. A pair of sensilla are present on tergite II and on the dorsum of the pterothorax. The latter are probably the sensilla of the abdominal tergite I.

Pleurites (or paratergal plates) are lateral sclerites that encircle the margins of the abdomen. Pleural nodi, which occur on the dorsomedial margin of the pleurites, are heavily pigmented and thickened, having a distinct shape which is useful taxonomically. The usual shape of the nodi is in the form of an anterodorsally elongated trapezoid. However, modifications occur in some species. They reach an extreme in *R. serratus*, in which the nodi are so shaped and oriented as to appear serrated (pl. 17, fig. 5). The dorsal portions of the pleurites have their anterior and posterior margins extended anteriorly at approximately a 45° angle from the anteroposterior margins of the tergites. The tergites cover the dorsal surface of the abdomen, with their lateral margins overlapping midway onto the pleural nodi. The sternites are separated laterally from the pleurites by membranous areas which contain irregularly shaped platelets. In females the posterior margin of sternite VIII is modified into the female terminalia, the vulva, which forms the outer wall of the genital opening. This margin is bilobed laterally and concave medially. The sclerites on this sternite have taxonomic value, but they are not always clearly evident. Sternite IX is absent in females. In males sternite VIII is similar to VII and sternite IX is broadly rounded. Sternite X is absent in males (Cope, 1941).

Legs.—The forelegs are short and are turned forward beneath the head as in other Mallophaga. Coxa I is large and elongated in an anteroposterior plane. The

trochanter arises from the coxa at right angles. The shape of coxae I appears to be uniform throughout *Ricinus,* but the size of trochanter I varies between species groups. Femora I and tibiae I are nearly equal in length. The second and third pairs of legs are similar in shape; the third pair is slightly larger. Femora are short and thick in *fringillae* and *arcuatus* species groups but narrow and elongated in other groups. The tarsi are two-segmented.

Male genitalia.—The external male genitalia appear to be fairly uniform and simple throughout the genus. Clay (1956) has stated that the sclerites of the male genitalia "may be fused in such a way as to make their homologies obscure and it is not always possible to homologize the parts even between species belonging to the same genus." The terminology of Blagoveshtchensky (1964) is used here for these sclerites. The basal plate, or basal apodeme, extends anteriad into the abdomen. Its shape varies greatly within a population; so caution must be exercised in using this character taxonomically. Two parameres articulate with the posterolateral corners of the basal plate. The shape of the parameres has taxonomic value: they may be elongated, short and triangular with acute or obtuse apices, or broadly rounded. The mesosome is a ringlike structure that articulates with the posterolateral corners of the basal plate. The posterior margin of the mesosome may be entire (pl. 19, fig. 6), weakly or strongly pointed (pl. 18, fig. 4), or expanded into a large plate (pl. 5, fig. 2). The preputial sac, or genital sac, is in the space surrounded by the basal plate and the mesosome and is lightly sclerotized.

The preputial sac appears to have a certain diagnostic value. Its shape in the *arcuatus* species group resembles a bouquet of cut flowers or the hemipenis of snakes (pl. 5, figs. 2, 4). The sac in the *fringillae* group resembles a flower with petal-like lobes surrounding the stoma (pl. 9, fig. 7). The sac in *R. marginatus* is extremely amorphous (pl. 18, fig. 4). In other species there is little variation in shape (pl. 19, fig. 6). Several pairs of campanuliform sensilla are present on the preputial sac. The preputial sac, mesosome, and parameres are everted during copulation (pl. 9, fig, 6).

Sexual dimorphism—Sexual dimorphism is usually limited to differences in size, to the characters of the terminal segments in each sex, and to the presence of the external genitalia in males. Males are usually somewhat smaller than females. Sexual dimorphism in the shape of the prosternal plate is limited to the males of some members of the *fringillae* species group in which the lateral prosternal nodi are turned inwardly and medially (pl. 9, fig. 8).

Nymphs.—Few nymphs were available for study. Either they are rarely collected or are ignored by collectors. Only once did I have an opportunity to observe males, females, and all three nymphal instars of a species, *R. arcuatus* (Kellogg and Mann). The chaetotaxy in all three nymphal instars of this species is similar to that of either the adult male or the adult female. The nymphs differ from each other in size and somewhat in the degree of sclerotization and pigmentation. They also differ from the adults in smaller size, in shape, in lesser degree of sclerotization and pigmentation, and in the absence of genital sclerites. Study of nymphs associated with adults is invaluable, for certain setae and structures are better observed in nymphs than in heavily sclerotized adults.

Eggs.—The eggs of *Ricinus* are easily distinguished from those of other Mallophaga. They have been figured and described by Mjöberg (1910), Eichler (1953), Blagoveshtchensky (1959), and Foster (1969*a*). The shiny white eggs are larger than the eggs of other Mallophaga found on passerines. The margin of the operculum is entire with the margin of the rest of the egg. The operculum and adjacent regions bear a pattern of interconnecting polygonal indentations.

CHAETOTAXY

According to Radovsky (1967), writing with reference to Acarina, chaetotaxy permits the use of patterns of setal distribution and differences in individual setae in description, classification, and phylogenetic interpretation. Several systems of chaetotaxy have been proposed by acarologists, but to my knowledge no such system has been erected for Mallophaga. Clay (1947) and Clay and Hopkins (1960) have made a start in this direction. I have adopted their terminology whenever it was practical. Letter designations are given to some contiguous groups of setae. Numbers following the letter designation indicate the number of that setae or setal pair in the letter group. Certain setae, e.g., labiomentals, anterior labrals, or postspiraculars, are designated by name rather than by letter. Each group of setae that is assigned a letter or name is believed to be homologous, as their location is consistent throughout the genus *Ricinus.* Stability and variation in these setae are particularly significant in demonstrating diagnostic features and relationships in *Ricinus.*

There is considerable asymmetry in certain setal groups such as those on the gular plate and along the margins of the antennal lappets. Therefore, the number of setae on each side in indicated as X × X. The usefulness of certain setal patterns is indicated where appropriate. Where no comments are made, it should be assumed that these setae are constant throughout the genus.

The Head

The cf series.—The cf series is composed of short setae that border the circumferential margin of the frons. In the *fringillae* and *arcuatus* species groups there are 12 setae; in the remaining species there are only 10. These setae are not illustrated.

The df series.—The df setae (pl. 2, fig. 1) are a pair of short setae situated submarginally on the dorsum of the frons. Since this pair is not found in the *fringillae* and *arcuatus* species groups, it is assumed that it is incorporated into the cf series, which occupies a position just anterior to where df would be present.

The f series.—The f series (pl. 2, fig. 1) is composed of two pairs of short setae located ventrally on the frons. Pair f1 is located submarginally and is longer than f2 in some species, as in *R. marginatus.* Pair f2 is on or near the tip of the frontal incrassation.

The d series.—The d series (pl. 2, fig. 1) is composed of three pairs of short setae on the dorsum of the head. They are consistent in size and relative position throughout the genus.

The a series.—The a series (pl. 2, fig. 1) consists of, at most, six pairs of setae on the dorsum of the head in the region of the temples. The letter designation is an expansion of the terminology of Clay and Hopkins (1960). The pair designated as a1 has one or two pairs of sensilla associated with it. Setae a1 vary interspecifically in length, whereas setae a2 to a6 are always short and pilose. The *arcuatus* and

brevicapitis species groups have the full complement of six pairs. Setae a4 are absent in the *fringillae* species group and setae a3 are absent in all other species groups. The presence or absence of pair a6 follows no taxonomic pattern, but it is usually absent in the smaller species of a group.

The t series.—The t series (pl. 2, fig. 1) consists of three pairs of long and whip-like setae situated dorsolaterally on the temples. Setae t1 and t2 are equal in length; t3 varies from approximately half the size of t1 and t2 to the same size.

The m series.—The m series (pl. 2, fig. 1) consists of four pairs of setae located dorsolaterally on the marginal carinae between the junction of these carinae with the clypeal carinae and the eyes. The anterior three pairs (m1–m3) are short and equal in size, except in the *fringillae* species group, where they are subequal, increasing in size from m1 to m3. Setal pair m2 varies in position with relation to m1 and usually is posteriad and submarginal to m1. In some species m2 is laterad or posteriad to m1 and is off the marginal carinae. Setal pair m4, which has a certain diagnostic value, varies in length from equal to the length of m1 to approximately the length of t3. Setal pair m4 is subequal to the lengths of pa1 and pa2.

Labrals.—Two rows of setae, the anterior and the posterior labrals (pl. 4, fig. 1), occur on the sclerotized labrum. The anterior labrals always consists of four setae; the outer pair are three or four times as long as the inner pair. The posterior labrals consist of 20 setae. The inner six pairs are short setae, nearly equal in length. They are equally spaced except for the innermost pair, which are separated from the others by a short diastoma. Outer pairs 1 and 3 are longer than the outer pair of anterior labrals. Pairs 2 and 4 are two to four times as long as the short inner setae but shorter than pairs 1 and 3.

Labial setae.—The pattern and number of setae on the labium appear to be diagnostic for *Ricinus* species (Clay and Hopkins, 1960). Figures of the labium and its setal pattern are given for each species.

Labiomental setae.—The labiomental setae are a pair of tiny setae at the junction of the labium and mentum (pl. 2, fig. 2).

Mental setae.—The mental setae (pl. 2, fig. 1) are a pair of medium to moderately long setae that occur laterally to each other on the mentum, except in *R. serratus* (Durrant), where they may be positioned anterposteriorly. The length of this pair is subequal to the maxillary setae.

Maxillary setae.—The maxillary setae (pl. 2, fig. 1) are a pair of medium-sized setae on or near the medial margin of the maxillary plate.

Paramaxillary setae (pm).—The paramaxillary setae are a pair of short setae situated laterad near the posterior end of the maxillary plate (pl. 2, fig. 1).

Gular setae.—The gular plate (pl. 4, fig. 1) bears several pairs of setae bordering its midlateral margins. Usually the posterior pairs are longer than the anterior pairs. Considerable intraspecific variation and asymmetry in pairing occur, although there is a basic number or pattern for some species. In *R. picturatus* (Carriker) the basic number is two pairs, but three pairs or the presence of unpaired setae such a 1x2, 1x3, or 2x3 are not uncommon. In *R. invadens* (Kellogg) there are three pairs of setae, with the middle pair longer than the anterior and posterior pairs. In *fringillae* and *arcuatus* species groups the number of pairs vary from three to nine, with much asymmetry. There is an extreme size difference between the anteriormost and the posteriormost pairs. These three examples show

that the presence of an additional pair of setae on the gular plate is not a good character for differentiating species.

The para-antennal setae (pa)—The pa series (pl. 2, fig. 1) consists of two pairs of ventral setae situated laterad to the proximal antennal segments. The pairs are usually similar in size. The para-antennals vary over the same range in size as m4 and are compared to m4.

The preantennal setae.—The preantennals are a pair of setae (pl. 2, fig. 1) located anteriad to each antenna. The inner seta is larger than the outer. In most species these setae are strongly spinose, but in some species in the *arcuatus* species group they are pilose.

The setae of the antennal lappets.—These setae constitute a series of small to medium size bordering the lateral margins of the antennal lappets (pl. 18, fig. 1). The number of setae, which ranges from two to 35 pairs among the species of *Ricinus*, usually varies considerably within a specimen, population, or species. Even so, certain species have a characteristic number or pattern. In some species these setae form a continuous series with the postocular series; in other species there is a diastoma between the two groups of setae.

The postocular series.—The postocular series (pl. 4, fig. 1) consists of three or four setae on the lateral edges of the carinae posterior to each eye. The first postocular is usually a medium-sized spinose seta. Setal pair po2 is pilose, varying from the same size as po1 to ten times that size. Seta po3 is a thin pilose seta equal to or shorter than po1. When four setae are present in the series, po2 and po3 are nearly equal and po4 is short and pilose.

Maxillary palpi setae.—The maxillary palpi are four-segmented. In most specimens it is impossible to determine the exact number of setae per segment because of the orientation of the segments and the difficulty in determining whether a seta is absent in fact or because of breakage. The distal segment bears approximately 14 to 20 setae terminally. Segment 3 appears to bear three setae throughout *Ricinus*, and segments 1 and 2 bear four setae. The proximal segment in some species, as in *R. mandibulatus*, has a strongly spinose seta or is bordered with microtrichiae. These setae are not illustrated.

Setae on the antennal segments.—There are two short setae on each of the first two segments of the antennae. No setae occur on the two distal segments.

The Prothorax

Prosternal plate setae.—There is one pair of short setae (pl. 3, fig. 1) on the anterior margin of the prosternal plate. The distance between these setae has diagnostic value in some species groups.

Dorsal prothoracic setae (pr).—Two pairs of short setae are positioned dorsally on the prothorax (pl. 3, fig. 1) throughout *Ricinus*.

Cervical setae.—Two short setae occur on each cervical plate throughout *Ricinus* (pl. 2, fig. 1).

Lateral prothoracic setae (L series).—The L series (pl. 3, fig. 1) consists of pairs of setae situated laterally or sublaterally along the margin of the prothorax (pl. 3, fig. 1). Setae L1 and L2 are always pilose. In heavily sclerotized species L3 is difficult to see, but it is absent only in *R. australis* and *R. mandibulatus*. Setae L5 are usually longer than L4 and L6 except in the *arcuatus* complex and in the species

R. invadens (Kellogg), where they are equal in length. L6 may be absent in some species, and in other species several setae are present between L5 and L7. These are called, for convenience, 6a through 6e, depending on the number present. Setae L7 and L8 are always long (equal in length to t1 and t2). Setae L9 is as long as L7 and L8 in some species, medium-sized in others, and short in most.

The Pterothorax

The c series.—The c series (pl. 3, fig. 1) consists of four pairs of setae situated dorsally on the pterothorax. Setae c1 are spinose and often larger than c2, which are either spinose or pilose. Setae c3 and c4 are pilose and vary in size even within a species. In the *arcuatus* complex only one of the two posterior pairs is present. Setae c4 are assumed to be absent and c3 present. The two latter pairs appear to have more diagnostic value than the two anterior pairs.

The w series.—The w series (pl. 3, fig. 1) consists of spinose setae located submarginally and dorsally along the anterior half of the pterothorax. The series varies in number from five to ten setae. The posteriormost pair or two pairs of setae, which are separated from the rest of the series, are usually smaller than the anterior pairs. The anteriormost setae are similar in size in *fringillae* and *arcuatus* complexes, but vary in other species groups. The number of setae tends to vary by no more than one or two setae within a species, but asymmetry is fairly common.

The q series.—The q series (pl. 16, fig. 4) is situated ventrally and submarginally. Setae q1 are located apically on the shoulder of the pterothorax and are pilose in most species. Posteriad to the last w pair is one pair of strongly spinose setae (q2) in most species, two pairs of short spinose setae (q2 and q3) in a few species, and three pairs of strongly spinose setae (q2–q4) in *R. serratus* (Durrant). Setae q5 are at the lateral terminal corner of the pterothorax when they are present.

The b series.—The b series (pl. 3, fig. 1) is situated dorsally on the posterior margin of the pterothorax. These setae are called "b" by Clay and Hopkins (1960), who pointed out the interspecific variation in size of the outer pair, b1. Setae b1 are small in most species to nearly equal to setae b2 in the *fringillae* species group.

The parasternal setae.—The parasternal pair of setae are at the lateral margin of the sternal plate about one-fourth the distance from its anterior margin. This pair is spinose and has its origin on the body, not on the sternal plate.

The sternal setae.—The short lateral setae of the sternal plate are represented by one or two pairs. The second pair is sometimes off the plate. The main centrally positioned setae, herein called the sternal setae (pl. 3, fig. 1) vary in number and length. In most species one, two, or three pairs of moderately long to long setae are present. The posterior pair are short to medium-sized setae.

The Abdomen

The first abdominal segment is fused with the metathorax. The abdominal segments are given in Roman numerals and are numbered II (= apparent I) through IX (= apparent VIII).

Postspiracular setae.—Each of the postspiracular setae (pl. 3, fig. 3), which are similar throughout the Mallophaga, arises from an alveolus. Two tiny setae are associated with each postspiracular seta. Clay (1954) stated that these setae are

usually on the tergites near the spiracles. In *Ricinus* the postspiracular setae are on the dorsal halves of the pleurites, somewhat removed from the spiracles. The spiracles and their associated sensilla are on the tergites of segments III through VIII. No spiracles occur on segment II, even though sensilla and postspiracular setae are present. Associated with each postspiracular seta is a short pilose seta anterolaterad to it.

Ventropleural setae.—Three setae (pl. 3, fig. 3) occur on each posteroventral margin of each of the abdominal segments II through VIII. Their size and shape, especially those of segments II through V, are diagnostic at the species level.

Tergal setae.—There are two pairs of tergal setae (pl. 5, fig. 1) of variable size on the posterolateral margins of the tergites. Usually each of the two pairs are adjacent to the others. The tergal setae are reduced to one pair on segment VIII in *R. marginatus.*

Setae on sternites.—Two pairs of setae (pl. 3, fig. 3) occur on sternites II through VIII in both sexes. The sternolaterals (the outer pair) and the sternocentrals (the inner pair) are equal in segments II through VI, whereas the sternolaterals of segment VII are much longer than the sternocentrals. In males only sternolaterals are present on sternites VIII and IX. In females the sternolaterals on sternite VIII are as long as those on VII. The sternocentrals on sternite VIII are absent in females and are replaced by thin pilose setae called the vulval setae. These setae show both intra- and interspecific variation in number, but each species appears to have a characteristic number or pattern.

Terminal setae of segment IX.—The terminal setae of segment IX (pl. 3, fig. 3) are arranged laterally on each side of the anus. The pattern of these setae, although subject to minor variation, has diagnostic value.

Anal fringe setae.—The anal fringe setae border the anus. In males, setae on both anterior and posterior fringes are short, sparse, and equal in length. In females of the *fringillae* species group the posterior fringe is similar to that of the male, whereas the anterior fringe is a double row of short setae of equal size. *R. arcuatus* is similar to *R. fringillae* except that the posterior fringe bears more setae in the female than in the male. The remaining species have two rows of tightly spaced setae that vary considerably in length.

Male genitalia setae.—Setae, from one to five on each tip, are found on the posterior tips of the parameres. Setae are present also along the margins of the parameres in *R. leptosomus* and *R. myiarchi.* No setae are found on the parameres of the *fringillae* species group.

The Legs

In general, chaetotaxy of the legs appears to be quite uniform throughout the genus. Interspecific variation does occur in the number of long setae (termed "tactile" herein for convenience) on some segments, and in the number of spinose setae on the distal end of each tibia, termed "crown" setae.

Setae of the prothoracic legs.—The pattern and number of setae on the coxae are remarkably constant. Interspecific variation occurs in the degree of spinosity exhibited in the three setae along the margin between the coxa and trochanter. Usually there are two long tactile setae posteriad on each coxa, but *R. serratus* and *R. sittae* have one seta. A spinose seta is present on the trochanter in some

species. The femur usually bears two tactile setae, but in some species a third seta is present. Five tactile setae are present on the tibia. The crown setae of the tibia include two or three spinose setae.

Setae of the pterothoracic legs.—The second and third pair of legs are similar in shape, but the third pair is larger. The patterns of setae are quite uniform except for the presence or absence of tactile setae and variation in the number of crown setae on the tibia. In some species the same number of tactile setae occurs on the coxa, trochanter, and femur of leg II and leg III. In most species one tactile seta is present on coxa II and one tactile seta on femur III. The number of spinose crown setae varies from two to five, with five the most common.

Tarsal setae.—The tarsi are usually not oriented properly to determine the number of setae on each segment. However, it appears that two pairs of setae occur on the first tarsal segment and three pairs on the second.

MEASUREMENTS

Measurements were made with the aid of an ocular micrometer and are expressed in millimeters unless otherwise indicated.

Total length.—Total length is the distance along the midline of a specimen from the tip of the frons to the end of the posterior anal lappet, exclusive of setae.

Greatest width.—The greatest width is measured along the suture dividing abdominal tergites IV and V (apparent tergites III and IV). The width of the abdomen is particularly subject to alternation by curatorial procedures. Usually the abdomen is shriveled as a result of dehydration or improper penetration of the mountant, rather than swollen.

Head length.—Head length is measured along the midline of the head from the tip of the frons to the dorsoposterior margin of the occiput. Care must be taken in distinguishing the occipital margin from the anterior margin of the prothorax or prosternal plate.

Head width.—The greatest width of the head is measured at the level of the eyes or slightly posterior to the eyes in species where the eyes have been reduced. The width of the head appears to be easily altered. Shrinkage is recognized by wrinkles along the marginal carinae and displacement of setae along the margins. Overcleared specimens are particularly subject to either shriveling or swelling.

Head index.—The head index is the ratio between head width and head length. It is determined by the following formula:

$$\frac{HL}{HW} \times 100 = HI$$

This ratio has descriptive but not diagnostic value in *Ricinus*.

Labral width.—The labrum is measured from tip to tip. The width does not differ whether the labrum is open or closed. Clearing and mounting procedures do not alter the width of the labrum.

Prothoracic length.—The length of the prothorax is measured along the midline of the dorsal surface of the prothorax. This measurement is rarely subject to alternation by curatorial procedures.

Prothoracic width.—This measurement is taken at the greatest width of the prothorax.

Male genitalia.—Several measurements were made on the male genitalia. However, the greatest width of the mesosome was the only measurement that did not show considerable intraspecific variation.

Distance between prosternal setae.—The distance in microns between the pair of setae on the anterior margin of the prosternal plate (pl. 3, fig. 1) is measured from the center of one alveolus to that of the other.

Setae.—Measurements of setae are not feasible in *Ricinus* because of variation in orientation. Hence the size and shape of setae are expressed in subjective or comparative terms. Setae that are considered long are t1–t2, the postspiracular setae, and certain of the labral, pleural, and sternal setae. Setae considered short are df, f1–2, d1–d3, a2–a6, pr1–pr2, m1, and the prosternal setae. Mental and maxillary setae are medium-sized. The w series and q2 are examples of spinose setae. The relative size of the setae is indicated in the figures for each species.

The mean and range of measurements of these features are given for each population and species of *Ricinus*. Certain species can be separated from each other by over-all size or size of one particular element, but the usefulness of other measurements is found in supplementing differences in characters such as shape of structures, chaetotaxy, and pigmentation patterns. Interpopulational differences in size without other accompanying differences do occur, but they are thought to be host-induced (Mayr et al., 1953) rather than genetic differences.

SHAPE OF STRUCTURES

The shape of structures such as the head, prothorax, male genitalia, female terminalia, and sternal plates have been used as diagnostic characters in *Ricinus* (Clay and Hopkins, 1951, 1960; Carriker, 1964). To affirm the value of these characters, variations in shape were studied with the use of the microprojector. An outline sketch was made of a particular structure from one specimen of a population by tracing the projected image on paper. This specimen was removed from the microprojector and replaced by another specimen. Similarities and differences were observed by comparing the image of the second specimen with the sketched outline of the first. Many specimens could be compared rapidly in this manner. Intrapopulation and interpopulational variation were observed by sketching superimposed outlines of several specimens on the same paper. The taxonomic value of the shape of a particular structure could be accurately assessed by this method (Clay and Hopkins, 1954).

The microprojector is extremely useful in comparing specimens from different populations that vary in size but appear similar in other characteristics. By changing the size of the objective lens, the projected image of each specimen was increased or decreased in size to that of the sketched specimens. Similarities, differences, and degree of distoration were determined accurately in this manner. Size often appeared to be the only difference between populations. In some specimens differences were brought out which were not apparent without this type of comparison.

Specimens that had been mounted in different media or that had undergone various degrees of clearing were compared to determine the amount of variation resulting from these procedures. If specimens of the same population were properly cleared, little difference was observed between specimens in Canadian balsam, synthetic resins, or Hoyer's mountant. The differences are of the same magnitude

as those seen among large series mounted in a single mountant. Specimens that were received in a desiccated condition and later relaxed in trisodium phosphate fell within the normal range of variation of a population. Overcleared specimens are distorted and are larger or smaller than properly cleared specimens.

As with measurements and chaetotaxy, there is some intrapopulational variation in shape, but it is minor. Any extreme differences usually result from obvious injury to the specimen, orientation of the specimen on the slide, or subtle shriveling of fragile characters. Certain differences in the shape of structures result from curatorial processes. *Ricinus spadix, R. exsul, R. orbifrons,* and *R. subtenius,* all described as new species by Carriker (1964), were described from distorted specimens and are synonyms of other species. Subtle changes are not easily recognized. Some intrapopulational differences in head shape may be explained by the orientation of the mounted specimen on the slide. The head may be tilted away from the horizontal position, and the pressure of the coverslip may alter both the shape of the frons and the occipital region. This orientation seems to account for the slight differences in several specimens referred herein to *R. diffusus* in which these specimens differ from typical *diffusus* only in the shape of the frons and the occipital margin.

Slight changes occur also in the shape of the mandibles, a character that has specific value. Populations of *Ricinus australis* initially appeared to have mandibles which vary greatly in shape. However, examination of the tips under high magnification shows shriveling in the proximal part of the tips, an area that is lightly sclerotized. The degree of shriveling accounts for the apparent difference in the shape of the mandibles. Three specimens taken from the same host, *Oporornis tolmiei,* referred to *Ricinus emersoni,* n. sp., all have differently shaped mandibles. In each instance the mandibles are oriented slightly at an angle from the horizontal. The type specimen of *R. subangulatus* also appears to have mandibles with shorter tips than in other specimens referred to this species. In this case the tips project outward into the oral cavity. Since the taxonomic value of the mandibles is great, it is important to determine whether differences are real or the result of artifacts.

PIGMENTATION

The pigmentation pattern has been used in species descriptions of *Ricinus* by most authors. Kellogg (1896*b*, 1899), Carriker (1902, 1903, 1964), and Durrant (1906*a*, 1906*b*) placed much emphasis on this character. Furthermore, Clay and Hopkins (1951, 1960) concluded that the pigmentation pattern has diagnostic value in *Ricinus*. Most species have a characteristic pattern or color, although a few species share a common pattern. Certain species can be easily identified solely by the pigmentation pattern, as in *R. australis*. A difference in pigmentation pattern unaccompanied by other distinguishing characters is rare; however, two such differences have been observed in this study. The population of *Ricinus* on *Parus* spp. has been referred to *R. medius* Uchida. This population differs from *R. fringillae* in only two characters: darker-colored carinae of the head and a darker sternite pattern. The lack of other differentiating characters has led Rheinwald (1968) and me to designate *R. medius* as a junior subjective synonym of *R. fringillae*. Specimens from *Dendroica petechia* from Florida and Cuba differ from specimens from the same host from Minnesota and New York in the coloration of the pleurites. In the latter specimens the pleurites are pigmented to the margin; in the former they are not pigmented. All species are referred to *R. dendroicae* n. sp. More collections must be made throughout the range of this host to clarify the status of these populations.

The basic color of the nodi, carinae, and plates has diagnostic value. The colors are black, brown, red-brown, gold, and oxblood. The intensity of these colors is often so modified by curatorial procedures that it is useless to describe the color other than in general terms. The background color of specimens, defined herein as the areas other than the nodi, carinae, and plates, has some importance. Usually the background is white, but in heavily pigmented species, such as *R. brevicapitis, R. arcuatus,* and *R. complicatus,* it is brown.

The nodi of the head, prothorax, prosternal plate, thorax, and pleurites as well as the epimera and phragmata of the thorax are pigmented in each species. The labrum and gular plate are nearly always pigmented. The patterns that have diagnostic value are those on the gular, mental, and sternal plates, and the markings on the female sternites. The tergites are rarely colored except in *R. japonicus, R. seiuri,* and the heavily pigmented species listed above. The pleurites may be pigmented to their outer margins as in *R. picturatus* or not pigmented as in *R. pallens*. This variation occurs fairly regularly in pairs of closely related species. The carinae of the head and legs are usually not much darker than the background, but are heavily pigmented in *R. australis, R. complicatus,* and *R. arcuatus* among others. Occasionally the mesosome of the male genitalia is colored, as in *R. seiuri* and *R. thoracicus*.

Since the pigmentation pattern is altered by staining, it is recommended that specimens of *Ricinus* should not be stained.

SPECIES CONCEPT

Species are defined as groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups (Mayr, 1942). Populations rather than individuals are considered to be the basic taxonomic units. Thus all the available biological data, especially regarding reproduction, are considered along with morphological data. In the absence of data from breeding experiments between populations, potential capabilities for interbreeding must be inferred indirectly from other information. Morphological differences between sympatric populations usually supply ample evidence of reproductive isolation. The investigator must judge whether allopatric populations can interbreed. Inference must be based on analysis of the morphological differences between these populations (Mayr, 1942). Since few biological data are available for Mallophaga, the potential capacity for interbreeding between populations must be inferred from morphological data and host distribution data.

Some workers believe that the best inference comes from the examination of host distribution data. Zlotorzycka (1964) stated that "... the Mallophaga display strict host specificity because their hosts especially various species of birds are essentially isolated from one another. Hence almost every bird species harbours different lice species (narrow specificity considered). Thus the detection of a parasite species so far unknown for this particular bird is an important hint for describing it as a new one." Eichler (1966) remarked, "Even if we have not yet

proven that morphological differences exist between 'populations' of lice of different hosts, we may assume that such a 'population' is 'reproductively isolated from other such populations (on other host species) to the extent that future evolution is likely to lead to further divergence from its relatives.' " Eichler also assumed that morphologically indistinguishable populations found on separate host species were sibling species.

The contentions of Eichler and Zlotorzycka are rejected for the following reasons:

1. Their hypothesis is based upon a priori assumptions that anticipate evolution and speciation rather than upon data that document the course of evolution and speciation in Mallophaga. Eichler's assumption that morphologically indistinguishable populations are sibling species is not supported by Mayr et al. (1953), who concluded that distributional data are not decisive in detecting sibling species. Such species are discovered in taxonomically well-known groups by refined methods (cytogenetical, biometrical, or taxonomic-ecological), none of which has been applied to Mallophaga.

2. Their hypothesis assumes a common mode of evolution for the Mallophaga which precludes the presence of extremely plastic or conservative groups within the lice, a situation found commonly in other groups of organisms (Worthington, 1940; Rensch, 1959).

3. Their hypothesis assumes that isolation of lice on different hosts is sufficient evidence to indicate that speciation has occurred. This idea is not in harmony with concepts of the majority of evolutionists. Blair (1943) outlined the following steps for speciation. Speciation occurs as the result of: (*a*) isolation of one or more parts of a previously interbreeding population: (*b*) morphological differentiation as a result of differential mutation and selection pressure; and (*c*) the development of mutual infertility through genic or chromosomal changes. Blair concluded that, since evolution is a dynamic process, speciation may be reversed as long as the third step has not occurred. Although it is generally agreed that speciation occurs in isolation (Mayr, 1963), isolation only supplies opportunity for it to occur. Since infertility between populations of Mallophaga has not yet been tested, speciation must be inferred from the degree of morphological differentiation. This contention is supported by Simpson (1961), who stated that morphological differentiation usually reflects genetical differentiation. He further said, "If no appreciable genetic differences have developed among them, it would be inconvenient or almost ridiculous to insist that each disjunct population is a separate genetical species, even if no interbreeding has occurred."

4. Their hypothesis leads to the conclusion that the classification of Mallophaga is based more on the classification of the host than upon its own merits. According to their hypothesis the inclusion of two previously recognized host species as conspecific or the division of one species into two or more separate species would automatically synonymize or erect species of lice.

5. Their hypothesis assumes that different host species are isolated from each other. This assumption is in accordance with the views of most workers in Mallophaga, such as Kellogg (1896*a*, 1913) and Hopkins (1942, 1949). However, I agree with Dubinin (1947), Vanzolini and Guimaraes (1955), Mayr (1957), and Keler (1958) that host species are not isolated as the above-mentioned authors

indicate. In fact, the mammalian and ornithological literature indicates that the frequency of interspecific contacts is far from rare. Thus the opportunities for interspecific transfer of lice are greater than has been previously recognized. Interspecific transfer of lice may ensue from the occurrence of mixed-species flocks, from the use of common dust baths, roosting sites, burrows, or nesting sites, through the activities of "helpers," and during hybridization.

Mix-species flocks include individuals of several different species, numbering from two to more than a dozen in extreme cases (Moynihan, 1962). Some mixed flocks are essentially transitory; others are semipermanent, very long-sustained, or dissolved and re-formed at more or less regular intervals. Certain of these flocks are tightly integrated and have a complicated social structure. Moynihan stated that mixed-species flocks are found everywhere, but appear to be more common and complex in certain regions of the tropics. Most of these flocks are largely or completely composed of passerines, including both permanent residents and a few migrant birds. These flocks afford ample opportunity for interspecific contacts of birds, and hence interspecific transfer of lice. Several of the most common species forming mixed-species flocks are known hosts of species of *Ricinus*.

The use of common dust baths, common roosting sites, and approximate nesting sites presents opportunities for interspecific transfer of lice through direct contacts of the birds or through the agility of the lice themselves. Hoyle (1938) has demonstrated both experimental and natural transfer of two species of lice from chickens to *Passer domesticus* through the use of common dust baths. Kellogg (1898) and Dubinin (1947) found Mallophaga typical of water birds occurring on land birds. They speculated that transfer had occurred because these birds frequently perch close together. Hoyt (1948) and Houck and Oliver (1954) reported nesting of different species of birds within 9, 10, 15, and 18 inches of each other. Lice could easily crawl these short distances.

Direct interspecific contacts occur between birds where one bird acts as a "helper" (Skutch, 1961), "a bird which assists in the nesting of an individual other than its mate, or feeds or otherwise attends a bird of whatever age which is neither its mate nor its dependent offspring." Several species that serve as hosts for species of *Ricinus* are reported as helpers by Skutch.

Hybridization also indicates evidence of direct contact between different host species. It may be argued that the hybrid would represent a dead end for the transfer of lice, since the hybrid is usually infertile. However, subsequent contacts made by the parents and the hybrid offspring may perpetuate secondary infestations. Furthermore, abortive attempts at mating between different species probably occur at a greater frequency than the observed successes. Kellogg (1898) speculated that the frequency of hybridization among ducks accounted for the distribution of the same two species of lice common to many duck species. Cockrum (1952) has listed the cases of hybridization of North American birds. Known hosts for *Ricinus* spp. which frequently hybridize are found in the Fringillidae (between *Passerina* spp., *Junco* spp., and *Junco* and *Zonotrichia*) and Parulidae (between *Vermivora* spp. and *Dendroica* spp.). Sibley (1957) reported an occurrence of hybridization between *Pipra erythrocephala* and *Manacus manacus*. Both of these hosts harbor the same two species of *Ricinus*. Short and Simon (1965) listed nine records of hybrids between *Junco hyemalis* and *Zonotrichia albicollis*.

The same two species of *Ricinus* are found on these hosts. Dickerman (1961) discovered a hybrid between *Melospiza melodia* and *Zonotrichia leucophrys,* both of which harbor the same two species of *Ricinus.* Other records are available, but these are sufficient to indicate that interspecific contacts through hybridization do occur.

Secondary infestations apparently have resulted, but few have been documented. Boyd (1951) reported that *Degeeriella nebulosa* (now in *Brueelia*) has transferred from *Sturnus vulgaris* to *Turdus migratorius* since the introduction of the former species into the New World. In turn a species from the New World family Icteridae, *D. illustris* (now *Brueelia ornatissimus*), has transferred to *S. vulgaris.* In mammals the dog has acquired a species of *Heterodoxus* from marsupials, and *Sylvilagus brasiliensis* has acquired three species of Mallophaga from cavies (Hopkins, 1949; Vanzolini and Guimaraes, 1955). Clay (1949*b*, 1957, 1962) has drawn attention to the possibilities of secondary infestation and cited several cases. The presence of two species of *Ricinus* on one host species appears to indicate secondary infestation by one of the species.

These observations indicate that different host species are not isolated and that contacts are frequent enough to account for the establishment of secondary infestations. It is probable that most interspecific transfers of lice fail to become established because another species of louse is already present in that niche. However, where the niche is open, establishment is likely. Since the infestation rate for species of *Ricinus* is low, it is not inconceivable that the same species could become established on different hosts through interspecific transfer. It is also probable that interspecific transfer provides sufficient gene flow between various populations of polyxenic species of *Ricinus* to prevent genetic drift and subsequent speciation.

The majority of taxonomists agree that, in the absence of direct reproductive data, the degree of morphological differentiation is the best indication of the potential capacity for interbreeding between allopatric populations. Simpson (1961) has recommended the use of multiple characters at each level of classification. Nelson and Price (1965), referring to Mallophaga, stated that taxonomic procedure should be based on current knowledge, and that it must always be recognized that structural and biological evidence may subsequently be found for further separation. This philosophy has been followed herein.

The following situations were observed in the course of this study on the populations of *Ricinus:* (1) populations that differed in several distinct characters; (2) populations that differed in a few minor but constant characters; (3) populations that differed in one character; (4) populations that differed in no respect except within the limits of the usual intrapopulational variation.

Obviously the populations in the first category represent good species. Those in the second category are also considered to be good species. The latter populations are found on a given taxon of hosts. For example, six closely related species found on species in the family Parulidae are similar in size, general shape, and chaetotaxy, but they can be separated by the characters of the mandibles, the pigmentation pattern on the sternites, and minor but constant differences in the shape of the head and gular plate. The differences are considered to be of specific value, whereas the similarities are interpreted as the result of adaptations to a common

environment afforded by the similarities in the size and plumage of the warblers.

Populations that differ in only one character are not given taxonomic status. These presumed single differences, such as the intensity of the pigmentation pattern or the shape of the head, are of a type that can be easily altered during curatorial procedures. Examples of these differences are discussed under the remarks for *R. elongatus, R. fringillae sensu lato,* and *R. diffusus.*

According to Clay (1962) the most controversial topic in mallophagan systematics is how to deal with populations that differ in no respect except for over-all size. There are no data for Mallophaga to indicate that size differences result from genetic or from host-induced differences. Mayr et al. (1953) reported that host-determined variation is most commonly expressed in size differences so far as studied. There is a rough correlation between the mean size of the louse population and the size of the hosts in these populations. This phenomenon has been referred to as Harrison's law (Clay, 1962). In view of the uncertainty over the cause of size differences, it appears better for the present not to recognize taxonomically populations that differ statistically only in over-all size. Such populations are referred to as of a species *sensu lato.*

Populations that do not differ from each other are considered conspecific. The polyxenic distribution (Sandground, 1929) of these species of *Ricinus* and a related genus, *Laemobothrion* (see Nelson and Price, 1965), seem unusual for Mallophaga. Other groups of lice appear to be strictly monoxenic (Ward, 1957) or oligoxenic (Keler, 1958), except for some species that have been referred to the *sensu lato* status by Clay (1962) and Price and Beer (1963). No adequate explanation is available to account for this lack of speciation. Both of the genera above are considered by Hopkins (1949) to be relicts. Lack of speciation and disjunct distributions seem to be characteristic of relicts.

Carson (1959) has outlined a hypothesis that accounts for species formation and species retardation based upon contrasting types of genetic adjustments exhibited by various populations. Adjustment by homoselection (selection for specific performance in a specific niche) results in genetically fixed adaptive features. Species formation is promoted since populations are small, inbred, and semi-isolated; random drift may operate and open recombination usually prevails. Adjustment by heteroselection (selection for general performance in all niches) results in genetic balance with the property of heterotic buffering. Species formation is retarded since populations generally are very large and outerossed with little isolation; random drift rarely operates and restricted recombination often prevails. Wenzel and Tipton (1966) stated that Carson's concept of homoselection versus heteroselection seems to apply to populations of host-limited and non-host-limited parasites, respectively. The concept does seem applicable to species of *Ricinus* that exhibit monoxenia and perhaps oligoxenia, but not to those with a wide host association. In the later the concept of heteroselection seems applicable only if it is assumed that enough interspecific transfer occurs to create the large population required by the hypothesis and to prevent random drift and isolation.

No populations are referred to the subspecies taxon. Johnson (1960) showed that the subspecies in lice has not been based on geographical variation or a zone of intergradation. Thus none of the described subspecies of Mallophaga conforms to the definition given by Mayr et al. (1953). Currently no adequate data are

available upon which to base decisions on the subspecific status of Mallophagan populations. Hall (1943) has presented a reasonable method for determining whether populations of mammals on islands should be considered species or subspecies. He used the amount of variation on the mainland as his baseline. This type of analysis might demonstrate subspecies in lice if a baseline for the total variation of a species throughout its range could be established. Until this is done the subspecies concept serves no useful purpose as applied to lice (Clay, 1962; Rheinwald, 1968).

PHYLOGENY

Since fossils of lice are unknown, deductions as to the origin and phylogeny of Mallophaga must be based on data collected from comparative anatomy of extant forms. Problems associated with the interpretation of these data are discussed by Clay (1947, 1949*b*, 1957) and Keler (1957, 1958). Owing to much apparent convergence and parallelism among lice, it is difficult to ascertain which characters have phylogentic significance and hence which show the primitive or derived state (Clay, 1947). Mayr (1955) has pointed out that as an almost regular occurrence a structure begins in a simple condition, becomes complex later in its evolution, but is eventually again simplified. Furthermore, he stated that the more important the structure is functionally, the more plastic it will be in evolution. With these cautions in mind, there yet appears to be a reasonable and plausible choice of characters that demonstrate the probable phylogenetic position of *Ricinus* within the Mallophaga and the apparent phylogeny within the genus.

It is generally acknowledged that the tentorium is useful in determining relationships throughout the Insecta. In the genera *Ricinus* and *Laemobothrion* Symmons (1952) found greater reduction of the tentorium than in other Mallophaga. Coupled with this reduction is the loss of frontoclypeal and postoccipital sutures in nymphs and adults of *Ricinus*. Loss of these landmarks and reduction of the tentorium are interpreted as evidence of specialization.

Specialization of the mandibles of *Ricinus* has occurred in several ways. My observations have shown them to be relatively smaller and less heavily sclerotized than in ten amblyceran genera studied (*Actornithophilus, Austromenopon, Colpocephalum, Dennyus, Eidmaniella, Eureum, Menacanthus, Menopon, Myrsidea,* and *Trinoton*). In these genera each mandible is heavily sclerotized and both condyles are evident. In *Ricinus* only the tips are heavily sclerotized, whereas the mandible proper is lightly sclerotized and partially membranous. The dorsal condyle appears reduced, and perhaps its articulation is ligamentous as Carriker (1960) surmised. The mandibles in *Ricinus* are of a modified form more adapted for piercing than chewing. Clay (1949*a*) considered this to be an indication of specialization.

Specializations have occurred in the labium and labrum. The labium has lost all apparent traces of division into glossae, paraglossae, and palpifers. These structures are present in the other genera of Amblycera examined. Conversely the labrum is well developed. Associated with the labrum are the pallettes, which probably have been derived from the epipharynx. These structures, which are unique to *Ricinus* and the *Ricinus*-like genera on hummingbirds, are specializations for attachment, suction, or both.

Further specialization in *Ricinus* is evidenced by the fusion of the elements

comprising the pterothorax, of the two terminal segments of the abdomen, and of the sclerites of the male genitalia. The pterothorax, which comprises the mesometathorax and abdominal segment I, has become fused to the extent that no external traces of division are apparent. According to Cope (1941) there is at least some external evidence of division of these elements in other Amblycera. Abdominal segments IX and X have become coalesced in both sexes, but Cope stated that this phenomenon has occurred repeatedly in the Menoponidae. The male genitalia are quite simple in *Ricinus* compared to those of other genera of Amblycera (Snodgrass, 1899). Although the homologies of the various sclerites of the male genitalia are difficult to ascertain (Clay, 1956), it is apparent that the endomeres have become either lost or fused with the mesosome.

In *Ricinus, Laemobothrion, Trochiloecetes,* and *Trochiliphagus* the antennal capsules are situated ventrally on the head rather than laterally as in other genera of Amblycera. The ventral position of the antennal capsules is regarded as the specialized condition. This reasoning is based upon the fact that genera with ventral capsules have the most reduced tentoria. The same reasoning is used with regard to the sparsity of setae exhibited by *Ricinus*. Nearly all other Amblycera are moderately or heavily setose. The reduction in the number of setae is considered a specialized character. Based upon the evidence of the modifications discussed above, it is concluded that *Ricinus* is one of the most specilized genera in the suborder Amblycera.

Evolution within *Ricinus* is evidenced by further specialization of certain structures and the development of common features in various groups of species. The combination of these results in data that are useful in deducing the probable phylogeny of the various species groups. A dendrogram (pl. 1) shows the hypothetical phylogeny of species of *Ricinus*. Modifications that show apparent phylogentic sequence are seen in the mandibles, (dimorphic, monomorphic, or intermediate) and tentorium.

It is generally agreed that in Insecta the chewing mouthparts are primitive, whereas piercing-sucking mouthparts are specialized. The mandibles in insects that masticate their food are dimorphic (Snodgrass, 1935). In the Mallophaga the Ischnocera feed almost exclusively on feathers and skin debris. The Ischnocera have dimorphic mandibles, as illustrated by Keler (1957). Most of the Amblycera feed on feathers, skin debris, and blood. Herein the mandibles are dimorphic, but the tips are more pointed—probably an adaption for piercing (Keler, 1957). In *Ricinus* both dimorphic and monomorphic mandibles occur. Species of *Ricinus* with dimorphic mandibles are considered more primitive.

The development of monomorphic mandibles represents a departure from the basic kind found in the Mallophaga and is considered the specialized form. The monomorphic form probably represents a more efficient structure for piercing. Among the species with monomorphic mandibles are those with short, thick mandibular tips, those with long needle-like tips, and those with mandibles that show various intermediate conditions in the structure of the tips. The long needle-like tips seem to represent the specialized form, being derived from the shorter, thicker type.

Modifications of the mandibles appear to be correlated with a reduction of the tentorium. The tentorium is best developed in species with dimorphic mandibles,

giving further support to the concept that these species are more primitive. Among these species the posterior tentorial pits are large and the tentorial arms are sclerotized. Among species of *Ricinus* with monomorphic mandibles the tentorium is best developed in members with short, thick mandibular tips; even so, the posterior pits are reduced and the arms appear membranous. In the species with needle-like mandibular tips the arms are rarely evident and the posterior pits are quite small or absent. The two species with the intermediate type of mandibles have relatively well-developed tentoria.

The species with dimorphic mandibles are divided into three groups: the *brevicapitis*, *arcuatus*, and *fringillae* groups. The first two groups appear to be related, but since the male of the only species in the *brevicapitis* group is unknown, the degree of relationship is unknown. These two groups are considered the most primitive of the extant species of *Ricinus*, whereas the *fringillae* species group is the most advanced of the species with dimorphic mandibles. Evidence for this is seen in the structure of the male genitalia and the host association of these groups. The genitalia of the *arcuatus* group have long, pointed parameres with apical setae. The margin of the mesosome ends in a broad plate or a sharp point. The genitalia of the *fringillae* group have rounded parameres without apical setae. The margin of the mesosome is entire. The latter type has probably been derived from the former. Furthermore, the *brevicapitis* and *arcuatus* groups are found on the suboscines, the primitive passerines, whereas the *fringillae* group occurs on the oscines, the advanced passerines.

Among the species with monomorphic mandibles there has been an apparent progressive reduction both in the mandibular tips, from a short, thick structure to a long needle-like structure, and in the tentorium. Species with long needle-like tips are not closely related to each other. Development of this kind of tip appears to have evolved independently within three different lines. Each line or species group is characterized by a particular type of ovoid sclerite in the hypopharyngeal apparatus and by the basic shape of the head. The *subangulatus* species group is distinguished by deeply pitted ovoid sclerites (pl. 31, fig. 2), and by the basic head shape (pl. 31, fig. 1). *Ricinus subhastatus* and *R. wolfi* represent the primitive numbers of this group, having short, thick mandibular tips, whereas the five other species in this group are advanced, having long needle-like tips. The *diffusus* group is distinguished by the presence of finely pitted ovoid sclerites (pl. 41, fig. 3) and by the basic head shape (pl. 41, fig. 1). This group is quite homogenous, with moderately thick mandibular tips. *R. carolynae*, *R. sittae*, and *R. australis* are the species with needle-like tips. The *marginatus* species group is distinguished by ovoid sclerites that are invisible or unornamented when observed at high magnification, and by the basic head shape (pl. 21, fig. 1). Needle-like tip occur in *R. dendroicae*, *R. flavicans*, *R. polioptilus*, and *R. seiuri*.

Ricinus serratus has deeply pitted ovoid sclerites as in the *subangulatus* group. However, the unique development of the prothorax and pleural nodi indicates that *R. serratus* should be placed in a separate group. Since this species has short, thick mandibular tips, it is considered to be a primitive offshoot of the line that gave rise to the *subangulatus* group.

In *R. invadens* and *R. mandibulatus* the mandibles show an intermediate condition between the species with dimorphic mandibles and those with monomorphic mandibles. In other characters these forms are closely related to species with monomorphic mandibles. *R. mandibulatus* superficially resembles *R. marginatus* in the shape of the head and prothorax. Furthermore, the ovoid sclerites are not evident. If convergence has not occurred, these characters are sufficient evidence to place *mandibulatus* near the base of the line that gave rise to the *marginatus* species group. Placement of *R. invadens* within the proposed phylogenetic scheme is difficult because it shares characters in common with the *arcuatus*, *marginatus*, and *subangulatus* groups. Therefore it is considered a separate offshoot, but its exact position cannot be determined.

In summary, it appears that *Ricinus* evolved either from a protomenoponid (Keler, 1957) or from an early menoponid ancestor about the time of the origin of passerine birds. Two separate radiations have taken place within the genus. The first involved forms having dimorphic mandibles; these species probably parasitized the progenitors of the modern families of passerines. The second radition involved forms having monomorphic mandibles. Evidence cited above indicates that monomorphic mandibles evolved from dimorphic mandibles; therefore, species with monomorphic mandibles must have radiated later than those with dimorphic mandibles. The forms with monomorphic mandibles are more successful in terms of number of species present in the New World, 26 as opposed to 10, and in the extent of the distribution in the New World, on 14 as opposed to 8 families of hosts.

The distribution of *Ricinus* on a world-wide basis is interpreted as a relict distribution (Hopkins, 1949). It is speculated that the forms having dimorphic mandibles were unable to cope with the changes of their hosts and hence became extinct over most of their range. Thus the present distribution of *Ricinus* is basically the result of secondary absence of forms with dimorphic mandibles. The species having monomorphic mandibles probably developed during the decline of forms with dimorphic mandibles, and after the development of most of the passerine families. Thus the distribution of forms with monomorphic mandibles may be basically primary with little secondary absence. Undoubtedly secondary infestations have occurred to account for some of the distribution of *Ricinus*. Although this hypothesis is highly speculative, it appears to be consistent with the available data on morphology and host association.

HOST-PARASITE EVOLUTION

Kellogg (1896*a*, 1913) and Harrison (1914) independently hypothesized that the distribution of Mallophaga is useful in elucidating the phylogeny of their hosts. This hypothesis developed from observations that related hosts harbor related Mallophaga. According to Hopkins (1949), it is based upon the following assumptions:

1. Mallophaga are usually extremely specific, permanent parasites of their hosts.
2. Mallophaga were present on the original ancestors of their hosts and have diverged as their hosts diverged, although at a slower rate.
3. Lice have undergone relatively slow evolutionary development.

It was concluded that the occurrence of a genus of lice on a taxon of hosts is indicative of a close relationship of these hosts. Several authors have shown that the distribution of lice can be useful in deducing probable host relationships (Hopkins, 1942, 1949; Clay, 1949*b*, 1957; Ward, 1957). Although other authors regard

the hypothesis as tenable, they have raised the question how far it may be pursued (Ferris, 1951; Vanzolini and Guimaraes, 1955; Mayr, 1957; Keler, 1957, 1958). They have noted that some of the data on host association of lice contradict the data on the host's morphology with reference to the phyolgeny of the hosts, and have cited instances in which the same species or genera of lice occur on obviously unrelated hosts.

Criticism can be leveled against both the assumptions upon which the hypothesis is based and the interpretations of the observed distribution of lice. The assumptions that are basic to the hypothesis of Kellogg and Harrison are not entirely accurate. The first assumption is that Mallophaga are extremely host-specific, but Keler (1958), Emerson (1964*a*, 1964*b*), Nelson and Price (1965), and the present work show that many species have wide host associations. The second is the implication that secondary infestations have not occurred. Observations cited above show that interspecific transfer is possible and has occurred. In view of these facts it is necessary to determine whether the distribution of a taxon of Mallophaga over one or more taxa of hosts is primary, and can be used to indicate a phylogenetic relationship of the hosts, or is secondary, and only implies an ecological relationship of the hosts. Since it is rarely possible to determine this directly, the best interpretation is made on the basis of all available data regarding the biology and evolutionary history of lice and their hosts.

For example, each of the genera *Colpocephalum*, *Laemobothrion*, and *Menacanthus* occurs on four or more unrelated orders of birds (Clay, 1957). Since it is difficult to comprehend how contact could occur between certain of these birds, Hopkins (1949) and Clay (1949*b*, 1957) speculated that these lice once were more widely distributed over the orders of birds, but have become extinct over part of their former range. The fact that ducks and flamingoes share certain genera of lice has led Hopkins (1942) and Clay (1957) to conclude that a phylogenetic relationship exists between these superficially dissimilar birds. Because both groups of birds live in similar habitats, flamingoes may have acquired lice from anserine birds through direct or indirect contacts, indicating only an ecological relationship between these hosts (Mayr, 1957). However, Clay supported her assumption with data from the fossil record and from comparative morphology of the plumage of these birds. Problems in interpreting the distribution of several species of *Ricinus* are discussed below.

Mayr (1957) stated that evidence (of phylogenetic relationship) presented by parasites may be suggestive, but can rarely be considered absolute proof unless it is corroborated by independent evidence. Furthermore, Ferris (1951) admonished that discrepancies between data from host association and host morphology should be accepted as they exist and not forced into some framework of ideas as to how they ought to be accounted for by the system of classification. Therefore it is concluded that data from host-parasite association should be considered only as circumstantial evidence affecting the interpretation of phylogenetic relationships of avian hosts as established by classical ornithological methodology.

Ricinus occurs on 28 of the 70 families of Passeriformes (table 2). Hopkins (1942, 1949) interpreted this as a relict distribution, since these 28 families are not closely related. Because of this type of distribution, he suggested that no reliance be placed on the use of *Ricinus* in determining relationships of these birds. However, Carriker (1964) noted a correlation between certain species of *Ricinus* and given host species. This correlation has also been observed herein. Since there are questions regarding the affinities and proper allocation of various taxa within the Passeriformes, data from *Ricinus* may be useful in suggesting the proper placement of some of these forms. It is recognized that data from one genus of lice are not conclusive; however, data from other genera of Mallophaga found on Passeriformes are not yet available. Owing to incomplete records and other limitations the following conclusions should be regarded as provisional.

TABLE 2

DISTRIBUTION OF FAMILIES OF PASSERIFORMES WHICH SERVE AS HOSTS FOR RICINUS

Old World	New World	Both Old and New World
Dicruridae	Cotingidae	Alaudidae
Oriolidae	Pipridae	Paridae
Ptilonorhynchidae	Tyrannidae	Sittidae
Paradisaeidae	Vireonidae	Troglodytidae
Pycnontidae	Coerebidae	Turdidae
Muscicapidae	Parulidae	Sylviidae
Prunellidae	Thraupidae	Regulidae
Sturnidae		Motacillidae
Meliphagidae		Bombycillidae
Nectariniidae		Fringillidae
Dicaeidae		

Certain species groups of *Ricinus* are useful in demonstrating relationships of some groups of birds, but in other species groups the distribution is so anomalous that definite correlations cannot be made. If the species groups of lice that contain only one species of *Ricinus* are eliminated from the discussion, the following relationships are indicated. The *arcuatus* and *fringillae* species groups show specificity at the superfamily and subordinal level of hosts, with the former occuring on members of the Tyrannoidea of the suborder Tyranni and the latter on members of the suborder Passeres. Except for *R. sittae* from Sittidae, the *diffusus* group shows specificity at the family level, occuring on members of the Fringillidae (*sensu* Wetmore, 1960). The *subangulatus* species group is found on Vireonidae, Thraupidae, and Fringillidae. Beecher (1953) and Tordoff (1945*a*, 1954*b*) both recognize the close relationship of these "nine-primaried" New World oscines. However, the family Parulidae, also a member of this group of birds, harbors species of *Ricinus* placed in the *marginatus* species group. Species from Tyrannidae and Regulidae are also included in the *marginatus* species group. Because of their anomalous distribution, the usefulness of the *subangulatus* and *marginatus* groups as indicators of host phylogeny is highly speculative.

Species of *Ricinus* demonstrate various degrees of host specificity (table 3). Of the 38 species recognized in the New World, 34 percent show monoxenia or host specificity at the species level. Since collecting records are incomplete, this figure may be high. However, strict host specificity presently cannot be ruled out. Host specificity at the generic level occurs, as is indicated by *Ricinus* spp. listed as oligoxenic in table 3. Host specificity at the family level also occurs. *Ricinus* that

show this type of specificity are the only representatives of the genus or of a species group that occur throughout that particular family of birds. These species are as follows: *R. invadens* of the *invadens* species group and *R. pessimalis* of the *arcuatus* species group on Pipridae; *R. japonicus* on Motacillidae; and *R. serratus* on Alaudidae.

Species that show an apparent secondary distribution on avian hosts are *R. elongatus* and *R. fringillae sensu lato*. *R. elongatus* occurs on species in the avian genus *Turdus* (family Turdidae) in both the Old and New World and on *Bombycilla garrulus* (family Bombycillidae). No relationship exists between these birds. The present anomalous distribution of *R. elongatus* may have resulted from extinction of this species over most of its range. However, a simpler explanation is that *B. garrulus* may have acquired *R. elongatus* secondarily from some *Turdus* sp. *Ricinus fringillae* occurs on species in two subfamilies of Fringilldae—Fringillinae and Emberizinae—and in Paridae. Again no relationship exists between birds in these families. Although both of the explanations given for the distribution of *R. elongatus* are applicable to *R. fringillae*, secondary transfer appears to be the simpler explanation.

TABLE 3

DEGREE OF SPECIFICITY EXHIBITED BY SPECIES OF RICINUS
(Terms after Sandground, 1929)

Monoxenous	Oligoxenous	Polyxenous
complicatus	*brevicapitis*	*arcuatus*
dalgleishi	*calcarii*	*australis*
flavicans	*carolynae*	*diffusus*
mandibulatus	*dendroicae*	*elongatus*
microcephalus	*frenatus*	*emersoni*
pallens	*ivanovi*	*fringillae*
polioptilus	*subangulatus*	*invadens*
ramphoceli	*vireoensis*	*japonicus*
seiuri	*wolfi*	*leptosomus*
sittae		*marginatus*
thoracicus		*pessimalis*
volatiniae		*picturatus*
		serratus
		subdiffusus
		subhastatus
		sucinaceus

Little can be said by way of interpretation of the distribution of the other species of *Ricinus* that have a polyxenic distribution (table 3). A species usually does occur on only one family or subfamily of hosts. Within a family or subfamily of hosts one species of *Ricinus* is found on several but not on all genera within these taxa. Furthermore, other genera in the same taxon of hosts harbor more than one member of the same species group of *Ricinus*. Although the distribution of a polyxenic species of *Ricinus* may indicate a phylogenetic relationship of some of these birds, it is possible that this relationship has become obscured by secondary infestations onto other species of hosts that are associated ecologically with these birds.

Species of *Ricinus* are suggestive in clarifying controversial theories or supporting various hypotheses on the classification of their hosts. The distribution of *arcuatus* supports the views of Dr. P. L. Ames and Dr. S. L. Warter (unpubl. theses, cited in De Schauensee, 1966) that some genera currently placed in Cotingidae belong to Tyrannidae. *R. arcuatus* occurs on three genera of tyrannids and on two cotingids, *Pachyrhamphus* and *Rhytipterna*. These are two of the genera that Ames and Warter considered as tyrannids, based on a study of the osteology and the syrinx.

The close relationship of *R. subhastatus*, found on *Pipilo* and *Chlorura*, and *R. wolfi* on *Aimophila* supports the suggestion of Marshall (1964) that *Pipilo* and some members of *Aimophila* are closely related. Marshall based his evidence on similarities between the behavioral patterns and calls of these birds. However, since these genera are ground-dwelling birds, the distribution of associated species of *Ricinus* may indicate only an ecological relationship of the avian hosts.

The avian families Thraupidae and Fringillidae have been the subject of much recent study. The proper allocation of genera and subfamilies traditionally placed in these families has been obscured by much convergence and parallalism in various structures. Most ornithologists consider these families as heterogenous groups (Beecher, 1953; Tordoff, 1954*a*, 1954*b*; Mayr, 1955; Wetmore, 1960; De Schauensee, 1966). Tordoff, basing his evidence on the morphology of the palatal region of the skull, placed certain members of the fringillid subfamily Richmondeninae in the family Thraupidae and placed the fringillid subfamily Carduelinae in the family Ploceidae (an Old World family). The distribution of species of *Ricinus* suggests that Richmondeninae has a duel origin, if no secondary transfer of lice is assumed. In this subfamily *Volatinia* harbors *R. volatiniae*, a species closely related to those species of *Ricinus* found on Thraupidae, whereas the *Passerina–Cyanocompsa-Guiraca* complex in Richmondeninae harbors *Ricinus australis*, a species of the *diffusus* group occurring on Fringillidae. Since the species of *Ricinus* found on Carduelinae are closely related to those from the fringillid subfamily Emberizinae, these data suggest that Tordoff's placement of Carduelinae in the Ploceidae is incorrect. The validity of this reasoning is based on the assumption that no secondary transfer has occurred. In further support of this reasoning, Dr. Clay (*in litt.*) has informed me that *Ricinus* does not occur on Ploceidae in the Old World.

Finally, it is extremely interesting that many of the same phenomena regarding types of host specificity in *Ricinus* were found in the acarine genus *Proctophyllodes* by Atyeo and Braasch (1966). These mites also are ectoparasites of Passeriformes, but occasionally occur on other orders. The authors found specificity at the specific, generic, family, and subordinal levels, and examples of species with anomalous distributions. Their statements concerning host-parasite relationships appear to be less subjective than those herein owing to the more even distributon of *Proctophyllodes* among the families of passerines.

SYSTEMATICS

Synonymy and Diagnosis of the Genus Ricinus

Ricinus DeGeer, 1778

Ricinus DeGeer, 1778. Mém. Hist. Ins. 7:69. Type species, by subsequent designation (Neumann, 1906, Bull. Soc Zool. France, 31:56) and fixed by opinion 627 of the International Commission of Zoological Nomenclature (1962): *Ricinus fringillae* DeGeer.

Nirmus Hermann, 1804, *nec* Nitzsch, 1818. Mém. Apterol.: 12. *Nomen novum* for *Ricinus* DeGeer.

Physostomum Nitzsch, 1818. Germar's Mag. Entomol. 3:302. Type species, by subsequent designation (Harrison, 1916, Parasit. 9:24): "*P. nitidissimum* = *fringillae* DeGeer."

Description.—Medium to large Amblycera; females 2.4 to 5.5 mm and males 1.9 to 4.5 mm in length. Head conical, spatulate, or subconical in shape, depressed. Epipharynx modified into two ventrolateral fleshy, sucker-like lobes, the pallettes. Antennae four-segmented, situated ventrally in capsules and overlain partially by lappets which are fringed laterally with setae. Two pairs of spinose or occasionaly pilose setae (preantennal setae) anterior to antennae; two pairs of para-antennal setae laterad to antennae, variable in length. Anterior margin of head (frons) narrowly to broadly rounded or truncate; usually with one pair of short setae dorsally (df) and two pairs of short setae ventrally (f series). Dorsum of head with three pairs of short setae. Lateral margins of head straight to slightly concave; marginal carinae bearing four pairs of setae (m series); m1–m3 short, m4 variable. Temples triangular; each bearing three long setae (t series) dorsolaterally and four to six pairs of short setae dorsally (a series; a1 variable in length. Three or four setae posteriad to eye (po series); eyes prominent. Occipital margin concave. Occipital nodus excavated, receiving anterior margin of prothorax; biconcave or concave in outline. Two or three pairs of pigmented nodi dorsally; antennal nodi falcate; tentorial nodi separated from or fused with lunar nodi. Tentorium reduced; anterior and posterior arms membranous; pits sclerotized; bridge ligamentous, usually not evident.

Mandibles reduced and slightly sclerotized; present in two forms, monomorphic and dimorphic; tips heavily sclerotized and modified for piercing; central condyle with ball-and-socket articulation; dorsal condyle reduced, articulation presumably ligamentous. Labrum large; bearing two rows of setae; anterior row with four setae, posterior with 20 setae; outermost setae of both rows and antepenultimate pair of setae of posterior row long; other setae short. Maxillary plates (stipes) large, each with one seta; palpi four-segmented. Galea membranous with many tooth-like structures. Maxillary forks tiny, usually not evident. Labium simple without division into glossae, paraglossae, and palpi; bearing 12 to 20 pairs of setae. Hypopharynx usually membranous; sitaphore scroll-like; ovoid sclerites variable, not evident to evident; when evident, sclerites are ornamented. Mentum triangular, bearing one pair of setae. Gular plate triangular, elongated with inner pigmented plate; bearing two to eight pairs of setae laterally.

Prothorax separated from pterothorax; hexagonal or subchordate in shape; concave anteriad and posteriad; bearing nine pairs of setae laterally (L series) and two pairs of short setae dorsally (pr series). L1 and L2 short and pilose; L3 spinose, absent in two species; L4–L6 spinose; L6 absent or duplicated in some species; L7 and L8 long and tactile; L9 variable in length. Prosternal plate with lateral pigmented nodi; bearing one pair of short setae anteriorly. One pair of cervical plates, each with two short setae. Epimera I pigmented, dumbbell-shaped. Submarginal dorsal nodi pigmented. Pterothorax (fused metathorax and first abdominal segment) bell-shaped with no apparent divisions. Sternal plate large, broad and rounded anteriorly, narrow and truncate posteriorly, bearing one or two pairs of short mediolateral setae; usually one to three pairs of medial setae and one pair of medium to short posterior setae. Five to ten pairs of anterolateral spinose setae situated dorsally (w series); two to four pairs of spinose setae situated ventrolaterally (q series). Four pairs of setae situated dorsally (e series); anterior two pairs spinose; posterior pair pilose. Two pairs of setae on posterior lateral margin (b series); b2 long, b1 usually short. Epimera and phragmata II and III heavily pigmented. Dorsal submarginal nodi pigmented.

Abdomen elongated, margins continuous with pterothorax. Eight apparent segments present (II–IX). Tergites II–VIII nearly equal in size and shape; bearing usually two pairs of setae at posterolateral corners, occasionally only one pair. Tergite IX with four to eight pairs of terminal setae; number and size showing sexual dimorphism. Spiracles and associated sensilla present on tergites III–VIII. Pleurites wrap around margin of abdomen; dorsal part of plate bearing one postspiracular seta and one short seta; ventral part with three setae, size and shape of setae vary among the segments. Pleural nodi pigmented; plates may or may not be pigmented. Sternites II–VI each bearing two pairs of equal-sized setae; sternolaterals longer than sternocentrals on VII. Sternite VIII forming vulva in female; sternolaterals long; zero to 30 setae along midvulval margin. In male, sternite VIII similar to VII; sternite IX with one pair of setae. Anal lappets placed ventrally, fringed with few to many setae. Male genitalia simple. Basal plate rodlike; mesosome simple with medial plate, medial point, or entire; parameres usually long and pointed with apical setae, occasionally short and rounded without setae.

Prothoracic legs oriented forward. Coxae I each with three medial spines, three anterior short setae, and one or two long tactile setae. Femora I each with one or two long setae; protibiae each with four terminal long setae and one medial long seta. Shape and chaetotaxy of meso- and metathoracic legs fairly uniform except for variable presence of long tactile setae. Tarsi two-segmented; segment one with medial membranous lobe; segment two drop-shaped with two claws. Carinae usually pigmented; legs usually hyaline, occasionally pigmented.

Egg large and glistening white. Margin of operculum entire with rest of egg; polygonal ornamentation limited to operculum and immediate adjacent area.

Distribution.—Species of the genus *Ricinus* are found exclusively on hosts of 28 of the 70 families of Passeriformes (Wetmore, 1960). A list of the families on which *Ricinus* occurs is given in table 2.

Remarks.—The concept of the genus *Ricinus* followed here is that of Carriker (1960, 1964), who included only species from passerine hosts in the genus. The *Ricinus*-like forms found on hummingbirds (order Apodiformes, family Trochilidae) were referred either to *Trochiloecetes* Paine and Mann or to *Trochiliphagus* Carriker. My examination of three species of *Trochiloecetes* showed that these species have many characters that separate this genus from *Ricinus*. Included among these are a highly modified hypopharyngeal apparatus and a distinct setal pattern. Although I have not seen any species referred to *Trochiliphagus*, examination of Carriker's (1960) description reveals few characters that differentiate *Trochiliphagus* from *Ricinus*. Study is necessary to clarify the status of this genus. Species from hummingbirds formerly included in *Physostomum* or *Ricinus* are discussed by Carriker.

The species of *Ricinus* found on passerines appear to comprise a homogeneous taxon. Although certain well-defined groups of species appear within the genus, these are linked to other groups by species of intermediate structure. Modifications that have developed are interpreted as the result of evolutionary trends and subsequent radiation within the genus. Recognizable groups of species are assigned to the species group status. The use of this non-nomenclatorial category is sufficient to show probable relationships among the New World species.

Key to the New World Species of the Genus Ricinus

1. Mandibular tips and lobes dimorphic; left mandibular lobe with knoblike extension (pl. 3, fig. 2); two nodi on head (tentorial and antennal); a3 present; maxillary palpi not genticuloid 2
   Mandibular tips monomorphic; mandibular lobes with or without knoblike extension; three nodi on head (lunar, tentorial, and antennal); a3 absent; maxillary palpi genticuloid 11
2. Head conical; antennal lappets each with 35 setae; body heavily pigmented, but terminal segment hyaline ..... *brevicapitis* (p. 47)
   Head spatulate or subconical; antennal lappets each with not more than 15 setae; body variously pigmented, but terminal segment not hyaline 3

3. C4 absent; a1 short; a4 present; b1 short; head spatulate; parameres pointed with apical setae 4
C4 present; a1 long; a4 absent; b1 long; head subconical, chunky; parameres rounded without apical setae 8
4. L7–L9 long and equal; preantennals pilose 5
L7–L8 long, L9 short; preantennals spinose 7
5. Preantennals tiny; sternal plate bearing one pair of short setae just anterior to "eyes" of diffuse, skull-like pattern (pl. 4, fig. 3); parameres without lateral setae..*arcuatus* (p. 48)
Inner pair of preantennals long; sternal plate bearing two pairs of long setae, without the pattern above; parameres with both apical and lateral setae 6
6. Labium with 12 pairs of setae; nodi of prosternal plate and pleurites narrow; lateral setae of parameres present on outer margins .....*leptosomus* (p. 52)
Labium with 14 pairs of setae; nodi of prosternal plate and pleurites broad; lateral setae of parameres present on inner and outer margins .....*myiarchi* (p. 52)
7. Prothorax hexagonal; a1 with two sensilla; m4 longer than m3; margin of mesosome ending in a small, sharp point .....*sucinaceus* (p. 54)
Prothorax subchordate; a1 with one sensillum; m4 short, equal to m3; margin of mesosome ending in broad plate .....*pessimalis* (p. 56)
8. Mandibles as in pl. 13, fig. 2; labium with 17 to 19 pairs of setae; temples rounded; two long tactile setae on coxae I–III and trochanters II–III; prosternal plate showing no sexual dimorphism .....*elongatus* (p. 66)
Mandibles otherwise; labium with 16 or fewer pairs of setae; apices of temples hooked; one pair of tactile setae on coxae II–III and trochanters II–III; prosternal plates showing sexual dimorphism 9
9. Setae q2 and q3 present; two pairs of long setae on sternal plate; pattern on gular plate diffuse .....*microcephalus* (p. 65)
Setae q3 absent; one pair of long setae on sternal plate; pattern on gular plate distinct 10
10. Head elongated (pl. 11, fig. 1); marginal carinae narrow at insertion of m1 and m2; maxillary plates relatively narrow; tergites pigmented, golden .....*japonicus* (p. 64)
Head not elongated (pl. 10, fig. 1); marginal carinae wide at insertion of m1 and m2; maxillary plates relatively wide; tergites unpigmented, white .....*fringillae* (p. 57)
11. Left mandibular lobe with short, knoblike extension 12
Left mandibular lobe similar to right lobe 13
12. Mandibular tips large; prothorax hexagonal; pleurities V–VIII each with one pair of long setae; gular plate with four pairs of setae, posterior pair longest ....*mandibulatus* (p. 69)
Mandibular tips moderate; prothorax subchordate; pleurites V–VIII each with two pairs of long setae; gular plate with three pairs of setae, middle pair longest..*invadens* (p. 70)
13. Ovoid sclerites evident, ornamented. 14
Ovoid sclerites not evident 29
14. Ovoid sclerites deeply pitted 15
Ovoid sclerites finely pitted, fuzzy in appearance 22
15. Pleural nodi oriented to give a serrated appearance; frons narrow; prothorax as in pl. 17, fig. 5; mesosome produced into a long, sharp point .....*serratus* (p. 72)
Not as above 16
16. Mandibles with short, heavy tips 17
Mandibles with long, needle-like tips 18
17. Mandibles as in pl. 28, fig. 2; coxae III without tactile setae; antennal lappets each with more than 9 setae .....*wolfi* (p. 90)
Mandibles as in pl. 27, fig. 2; coxae III each with one tactile seta; antennal lappets each with less than 9 setae .....*subhastatus* (p. 89)
18. Heavily pigmented, brown throughout; q2 weakly spinose 19
Lightly pigmented, background white; q2 strongly spinose 20
19. Labium with 14 pairs of setae; tips of mandibles long (pl. 31, fig. 2); sternal plate as in pl. 31, fig. 4 .....*ramphoceli* (p. 93)
Labium with 13 pairs of setae; tips of mandibles relatively short (pl. 30, fig. 2); sternal plate as in pl. 30, fig. 4 .....*complicatus* (p. 93)
20. Pleurites pigmented to margin; prothorax more hexagonal than subchordate; mid-procoxal spine largest .....*volatiniae* (p. 94)
Pleurites not pigmented to margin; prothorax subchordate; outermost coxal spine largest ..21
21. Labium with 13 pairs of setae; innermost setae of ventropleural plates V–VIII short; head as in pl. 33, fig. 1 .....*vireoensis* (p. 95)
Labium with 14 pairs of setae; innermost setae of ventropleural plates V–VIII long; head as in pl. 29, fig. 1 .....*subangulatus* (p. 91)
22. Hourglass-shaped, golden markings on sternites II–VII; L3 absent; a distinct dark blotch laterad to sternal plate; sensilla of a1 large .....*australis* (p. 108)
Not as above 23
23. Coxa I with one long tactile seta; mandibles needle-like as in pl. 35, fig. 3 ....*sittae* (p. 98)
Coxa I with two long tactile setae; mandibles not needle-like 24
24. Transverse carina arched medially; a1 longer than a4 25
Transverse carina not arched medially; a1 short 26
25. Setae a1 as long as pa series; pleurites not pigmented to margin; color of nodi oxblood; distinct golden markings of sternites V-VIII .....*carolynae* (p. 107)
Setae a1 less than pa series; pleurites pigmented to margin; color of nodi red-brown; diffuse golden markings of sternites V–VII .....*ivanovi* (p. 106)
26. Labium with 14 pairs of setae, gular plate with two pairs of setae; total length of females less than 3.8 mm .....*subdiffusus* (p. 97)
Labium with 15 pairs of setae, gular plate with three or four pairs of setae; total length of females greater than 3.8 mm 27
27. Prothorax broad, as in pl. 38, fig. 4; head much wider than long; setae on ventral pleurites IV all strongly spinose; transverse carina rounded, but never arched ..*thoracicus* (p. 105)
Prothorax not as broad as above; head as wide as long or longer; middle setae on ventral pleurites IV long and pilose; transverse carina straight 28
28. Head as wide as long; a1 twice as long as a4; head as in pl. 37, fig. 1 .....*calcarii* (p. 104)
Head longer than wide; a1 equal to a4; head as in pl. 36, fig. 1 .....*diffusus* (p. 98)
29. Prothorax subchordate; labium with 12 pairs of setae .....*polioptilus* (p. 80)
Prothorax hexagonal; labium with 14 pairs of setae 30
30. Setae a1 as long as pa series .....*frenatus* (p. 79)
Setae a1 as long as a4 31
31. One pair of setae on tergite VIII; occipital nodi convex medially; tentorial nodi smaller than lunar nodi; total length of females greater than 4.0 mm .....*marginatus* (p. 74)
Two pairs of setae on tergite VIII; occipital nodi concave medially; tentorial and lunar nodi equal; total length of females less than 4.0 mm 32
32. Frons circular in outline; mandibles as in pl. 17, fig. 3 .....*flavicans* (p. 74)
Not as above 33
33. Pleurites not pigmented to margin 34
Pleurites pigmented to margin 35
34. Mandibles as in pl. 21, fig. 4; head as in pl. 21, fig. 1 .....*pallens* (p. 81)
Mandibles as in pl. 25, fig. 3; head as in pl. 25, fig. 1 .....*dendroicae* (in part) (p. 85)
35. Sternites with golden spots on sternites VI and VII 36
Sternites not as above 38
36. More than ten setae along each antennal lappet; mandibles with weakly developed dorsal lobes as in pl. 22, fig. 2 .....*dalgleishi* (p. 82)
Ten or fewer setae along each antennal lappet; mandibles with strongly developed dorsal lobes 37
37. Mandibles short as in pl. 23, fig. 3 .....*picturatus* (p. 82)
Mandibles long as in pl. 25, fig. 3 .....*dendroicae* (in part) (p. 85)
38. Sternites V–VIII pigmented, gold; mandibles needle-like as in pl. 26, fig. 3; total length of females greater than 3.5 mm .....*seiuri* (p. 88)
Sternites without markings, white; mandibles not needle-like, as in pl. 24, fig. 3; total length of females less than 3.2 mm .....*emersoni* (p. 84)

TABLE 4

CHAETOTAXY OF VENTRAL ABDOMINAL PLEURITES

Species of *Ricinus*	II	III	IV	V	VI	VII	VIII
arcuatus	sss	sss	sIi	sIi	sIi	sIi	iIi
australis	SSs	sss	SIS	iII	iII	iII	iII
brevicapitis	sss	sss	sII	sII	sII	sII	iII
calcarii	SSs	Sss	SIS	iIi	iIi	iIi	iIi
carolynae	SSs	sss	SIS	iIm	iIm	iIm	iIm
complicatus	SSs	sss	SIS	iIm	iIm	iIL	iIL
dalgleishi	SSS	sii	SIS	iIi	iIi	iIi	iIm
dendroicae	sSs	sii	SIS	iIi	iIi	iIi	iIi
diffusus	SSS	sSs	SIS	iIL	iIL	iIL	iIm
elongatus	sss	sss	sII	sII	sII	iII	iII
emersoni	ssi	sii	SIS	iIi	iIi	iIi	iIi
flavicans	si	ssi	sIs	iIi	iIi	iIi	iIi
frenatus	SSi	sii	SIS	iIi	iIi	iIi	iIi
fringillae	ssi	ssi	sII	sII	sII	iII	iII
invadens	SSS	SSs	SII	SII	SII	SII	sIm
ivanovi	SSs	sss	SIS	iIm	iIm	iIm	iIm
japonicus	sss	sss	sII	sII	sII	iII	iII
leptosomus	sss	sis	SIi	sIi	sIi	sIi	sIi
mandibulatus	SSS	Sss	S?S	SIi	sIi	sIi	sIi
marginatus	ss	sss	sIi	sIi	sIi	sIi	sIi
microcephalus	sss	sii	sII	iII	iII	iII	iII
myiarchi	sss	sss	sIs	sIs	sIs	sIs	sIs
pallens	SSS	sss	SIS	iIi	iIi	iIi	iIL
pessimalis	sii	sii	sIi	sIi	sIi	sIi	sIi
picturatus	sSi	sii	SIS	sIi	sIi	iIi	iIi
polioptilus	sSs	ssi	SIi	iIi	iIi	iIi	iIi
ramphoceli	Sss	iii	SIS	iIi	iIL	iIL	iIL
seiuri	sSs	ssi	SIS	iIi	iIi	iIi	iIm
serratus	SSS	ssi	SIS	iIi	iIi	iIi	iIi
sittae	SSi	iii	SIS	iIi	iIi	iIi	iIi
subangulatus	SSs	sSs	SIS	iIL	iIL	iIL	iIL
subdiffusus	SSs	ssi	sIs	iIL	iIL	iIL	iIL
subhastatus	SSs	iii	SIS	iIL	iIL	iIL	iIL
sucinaceus	iii	iIi	iIi	iIi	iIi	iIi	iIi
thoracicus	SSS	sss	SSS	iIi	iIi	iIi	iIi
vireoensis	sSs	sss	SII	iIi	iIi	iIm	iIm
volatiniae	SSs	sss	SIS	iII	iII	iIL	iIL
wolfi	SSs	ssi	SIS	iIm	iIm	iIm	iIL

S = large spine
s = small spine
= small pilose seta

m = medium pilose seta
L = moderately long pilose seta
I = long pilose seta

DESCRIPTION OF THE SPECIES

Ricinus brevicapitis Species Group

DIAGNOSTIC CHARACTERISTICS

1. Head conical with margins of frons continuous with that of marginal carinae.
2. Tips of mandibles dimorphic, left mandibular lobe with knob or finger-like articulation.
3. Ovoid sclerite not evident.
4. Setae a1 long, each with two sensilla; a1–a6 present.
5. C4 present.
6. Tentorium well developed; tentorial nodi large, U-shaped; lunar nodi absent.
7. Both pairs of tergal and sternal setae on abdomen long.
8. Terminal tergite and anal lappets hyaline.

Remarks.—The *brevicapitis* species group consists of a single species, *brevicapitis*. The unique features exhibited by this species warrant recognition as a separate group. Perhaps the undescribed form of *Ricinus* from *Schiffornis* (Pipridae) referred to by Carriker (1964) will prove to belong to this group.

Ricinus brevicapitis Carriker, 1964

Ricinus brevicapitis Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:48–49, figs. 2, A-6. Type locality: La Cumbre de Valencia, Venezuela. Type host: *Tityra semifasciata colombiana* Ridgway.

Ricinus spadix Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:48, figs. 1, B-3. Type locality: Rio Caura, El Llagual, Venezuela. Type host: *Tityra c. cayana* (Linnaeus). New synonymy.

Diagnosis.—A large, heavily sclerotized species with characters of the *brevicapitis* species group. Closely related to *R. arcuatus* but differing in shape of head and mandibles. Setae a1 long and equal to m4 and pa series. Tentorial nodi large and U-shaped. Terminal segment and anal lappets hyaline; legs hyaline. Tactile setae on all femora. Number of setae along antennal lappets, 35 × 35. Setae of tergites and sternites of abdomen long. L7 and L8 long and widely separated; L9 short, placed posteriorly. C4 present.

Description.—Head conical, wider than long, as in pl. 2, fig. 1. Mandibles as in pl. 3, fig. 2, right mandibular tip thin and hooked. Labium with 16 pairs of setae; pattern as in pl. 2, fig. 2. Setae df1 present and submarginal. Inner margin of clypeal carinae undulated. Maxillary plates as in *R. arcuatus;* maxillary setae equal in length to mental setae. Palpi reaching margin of head; palpal setae of segment one as long as length of second palpal segment; spinose. Preantennal setae spinose. Setae a1 as long as m4 and pa series; setae a1–a6 present. Gular plate as in pl. 2, fig. 1; number of setae 6 × 7 and 4 × 5. Antennal lappets with 35 pairs of setae.

Prothorax as in pl. 3, fig. 1; L7 and L8 long; L8 placed at posterior terminal edge; L9 short, on posterior margin; several setae in L6 position. Prosternal plate as in pl. 3, fig. 1; prosternal setae 29μ and 35μ apart. Two tactile setae on profemur. No spinose setae on trochanter I; three spinose setae on dorsoposterior surface of coxa I. Six spinose setae in w series. Setae q2 equal to w2; b1 equal to w2. Setae c1 twice as long as c2; c3 and c4 pilose and long. Sternal plate as in pl. 3, fig. 1; bearing one pair of long setae and one medium-sized pair posteriad. Tactile setae on coxa II and femora II and III. Except for coxae and trochanters, legs hyaline.

Terminal segments of abdomen of female as in pl. 3, fig. 3. Terminal segment and anal lappets hyaline. Chaetotaxy of ventral pleurites as given in table 4; nodi thick as in *R. arcuatus*. Setae on tergites and sternites long. Vulval margin with ten setae. Except for legs and apical segment, a heavily sclerotized species. Color brown to black.

Male unknown.

Dimensions.—Dimensions are given only for the type specimen. The type of *R. spadix* Carriker is so shriveled that most dimensions of this specimen are not typical. Total length 5.10; greatest width 1.46; head length 0.97; head width 1.11; labral width 0.48; prothoracic length 0.62; prothoracic width 1.08.

Distribution.—Known from two specimens, one each from two species in genus *Tityra*, family Cotingidae.

Material examined.—From *Tityra semifasciata columbiana* Ridgeway: holotype ♀ (USNM 68779) from La Cumbre de Valencia, Venezuela, on 24 September 1910 by M. A. Carriker, Jr. From *Tityra c. cayana* (Linnaeus): 1 ♀ (USNM 68778, holoytpe of *R. spadix*) from Rio Caura, El Llagual, Venezuela, on 12 January 1910 by M. A. Carriker, Jr.

Remarks.—Carriker (1964) described *R. spadix* and *R. brevicapitis* each from two species of *Tityra*, family Cotingidae. *R. spadix*, however, is so shriveled that the head, maxillary plates, mandibles, and labrum are distorted. Carriker differ-

entiated these species by several characters, but none, I believe, is valid. The second of two black incrassations between the labral lobes (pallettes and the antennal fossae appear in both of Carriker's species. This structure is composed of the heavily sclerotized and thickened ventral rims of the pallettal fossae. The difference in the number of gular setae, 4x5 versus 6x7, is not diagnostic. Carriker's other differences are illusionary, owing to artifacts.

R. spadix has page priority over *R. brevicapitis;* but the Code recommends using the name which will best maintain stability. As first revisor, I have chosen *R. brevicapitis* as the senior synonym since the type of this species is in good condition whereas the type of *R. spadix* is not.

Ricinus arcuatus Species Group

DIAGNOSTIC CHARACTERISTICS

1. Head spatulate; frons broadly elliptical without frontal transverse carina, margin of frons continous with that of marginal carinae, which are nearly straight; temples narrow, not expanded; dorsal occipital margin broadly elliptical, flattened medially; occipital nodus truncate medially.
2. Mandibles dimorphic; left mandible larger, receiving tip of right mandible; bearing a knoblike extension on mandibular lobe which articulates with right mandibular lobe.
3. Margin of labium rounded.
4. Maxillary plates large, rectangular in shape; palpi straight or weakly genticuloid.
5. Gular plate broadly triangular, usually with more than three pairs of setae.
6. Tentorium well developed; lunar nodi absent.
7. Ovoid sclerite of hypopharynx rounded, usually not evident; unornamented.
8. Df1 and c4 absent.
9. Setae a1–a6 present.
10. Tactile setae absent on femora except for one pair on femur I in *R. pessimalis.*
11. Preputial sac shaped like a bouquet of cut flowers.
12. Parameres relatively narrow.

Ricinus arcuatus (Kellogg and Mann, 1912) *sensu lato*

Physostomum fasciatum var. *arcuatum* Kellogg and Mann, 1912. Entomol. News 23:65. Type locality: Paso Robles, California. Type host: *Tyrannus vociferus* (now *Tyrannus vociferans* Swainson).

Ricinus arcuatus (Kellogg and Mann). Harrison, 1916, Parasit. 9:66; Hopkins and Clay, 1952, Checklist of Mallophaga, 324; Carriker, 1957, Microentomol. 22:105 (lectotype); Malcomson, 1960, Wilson Bull. 72:194; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 187; Emerson, 1964*a*, Checklist, II, Amblycera, 95; Keirans, 1967, Agric. Exp. Sta. Bull. 492:65, Univ. New Hampshire.

Ricinus pronotus pronotus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:52, figs. 5, B-10. Type locality: Maripa, Rio Caura, Venezuela. Type host: *Rhyt(i)pterna simplex fredrici* Bangs and Penard. New synonymy.

Ricinus pronotus rufus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:53, fig. 5a. Type locality: Lagunita de Aroa, Yaracuy, Venezuela. Type host: *Pachyrhamphus rufus* (Boddaert). New synonymy.

Ricinus pronotus niger Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:53, fig. 5b. Type locality: Lagunita de Aroa, Yaracuy, Venezuela. Type host: *Pachyrhamphus polychopterus niger* (Spix). New synonymy.

Ricinus tristis Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:57, figs. 11, B-8. Type locality: Sabana Mendoza, Trujillo, Venezuela. Type host: *Pachyrhamphus polychopterus tristis* (Kaup). New synonymy.

Ricinus polychropterus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:57–58, figs. 12, B-11. Type locality: near Villa Nueva, Sierra Perija, Venezuela. Type host: *Pachyrhamphus polychopterus cinereiventris* Sclater. New synonymy.

Diagnosis.—A large species of the *arcuatus* group; heavily sclerotized; color dark brown. Mandible characteristics as in pl. 4, 2; right tip not thin or hooked. Preantennal setae tiny and pilose. Setae a1 each with one anteriad sensillum. Maxillary palps extending to inner margin of marginal carinae. L7–9 long; several setae at L6 position. Inner margin of prosternal nodi entire. Sternal plate with two small setae just anteriad to "eyes" of diffuse skull-shaped pattern on sternal plate; setae as short as or shorter than posterior setae. Setae q3 present, larger than q2; spinose. Male genitalia characteristic; parameres each with four apical setae.

Description.—Head as in pl. 4, fig. 1. Mandibles as in pl. 4, fig. 2; right tip not thin or hooked. Labium with 14 pairs of setae; pattern as in pl. 4, fig. 4. Maxillary palpi not extending to margins of head, but to inner margin of marginal carinae. Frontal incrassation attached in winglike fashion to frontal carinae. Preantennal setae small to tiny, pilose. Setae a1 each with one anteriad sensillum. Setae m2 on lateral margins of carinae. Gular plate as in pl. 4, fig. 1; indented and expanded apically; chaetotaxy variable in number, 3×3 to 5×7, average 4.6×4.6. Setae along antennal lappets extremely variable in number, 8×7 to 15×15, average 10.6×10.6. Setae pa1-2 three times as long as m4.

TABLE 5

MEAN AND RANGE OF MEASUREMENTS OF FEMALES OF RICINUS ARCUATUS POPULATIONS

Character	*Tyrannus vociferans* n = 4	*Tyrannus verticalis* n = 8	*Tyrannus tyrannus* n = 7	*Tyrannus dominicensis* n = 10	*Tyrannus melancholicus* n = 1
Total length	4.12 (n = 3)	4.13	3.84	4.04	3.98
	4.09–4.16	4.01–4.20	3.70–3.99	3.79–4.22	
Greatest width	1.21 (n = 3)	1.19	1.03	1.14	1.12
	1.19–1.23	1.15–1.22	0.98–1.15	1.06–1.21	
Head length	0.80	0.78	0.74	0.82	0.80
	0.80–0.81	0.75–0.79	0.71–0.80	0.78–0.83	
Head width	0.83	0.81	0.75	0.80	0.79
	0.81–0.84	0.80–0.83	0.72–0.79	0.78–0.82	
Head index	97	96	99	101	101
	96–99	94–97	95–102	98–104	
Labral width	0.445	0.46	0.42	0.45	0.44
	0.43–0.48	0.42–0.48	0.39–0.46	0.42–0.46	
Prothoracic length	0.48 (n = 3)	0.47	0.43	0.47	0.47
	0.47–0.49	0.45–0.48	0.40–0.45	0.44–0.48	
Prothoracic width	0.78	0.78	0.72	0.78	0.76
	0.76–0.80	0.77–0.80	0.68–0.76	0.74–0.80	
Distance between prosternals	103μ	106μ	98μ	103μ	112μ
	93–107μ	99–112μ	80–112μ	96–112μ	

Prothorax as in pl. 4, fig. 3; L7–9 long. Prosternal plate as in pl. 4, fig. 3; inner margin never indented, entire. Setae pr2 shorter than c3. Outermost spine on coxa I heavily spinose; medial two spinose setae subequal. Spinose setae on dorsoposterior margin of coxa I. Sternal plate with one small pair of setae just anterior to "eyes" of a diffuse skull-like pattern on sternal plate, pl. 4, fig. 3; posterior pair of setae as long as or longer than the anterior setae. Setae q3 slightly longer than q2, both spinose. W series variable; w1–6 to w1–10, average w1–8. Setae b1 pilose. Three and two spinose setae on coxae II and III, respectively; a long tactile seta on coxa II. Femora II and III with lateral unpigmented blotches one-third distance from distal ends.

Terminal segments of abdomen and female terminalia as in pl. 5, fig. 1. Pleurites pigmented; nodi broad; pattern of setae on ventral pleurites as given in table 4. Inner tergal setae half as long as postspiracular setae. Sternocentral and sternolateral setae of sternites II–VI nearly equal. Vulval margin with 20 to 32 setae, average 25. Male genitalia as in pl. 5, fig. 2; parameres each with four apical setae.

TABLE 5 (*Continued*)

Character	*Muscivora tyrannus* n = 6	*Pitangus sulphuratus* n = 6	*Pachyrhamphus* spp. n = 3	*Rhynipterna simplex* n = 1
Total length	3.81 3.77–3.93	4.25 4.15–4.40	3.88 3.63–4.08	3.66
Greatest width	1.00 0.91–1.09	1.05 0.96–1.10	1.04 1.01–1.08	1.02
Head length	0.76 0.75–0.79	0.84 0.82–0.86	0.78 0.76–0.80	0.78
Head width	0.72 0.69–0.75	0.78 0.76–0.81	0.80 0.74–0.89	0.74
Head index	106 101–109	107 105–110	99 90–108	105
Labral width	0.40 0.38–0.43	0.44 0.43–0.46	0.41 0.38–0.43	0.43
Prothoracic length	0.42 0.41–0.43	0.48 0.46–0.51	0.42 0.42–0.43	0.42
Prothoracic width	0.71 0.70–0.73	0.77 0.75–0.80	0.77 0.69–0.80	0.69
Distance between prosternals	98μ (n = 4) 88–108μ	102μ 96–112μ	90μ 80–101μ	112μ

TABLE 6

MEAN AND RANGE OF MEASUREMENTS OF MALES OF RICINUS ARCUATUS POPULATIONS

Character	*Tyrannus vociferans* n = 1	*Tyrannus verticalis* n = 3	*Tyrannus tyrannus* n = 2	*Tyrannus dominicensis* n = 6	*Pitangus sulphuratus* n = 1	*Pachyrhamphus polychopterus* n = 1
Total length	2.93	3.07 3.05–3.10	2.90 2.87–2.92	3.05 2.98–3.13	3.32	3.09
Greatest width	0.83	0.89 0.85–0.92	0.88 0.88	0.86 0.83–0.89	0.90	0.84
Head length	0.67	0.66 0.65–0.66	0.665 0.66–0.67	0.71 0.70–0.73	0.74	0.69
Head width	0.68	0.70 0.69–0.71	0.66 0.66	0.69 0.69–0.71	0.70	0.62
Head index	99	94 92–96	100 99–101	102 99–104	106	110
Labral width	0.36	0.38 0.36–0.39	0.375 0.37–0.38	0.39 0.38–0.40	0.38	0.36
Prothoracic length	0.37	0.38 0.37–0.38	0.35 0.34–0.36	0.38 0.37–0.39	0.43	0.36
Prothoracic width	0.62	0.65 0.64–0.66	0.62 0.61–0.63	0.66 0.64–0.68	0.67	0.58
Distance between prosternals	88μ	97μ 94–99μ	85μ 85μ	98μ 94–104μ	96μ	80μ
Width of ♂ genitalia	0.17	0.18 0.17–0.20	0.17 0.16–0.18	0.18 0.17–0.19	0.20	0.18

This species is heavily pigmented; color dark brown on brown background.

Dimensions.—See tables 5 and 6.

Distribution.—Known from genera *Tyrannus*, *Muscivora*, and *Pitangus* in Tyrannidae and *Pachyrhamphus* and *Rhynipterna* in Cotingidae.

Material examined.—From *Tyrannus vociferans* Swainson: ♀ lectotype and ♀ paralectotype (VLK 166–895) from Paso Robles, California; no other data; 1 ♂, 3 ♀ (BMNH 12779) from California in February 1939 by R. Meinertzhagen. From *Tyrannus verticalis* Say: 2 ♂, 2 ♀, 8 N (BCN) from West Drain, Kern Co., California, on 9 August 1962 by James Bruen; 2 ♀ (VLK) from near Santa Cruz, California, on 1 July 1924 by E. Rett; 1 ♂, 1 ♀ (BCN 608) from Hopland Field Station, Mendocino Co., California, on 6 June 1965 by B. C. Nelson; 2 ♀ (UM 126–127) from Delta, Manitoba, Canada, on 2 August 1961 by David Olson. From *Tyrannus tyrannus* (Linnaeus): 1 ♀ (BCN 709 in USNM) from Miami, Florida, on 27 August 1918 by J. A. Weber; 1 ♀ (INHS) from Urbana, Illinois, on 28 June 1932 by H. H. Ross; 1 ♂ (UNH) from Durham, Strafford Co., New Hampshire, on 19 July 1965 by J. E. Keirans; 1 ♀ (CU) from Ithaca, New York, in 1928; 1 ♀ (CU) from Huyck Preserve, Albany Co., New York, on 9 July 1964 by R. C. Dalgleish; 1 ♂ (USNM) from Sheldon, North Dakota, on 19 July 1929 by W. G. Bruce; 2 ♀ from Adel, Oregon, on 19 August 1930 by Alex Walker; 1 ♂, 1 ♀ (UW) from Arena, Oconto Co., Wisconsin, on 31 May 1952 by W. J. Woodman. From *Tyrannus melancholicus* Vieillot: 1 ♀ (BMNH) from Kanaku Mts., Rupununi, on 23 February 1961 by Theresa Clay. From *Tyrannus dominicensis* (Gmelin): 2 ♀ (CU) from Puerto Rico; 1 ♂ (USNM) from Guane, Cuba, on 5 July 1933 by S. T. Danforth; 2 ♀ (USNM) from Bahama Is., Fortune Is., on 12 July 1930 by H. S. Peters; 2 ♀ (USNM) from Acklin Is., B.W.I., on 10 July 1930 by H. S. Peters; 1 ♀ (USNM) from Little Inagua Is., B.W.I., on 5 August 1930 by H. S. Peters; 3 ♂, 3 ♀ (USNM) from Great Inagua Is., B.W.I., on 8 August 1930 by H. S. Peters; 2 ♀ (BMNH 12630) from Bahamas by R. Meinertzhagen. From *Muscivora tyrannus* (Linnaeus): 4 ♀ (USNM) from Tlacotalpam, Mexico, on 8 February 1940; 1 ♀ (USNM) from San Sebastian, S.N. de Sta. Marta, Colombia, on 2 March 1964; 1 ♀ (USNM) from Anzoatequi, Cantauro, Venezuela, on 6 September 1948, all collected by M. A. Carriker, Jr. From *Pitangus sulphuratus* (Linnaeus): 2 ♀ (USNM) from Venecia Caqueta, Colombia, on 3 June 1952 by M. A. Carriker, Jr.; 1 ♂, 4 ♀ (BMNH-TRVL 4319) from Cumuto, Trinidad on 3 May 1960. From *Pachyrhamphus rufus* (Boddaert): 1 ♀ (USNM 68784, holotype of *R. pronotus rufus*) from Lagunita de Aroa, Edo. Yaracuy, Venezuela, on 10 December 1910 by M. A. Carriker, Jr. From *Pachyrhamphus polychopterus niger* (Spix): 1 ♀ (USNM 68785, holotype of *R. pronotus niger*) from same locality as above on 10 December 1910 by M. A. Carriker, Jr. From *Pachyrhamphus polychopterus cinereiventris* Sclater: 1 ♂ (USNM 68792, holotype of *R. polychopterus*) from Sierra Perija, near Villa Nueva, Colombia, on 8 July 1945 by M. A. Carriker, Jr. From *Pachyrhamphus polychopterus tristis* (Kaup): 1 ♀ (USNM 68791, holotype of *R. tristis*) from Trujillo, Sabana Mendoza, Venezuela, on 27 April 1922 by M. A. Carriker, Jr. From *Rhytipterna simplex fredrici* Bangs and Penard: 1 ♀ (USNM 68783, holotype of *R. pronotus*) from Maripa, Rio Caura, Venezuela, on 15 October 1909. From "Swallow": obviously a straggler: 1 ♀ (CU) from Costa Rica.

Remarks.—*R. arcuatus* occurs on various genera in the Tyrannidae and on two genera, *Rhytipterna* and *Pachyrhamphus*, currently considered to be Cotingidae. Except for differences in over-all size, there are no consistent differences in the shape of structures, pigmentation patterns, or chaetotaxy to differentiate between these populations. The differences in width of the head and abdomen in specimens from *Muscivora* and *Pitangus* are in part the result of shriveling due to improper mounting. Inclusion of populations from cotingids in *R. arcuatus* is discussed below in the remarks under *R. leptosomus*.

The distribution of *R. arcuatus* seems to indicate a close relationship between the infested genera. De Schauensee (1966) has indicated that there is a difference of opinion among ornithologists regarding the correct allocation of certain genera now placed in Cotingidae. Although De Schauensee kept the traditional arrange-

ment of the family, he indicated which genera were subject to question, citing two recent and unpublished theses by Dr. P. L. Ames and Dr. S. L. Warter. I discussed the problem with Dr. Ames. He stated that in the shape of the skull and the syrinx, *Rhytipterna* and *Pachyrhamphus* are similar to the Tyrannidae. They were placed in Cotingidae soley because of the shape of the tarsi. De Schauensee (1966) also stated that S. L. Warter believes that *Rhytipterna* is a tyrannid. The distribution of *Ricinus arcuatus* supports the arguments of Ames and Warter.

Ricinus myiarchi, new species

Type locality: St. Anthony's Park, Minnesota.
Type host: *Myiarchus crinitus* (Linn.).

Diagnosis.—A medium-sized species of the *arcuatus* species group. Closely related to *R. leptosomus*. Shape of mandibles characteristic, left tip notched. Labium with 14 pairs of setae. Prosternal and pleural nodi thick. Setae on apex and both inner and outer margins of parameres.

Description.—Head shape as in pl. 6, fig. 1. Mandibles as in pl. 6, fig. 2; left tip notched. Labium with 14 pairs of setae; pattern as in pl. 6, fig. 4. Setae m2 situated medially on marginal carinae. Preantennal setae pilose; inner pair as long as mental setae. Frontal incrassations attached to frontal carinae in winglike fashion. Gular plate as in pl. 6, fig. 1; chaetotaxy 3 × 3 in ♂ and 2 × 3, 3 × 4, and 3 × 5 in 3 ♀. Number of setae along antennal lappets 7 × 9 in ♂, 7 × 9, 8 × 8, and 8 × 8 in ♀.

Prothorax as in pl. 6, fig. 3; L7–L9 long and equal. Prosternal plate with thick nodi, similar to *R. arcuatus*, but inner anterior margin indented. Sternal plate as in pl. 6, fig. 3; two pairs of moderately long setae present, both longer than posterior pair. Q2 and w1–6 spinose and equal in size.

Terminal abdominal segments of female as in pl. 5, fig. 3. Pleural carinae thick as in *R. arcuatus;* pleurites completely pigmented; chaetotaxy of ventral pleurites as given in table 4. Inner tergal, sternocentral, and terminal setae of tergite IX as in *R. leptosomus*. Vulval margin with 14 to 16 setae, average 15. Male genitalia as in pl. 5, fig. 4; chaetotaxy of right paramere: 2 outer lateral, 4 apical, 1 inner lateral setae; left paramere: 1 outer lateral, 3 apical, 2 inner lateral setae. Specimens heavily pigmented, brown with background a golden brown.

Dimensions.—Total length, ♀ 3.51–3.57 (3.54), ♂ 2.80; greatest width, ♀ 0.98–1.03 (1.00), ♂ 0.80; head length, ♀ 0.735, ♂ 0.64; head width, ♀ 0.71–0.72 (0.715), ♂ 0.60; head index, ♀ 102–14 (103), ♂ 107; labral width, ♀ 0.43, ♂ 0.37; prothoracic length, ♀ 0.41–0.43 (0.42), ♂ 0.34; prothoracic width, ♀ 0.67–0.69 (0.68), ♂ 0.55: ♂ genitalia width, 0.20; distance between prosternal setae, ♀ 72–88μ (80μ), ♂ 70μ.

Material examined.—Holotype ♂, allotype ♀ (♀ on far right of slide) and 2 ♀ paratypes (UM 85 from *Myiarchus crinitus* (Linnaeus) collected from St. Anthony's Park, Minnesota, on 16 June 1896.

Ricinus leptosomus (Carriker, 1903)

Physostomum leptosomum Carriker, 1903. Univ. Stud. Nebraska 3:166–168, pl. 5, fig. 2; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Juan Vinas, Costa Rica. Type host: *Myiozetetes similis texensis* (Giraud) by Carriker (1949).

Ricinus leptosomus (Carriker). Harrison, 1916, Parasit. 9:67; Carriker, 1949, Proc. U. S. Nat. Mus. 100 (3266):385; Hopkins and Clay, 1952, Checklist of Mallophaga, 326; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:62.

Ricinus sucinaceus leptosomus (Carriker). Eichler, 1953, Bonn. zool. Beitr. 4:343.

Diagnosis.—A medium-sized species of the *arcuatus* species group. Closely related to *R. myiarchi*. Shape of mandibles characteristic; left tip without notch. Labium with 12 pairs of setae. Prosternal and pleural nodi relatively thin. Lateral setae present only on outer margin of parameres.

Description.—Head shape as in pl. 7, fig. 3. Mandibles characteristic, as in pl. 7, fig. 6; left tip without notch. Labium with 12 pairs of setae; pattern as in pl. 7, fig. 1. Setae m2 situated medially on marginal carinae. Setae a1 each with one medial sensillum. Preantennal setae pilose; inner pair as long as mental setae. Gular plate as in pl. 7, fig. 3; setal pattern of type 3 × 3; others usually 4 × 4, but asymmetrical combinations of 3 × 4, 3 × 5, and 4 × 5 present. Setae along antennal lappets variable in number, 4 × 8 to 8 × 10; average 7 × 7; type 8 × 9. Prosternal nodi relatively thin with inner anterior margin indented. Thorax as in pl. 7, fig. 5. Sternal plate bearing two pairs of long setae originating from two unpigmented spots. L7–L9 long, equal in length. Setae q2 and w1–7 (w1–6 in type) spinose, equal in length.

Terminal abdominal segments of female as in pl. 7, fig. 4. Pleurites pigmented; VIII pigmented as in figure. Ventral pleural setae as given in table 4. Inner tergal setae half as long as postspiracular setae. Sternocentral setae of sternites II–VI longer than sternolaterals. Vulval margin with 17 to 25 setae, average 22.3. Male genitalia as in pl. 7, fig. 2; one or two pairs of setae on outer margins of parameres. Moderately pigmented species; color brown with background whitish.

Dimensions.—Total length, ♀ 3.37–3.49 (3.45), ♂ 2.61, 2.73, ♂ type 2.55; greatest width, ♀ 0.98–1.03 (1.00), ♂ 0.80, ♂ type 0.73; head length, ♀ 0.66–0.69 (0.67), ♂ 0.56, 0.57, ♂ type 0.57; head width, ♀ 0.63–0.66 (0.65), ♂ 0.55, ♂ type 0.56; head index, ♀ 102–107, ♂ 102, 104, ♂ type 102; labral width, ♀ 0.36–0.40 (0.39), ♂ 0.32, 0.33, ♂ type 0.30; prothoracic length, ♀ 0.36–0.38 (0.37), ♂ 0.28, 0.29, ♂ type 0.29; prothoracic width, ♀ 0.59–0.62 (0.60), ♂ 0.48, 0.50, ♂ type 0.50; ♂ genitalia width, 0.18, 0.20, ♂ type 0.18; distance between prosternal setae, ♀ 72μ–85μ (81μ), ♂ 58μ, 64μ, ♂ type 67μ.

Material examined.—From *Myiozetetes similis texensis:* holotype ♂ (USNM 68285) collected in Juan Vinas, Costa Rica, in March 1902 by M. A. Carriker, Jr. (Carriker's 1964 correction is in error). From *Myiarchus c. cinerascens* (Lawrence): 2 ♂ and 12 ♀ (BMNH 13145, 2 slides) collected in Arizona in March 1939 by R. Meinertzhagen.

Remarks.—Carriker has changed the hosts for *R. leptosomus* twice, resulting in several contradictions and much confusion. In his original description of *leptosomus* Carriker (1903) indicated that in the type series there were two ♀ from *Myiarchus lawrencei nigricapillus* and two ♂ from *Myiozetetes cayanensis* collected from Juan Vinas, Costa Rica in March, 1902 by him. In 1949 he stated that the male type was from *Myiozetetes similis texensis* (Giraud), but the females attributed to this species were from *Myiarchus tuberculifer nigricapillus*. Nothing was mentioned about the other male. In 1964 Carriker stated that the ♂ holotype, the ♀ allotype and a ♂ paratype were labeled as being from *Myiozetetes similis texensis* (= *M. texensis ridgwayi*). The other ♀ paratype was lost. Furthermore, Carriker said that his researches left him without any doubt that *R. leptosomus* was from some species of Cotingidae as it was closely related to *R. pronotus* from *Rhyt(i)pterna simplex*. He went on to indicate that some mistake probably was made in labelling back in 1902. In that year he made a collection in Pozo Azul in Costa Rica where cotingids were collected. Thus he assumed that *Rhyt(i)pterna homochroa* (*sic*) (= *holerythra*) was the correct host of *Ricinus leptosomus*. He stated as evidence that the male genitalia of *leptosomus* was very close to that of *R. polychropterus* Carriker, also from Cotingidae.

By careful examination of the males of the *arcuatus* species group, I became convinced that the genus from which *R. leptosomus* was taken could be determined. The type of *R. leptosomus* had the inner preantennal setae as long as the mental setae, a characteristic shape of the mandibles, two pairs of long setae on the sternal plate and tiny setae on the outer margins of the parameres as well as apical setae. Specimens from Cotingidae do not have this combination of characters. On the contrary, they resemble specimens of *R. arcuatus* from *Tyrannus* spp. in the following characters: shape of the mandibles; one pair of small setae on the sternal plate equal in length to the posterior sternal pair; no lateral setae on the parameres;

and short, pilose preantennal setae. In properly oriented and cleared specimens of *R. arcuatus,* the four tiny "setae" bordering the left mandibles are present as pictured by Carriker for *R. polychropterus.* These "setae" are not evident in *R. leptosomus.* The only available specimens that have the same combination of characters as the type of *leptosomus* are from *Myiarchus* spp. Specimens from *M. crinitus* (Linn.) differ from *leptosomus* in other respects and are described herein as *R. myiarchi.* Specimens from *M. cinerascens* are identical except for the degree of pigmentation which may or may not be an artifact. It appears that either *Myiarchus tuberculifer* or *Myiozetetes similis* is the type host of *R. leptosomus* rather than some species of Cotingidae. It appears best to use Carriker's (1949) statement regarding the type host until material is available for study from *Myiozetetes similis.*

Ricinus sucinaceus (Kellogg, 1896) *sensu lato*

Physostomum sucinaceum Kellogg, 1896*b*. Proc. Calif. Acad. Sci. 6:515, pl. 70, fig. 2; Kellogg, 1899, Occ. Pap. Calif. Acad. Sci. 6:137; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Paine and Mann, 1913, Psyche 20:21. Type locality: Palo Alto, California. Type host: *Empidonax difficilis* Baird.

Ricinus sucinaceus (Kellogg). Harrison, 1916, Parasit. 9:68; Peters, 1928, Ohio J. Sci., 28:223; Hopkins and Clay, 1952, Checklist of Mallophaga, 328; Carriker, 1957, Microentomol. 22:105 (lectotype); Malcomson, 1960, Wilson Bull. 72:195; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 187; Emerson, 1964*a*, Checklist, II, Amblycera, 98.

Ricinus subtenius Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:61, figs. 18, 19, B-6. Type locality: Upata, Bolivar, Venezuela. Type host: *Myiobius atricaudus modestus* Todd. New synonymy.

Diagnosis.—A small species of the *arcuatus* species group. Closely related to *R. pessimalis.* Prothorax hexagonal; L7 and L8 long, L9 short; prosternal setae less than 40μ apart. Setae a1 with two sensilla. M4 three times as long as m3. Preantennal setae spinose. No tactile seta on femur I. Chaetotaxy of ventral pleurites as in table 4. Margin of mesosome ending in a median, well-developed point. A lightly sclerotized species, color gold on whitish background.

Description.—Head as in pl. 8, fig. 2. Mandibles and labium as in pl. 8, figs. 3 and 4, respectively. Setae a1 each with one sensillum medially and one sensillum anteriad. Preantennal setae spinose. Gular plate as in pl. 8, fig. 2; chaetotaxy variable, 4×3 to 6×6, average 5×5. Setae m4 three times as long as m3. Setae along antennal lappets variable in number, 6×6 to 8×9, average 7×7. Mental setae slightly longer than maxillary setae.

Prothorax as in pl. 8, fig. 6; hexagonal; lateral prothoracic setae 7 and 8 long and 9 short. Prosternal plate as in pl. 8, fig. 6, with prosternal setae less than 40μ apart. Setae q2 weakly spinose, equal in length to b1. Setae 2 and 3 of w series longer than others; 5 to 7 setae present in w series, average 5.6. Sternal plate characteristic as in pl. 8, fig. 6; bearing two long pairs of setae and one pair of short posterior setae.

Terminal abdominal segments of female and chaetotaxy as in pl. 8, fig. 5. One pair of medium-sized setae on tergites II–VIII; chaetotaxy of ventral pleurites as given in table 4. Vulval margin with 8 to 14 setae, average 11.5; one pair of these setae lateroposteriad to long sternolateral setae of sternite VIII. Male genitalia as in pl. 8, fig. 1; apical setae present but exact number cannot be determined. Posterior margin of mesosome ending in strong medial point. A lightly pigmented species; color gold with whitish background; nodi of head golden brown.

Dimensions.—From *Empidonax* spp.: Females (n = 12): total length 2.80–3.00 (2.91); greatest width 0.80–0.90 (0.85); head length 0.56–0.64 (0.59); head width 0.52–0.57 (0.54); head index 106–114 (110); labral width 0.33–0.35 (0.34); prothoracic length 0.28–0.36 (0.32); prothoracic width 0.49–0.53 (0.51); distance between prosternals 21–37μ (28μ). From *Pipilo aberti:* Females (n = 4); TL 3.20–3.33 (3.23); GW, 0.90–0.95 (0.92); HL, 0.61–0.63 (0.62); HW, 0.53–0.57 (0.56); HI, 107–111 (110); LW, 0.35–0.37 (0.36); PL, 0.31–0.33 (0.32); PW, 0.52–0.55 (0.53); distance between prosternals 24–32μ (28μ). From *Sayornis saya:* Females (n = 7): TL 3.13–3.31 (3.19); GW, 0.90–0.95 (0.92); HL, 0.61–0.64 (0.62); HW 0.56–0.58 (0.57); HI, 107–110 (109); LW, 0.35–0.37 (0.36); PL, 0.32–0.35 (0.33); PW, 0.50–0.54 (0.53); distance between prosternals 22–26μ (25μ). Males (n = 2): TL, 2.50, 2.56; GW, 0.69, 0.73; HL, 0.55, 0.56; HW, 0.50, 0.51; HI, 110, 111; LW, 0.31, 0.32; PL, 0.27; PW, 0.45, 0.46; distance between prosternals 15μ, 24μ; width of genitalia 0.15, 0.18.

Distribution.—*R. sucinaceus* occurs on various species of *Empidonax* flycatchers, *Myiobius* sp., and on *Sayornis saya.* It is probable that all *Empidonax* spp. may be parasitized by *R. sucinaceus.* Whether other *Sayornis* spp. or other genera of tyrannids have *R. sucinaceus* remains to be determined. Paine and Mann (1913) reported this species from *Elainea* sp., but I have not seen any specimens to verify this.

Material examined.—From *Empidonax flaviventris difficilis* (now *Empidonax difficilis* Baird): lectotype ♀ and 2 ♀ paralectotypes (VLK 382a, "fig.'d) from Palo Alto, California, in 1896 by V. L. Kellogg; 1 ♀ (VLK 643a), same data, collected in 1897. From *Empidonax traill* (Audubon): 3 ♀ (USNM) from Seattle, Washington, on 23 June 1930 by M. R. Fahout; 1 ♀ (BCN 564 in YU) from P.Q., Gaspé, Grand Greve, on 27 July 1946 by S. C. Bell. From *Empidonax* sp.; 4 ♀ (UK) from Toocle Co., Stansbury Mts., Utah, on 14 June 1954 by N. Chamberlain. From *Sayornis saya* (Bonaparte): 1 ♀ (VLK) from Ontario, California, in 1897 by B. Chapman; 1 ♀ (KCE) from Tooele Co., south end of Cedar Mts., vicinity of Dugway Valley, Utah, on 11 May 1953 by R. D. Porter; 5 ♀, 2 ♂ (BMNH 13018, 13295) from California in March 1939 by R. Meinertzhagen. From *Pipilo aberti* Baird (probably an error): 4 ♀ (USNM) from El Paso, Texas, on 20 April 1930 by H. S. Peters. From *Myiobius atricaudus modestus:* 1 ♂ (USNM 68798, holotype of *R. subtenius*) from Todd, Upata, Bolivar, Venezuela, on 22 February 1910 by M. A. Carriker, Jr.

Remarks.—Carriker (1957) designated the lectotype for *R. sucinaceus* from three females mounted on the same slide. I have remounted these specimens; the type has the original slide label, whereas the paralectotypes are mounted on a separate slide and labeled as paralectotypes.

R. sucinaceus belongs to the *arcuatus* species group on the basis of many characters held in common with other species in this complex. However, *sucinaceus* appears to differ in several characters from the other species: shape of the male genitalia; shape of the prothorax; number of sensilla accompanying a1 and the spinose preantennal setae.

The populations from *Sayornis saya* are statistically separable from the populations from *Empidonax* spp. However, they cannot be separated by any morphological criteria except size. Since it is not yet known whether size difference has a genetic basis in Mallophaga, I have not separated these populations into two species, but have designated populations as *R. sucinaceus sensu lato.* These populations follow Harrison's law that the larger-sized form occurs on the larger-sized birds, i.e., *Sayornis saya.*

It is probable that the populations of *R. sucinaceus* from *Pipilo aberti* actually came from *Sayornis saya,* since *R. sucinaceus* does not occur on any member of the family Fringillidae. Furthermore, *P. aberti* superficially resembles *S. saya* in size and color of plumage. Thus it is possible that the host was misidentified by the collectors.

R. subtenius Carriker is included as a synonym of *R. sucinaceus.* The few measurements that can be taken from the shriveled type specimen are similar to those of a male specimen of *R. sucinaceus* from *S. saya. R. subtenius* also is similar to *R. sucinaceus* in the shape of the head, shape of the prothorax, and shape of the male genitalia, which has the same pointed margin on the mesosome. Characters given

by Carriker (1964) to differentiate this species are considered to be artifacts. *R. subtenius* is designated a junior subjective synonym of *R. sucinaceus* (Kellogg).

Ricinus pessimalis Eichler, 1956

Ricinus pessimalis Eichler, 1956. *In* Niethammer, Bonn. zool. Beitr. 7:115. Type locality: Beni, Bala, Bolivia. Type host: *Pipra chloromeros* Tschudi.

Ricinus lanceolatus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:58–59; figs. 13, A-4. Type locality: San Esteban, Venezuela. Type host: *Chiroxiphia lanceolata* (Wagler). New synonymy.

Ricinus manacus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:59, figs. 14, A-7. Type locality: Maripa, Venezuela. Type host: *Manacus manacus interior* Chapman. New synonymy.

Diagnosis.—*R. pessimalis* is the smallest species of the genus. Closely related to *R. sucinaccus*. Prothorax subchordate. Gular plate with long posterolateral projections. Prosternal plate pointed laterally. Preantennal setae spinose. Setae m4 equal in size to m1–m3. Setae a1 each with one medial sensillum. L9 short; L7 and L8 long. One pair of medium-sized setae on tergites II–VIII. Margin of mesosome ending in a large plate.

Description.—Smallest species in the genus: females less than 2.6 mm; male less than 2.0 mm. Head shape as in pl. 9, fig. 1. Mandibles and labium as in pl. 9, figs. 2 and 3, respectively. Preantennal setae spinose. Setae a1 each with one medial sensillum. Setae m4 shorter than pa setae; equal in length to m1–m3. Mental setae longer than maxillary setae; maxillary palpi extend to margin of head. Gular plate with long posterolateral projections as pl. 9, fig. 1; number of gular setae 3×4 to 3×5, average 4×4. Setae along antennal lappets variable in number, 5×5 to 6.7, average 5.7×5.7.

Prothorax subchordate; prosternal plate as in pl. 9, fig. 4; anterior prosternal setae more than 40μ apart, but less than 60μ apart. L7 and L8 long, L9 short. Five setae usually present in w series; w setae strongly spinose; w1 and w2 larger than w3–w5. Setae q2 equal in length to w1; b1 smaller and less spinose than q2. Sternal plate as in pl. 9, fig. 4; bearing two pairs of setae variable in length from medium to long, longer than posterior pair.

Terminal segments of female abdomen as in pl. 9, fig. 5. Chaetotaxy of ventral pleurites as given in table 4. Only one pair of medium-sized setae on tergites II–VIII. Pleurites pigmented; pleural nodi as in pl. 9, fig. 5. Vulval margin with 4 to 8 setae, average 5.5. Male genitalia as in pl. 9, fig. 6; posterior margin of mesosome bearing a plate; apical setae invisible owing to distortion of parameres. Moderately pigmented; brown with whitish background.

Dimensions.—From *Manacus manacus:* Females (n = 7): total length 2.42–2.57 (2.49); greatest width 0.59–0.69 (0.66); head length 0.50–0.52 (0.51); head width 0.47–0.49 (0.48); head index 101–110 (104); labral width 0.28–0.29 (0.28); prothoracic length 0.31–0.32 (0.32); prothoracic width 0.47–0.48 (0.48); distance between prosternals 40–53μ (45μ). Male (n = 1): TL, 1.97; GW, 0.53; HL, 0.45; HW, 0.43; HI, 103; LW, 0.25; PL, 0.27; PW, 0.40; distance between prosternals 40μ; width of genitalia 0.14. From *Pipra erythrocephala* Females (n = 8): TL, 2.32–2.48 (2.42); GW, 0.63–0.69 (0.65); HL, 0.48–0.50 (0.49); HW, 0.46–0.49 (0.47); HI, 103–106 (104); LW, 0.27–0.29 (0.28); PL, 0.27–0.31 (0.29); PW, 0.44–0.48 (0.45); distance between prosternals 40–50μ (45μ). From *Chiroxiphia lanceolata:* Females (n = 2): TL, 2.56, 2.57; GW, 0.55, 0.60; HL, 0.53; HW, 0.46; HI, 117; LW, 0.26, 0.27; PL, 0.31; PW, 0.44, 0.46; distance between prosternals 53μ, 56μ. Measurements of greatest width and head width and head index ratio of specimens from *C. lanceolata* appear to differ from those other specimens of *R. pessimalis*. Both specimens are somewhat shriveled, and these differences are considered artifacts.

Distribution.—Known from species of Pipridae.

Material examined.—From *Manacus manacus interior* Chapman: 1 ♀ (USNM 68794) from Maripa, Venezuela, on 9 October 1909 by M. A. Carriker, Jr. (holotype of *Ricinus manacus* Carriker). From *Manacus manacus* (Linnaeus): 1 ♂, 5 ♀ (BMNH) from Vega de Oropouche, Trinidad, on 8 December 1959 (TRVL 3730), 4 December 1957 (3717, 3719), and 2 February 1960 (TRVL 4019); 1 ♀ from Ft. Read, Trinidad, on 2 March 1960 (TRVL 4144). From *Chiroxiphia lanceolata* (Wagler): 2 ♀ (USNM 68793) from San Esteban, Venzuela, on 2 November 1910 by M. A. Carriker, Jr. (holotype and paratype of *Ricinus lanceolatus* Carriker).

From *Pipra erythrocephala:* 6 ♀ (BMNH) from Brazil Village, Trinidad, on 25 February 1966 by T. H. G. Aitken; 1 ♀ from Arima Valley, Trinidad, on 10 March 1961 by T. Clay (179).

Remarks.—Eichler (1956) described *R. pessimalis* from one female specimen collected from *Pipra chloromeros*. This species cannot be identified from the description, and the type is unavailable to me. Rather than designate the name *species indeterminata*, I have chosen to recognize it as one of the two species occurring on birds in the family Pipridae. The first species is referable to *R. invadens* (Kellogg) described from specimens taken from *Chiroxiphia*. In 1954 Eichler gave the name *R. expeditionis* to specimens from *P. chloromeros*. The head of *R. expeditionis* figured by Eichler is identical with that of *R. invadens;* thus *R. expeditionis* is a junior subjective synonym of *R. invadens*. *R. invadens* is known from *Machaeropterus* and *P. erythrocephala*. The second species comprises the populations from *Manacus, Chiroxiphia,* and *P. erythrocephala*. Eichler (1954) stated that two forms were found on *P. chloromeros*. Since the first form proved to be *R. invadens,* the second form must be conspecific with populations from *Manacus, Chiroxiphia,* and *P. erythrocephala*. Eichler's name, *R. pessimalis,* is the oldest name applied to this form and takes precedence over *R. manacus* Carriker, 1964, and *R. lanceolata* Carriker, 1964.

Mayr et al. (1953) have indicated that redescriptions of poorly described forms are important. They suggest that specimens on which redescriptions are based should be clearly indicated in case of misidentification. In the event that I have made an error in the assumptions above, I designate the holotype of *R. manacus* (now *R. pessimalis*) as the plesiotype.

Ricinus fringillae Species Group

DIAGNOSTIC CHARACTERISTICS

1. Shape of head characteristic; frons broadly elliptical, margin not continuous with that of marginal carinae; occipital margin and occipital nodus biconcave, convex medially.
2. Mandibles dimorphic with finger-like extension of left mandibular lobe.
3. Lunar nodi absent.
4. Ovoid sclerite small and round, not ornamented; cornu bearing a plumose-like structure.
5. Tentorium strongly developed.
6. Setae m1–m3 subequal.
7. Head articulated with prothorax by rodlike structures.
8. Prosternal plate sexually dimorphic, except in *R. elongatus;* prosternal setae close together.
9. Setae b1 and b2 both long.
10. Sternal setae of abdomen moderately long; both pairs of tergal setae long except on tergite VIII.
11. Parameres short and rounded without setae; mesosome entire.

Ricinus fringillae DeGeer, 1778, *sensu lato*

Ricinus fringillae DeGeer, 1778. Mém. Hist. Ins. 7:71, pl. 4, figs. 5–8; Neumann, 1906, Bull. Soc. zool. France 31:56; Clay, 1937, Entomologist 71:207; Seguy, 1944, Fauna de France 43:159; Hopkins, 1947, Entomologist 80:14–19; Hopkins and Clay, 1952, Checklist of Mallophaga, 325; Balat, 1952, Biol. Sbor. 7:160–161, fig. 6; Clay and Hopkins, 1954, Bull. Brit. Mus. (Nat. Hist.) Entomol. 3(6):235–237, figs. 15–17 (neotype); *ibid.,* 1960, 9(1):26–30, figs. 35, 41, 47; Bechet, 1956, Stud. Cercet. Biol., Filial. Cluj. Acad. Repub. Romine, 7:140; Hopkins and Clay, 1960, Bull. Zool. Nomencl. 17(9–11):326–333; Opinion 627, 1962, Bull. Zool. Nomencl. 19(2):91–96 (fixation of neotype); Zlotorzycka, 1965, Acta Parasit. Polonica 13:60–61; Balat, 1966, Angewand. Parasit. 7:26; Rheinwald, 1968, Mitt. Hamburg. Zool.

Mus. Inst. 65:202–217, pls. 1a–c, 2–3. Type locality: Saxony, Germany. Type host: *Emberiza citrinella* Linn. by subsequent designation, Clay and Hopkins, 1954, Bull. Brit. Mus. (Nat. Hist.) Entomol. 3(6):236.

Physostomum nitidissimum Nitzsch, 1818 (*nomen novum* for *Ricinus fringillae* DeGeer). Germar's Mag. Entomol. 3:302; Denny, 1842, Monog. Anopl. Brit., 244; Giebel, 1866, Zeit. gesamm. Naturwiss. 26:395–396; Giebel, 1874, Insecta epizoa, 255; Piaget, 1880, Les Pediculines, 604; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Keler, 1936, Bull. Entomol. Pologne 14–15:313–323. Type locality: Saxony, Germany. Type host: *Emberiza citrinella* Linn.

Physostomum bombycillae Denny, 1842 (*partim*). Monog. Anopl. Brit., 203, 242, fig. 5.

Physosotomum diffusum var. *pallidum* Kellogg, 1896*b*. Proc. Calif. Acad. Sci. 6:519; Kellogg, 1899, Occ. Pap. Calif. Acad. Sci. 6:137; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Uchida, 1915, Annot. Zool. Jap. 9:67–68. Type locality: Lawrence, Kansas. Type host: *Junco* sp.

Physostomum hastatum Osborn, 1902. Ohio Nat. 2:203, pl. 14, fig. 3; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Ft. Robinson, Nebraska. Type host: *Junco aikeni* Ridgway by subsequent designation, Emerson, 1960, Proc. Biol. Soc. Wash. 73:162.

Physostomum intermedium Uchida, 1915, *nec* Piaget, 1880. Annot. Zool. Jap. 9:68–70, fig. 1. Type locality: Prov. Shinano, Japan. Hosts: *Parus ater insularis* Hellmayr and *Parus atricapillus restrictus* Hellmayr.

Ricinus nitidissimus (Nitzsch), Harrison, 1916, Parasit. 9:67; Helen, 1923, Mem. Soc. Fen. 68; Blagoveshtchensky, 1951, Mag. Parazit. Leningrad, 13:285; Clay and Hopkins, 1960, Bull. Brit. Mus. (Nat. Hist.) Entomol. 9:58 (neotype); Hopkins and Clay, 1960, Bull. Zool. Nomencl. 17(9–11):327, 332; Opinion 627, 1962, Bull. Zool. Nomencl. 19(2):92, 95 (placed on Official Index of rejected names).

Ricinus pallidus (Kellogg), Harrison, 1916, Parasit. 9:67; Peters, 1928, Ohio J. Sci. 28:223; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Malcomson, 1960, Wilson Bull. 72:197; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 216; Emerson, 1964*a*, Checklist, II, Amblycera, 98; Keirans, 1967, Agric. Exp. Sta. Bull. 492:63, Univ. New Hampshire.

Ricinus hastatus (Osborn). Harrison, 1916, Parasit. 9:66; Hopkins and Clay, 1952, Checklist of Mallophaga, 325; Emerson, 1960, Proc. Biol. Soc. Wash. 73:162 (lectotype); Malcomson, 1960, Wilson Bull. 72:197; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 216; Emerson, 1964*a*, Checklist, II, Amblycera, 96; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:46–47.

Ricinus uchidae Fresca, 1924 (*nomen novum* for *P. intermedium* Uchida, *nec* Piaget, 1880: error). Bol. Soc. Hist. Nat., 24:274–275, fig. 1. Type locality: San Rafael, Segovia, Spain. Type host: *Fringillae coelebs* Linnaeus.

Ricinus medius Uchida, 1926 (*nomen novum* for *P. intermedium* Uchida, 1915, *nec* Piaget, 1880). J. Coll. Agric. Imp. Tokyo, 9:54; Hopkins and Clay, 1952, Checklist of Mallophaga, 326; Balat, 1958, Prace, Brn. Zakl. Cheskoslov. Akad. Ved. 30:404; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 199; Emerson, 1964*a*, Checklist, II, Amblycera, 97; Zlotorzycka, 1965, Acta Parasit. Polonica 13:62; Balat, 1966, Angewand. Parasit. 7:26; Keirans, 1967, Agric. Exp. Sta. Bull. 492:62, Univ. New Hampshire. Type locality: Prov. Shinano, Japan. Type host: *Parus ater insularis* Hellmayr, by subsequent designation: Zlotorzycka, 1965, loc. cit.

Diagnosis.—A moderately sclerotized species of the *fringillae* species group. Easily distinguished from *R. elongatus* by shape of mandibular tips, fewer pairs of setae on labium, and prosternal plate showing sexual dimorphism. Closely related to *R. japonicus* and *R. microcephalus*, but separable from these by shape of head. Labium with 15 pairs of setae. Marginal carinae thick between m2 and m3 and at insertions of m1 and m2. Maxillary plate relatively wide with characteristic pigmented pattern. Mental plate not lunar-shaped. Temples expanded, apices hooked. Setae q2 strongly spinose; q3 rarely present. Setae c4 much longer than c3. One pair of long setae on sternal plate, longer than posterior pair. One pair of tactile setae on coxae, trochanters, and femora II and III. Three pairs of long setae on terminal segment of abdomen in females.

Description.—Head as in pl. 10, fig. 1. Mandibles dimorphic, as in pl. 10, fig. 3. Labium with 15 pairs of setae, as in pl. 10, fig. 2. Maxillary plate sausage-shaped, relatively wide; characteristic pigment pattern. Maxillary palpi straight, extending past edge of head. Mentum with characteristic pigmented pattern, not lunar-shaped. Setae m1–m3 subequal; m1–m2 laterad usually; m4 half as long as pa series. Marginal carinae wide at insertion of m1 and m2 and between m2 and m3. Ovoid sclerite round and compact; anterior cornu bearing a plumose-like structure. Lunar nodi absent. Gular plate as in pl. 10, fig. 1; gular setae in females number 2 × 3 to 7 × 7, average 4.8 × 4.8; in males 2 × 4 to 6 × 6, average 4.2 × 4.2. Setae along antennal lappets variable in number; in females 6 × 7 to 11 × 13, average 8.6 × 8.6; in males 5 × 7 to 9 × 9, average 7.1 × 7.1. Setae po2 nearly as long as t1; po1 spinose, length variable; po3 variable. Temples expanded, not tapering gently, apices hooked.

TABLE 7

MEAN AND RANGE OF MEASUREMENTS OF FEMALES OF RICINUS FRINGILLAE POPULATIONS

Character	*Junco* spp. n = 38	*Pooecetes* sp. n = 11	*Amphispiza* spp. n = 10	*Zonotrichia* spp. n = 14	*Spizella* spp. n = 9	*Melospiza* sp. n = 3
Total length	3.31	3.44	3.42	3.35	3.34	3.40
	3.10–3.55	3.19–3.51	3.17–3.57	3.15–3.44	3.23–3.46	3.28–3.53
Greatest width	0.97 (n = 35)	1.01 (n = 10)	1.10 (n = 9)	0.96	0.96	1.02
	0.91–1.05	0.97–1.04	1.04–1.14	0.91–1.00	0.92–0.99	0.98–1.10
Head length	0.67	0.71 (n = 10)	0.68	0.68	0.67	0.68
	0.64–0.71	0.65–0.74	0.65–0.71	0.66–0.71	0.66–0.71	0.63–0.73
Head width	0.60	0.63 (n = 10)	0.62	0.62	0.62	0.62
	0.57–0.64	0.57–0.66	0.57–0.65	0.60–0.64	0.60–0.64	0.60–0.66
Head index	111	113 (n = 10)	108.5	112	112	109
	107–115	109–121	107–113	109–114	110–115	103–113
Labral width	0.33	0.35	0.34	0.33	0.33	0.34
	0.29–0.35	0.32–0.35	0.32–0.34	0.32–0.34	0.31–0.34	0.32–0.36
Prothoracic length	0.33	0.35	0.34	0.33	0.33	0.33
	0.29–0.36	0.32–0.36	0.30–0.36	0.32–0.34	0.32–0.34	0.32–0.34
Prothoracic width	0.54	0.57	0.56	0.55	0.55	0.58
	0.49–0.57	0.54–0.60	0.48–0.59	0.51–0.57	0.53–0.57	0.56–0.61
Distance between prosternals	12μ	15μ	12.5μ	13μ	12μ (n = 8)	14μ
	8–16μ	11–21μ	10–19μ	10–16μ	8–16μ	13–16μ

Prothorax as in pl. 10, fig. 5. Setae L7 and L8 long; L9 pilose, about equal to m4; L3 longer than L4; L5 longer than L6. Prosternal plate as in pl. 10, fig. 5, and pl. 9, fig. 8; showing sexual dimorphism; prosternal setae close together. Three tactile setae on femora I. Setae c1 and c2 spinose; c3 and c4 pilose; c4 much longer than c3. Setae q2 strongly spinose; q3 rarely present. Usually six setae in w series. Setae b1 and b2 long. Sternal plate as in pl. 10, fig. 5; bearing one pair of long setae, longer than posterior pair. Coxae, trochanters, and femora of legs II and III each with one tactile setae.

Terminal segments of female abdomen as in pl. 10, fig. 4. Abdomen slightly ovoid. Pleurites pigmented to margin; color brown. Setae of ventral pleurites as given in table 4. Both pairs of tergal setae long on tergites II-VII; outer setae long on tregite VIII. Sternolateral and sternocentral setae long, equally spaced on sternites II–VI; closer together on sternite VII. Tergites whitish; sternites light gold in color. Vulva with four tiny setae. Terminal segment of female with three pairs of long setae. Four or five pairs of setae on sides of anterior anal corona. Male genitalia as in pl. 9, fig. 7. Parameres round, without setae. Margin of mesosome entire.

Dimensions.—See tables 7 and 8.

TABLE 7 (*Continued*)

Character	*Passerella iliaca* n = 1	*Pipilo erythrophthalmus* n = 1	*Pipilo fuscus* n = 18	*Passer domesticus* n = 1
Total length	3.34	3.44	3.75 3.63–3.88	3.24
Greatest width	0.99	1.00	1.16 1.12–1.20	0.92
Head length	0.67	0.71	0.74 0.72–0.77	0.63
Head width	0.60	0.63	0.68 0.66–0.70	0.60
Head index	112	112	107.5 105–110	105
Labral width	0.35	0.34	0.36 0.34–0.38	0.31
Prothoracic length	0.33	0.34	0.38 0.34–0.41	0.32
Prothoracic width	0.55	0.55	0.60 0.59–0.62	0.53
Distance between prosternals	13μ	14μ	11μ 8–16μ	10μ

TABLE 8

MEAN AND RANGE OF MEASUREMENTS OF MALES OF RICINUS FRINGILLAE POPULATIONS

Character	*Junco* spp. n = 4	*Zonotrichia* spp. n = 3	*Amphispiza* spp. n = 4	*Pooecetes* sp. n = 3	*Spizella* sp. n = 2
Total length	2.56 2.47–2.65	2.53 2.50–2.56	2.66 2.60–2.71	2.71 (n = 2) 2.70–2.73	2.58 2.52–2.63
Greatest width	0.78 0.77–0.80	0.78 0.74–0.80	0.86 0.78–0.91	0.81 0.80–0.84	0.79 0.78–0.80
Head length	0.58 0.57–0.60	0.59 0.59–0.60	0.59 0.57–0.60	0.61 0.60–0.63	0.595 0.59–0.60
Head width	0.54 0.53–0.55	0.55 0.53–0.55	0.54 0.52–0.56	0.54 0.51–0.57	0.54 0.53–0.55
Head index	109 106–112	109 108–110	108 106–108	113 110–118	109.5 109–110
Labral width	0.29 0.28–0.30	0.29 0.28–0.30	0.30 0.29–0.30	0.30 0.29–0.30	0.29 0.29
Prothoracic length	0.26 0.24–0.27	0.26 0.26–0.27	0.265 0.26–0.27	0.27 0.26–0.29	0.265 0.26–0.27
Prothoracic width	0.46 0.45–0.47	0.46 0.46	0.47 0.45–0.48	0.48 0.47–0.48	0.45 0.45
Distance between prosternals	11μ 10–11μ	12μ 10–13μ	10.5μ 10–11μ	12μ 11–13μ	12μ 11–13μ
Width of male genitalia	0.17 0.16–0.17	0.16 0.16	0.16 0.16–0.17	0.19 0.17–0.20	0.15 0.14–0.16

Distribution.—The distribution of *R. fringillae sensu lato* is interesting. Most populations are from hosts of the fringillid subfamily Emberizinae in North America. One population from *Parus atricapillus* Linnaeus (family Paridae) is indistinguishable from populations from *Junco* spp. One specimen from the introduced *Passer domesticus* (Linaeus) probably is a straggler.

Material examined.—From *Emberiza citrinella* Linnaeus (type host): 1 ♀ (USNM) from Slovenije on 2 March 1951 by S. Brelih. From *Emberiza schoeniclus* Linnaeus: 1 ♀ (VLK) from Norfolk, East Anglia, by H. H. Brindley. From *Parus atricapillus* Linnaeus: 1 ♂ (UNH) from Bar Harbor, Maine, on 23 November 1936 by E. Anthony; 5 ♀ (UM) from Cedar Creek Forest, Anoka Co., Minnesota, on 11 March 1958 by J. Beer. From *Passer domesticus* (Linnaeus): 1 ♀ (RGD) from N. Skull Valley, Tooele Co., Utah, on 13 February 1964. From *Junco hyemalis* (Linnaeus): lectotype ♀, 1 ♀ paralectotype, 1 N (VLK 234, type series of *Physostomum diffusum* var. *pallidum* Kellogg, 1896) from Lawrence, Kansas, in 1896 by V. L. Kellogg; 2 ♀ paralectotypes (OSU, type series of *Physostomum hastatum* Osborn, 1902) from Ft. Collins, Colorado, on March 1893 by A. C. Stephenson; 1 ♀ (USNM) from Guffey, Colorado, on 2 December 1939 by C. Rohwer; 3 ♀ (INHS) from Putnam, Illinois, on 2 November 1933 by T. H. Frison; 2 ♀ (USNM) from Brown Co., Indiana, on 28 January 1962 and Bloomington, Indiana, on 20 February 1962 by Val Nolan; 2 ♀ (BCN 444) from 4.5 mi. N, 1 mi. E Lawrence, Jefferson Co., Kansas, on 10 February 1962 by P. A. Thomas; 1 ♀ (USNM) from Leavenworth, Kansas, on 23 January 1955 by K. C. Emerson; 1 ♀ (USNM) from Silver Spring, Maryland, on 12 February 1933 by H. S. Peters; 2 ♀ (UM) from St. Paul, Minnesota, on 18 April 1961 by J. Beer and Henderson, Sibley Co., Minnesota, on 18 February 1960 by C. Knedel; 1 ♀ (UNH) from Durham, New Hampshire, by E. Hooghkirk; 3 ♀ (CU) from Ithaca, New York, on 10 March 1929 by Brower and Orient, Long Island, New York, on 5 October 1931 by Roy Latham; 2 ♀ (UM) from Park River, North Dakota, on 10 April 1939; 2 ♀, 3 N (USNM) from Kimberly, Oregon, on 28 December 1931 by M. F. Canova; 1 ♀ (UM) from Lake Rouvaix, South Dakota, on 12 September 1961 by J. Beer; 1 ♀ (USNM) from Harrisonburg, Virginia, on 22 September 1937 by G. R. Hostetter; 1 ♀ (VLK 548) from Washington in 1897 by B. Chapman; 1 ♀ (UW) from Wisconsin (no other data). From *Junco oreganus* (Townsend): 3 ♂, 3 ♀ (BCN 536, 546) from Hopland Field Station, Mendocino Co., California, on 20 March 1965 and 2 April 1965 by B. C. Nelson; 1 ♀ (BCN) from Berkeley, Alameda Co., California, on 3 March 1964 by R. D. Sage; 3 ♀ (USNM) from Oakland, California, on 15 February 1932 by R. F. Annereaux; 1 ♀ (BCN 656 in CAS) from 3 mi. NE Edna Lake, Tuolumne Co., California, on 28 November 1947 by R. T. Orr; 1 ♂, 1 ♀ (KCE) from Cedar Mt., Sewerline, Tooele Co., Utah, on 4 March 1953 and 19 March 1957 by R. D. Porter. From *Junco phaeonotus* Wagler: 1 ♀ (UM) from Portal, Arizona, on 11 August 1957 by J. Beer. From *Pipilo erythrophthalmus* (Linnaeus): 1 ♀ (BCN) from C. Tracy Ranch, Kern Co., California, on 15 December 1961 by Boyd Hill. From *Pipilo fuscus* Swainson: 18 ♀ (BMNH 13256, 13257) from Arizona in March 1939 by R. Meinertzhagen. From *Pooecetes gramineus* (Gmelin): 1 ♀ (BCN 710) from Miami, Florida, on 29 June 1926 by J. A. Weber; 2 ♂, 8 ♀ (CU) from Little Falls, Minnesota, on 17 May 1930; 1 ♀ (KCE) from Tibbee, Mississippi, on 25 December 1935 by E. W. Stafford; 1 ♂, 1 ♀ (KCE) from Sewerline, vicinity Dugway Valley, Tooele Co., Utah, on 23 March 1953 by W. Denzer. From *Amphispiza bilineata* (Cassin): 3 ♂, 5 ♀ (USMN) from El Paso, Texas, on 20 April 1930 by H. S. Peters; 1 ♀ 2 N (KCE) from 5 mi. N Camelback Mt., Tooele Co., Utah, on 29 April 1953 by R. D. Porter; 1 ♀ (CU) from Heinway, Washington, on 16 April 1938 by R. K. Grater. From *Amphispiza belli:* 1 ♀ (VLK 2270) from Claremont, California, by Chas. Metz; 1 ♂ 2 ♀ (KCE) from vicinity Dugway Valley, Tooele Co., Utah, on 7 and 25 January 1954 and 29 April 1953 by R. D. Porter and J. Bushman. From *Spizella arborea* (Wilson): 1 ♀ (USNM) from South Hadley, Massachusetts by E. Boyd; 1 ♀ (KCE) from Callao, Juab Co., Utah, on 25 February 1954 by R. D. Porter. From *Spizella passerina* (Bechstein): 2 ♂, 3 ♀ (BCN 595) from Hopland Field Station, Mendocino Co., California, on 16 May 1965 by B. C. Nelson. From *Spizella breweri* Cassin: 4 ♀ (BMNH 13189, 13250) from Arizona on March 1939 by R. Meinertzhagen. From *Zonotrichia querula* (Nuttall): 2 ♀ (KCE) from Stillwater, Oklahoma, on 10 March 1948 by K. C. Emerson; 2 ♀ (USNM) from S W Keewatin, Canada, on 17 May 1947 by F. Harper. From *Zonotrichia leucophrys* (Forster): 2 ♀ (KCE) from Orient, New York, on 19 May 1947 by Roy Latham; 1 ♂, 1 ♀ (KCE) from Cedar Mt., Tooele Co., Utah, on 19 March 1953 by R. D.

Porter. From *Zonotrichia atricapilla* (Gmelin): 2 ♂, 3 ♀ (BCN 521) from Corral Hollow, Alameda Co., California, on 22 February 1965 by B. C. Nelson and L. L. Wolf; 1 ♀ (BCN 464) from Hopland Field Station, Mendocino Co., California, on 10 April 1964 by J. Hoy. From *Zonotrichia albicollis* (Gmelin): 1 ♀ (UNH) from Durham, Strafford Co., New Hampshire, on 4 May 1965 by J. E. Keirans; 1 ♀ (USNM) from Ithaca, New York, on 7 May 1946 by H. Meng; 1 ♀ (UW) from Madison, Wisconsin, on 12 May 1952 by P. Hickey. From *Passerella iliaca* (Merrem): 1 ♀ (UNH) from Jefferson, Coos Co., New Hampshire, on September 1965 by D. J. Lennox. From *Melospiza melodia* (Wilson): 1 ♀ (USNM) from Lakewood, Ohio, on 4 March 1930 by E. C. Hoffman; 1 ♀ (USNM) from Fargo, North Dakota, on 6 June 1932 by W. G. Bruce; 1 ♀ (USNM) from Northville, South Dakota, on 24 April 1931 by J. F. Breuckle. From *Plectrophenax hyperboreus:* 1 ♀ (VLK 1165) from Alaska.

Remarks.—After Neumann (1906) restored the generic name *Ricinus* DeGeer, Harrison (1916) raised the question of the availability of the name *R. fringillae.* Harrison argued that *Pediculus* Linnaeus, *Ricinus* DeGeer, and *Nirmus* Hermann must be treated as equivalent because each included all the then known Mallophaga. According to this concept *R. fringillae* DeGeer should be considered a junior homonym of *Pediculus fringillae* Scopoli, 1772 (now *Philopterus*). That Harrison's interpretation is wrong was shown by Mayr et al. (1953), who based their stand on the position taken on historical secondary homonyms by the International Commission at Paris in 1948. The Commission stated that it is the actual combination of generic and specific names that creates secondary homonymy. Technically, therefore, a homonymy does not exist until both names are cited in the same genus. Since *R. fringillae* DeGeer and *P. fringillae* Scopoli have never been cited together, nor are they presently considered congeneric, both names are available.

There is no doubt that many of the populations of *Ricinus* with dimorphic mandibles from North American fringillids can be assigned to *R. fringillae.* These populations are similar to the description and figures given by Clay and Hopkins (1954, 1960) for the neotypes of *R. fringillae* and to the single specimen of *R. fringillae* which I have seen from the type host, *Emberiza citrinella.* Furthermore, I have compared populations with specimens from New World hosts examined and assigned to *R. fringillae* by Rheinwald (1968), who compared these specimens with type material. *R. fringillae* appears to have a wide host association on birds in both the Old and the New World. Since this wide host distribution heretofore has not been recognized except by DeGeer (1778), several names have been applied for various populations on exclusively Old World hosts (Rheinwald, 1968). These names are not included in the synonymy above as they apply to populations which I have not examined.

The name *Physostomum bombycillae,* referable to a population of *Ricinus* on a host with Holarctic distribution, was found to be a synonym of *R. fringillae* by Rheinwald (1968). Denny (1842) described *P. bombycillae* Denny from *Bombycilla garrulus* and *Emberiza nivalis.* Piaget (1880) erroneously thought that it was inappropriate to use *bombycillae* as the specific name, since the species was not found exclusively on *Bombycilla.* Consequently he described *P. intermedium* as a *nomen novum* for *P. bombycillae* Denny with the type host as *Bombycilla garrulus.* It is apparent from the measurements given by Denny and Piaget for their species that they were dealing with two different species. Kellogg (1908) accepted *P. intermedium* as a *nomen novum* for *P. bombycillae,* whereas Harrison (1916) and Hopkins and Clay (1952) considered Piaget's species as a junior objective synonym of *P. bombycillae.* Rheinwald (1968) examined the syntypes of

P. bomycillae Denny and found them to be indistinguishable from *R. fringillae* DeGeer; thus *bombycillae* is a junior objective synonym of *R. fringillae.* In retrospect it appears that Denny's specimens from *Bombycilla garrulus* may have come from *Emberiza nivalis,* a known host of *R. fringillae,* thus accounting for the smaller size of Denny's specimens. *R. fringillae* DeGeer is not known to occur on *Bombycilla garrulus.* The status of the population from this bird species is discussed under *R. elongatus* (Olfers).

R. pallidus (Kellogg, 1896*b*) and *R. hastatus* (Osborn, 1902) are synonyms of *R. fringillae. R. hastatus* is also a junior objective synonym of *R. pallidus.* No lectotype has been designated for *Physostomum diffusum* var. *pallidum,* Kellogg, 1896*b.* Carriker (1957) mentioned three females on one slide, but did not designate one of them as lectotype. The lectotype is herein designated as that female remounted on the original slide with the original label. The other female and nymph —not a third female as indicated by Carriker (1957)—are remounted on another slide and labeled paralectotypes. I am puzzled as to why Kellogg (1896*b*) included *pallidus* as a variety of *diffusus,* since *R. diffusus* and the form *pallidus* do not resemble each other. Although no specimens referable to *R. diffusus* from *Junco* sp. are present in the Kellogg collection, specimens of typical *diffusus,* taken from *Junco* sp., are present in the USNM collections. Emerson (1960) designated a lectotype for *Physostomum hastatum* Osborn, 1902, from *Junco aikeni.* He mentioned that Osborn's other two specimens were missing. They have been found in the collections of the Ohio State University and are labeled paralectotypes.

The *R. fringillae* complex is one of the most interesting and most confusing complexes in *Ricinus.* Most populations, occurring on three families of passerines, are very similar morphologically. Within the complex are populations that differ in size alone or in degree of pigmentation. In all these populations the shape of the mandibles, prothorax, female terminalia, and male genitalia are identical, varying only in over-all size. Populations from *Amphispiza* spp., *Junco* spp., *Melospiza melodia, Passerella iliaca, Pooecetes gramineus, Spizella* spp., and *Zonotrichia* spp. are also identical in chaetotaxy and fall within the same size limits. It is impossible to separate specimens collected from these hosts.

Two populations of *R. fringillae* from *Pipilo fuscus* and *Passerina hyperborea* (now *Plectrophenax hyperboreus*) are identical in shape, chaetotaxy, and other morphological characteristics. However, these populations are significantly different statistically in over-all size. The one specimen from *P. hyperboreus* also is heavily pigmented. I am reluctant to describe and name a new species based on one specimen and two characters that are subject to alteration through curatorial procedures. This population is included in *R. fringillae sensu lato.* The specimens from *P. fuscus* are overcleared to the extent that pigmentation patterns appear to have been altered, but the shape of structures seems unaffected. A single specimen from *Pipilo erythrophthalmus* falls within the size range of *R. fringillae* from *Junco* spp., whereas the population from *P. fuscus* is much larger than *R. fringillae sensu stricto.* In *Ricinus* the over-all size difference without accompanying morphological differences does not appear to be a character of specific value. At present it is not known whether size difference has a genetic or an environmental basis. It appears best, in the absence of distinguishing morphological characters, to regard this population as *R. fringillae sensu lato.*

Specimens from *Passer domesticus* (probably a straggler) and *Parus atricapillus* are also similar in size, shape, and chaetotaxy to *R. fringillae*. The latter population from *Parus* sp. was described as a new species, *R. medius*, by Uchida (1926). The only apparent difference between *medius* and *fringillae* is the pigmentation pattern. The carinae and nodi are black as opposed to brown or golden brown in *fringillae*. The pattern on the sternites appears to differ from *fringillae*, but clearing may have altered this pattern in *medius*. Overcleared specimens of *medius* differ in no respect from overcleared specimens of *fringillae*. Therefore, the only data that indicate that *medius* should be separated from *fringillae* are the differences in degree of pigmentation and the host association. The population called *medius* occurs on hosts of the family Paridae, which is not closely related to Fringillidae. In my opinion these differences are not of species stature. In other species of *Ricinus*, changes in pigmentation pattern also have been accompanied by differentiation in other characters. *R. medius* Uchida is considered to be a junior subjective synonym of *R. fringillae* DeGeer by Rheinwald (1968) and myself.

Two populations appear to be different in size, coloration pattern, and several morphological features. These are referable to *R. microcephalus* (Kellogg) and *R. japonicus* (Uchida). Although these populations are similar to *fringillae* in several characters that Clay and Hopkins (1951, 1954, 1960) indicated had specific value in *Ricinus*, they differ from *fringillae* in shape of head, setation of labium, and pigmentation pattern. These characters also were said to have specific value by Clay and Hopkins. Because several characters are available to separate these populations from *fringillae*, I consider *R. japonicus* (Uchida) and *R. microcephalus* (Kellogg) as good species. The former species is found on hosts in the family Motacillidae, whereas the latter's host species is a member of the family Fringillidae, subfamily Carduelinae. Rheinwald (1968) considered these species as synonyms of *R. fringillae*.

Ricinus japonicus (Uchida, 1915)

Physostomum japonicus Uchida, 1915. Annot. Zool. Jap. 9:70. Type locality: Prov. Shinano, Japan. Type host: *Anthus spinoletta japonicus* Temminck and Schlegel.

Ricinus japonicus (Uchida). Harrison, 1916, Parasit. 9:67; Uchida, 1926, J. Coll. Agric. Imp. Tokyo 9:53; Hopkins and Clay, 1952, Checklist of Mallophaga, 326; Balat, 1955, Zool. Entomol. Listy 4:391; Balat, 1958, Prace, Brn. Zakl. Cheskoslov. Akad. Ved. 30:410; Ash, 1960, Ibis 102:110; Malcomson, 1960, Wilson Bull. 72:196; Bechet, 1961, Stud. Cercet. Biol., Filial. Cluj. Acad. Repub. Pop. Romine, 12:94; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 206; Emerson, 1964*a*, Checklist, II, Amblycera, 96; Zlotorzycka, 1965, Acta Parasit. Polonica 13:62; Balat, 1966, Angewand. Parasit. 7:26.

Ricinus fringillae DeGeer, 1778 (*partim*). Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:202, 215, pl. 3c.

Diagnosis.—A medium-sized species of the *fringillae* species group. Closely related to, but inseparable from, *R. fringillae* in characters of mandibles, prothorax, and male genitalia. Differs in other characters. Shape of head characteristic, longer than in *fringillae*. Temples narrow, tapering gently from eye to apices, ending in acute angle, barely hooked. Labium with 16 pairs of setae. Shape of gular plate characteristic. Marginal carinae wide between m2 and m3; setae m1 anterior to m2. Inner margin of carinae anterior to m1, narrow and straight for short distance then hooking mediad and slightly posteriad where margin becomes diffuse or absent, appearing to be fused with tentorial nodi. Q5 present. Pigmentation of abdomen characteristic; color golden-brown. Posterior margin of pterothorax, tergites II–VII, and sternites III–VII unpigmented. Unpigmented areas surround bases of tergal and sternal setae on these segments.

Description.—Head elongated, as in pl. 11, fig. 1. Mandibles similar to those of *R. fringillae*, as in pl. 11, fig. 3. Labium with 16 setae, as in pl. 11, fig. 2. Marginal carinae wide between m2 and m3; setae m1 anterior to m2. Anterior margin of carinae narrow and straight, hooking medially and slightly posteriorly where margin becomes diffuse or absent; apparently fused with tentorial nodi. Setae a1 as long as m4, the latter shorter than the pa series. Maxillary plates sausage-shaped; palpi barely extending past margin of head. Temples narrow; tapering gently posteriad ending in acute angle; apices barely hooked. Gular plate as in pl. 11, fig. 1; setae 2×4 to 5×7, average 4.5×4.5. Setae along antennal lappets variable, 8×9 to 9×11, average 9.5×9.5.

Prothorax and sternal plate as in pl. 11, fig. 6; sternal plate setation similar to that of *R. fringillae*. Six setae in w series; terminal pair pilose. Setae q2 spinose, q5 present. Setae b1 half as long as b2. Setae c4 three times as long as c3. Chaetotaxy of ventral pleurites as given in table 4.

Terminal segments of female abdomen as in pl. 11, fig. 5. Pleurites pigmented to margin. Tergites and sternites pigmented; color golden brown. Posterior margins of pterothorax, tergites II–VII and sternites III–VII unpigmented. Unpigmented areas surround bases of tergal and sternal setae on these segments. Vulval margin with five setae. Male genitalia as in pl. 11, fig. 4.

Dimensions.—Females (n = 7): total length 3.41 – 3.63 (3.53); greatest width 0.99 – 1.08 (1.03); head length 0.75 – 0.79 (0.77); head width 0.64 – 0.68 (0.66); head index 114 – 118 (116); labral width 0.35 – 0.37 (0.36); prothoracic length 0.34 – 0.38 (0.36); prothoracic width 0.55–0.59 (0.58); distance between prosternals 10 –16μ (12μ). Male (n = 1): TL, 2.76; GW, 0.84; HL, 0.65; HW, 0.57; HI, 115; LW, 0.29; PL, 0.27; PW, 0.50; distance between prosternals 11μ; width of genitalia 0.18.

Distribution.—Known only from *Anthus spinoletta* (Linnaeus), family Motacillidae, in North America.

Material examined.—From *Anthus spinoletta* (Linnaeus): 1 ♂, 4 ♀ (UM, NAMV 71, 95, 117) from Beartooth Plateau, Wyoming, in 1963–1964 by Verbeek; 3 ♀ (USNM) from Raleigh, North Carolina, on 22 February 1895 by H. H. and C. S. Brimley.

Ricinus microcephalus (Kellogg, 1896)

Physostomum microcephalum Kellogg, 1896*b*. Proc. Calif. Acad. Sci. 6:513–514, pl. 70. fig. 1; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Palo Alto, California. Type host: *Carpodacus mexicanus frontalis* (Say).

Ricinus microcephalus (Kellogg). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Eichler, 1953, Bonn. zool. Beitr. 4:343; Carriker, 1957, Microentomol. 22:105; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 214; Emerson, 1964*a*, Checklist, II, Amblycera, 97.

Ricinus fringillae DeGeer, 1778 (*partim*). Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:202, 215.

Diagnosis.—A medium-sized species of the *fringillae* species group. Closely related to *R. fringillae*. Shape of head similar to *fringillae*, but broader. Labium with 16 pairs of setae. Maxillary plate narrow. Gular plate characteristic; pigmented area diffuse. Setae q2 and q3 present. Two pairs of long setae and one pair of short posterior setae on sternal plates. Sternolateral and sternocentral setae equally spaced on sternites II–VII. Trochanter II and III each with one large and one medium-sized tactile seta. A lightly sclerotized species; color gold with whitish background.

Description.—Head as in pl. 12, fig. 1. Mandibles as in pl. 12, fig. 3. Labium with 16 pairs of setae, pattern as in pl. 12, fig. 2. Maxillary plates sausage-shaped, narrow. Pigmented portion of mentum lunar-shaped. Gular plate as in pl. 12, fig. 1; pigmented portion diffuse; setae 4×4 or 5×5, average 4.4×4.4. Number of setae along antennal lappets averages 11×11.

Prothorax as in pl. 12, fig. 5; setation similar to *R. fringillae*. Six setae present in w series, w5 and w6 small and pilose, w1–4 spinose. Setae q2 and q3 spinose. Sternal plate as in pl. 12, fig. 5, bearing two long pairs of setae, both longer than posterior pair. Setae c4 twice as long as c3.

Terminal segments of female abdomen as in pl. 12, fig. 4. Sternolateral and sternocentral setae equally spaced on sternites II–VII. Setae of ventral pleurites as given in table 4. Tro-

chanters II and III each bearing one long and one medium-sized tactile seta. Lightly sclerotized; color gold.

Male unknown.

Dimensions.—Females (n = 5): total length 3.59–3.73 (3.66); greatest width 1.18–1.22 (1.21); head length 0.74–0.80 (0.77); head width 0.71–0.76 (0.73); head index 104–108 (105); labral width 0.37–0.40 (0.38); prothoracic length 0.37–0.41 (0.39); prothoracic width 0.61–0.66 (0.64); distance between prosternals 8–16μ (13μ).

Distribution.—Known only from *Carpodacus mexicanus* (Müller). The single specimen from *Sayornis saya* (Bonaparte) is identical with specimens from *C. mexicanus* and is considered a straggler from the latter species. *R. microcephalus* is the only member of the *fringillae* species group from fringillid subfamily Carduelinae found in North America.

Material examined.—From *Carpodacus mexicanus* (Müller): holotype ♀ (VLK 393) from Palo Alto, California, in 1896; 2 ♀ (BCN) from near Arvin, Kern Co., California, on 10 July 1962 by B. C. Nelson and Boyd Hill; 1 ♀ (KCE) from Cedar Mt., vicinity Dugway Valley, Tooele Co., Utah, on 21 April 1953 by R. Porter. From *Sayornis saya* (error): 1 ♀ (KCE) from S end Cedar Mts., Toole Co., Utah, on 29 April 1953 by R. D. Porter.

Ricinus elongatus (Olfers, 1816)

Nirmus elongatus Olfers, 1816. De vegetativis et animatis corporibus in corporibus animatis reperiundis commentarius, 88. Type locality: Hodonin, Czechoslovakia. Type host: *Turdus viscivorus* Linnaeus.

Physostomum mystax Burmeister, 1838. Handb. Entomol., 2:422; Denny, 1842 (*partim*), Monog. Anopl. Brit., 203, 241–242, fig. 6.; Giebel, 1874, Insecta epizoa, 254–255, figs. 2–3; Piaget, 1880, Les Pediculines, 602–603, fig. 2; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Enderlein, 1914, Brohmer's Fauna Deutschl., 114; Uchida, 1915, Annot. Zool. Jap. 9:67. Type locality: not recorded. Type host: *Turdus pilaris* Linnaeus.

Physostomum bombycillae Denny, 1842 (*partim*). Monog. Anopl. Brit., 203–204, 242; Giebel, 1866, Zeit. gesamm. Naturwiss. 28:396; Giebel, 1874, Insecta epizoa, 257. Type locality: Leeds, England. Hosts: *Bombycilla garrulus* (Linn.) and *Emberiza nivalis* Linnaeus.

Physostomum mystax Denny (*sic*), Grube, 1851, von Middendorff's Reise Sibiriens, 2:496–497.

Physostomum intermedium Piaget, 1880, *nec* Uchida, 1915 (*nomen novum* for *P. bombycillae* Denny, 1842). Les Pediculines, 605–606, fig. 4; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: not recorded. Type host: *Bombycilla garrulus* (Linnaeus).

Physostomum merula Durrant, 1906. Ohio Nat. 7:35, fig. 1d; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Ft. Collins, Colorado. Type host: *Merula migratoria propinqua* (now *Turdus migratorius propinquus* Ridgway).

Ricinus elongatus (Olfers). Harrison, 1916, Parasit. 9:66; Seguy, 1944, Fauna de France, 43:158; Hopkins and Clay, 1952, Checklist of Mallophaga, 325; Balat, 1952, Biol. Sbor. 7:156; Clay and Hopkins, 1960, Bull. Brit. Mus. (Nat. Hist.) Entomol. 9:26–30, figs. 38, 40, 42, 44, 46 (neotype); Ash, 1960, Ibis 102:98; Zlotorzycka, 1965, Acta Parasit. Polonica 13:59; Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:219–288, pl. 7.

Ricinus merulae (Durrant). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Malcomson, 1960, Wilson Bull. 72:195; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 204; Emerson, 1964*a*, Checklist, II, Amblycera, 97: Zlotorzycka, 1965, Acta Parasit. Polonica 13:63; Keirans, 1967, Agric. Exp. Sta. Bull. 492:62–63, Univ. New Hampshire.

Ricinus bombycillae (Denny). Harrison, 1916, Parasit. 9:66; Uchida, 1926, J. Coll. Agric. Imp. Tokyo 9:54; Seguy, 1944, Fauna de France 43:156; Hopkins and Clay, 1952, Checklist of Mallophaga, 324; Balat, 1952, Biol. Sbor. 7:159, fig. 8; Malcomson, 1960, Wilson Bull. 72:195; Bechet, 1961, Stud. Cercet. Biol., Filial. Cluj. Acad. Repub. Pop. Romine, 12:94; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 207; Emerson, 1964*a*, Checklist, II, Amblycera, 96; Zlotorzycka, 1965, Acta Parasit. Polonica 13:58, fig. 7a; Balat, 1966, Angewand. Parasit. 7:26.

Ricinus ernstlangi Eichler, 1941. Arch. Naturgesch. 10:375; Hopkins and Clay, 1952, Checklist of Mallophaga, 325; Malcomson, 1960, Wilson Bull. 72:195; Bechet, 1961, Stud. Cercet. Biol., Filial. Cluj. Acad. Repub. Pop. Romaine, 12:94; Zlotorzycka, 1965, Acta Parasit. Polonica 13:59–60, fig. 7b; Baum, 1968, Angewand. Parasit. 9:141, 143–44 ff., pl. 6 (biology). Type locality: not recorded. Type host: *Turdus merula* Linnaeus.

Ricinus mystax (Burmeister), Hopkins and Clay 1952, Checklist of Mallophag, 327; Zlotorzycka, 1965, Acta Parasit. Polonica 13:63.

Ricinus elongatus ernstlangi Eichler. Eichler, 1953, Bonn. zool. Beitr. 4:343; Balat, 1966, Angewand. Parasit. 7(1):26.

Diagnosis.—A large species of the *fringillae* species group. Shape of mandibles characteristic; tips narrow. Labium with 17 to 19 pairs of setae. Temples expanded, apices not hooked. One pair of setae on sternal plate, moderately long; posterior pair medium in length. Prosternal plate not showing sexual dimorphism. Two long tactile setae on coxae I–III and trochanters II and III; one long tactile seta on femora II and III. Terminal tergite with two pairs of long setae and two pairs of small setae bordering long setae. Setae q5 present.

Description.—Head as in pl. 13, fig. 1. Mandibles dimorphic, tip narrow, as in pl. 13, fig. 2. Labium with 17 to 19 pairs of setae, pattern as in pl. 13, fig. 3. Mentum with pigmented plate, occasionally with central circular unpigmented area; bearing one pair of setae equal in length to maxillary setae. Maxillary plate sausage-shaped; palpi straight, bearing short pilose setae. Setae m1–m3 subequal, m1 anteriad to m2. Inner margin of marginal carinae between m2 and m3 straight. Setae m4 nearly as long as pa series. Preantennal setae spinose. Setae po1 strongly spinose, po2 long, po3 small, pilose. Setae a1 long, each with one medial sensillum; a4 and a6 absent. Setae t3 less than half as long as t1 and t2. Gular plate as in pl. 13, fig. 1, number of setae variable from 5 × 5 to 8 × 8, average 6.5 × 6.5. Setae along antennal lappets variable in number, 8 × 7 to 10 × 13, average 9.9 × 9.7.

Prothorax as in pl. 14, fig. 5; L3 not appreciably larger than L4; L7–L8 long; L9 medium in length, pilose. Prosternal plate as in pl. 14, fig. 5; setae close together. No sexual dimorphism in shape of prosternal plate (♂ of population from *B. garrulus* unknown). Two tactile setae on femur I and coxa I. Setae q1 pilose; q2 spinose; q5 small, situated terminally. Usually seven setae in w series; posterior two pairs of w setae smaller and pilose. Setae of b series long. Setae c1 spinose, twice as long as c2; c4 longer than c3. Sternal plate as in pl. 14, fig. 5; bearing one pair of moderately long setae which are longer than medium-sized posterior pair. Two pairs of tactile setae on coxae II and III and trochanters II and III; one pair on femora II and III. Three spinose crown setae on tibia I; five on tibia II and III.

Terminal segments of female abdomen as in pl. 13, fig. 4. Pleurites pigmented to margin; color golden brown. Setation of ventral pleurites as given in table 4. Both pairs of tergal setae long except on tergite VIII where inner pair is small. Sternal setae of segments II–VI long and equal in length. Sternites lightly pigmented, gold in color. Vulval setae short, variable in number, 4 to 10, average 7.2. Two pairs of long setae on margin of terminal segment of females; one pair in males. Male genitalia as in pl. 13, fig. 5; width of genitalia 0.21 mm.

Dimensions.—See table 9.

Distribution.—*R. elongatus* is known from *Turdus* spp. and *Bombycilla garrulus* from both the Old and the New World. The presence of this species on two different familes, Turdidae and Bombycillidae, is indeed strange. The distribution may have resulted from transfer of this species from Turdidae to *B. garrulus*, or it may represent a relict distribution of *R. elongatus* which was once more widely distributed. The first hypothesis appears more plausible.

Material examined.—From *Turdus merula* Linnaeus: 1 ♀ (BMNH 1965–186) from Derby, Eskgrove lab., England, on 31 July 1964; 1 ♂ (BMNH 1961–671) from Atherton, Lancs., England, on 12 May 1961 by A. Hazelwood; 1 ♀ (CIS) from Hanau, Germany, on 20 January 1953. From *Turdus migratorius* Linnaeus: 1 ♀ (3 C.F.B. in OSU, holotype of *P. merulae*) from Ft. Collins, Colorado, on 5 April 1892 by C. F. Baker; 4 ♀ (USNM) from Salmon Creek, Juneau, Alaska, on 6 August 1950 by R. B. Williams; 1 ♀ (USNM) from Coachella, California, on 16 February 1932 by Mrs. B. L. Clary; 1 ♀ (USNM) from Fort du Pont, Delaware, on 13 April 1933 by H. S. Peters; 1 ♀ (CU 761) from Metaira, Louisiana, in February 1934 by A. Betz; 2 ♀ (USNM) from Emigrant Springs, Oregon, on 11 May 1932 by H. H. Stage; 5 ♀ (USNM) from Rosslyn, Virginia, on 20 March 1935 by H. S. Peters. From *Bombycilla garrulus* (Linnaeus): 2 ♀ (CIS) from Denver, Colorado, in 1917 by W. H. Bergtold; 10 ♀ (BCN 653 in CAS) from Atlin, British Columbia, Canada, on 16 July 1929 by H. S. Smith; 1 ♀ (BMNH

1922–75) from Holy Island on 28 November 1921 by J. Waterson; 1 ♀ (BMNH 1950–389) from Moravia, Czechoslovakia, in March 1949; 1 ♀ (USNM) from Hrvotsksy, Dubrovnik, on 22 February 1962 by S. Brelih.

Remarks.—Olfers (1816), who accepted the generic name *Nirmus* Hermann over *Ricinus* DeGeer, described *N. elongatus* from *Turdus viscivorus* Linn. Since *elongatus* was a pre-Nitzschian name, nineteenth-century workers ignored it; however, no worker during this period referred the population of *Ricinus* from *T.*

TABLE 9

MEAN AND RANGE OF MEASUREMENTS OF RICINUS ELONGATUS POPULATIONS

Character	*Bombycilla garrulus* n = 15, ♀	*Turdus migratorius* n = 15, ♀	*Turdus merula* n = 2, ♀	*Turdus merula* 1♂
Total length	4.40 4.01–4.58	4.73 4.52–4.92	4.76 4.70–4.82	3.45
Greatest width	1.51 1.18–1.59	1.40 1.30–1.47	1.365 1.36–1.37	1.03
Head length	0.83 0.78–0.86	0.89 0.86–0.93	0.89 0.87–0.91	0.72
Head width	0.84 0.76–0.88	0.82 0.80–0.87	0.815 0.80–0.83	0.71
Head index	99 96–104	108 104–113	108.5 104–113	101
Labral width	0.45 0.42–0.47	0.46 0.44–0.47	0.47 0.46–0.48	0.39
Prothoracic length	0.48 0.43–0.51	0.50 0.46–0.52	0.495 0.49–0.50	0.44
Prothoracic width	0.78 0.71–0.83	0.78 0.74–0.82	0.815 0.80–0.83	0.62
Distance between prosternals	15μ 9–19μ	17μ 13–21μ	18.5μ 18–19μ	16μ

viscivoris to any other name. In 1838 Burmeister referred the population of *Ricinus* from *Turdus pilaris* Linn. to *Physostomum mystax*. Populations from other *Turdus* spp. were referred to *mystax* by Denny (1842) and Grube (1851). Both Giebel (1874) and Piaget (1880) redescribed *P. mystax*. Piaget also described the slight differences between the typical *mystax* and a specimen of *Physostomum* from *Turdus merula*, but did not give a name to this population. Eichler (1941) proposed the name *R. ernstlangi* for this specimen, now lost, in the Piaget collection. Durrant (1906*b*) described *Physostomum merulae* from the North American host, *Turdus migratorius*.

Following the restoration of the generic name *Ricinus* by Neumann (1906), Harrison (1916) restored many of the pre-Nitzschian names including *R. elongatus* (Olfers, 1816). He designated *Physostomum mystax* as a junior synonym of *R. elongatus*. Harrison listed *R. merulae* Durrant as valid. Harrison's action regarding *mystax* was not followed by Hopkins and Clay (1952), who held *elongatus, mystax, merulae,* and *ernstlangi* to be valid species in *Ricinus*. Balat (1952), in his study of the central European species of *Ricinus*, placed both *R. mystax* and *R. ernstlangi* into synonymy with *elongatus*. In 1960 Clay and Hopkins described

and figured a neotype for *R. elongatus*. They placed *ernnstlangi* into synonymy and further indicated that *mystax* may also be a synonym of *elongatus*. Zlotorzycka (1965) thought that the three names (*elongatus, mystax,* and *ernstlangi*) apply to three distinct species, but she failed to give conclusive support for her contentions.

According to Rheinwald (1968), *Ricinus* taken in the Old World from *Bombycilla garrulus* were similar to populations from *Turdus* spp. My examinations of specimens from these hosts collected in both hemispheres lead me to agree. No differences in chaetotaxy, pigmentation pattern, or shape of structures exist between populations from *Turdus* spp. and *B. garrulus*. The differences in the dimensions of the head and abdomen given in table 9 are considered to have resulted from overclearing. Ten of fifteen specimens from *B. garrulus* are overcleared. Statistically the two populations are separable at the subspecific level based on differences in total length. This alone, however, is insufficient to separate these populations into different species. Specimens from *B. garrulus* are referred to as *R. elongatus*. Since the name *bombycillae* is referable to *R. fringillae* (see remarks under this species), the next name available for the population is *R. intermedius* (Piaget, 1880, *nec* Uchida, 1915). This name is designated as a junior subjective synonym of *R. elongatus* (Olfers, 1816).

Ricinus mandibulatus Species Group

DIAGNOSTIC CHARACTERISTICS

1. Mandibular tips monomorphic; mandibular lobes dimorphic, left lobe with small knoblike extension articulating with right lobe.
2. Head conical in shape; frons truncate with parallel margins; margins of head slightly concave; occipital margin concave; occipital nodus biconcave.
3. Ovoid sclerites not evident.
4. Tentorium well developed; lunar nodi present.
5. Maxillary palpi genticuloid.
6. Setae a1 with two sensilla; a3 absent.
7. Prothorax hexagonal.
8. Preantennals spinose.
9. Setae of sternites moderate in length.
10. Head attached to prothorax by two broad lobelike articulations.

Remarks.—The *mandibulatus* species group is represented by one species, *R. mandibulatus*. This species appears to represent a link between the species of *Ricinus* with dimorphic mandibles and the *marginatus* species group. But for the dimorphic lobes of the mandibles, inclusion in the *marginatus* species group is suggested.

Ricinus mandibulatus, new species

Type locality: Choluteca, San Francisco, Honduras.

Type host: *Chamaethlypis poliocephala* (Baird).

Diagnosis.—A species of the *mandibulatus* species group. Shape of head and thorax resembles *R. marginatus*. Mandibles with huge tips; mandibular lobes dimorphic. Labium with 14 pairs of setae. First segment of maxillary palpi bearing a large spine. Shape of prosternal and sternal plates as in pl. 14, fig. 5. Pleurites pigmented to markin. L3 absent.

Description.—Shape of head as in pl. 14, fig. 1, resembling that of *R. marginatus* except for shape of occipital nodus. Frons truncate, transverse carina straight; frontal incrassations fused with transverse carina. Mandibles with huge monomorphic tips; mandibular lobes dimorphic; knoblike extension of left mandible small, as in pl. 14, fig. 3. Labium with 14 pairs of setae, pattern as in pl. 14, fig. 2. Setae m2 on marginal carinae; m4 three times as long as pa series.

Maxillary plates sausage-shaped, broad, maxillary palpi genticuloid; first segment of palpi bearing a large spine. Lunar nodus larger than tentorial nodus. Setae a1 short with two sensilla; a1 mediad to posterior sensilla; a6 present. Gular plate as in pl. 14, fig. 1, setae 4 × 4. Setae along antennal lappets 12 × 10. Setate po1 spinose, equal to pilose po2; po3 short and pilose.

Prothorax hexagonal, as in pl. 14, fig. 4; L3 absent; L5 longer than L6. Prosternal plate as in pl. 14, fig. 4, setae 74μ apart. Procoxal spines equal; coxa and femur I each with two tactile setae. Six setae in w series; setae q2 equal in size to w3. Setae c1 spinose, three times as large as c2; c3 and c4 long and pilose, c4 twice as long as c3. Sternal plate as in pl. 14, fig. 4, bearing two pairs of long setae and one pair of short posterior setae.

Terminal segments of female abdomen partially obliterated, not illustrated. Pleurites pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Setae on sternites II–VI equal to m4. Vulval margin with 15 setae. Sternites VI–VIII pigmented, color gold.

Male unknown.

Dimensions.—Total length 3.85; greatest width 1.12; head length 0.82; head width 0.76; head index 108; labral width 0.38; prothoracic length 0.42; prothoracic width 0.66; distance between prosternals 74μ.

Distribution.—Known only from *Chamaethlypis poliocephala* (Baird), family Parulidae.

Material examined.—From *Chamaethlypis poliocephala* (Baird): holotype ♀ (RSM-BCN 626) from Choluteca, San Francisco, Honduras, on 12 February 1963. The type is in the entomological collection of the U. S. National Museum.

Ricinus invadens Species Group

DIAGNOSTIC CHARACTERISTICS

1. Narrow conical head; margin of frons continuous with margin of marginal carinae.
2. Tips of mandibles essentially monomorphic; left mandibular lobe with small finger-like articulation.
3. Ovoid sclerites not evident.
4. Maxillary plates sausage-shaped; palpi genticuloid.
5. Pleurites pigmented; nodi thick as in *arcuatus* species group.
6. Lunar, tentorial, and antennal nodi present.
7. Setae a3 absent.
8. Chaetotaxy of ventral pleurites as in table 4.
9. Preputial sac large, rounded structure with large stoma.

Remarks.—The *invadens* species group is represented by a single species, *R. invadens*. The shape of mandibles shows an intermedate condition between the forms having dimorphic mandibles and those having monomorphic mandibles. This species also shares many structures that are characteristic of other species groups; thus it cannot be adequately placed in any of these groups. Its uniqueness warrants the recognition of a separate species group. The specimen of *Ricinus* erroneously called *R. alphaaurigae* by Carriker (1964) is referable to this group (see discussion under *species inquirendae* section).

Ricinus invadens (Kellogg, 1899)

Physostomum invadens Kellogg, 1899. Occ. Pap. Calif. Acad. Sci. 6:50; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Panama. Type host: *Chiroxiphia lanceolata* (Wagler) by Carriker, 1957, Microentomol. 22:105.

Ricinus invadens (Kellogg). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 326; Carriker, 1957, Microentomol. 22:105 (lectotype).

Ricinus expeditionis Eichler, 1954. Fauna Peru. 4:45, fig. 23. Type locality: Rio Beni, Bala, Bolivia. Type host: *Pipra chloromeros* Tschudi. New synonymy.

Ricinus machaeropterus machaeropterus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:59–60, figs. 15, A-5. Type locality: Sta. Elena, Zulia, Venezuela. Type host: *Machaeropterus regulus obscurostriatus* Phelps and Gilliard. New synonymy.

Ricinus machaeropterus subsimilis Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:60, figs. 16, B-1. Type locality: Las Quiguas, Carabobo, Venezuela. Type host: *Pipra e. erythrocephala* (Linnaeus). New synonymy.

Diagnosis.—A small species with characters of the *invadens* species group. Head narrow and conical with lunar nodi present. Mandibles monomorphic; mandibular lobes dimorphic. Setation of gular plate characteristic, anterior and posterior pairs of setae equal in length, shorter than middle pair. Prothorax subchordate. Prosternal and pleural carinae thick. Tergal setae long. Outer pair of apical setae on parameres twice as long as inner pair.

Description.—Head as in pl. 15, fig. 1; frons truncate. Transverse carina pigmented, fused with frontal incrassation. Mandibles as in pl. 15, fig. 3. Labium with 12 pairs of setae, pattern as in pl. 15, fig. 2. Maxillary plates sausage-shaped; maxillary seta longer than mental seta. Maxillary palpi not reaching to margin of head, genticuloid; first segment with spinose setae and microtrichiae on anterior distal margin. Setae m4 and pa series short and equal in length, about three times as long as m1–m3. Setae a1 short, each with two widely spaced sensilla; a3 absent. Gular plate as in pl. 15, fig. 1; anterior and posterior pairs of setae medium in length, middle pairs long; pattern 3 × 3 usually, 2 × 3(2), 4 × 4(1). Number of setae along antennal lappets variable, 4 × 5 to 9 × 8, average 7 × 7.

Prothorax as in pl. 15, fig. 6; setae L7–8 long, L9 short. Prosternal plate as in pl. 15, fig. 6. A large spinose seta on outer margin of procoxa. Two tactile setae on femur I. Sternal plate wide medially as in pl. 15, fig. 6; bearing two pairs of long setae and one posterior pair medium in length. Five or six spinose setae in w series; w3 as large as q2, w1–2 and w4 and 5 subequal. Setae q2 spinose. Setae c1 spinose, short, slightly longer than pilose c2; c3 and c4 medium-sized and equal in length. Phragmata III weakly pigmented. Coxa II and femora II and III each with one tactile seta. Crown setae of tibiae I–III with two strongly spinose setae.

Terminal segments of abdomen of female as in pl. 15, fig. 5. Pleurites pigmented to margin; color brown. Nodi thick. Chaetotaxy of ventral pleurites as given in table 4. Medium-sized setae on sternites II–VI. Tergal chaetotaxy unique; inner and outer tergal setae of II–IV long; outer setae of VIII short, inner setae medium in length. Vulval margin with six to ten setae. Sternites VI–VIII lightly pigmented, gold in color. In males sternal setae of sternite IX close together. Male genitalia as in pl. 15, fig. 4; margin of mesosome ending in a strong point. Preputial sac large and rounded with large stoma. Two pairs of apical setae on parameres; outer pair twice as long as inner pair. Moderately sclerotized species, pleurites and nodi brown; golden background.

Dimensions.—From *Chiroxiphia lanceolata:* Males (n = 5): total length 2.52–2.74 (2.65); greatest width (n = 4) 0.69–0.72 (0.72); head length 0.59–0.64 (0.63); head width 0.55–0.57 (0.56); head index 108–118 (113); labral width 0.25–0.27 (0.26); prothoracic length 0.29–0.32 (0.30); prothoracic width 0.49–0.52 (0.50); distance between prosternals (n = 2) 72μ, 75μ; width of genitalia 0.16–0.17 (0.168). Females (n = 2); TL, 3.02, 3.04; GW, 0.81, 0.82; HL, 0.66, 0.69; HW, 0.60; HI, 110, 115; LW, 0.29; PL, 0.32, 0.34; PW, 0.56, 0.57; distance between prosternals 88μ. From *Machaeropterus regulus:* female (n = 1): TL, 2.81; GW, 0.76; HL, 0.64, HW, 0.60; HI, 108; LW, 0.27; PL, 0.30; PW, 0.52; distance between prosternals 51μ. From *Pipra erythrocephala:* Females (n = 2): TL, 2.89, 2.93; GW, 0.80, 0.84; HL, 0.67; HW, 0.60, 0.62; HI, 109, 113; LW, 0.27, 0.28; PL, 0.34; PW, 0.55; distance between prosternals 58μ, 70μ.

Distribution.—Known to occur on three genera in the family Pipridae.

Material examined.—From *Chiroxiphia lanceolata* (Wagler): lectotype ♂ and 4 ♂ and 1 ♀ paralectotypes (VLK 416a) from Panama in September 1896 by R. C. McGregor. From *Melanerpes wagleri* (error: straggler from type host): 1 ♀ paralectotype (VLK 414a) with same data as above. From *Machaeropterus regulus obscurostriatus* Phelps and Gilliard: 1 ♀ (USNM 68795, holotype of *R. m. machaeropterus*) from Estado Zulia, Sta. Elena, Venezuela, on 17 August 1922 by M. A. Carriker, Jr. From *Pipra erythrocephala* (Linnaeus): 1 ♀ (USNM 68796, holotype of *R. m. subsimilis*) from Estado Carabobo, Las Quiguas, Venezuela, on 2 September 1910 by M. A. Carriker, Jr.; 1 ♀ (RSM) from Amazonas, Rio Maranon, Urakusa, Peru, on 31 July 1964 by J. A. Farrand.

Remarks.—Kellogg (1899) described *Physostomum invadens* from *Chiroxiphia lanceolata* and *Melanerpes wagleri*. Carriker (1957) designated a male specimen collected from *C. lanceolata* as the lectotype. This is now mounted on a separate slide and labeled properly. Two paralectotypes were remounted on another slide. Carriker thought that the specimen from *M. wagleri* was a straggler, and removed the species from the host list. I fully agree with this action.

I have been unable to secure the type of *Ricinus expeditionis* Eichler, 1954. The figure of the head agrees completely with that of *R. invadens*. *R. expeditionis* Eichler is designated a junior subjective synonym of *R. invadens* (Kellogg). The two subspecies, *R. m. machaeropterus* and *R. m. subsimilis*, described by Carriker (1964), are similar to *R. invadens* and are designated as junior subjective synonyms of this species.

Ricinus serratus Species Group

DIAGNOSTIC CHARASTERISTICS

1. Head conical, with distinct postfrontal constriction; broader than long.
2. Clypeal carinae fused with transverse frontal carinae forming an arch.
3. Mandibular tips heavy; monomorphic.
4. Ovoid sclerites appear to be fused medially; heavily ornamented.
5. Pallettes each with two sclerites.
6. Setae along antennal lappets reduced, five or less, usually two or three pairs.
7. Gular plate without posterior extensions; truncate behind.
8. Occiput concave; occipital nodus weakly biconcave.
9. Prothorax deeply notched between L4 and L5; L3 twice as long as L4; L7 and L8 long.
10. Prosternal plate without sclerotized nodi; pear-shaped; prosternal setae close together.
11. Setae q2–4 large and spinose.
12. Scalelike sculpturing on anterior margin of prothorax, on lateral margins of pterothorax along phragmata II and III, and on pleurites.
13. Pleural nodi unique, with undulating margins; oriented medially.
14. Mesosome V-shaped, ending medially in a long produced point.

Ricinus serratus (Durrant, 1906)

Physostomum serratum Durrant, 1906*a*. Ohio Nat. 6:528, fig. 1b; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Ft. Collins, Colorado. Type host: "Desert Horned Lark," *Otocoris* sp. (now *Eremophila alpestris hoyti* (Bishop)).

Physostomum clypeatum Mjöberg, 1910. Ark. Zool. 6:60, figs. 35–36, pl. 2, fig. 1. Type locality: not recorded. Type host: *Alauda alpestris* (now *Eremophila alpestris* (Linn.)).

Ricinus clypeatus (Mjöberg). Harrison, 1916, Parasit. 9:66; Baker, 1919, Rept. Canad. Arctic Exped. 3:4; Seguy, 1944, Fauna de France 43:157.

Ricinus serratus (Durrant). Harrison, 1916, Parasit. 9:68; Uchida, 1926, J. Coll. Agric. Imp. Tokyo 9:52; Blagoveshtchensky, 1951, Mag. Parazit. 13:285; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Malcomson, 1960, Wilson Bull. 72:194; Emerson, 1962, Tent. List Mallophaga N. Amer., Dugway Proving Ground, Utah, 192; Emerson, 1964*a*, Checklist, II, Amblycera, 98; Zlotorzycka, 1965, Acta Parasit. Polonica 13:63; Keirans, 1967, Agric. Exp. Sta. Bull. 492:63, Univ. New Hampshire; Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:229–235, pl. 10.

Ricinus serratus var. *Magnus* Uchida, 1926. J. Coll. Agric. Imp. Tokyo 9:52–53. Type locality: River Dido, Korea. Type host: *Alauda arvensis* Linnaeus.

Ricinus magnus Uchida. Hopkins and Clay, 1952, Checklist of Mallophaga, 326; Bechet, 1961, Stud. Cercet. Biol. Filial. Cluj. Acad. Repub. Pop. Romine, 12:94; Emerson, 1964*a*, Checklist, II, Amblycera, 97.

Ricinus serratus magnus Uchida. Zlotorzycka, 1965, Acta Parasit. Polonica 13:63.

Diagnosis.—A large species with characters of the *serratus* species group. Easily differentiated from all other *Ricinus* by shape of head, shape of prothorax, shape of gular and prosternal plates, shape of pleural nodi, reduction in number of setae along antennal lappets, presence of q2–q4, and shape of male genitalia, in particular the mesosome.

Description.—Head as in pl. 16, fig. 1; unique in that margin of frons indented inward from marginal carinae forming an arch. Mandibles monomorphic as in pl. 16, fig. 2. Labium with 14 pairs of setae, pattern as in pl. 16, fig. 3. Ovoid sclerites heavily ornamented, pitted as in pl. 16, fig. 2. Maxillary plates unsclerotized; palpi genticuloid with anterodistal spinose setae on segment one; palpi extending past margin of head. Setae m2 mediad to m1; m4 long, equal in length to pa series. Preantennal setae spinose. Lunar nodi present. Tentorium reduced, posterior pits tiny. Gular plate as in pl. 16, fig. 1; number of setae variable, 0×2 to 3×3, average 2.6×2.6. Postocular series with four or five setae, pilose and subequal, larger posteriad.

Prothorax unique, as in pl. 16, fig. 4; L3 twice as long as L4; L7 and L8 long. Prosternal plate without nodi, pear-shaped; prosternal setae close together; ♀ average 40μ apart, ♂ 26μ apart. One tactile setae on coxa I and femur I. Setae q2–q4 large and spinose; q4 sometimes absent. Five setae in w series, weakly spinose. Setae c1 spinose, c2–c4 pilose, equal in length. Sternal plate as in pl. 16, fig. 4, bearing one pair of long setae and one pair of moderately long posterior setae. One tactile seta on coxa II and femur III. Scalelike sculpturing on anterior margin of prothorax, lateral margin of pterothorax, and on phragmata and pleurites of abdomen.

Terminal segments of abdomen of female as in pl. 17, fig. 5. Pleural nodi unique as in figure above giving abdomen a serrated appearance. No pleural carinae on terminal segment of either sex. Chaetotaxy of ventral pleurites as given in table 4. Setae on sternites II–VI short. Outer tergal setae longer than inner tergal setae except on tergite VIII. Vulval margin with 14 to 20 setae, average 17. Sternites lightly pigmented, gold in color. Pleural nodi brown; nodi of head gold. Male genitalia as in pl. 16, fig. 5, apices of paramere each with one or two setae. Preputial sac large, round, with large stoma.

Dimensions.—Females (n = 15): total length 4.60–4.91 (4.78); greatest width 1.34–1.53 (1.41); head length 0.80–0.85 (0.83); head width 0.85–0.96 (0.93); head index 87–93 (89); labral width 0.34–0.36 (0.35); prothoracic length 0.50–0.57 (0.55); prothoracic width 0.85–0.94 (0.90); distance between prosternals 29–48μ (40μ). Males (n = 3): TL, 3.82–4.00 (3.89); GW, 1.02–1.15 (1.08); HL, 0.69–0.73 (0.71); HW, 0.77–0.81 (0.78); HI, 90–91 (90); LW, 0.29–0.32 (0.31); PL, 0.42–0.46 (0.44); PW, 0.72–0.74 (0.73); distance between prosternals 24–27μ (26μ); width of genitalia 0.20–0.22 (0.21).

Distribution.—Known only from birds in family Alaudidae. In the New World this species is known from the Horned Lark, *Eremophila alpestris* (Linn.) and the introduced Skylark, *Alauda arvensis* Linn.

Material examined.—From *Eremophila alpestris* (Linnaeus): holotype ♀ (OSU, Herbert Osborn 43) from Ft. Collins, Colorado, on March 1892 by J. H. Cowen; 1 ♀ (USNM) with same data as holotype except "bet. (*sic*) Osb."; 1 ♂ (CIS) from Denver, Colorado, in 1917 by W. B. Bergtold; 1 ♂, 11 ♀ (BMNH 13237–39) from Arizona in March 1939 by R. Meinertzhagen; 1 ♂, 1 ♀ (KCE) from Sewerline, vicinity Dugway Valley, Tooele Co., Utah, on 2 July 1953 by W. G. Denzer; 1 ♀ (KCE) from Lake Huron, Ontario, Canada, on 1 November 1941 by N. R. Brown.

Remarks.—The holotype of *R. serratus* (Durrant) is in the Herbert Osborn collection at Ohio State University. The data given in the materials examined are printed in ink on the original slide label. Also on the label, written in pencil, are the words "Physostomum," "drawn E.D.D.," and "type." This slide is labeled by me as the holotype. Another slide with the same data as the holotype is in the U. S. National Museum, but is not considered part of the type series, as Durrant (1906*a*) described *R. serratus* from a single female specimen. Thus the National Museum specimen is not a paratype.

Ricinus marginatus Species Group

DIAGNOSTIC CHARACTERISTICS

1. Ovoid sclerites not evident.
2. Mandibles monomorphic.

3. Head conical, elongated; frons usually truncate, sides parallel; margin of frons not continuous with margin of head; sides of head slightly concave; occipital margin concave, except in *R. marginatus*.
4. Margin of labium concave.
5. Maxillary palpi genticuloid; plates sausage-shaped.
6. Setae a1 each with two sensilla; a3 absent.
7. Prothorax hexagonal, except in *R. polioptilus*.
8. Preantennals spinose.
9. Gular plate with posterior projections.
10. Prosternal setae widely spaced.
11. Preputial sac rounded, with large stoma.
12. Margin of mesosome variable, entire or with a blunt to sharp median point; parameres pointed, bearing apical setae.
13. Pattern on terminal tergite of female, iIIi × iIIi.
14. Setae c3 and c4 present.
15. Lunar nodi present.
16. Tentorium well to poorly developed; posterior pits well developed in *R. marginatus*, weak or absent in *R. seiuri*.

Ricinus flavicans Carriker, 1964

Ricinus flavicans Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:60–61, figs. 17, B-9. Type locality: Paromode Rosas, Lara, Venezuela. Type host: *Myiophobus flavicans venezuelensis* (Hellmayr).

Diagnosis.—A small species of the *marginatus* species group. Mandibles with large needle-type tips. Frons truncate, rounded laterally. Lunar nodi diffuse. Occipital nodus biconcave; medial margin extending to edge of dorsal occipital margin. Temple apices blunt, not hooked. Gular plate characteristic. Setae a1 each with two sensilla; anterior pair separated from a1 by distance of diameter of sensillum; posterior sensilla widely separated, in line with setae m3. Pleurites pigmented to margin. Both pairs of tergal setae present on tergite VIII. Known only from type specimen.

Description.—Head as in pl. 17, fig. 1. Frons truncate, rounded laterally; frontal carinae wide. Transverse carina wide, fused together with frontal incrassations. Mandibles as in pl. 17, fig. 3. Labium obliterated in holotype. Maxillary palpi genticuloid. Lunar nodi diffuse. Setae a1 each with two sensilla; anterior sensillum separated from a1 by distance of diameter of sensillum; posterior sensillum widely separated, in line with setae m3. Setae m4 small, slightly smaller than pa series. Setae po2 slightly larger than po1 and po3. Gular plate as in pl. 17, fig. 1, setae 2 × 2. Setae along antennal lappets obliterated. Temples bluntly pointed, not hooked.

Prothorax hexagonal as in pl. 17, fig. 4; L6 absent; L7–8 long, L9 small. Coxae and femur I each with two tactile setae. Setae c1 and c2 spinose; c3 and c4 pilose, equal in length. Five setae in w series. Setae q2 not longer than setae of w series. Sternal plate with two pairs of long setae and one pair of short posterior setae. Tactile setae present on coxa II; none present on femora II and III (? broken). Pleurites pigmented; pattern on ventral pleurites as indicated in table 4. Both pairs of tergal setae present on tergite VIII. Setae of sternite II–VI short. Vulva with six setae. Terminal segments of abdomen as in pl. 17, fig. 2.

Male unknown.

Dimensions.—Type specimen: total length 3.02; greatest width 0.84; head length 0.64; head width 0.58; head index 111; lateral width 0.22; prothoracic length 0.30; prothoracic width 0.48; distance between prosternals 48μ.

Distribution.—Known only from the holotype.

Material examined.—From *Myiophobus flavicans venezuelensis* (Hellmayr): Holotype ♀ (USNM 68797) from Paromode Rosas, Lara, Venezuela, on 17 March 1911 by M. A. Carriker, Jr.

Ricinus marginatus (Children, 1836) *sensu lato*

Physostomum marginatum Children, 1836. *In* Back's Arctic Land Exped., 539. Type locality: Arctic America. Type host: no host recorded.

Physostomum angulatum Kellogg, 1896*b*. Proc. Calif. Acad. Sci. 6:515–516, pl. 70, fig. 5; Kellogg and Kuwana, 1902, Proc. Wash. Acad. Sci. 4:498; (*non*) Carriker, 1903, Univ. Stud. Nebraska 3:168; Kellogg, 1908, Wytsman's Genera Insectorum, 66:71. Hosts: *Tyrannus tyrannus* (Linnaeus) and *Passerella iliaca* (Merrem). New synonymy.

Ricinus angulatus (Kellogg). Harrison, 1916, Parasit. 9:66; Peters, 1928, Ohio J. Sci. 28:223; Hopkins and Clay, 1952, Checklist of Mallophaga, 324; Carriker, 1957, Microentomol. 22:105 (lectotype); Malcomson, 1960, Wilson Bull. 72:194, 197; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 187; Emerson, 1964*a*, Checklist, II, Amblycera, 94; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 23:43; Linsley and Usinger, 1966, Proc. Calif. Acad. Sci., ser. 4, 33:128; Keirans, 1967, Agric. Exp. Sta. Bull. 492:60; Univ. New Hampshire. Type locality: Lawrence, Kansas. Type host: *Tyrannus tyrannus* (Linn.), by subsequent designation, Carriker, 1957, Microentomol. 22:105. New synonymy.

Ricinus marginatus (Children). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 326; Emerson, 1964*a*, Checklist, II, Amblycera, 97.

Ricinus rubinus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:49, figs. 3, B-4. Type locality: Tocuyo, Venezuela. Type host: *Pyrocephalus rubinus saturatus* Berlepsch and Hartert. New synonymy.

Ricinus tuberculifer Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:50, fig. 3a. Type locality: Lagunita de Aroa, Venezuela. Type host: *Myiarchus tuberculifer pallidus* Zimmer and Phelps. New synonymy.

Ricinus similis Carriker, 1964, *nec* Giebel, 1874. Mem. Soc. Cienc. Nat. La Salle 24:56, figs. 9, B-5. Type locality: Sabana Mendoza, Venezuela. Type host: *Myiozetetes similis columbianus* Cabanis and Heine. New synonymy.

Diagnosis.—A large species of the *marginatus* species group; populations herein attain the greatest size in *Ricinus*. Shape of head characteristic; frons truncate. Mandibles characteristic, tips arched. Transverse carina wide, fused with frontal incrassations. Tentorial nodi half as large as lunar nodi. Temples expanded, appressed to prothorax. Dorsal occipital margin concave; margin of occipital nodus biconcave, medial margin posterior to occipital margin. One pair of tergals on tergite VIII. Preputial sac irregular in shape, with stalklike stoma. Pleural nodi pigmented; pleurites not pigmented.

Description.—Head as in pl. 18, fig. 1. Frons truncate. Transverse carina fused laterally with frontal incrassations. Frontal carinae extending along margin of frons. Mandibles as in pl. 18, fig. 2, tips arched. Labium with 14 pairs of setae, as in pl. 18, fig. 3. Setae m2 along inner margin of marginal carinae. Maxillary plate sausage-shaped; palpi genticuloid, not extending to margin of head. Tentorial nodi small, half as large as lunar nodi. Preantennals spinose. Setae a1 with two sensilla; a3 absent. Setae m4 slightly longer than pa series; pa series equal in length to mental setae. Setae po2 twice that of spinose po1. Gular plate strongly pointed as in pl. 18, fig. 1; number of setae variable, 0 × 2 to 4 × 4, average 2.5 × 2.5. Setae along antennal lappets extremely variable in number, 8 × 11 to 15 × 17, average 12 × 12. Temples expanded, outer margin curves inwardly, ending in a hooklike structure, inner margins appressed close to prothorax. Dorsal occipital nodus biconcave, medial margin extending posteriad to occipital margin.

Prothorax hexagonal, as in pl. 18, fig. 5; L3 spinose, thinner and longer than L4; L7–8 long; L9 small, pilose. L6 often absent. Three spines on lateral margin of coxa I equal in size, one spinose seta on dorsal surface of coxa I. Coxa I and femur I with two tactile setae. Sternal plate as in pl. 18, fig. 5; bearing two or three pairs of long setae and one pair of short posterior setae. Setae of q2 strongly spinose. Usually six setae in w series; w5 and w6 shorter than w1–4. Setae b2 long; b1 equal to w6. Setae c1 and c2 spinose; c3 and c4 pilose. One tactile seta on coxa II and femur III.

Terminal segments of abdomen of female as in pl. 19, fig. 5. Pleural nodi pigmented; pleurites not pigmented. Chaetotaxy of ventral pleurites as given in table 4. Tergites II–VII each with one long and one short pair of setae; outer pair usually longer on II–IV; usually only one pair of medium-sized setae on tergite VIII. Setae on sternites II–VI short, equal to pr2. Vulva with 4 to 12 setae, average 8. Diffuse gold area on sternites VI and VII. Nodi and carinae dark brown to red-brown in color. Male genitalia as in pl. 18, fig. 4. Margin of mesosome ending in a short point. Apices of parameres each with three setae. Preputial sac irregular in shape, stoma small.

Dimensions.—See tables 10 and 11. Total numbers of specimens measured for each population are not the same as total number of specimens examined. Only adequately curated specimens were measured.

Distribution.—*R. marginatus sensu lato* occurs on species of the family Tyrannidae. Three cases of occurrence on Thraupidae, Parulidae, and Fringillidae are considered to represent straggling. Carriker's (1903) record of *P. angulatum* (now *R. marginatus*) from *Tanagra cana* is considered to represent straggling, contamination, or misidentification. Two females collected from *Platypsaris aglaiae*, Cotingidae, which is in the same superfamily as Tyrannidae, are similar to populations from *Tyrannus tyrannus*. Since few specimens have been collected from cotingids, this record cannot be definitely classified as straggling. If further collecting shows that this is not a case of straggling, the distribution of *R. marginatus* gives support to the close relationship between these two families.

Material examined.—From *Empidonax trailli* (Audubon): lectotype ♀ from Arctic America in 1833–1835 by Captain Back; 2 ♀ (USNM) from Sioux Co., Nebraska, on 21 June 1901 by M. A. Carriker, Jr. From *Empidonax minimus* (Baird and Baird): 1 ♀ (USNM) from Leetonia, Ohio, on 10 May 1934 by P. A. Stewart; 1 ♀ (USNM) from Tres Zapotes, Mexico, on 27 March 1940 by M. A. Carriker, Jr.; 3 ♀ (USNM) from Ascuncion Mita, Dept. Juliapa, Guatemala, by M. A. Carriker, Jr. From *Empidonax wrighti* Baird: 2 ♀ (KCE) from Santa Rosa Mts., Arizona, on 6 May 1939 by Brewster. From *Empidonax difficilis* Baird: 2 ♀ (VLK 578) from Ontario, California, in 1897 by B. Chapman. From *Myiozetetes similis* (Spix): 1 ♀ (USNM 68789; holotype of *Ricinus similis* Carriker *nec* Giebel, 1874) from Sabana Mendoza, Venezuela, on 28 April 1922 by M. A. Carriker, Jr. From *Myiozetetes cayanensis* (Linnaeus): 1 ♀ (BMNH) from Rupununi, near Lethem, British Guiana, on 23 February 1961 by T. Clay. From *Myiarchus crinitus* (Linnaeus): 1 ♀ (CU) from New Orleans, Louisiana, on 15 April 1938 by Jung. From *Myiarchus magnirostris* (Gray): 1 ♀ (VLK 1050) from Galapagos Is., Albemarle Is., in 1899. From *Myiarchus tyrannulus* (Muller): 1 ♀ (USNM) from Rio Lipeo, Bolivia, on 19 August 1936 by M. A. Carriker, Jr. From *Myiarchus tuberculifer* (Lafresnaye and D'Orbigny): 1 ♀

TABLE 10

MEAN AND RANGE OF MEASUREMENTS OF FEMALES OF RICINUS MARGINATUS POPULATIONS

Character	*Pyrocephalus rubinus* n = 3	*Sayornis phoebe* n = 4	*Contopus* spp. n = 4	*Myiarchus* spp. *Myiozetetes* sp. n = 8	*Empidonax* spp. n = 12
Total length	4.53	4.64	4.28	4.34	4.21 (n = 11)
	4.47–4.59	4.50–4.77	4.20–4.39	4.03–4.65	3.93–4.48
Greatest width	1.37	1.40	1.27	1.28 (n = 6)	1.21
	1.35–1.39	1.32–1.50	1.26–1.28	1.20–1.35	1.13–1.37
Head length	0.89	0.92	0.87	0.90	0.86
	0.88–0.90	0.90–0.95	0.85–0.90	0.84–0.96	0.82–0.89
Head width	0.87	0.88	0.82	0.82	0.80
	0.85–0.89	0.85–0.90	0.79–0.85	0.76–0.86	0.74–0.85
Head index	103	104	106	109	107
	101–106	101–106	105–108	106–113	102–118
Labral width	0.40	0.43	0.41	0.43	0.41
	0.38–0.42	0.41–0.44	0.41–0.43	0.41–0.47	0.39–0.43
Prothoracic length	0.42	0.43	0.41	0.41	0.39
	0.41–0.43	0.42–0.44	0.39–0.43	0.37–0.44	0.36–0.41
Prothoracic width	0.69	0.71	0.66	0.67	0.65 (n = 11)
	0.69–0.70	0.69–0.72	0.65–0.67	0.62–0.69	0.62–0.70
Distance between prosternals	76μ	91μ	84μ	78μ (n = 6)	78μ (n = 8)
	64–83μ	88–96μ	77–91μ	69–93μ	56–88μ

TABLE 10 (*Continued*)

Characters	*Tyrannus tyrannus* n = 11	*Tyrannus vociferans* n = 6	*Tyrannus melancholicus* n = 4	*Muscivora forficata* n = 1	Straggler on *Seiurus* sp. n = 1
Total length	5.01	5.27	5.04	5.14	5.13
	4.83–5.21	5.12–5.50	4.97–5.14		
Greatest width	1.42	1.46	1.42	1.46	1.39
	1.32–1.58	1.40–1.58	1.39–1.46		
Head length	1.01	1.05	1.02	1.02	1.01
	0.94–1.11	0.99–1.11	0.99–1.04		
Head width	0.97	1.00	0.98	0.98	0.97
	0.94–1.05	0.97–1.05	0.96–0.99		
Head index	104	104	104	104	104
	100–110	101–107	103–106		
Labral width	0.48	0.48	0.48	0.49	0.47
	0.44–0.50	0.46–0.51	0.47–0.49		
Prothoracic length	0.48	0.51	0.49	0.50	0.50
	0.43–0.51	0.47–0.55	0.47–0.51		
Prothoracic width	0.79	0.81	0.79	0.80	0.80
	0.76–0.85	0.78–0.84	0.77–0.80		
Distance between prosternals	99μ	98μ	93μ	93μ	?
	75–112μ	88–105μ	88–97μ		

TABLE 11

MEAN AND RANGE OF MEASUREMENTS OF MALES OF RICINUS MARGINATUS POPULATIONS

Character	*Tyrannus tyrannus* n = 2	*Tyrannus vociferans* n = 4	*Tyrannus melancholicus* n = 2	*Muscivora forficata* n = 2	*Pyrocephalus rubinus* n = 1	*Contopus* sp. n = 1
Total length	4.03	4.06 (n = 3)	4.00	4.16	3.60	3.53
	4.00–4.06	3.99–4.12	3.96–4.04	4.15–4.17		
Greatest width	1.12	1.10	1.08	1.13	1.13	0.94
	1.09–1.15	1.06–1.16	1.05–1.11	1.13		
Head length	0.90	0.90	0.94	0.94	0.80	0.80
	0.88–0.91	0.90–0.91	0.93–0.94	0.94		
Head width	0.86	0.85	0.86	0.88	0.80	0.76
	0.86	0.83–0.86	0.85–0.88	0.88		
Head index	104	107	108	107	100	105
	102–106	105–108	107–109	107		
Labral width	0.41	0.41	0.43	0.43	0.37	0.38
	0.40–0.42	0.41	0.43	0.43		
Prothoracic length	0.42	0.42	0.43	0.43	0.36	0.35
	0.41–0.42	0.41–0.43	0.42–0.44	0.43		
Prothoracic width	0.69	0.69	0.70	0.715	0.62	0.58
	0.69	0.66–0.70	0.69–0.71	0.71–0.72		
Distance between prosternals	90μ	88μ	86μ	96μ	80μ	80μ
	83–96μ	83–100μ	80–93μ	94–98μ		
Width of ♂ genitalia	0.24	0.25	0.22	0.27	0.21	0.21
	0.24	0.24–0.26	0.22–0.23	0.27		

(USNM 68781; holotype of *Ricinus tuberculifer* Carriker) from Lagunita de Aroa, Venezuela, on 29 December 1910; 1 ♂, 2 ♀ (USNM) from La Combrede Valencia, Venezuela, on 14 October 1910 by M. A. Carriker, Jr.; 1 ♀ (RSM) from St. Barbara Cerro, St. Barbara, Honduras, on 4 December 1962 by B. L. Monroe, Jr. From *Contopus sordidulus* Sclater: 1 ♂, 1 ♀ (VLK 602) from Los Angeles, California, in 1897 by V. L. Kellogg; 2 ♀ (USNM) from Brownsboro, Oregon, on 22 June 1924 by I. N. Gabrielson. From *Contopus virens* (Linnaeus): 1 ♀ from Nuqui, Chaco, Colombia, on 9 February 1951 by M. A. Carriker, Jr. From *Sayornis phoebe* (Latham): 1 ♀ (USNM) from Valdosta, Georgia, on 10 November 1935 by B. V. Travis; 2 ♀ (USNM) from Kensington, Maryland, on 21 April 1905 by R. S. Mathews; 1 ♀ (USNM) from Lake Nipigon, Ontario, Canada, on 7 July 1924 by L. L. Snyder. From *Pyrocephalus rubinus* (Boddaert): 1 ♀ (USNM 68780, holotype of *Ricinus rubinus* Carriker) from Tocuyo, Venezuela, on 27 January 1909 by M. A. Carriker, Jr.; 1 ♂, 2 ♀ (BMNH 13224–25) from Arizona in March 1939 by R. Meinertzhagen. From *Muscivora forficata* (Gmelin): 2 ♂, 1 ♀ (BCN) from Mexico on 28 June 1964 by L. L. Wolf. From *Tyrannus tyrannus* (Linnaeus): 2 ♀ (VLK 335a, lectotype and paralectotype of *Physostomum angulatum* Kellogg, 1896) from Lawrence, Kansas, in May 1884 by V. L. Kellogg; 1 ♀ (USNM) from Chillum, Maryland, on 30 May 1931 by R. Greenfiels; 2 ♂, 3 ♀ (UM) from Minneapolis, Minnesota, on 19 May 1961 by R. D. Price; 1 ♀ (VLK) from Lincoln, Nebraska, by L. Bruner; 1 ♀ (UW) from Oakdale, Nebraska, on 19 July 1944 by D. Gates; 1 ♂, 1 ♀ and 1 ♀ (USNM) from Shelton and Wahpeton, North Dakota, on 19 July 1929 and 6 June 1932 by W. G. Bruce; 1 ♀ (USNM) from Kingstree, South Carolina, on 1 July 1933 by G. R. Lunz; 1 ♀ (UM) from Delta, Manitoba, Canada, on 30 July 1961 by David Olson. From *Tyrannus dominicensis* (Gmelin): 2 ♀ (USNM) from Papyan, Colombia, on 23 September 1959 by M. A. Carriker, Jr. From *Tyrannus melancholicus* Vieillot: 1 ♀ (KCE) from Tucson, Arizona, on 19 August 1932; 1 ♀ (BCN 655 in CAS) from Puerto Anmelis, Panama, on 11 November 1929; 1 ♂, 1 ♀ (BMNH) from Georgetown, British Guiana, on 24 June 1915 by M. de Freitas; 1 ♀ (BMNH 1958–433) from Paramitibbo, Surinam, on 16 October 1955 by Haverschmidt; 2 ♀ (USNM) from Botero, Antioquia, Columbia, in September 1950 by M. A. Carriker, Jr.; 1 ♂ (USNM) from Palambla, Peru, on 20 June 1923 by M. A. Carriker, Jr. From *Tyrannus vociferans* Swainson: 2 ♀ (VLK 2267) from Claremont, California, by C. Metz; 3 ♂, 2 ♀ (BM NH 12779) from California in February 1939 by R. Meinertzhagen; 1 ♂, 2 ♀ from 3 mi. N Silver City, New Mexico on 11 May 1961 by John Hubbard. From *Passerella iliaca* (Merrem), straggler: 1 ♀ (VLK 337a) from Lawrence, Kansas, in March 1889 by V. L. Kellogg. From *Seiurus noveboracensis* (Gmelin), ? straggler: 1 ♀ (CU) from Orient, Long Island, New York, on 2 October 1929 by R. Latham. From *Platypsaris aglaiae* (Lafresnaye), ? straggler: 2 ♀ from Tres Zapotes, Mexico, on 16 March 1940 by M. A. Carriker, Jr. From *Tanagra lanirostris crassirostris*, ? straggler; 1 ♀ from Carabobo, Las Quiguas, Venezuela, on 10 September 1910 by M. A. Carriker, Jr.

Remarks.—Children (1836) described *Physostomum marginatum* from one female specimen collected in Arctic America by the Back expedition. No host was given, but a list of birds collected on the expedition was recorded. These birds were referred to in Swainson and Richardson (1831). Dr. Clay kindly lent me the syntypes of *P. marginatum*. One of the specimens is referable to *R. diffusus* (Kellogg) and probably is the specimen identified as *P. sulphureum* Nitzsch from the snowbird by Children (1836). The other specimen is the type of *P. marginatum*. Unfortunately the mandibles and labium are distorted; however, this specimen is similar in all other details to populations taken from *Empidonax* flycatchers. *Tyrannula pusilla* (now *Empidonax trailli*) was the only tyrannid collected by the Back expedition. Study has shown that the type agrees completely with specimens from *E. trailli;* therefore I establish the type host of *R. marginatus* as *Empidonax trailli* (Audubon).

The populations of *marginatus* from Tyrannidae vary from each other in size but not in other characters such as pigmentation, chaetotaxy, and shape of structures. As no consistent criteria are available to separate these populations, I have included them under the name *R. marginatus sensu lato* as suggested by Clay (1962). Unfortunately, owing to this action a long-established name, *R. angulatus* (Kellogg, 1896), becomes a junior subjective synonym. Except for workers in Mallophaga, the sinking of *angulatus* poses no problems, as the name has not been used extensively. I am reluctant to ask the International Commission to invalidate *marginatus*. Future work may reveal biological differences that warrant separation of populations now in *marginatus* to specific status. *R. angulatus* could then be restored for the population on *Tyrannus, Muscivora,* and *Pyrocephalus.* If *marginatus* is invalidated, the separation of populations would leave the population from *Empidonax* spp. without a name.

Ricinus frenatus (Burmeister, 1838)

Physostomum frenatum Burmeister, 1838. Handb. Entomol. 2:442; Denny, 1842, Monog. Anopl. Brit., 204, 244; Keler, 1957, Zeit. Parasitenk. 18:106, 119, figs. 19, 31. Type locality: not recorded. Type hosts: *Troglodytes troglodytes* (Linnaeus) or *Regulus regulus* (Linnaeus).

Physostomum frenatum Nitzsch, 1866. Zeit. gesamm. Naturwiss., 27:121–122; Giebel, 1866, Zeit. gesamm. Naturwiss., 28:295; Giebel, 1874, Insecta epizoa, 256, fig. 6; Piaget, 1880, Les Pediculines, 606; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Kellogg, 1913, Amer. Nat. 47:153; Uchida, 1915, Annot. Zool. Jap. 9:67.

Ricinus frenatus (Nitzsch, *in* Burmeister, 1838), Harrison, 1916, Parasit. 9:66; Blagoveshtchensky, 1951, Mag. Parazit., 13:286; Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:275–278, pl. 26.

Ricinus frenatus (Burmeister). Hopkins and Clay, 1952, Checklist of Mallophaga, 325; Balat, 1952, Biol. Sbor. 7:157–158, fig. 4; Balat, 1958, Prace, Brn. Zakl. Cheskoslov. Akad. Ved. 30:401; Malcomson, 1960, Wilson Bull. 72:196; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 202; Emerson, 1964*a*, Checklist, II, Amblycera, 96: Zlotorzycka, 1965, Acta Parasit. Polonica 13:60, figs. 7c, d; Balat, 1966, Angewand. Parasit. 7:26; Keirans, 1967, Agric. Exp. Sta. Bull. 492:61, Univ. New Hampshire.

Diagnosis.—A small species of the *marginatus* species group. Closely related to *R. polioptilus* from Regulidae and *R. picturatus* and *R. emersoni* from Parulidae. Shape of head characteristic; sides of frons parallel, margin rounded. Mandibles characteristic, with anterior lobes reduced. Labium with 14 pairs of setae. Setae a1 three to four times as long as a4. Gular plate short and bluntly pointed. Femur II and III with a long tactile seta. Pleurites not pigmented to margin; pleural nodi pigmented. Vulval setae absent, lacking setae. Mesosomal margin ending in a median blunt point. Parameres stout; apices each with three setae.

Description.—Head as in pl. 19, fig. 1; sides of frons parallel, margin rounded; temples short and thick. Mandibles as in pl. 19, fig. 3; anterior lobes reduced. Labium with 14 pairs of setae, pattern as in pl. 19, fig. 2. Maxillary plates sausage-shaped; palpi genticuloid. Ovoid sclerites present in stained specimens, unornamented. Setae m4 longer than pa series, but not twice as long; m2 on marginal carinae. Setae po2 slightly longer than po1 and po3. Setae a1 three to four times as long as a4; each with two sensilla; anterior pair widely separated from a1, near anterior tentorial pit; posterior pair proximate; a3 and a6 absent. Gular plate as in pl. 19, fig. 1; setae 2 × 2. Setae along antennal lappets well spaced, 6 × 6. Tentorial nodi as large as lunar nodi.

Prothorax hexagonal, as in pl. 19. fig. 4; L5 larger than L6a and L6b; L7 and 8 long, L8 not centrally placed along the prothoracic margin. Coxa I with two tactile setae; femur I with three tactile setae. W series with six setae. Setae q2 strongly spinose. Setae c4 twice as long as c3. Sternal plate as in pl. 19, fig. 4, bearing two pairs of long setae and one pair of short posterior setae. Coxa II and femora II and III each with one tactile seta.

Pleurites not pigmented to margin; chaetotaxy of ventral pleurites as given in table 4. Vulva without setae except for long sternolateral setae. Male genitalia as in pl. 19. fig. 6. Margin of mesosome ending in a blunt point. Parameres stout; apices each with three setae. Nodi red-brown;

background whitish; no markings on sternites VI–VII.

Dimensions.—Female (n = 1): total length 3.21; greatest width 0.94; head length 0.64; head width 0.62; head index 103; labral width 0.30; prothoracic length 0.31; prothoracic width 0.54; distance between prosternals 61μ. Male (n = 1): TL, 2.76; GW, 0.78; HL, 0.58; HW, 0.55; HI, 105; LW, 0.27; PL, 0.26; PW, 0.48; distance between prosternals 37μ; width of genitalia 0.16.

Distribution.—Occurs on species in genus *Regulus*, family Regulidae, throughout Europe, Asia, and North America.

Material examined.—From *Regulus calendula* (Linnaeus): 1 ♂, 1 ♀ (USNM) from Savannah, Georgia, on 27 February 1943 by Smith and Gouck.

Remarks.—Specimens from *Regulus calendula* are identical with the illustrations of *Physostomum frenatum* given by Keler (1957) and the description of *Ricinus frenatus* by Rheinwald (1968).

Ricinus polioptilus Carriker, 1964

Ricinus polioptilus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:54–55; figs. 7, B-2. Type locality: Villa Felisa Sant. N., Colombia. Type host: *Polioptila plumbea plumbescens* Lawrence.

Ricinus guianensis Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:55, figs. 8, B-7. Type locality: La Bomba, Bolivar, Venezuela. Type host: *Polioptila plumbea inornata* Hellmayr. New synonymy.

Diagnosis.—A medium-sized species of the *marginatus* species group. Related to *R. frenatus*. Shape of head characteristic, frons truncate; head longer than wide, temples long and narrow. Mandibles with long needle-like tips. Labium with 12 pairs of setae. Gular plate long and pointed. W series with seven setae. Setae a1 short. Pleurites pigmented to margin. Prothorax subchordate.

Description.—Head as in pl. 20, fig. 1; frons truncate; temples long and thin. Mandibles as in pl. 20, fig. 2; with long needle-like tips. Labium with 12 pairs of setae, pattern as in pl. 20, fig. 3. Setae m4 twice as long as pa series; m2 off marginal carinae. Setae a1 short, each with two sensilla, posterior sensillum near a1; a3 and a6 absent. Setae po2 twice as long as po1 and po3. Gular plate as in pl. 20, fig. 1; setae 2 × 2. Seven pairs of setae along antennal lappets. Tentorial nodi larger than lunar nodi.

Prothorax subchordate, resembles that of *R. vircoensis;* as in pl. 20, fig. 5. L5 larger than L6; L7–8 long, L8 situated medially on prothoracic margin; L9 short. Seven setae in w series; q2 broken in the type. Setae c1 spinose, twice as long as c2; e4 longer than e3, both pilose. Femur I and coxa I with two tactile setae. Coxae II and III with one tactile seta; femur III with a medium-sized tactile seta. Sternal plate as in pl. 20, fig. 5, bearing two pairs of long setae and one posterior pair longer than m4.

Terminal segments of female abdomen as in pl. 20, fig. 4. Pleurites pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Vulva with four setae. Nodi oxblood; carinae and markings on sternites VI and VII gold; background whitish.

Male unknown.

Dimensions.—Type specimen: total length 3.62; greatest width 1.01; head length 0.83; head width 0.73; head index 114; labral width 0.35; prothoracic length 0.34; prothoracic width 0.62; distance between prosternals 61μ.

Distribution.—Known only from *Polioptilus plumbea*, family Regulidae. Possibly occurs on the two species of *Polioptilus* in North America.

Material examined.—From *Polioptilus plumbea plumbescens* Lawrence: holotype ♀ (USNM 68787) from Villa Felisa Sant. N., Colombia, on 18 May 1947 by M. A. Carriker, Jr. From *P. plumbea inornata:* 1 ♀ (USNM 68788, holotype of *R. guianensis* Carriker) from Bolivar Estado, La Bomba, Venezuela, on 18 April 1908 by M. A. Carriker, Jr.

Remarks.—R. guianensis Carriker is considered a junior objective synonym of *R. polioptilus* Carriker. The type of *guianensis* is shriveled and distorted, but appears to be similar in size and shape to *polioptilus*. No record of two different species of *Ricinus* occurring on two different subspecies of the same species of host is known. It appears that Carriker (1964) was misguided by the distorted features of *guianensis*.

Ricinus pallens (Kellogg, 1899)

Physostomum pallens Kellogg, 1899. Occ. Pap. Calif. Acad. Sci. 6:49–50, pl. 4, fig. 7; Carriker, 1903, Univ. Stud. Nebraska 3:170; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Hosts: *Protonotaria citrea* (Boddaert) and *Elainea flavogaster subpagana* Sclater and Salvin.

Ricinus pallens (Kellogg). Harrison, 1916, Parasit. 9:67; Peters, 1928, Ohio J. Sci. 28:223; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Carriker, 1957, Microentomol. 22:105 (lectotype); Malcomson, 1960, Wilson Bull. 72:196; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 211; Emerson, 1964*a*, Checklist, II, Amblycera, 97; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:45, 62. Type locality: Panama. Type host: *Protonotaria citrea* (Boddaert), by subsequent designation, Carriker, 1957, Microentomol. 22:105.

Diagnosis.—A large species occurring on family Parulidae. Closely related to *R. dalgleishi* n. sp. Mandibles with large anterior lobe. Head shape as in *dalgleishi*. More than ten setae along each antennal lappet. Seven setae in w series. Setae e4 not much longer than e3. Only pleural nodi pigmented. Pigmented spots on sternites VI and VII. Vulva with zero to four setae. Anterior margin of mesosome pigmented; posterior margin with slight median knob. Apices of parameres each with three setae.

Description.—Head as in pl. 21, fig. 1. Mandibles with large anterior lobe as in pl. 21, fig. 4. Labium with 14 pairs of setae, as in pl. 21, fig. 3. Maxillary plates sausage-shaped, narrow; palpi genticuloid. Setae a1 short, each with two sensilla; anterior sensillum widely spaced from a1; a3 absent. Lunar and tentorial nodi equal in size. Setae m4 twice as long as pa series; m2 medially placed on marginal carinae. Gular plate with posterolateral projections as in pl. 21, fig. 1; setae 2 × 2. Setae along antennal lappets variable in number, 11 × 11 to 13 × 14, average 11.9 × 11.9. Po series nearly equal in size and shape.

Prothorax hexagonal, as in pl. 21, fig. 6; L7 and L8 long. Two tactile setae on coxa I and femur I. Seven setae in w series; w3 not twice the size of w2. Seta q2 long and spinose. Seta e4 slightly longer than e3. Sternal plate as in pl. 21, fig. 6; posterior setae short. A short tactile seta on coxa II; a long tactile seta on femur III.

Terminal segments of female abdomen as in pl. 21, fig. 5. Pleural nodi not pigmented to margin. Color blackish to oxblood. Chaetotaxy on ventral pleurites as given in table 4. Vulva with 0 to 4 setae, average 0.5. Pigmented markings on sternites VI and VII; background whitish; nodi black to oxblood in color. Male genitalia as in pl. 21, fig. 2. Mesosome not thick; upper margin pigmented; posterior margin with small median knob. Apices of parameres each with three setae.

Dimensions.—Females (n = 7): total length 3.46–3.68 (3.55); greatest width 0.88–0.92 (0.90); head length 0.71–0.74 (0.73); head width 0.63–0.66 (0.65); head index 110–114 (113); labral width 0.29–0.32 (0.31); prothoracic length 0.33–0.35 (0.34); prothoracic width 0.54–0.55 (0.55); distance between prosternals 50–64μ (56μ). Males (n = 3): TL, 2.95–3.09 (3.03); GW, 0.72–0.80 (0.76); HL, 0.64–0.68 (0.66); HW, 0.56–0.60 (0.58); HI, 114–116 (115); LW, 0.28–0.29 (0.28); PL, 0.28–0.31 (0.29); PW, 0.46–0.50 (0.48); distance between prosternals 48–56μ (53μ); width of genitalia 0.16.

Distribution.—Known only from *Protonotaria citrea*. The specimens from *Vireo griseus* are considered stragglers or contaminants. The specimen in the type series from *Elainea flavogaster subpagana* is pigmented as in *pallens*, but is much smaller, 2.12 mm in total length, and has a different head shape. It is not *R. pallens*.

Material examined.—From *Protonotaria citrea* (Boddaert): lectotype ♀, 2 ♀ paralectotypes (VLK 421 fig'd.) from Panama in September 1896 by R. McGregor; 1 ♂ (USNM) from El Dificil, Magdalena, Colombia, on 2 January 1947 by M. A. Carriker, Jr.; 1 ♂, 1 ♀ (USNM) from Gaira Di Magdalena, Colombia, on 11 November 1913 by M. A. Carriker, Jr.; 1 ♀ (USNM) from Gulfport, Mississippi, on 28 April 1940 by G. G. Rowher. From *Vireo griseus* (Boddaert), stragglers: 1 ♂, 2 ♀ (KCE) from Leon Co., Florida, in spring of 1961 and 1962 by Val Nolan.

Remarks.—Carriker (1957) designated the lectotype from three female specimens on one slide. I have removed the two paralectotypes to another slide. In 1964 Carriker raised doubt about the status of the type specimen and Kellogg's (1899) description. Carriker stated that specimens from the type host in his collection differed greatly in size from Kellogg's measurements. My measurements of his specimens do not differ from the measurements of Kellogg's specimens. Thus Carriker's remarks should be disregarded.

Ricinus dalgleishi, new species

Type locality: State College, Mississippi.

Type host: *Geothlypis trichas* (Linnaeus).

Diagnosis.—A large species occurring on the family Parulidae. Closely related to *R. pallens.* Mandibles without large anterior lobe. W series strongly spinose; six setae in w series. More than nine setae along antennal lappets. Pleurites pigmented to margin, color red-brown, nodi blackish.

Description.—Head as in pl. 22, fig. 1. Mandibles without large anterior lobe, as in pl. 22, fig. 2. Labium with 14 pairs of setae, pattern as in pl. 22, fig. 3. Gular plate with posteriad projections, setae 2×2. Setae along antennal lappets closely spaced, 8×9 to 11×12, average 10.6×10.6. Markings and chaetotaxy of head as in *R. pallens.*

Prothorax as in pl. 22, fig. 4; L7 and 8 long. W series strongly spinose with six setae. Setae q2 long and spinose. Setae c3 and c4 nearly equal. Sternal plate as in pl. 22, fig. 4. Terminal segments of female abdomen as in pl. 22, fig. 5. Pleurites pigmented to margin; color red-brown, nodi blackish. Chaetotaxy of ventral pleurites as given in table 4. Two gold spots on sternites VI and VII. Vulva with four setae.

Male unknown.

Dimensions.—Females (n = 16): total length 3.37–3.59 (3.50); greatest width 0.84–0.92 (0.88); head length 0.70–0.73 (0.71); head width 0.59–0.63 (0.61); head index 114–118 (116); labral width 0.29–0.31 (0.30); prothoracic length 0.31–0.34 (0.32); prothoracic width 0.49–0.54 (0.51); distance between prosternals 40–59μ (50μ).

Distribution.—Known only from *Geothlypis trichas,* family Parulidae.

Material examined.—From *Geothlypis trichas* (Linnaeus): holotype ♀, 1 ♀ paratype from State College, Mississippi, on 12 May 1936 by E. W. Stafford; 2 ♀ paratypes (USNM) from Pearlington, Mississippi, on 3 June 1910 by G. G. Rohwer; 2 ♀ paratypes (USNM) from Groton, Massachusetts, on 21 May 1933 by W. P. Wharton; 1 ♀ paratype (USNM) from Demarest, New Jersey, on 20 May 1926 by B. S. Bowdish; 8 ♀ paratypes (USNM) from Elmhurst, New York, on 9 May 1932 by M. V. Beals; 2 ♀ paratypes (USNM) from New London, North Carolina, on 4 April 1945 by R. C. Simpson.

Remarks.—*R. dalgleishi* is named in honor of R. C. Dalgleish, who kindly supplied many of the specimens of *Ricinus* used in this revision.

Ricinus picturatus (Carriker, 1902)

Physostomum picturatum Carriker, 1902. J. N. Y. Entomol. Soc. 10:224–225, pl. 23, fig. 3; Carriker, 1903, Univ. Stud. Nebraska 3:170; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Lincoln, Nebraska. Type host: *Helminthophila celata* (now *Vermivora celata* (Say)).

Ricinus picturatus (Carriker). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Malcomson, 1960, Wilson Bull. 72:196; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 211; Emerson, 1964*a*, Checklist, II, Amblycera, 98; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:48; Foster, 1969, J. Parasit. 55:453–456, fig. 2 (egg); Foster, 1969, Ecology 50:315–323 (biology).

Diagnosis.—A small species occurring on Parulidae. Closely related to *R. emersoni.* Shape of mandibles characteristic; tips short and thin. Shape of head characteristic, frons narrow. Anterior portion of gular plate swollen. Less than nine setae along each antennal lappet, average six. Setae a6 absent. Setae L3–L6 equal in size. W series and q2 strongly spinose. Pleurites

pigmented to margin; color oxblood. Sternites VI–VII with gold markings. Mesosome with median blunt point. Parameres stout, each with two or three apical setae.

Description.—Head shape as in pl. 23, fig. 1. Frons narrow, with lightly pigmented transverse carina. Mandibles as in pl. 23, fig. 3. Labium with 14 pairs of setae; pattern as in pl. 23, fig. 2. Setae m4 twice as long as pa series. Maxillary plate narrow posteriad; palpi genticuloid. Gular plate and central sclerotized area as in pl. 23, fig. 1; number of setae 2×2. Setae along antennal lappets variable in number, 3×5 to 7×9, average 6.3×6.3. Setae a1 with two sensilla; one sensillum usually widely separated from a1; a3 and a6 absent. Po series nearly equal in size.

TABLE 12

MEAN AND RANGE OF MEASUREMENTS OF RICINUS PICTURATUS POPULATIONS

Character	*Vermivora celata* n = 3, ♂	*Vermivora celata* n = 25, ♀	*Vermivora pinus* n = 4, ♀	*Vermivora ruficapilla* n = 1, ♀	*Parula americana* n = 2, ♀
Total length	2.81 2.77–2.88	3.17 (n = 23) 3.02–3.27	3.28 (n = 3) 3.27–3.31	3.11	3.12 3.11–3.13
Greatest width	0.73 0.71–0.74	0.82 (n = 24) 0.76–0.85	0.86 0.84–0.88	0.83	0.82 0.80–0.83
Head length	0.61 0.60–0.62	0.66 0.63–0.68	0.66 0.64–0.68	0.66	0.655 0.65–0.66
Head width	0.52 0.50–0.54	0.58 0.55–0.60	0.60 (n = 3) 0.59–0.62	0.58	0.57 0.57
Head index	115 113–118	114 111–116	110 (n = 3) 108–110	114	115.5 115–116
Labral width	0.26 0.24–0.28	0.28 0.27–0.30	0.28 0.27–0.29	0.29	0.28 0.28
Prothoracic length	0.28 0.26–0.29	0.30 0.29–0.32	0.32 (n = 3) 0.32	0.31	0.30 0.30
Prothoracic width	0.45 0.45–0.46	0.50 0.48–0.52	0.52 (n = 3) 0.52	0.50	0.485 0.48–0.49
Distance between prosternals	49μ 40–56μ	52μ 43–59μ	61μ 56–67μ	56μ	56μ 51–61μ

Prothorax as in pl. 23, fig. 6; L3–L6 equal in size; L7–L8 long; L9 small. Femur I and coxa I with two long tactile setae. Six setae in w series; w1–5 strongly spinose. Setae q2 strongly spinose. Sternal plate as in pl. 23, fig. 6. C4 longer than c3. Femur III and coxa II with one tactile seta.

Terminal segments of female abdomen as in pl. 23, fig. 5. Pleurites pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Vulva with 0 to 6 setae, average 3.3. Male genitalia as in pl. 23, fig. 4. Mesosome with median blunt point. Parameres stout, each with two or three apical setae. Nodi pigmented, oxblood; background whitish. Two golden spots on sternites VI and VII.

Dimensions.—See table 12.

Distribution.—Known from two genera, *Vernivora* and *Parula,* family Parulidae.

Material examined.—From *Vermivora celata* (Say): holotype ♂ (USNM 68259), ♀ allotype from Lincoln, Nebraska, on 22 and 30 April 1901 by J. C. Crawford, Jr., and M. A. Carriker, Jr.; 1 ♂, 8 ♀ (BCN 568–69) from Hopland Field Station, Mendocino Co., California, on 22 April 1966 by B. C. Nelson and Val Dutson; 1 ♀ (KCE) from Clover Creek, Tooele Co., Utah, on 13 September 1954 by J. Bushman. From study skins of *V. celata* collected by Mercedes Foster: 1 ♀, Haines, Alaska, on 1 June 1899 by W. H. Osgood; 2 ♀, Tucson, Arizona, on 22 March 1902 by Sworth; 3 ♀, West Anacapa Is. on 19 March 1941 by von Bloeker; 1 ♂, 2 ♀, Palo Alto, California, on 16 April 1898 and 8 April 1901 by Hoover; 1 ♀, San Geronimo, Marin Co., California, on 11 April 1905 by Meillard; 1 ♀, Alhambra, Los Angeles Co., Cali-

fornia, on 18 February 1905 by Richardson; 1 ♀, Hollywood, California, on 26 Maren 1918 by Bishop; 1 ♀, Santa Cruz Is., California, on 25 March 1920 by AJUR; 1 ♀, Rockwood, Colorado, on 23 July 1885 by Biyont; 1 ♀, Cypress Hill, Saskatchewan, Canada, on 29 July 1906 by Bishop. From *Vermivora peregrina* (Wilson): 1 ♀ from Juan Vinas, Costa Rica, in March 1902 by M. A. Carriker, Jr. From *Vermivora pinus* (Linnaeus): 4 ♀ (BCN 703) from Miami, Florida, on 11 May 1918 by J. A. Weber. From *Vermivora ruficapilla* (Wilson): 1 ♀ (BCN 712) from Miami, Florida, on 11 May 1918 by J. A. Weber. From *Parula americana* (Linnaeus): 2 ♀ (USNM) from Charleston, South Carolina, on 1 May 1933 by H. S. Peters. From *Numenius (phaeopus) hudsonica* Latham, straggler: 1 ♀ (VLK 1293C) from Kowak River, Alaska.

Remarks.—Carriker (1902) described *R. picturatus* from two female specimens collected from *Vermivora celata* from Lincoln, Nebraska. The two specimens in the type series in the U. S. National Museum are a male and a female. The male is labeled as the holotype. This specimen is poorly cleared, and perhaps Carriker originally misidentified the sex.

Ricinus emersoni, new species

Type locality: Miami, Florida.

Type host: *Wilsonia canadensis* (Linnaeus).

Diagnosis.—A small species from the family Parulidae. Closely related to *R. picturatus*. Mandibles characteristic; tips short and thick. Shape of head characteristic, frons wide. Less than eight setae along each antennal lappet. W series and q2 not strongly spinose. Color oxblood with no pigmentation on sternites. Mesosome with small median knoblike extension. Parameres narrow; apices each with three setae, outermost slightly larger than inner setae. Gular plate short and wide; anterior part slightly swollen. C4 much longer than c3.

Description.—Head shape as in pl. 24, fig. 1; frons wide. Mandibles as in pl. 24, fig. 3. Labium with 14 pairs of setae, pattern as in pl. 24, fig. 2. Frontal incrassations fused with transverse carina. Setae m4 longer than pa series. Maxillary plates sausage-shaped; palpi genticuloid. Setae a1 each with two sensilla, anterior and posterior pair equidistant from a1; a3 absent. Gular plate as in pl. 24, fig. 1; number of setae 1×1 to 2×2, average 1.9×1.9. Setae along antennal lappets widely spaced; 4×4 to 7×8, average 6.4×6.4. Po series all nearly equal in size.

Prothorax as in pl. 24, fig. 5; L7 and L8 long; L9 tiny. Femur I and coxa I with two long tactile setae. Usually six setae in w series (21), five setae (3); not strongly spinose. Setae q2 not strongly spinose. Setae c1 spinose, twice as large as c2; c4 pilose, more than twice as long as c3. Sternal plate as in pl. 24, fig. 5.

Terminal segments of female abdomen as in pl. 24, fig. 6. Pleurites pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Vulva with 2 to 6 setae, average 3.8. Sternites not pigmented. Male genitalia as in pl. 24, fig. 4. Mesosome with median knoblike extension. Parameres narrow; apices each with three setae, outermost slightly longer than inner setae. Nodi and incrassations oxblood with whitish background.

Dimensions.—From *Wilsonia canadensis:* Females (n = 17): total length 2.89–3.04 (2.99); greatest width 0.71–0.80 (0.75); head length 0.62–0.64 (0.62); head width 0.55–0.58 (0.56); head index 111–114 (112); labral width 0.28–0.30 (0.29); prothoracic length 0.29–0.31 (0.29); prothoracic width 0.46–0.49 (0.47); distance between prosternals 40–60μ (56μ). Males (n = 4): TL, 2.65–2.73 (2.70); GW, 0.64–0.69 (0.67); HL, 0.46–0.58 (0.57); HW, 0.49–0.52 (0.51); HI, 111–114 (113); LW, 0.24–0.27 (0.26); PL, 0.25–0.27 (0.26); PW, 0.41–0.43 (0.42); distance between prosternals (n = 3) 40–48μ (44μ); width of genitalia 0.16–0.18 (0.17). From *Oporornis tolmiei:* Females (n = 2): TL, 3.14, 3.18; GW, 0.77, 0.78; HL, 0.62, 0.64; HW, 0.55; HI, 113, 117; LW, 0.26, 0.28; PL, 0.29; PW, 0.47, 0.48; distance between prosternals 38μ, 48μ. Male (n = 1): TL, 2.94; GW, 0.71; HL, 0.57; HW, 0.50; HI, 114; LW, 0.27; PL, 0.28; PW, 0.43; distance between prosternals 36μ; width of genitalia 0.18.

Distribution.—Known from genera *Wilsonia and Oporornis,* family Parulidae.

Material examined.—From *Wilsonia canadensis* (Linnaeus): holotype ♂, allotype ♀ (both on same slide), and 2 ♀ paratypes (BCN 705) from Miami, Florida, on 2 June 1917 by J. A. Weber; 2 ♂, 9 ♀ paratypes (BCN 702) with same data collected on 18 May 1918; 3 ♀ paratypes (BCN 714) with same data collected on 20 May 1928; 1 ♂, 2 ♀ paratypes (USNM) from Elmhurst, Long Island, New York, on 19–20 May 1933 by Mrs. M. V. Beals. From *Oporornis tolmiei* (Townsend): 1 ♂, 2 ♀ (KCE) from Skull Valley, Tooele Co., Utah, on 5 May 1954.

Remarks.—*Ricinus emersoni* is named in honor of Dr. K. C. Emerson, who gave me much encouragement and supplied many specimens and data.

Ricinus dendroicae, new species

Type locality: Cass Lake, Minnesota.

Type host: *Dendroica striata* (Forster).

Diagnosis.—A medium-sized species from Parulidae. Closely related to *R. picturatus*. Mandibles characteristic; tips narrow and hooked. Setae a1 each with two sensilla; anterior pair widely separated from a1; setae a6 absent. Antennal lappets each with ten or fewer setae. Setae L5 longer than L6. Pleurites pigmented to margin; color oxblood. Margin of mesosome entire; apices of stout parameres each with three setae. C4 longer than c3. Sternites VI–VII with golden pigmented markings.

TABLE 13

MEAN AND RANGE OF MEASUREMENTS OF FEMALES OF RICINUS DENDROICAE POPULATIONS

Character	*Dendroica striata* n = 1	*Dendroica petechia* n = 9	"Warbler" n = 11	*Dendroica discolor* n = 12	*Dendroica pinus* n = 13
Total length	3.19	3.37 3.27–3.47	3.24 3.14–3.34	3.27 3.05–3.51	3.37 3.25–3.51
Greatest width	0.85	0.84 0.75–0.87	0.89 0.85–0.92	0.88 0.82–0.94	0.94 0.92–0.94
Head length	0.67	0.68 0.65–0.71	0.67 0.67	0.67 0.63–0.71	0.69 0.66–0.71
Head width	0.58	0.58 0.55–0.60	0.58 0.57–0.60	0.59 0.55–0.62	0.62 0.61–0.65
Head index	116	118 113–120	116 112–117	113 112–115	110 108–113
Labral width	0.29	0.29 0.28–0.31	0.29 0.28–0.29	0.28 0.26–0.29	0.30 0.29–0.30
Prothoracic length	0.32	0.31 0.29–0.32	0.31 0.29–0.32	0.31 0.29–0.32	0.33 0.31–0.34
Prothoracic width	0.49	0.49 0.47–0.50	0.50 0.49–0.52	0.50 0.47–0.53	0.53 0.51–0.54
Distance between prosternals	53μ	51μ 37–56μ	47μ 38–54μ	49μ 40–64μ	53μ 40–64μ

Terminal segments of female abdomen as in pl. 25, fig. 6. Pleurites pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Sternites VI and VII with golden markings. Male genitalia as in pl. 25, fig. 4. Margin of mesosome entire. Parameres stout, apices each bearing three setae. Nodi oxblood; background whitish.

Dimensions.—See tables 13 and 14.

Description.—Head as in pl. 25, fig. 1. Mandibles as in pl. 25, fig. 3. Labium with 14 pairs of setae; pattern as in pl. 25, fig. 2. Setae a1 each with two sensilla; anterior pair widely separated from a1; a3 and a6 absent. Maxillary plates sausage-shaped; palpi genticuloid. Setae m4 longer than pa setae. Gular plate as in pl. 25, fig. 1; number of setae 2×2 to 4×4, average 2.1×2.1. Setae along antennal lappets variable in number, 5×5 to 10×10, average 7.4×7.4. Po series nearly equal in size and shape.

Prothorax as in pl. 25, fig. 5; L5 larger than L6; L7 and L8 long; L9 small. Coxa I and femur I with two long tactile setae. W series and q2 strongly spinose. C4 longer than c3. Sternal plate and setae as in pl. 25, fig. 5. Short tactile seta on coxa II; long tactile seta on femur III.

Distribution.—Known from the genus *Dendroica*, family Parulidae. A population collected by H. S. Peters from a Carribbean island and labeled "Warbler" is assigned to *R. dendroicae.*

Material examined.—From *Dendroica striata* (Forster): holoytpe ♂ (USNM) from Cass Lake, Minnesota, on 7 May 1930 by O. L. Austin, Jr.; allotype ♀ (KCE) from Orient, Long Island, New York, on 8 October 1947 by Roy Latham. From *Dendroica petechia* (Linnaeus): 3 ♀ paratypes (BCN 706, 715) from Miami, Florida, on 4 June 1917 by J. A. Weber; 3 ♀ paratypes (UM) from St. Paul, Minnesota, on 4 June 1961 by R. D. Price; 1 ♂ paratype (USNM) from Hinsdale, New Hampshire, on 26 May 1936; 1 ♀ paratype (CU) from Orient, New York, on 1 July 1935 by Roy Latham; 2 ♂, 2 ♀ paratypes (USNM) from Guantanamo, Cuba, on 14 August 1930 by H. S. Peters. From *Dendroica magnolia* (Wilson): 1 ♀ paratype (INHS), no data; 1 ♀ paratype (UM) from Eau Claire, Wisconsin, on 14 September 1961. From *Dendroica coronata* (Linnaeus): 1 ♀ paratype (UM) from Minnesota; 1 ♀ paratype (USNM) from Handsboro, Mississippi, on 19 February 1940 by G. G. Rohwer; 1 ♂ paratype (USNM) from Wilmington, North Carolina, on 31 March 1933 by Peters and Lunz. From *Dendroica virens* (Gmelin): 1 ♀ paratype (UNH) from Durham, Strafford Co., New Hampshire, on 4 June 1964 by J. E. Keirans. From *Dendroica fusca* (Muller): 1 ♀ paratype (USNM) from Chevy Chase, Maryland, on 6 September 1932 by W. H. Bell; 3 ♀ paratypes (UW) from Madison, Wisconsin, on 24 May 1952 by W. J. Woodman. From *Dendroica castanea* (Wilson): 4 ♀ paratypes (BCN 701, 707) from Miami, Florida, on May 1919 and 23 July 1926 by J. A. Weber; 1 ♀ paratype (UM) from Carlos Avery, Anoka Co., Minnesota, on 20 September 1961 by J. Beer. From *Dendroica pinus* (Wilson): 3 ♂, 3 ♀ paratypes (BMNH 13298) from Arizona on March 1939 by R. Meinertzhagen; 2 ♀ paratypes (CU, KCE) from State College, Mississippi, on 16 January 1936 by E. W. Stafford; 1 ♀ paratype (USNM) from Gulfport, Mississippi, on 11 February 1940 by G. G. Rohwer; 4 ♀ (USNM), 3 ♀ paratypes (VLK 1539) from Raleigh, North Carolina, on 19 March 1897 and 9 April 1902 by the Brimley Bros. From *Dendroica discolor* (Vieillot): 2 ♀ paratypes (KCE) from Leon Co., Florida, in spring 1958 by H. L. Stoddard; 5 ♀ paratypes (USNM) from same locality in springs 1960–62 by Val Nolan; 1 ♀ paratype (USNM) from Chevy Chase, Maryland, on 5 August 1932 by W. H. Ball; 1 ♀ paratype (USNM) from Carapatch Cay, Cuba, on 21 September 1930 by H. S. Peters; 2 ♀ paratypes (USNM) from Mayaquez, Puerto Rico, on 7 Feb-

TABLE 13 (*Continued*)

Character	*Dendroica castanea* n = 5	*Dendroica fusca* n = 3	*Dendroica palmarum* n = 1	*Dendroica virens* n = 1	*Dendroica magnolia* n = 2	*Dendroica coronata* n = 2
Total length	3.19 3.13–3.25	3.28 3.26–3.32	3.29	3.20	3.09 3.06–3.12	3.13 (n = 1)
Greatest width	0.80 0.76–0.84	0.79 0.77–0.80	0.83	0.75	0.755 0.74–0.77	0.82 0.82
Head length	0.65 0.62–0.67	0.67 0.67	0.66	0.64	0.63 0.61–0.65	0.63 0.62–0.64
Head width	0.58 0.56–0.59	0.55 0.55	0.57	0.55	0.55 0.55	0.56 0.55–0.57
Head index	113 110–114	121 120–121	115	118	115 112–119	112 111–113
Labral width	0.28 0.27–0.29	0.28 0.28	0.28	0.28	0.27 0.26–0.28	0.28 0.28
Prothoracic length	0.31 0.30–0.32	0.31 0.31–0.32	0.30	0.32	0.29 0.28–0.31	0.305 0.30–0.31
Prothoracic width	0.49 0.48–0.50	0.48 0.47–0.49	0.49	0.48	0.46 0.45–0.47	0.47 0.45–0.49
Distance between prosternals	58μ (n = 4) 53–62μ	48μ 48μ	53μ	50μ	46.5μ 45–48μ	40μ (n = 1)

TABLE 14

MEAN AND RANGE OF MEASUREMENTS OF MALES OF RICINUS DENDROICAE POPULATIONS

Character	*Dendroica striata* n = 1	*Dendroica pinus* n = 3	*Dendroica petechia* n = 3	*Dendroica fusca* n = 1	*Dendroica discolor* n = 1	*Dendroica coronata* n = 1	"Warbler" n = 2
Total length	2.93	2.84 2.81–2.86	3.08 3.06–3.10	2.80	2.84	2.80	2.92 2.79–3.04
Greatest width	0.75	0.77 0.76–0.78	0.76 0.76–0.77	0.75	0.76	0.69	0.76 0.73–0.78
Head length	0.63	0.62 0.62	0.65 0.64–0.66	0.62	0.60	0.60	0.62 0.60–0.64
Head width	0.54	0.56 0.56–0.57	0.55 0.52–0.60	0.53	0.52	0.51	0.515 0.51–0.52
Head index	117	110 109–111	117 112–121	116	116	116	121 116–125
Labral width	0.27	0.24 0.24	0.27 0.26–0.27	0.25	0.26	0.25	0.265 0.26–0.27
Prothoracic length	0.27	0.27 0.27–0.28	0.27 0.27	0.28	0.27	0.26	0.265 0.26–0.27
Prothoracic width	0.46	0.45 0.45–0.46	0.45 0.44–0.47	0.43	0.43	0.44	0.435 0.43–0.44
Distance between prosternals	48μ	— —	51μ 40–64μ	56μ	45μ	53μ	37μ 36–38μ
Width of ♂ genitalia	0.17	0.18 0.18	0.175 (n = 2) 0.17–0.18	0.17	0.17	0.18	0.165 0.15–0.18

ruary 1936 by H. L. Dozier; 1 ♀ paratype from Virginia Gorda, West Indies, on 10 December 1889. From *Dendroica palmarum* (Gmelin): 1 ♀ paratype (USNM) from Penderlea, North Carolina, on 12 December 1942 by G. G. Rohwer. From "Warbler": 2 ♂ (USNM) from Cayo Perla, Cuba, on 2 September 1930 by H. S. Peters; 11 ♀ (USNM) from British West Indies and Cuba in September 1930 by H. S. Peters. From Wood Duck, straggler: 1 ♀ (INHS) from Havana, Illinois, on 12 November 1935 by F. Hunt.

Remarks.—The population of *Ricinus* from various species of *Dendroica* appear to be one species. However, an interesting variation has appeared in collections from *D. petechia*. The specimens from Minnesota, New Hampshire, and New York are typical *R. dendroicae*. Specimens from Florida and Cuba differ from typical *R. dendroicae* only in the pigmentation of the pleurites. Only the nodi are pigmented in the southern specimens. Because only a few specimens are known from each locality, I have not separated the southern populations taxonomically. Further collecting is necessary to determine whether subspeciation or speciation is developing within the populations of *Ricinus* from *D. petechia*.

Ricinus seiuri, new species

Type locality: Long Island, New York.
Type host: *Seiurus noveboracensis* (Gmelin).

Diagnosis.—Largest species of *Ricinus* occurring on Parulidae. Mandibles characteristic; tips long, thin, and hooked as in *R. dendroicae*. Head shape characteristic, elongated. Color brown; pleurites pigmented to margin. All sternites pigmented, light golden-brown; tergites lightly pigmented. More than nine setae along antennal lappets. Mesosome thick, upper margin pigmented. Parameres each with four or five apical setae. Setae c4 twice as long as c3. Setae w3 twice as long as w2.

Description.—Head shape as in pl. 26, fig. 1. Frontal incrassations not fused with narrow transverse carina. Mandibles characteristic as in pl. 26, fig. 3. Labium with 14 pairs of setae, as in pl. 26, fig. 2. Maxillary plates narrow, palpi genticuloid. Lunar and tentorial nodi equal in size. Setae m2 situated medially on marginal carinae. Setae m4 three times as long as pa series. Setae a1 short, each with two sensilla, anterior sensilla widely separated from setae a1; setae a3 absent. Gular plate as in pl. 26, fig. 1; number of setae 1×1 to 3×2, average 2×2. Number of setae along antennal lappets 8×9 to 11×12, average 9.8×9.8. Po series all nearly equal in size.

Prothorax as in pl. 26, fig. 5; L7 and 8 long. Femur I with three tactile setae; coxa I with two. Setae w3 twice the size of w2; six setae in w series. Setae q2 long. Setae c4 twice as long as c3. Sternal plate as in pl. 26, fig. 5. A short tactile seta on coxa II; a long tactile seta on femur III.

Terminal segments of abdomen of female as in pl. 26, fig. 4. Mesosome thick; upper margin pigmented; lower margin entire. Parameres broad; apices each with four or five setae.

Dimensions.—Females (n=12): total length 3.63–3.77 (3.70); greatest width 0.90–0.99 (0.95); head length 0.73–0.78 (0.76); head width 0.63–0.69 (0.66); head index 112–117 (116); labral width 0.33–0.34 (0.34); prothoracic length 0.32–0.35 (0.34); prothoracic width 0.52–0.57 (0.55); distance between prosternals 51–64μ (58μ). Males (n=3): TL, 3.09–3.18 (3.14); GW, 0.81–0.82 (0.82); HL, 0.68–0.69 (0.68); HW, 0.59–0.61 (0.59); HI, 113–117 (115); LW, 0.29; PL, 0.29; PW, 0.49–0.50 (0.49); distance between prosternals 50–54μ (52μ); width of genitalia 0.17–0.19 (0.18).

Distribution.—Known from one species in parulid genus *Seiurus*.

Material examined.—From *Seiurus noveboracensis* (Gmelin): holotype ♂, allotype ♀ (both on same slide) and 2 ♀ paratypes (KCE) from Long Island, New York, by Roy Latham; 2 ♂, 6 ♀ paratypes (USNM) from Doce Leques, Cuba, on 6 September 1930 by H. S. Peters; 2 ♀ paratypes (USNM) from Vieques Is., West Indies, on 30 December 1935 by S. T. Danforth; 1 ♀ paratype (USNM) from Acandi Choco, Colombia, on 2 January 1950 by M. A. Carriker, Jr. All material is deposited in U. S. National Museum except one paratype ♀ in the collection of the author.

Ricinus subangulatus Species Group
DIAGNOSTIC CHARACTERISTICS

1. Ovoid sclerites ornamented with pitlike depressions.
2. Mandibles monomorphic.
3. Margins of frons continuous with that of head; sides straight, diverging slightly; occipital nodus deeply excavated.
4. Margin of labium concave.
5. Maxillary palpi genticuloid; plates sausage-shaped.
6. Preantennals spinose.
7. Gular plate with posterior projections.
8. Setae c3 and c4 present.
9. Setae a3 absent.
10. Preputial sac rounded, with large stoma.
11. Margin of mesosome entire or with a small, blunt point; parameres pointed, bearing apical setae.
12. Prosternal setae widely spaced.
13. Lunar nodi present; tentorium reduced; posterior pits not evident in some species.
14. Pattern on terminal tergite of female, iIIi × iIIi.

Remarks.—Two subdivisions can be recognized within the *subangulatus* species group based on the shape of the prothorax and mandibles. *R. subhastatus* and *R. wolfi* can be distinguished from other members by the hexagonal prothorax and the short, thick mandibular tips. These species are found on hosts in the subfamily Emberizinae, family Fringillidae. The other members have long needle-like mandibular tips and a subchordate prothorax. These species are found on hosts in the families Vireonidae and Thraupidae, and one species on *Volatinia*, which is placed by some ornithologists in Fringillidae and by others in Thraupidae.

Ricinus subhastatus (Durrant, 1906)

Physostomum subhastatum Durrant, 1906. Ohio Nat. 6:258–259, fig. 12; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Kellogg, 1912, Entomol. News 23:65. Type locality: Ft. Collins, Colorado. Type host: *Pipilo maculatus megalonyx* (now *Pipilo erythrophthalmus arcticus* (Swainson).

Ricinus subhastatus (Durrant). Harrison, 1916. Parasit. 9:68; Hopkins and Clay, 1952, Checklist of Mallophaga, 328; Malcomson, 1960, Wilson Bull. 72:197., Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 215; Emerson, 1964*a*, Checklist, II, Amblycera, 98; Keirans, 1967, Agric. Exp. Sta. Bull. 492:64, Univ. New Hampshire.

Diagnosis.—A species of the *subangulatus* species group with short, thick mandibular tips. Closely related to *Ricinus wolfi*. Shape of mandibular tips characteristic, notched below. Frons rounded. Pigmented portion of gular plate not swollen anteriad, usually with two pairs of setae. Setae along antennal lappets less than nine. Shape of prothorax characteristic; margin between L7 and L8 straight or slightly concave; L5 shorter than q2. Setae q2 equal in size to w3. Coxa III with one tactile setae. Intensity of pigment on sternites VI and VII equal, less intense on sternite V; lightly pigmented on III and IV. Parameres not as stout as in *R. wolfi*.

Description.—Head as in pl. 27, fig. 1; frons rounded; transverse carina convex. Margin of frons continuous with margin of marginal carinae. Setae m2 on inner margin of carinae; m4 less than twice as long as pa series. Setae a1 each with two sensilla, anterior pair twice as far from a1 as posterior pair; a6 absent. Templar or postocular carinae thin. Setae po2 slightly larger than po1; po3 usually absent. Mandibles as in pl. 27, fig. 2, tips notched below. Labium with 13 pairs of setae, pattern as in pl. 27, fig. 3. Gular plate as in pl. 27, fig. 1; number of setae 1×1 to 3×3, average 2×2. Usually less than nine setae along antennal lappets; 4×6 to 7×11, average 6.6×6.6.

Prothorax hexagonal as in pl. 27, fig. 6; margin between L7 and L8 straight or slightly concave; posterior margin nearly straight. L5 shorter than q2. Setae q2 equal to w3; six setae in w

series. Setae c3 and c4 nearly equal, variable in length. Sternal plate as in pl. 27, fig. 6, bearing two pairs of long setae and one pair of posterior setae, shorter than mental setae. Coxa I and femur I with two long tacile setae. Coxae II–III and femora II–III each with one tactile seta.

Terminal segments of female abdomen as in pl. 27, fig. 5. Pleural nodi lightly pigmented to margin; color dark brown. Chaetotaxy of ventral pleurites as given in table 4. Pleurite IX of male lightly pigmented. Vulva with 2 to 7 setae, average 5; one pair twice as long as other setae. Intensity of pigment on sternite VI–VII equal; III–V much lighter, color gold. Male genitalia as in pl. 27, fig. 4. Margin of mesosome entire. Parameres usually not stout, apices each with three setae. Color dark brown with whitish background; carinae and sternites golden.

Dimensions.—From *Pipilo erythrophthalmus:* Females (n = 6): total length 3.46–3.69 (3.58); greatest width 0.94–1.03 (0.98); head length 0.69–0.75 (0.72); head width 0.64–0.67 (0.66); head index 105–113 (110); labral width 0.32–0.34 (0.33); prothoracic length 0.35–0.38 (0.37); prothoracic width 0.55–0.58 (0.56); distance between prosternals 56–78μ (66μ). Males (n = 5): TL, 3.16–3.38 (3.28); GW, 0.85–0.94 (0.89); HL, 0.68–0.70 (0.69); HW, 0.60–0.65 (0.63); HI, 108–114 (111); LW, 0.29–0.31 (0.30); PL, 0.33–0.34 (0.34); PW, 0.50–0.55 (0.52); distance between prosternals 45–72μ (57μ); width of genitalia 0.18–0.21 (0.19). From *Pipilo fuscus:* Females (n = 8): TL, 3.63–3.85 (3.73); GW, 1.06–1.11 (1.08); HL, 0.72–0.76 (0.74); HW, 0.67–0.73 (0.69); HI, 104–108 (107); LW, 0.30–0.34 (0.32); PL, 0.38–0.41 (0.39); PW, 0.56–0.62 (0.59); distance between prosternals 56–88μ (68μ). Males (n = 5): TL, 3.30–3.47 (3.36); GW, 0.94–0.97 (0.96); HL, 0.66–0.71 (0.70); HW, 0.62–0.68 (0.65); HI, 105–111 (107); LW, 0.28–0.32 (0.30); PL, 0.33–0.37 (0.35); PW, 0.54–0.57 (0.55); distance between prosternals 56–67μ (58μ); width of genitalia 0.20 (0.20). From *Chlorura chlorura:* female (n = 1): TL, 3.67; GW, 1.04; HL, 0.74; HW, 0.68; HI, 109; LW, 0.32; PL, 0.38; PW, 0.59; distance between prosternals 72μ. Male (n = 1): TL, 3.23; GW, 0.90; HL, 0.68; HW, 0.60; HI, 113; LW, 0.29; PL, 0.33; PW, 0.53; distance between prosternals 61μ; width of genitalia 0.20.

Distribution.—Known from the genera *Pipilo* and *Chlorura*, family Fringillidae.

Material examined.—From *Pipilo erythrophthalmus* (Linnaeus): holotype ♂ (OSU no. 8) from Ft. Collins, Colorado, on 27 May 1895 by C. G. Baker; 1 ♂ (USNM) with same data, 27 May 1894 (?); 2 ♀ (KCE) from Oak Brush Canyon, Tooele Co., Utah, on 28 July 1954 by J. Bushman; 3 ♂, 4 ♀ (BMNH 1955–618) from Socorro Island, Revillagigedo Archipelago, Mexico, in 1955 by R. Meinertzhagen. From *Pipilo fuscus* Swainson: 1 ♂, 5 ♀ (BMNH 13256–57) from Arizona on March 1939 by R. Meinertzhagen; 3 ♂ (VLK 588) from Ontario, California, in 1897 by B. Chapman; 1 ♂, 2 ♀ (VLK 178–907) from Paso Robles, California, in 1899 by B. Chapman. From "Towhee": 1 ♀ (USNM) from Arizona in 1927 by P. E. Trapier. From *Chlorura chlorura* (Audubon): 1 ♂, 1 ♀ from vicinity Dugway Valley, Tooele Co., Utah, on 7 May 1953 by R. D. Porter.

Remarks.—Durrant (1906*a*) described *R. subhastatus* from a single female specimen. No female specimen was found in the Osborn collection at Ohio State University. A male specimen was found with the same collection data on the slide label as given by Durrant. This specimen was so poorly prepared and uncleared that the male genitalia were obliterated. It is obvious from the description, the figure of the terminal segment, and the size of the specimen given by Durrant that his specimen was a male. This specimen is now labeled as the holotype. A male specimen with the same collection data as the type (except for the year 1894 instead of 1895 on the type) is in the U. S. National Museum. This specimen is labeled "Not type."

Ricinus wolfi, new species

Type locality: Tarpon Springs, Florida.

Type host: *Aimophila aestivalis* (Lichtenstein).

Diagnosis.—A species belonging to the *subangulatus* species group with short, thick mandibular tips. Closely related to *R. subhastatus*. Shape of mandibular tips characteristic, not notched below. Frons flattened medially. Pigmented pattern of gular plate swollen anteriad, plate with usually three pairs of setae. More than nine setae along antennal lappets. Shape of prothorax

characteristic, margin between L7 and L8 concave; L5 longer than or as long as q2. Setae q2 longer than w setae. Coxa III without a tactile seta. Intensity of pigment of sternites V–VII equal, but lighter on sternites III and IV. Parameres stout.

Description.—Head as in pl. 28, fig. 1; frons rounded but flattened medially; transverse carina arched. Margin of frons not continuous with that of marginal carinae; m2 on inner margin of marginal carinae; m4 twice as long as pa series. Setae a1 each two sensilla, anterior pair three times as far from a1 as posterior pair; a6 present. Po2 nearly twice as long as po1, po1 spinose; po3 pilose. Postocular carinae thick. Lunar and tentorial nodi equal in size. Shape of gular plate as in pl. 28, fig. 1; setae 2 × 2 to 4 × 4, average 2.9 × 2.9. Setae along antennal lappets variable, 9 × 9 to 12 × 12, average 10.6 × 10.6. Labium with 13 pairs of setae, pattern as in pl. 28, fig. 5. Mandibles as in pl. 28, fig. 2, tips not notched.

Prothorax hexagonal, as in pl. 28, fig. 4; margin between L7 and L8 concave. L5 as long as or longer than q2. Posterior margin of prothorax concave. W series with six setae, w1–w5 strongly spinose; q2 slightly longer than w3. Setae c3 and c4 nearly equal, long and pilose. Sternal plate as in pl. 28, fig. 4; bearing two pairs of long setae and one pair of posterior setae, shorter than mental setae. Coxa I and femur I with two long tactile setae. Coxa II and femora II and III each with one tactile seta.

Terminal segments of female abdomen as in *subhastatus*. Chaetotaxy of ventral pleurites as given in table 4. Vulva with 3 to 6 setae, average 4.4; inner pair twice as long as outer setae. Intensity of pigmentation on sternites V–VII equal, lighter on III and IV; color gold. Pigmentation of species similar to *R. subhastatus*. Male genitalia as in pl. 28, fig. 3. Margin of mesosome entire. Parameres stout, apices each with four setae.

Dimensions.—From *Aimophila aestivalis:* Females (n = 11): total length 3.80–4.07 (3.96); greatest width 1.05–1.21 (1.14); head length 0.76–0.82 (0.80); head width 0.71–0.78 (0.76); head index 104–107 (105); labral width 0.32–0.35 (0.34); prothoracic length 0.39–0.42 (0.40); prothoracic width 0.64–0.69 (0.67); distance between prosternals (n = 10) 59–80μ (70μ). Males (n = 4): TL, 3.34–3.64 (3.42); GW, 0.88–1.08 (0.98); HL, 0.71–0.77 (0.74); HW, 0.66–0.73 (0.70); HI, 103–108 (106); LW, 0.31–0.32 (0.32); PL, 0.35–0.37 (0.36); PW, 0.57–0.64 (0.61); distance between prosternals 54–72μ (66μ); width of genitalia (n = 3) 0.21–0.22 (0.22). From *Aimophila ruficeps:* Female (n = 1): TL, 3.98; GW, 1.13; HL, 0.80; HW, 0.72; HI, 111; LW, 0.34; PL, 0.41; PW, 0.62; distance between prosternals 72μ. From *Tanagra gouldi* (?): Male (n = 1): TL, 3.49; GW, 0.91; HL, 0.74; HW, 0.63; HI, 117; LW, 0.34; PL, 0.35; PW, 0.59; distance between prosternals 64μ; width of genitalia 0.19.

Distribution.—Known from species in genus *Aimophila*, Family Fringillidae. Specimens labeled from "Florida Bluebird" were collected on the same day as the holotype. Since they are similar to the type and no *Ricinus* is known from bluebirds, *Sialis* spp., these specimens are probably contaminants from the type series onto a specimen of Florida Bluebird. A single specimen from *Tanagra gouldi* is probably a contaminant from some species of *Aimophila*.

Material examined.—From *Aimophila aestivalis* (Lichtenstein): holotype ♂, allotype ♀, 1 ♂, 3 ♀ paratypes (USNM) from Tarpon Springs, Florida, on 31 March 1930 by W. G. Fargo; 2 ♀ paratypes from Valdosta, Georgia, on 21 March 1936 by B. V. Travis; 2 ♂, 1 ♀ paratypes from State College, Mississippi, on 16 September 1934 by H. E. Stafford; 1 ♀ paratype from Silsbee, Texas, on 27 April 1941 by G. G. Rowher. From "Florida Bluebird," contaminant from type species (?): 2 ♀ from Tarpon Springs, Florida, on 31 March 1930 by W. G. Fargo. From *Aimophila ruficeps* (Cassin): 1 ♀ (BCN) found by L. L. Wolf on museum study skin collected from Sierra del Carmen, Coahuila, Mexico, on 22 April 1953 by A. H. Miller. From *Tanagra gouldi* (Sclater), error (?): 1 ♂ (BCN) from 1 mi. SW Valle Nacional, Oaxaca, Mexico, on 14 February 1961 by L. L. Wolf.

Remarks.—*Ricinus wolfi* is named in honor of Dr. Larry L. Wolf, who supplied many specimens of *Ricinus* and aided me with his knowledge of the ornithological literature.

Ricinus subangulatus (Carriker, 1903)

Physostomum subangulatum Carriker, 1903. Univ. Stud. Nebraska 3:168–170, pl. 5, fig. 3; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72. Type locality: Juan Vinas, Costa Rica. Type host: *Thraupis episcopus cana* (Swainson).

Ricinus subangulatus (Carriker). Harrison, 1916, Parasit. 9:68; Carriker, 1949, Proc. U. S. Nat. Mus. 100(3266):385; Hopkins and Clay, 1952, Checklist of Mallophaga, 328; Carriker, 1960, Proc. U. S. Nat. Mus. 112(3438):309, fig. 1e; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:43.

Ricinus exsul Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:54, figs. 6, 6a, A-2. Type locality: Las Quiguas, Carabobo, Venezuela. Type host: *Tanagra xanthogaster exsul* (Berlepsch). New synonymy.

Diagnosis.—A lightly sclerotized species of the *subangulatus* species group with needle-like mandibles. Closely related to *R. volatiniae*. Mandibles characteristic with long narrow tips. Labium with 14 pairs of setae. Prothorax subchordate. Pleurites not pigmented to margin. Margin of frons rounded, paralleling transverse carina. Ventral pleurites with characteristic chaetotaxy (table 4). Two golden markings on sternites VI and VII. Setae q2, w1, and w3 strongly spinose, equal in size. Setae c3 and c4 long and subequal.

Description.—Head as in pl. 29, fig. 1; frons rounded, with transverse carina parallel with margin of frons. Mandibles as in pl. 29, fig. 2. Labium with 14 pairs of setae, pattern as in pl. 29, fig. 5. Pattern on ovoid sclerites as in pl. 29, fig. 3. Setae m2 on inner margin of marginal carinae; m4 twice as long as pa series. Lunar and tentorial nodi equal in size. Setae a1 each with two sensilla, posterior pair closer to a1 than anterior pair; a6 absent. Gular plate as in pl. 29, fig. 1; setae 2 × 2. Setae along antennal lappets variable in number, 8 × 10 to 9 × 12, average 9.5 × 9.5.

Prothorax as in pl. 30, fig. 5; L5 greater than L6; L7 and L8 long; L8 more anteriad than in most *Ricinus;* no slight indentation at insertion of L8. Sternal plate as in pl. 30, fig. 5; bearing two pairs of long setae and one posterior pair longer than m4. Six setae in w series; w1 and w3 strongly spinose, equal in length to q2. Setae c3 and c4 long, pilose, nearly equal in length. Coxa and femur I each with two long tactile setae. Middle spine on coxa I the largest. Coxa II and femur III each with one tactile seta.

Terminal segments of female abdomen as in pl. 29, fig. 4, Pleurites not pigmented to margin; color of nodi brown. Chaetotaxy of ventral pleurites as given in table 4. Vulva with 4 to 6 setae, average 5.3; two of the setae twice as long as the other setae. Two golden spots on sternites VI and VII. Male specimen in poor condition, genitalia not figured. Pigmentation dark brown on whitish background.

Dimensions.—Female (n = 5): total length 4.20–4.38 (4.28); greatest width 1.03–1.18 (1.12); head length 0.85–0.89 (0.87); head width 0.78–0.82 (0.80); head index 106–112 (109); labral width 0.36–0.37 (0.37); prothoracic length 0.41–0.46 (0.43); prothoracic width 0.68–0.72 (0.71); distance between prosternals 67–82μ (76μ).

Distribution.—Found on species of *Thraupis* and *Tanagra*, family Thraupidae. The single specimen from *Elainea flavogaster* is probably a contaminant or straggler.

Material examined.—From *Thraupis episcopus cana* (Swainson): holotype ♀ (USNM 68286) from Juan Vinas, Costa Rica, on May 1902 by M. A. Carriker, Jr. From *Thraupis episcopus diaconus* (Lesson): 1 ♂ (USNM) from Tres Zapotes, Mexico, on 25 March 1940 by M. A. Carriker, Jr. From *Tanagra xanthogaster exsul* (Berlepsch): 1 ♀ (USNM 68786; holotype of *Ricinus exsul*) from Carabobo, Las Quiguas, Venezuela, on 9 September 1910 by M. A. Carriker, Jr. From *Thraupis palmarum* (Weid): 3 ♀ (BMNH) from Fort Read, Trinidad, on 18 March 1966 by T. H. G. Aitken. From *Elainea flavogaster* (Thunberg), error (?): 1 ♀ (BMNH) from Tumpuna Road, Trinidad, on 15 August 1960.

Remarks.—There is some confusion concerning the type host of *R. subangulatus*. Carriker (1903) stated that he collected the type series from *Tanagra cana* (Swainson). In 1949 he corrected the host to *Thraupis episcopus diaconus* (Lesson). Hopkins and Clay (1952) referred to the host as *Tanagra (episcopus) cana* (Swainson). The label on the holotype present in the U. S. National Museum gives the host as *Thraupis virens cana*. There appears to be some confusion regarding the correct name for the Bluegray Tanager. Modern checklists use the name *virens* rather than *episcopus*. Both *cana* and *diaconus* are considered subspecies of *episcopus*. In addition, *episcopus* has been placed by some ornithologists in *Thraupis* and by others in *Tanagra*. The Check-list of Mexican birds (1957) and De Schauensee (1966) place *episcopus* in *Thraupis*. The names proposed for the type host actually refer to the same species of host but not to the same subspecies. No evidence is available to indicate that different species of *Ricinus* occur on two different subspecies of host. Therefore the exact determination of the subspecies appears to be unimportant.

Ricinus complicatus Carriker, 1964

Ricinus complicatus Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:56, figs. 10, B-3. Type locality: El Callao, Bolivar, Venezuela. Type host: *Tachyphonus rufus* (Boddaert).

Diagnosis.—A heavily sclerotized species of the *subangulatus* species group with needle-like mandibles. Closely related to *Ricinus ramphoceli*. Mandibles characteristic; tips shorter than those of *ramphoceli*. Shape of gular plate characteristic, broad. Nodi of head larger than in *ramphoceli*. Sternal plate characteristic, as in pl. 30, fig. 4. Setae q2 not strongly spinose, shorter than w3. Maxillary plate wider than *ramphoceli*.

Description.—Head as in pl. 30, fig. 1; margin of frons continuous with those of marginal carinae. Transverse carina straight; frons rounded. Mandibles as in pl. 30, fig. 2. Labium with 14 pairs of setae, as in pl. 30, fig. 3. Setae a1 each with two sensilla, positions of sensilla variable; a6 absent. Setae m4 twice as long as pa series. Po series all equal in length. Maxillary palpi wide, sausage-shaped; palpi genticuloid. Gular plate as in pl. 30, fig. 1, broad, setae number 2 × 2. Setae along antennal lappets number 9 × 8, 11 × 11, and 10 × 10 (type). Nodi of head large.

Prothorax as in pl. 30, fig. 4; slightly indented at insertion of L8; L5 larger than L6. Sternal plate as in pl. 30, fig. 4, bearing two pairs of long setae. Setae c1 larger than c2; c3 and c4 nearly equal. Six setae in w series. Setae q2 not strongly spinose, shorter than w1.

Terminal segments of female abdomen as in *R. ramphoceli*. Pleurites pigmented to margin. Chaetotaxy of ventral pleurites as given in table 4. Vulva without marginal setae. Sternocentral and sternolateral setae as long as c3. A heavily sclerotized species; Nodi and incrassations dark brown; background and legs golden-brown.

Male unknown.

Dimensions.—Females (n = 2): total length 4.16, 4.20; greatest width 1.17, 1.18; head length 0.83; head width 0.83; head index 100; labral width 0.36; prothoracic length 0.43; prothoracic width 0.75; distance between prosternals 88μ, 96μ.

Distribution.—Known only from the type host *Tachyphonus rufus*, family Thraupidae.

Material examined.—From *Tachyphonus rufus* (Boddaert): holotype ♀ (USNM 68780) from El Callao, Estado Bolivar, Venezuela, on 2 March 1910 by M. A. Carriker, Jr.; 2 ♀ (USNM) from Pueblo Nuevo, Colombia, on 30 August 1916 by M. A. Carriker, Jr.

Ricinus ramphoceli, new species

Type locality: Fort Read, Trinidad.

Type host: *Ramphocelus carbo* (Pallas).

Diagnosis.—A heavily sclerotized species of the *subangulatus* species group with needle-like mandibles. Closely related to *Ricinus complicatus*. Mandibles with long thin tips. Labium with 13 pairs of setae. Gular plate narrow. Nodi of head smaller than in *R. complicatus*. Maxillary plates narrow. Setae q2 not strongly spinose, shorter than w3. Shape of sternal plate characteristic, as in pl. 31, fig. 4. Mesosomal margin entire. Parameres thin; apices each with three setae. Pleurites IX sclerotized in males.

Description.—Head as in pl. 31, fig. 1. Frons rounded; transverse carina slightly convex; margin of frons continuous with marginal carinae. Setae m2 on inner margin of marginal carinae; m4 twice as long as pa series. Mandibles as in pl. 31, fig. 2. Labium with 13 pairs of setae, pattern as in pl. 31, fig. 5. Setae a1 each with two sensilla; position of sensilla variable; a6 absent. Po series equal in length. Maxillary plates thin; palpi genticuloid. Gular plate as in pl. 31, fig. 1, setae number 2 × 2. Setae along antennal lappets variable in number, 7 × 9 to 11 × 13, average 10.5 × 10.5.

Prothorax as in pl. 31, fig. 4; slightly indented at insertion of L8; L5 longer than L6. Coxa I

each with two long tactile setae; outermost spine largest; femur I with two tactile setae. Setae c1 and c2 nearly equal in size, spinose; c3 and c4 long, pilose, c4 slightly longer than c3. Six setae in w series; w1 and w3 equal in length and strongly spinose. Setae q2 not strongly spinose, smaller than w1 and w3. Coxa II and femur III each with two tactile setae. Sternal plate and its setae as in pl. 31, fig. 4.

Terminal segments of female as in pl. 32, fig. 5. Pleurites pigmented to margin. Chaetotaxy of ventral pleurites as given in table 4. Vulval margin without setae. Setation of tergites and sternites as in pl. 32, fig. 5. Male genitalia as in pl. 31, fig. 3. Margin of mesosome entire. Parameres thin; apices each with three setae. Pigmentation similar to *R. complicatus*. Pleurites IX of male present and pigmented.

Dimensions.—Females (n = 12): total length 3.89–4.11 (4.03); greatest width 1.06–1.16 (1.12); head length 0.80–0.85 (0.82); head width 0.77–0.81 (0.80); head index 101–105 (103); labral width 0.34–0.38 (0.36); prothoracic length 0.39–0.43 (0.41); prothoracic width 0.69–0.74 (0.72); distance between prosternals 64–88μ (77μ). Males (n = 5); TL, 3.49–3.65 (3.58); GW, 0.96–0.99 (0.98); IIL, 0.77–0.78 (0.78); HW, 0.74–0.77 (0.75); HI, 101–106 (104); LW, 0.34–0.36 (0.35); PL, 0.36–0.38 (0.38); PW, 0.66–0.68 (0.67); distance between prosternals 64–80μ (73μ); width of genitalia 0.18–0.21 (0.19).

Distribution.—Known only from the type host *Ramphocelus carbo* (Pallas), family Thraupidae.

Material examined.—From *Ramphocelus carbo* (Pallas): holotype ♂, allotype ♀, 2 ♂ and 6 ♀ paratypes (BMNH) from Fort Read, Trinidad, on 18 March 1966 by T. H. G. Aitken; 2 ♂, 5 ♀ paratypes (BMNH) from Cumuto, Trinidad, on 10 March and 3, 10, 17 May and 26 April 1960 by T. H. G. Aitken.

Ricinus volatiniae, new species

Type locality: Brazil Village, Trinidad.
Type host: *Volatinia jacarina* (Linnaeus).

Diagnosis.—A species of the *subangulatus* species group with needle-like mandibles. Closely related to *subangulatus*. Mandibles with long thin tips. Labium with 14 pairs of setae. Shape of marginal carinae characteristic, indented at m1. Prothorax hexagonal; L8 centrally situated along margin. Setae w1, w3, and q2 strongly spinose. Chaetotaxy of ventral pleurites characteristic (table 4). Pleurites pigmented to margin. Distinct pattern of pigmentation on sternites.

Description.—Head as in pl. 32, fig. 1; margin of frons continuous with marginal carinae. Shape of marginal carinae characteristic, indented at m1. Frons rounded; transverse carina straight. Mandibles as in pl. 32, fig. 3. Labium with 14 pairs of setae, pattern as in pl. 32, fig. 4. Setae m2 off marginal carinae; m4 larger than pa series. Setae a1 each with two sensilla, posterior pair close to a1, anterior pair widely separated; a6 absent. Po series all nearly equal. Gular plate as in pl. 32, fig. 1; number of setae 1 × 2, 1 × 3, and 2 × 2. Number of setae along antennal lappets 6 × 7 to 9 × 8, average 7.5 × 7.5.

Prothorax hexagonal; no indentation at insertion of L8; L8 situated more anterior than in other species of *Ricinus;* L5 larger than L6. Middle coxal spine of coxa I larger than other two spines. Coxa and femur I each with two long tactile setae. Setae w1, w3, and q2 strongly spinose, equal in size. Setae c1 twice that of c2; c3 and c4 equal in size. Six setae in w series. Sternal plate bearing two pairs of long setae and a posterior short pair.

Terminal segments of female abdomen as in pl. 32, fig. 2. Pleurites pigmented to margin. Chaetotaxy of ventral pleurites as in table 4, characteristic. Inner tergal setae of tergites II–IV half as long as outer tergals. Vulva with five setae on margin. Pigmentation pattern as in pl. 32, fig. 2, color gold.

Male unknown.

Dimensions.—Females (n = 3): total length 3.37–3.51 (3.45); greatest width 0.97–1.01 (0.99); head length 0.73–0.78 (0.75); head width 0.70–0.73 (0.71); head index 103–109 (105); labral width 0.31–0.33 (0.32); prothoracic length 0.34–0.37 (0.36); prothoracic width 0.61–0.63 (0.62); distance between prosternals 72–77μ (75μ).

Distribution.—Known only from *Volatinia jacarina* (Linnaeus), family Fringillidae.

Material examined.—From *Volatinia jacarina* (Linn.): holotype ♀, 1 ♀ paratype (BMNH) from Brazil Village, Trinidad, on 18 February 1966; 1 ♀ paratype (BMNH) from Fort Read, Trinidad, on 18 March 1966 by T. H. G. Aitken.

Ricinus vireoensis, new species

Type locality: Leon County, Florida.
Type host: *Vireo griseus* (Boddaert).

Diagnosis.—A species of the *subangulatus* species group with long needle-like mandibular tips. Closely related to *R. subangulatus* and *R. volatiniae*. Head narrower than in these species, sides less divergent. Mandibles characteristic, with large anterior lobes. Labium with 13 pairs of setae. Tentorial nodi larger than lunar nodi. Sensilla of a1 equally spaced from a1. Prothorax subchordate. Setae w1 and w3 equal to q2. C3 usually equal in length to c4. Short tactile setae on coxae II and III. Chaetotaxy of ventral pleurites differs from *subangulatus* and *volatiniae* (table 4). Mesosome broad. Apices of parameres each with three or four setae. Pleurites not pigmented to margin.

Description.—Head as in pl. 33, fig. 1, narrow; margin of frons continuous with rest of head, but less divergent than in other species of this group. Frons rounded; transverse carina parallels margin of frons. Mandibles as in pl. 33, fig. 5, with large anterior lobes. Labium with 13 pairs of setae, pattern as in pl. 33, fig. 2. Maxillary plates sausage-shaped, broader distally; palpi genticuloid. Mental setae situated far posteriad on mentum. Tentorial nodi larger than lunar nodi. Setae m2 usually on outer edge of marginal carinae; m4 larger than pa series. Setae a1 with two equally spaced sensilla; a6 absent. Inner po setae larger, but not twice as large as po1 and po3. Gular plate as in pl. 33, fig. 1; number of setae 2 × 2. Setae along antennal lappets variable in number, 3 × 5 to 5 × 9, average 6.4 × 6.4. Pattern on ovoid sclerite as in pl. 33. fig. 6.

Prothorax as in pl. 33, fig. 4; L5 larger than L6; L7 and L8 long, L9 small. Outermost coxal spine largest. Coxa I with two tactile setae; femur I with two long setae and one medium-sized tactile seta. Sternal plate as in pl. 33, fig. 4. Setae c1 spinose, larger than pilose c2; c3 and c4 pilose, usually subequal in size. W3 larger than c1; w1, w3, and q2 strongly spinose, subequal in length. Usually six setae in w series. Coxae II and III each with one short tactile seta; femur III with one long tactile seta.

Terminal segments of female abdomen as in *R. subangulatus*. Pleurites pigmented only on nodi; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Outer tergal setae of tergites II–VI as long as sternolateral setae of same segments. Vulva with 2 to 10 setae, average 6.5. Sternites with gold markings on sternites VI and VII. Male genitalia as in pl. 33, fig. 3 Mesosome thick, margin entire. Parameres stout, apices each bearing three or four setae. Nodi oxblood on whitish background.

Dimensions.—See tables 15 and 16.

Distribution.—Known from species of the genus *Vireo*, family Vireonidae.

Material examined.—From *Vireo griseus* (Boddaert): holotype ♂, allotype ♀, 10 ♂, 24 ♀ paratypes (USNM) from Leon Co., Florida, in March 1960 by Van Nolan; 3 ♂, 11 ♀ paratypes (USNM) from same locality in spring 1961; 16 ♂, 27 ♀ paratypes (USNM) from same locality in spring 1962; 1 ♂, 3 ♀ paratypes from same locality on 28 March 1960 by H. L. Stoddard; 4 ♀ paratypes (YU) from Cudjoe Key, Florida, on 29 April 1957 by G. E. Watson III; 1 ♀ paratype (YU) from Homestead, Dade Co., Florida, on 30 June 1957; 1 ♀ paratype (BCN 708) from Miami, Florida, on 16 June 1929 by J. A. Weber; 1 ♂, 2 ♀ paratypes (BMNH 12623) from New York by R. Meinertzhagen; 3 ♂, 7 ♀ paratypes (USNM) from Charleston, South Carolina, on 27 March 1933 by H. S. Peters; 1 ♀ paratype (USNM) from Little Inagua Is., Bahama Is., on 8 May 1930 by H. S. Peters. From *Vireo crassirostris* (Bryant): 1 ♀ (USNM) from Rugged Is., Bahama Is., on 29 June 1930 by H. S. Peters. From *Vireo belli* Audubon: 1 ♂, 2 ♀ (VLK 598) from Ontario, California, in June 1896 by Brown. From *Vireo olivaceous* (Linnaeus): 1 ♀ (USNM) from Fairhope, Alabama, on 26 September 1931 by Mrs. W. A. Edwards; 1 ♀ (USNM) from Deer Island, Mississippi, on 9 August 1941 by T. D. Burleigh; 1 ♀ (USNM) from Winchester, New Hampshire, on 23 May 1936; 1 ♀ (CU) from Clarksville, Tennessee, on 20 May 1940 by A. Clebach; 1 ♀ (BMNH) from Vega de Oropouche, Trinidad, on 2 July 1965 by T. H. G. Aitken. From *Vireo flavoviridis* (Cassin): 1 ♀ (USNM) from Long Pine, Nebraska, on 10 June 1896; 1 ♂, 2 ♀ (HO) from Costa Rica.

TABLE 15

MEAN AND RANGE OF MEASUREMENTS OF FEMALES OF RICINUS VIREOENSIS POPULATIONS

Character	*Vireo griseus* n = 80	*Vireo olivaceous* n = 5	*Vireo belli* n = 1	*Vireo flavoviridis* n = 2	*Vireo crassirostris* n = 1
Total length	3.93	3.85	3.85	4.02	3.92
	3.63–4.07	3.70–3.98		3.95–4.10	
Greatest width	1.02	0.97	1.01	1.07	1.02
	0.87–1.11	0.94–1.02		1.05–1.08	
Head length	0.83	0.82	0.80	0.86	0.81
	0.78–0.86	0.79–0.84		0.85–0.87	
Head width	0.75	0.73	0.71	0.76	0.73
	0.71–0.79	0.72–0.74		0.74–0.78	
Head index	110	112	113	113	111
	107–117	110–114		112–115	
Labral width	0.35	0.35	0.36	0.36	0.36
	0.34–0.37	0.34–0.36		0.36	
Prothoracic length	0.38	0.38	0.37	0.395	0.37
	0.36–0.41	0.36–0.39		0.39–0.40	
Prothoracic width	0.65	0.63	0.64	0.67	0.66
	0.61–0.69	0.60–0.65		0.65–0.69	
Distance between prosternals	74μ (n = 78)	66μ	66μ	66.5μ	67μ
	58–88μ	59–75μ		66–67μ	

TABLE 16

MEAN AND RANGE OF MEASUREMENTS OF MALES OF RICINUS VIREOENSIS POPULATIONS

Character	*Vireo griseus* n = 34	*Vireo belli* n = 2	*Vireo flavoviridis* n = 2
Total length	3.29	3.24	3.38
	3.03–3.39	3.24	3.37–3.39
Greatest width	0.82	0.85	0.87
	0.74–0.87	0.83–0.87	0.87
Head length	0.75	0.745	0.80
	0.71–0.77	0.74–0.75	0.80
Head width	0.66	0.64	0.69
	0.62–0.69	0.64	0.69
Head index	114	117	116
	110–118	116–118	116
Labral width	0.32	0.32	0.33
	0.31–0.34	0.32	0.33
Prothoracic length	0.33	0.32	0.34
	0.31–0.34	0.32	0.34
Prothoracic width	0.58	0.56	0.61
	0.55–0.60	0.56	0.60–0.62
Distance between prosternals	71μ	65μ	58.5μ
	56–82μ	64–66μ	56–61μ
Width of ♂ genitalia	0.186	0.19	0.205
	0.17–0.20	0.18–0.20	0.20–0.21

Ricinus diffusus Species Group

DIAGNOSTIC CHARACTERISTICS

1. Ovoid sclerites finely pitted, fuzzy in appearance.
2. Mandibles monomorphic.
3. Prothorax broadly hexagonal, with "shelf" anteromediad to L5.
4. Head conical; frons rounded, margins not continuous with sides of head; sides of head diverging; occiput weakly excavated.
5. Pattern on terminal tergite of female iIIiim × miiIIi, except in *R. australis*.
6. Prosternal setae moderately spaced.
7. Gular plate with posterolateral projections.
8. Setae a1 with two sensilla, a3 absent.
9. Male genitalia as in *subangulatus* species group.
10. Setae c3 and c4 present.
11. Margin of labium concave medially.
12. Maxillary palpi genticuloid; plates sausage-shaped.
13. Lunar nodi present; tentorium reduced, posterior pits very reduced.

Ricinus subdiffusus, new species

Type locality: Hopland Field Station, Mendocino Co., California.

Type host: *Spizella passerina* (Bechstein).

Diagnosis.—A small species of the *diffusus* species group. Related to *R. sittae* and *R. diffusus*. Head with frons rounded, transverse carina straight. Shape of mandibles characteristic. Labium with 14 pairs of setae. Lunar nodi equal to tentorial nodi in size. Pigmented area of gular plate wide; setae on gular plate equal to maxillary setae; posterior setae as long as t1. Sternal plates narrow anteriad; prothorax hexagonal. Setae on sternites II–IV short; sternolateral setae of V–VI as long as mentals; sternocentral setae as long as maxillaries. Pigmentation of sternites VI and VII more extensive than in *diffusus*. Pleurites pigmented to margin, color oxblood. Parameres of male genitalia stout. Two long tactile setae on coxa I.

Description.—Head as in pl. 34, fig. 1; frons rounded; transverse carina straight. Mandibles as in pl. 34, fig. 2. Labium with 14 pairs of setae, pattern as in pl. 34, fig. 3. Maxillary plates sausage-shaped; palpi genticuloid, reaching past margin of head. Mental setae longer than maxillaries. Setae m2 off marginal carinae; m4 three times as long as pa series. Setae a1 short, each with two sensilla; posterior pair close to a1; anterior pair laterad to anterior tentorial nodi; a6 present. Lunar nodi equal to tentorial nodi. Setae po1 weakly spinose, slightly shorter than po2. Gular plate as in pl. 34, fig. 1; number of setae 2 × 2; anterior pair equal to maxillaries; posterior pair equal to t1. Number of setae along antennal lappets 9 × 10 to 11 × 14, average 10.8 × 10.8.

Prothorax hexagonal, as in pl. 34, fig. 5. Prosternal plate as in same figure. L3–5 longer than L6. Coxal spines equal in size. Coxa I and femur I each with two long tactile setae. W series with six setae; w5 and w6 weakly spinose; w3 as long as q2. Setae c1 slightly longer but more strongly spinose than c2; c3 and c4 equal in size. Sternal plate as in pl. 34, fig. 5; narrow anteriad. Coxa II and femur II each with a short tactile seta; femur III with a long tactile seta.

Terminal segments of female abdomen as in pl. 34, fig. 6. Pleurites pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as given in table 4. Vulva with 7 to 10 setae, average 9. Setae of sternites II–IV short; sternolateral setae of sternites V and VI as long as mentals; sternocentral setae as long as maxillaries. Pigmentation of sternites VI and VII more extensive than in *R. diffusus*. Male genitalia as in pl. 34, fig. 4. Margin of mesosome ending in a medium blunt point. Parameres stout, apices each with three setae. Nodi of head, thorax, and pleurites oxblood, background whitish.

Dimensions.—Females (n = 7): total length 3.35–3.74 (3.55); greatest width (n = 5) 0.97–1.06 (1.00); head length 0.70–0.77 (0.73); head width 0.64–0.72 (0.68); head index 104–110 (107); labral width 0.28–0.34 (0.31); prothoracic length 0.35–0.38 (0.37); prothoracic width 0.57–0.63 (0.60); distance between prosternals 48–62μ (55μ). Males (n = 3): TL, 3.02–3.17 (3.08);

GW, 0.85–0.90 (0.87); HL, 0.64–0.68 (0.66); HW, 0.59–0.62 (0.60); HI 107–110 (109); LW, 0.26–0.28 (0.27); PL, 0.30–0.32 (0.31); PW, 0.50–0.53 (0.52); distance between prosternals 48–80μ (59μ); width of genitalia 0.18 (0.18).

Distribution.—Found on *Spizella passerina, S. breweri,* and *Amphispiza belli* in California, Arizona, and Utah. Interestingly, *R. diffusus* is recorded on *S. passerina* in Ohio and is also known from *S. arborea* both in the eastern U. S. and in Utah. Further collection is necessary to clarify the distribution of *R. subdiffusus* and *R. diffusus* on the genus *Spizella. Spizella* and *Amphispiza* belong to the subfamily Emberizinae, family Fringillidae.

Material examined.—From *Spizella passerina* (Bechstein): holotype ♂, allotype ♀ (BCN 597) from Hopland Field Station, Mendocino Co., California, on 20 May 1965 by B. C. Nelson. From *Spizella breweri* Cassin: 1 ♂, 1 ♀ paratypes (BMNH 13189, 13250) from Arizona on March 1939 by R. Meinertzhagen. From *Amphispiza belli* (Cassin): 3 ♀ (KCE) from vicinity Dugway Valley, Tooele Co., Utah, on 21 April 1953 by R. Porter. From "Sparrow V": 1 ♂, 2 ♀ paratypes (USNM) from Arizona: 5 mi. N Wickenburg, Arizona, on 29 April 1937 by Roy Komarek. A poorly prepared female specimen from *Spizella pusilla* (Wilson) in the UM collection from St. Anthony Park, Minnesota, collected on 22 June 1895 is tentatively assigned to this species:

Remarks.—The holotype and allotype are deposited in the entomological collection of the U. S. National Museum.

Ricinus sittae, new species

Type locality: Paso Robles, California.

Type host: *Sitta canadensis* Linnaeus.

Diagnosis.—A small species of the *diffusus* species group. Closely related to *Ricinus subdiffusus,* n. sp. Head with frons rounded, transverse carina convex. Mandibles characteristic, tips thin and pointed. Labium with 14 pairs of setae. Prothorax hexagonal. Abdomen narrow. Coxa I with one tactile seta. Chaetotaxy of ventral pleurites characteristic (table 4). Male genitalia characteristic (pl. 35, fig. 5).

Description.—Shape of head as in pl. 35, fig. 1; frons rounded, transverse carina convex. Mandibles as in pl. 35, fig. 3. Labium with 14 pairs of setae, pattern as in pl. 35, fig. 2. Setae m2 on marginal carinae; m4 slightly larger than pa series. Maxillary plates sausage-shaped; palpi genticuloid, barely reaching margin of head. Mental setae equal in length to maxillary setae. Setae a1 short, with two sensilla; a6 absent. Setae po1 half as long as po2; po3 short. Gular plate as in pl. 35, fig. 1, number of setae 2 × 2. Eight setae along each antennal lappet.

Prothorax hexagonal, as in pl. 35, fig. 4; bearing two pairs of long setae; posterior pair short. Six setae in w series; w5 and w6 weakly spinose. Setae q2 equal in size to w3. C1 twice as long as c2; c3 shorter than c4. Coxa I with one tactile seta; femur I with two tactile setae; coxae II and III without tactile setae; femur III with one tactile seta. Pleurites pigmented to margin; color oxblood. Setae on sternite II–VI small. Chaetotaxy of ventral pleurites as given in table 4. Abdomen narrow. Male genitalia as in pl. 35, fig. 5. Margin of mesosome bearing a median blunt point; apices of parameres each with three setae. Nodi of head, thorax, and pleurites oxblood in color; background whitish.

Female unknown.

Dimensions.—Measurements of type given first: total length 2.90 and 2.97; greatest width 0.69; head length 0.63 and 0.64; head width 0.56 and 0.57; head index 112; labral width 0.27; prothoracic length 0.27 and 0.28; prothoracic width 0.46; distance between prosternals 53μ; male genitalia width, 0.18 and 0.17.

Distribution.—Known from two specimens taken from *Sitta canadensis* Linnaeus, family Sittidae.

Material examined.—From *Sitta canadensis* Linnaeus: holotype ♂, paratype ♂ (VLK 111-840) from Paso Robles, California, in 1899 by B. Chapman.

Ricinus diffusus (Kellogg, 1896)

Physostomum diffusum Kellogg, 1896. Proc. Calif. Acad. Sci. 6:518–519, pl. 70, fig. 3; Osborn, 1902, Ohio Nat. 2:204; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72; Kellogg, 1912, Entomol. News 23:65. Type locality: Stanford University, California. Type host: *Passerculus sandwichensis* (Gmelin), by subsequent designation, Carriker, 1957, Microentomol. 22:105.

Ricinus diffusus (Kellogg). Harrison, 1916, Parasit. 9:66; Peters, 1928, Ohio J. Sci. 28:223; Hopkins and Clay, 1952, Checklist of Mallophaga, 325; Carriker, 1957, Microentomol. 22:105 (lectotype); Malcomson, 1960, Wilson Bull. 72:197; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 215; Emerson, 1964*a*, Checklist, II, Amblycera 96; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:44; Keirans, 1967, Agric. Exp. Sta. Bull. 492: 61, Univ. New Hampshire.

Physostomum melospizae McGregor, 1917. Entomol. News 28:436–438, pl. 28, figs. 3, 6. Type locality: St. Anthony's Park, Minnesota. Type host: *Melospiza melodia* (Wilson). New synonymy.

Ricinus melospizae (McGregor). Peters, 1928, Ohio J. Sci. 28:223; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Malcomson, 1960, Wilson Bull. 72:197; Emerson, 1962, Tent. List Mallophaga, N. Amer. Birds, Dugway Proving Ground, Utah, 216; Emerson, 1964*a*, Checklist, II, Amblycera, 97; Keirans, 1967, Agric. Exp. Sta. Bull. 492:62, Univ. New Hampshire.

Ricinus capensis Sasvari-Schäfer, 1964–65. Aguila 71–72: 215–216, 218, figs. 23–24, 28. Type locality: El Bolson, Argentina. Type host: *Zonotrichia capensis* (P. L. S. Müller). New synonymy.

Diagnosis.—A medium-sized species of the *diffusus* species group. Closely related to *R. subdiffusus,* but larger, and *R. calcarii,* but smaller. Head longer than wide. Transverse carina straight. Mandibles characteristic; anterior lobes large, posterior lobes rounded. Labium with 15 pairs of setae. Tentorial nodi smaller than lunar nodi. Pigmented portion of gular plate not tapered, straight; with three pairs of setae. Prothorax not broad. Sternal plate narrow posteriad, wide anteriad. Femur II without tactile setae. Setae on sternites II–VI short, subequal. Pigmentation on sternites VI and VII characteristic, hourglass-shaped on VI, funnel-shaped on VII; gold in color. Pleurites pigmented to margin, red-brown in color. Parameres not stout as in *R. subdiffusus.*

Description.—Head longer than wide, as in pl. 35, fig. 1; frons variable from rounded to truncate; transverse carina straight. Mandibles as in pl. 36, fig. 4. Labium with 15 pairs of setae, pattern as in pl. 36, fig. 5. Setae m2 off marginal carinae; m4 three times as long as pa series. Lunar nodi larger than tentorial nodi. Maxillary plates sausage-shaped, narrower proximally; palpi genticuloid, reaching past margin of head. Mental setae larger than maxillary setae. Setae a1 short, each with two sensilla, posterior pair close to a1, anterior pair laterad to anterior tentorial pits. Setae po1 spinose, equal in size to pilose po3; po2 twice as long as po1. Gular plate as in pl. 36, fig. 1; number of setae 2 × 3 to 5 × 5, average 3.2 × 3.2. Setae along antennal lappets variable in number, 8 × 9 to 15 × 16, average 11.2 × 11.2.

Prothorax and sternal plates as in pl. 36, fig. 3. L5 longer than L3, L4, and L6. Outermost two procoxal setae strongly spinose, innermost weakly spinose. Coxa and femur I each with two long tactile setae. W series with five or six setae, w5 and w6 weakly spinose. Setae q2 larger than w3. Sternal plate bearing two pairs of long setae and one short posterior pair. Setae a1 twice as long as c2; maxillary setae c3 and c4 subequal. Coxa II and femur III each with one long tactile seta.

Terminal segments of female abdomen as in pl. 35, fig. 6. Pleurites pigmented to margin; color red-brown. Chaetotaxy of ventral pleurites as given in table 4. Setae on sternites II–VI short, subequal. Vulva with 3 to 10 setae, average 6.2. Pattern on sternites limited to VI and VII, pattern on VI hourglass-shaped, funnel-shaped on VII, gold in color. Male genitalia as in pl. 36, fig. 2. Margin of mesosome ending in a median blunt point. Parameres relatively thin; apices each bearing three setae. Color of nodi of head, thorax, and pleurites red-brown on whitish background.

Dimensions.—See tables 17 and 18.

Distribution.—Known from following genera in subfamily Emberizinae, family Fringillidae, in North America: *Passerculus, Spizella, Ammodramus, Ammospiza, Zonotrichia, Junco, Passerella,* and *Melospiza.* Specimens attributed to *Passerina* spp. are thought to be instances of mislabeling. Specimens from *Sitta, Icterus, Myiarchus,* and *Bombycilla* are considered stragglers or contaminants.

TABLE 17

MEAN AND RANGE OF MEASUREMENTS OF FEMALES OF RICINUS DIFFUSUS POPULATIONS

Character	*Passerculus* spp. n = 25	*Zonotrichia* spp. n = 26	*Melospiza* spp. n = 33	*Spizella* spp. n = 20	*Passerella* sp. n = 4	*Junco* sp. n = 2	*Passerina* spp. n = 2
Total length	4.13	4.00	4.08	4.19	4.04	4.22	4.15
	3.99–4.26	3.81–4.19	3.84–4.38	4.10–4.24	3.92–4.18	4.20–4.24	4.12–4.19
Greatest width	1.15	1.12 (n = 25)	1.14	1.14	1.14	1.18	1.18
	1.12–1.18	1.08–1.13	1.06–1.23	1.10–1.18	1.07–1.22	1.16–1.20	1.06–1.16
Head length	0.84	0.85	0.84	0.85	0.85	0.865	0.83
	0.82–0.96	0.82–0.88	0.80–0.88	0.83–0.85	0.82–0.90	0.86–0.87	0.82–0.84
Head width	0.79 (n = 24)	0.78	0.77	0.78	0.79	0.78	0.76
	0.76–0.80	0.76–0.82	0.74–0.80	0.76–0.80	0.74–0.84	0.78	0.76
Head index	107 (n = 24)	108	108	108	108	110.5	109
	104–110	104–111	104–111	106–112	106–110	110–111	107–111
Labral width	0.36	0.37	0.37	0.36	0.37	0.37	0.36
	0.34–0.37	0.35–0.39	0.35–0.38	0.35–0.38	0.37–0.38	0.37	0.36
Prothoracic length	0.43	0.43	0.43	0.43	0.44	0.43	0.43
	0.40–0.45	0.37–0.46	0.41–0.46	0.41–0.45	0.41–0.45	0.43	0.42–0.44
Prothoracic width	0.69	0.69	0.68	0.70	0.70	0.68	0.67
	0.66–0.71	0.65–0.71	0.65–0.71	0.66–0.71	0.67–0.75	0.68	0.65–0.69
Distance between prosternals	62μ	55μ	58μ (n = 31)	55μ	48μ (n = 3)	67μ	52μ
	51–78μ	40–67μ	40–80μ	40–64μ	40–56μ	64–70μ	48–56μ

TABLE 17 (*Continued*)

Character	*Ammodramus savannarum*	*Ammospiza maritima*	*Syntype "Ricinus marginatus"*	*Sitta carolinensis*	*Icterus galbula*	*Myiarchus cinerascens*	*Bombycilla cedrorum*
Total length	4.19	4.27	4.03	4.12	4.24	4.26	4.26
Greatest width	1.22	1.19	1.13	1.13	1.11	1.17	1.20
Head length	0.88	0.88	0.83	0.84	0.83	0.86	0.85
Head width	0.82	0.80	0.80	0.78	0.78	0.80	0.80
Head index	107	110	104	108	106	108	106
Labral width	0.37	0.37	0.34	0.36	0.37	0.38	0.38
Prothoracic length	0.45	0.46	0.42	0.43	0.43	0.44	0.46
Prothoracic width	0.71	0.71	0.70	0.67	0.69	0.71	0.71
Distance between prosternals	69μ	61μ	51μ	64μ	58μ	64μ	67μ

TABLE 18

MEAN AND RANGE OF MEASUREMENTS OF MALES OF RICINUS DIFFUSUS POPULATIONS

Character	*Passerculus* sp. n = 2	*Zonotrichia* spp. n = 9	*Melospiza* spp. n = 7	*Spizella* sp. n = 4	*Passerella* sp. n = 1	*Junco* sp. n = 1	*Passerina* spp. n = 2
Total length	3.52	3.56	3.60	3.57 (n = 1)	3.48	3.68	3.635
	3.44–3.60	3.49–3.61	3.46–3.76				3.60–3.67
Greatest width	0.93	0.97	0.97	0.96	0.91	1.01	0.98
	0.89–0.97	0.92–1.02	0.94–1.04	0.94–0.98			0.95–1.02
Head length	0.74	0.78	0.76	0.76	0.75	0.78	0.77
	0.71–0.76	0.76–0.79	0.74–0.79	0.75–0.76			0.76–0.78
Head width	0.68	0.71	0.69	0.69	0.69	0.69	0.70
	0.66–0.70	0.69–0.74	0.67–0.71	0.68–0.71			0.69–0.71
Head index	107.5	109	110	110	108	112	110.5
	107–108	106–113	108–112	108–110			110–111
Labral width	0.32	0.35	0.33	0.325	?	0.33	0.335
	0.32	0.33–0.37	0.30–0.34	0.32–0.33			0.33–0.34
Prothoracic length	0.35	0.37	0.36	0.36	0.37	0.37	0.365
	0.34–0.36	0.36–0.38	0.35–0.38	0.36			0.36–0.37
Prothoracic width	0.59	0.60	0.59	0.60	0.59	0.61	0.60
	0.57–0.61	0.58–0.62	0.58–0.61	0.59–0.62			0.59–0.61
Distance between prosternals	48μ (n = 1)	49μ	51μ	44μ	48μ	56μ	45.5μ
		43–56μ	40–59μ	40–48μ			43.48μ
Width of ♂ genitalia	0.20	0.20	0.20	0.18	0.20	0.21	0.195
	0.19–0.21	0.19–0.22	0.17–0.21	0.17–0.20			0.19–0.20

Material examined.—From *Passerculus sandwichensis* (Gmelin): lectotype ♀ (VLK 334a) from Stanford University, California, in 1896 by V. L. Kellogg; 9 ♀ (BCN 713) from Miami, Florida, in December 1924 by J. A. Weber; 1 ♀ (USNM) from Martha's Vineyard, Massachusetts, on 23 April 1933 by L. B. Lunz, Jr.; 7 ♀ (USNM) from McMillan, Michigan, on 30 May 1932 by O. M. Bryens; 1 ♀ (USNM) from Lincoln, Nebraska, on 18 April 1901 by M. A. Carriker, Jr.; 1 ♂, 1 ♀ (UNH) from Durham, Strafford Co., New Hampshire, on 29 September 1921 by P. R. Lowry; 1 ♀ (USNM) from Beaver, Pennsylvania, in May 1908 by M. A. Carriker, Jr.; 1 ♂, 2 ♀ from Georgetown, South Carolina, on 29 March 1933 by Peters and Lunz; 1 ♀ (CU) from Churchill, Manitoba, Canada, on June 1934 by A. M. Herdweiller. From *Passerculus princeps* Maynard: 1 ♀ (BCN 711) from Miami, Florida, on 28 December 1929 by J. A. Weber. From *Ammodramus savannarum* (Gmelin): 1 ♀ (VLK 844) from Paso Robles, California, in 1899 by B. Chapman. From *Ammospiza maritima* (Wilson): 1 ♀ (BCN 717) from Miami, Florida, on 17 June 1929 by J. A. Weber. From *Junco oreganus* (Townsend): 1 ♂, 2 ♀ (CU) from Frenchglen, Harner Co., Oregon, on 2 February 1936 by S. G. Jewett. From *Spizella arborea* (Wilson); 1 ♀ (USNM) from Lincoln, Nebraska, on 5 January 1901 by Crawford; 1 ♀ (USNM) from Mohonk Lake, New York, on 8 April 1931 by D. Smiley, Jr.; 4 ♂, 13 ♀ (CU) from Ithaca, New York, on various days from January to April 1935 by A. M. Herdweiller; 2 ♀ (KCE) from vicinity Dugway Valley, Tooele Co., Utah, on 13 March 1955 by R. Porter. From *Spizella passerina* (Bechstein): 2 ♀ (USNM) from Chain Bridge, District of Columbia, on 14 December 1930 by J. C. Jones; 1 ♀ (USNM) from Gates Mill, Ohio, on 29 April 1939 by H. S. Peters. From *Zonotrichia leucophrys* (Forster): 2 ♀ (USNM) from Winchester, New Hampshire, on 12 May 1933 by L. R. Nelson; 1 ♀ (USNM) from Leetonia, Ohio, on 2 May 1933 by P. A. Steward; 3 ♀ (USNM) from Sonora, Texas, on 26 February 1934 by O. G. Babcock. From *Zonotrichia atricapilla* (Gmelin): 3 ♂, 3 ♀ paralectotypes (VLK 355a) from Palo Alto, California, in 1896 by V. L. Kellogg; 5 ♂, 4 ♀ (BCN 458) from Russell Tree Farm, Contra Costa Co., California, on 3 March 1964 by W. A. Stumpf; 2 ♀ (USNM) from Portland, Oregon, on 1 April 1923 by I. N. Gabrielson. From *Zonotrichia albicollis* (Gmelin): 2 ♀ (KCE) from State College, Mississippi, on 18 April 1937 by E. W. Stafford; 1 ♂, 4 ♀ (USNM) from Gates Mill, Ohio, on 26 April and 3 May 1932 by H. S. Peters; 1 ♀ (USNM) from Mohonk Lake, New York, on 23 April 1939 by D. Smiley, Jr.; 4 ♀ (UW) from Madison, Wisconsin, on 30 April 1953 by P. Hickey. From *Passerella iliaca* (Merrem): 1 ♀ (USNM) from Handsboro, Mississippi, on 12 February 1940 by G. G. Rohwer; 1 ♀ (USNM) from Elmhurst, New York, on 25 October 1936 by M. V. Beals; 1 ♀ (USNM) from Columbus, Ohio, on 13 March 1926 by H. S. Peters; 1 ♂, 1 ♀ (OSU), no collection data. From *Melospiza georgiana* (Latham): 1 ♀ (USNM) from Jackson, Michigan, on 20 June 1930 by W. G. Fargo; 2 ♀ (KCE) from Vicksburg, Mississippi, on 6 January 1946 by M. L. Miles; 2 ♂, 2 ♀ (USNM) from Conway, South Carolina, on 31 March 1933 by Peters and Lunz. From *Melospiza melodia* (Wilson): 1 ♂, 2 ♀ (VLK 365a) from Palo Alto, California, on 21 and 23 March 1896 by R. E. Snodgrass; 1 ♀ (VLK 632) from same locality in 1897; 5 ♀ (USNM) from Ft. Dupont, Delaware, on 13 April 1933 by Peters and Lunz; 1 ♀ (BCN 716) from Miami, Florida, on 13 November 1930 by J. A. Weber; 1 ♀ (USNM) from Mackinac Co., Michigan, on 5 June 1930 by W. G. Fargo; 4 ♀ (CU) from Ithaca, New York, on 28 April and 3 May 1930 by A. B. Klotz; 1 ♂, 9 ♀ (USNM) from Gates Mill, Ohio, in April and May 1932 by H. S. Peters; 2 ♂, 3 ♀ (USNM) from Lakewood, Ohio, on 21 June 1929 and 4 March 1930 by E. C. Hoffman. Host unknown: 1 ♀ (BMNH, syntype of *R. marginatus*) from Arctic America by Captain Back in 1833–1835.

The following records are designated as cases of straggling or contamination: From *Passerina amoena* (Say): 1 ♂, 1 ♀ (USNM) from Sioux Co., Nebraska, on 3 June 1901 by M. A. Carriker, Jr. From *Passerina cyanea* (Linnaeus): 1 ♂, 1 ♀ (VLK 665a) from Palo Alto, California, in 1898 by B. Chapman. From *Myiarchus cinerascens* (Linnaeus): 1 ♀ (VLK 665a) from Palo Alto, California, in 1897 by V. L. Kellogg. From *Sitta carolinensis* Latham: 1 ♀ (RCD) from Ithaca, New York, on 15 November 1963 by R. C. Dalgleish. From *Icterus galbula* (Linnaeus): 1 ♀ (USNM) from Jackson, Michigan, on 28 May 1930 by W. G. Fargo.

Remarks.—Kellogg (1896*b*) described *Physostomum diffusum* from *Passerculus sandwichensis* and *Zonotrichia atricapilla.* In 1957 Carriker designated a female specimen from *P. sandwichensis* as the lectotype. Carriker raised the question

whether the specimens designated as *"diffusum"* by Kellogg from *Z. atricapilla* and other hosts in the Kellogg collection were conspecific with specimens from *P. sandwichensis*. Study has shown that *R. diffusus* does have a wide host distribution.

Two "different" forms are found in populations of *R. diffusus* based on the shape of the frons and an accompanying difference in the shape of the occiput. Both of these forms can be found in the same population or series of specimens from the same host. These alleged differences are interpreted as artifacts resulting from pressure of the coverslip on the frons and occiput. Because of the lack of other differentiating characters I have assigned these specimens to one species.

In 1917 McGregor described *Physostomum melospizae* from *Melospiza melodia*. He gave the total length of the female as 2.17 mm, which would make this species the smallest known *Ricinus*. My examination of the type revealed that his two syntypes were nymphs. Since two species of *Ricinus, R. fringillae* and *R. diffusus*, occur on *M. melodia*, a comparison of the syntypes was made with nymphs of these two species. The syntypes resemble the nymphs from *R. diffusus*. *R. melospizae* is designated a junior synonym of *R. diffusus* (Kellogg).

In his description of *R. capensis* based upon a female specimen from *Zonotrichia capensis*, Sasvari-Schäfer (1964–65) gave features that are applicable to most species of *Ricinus*. His photographs revealed a specimen that is inadequately cleared and that resembles *R. diffusus*. His drawing of the specimen showed a pattern of chaetotaxy that is unique, so much so that I believe that the pattern has been grossly misinterpreted. *R. capensis* must be referred to either as a *species inquirendae* or as a junior subjective synonym of *R. diffusus*. Other species of *Zonotrichia* are infested with *R. fringillae* and *R. diffusus*. I have chosen the latter course.

Ricinus calcarii, new species

Type locality: Golovin, Alaska.

Type host: *Calcarius ornatus* (Townsend).

Diagnosis.—A large species of the *diffusus* species group. Closely related to *R. thoracicus*. Shape of head characteristic, as wide as long. Frontal carinae straight. Labium with 15 pairs of setae. Setae a1 longer than a4. Outer and inner setae on pleurites IV spinose, with middle setae long and pilose. Pleurites lightly pigmented to margin. Male genitalia characteristic, with blunt tips on margin of mesosome. Prothorax not as broad as in *thoracicus*.

Description.—Head as wide as long, as in pl. 37, fig. 1. Transverse carina straight; frons rounded. Mandibles as in pl. 37, fig. 5. Labium with 15 pairs of setae, pattern as in pl. 37, fig. 2. Setae m2 off marginal carina, m3 and m4 mediad on marginal carinae; m4 twice as long as pa series. Setae a1 longer than a4, each with two sensilla, both equal distance from a1. Po series as in *ivanovi*. Gular plate as in pl. 37, fig. 1, number of setae 2 × 3 to 4 × 4, average 3 × 3. Setae along antennal lappets variable in number, 11 × 11 to 14 × 15, average 12.5 × 12.5.

Prothorax as in pl. 37, fig. 4. Setation as in *R. ivanovi*. Prosternal plate as in pl. 37, fig. 4. C series as in *thoracicus*. Setae q2 much longer than any seta of w series. Five or six setae in w series; w5 or w6 short.

Terminal segments of female abdomen as in pl. 39, fig. 1. Pleurites lightly pigmented to margin; nodi red-brown. Pigmentation on sternites as in pl. 39, fig. 1. Chaetotaxy of ventral pleurites as given in table 4; outer and inner setae of IV spinose with middle setae long and pilose. Vulva with 2 to 7 setae, average 4.3. Male genitalia as in pl. 37, fig. 3. Margin of mesosome with medial blunt tip. Apices stout, each bearing three setae.

Dimensions.—Females (n = 11): total length 4.31–4.63 (4.49); greatest width 1.23–1.34 (1.28); head length 0.81–0.90 (0.86); head width 0.80–0.87 (0.85); head index 98–104 (101); labral width 0.36–0.40 (0.39); prothoracic length 0.43–0.48 (0.46); prothoracic width 0.72–0.79 (0.76); distance between prosternals 48–74μ (60μ). Males (n = 2): TL, 3.67, 3.79; GW, 1.05; HL, 0.75; HW, 0.74, 0.75; HI, 100, 102; LW 0.33, .34; PL, 0.36, 0.37; PW, 0.64, 0.65; distance between prosternals 50μ, 54μ; width of genitalia 0.20.

Distribution.—Known from two species of genus *Calcarius*, family Fringillidae.

Material examined.—From *Calcarius ornatus* (Townsend): holotype ♂, allotype ♀, 1 ♂, 2 ♀ paratypes (USNM) from Golovin, Alaska, on 20 May 1931 by E. C. Cushing. From *Calcarius lapponicus* (Linnaeus): 1 ♂ and 2 ♀ paratypes (USNM) from Point Barrow, Alaska, on 1 June 1951 by H. E. Childs and on 1 June 1952 by F. A. Pitelka; 1 ♀ paratype (USNM) from Livengood, Alaska, on 15 May 1953 by B. Zuckerman; 1 ♀ paratype (USNM) from Manhattan, Kansas, on 1 January 1937; 1 ♀ paratype (USNM) from Luce Co., Michigan, on 5 January 1937 by Oscar McK. Bryens; 1 ♀ paratype (USNM) from Lincoln, Nebraska, on 6 March 1902 by J. S. H.; 1 ♀ paratype (CU) from Clarksville, Tennessee, on 15 February 1940 by A. Clebsch.

Ricinus thoracicus (Packard, 1870)

Nirmus thoracicus Packard, 1870, *nec* Piaget, 1880. Amer. Nat. 4:90, pl. 1, fig. 5. Type locality: not recorded. Type host: *Plectrophenax nivalis* (Linnaeus).

Ricinus thoracicus (Packard). Harrison, 1916, Parasit. 9:68; Hopkins and Clay, 1952, Checklist of Mallophaga, 328; Balat, 1952, Biol. Sbor. 7:161–162, fig. 7; Blagovoshtchensky, 1958, Entomol. Sbornik 37:5; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 216; Emerson, 1964*a*, Checklist, II, Amblycera, 98; Zlotorzycka, 1965, Acta Parasit. Polonica 13:65, figs. 9c, 9d; Keirans, 1967, Agric. Exp. Sta. Bull. 492:64, Univ. New Hampshire; Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:296–298, pl. 32.

Diagnosis.—A large species of the *diffusus* species group. Closely related to *R. diffusus* and *R. calcarii*. Shape of head characteristic, much wider than long. Frons rounded, transverse carina parallel with margin of frons. Labium with 15 pairs of setae. Prothorax broad. Setae on pleurite IV strongly spinose, middle setae not long and pilose. Pleurites lightly pigmented to margin. Setae a1 as long as a4.

Description.—Head as in pl. 38, fig. 1; wider than long, head index 93; frons short, rounded; frontal carina parallel to margin of frons. Mandibles as in pl. 38, fig. 5. Labium with 15 pairs of setae, pattern as in pl. 38, fig. 2. Mental setae longer than maxillaries. Maxillary plate sausage-shaped; palpi genticuloid, reaching past margin of head. Lunar nodi larger than tentorial nodi. Setae m2 off margin of marginal carinae; m3 and m4 on inner margin; m4 more than twice as long as pa series. Setae po1 spinose; po2 pilose, twice as long as po1; po3 pilose, variable in length. Setae a1 short, each with two sensilla, both usually equidistant from a1. Apices of temples blunt. Gular plate as in pl. 38, fig. 1; number of setae 2 × 3 to 3 × 4, average 2.9 × 2.9. Number of setae along antennal lappets variable, 10 × 13 to 13 × 16, average 13 × 13.

Prothorax broad, as in pl. 38, fig. 4; L4 as long as L5, both longer than L6. Prosternal and sternal plates as in pl. 38, fig. 4. Setae c1 much longer than c2; c3 and c4 short and nearly equal in length. Six setae in w series; w1–4 spinose, w5–6 short and pilose. Setae q2 strongly spinose, larger than w3. Coxa and femur I each with two tactile setae. Coxa II and femur III each with one tactile seta.

Terminal segments of female abdomen as in pl. 39, fig. 2. Pleurites lightly pigmented to margin; nodi dark brown. Chaetotaxy of ventral pleurites as in table 4; setae on pleurite IV all spinose; middle setae twice as long as other two setae. Vulva with 3 to 10 setae, average 5. Male genitalia as in pl. 38, fig. 3. Margin of mesosome ending in a blunt, rounded point. Parameres stout, tips thin; each with three or four setae. Sternite VI with hourglass-shaped golden marking; sternite VII with round golden spot. Nodi brown on whitish background.

Dimensions.—Females (n = 8): total length 4.49–4.87 (4.66); greatest width 1.40–1.58 (1.47); head length 0.83–0.89 (0.85); head width 0.90–0.95 (0.92); head index 91–94 (93); labral width 0.35–0.40 (0.37); prothoracic length 0.49–0.54 (0.53); prothoracic width 0.80–0.90 (0.83); distance between prosternals 37–64μ (57μ). Males (n = 3): TL (n = 2), 3.76, 3.82; GW, 1.06–1.20 (1.12); HL, 0.72–0.76 (0.74); HW (n = 2), 0.79; HI (n = 2), 95, 97; LW, 0.32–0.34 (0.33); PL, 0.40–0.42 (0.41); PW (n = 2), 0.67; distance between prosternals 46–54μ (51μ); width of genitalia 0.20–0.21 (0.20).

Distribution.—Known from *Plectrophenax nivalis* (Linnaeus), family Fringillidae.

Material examined.—From *Plectrophenax nivalis* (Linnaeus): 2 ♀ (KCE), 1 ♀ (USNM) from McMillan, Michigan, on 22 February 1936 and 21 February 1937 by O. M. Byrens; 2 ♂, 1 ♀

(CU) from Montauk, New York, on 17 November 1929 by Roy Latham; 1 ♂, 4 ♀ (BMNH 4357) from Ross-shire in October 1935 by R. Meinertzhagen. From *Calcarius lapponicus* (Linnaeus), error (?): 1 ♀ (CU) from Ithaca, New York, on 4 March 1935 by A. M. Haydwaillar.

Remarks.—Packard (1870) described *Nirmus thoracicus* from the Snow Bunting, *Plectrophenax nivalis*. Although his description is inaccurate, his figure is definitely that of a female specimen of *Ricinus*. Packard called the pallettes, trabeculae, which are found not in the suborder Amblycera but in Ischnocera, and called the maxillary palpi the antennae. Because of these mistakes it appears that Packard thought this form represented a new species in *Nirmus* Nitzsch, 1818, rather than in *Physostomum*.

A neotype must be designated for *R. thoracicus*. Packard (1870) gave no indication where the holotype was housed. Dr. Emerson (*in litt.*) has not located the type in his search for this and other type specimens of North American Mallophaga in collections of the U. S. National Museum, Cornell University, the Osborn collection at Ohio State University, or the V. L. Kellogg collection. Dr. Clay and Dr. Rheinwald (*in litt.*) have failed to find the type in their search of European museums.

It is necessary for the name *thoracicus* to be fixed to a particular form, as three species of *Ricinus* have been recorded from the Snow Bunting: *R. bombycillae* (now *R. fringillae*) by Denny (1842); *R. diffusus* (Kellogg) by Children (1836), and one specimen taken by Dr. P. D. Hurd, Jr., in Alaska; and the form considered herein as *thoracicus*. This form more closely resembles Packard's figure than the others recorded from *Plectrophenax nivalis*. Balat (1952) referred to this form as *R. thoracicus*. Two other species superficially resemble *R. thoracicus* (as defined herein); *R. ivanovi* Blagoveshtchensky and *R. calcarii*, n. sp. This situation appears to meet the "exceptional circumstances" requirement in the Code for designation of neotypes. Unfortunately none of the specimens examined herein is curated adequately enough to be designated as the neotype. In each specimen at least one diagnostic feature is obliterated or distorted. Designation of a neotype for *R. thoracicus* is withheld for the present pending receipt of specimens in good condition.

Ricinus ivanovi Blagoveshtchensky, 1951

Ricinus ivanovi Blagoveshtchensky, 1951. Mag. Parazit. 13:283, fig. 5, 5c; Hopkins and Clay, 1953, Ann. Mag. Nat. Hist., ser. 12, 6:444; Blagoveshtchensky, 1959, Fauna USSR, ser. 21, 1:23, fig. 2; Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:299–301, pl. 33. Type locality: Vewrk, Gissar's Range, Pamir, USSR. Type host: *Leucosticte brandti* (Bonaparte).

Diagnosis.—A large species of the *diffusus* species group. Closely related to *R. thoracicus* and *R. carolynae*. Shape of head characteristic, width equal to length. Frontal carina arched medially. Labium with 14 pairs of setae. Gular and sternal plate characteristic. Outer and inner setae on pleurites IV strongly spinose with middle pair long and pilose. Pleurites pigmented to margin. Male genitalia characteristic. Prothorax not as broad as in *thoracicus*. Setae a1 longer than a4.

Description.—Head as in pl. 40, fig. 1, head as wide as long. Frontal carina arched medially; frons rounded. Mandibles as in pl. 40, fig. 3. Labium with 14 pairs of setae, pattern as in pl. 40, fig. 5. Mental setae longer than maxillaries. Maxillary plate sausage-shaped, broader distally; palpi genticuloid, extending past margin of head. Lunar nodi larger than tentorial nodi. Setae m2 on marginal carinae; m4 on inner margin of carinae, twice as long as pa series. Setae a1 longer than a4; a1 each with two sensilla; anterior sensillum variable in its position relative to a1. Setae po1 spinose; po2 pilose, slightly longer than po1; po3 pilose, variable in size. Gular plate as in pl. 40, fig. 1, number of setae 2 × 3 to 3 × 4, average 3 × 3. Setae along antennal lappets variable in number, 9 × 9 to 15 × 17, average 13.2 × 13.2.

Prothorax not as broad as that of *R. thoracicus*, as shown in pl. 40, fig. 4; L4 equal to L5, both larger than L6. Prosternal and sternal plate as in pl. 40, fig. 4. Six setae in w series; w1–4 spinose, w1 and w3 equal in size; w5 and w6 short and pilose. Setae q2 equal to w1 and w3. C series as in *R. thoracicus*.

Terminal segments of female abdomen and pigmentation of sternites as in pl. 42, fig. 1. Chaetotaxy of ventral pleurites as given in table 4; outer and inner setae of pleurites IV spinose, with middle setae long and pilose. Vulva with 8 to 10 setae, average 9. Pleurites pigmented to margin; color brown. Male genitalia as in pl. 40, fig. 2. Parameres stout; apices broad, blunt, each with five setae. Nodi red-brown on whitish background.

Dimensions.—Females (n = 6): total length (n = 6) 4.46–4.76 (4.61); greatest width (n = 6) 1.30–1.40 (1.36); head length 0.84–0.86 (0.85); head width 0.83–0.88 (0.86); head index 97–101 (99); labral width 0.36–0.38 (0.37); prothoracic length 0.45–0.48 (0.46); prothoracic width 0.74–0.78 (0.76); distance between prosternals 61–88μ (73μ). Males (n = 3): TL, 3.60–3.70 (3.66); GW, 0.98–1.04 (1.02); HL, 0.75–0.77 (0.76); HW, 0.74–0.75 (0.74); HI, 102–103 (102); LW, 0.32–0.35 (0.33); PL, 0.36–0.37 (0.37); PW, 0.63–0.66 (0.64); distance between prosternals 48–62μ (55μ); width of genitalia 0.21–0.22 (0.21).

Distribution.—Known from *Leucosticte brandti* in Russia and *Leucosticte tephrocotis* in North America, in family Fringillidae, subfamily Carduelinae.

Material examined.—From *Leucosticte tephrocotis* (Swainson): 2 ♂, 4 ♀ (USNM) from Adel, Oregon, on 9 February 1932 by S. G. Jewett; 1 ♂, 4 ♀ (USNM) from Joseph, Oregon, on 24 January 1932 by S. G. Jewett.

Remarks.—Although I have not examined material from the type host, the material at hand fits the excellent descriptions of *R. ivanovi* given by Blagoveshtchensky (1951) and Rheinwald (1968).

Ricinus carolynae, new species

Type locality: Hopland Field Station, Mendocino Co., California.
Type host: *Spinus psaltria* (Say).

Diagnosis.—A species of the *diffusus* species group. Closely related to *R. diffusus* and *R. ivanovi*. Shape of head conical, wider than long. Frons rounded, transverse carina arched. Mandibles characteristic, tips moderately thin. Labium with 14 pairs of setae. Setae a1 as long as pa series. Lunar and tentorial nodi equal in size. Gular plate similar to *R. diffusus*. Sternal plate wider posteriad. Prothorax hexagonal; L3 present. Setae q2 larger than w3; five setae in w series. Femur II with a short tactile seta. Pleurites not pigmented to margin. Pigmented markings on sternites V–VII, color golden. Nodi of head, thorax, and pleurites, the carinae of labium, temples, and legs, and the male genitalia oxblood in color. Male genitalia characteristic (pl. 41, fig. 4).

Description.—Head as in pl. 41, fig. 1; frons rounded; transverse carina arched. Mandibles as in pl. 41, fig. 3. Labium with 14 pairs of setae, pattern as in pl. 41, fig. 2. Setae m2 off marginal carinae; m4 twice as long as pa series. Maxillary palpi genticuloid, extending past margin of head. Lunar and tentorial nodi equal in size. Setae a1 as long as pa series, each with two sensilla. Setae po1 spinose; po2 pilose, twice as long as po1 and po3. Gular plate as in pl. 41, fig. 1; number of setae 1 × 2 to 4 × 3, average 2.6 × 2.6. Setae along antennal lappets variable in number, 9 × 10 to 13 × 14, average 10.9 × 10.9.

Prothorax and prosternal and sternal plates as in pl. 41, fig. 5. L3 present; L5 larger than L6. Outermost two spines of procoxa strongly spinose; innermost pilose and longer than outermost spines. Coxa and femur I each with two long tactile setae. Five setae in w series; w5 weakly spinose; q2 larger than w3. Setae c1 larger than c2; c3 and c4 equal. One tactile setae on coxa II and femora II and III; that on femur II short.

Terminal segments of female abdomen as in pl. 42, fig. 2. Pleurites not pigmented to margin; color oxblood. Chaetotaxy of ventral pleurites as in table 4. Size of setae on sternites II–VI progressively larger from II to VI. Vulva with 9 to 13 setae, average 11. Golden markings on sternites V to VII; that on VI hourglass-shaped. Male genitalia as in pl. 41, fig. 4. Margin of mesosome with median point. Apices of paramere each with four setae. Nodi of head, thorax, and pleurites, the carinae of labrum, temples, and legs, and the male genitalia oxblood in color; background whitish.

Dimensions.—Females (n = 6): total length 4.05–4.32 (4.22); greatest width 1.06–1.24 (1.18); head length (n = 5) 0.80–0.84 (0.82); head width (n = 5) 0.81–0.85 (0.83); head index (n = 5) 97–99 (98); labral width 0.32–0.36 (0.34); prothoracic length 0.40–0.46 (0.44); prothoracic width 0.70–0.77 (0.75); distance between prosternals 51–80μ (59μ). Male (n = 1): **TL, 3.58; GW,** 1.06; HL, 0.75; HW, 0.75; HI, 100; LW, 0.33; PL, 0.38; PW, 0.66; distance between prosternals 48μ; width of genitalia 0.20.

Distribution.—Known from species in genus *Spinus*, subfamily Carduelinae, family Fringillidae.

Material examined.—From *Spinus psaltria* (Say): holotype ♂, 2 ♀ paratypes (BCN 786, 776) from Hopland Field Station, Mendocino Co., California, on 16 and 22 June 1966 by B. C. Nelson; 1 ♀ paratype (VLK 2265) from Claremont, California, by C. Metz. From *Spinus notatus* (DuBus): 1 ♀ (USNM) from 3 mi. WSW Mazamitla, Jalisco, Mexico, on 15 June 1955 by J. R. Alcorn. From *Spinus pinus* (Wilson): 2 ♀ (KCE) from Tucson, Arizona, on 7 February 1949 by A. R. Phillips.

Remarks.—Ricinus carolynae is named in honor of my wife, Carolyn, who helped me extensively in the field and encouraged me in the completion of this work.

The holotype and paratypes are deposited in the collections of the U. S. National Museum.

Ricinus australis (Kellogg, 1896)

Physostomum australe Kellogg, 1896. Proc. Calif. Acad. Sci. 6:516–517, pl. 70, fig. 4; (*non*) Carriker, 1903, Univ. Stud. Nebraska 3:168; Kellogg, 1908, Wytsman's Genera Insectorum, 66:71. Type locality: Cameron County, Texas. Type host: *Passerina versicolor* (Bonaparte).

Ricinus australis (Kellogg). Harrison, 1916, Parasit. 9:66; Guimaraes, 1944, Pap. Avulsos, Dept. Zool. Brasil, 6:16–17; Hopkins and Clay, 1952, Checklist of Mallophaga, 324; Malcomson, 1960, Wilson Bull. 72:196; Emerson, 1962, Tent. List Mallophaga N. Amer. Birds, Dugway Proving Ground, Utah, 214; Emerson, 1964*a*, Checklist, II, Amblycera, 95; Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:44.

Ricinus orbifrons Carriker, 1964. Mem. Soc. Cienc. Nat. La Salle 24:51–52, figs. 4, A-1. Type locality: La Goajira, Venezuela. Type host: *Trogon melanurus macrourus* Gould, error. New synonymy.

Diagnosis.—A species of the *diffusus* species group. Closely related to *R. diffusus* and *R. carolynae*. Shape of head characteristic; frons truncate with lateral margins angled medially. Sides of head undulating. Transverse carina convex. Mandibles characteristic, with needle-like tips. Labium with 13 pairs of setae. Maxillary plates meet along midline, separating mentum from gular plate. Mentum small, shaped as in inverted equilateral triangle. Gular plate characteristic (pl. 43, fig. 1). Anterior eye facet much larger than posterior facet. Sensilla associated with a1 large, appear to be set in depressions. Shape of prothorax characteristic (pl. 41, fig. 6). L3 absent. Setae q2 much larger than in other *Ricinus*. Two distinct blotches at outer mid-margins of sternal plate. Pleurites not pigmented to margin. Two long setae on pleurites IV–VIII. Setae of sternites as long as m4. Hourglass-shaped bloches on sternites II–VII, square-shaped blotch on sternite VIII, color golden. Pigmentation pattern characteristic. Nodi of head, thorax, and pleurites, the carinae of temples, labrum, and legs, and the male genitalia oxblood in color, background whitish.

Description.—Shape of head as in pl. 43, fig. 1; sides undulating; marginal carinae wide. Frons truncate with lateral margins angled anteromediad. Transverse carina convex. Setae m2 laterad and mediad to m1, m4 twice as long as pa series. Mandibles as in pl. 43, fig. 3. (Mandibles are particularly subject to alternation during mounting.) Labium with 13 pairs of setae, pattern as in pl. 43, fig. 2. Maxillary plates meet along midline separating mentum from gular plate; mentum small, equilateral in shape. Maxillary palpi genticuloid, barely reaching margin of head. Maxillary setae equal to mental setae. Sensilla associated with short setae a1 large, appear to be set in depressions; a6 absent. Setae po1 and po3 spinose, shorter than po2. Gular plate as in pl. 43, fig. 1; number of setae 1 × 2 to 3 × 3, average 2.1 × 2.1. Setae along antennal lappets number fewer than ten, 3 × 5 to 7 × 8, average 6.2 × 6.2.

Prothorax as in pl. 41, fig. 6; L3 absent. Prosternal and sternal plates as in pl. 41, fig. 6; sternal plate with two pairs of long setae and one short pair posteriad. Six setae in w series; w6 pilose. Setae q2 larger than in other species of *Ricinus*. Setae c3 slightly longer than c4. Coxa I with two long tactile setae; femur I with three tactile setae. Coxa II and femur III each with one tactile seta.

Terminal segments of female abdomen as in pl. 43, fig. 5. Pleurites not pigmented to margin. Chaetotaxy of ventral pleurites as given in table 4; two long setae on each pleurite on segments IV–VIII. Setae on sternites II–VI as long as m4. Hourglass-shaped golden markings on sternites II–VII, square-shaped mark on sternite VIII. Male genitalia as in pl. 43, fig. 4. Margin of mesosome entire; apices stout, each with four setae.

Pigmentation pattern characteristic. Two distinct blotches on outer margins of sternal plate. Nodi of head, thorax, and pleurites, the carinae of temples, labrum, and legs, and the male genitalia oxblood in color.

Dimensions.—From *Passerina* spp.: Females (n = 11): total length 3.96–4.55 (4.15); greatest width 1.13–1.22 (1.19); head length 0.77–0.87 (0.82); head width 0.74–0.86 (0.79); head index 100–106 (103); labral width 0.30–0.34 (0.32); prothoracic length 0.41–0.48 (0.44); prothoracic width 0.68–0.82 (0.74); distance between prosternals 72–96μ (83μ). Male (n = 1): TL, 3.42; GW, 0.98; HL, 0.71; HW, 0.68; HI, 105; LW, 0.29; PL, 0.35; PW, 0.63; distance between prosternals 80μ; width of genitalia 0.18. From *Cyanocompsa cyanea:* Females (n = 2): TL, 4.15, 4.21; GW, 1.20, 1.24; HL, 0.83; HW, 0.80; HI, 104; LW, 0.33, 0.35; PL, 0.42, 0.44; PW, 0.73, 0.77; distance between prosternals 75μ, 96μ. From *Guiraca caerulea:* Females (n = 3): TL, 3.93–4.16 (4.08); GW, 1.11–1.20 (1.16); HL, 0.74–0.80 (0.78); HW, 0.74–0.80 (0.78); HI, 100–101 (100); LW, 0.32–0.34 (0.33); PL, 0.41–0.42 (0.41); PW, 0.69–0.74 (0.72); distance between prosternals 72–88μ (82μ). Male (n = 1): TL, 3.23; GW, 0.95; HL, 0.68; HW, 0.65; HI, 105; LW, 0.29; PL, 0.34; PW, 0.60; distance between prosternals 72μ; width of genitalia 0.20.

Distribution.—Known from species of three genera, *Passerina, Guiraca,* and *Cyanocompsa,* in subfamily Richmondeninae, family Fringillidae.

Material examined.—From *Passerina versicolor* (Bonaparte): lectotype ♀, paralectotype ♀ (VLK 342a) from Cameron Co., Texas, in 1896 by V. L. Kellogg. From *Passerina cyanea* (Linnaeus): 2 ♀ (VLK 976b) from Paso Robles, California, in 1899 by B. Chapman; 2 ♀ (LSU) from Pointe Coupee Parish, E. Atchafalaya Spillway, Louisiana, on 2 April 1962 by Adams and Sanford; 1 ♀ (CU) from State College, Mississippi, on 26 June 1943 by H. E. Stafford; 1 ♀ (USNM) from Hinsdale, New Hampshire, on 26 May 1936; 1 ♂ (CU) from Huyck Preserve, Albany Co., New York, on 19 July 1964; 1 ♀ (USNM) from Philadelphia, Pennsylvania, on 18 May 1936 by A. M. Stabler. From *Passerina amoena* (Say): 1 ♀ (USNM) from Sioux Co., Nebraska, on 3 June 1901 by M. A. Carriker, Jr. From *Passerina ciris* (Linnaeus): 2 ♀ (BMNH 11179) from Yucatan, Mexico, by R. Meinertzhagen. From *Cyanocompsa cyanea* (Linnaeus): 1 ♀ (USNM) from El Cayo, British Honduras, on 31 March 1926 by E. G. Holt; 1 ♀ (BMNH 1961–489) from Prov. Chiquitos, Dt. Santa Cruz, Bolivia. From *Guiraca caerulea* (Linnaeus): 1 ♂, 1 ♀ (KCE) from State College, Mississippi, on 23 July 1934 by H. E. Stafford; 2 ♀ (KCE) from Stillwater, Oklahoma, on 5 June 1948 by K. C. Emerson. From *Passerculus sandwichensis* (Gmelin), mislabeling error (?): 1 ♀ (USNM) from Lincoln, Nebraska, on 18 April 1901 by M. A. Carriker, Jr. From *Trogon melanurus macrourus* Gould, error: 1 ♀ (USNM 68782, holotype of *Ricinus orbifrons*) from La Goajira, Venezuelan Sierra Perija, W of Carraipia, Colombia, on 10 June 1941 by M. A. Carriker, Jr.

Species inquirendae

Ricinus alphaaurigae Eichler, 1956

Ricinus alpha-aurigae Eichler, 1956. *In* Niethammer, Bonn. zool. Beitr., 7:104, (*non*) Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:45. Type locality: Bolivia. Type host: *Lessonia rufa oreas* Sclater and Salvin.

Eichler (1956) described *R. alphaaurigae* from one male and one female specimen collected from *Lessonia rufa oreas* Sclater and Salvin in Bolivia. His description is inadequate for identification and the type is unavailable to me. Until an adequate description or figure is available or the type is examined, this is a

species inquirendae. Eichler indicated that it was most similar to *R. frenatus* (Burmeister) and *R. expeditionis* Eichler (now *R. invadens* (Kellogg)). It was distinguished from these by the concave sides of the head produced by the broadened clypeus and expanded temples.

Carriker (1964) included *R. alphaaurigae* in his key, taking the differentiating characters from one female specimen collected from *Lessonia rufa rufa* in Fortin Campero, Bolivia, on September 19, 1936. The head of this specimen has straight rather than concave sides, and the clypeus (= frons) and temples are not expanded. Therefore it is unlikely that the specimens of Eichler and Carriker are conspecific.

Ricinus cherriei (Durrant, 1906)

Physostomum cherriei Durrant, 1906*b*. Ohio Nat. 7:36–37, fig. 1e, f.; Kellogg, 1908, Wytsman's Genera Insectorum, 66:71. Type host: not designated. Type locality: not recorded. Hosts: *Melozone (kieneri) cabanisi* Sclater and Slavin and *M. leucotis* Cabanis.

Ricinus cherriei (Durrant), Harrison, 1916. Parasit. 9:66; Hopkins and Clay, 1952, Checklist of Mallophaga, 325.

Durrant (1906) described *Physostomum cherriei* from seven specimens: four females from *Melozone cabanisi* and two males and one female from *M. leucotis.* These specimens have not been located at Ohio State University, Cornell University, in the V. L. Kellogg collections, or in the collections of the U. S. National Museum. They are assumed to be lost.

Durrant compared *R. cherriei* to *R. subangulatus* (Carriker) and *R. subhastatus* (Durrant). It resembles these species in general shape, but differed in markings, details of shape, and size. Although the description was long and figures were included, no good diagnostic characters were given. Therefore this species is designated as *species inquirendae.*

Ricinus muscisaxicolae Eichler, 1956

Ricinus muscisaxicolae Eichler, 1956. *In* Niethammer, Bonn. zool. Beitr. 7:103. Type locality: Bolivia. Type host: *Muscisaxicola maculirostris maculirostris* Sclater.

Eichler (1956) described *R. muscisaxicolae* from one male and one female specimen from *Muscisaxicola m. maculirostris.* Unfortunately his description gives no clues to its identification. It presents two characters which do not distinguish this species from other species of *Ricinus.* Also, it is compared with another species described in the same paper which is equally unidentifiable from the description given. I have not been able to obtain the types of this species. Until a clear description and figures are presented, this species is considered *species inquirendae.*

Ricinus praetextus (Nitzsch, 1874)

Physostomum praetextum Nitzsch, 1874. *In* Giebel, Insecta epizoa, 257; Piaget, 1880, Les Pediculines, 606; Kellogg, 1908, Wytsman's Genera Insectorum, 66:72.

Ricinus praetextus (Nitzsch). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 327. Type locality: "From a dried museum skin in Berlin." Type host: *Campylops mexicanus* (now *Diglossa baritula* Wagler).

Physostomum praetextum Nitzsch was published posthumously by Giebel (1874) from Nitzsch's handwritten description. The type and only specimen was collected from *Campylops mexicanus* (now *Diglossa baritula* Wagler). The description was inadequate for identification and no figure was published. Furthermore, the type has been destroyed. Specimens are needed from the type host for identification and designation of a neotype. Dr. D. P. Furman attempted to obtain specimens from *Diglossa* in Venezuela, but found only egg cases, which are identified as belonging to *Ricinus.* At present this species must be considered *species inquirendae.*

When specimens of *R. praetextus* are obtained, they should provide interesting data on the family position of *Diglossa. Diglossa* has been placed traditionally in Coerebidae, but Beecher (1951) presented evidence that Coerebidae was an artificial family. Genera included herein were specialized members of two families, Parulidae and Thraupidae, which have undergone similar morphological changes due to adaptation to a common mode of feeding. Beecher (1951) included *Diglossa* in Thraupidae. If Mallophaga indeed can be used to indicate relationships of their hosts, then *R. praetextus* should show evidence that suggests support for either Beecher's or the traditional family allocation of the genus *Diglossa.* Atyeo and Braasch (1966) found that the distribution of species of *Proctophyllodes* on various genera of Coerebidae supported Beecher's allocation of these genera into the above-mentioned families.

Ricinus tanagraephilus Eichler, 1956

Ricinus tanagraephilus Eichler, 1956. *In* Niethammer, Bonn. zool. Beitr. 7:133. Type locality: Peru. Type host: *Tanagra laniirostris hypoxantha* Von Koepcke.

(*non*) *Ricinus tanagraephilus* Eichler. Carriker, 1964, Mem. Soc. Cienc. Nat. La Salle 24:50–51, fig. 3b.

Eichler (1956) described *R. tanagraephilus* from one female specimen collected from *Tanagra laniirostris hypoxantha,* but his description is inadequate for identification. This name is designated as *species inquirandae.*

Carriker (1964) redescribed *R. tanagraephilus* from one female specimen presumably taken by him from *Tanagra laniirostris crassirostris* from Las Quiguas, Carobobo, Venezuela, on September 10, 1910. Carriker compared his specimen with his new species *R. tuberculifer* (now *R. marginatus*). This specimen was examined and found to be in poor shape, being extremely shriveled and discolored. It differs from any known specimen from Thraupidae in lacking a strongly ornamented ovoid sclerite. The other characters that are visible are reminiscent of *R. marginatus:* the presence of a spinose seta on the posterodorsal surface of coxa I, the small tentorial nodi, the shape of the mandibular tips and prothorax, and the presence of three pairs of long setae on the sternal plate. It appears to me that Carriker's redescription and figure actually represent a distorted specimen of *R. marginatus.* If this is true the host was probably some species of Tyrannidae rather than Thraupidae.

Nomen dubium

Ricinus nigrolimbatus (Mjöberg, 1910)

Physostomum nigrolimbatum Mjöberg, 1910. Ark. Zool. 6(13):58–60, pl. 2, fig. 3. Type locality: Jinretlen. Type host: *Sylvicola* sp. or *Calamoherpe* sp.

Ricinus nigrolimbatus (Mjöberg). Harrison, 1916, Parasit. 9:67; Hopkins and Clay, 1952, Checklist of Mallophaga, 327; Rheinwald, 1968, Mitt. Hamburg. Zool. Mus. Inst. 65:302 (*nomen dubium*).

Mjöberg (1910) described this specimen from one female taken from *Sylvicola* sp. or *Calamoherpe* sp. in Jinretlen on May 5, 1879, by Dr. Stuxberg. Hopkins and Clay (1952) assumed that the correct host was probably an *Acrocephalus* sp. After examination of the type, Rheinwald (1968) stated that he could not find any known

species in the Old World that compared with *R. nigrolimbatus*. Dr. Kjellander of the Swedish Museum of Natural History kindly sent me the type.

The condition of this specimen, which is overcleared and distorted, is so poor that identification is not possible beyond placement in the *marginatus* species group. Since identification of the type and type host cannot be made, appeal will be submitted to the International Commission of Zoological Nomenclature for inclusion in the Official Index of Rejected and Invalid Names in Zoology as a *nomen dubium*.

HOST DISTRIBUTION LIST

The following host list includes only New World birds and two introduced Old World birds. The family classification follows Wetmore (1960). Nomenclature of the avian hosts follows that of the AOU check-list for North American birds (1957), the Mexican check-list for Central American birds (1957), and De Schauensee (1966) for South American birds. Subspecific names are not included, since it is not feasible to determine the correct subspecific names from geographical information on slide labels. Furthermore, there are no data available to support specific relationships of *Ricinus* with subspecies of hosts. Nonspecific records and records considered to be of stragglers or contaminants are omitted.

When no asterisk occurs before the names of *Ricinus* the host association of that species has been repeatedly confirmed by few to many collections. Names preceded by one asterisk (*) are from a single collection. Names preceded by two asterisks (**) are records of host association taken from the literature which have not been personally verified.

Order Passeriformes
Suborder Tyranni
Family Cotingidae
Rhytipterna simplex (Lichtenstein, 1823)—**Ricinus arcuatus*
Pachyrhamphus rufus (Boddaert, 1783)—**Ricinus arcuatus*
Pachyrhamphus polychopterus (Vieillot, 1818)—**Ricinus arcuatus*
Platypsaris aglaiae (Lafresnaye, 1839)—**Ricinus marginatus*
Tityra cayana (Linnaeus, 1766)—**Ricinus brevicapitis*
Tityra semifasciata (Spix, 1825)—**Ricinus brevicapitis*
Family Pipridae
Pipra erythrocephala (Linnaeus, 1758)—*Ricinus pessimalis, Ricinus invadens*
Pipra chloromeros Tschudi, 1844—***Ricinus pessimalis, **Ricinus invadens*
Chiroxiphia lanceolata (Wagler, 1830)—**Ricinus pessimalis, Ricinus invadens*
Manacus manacus (Linnaeus, 1766)—*Ricinus pessimalis*
Machaeropterus regulus (Hahn, 1819)—**Ricinus invadens*
Family Tyrannidae
Tyrannus tyrannus (Linnaeus, 1758)—*Ricinus arcuatus, Ricinus marginatus*
Tyrannus dominicensis (Gmelin, 1788)—*Ricinus arcuatus, Ricinus marginatus*
Tyrannus melancholicus Vieillot, 1819—**Ricinus arcuatus, Ricinus marginatus*
Tyrannus verticalis Say, 1823—*Ricinus arcuatus*
Tyrannus vociferans Swainson, 1826—*Ricinus arcuatus, Ricinus marginatus*
Muscivora tyrannus (Linnaeus, 1766)—*Ricinus arcuatus*
Muscivora forficata (Gmelin, 1789)—*Ricinus marginatus*
Pitangus sulphuratus (Linnaeus, 1766)—*Ricinus arcuatus*
Myiozetetes similis (Spix, 1825)—**Ricinus leptosomus, *Ricinus marginatus*
Myiozetetes cayanensis (Linnaeus, 1766)—**Ricinus marginatus*
Myiarchus tyrannulus (Müller, 1776)—**Ricinus marginatus*
Myiarchus crinitus (Linnaeus, 1758)—**Ricinus myiarchi, *Ricinus marginatus*

Myiarchus tuberculifer (d'Orbigny and Lafresnaye, 1837)—***Ricinus leptosomus, *Ricinus marginatus*
Myiarchus cinerascens (Lawrence, 1851)—*Ricinus leptosomus*
Myiarchus magnirostris (Gray, 1841)—**Ricinus marginatus*
Sayornis phoebe (Latham, 1790)—*Ricinus marginatus*
Sayornis saya (Bonaparte, 1825)—*Ricinus sucinaceus*
Empidonax sp.—*Ricinus sucinaceus*
Empidonax traillii (Audubon, 1828)—*Ricinus sucinaceus, Ricinus marginatus*
Empidonax minimus (Baird and Baird, 1843)—*Ricinus marginatus*
Empidonax wrighti Baird, 1858—**Ricinus marginatus*
Empidonax difficilis Baird, 1858—*Ricinus sucinaceus, *Ricinus marginatus*
Contopus virens (Linnaeus, 1766)—**Ricinus marginatus*
Contopus sordidulus Sclater, 1859—*Ricinus marginatus*
Pyrocephalus rubinus (Boddaert, 1783)—*Ricinus marginatus*
Myiobius atricaudus Lawrence, 1863—**Ricinus sucinaceus*
Myiophobus flavicans (Sclater, 1860)—**Ricinus flavicans*
Elainea flavogaster (Thunberg, 1822)—***Ricinus sucinaceus, Ricinus* sp.
Suborder Passeres
Family Alaudidae
Alauda arvensis Linnaeus, 1758—***Ricinus serratus*
Eremophila alpestris (Linnaeus, 1758)—*Ricinus serratus*
Family Paridae
Parus atricapillus Linnaeus, 1766—*Ricinus fringillae*
Family Sittidae
Sitta carolinensis Latham, 1790—**Ricinus diffusus*
Sitta canadensis Linnaeus, 1766—**Ricinus sittae*
Family Turdidae
Turdus migratorius Linnaeus, 1766—*Ricinus elongatus*
Family Regulidae
Polioptila plumbea (Gmelin, 1788)—**Ricinus polioptilus*
Regulus calendula (Linnaeus, 1766—*Ricinus frenatus*
Family Motacillidae
Anthus spinoletta (Linnaeus, 1758)—*Ricinus japonicus*
Family Bombycillidae
Bombycilla garrulus (Linnaeus, 1758)—*Ricinus elongatus*
Family Vireonidae
Vireo griseus (Boddaert, 1783)—*Ricinus vireoensis*
Vireo bellii Audubon, 1844—**Ricinus vireoensis*
Vireo flavoviridis (Cassin, 1850)—**Ricinus vireoensis*
Vireo olivaceus (Linnaeus, 1766)—*Ricinus vireoensis*
Vireo crassirostris (Bryant, 1859)—**Ricinus vireoensis*
Family Parulidae
Protonotaria citrea (Boddaert, 1783)—*Ricinus pallens*
Vermivora pinus (Linnaeus, 1766)—**Ricinus picturatus*
Vermivora peregrina (Wilson, 1811)—**Ricinus picturatus*
Vermivora celata (Say, 1823)—*Ricinus picturatus*
Vermivora ruficapilla (Wilson, 1811)—**Ricinus picturatus*
Parula americana (Linnaeus, 1758)—**Ricinus picturatus*
Dendroica petechia (Linnaeus, 1766)—*Ricinus dendroicae*
Dendroica magnolia (Wilson, 1811)—**Ricinus dendroicae*
Dendroica coronata (Linnaeus, 1766)—**Ricinus dendroicae*
Dendroica virens (Gmelin, 1789)—**Ricinus dendroicae*
Dendroica fusca (Müller, 1776)—*Ricinus dendroicae*
Dendroica castanea (Wilson, 1810)—*Ricinus dendroicae*
Dendroica striata (Forster, 1772)—**Ricinus dendroicae*
Dendroica pinus (Wilson, 1811)—*Ricinus dendroicae*

Dendroica discolor (Vieillot, 1807)—*Ricinus dendroicae*
Dendroica palmarum (Gmelin, 1789)—**Ricinus dendroicae*
Seiurus noveboracensis (Gmelin, 1789)—*Ricinus seiuri*
Oporornis tolmiei (Townsend, 1839)—**Ricinus emersoni*
Geothlypis trichas (Linnaeus, 1766)—*Ricinus dalgleishi*
Chamaethlypis poliocephala (Baird, 1865)—**Ricinus mandibulatus*
Wilsonia canadensis (Linnaeus, 1766)—*Ricinus emersoni*

Family Ploceidae
Passer domesticus (Linnaeus, 1758)—**Ricinus fringillae*

Family Coerebidae
Dacnis cavana (Linnaeus, 1766)—***Ricinus australis*

Family Thraupidae
Tanagra xanthogastra (Sclater, 1851)—**Ricinus subangulatus*
Thraupis episcopus (Linnaeus, 1766)—**Ricinus subangulatus*
Thraupis palmarus (Wied, 1821)—*Ricinus subangulatus*
Ramphocelus carbo (Pallas, 1764)—*Ricinus ramphoceli*
Tachyphonus rufus (Boddaert, 1783)—**Ricinus complicatus*

Family Fringillidae
Subfamily Richmondeninae
Guiraca caerulea (Linnaeus, 1758)—**Ricinus australis*
Passerina cyanea (Linnaeus, 1766)—*Ricinus australis*
Passerina amoena (Say, 1823)—**Ricinus australis*
Passerina versicolor (Bonaparte, 1837)—*Ricinus australis*
Passerina ciris (Linnaeus, 1758)—**Ricinus australis*
Cyanocompsa cyanea (Linnaeus, 1758)—**Ricinus australis*
Volatinia jacarina (Linnaeus, 1758)—**Ricinus volatiniae*

Subfamily Carduelinae
Carpodacus mexicanus (Müller, 1776)—*Ricinus microcephalus*
Leucosticte tephrocotis (Swainson, 1831)—*Ricinus ivanovi*
Spinus pinus (Wilson, 1810)—**Ricinus carolynae*
Spinus notatus (DuBus, 1855)—**Ricinus carolynae*
Spinus psaltria (Say, 1823)—*Ricinus carolynae*

Subfamily Emberizinae
Chlorura chlorura (Audubon, 1839)—**Ricinus subhastatus*
Pipilo erythrophthalmus (Linnaeus, 1758)—**Ricinus fringillae, Ricinus subhastatus*
Pipilo fuscus Swainson, 1827—*Ricinus fringillae, Ricinus subhastatus*
Passerculus princeps Maynard, 1872—*Ricinus diffusus*
Passerculus sandwichensis (Gmelin, 1789)—*Ricinus diffusus*
Ammodramus savannarum (Gmelin, 1789)—**Ricinus diffusus*
Ammospiza maritima (Wilson, 1811)—**Ricinus diffusus*
Pooecetes gramineus (Gmelin, 1789)—*Ricinus fringillae*
Aimophila ruficeps (Cassin, 1852)—**Ricinus wolfi*
Aimophila aestivalis (Lichtenstein, 1823)—*Ricinus wolfi*
Amphispiza bilineata (Cassin, 1850)—*Ricinus fringillae*
Amphispiza belli (Cassin, 1850)—*Ricinus fringillae, *Ricinus subdiffusus*
Junco aikeni Ridgway, 1873—***Ricinus fringillae*
Junco hyemalis (Linnaeus, 1758)—*Ricinus fringillae*
Junco oreganus (Townsend, 1837)—*Ricinus fringillae, *Ricinus diffusus*
Junco phaeonotus Wagler, 1831—**Ricinus fringillae*
Spizella arborea (Wilson, 1810)—*Ricinus fringillae, Ricinus diffusus*
Spizella passerina (Bechstein, 1798)—*Ricinus fringillae, *Ricinus diffusus, *Ricinus subdiffusus*
Spizella breweri Cassin, 1856—**Ricinus fringillae, *Ricinus subdiffusus*
Spizella pusilla (Wilson, 1810)—**Ricinus subdiffusus*
Zonotrichia querula (Nuttal, 1840)—*Ricinus fringillae*

Zonotrichia leucophrys (Forster, 1772)—*Ricinus fringillae, Ricinus diffusus*
Zonotrichia atricapilla (Gmelin, 1789)—*Ricinus fringillae, Ricinus diffusus*
Zonotrichia albicollis (Gmelin, 1789)—*Ricinus fringillae, Ricinus diffusus*
Passerella iliaca (Merrem, 1786)—**Ricinus fringillae, Ricinus diffusus*
Melospiza lincolni (Audubon, 1834)—**Ricinus diffusus*
Melospiza georgiana (Latham, 1790)—*Ricinus diffusus*
Melospiza melodia (Wilson, 1810)—*Ricinus fringillae, Ricinus diffusus*
Calcarius lapponicus (Linnaeus, 1758)—*Ricinus calcarii*
Calcarius ornatus (Townsend, 1837)—*Ricinus calcarii*
Plectrophenax nivalis (Linnaeus, 1758)—***Ricinus fringillae, *Ricinus diffusus, Ricinus thoracicus*
Plectrophenax hyperboreus Ridgway, 1884—**Ricinus fringillae*

SUMMARY

Species of *Ricinus* (Mallophaga: Amblycera) that are ectoparasites of passerine birds in the New World are revised. The genus occurs on members of 28 of the 70 families of Passeriformes. A reliet distribution is indicated.

Little biological information is available for species of *Ricinus*. Rates of incidence and infestation usually are low, at least in California. Observations that are available indicate an apparent concordance in the reproductive seasons of the lice and their hosts. "Preferred" ovipositional sites are demonstrated. Hematophagia as an exclusive method of feeding is strongly suggested by piercing-sucking mouthparts and the presence of blood in the gut. An investigation of the zoonotic role of species of *Ricinus* is needed.

A historical review of the extreme confusion that has surrounded the status of the name *Ricinus* and that of its type species *R. fringillae* is presented. Their status is now fixed and accepted through the declaration of Opinion 627 by the International Commission of Zoological Nomenclature.

The external morphology of the species of *Ricinus* is described, with emphasis on the salient features used in defining and recognizing species. A system of chaetotaxy is erected. Measurements of various structures are of little use in defining species because of presence of much intraspecific variation and apparent host-induced variation. Characters found to have diagnostic value are the shape of structures, the pigmentation pattern, and the chaetotaxy. A species is defined on the basis of multiple characters.

A hypothetical phylogeny is proposed for the genus *Ricinus* and its species, based upon modifications of several structures found on extant forms. Changes in the structure of the labium, labrum, mandibles, tentorium, and thorax among others demonstrate the *Ricinus* is a specialized genus in the suborder Amblycera. Specializations exhibited within the genus indicate that *Ricinus* had undergone two separate radiations, interspersed by a period of decline.

The genus is redescribed and divided into eight species groups. Thirty-eight species are considered valid. Twenty-five specific and subspecific names are judged synonyms. Five names are designated *species inquirendae*. *Ricinus nigrolimbatus* (Mjöberg, 1910) is designated *nomen dubium*. Twenty-four species are redescribed, of which four, *R. arcuatus*, *R. fringillae*, *R. marginatus*, and *R. sucinaceus*, are given *sensu lato* status. Fourteen new species are described: *R. calcarii*, *R. carolynae*, *R. dalgleishi*, *R. dendroicae*, *R. emersoni*, *R. mandibulatus*, *R. myiarchi*, *R. seiuri*, *R. sittae*, *R. subdiffusus*, *R. vireoensis*, *R. volatiniae*, and *R. wolfi*.

Certain species of *Ricinus* show host specificity at the specific, generic, and family level. Certain species groups show host specificity at the family, superfamily, or subordinal level. These forms are found useful in deducing probable host phylogeny. Other species and species groups are distributed so anomalously that no correlation is apparent between the evolution of the lice and their hosts. It is proposed that secondary transfers have occurred, obscuring any phylogenetic relationship. The potential for and occurrence of secondary transfer are discussed and shown to be more common than previously realized. A seemingly anomalous distribution of a louse on two or more species of host probably indicates an ecological relationship for the hosts involved.

Several cases are resolved in which two and, rarely, three species of *Ricinus* regularly occur on the same host species. This synoxenic distribution follows no geographical or taxonomic pattern.

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INDEX

Only nominal taxa of the Mallophaga are included. Names of lice given in the distribution list (beginning on p. 112 and following) are omitted. Inclusion in keys is indicated by page numbers in italics.

PLATES

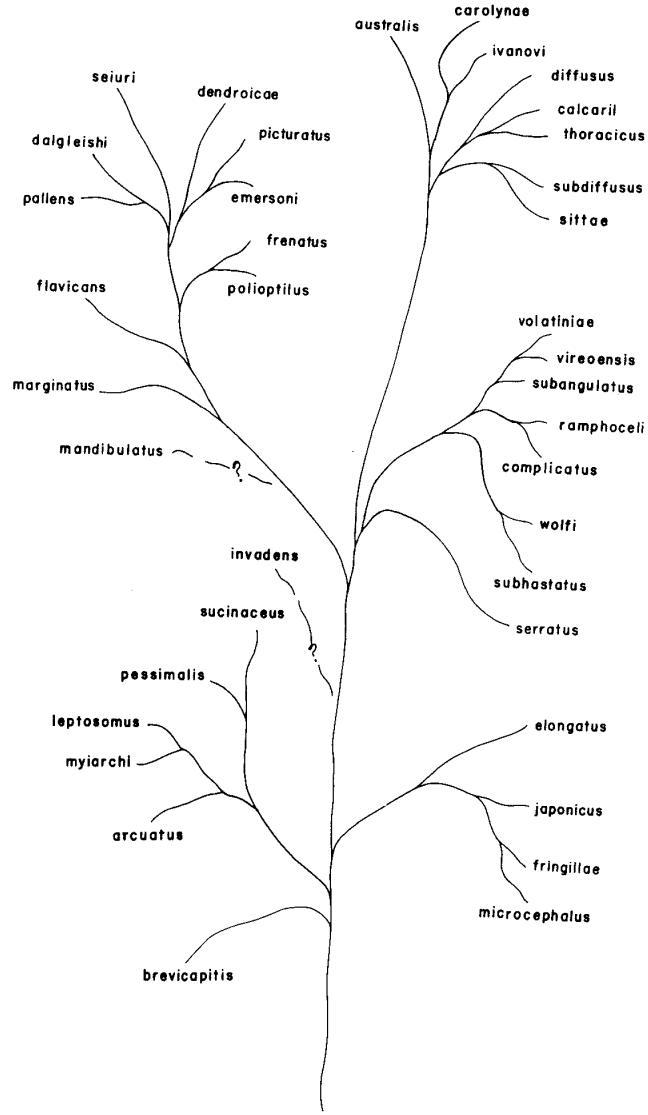
Each plate is accompanied by a detailed legend. Figures of the head and terminal segments of females are dorsoventral views. Figures of the thorax are ventrodorsal views. The abbreviations and series of chaetotaxy are given below. The plate and figure following each abbreviation or series of setae indicate where that structure or series is first labeled.

ABBREVIATIONS

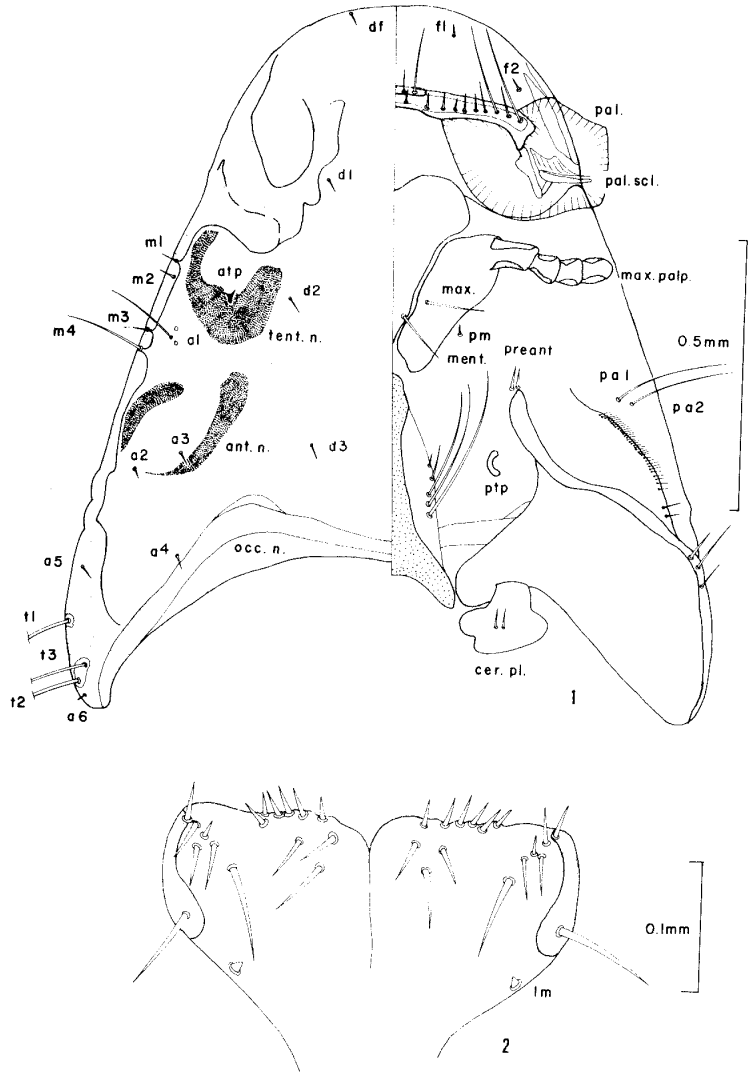
ant. labr.	anterior labrals	pl. 4, fig. 1
ant. lap.	antennal lappet	pl. 18, fig. 1
ant. n.	antennal nodus	pl. 2, fig. 1
atp.	anterior tentorial pit	pl. 2, fig. 1
b. p.	basal plate	pl. 5, fig. 2
cer. pl.	cervical plate	pl. 2, fig. 1
dps.	dorsal pleural setae	pl. 3, fig. 3
gul. pl.	gular plate	pl. 4, fig. 1
labr.	labrum	pl. 13, fig. 1
lm.	labiomental seta	pl. 2, fig. 2
lun. n.	lunar nodus	pl. 15, fig. 1
mar. carn.	marginal carina	pl. 10, fig. 1
max.	maxillary seta	pl. 2, fig. 1
max. palp.	maxillary palpus	pl. 2, fig. 1
max. pl.	maxillary plate	pl. 16, fig. 1
ment.	mental seta	pl. 2, fig. 1
mes.	mesosome	pl. 5, fig. 2
occ. n.	occipital nodus	pl. 2, fig. 1
ov. scl.	ovoid sclerite	pl. 16, fig. 2
pal.	palette	**pl. 2, fig. 1**
pal. scl.	palettal sclerite	pl. 2, fig. 1
para.	paramere	pl. 5, fig. 2
pl. n.	pleural nodus	pl. 5, fig. 1
pm.	paramaxillary seta	pl. 2, fig. 1
post. labr.	posterior labrals	pl. 4, fig. 1
p. p. s.	preputial sac	pl. 5, fig. 2
preant.	preantennal seta	pl. 2, fig. 1
prst. pl.	prosternal plate	pl. 3, fig. 1
prst. s.	prosternal setae	pl. 3, fig. 1
p. s. s.	postspiracular seta	pl. 3, fig. 3
ptp.	posterior tentorial pit	pl. 2, fig. 1
sc.	sternocentral	pl. 3, fig. 3
sen.	sensillum	pl. 3, fig. 3
sl.	sternolateral	pl. 3, fig. 3
spir.	spiracle	pl. 3, fig. 3
st. pl.	sternal plate	pl. 3, fig. **1**
temp.	temple	pl. 13, fig. **1**
ten. n.	tentorial nodus	pl. 2, fig. **1**
terg.	tergal setae	pl. 5, fig. **1**
term. s.	terminal setae	pl. 3, fig. 3
tr. carn.	transverse carina	pl. 18, fig. 1
vps.	ventral pleural setae	pl. 3, fig. 3
vul.	vulval setae	pl. 5, fig. **1**

SERIES OF SETAE

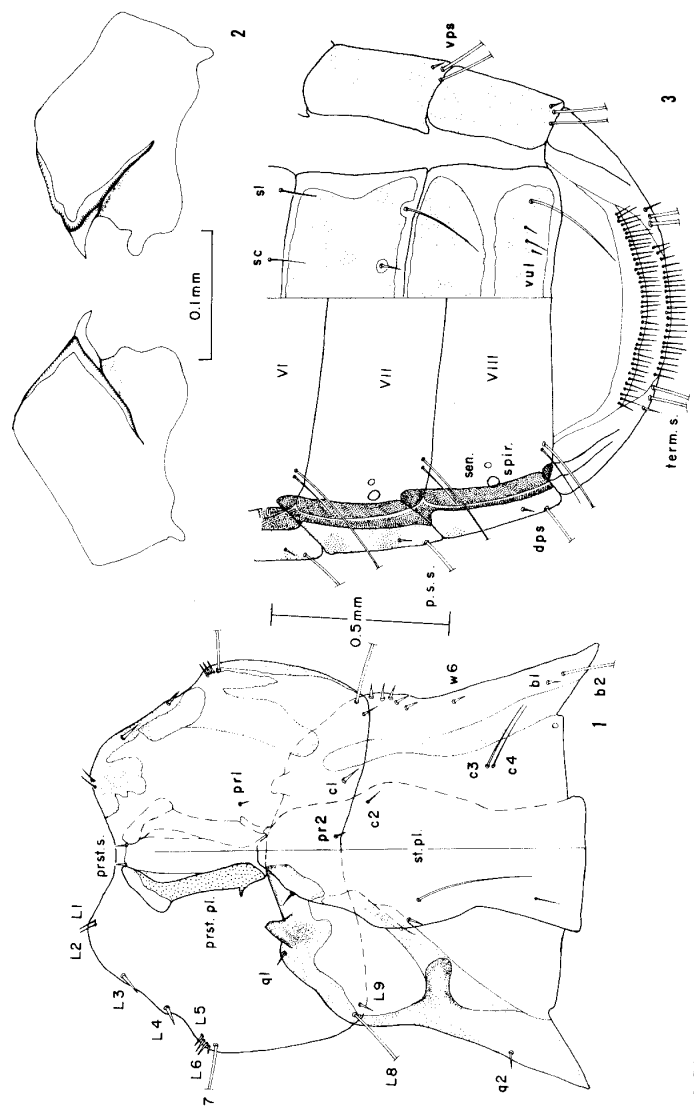
PLATES



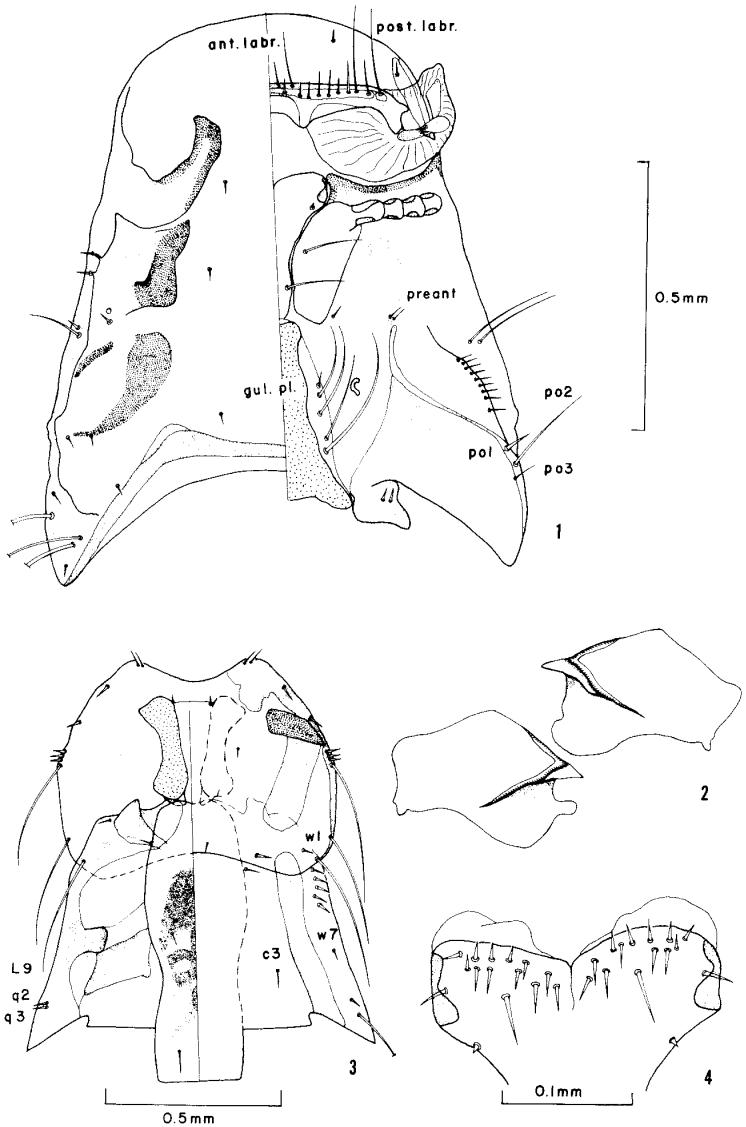
Pl. 1. Dendrogram showing proposed hypothetical phylogeny of species of *Ricinus* occurring in the New World.



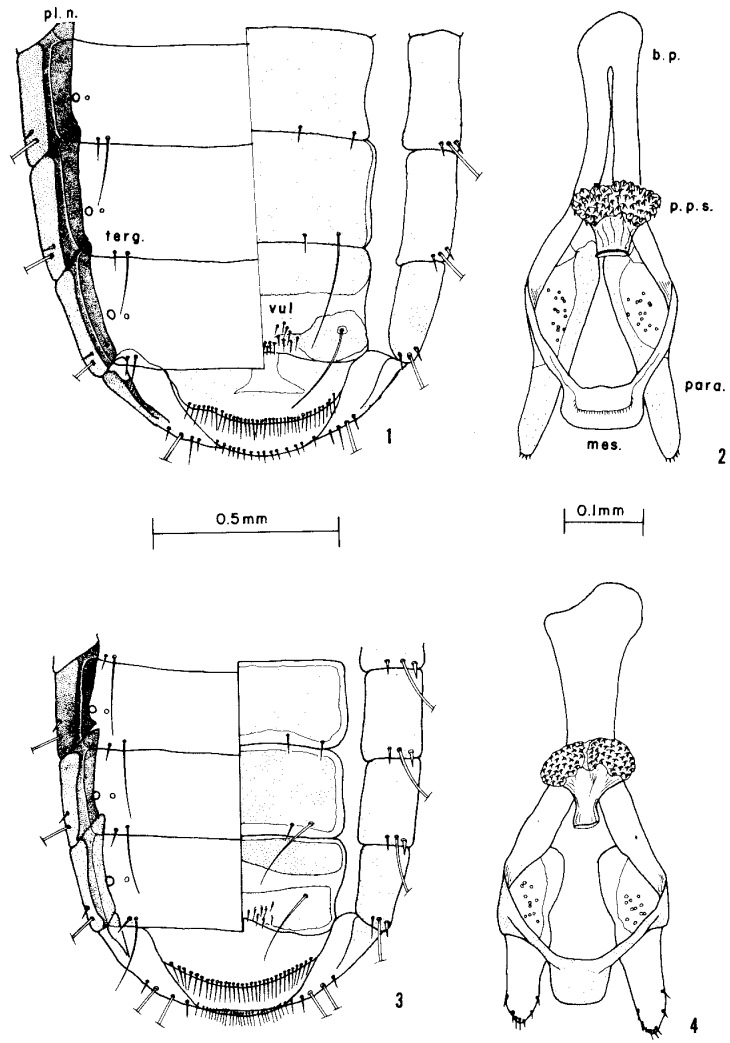
Pl. 2. *Ricinus brevicapitis* Carriker. Fig. 1, head. Fig. 2, labium.



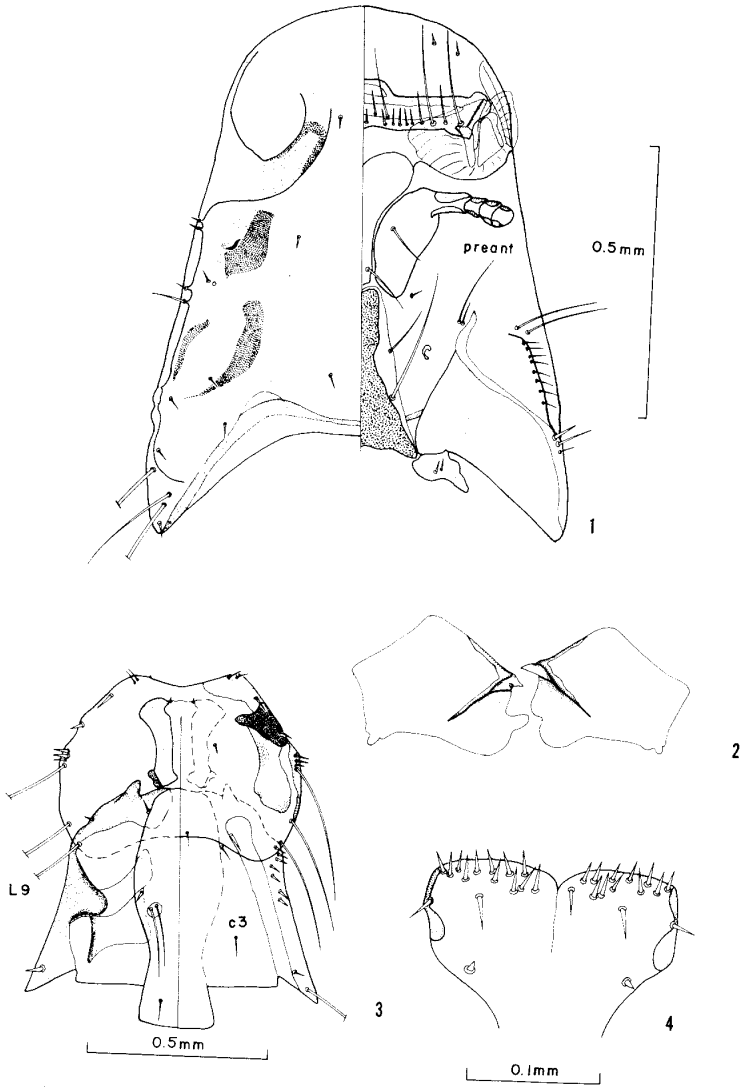
Pl. 3. *Ricinus brevicapitis* Carriker. Fig. 1, thorax. Fig. 2, mandibles (right and left mandibles are reversed). Fig. 3, terminal segments of female abdomen.



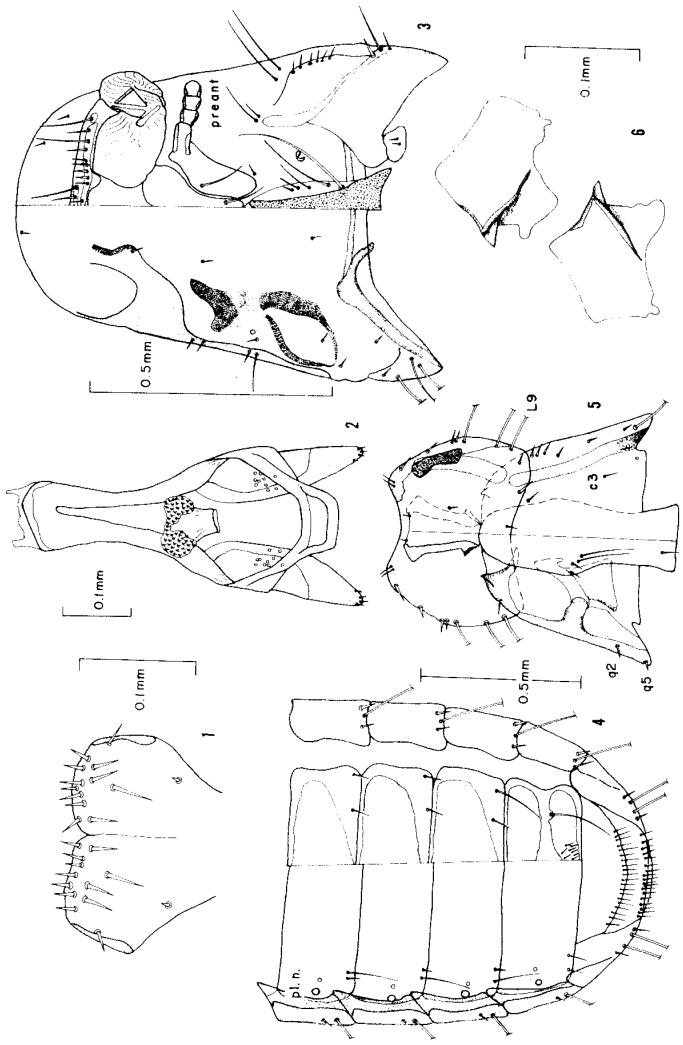
Pl. 4. *Ricinus arcuatus* (Kellogg and Mann). Fig. 1, head. Fig. 2, mandibles (left mandible below; right mandible above). Fig. 3, thorax. Fig. 4, labium.



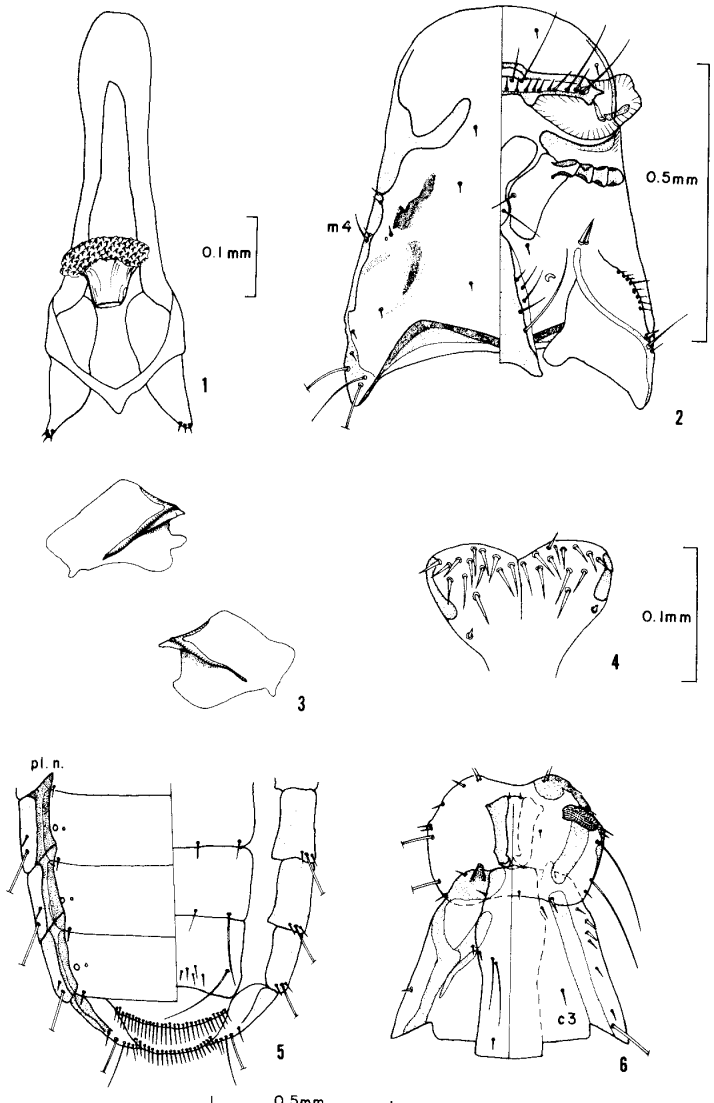
Pl. 5. *Ricinus arcuatus* (Kellogg and Mann). Fig. 1, terminal segments of female abdomen. Fig. 2, male genitalia. *R. myiarchi* n. sp. Fig. 3, terminal segments of female abdomen. Fig. 4, male genitalia.



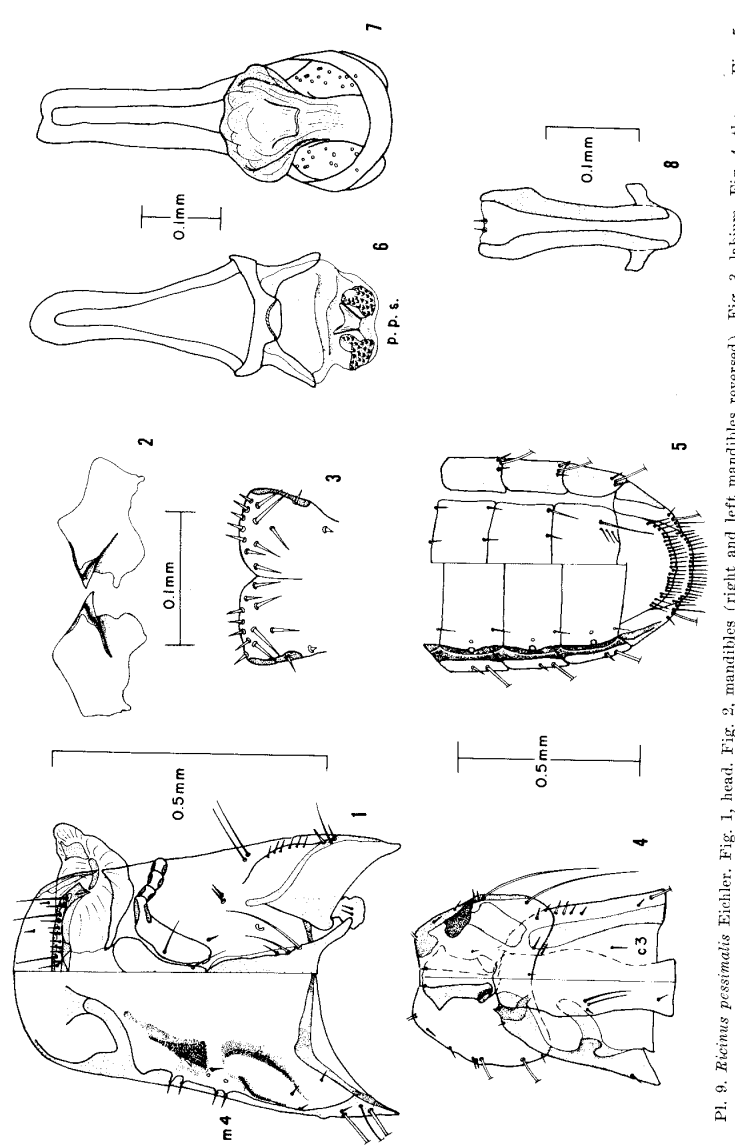
Pl. 6. *Ricinus myiarchi* n. sp. Fig. 1, head. Fig. 2, mandibles. Fig. 3, thorax. Fig. 4, labium.



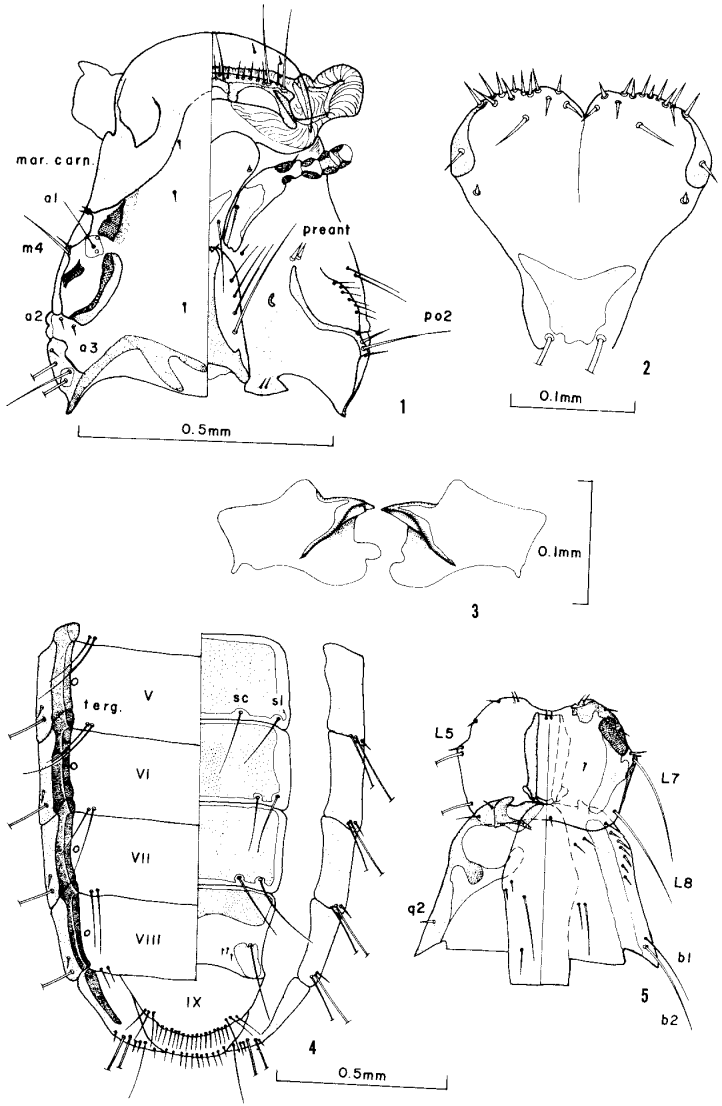
Pl. 7. *Ricinus leptosomus* (Carriker). Fig. 1, labium. Fig. 2, male genitalia. Fig. 3, head. Fig. 4, terminal segments of female abdomen. Fig. 5, thorax. Fig. 6, mandibles (left mandible above; right mandible below).



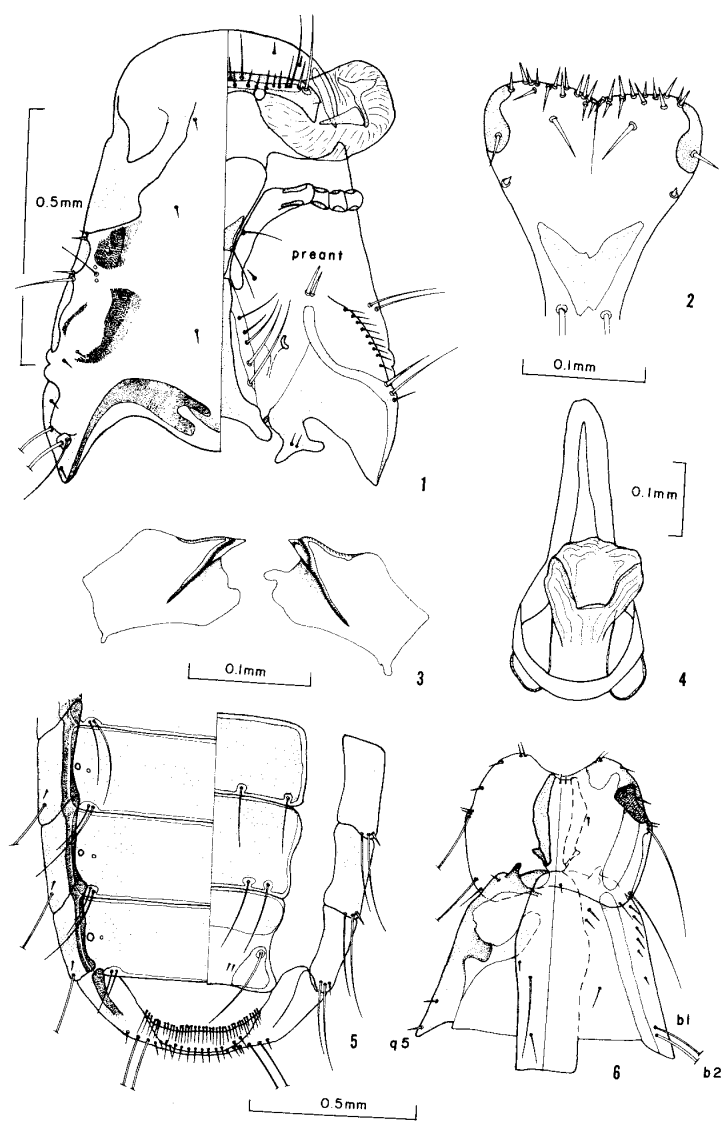
Pl. 8. *Ricinus sucinaccus* (Kellogg). Fig. 1, male genitalia. Fig. 2, head. Fig. 3, mandibles (left mandible above; right mandible below). Fig. 4, labium. Fig. 5, terminal segments of female abdomen. Fig. 6, thorax.



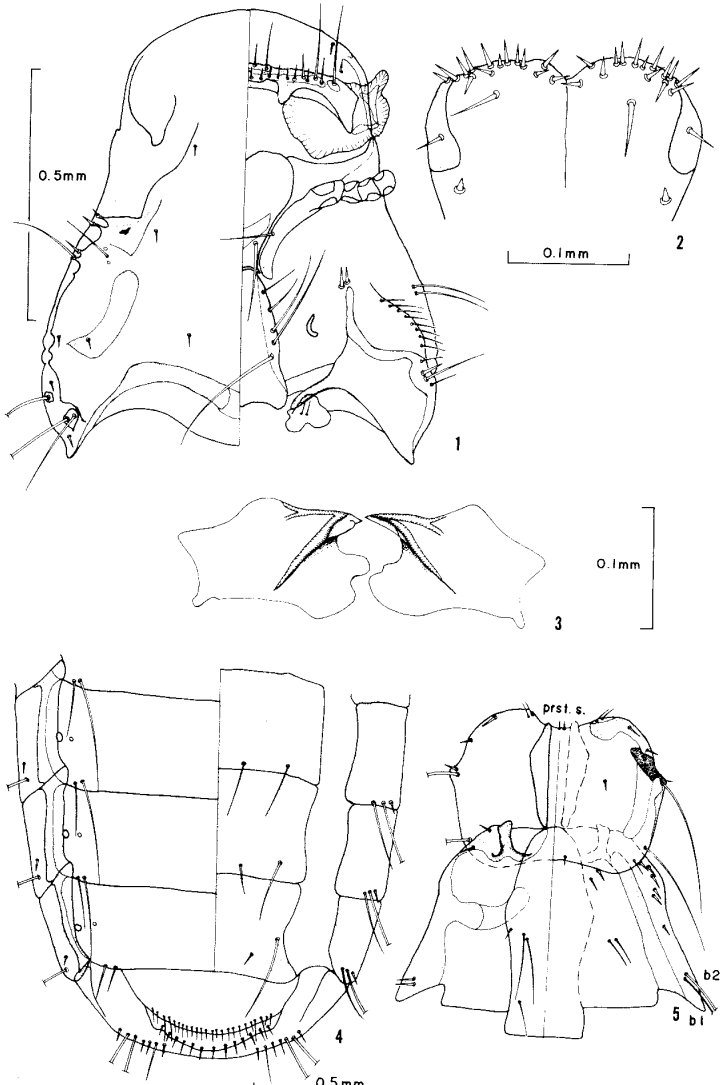
Pl. 9. *Ricinus pessimatis* Eichler. Fig. 1, head. Fig. 2, mandibles (right and left mandibles reversed). Fig. 3, labium. Fig. 4, thorax. Fig. 5, terminal segments of female abdomen. Fig. 6, male genitalia with preputial sac everted. *R. fringillae* DeGeer. Fig. 7, male genitalia. Fig. 8, male prosternal plate.



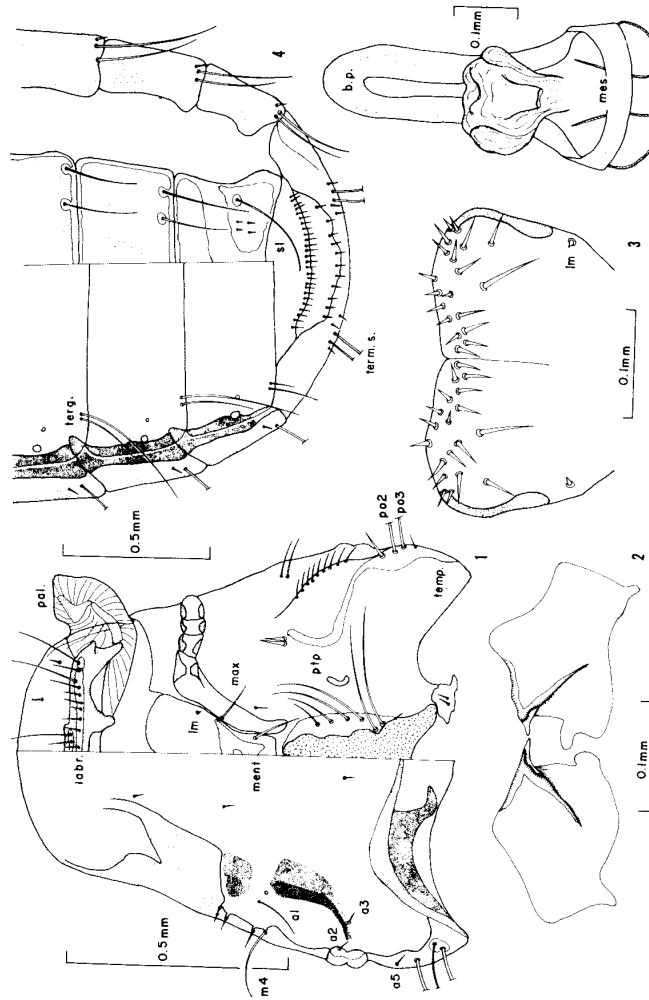
Pl. 10. *Ricinus fringillae* DeGeer. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, terminal segments of female abdomen. Fig. 5, thorax.



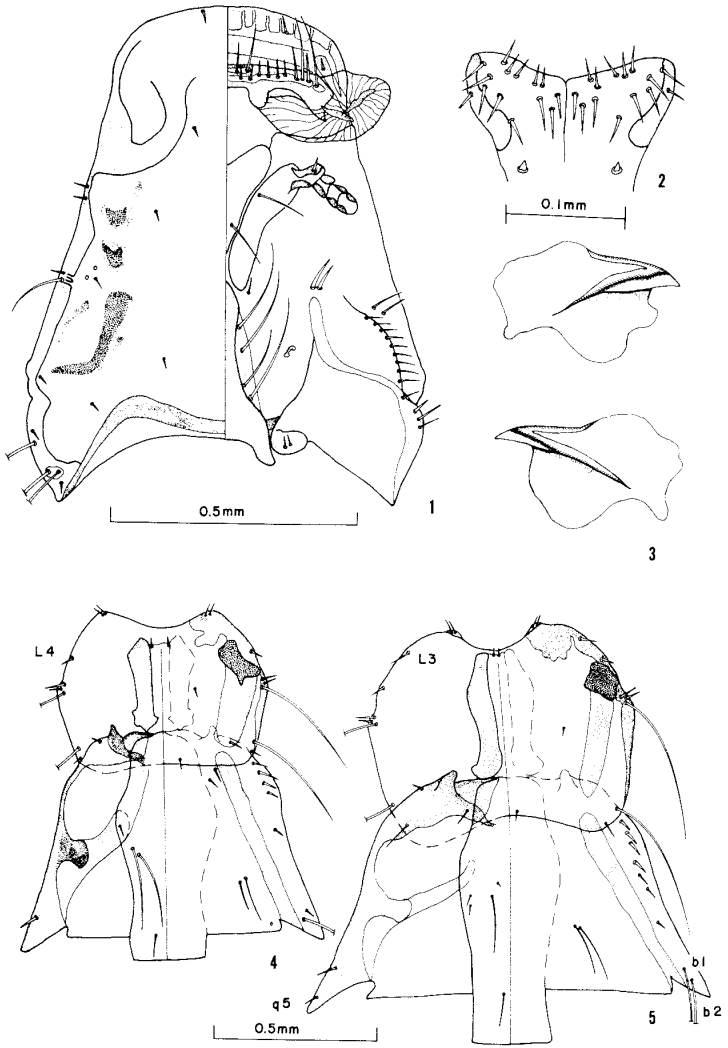
Pl. 11. *Ricinus japonicus* (Uchida). Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles (left and right mandibles are reversed). Fig. 4, male genitalia. Fig. 5, terminal segments of female abdomen. Fig. 6, thorax.



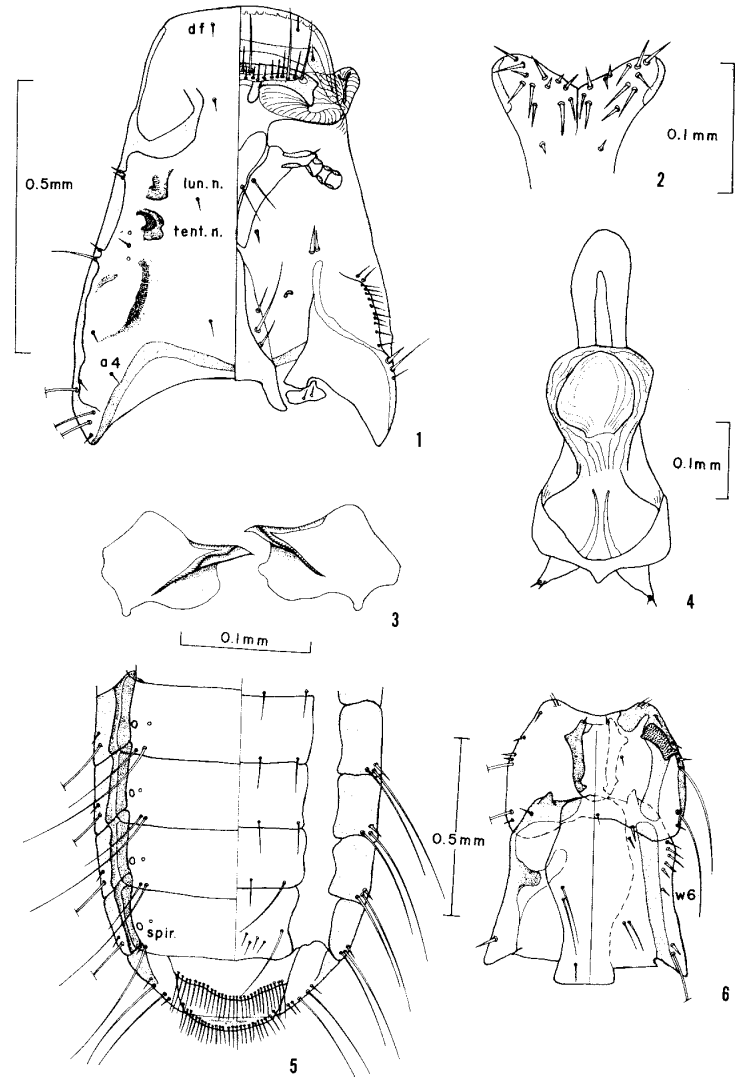
Pl. 12. *Ricinus microcephalus* (Kellogg). Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, terminal segments of female abdomen. Fig. 5, thorax.



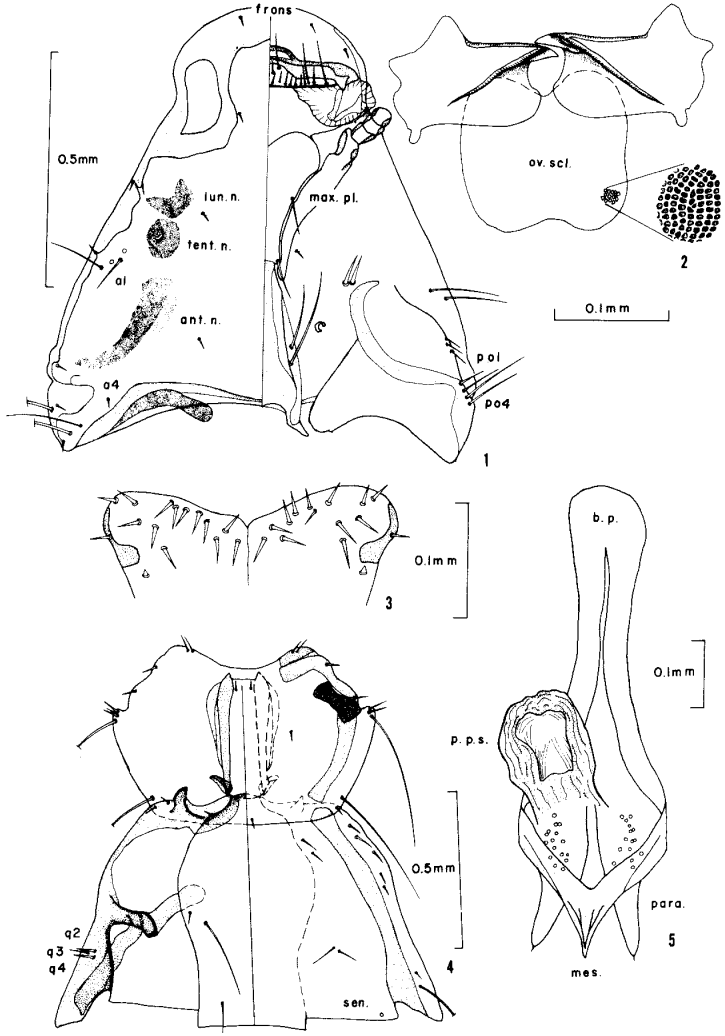
Pl. 13. *Ricinus elongatus* (Olfers). Fig. 1, head. Fig. 2, mandibles (left and right mandibles are reversed). Fig. 3, labium. Fig. 4, terminal segments of female abdomen. Fig. 5, male genitalia.



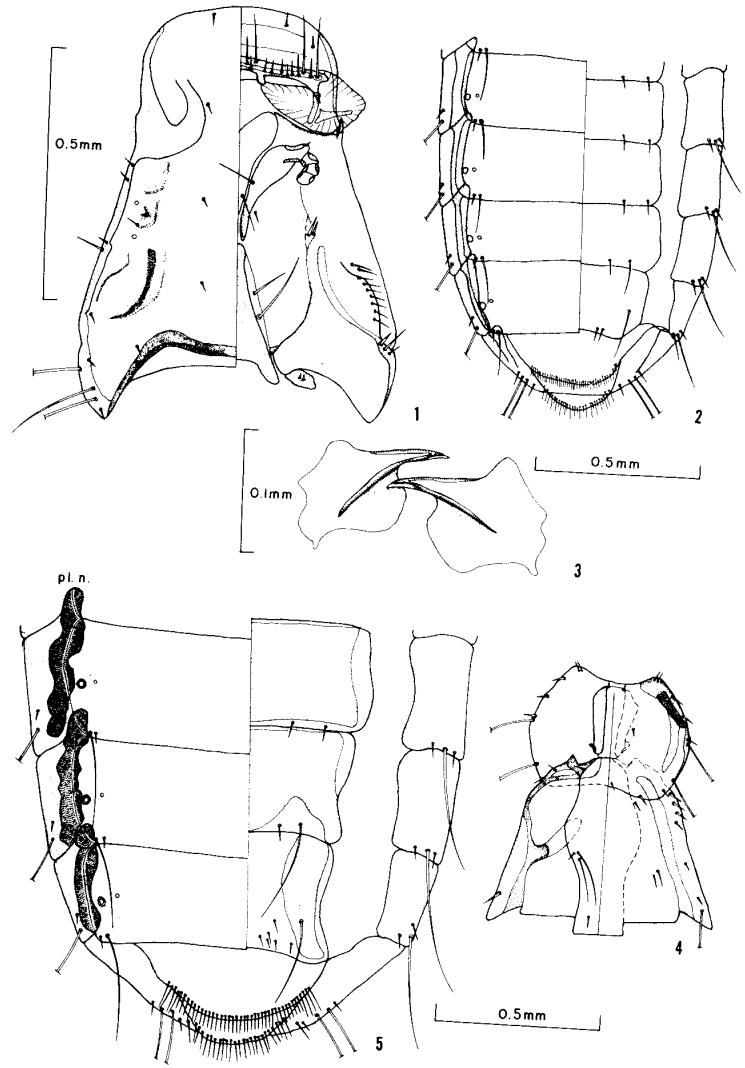
Pl. 14. *Ricinus mandibulatus* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles (left mandible above; right mandible below). Fig. 4, thorax. *R. elongatus* (Olfers). Fig. 5, thorax.



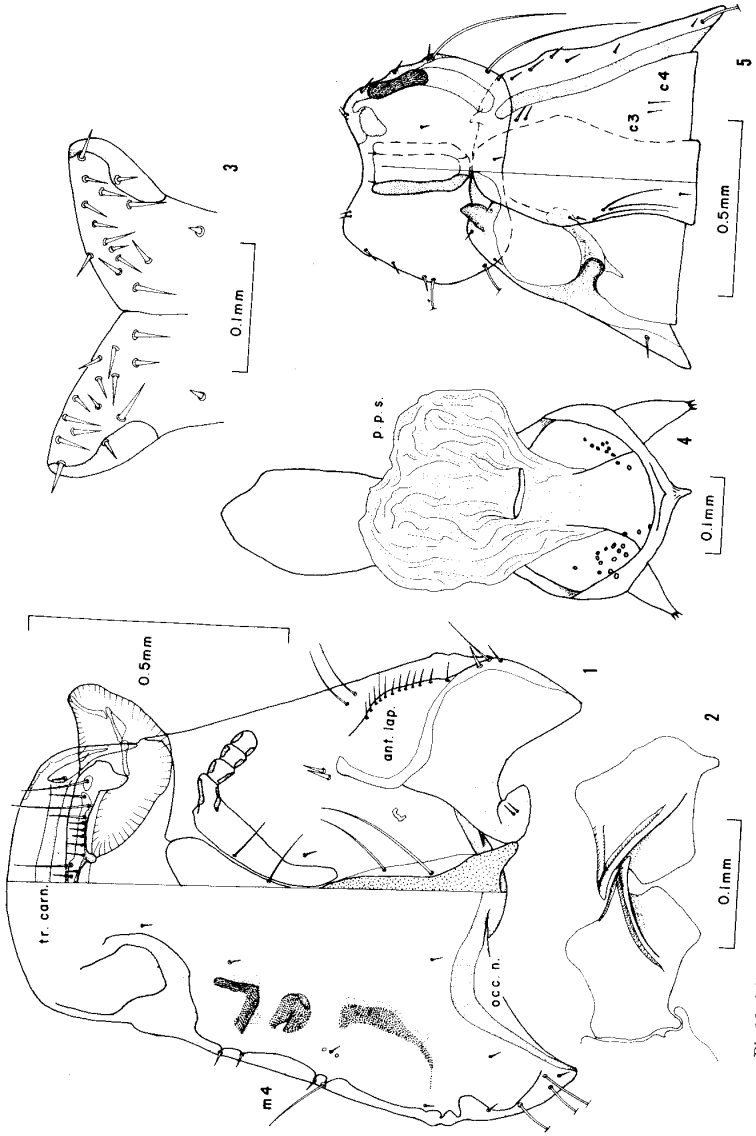
Pl. 15. *Ricinus invadens* (Kellogg). Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles (left and right mandibles are reversed). Fig. 4, male genitalia. Fig. 5, terminal segments of female abdomen. Fig. 6, thorax.



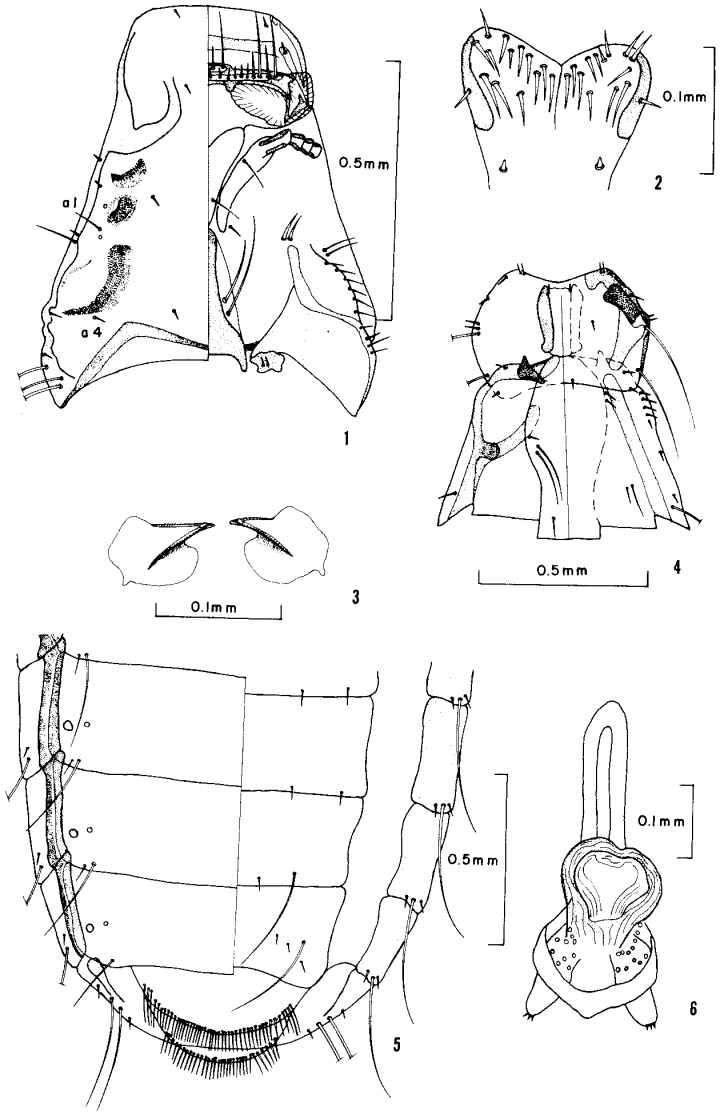
Pl. 16. *Ricinus serratus* (Durrant). Fig. 1, head. Fig. 2, mandibles and pattern on ovoid sclerites. Fig. 3, labium. Fig. 4, thorax. Fig. 5, male genitalia.



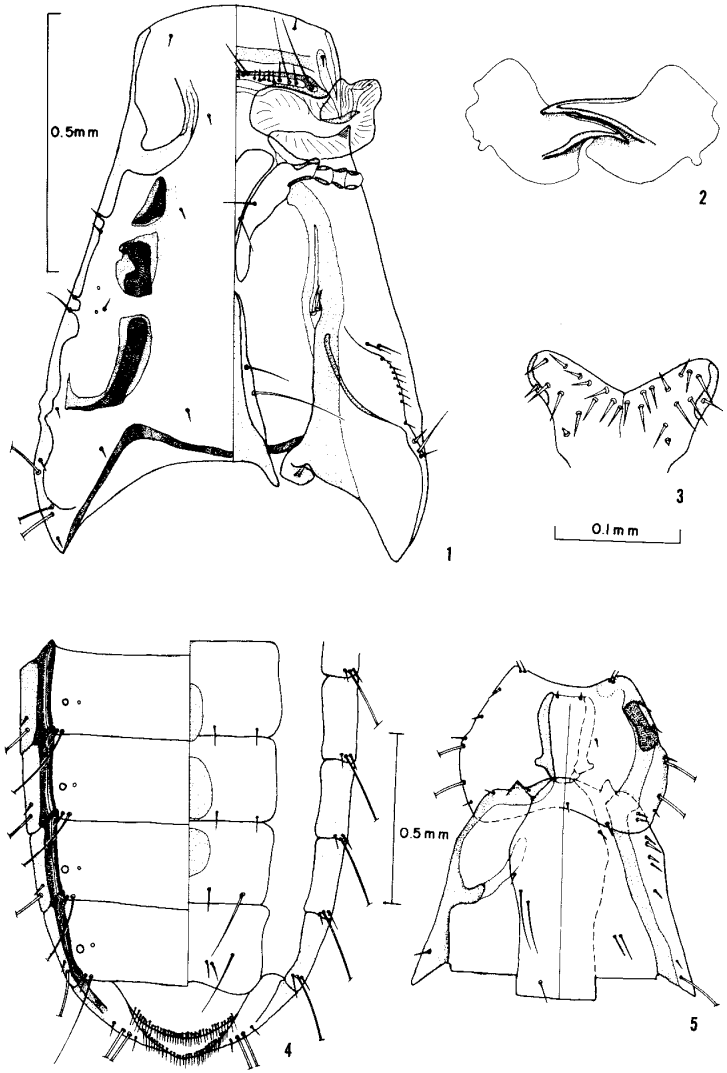
Pl. 17. *Ricinus flavicans* Carriker. Fig. 1, head. Fig. 2, terminal segments of female abdomen. Fig. 3, mandibles. Fig. 4, thorax. *R. serratus* (Durrant). Fig. 5, terminal segments of female abdomen.



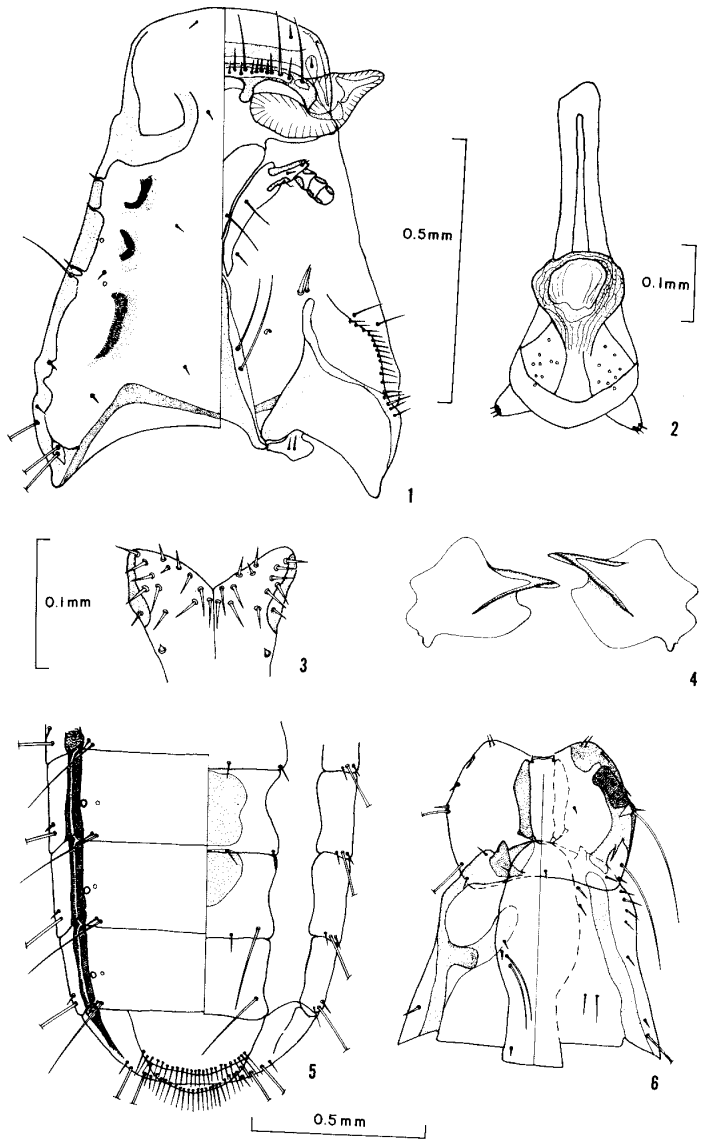
Pl. 18. *Ricinus marginatus* (Children). Fig. 1, head. Fig. 2, mandibles. Fig. 3, labium. Fig. 4, male genitalia. Fig. 5, thorax.



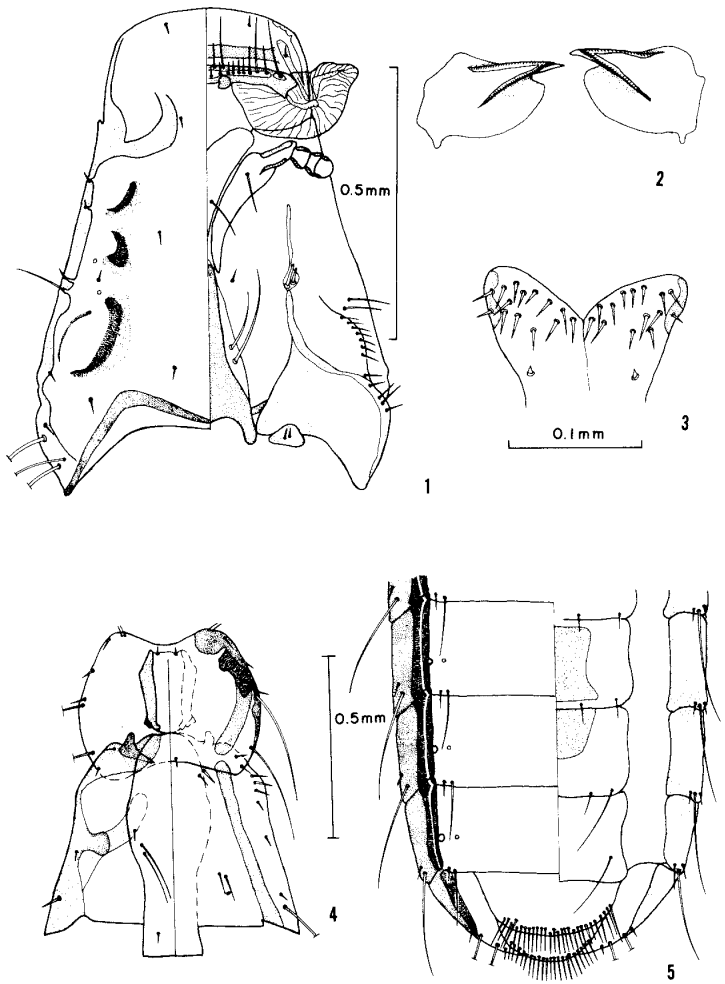
Pl. 19. *Ricinus frenatus* (Burmeister). Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, thorax. Fig. 6, male genitalia. *R. marginatus* (Children). Fig. 5, terminal segments of female abdomen.



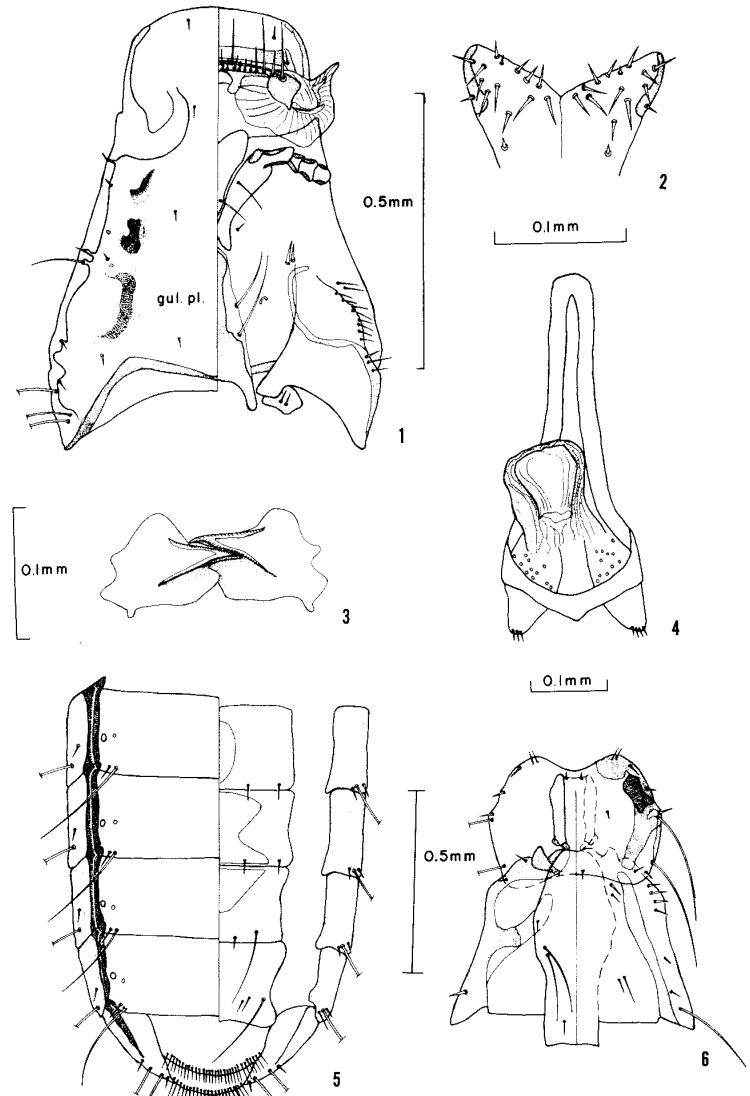
Pl. 20. *Ricinus polioptilus* Carriker. Fig. 1, head. Fig. 2, mandibles. Fig. 3, labium. Fig. 4, terminal segments of female abdomen. Fig. 5, thorax.



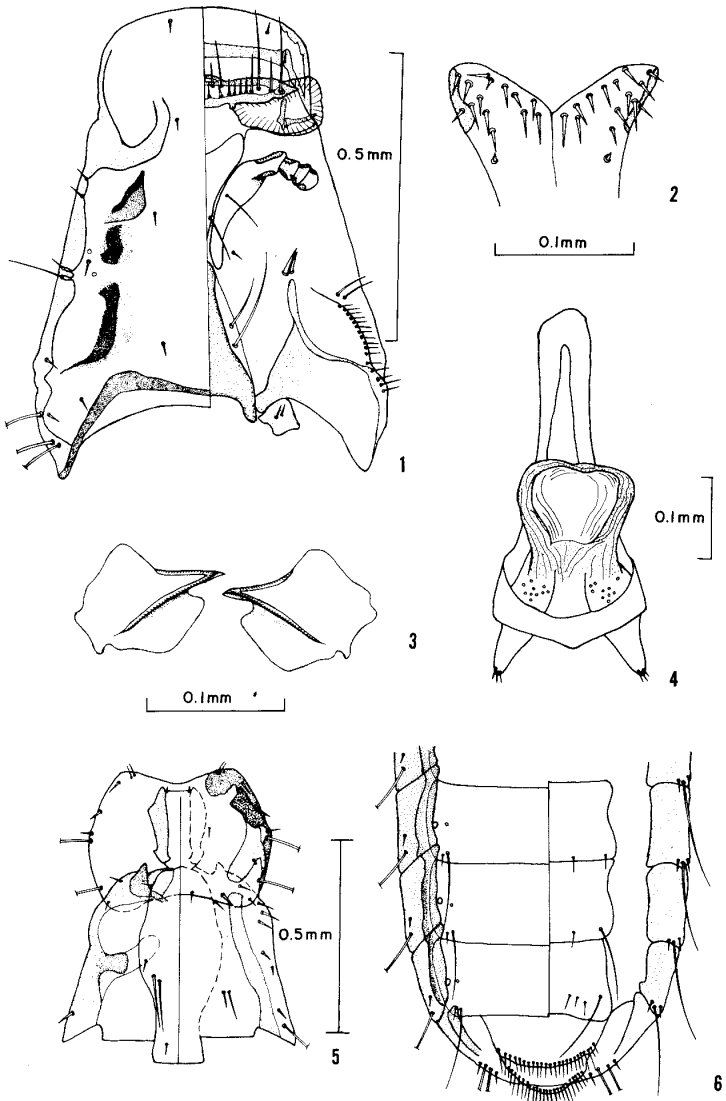
Pl. 21. *Ricinus pallens* (Kellogg). Fig. 1, head. Fig. 2, male genitalia. Fig. 3, labium. Fig. 4, mandibles. Fig. 5, terminal segments of female abdomen. Fig. 6, thorax.



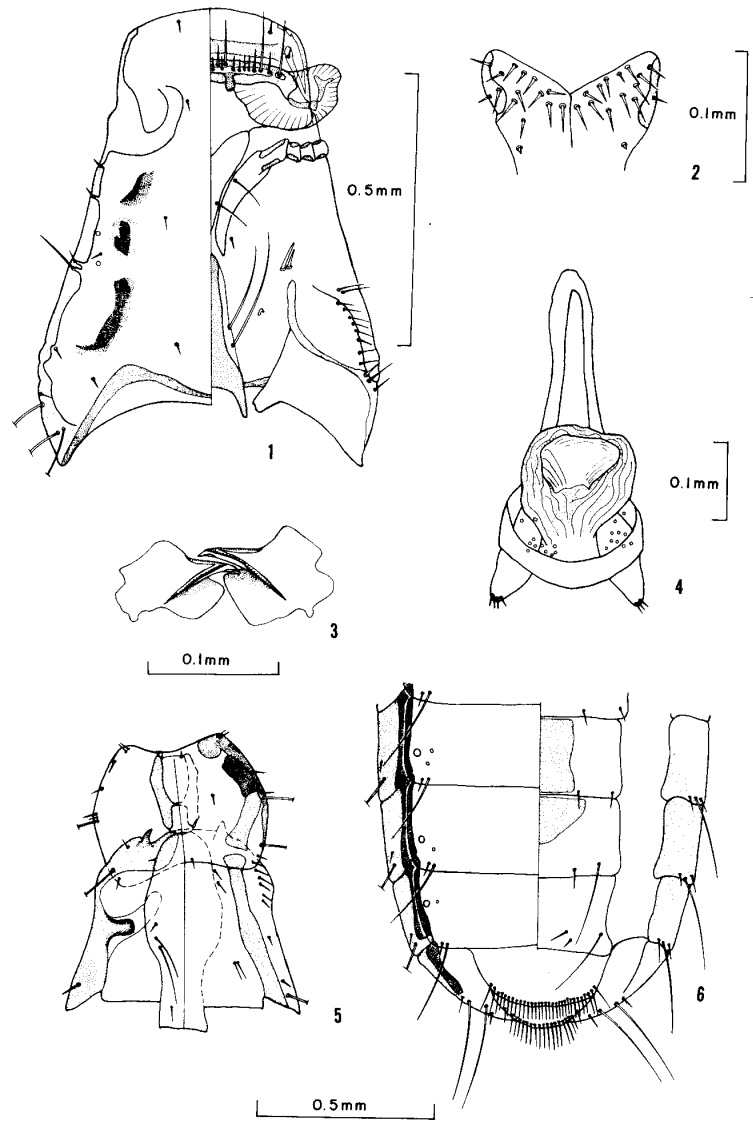
Pl. 22. *Ricinus dalgleishi* n. sp. Fig. 1, head. Fig. 2, mandibles. Fig. 3, labium. Fig. 4, thorax. Fig. 5, terminal segments of female abdomen.



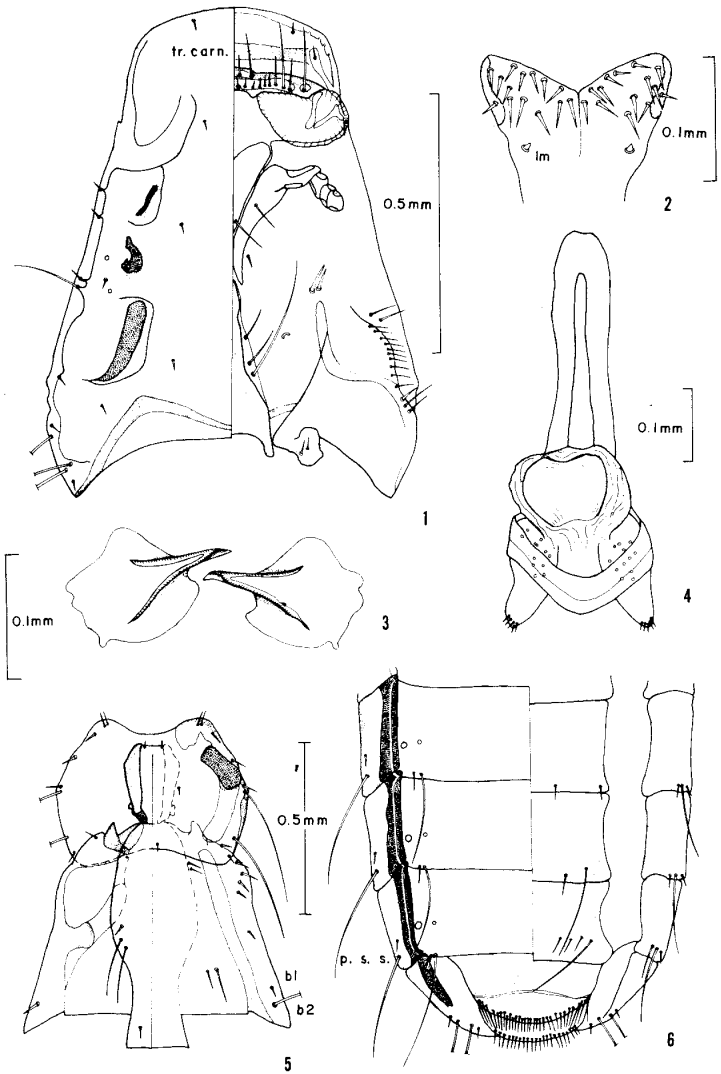
Pl. 23. *Ricinus picturatus* (Carriker). Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, male genitalia. Fig. 5, terminal segments of female abdomen. Fig. 6, thorax.



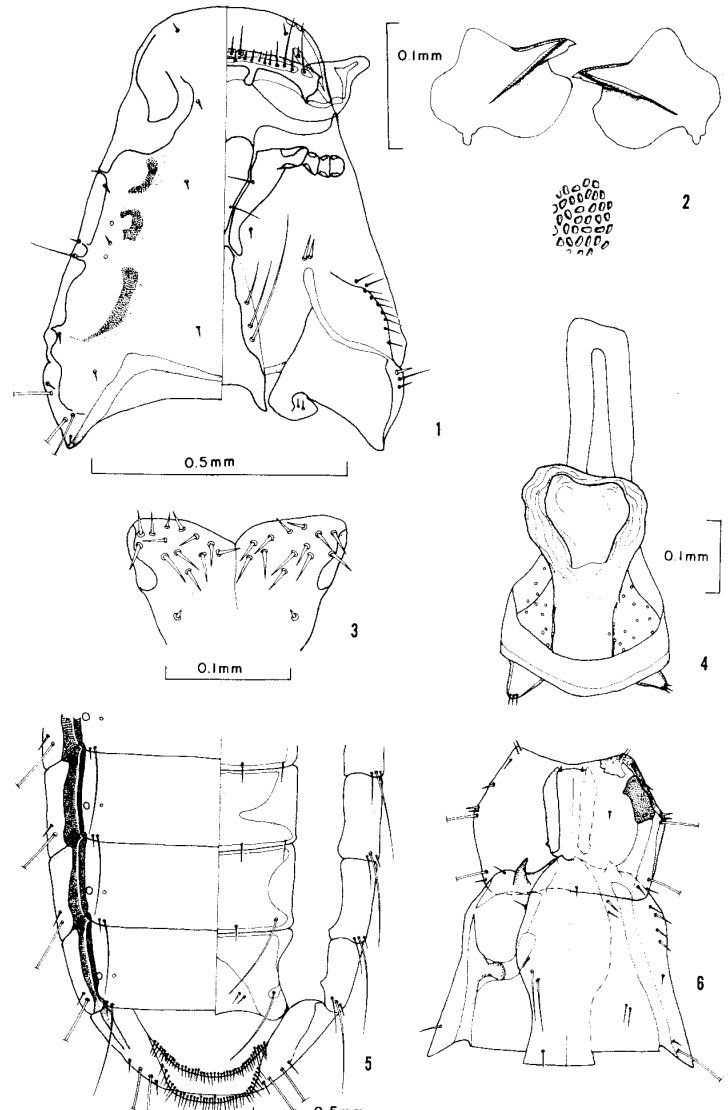
Pl. 24. *Ricinus emersoni* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, male genitalia. Fig. 5, thorax. Fig. 6, terminal segments of female abdomen.



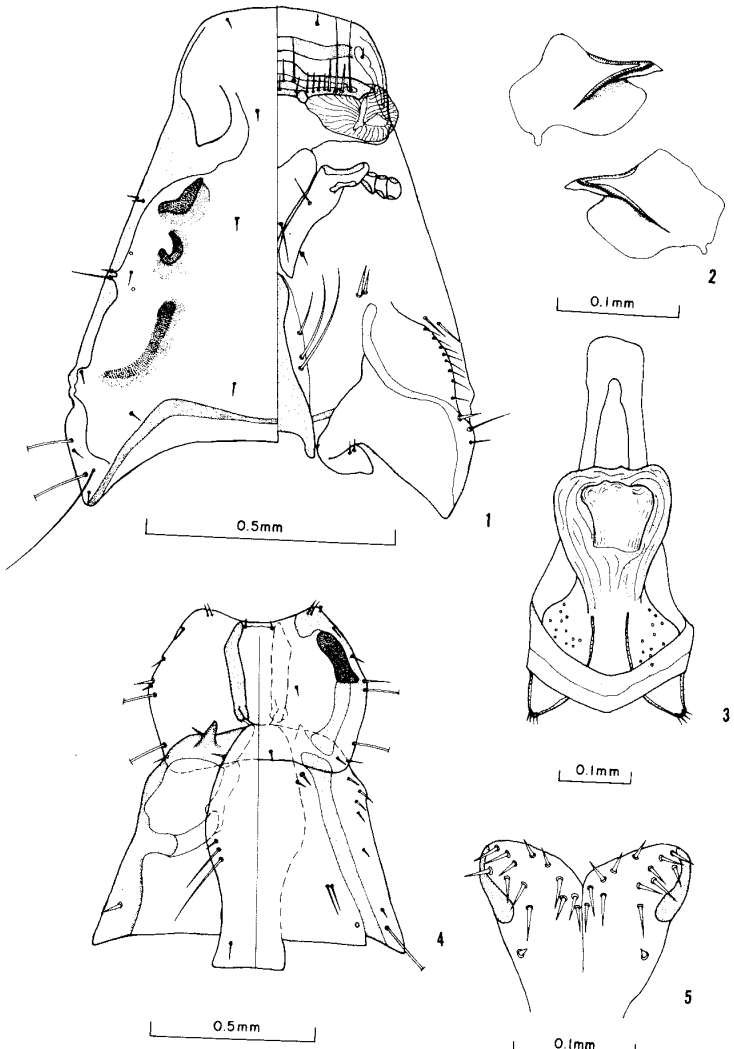
Pl. 25. *Ricinus dendroicae* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, male genitalia. Fig. 5, thorax. Fig. 6, terminal segments of female abdomen.



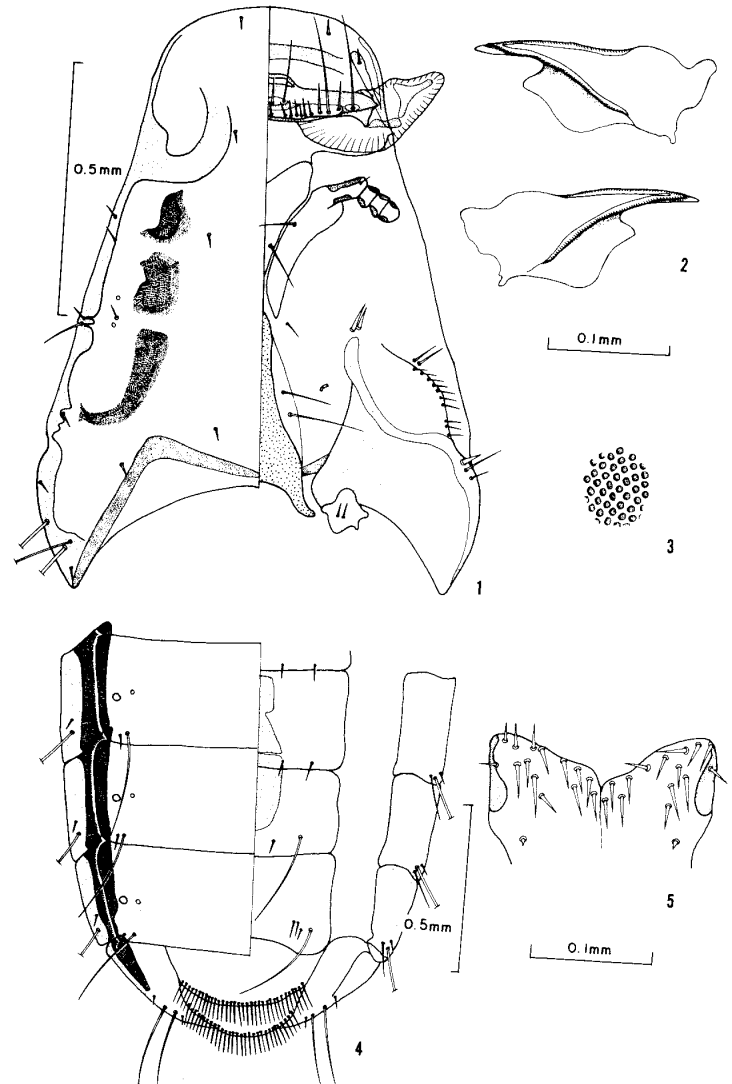
Pl. 26. *Ricinus sciuri* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, male genitalia. Fig. 5, thorax. Fig. 6, terminal segments of female abdomen.



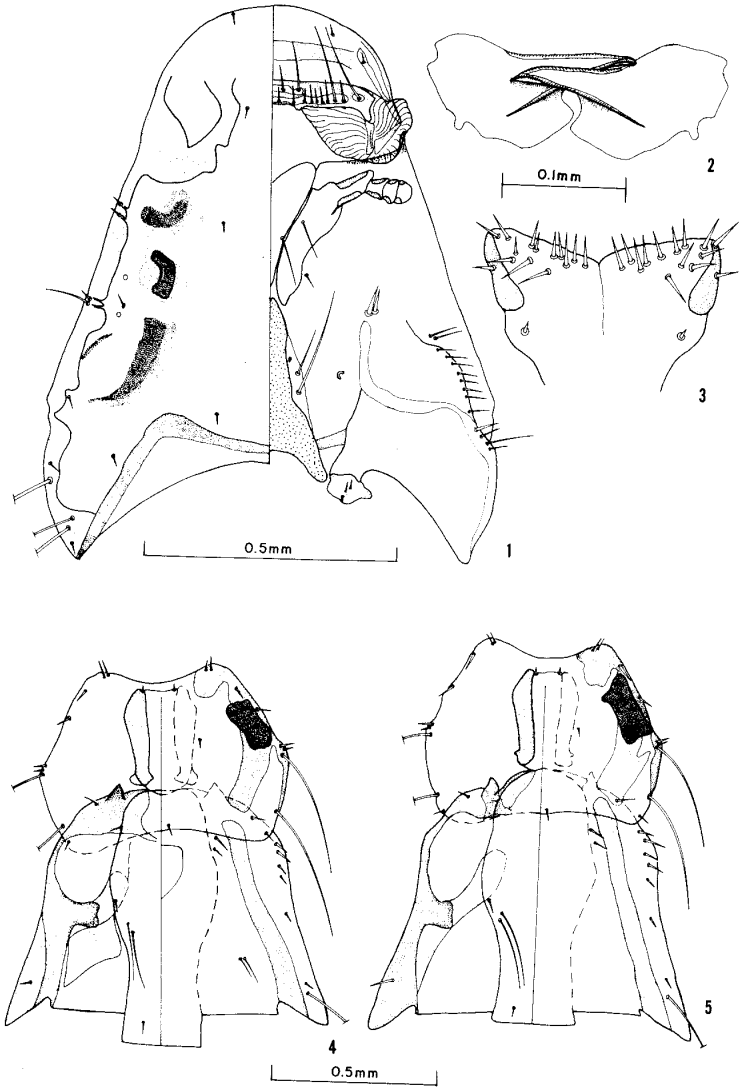
Pl. 27. *Ricinus subhastatus* (Carriker). Fig. 1, head. Fig. 2, mandibles and pattern of ovoid sclerites. Fig. 3, labium. Fig. 4, male genitalia. Fig. 5, terminal segments of female abdomen. Fig. 6, thorax.



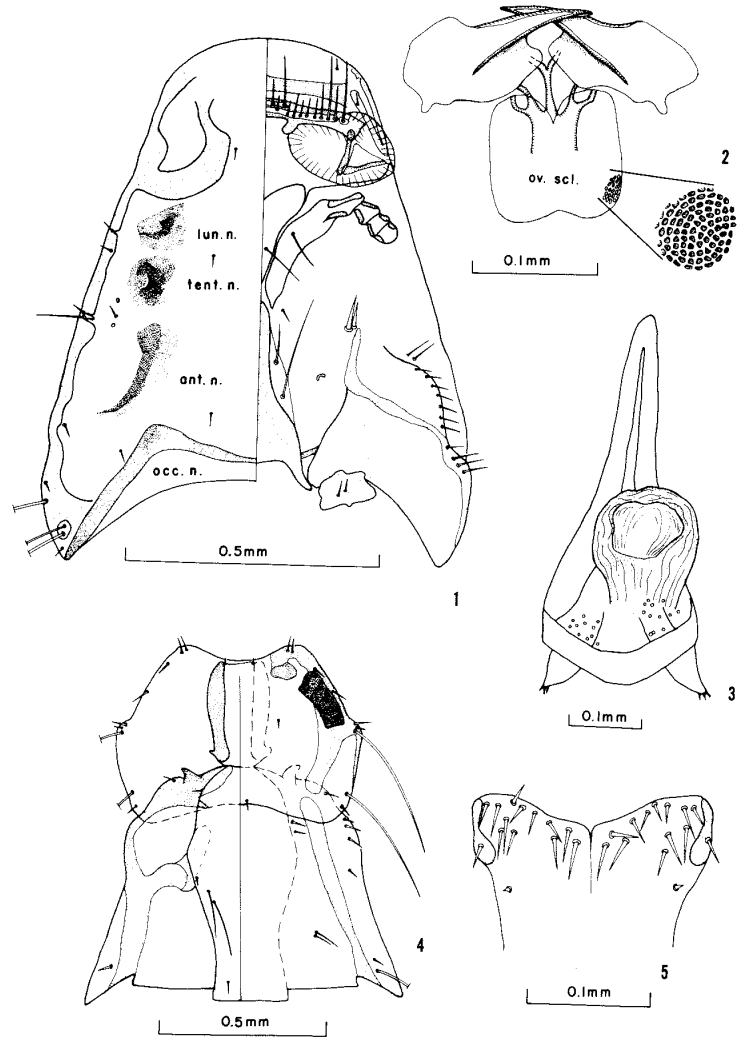
Pl. 28. *Ricinus wolfi* n. sp. Fig. 1, head. Fig. 2, mandibles. Fig. 3, male genitalia. Fig. 4, thorax. Fig. 5, labium.



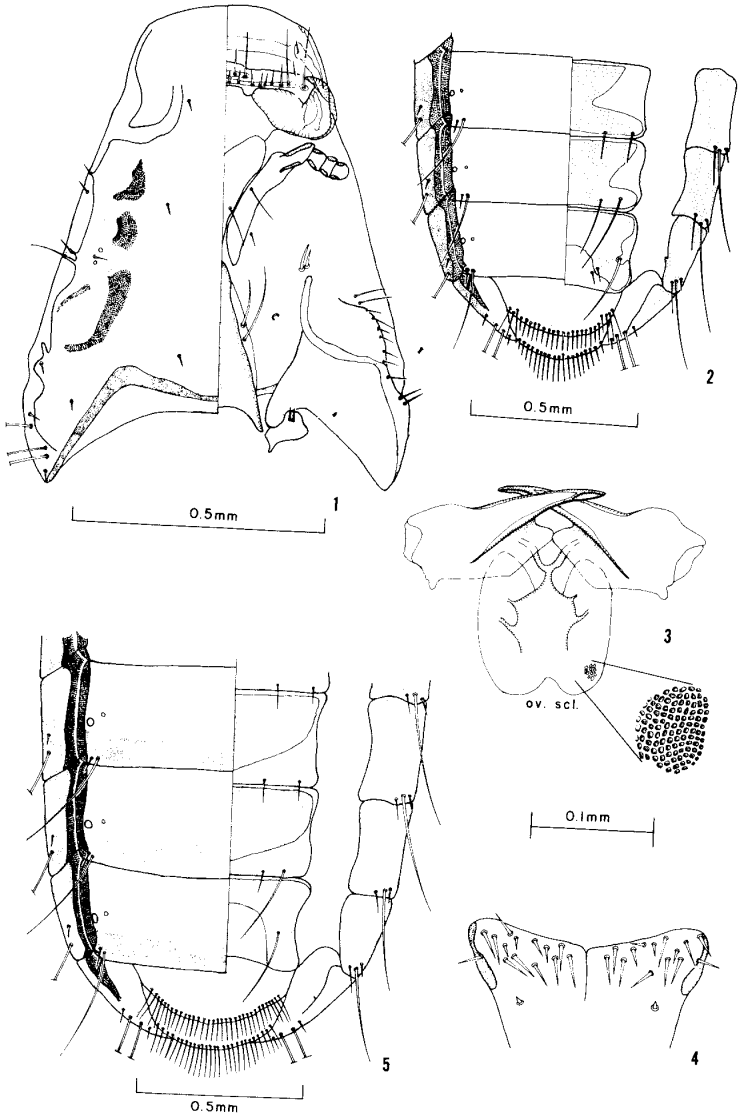
Pl. 29. *Ricinus subangulatus* (Carriker). Fig. 1, head. Fig. 2, mandibles. Fig. 3, pattern on ovoid sclerites. Fig. 4, terminal segments of female abdomen. Fig. 5, labium.



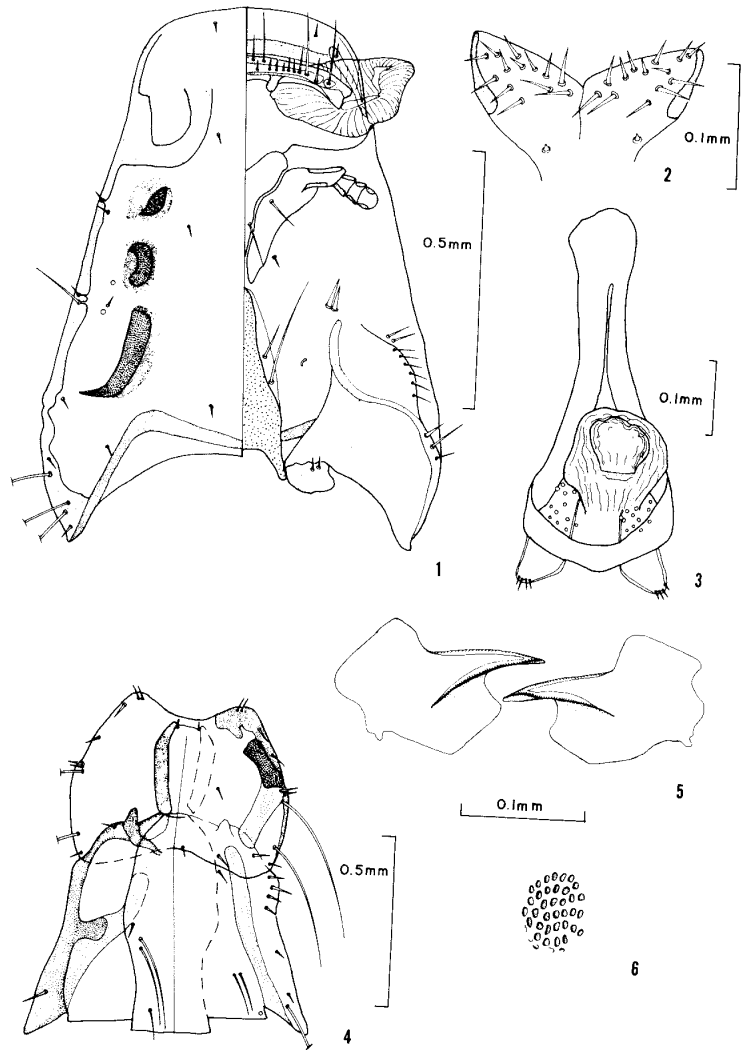
Pl. 30. *Ricinus complicatus* Carriker. Fig. 1, head. Fig. 2, mandibles. Fig. 3, labium. Fig. 4, thorax. *Ricinus subangulatus* (Carriker). Fig. 5, thorax.



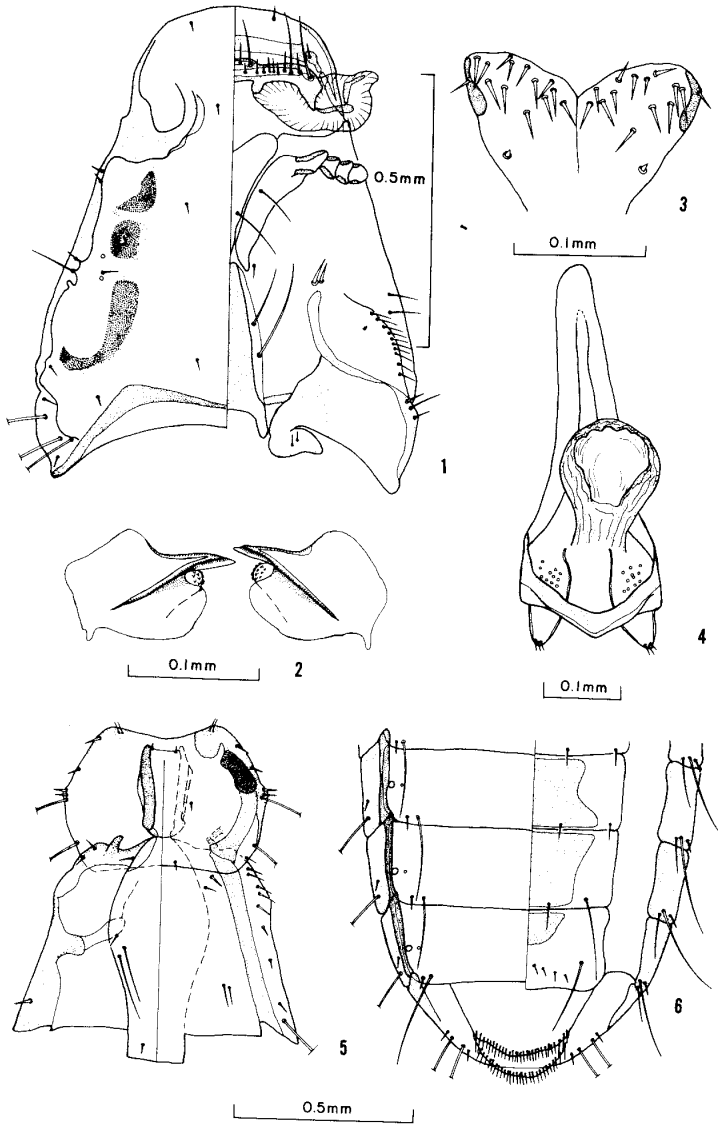
Pl. 31. *Ricinus ramphoceli* n. sp. Fig. 1, head. Fig. 2, mandibles and fused ovoid sclerites. Fig. 3, male genitalia. Fig. 4, thorax. Fig. 5, labium.



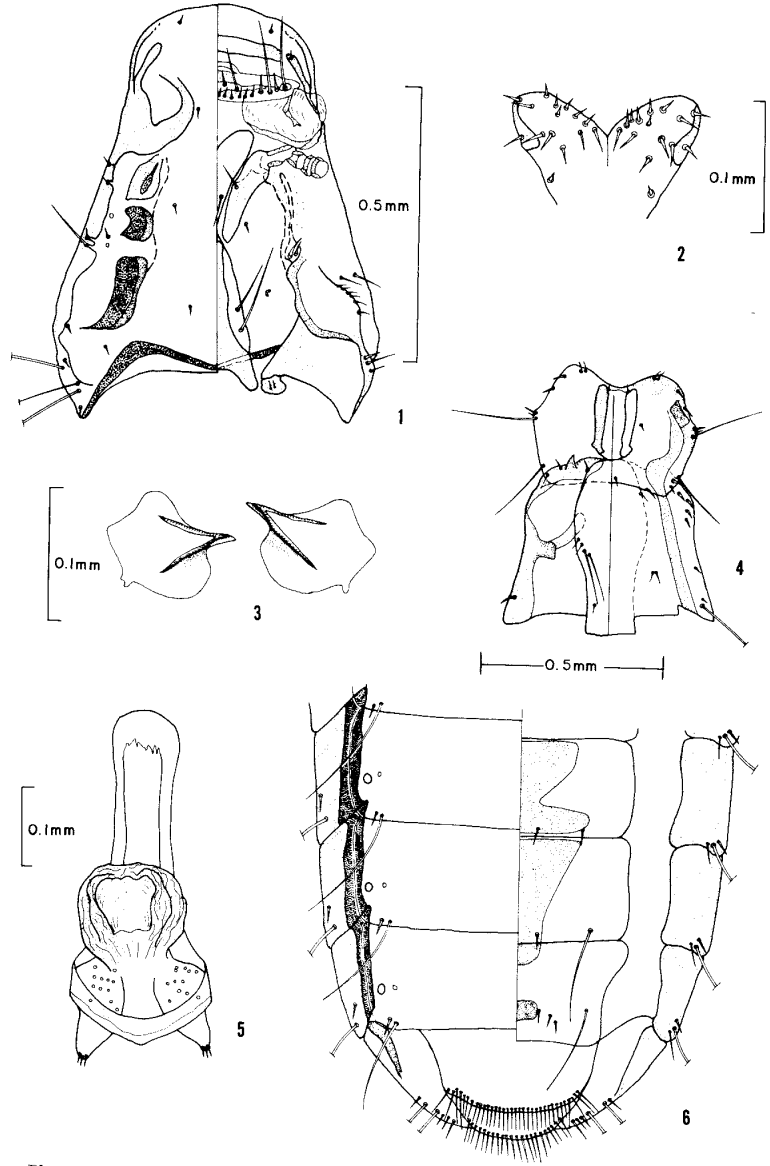
Pl. 32. *Ricinus volatiniae* n. sp. Fig. 1, head. Fig. 2, terminal segments of female abdomen. Fig. 3, mandibles and ovoid sclerite. Fig. 4, labium. *R. ramphocedi* n. sp. Fig. 5, terminal segments of female abdomen.



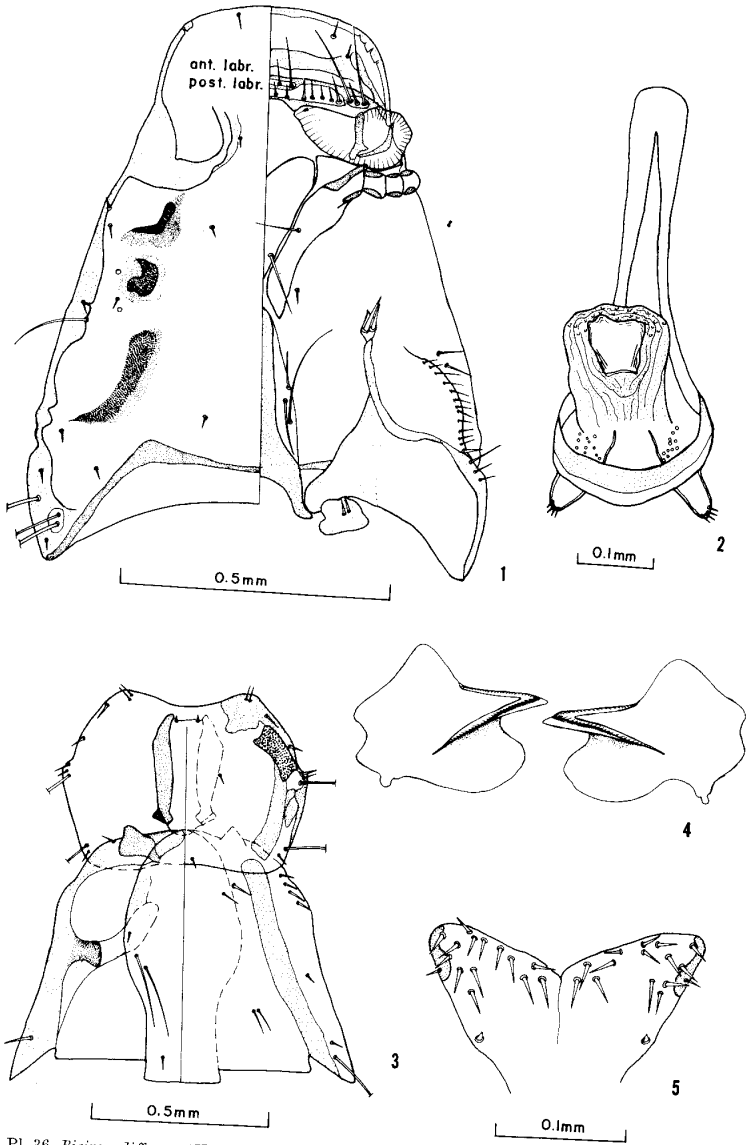
Pl. 33. *Ricinus virecensis* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, male genitalia. Fig. 4, thorax. Fig. 5, mandibles. Fig. 6, pattern of ovoid sclerite.



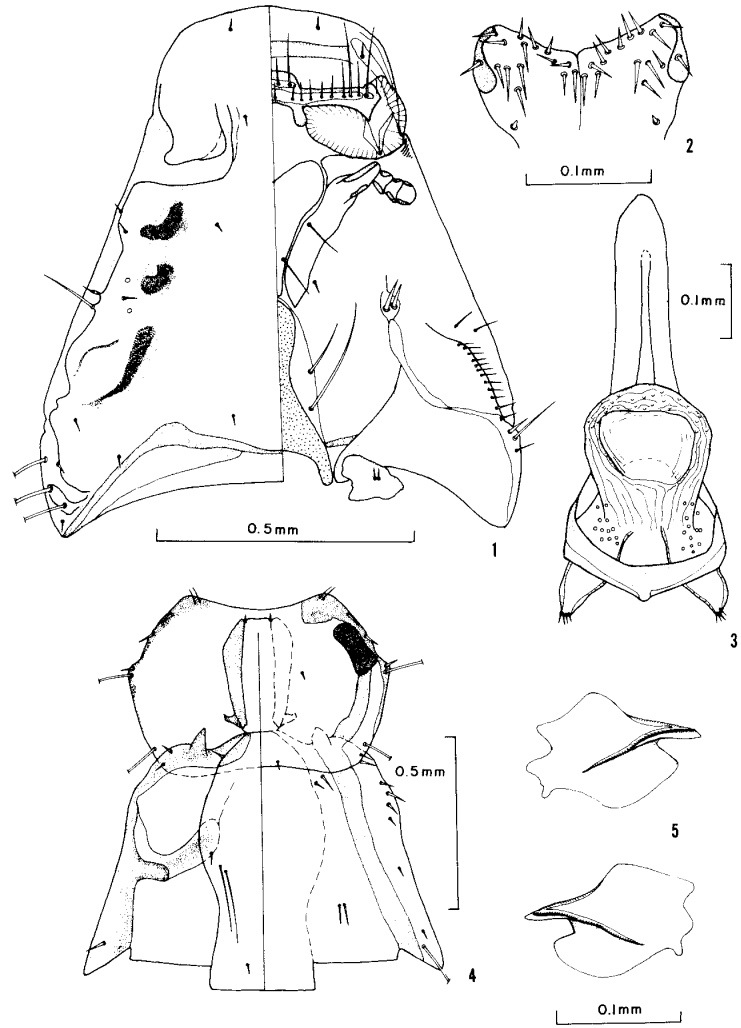
Pl. 34. *Ricinus subdiffusus* n. sp. Fig. 1, head. Fig. 2, mandibles. Fig. 3, labium. Fig. 4, male genitalia. Fig. 5, thorax. Fig. 6, terminal segments of female abdomen.



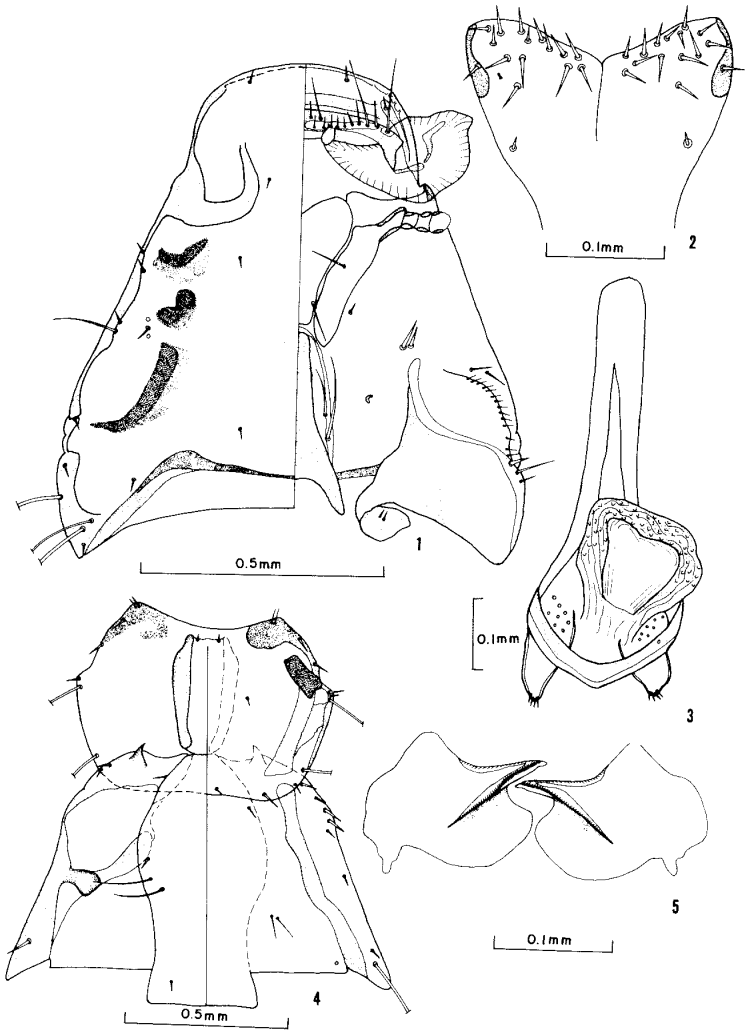
Pl. 35. *Ricinus sittae* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, thorax. Fig. 5, male genitalia. *R. diffusus* (Kellogg). Fig. 6, terminal segments of female abdomen.



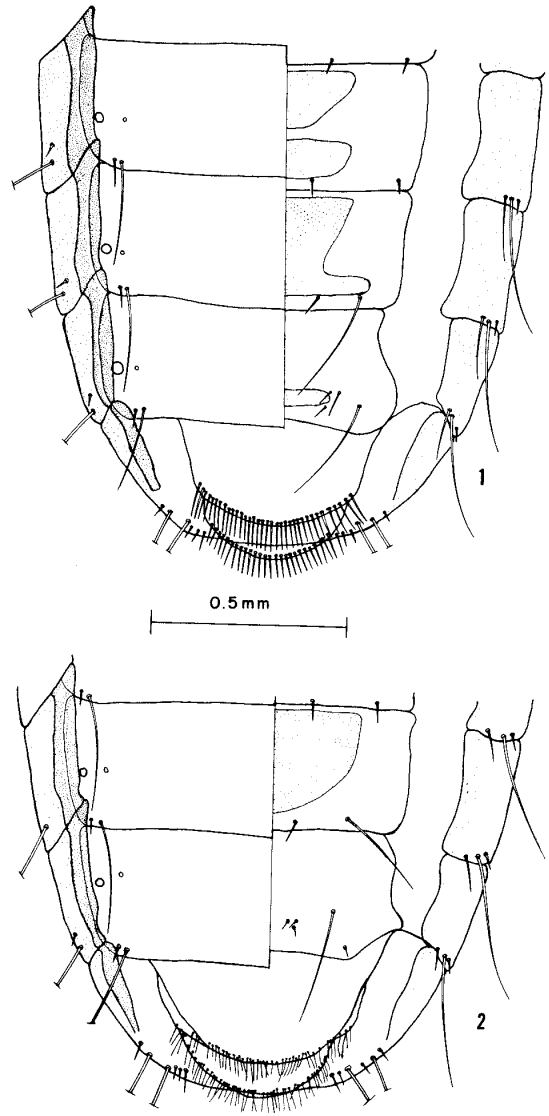
Pl. 36. *Ricinus diffusus* (Kellogg). Fig. 1, head. Fig. 2, male genitalia. Fig. 3, thorax. Fig. 4, mandibles. Fig. 5, labium.



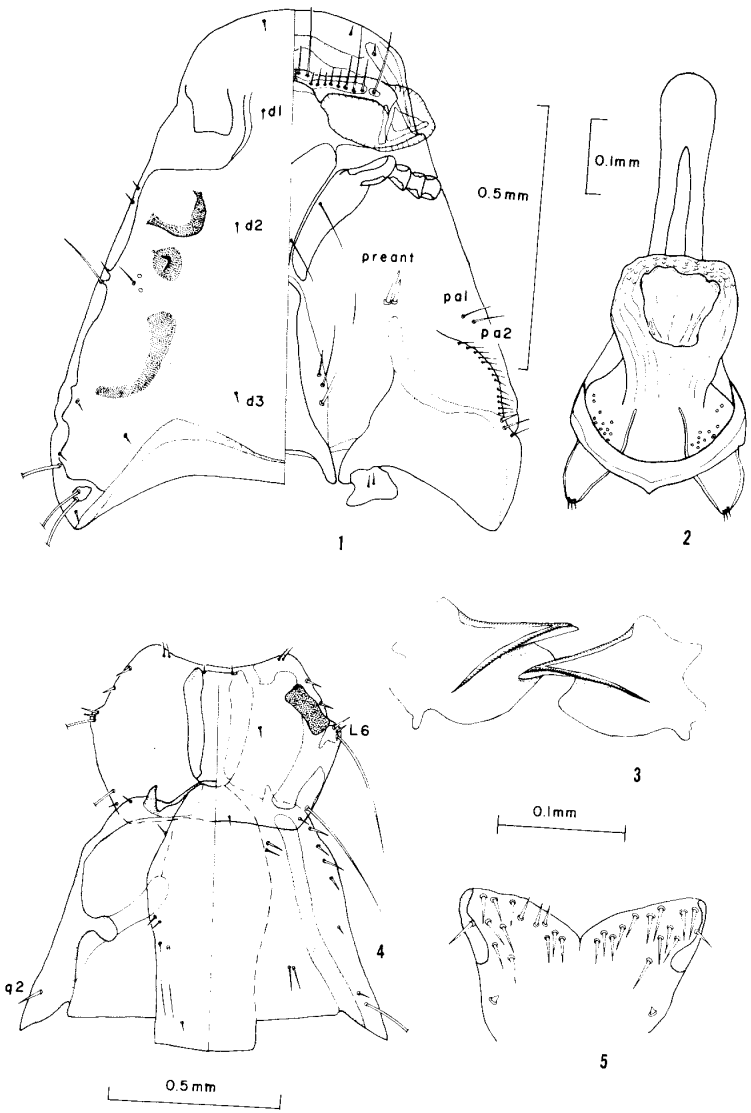
Pl. 37. *Ricinus calcarii* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, male genitalia. Fig. 4, thorax. Fig. 5, mandibles.



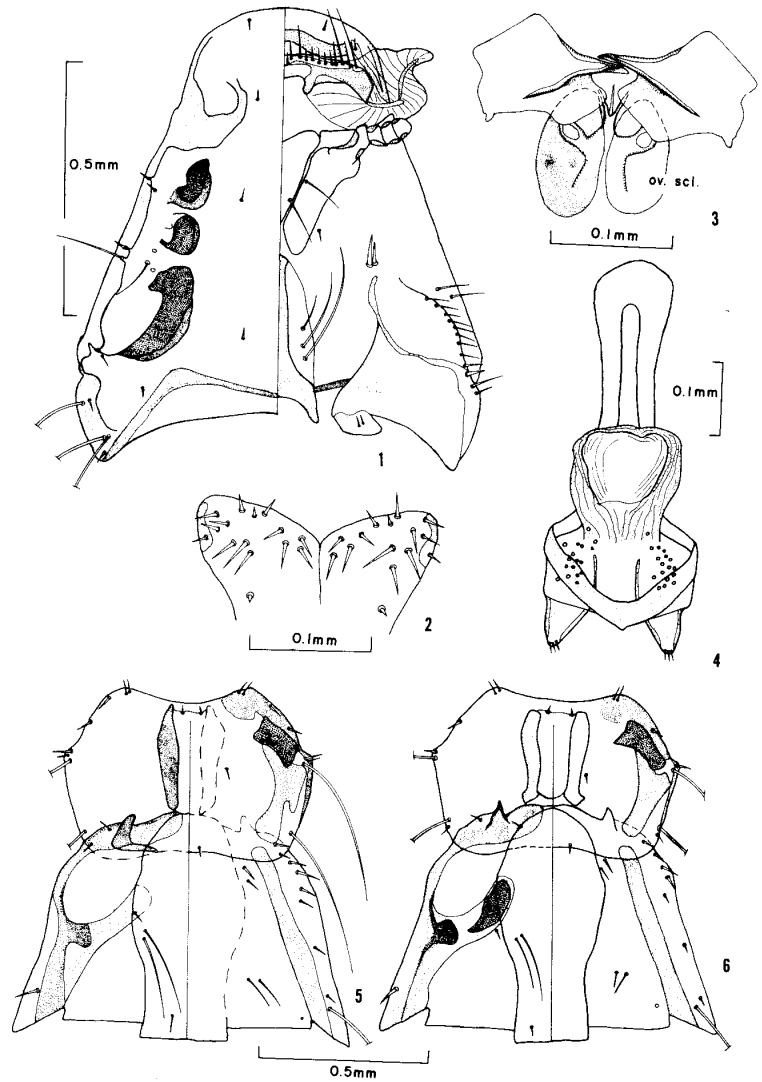
Pl. 38. *Ricinus thoracicus* (Packard). Fig. 1, head. Fig. 2, labium. Fig. 3, male genitalia. Fig. 4, thorax. Fig. 5, mandibles.



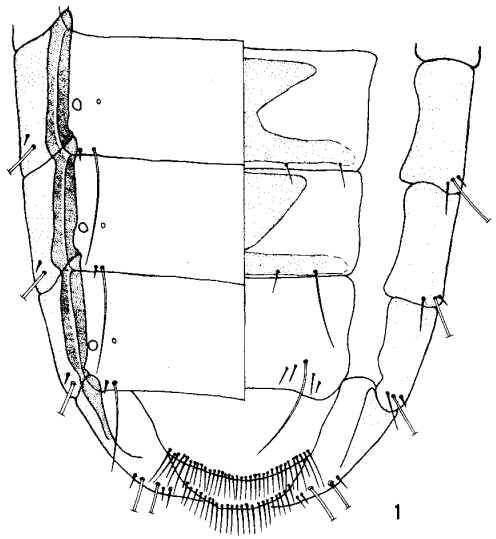
Pl. 39. *Ricinus calcarii* n. sp. Fig. 1, terminal segments of female abdomen. *R. thoracicus* (Packard). Fig. 2, terminal segments of female abdomen.



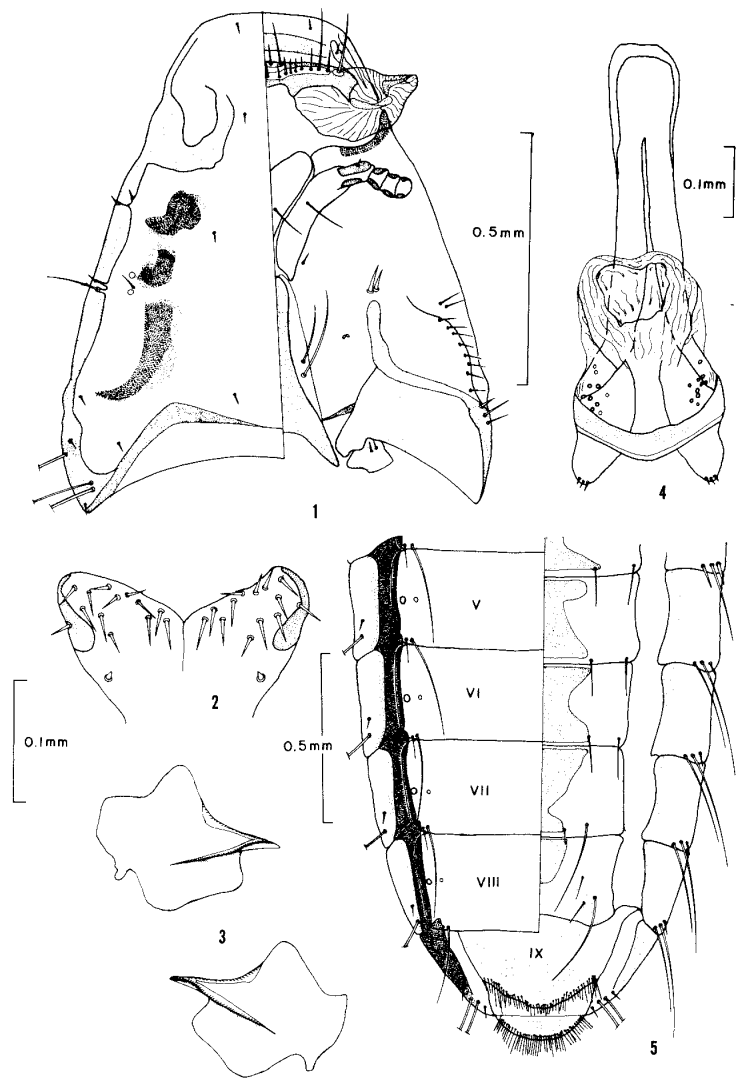
Pl. 40. *Ricinus ivanovi* Blagoveshtchensky. Fig. 1, head. Fig. 2, male genitalia. Fig. 3, mandibles. Fig. 4, thorax. Fig. 5, labium.



Pl. 41. *Ricinus carolynae* n. sp. Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles and ovoid sclerites. Fig. 4, male genitalia. Fig. 5, thorax. *R. australis* (Kellogg). Fig. 6, thorax.



Pl. 42. *Ricinus ivanovi* Blagoveshtchensky. Fig. 1, terminal segments of female abdomen. *R. carolynae* n. sp. Fig. 2, terminal segments of female abdomen.



Pl. 43. *Ricinus australis* (Kellogg). Fig. 1, head. Fig. 2, labium. Fig. 3, mandibles. Fig. 4, male genitalia. Fig. 5, terminal segments of female abdomen.