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Title: Taxonomy and Evolution of the Orthotyline Genus Lopidea (Heteroptera: Miridae)

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Abstract approved: John D. Lattin

The genus Lopidea Uhler is revised for America north of Mexico. The relationship of Lopidea to other orthotyline genera is discussed and it is proposed that the genus Ilnacora Reuter is the sister group of Lopidea.

Forty-eight species of Lopidea are recognized in North America, one of which is described as new. The following synonymies are created (junior names first): Lopidea navajo Knight = L. arizonae Knight; L. chelifer Knight = L. balli Knight; L. paddocki Knight and L. deserta Knight = L. bullata Knight; L. trispicata Knight = L. chandleri Moore; L. burkei Knight = L. confraterna (Gibson); L. arkansae Knight and L. biselli Knight = L. davisi Knight; L. denmani Knight and Schaffner = L. falcicula Knight; L. mohave Knight = L. garryae Knight; L. amorphae Knight and L. wisteriae Chandler = L. hesperus (Kirkaldy); L. marginalis (Reuter) = L. instabilis (Reuter); L. texana Knight, L. polingorum Knight and L. matamorensis Knight = L. major Knight; L. drakei Knight = L. marginata Uhler; L. phlogis Knight, L. petalostemi Knight and L. johnstoni Knight = L. minor Knight; Lopidea raineri Knight, Lopidea sculleni Knight, Lopidea rolfsi Knight and Lopidea wilcoxi Knight = Lopidea nigridia nigridia Uhler; Lopidea nigridea hirta Van Duzee,

Lopidea usingeri Van Duzee, *Lopidea discreta* Van Duzee, *Lopidea fallax* Knight, *Lopidea nicholi* Knight, *Lopidea yakima* Knight, *Lopidea audeni* Knight, *Lopidea eriogoni* Knight, *Lopidea calcaria* Knight, *Lopidea chamberlini* Knight, *Lopidea angustata* Knight, *Lopidea rubrofusca* Knight and *Lopidea flavicostata* Knight and Schaffner = *Lopidea nigridia aculeata* Van Duzee; *Lopidea medleri* Akingbohungbe = *Lopidea nigridia serica* Knight Uhler; *L. oregona* Hsiao, *L. calli* Knight, *L. knowltoni* Knight, *L. dawsoni* Knight, *L. utahensis* Knight and *L. yampae* Knight = *L. picta* Knight; *L. staphyleae sanguinea* Knight = *L. s. staphyleae* Knight; *L. taurula* Knight, *L. malvastri* Knight, *L. nevadensis* Knight and *L. fuscina* Knight = *L. taurina* Van Duzee; *L. stitti* Knight and *L. becki* Knight = *L. ute* Knight.

A sample of 16 speciation events derived from cladistic analyses suggests that vicariance can account for at least 50% of species generation in *Lopidea*. The frequency of sympatric host plant speciation may be as high as 30% and speciation by peripheral isolation has been rare if it has occurred at all.

Taxonomy and Evolution of the Orthotyline Genus Lopidea
(Heteroptera: Miridae)

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Redacted for Privacy

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Redacted for Privacy

Dean of Graduate School

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CHAPTER I
INTRODUCTION

The orthotyline mirid genus *Lopidea* Uhler comprises over 100 described species from Central and North America (Henry and Wheeler, 1988). Most are large (> 5.0 mm), brightly colored plant bugs displaying some pattern of contrasting red-black or yellow-black coloration and there is evidence that these brightly colored species are aposematic (McClain, 1984; McIver and Lattin, In Press). There is no taxonomic revision of the genus, but most species were described in a series of papers by Knight (1917; 1918a; 1918b; 1923; 1962; 1965; 1968) and Knight and Schaffner (1968; 1972). The present study investigates the morphology, taxonomy and evolution of the genus for America north of Mexico.

In chapter II, I attempt to resolve the taxonomy of a western species group, which I will refer to as the *nigridia* "complex." This group consisted of several species described from western North America which had parameres very similar if not identical to an earlier described species, *Lopidea nigridia* Uhler. My work on this group was initiated first because it presented the largest taxonomic problem within *Lopidea* and because current research and publications on the biology and behavior of one of the nominal species in this group required taxonomic clarification and nomenclatorial stability. In this chapter, I describe the morphological, genitalic and color variation within this "complex" and document the characters that unite it as a single taxonomic unit.

The large number of described species (>100), and the lack of available keys, particularly for the western fauna, prompted this revision of the genus Lopidea for North America, chapter III. The goals of this chapter are 1) to aid in the identification of species and to summarize the available geographical and ecological information, and 2) to compare Lopidea to other orthotyline genera and determine its sister taxa. First, I describe the morphological structures and patterns of variation in the genus, and also discuss the relationship of Lopidea to other genera of Orthotylini. For each of the 48 species I recognize as occurring north of Mexico, I provide a brief diagnosis, a detailed description, particularly of the male genitalia, a summary of its distribution and biology, and a distribution map. In addition, I provide a key to adult males of all species in North America.

Chapter IV was initiated following the generic revision of the North American species of Lopidea Uhler in chapter III. The information and methodology used in chapter IV are essentially derived from synthesizing the morphological, distributional and host plant data presented in the generic revision, and the cladisticly derived hypothesis of species relationships presented in chapter IV. The primary purposes of this study are 1) to identify monophyletic species groups, 2) provide detailed evolutionary hypotheses of speciation patterns, and 3) illustrate ecological and biogeographic patterns for future work on Lopidea and for comparison with other groups of Miridae.

CHAPTER II

TAXONOMY AND VARIATION OF THE *LOPIDEA NIGRIDIA* COMPLEX OF WESTERN NORTH AMERICA (HETEROPTERA: MIRIDAE: ORTHOTYLINAE)

ABSTRACT

External morphological variation in the *Lopidea nigridia* "complex" of western North America was examined using principle components analysis (PCA), and showed continuous variation among populations in most characters. External morphology did not parallel paramere structure and did not substantiate previously recognized species concepts. There was little correlation between dorsal coloration and paramere structure. Cluster analysis (UPGMA) using paramere and color characters failed to group populations coded as the same species and failed to group all specimens of any one population. The variation in structure of the parameres and vesicae among populations of the *nigridia* "complex" was no greater than the interpopulational variation of these structures in the congeneric species *marginata* Uhler.

Lopidea nigridia Uhler is treated as a polytypic species composed of three subspecies: *Lopidea nigridia nigridia* Uhler, a fuscous-white form from the sagebrush steppe of the Great Basin and the chaparral of southern California; *Lopidea nigridia serica* Knight, a solid red form from the eastern slopes of the Rocky Mountains from Alberta to Colorado and east across the northern Great Plains to southern Manitoba; *Lopidea nigridia aculeata* Van Duzee a polymorphic form, varying from solid red to fuscous red and white from the Cascade Mountains and eastern slopes of the coastal ranges of British Columbia, Washington and Oregon,

the Blue and Wallawa Mountains of Oregon and Washington, and throughout the Coastal and Sierra Nevada Ranges of California.

The following new synonymies are recognized: Lopidea nigridia nigridia Uhler = Lopidea raineri Knight, Lopidea sculleni Knight, Lopidea rolfsi Knight and Lopidea wilcoxi Knight; Lopidea nigridia aculeata Van Duzee = Lopidea nigridea hirta Van Duzee, Lopidea usingeri Van Duzee, Lopidea discreta Van Duzee, Lopidea fallax Knight, Lopidea yakima Knight, Lopidea audeni Knight, Lopidea eriogoni Knight, Lopidea calcaria Knight, Lopidea chamberlini Knight, Lopidea angustata Knight, Lopidea rubrofusca Knight and Lopidea flavicostata Knight and Schaffner; Lopidea nigridia serica Knight = Lopidea medleri Akingbohungbe.

INTRODUCTION

Lopidea Uhler comprises over 100 described species from Central and North America (Henry and Wheeler, 1988). Most are large (> 5.0 mm) brightly colored plant bugs displaying some pattern of contrasting red-black or yellow-black coloration. There is no taxonomic revision of the genus, but most species were described in a series of papers by Knight (1917; 1918a; 1918b; 1923; 1962; 1965; 1968) and Knight and Schaffner (1968; 1972).

Many species are superficially very similar in habitus, and most have been distinguished by the form of the right paramere. This structure is relatively uniform in any given species, but extremely variable in size and form among different species of *Lopidea*. It appears that this is the most valuable diagnostic character available for distinguishing different species of *Lopidea* aside from the vesica.

External and internal male genitalia are now widely used to differentiate taxa in certain groups of Heteroptera, but detailed studies of the variation in these structures are lacking. In the Orthotylini, males often have elaborate parameres and vesicae, and differences in these structures are used to define species (Kelton, 1959; Stonedahl & Schwartz, 1986). The limits of the variation of these structures in populations and throughout the range of species need to be defined.

Several species of *Lopidea* described from western North America have parameres very similar if not identical to an earlier described species, *Lopidea nigridia* Uhler. I undertook the present study to resolve the taxonomy of this group, which I refer to as the *nigridia* "complex." In this paper, I describe the morphological, genitalic and color variation within this "complex" and document the characters that unite it as a single taxonomic unit.

MATERIALS AND METHODS

Over 3,000 specimens from throughout the range of Lopidea were examined during the course of this study. Male specimens with "nigridia type" paramere morphology and the associated females were sorted by grouping series that displayed common patterns of color, size and paramere morphology.

Male genitalia of specimens from different geographic localities within each group, were examined. Techniques for the dissections generally followed Kelton (1959). To determine the infraspecific variation in the structures, variation within and among the populations was compared with the closely related species marginata Uhler. I had previously determined that the female genitalia are too uniform throughout the genus to provide information at the specific and subspecific levels.

Morphological variation in this complex was examined by recording metric data from 139 males from the following localities (N follows each locality): Mexico: Baja California Norte, Parque San Pedro (7); California: Los Angeles Co., El Segundo (10); Mono Co., Leavitt Meadow (10); Trinity Co., Buckhorn Mt. (14); Tuolumne Co., Yosemite Park (10); Colorado: Elbert Co, Kiowa (11); Nevada: Elko Co., (7); Oregon: Polk Co., Dallas (2); Crook Co., Ochoco Summit (10); Deschutes Co., Metolius River (5); Harney Co., Pike Creek (5); Jackson Co., Pinehurst (10); Washington: Pierce Co., Mt. Adams (10); Pierce Co., Mt. Rainier (10); Wyoming:

Carbon Co. (14).

Specimens from Mt. Adams and Mt. Rainier are topotypes of *L. rolfsi* Knight and *rainieri* Knight, respectively. Samples from the rest of the populations were selected to cover the range of type localities, and color and paramere variation of the nominal species in the *nigridia* "complex".

An ocular micrometer was used to measure eight external characters: rostral length (RL) - because the rostrum was often bent at the joints, making its total length difficult to ascertain, only the length of the last three segments was measured; hind tibial length (HTL); length of antennal segment 1 (A1); length of antennal segment 2 (A2); width of head across eyes (HW); maximum length of the pronotum (PL); anterior width of the pronotum (APW); posterior width of the pronotum (PPW). In order to examine the multidimensional morphological variation in these populations, I applied principle component analysis to the measurements (PCA; Morrison, 1976) using SYSTAT (Wilkinson, 1986). Although a logarithmic transformation usually results in a more nearly normal distribution of the data (Sokal and Rohlf, 1981), it can also distort the multivariate space described by the measurements (Ricklefs and Travis, 1980). Analyses using both raw and log-transformed data produced almost identical results, therefore only results using raw data are presented here.

Because most of the described species in the *nigridia* "complex" were based on differences in color and male paramere morphology, I recorded eight characters of color and paramere morphology from the 139 specimens used in the morphometric analysis. Color characters: calli, scutellum, embolium and cuneus coded for black, red or white. Paramere characters: Angle of the dorsal spine (CA), Straight, Slightly angled, Acute; number of serrations on apex of paramere (SER); number of spines/bifurcations at apex of dorsal spine (SPIN); development of secondary spine on body of paramere (SECSPIN). These data were standardized and analyzed by SPSS/PC Hierarchical Cluster Analysis using UPGMA on distance matrices of squared euclidean distances.

RESULTS

PCA: The first two principal components accounted for 84% of the morphological variation among individuals. The first component (PC I, 76.1%) reflects the general size variation among individuals; all variables were positively correlated with PC I (Table II.1). PC II (7.9%) reflects an inverse relationship between RL and A2. To illustrate the distribution of populations in the morphological space described by the principal components, individuals were plotted on axes described by PC I and PC II and populations were enclosed in polygons by connecting the outlying individuals with lines (Fig. II.1).

This analysis illustrates some of the morphological differences among populations. For example, the Yosemite population (Y) is composed of large individuals with relatively long antennae and short rostra. The Mono Co. population (M) is composed of relatively small individuals with short antennae and long rostra. These two populations examined separately are quite distinct; they do not overlap in overall size and have differently proportioned antennae and rostra. However, both populations overlap other groups to some degree creating a continuum of morphological variation in all dimensions. This pattern makes it difficult to clearly segregate a population or groups of populations based on external morphology alone.

There was no clear pattern of morphological variation with regard to geography. The largest individuals were found in two California populations (Y, T), the Wyoming population (Ca), and the Colorado population (E). Individuals with short antennae and long rostra were found in the Wyoming population (Ca) and a California population (M). The two most morphologically similar populations were Wyoming (Ca) and Los Angeles Co. (LA).

Not all coefficients of variables in the PCA analysis were of equal magnitude, suggesting allometric relationships among the variables. For example, PC I represents general size variation among individuals and rostral length has the lowest correlation with PC I (Table II.1). This suggests that as size increases rostral length increases more slowly than other characters.

The significance of this pattern can be seen by examining the relationship of rostral length to the best single measure of size, pronotal length. The relative length of the rostrum (RL/PL) decreases with increasing size (Fig. II.2). Very small individuals have rostra that are 1.5 times the length of the pronotum whereas very large individuals have rostra that are only equal to the length of the pronotum. This has important implications regarding the taxonomic value of these and similar characters, such as the distance the rostrum extends posteriorly on the sternum. In very small individuals of the <u>nigridia</u> "complex", the rostrum extends to or slightly beyond the metacoxae, whereas in large individuals the rostrum may not reach the mesocoxae.

COLOR PATTERN: Dorsal coloration of individuals from any one series was usually uniform, but color varied dramatically among collections. At one extreme is a red form which is uniformly brick red with slight to moderate infuscation on the clavus. At the other extreme is a fuscous-white form with the clavus and corium predominately to completely reddish fuscous and the embolium and cuneus pale white (Fig. II.3). Color variants intermediate of the two extremes also occur.

The color patterns of the nigridia "complex" also occur in several related sympatric species. Lopidea marginata Uhler displays very similar color variation, with some populations composed of solid red individuals, and the clavus and corium infuscated and the embolium and cuneus pale white in other populations.

The different color forms in the nigridia "complex" do not appear to be segregated with regard to host plant west of the Rocky Mountains, and both color extremes have been collected from near sea level in southern California to > 5000 ft elevation in the Sierra Nevada and Cascade mountain ranges. The most conspicuous geographic patterns are the absence of the red form from the Intermountain Sagebrush Province and the absence of the fuscous-white form from the Great Plains Short Grass Prairie (Fig. II.4). This latter pattern also seems to correspond to a switch in preferred host plants from Lupinus to Astragalus (See Ecology).

PARAMERE STRUCTURE: There were few correlations between color and paramere variables and morphology. PC I, representing size, is negatively correlated with the number of serrations on the paramere, and all color variables (Table II.2). In general, populations of large individuals also tend to have more serrations and be solid red with no white on the embolium or cuneus and smaller individuals have fewer serrations and are more fuscous with a white embolium and cuneus. Although this trend is apparent for most specimens I examined, it is not always true; individuals from Deschutes Co., Oregon (D) are relatively small yet are solid red in color, and I have seen very large specimens from Santa Barbara Co., California that have a light embolium and cuneus.

Many characters of the right paramere formerly used to distinguish species within the nigridia "complex" vary among individuals within a population. For example, wilcoxi Knight was distinguished from rainieri Knight by the absence of a secondary spine in wilcoxi. In only two populations examined did all individuals either have or completely lack this structure. Some populations in the Siskiyou Mountains of California and Oregon contain individuals with a distinct toothed hook ventrally on the apex, used by Knight (1965) to distinguish calcaria Knight and eriogoni Knight. Other individuals from the same series lack this structure and display parameres more similar to other described species in the "complex." Figure II.5 illustrates the extent of variation of the right paramere seen in the nigridia "complex." The only aspect of the right paramere common to all populations and absent in other species of Lopidea is the presence of the elongate dorsal spine at the apex.

Examination of the left paramere and internal genitalia corroborated the patterns seen in the right paramere. The left paramere is structurally less complex than its counterpart, and thus shows less variation. The medial flange is digitiform, with its distal end usually slightly clavate and free from the main body of the paramere. The vesica bears a slender, slightly curved ventral spicula, toothed at the apex and with a slight swelling at its midpoint. The dorsal spicula is short, broadly lanceolate, toothed and slightly curved. The variation in these structures between color forms of the nigridia "complex" is no greater than the infraspecific variation seen in other species. This is illustrated in Figure II.6, where genitalic structures of a fuscous-white and a red forms of nigridia, both from Wyoming, are compared with the same structures from individuals of marginata Uhler from Oregon and Baja California. The dorsal spicula is usually shorter and straighter in the fuscous-white color form. The dorsal spicula however, varies in shape from straight and blunt to curved and evenly pointed (Fig. II.7), and also shows considerable variation in other species of Lopidea.

CLUSTER ANALYSIS: This analysis demonstrates the difficulty of separating groups within the nigridia "complex" based on color and paramere characters. In no case were all individuals from one population found to be most similar to each other, at least one individual was always grouped with those from another population. In most cases, individuals from any given population were scattered throughout the dendogram. For example, the Mt. Adams population (A) had individuals placed in four of the five major clusters (Fig. II.8a).

The cluster analysis does not identify groups composed of individuals that I determined as being the same color form. For example, all individuals from Crook Co. (Cr), Trinity (T) (Fig. II.8b) and Jackson Co. (J) (Fig. II.8a) represent the solid red form, however, Cr specimens are grouped in the upper most cluster, T specimens in the next lower cluster and J specimens in the middle three clusters. Similarly, specimens representing the fuscous-white form are also found in all of the major clusters. This analysis further suggests that grouping specimens within the nigridia "complex" based on color and paramere morphology gives equivocal results.

TAXONOMY

All specimens examined in this study clearly belong to a monophyletic group. They are united by the presence of an elongate dorsal spine on the apex of the right paramere, a free, digit-shaped medial flange on the left paramere, and a slender, slightly spindle-shaped ventral spicula; these are derived characters found in no other species of Lopidea. In addition, all specimens are believed to be conspecific for the following reasons. Populations or groups of populations cannot be distinguished by combinations of external morphological measurements. Although populations display considerable color variation, color is not highly correlated with external or paramere morphology, and similar color variation is seen in related species. Most characters of the right paramere vary among individuals from any population. Only characters common to all populations, such as the elongated spine on the dorsal apex of the right paramere and the digit-shaped medial flange on the left paramere, also corresponded with unique characters of the male vesica.

I have also examined the type specimens of all nominal species in the nigridia "complex" and have determined that they also are conspecific with nigridia Uhler using the criteria stated above. I interpret nigridia as being a polytypic species composed of three subspecies segregated to some degree by geography and/or habitat. I have elected to use the subspecies category for these taxa because, based on the available data, it adequately describes the broad geographic patterns of the color forms. I have retained the subspecies L. n. nigridia Uhler for the Inter-mountain, fuscous-white form, and L. n. serica Knight for the solid red, eastern Rocky Mountain and prairie form. I also recognize L. n. aculeata Van Duzee as a polymorphic montane form of the Pacific coast states. Below I provide a complete synonymy for nigridia and its subspecies. All lectotype and holotype label data are given verbatim.

Lopidea nigridia Uhler

Lopidea nigridia Uhler, 1895: 30 (n. sp., desc.). Lopidea nigridea: Osborn, 1898:233 (dist.). Van Duzee, 1914:28 (list). Van Duzee, 1916:241 (cat.). Van Duzee, 1917:384-385 (cat.). Van Duzee, 1921:127 (n. subsp.). Knight, 1923:69 (fig.). Van Duzee, 1933:96 (note). Carvalho, 1958:87 (cat.). Knight, 1965: 8-10 (fig.). Akingbohungbe, 1972:842 (note). Henry and Wheeler, 1988:422 (cat.).

LECTOTYPE (designated here): M, Colo. 1387 [1387 = Steamboat Springs, Col. July C.F. Baker, ex. Delphinium occidentale]; Lopidea nigridea, det Knight; LECTOTYPE Lopidea nigridia Uhler, det A. Asquith; deposited in the USNM.

HOLOTYPES OF SYNONYMS: Lopidea aculeata Van Duzee: M, Seattle, Wash.; W.M. Giffard, 7-VII-17; (CAS). Lopidea angustata Knight: M, Antioch Calif., Sand Dunes, June 4, 1942, H.A. Scullen; (USNM). Lopidea audeni Knight: M, Midday Valley, Merritt B.C., July 1925, K.F. Auden; (USNM). Lopidea calcaria Knight: M, Crater Lake, Ore., South Rim, 7100 ft elev., July 29, 1930; H.A. Scullen; (USNM). Lopidea chamberlini Knight: M, Whitman N.F., OR, VII-22-14; W.J. Chamberlin Collector; (USNM). Lopidea discreta Van Duzee: M, Huntington Lake Ca., July 26 19; Fresno Co. 7,000 ft.; E.P. Van Duzee Collector; (CAS). Lopidea eriogoni Knight: M, Drake Peak, Lake Co., Ore., 7850 ft. elev., July 26, 1930; (USNM). Lopidea fallax Knight: M, Below Mt. Springs, San Diego Co. Calif., June 11, 1915, Harold Morrison;

(USNM). Lopidea flavicostata Knight and Schaffner: M, Camino, Calif., July 10, 1965, H.H. Knight; (USNM). Lopidea medleri Akingbuhunge: (holotype not examined) Eau Claire Co., Fairchild, Wisc., 7-15-63, J.T. Medler (UWM). Lopidea nigridea hirta Van Duzee: M, San Miguel Isl., Cal., V-20-1919; EP Van Duzee Collector; (CAS). Lopidea rainieri Knight: M, Mt. Rainier Wash., Aug. 14, 1931, H.H. Knight; (USNM). Lopidea rolfsi Knight: M, Mt. Adams Wa., Aug. 3 1930, A.R. Rolfs; (USNM). Lopidea rubrofusca Knight: M, Monticello, Ut., 6-18-33; G.F. Knowlton Collector; (the name written on the holotype label is spelled "rubrofuscata" but was published as rubrofusca) (USNM). Lopidea sculleni Knight: M, Cornucopia, OR, 7100', July 25, 1936, H.A. Scullen, col.; (USNM). Lopidea serica Knight: Ft. Collins, Col. 6-28-00; (USNM). Lopidea usingeri Van Duzee: M, Oakland Rec. Camp, Cal., VII-20-27; Toulumne Co.; R.L. Usinger Collector; (CAS). Lopidea wilcoxi Knight: M, Mt. Rainier, Wa., VII-13-'31, sunrise, 6318'; J. Wilcox, Coll.; (USNM). Lopidea yakima Knight: M, Olympia, Wash., Aug. '93; (USNM).

DIAGNOSIS: Lopidea nigridia belongs to a western species group united by the rectangular shape and serrate apex of the right paramere, slender, unforked ventral spicula and red-white dorsal color pattern. Males can be distinguished by the presence of a straight, elongate dorsal spine at the apex of the right paramere (Fig. II.5).

Because of the extreme, yet common patterns of color variation between nigridia and sympatric species, females are difficult to identify. Females of ute Knight and garryae Knight lack erect, dark setae on the head and pronotum. In taurina Van Duzee the dark setae are much shorter and decumbent and the embolium usually supports only pale setae. Females of dakota Knight have the second antennal segment strongly tapered distally. L. chelifer Knight is also solid red in eastern Colorado but has the anterior width of the pronotum narrower than n. serica and western populations have white on the clavus. L. marginata Uhler, in areas of sympatry, can be distinguished only by its smaller size and white coloration on the clavus when present.

DISTRIBUTION: L. nigridia is widely distributed throughout western North America, and the three subspecies display a largely parapatric distribution (Fig. II.9). In the original description, Uhler (1895) listed this species from New Mexico and Arizona, states in which nigridia is not known to occur. Osborn (1898) reported nigridia from Iowa. This was clearly a misidentification, as at that time only the fuscous-white n. nigridia subspecies was recognized, and this form does not occur east of the Rocky Mountains.

REDESCRIPTION: Male. Length 4.52-6.55; red to grayish fuscous; dorsum with erect, black setae and small, appressed sericeous setae. HEAD: width across eyes 1.01-1.29, vertex 0.61-0.76, vertically declivent, triangular; tylus produced, arcuate anteriorly, black; distance between antennal fossa and anterior margin of eye less than width of second antennal segment, antennal socket ringed in black; gena red; all sutures black; frons slightly convex, red, vittae black; vertex slightly concave, posterior margin black; basal carina usually distinct from, lined with erect, black setae; posterior margin of head straight in dorsal view, postocular regions pale to rufous. ROSTRUM: length 1.53-1.78, black, dorsal surface slightly lighter; first segment rufous or pale dorsally and laterally, reddish fuscous distally with black apex. ANTENNAE: black, fuscous or red; I, length 0.40-0.64, with two, large, stiff setae distally on the medial surface, II, 1.34-2.28; III, 0.81-1.50; IV, 0.35-0.51. PRONOTUM: length 0.65-1.29, posterior width 1.25-1.96, broadly convex, surface smooth, anterior angles rounded, lateral margins carinate, slightly arcuate in dorsal view, lined with erect, black setae, posterior margin straight or slightly sinuate; calli lightly infuscate to piceous, posterior angles broadly rounded, surrounded by fulvus or yellowish white; disk brick red to gray fuscous; propleura smooth, glabrous, episternum fulvus to white, sternum black. LEGS: black, testaceous or fulvus; coxae and trochanters pale or fulvus; femora black on dorsum, paler on anterior and ventral surfaces, often spotted with fuscous, pale at apex; tibia black or dark red, tarsi black. GENITALIA: Tergal process: relatively long compared to other species of Lopidea, evenly narrowed to a sharp point, slightly curved medially. Right paramere: roughly rectangular in outline, apex with long, erect spine; spine pointed or bifurcate at tip, straight or inclined towards base of paramere (Fig. II.5). Apical edge of paramere slightly curved medially, usually with two vertical rows of small teeth; number and position of teeth variable. Small secondary spine occasionally present on dorsal edge near base of apical spine. Basal arm long, thick, curved medioventrally, apex variable, usually bifurcate (Fig. II.6). Left paramere: sharply angled with apical lobe oval in lateral view. Medial flange distinct, separate from lateral flange for most of its length; narrow, elongate with distal end usually slightly expanded (Fig. II.6). VESICA: Dorsal spicula: short, lanceolate, straight or slightly curved, both margins of distal third serrate (Fig. II.7). Ventral spicula: long, slender, slightly curved, a small swelling present near middle, apex with small teeth (Fig. II.6). VESTITURE: head and pronotum with short, stiff, erect, black setae, black setae on hemelytra variable in length, suberect to erect, occasionally pale on light colored area of corium, pronotum and hemelytra also with flattened sericeous setae, venter with moderately covered with short suberect pale setae.

Female. Similar in structure, color and vestiture, but larger, broader and more robust; frons more protuberant and broadly convex than male, vertex flat, basal carina less distinct, lateral margins of pronotum less carinate, hemelytra arcuate laterally. Length 4.82-7.46, HEAD: width across eyes 1.12-1.30, vertex 0.69-0.82,. ROSTRUM: length 1.22-1.55. ANTENNAE: I, length 0.51-0.76; II, 1.48-2.49; III, 1.01-1.47; IV, 0.41-0.52. PRONOTUM: length 0.91-1.50, posterior width 1.42-2.17.

Lopidea nigridia nigridia Uhler

Lopidea nigridia Uhler, 1895:30 (n. sp., desc.).

Lopidea nigridea nigridea: Van Duzee, 1921:128. Henry and Wheeler, 1988:423 (cat.).

Lopidea rainieri Knight, 1965:8-9 (n. sp.). Henry and Wheeler, 1988:423 (cat.). **NEW SYNONYMY.**

Lopidea sculleni Knight, 1965:9 (n. sp.). Henry and Wheeler, 1988:424 (cat.). **NEW SYNONYMY.**

Lopidea rolfsi Knight, 1965:9 (n. sp.); Akingbohungbe, 1972:842 (note). Henry and Wheeler, 1988:424 (cat.). **NEW SYNONYMY.**

Lopidea wilcoxi Knight, 1965:11-12 (n. sp.). Henry and Wheeler, 1988:425 (cat.). **NEW SYNONYMY.**

DIAGNOSIS: L. n. nigridia Uhler is small to moderate in size, parallel sided, with a contrasting dorsal color pattern of smoky fuscous on the pronotum, scutellum, clavus and most of the corium and pale white on the outer corium, embolium and cuneus (Fig. II.3a).

DISTRIBUTION: *L. n. nigridia* occurs along the western slopes of the Rocky Mountains, throughout the Great Basin from southern Nevada and Utah to southern British Columbia. It is the common form along the western slopes of the Cascade and northern Sierra Nevada Mountains and occurs west of these ranges through xeric, low elevation passes and river basins in California. *L. n. nigridia* also occurs throughout the coastal chaparral of southern California and into Baja California Norte. This subspecies inhabits the sage brush-steppe habitat of the Great Basin, xeric mountain slopes and dry lowlands. Its range appears to interdigitate with and superimpose on the ranges of the other two subspecies in some areas. However, the subspecies appear to be segregated by habitat in areas of sympatry, with *n. nigridia* inhabiting xeric shrub-steppe or chaparral habitats and the other subspecies occurring in more mesic conditions, usually at higher elevations.

SPECIMENS EXAMINED:

CANADA: British Columbia: Oliver;

USA: California: Alpine Co.: Hope Valley; 1 mi W Markleeville; Eldorado Co.: 3 mi S Camino; Camino; Fallen Leaf Lake; Tallac Lake, Tahoe; Fresno Co.: Heart Lake, 10500 ft; Nellie Lake, 9000 ft; Inyo Co.: Big Pine; 15 mi W Bishop; Independence; 7.8 mi W Lone Pine; Ruby Lake, ex. *Salix*; Symmes Crk., 6.5 mi. W Independence; 3.5 mi W Westgard Pass Summit on Rt. 168, 7178 ft, ex. *Purshia glandulosa*; Kern Co.: Short Canyon, 6 mi W Inyokern; Los Angeles Co.: El Segundo, ex. *Lupinus chamissionis*; El Segundo Sand Dunes; El Segundo, ex. *Oenothera cheiranthefolia*; Los Angeles; Placerita Canyon; Redondo;

0.9 mi W Wrightwood on Rt. 2, 6663 ft, ex. Lupinus sp.; Mono Co.: Leavitt Meadow, ex. Wyethia; Monterey Co.: Paraiso Hot Springs; Plumas Co.: 4 mi W Quincy; Riverside Co.: Anza, ex. Lupine; Dripping Springs; Gavilan, ex. Sambucus caerulea; 2 mi N Mountain Center; Idyllwild; San Jacinto Mts.; San Jacinto Mnts., Hemet Reservoir; San Bernardino Co.: Camp Baldy; Mohave River, near Deep Creek, ex. Ericameria = Haploppapus; San Diego Co.: Mnt. Palomar; Lakeside, ex. grass; Mnt. Palomar; below Mt. Springs; Rancho San Diego Botanical Gardens; San Louis Obispo Co.: Arroyo Grd. Crk., SW San Louis Obispo, 525 ft, ex. Lupinus ludivicianus; Santa Barbara Co.: Jalama Beach Sta.; 3 mi SE Zaka Park,, 4300 ft; Santa Clara Co.: Mnt. Hamilton; Palo Alto; Santa Cruz Mnts.; Sargent; Santa Cruz Co.: Ben Lomond Mt., 3 mi W Boulder Crk., 2400 ft; Felton; Shasta Co.: Hat Crk. P.O.; Hat Crk. R.S.; Hat Crk.; Lake Britton; 1 mi NE Montgomery Creek; 1 mi S jct. Hwys. 89 & 299, 3100 ft, ex. Castilleja; Sierra Co.: Gold Lake; Siskiyou Co.: Medicine Lake; Medicine Lake Rd., 4800 ft, ex. Cercocarpus ledifolius; Trinity Co.: Van Duzen Rd., ex. wild pea; Tulare Co.: Fairview; 9 mi S Fairview; Sequoia Nat. Prk., Ash Mt.; Springville; 3 mi above Springville, ex. Eriodictyon californicum; Tuolumne Co.: Blue Canyon, Sonora Pass; Oakland Recreation Cmpgrd.; Strawberry; 14 mi NE Strawberry; Tuolumne Meadows; Vandevanter Flat; Yosemite, 3900 ft; Ventura Co.: Sespe Canyon; Yolo Co.: 4 mi NE Rumsey; 5 mi N Rumsey; 2 mi W Rumsey;

Colorado: Delta Co.: Paonia; Mesa Co.: Mack; 8 mi S Mesa; Montezume Co.: Mese Verde Nat'l. Prk.; Montrose Co.: Montrose; Routt Co.: Steam Boat Springs, ex. Artemisia tridentata; Steamboat Springs, 6700-7000 ft; Rocky Mountain Nat'l. Park: Cascade Lodge; County ?: Northgate; Idaho: Butte Co.: Craters of the Moon Nat'l. Mon.; Franklin Co.:

Montpeilier, 6100 ft; Williams Cyn., Rt. 36, 8000 ft; Fremont, Henry's Lake, 7000 ft; Henry's Lake; Latah Co.: Moscow Mnt., 3000 ft; Owyhee Co.: Silver City, 6200 ft; Twin Falls Co.: Rock Creek R.S., Sawtooth N. F.; Valley Co.: Brundage Mnt.; Council; 4.5 mi W Donnelly, from mountain meadow; 4.5 mi W Donnelly, sweeping hay meadow; **Montana:** County??: Beaver Crk; 6300 ft; **Nevada:** Douglas Co.: Carson City; Elko Co.: 30 mi SE I-80 on Hwy. 229, 6260 ft, ex. Lupinus sp.; Humboldt Co.: 6 mi S Hwy 140, 4 mi NW Winnemucca, 5500 ft; Lander Co.: Kingston Crk. Cyn., Toiyabe Mts., 6500-7500 ft, T16N R43E, S27&35, ex. Astragalus filpes; Scott Summit, 6 mi E Austin, 7268 ft; Nye Co.: 28 mi N Belmont, Hwy. 82, 6760 ft, ex. Sarcobates vermiculatus; Ormsby Co.: Washoe Co.: Little Valley Research Area, 4.5 mi SW Washoe, T16N R19E Sec2, 6200 ft, ex. Purshia tridentata; Pyramid; 6 mi. E Vya, ex. Lupinus caudatus; **Oregon:** Baker Co.: 3.3 mi E Halfway; Unity; Deschutes Co.: 5 mi S La Pine; Grant Co.: Izee, Kerrin's Ranch; 0.7 mi E Seneca, 4800 ft; Harney Co.: Burns; Pike Crk., 5800 ft, ex. Lupinus caudatus; Pike Crk., ex. Lupinus caudatus; Jackson Co.: Mnt. Ashland, 7100 ft; 0.5 mi E Pinehurst, 3550 ft, ex. Lupinus sp.; Pinehurst, 3400 ft; just E Pinehurst, 3740 ft, ex. Lupinus; Josephine Co.: Oregon Caves, 3900 ft; Rough & Ready Wayside, S Cave Junction, ex. Lupinus; 1 mi S Rough & Ready Wayside, Lupinus sp.; 10 mi E Selma; R7W-T39S-Sec.36, ex. Leguminosae; Klamath Co.: Chiloquin, Rt. 97, ex. Lupinus; Fort Klamath; **Utah:** Cache Co.: Cache Jct.; Carbon Co.: entr. Price Canyon Recr. Area, 8 mi NW Helper off UT Rt. 50/6, 8000 ft, ex. Cercocarpus ledifolius; Rich Co.: Garden City; San Juan Co.: Verdure; Sevier Co.: Clear Creek Narrows summit on Rt. 4, 7362 ft; Fish Lake Nat'l. For., N end of Johnson Valley Reservoir, 8940 ft, ex. Potentilla fruticosa; 2.3 mi N I-70 on Rd. to Kanosh, 6980 ft, ex. Artemisia sp.;

Summit Co.: Park City; Wasatch Co.: Dock Flat, 1 mi NE UT St Rt. 40, T2S R12W Sec9, 8000 ft, ex. *Symphoricarpos oreophilus*; Weber Co.: Huntsville; **Washington:** Chelan Co.: Squilchuck; Wenatchee Nat. For., Pomas Pass, 6020 ft, sweeping grass; Kittitas Co.: Fish Lake; Wenatchee Mnts.; Pierce Co.: Mnt. Rainier, 6318 ft; Mnt. Rainier, Yakima Park, 5000 ft; Yakima Co.: Mnt. Adams; Naches; Tieton Canyon; Yakima; **Wyoming:** Fremont Co.: Green River Lake, Wind River Mnts., 8500 ft; National Park; National Park; Lincoln Co.: 1 mi N Alpine, 5900 ft; Auburn; Park Co.: 19 mi E Cooke City on Rt. 212, 8000 ft, ex. *Lupinus* sp.; Teton Co.: Grand Teton National Park,; Jackson, 6300 ft; Yellowstone Nat'l. Pk.; ???? Big Horn Mts., 6500 ft.

Lopidea nigridia aculeata Van Duzee **NEW STATUS**

Lopidea *aculeata* Van Duzee, 1917:271 (n. sp.). Knight, 1965:11 (color, dist.). Henry and Wheeler, 1988:417 (cat.).

Lopidea discreta Van Duzee, 1921:127 (n. sp.). Carvalho, 1958:84 (cat.). Henry and Wheeler, 1988:419 (cat.). **NEW SYNONYMY.**

Lopidea nigridea hirta Van Duzee, 1921:128, (n. subsp.). Carvahlo, 1958:87 (cat.). Henry and Wheeler, 1988:423 (cat.). **NEW SYNONOMY.**

Lopidea fallax Knight, 1923:69 (n. sp.). Van Duzee, 1933:96 (note); Carvalho, 1958:84 (cat.) Henry and Wheeler, 1988:420 (cat.). **NEW SYNONYMY.**

Lopidea yakima Knight, 1923:69-70 (n. sp.). Carvalho, 1958:88 (cat.). Henry and Wheeler, 1988:425 (cat.). **NEW SYNONYMY.**

Lopidea usingeri Van Duzee, 1933:96 (n. sp.). Carvalho, 1958:88 (cat.). Henry and Wheeler, 1988:425 (cat.). **NEW SYNONYMY.**

Lopidea audeni Knight, 1965:9-10 (n. sp.). Henry and Wheeler, 1988:417 (cat.). **NEW SYNONYMY.**

Lopidea eriogoni Knight, 1965:10 (n. sp.). Henry and Wheeler, 1988:420 (cat.). **NEW SYNONYMY.**

Lopidea calcaria Knight, 1965:11-12. (n. sp., note). Henry and Wheeler, 1988:418 (cat.). **NEW SYNONYMY.**

Lopidea chamberlini Knight, 1965:12-13. (n. sp., note). Henry and Wheeler, 1988:418 (cat). **NEW SYNONYMY.**

Lopidea angustata Knight, 1965:12 (n. sp.). Henry and Wheeler, 1988:417 (cat). **NEW SYNONYMY.**

Lopidea rubrofusca Knight, 1965:13 (n. sp.). Henry and Wheeler, 1988:424 (cat.). **NEW SYNONYMY.**

Lopidea flavicostata Knight and Schaffner, 1968:75 (n. sp.). Henry and Wheeler, 1988:420 (cat.). **NEW SYNONYMY.**

DIAGNOSIS: L. n. aculeata Van Duzee is highly variable in size and coloration (Fig. II.3b). It is usually larger than n. nigridia and often larger than n. serica, but always more linear than the latter. In the mountains of British Columbia, Washington and Oregon it is solid red in dorsal coloration with more yellowish individuals found at lower elevations. In northern California individuals show some white along the embolium and cuneus and this pattern increases in distinctness and frequency in southern populations.

This subspecies is itself highly variable, and several distinct color forms can be distinguished as follows: (1) The type specimens of aculeata from Seattle, WA are yellowish with a dark-black head, and a large hook at the posterior angle of the apex of the right paramere. The type material is representative of populations found at low elevations in the Willamette-Puget Lowland area of Washington and Oregon. (2) _L. n. hirta_ Van Duzee was described from San Miguel Island off the coast of southern California. These specimens are solid red, small and convexly arcuate laterally. I have seen four males from San Miguel Island in the USNM. These specimens are larger and slightly less arcuate than the type specimens of _n. hirta_, but still different than mainland populations at that latitude. (3) Specimens from the mainland of southern California are large, linear and most have a noticeably pale embolium and cuneus. Specimens from the southern Sierra Nevadas, the San Gabriel and Santa Rosa Mountains of southern California are very distinct. The hemelytra are darker, almost fuscous, the disk of the pronotum is deep red and always shiny, and the setae, especially on the pronotum are shorter and more decumbent. The species _discreta_ Van Duzee is of this form.

DISTRIBUTION: _L. n. aculeata_ occurs in the Cascade Mountains of British Columbia, Washington and Oregon, the eastern slopes of the coastal mountain ranges in these areas and in the Blue and Wallawa Mountains of Oregon and Washington. It occurs throughout the Coastal and Sierra Nevada Ranges of California. In southern California, however, the ranges of the _n. aculeata_ and _n. nigridia_ overlap, and specimens intermediate and distinct in color pattern occur. Detailed studies of the local distributions of the color forms in this area are needed to clarify the problem.

SPECIMENS EXAMINED:

CANADA: British Columbia: Cowichan Bay; Lillooet; Manning Park, Blackwell, 6000 ft.; Merritt, Midday Valley; Nicola Lake; Saanich.

MEXICO: Baja California Norte: Ensanada; 38 km E Rt. 1 to Parque San Pedro Martir, 1312 ft.; Tecate, 3.4 mi S El Condor, 4000 ft.;

USA: California: Butte Co.: 5 mi W Paradise; Calaveras Co.: Mokelumne Hills; Mokelumne River; Contra Costa Co.: Antioch, sand dunes; Mnt. Diablo; Mt. Diablo St. Park, Stagecoach Cmpgrd., 2200 ft; El Dorado Co.: China Flat; Lake Tahoe; 4 mi S Meyers; 2 mi N Placerville; Snowline Camp; Fresno Co.: Clinghams Jnct.; Huntington Lake, 7000 ft, ex. Lupine; Kings Canyon; Paradise Valley, King's River, 7000 ft; San Joaquin Mnts.; Humboldt Co.: Mnts. above Ball Creek; Dinsmores; Kneeland; Kern Co.: Fort Tejon; Mnt. Pinos, 6400 ft; Poso Creek; Lake Co.: St. Hwy E of Clear Lake; 0.6 mi SE Glenbrook; 2 mi N Hoberg's, ex. Amorpha & Lupinus; Middle Creek; Lassen Co.: Bogg's Lake; Eaglelake, 45 km N Susanville, Brockman Flat at Merrill Burn, 5200 ft; 3 mi W Nubieber, 4609 ft; Los Angeles Co.: Claremont; Baker; Lancaster; Mint Canyon, Elderberry; Pasadena; 5 mi. E Saugus, Mint Canyon; Tanbark Flat; Whittier, Turnbull Elder; Los Angeles Co.; Madera Co.: Bass Lake, ex. Sambucus; Coarsegold, ex. Lupinus; Mariposa Co.: Hwy. 140, Cathy Park, ex. Avena fatua; Santa Cruz Mts.; Yosemite Valley; Mendocino Co.: Eel River, ex. Lupinus luteolus; 4 mi W Eel River R.S., 1450 ft, ex. Wyethia sp.; Hopland Grade; Modoc Co.: Fandango Pass Summit, 6200 ft, ex. Lupinus; 1 mi S Fort Bidwell, 4724 ft, ex. Lupinus; Monterey Co.: Pleyto; Pleyto Canyon; Napa Co.: Cave Lake, 1 mi W Markley, ex. Lupinus albifrons; 4.3 mi W Monticello, ex. Lupinus albifrons; Putah Canyon; Nevada Co.: Basin Peak, ex. Astragalus whitneyi; Castle Peak, 9100 ft, ex. Symphoricarpos; S Fork of Yuba River; Orange Co.:

Atwood; El Toro, ex. sunflower; Irvine Park; Rancho S. Ano Bot. Garden, ex. Encelia californica; Santa Anna, El Paddock, ex. Sambucus glauca; Plumas Co.: Butte Lake; Meadow Valley, 4000-5000 ft; Quincy, 3450 ft, ex. Arctostaphylos; Riverside Co.: Chino Canyon; Deep Canyon, 2960 ft; Menifree Valley (W end), 1800 ft, ex. Eriogonum; San Jacinto Mnts., ex. Lupinus; Idyllwild, ex. Lupinus; Sandia Canyon; Riverside; Soboba Springs; San Jacinto Mnts.; San Timotco Canyon; Snow Creek; Stone Canyon; San Jacinto Mnts., ex. Lupinus; Symmes Creek, 6.5 mi W Independence, ex. Lupinus albifrons; Whitewater Oasis; Sacramento Co.: Carmichael; Folsom; Freeport, ex. mustard; Sacramento; San Benito Co.: San Bernardino Co.: Big Bear Lake; 2 mi E Camp Angeles, ex. Lupine; Pinon Hills; San Bernardino, ex. Elder; Siberia Creek; 3 mi SW Victorville, ex. Dalea saundersii; 2 mi E Wrightwood on Rt. 2, 5128 ft, ex. Sambucus mexicana; San Diego Co.: Alpine; Anza-Borrego St. Prk., Grapevine Canyon, mp 74 on Co. Rt. 52, ex. Encelia sp.; De Luz; 3.5 mi N Henshaw Dam on S7, 4002', ex. Lupinus; Jacamba-Campo, alder; Palomar Mnt.; Paradise Valley; Ramona; Solana Beach; San Louis Rey, ex. alfalfa; San Mateo Co.: San Bruno Mnt.; Stanford Univ. Campus Exp. Area; San Louis Obispo Co.: Bryson; Santa Margarita; Santa Ana Co.: Green River Camp; Santa Barbara Co.: Arrowhead; Figueroa Peak; Upper Oso Cmpgrd. off Rt. 154, 1018 ft, ex. Sambucus mexicana; San Miguel Isl., Cuyler Harbor area; San Miguel Isl.; San Miguel Isl., ex. Astragalus; Santa Maria, ex. lupine; Siskiyou Co.: 1 mi W Bartle, 4002 ft, ex. Lathyrus; 5 mi SW Callahan, Cecilville Rd., ex. Cirsium pastoris; Hebron Summit, 5202 ft; Lava Beds Natl. Mon., 5118 ft, ex. Cercocarpus ledifolius; 5 mi S MacDoel; 12.3 mi N St. Hwy. 89 on Powder Hill Rd., ex. Purshia tridentata; Mt. Eddy, ex. Astragalus whitneyi; 15 mi SE Mnt. Shasta, 3500 ft; 5 mi SE

Shasta City, brushy meadow; Shasta Springs; Solano Co.: near Cordelia; 4 mi S Cordelia; Monticello Dam, *Wyethia helenoides*, ex. *Lupinus albifrons*; Winters; Sonoma Co.: Geyserville,, ex. *Lathyrus californicus*, *Salix*; Mesa Grande; Trinity Co.: 0.5 mi W Buckhorn Mnt. Summit, 3400 ft, ex. *Lupinus* sp.; 0.5 mi W Buckhorn Mnt. Summit, 3400 ft, ex. *Lotus* sp.; Tulare Co.: California Hot Springs; Crescent Meadow, Hamilton Lake, Sequoia Nat. Park, Central; Marion Mnt. Camp, San Jacinto Mnts.; Mnt. Home; 20 mi E Porterville; Redwood Meadows; Road's End; Woodlake; Tuolumne Co.: Eleanor Lake; Strawberry; Pinecrest, ex. *Lotus*; Wawona; Ventura Co.: Camp Ozena; Ojai; 1 mi N Santa Paula; Wheeler Springs; County ??: Devil's Basin, 8200 ft; Nevada: Washoe Co.: 6 mi W Vya toward Cedarville, 5938 ft, ex. *Lupinus*; Oregon: Benton Co.: 8 mi S Philomath; Columbia Co.: Saint Helens, 500 ft, ex. *Epilobium angustifolium*; Crook Co.: Bandit Springs, Hwy. 26, Ochoco Nat'l. For., ex. *Lupinus*; 26 mi E Prineville, ex. *Lupinus caudatus*; 30 mi NE Prineville; 29 mi NE Prineville, 4700 ft; Deschutes Co.: 1 mi W Camp Sherman; Pioneer Ford, Metolius River; Metolius River; 6 mi NW Sisters, ex. *Lupinus*; 6 mi SW Sisters on FS rd. 1536, Brush Draw, T15S R9E Sec29, ex. *Pinus ponderosa*; 7 mi W Sisters, ex. *Lathyrus*; 9 mi W Sisters, 3400 ft; Douglas Co.: Kelsay Valley; Hood River Co.: Hood River; Parkdale; Jackson Co.: Ashland Peak, 6500 ft; Moon Prarie; 0.5 mi E Pinehurst, 3550 ft, ex. *Lupinus* sp.; 1 mi E Pinehurst on Hwy. 66, ex. *Lupinus* sp.; 0.5 mi S Siskiyou Summit on old Rt. 99, 4429 ft;

Jefferson Co.: Allen Springs, Metolius Riv.; Klamath Co.: Crater Lake, South Rim, 7100 ft; Crater Lake, South Rim, 7100 ft; Gearhart Mnt., ex. *Phlox*; 13 mi W Keno, Rt. 66, 4600 ft, sweeping natural vegetation; Oasis Springs, Crater Lake Nat'l. Prk.; Rocky Point; Lake Co.: Drake Peak, 8218 ft; Drake Peak, 7850 ft, ex. _Eriogonum_; Warner Canyon, Lakeview roadside, 5450 ft; _Lane Co._: H.J. Andrews Exp. For., 11 mi E Blue River, 1.3 mi N Frissell Point, 4750 ft; _Mount Hood Co._: 27 mi S of Mt. Hood; _Multnomah Co._: Portland; _Polk Co._: Black Rock, 16 mi SW Dallas; Rickreal Ridge, 10 mi W Dallas; _Tillamook Co._: Tillamook Burn, jct. Jordan Creek & Lyda Rd.; _Union Co._: La Grande; _Wasco Co._: 24 mi SW The Dalles, Kuebal Springs, 3900 ft; Warm Springs; _Wheeler Co._: 11 mi S Mitchell; 2 mi W Mitchell on Hwy. 26, ex. _Lupinus_ sp.; 1 mi E Ochoco Divide, ex. _Ceanothus_ sp.; **Washington:** _Clallam Co._: Olympic Nat'l. Pk., 5700 ft; Olympic Nat'l. Pk., Blue Mnt., 5500 ft, ex. _Astragalus australis_; _Custer Co._: Cliffdell; _King Co._: Seattle; _Lemhi Co._: N Bonneville; _Pierce Co._: Buckley; Puyallup; _Skagit Co._: Clear Lake; _Skamania Co._: Underwood; _Thurston Co._: Rochester.

Lopidea nigridia serica Knight **NEW STATUS**

Lopidea serica Knight, 1923:69 (n. sp.); Kelton, 1980:235 (dist., hosts, fig., key). Akingbohungbe, 1972:842 (note). Henry and Wheeler, 1988:424 (cat.).

Lopidea medleri Akingbohungbe, 1972:840-842 (n. sp.). Henry and Wheeler, 1988:422 (cat.). **NEW SYNONYMY.**

DIAGNOSIS: _L. n. serica_ Knight is larger, more robust, with the lateral margins usually arcuate and solid red in dorsal coloration, except for black on the calli and light infuscation on the clavus (Fig. II.3c). Females are usually sub-macropterous, with the membrane of the hemelytra reduced and barely reaching the end of the abdomen. Although this is the most morphologically distinct of the subspecies, it did not appear as such in the PCA because I did not use characters such as total length and maximum width of hemelytra.

DIAGNOSIS: L. n. serica occurs along the eastern slopes of the Rocky Mountains from Alberta to Colorado and east across the northern Great Plains to southern Manitoba. It appears to inhabit the mesic grasslands of the eastern Rocky Mountains and Short-grass Prairie systems.

There are two interesting disjunct localities for n. serica in western Wisconsin and southwestern Yukon Territory and adjacent Alaska (Fig. II.9). Although n. serica might be expected to occur in the relictual prairies of Wisconsin, the Wisconsin record comes from an area of scrub oak savannah. The Yukon records are from an area along the western edge of the Yukon Plateau, and at the southern edge of the Alaska-Yukon glacial refugium. This record may represent a relictual population from the refugium or the tip of the post-Pleistocene northern migration along the Interior Plateau of British Columbia, although there are no other localities north of southern British Columbia. The host plants Lupinus and Astragalus are common to both the disjunct localities.

SPECIMENS EXAMINED:

CANADA: **Alberta:** Banff; Bow River; Elkwater Park; Lethbridge; Manyberries; Waterton Lake; Waterton Nat'l. Prk.; **Manitoba:** Millwood; **Saskachewan:** St. Victor; Willow Bunch; **Yukon Territory:** Alaska Highway, mi 1054, Kluane Lake; Destruction Bay; Kluane Nat. Pk., base Mt. Wallace, 3500 ft.; Silver City;

USA: **Alaska:** mi. 1019, (a-238-59); **Colorado:** Boulder Co.: Nederland; Elbert Co.: E Kiowa along W Bijon Creek; 3 mi E Kiowa, 6500 ft, ex. Astragalus sp.; Jefferson Co.: Golden;

Indian Hills, 7000 ft, ex. Astragalus sp.; Gilpin Co.: Pinecliffe; Larimer Co.: Estes Park; Fort Collins; Pingree Park; Rist Cyn., 7000 ft; Estes Park, 7500 ft; Weld Co.: Central Plains Exp. Range, 8 km N Nunn, ex. Astragalus mullisinus seeds; 3 mi N Rockport, 5794 ft; County?: Pinewood; Pondre Canyon; Trailridge Rd., 12100 ft; **Montana:** Carbon Co.: 15 mi NE Beartooth Summit on Rt. 212, 8200 ft, sweeping subalpine meadow; Parkside Cmpgrd., 11 mi S Red Lodge, 7250 ft, ex. Lupinus sp.; Gallatin Co.: Bridger Mts., 7500 ft; Glacier Co.: 40 mi E Glacier Nat'l. Park; Sweet Grass Co.: Melville; **North Dakota:** Hettinger Co.: Mott, ex. Agropyron smithii; **Wyoming:** Albany Co.: 9 mi E Laramie, 8600 ft; Carbon Co.: Parkside Cmpgrd., 11 mi S Red Lodge, 7250 ft, ex. Lupinus; Goshen Co.: Jay Em; Laramie Co.: 14.8 mi E Albany/Laramie co. line, ex. Astragalus humistriatus; Rt. 80, Medicine Bow Mnts. Summit, 8640 ft; Niobrara Co.: Lusk; Whitman; Teton Co.: Teton Science School near Kelly.

DISCUSSION OF SPECIES

Lopidea nigridia is the original spelling used in the description by Uhler (1895). This clearly was not a lapsus, as I have seen Uhler determination labels using this spelling. The next citation to the species is Van Duzee (1914), who used the incorrect spelling of nigridea. All subsequent citations have also used the incorrect spelling.

There is confusion concerning the true identity of the species that Uhler referred to as nigridia. In his description, (Uhler, 1895), he described the color as brownish black with the outer border of the corium and cuneus rufo-fulvous or rufous, with no mention of white on the embolium or cuneus. However, this is clearly a contrasting dark-light pattern like that of the fuscous-white color form (n. nigridia). In addition, Uhler describes the anterior border of the pronotum as white, a pattern that occurs only in the fuscous-white form (n. nigridia) and not the red form (n. serica).

I located a fuscous-white specimen in the USNM bearing the label Colo. 1387. This number, 1387, corresponds to the following information in the C.F Baker catalog: Steamboat Springs, Col., July, C.F. Baker, ex. Delphinium occidentale (I attached a label with these data on the specimen). The same information was given by Uhler for one of the specimens he examined for his original description. Knight (1923) illustrated the right paramere of another specimen from the type locality and it is this concept of nigridia that has been used by all subsequent authors. Therefore, I have selected the former specimen as the lectotype of Lopidea nigridia Uhler, and indicated such by attaching a label.

I have also seen specimens of nigridia with Uhler determination labels bearing the name Lopidea obscura Uhler, a Uhler manuscript name. It is possible that this is the name Uhler used for L. n. nigridia, and his description of nigridia referred to some other species with a contrasting light-dark color pattern. In addition, I have seen different specimens from the same locality identified by Uhler as both nigridia and obscura. However, it is evident that the specimen I have selected as the lectotype was among those examined by Uhler in his description of nigridia.

DISCUSSION OF SUBSPECIES

Lopidea nigridia aculeata is highly variable and remains confusing to taxonomists. When discussing aculeata, Knight (1965) noted that specimens collected from different areas in Oregon had identical parameres but varied from yellow fuscous to red fuscous and concluded that this species was variable in color. Van Duzee (1921) when describing discreta commented "It might be best to consider this a race or variety of nigridea ...," and in his discussion of usingeri (Van Duzee, 1933) he stated "This species, like obscura exhibits considerable variation in the depth of coloration...."

Knight distinguished serica from nigridia by the presence of golden sericeous pubescence in serica, but all specimens of nigridia (all Lopidea in fact) have this pubescence if it is not rubbed off.

I have seen specimens that are topotypes of rolfsi Knight and rainieri Knight that Knight originally determined as nigridia Uhler and other fuscous and white specimens from Idaho determined as nigridia Uhler. Several specimens of intermediate color pattern from California have also been determined as nigridia by Van Duzee.

Lopidea rubrofusca Knight was described from a single male from Monticello, Utah, and is somewhat enigmatic. It is almost solid red, typical of n. serica. In size and development of the hemelytral membrane, however, it is more similar to n. nigridia and I have synonymized it with n. nigridia.

Analysis of the ecology, behavior, habitat and host preference in areas of sympatry may prove that the subspecies of L. nigridia are actually distinct species, but morphologically they do not display differences as great as those seen between other species of Lopidea. In addition, more detailed studies of the populations in some areas may suggest that some of the color forms within the subspecies deserve taxonomic recognition. With the available information, however, it is more prudent to recognize the structural similarity between these populations and the rest of nigridia and detail the geographic variation, rather than assign names to populations with distinct color patterns.

GENITALIA

I have weighted genitalic characters heavily in forming a species concept for L. nigridia. This is based on examinations of these structures throughout the genus and in related Orthotylini. My analyses of paramere structure show no geographic pattern or distinction among subspecies. It is possible that incipient speciation has occurred in this "complex," and that it is not reflected in paramere morphology. This is most plausible for L. n. nigridia and L. n. serica in the northern and eastern parts of the range, where they retain distinct color patterns and exhibit the greatest differences in the shape of the dorsal spicula. Other species of Miridae also display geographic variation in size, vestiture or color, including Irbisia brachycera (Uhler) (Schwartz, 1984) and Pilophorus tibialis Van Duzee (Schuh and Schwartz, 1988).

With the exception of Wagner (1970), who recognized geographic subspecies of Orthotylus ericetorum (Fallen) based on differences in paramere and vesicae morphology, few studies have described the within-species variation of these structures. Stonedahl and Schwartz (1986) illustrate the variation in paramere structure for some species of Pseudopsallus. Stonedahl (1988) described clinal variation in the size and shape of the vesica of Phytocoris yollabollae Bliven, and recognized two biotypes of P. fraterculus Van Duzee based on geographic differences in male genital structures. He found that other species of Phytocoris such as P. tenuis Van Duzee are highly variable in size, color and genital structure, yet none of these variables were correlated with each other, nor did any show clear patterns of geographic variation. Detailed documentation of variation in genitalic structures are rare for any group of Heteroptera. Several examples are available for the Auchenorhynchous Homoptera, however. Euscelis incisus (Kirschbaum) exhibits seasonal variation (Muller, 1954) and E. incisus Brulle shows temperature induced variation (Muller, 1957) of the aedeagus. Wagner (1955) illustrated extreme clinal geographic variation in the aedeagus of Philaenus spumarius (L.). Other studies have documented the intra and interpopulational variation of aedeagal characters in this group (Wagner, 1967; Le Quesne and Woodroffe, 1976; Oman, 1987). Studies of the infraspecific variation in spicula shape in the orthotyline Miridae are greatly needed. In L. nigridia the dorsal spicula varies from straight and blunt to curved and pointed (Fig. II.7). The ventral spicula can also be twisted and varied in its curvature and dentation.

COLOR

The distinction between the subspecies in some areas and their discrete distributions probably reflects some degree of genetic segregation. This pattern might be interpreted as a species level phenomenon, however the subspecies are almost identical morphologically and do not appear to be segregated by host plant, as are other species of Lopidea. L. n. aculeata, however, shows inter- and intrapopulational variation in color pattern from fuscous-red or solid red to red-white.

Although I have placed subspecies determination labels on all specimens I examined for this study, the assignment of some populations to L. n. nigridia or n. aculeata is equivocal. For example, I have examined two series of specimens, each collected from Mokelumne Hill, Calaveras Co., California, but from different years. One series exhibits the fuscous-white color pattern typical of n. nigridia, while the other series is a lighter red-white in color typical of n. aculeata. There are a few additional localities from which two of the subspecies have been collected, although not from the same year or dates. Because of the lack of detailed local geographic variation, habitat preferences, and biological data from these areas, I refrain from making suggestions regarding hybrid suture zones and intergradation for these forms of L. nigridia. This suggests the possibility that these forms are not distinct lineages but only ecotypes.

Because temperature is known to effect the deposition of red and black pigments in Heteroptera (Knight, 1924; Aldrich, 1986) it is likely that some of the color variation of L. nigridia is environmentally induced, and different color forms could develop at the same locality at different times of the year or different years. I have reared two of the subspecies, n. nigridia and n. aculeata under three temperature regimes, 13°C, 21°C and 33°C. Individuals of both subspecies reared at 13°, were clearly darker than those reared at 33°; those reared at 13° exhibited fuscous or black coloration on areas of the head, pronotum and hemelytra that were red in the specimens reared at 33°. However, the pale embolium and cuneus of the n. nigridea individuals were not affected by temperature, nor was the red color of these structures affected in the specimens of n. aculeata.

The pattern of color variation seen in L. nigridia is common in the genus Lopidea. Several other western species such as marginata Uhler, taurina Van Duzee and chelifer Knight also have populations of solid red individuals and other populations of individuals with white margins of the hemelytra. The same distribution pattern of the nigridia subspecies is seen in other species with color polymorphism;

the red-white or black-white forms occur in the Intermountain region and the solid red forms occur further north and in the Rocky Mountains. It is also interesting that the distribution of the subspecies of nigridia corresponds to the distribution of other species of Lopidea of constant color. Species with contrasting red-white or fuscous-white patterns tend to predominate in the Intermountain region where the fuscous-white n. nigridia is found and solid red or red-fuscous species are more common in the northern US and Canada and the Great Plains where only the red n. serica occurs.

Other explanations such as host plant induced color patterns (Palmer and Knight, 1924a,b) or selection for a certain pattern by different predator complexes (McIver and Lattin, in press) are equally viable.

BIOLOGY

The biology of a population of Lopidea nigridia Uhler in eastern Oregon was described in detail by McIver and Asquith (1989). At their study site, nigridia has one generation per year and overwinters in the egg stage in the tissue of its host plant Lupinus caudatus Kell. Nymphs appear from late April to early June and most individuals are adults by mid June. Oviposition is from late June through July and most activity ends by early August.

In California, adults have been collected from April 4 to September 1, but are most commonly taken between May 15 and July 15, with the average collection date being the third week in June. In other parts of the range adults emerge later in the season and are most common between June 7 and August 15, with an average collection date in the second week of July.

Lopidea nigridia has been collected from at least 28 different genera of plants. West of the Rocky Mountains greater than 48% percent of the host plant records are Lupinus. Testing this observation against a null hypothesis of an equal number of collections from all recorded hosts, shows that nigridia is collected from Lupinus more often than would be expected by chance (X^2=326.26, $p<0.001$, N=75, DF=25). Further, four of five confirmed breeding records were on Lupinus and one on Astragalus.

In the Great Plains more than 50% of the records are of Astragalus. This switch in host preference corresponds with the distribution of the subspecies L. n. nigridia and n. serica. Another mirid, Coquillettia insignis Uhler, which is typically associated with Lupinus in western North America, also feeds on Astragalus in Colorado and Wyoming (McIver and Stonedahl, 1987). This pattern may reflect a change in the abundance and availability of the two host plants.

Table II,1. Correlations between the first two principal components and the morphometric measurements of male *Lopidea nigridia*.

Character	PC I	PC II
Rostrum length	0.636	-0.731
Hind tibia length	0.896	0.129
Antennal segment 1	0.912	0.173
Antennal segment 2	0.870	0.288
Head width	0.892	-0.135
Pronotal length	0.941	0.032
Anterior pronotal width	0.847	0.002
Posterior pronotal width	0.892	-0.031

Table II.2. Pearson correlation coefficients between the first two principal components and paramere and color characters of male Lopidea nigridia. * = significant at alpha < 0.05. ** = significant at alpha < 0.001. NS = not significant (alpha > 0.05).

Character	PC I	PC II
CA	-0.157 NS	-0.121 NS
SER	-0.361 **	-0.066 NS
SPIN	-0.02 NS	-0.054 NS
SECSPIN	-0.067 NS	-0.11 NS
CALLI	-0.308 **	0.195 *
SCUT	-0.207 *	0.18 *
EMBOL	-0.594 **	0.072 NS
CUN	-0.564 **	0.116 NS

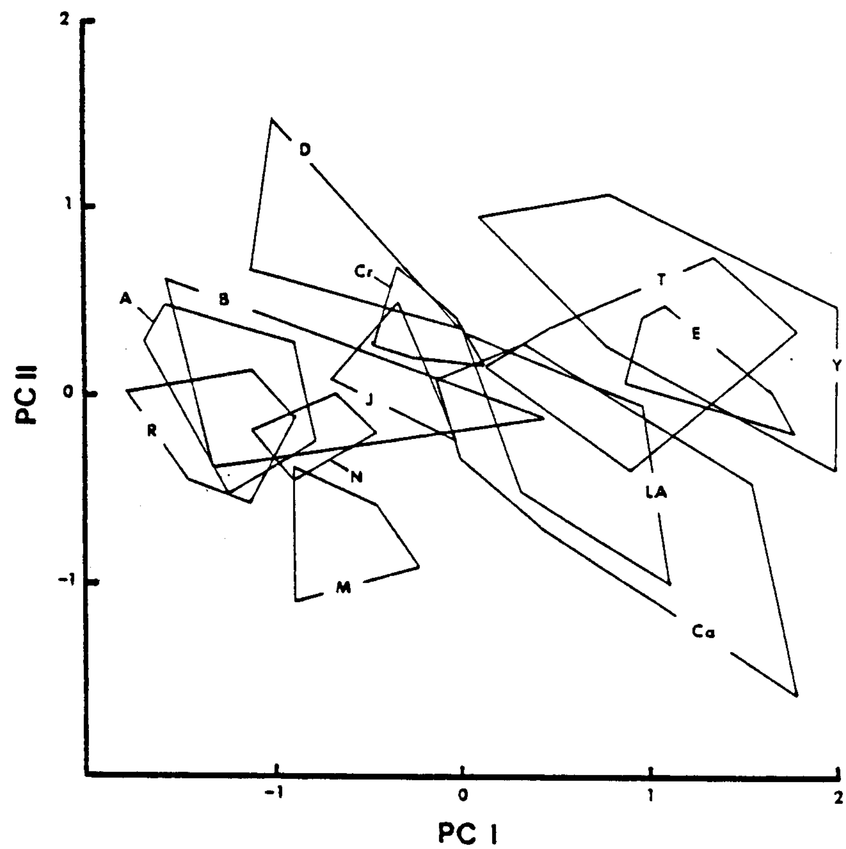

Figure II.1. Morphological variation of Lopidea nigridia Uhler based on principle components analysis. Populations are plotted on the first (PC I) and second (PC II) principle components, enclosed in polygons connecting the outlying individuals of each sample. Abbreviations: R = Mt. Rainier, WA (L. n. nigridia). A = Mt. Adams, WA (L. n. nigridia). Ca = Carbon Co., WY (L. n. serica). N = Elko Co., NV (L. n. nigridia). B = Baja California Norte (L. n. aculeata). J = Jackson Co., OR (L. n. aculeata). Cr = Crook Co., OR (L. n. aculeata). LA = Los Angeles Co., CA (L. n. nigridia). M = Mono Co., CA (L. n. nigridia). E = Elbert Co., CO (L. n. serica). T = Trinity Co., CA (L. n. aculeata). Y = Yosemite Park, CA (L. n. aculeata). D = Deschutes Co., OR (L. n. aculeata).

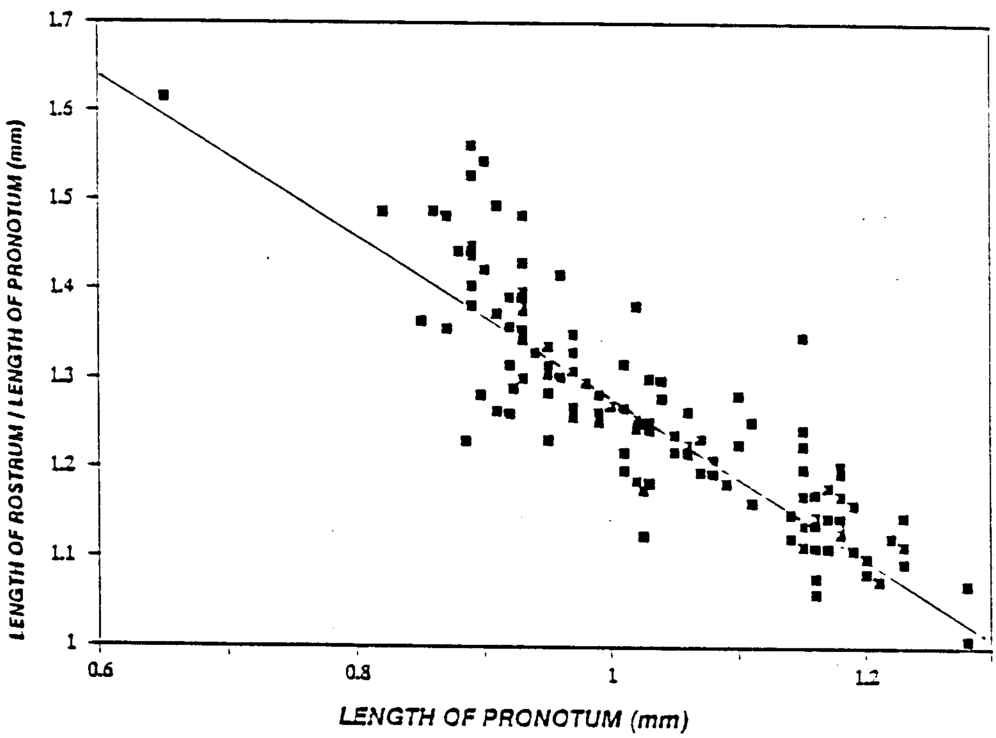

Figure. II.2. Relationship between relative length of the rostrum (Rostrum length/Pronotum length) and pronotum length in Lopidea nigridia. $y = 2.1777 - 0.884x$, $r^2 = 0.757$ N = 128.

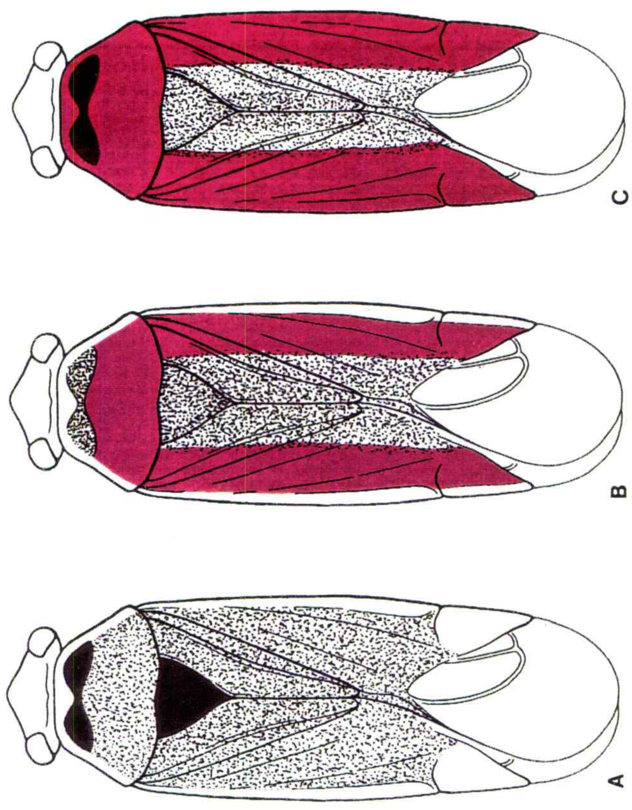

Figure II.3. Variation in dorsal color pattern of Lopidea nigridia Uhler. A. Fuscous-white color pattern characteristic of L. n. nigridia Uhler. B. Fuscous-red-white color pattern characteristic of L. n. aculeata Van Duzee. C. Solid red color pattern characteristic of L. n. serica Knight.

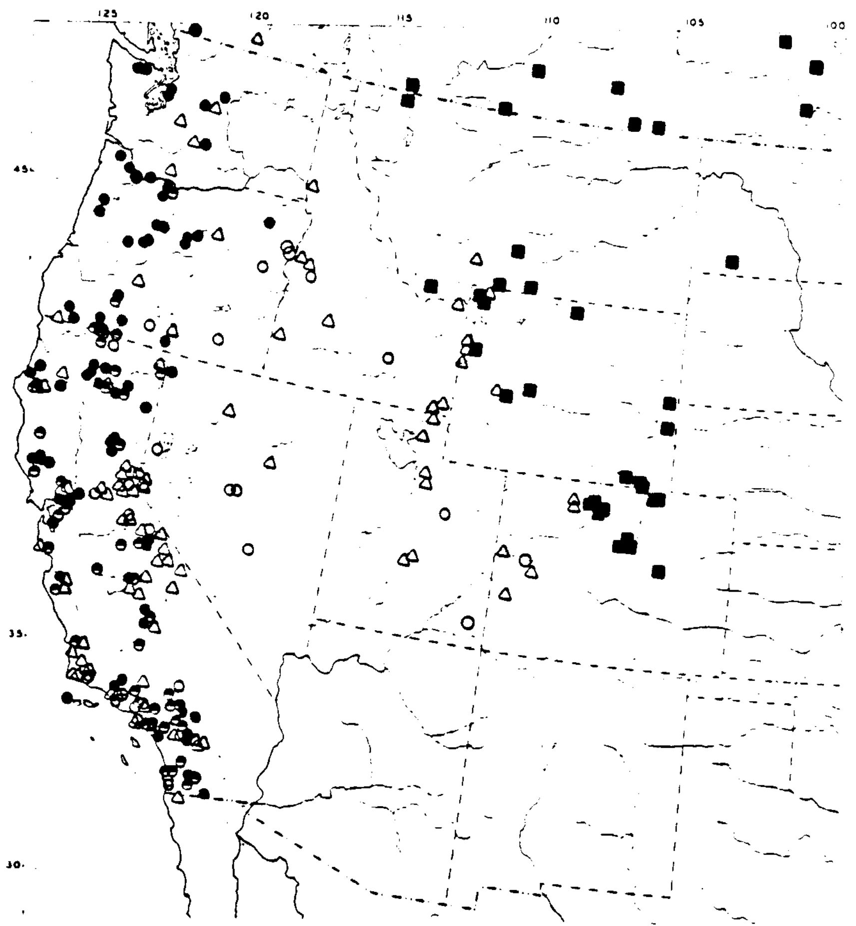

Figure II.4. Distribution of subspecies and color forms of L. nigridia Uhler in western North America. Triangles = fuscous-white form of L. n. nigridia Uhler. Open circles = more reddish color form of L. n. nigridia Uhler. Solid circles = solid red color form of L. n. aculeata Van Duzee. Half solid circles = red-white color form of L. n. aculeata Van Duzee. Solid squares = L. n. serica Knight.

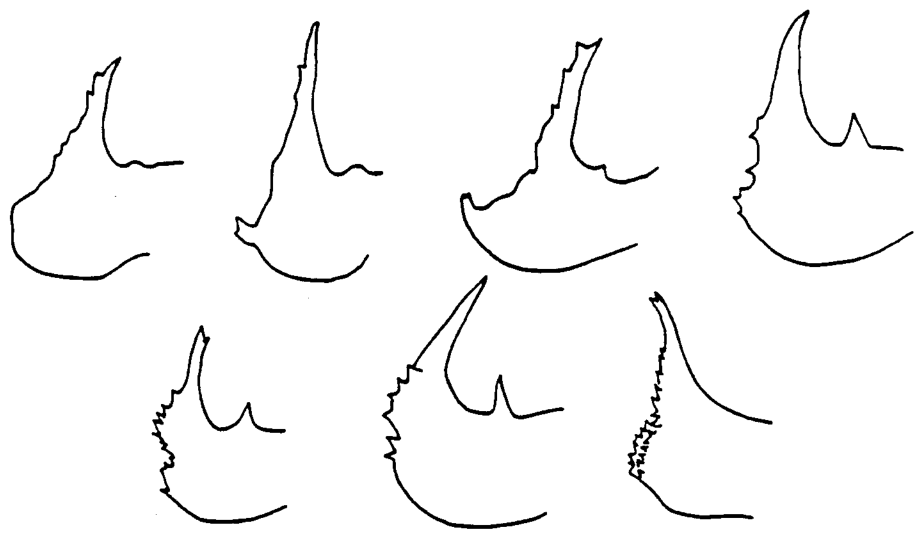

Figure II.5. Variation of right paramere in Lopidea nigridia Uhler. Drawn in postero-lateral view.

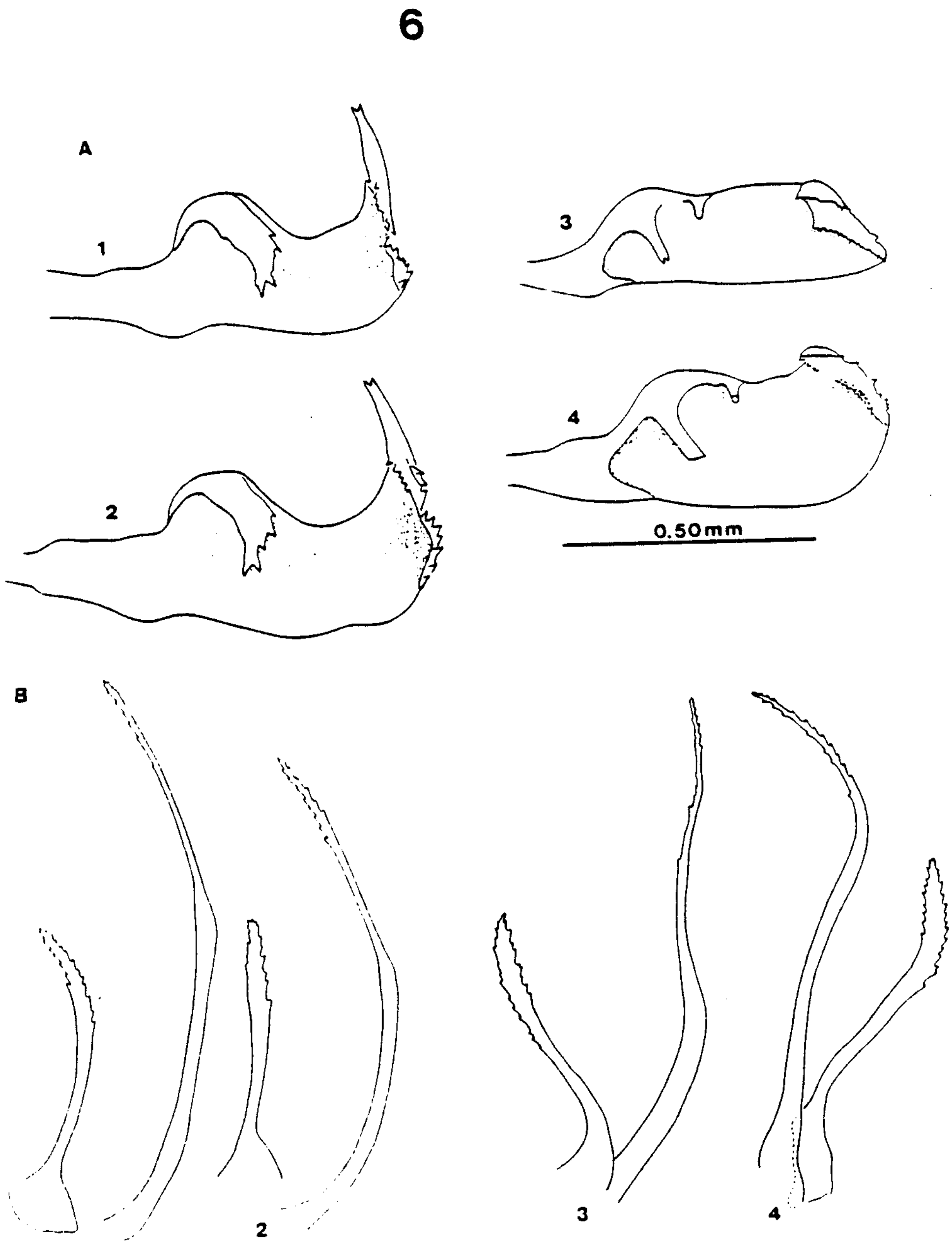

Figure II.6A-B. Comparison of genitalic structures of Lopidea species. A. Right paramere 1. L. n. nigridia Uhler, Yellowstone Nat. Pk., WY. 2. L. n. serica Knight. 3. L. marginata Uhler, Benton Co., OR. 4. L. marginata Uhler, Baja California Norte. B. Spiculae. Species as in A.

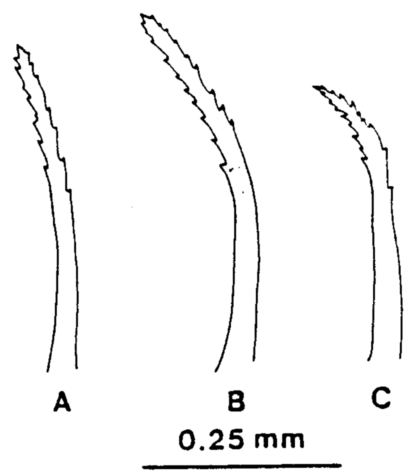

Figure II.7. Variation of the dorsal spicula in Lopidea nigridia Uhler. A. L. n. nigridia Uhler, Lander Co., Nevada. B. L. n. serica Knight, Carbon Co., Wyoming. C. L. n. aculeata Van Duzee, Trinity Co., California.

Figure II.8a & b. Results of UPGMA cluster analysis of color and paramere characters of 12 populations of L. nigridia. Letters represent populations, numbers represent the number of individuals from that population placed in that cluster. Both dendograms are identical; to facilitate viewing and discussion half the samples are shown on dendogram a and the other half on dendogram b. a. R = Mt. Rainier, WA (L. n. nigridia). A = Mt. Adams, WA (L. n. nigridia). Ca = Carbon Co., WY (L. n. serica). N = Elko Co., NV (L. n. nigridia). B = Baja California Norte (L. n. aculeata). J = Jackson Co., OR (L. n. aculeata). b. Cr = Crook Co., OR (L. n. aculeata). LA = Los Angeles Co., CA (L. n. nigridia). M = Mono Co., CA (L. n. nigridia). E = Elbert Co., CO (L. n. serica). T = Trinity Co., CA (L. n. aculeata). Y = Yosemite Park, CA (L. n. aculeata). A scale of distance values is not included because this analysis was not performed to measure morphological differences among OTU's, but to illustrate groupings of OTU's using conventional taxonomic characters (see text).

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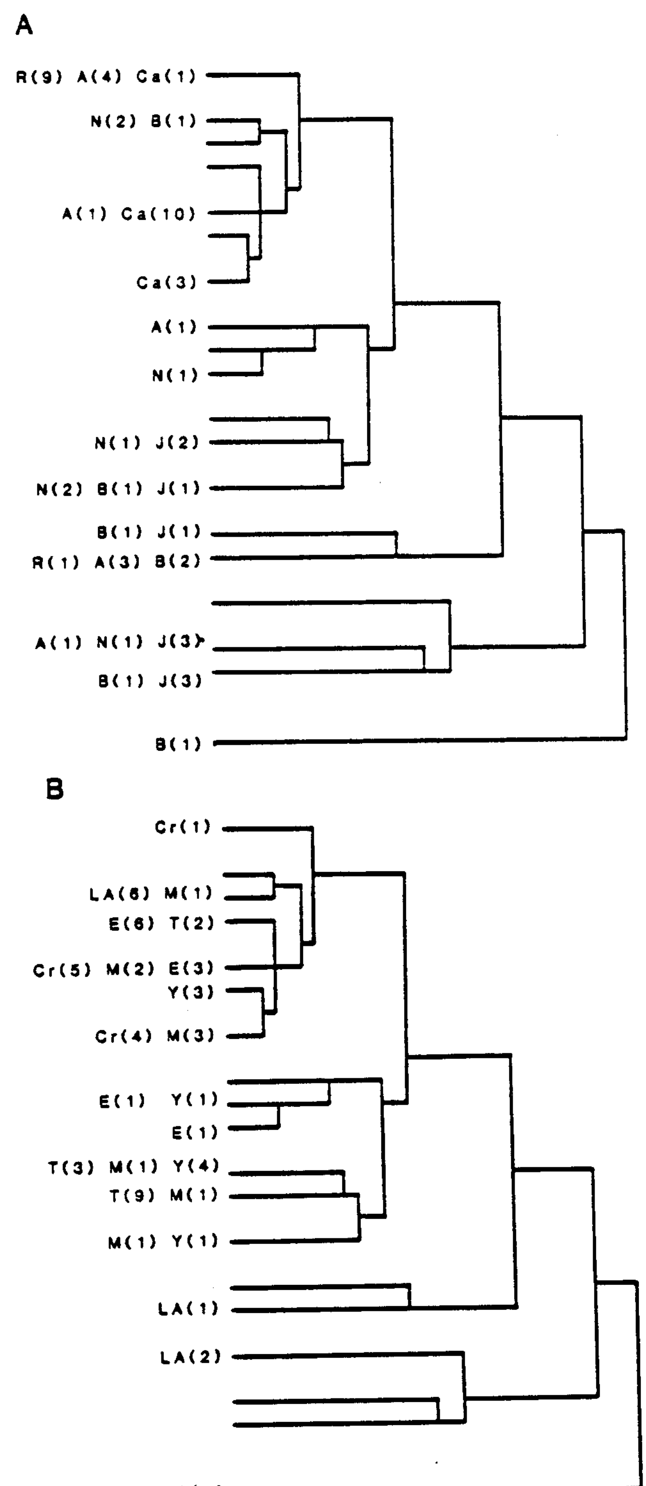
A
R(9) A(4) Ca(1)
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E(6) T(2)
Cr(5) M(2) E(3)
Y(3)
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E(1) Y(1)
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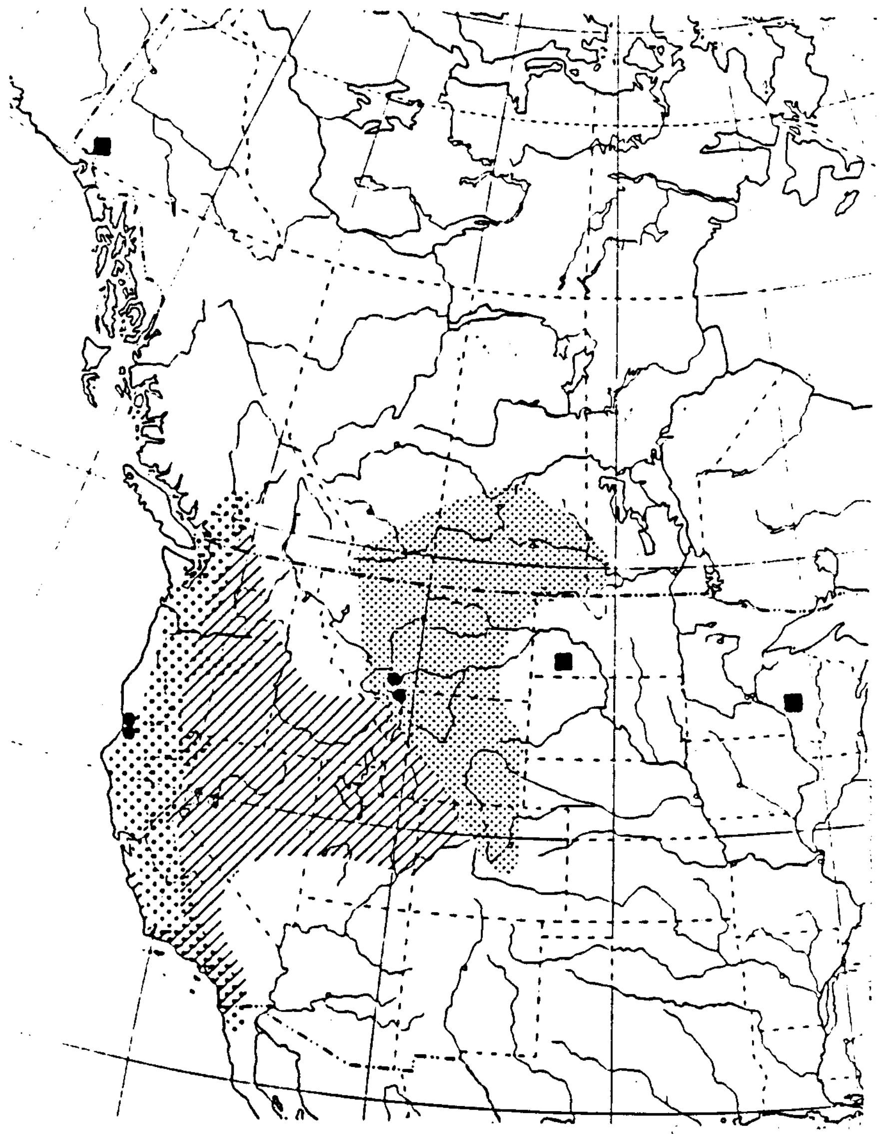

Figure II.9. Generalized distribution of L. nigridia Uhler. Large dots = L. n. serica Knight. Small dots = L. n. aculeata Van Duzee. Lines = L. n. nigridia Uhler. Dark circles = additional localities for L. n. nigridia. Dark squares = additional localities for L. n. serica.

CHAPTER III

REVISION OF THE GENUS *LOPIDEA* UHLER IN AMERICA NORTH OF MEXICO (HETEROPTERA: MIRIDAE: ORTHOTYLINAE)

ADAM ASQUITH

ABSTRACT

The genus *Lopidea* Uhler is revised for America north of Mexico. The relationship of *Lopidea* to other orthotyline genera is discussed and it is proposed that the genus *Ilnacora* Reuter is the sister group of *Lopidea*. Scanning electron micrographs are presented showing the similarity among the scale-like setae of *Lopidea*, *Ilnacora* and *Ilnacorella*.

Forty eight species of *Lopidea*, one of which is described as new, are recognized as occurring in America north of Mexico. Line drawings are presented for male genitalic structures of all species. A key to adult males and distributional maps for all species are also included. The following synonymies are created (junior names first): *Lopidea navajo* Knight = *L. arizonae* Knight; *L. chelifer* Knight = *L. balli* Knight; *L. paddocki* Knight and *L. deserta* Knight = *L. bullata* Knight; *L. trispicata* Knight = *L. chandleri* Moore; *L. burkei* Knight = *L. confraterna* (Gibson); *L. arkansae* Knight and *L. biselli* Knight = *L. davisi* Knight; *L. denmani* Knight and Schaffner = *L. falcicula* Knight; *L. mohave* Knight = *L. garryae* Knight; *L. amorphae* Knight and *L. wisteriae* Chandler = *L. hesperus* (Kirkaldy); *L. marginalis* (Reuter) = *L. instabilis* (Reuter); *L. texana* Knight, *L. polingorum* Knight and *L. matamorensis* Knight = *L. major* Knight; *L. drakei* Knight = *L. marginata* Uhler; *L.*

phlogis Knight, L. petalostemi Knight and L. johnstoni Knight = L. minor Knight; L. nicholi Knight = L. nigridia Uhler; L. oregona Hsiao, L. calli Knight, L. knowltoni Knight, L. dawsoni Knight, L. utahensis Knight and L. yampae Knight = L. picta Knight; L. staphyleae sanguinea Knight = L. s. staphyleae Knight; L. taurula Knight, L. malvastri Knight, L. nevadensis Knight and L. fuscina Knight = L. taurina Van Duzee; L. stitti Knight and L. becki Knight = L. ute Knight.

INTRODUCTION

The large number of described species (>100), and the lack of available keys, particularly for the western fauna, prompted this revision of the genus Lopidea for North America. The goals of this paper are 1) to aid in the identification of species and to summarize the available geographical and ecological information, and 2) to compare Lopidea to other orthotyline genera and determine its sister taxa. First, I describe the morphological structures and patterns of variation in the genus, and also discuss the relationship of Lopidea to other genera of Orthotylini. For each of the 48 species I recognize as occurring north of Mexico, I provide a brief diagnosis, a detailed description, particularly of the male genitalia, a summary of its distribution and biology, and a distribution map. In addition, I provide a key to adult males of all species in North America.

Lopidea Uhler comprises over 100 described species from Central and North America (Carvalho, 1958; Henry and Wheeler, 1988). Most are large (> 5.0 mm) brightly colored plant bugs displaying some pattern of contrasting red-black or yellow-black coloration. There is no previous taxonomic revision of the genus, but most species were described in a series of papers by Knight (1917; 1918a; 1918b; 1923; 1962; 1965) and Knight and Schaffner (1968; 1972). Keys to some of the eastern species are found in Blatchley (1926) and Knight (1941).

The genus has a simple nomenclatorial history. Uhler (1872) erected the genus Lopidea for Capsus medius Say. Reuter (1876) proposed the genus Lomatopleura for his species caesar and distinguished it from Lopidea by the enlarged second antennal segment. Knight (1917) noted that some species have second antennal segments of intermediate enlargement and could not be confidently placed in either Lopidea or Lomatopleura. He further mentioned that the left paramere of caesar displays the same characteristics found in media, robiniae and confluens and considered Lomatopleura a synonym of Lopidea.

Asquith (1990b) provided a phylogenetic analysis of the North American species and discussed the ecological and biogeographic patterns seen in the genus. The only subdivision of the genus prior to Asquith (1990b) was the recognition of the minor group by Knight (1965). Knight provided no diagnosis of this group other than "...species with male claspers rather similar in general form..." Asquith (1990b) reviewed the status of a group of nominal species related to nigridia Uhler. He described the variation in genitalic structure and dorsal coloration of nigridia Uhler and illustrated the importance of recognizing intraspecific variation in Lopidea, which is followed in this paper.

Many species are superficially very similar in habitus, and most have been distinguished by the form of the right paramere. This structure is relatively uniform within any given species, but extremely variable in size and form among different species of Lopidea. It appears to be the most valuable diagnostic character available for distinguishing species of Lopidea

MATERIALS AND METHODS

Approximately 20,000 specimens were examined representing material from over 30 institutions and collections. A list of these institutions, abbreviations, and their respective curators are provided in the acknowledgments. Because of the large number of specimens examined, label data in the specimens examined sections of the treatments are abbreviated, with dates of collection summarized and collectors omitted. Exceptions to this are new species and rare species, those for which 10 or fewer specimens were examined; for these species more complete label data is provided.

Distribution maps are provided for all species. Localities on the maps represent only those specimens which I examined, because misidentifications made earlier distribution records questionable. These earlier published distribution records are noted in the bibliography for each species. In summarizing available host plant information, I have tried to distinguish between plants used for breeding and those recorded only as feeding or sitting records. "Confirmed host plant" refers to breeding records obtained from specimens that I examined where either both nymphs and adults were collected from the plant, or a series of teneral adults was collected from the plant. I also note literature records that refer to adults "breeding" on a plant or collected in company with nymphs.

Dissections of the male genitalia were performed using the technique of Kelton (1959). Genitalia were illustrated in positions which provided the best view of diagnostic species characters. In the case of the vesical spiculae, these structures may have to be rotated about their axes to achieve the positions shown in the illustrations. The terminology generally follows that of Kelton (1959) and Stonedahl and Schwartz (1986). However, I have modified some of the terminology and introduced new terms for structures diagnostic of Lopidea species. Those structures and their terminology are described in the generic description and discussion of taxonomic characters.

BIOLOGY

Species of *Lopidea* are monophagous or stenophagous plant feeders, that concentrate on leaves, stem terminals, and reproductive tissues including flowers and seeds. Like many phytophagous mirids, *Lopidea* are probably opportunistically predacious to some degree and I have examined a specimen of *L. instabile* that was observed feeding on an aphid mummy. *Lopidea* often form large, dense populations on their host plants, in some cases causing, spotting, yellowing and foliar necrosis. Knight (1923) reports *Lopidea lathryi* Knight as being so numerous as to kill its host plant *Lathyrus venosus* in Minnesota, and *Lopidea davisi* Knight is considered a pest on cultivated Phlox in the eastern United States (Cory and McConnell, 1927; Knight, 1941).

Although some *Lopidea* are common, conspicuous plant bugs, the biologies of only a few species have been studied in any detail. Cory and McConnell (1927) examined the biology of *Lopidea davisi* Knight on *Phlox paniculata* in Maryland. This species is bivoltine, overwintering as eggs which are laid in stems and leaf petioles of its host plant. The spring generation appears in early May and persists to late June, while the summer generation hatches in early July and lasts to late September. Adults and nymphs feed primarily on upper leaf surfaces and developing buds.

Wheeler and Henry (1976) described the egg, fifth instar nymph and phenology of *Lopidea incurva* Knight on *Gleditsia triacanthos* in Pennsylvania. In their study, eggs hatched in late May and adults appeared in early July and were gone by late August. The biology of a population of *Lopidea nigridia* Uhler in eastern Oregon was described in detail by McIver and Asquith (1989). At their study site, *nigridia* has one generation per year and overwinters in the egg stage in the tissue of its host plant *Lupinus caudatus* Kell.

Nymphs appear from late April to early June and most individuals are adults by mid June. Oviposition is from late June through July and most activity ends by early August. Lopidea media (Say) breeding on Solidago in New York is also univoltine, with nymphs appearing from early May to late June and most individuals becoming adults by early July (Messina, 1975).

Most species of Lopidea appear to be univoltine. The only species known to be bivoltine is davisi Knight (Cory and McConnell, 1927), but based on bimodal distributions of collection records, several other species including ute, confluenta, anisacanthi, garryae and minor may also have two generations a year (Table III.1). Other species of Lopidea, although univoltine, clearly develop at different times of the year (Table III.1). Those species appearing very early in the season, March-April, all occur in the far southcentral or southwestern states.

Species of Lopidea, like other mirids (Knight, 1923a; Schwartz, 1984) disperse short distances after developing on a host plant. Knight (1917) reports Lopidea staphyleae dispersing from its host plant Staphylea trifolia on to surrounding trees and forming breeding aggregations. I have observed large numbers of Lopidea nigridia aculeata aggregating on the flowers of Sambucus after having completed their development on nearby Lupinus.

Some species of Lopidea are apparently restricted to a single species of host plant, for example, L. robiniae breeds only on Robinia pseudoacacia. On the other hand, other species may breed on several different unrelated plants. Lopidea heidemanni Knight, for example, breeds most often on Ulmus, but it has also been recorded breeding on Achillea and Solidago (Knight, 1917). In addition, the preferred host of Lopidea nigridia aculeata Uhler is

Lupinus, but I have also found it breeding on _Astragalus_, _Vicia_ and _Lathyrus_.

Males of several species, in particular _Lopidea_ _media_ and _confraterna_, are attracted to lights. McPherson et al. (1983) recorded large numbers of _heidemanni_ from window traps set 2 meters above the ground, and one specimen of _robiniae_ was collected at a height of 7 meters.

Almost all species display some pattern of contrasting red-black or yellow-black coloration, which often functions as warning coloration in other insects (Rothschild, 1972). McClain (1984) demonstrated that _Lopidea_ _instabile_ is distasteful to the iguanine lizard _Anolis_, and that _instabile_ contains alkaloids similar to those in its host plants. McIver and Lattin (1990) also present evidence for aposematism in _Lopidea_ _nigridia_ Uhler. This species is more highly aggregated than other syntopic mirid species, and it is distasteful to some visually oriented arthropod predators. Other predators, such as the assassin bug _Sinea_ _diadema_, accept _L._ _nigridia_ as prey. A few species of _Lopidea_, however, such as _picta_ and _bullata_ are not bright but rather drab colored. Preliminary data suggest that one of these species (_picta_) is clearly palatable to arthropod predators (McIver, pers. comm.).

SPECIES AND SUBSPECIES CONCEPTS

The species concept in the genus _Lopidea_ has changed relatively little since the description of _Capsus_ _medius_ by Say (1832). Up to the time of Uhler and including Uhler's works (1871; 1895), species of _Lopidea_ were recognized almost exclusively by their dorsal color pattern. Because of the similarity in coloration among species, this led to the recognition of only a few species such as _media_ and _caesar_, that were reported as occurring virtually from coast to coast.

Knight (1917) began to use the male parameres for species recognition in Lopidea. The parameres are indeed very diagnostic, and Knight's early work (1917; 1918a; 1918b) clearly defined entities that I continue to recognize as species in this paper. Many North American species described later, however, were defined by slight variations in the right paramere or the dorsal color pattern. With few exceptions, intraspecific variation in Lopidea was simply not recognized and any variant was described as a new species.

I have attempted to define discrete, recognizable species in Lopidea, and delimit the intraspecifc variation. Although out of necessity I employ an almost exclusively morphological species concept, I have tried to define species by unique characters found in all specimens (apomorphies) rather than distinguishing them from other species by what they don't have (plesiomorphies). Although species of Lopidea are most confidently recognized by the structure of the right paramere, never is this the only character defining a species; there are always concomitant differences in color, vestiture and the vesicae. In addition, the morphological concept of Lopidea species is always supported by host plant and/or distributional data.

I recognize subspecies in Lopidea as distinct, geographic races. It is my opinion that these subspecies are true phylogenetic species (distinct entities with their own evolutionary trajectories), but they are clearly not the same kind of evolutionary unit as other species of Lopidea. So in order to maintain a more homogeneous species concept for Lopidea, I have elected to use the subspecies concept to distinguish what appear to be separate geographic forms. Generally, these forms have parapatric distributions and are distinguished by abrupt changes in paramere structure. Along with paramere structure, there are also abrupt or clinal variations in other characters such as color or antennal structure in some species. More detailed studies of the morphology and ecology of populations along the presumed contact zones between these subspecies will provide the most important future insight on the evolution and taxonomy of Lopidea.

TAXONOMIC CHARACTERS

Size and Morphometrics: The sizes of Lopidea species are normally distributed, with most species between 5 mm and 7 mm in total length (fig. III.1). Some species are noticeable for their extremely small size, such as minima Knight and minor Knight which are both less than 5.0 mm total length. Larger species are not as distinctive because they vary more than 1 mm in absolute size, and overlap several other species.

Most other linear dimensions are strongly correlated with body size (Table III.2). Not all dimensions, however, are linear functions of size. For example, the relative length of antennal segment II increases slightly with size (log length antennal segment II = 1.17476(log pronotal length) + 0.26089) and relative head width decreases with size (log head width = 0.40224(log pronotal length) + 0.042667; fig. III.2). Thus the ratio of length antennal segment II/head width is strongly influenced by size, with very small species having ratios of less than 1.5 and large species having ratios of greater than 2.0 (fig. III.3). The opposite pattern is seen in the ratio of vertex/length antennal segment I, which decreases with body size (fig. III.4).

I have used these ratios both in the species description and in the key to species, but because they are functions of body size, they are normally distinctive only for very large or very small species. These ratios are most useful when they deviate from the general relationship with body size. For example, bullata is not among the smallest of species, but it has an extraordinarily large vertex/length antennal segment I ratio of 2.0 (fig. III.4).

Head Shape: Although most Lopidea are extremely similar in their general habitus, there are small variations in head shape that provide useful taxonomic information. The vertex (in frontal view) can be flat or weakly convex as in gainesi Knight or strongly concave as in media (Say) (fig. III.5). The frons in dorsal view can be strongly protruding and broadly rounded as in garryae Knight, to weakly produced and narrowly rounded as in heidemanni Knight (fig. III.6). The vertical height of the head (head length) also varies slightly, particularly in the length of the gena. In species such as nigridia Uhler the gena is long and the buccula is separated from the pronotal collar (fig. III.7), whereas in species like erimata Van Duzee the gena is short and the buccula is touching the collar. This is a difficult character to interpret, however, because the rotation of the head in the vertical plane influences the distance between the buccula and the collar. Nonetheless, I have used this character in species descriptions because the extreme conditions are distinctive.

The distance between the antennal fossa and the anterior margin of the eye is an important taxonomic character in Lopidea. For ease of comparison, I discuss this distance in relation to the width of the antennal segments. For example, bullata Knight has a very large antennal fossa-eye distance, much greater than the width of antennal segment I. In media (Say), however, the fossa and eye are almost contiguous, at least less than the width of antennal segment II (fig. III.8).

The shape of antennal segment II is most commonly cylindrical, but in a few species it is weakly to strongly fusiform. The inflated appearance, however, is only in part due to the enlargement of the diameter of the antennae. It is also caused by an increase in the length and angularity of the setae near the middle of the segment.

The length of the rostrum, although not a linear function, is dependant on body size, both intraspecifically (Asquith, 1990a) and interspecifically (Asquith and Booth, unpublished data). The tip of the rostrum reaches from the middle of the mesosternum to just past the metacoxae. This is not an important character in Lopidea taxonomy, because it rarely varies from its relation to body size, and it is also influenced by the position of the head and angles between the rostral segments.

Genital Capsule: Some species of Lopidea have the left posterodorsal margin of the genital aperture modified into what I have termed a sensory lobe. This structure does not occur in related genera and its development is sporadic among Lopidea species. Most commonly, the left dorsolateral angle is weakly developed as a broadly rounded vertical ridge. In some species such as salicis Knight the dorsolateral angle is highly modified as a short, narrow, cylindrical lobe (fig. III.9).

The shape of the tergal process is highly variable in the genus and is an extremely useful taxonomic character. The shape of the tergal process varies from long and slender in species like media (Say), to short and blunt in species like pteleae Knight and Schaffner. In the key to species, I have compared the length of the tergal process to the width of the antennal segments. Although this is not an absolute character (as presence or absence) it does allow the separation of two large groups of species.

Genitalia: Because of the their uniqueness and the detailed descriptions of their structures, I have introduced several new terms for distinctive features of Lopidea genitalia. They are meant only for use in the genus Lopidea, but their possible homologies with structures found in other orthotyline genera are discussed in the Generic Relationships section below. In this section on Taxonomy, I have underlined all new terms regarding Lopidea genitalic structures.

Right Paramere: The right paramere is the most morphologically variable structure in the genus, and is therefore the most important character in species diagnoses. In addition, I have used the structure of the right paramere extensively in developing a key to North American Lopidea. In this paper, I describe the right paramere as displaying one of three general forms, which are named for the most common eastern species which display these forms. These paramere forms only partly reflect phylogenetic affinities (Asquith, 1990b), therefore the key to species does not attempt to segregate natural groups.

The davisi type of right paramere is roughly rectangular or rhomboidal in outline (fig. III.10), its length less than three times its mid-dorsal height. The media type is elongate in outline (fig. III.11), its length greater than or equal to three times its middorsal height, it also typically bears a long, slender basal arm. The robiniae type is distinctly C-shaped or L-shaped (fig. III.12), with ventral and dorsal arms, the dorsal arm being distinct from the basal arm.

Most species have a medial flange found on the distal, medial surface of the right paramere. This flange varies from a narrow, erect process in _media_ (Say) (fig. III.11), to an elongate, serrate ridge in _davisi_ Knight (fig. III.10), to a reduced dentate surface in _minima_ Knight (fig. III.54). A _dorsal flange_ is found on the middorsal margin of most species. Although it may be greatly expanded into a narrow, erect process as in _major_ Knight (fig. III.51), it is more commonly present as 2-4 short teeth, separate or raised on a common base. The _basal arm_ arises from the dorsomedial surface of the basal area of the main body of the paramere. It varies in form from long and slender in _media_ (Say) (fig. III.11) to short and thick in _davisi_ Knight (fig. III.10) and is absent in a few species. In those species with _robiniae_ type right parameres, I have distinguished a _ventral arm_ and a _dorsal arm_ (fig. III.12). The ventral arm is homologous with the main body of the paramere in other species of _Lopidea_ and the dorsal arm is a variably developed outgrowth of the dorsal surface of the basal region of the paramere (see Generic Relationships). The ventral arm can be cylindrical (_taurina_ Van Duzee; figs. III.66, III.67) to flat (_balli_ _chelifer_ Knight; fig. III.24a), apically pointed (_incurva_ Knight; fig. III.45) or strongly serrate (_dakota_ Knight; fig. III.34), erect (_lathyri_ Knight; fig. III.50) or recurved horizontally (_taurina_ Van Duzee; fig. III.66). Occasionally, the ventral arm is vestigial or entirely absent (_instabilis_ _instabilis_ (Reuter); fig. III.).

Left paramere: The left paramere is distally divided into a _lateral flange_ and a _medial flange_.. The lateral flange is typically broad and flattened in the vertical plane with the apex broadly rounded (fig. III.13a). The medial flange is typically narrowly digitiform, connected with the lateral flange along most of its ventral margin. In several species (e.g. _instabilis_ (Reuter); fig. III.13b) the left paramere is distinctly elongate and narrowed, occasionally with either the lateral or medial flange reduced or absent. A few species have the angle of the left paramere expanded vertically, either as a small, rounded bump (ampla Van Duzee) or as a narrow, spine-like process (confraterna (Gibson)).

Dorsal Spicula: The dorsal spicula is typically short, broad and lanceolate, but in some species (media) it is long, slender and strongly curved (fig. III.14). All species have a basal sclerite attached to the base of the dorsal spicula. The presence and development of a basal process on this sclerite is an important taxonomic character.

Ventral Spicula: The most important taxonomic character of this structure is the presence or absence of a secondary arm and its degree of development. In some species such as ute, the development of the secondary arm is highly variable, being completely absent in some populations.

Color: In general, dorsal coloration is the most variable taxonomic character in the genus Lopidea. In some species the color variation is extreme and confusing. For example, nigridia Uhler varies from solid red, to red-white to fuscous-white (Asquith, 1990a). Typically, color variation is less drastic and is confined to variably paleness of the embolium and cuneus and the degree of infuscation on the clavus and medial aspect of the corium. A few species have a distinctive, invariable coloration. For example, ampla Van Duzee is the only species occurring along the Pacific Coast that displays a yellow and black dorsal color pattern.

Vestiture: The length and angle of the simple setae on the hemelytra is an important character. It varies from extremely short, sparse and strongly inclined in arizonae Knight, to long, dense and erect in erimata Van Duzee. The color of the setae is more variable and not as diagnostic. In some species such as confraterna (Gibson), I have seen specimens with all pale setae, mixed black and pale setae, and others with all black setae. In many species with predominately pale setae, there are often black setae along the claval suture and the medial border of the membrane and in general on dark fuscous colored areas. Knight (1965) referred to simple setae and "bristle-like" setae in separating some species of his minor species group. I have examined both simple pale setae and black "bristle-like" setae on the same specimen of davisi Knight using a scanning electron microscope. The structure of these setae is identical, and the "bristle-like" setae only appear to be stouter due to their dark color.

GENERIC RELATIONSHIPS

The relationship of Lopidea to other orthotyline genera has not been discussed in detail by previous authors. Van Duzee (1916) erected the division Lopidearia for the genera Lopidea, Lomatopleura (=Lopidea) and Hadronema. Blatchley (1926) also recognized this grouping as the tribe Lopidini and included the genus Ilnacora. The tribe Lopidini has only occasionally been used by subsequent authors (Ueshima, 1979).

Lopidea was placed in the Orthotylus group of genera by Schuh (1974), defined by the presence of long, sclerotized spiculae on the vesica. Kelton (1959) noted the similarity of the parameres in Lopidea and Ilnacora and suggested a relationship between Lopidea and Slaterocoris, Ilnacora, Ilnacorella, and Hadronema. Although Knight (1968) suggested that Daleapidea and Lopidella were united with Lopidea by the presence of the genal suture, Schuh (1989) correctly noted that this character has a much wider occurrence in the Orthotylini, and these three genera are not closely related. Stonedahl and Schwartz (1986) mentioned that Lopidea possesses a tergal process on the male genital capsule in common with several other orthotyline genera.

Below I outline characters that are diagnostic for Lopidea and I discuss their distribution in other genera in an attempt to elucidate intergeneric relationships. Because Lopidea is endemic to North America, and most genera of the Orthotylus group (Schuh, 1974), and at least those genera showing distinct relations with Lopidea are Nearctic in distribution, I have restricted my comparisons primarily to North American orthotyline genera.

HEAD: The primitive condition in the Orthotylus group, appears to be that the head is horizontal or only weakly inclined, and the tylus is large, protruding anteriorly well past the jugae and lora. In Lopidea, Ilnacora and some species of Melanotrichus the head is strongly vertical, with the tylus only weakly produced anteriorly. Lopidea has often been defined by the presence of a distinct, oblique genal suture running below the eye (Blatchley, 1926; Knight, 1941). This suture, is present in all members of the Orthotylus group that I examined (see Schuh, 1989), although it is usually short and runs to the anteroventral margin of the eye. It is much more distinct in Lopidea because it is typically darkly pigmented and, because the gena is elongated, the suture is long and runs below the ventral margin of the eye. Ilnacora also has an elongate gena and shares the visibly elongate suture with Lopidea.

VESTITURE: Most genera of the Orthotylus group possess long, erect simple setae. In contrast, these setae in many species of Lopidea are very short and strongly inclined. Several authors have also used the presence and structure of scale-like setae to define genera or generic groups in the

Orthotylini (Kelton, 1979a, 1979b; Southwood, 1953; Wagner, 1973). Lopidea has never been included in groups possessing scale-like setae, although recumbent "sericeous" setae have been noted on some species of Lopidea (Knight, 1965). All species of Lopidea that I have examined have distinctly flattened, scale-like setae (fig. III.15), albeit very small and sparse in some species. Stonedahl and Schwartz (1986) first discussed the taxonomic importance of the fine structure of these scale-like setae. Of the two setal types they recognized, Lopidea clearly possesses type 2, being moderately lanceolate and apically acuminate. Furthermore, the setae on Lopidea possess converging ridges rather than parallel ridges (fig. III.15). This condition also occurs in Ilnacora and Ilnacorella (fig. III.15), Brooksetta and Noctuocoris.

GENITAL CAPSULE: The genital apertures of Lopidea, Ilnacora and Pseudopsallus are circular and strongly vertical whereas in species of Orthotylus, Melanotrichus, Brooksetta and other genera it is oval or triangular and distinctly angled.

Lopidea possesses a single tergal process on the right anterodorsal margin of the genital aperture (fig. III.16). In those species where the tergal process is well developed, it appears to act as a lateral or ventrolateral support for the rectal tube. As also noted by Stonedahl and Schwartz (1986) several other genera of Orthotylini have a tergal process in this position, including Brooksetta, Ilnacora, Lindbergocapsus and Orthotylus. The size, shape and exact placement of the tergal process varies within Lopidea and certainly among the other genera mentioned. In some species of Melanotrichus for example, the tergal process is situated dorsally rather than dorsolaterally. Rather than allowing for multiple independent origins, however, I interpret the presence of a single tergal process in this position as plesiomorphic.

Some species of Lopidea have the left margin, or left anterodorsal angle of the genital capsule modified into what I term a sensory lobe. In species such as nigridia, this structure is merely an enlarged vertical ridge, whereas in other species such as salicis it is a distinct, cylindrical process (fig. III.9). It is always associated with a group of long, stout setae on the anterodorsal angle. The development of the sensory lobe occurs sporadically in Lopidea and I have not seen identical structures in other genera. However, the genus Squamocoris has a spine or tubercle in this position which is also associated with long, stout setae (Stonedahl and Schuh, 1986), and some species of Reuteria also have a similar structure, although lacking the enlarged setae.

RIGHT PARAMERE: The right paramere of the Orthotylus group is extremely variable, and it is difficult to homologize particular structures among genera. I have introduced several new terms to described specific aspects of the genitalia, in particular the parameres. I will try to point out where I think homologies exist and where my terminology overlaps that of other authors, in particular that used by Stonedahl and Schwartz (1986) in describing the various structures associated with the genitalia of the genus Pseudopsallus.

My interpretation of evolutionary trends in the right paramere involves the recognition of at least two "growth centers" on the paramere. The "growth centers" are areas of the paramere that produce distinct, modified structures. For example, in Lopidea, Ilnacora, Ilnacorella, Reuteria, Slaterocoris and Melanotrichus there appears to be a common apical or ventroapical "growth center" that produces a distal elongation and often a dorsal curvature of the paramere. There is also a middorsal growth center that produces the vertical lobe seen in several species of Orthotylus (Southwood, 1953), various dorsal processes in the previously mentioned genera, and the dorsal lobe in Pseudopsallus (Stonedahl and Schwartz, 1986). The dorsal process of some species of Lopidea is greatly enlarged and modifies the entire outline of the paramere. In these species therefore, I have termed it the "dorsal arm" (fig. III.12), although it is homologous with the dorsal process of other species of Lopidea and other genera.

A third "growth center" is found on the dorsal or dorsomedial margin near the base of the body of the paramere. I believe that this growth center produces the short, vertical spines in species of Ilnacorella, and Melanotrichus and the basal arms of Lopidea and Ilnacora. In many species of Lopidea and Ilnacora the basal arm is very broad basally and strongly recurved medially and ventrally (fig. III.10). In these cases the structure acts as a medial guide for the vesica during copulation as it slides along the medial surface of the paramere. This also appears to be true for the medial interior flange of Pseudopsallus, and I interpret this structure, or at least the basalmost part, as being produced by the basal growth center and being homologous with the basal arm of Lopidea and Ilnacora.

All species of Lopidea possess a serrate flange on the medial, distal surface of the paramere (medial flange; figs. III.10, III.11). I have not seen this structure in other genera and it may represent an apomorphy for Lopidea. This structure is highly variable in its size and shape and probably serves in some stimulatory capacity, as it and the serrate apical margin of the paramere are placed just inside the female genital aperture during copulation.

LEFT PARAMERE: The left paramere of Lopidea is divided into distinct lateral and medial flanges (fig. III.13). This condition is also seen in North American species of Orthotylus, Reuteroscopus and Ilnacora. Only in Ilnacora, however, is the structure similar to Lopidea, where the lateral flange is flattened vertically, and the medial flange is truly medial and not dorsad or ventrad of the lateral flange. This condition is reversed in the instabile species group of Lopidea (Asquith, 1990b), but I consider the flattened lateral flange synapomorphic for Lopidea and its closest relatives.

VESICAE: As defined by Schuh (1974) members of the Orthotylus group all possess long, sclerotized spiculae on the vesica. I interpret the primitive condition in this group as having the full complement of spiculae as found in most species of Orthotylus (Southwood, 1953). This full complement being composed of a right spicula with a dorsal (dorsal spicula of Lopidea) and ventral branch, and a left spicula (ventral spicula of Lopidea). The degree to which the spiculae are secondarily branched is highly variable and I have not attempted to polarize this character to any degree. However, the left spicula in some species of Lopidea is bifurcate, and because this condition is seen in several other related genera I have considered this condition plesiomorphic in Lopidea.

A variety of derived spiculae conditions exist in related North American genera. I have diagrammatical illustrated what I hypothesize to be some of the evolutionary trends in spiculae modification (fig. III.17). The two features that are most obvious are 1) there has been a trend towards the loss of all or parts of either spicula and 2) the steps in these losses are not sequential and branching, but rather a show a mosaic pattern. For example, in some species of Ilnacorella and Brooksetta the left spicula only has been lost. In species of Melanotrichus both the left spicula and the ventral arm of the right spicula have been lost. Ilnacora, in contrast, has lost only the dorsal arm of the right spicula and Lopidea has lost only the ventral arm of the right spicula. Because of the obvious trend towards the loss of spiculae, and therefore the strong likelihood of parallel losses, further interpretation of this character will be difficult and must await a more detailed study of generic relationships. Based on my preliminary observations, however, Lopidea appears to posses the uniquely derived condition of the loss of only the ventral branch of the right spicula.

Another informative character of spicula morphology is the presence of a basal process on the dorsal branch of the right paramere (fig. III.14b). This condition is probably plesiomorphic because the process is present in some species of Pseudopsallus, Melanotrichus, Brooksetta and Lopidea. For this reason I consider the loss of the basal process in some species of Lopidea a derived feature.

CHROMOSOME NUMBER: The chromosomes of only four species of Lopidea have been examined (Akingbohungbe, 1974), but they are so unusual that they may represent the most diagnostic generic character. Lopidea incurva, lathyri, instabile and robiniae all have diploid chromosome numbers of 80 (Akingbohungbe, 1974). This is the highest number recorded from any heteropteran insect (Ueshima, 1979). All other orthotyline mirids that have been examined have less than half this number and the two species of Ilnacora that have been examined both showed diploid numbers of 26 (Akingbohungbe, 1974). A more complete survey of chromosome numbers in Lopidea is needed to determine if this high number is an apomorphy for the genus, as I have tentatively treated it.

The above comparisons suggest that Lopidea is related to those North American genera with flattened scale-like setae and a single tergal process on the right anterodorsal margin of the male genital capsule. I follow Blatchley (1926) and Kelton (1959) in recognizing a close relationship between Lopidea and Ilnacora. The superficial resemblance of Hadronema to Lopidea, on the other hand, is the result of strong convergence, as the structure and position of the spiculae in this genus are very different from Lopidea and its relatives, and Hadronema lacks scale-like setae and a tergal process.

I hypothesize that Ilnacora is the sister group of Lopidea (fig. III.18), and in Table III.3 I provided synapomorphies for Lopidea + Ilnacora and apomorphies for Lopidea. These characters were polarized by comparison with those genera with scale-like setae with converging ridges (Stonedahl and Schwartz, 1986) and a single tergal process on the genital capsule. Genera outside this group show some convergence with Lopidea and Ilnacora. For example, some species of Pseudopsallus also have nearly vertical and circular genital apertures, and the head in Hadronema is distinctly vertical.

SYSTEMATICS

Lopidea Uhler

Lopidea Uhler 1872:411 (new genus, type species Capsus medius Say). Uhler, 1878:405 (description). Distant, 1883:258 (note). Provancher, 1887:106 (description). Knight, 1918:455 (note). Blatchley, 1926:834-836 (description, key to species). Knight, 1941:84-87 (key to species).

Froeschner, 1949:139 (139-140, 167-169). Kelton, 1959:28-29 (diagnosis). Knight, 1965:5 (key to species). Kelton, 1980:231 (description, key to species). Henry and Wheeler, 1989:417-425 (catalog). Stonedahl and Schwartz, 1986:4,5 (morphology).

Lomatopleura Reuter 1876:67 (new genus, type species Lomatopleura caesar Reuter). Knight, 1917:455 (synonymized with Lopidea).

DIAGNOSIS: Recognized by the conspicuous red and black or yellow and black coloration of most species; dorsal vestiture mixed, with variably length, pale or dark colored simple setae, and extremely small, scale-like setae with converging ridges. Male genitalia with following characteristics: right dorsolateral margin of aperture of genital capsule with a single, laterally flattened tergal process, supporting rectal tube; right paramere with medial interior flange developed as narrow, basal arm; left paramere distally with lateral and smaller, digitiform medial flange, margins of both flanges entire; vesica missing right ventral spicula.

DESCRIPTION: Macropterous male. Small to large, elongate orthotylines; length (apex of tylus to apices of hemelytra) 3.5-7.7; width (anteriad of cuneal fracture) 1.4-2.2. DORSAL ASPECT. Red, yellow, or grayish green on head, pronotum and hemelytra, often with fuscous to black middorsal stripe; fuscous to black on carina, vitae, tylus and calli; embolium and cuneus frequently pale; dorsal surface smooth, occasionally rugulose, frequently shining; dorsal vestiture composed of scattered, inclined to erect, simple setae and moderately distributed recumbent, silvery, scale-like setae. HEAD. Vertical, tylus not visible in dorsal view; subovate to ovate in lateral view; frons moderately protruding beyond anterior margin of eyes; posterior margin of head with distinctly elevated carina medially, posterior margin straight to strongly concave; vertex weakly convex to strongly concave; antennal fossa contiguous with to greatly removed from anterior margin of eye; antennal segment I thick, "coke-bottle" shaped, length greater than dorsoventral height of eye, clothed with short, inclined, simple setae; apical region with 3-6 semierect, stout setae; segment II cylindrical to weakly fusiform; segments III and IV cylindrical, only slightly thinner than segment II; segments II, III and IV clothed with short, inclined simple setae. Eyes small, occupying four tenths to seven tenths height of head, anterior margin of eye straight to weakly emarginate; lower margin of antennal fossa even with or below ventral margin of eye; juga short, quadrate, lora short; genae very wide, twice width of antennal segment II; bucculae long, narrow; rostrum reaching to apex of mesosternum or beyond. PRONOTUM. Trapezoidal; weakly to strongly convex, lateral margins straight to weakly sinuous, occasionally weakly explanate, posterior margin weakly concave medially, posterior angles broadly rounded or distinctly acute, anterior margin evenly curved to weakly sinuate; calli distinct, anterior and posterior margins bordered by shallow to deep depressions; mesoscutum hidden to narrowly exposed; scutellum weakly to strongly convex, anterior region sometimes transversely rugose. HEMELYTRA. Elongate, parallel-sided to weakly arcuate, broadest across posterior region of clavus, claval and radial veins sometimes strongly elevated, embolium narrow, cuneal fracture distinct, cuneus distinctly longer than broad; membrane weakly to strongly infuscated, outer cell elongate, inner cell small, triangular. LEGS. Coxae rectangular;

femora slightly flattened, tapered slightly at both ends, frequently with small fuscous spots on apical half, ventral surface frequently pale;; femora and tibiae with short, inclined, simple setae and stout, semierect setae, tibiae cylindrical, with two rows of small spinules; tarsi cylindrical, segment I and II approximately four fifths length of segment III; claws broad at base, strongly curved distally. GENITALIA. Figures III.9 - III.14 include identification of structures. **Genital aperture:** Large, round, vertical; dorsomedial margin only weakly concave (fig. III.16), weakly sclerotized membrane extending from middle of dorsal concavity to medial margin of tergal process; left dorsolateral margin of aperture variably developed as an expanded sensory lobe, varying from a thick, broadly rounded, vertical ridge to a small, erect, rounded process; right dorsolateral margin of aperture with single, laterally flattened tergal process, base of which supports the rectal tube. **Right paramere:** elongate rectangle in lateral view, or C-shaped or L-shaped, with distinct dorsal and ventral arms; interior surface with medial flange modified as a narrow, basal arm; medial surface in rectangular forms with additional flange apically (medial flange); small vertical flange typically present near middle of dorsal margin (dorsal flange). **Left paramere:** triangular and strongly flattened to elongate and weakly flattened; distally divided into lateral and medial flanges, medial flange digitiform, attached basally and partially ventrally to lateral flange. **Phallotheca:** boat-shaped; open on dorsal and distal surfaces, dorsal opening large, arched, dorsal spicula emerging from opening; distal opening slit-like along left surface, reaching basally to dorsal opening; all surfaces smooth. **Vesica:** ductus seminis simple, cylindrical, flexible, oval secondary gonopore on dorsal surface of apex;

two long vesical appendages (spiculae) attached to middle of ductus seminis; bases of spiculae situated dorsal and right of ductus axis (dorsal spicula), and ventral and right of ductus axis (ventral spicula); dorsal spicula short, serrate distally, with closely attached basal sclerite, often with slender process (basal process); ventral spicula long, slender, frequently bifurcate distally, at least apex typically serrate.

FEMALE: Macropterous, submacropterous or brachypterous. Usually slightly larger than male, more robust, lateral margins of hemelytra arcuate; head broader, frons strongly protruding. Color similar to male but typically lighter.

KEY TO THE NORTH AMERICAN LOPIDEA SPECIES

1. Right paramere C-shaped (figs. III.61, III.66, III.67), L-shaped (figs. III.29, III.50) or U-shaped figs. III.43, III.44), with distinct dorsal and ventral arms (ventral arm absent in instabile instabile) 2

- Right paramere rectangular, rhomboidal (figs. III.19, III.35) or elongate (figs. III.21, III.53), basal arm frequently elongate, but never oriented vertically as dorsal arm 15

2. Ventral arm of right paramere absent or vestigial, paramere S-shaped (figs. III.34, III.46) 3

- Ventral arm of right paramere present 4

3. Ventral arm of right paramere vestigial, ventral angle with rounded, dentate lobe (fig. III.34a-b); left paramere with both lateral and medial flanges present (fig. III.34c); tergal process broad, apex acute or narrowly rounded (fig. III.34c); antennal segment II cylindrical to weakly fusiform; dorsal color red and fuscous, margins never pale .... dakota Knight

- Ventral arm of right paramere completely absent (fig. III.46a-b); left paramere without lateral flange (fig. III.46c); tergal process narrow, apex blunt (fig. III.46d); antennal segment II distinctly fusiform; dorsal color red with pale lateral margins .... instabilis instabilis (Reuter)

4. Right paramere U-shaped (figs. III.43, III.44); dorsal arm vestigial or absent; lateral margin of apex flared; tergal process long, broadly flattened vertically.......... hesperus (Kirkaldy)

- Right paramere L-shaped (figs. III.29, III.50) or C-shaped (figs. III.61, III.66, III.67); dorsal arm distinct 5

5. Right paramere L-shaped (figs. III.29, III.50), dorsal arm vertical, never recurved horizontally or medially 6

- Right paramere C-shaped (figs. III.61, III.66, III.67), dorsal arm recurved horizontally or medially, or at least apex recurved 8

6. Ventral arm of right paramere with thin, strap-like apical process (fig. III.29); antennae distinctly fusiform; color dark red; setae black .... caesar (Reuter)

- Ventral arm of right paramere without strap-like apical process; antennae cylindrical; color yellow or light red; setae predominately pale 7

7. Apical third of ventral arm of right paramere strongly curved dorsally, apex sharply pointed (fig. III.45); .... incurva Knight

- Apical third of ventral arm of right paramere short, at most only weakly curved dorsomedially (fig. III.50), ... lathyri Knight

8. Ventral arm of right paramere at least weakly vertically flattened; dorsal or dorsolateral margin crenulate or

serrate (figs. III.26, III.61) 9

- Ventral arm of right paramere cylindrical, not flattened; apex may be serrate, but never dorsal margin (figs. III.66, III.67) 12

9. Color yellow and black; eastern North America 10

- Color red, red-white or grey; western North America 11

10. Dorsal arm of right paramere prominent (fig. III.61); distance between ventral and dorsal arm greater than length of ventral arm; breeds on Robinia .... robiniae Knight

- Dorsal arm shorter (fig. III.65); distance between ventral and dorsal arm less than or equal to length of ventral arm; breeds on Gleditsia .... staphyleae Knight

11. Color red or red and white; western plains and Rocky Mountains; left paramere narrow, lateral flange thin, situated dorsally (figs. III.23, III.24) .... balli Knight

- Color grey and fuscous; California and Oregon; left paramere broad, lateral flange broadly rounded (fig III.26) .... bifurca Van Duzee

12. Antennal segment II strongly fusiform; apex of tergal process blunt (fig. III.47); southeastern states .... instabilis rubella Knight

- Antennal segment II cylindrical or only weakly fusiform; apex of tergal process acute or narrowly rounded, not far southeastern states 13

13. Tergal process narrow, usually folded medially so not visible from lateral view; angle of left paramere broad, paramere strongly constricted distad of angle (fig. III.65); eastern North America .... staphyleae Knight

- Tergal process thick; left paramere narrow throughout, clearly visible; western North America 14

14. Southern Rocky Mountains; dorsal arm of right paramere typically short and narrow, less or equal to half the length of ventral arm; left paramere with both lateral and medial flanges well developed (fig. III.38) .... <u>falcicula</u> Knight

- Far western states and northwestern Rocky Mountains; dorsal arm of right paramere same size as ventral arm; left paramere with lateral flange vestigial or absent (figs. III.66, III.67) .... <u>taurina</u> Van Duzee

15. Right paramere roughly rectangular or rhomboidal in outline, length less than 3 times its middorsal height (fig. III.35) 16

- Right paramere elongate, length greater than 3 times its middorsal height (figs. III.49, III.53) 35

16. Ventroapical angle of right paramere sharply acute, or very narrowly rounded (figs, III.31, III.35) 17

- Ventroapical angle of right paramere obtuse or broadly rounded .... (figs. III.57, III.68, III.69) 28

17. Color black and yellow 18

- Color red, grey or green, not yellow 19

18. Large species, total length greater than 6.0; dorsum with long, erect, black setae; Pacific Coast (fig. III.19) .... <u>ampla</u> Van Duzee

- Smaller species, total length less than 6.0; dorsum with short, inclined, black or pale setae; eastern North America (fig. III.31) .... <u>confluenta</u> (Say)

19. Dorsoapical angle of right paramere flared dorsally (fig. III.35) or expanded as erect, vertical process (fig. III.41) 20

- Dorsoapical angle of right paramere not flared dorsally, or expanded and process reflexed basally, not erect (fig. III.20) 22

20. Ventroapical angle of right paramere sharply and acutely angled; apex of tergal process bluntly truncate (fig. III.35) .... davisi Knight

- Ventroapical angle of right paramere narrowly rounded but not sharply angled; apex of tergal process not blunt (figs. III.31, III.41) 21

21. Southwestern North America; apex of right paramere vertical (fig. III.41); color pale red or light fuscous .... garryae Knight

- Eastern North America; apex of right paramere strongly angled (fig. III.31); color red .... confluenta (Say)

22. Dorsoapical process of right paramere distinct but reflexed basally (fig. III.20); southwestern states .... anisacanthi Knight

- Dorsoapical process of right paramere only weakly developed 23

23. Color pale, green, black or white 24

- Color red or red and white 26

24. Genital capsule with small but distinct sensory lobe .... (fig. III.58) picta Van Duzee

- Genital capsule without sensory lobe 25

25. Right paramere elongate rectangular; Utah (fig. III.27) .... bonanza sp. nov.

- Right paramere short rectangular or triangular (fig. III.60); California .... puella Van Duzee

26. Color red or red and white; west of Rocky Mountains; medial flange of left paramere small (fig. III.52); ratio antennal segment II-head width = 1.5 .... marginata Uhler

- Color red; east of Rocky Mountains; medial flange of left paramere large; ratio antennal segment II-head width < 1.5 27

27. Texas; apex of right paramere with hooked ventrally oriented angle (fig. III.40) .... gainesi Knight

\- Northern and eastern states; apex of right paramere entire, without hooked angle (fig. III.55) .... minor Knight

28. Dorsoapical angle of right paramere expanded as vertical process (fig. III.57), often reflexed basally but always visible from lateral view (figs. III.69, III.70) 29

\- Dorsoapical angle of right paramere not expanded as vertical process (fig. III.68), or process not visible from lateral view (fig. III.63) 30

29. Dorsoapical process of right paramere long, erect, slender, as long as middorsal height of paramere (fig. III.57); dorsum with long, semierect, black setae .... nigridia Uhler

\- Dorsoapical process of right paramere short, thick, weakly to strongly reflexed basally, length less than middorsal height of paramere (figs. III.69, III.70); dorsum with short, inclined, black or pale setae .... ute Knight

30. Ventroapical angle of right paramere obtuse, very broadly rounded (fig. III.22); 31

\- Ventroapical angle of right paramere broadly rounded but not obtuse (figs. III.54, III.55); 33

31. Sensory lobe large, conspicuous; western plains and Rocky Mountains (fig. III.68) .... teton Knight

\- Sensory lobe indistinct or absent; southwest or eastern North America 32

32. Dorsal flange of right paramere very wide, 3 times as long as vertical height; medial flange of right paramere a narrow ridge (fig. III.22); southwestern states .... arizonae Knight

\- Dorsal flange of right paramere narrow, length equal to or less than height; medial flange of right paramere developed as thick, serrate process, strongly reflexed basally so not visible in lateral view (fig. III.63); eastern states .... <u>sayi</u> Knight

33\. Tergal process short, thick, apex distinctly blunt (fig. III.55); east of Rocky Mountains .... <u>minor</u> Knight

\- Tergal process narrow, pointed or narrowly rounded, never blunt; west of Rocky Mountains 34

34\. Dorsum with short, inclined, black setae; dorsoapical margin of right paramere inornate, at most weakly denticulate (fig. III.54) .... <u>minima</u> (Gibson)

\- Dorsum with erect, pale setae; apex of right paramere serrate or ornate with short processes (fig. III.56) .... <u>nicholella</u> Knight

35\. Tergal process short, length less than or equal to width of antennal segment I (figs. III.42, III.59) 36

\- Tergal process long, length greater than width of antennal segment I (figs. III.43, III.44, III.53) 48

36\. Short, broad species; antennal segment II very short, equal to width of head (fig. III.28); vertex two times length of antennal segment I .... <u>bullata</u> Knight

\- Linear species; antennal segment II long, greater than width of head; vertex narrow, less than two times length of antennal segment I 37

37\. Sensory lobe absent or very indistinct 38

\- Sensory lobe distinct 43

38\. West of Rocky Mountains 39

\- East of Rocky Mountains 42

39\. Color fuscous or black and white 40

\- Color red and fuscous 41

40. Ratio of vertex-length antennal segment I greater than or equal to 1.5; ventroapical angle of right paramere acute (fig. III.39); color fuscous and white .... <u>fuscosa</u> Knight

- Ratio vertex-length of antennal segment I less than 1.5 times; ventroapical angle of right paramere broadly rounded (fig. III.49); color dark fuscous or black with pale lateral margins .... <u>lateralis</u> Knight

41. Right paramere lacking basal arm; apex of right paramere strongly curved dorsally; lateral flange of left paramere with apex broadly rounded (fig. III.37); southern Rocky Mountains and Mexico .... <u>falcata</u> Knight

- Right paramere with long, slender basal arm; apex of right paramere not strongly curved dorsally, apex with margins entire, inornate; lateral flange of left paramere with apex narrowly rounded (fig. III.25); southern Arizona and Mexico .... <u>barberi</u> Knight

42. Medial flange of right paramere an elongate, serrate ridge, parallel to margin of paramere (fig. III.42); length of antennal segment I greater than width of vertex; eastern states .... <u>heidemanni</u> Knight

- Medial flange of right paramere a short, rounded, dentate lobe (fig. III.59); length of antennal segment I less than width of vertex; southcentral Texas .... <u>pteleae</u> Knight and Schaffner

43. Apex of right paramere bifurcate or with distinct dorsal process (figs. III.30, III.71) 44

- Apex of right paramere not bifurcate and without dorsal process (fig. III.21, III.33) 45

44. Central Texas and Mexico; apex of right paramere extremely narrow, weakly curved dorsally, with a narrow, vertical, serrate process; apex of tergal process bluntly square (fig. III.71); .... <u>wileyae</u> Knight

- Southeastern states; apex of right paramere not strongly curved dorsally; apex bifurcate into short, thick dorsal and ventral processes (fig. III.30); apex of tergal process weakly curved ventrally .... _chandleri_ Moore

45. Rocky Mountains and western states 46

- Eastern states 47

46. Southern Rocky Mountains, New Mexico and Arizona; dorsum with short, inclined setae (fig. III.21) .... _apache_ Knight

- Mohave and Chihuahuan deserts; dorsum with long, erect, dark setae, also on pronotum; pronotum and scutellum strongly convex (fig. III.36) .... _erimata_ Van Duzee

47. Apex of right paramere rounded and distinctly curved ventrally; sensory lobe large, broadly rounded (fig. III.33); medial border of clavus and corial-claval suture usually pale, setae predominately pale .... _cuneata_ Van Duzee

- Apex of right paramere more acute, _not_ curved ventrally (fig. III.62); sensory lobe small, cylindrical; claval suture never pale; setae predominately dark .... _salicis_ Knight

48. Tergal process thick, dorsoventral height equal to width of antennal segment III for most of length (figs. III.43, III.44); distal half of right paramere strongly curved dorsally, paramere U-shaped; lateral margin of apex flared .... _hesperus_ (Kirkaldy)

- Tergal process narrow, height less than width of antennal segment III; paramere not strongly curved 49

49. General dorsal coloration dark fuscous-black; scutellum ivory white; west of Rocky Mountains (fig. III.64) .... _scutata_ Knight

- General dorsal coloration red or pale yellow; east of Rocky Mountains 50

50. Large species, greater than 6.5 mm total length; antennal segment II weakly fusiform; dorsal flange of right paramere strongly developed, length as long as middorsal height of paramere (fig. III.51); south Texas and Mexico .... major Knight

- Smaller species, less than 6.5 mm total length; antennal segment II slender, cylindrical; dorsal flange not greater expanded 51

51. Angle of left paramere expanded into vertical, spine-like process (figs. III.32, III.48); dorsal flange of right paramere reduced to a few short teeth, never an erect process 52

- Angle of left paramere not developed into spine-like process (fig. III.53); dorsal flange of right paramere present as distinct, erect process .... media (Say)

52. Medial flange of right paramere developed as an erect, narrow,serrate process (fig. III.48); dorsal color dark red; southcentral Texas .... intermedia Knight

- Medial flange of right paramere an elongate, dentate ridge, parallel with margin of paramere (fig. III.32); dorsal color light red to pale yellow .... confraterna (Gibson)

Table III.1. Seasonal phenology of North American *Lopidea* species. Each species is listed above the time of year in which the majority (>60%) of collection records occurred.

major
wileyae
... scutata ...
gainesi
intermedia
heidemanni
puella
teton
salicis
chandleri
bullata
nigridia
nicholella
marginata
fuscosa
bonanza
apache
taurina
staphyleae
sayi
picta
media
hesperus
... robiniae ...
incurva
caesar
arizonae
lateralis
lathyri
instabilis
falcicula
dakota
cuneata
bifurca
ampla barberi
ute ute
confluenta confluenta
davisi davisi
anisacanthi anisacanthi
confraterna confraterna
garryae garryae
minor minor
minima minima

MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER

TABLE III.2. Correlation coefficients among six measurements of 48 species of North American Lopidea. Measurements were made on three male specimens of each species, except for two species for which fewer than three males were available. N = 146; all correlations are significant at $P < 0.001$. TOTL = Total length. PL = Pronotal length. PPW = Posterior pronotal width. HW = Head width. VERT = Width of vertex. AIL = Length of antennal segment I. AIIL = Length of antennal segment II.

	TOTL	PL	PPW	HW	VERT	AIL
PL	0.884					
PPW	0.878	0.949				
HW	0.732	0.720	0.756			
VERT	0.525	0.585	0.627	0.832		
AIL	0.871	0.791	0.758	0.657	0.488	
AIIL	0.889	0.775	0.740	0.648	0.435	0.935

TABLE III.3. List of synapomorphic characters uniting the genera Lopidea and Ilnacora and apomorphic characters defining the genus Lopidea. Character 8 is tentative because it is based on an examination of only four species.

Lopidea + Ilnacora

1. Head strongly vertical, tylus hidden or only partly visible when viewed from above.
2. Gena elongate; genal suture long, running beneath well beneath eye.
3. Left paramere with distinct lateral and medial flanges and having the lateral flange flattened vertically.
4. Genital capsule strongly vertical and round to oval.

Lopidea

5. Red-black or yellow-black coloration.
6. Loss of right ventral spicula only.
7. Serrate flange present on medial apical surface of right paramere (medial flange).
8. Diploid chromosome number of 80. *

<u>Lopidea</u> <u>ampla</u> Van Duzee
Figures III.19, III.72; Map III.1

<u>Lopidea</u> <u>ampla</u> Van Duzee, 1917:272 (new species). Henry and Wheeler, 1988:417 (catalog).

DIAGNOSIS: This species can be distinguished from all sympatric species by its large size, black-yellow coloration and prominent, erect, black setae.
DESCRIPTION: Large species, length 6.0-7.4, elongate oval, widest across apex of clavus. Vertex flat; frons narrowly rounded protruding only slightly; eyes small, ventral margin of eye reaching below frons-tylus suture; eye-antennal fossa distance < width antennal segment I, equal to width antennal segment II; head long, buccula distinctly separated from collar; antennae thick, weakly tapered distally, long, ratio length antennal segment II - head width > 1.8; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe undeveloped; tergal process long (fig. III.19d), curved medially, tapering to a narrow point.

Genitalia (figs. III.19, III.72): Right paramere <u>davisi</u> type, apical margin constricted into short, tongue-shaped lobe; ventral angle of apex expanded into a thick, rounded lobe; medial flange thick, fused with dorsoapical margin of paramere; dorsal flange short, situated medially; basal arm very short, directed horizontally towards apex of paramere. Left paramere relatively narrow, constricted at middle; basal angle with small rounded lobe dorsally; lateral flange slightly expanded apically, dorsal angle of apex acutely rounded, ventral angle of apex broadly rounded; medial flange situated dorsally, short, apex bluntly rounded. Dorsal spicula short, twisted; both margins serrate along distal halves; basal sclerite small, quadrate, arm present but vestigial. Ventral spicula weakly, evenly curved; distal third evenly tapered, both margins serrate.

COLOR AND VESTITURE: General coloration black and yellow. Head fuscous to black except for dull yellow spot on vertex either side of midline; gena and lorum testaceous to piceous. Antennae, rostrum, appendages and ventral surface fuscous to piceous. Anterior third of pronotum black, posterior surface yellow; scutellum, clavus and medial half of corium fuscous; lateral half of corium yellow. Dorsum with long, thick, semi-erect black setae.

FEMALE: Same size as male, length 5.8-7.4; antennae weakly fusiform; macropterous.

TYPE: **HOLOTYPE** M, *Lopidea ampla* Van Duzee: **California**, *San Francisco Co.*, July 24, 1917, W.M. Giffard (CAS).

DISTRIBUTION: *Lopidea ampla* occurs in the Pacific Forest province from the Queen Charlotte Islands to Monterey Co., California (Map III.1). It is most common at low elevations along the western slopes of the Coast Range, but has been collected at 7000 ft elevation and as far east as Hood River, Oregon.

DISCUSSION: *Lopidea longicornis* is a Uhler manuscript name that is found attached to some specimens. Van Duzee (1917) noted a specimen from Seattle, Washington in the CAS with a label bearing the name *Lopidea longicornis* Uhler, in Uhler's handwriting. I have seen an additional specimen in the KU collection from Washington Territory with a *L. longicornis* determination label, hand written by Uhler.

L. ampla has been recorded from potatoes, *Lathyrus*, *Epilobium*, *Salix*, *Dahlia*. The only confirmed breeding records are from *Vicia gigantea* (Fabaceae) from California and Washington. Collection records from April 30 to September 8 with 87% in July and August.

SPECIMENS EXAMINED:

CANADA: British Columbia: Crease Isl., Blackfish Sd.; Galiano Isl.; Jordan Riv.; Leone Isl., Blackfish Sd.; Lulu Isl.; Quadra Isl.; Sea Isl., ex potato leaves and shoots; Queen Charlotte Isls., Graham Isl.; Queen Charlotte Isls., Tlell, ex Lathyrus; Skidgate; Sonora Isl., Thurston Bay; Tofino; Vancouver; Vancouver Isl., Brooks Pen., Quineex, wet supratidal meadow; Vancouver Isl., Forbidden Plateau, 7000 ft; Vancouver Isl., Kelsey Bay; White Cliff Isl., Queen Charlotte Strait; Victoria.

USA: California: Humboldt Co.: Arcata; Cutten; Elk Riv. Corners, Falk; Kneeland; Van Duzen Riv., near Carlotta; Marin Co.: Inverness; Lagunitas; McClure's Beach; Point Reyes Nat'l Seashore, coast trail; Monterey Co.: Carmel; San Francisco Co.: Lands End; San Mateo Co.: 2 mi N Half Moon Bay; 2 mi N Montara; Pillar Point, 3 mi S Montara; San Bruno Mts.; Santa Cruz Co.: Felton; Sonoma Co.:

Oregon: Benton Co.: Corvallis; Mary's Peak, 14 mi W Corvallis, 4000 ft; Clatsop Co.: Astoria; Ecola St Prk., Indian Beach; Columbia Co.: Pittsburgh, 2000 ft.; Rainier; St. Helens, 500 ft, ex Epilobium angustifolium; Curry Co.: Brookings; Hood River Co.: Hood River; Lincoln Co.: Boiler Bay; Waldport; Multnomah Co.: Portland, ex willow; Washington Co.: Dilley; Forest Grove, ex Dahlia; Yamhill Co.: Top of Bald Mt.; **Washington:** Cowlitz Co.: Kalama Riv.; Grays Harbor Co.: Hoquiam; Island Co.: Coupeville; Jefferson Co.: Kalaloch; La Push, ex Vicia gigantea; Olympic Nat'l. Prk., Kalaloch; 10 mi N Queets; Queets; King Co.: Seattle; Pacifc Co.: Bay Center; Nahcotta; Naselle Riv.; Ocean Park; Seaview; Skating Lake; Willapa Bay, salt marsh; Pierce Co.: Mt. Rainier; Puyallup; Snohomish Co.: Everett; Thurston Co.: Olympia.

Lopidea anisacanthi Knight
Figures III.20, III.73; Map III.2

Lopidea anisacanthi Knight 1962:31 (new species). Henry and Wheeler, 1988:417 (catalog).

DIAGNOSIS: Recognized by the lingulate apical process of the right paramere (fig. III.20).

DESCRIPTION: Small species, length 4.3-5.0; linear. Vertex flat to weakly concave; frons weakly protruding, narrowly rounded; eyes moderately large, reaching to or just short of frons-tylus suture; eye-antennal fossa distance short, less than width antennal segment II; head short, buccula not extending completely past collar; antennae linear, short, ratio length of antennal segment II-head width 1.3-1.5; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe weakly developed, narrowly rounded. Tergal process short, straight, evenly tapered to narrowly rounded apex (fig. III.20d).

Genitalia (figs. III.20, III.73): Right paramere davisi type; dorsal flange short, reduced to two blunt teeth; dorsoapical margin serrate, reflexed medially, dorsal angle expanded as a short process, strongly reflexed basally; ventral angle narrowed to an acutely rounded, lingulate apex; medial flange reduced to a double, horizontal row of short teeth; basal arm extremely short, oriented ventromedially, usually with a basal tooth. Left paramere with lateral flange very narrow, evenly tapering to a narrow, rounded apex; medial flange reduced to a very short curved process at apex of lateral flange. Dorsal spicula short, strongly and evenly curved; strongly narrowed distally; only apex serrate; basal sclerite small, roughly rectangular, process not distinguishable. Ventral spicula sinuous, abruptly narrowed and bifurcate at middle; primary arm long, straight, serrate distally; secondary arm half the length of primary arm, recurved basally, margins entire.

COLOR AND VESTITURE: General coloration variable, from solid red to fuscous and yellow-red. Head fuscous to cream; antennae light reddish fuscous to black; rostrum reddish brown. Coxae and femora rufous to light fuscous, apices pale; tibia reddish fuscous; tarsi black. Venter pale yellow to infuscated rufous. Pronotum solid red to fuscous, anterior and lateral margins pale. Calli concolorous with pronotum in red and pale specimens; fuscous in dark specimens. Scutellum and hemelytra rufous to fuscous; clavus and medial area of corium lightly infuscated in red and pale specimens; lateral margin of corium and embolium reddish yellow in dark colored specimens. Dorsum with very short, inclined setae; setae usually pale, but may be dark on fuscous specimens.

FEMALE: Slightly larger than male, length 4.7-5.3; macropterous.

TYPE: **HOLOTYPE** M, Lopidea anisacanthi Knight: **Arizona**, Pima Co., Tuscon, May 31, 1924, A.A. Nichol (USNM).

DISTRIBUTION: Occurs in the Mohave and northern Chihuahuan deserts of southern California, Arizona and southwestern New Mexico Map III.2).

DISCUSSION: Collection records from April 15 to September 4. Most commonly collected in May and August, suggesting a bivoltine lifecycle. The majority host plant records and the two confirmed breeding records are from Anisacanthus thurberi. Also collected from Sphaeralcea, Celtis and Eriogonum.

SPECIMENS EXAMINED:

Arizona: Cochise Co.: Chiricahua Mts.; Douglas, ex. *Anisacanthus thurberi*; San Bernardino Ranch, 15 mi E Douglas; Dry Canyon, Sands Ranch, SE end of Whetstone Mts.; Onion Saddle, 3.5 mi. E Nat'l. For. boundary, Chiricahua Mts., 5300-5600 ft; Portal, ex. *Anisacanthus thurberi*; *Eriogonum*; vicinity of Portal; 1 mi S Warren, ex. 7 mi. E Wilcox; Maricopa Co.: 5 mi S Freeman, SE Gila Bend, ex. *Anisacanthus thurberi*; Mohave Co.: 24 mi SE Wikieup, ex. *Sphaeralcea*; Pima Co.: Continental; Coyote Mts., 3500 ft; Rincon Mts., 3500 ft; Santa Catalina Mts., Box Canyon, ex. *Gossypium thurberi*; Santa Catalina Mts., Molino Basin; Sabino Canyon; Santa Rita Mts., Madera Canyon; Tucson; Santa Cruz Co.: 10 mi. E Arivaca; Atascosa Mts.; 14 mi NE Nogales, ex. *Celtis*; 4 mi W Patagonia; 7 mi S Sonoita; Tubac; **New Mexico:** Hidalgo Co.: 7 mi SW Rodeo.

Lopidea apache Knight

Figures III.21, III.74 Map III.3

Lopidea apache Knight 1918:173 (new species). Henry and Wheeler, 1988:417 (catalog).

DIAGNOSIS: Very similar to *heidemanni*, distinguished by the presence of a well developed sensory lobe, the short medial flange of the right paramere and its southwestern distribution.

DESCRIPTION: Medium sized species, length 6.1-6.5, parallel sided. Vertex flat to slightly concave; frons narrowly rounded, moderately protruding; eyes large, reaching below frons-tylus suture; eye-antennal fossa distance very short, less than width of third antennal segment II; head short, buccula just separate; antennae slender, cylindrical, ratio antennal segment II- width of head 1.7-1.9; rostrum reaching posterior margin of mesocoxae or beyond.

Genital Capsule: Sensory lobe of genital capsule large, evenly rounded, oriented laterally. Tergal process very short, almost absent (fig. III.21d).

Genitalia (figs. III.21, III.74): Right paramere media type; dorsal flange reduced to 2-3 short teeth; apex angled ventrally, dorsoapical margin serrate; medial flange short, vertical, apex serrate; basal arm long, thick, oriented almost perpendicular to axis of paramere, apex with 2-4 short teeth. Left paramere with lateral flange broadly and evenly rounded; medial flange short, barely surpassing apex of lateral flange, strongly curved ventrally, apex narrow. Dorsal spicula short, linear, distal third serrate; basal sclerite present, process well developed. Ventral spicula very long, slender, bifurcate at middle, both arms of equal length and minutely dentate at apices.

FEMALE: Larger than male, length 6.5-6.7; macropterous form only.

COLOR AND VESTITURE: General coloration red or reddish brown. Head rufous-white; antennae fuscous to black; rostrum reddish brown. Coxae and trochanters white to reddish brown, occasionally specalled with fuscous; femora and tibiae rufous to fuscous, ventral surface pale; tarsi red to black. Pronotum red, anterior and lateral margins occasionally pale; calli black or fuscous. Scutellum dark red to fuscous; hemelytra red, veins infuscated; embolium and cuneus sometimes pale. Pronotum almost glabrous. Hemelytra with very short, inclined, dark setae.

FEMALE: Larger than male, length 6.5.-6.7; macropterous.

TYPE: **HOLOTYPE** M, Lopidea apache Knight: **Arizona**, Graham Co., Bonita, Post Creek Canyon, July 16, 1917, H.H. Knight (CU).

DISTRIBUTION: Occurs in the southern Rocky Mountains of New Mexico and southeastern Arizona (Map III.3).
DISCUSSION: Collected on Robinia neomexicana, but there are no known breeding records. Collection records from April 21 to August 18 with 80% in June and July.
SPECIMENS EXAMINED:
Arizona: Cochise Co.: Chiricahua Mts.; Graham Co.: Arcadia Forest Camp, Pinaleno Mts., 6700 ft.; Bonita, Post Creek Canyon; Yavapai Co.: Prescott; **New Mexico:** Lincoln Co.: Ruidoso (MCSU); White Mts., S Fork of Eagle Creek, 8000 ft.; Los Alamos Co.: Jemez Springs, 6400 ft.; Torrance Co.: Tajique.

Lopidea arizonae Knight
Figures III.22, III.75; Map III.4

Lopidea arizonae Knight 1918:172. (new species). Henry and Wheeler, 1988:417 (catalog).
Lopidea navajo Knight 1918:173. (new species). Henry and Wheeler, 1988:422 (catalog). **NEW SYNONOMY.**

DIAGNOSIS: Recognized by its symmetric, rectangular right paramere (fig. III.22) and dark red dorsal coloration with contrasting white embolium.
DESCRIPTION: Medium to large species, length 5.3-6.2; linear, parallel sided. Vertex weakly to strongly concave; frons narrowly rounded, moderately protruding; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance large, subequal to width antennal segment II; face long, buccula distinctly separated from collar; antennae cylindrical, very slender, ratio length segment II-head width 1.5-1.7; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe very small, inconspicuous. Tergal process very short, abruptly narrowed, apex pointed (fig. III.22d).

Genitalia (figs. III.22, III.75): Right paramere davisi type; dorsal flange long, occasionally arising from medial surface; apex angled dorsally; dorsoapical margin only weakly serrate; medial flange very narrow, flat, horizontal flange, parallel with dorsoapical margin of paramere; basal arm short, thick, apex bluntly pointed, oriented with axis of paramere. Left paramere narrowed; lateral flange weakly constricted basally; apex evenly rounded; medial flange very narrow, digitiform, widely separated from lateral flange, apex bluntly squared. Dorsal spicula long, linear, thick, both margins serrate; basal sclerite very small, process vestigial or absent. Ventral spicula long, thick, strongly and evenly curved, widest at middle, both margins serrate distally.

COLOR AND VESTITURE: Head white to rufous; antennae red, segment I and basal half of segment II occasionally pale red; rostrum reddish brown. Coxae and trochanters pale, base of coxae fuscous; femora pale fuscous; tibia and tarsi light to dark fuscous. Pronotum red to yellowish brown, anterior margin pale; calli black. Scutellum pale red to white. Hemelytra red to reddish fuscous; clavus-corium suture pale; embolium and cuneus white. Dorsum with very short, inclined setae; color variable, most commonly pale, but occasionally dark along embolium and more extensive in dark specimens.

FEMALE: Slightly larger than male, length 5.3-6.3; macropterous.

TYPE: **HOLOTYPE** M, Lopidea arizonae Knight: **Arizona**, Graham Co., Bonita, Post Creek Canyon, July 16, 1917, H.H. Knight, (CU).

TYPE OF SYNONYM: **HOLOTYPE** M, Lopidea navajo Knight: **Arizona**, Coconino Co., Williams, August 4, 1917, H.H. Knight, (CU).
DISTRIBUTION: Known from the southern Rocky Mountains of New Mexico and eastern Arizona (Map III.4).
DISCUSSION: The proposed synonymy of navajo with arizonae is based on the identical genitalic structures of the males. Knight (1918) distinguished navajo from arizonae by the anterior margin of the pronotum being yellowish rather than white. This color difference is not consistent between the two nominal species. Knight (1918) reports finding both nymphs and adults abundant on the infloresences of Robinia neomexicana. Collection records from 5 June to 18 August; common in all three months.
SPECIMENS EXAMINED:
Arizona: Apache Co.: Alpine; Cochise Co.: Barfoot Park, Chiricahua Mts.; Douglas; Rustlers Park, 6400 ft.; Coconino Co.: Bill Williams Mt., Williams; Flagstaff; Grand Canyon, S rim; Greenland Lake; Williams, 7000 ft; Gila Co.: Globe, Pioneer Pass, ex. Acacia; Graham Co.: Bonita; Pima Co.: Mt. Lemon, ex. Acacia; Rincon Mts., 7000 ft.; Yavapai Co.: 3 mi SW Prescott; **New Mexico:** Los Alamos Co.: Jemez Springs; Lincoln Co.: Ruidoso; Otero Co.: Cloudcroft, ex. Robinia; Socorro Co.: Magdalena.

Lopidea balli Knight

Figures III.23, III.24, III.76; Map III.5

Lopidea balli Knight, 1923:66 (new species). Kelton, 1980:236 (description, illustration, distribution). Henry and Wheeler, 1988:417 (catalog).

Lopidea chelifer Knight, 1923:67 (new species). Knight, 1927:38 (distribution, host plant). Henry and Wheeler, 1988:418 (catalog). **NEW SYNONOMY.**

DIAGNOSIS: Because of its variable color pattern, and the similarity of sympatric species, this species can be confidently recognized only by the distinctly C-shaped or L-shaped right paramere (figs. III.23, III.24). Lopidea falcicula Knight also has a C-shaped right paramere, but in that species the arms of the paramere are cylindrical, whereas they are lateral compressed in balli.

DESCRIPTION: Medium sized species, length 5.8-6.6, linear, parallel sided. Vertex flat or slightly concave; ventral margin of eye not reaching frons-tylus suture; eye-antennal fossa distance < width of antennal segment II; antennae long, occasionally weakly tapered distally, ratio antennal segment II-head width = 1.7; rostrum reaching mesocoxae.

Genital Capsule: Sensory lobe large, well developed, oriented posteromedially. Tergal process short, broad, flattened, apex abruptly pointed and curved ventromedially (fig. III.24d).

Genitalia (figs. III.23, III.24, III.76): Right paramere robiniae type; ventral arm with dorsal surface bearing 3-4 short blunt teeth, apex curved dorsomedially, occasionally with 1-2 short teeth; dorsal arm weakly recurved horizontally and medially, apex sharply tapering to a point (L. b. chelifer, fig. III.24) or bearing 3-5 stout denticles (L. b. balli, fig. III.23); basal arm short, apex blunt or toothed, directed towards apicoventral angle of paramere. Left paramere narrow, elongate; lateral flange narrow, situated ventrally, apex curved ventromedially; medial flange short, narrow, situated dorsally. Dorsal spicula long, apical half broad, both margins serrate; basal sclerite small, quadrate; process very short. Ventral spicula long, sinuous, bifurcate; length of secondary arm variable; short in western populations (L. b. chelifer, fig. III.76a-b)), one third length of primary arm, eastern populations (L. b. balli, III.76c) with longer secondary arm, three quarters length of primary arm; primary arm serrate on both margins; secondary arm minutely serrate or not.

COLOR AND VESTITURE: General coloration red or red and white. Head rufous to red, vitae and carina only fuscous; lateral margins of frons and jugum yellowish white; antennal segment I red to fuscous; antennal segments II-IV fuscous; rostrum red to fuscous. Coxae variable, pale to fuscous; femora and tibia reddish fuscous to black; tarsi black. Pronotum pale red, occasionally bi-colored with anterior half pale and posterior half red; calli red, occasionally dotted with fuscous but never black. Scutellum rufous to red. Hemelytra red with fuscous along claval suture; western populations often with pale clavus or claval-corium suture and embolium and cuneus. Dorsum with long semi-erect, setae light in pale specimens or pale colored areas, and dark on other specimens and fuscous areas.

FEMALE: Same size as male, length 5.6-6.6; macropterous.

TYPE: **HOLOTYPE** M, **Colorado**, Arapahoe Co.: Denver, July 22, 1900, E.D. Ball (USNM).

TYPE OF SYNONYM: **HOLOTYPE** M, **New Mexico**, Los Alamos Co., Jemez Springs, August 1-15, 1916, J. Woodgate (USNM).

DISCUSSION: I interpret Lopidea balli as a polytypic species composed of two geographically separate subspecies. L. b. balli occurs along the east slopes of the Rocky Mountains and in the northern shortgrass prairie province from Colorado to Saskatchewan, and L. b. chelifer occurs along the western slopes of the Rocky Mountains and the

Colorado Plateau from southern Wyoming, Colorado and Utah south to Arizona and New Mexico. The vesica of this species is highly variable. Among populations of b. chelifer, the secondary arm of the ventral spicula may be absent or half the length of the primary arm, whereas in b. balli, the secondary arm is always well developed. Both subspecies vary somewhat in dorsal coloration, usually being a solid light red. Some populations of b. chelifer however are very pale, with the red occurring only on the posterior lobe of the pronotum and the corium. Some specimens of b. balli from Colorado have a pale embolium and cuneus.

I have seen no confirmed breeding records for this species, although Knight (1927) records it breeding on Robinia neomexicana in Colorado. Specimens have also been taken on Salix amygdaloides and Solidago sp.. Collection records are from June 4 to September 9 with 83% in July and August.

Lopidea balli balli Knight **NEW STATUS**

Figures III.23, III.76c; Map III.5

Lopidea balli Knight, 1923:66 (new species). Kelton, 1980:236 (description, illustration, distribution). Henry and Wheeler, 1988:417 (catalog).

DIAGNOSIS: Recognized by the dorsal arm of the right paramere which is not recurved horizontally, and its apex bears several short stout teeth.

DISTRIBUTION: L. balli balli occurs along the eastern slopes of the Rocky Mountains and in the northern shortgrass prairie province from Colorado to Saskatchewan (Map III.5).

SPECIMENS EXAMINED:

CANADA: Alberta: Castor; Medicine Hat; Milk River, 5 km E Writing-on-Stone; **Saskatchewan:** Dundurn; Saskatchewan Landing; Saskatoon;
USA: Colorado: Arapahoe Co.: Denver; Crowley Co.: Fowler; El Paso Co.: Colorado Springs, 5915 ft; Larimer Co.: Ft. Collins; Morgan Co.: Snyder; Otero Co.: Rocky Ford; Sedgwick Co.: Julesburg; Weld Co.: Central Plains Exp. Range, 8 km N Nunn, ex Salix amygdaloides and Solidago; 3 mi SE Rockport; Windsor; **Nebraska:** Sioux Co.: Badlands; **North Dakota:** Melean Co.: Garrison; **South Dakota:** Washabaugh Co.: Interior; **Wyoming:** Albany Co.: Albany; Big Horn Co.: Greybull; Weston Co.: Newcastle, ex. greasewood.

Lopidea balli chelifer Knight **NEW STATUS**

Figures III.24, III.76a-b; Map III.5

Lopidea chelifer Knight, 1923:67 (new species). Knight, 1927:38 (distribution, host plant). Henry and Wheeler, 1988:418 (catalog).

DIAGNOSIS: Recognized by the dorsal arm of the right paramere of being recurved horizontally with the apex narrow and sharply pointed.

DISTRIBUTION: L. balli chelifer occurs along the western slopes of the Rocky Mountains and the Colorado Plateau from southern Wyoming, Colorado and Utah, south to Arizona and New Mexico (Map III.5).

SPECIMENS EXAMINED:

Arizona: Cocinino Co.: Cameron; **Colorado:** Archuleta Co.: Pagosa Springs, 7200 ft; Costilla Co.: Veta Pass; Custer Co.: Westcliff; Eagle Co.: Gypsum, 6300 ft; Fremont Co.:; Gunnison Co.: 8 mi SW McClue Pass; Mesa Co.: Mesa; **New Mexico:** Bernalillo Co.: Belen; Socorro Co.: 2 mi NE Bernardo; Valencia Co.: Valencia; **Utah:** Grand Co.: Moab;

Los Alamos Co.: Jemez Springs; San Juan Co.: Bluff; Uintah Co.: White Rocks; Washington Co.: Santa Clara; Zion Nat'l. Pk.; Weber Co.: Ogden; Co.?: Antelope; **Wyoming**: Carbon Co.: Baggs.

Lopidea barberi Knight

Figures III.25, III.77; Map III.6

Lopidea barberi Knight 1962:33 (new species). Henry and Wheeler, 1988:418 (catalog).

DIAGNOSIS: Recognized by its long, slender right paramere with its inornate apex, and its short, sparse, pale setae.
DESCRIPTION: Medium sized species, length 5.7-6.1, linear. Frons weakly protruding, broadly rounded; vertex weakly concave; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance short, < width antennal segment II; head short, buccula not separated from collar; antennae linear, long, ratio antennal segment II - width head 1.7-1.9; rostrum just reaching mesocoxae. Lateral margins of pronotum distinctly carinate.

Genital Capsule: Sensory lobe absent or very weakly developed; tergal process short, abruptly narrowed to acute apex (fig. III.25).

Genitalia (figs. III.25, III.77): Right paramere media type; dorsal flange reduced to 2 small teeth, not connected basally. Northern populations with apex short, abruptly rounded (fig. III.77e); medial flange long, narrow, margins serrate. Southern populations with lateral margin expanded, serrate and occasionally bifurcate (fig. III.77f-g); medial flange more elongate; basal arm long, narrow, situated dorsally, oriented with axis of paramere. Left paramere weakly expanded vertically at angle, abruptly narrowed distal of angle; lateral flange narrow, apex acutely rounded, strongly curved ventrally; medial flange short, wide, strongly curved ventrally. Dorsal spicula variable; northern population very short, tapering from thick base to extremely slender distal half, strongly and evenly curved, margins entire; southern populations spicula is longer, distal half thicker and serrate; basal sclerite large, triangular, process extremely long. Ventral spicula very long, thick, curved at middle, bifurcate at distal third, arms of equal length; apical margins of primary arm strongly serrate, margins of secondary arm less so.

COLOR AND VESTITURE: General coloration red and black. Head red; antennae black; rostrum reddish brown. Legs dark fuscous to black; apices of coxae and trochanters lighter. Venter dark red; genital capsule black. Pronotum red, broad fuscous to black medial stripe; calli black. Scutellum black. Hemelytra red, clavus and medial area of corium fuscous to black; membrane dark fuscous. Dorsum with sparse, short, inclined, pale setae. Setal color variable; typically pale on red areas and dark on black areas although some specimens display only black setae.

FEMALE: Same size as male, length 5.5-6.1. Macropterous form only.

TYPE: **HOLOTYPE** M, <u>Lopidea</u> <u>barberi</u> Knight: **Arizona**, Huachuca Mts. 31 July, 1905, H.G. Barber (USNM).

DISTRIBUTION: Known in the U.S. only from the southeastern corner of Arizona, but probably extends far south into Mexico (Map III.6).

DISCUSSION: <u>Lopidea</u> <u>barberi</u> is a predominately Mexican species and the mountains of southeast Arizona appear to be the northern end of its range. There is considerable variation in the right paramere and dorsal spicula among specimens I have examined from Arizona to Chiapas, Mexico. There seems to be a North-South cline, with the apex of the right paramere becoming bifurcate and more elaborate, and the size of the dorsal spicula increasing in more southern populations. Some of the species of Lopidea described from Mexico are probably synonyms of barberi, but more material is needed to evaluate the geographic variation in this group. Collection records are from 5 July to 20 September, with 60% in August.

SPECIMENS EXAMINED:

MEXICO: Chiapas: Gutierrez, 75 mi SW Tuxtla, 3000 ft, 5 July, (NAU); **Durango:** 15 mi SW Durango, 7100 ft, 17 August, (NAU); **Jalisco:** mts. N Ajijic, 7500 ft, scrub forest, 20 September, (UA).

USA: Arizona: Cochise Co.: Portal, 3 August (UCB); Canelo, 3 August (UA).

Lopidea bifurca Van Duzee
Figures III.26, III.78; Map III.7

Lopidea bifurca Van Duzee 1921:126 (new species). Henry and Wheeler, 1988:418 (catalog).

DIAGNOSIS: Recognized by its well developed sensory lobe and strongly flattened, serrate ventral arm of the right paramere (fig. III.26).

DESCRIPTION: Small species, length 4.9-5.2, linear. Frons weakly protruding, narrowly rounded; vertex weakly concave; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance short, equal to width antennal segment I; head relatively long, buccula just separated from collar;

antennae linear, relatively short, ratio length antennal segment II - head width 1.5-1.6; rostrum reaching metacoxae.

Genital Capsule: Sensory lobe well developed, apex abruptly narrowed; oriented dorsolaterally. Tergal process long, narrow, straight, evenly tapered to sharp apex (fig. III.26d).

Genitalia (figs. III.26, III.78): Right paramere robiniae type; dorsal arm variable, short, thick, horizontal or long, thin and almost vertical; ventral arm thick dorsoventrally, apex serrate, ventroapical angle acute; basal arm short, thick, oriented ventrally, apex with blunt teeth. Left paramere with dorsal margin of angle weakly expanded vertically; lateral flange with apex broadly rounded; medial flange equal in length to lateral flange, evenly tapered to narrowly rounded apex. Dorsal spicula long, broad, abruptly curved at base, distal third of both margins serrate; basal sclerite small, quadrate; process absent. Ventral spicula long, evenly curved, basal third very broad; bifurcate distally; secondary arm very short, slender, margins entire; primary arm long, straight, both margins sparsely serrate.

COLOR AND VESTITURE: General coloration yellowish brown or slate grey. Head reddish yellow; antenna reddish fuscous to black. Legs yellow brown to fuscous. Venter yellowish brown to light fuscous; genital capsule darker. Pronotum yellowish brown, anterior margin pale; calli dark fuscous to black. Scutellum dark fuscous to black. Hemelytra yellowish brown in northern populations, slate grey in southern populations, clavus occasionally lightly infuscated, embolium and cuneus pale yellow. Dorsum with short, inclined, pale setae.

FEMALE: Slightly larger than male, length 5.1-5.5; macropterous.

TYPE: **HOLOTYPE** F, Lopidea bifurca Van Duzee: **Oregon**, Jackson Co., Colestin, August 1, 1918, E.P. Van Duzee (CAS).
DISTRIBUTION: Occurs in the Coastal and Sierra Nevada ranges of the Pacific coast from southern Oregon to Los Angeles Co., California (Map III.7).
DISCUSSION: Van Duzee (1921) stated that the holotype is a male, but I have examined the type series in the CAS and determined that the holotype is a female and the allotype is a male. Specimens from central and southern California are rather distinct from those of northern populations. These specimens are solid, slate grey in color, with the sensory lobe much reduced and the dorsal arm of right paramere strongly reduced and almost vertical. Although these populations may represent a distinct taxon, much more material is needed to determine the significance of the differences I describe, and presently I consider these southern populations as bifurca. Collection records are from 6 July to 1 August.
SPECIMENS EXAMINED:
California: Contra Costa Co.: Mt. Diablo, July 14 (CAS); Los Angeles Co.: Mt. Wilson, July 26 (TXA&M); Plumas Co.: Caribou, July 6 (UCB); San Bernardino Co.: Cajon Pass (KU); Siskiyou Co.: Siskiyou Nat'l. For., July 14 (KU); **Oregon**: Jackson Co.: Colestin, August 1 (CAS).

Lopidea bonanza, new species

Figures III.27, III.79; Map III.8

DIAGNOSIS: Recognized by its pale, grayish green coloration, and extremely narrow tergal process (fig. III.27d).
DESCRIPTION: Small species, length 4.8-5.2, linear, sides weakly arcuate. Vertex flat; frons broadly rounded,

moderately protruding; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance large, $\geq$ width antennal segment II; head short, buccula touching collar; antennae slender, cylindrical, short, ratio length antennal segment II - head width 1.4-1.6; rostrum reaching mesocoxae.

Genital capsule: Sensory lobe well developed, very broadly rounded. Tergal process, short, straight, thin, abruptly narrowed basally (fig. III.27d).

Genitalia (figs. III.27, III.79): Right paramere short *media* type; apex curved dorsally; dorsoapical margin folded medially, minutely serrate; medial flange present as short, serrate ridge, parallel with margin of paramere; medial flange short, thick, oriented medially; basal arm short, extremely thick, angled ventrally, apex with large, blunt teeth. Left paramere with lateral flange weakly curved ventrally, apex narrowly rounded; medial flange short, abruptly narrowed from broad base. Dorsal spicula curved basally, tapered distally, margins strongly serrate; basal sclerite large, quadrate, presence of process undetermined. Ventral spicula short, slender, sinuous, margins entire.

COLOR AND VESTITURE: General coloration grayish green. Head white to pale yellow; frons and tylus occasionally rufous; antennae reddish fuscous to black; rostrum reddish brown. Coxae pale, bases infuscated; trochanters pale; femora and tibiae greenish fuscous; tarsi fuscous to black. Venter yellow-green, variably infuscate. Pronotum grey, anterior and medial margins pale; calli greenish yellow, variably conspurcate with black. Scutellum and hemelytra greyish green; lateral margin of corium, embolium and cuneus yellow green to pale. Dorsum with short, decumbent, pale setae.

FEMALE: Same size as male, length 4.9-5.3; macropterous only.

ETYMOLOGY: Named for the locality in northeastern Utah where all known specimens were collected.

HOLOTYPE M: **Utah**, Uintah Co., Bonanza, @ White River Shale Project trailers, 5000 ft., T9S R24E Sec23, ex. Astragalus sp., M.D. Schwartz, deposited in the American Museum of Natural History.

PARATYPES: 7M, 6F same data as holotype (AMNH); 8M, 2F **Utah**, Uintah Co., 5-10 mi SW Bonanza, 5000-5600 ft., Kyber Pass, T10S R24E Sec 29, M.D. Schwartz (AMNH).

DISCUSSION: This species superficially resembles the sympatric picta Van Duzee and can be distinguished by the much narrower tergal process, smaller medial flange of the left paramere and shorter, thinner ventral spicula. This species is described from two series collected in early June. One series was taken on Astragalus sp., the other on Hedysarum borsale. Both series contain teneral specimens suggesting that this species breeds on both these plants.

Lopidea bullata Knight

Figures III.28, III.80; Map III.3

Lopidea bullata Knight 1923:71 (new species). Henry and Wheeler, 1988:418 (catalog).

Lopidea bullata bullata Knight 1923:71 (new subspecies). Henry and Wheeler, 1988:418 (catalog). **NEW SYNONYMY**

Lopidea bullata fusca Knight 1923:71 (new subspecies). Henry and Wheeler, 1988:418 (catalog). **NEW SYNONYMY**

Lopidea paddocki Knight 1962:34 (new species). Henry and Wheeler, 1988:423 (catalog). **NEW SYNONYMY**

Lopidea deserta Knight 1968:99 (new species). Henry and Wheeler, 1988:419 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Recognized by its ovate form, extremely broad head and thin, ventrally curved tergal process.
DESCRIPTION: Small species, length 4.1-5.4; narrowly to broadly ovate in outline. Vertex flat to slightly convex; frons strongly protruding, broadly rounded; eyes very small, not reaching frons-tylus suture; eye-antennal fossa distance large, much greater than width of antennal segment II; head short, buccula touching collar; antennae cylindrical, slender, very short, ratio length antennal segment II-head width = 1.0; rostrum reaching posterior margin of metacoxae or beyond. Pronotum very short, lateral margins rounded, indistinctly carinate; depressions surrounding calli very shallow.

Genital Capsule: Sensory lobe of genital capsule poorly developed, weakly and broadly rounded; tergal process very short, thin, apex acute and strongly curved ventrally (fig. III.28d).

Genitalia (figs. III.28, III.80): Right paramere <u>media</u> type; dorsal flange narrow; apex weakly curved vertically, apical serrate, serrations sometimes grouped; medial flange well developed, narrow, horizontal; basal arm short, oriented with axis of paramere or weakly angled medially. Left paramere narrow; lateral flange short, deflexed ventrally, apex evenly rounded; medial flange short, strongly curved ventrally, apex bluntly rounded. Dorsal spicula short, very broad, linear, evenly narrowed, both margins serrate distally; basal sclerite large, process absent. Ventral spicula short, thick, slightly curved distally, single large tooth present near apex.
COLOR AND VESTITURE: General coloration greyish green to greyish fuscous. Head pale; antennal segment I pale to fuscous, base black, segment II, pale to fuscous, base

lighter; segments III and IV fuscous; ventral surface of first rostal segment pale, remainder reddish-brown to fuscous. Appendages variable, lighter forms with legs pale, except fuscous tarsi; darker forms with base of coxae black, remainder of coxae pale but infuscated; trochanters speckled fuscous; femora and tibiae greyish fuscous; tarsi black. Pronotum pale to fuscous, anterior margins always pale; calli speckled fuscous to black. Scutellum pale to fuscous, pale middorsal stripe present. Hemelytra variable; light forms light grey, veins fuscous, lateral margins and cuneus pale; darker forms, smoky fuscous, embolium and cuneus pale grey. Vestiture extremely variable, pronotum almost glabrous with very short, pale, inclined setae, to long, dark, semi-erect setae; hemelytra with short, inclined, pale to yellowish brown setae, length variable.

FEMALE: Smaller than male, length 3.8-5.3, more ovate, much lighter in color; brachypterous form common.

TYPES: **HOLOTYPE** M, Lopidea bullata Knight: **California**, Los Angeles Co. (CU). **HOLOTYPE** M, Lopidea bullata bullata Knight: **California**, Los Angeles Co. (CU). **HOLOTYPE** M, Lopidea bullata fusca Knight: **California**, Los Angeles Co. (CU). **HOLOTYPE** M, Lopidea paddocki Knight: **California**, Mill Creek Canyon, May 4, 1935, E.L. Paddock (USNM). **HOLOTYPE** M, Lopidea deserta Knight: **Nevada**, Nye Co., Mercury, June 13, 1965, Beck, H. Knight & J. Merino (USNM).

DISTRIBUTION: Lopidea bullata occurs in the Great Basin and Mohave deserts from northern Utah and Nevada to southern California (Map III.3).

DISCUSSION: The proposed synonymies of bullata bullata, bullata fusca, paddocki and deserta with bullata are based on the identical shapes of the male genitalia and the continuous variation in size, color and setal coloration. L. b. bullata and b. fusca were both described from the same series collected in Los Angeles Co., California. The holotypes are virtually identical, differing only in the intensity of coloration. *L. paddocki* was also described from a series collected in California and differs in no appreciable way from *bullata*. Knight (1962) allied this species with *scutata* and did not mention a relationship with *bullata*. *L. deserta* was described from southern Nevada and is smaller and paler than the type specimens of *bullata*. Knight (1968) distinguished this species from *bullata* by the length of antennal segment II being subequal to or greater than head width. This character however varies with total length. There is considerable geographic variation in this species. Specimens from southern California are typically larger, darker with longer, erect, yellowish-brown setae. Specimens from the Great Basin are smaller, paler with shorter, more inclined and paler setae.

The only confirmed breeding record is *Tetradymia* sp., but I have also seen a large series of teneral specimens collected on *Chrysothamnus* sp. Also collected from *Senecio*, *Ephedra* and *Hedysarum*. Collection records are from April 20 to July 26 with 80% in May and June.

SPECIMENS EXAMINED:

California: Los Angeles Co.: Mint Canyon, Solemint (CNC); Saugus, Mint Canyon (CAS); San Bernardino Co.: 4 mi E Mentone, 750 m, elev., ex. *Chrysothamnus* (AMNH); Victorville (UCB); Yucca Valley, 6.3 mi. N on Old Woman Sprgs. Rd. (UCR); Co. ?: Mill Creek Canyon (CNC); **Nevada:** Carson City Co.: Carson City (CAS); Elko Co.: Secret Canyon Rt 11, 18 mi. SE Halleck, 6000-6500 ft., ex. *Chrysothamnus nauseosus* (AMNH); Nye Co.: Mercury, CM, ex. *Ephedra nevadensis* (BYU); Nevada Atomic Test Site, 2 mi. W Tippapah Hwy on Mine Mt. Rd., 4400 ft., ex. *Tetradymia* (AMNH); Pershing Co.: Lovelock, 60 mi. N (CAS); **Utah:** Uintah Co.: 5-10 mi. SW

Bonanza, Kyber Pass, 5000-56000 ft, ex. Hedysarum (AMNH).

Lopidea caesar (Reuter)
Figures III.29, III.81; Map III.9

Lomatopleura caesar Reuter 1876:67 (new species). Uhler, 1894:250 (list). Osborn, 1898:233 (list). Smith, 1910:162 (list).
Lopidea caesar: Knight, 1918b:212-213 (illustration). Hussey, 1922b:32 (list). Knight, 1923:505-506 (description, illustration). Blatchley, 1926:836-837 (description). Henry and Wheeler, 1977:152 (list). Henry and Smith, 1979:214 (list). Henry and Wheeler, 1988:418 (catalog).

DIAGNOSIS: Recognized by its large size, distinctly fusiform second antennal segment and the thin, strap-like apical process of the right paramere (fig. III.29).
DESCRIPTION: Large species, length 6.6-7.2; sides weakly arcuate. Vertex flat; frons broadly rounded, moderately protruding; eyes relatively short, just short of frons-tylus suture; eye-antennal fossa distance short, less than width of antennal segment II; head short, buccula touching or just separated from collar; antennae thick, distinctly fusiform, long, ratio length antennal segment II - head width 2.1-2.2; rostrum reaching mesocoxae.

Genital Capsule: Sensory lobe strongly developed, narrow, cylindrical. Tergal process short, evenly tapered to pointed apex; weakly curved medially (fig. III.29d).

Genitalia (figs. III.29, III.81): Right paramere robiniae type; ventral arm with two apical flanges; dorsal flange short, rounded, oriented vertically; ventral flange extremely long, strap-like, recurved vertically; dorsal arm vertical, evenly tapered to acute apex; basal arm narrow, oriented ventromedially, apex sharply pointed. Left paramere with angle weakly expanded vertically; lateral flange situated ventrally, very narrow, apex evenly rounded; medial flange long, thick, situated dorsally. Dorsal spicula short, curved basally, very broad, margins strongly serrate; basal sclerite small, quadrate, process absent. Ventral spicula long, very broad, bifurcate, arms subequal in length; primary arm broad, apex strongly serrate; secondary arm slender, margins entire.

COLOR AND VESTITURE: General coloration red and black. Head red; antennae dark red to fuscous; rostrum red to dark reddish brown. Coxae and trochanters red to fuscous; femora and tibiae reddish fuscous to black; tarsi black. Venter red to reddish fuscous; genital capsule reddish fuscous to black. Pronotum red or occasionally yellow; calli rarely weakly infuscated. Scutellum and hemelytra variable, from solid red to solid black. Dorsum with short, inclined, black setae.

FEMALE: Slightly larger than male, length 6.6-7.4, sides distinctly arcuate; macropterous.

TYPE: Not examined.

DISTRIBUTION: Lopidea caesar is an eastern species known from Massachusetts and Florida west to Wisconsin and Arkansas (Map III.9).

DISCUSSION: I have not examined the type of caesar and it is not certain that the name belongs to the species under consideration. Reuter (1876) gave the type locality as Pennsylvania and Knight (1917), although not having seen the holotype, was convinced of the identity of this species based on the fusiform antennae and color. Lopidea caesar is an uncommon species, however, and instabilis and hesperus are more common eastern species with inflated second antennal segments and color similar to caesar. Collections are from 13 May to 9 August with 64% in July. I have seen no confirmed breeding records and very little information on host plants in general.

SPECIMENS EXAMINED:

CANADA: Ontario: Simcoe.

USA: Arkansas: Franklin Co.: Barnes; **Connecticut:** Middlesex Co.: Portland; **Florida:** Liberty Co.: Torreya St. Pk; **Maryland:** Frederick Co.: Wolfville; **Massachusetts:** Hampden Co.: Chester; Worcester Co.: Rutland; **Michigan:** Gratiot Co.:; **New Jersey:**; **New York:** Cattaraugus Co.: Gowanda; Salamanca; Monroe Co.: Rochester; Orange Co.: Ft. Montgomery; Tompkins Co.: Ithaca; Co.??: Long Island; **North Carolina:** Buncombe Co.: Black Mts.; Graham Co.: Robbinsville; Swain Co.: Smokemont; Watauga Co.:; **Vermont:** Windham Co.: Dummerston; **Virginia:** Arlington Co.: Glenncarlyn; Loudoun Co.: Bluemont; **West Virginia:** Greenbriar Co.: White Sulphur Springs; **Wisconsin:** Oconto Co.: Lakewood; Waupaca Co.: Clintonville.

Lopidea chandleri Moore

Figures III.30, III.82; Map III.10

Lopidea chandleri Moore 1956:40 (new species). Henry and Wheeler, 1988:418 (catalog).

Lopidea trispicata Knight 1965:14 (new species). Henry and Wheeler, 1988:425 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Recognized by the distinctly fusiform second antennal segment; short, strongly inclined setae, and the trispicate apex of the right paramere (fig. III.30).

DESCRIPTION: Large species, length 6.6-7.3; sides weakly arcuate. Vertex flat; frons broadly rounded, strongly protruding; eyes relatively large, just reaching frons-tylus suture; eye-antennal fossa distance small, less than width antennal segment II; head short, buccula touching or just separated from collar; antennae thick, segment II distinctly fusiform, long, ratio length antennal segment II - head width 2.2-2.3; rostrum reaching to mesocoxae or beyond. Pronotum weakly campanulate.

Genital capsule: Sensory lobe large, distinct, broadly rounded; tergal process short, thick, apex curved ventrally.

Genitalia: (III.30, III.82): Right paramere <u>media</u> type; apex expanded, dorsal and ventral angles developed as short, thick arms; dorsal angle of arm oriented vertically, with short teeth distally; ventral angle arm oriented laterally and curved medially, evenly tapered to acute apex; medial flange present as short, thick, serrate arm; dorsal flange present as long, cylindrical arm arising from medial surface; basal arm present as short, toothed protuberance. Left paramere with angle expanded vertically into short, rounded process; lateral flange short, apex evenly rounded; medial flange situated dorsally, long, straight, thick, apex broadly rounded. Dorsal spicula very thick, weakly curved basally, margin of distal third strongly serrate; basal sclerite small, quadrate, process absent. Ventral spicula long, thick, weakly curved; bifurcate at middle, primary arm thick, apical margins serrate; secondary arm half length of primary arm, slender, margins entire.

COLOR AND VESTITURE: General coloration red and black. Head variable, solid red to solid black; antennae and rostrum red to black. All appendages solid red to solid black. Pronotum red; calli and anterior margin weakly fuscous to black, medial area of disk occasionally black. Scutellum reddish fuscous to black. Hemelytra red, clavus, medial area of corium, and cuneus frequently black. Dorsum with short, sparse, inclined, black setae.

FEMALE: Not examined.

TYPE: **HOLOTYPE** M, Lopidea chandleri Moore: **Illinois**, Jackson Co., Carbondale, May 28, 1955, S.C. Chandler, ex. Wisteria vine (INHS).

TYPE OF SYNONYM: **HOLOTYPE** M, Lopidea trispicata Knight: **Florida:** Jefferson Co.: Monticello, May 2, 1927, F.W. Walker, ex. oleander (USNM).

DISTRIBUTION: Lopidea chandleri occurs in the southeastern states from North Carolina and Florida west to southern Illinois and Mississippi (Map III.10).

DISCUSSION: Knight (1965) distinguished trispicata from chandleri by differences in the dorsal flange and apex of the right paramere, and the tergal process. I observed only slight variation in these structures among specimens from several localities and I interpret this as minor infraspecific variation. The proposed synonymy of trispicata with chandleri is based on the identical structure of the male genitalia and dorsal vestiture. Collection records are from May 2 to June 27. I have seen no confirmed host records for this species. Specimens have been taken on Cornus, Wisteria, wild grape and Oleander.

SPECIMENS EXAMINED:

Florida: Jefferson Co.: Monticello, ex. oleander (USNM); **Georgia:** Chatham Co.: Savannah (CAS); **Illinois:** Jackson Co.: Carbondale, (INHS); Grand Tower; **Mississippi:** Noxubee Co.: Noxubee Nat'l. Wldlf. Ref., ex. flowering Cornus stricta (MEM); **North Carolina:** New Hanover Co.: biting man (NCS); **South Carolina:** Barnwell Co.: Blackville, ex. wild grape (MEM); Charlestown Co.: McClellanville, sweeping (NCS); Pickens Co.: Clemson (TXA&M); **Tennessee:** Lake Co.:

Reelfoot Lake (USNM).

Lopidea confluenta (Say)
Figures III.31, III.83; Map III.11

Capsus confluentus Say 1832:23 (new species).
Lopidea confluens: Reuter 1876:66 (new combination). Provancher, 1887:106 (description). Osborn, 1892:123 (list). Gillete and Baker, 1895:30 (list). Tucker, 1907:59 (list). Smith, 1910:161 (list). Van Duzee, 1912:320 (list). Parshley, 1914:141 (list). Knight, 1918b:211-212 (illustration, distribution, host plant). Hussey, 1922b:32 (list). Knight, 1923:502 (description, illustration, host plant). Blatchley, 1926:838 (description, host plant). Watson, 1928:39 (list). Kelton, 1959:29, 65 (illustration). Reid et al., 1976:563 (host plant).
Lopidea confluenta: Van Duzee 1894:176 (list). Adkins, 1917:61 (list, host plant). Knight, 1941:87 (description, illustration, host plant). Froeschner, 1949:168 (list). Knight, 1968:98 (illustration). Knight and Schaffner, 1968:77-78 (host plant, biology). Lavigne, 1976:760, 762 (host plant). Henry and Wheeler, 1977:152 (list). Henry and Smith, 1979:214 (list). Wheeler et al., 1983:140 (list). Blinn and Yonke, 1985:81 (list, host plant). Henry and Wheeler, 1988:418 (catalog).

DIAGNOSIS: Recognized by the very short, decumbent setae and the strongly angled dorsoapical margin of the right paramere (fig. III.31).
DESCRIPTION: Medium sized species, length 5.2-6.0; sides weakly arcuate. Vertex flat to weakly concave; frons narrowly rounded, weakly protruding; eyes small, not

reaching frons-tylus suture; eye-antennal fossa distance small ≤ width antennal segment II; head moderately long, buccula just separated from collar; antennae slender, cylindrical, long, ratio length antennal segment II - head width 1.9-2.0; rostrum reaching posterior coxae.

Genital Capsule: Sensory lobe, poorly developed, broadly rounded; tergal process moderately long, narrow, evenly tapered to acute apex (fig. III.31d).

Genitalia (figs. III.31, III.83): Right paramere davisi type; dorsoapical margin serrate, strongly angled basally; dorsal angle extended as short, blunt spine; ventroapical angle narrowly rounded; medial flange long, narrow, parallel with margin of paramere, serrate; dorsal flange short, thick, arising from medial surface and oriented almost horizontally; basal arm long, thick, angled ventrally, with axis of paramere. Left paramere angled; lateral flange very short, apex broad, evenly rounded; medial flange long, thick basally, strongly curved ventrally, angled medially. Dorsal spicula short, very thick; relatively straight, only distal third weakly curved; margin strongly serrate; basal sclerite small, quadrate; arm vestigial or absent. Ventral spicula relatively short, slender, straight, weakly expanded near middle; bifurcate at distal third; secondary arm half the length of primary arm; primary arm with apex minutely serrate; margins of secondary arm entire.

COLOR AND VESTITURE: General coloration red or yellow and fuscous. Head red or reddish yellow; antennae reddish fuscous to black; rostrum reddish brown. Coxae pale red or yellow, base infuscated; trochanters pale; femora and tibiae dark reddish fuscous; tarsi black. Venter red to yellow, fuscous medially; genital capsule fuscous. Pronotum red or yellow; calli and medial area of disk variably fuscous. Scutellum fuscous. Hemelytra red or yellow, clavus and medial area of corium, embolium and lateral margin of cuneus occasionally pale. Dorsum with short, inclined setae; color variable, black on fuscous areas, pale on light areas.

FEMALE: Larger than male, length 5.6-6.4; macropterous.

TYPE: **NEOTYPE** M, (here designated) Capsus confluentus Say: **Missouri**, Boone Co., Columbia, 15 May, 1983, M.S. Davis (UM).

DISTRIBUTION: Lopidea confluenta occurs throughout eastern North America from Quebec and North Carolina west to Colorado and Texas (Map III.11).

DISCUSSION: Because the original Say types have been lost or destroyed, I have here designated a neotype to fix the concept of this species. Say (1832) described Capsus confluentus from several specimens collected in Missouri and I have selected a neotype that was also collected in Missouri. This species has been collected on Phlox, Robinia psuedoacacia, Gleditsia triacanthos, red clover, alfalfa, Achillea, Andropogon, day lily (Commelina), Solidago and Polymnia. I have seen no confirmed breeding records, but Knight (1918) found this species breeding on Polymnia uvedalia (Asteraceae) in Missouri. Collection records are from May 8 to September 22 with 94% in June to August.

SPECIMENS EXAMINED:

CANADA: Ontario: Apple Valley; Dalston; Effingham; Fuller, ex. Solidago canadensis; Grimsby Niagra Falls; Kingston, ex. Solidago; Ojibway; Queenston; St. Lawerence Isl. Nat'l. Pk.; Simcoe; Strathroy; Tillsonburg; Waterford;

Quebec: Montreal.

USA: Alabama: Marengo Co.: Flatwood; **Arkansas:** Arkansas Co.:; Polk Co.:; Franklin Co.: Barnes; Hempstead Co.: Hope; Sevier Co.: De Queen; Washington Co.: **Connecticut:** Hartford Co.: West Hartford; New London Co.: Pachaug St. For.; Tolland Co.: Storrs; **District of Columbia:** Washington;

Illinois: Champaign Co.: Seymour; Edgar Co.: Kansas; Edwards Co.: Grayville; Gallatin Co.: Shawneetwon, oak-hickory woods; Hardin Co.: Elizabethtown, ex. Robinia psuedoacacia; Jackson Co.: Grand Tower; Lawrence Co.: Lawrenceville; La Salle Co.: Starved Rock; Mason Co.: Sand Ridge St. For.; Peoria Co.: Peoria; Piatt Co.: Monticello; White Heath; Pike Co.: Pike; Pope Co.: Golconda, ex. Symphoricarpos orbiculatus, Salix, Petalostemom, Trifolium pratense; Herod, ex. Phlox; Vermilion Co.: Muncie; Washington Co.: Du Bois; Woodford Co.: Spring Bay; **Indiana:** Howard Co.:; Parke Co.: Racoon Lake St. Pk.; Putnam Co.:; **Iowa:** Henry Co.: Mt. Pleasant; Story Co.: Ames; **Kansas:** Atchinson Co.:; Douglas Co.:; Riley Co.:; **Kentucky:** Fulton Co.: Fulton; **Louisiana:** Madison Parish: Tallulah; **Massachussetts:** Franklin Co.: Sunderland, Mt. Toby; Hampshire Co.: Williamsburg; **Maryland:** Frederick Co.:; Montgomery Co.: Glen Echo; Plummer's Isl.; Prince Georges Co.: Marsh Hall; **Michigan:** Lake Co.: Loon Lake; Lapeer Co.:; Midland Co.:; Shiawassee Co.:; **Missouri:** Boone Co.: Ashland Wildlf. Area; Devil's Backbone; Callaway Co.: Fulton; Turkey Prairie; Camden Co.:; Carter Co.: Van Buren, Ozark Mts.; Franklin Co.: Meremac St. Pk.; Gasconade Co.: Gasconade; Greene Co.: Springfield; Howard Co.: Columbia; Lincoln Co.: Elsberry; Logan Co.: Hatton, ex. red clover; McDonald Co.: Noel; Montgomery Co.: Graham Cave St. Pk.; Montgomery City; Morgan Co.:; St. Louis Co.: Jefferson Barracks St. Pk.; St. Louis; Stoddard Co.: Dexter Holly Preserve; Wright Co.: Mountain Grove; **Nebraska:** Nemaha Co.: Peru, ex. Sicyos angulatus; **New York:** Cattaraugus Co.: Gowanda; Salamanca; Erie Co.: Hamburg; Lancaster; Genesee Co.: Batavia; Reusselaer Co.: Reusselaerville; Suffolk Co.: Cold Spring Harbor; Tompkins Co.: Ithaca; **North Carolina:** Buncombe Co.: Black Mts., 2900 ft.; Jackson Co.: Balsam Mt. Gap, 3300 ft.; Macon Co.:

Highlands; Stanley Co.: Albemarle; Swain Co.: Great Smoky Mts. Nat'l. Pk.; Transylvania Co.: Joanna Bald; Wake Co.: Raleigh, ex. day lily; Watauga Co.: Blowing Rock; Yancey Co.: Mt. Mitchell; **Oklahoma:** Adair Co.: Watts; Delaware Co.: Flint; Grove; Latimer Co.: Red Oak; Wilburton; McCurtain Co.: Broken Bow; Idabel; McIntosh Co.: Quinton; Mayes Co.: Spavinaw; Pushmataha Co.: Nashoba; Sequoyoh Co.: Sallisaw; **Pennsylvania:** Franklin Co.: Pen Mar; Lackawanna Co.: La Plume; Wayne Co.: Honesdale; **Tennessee:** Carter Co.: Roan Mt., 2600 ft.; Fayette Co.: ex. Prunus; Sevier Co.: Elkmont; Shelby Co.: Millinton; **Texas:** Bastrop Co.: Buescher St. Pk.; Kerr Co.: Kerrville; **Virginia:** Arlington Co.:; Fauquier Co.: Paris; **Wisconsin:** Dane Co.: Madison; Marquette Co.: Packwaukee, ex. Andropogon sp..

Lopidea confraterna (Gibson)

Figures III.32, III.84; Map III.12

Hadronema confraterna Gibson, 1918:83 (new species).

Lopidea lepidii Knight, 1918:175 (new species). Kelton, 1980:234-235 (description, illustration, distribution, host plant). Henry, 1985:1125 (synonymized with confraterna Gibson).

Lopidea occidentalis Van Duzee, 1918:296 (new species). Carvalho, 1958:86 (synonymized with lepidii Knight). Henry, 1985:1125 (synonyms).

Lopidea confraterna: Carvalho, 1958:84 (transferred to Lopidea). Henry, 1985:1125 (discussion). Henry and Wheeler, 1988:419 (catalog).

Lopidea burkei Knight, 1965:17 (new species). Knight and Schaffner, 1968:76 (distribution). **NEW SYNONOMY**

DIAGNOSIS: Identified by its small size, long, narrow tergal process and erect, spine-like process on the angle of the left paramere (fig. III.32).

DESCRIPTION: Small species, length 4.1-5.5, linear, parallel sided. Vertex weakly to strongly concave; frons weakly protuberant; eyes just reaching frons-tylus suture; head very short, buccula touching collar; eye-antennal fossa distance < width antennal segment II; antennae linear, short, ratio length antennal segment II-head width = 1.5; rostrum reaching to posterior coxae.

Genital capsule: Sensory lobe absent. Tergal process extremely long, narrow, apex variable, tapering to a point, bluntly rounded or squared off (fig. III.32c).

Genitalia (figs. III.32, III.84): Right paramere <u>media</u> type; apex angled basally, broad or narrow, margin serrate; medial flange present as elongate toothed ridge, parallel with margin of paramere; dorsal flange reduced to 2-3 short teeth, not connected basally; basal arm very long, narrow, apex acute, orientation variable, from dorsomedial to ventroapical. Left paramere very broad; angle with prominent erect spine; lateral flange deflexed ventrally, short, broad, apex broadly rounded or bluntly square; medial flange angled ventral, long, thick. Dorsal spicula strongly and evenly curved, tapering to acute point distally, margins serrate distally; basal sclerite large, triangular, process well developed. Ventral spicula short, slender; bifurcate, secondary arm short one third to half length of primary arm, serrate for most of length; margins of primary entire or minutely dentate near apex.

COLOR AND VESTITURE: General coloration red. Head reddish orange; antennae reddish fuscous to black, rostrum red to black. Coxae pale to reddish fuscous apices usually pale; trochanters pale red; femora red to fuscous; tibiae and tarsi black. Venter pale to red; genital capsule usually fuscous. Pronotum red; anterior half of disk sometimes pale red; calli fuscous to black,. Scutellum fuscous, occasionally with thin red medial stripe. Hemelytra red, clavus, medial aspect of corium and membrane infuscated. Pronotum with short, erect dark setae and decumbent pale setae. Hemelytra with inclined setae, color variable, usually pale, often dark on fuscous areas, sometimes dark throughout.

FEMALE: Slightly larger than male, length 4.5-5.7; macropterous.

TYPE: **HOLOTYPE** M, Hadronema confraterna Gibson: **New Mexico**, Dona Ana Co.: Las Cruces (USNM).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea lepidii Knight: **Arizona**, Graham Co.: Bonita, July 17, 1917, H.H. Knight (CU). **HOLOTYPE** M, Lopidea occidentalis Van Duzee: **California**, Riverside Co.: Palm Springs, May 19, 1917, E.P. Van Duzee (CAS). **HOLOTYPE** M, Lopidea burkei Knight: **Mexico**, San Louis Potosi, August 23, 1964, H.R. Burke (USNM).

DISTRIBUTION: Lopidea confraterna ranges from tropical Mexico in Puebla, north through the Mexican Plateau into the Sonoran and Mohave deserts of Arizona and California. It ocurrs in the eastern Great Basin Desert of Utah and in the western Great Plains and Short-grass prairie as far north as southern Alberta (Map III.12).

DISCUSSION: Lopidea burkei Knight and Schaffner was described from a single male and three females taken in San Louis Potosi, Mexico. These specimens are from the extreme southern edge of the range of confraterna, and although the apex of the right paramere is narrow and recurved ventromedially, there appears to be a North-South clinal variation in the shape of the paramere towards this state. The proposed synonymy is based on this and the fact that the left parameres and vesicae of specimens from southern Mexico and the U.S. are virtually identical.

There is some geographic variation in dorsal coloration of confraterna. Some specimens from the Great Basin Desert and the western slopes of the Rocky Mountains are very pale, have yellowish hemelytra with white embolia. L. confraterna is highly variable in the length and color of the dorsal vestiture. I have examined specimens from Eddy Co., New Mexico with dorsal setae that are longer than the width of antennal segment II, and specimens from Brewster Co., Texas with the setae much shorter than width of antennal segment II. Although most specimens I examined had predominately pale setae on the dorsum, setae were often dark on the fuscous areas of the hemelytra and some series of specimens had only dark setae. There was some geographic pattern to setal color variation. Specimens from the Mexican Plateau and the Great Plains east of the Rockies have predominately dark setae, those from the northern Chihuahuan and Sonoran deserts in New Mexico and Arizona usually have mixed light and dark setae, and those from the northeastern Great Basin and Mohave deserts in Utah and California have predominately pale setae.

This species has been collected from numerous plants, mostly desert shrubs, but there are no confirmed breeding records. Collection records are from 19 April to 23 October, with a bimodal pattern of May and September, suggesting a bivoltine cycle.

SPECIMENS EXAMINED:

MEXICO: Chihuahua: 7 mi SE Galena, 4850 ft; 33 mi N Hidalgo de Parral; **Coahuila:** Cuesta La Murella; 9 mi W Los Lirios, 6000 ft.; **Durango:** 5 mi SW Cuencame; 4 mi SW Yerbanis; **Hidalgo:** 12 mi W Del Parra, 6200 ft, blacklight; 7 mi SW Huichupan, 6500 ft; Pachuca; 3 mi E Pachuca; Puebla: 49 mi

E Puebla, 6550 ft; San Louis Potosi: 7 mi E San Louis Potosi, 6225 ft; **Zacatecas:** 3 mi N Zacatecas, 8300 ft.; ?? 36 mi N Aguascalientes; ?? 16 mi E Buena Ventura, 5400 ft. **CANADA:** **Alberta:** Breed Crk., 10 km. S Milk River; Diamond City, ex sagebrush; Drumheller.

USA: **Arizona:** Cochise Co.: Benson, ex. Solanum elaeagifolium, Tamarix pentandra, Sphaeralcea angustifolia; 11 mi W Benson, ex. Bahia absinthifolia; 10 mi NW Bisbee, Mule Mts., 5500 ft; Box Canyon, Chiricahua Mts.; Carr Canyon, Huachuca Mts., 5300 ft; Jct. of Carr Crk Rd. and Hwy 92, 4600 ft; 1 mi SE Cochise; Cochise Stronghold, blacklight; Douglas, ex. Solanum elaeagifolium; 15 mi E Douglas, San Bernadino Ranch; 5 mi E Douglas, ex Haplopappas hartwegi; Dragoon Marble Quarry; Elfrida, ex. flowers of Heterotheca subarillaris; Huachuca Canyon, ex. Sideranthus = Haplopappus; Ft. Huachuca Game Area; McNeal, 4100 ft; 4 mi N Pearce; 1 mi N Portal; San Pedro, Fairbanks; 7 mi S Sierra Vista; Tombstone, 4500 ft; 12 mi W Tombstone, 4300 ft; W Turkey Crk. Camp, Chiricahua Mts., 5900 ft; 2.3 mi SE Wilcox; 1 mi E Wilcox; Coconino Co.: 1 mi E Tuba City, Rt. 163, 5000 ft, ex. Sarcobates vermiculatus; Graham Co.: Bonita; Stockton Pass, Pinaleno Mts., 5200-5500 ft, mercury light; Pima Co.: Continental; Rosemont, N end of Santa Rita Mts., 4400-6100 ft, Brickella californica; Sahuarita, ex. Ambrosia; Sierrita Mts.; 4 mi N Sonoita; Hwy 83, 6 mi N Sonoita, prickly poppy; Tuscon; Santa Cruz Co.: Amado, 3000 ft; 10 mi E Arivaca; Badger; Canelo; 12 mi E Nogales; 11 mi NE Nogales, 4200 ft; Patagonia, 4000 ft, ex. aster; 4 mi N Patagonia, ex. Hymenothrix wislizeni; 9 mi NE Patagonia; 2 mi N Sonoita; 8 mi E Sonoita; **California:** Inyo Co.: Little Lake; Kern Co.: 5 mi N Mohave; Ord Mts., near Lucerne Valley; Red Rock Canyon; Los Angeles Co.: Littlerock; Palmdale; Orange Co.: Laguna; Riverside Co.: Barstow; NE

Black Hill, T6S R6E S19, 3 mi E Ribbon Wood, 2800 ft; 5 mi E Alpine Village, ex. Erigeron; Palms to Pines Hwy, 3000 ft, ex. Eriogonum fasciculatum; Palm Springs; Riverside, ex. Salvia apiaua; San Bernardino Co.: 9 mi S Baker, sand dunes, S Zzyzx Sprgs.; E Goffs, 2700 ft, ex. Cassia armata; Morengo Valley, ex. Larrea divaricata, Croton californicus, Yucca Valley, 6 mi N on Old Woman Sprgs. Rd.; San Diego Co.: Anza-Borrego St. Pk., Palm Canyon Cmpgd, 592 ft, mercury vapor light; Palm Canyon, Borrego, ex. Dalea scholti; San Felipe Crk.; **Colorado:** Dolores Co.: Dolores; Montezuma Co.: Mesa Verde Nat'l. Prk.; Prowers Co.: Lamar, 3600 ft; Yuma Co.: Eckley; Weld Co.: Keensburg, Sandhills; Co.?: Macedonia; **Kansas:** Barber Co.: 16 mi W Hardtner; Clark Co.: Sitka; Finney Co.: Garden City; Hamilton Co.: Syracuse, ex. Malvastrum; Kiowa Co.:; Morton Co.: 3200 ft; Scott Co.: Scott St. Pk.; Seward Co.: Liberal; St. John Co.:; **Montana:** Carbon Co.: Smith Mine, between Red Lodge and Belfry, 5200 ft, ex. Artemisia cana; **New Mexico:** Chaves Co.: 3 mi NE Elk; 5 mi E Roswell, ex. Haplopappas pluriformis; Roswell, ex. Solidago; Eddy Co.: Carlsbad, ex. Gutierrezia; Grant Co.: 3.4 mi E Arizona line on Rd. 78, ex. Sphaeralcea fendleri; Hidalgo Co.: 1 mi N Granite Gap; McKinley Co.: Ft. Wingate; Otero Co.: 25 mi W Tularosa; **North Dakota:** Billings Co.: Sully Crk. St. Prk.; McKenzie Co.: Theodore Roosevelt Nat'l Prk., ex. Salix, ex. Artemisia; N of Unit Prk.; **Oklahoma:** Beaver Co.: Beaver St. Prk; Ellis Co.: 6 mi SE Arnett; Kingfisher Co.: 5 mi W Lacey, ex. Yucca; Co.?: Range, 1 mi NW Supply; **South Dakota:** Butte Co.: Castle Rock; Shannon Co.: Oelrichs, ex. Artemisia; **Texas:** Brewster Co.: Big Bend Nat'l. Prk.; El Paso Co.: El Paso; Hudspeth Co.: 4.2 mi S Dell City on FM 1437; Ft. Hancock; Motley Co.: sweeping; Potter Co.: 33 mi N Amarillo; Reeves Co.: Pecos; Ward Co.: 1 mi S Grandfalls; Yoakum Co.: 9 mi N Plains;

Utah: Duchesne Co.: Duchesne; Garfield Co.: Capitol Reef Nat'l. Prk., Grand Wash-Cobab Canyon, 5500-6600 ft, ex *Chrysothamnus nauseosus*; Wasatch Co.: 5 mi W Duschene Co. line on UT St Rt. 40, 7000 ft, ex. *Salix*; **Wyoming:** Converse Co.: Glenrock, D. Johnston Place.

Lopidea cuneata Van Duzee
Figures III.33, III.85; Map III.13

Lopidea cuneata Van Duzee 1910:79 (new species). Knight, 1923:504 (description, illustration, host plant). Blatchley, 1926:841 (description). Watson, 1928:39 (list). Knight, 1941:89 (description, illustration, host plant). Henry and Wheeler, 1983:140 (list). Henry and Wheeler, 1988:419 (catalog).

DIAGNOSIS: Easily recognized by its distinct dorsal color pattern, being the only eastern species with a pale medial margin of the clavus and pale claval suture.
DESCRIPTION: Medium sized species, length 5.3-6.1; parallel sided. Vertex flat; frons moderately protruding; eyes small, not reaching frons tylus suture; head short, buccula touching or almost touching collar; eye-antennal fossa distance < width antennal segment II; antennae cylindrical, thick; ratio antennal segment II-width of head 1.7-2.0; rostrum reaching mesocoxae. Lateral margins of pronotum weakly explanate; posterior pronotal lobe transversely rugose.

Genital capsule: Sensory lobe broadly rounded, oriented anterolaterally; tergal process very short, curved ventrally, apex abruptly narrowed to point (fig. III.33d).

Genitalia (figs. III.33, III.85): Right paramere _media_ type, apex rounded, curved ventrally; dorsoapical margin serrate; medial flange a short, bunched row of teeth; basal arm long, slender, elevated, oriented with axis of paramere, apex with 2-3 minute teeth. Left paramere with lateral flange short, broadly and evenly rounded; medial flange long, strongly curved ventrally. Dorsal spicula lanceolate, curved and serrate distally; basal sclerite large, process well developed. Ventral spicula short, evenly curved, evenly tapered apically, apex serrate.

COLOR AND VESTITURE: Head rufous, medial margin of eye, jugum and gena rufous to white; antennae red to dark fuscous; rostrum reddish brown. Coxae and trochanters pale to fuscous; femora rufous to fuscous, apices pale; tibiae and tarsi red to black. Pronotum reddish brown to fuscous, anterior and lateral margins pale; calli dark fuscous to black. Scutellum and hemelytra reddish brown to fuscous, embolium, cuneus and claval suture light red; medial border of clavus pale; color variable, occasionally scutellum, claval suture and border of membrane pale. Dorsum with very short, reclined, usually pale setae.

FEMALE; Larger than male, length 5.8-6.2; antennae slender; pronotum campanulate; macropterous.

TYPE: **LECTOTYPE** M, _Lopidea_ _cuneata_ Van Duzee: New York, Lancaster, 4 August, 1906, E.P. Van Duzee (CAS).

DISTRIBUTION: Widely distributed in eastern North America from New York, west to Minnesota and Colorado (Map III.13). The California specimen reported by Van Duzee (1910) was undoubtedly a misidentification.

DISCUSSION: Van Duzee (1910) described _cuneata_ from one male and four female specimens collected at Lancaster, New York. I examined two females in the Cornell University Insect Collection from this locality, one bearing a cotype label.

I also examined one male and one female specimen in the California Academy of Sciences also from the original series. The male specimen (CAS type # 2076) bears a red Lectotype label and the female specimen (CAS type # 2077) bears a Allotype label. Van Duzee did not designate a holotype in the original description, nor did he publish a lectotype designation. I hereby designate as lectotype the male specimen (CAS Type # 2076) with the following label data: Label 1, "Lancaster, 8/4 N.Y. 06"; Label 2, "Van Duzee Collector"; Label 3, "LECTOTYPE cuneata"; Label 4, "E.P. Van Duzee Collection."

Although widely distributed, this species is uncommon in collections. Although there are no confirmed breeding records, it is has been collected only from trees in the genus Populus. Collection records are from June 17 to September 2, with 85% in July and August.

SPECIMENS EXAMINED:

Arkansas: Washington Co.: ex. oak; **Colorado:** Larimer Co.: Pingree Park; Otero Co.: Rocky Ford; **Illinois:** Cass Co.: Willow Springs; Knox Co.: Galesburg; McHenry Co.: Harvard; Pike Co.: Pike; **Iowa:** Marshall Co.: Marshalltown; **Kansas:** ?Co.:? Maaron; **Michigan:** Kalamazoo Co.: Gull Lake Biol. Sta.; **Minnesota:** Ramsey Co.: St. Anthony's Park; **Nebraska:** Filmore Co.: Fairmount, Jct. 6 & 81, ex. Populus deltoides; **New York:** Erie Co.: Lancaster, ex. Populus sp.; **North Dakota:** Emmons Co.: Cannon Ball.

Lopidea dakota Knight

Figures III.34, III.86; Map III.14

Lopidea _dakota_ Knight 1923:67 (new species). Strickland, 1953:200 (list, host plant). Kelton, 1980:236 (description, illustration, distribution, host plant). Henry and Wheeler, 1988:419 (catalog).

DIAGNOSIS: Identified by the S-shaped right paramere. Distinguished from _instabilis_ by the presence of a short basal arm and a thick, rounded, dentate process at the ventroapical angle of the right paramere (fig. III.34).

DESCRIPTION: Large species, length 6.1-6.9, sides weakly arcuate. Vertex flat; frons protruding only slightly, broadly rounded; eyes small, not reaching frons-tylus suture; eye - antennal fossa distance < width of antennal segment II; antennae cylindrical to weakly fusiform, long, ratio length antennal segment II - head width 1.9-2.0; rostrum reaching to apices of mesocoxae.

Genital Capsule: sensory lobe well developed, narrowly rounded; tergal process short and thick, apex usually abruptly narrowed to a point (fig. III.34d).

Genitalia (III.34, III.86): Right paramere _robiniae_ type, S-shaped; dorsal arm vertical, sinuous, apex curved medially, serrate; ventral arm reduced to large, rounded, serrate process, reflexed medially; basal arm short, thin, directed ventrally, apex blunt or bifurcate. Left paramere very narrow, elongate, lateral flange situated ventrally, short, apex curved medially; medial flange situated dorsally, short, thin, apex abruptly narrowed. Dorsal spicula short, straight, narrowly lanceolate, strongly serrate distally; basal sclerite small, quadrate, process short or vestigial. Ventral spicula long, narrow, weakly curved; bifurcate, primary arm four tenths length of secondary arm, apex weakly serrate, strongly tapered; secondary arm weakly expanded and serrate distally

COLOR AND VESTITURE: General coloration dark red. Head red; antennae black; rostrum black. Appendages black, ventral surface of femora occasionally dark red. Pronotum, scutellum and hemelytra red, calli, scutellum, claval suture and medial region of corium and cuneus variably fuscous; embolium occasionally pale. Dorsum with short, semierect black setae.

FEMALE: Slightly larger than male, length 5.9-7.3; antennal segment II distinctly fusiform, tapering distally; macropterous.

TYPE: **HOLOTYPE** M, Lopidea dakota Knight: **North Dakota**, Cass Co., July 12, 1920, A.A. Nichol (USNM).

DISTRIBUTION: This species is wide spread in western North America and occurs farther north than any other species of Lopidea. L. dakota occurs from northern Alaska south to southern Colorado, from British Columbia and Idaho east across the northern Great Plains to Minnesota (Map III.14).

DISCUSSION: 66% of host plant records are herbaceous legumes, including Hedysarum, vetch, clover and alfalfa. Collections records are from 18 June to 19 September, with 91% in July and August.

SPECIMENS EXAMINED:

CANADA: **Alberta:** Banff; Breed Crk, 10 km S Milk R.; Calgary; Edmonton, ex grass; Jasper Nat'l. Pk.; Jasper Nat'l. Prk., Pocahantas, ex vetch; Kananaskis Hwy., ex vetch; Kananaskis R., "Beaver Pond"; Lethbridge; Manyberries, ex Glycyrrhiza; Red Deer; N Saskatchewan R., near Nordegg; Waterton; **British Columbia:** Arras; Australian, ex alfalfa; Fraser Lk., Beaumont Prov'l. Prk.; East Pine; Hazelton; Houston, ex clover; 21 mi N Kitwancoel; Penticton; Qeusnel; Racing R., km 670 Alaska Hwy.; Smithers; Soda Crk.; Tatla Lk.; Vernon; **Manitoba:** Asessipp Prov. Pk.; Aweme; Boissevain; Dauphin; Douglas; Riding Mt. Nat'l. Pk., ex vetch; Russell; Winnipeg; **Northwest Territory**: Norman Wells; **Saskatchewan:** Cypress Hills, ex alfalfa; Esterhazy; Estevan; Farewell Crk.; Hudson Bay; Lloydminster; Saskatoon; **Yukon Territory:** Alaska Hwy., mi 1054, Kluane Lake; near Minto, 62 degrees 35', 136 degrees, 50"; Dawson; 10 km E Dawson; Haines Jct., ex willow; Klondike R., Dempster Corner, 63d 55', 138d 43'; Koidern, ex Hedysarum boreale; Magundy R., km 448 Campbell Hwy., 62d 11', 133d 40'; McQeust River; Pelly Crossing; Silver City; Stewart Crossing; Tatchum, ex Hedysarum mackenzii; Tatchun Creek, 62 degrees 17', 136 degrees 17'; Von Wilczek Lake, 62 degrees 44', 136 degrees 42'.

USA: **Alaska:** Ft. Yukon; 17 mi N Richardson; Tanana Riv., 64d 20', 146d 51'; **Colorado:** Arapahoe Co.: Denver; Boulder Co.: Longmount; Douglas Co.: 6 mi N Castlerock; Jefferson Co.: Waterton, Platte R., 5350 ft, ex Salix, Symphoricarpos; Larimer Co.: Ft. Collins; Las Animas Co.: Trinidad; Moffat Co.: Stonewall Co.: Trinidad; Weld Co.: 8 km W Nunn, Central Plains Experimental Range, ex flowers of Solidago canadensis; Co.?: Vir Dale; **Idaho:** Bear Lake Co.: Paris; Franklin: Preston; **Minnesota:** Anoka Co.:; Big Stone Co.:; Clay Co.: malaise trap; Kittson Co.:; Marshall Co.: Middle River; Norman Co.:; Pennington Co.: Traverse Co.: Lake Traverse, 1 mi NW Brown's Valley; Wadena Co.:; **Montana:** Gallatin Co.: Bozeman; Three Forks; Jefferson Co.: Whitehall; Judith Basin Co.: Hobson; Missoula Co.: Missoula; Park Co.: 6000 ft; Pillips Co.: Assiniboine; Roosevelt Co.: Poplar; **North Dakota:** Barnes Co.: Saaborn; Benson Co.: Devil's Lake; Billings Co.: Theodore Roosevelt Memorial Pk.; Burleigh Co.: Bismark; Cass Co.: Fargo; Dunn Co.:; Grand Forks Co.:; Giriggs Co.: Binford; Hettinger Co.:; McKenzie Co.: Theodore Roosevelt Memorial Pk., ex Salix; Morton Co.:; Nelson Co.:; Oliver Co.: 2 mi E Hensler; Ransom Co.:;

Richland Co.:; Trail Co.:; ?Co.: Knox,; Mandan; **Nebraska:** Sioux Co.: Glen; **South Dakota:** Brookings Co.: Brookings; Custer Co.: Custer; Lawrence Co.: Deadwood, ex. Glycorrhiza; Custer; Roberts Co.: Lake Traverse, 12 mi SE Sisseton; **Utah:** Daggett Co.: 4 mi S Manila; Duchesne Co.: Myton; Madison Co.: Ennis; Uintah Co.: Vernal; Utah Co.: Lehi; Naples; Provo, 4759 ft; Weber Co.: Weber; Co.?: White Rocks; **Wyoming:** Albany Co.: W Centennial, Libby Crk. Cmpgd.; Laramie; Laramie, University Wyoming Agron Farm; Big Horn Co.: Basin; Greybull; Carbon Co.: Baggs; Rawlins; Converse Co.: Glenrock; Crook Co.: Sundance; Larimer Co.: Cheyenne; Niobrara Co.: Lusk, ex alfalfa; Platte Co.: Wheatland; Sheridan Co.: Sheridan; Washakie Co.: Ten Sleep; Yellowstone Nat'l. Pk.

Lopidea davisi

Figures III.35, III.87; Map III.15

Lopidea davisi Knight, 1917:458 (new species). Knight, 1923:502-503 (description, illustration, host plant). Blatchley, 1926:842 (description, host plant). Cory and McConnell, 1927:15-22 (biology, nymphs, illustration). Knight, 1927:38 (distribution). Watson, 1928:39 (list). Knight, 1941:87-88 (description, illustration, host plant). Froeschner, 1949:168 (list). Henry and Smith, 1979:214 (list). Wheeler, et al., 1983:140 (list, host plant). Blinn and Yonke, 1985:81 (list, host plant). Henry and Wheeler, 1988:419 (catalog).

Lopidea arkansae Knight 1965:4 (new species). Henry and Wheeler, 1988:417 (catalog). **NEW SYNONYMY**

Lopidea _bisselli_ Knight 1965:4 (new species). Henry and Smith, 1979:214 (list). Henry and Wheeler, 1988:418 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Recognized by its small size, semierect to erect setae, and the distinctly dorsoventrally flared apex of the right paramere. Distinguished from _minor_ by the vertically expanded dorsoapical angle of the right paramere and from _confluenta_ by the blunt apex of the tergal process (fig. III.35).

DESCRIPTION: Small species, length 4.5-6.0; parallel sided. Vertex flat or slightly concave; frons moderately protruding, broadly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance = width antennal segment II; head long, buccula widely separated from collar; antennal segment II cylindrical, ratio length antennal segment II-width head = 1.8; rostrum reaching to posterior coxae.

Genital Capsule: Sensory lobe undeveloped; tergal process short, bluntly rounded or apex abruptly pointed, dorsal margin weakly rugulose (fig. III.35d).

Genitalia (figs. III.35, III.87): Right paramere _davisi_ type; apex dorsoventrally flared, serrate; dorsoapical angle expanded vertically as a short, thick process; medial flange indistinct, elongate ridge, parallel with margin od paramere; dorsal flange present as short, thin process; basal arm short, thick, oriented with axis of paramere and angled ventrally, apex blunt or minutely dentate. Left paramere short; lateral flange short, apex broadly and evenly rounded; medial flange long, thick, curved ventrally, tapering to acute apex. Dorsal spicula very short, broadly lanceolate, strongly serrate distally; basal sclerite small, quadrate, process absent. Ventral spicula long, abruptly narrowed distally apex minutely serrate.

COLOR AND VESTITURE: General coloration red. Head light red to reddish yellow, jugum occasionally pale; antennae fuscous to black; rostrum rufous to black. Coxae fuscous, apices pale; trochanters bicolored pale and fuscous; femora fuscous to black, apices sometimes pale; tibiae and tarsi black. Pronotum variable, straw-yellow to dark red; calli and scutellum fuscous. Hemelytra yellow to red, medial aspect of clavus and corium occasionally infuscated. Dorsum with short, inclined setae. Color of setae variable, light or dark, usually dark on fuscous areas.

FEMALE: Equal in size to male, length 4.3-6.1; submacropterous or macropterous.

TYPE: **HOLOTYPE** M, Lopidea davisi Knight: **Maryland**, Cabin John Run, June 20, 1911, W.T. Davis (USNM).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea arkansae Knight: **Arkansas**, Garland Co., May 21, 1952 (USNM). **HOLOTYPE** F, Lopidea bisselli Knight: **Georgia**, Spalding Co., July 24, 1937, T.L. Bissell (USNM).

DISTRIBUTION: This species occurs in the eastern United States from South Dakota and Arkansas east to Maryland and Georgia (Map III.15).

DISCUSSION: The proposed synonymy of arkansae with davisi is based on the identical genitalic structures of the males. Knight (1965) distinguished arkansae from davisi by the shorter rostrum and the presence of appressed, simple setae. The relative lengths of the rostra between the two nominal species is minimal and this character varies with the size of the specimen (Asquith, 1990a). The type specimens of davisi have short, inclined, dark setae and the type specimens of arkansae have short, inclined, pale setae. However, setal color in davisi varies from dark to pale, with some specimens having predominately pale setae, with dark setae on fuscous areas of the clavus. Additionally, the angle of the setae varies from strongly inclined to semi-erect.

The proposed synonymy of bisselli with davisi is based on size, structure of the head and pubescence. Knight (1965) described bisselli from a single female specimen from Georgia and distinguished it from davisi by its small size and presence of sericeous pubescence. The sericeous pubescence of davisi is very small and is difficult to see, but is present on all specimens; in addition, the holotype of bisselli is within the range of size variation seen in davisi. Numerous records suggest that this species breeds exclusively on the genus Phlox (Polemoniaceae), and is considered a pest of cultivated varieties (Cory and McConnell, 1927). Collection records are from May 21 to September 26 with 85% in June to August, although it is bivoltine at least in Maryland (Cory and McConnell, 1927).

SPECIMENS EXAMINED:

Arkansas: Garland Co.: ex. Hardy phlox; Sevier Co.:; **Washington D.C.:** Rock Creek; Washington; **Illinois:** Cass Co.: Ashland, ex hardy phlox; Champaign Co.: Champaign, frequenting willow; Urbana, in clumps of grass; Christian Co.: Assumption; Coles Co.: Charleston, ex. phlox; Cook Co.: Oak Lawn; Palos Park; Gallatin Co.: Equality; Hardin Co.: 3 mi N Elizabethtown, Hog Thief Crk.; Iroquois Co.: Watseka; Jersey Co.: Jerseyville, ex. phlox; Kankakee Co.: Sand dunes E St. Anne; Lake Co.: Waukegan; Morgan Co.: Jacksonville, ex. phlox; Pope Co.: Herod; Saline Co.: Eldorado, garden phlox; Schuyler Co.: ex. phlox; Union Co.: Cobden; Vermilion Co.: Oakwood; White Co.: Norris City; Co.?: Rocky Branch, Dolson; **Indiana:** Marion Co.: W.S.B.; **Iowa:** Story Co.: Ames; **Kansas:** Brown Co.: Horton; Franklin Co.: Ottawa; Johnson Co.: ex Phlox; Wyandotte Co.: Kansas City, ex phlox;

Maryland: Montgomery Co.: Chevy Chase Lake; Prince Georges Co.: Berwyn, ex phlox; ? Co.: Cabin John Run; **Minnesota:** Dodge Co.: Mantorville; Rice Co.: Faribault; Steele Co.: Owatoma; Winona Co.: Winona; Co.?: Maple; **Mississippi:** Monroe Co.: Aberdeen, ex phlox; **Missouri:** Callaway Co.: Fulton; Carter Co.: Big Sprg. St. Pk.; Gasconade Co.: Mint Sprg. Nat. Hist. Area; Jackson Co.: Kansas City; Madison Co.: Hwy 72 at Castor Riv. bridge; Phelps Co.: Lane Sprg. Cmpgd.; St. Louis Co.: Webster Groves, ex. Phlox; **North Carolina:** Yancey Co.: Valley of Black Mts.; **South Dakota:** Minnehaha Co.: Sioux Falls; **Tennessee:** Bledsoe Co.: Pikeville, ex. Phlox; **Virginia:** Arlington Co.: Glen Carlyn; Fairfax Co.: Arlington Farms, ex. Phlox; Falls Church; **West Virginia:** Jefferson Co.: Charlestown, ex phlox; **Wisconsin:** Kenoska Co.: Kenoska.

Lopidea erimata Van Duzee

Figures III.36, III.88; Map III.8

Lopidea erimata Van Duzee 1923:154 (new species). Usinger, 1933:172 (distribution, host plant). Henry and Wheeler, 1988:419 (catalog).

DIAGNOSIS: Easily recognized by its strongly convex pronotum and scutellum, extremely short head and exceptionally long, erect setae on the pronotum and scutellum.

DESCRIPTION: Small to medium sized species, length 4.5-5.2; robust, distinctly oval. Vertex flat to weakly concave; frons moderately protruding, broadly rounded; Eyes large, reaching below frons-tylus suture; eye-antennal fossa distance short, < width antennal segment II; head extremely short, buccula not extending past collar; antennae linear, segment II evenly enlarged distally, short, ratio length antennal segment II-head width 1.3-1.4; rostrum reaching to mesocoxae. Pronotum strongly convex, wide, posterior margin broadly rounded. Scutellum strongly concave. Anteromedial region of clavus occasionally minutely punctate.

Genital Capsule: Sensory lobe absent; tergal process large, thick basally, abruptly narrowed and ventrally curved distally (fig. III.36d).

Genitalia (figs. III.36, III.88): Right paramere media type; apex weakly curved dorsally, apex serrate, medial flange short, narrow, erect; dorsal flange present as row of short teeth; basal arm long, slender, oriented medially and with axis of paramere, apex sharply acute. Left paramere abruptly narrowed at base of flanges; lateral flange narrow, apex evenly and narrowly rounded; medial flange straight, very narrow. Dorsal spicula short, wide, evenly curved, strongly serrate; basal sclerite small, quadrate, basal process short. Ventral spicula short; wide basally; bifurcate distally, primary arm slender, weakly serrate apically; secondary arm half the length of primary arm, serrate for most of length.

COLOR AND VESTITURE: General coloration red and fuscous. Head white to rufous; antennae black; rostrum pale red. Coxae white, bases occasionally rufous; remora pale red, infuscated; tibiae and tarsi rufous to black. Pronotum red to dark fuscous, anterior margin light; calli fuscous. Scutellum fuscous. Hemelytra red, clavus and occasionally medial area of corium lightly infuscated. Dorsum with stiff, semi-erect to erect, dark setae. Erect setae also prominent on pronotum.

FEMALE: Larger than male, length 4.5-5.7; macropterous.

TYPE: **HOLOTYPE** M, Lopidea erimata Van Duzee: **Mexico, Baja California Norte**, Monserrate Island, Gulf of California, May 25, 1921, E.P. Van Duzee (CAS).

DISTRIBUTION: This species occurs in the Mohave and Chihuahuan deserts from southern Nevada south to Baja California Sur (Map III.8).

DISCUSSION: Lopidea erimata is most commonly collected on Olneya tesota, which is also the only confirmed breeding record. I have also seen teneral specimens collected on Acacia greggii. This species has also been taken from Cercidium microphyllum, Prosopsis, Condolia and Dalea. Collection records from March 3 to November 2, with 84% in April to June.

SPECIMENS EXAMINED:

MEXICO: Baja California Norte: Isla San Esteban; 6 mi S San Felipe; Baja California Sur: 1 km W El Centenario, ex. Prosopsis; 26 mi W La paz, ex. Condolia sp.; Monserrate Isl. **USA: Arizona:** Maricopa Co.: Fish Creek, Tonto Nat'l. For.; Freeman, 24 mi E Gila Bend; Sentinel, ex. Palo verde; Phoenix; Tempe; Woolsey Wash, near Painted Rock Dam, ex. Dalea spinosa; Pima Co.: Organ Pipe Cactus Nat'l. Mon., Alamo Wash, ex. Acacia greggii; Tuscon Mts.; Pinal Co.: 26 mi S Phoenix, 1400 ft, ex. Olneya tesota; 7 mi N Stanfield, ex. Olneya tesota; 9 mi W Superior, 2350 ft; Yuma Co.: Aztec; Fortuna Wash; Palm Canyon, at light; Quartzite, ex. Olneya tesota; 2 mi S Stone Cabin, ex. Cercidium microphyllum and Olneya tesota; Yuma; 20 mi E Yuma; ex. Olneya tesota; 10 mi N Yuma, ex. Olneya tesota; **California:** Imperial Co.: 14 mi NE Bones Well, ex. Acacia greggii; 2 mi NW Glamis, ex. Acacia; Glamis Sand Dunes, 5 mi W Ogilby, ex. Olneya tesota; Indian Wash, 13 mi S Hwy 28; 3 mi S Palo; Riverside Co.: 32 mi N Blythe; Chuckwalla Mts., 2.4 mi E Corn Springs; Desert Center; 8 mi NE Desert Center, ex. Olneya tesota, ex. Dalea spinosa; Hot Mineral River; 3 mi E Mecca, ex. Dalea spinosa; San Diego Co.: Borrego Valley, ex. smoke tree; Yaqui, ex. ironwood; **Nevada:** Clark Co.: Lower Lee Canyon.

Lopidea falcata Knight
Figures III.37, III.89; Map III.6

Lopidea falcata Knight 1923:72 (new species). Knight and Schaffner, 1968:77 (distribution). Henry and Wheeler, 1988:420 (catalog).

DIAGNOSIS: Recognized by the extremely narrow right paramere and the absence of the basal arm (fig. III.37).

DESCRIPTION: Medium sized species, length 5.6-6.0, linear. Frons weakly protruding, narrowly rounded; vertex flat to weakly concave; eyes moderately large, just reaching frons-tylus suture; eye-antennal fossa distance small, < width antennal segment II; head long, buccula separated from collar; antennae linear, ratio length antennal segment II - head width 1.7; rostrum reaching mesocoxae.

Genital Capsule: Sensory lobe weakly developed as vertical ridge; tergal process very short, abruptly narrowed, apex acute, curved ventrally (fig. III.37d).

Genitalia (figs. III.37, III.89): Right paramere *media* type; apex strongly curved dorsally, dorsoapical angle produced as long spike-like, serrate process; medial flange also produced as a narrow, erect, weakly serrate process; dorsal flange absent; basal arm absent. Left paramere with lateral flange weakly expanded apically, ventral angle acutely rounded, weakly dentate; medial flange straight, widely separate from lateral flange, extremely narrow.
Dorsal spicula long, very slender, strongly and evenly curved, apex weakly serrate; basal sclerite large, triangular, process long, well developed. Ventral spicula

long, very broad basally, deeply bifurcate, arms of equal length, very slender; primary arm serrate on distal half; secondary arm weakly serrate apically.

COLOR AND VESTITURE: General coloration red fuscous. Head red, medial border of eyes pale; antennae black, segment I usually dark reddish fuscous; rostrum reddish brown. Coxae red; trochanters pale; femora dark red, fuscous dorsally; tibiae and tarsi dark red to black. Venter light red; genital capsule reddish fuscous. Pronotum red, medial area fuscous; calli black. Scutellum fuscous. Hemelytra red, clavus and medial area of corium fuscous. Dorsum with medium length, inclined setae. Color variable, dark on fuscous areas, yellowish on red areas.

FEMALE: Slightly larger than male, length 6.2-6.3; macropterous.

TYPE: **HOLOTYPE** M, Lopidea falcata Knight: **New Mexico**, Los Alamos Co., Jemez Springs, 6400 ft., 1 August, 1916 (USNM).

DISTRIBUTION: Known only from the Jemez Mountains of northern New Mexico (Map III.6).

DISCUSSION: This species is only known from the type specimens and one additional male from Sapello, New Mexico collected on oak. One specimen was collected from oak. L. falcata is closely related to lateralis and barberi. It is distinguished from all these species by the absence of the basal arm on the right paramere. Like barberi, falcata may be a predominately Mexican species, with the southern Rockies of New Mexico representing the northern extent of its range.

SPECIMENS EXAMINED:

New Mexico: Los Alamos: Jemez Springs, 12 July, 1919, 6400 ft., Woodgate (USNM, CAS); Sapello, 24 July, 1950, ex. oak, R.H. Brown, (KU).

<u>Lopidea</u> <u>falcicula</u> Knight
Figures III.38, III.90; Map III.4

<u>Lopidea</u> <u>falcicula</u> Knight, 1923:68 (new species). Knight, 1927:38 (distribution). Henry and Wheeler, 1988:420 (catalog).
<u>Lopidea</u> <u>denmani</u> Knight and Schaffner, 1972:47 (new species). Henry and Wheeler, 1988:419 (catalog). **NEW SYNONOMY.**

DIAGNOSIS: Recognized by its usually dark fuscous to black head, its C-shaped right paramere (fig. III.38) and southern Rocky Mountain distribution..
DESCRIPTION: Large species, length 6.2-7.2, linear, parallel sided. Vertex flat or slightly concave, eyes just reaching frons-tylus suture, eye-antennal fossa distance < width of antennal segment II; head relatively long, buccula just separated from collar; antennae cylindrical, ratio length antennal segment II-width head = 1.8; rostrum reaching to posterior aspect of mesocoxae or anterior aspect of metacoxae.

Genital capsule: Sensory lobe well developed, rounded, vertical ridge; tergal process short, flattened vertically, apex bluntly pointed and curved medially (fig. III.38).

Genitalia (figs. III.38, III.90): Right paramere <u>robiniae</u> type; ventral arm thick, apex curved dorsomedially, bifurcate or with large teeth; dorsal arm variable in size, usually short, apex pointed, occasionally long, apex expanded and dentate; basal arm short, narrow and pointed, curved dorsally. Left paramere narrow, linear; lateral flange narrow, strongly curved ventrally and medially; medial flange situated dorsally, straight, narrow. Dorsal spicula long, linear, serrate distally; basal sclerite large, quadrate, process absent. Ventral spicula slightly sinuate, bifurcate; secondary arm three fourths length of primary arm; both arms very slender, minutely serrate.

COLOR AND VESTITURE: Head red to fuscous; antennae and appendages reddish fuscous to black. Venter red; genital capsule fuscous to black. Anterior margin of pronotum light red, posterior lobe usually bicolored, with anterior region greyish white and posterior region red; calli black. Scutellum fuscous. Hemelytra red, clavus and medial area of corium fuscous; membrane smoky fuscous. Dorsum with short, inclined, black setae.

FEMALE: Same size as male, length 6.3-7.3; antennae tapered distally, occasionally weakly fusiform; macropterous.

TYPE: **HOLOTYPE** M, Lopidea falcicula Knight: **Colorado,** Dolores Co., Rico, August 2, 1900 E.D. Ball (USNM).

TYPE OF SYNONYM: **HOLOTYPE** M, Lopidea denmani Knight and Schaffner: **Colorado**, Conejos Co., Elk Creek Recreation Area, August 22, 1969, J.C. Schaffner (USNM).

DISTRIBUTION: This species occurs in the southern Rocky Mountains of Colorado and Northern New Mexico and southwest to the Mogollon Plateau of Arizona (Map III.4).

DISCUSSION: The proposed synonymy of denmani with falcicula is based on the identical structure of the male genitalia. Although both species were described from specimens from southern Colorado, in the description of denmani, the authors suggested that this species was related to bispinosa Knight and did not mention a relationship with falcicula. Although the type specimens of denmani and falcicula are identical in all aspects, I have seen specimens from northeast Arizona in which the arms of the right paramere are greatly developed, almost touching each other. I have seen no host plant information for this species. Collection records are from 6 June to 2 September with 93% of the records from July and August. SPECIMENS EXAMINED: **Arizona:** Apache Co.: Eager; Springerville; **Colorado:** Archuleta Co.: Pagosa Springs, 7200 ft; Conejos Co.: Elk Crk. Rec. Area; Dolores Co.: Cottonwood Spring, 21 mi NE Dolores; Rico; Huerfano Co.: East Spanish Peak; Los Animas Co.: 1 mi N Stonewall, Purgatoire Cmpgd. Rd., 8400 ft; Trinidad, Stonewall, 8500 ft; Montezuma Co.: Mancos; Mesa Verde Nat'l. Prk.; Ouray Co.: Ridgway, 7000 ft; Pitkin Co.: Aspen, 8000 ft; Rio Blanco Co.: Meeker, 6200 ft; **New Mexico:** Rio Arriba Co.: Chama; San Miguel Co.: Spark's Ranch, Pecos Canyon, 3500 ft; Santa Fe Co.: Santa Fe; Tesuque.

Lopidea fuscosa Knight

Figures III.39, III.91; Map III.2

Lopidea fuscosa Knight 1968:100 (new species). Henry and Wheeler, 1988:420 (catalog).

DIAGNOSIS: Recognized by its small size and the combination of erect dark setae, large left paramere (fig. III.39) and strongly submacropterous females.

DESCRIPTION: Small species, length 4.6-5.3; broadly linear in outline. Frons strongly protruding, broadly rounded; vertex flat to weakly convex; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance large, = width antennal segment II; head short, buccula touching collar; antenna linear, short, ratio length antennal segment II-head width 1.1-1.4; rostrum reaching to metacoxae.

Genital Capsule: Sensory lobe absent; tergal process very short, sharply tapered to acute apex, weakly curved medially (fig. III.39d).

Genitalia (figs. III.39, III.91): Right paramere media type; apex sloping ventrally, serrate; medial flange short, narrow, erect; dorsal flange small, reduced to two short teeth; basal arm very long, slender, sinuous, strongly recurved so apex is oriented towards body of paramere, apex usually pointed or with 1-2 short teeth. Left paramere very large; dorsal margin of angle weakly expanded vertically; lateral flange very short, apex broadly rounded; medial flange, very long, thick, angled ventrally. Dorsal spicula very long, evenly curved, outer margin serrate for entire length; basal sclerite very large, triangular, process very long, two-thirds the length of spicula. Ventral spicula very short, slender, straight, apex minutely serrate.

COLOR AND VESTITURE: General coloration fuscous and white. Head white, middle of frons reddish brown; antennae pale fuscous to black; rostrum reddish brown. Coxae and trochanters pale fuscous, apices white; femora and tibiae fuscous; tarsi dark fuscous to black. Venter reddish brown; genital capsule dark fuscous. Pronotum grey to fuscous, anterior margin and occasionally a short, narrow medial stripe pale; calli dark fuscous to black. Scutellum dark grey to fuscous, apex occasionally pale. Hemelytra smoky fuscous, lateral margins and cuneus white.

Dorsum with short, erect, dark setae, prominent on head and pronotum.

FEMALE: Smaller than male, length 4.2-4.4; submacropterous. Hemelytra much reduced, last abdominal segment visible. Hind wings reaching to 5th abdominal tergite.

TYPE: **HOLOTYPE** M, Lopidea fuscosa Knight: **Nevada**, Nye Co., Mercury, June 23, 1965, H. Knight & J. Merino (USNM).

DISTRIBUTION: Occurs in montane areas from the Wasatch Mountains of Utah, west to the east slopes of the Sierra Nevadas (Map III.2).

DISCUSSION: Collection records from 6 May to 13 July. This species has been collected from Lupinus, Artemisia, Purshia and Cercocarpus. Although there are no confirmed breeding records, I have seen a large series with teneral specimens collected on Artemisia tridentata.

SPECIMENS EXAMINED:

California: Inyo Co.: 3.5 mi W Westgard Pass Summit, Rt. 168, July 12, ex. Purshia glandulosa (AMNH); Kern Co.: Lebec, 4000 ft, May 15, (CAS); Lassen Co.: 10 mi S Doyle, June 20 (OSU); San Bernardino Co.: Apple Valley, May 6 (CNC); **Nevada:** Eureka Co.: Garden Summit on Rt. 278, 6500 ft, June 27, ex. Artemisia tridentata (AMNH); Humboldt Co.: 4 mi E Winnemucca, June 23, (OSU); Nye Co.: 3.5 mi SE Manhattan, Toiyabe Nat'l. For., 7177 ft, July 13, ex. Lupinus sp., (AMNH); Mercury, June 15 (CNC); White Pine Co.: Wheeler Pk. road W Baker, Humboldt Nat'l. For., 8560 ft, July 4, ex. Cercocarpus ledifolius (AMNH); **Utah:** Sevier Co.: 2.4 mi S Rt. 4 on Kanosh road, 7150 ft, June 16, ex. Artemisia tridentata (AMNH).

Lopidea gainesi Knight

Figures III.40, III.92; Map III.16

Lopidea gainesi Knight 1962:32 (new species). Knight and Schaffner, 1968:77 (distribution). Henry and Wheeler, 1988:420 (catalog).

DIAGNOSIS: Recognized by its broad form; wide, convex pronotum; long, erect, pale setae. Distinguished from minor and davisi by the free, ventrally oriented apical process of the right paramere (fig. III.40). Distinguished from bonanza by its red color, thick, dorsally curved tergal process and narrower left paramere.

DESCRIPTION: Small to medium sized species, length 3.6-5 . 1 ; broadly linear, sides distinctly arcuate. Vertex flat to weakly convex; frons moderately protruding, broadly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance short, less than or equal to width antennal segment II; head moderately long, buccula just separated from collar; antennae linear, thick, short, ratio length antennal segment II - head width 1.1-1.3; rostrum reaching metacoxae.

Genital Capsule: Sensory lobe small but distinct, oriented posteriorly; tergal process short, thick, weakly curved dorsally, apex bluntly rounded; dorsal margin minutely crenulate (fig. III.40d).

Genitalia (figs. III.40, III.92): Right paramere davisi type; apex constricted ventrally, recurved medially, ventroapical angle forming a narrow, acute process; medial flange a weakly developed, serrate ridge, indistinct, ventrally fused with apical margin of paramere; dorsal flange short, vertical, apex with to 2-3 short teeth; basal arm moderately long, very thick, oriented with axis of paramere, angled ventrally, apex with blunt teeth. Left paramere narrow, abruptly constricted distad of angle; lateral flange short, apex broadly rounded; medial flange long, broadly tapered, curved ventrally. Dorsal spicula curved basally, straight distally, both margins weakly serrate distally; basal sclerite small, rectangular, process absent. Ventral spicula short, evenly curved, weakly serrate distally.

COLOR AND VESTITURE: General coloration red. Head red, carina and vitae only weakly infuscated; antennae dark red to black; rostrum reddish brown. Coxae reddish fuscous; trochanters pale; femora and tibiae red to reddish fuscous;

tarsi reddish fuscous. Venter reddish fuscous; genital capsule dark fuscous. Pronotum red; calli variably infuscated. Scutellum fuscous. Hemelytra red; medial area of clavus and corium, and membrane variably fuscous. Dorsum with long, semi-erect to erect, pale setae.

FEMALE: Slightly larger than male, length 4.2-5.2; macropterous.

TYPE: **HOLOTYPE** M, Lopidea gainesi Knight: **Texas**, Brazos Co.: College Station, 7 June, 1932, J.C. Gaines (USNM).

DISTRIBUTION: Known only from south-central and west Texas (Map III.16).

DISCUSSION: Non-breeding records include Dalea, Brazoria, Lupinus, Stillingia, Monarda and Aster. I have a seen a large series with several teneral specimens collected on Phlox sp. Collection records from 3 April to 23 October, with 80% in April to June.

SPECIMENS EXAMINED:

Texas: Atascosa Co.: Pleasanton; Bastrop Co.: Bastrop St. Park, ex. Phlox sp.; Bexar Co.: 20 mi S San Antonio; Brazos Co.: 4 mi W Wellborn; Burnett Co.: Inks St. Park; Colorado Co.: Columbus; Duval Co.: 9 mi E Hebbronville; Edwards Co.: 22 mi S Rocksprings; El Paso Co.: El Paso; Erath Co.: 10 mi S Stephenville; Goliad Co.: Goliad, ex. Dalea aurea; Guadalupe Co.: Seqiun; Kennedy Co.: 25 mi S Kingsville; 25 mi S Sarita; 20 mi N Raymondville; Llano Co.: 21 mi W Llano; Lee Co.: Giddings, ex. Brazoria truncata; Live Oak Co.: Three Rivers; Robertson Co.: 12 mi E jct Hwys 6 & OSR, ex. Rudbeckia; San Patricio Co.: Welder Wildlife Refuge, 8 mi NE Sinton; Travis Co.: Austin; Uvalde Co.: Uvalde; Victoria Co.: Victoria, ex. Lupinus, ex. Braxoria fruneata, ex. Stillingia syiroria; Willacy Co.: Raymondsville, ex. Monarda citriodora & Aster tenacetifolium, ex. horsemint; Co. ??: Beeville.

<u>Lopidea garryae</u> Knight

Figures III.41, III.93; Map III.17

<u>Lopidea garryae</u> Knight 1918:175 (new species). Henry and Wheeler, 1988:420 (catalog).
<u>Lopidea mohave</u> Knight 1923:70 (new species). Henry and Wheeler, 1988:422 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Similar in size and color to <u>L. marginata</u>. Distinguished from <u>marginata</u> by the produced ventral angle and the short, narrow process of dorsoapical angle of the right paramere (fig. III.41).

DESCRIPTION: Small species, length 4.3-5.6, parallel sided. Vertex flat; frons strongly protruding, broadly rounded; eyes small not reaching frons-tylus suture; eye - antennal fossa distance less than width of antennal segment II; head long, buccula separated from collar; antennae slender, cylindrical, short, ratio length of antennal segment II - head width 1.2-1.3; rostrum reaching to metacoxae or beyond.

Genital Capsule: Sensory lobe well developed, short rounded process; tergal process short, straight evenly narrowed (fig. III.41d).

Genitalia (figs. III.41, III.93): Right paramere <u>davisi</u> type, apex serrate, weakly expanded, ventral angle produced as a short, thick rounded lobe, dorsal angle produced as short, narrow, spine-like process; medial flange indistinct, narrow, elongate, serrate ridge, parallel with margin of paramere; dorsal flange short, erect, apex with 2 short teeth; basal arm short, strongly curved ventrally, apex entire. Left paramere small, lateral flange short, apex narrowly rounded; medial flange long, narrow. Dorsal spicula short, lanceolate, curved, widest at three quarters distance from base then sharply narrowing to a point; both margins serrate along distal third; basal sclerite quadrate, arm small but distinct. Ventral spicula short, basal half wide, distal half suddenly narrowed and bent, apex minutely dentate; small secondary arm arising from middle, reaching to three-quarters length of primary arm, apex not or minutely serrate.

Color and Vestiture: General coloration pale red to light greyish fuscous. Head white to pale red; antennae reddish fuscous to black; rostrum reddish brown. Appendages red to dark fuscous; tibiae black. Venter reddish fuscous; genital capsule darker. Dorsum grey fuscous or pale red. Anterior margin of pronotum, embolium and outer aspect of corium and cuneus occasionally pale white. Dorsum with short, inclined, pale setae.

Female: Slightly larger than male, length 4.83-5.80; macropterous.

TYPE: **HOLOTYPE** M, _Lopidea garryae_ Knight: **Arizona**, _Graham Co._, Bonita, Post Creek Canyon, July 16, 1917, H.H. Knight (Cornell).

TYPE OF SYNONYM: **HOLOTYPE** M, _Lopidea mohave_ Knight: **California**, _San Bernardino Co._, San Antonio Canyon, Ontario, July 25, 1907 (USNM).

DISTRIBUTION: Known from the San Gabriel Mountains of Southern California, the southern edge of the Colorado Plateau in Central Arizona and the Cochise Mountains of southeastern Arizona (Map III.17).

DISCUSSION: The proposed synonymy of _mohave_ with _garryae_ is based the identical structure of the male genitalia. In his discussion of _mohave_, Knight (1923) stated that this species was related to _marginata_ based on paramere structure and dorsal coloration but did not mention _garryae_. Four of the six host records for this species are the desert shrub Garrya (Cornaceae), and the only confirmed breeding record is from Garrya in southern California. Collection records are from 11 April to 17 September with 90% of records from June to August.

SPECIMENS EXAMINED:

Arizona: Cochise Co.: Chiricahua Mts., 6200 ft, ex. Garrya wrightii; Dragoon Marble Quarry; Mustang Mt.; Coconino Co.: 3.5 mi S Sedona on Rt 179, 4200 ft, ex. Quercus turbinella; Graham Co.: Bonita, Post Creek Cyn.; Greenlee Co.: 6 mi S Grey's Peak; Pima Co.: 4 mi N Coronado Nat'l. For. boundary on Mt Lemon Rd., 4000 ft ex Garrya wrightii; 7.5 mi S Coronado Nat'l. For. boundary on Mt Lemon Rd., 4700 ft ex. Garrya wrightii; Coyote Mts., 3500 ft; Pinal Co.: Oracle; Santa Cruz-Pima Cos.: Santa Rita Mts.; **California:** Los Angeles Co.: Pasadena; San Bernardino Co.: Cajon Pass; Jct. I-15 and Rt 138, 4100 ft, ex. Garrya veatchii; Mt. S. Antonis?, 5500 ft, ex. Eriogonum falciculatum; Ontario; San Diego Co.: Oak Grove.

Lopidea heidemanni Knight
Figures III.42, III.94; Map III.18

Lopidea heidemanni Knight 1917:456 (new species). Knight, 1923:503 (description, illustration, host plant). Blatchley, 1926:840 (description). Watson, 1928:38 (list, host plant). Knight, 1941:88-89 (description, illustration, host plant). Froeschner, 1949:160 (list). Slater, 1950:49 (illustration). Wheeler and Henry, 1977:150, 152 (list). Messina, 1978:139, 141 (list). Henry and Smith, 1979:214 (list). McPherson et al., 1983:37 (list). Wheeler et al., 1983:140 (list). Snodgrass et al., 1984:853 (list, host plant). Blinn and

Yonke, 1985:81 (list, host plant). Wheeler and Hoebeke, 1985:358 (host plant). Henry and Wheeler, 1988:420 (catalog).

DIAGNOSIS: Recognized by its narrow vertex and narrow, elongate right paramere (III.42). Distinguished from salicis by the absence of a developed sensory lobe on the genital capsule. Distinguished from pteleae by its long first antennal segment.

DESCRIPTION: Medium sized to large species, length 5.1-7.1. Vertex very narrow, weakly to strongly concave; frons weakly protruding; eyes large, reaching to or below frons-tylus suture; eye-antennal fossa distance very short, almost contiguous; head long, buccula separated from collar by width of antennal segment III; antennae cylindrical, long, ratio length antennal segment two-head width 1.8-1.9; rostrum reaching to mesocoxae or beyond.

Genital Capsule: Sensory lobe not developed; tergal process very short, abruptly narrowed to blunt point, sometimes curved medially (fig. III.42d).

Genitalia (figs. III.42, III.94): Right paramere media type; apex, serrate, elongate and tapered to ventral angle; medial flange narrow, an elongate, serrate ridge, parallel to margin of paramere; dorsal flange short, wide ridge of 2-3 teeth; basal arm long, narrow, oriented with axis of paramere, slightly curved towards body of paramere, 2-4 short teeth apically. Left paramere strongly angled; lateral flange with apex broadly rounded, ventral angle acute; medial flange long, narrow, curved ventrally, apex tapering to blunt point. Dorsal spicula long, curved, serrate distally; basal sclerite small, triangular, process well developed. Ventral spicula short, slender, slightly expanded at middle, bifurcate just distad of expansion, arms of equal length; primary arm at right angle or recurved from axis of spicula, apex serrate; secondary arm short, slender, apex minutely dentate or entire.

COLOR AND VESTITURE: General coloration red and fuscous. Head red, medial borders of eyes white; antennae dark red to black; rostrum reddish brown. Appendages fuscous to black; apices of coxae and femora occasionally pale. Pronotum red; calli black. Scutellum fuscous to black. Hemelytra rufous to red, claval suture and border of membrane infuscated. Dorsum with short, inclined, dark setae.

FEMALE: Same size as male, length 5.9-6.9, linear; macropterous.

TYPE: **HOLOTYPE** M, Lopidea heidemanni Knight: **New York**, Genesee Co., Batavia, June 20, 1916, H.H. Knight (USNM).

DISTRIBUTION: This species is widely distributed in eastern North America from Quebec and Georgia west to Wyoming, Colorado and Texas Map (Map III.18).

DISCUSSION: Knight (1917) reported this species breeding on Ulmus and Achillea millefolium, and Wheeler and Hoebeke (1985) found nymphs and adults on Physocarpus opulifolius (L). L. heidemanni has been collected from a variety of other plants, but most commonly taken on Quercus and Achillea. Collection records from April 2 to July 25 with 85% in May and June.

SPECIMENS EXAMINED:

CANADA: **Ontario:** Fuller, ex. Solidago; Marmora; Niagra Glen; **Quebec:** Hull; Knowlton.

USA: **D.C.:** Washington; **Alabama:** De Kalb Co.: Desoto St. Pk.; **Arkansas:** Franklin Co.:; Johnson Co.: 8 mi. N Clarksville; Ozark Nat'l. For., sweeping; Lee Co.:; Marion Co.: Buffalo Point Cmpgd.; Mississippi Co.: ex. vetch; Pope Co.: 18 mi. N Russelville, in Legett trap; Washington Co.:

Fayetteville; ex. light trap; **Colorado:** Otero Co.: Rocky Ford; **Connecticut:** New Haven Co.: Milford; New London Co.: Pattogansett; Tolland Co.: Bolton; Storrs; Windham Co.: Chaplin; Mansfield; Scotland; **Delaware:** New Castle Co.: Newark; **Georgia:** Gwinette Co.: ex. *Vicia dasycarpa*; Rabun Co.: Pine Mt., 1400 ft; **Illinois:** Calhoun Co.: Hardin, ex. *Staphylea trifolia*; Kampsville; Champaign Co.: Homer; Mahomet; Seymour; St. Joseph; Urbana; Clark Co.: Clarksville, Rocky Branch, West Union, ex. *Salix*; Effingham Co.: Funkhauser; Fayatte Co.:; Franklin Co.: Zeigler; Gallatin Co.: Pounds Hollow Rec. Area; Hardin Co.: Elizebethtown; Jackson Co.: Giant City St. Pk.; Murphysboro; Johnson Co.: Ferne Cliff St. Pk.; Goreville; Ozark; Vienna; Lake Co.: Gray's Lake; La Salle Co.: Starved Rock St. Pk.; McHenry Co.: Harvard; Macoupin Co.: Carlinville; Masson Co.: Sand Ridge St. For.; Mercer Co.: Keithsburg; Morgan Co.: Jacksonville, ex. *Phlox*; Pope Co.: Golconda, ex. *Symphoricarpos orbiculatus*; Herod; Pulaski Co.: Pulaski; Union Co.: Dongola; Jonesboro, ex. *Achillea millefolium*; Pine Hills, ex. *Crataegus mollis*; Vermilion Co.: Oakwood; Washington Co.: Du Bois; **Indiana:** Brown Co.:; Orange Co.: 1 mi. SE Chambersburg; **Iowa:** Henry Co.: 3 mi NW Salem; Johnson Co.: Iowa City; Story Co.: Ames; Woodbury Co.: Sioux City; **Kansas:** Douglas Co.:; Leavenworth Co.: Leavenworth; Riley Co.: Manhattan; **Kentucky:** Nelson Co.: Bardstown; Rowan Co.: Morehead; **Louisiana:** Caddo Prov.: Gilliam; **Maryland:** Harford Co.: Fallston; Montgomery Co.: Glen Echo; Great Falls; Plummer's Isl.; **Massachusetts:** Middlesex Co.: Hooliston; Natick; **Michigan:** Crawford Co.: Crawford; Kalkaska Co.:; Otsego Co.:; Co.?: Nottawa; **Minnesota:** Fillmore Co.: Preston; Houston Co.: Mississippi Bluff, 1 mi. N State line; **Missouri:** Barry Co.: Oak Ridge; Roaring River St. Pk.; Boone Co.: 1.3 mi. N Ashland, ex. tall fescue, Dvac; Columbia, ex. *Carya*; ex. *Juglans nigra*; ex. black locust; ex. *Cerastium* and *Quercus alba*; ex. *Helianthus*, *Ambrosia Salix*; *Cooper Co.*:; *Crawford Co.*: 2 mi. E Rosati; Steelville, ex. *Yarrow*; *Gasconade Co.*: ex. grape; *Madison Co.*: Hwy 72 at Castor Bridge; *Pettis Co.*: Paint Brush Pr., sweeping prairie; *Phelps Co.*: Yancy Mills, ex. jack oak; *St. Louis Co.*: 1 mi N Eureka; *Shannon Co.*: Logger's Lake, ex. black locust; *Texas Co.*: Licking, ex. green ash; *Washington Co.*: ex. alfalfa; **New Jersey:** *Atlantic Co.*: Hammonton; *Passaic Co.*: Newfoundland; Ramapo; *Somerset Co.*: Basking Ridge, ex. elm; New Brunswick; *Sussex Co.*: Duttonville; *Union Co.*: Westfield; *Warren Co.*: Columbia; Hackettstown, sweeping; **New York:** *Cattaraugus Co.*: Four Mile; Rock City; Vandalia, Chipmunk Swamp; *Genesee Co.*: Batavia; *Greene Co.*: Maplecrest, Catskill Mts.; *Livingston Co.*: Consesus Lake; *Madison Co.*: Madison; *Monroe Co.*: Rochester Jct.; *Rockland Co.*: Grand View; *Tompkins Co.*: Ithaca; *Ulster Co.*: Oliverea; *??Co.*: Long Isl.; **North Carolina:** *Henderson Co.*: Pisgah Nat'l. For., N River Mills Cmpgd; *Haywood Co.*: Sunburst; *Jackson Co.*; Cherokee, 2000 ft; *Moore Co.*: West End, ex. *Vitis rotundifolia*; *Swain Co.*: 17 mi. SW Bryson; *Wake Co.*: 3.5 mi., N Apex, ex. *Iris* blossom; **Ohio:** *Ashland Co.*: Mohican Mem. St. For.; *Ashtabula Co.*: Andover; *Cuyahoga Co.*: Cleveland; *Summit Co.*: Barberton; *Washington Co.*: Marrietta; **Oklahoma:** *Bryan Co.*: 3 mi. S Bennington, ex. malaise trap; *Carter Co.*: Noble Found Ardmore, ex. malaise trap; *Creek Co.*: 1.5 mi NE Kellyville, ex. malaise trap; *Latimer Co.*:; *Pawnee Co.*: Feyodi Creek; *Pittsburgh Co.*:; *Pushmataha Co.*: Tuskahoma; *Tulsa Co.*: Bixby, ex. black light trap; **Pennsylvania:** *Berks Co.*: Virginville, ex. mullein; *Dauphin Co.*: Willoughby and Nyes Rd., ex. *Vitis* sp.; *Union Co.*: Lewsiburg; *Westmoreland Co.*: Greenburg; Jeannette; *York Co.*: Menges Mill, *Achillea millifolia*; **South Carolina:**

Greenville Co.: Greenville, at light; Spartanburg Co.: Cross Anchor; Pickens Co.: Clemson, ex. Daucus; **Tennessee:** Clairborne Co.: N Benn Station; Hamilton Co.: East Sanctuary, East Ridge; Sevier Co.: Gatlinburg, Fork Little Pigeon River; ex. Erigeron; Stewart Co.: Land Between the Lakes, near Model; **Texas:** Brazos Co.: Bryan; College Station, ex. Quercus virginianus; ex. Vicia; Grassbur Rd., ex. oak; Dallas Co.:; Grimes Co.: Navasota; Limestone Co.: 3 mi. NNW Groesbeck, ex. blue bonnets; Madison Co.: 4 mi W N Zulch; **Virginia:** Fouquier Co.: Warrenton; Giles Co.: Mountain Lake; Grayson Co.: ex. Aruncus; Rockingham Co.: 3 mi E Elkton; Shenandoah Co.: Woodstock; Tazwell Co.: Tazwell; **West Virginia:** Raleigh Co.: ex. Apocynum cannabinum; Co.?: Rockport; **Wyoming:** Platte Co.:.

Lopidea hesperus (Kirkaldy)

Figures III.43, III.44, III.95, III.96; Map III.19

Capsus coccineus Walker 1873:93 (new species, preoccupied by Capsus coccineus Meyer, 1843) Henry 1985:1126 (lectotype designation, discussion).

Lomatopleura hesperus Kirkaldy 1902:252 (new name for coccineus Walker). Barber, 1914:500 (list).

Lomatopleura coccineus: Distant 1904:109.

Lomatopleura hesperia: Van Duzee, 1917:383 (list).

Lomatopleura hesperius: Van Duzee 1916:44 (list).

Lopidea reuteri Knight 1918:459 (new species). Knight, 1923:506 (descriptio, illustration, host plant). Knight, 1941:91 (description, illustration, host plant). Froeschner, 1949:168 (list). Wheeler and Henry, 1977:152 (list). Henry and Smith, 1979:214 (list). Wheeler et al., 1983:141 (list). Henry 1985:1126 (synonymized with hesperus).

Lopidea amorphae Knight 1923:65. (new species). Blatchley, 1926:837 (description). Knight, 1927:38 (distribution). Knight, 1941:90-91 (description, illustration, host plant). Froeschner, 1949:169 (list). Blinn and Yonke, 1985: (list, host plant). Henry and Wheeler, 1988:417 (catalog). **NEW SYNONYMY**

Lopidea hesperia: Blatchley 1926:837 (description, discussion).

Lopidea wisteriae Moore 1956:39 (new species). Henry and Wheeler 1988:425 (catalog). **NEW SYNONYMY**

Lopidea hesperus: Carvalho 1959:85. Knight, 1965:14 (illustration, distribution, discussion). Blinn and Yonke, 1985:81 (list). Henry 1985:1126 (synonymies). Henry and Wheeler 1988:420 (catalog). Palmer and Bennett, 1988:218 (host plant).

DIAGNOSIS: Distinguished by the thick, U-shaped right paramere, with expanded apex and its long, thick tergal process (figs. III.43, III.44).

DESCRIPTION: Medium to large species, length 6.4-8.0, sides distinctly arcuate. Vertex flat; frons protruding only slightly; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance < width antennal segment two; antennal segment II variable, weakly to distinctly fusiform, more so in large specimens, length variable, ratio length antennal segment II-width head positively correlated with size, 1.4 in small individuals to 2.1 in large individuals; rostrum reaching to mesocoxae or beyond.

Genital Capsule: Sensory lobe well developed; tergal process long, strongly flattened, straight to weakly spindle shaped in lateral view (figs. III.43d, III.44d).

Genitalia (figs. III.43, III.44, III.95, III.96): Right paramere modified media type; U-shaped in lateral view; apex serrate, expanded and explanate; medial flange, large, broad, erect occasionally reduced to broadly rounded, dentate lobe; dorsal flange, distinct, short, narrow; basal arm very short, thick, oriented parallel to body of paramere, apex blunt or with 2-3 small teeth. Left paramere rather broad, short; lateral flange short, broadly and evenly rounded apically; medial flange long, evenly narrowed, strongly curved ventrally. Dorsal spicula very broad, weakly narrowed distally, strongly serrate; basal sclerite subrectangular, process well developed. Ventral spicula variable in size, typically long, broad, bifurcate near middle, arms of equal length.

FEMALE: Same size as male, length 6.0-7.9; antennae more conspicuously fusiform; macropterous.

COLOR AND VESTITURE: Head red; antennae black. Coxae, trochanters and femora red to fuscous; tibiae and tarsi black. Venter reddish fuscous to pale yellowish red. Pronotum red; calli fuscous to black. Scutellum fuscous to black. Hemelytra red, medial aspect of clavus, corium and cuneus fuscous to black, dark color occasionally expanded to include posterior pronotum and all of clavus and cuneus. Dorsum with short, sparse, inclined dark setae.

TYPE: **LECTOTYPE** M, <u>Capsus</u> <u>coccineus</u> Walker: **Florida**, St. John's Bluff (BM).

TYPES OF SYNONYMS: **HOLOTYPE** M, <u>Lopidea</u> <u>reuteri</u> Knight: **Missouri**, <u>Taney Co.</u>, Hollister, July 22, 1925 (USNM). **HOLOTYPE** M, <u>Lopidea</u> <u>amorphae</u> Knight: **Minnesota**, <u>Ramsey Co.</u>, July 8, 1922, H.H. Knight (UMN). **HOLOTYPE** M, <u>Lopidea</u> <u>wisteriae</u> Moore: **Illinois**, <u>Jackson Co.</u>, Carbondale July 7, 1955, H.H. Ross & T.E. Moore (INHS).

DISCUSSION: Henry (1985) synonymized <u>reuteri</u> with <u>hesperus</u>, stating that the slight differences in the tergal process, used by Knight to distinguish the species, was clearly infraspecific variation. The proposed synonymy of wisteriae with hesperus is based on the identical genitalic structures of the male. Moore (1956) distinguished wisteriae from reuteri (= hesperus) by its smaller size and some aspect of the male genitalia which he did not discuss. The type specimens of wisteriae are actually larger than many specimens of hesperus, particularly those from the northern states. The length and serration of the spiculae and the number and shape of the teeth at the apex of the right paramere in wisteriae fall within the small range of variation seen in these structures in hesperus.

The proposed synonymy of amorphae with hesperus is based on the identical structure of the male parameres and the similarity in shape, color and vestiture. Although the parameres of the two species are identical (figs. III.43, III.44), there are some differences in the thickness of the second antennal segment, and the vesicae. Herein, I treat amorphae as a distinct subspecies, L. h. amorphae occurring in western and midwestern prairies and L. h. hesperus occurring in the eastern forests. The two subspecies, h. hesperus and h. amorphae have never been collected from the same locality, but I have examined specimens from Arkansas which appear to be intermediate in size and genitalic structure. In addition to geographic separation, the two subspecies may occur on different host plants. The only confirmed breeding records for amorphae are Amorpha. Knight (1923) found hesperus breeding on Hamamelis virginiana, but the only confirmed breeding records for hesperus that I have seen are on Wisteriae, however, I have also seen teneral specimens collected on Amorpha. The present interpretation of these two taxa is clearly tenuous and detailed information of genitalic variation and host plant preference, particularly in areas of presumed parapatry is needed.

Lopidea hesperus hesperus (Kirkaldy) **NEW STATUS**
Figures III.43, III.95; Map III.19

Capsus coccineus Walker 1873:93 (new species, preoccupied by Capsus coccineus Meyer, 1843) Henry 1985:1126 (lectotype designation, discussion).
Lomatopleura hesperus Kirkaldy 1902:252 (new name for coccineus Walker). Barber, 1914:500 (list).
Lomatopleura coccineus: Distant 1904:109.
Lomatopleura hesperius: Van Duzee 1916:44 (list).
Lomatopleura hesperia: Van Duzee, 1917:383 (list).
Lopidea reuteri Knight 1918:459 (new species). Knight, 1923:506 (description, illustration, host plant). Knight, 1941:91 (description, illustration, host plant). Froeschner, 1949:168 (list). Wheeler and Henry, 1977:152 (list). Henry and Smith, 1979:214 (list). Wheeler et al., 1983:141 (list). Henry 1985:1126 (synonymized with hesperus).
Lopidea hesperia: Blatchley 1926:837 (description, discussion).
Lopidea wisteriae Moore 1956:39 (new species). Henry and Wheeler 1988:425 (catalog).
Lopidea hesperus: Carvalho 1959:85. Knight, 1965:14 (illustration, distribution, discussion). Blinn and Yonke, 1985:81 (list). Henry 1985:1126 (synonymies). Henry and Wheeler 1988:420 (catalog). Palmer and Bennett, 1988:218 (host plant).

DIAGNOSIS: Distinguished from h. amorphae by its larger size (total length of male 6.4-7.9), distinctly fusiform second antennal segment and by the larger, wider and serrate ventral spiculae (fig. III.95).

DISCUSSION: This subspecies occurs along the east coast from Maine to Florida, west to Michigan and Illinois in the North and to the Ozark Plateau in the South (Map III.19). Knight (1941) recorded this subspecies (as reuteri) from Grand Tower, Jackson Co., Illinois. This record was based on a single female specimen collected with a series of L. h. amorphae. I have examined this female and it does not differ from the rest of the series, all the specimens have linear antennae and I consider them all to represent L. h. amorphae.

Collection records from April 14 to September with 73% in June and July. The only confirmed breeding record is Wisteria and three of the seven host records are Wisteria. However, I have seen teneral specimens collected from Amorpha fruiticosa in Florida.

SPECIMENS EXAMINED:

Arkansas: Franklin Co: Barnes; Garland Co.: Hot Springs; Hempstead Co.: Hope; Mississippi Co.:; Washington Co.: Devil's Den St. Prk.; **Connecticut:** Middlesex Co.: Portland; **Florida:** Jackson Co.: ex. Amorpha fruiticosa; Putnam Co.: Crescent City; Seminole Co.: Sanford; Co.? St. John's Bluff; **Georgia:** Charleston Co.: Billy's Isl., Okefenokee Swamp, June; McIntosh Co.: Sapelo Isl.; Co.?: Midway; **Illinois:** Jackson Co.: ex Wisteria; **Maine:** Cumberland Co.: Bridgeport; **Massachusetts:** Norfolk Co.: Boston; Sharon; Worcester Co.: Athol; **Michigan:** Gratiot Co.:; Midland Co.:; **Mississippi:** Kemper Co.: Scooba; Lee Co.: Tupelo; Monroe Co.: Aberdeen; Oktibbeha Co.: Agric. Co.., Starkville, ex pecan; 6 mi SW Starkville; **Missouri:** Reynolds Co.: Sutton's Bluff Cmpgd.; Taney Co.: Holister; **New Jersey:** Bergen Co.: Bear Swamp, nr. Ramsey; **New York:** Orange Co.: Huguenot; Rockland Co.: Ramapo; **North Carolina:** Cumberland Co.: Ft. Bragg; Hanover Co.: Wilmington; Sampson

Co.:; Wake Co.: Raleigh, ex Wisteria; **South Carolina:** Berkeley Co.: 18 mi N Charleston; **Pennsylvania:** Lehigh Co.: Lehigh Gap; Luzerne Co.: Red Rock; **Tennessee:** Perry Co.: Perryville; Shelby Co.: Memphis, ex. Amorpha fruticosa, Carya sp.; **Virginia:** Co.? Glencarlyn; **West Virginia:** Logan Co.: Sulphur Springs.

Lopidea hesperus amorphae Knight **NEW STATUS**
Figures III.44, III.96; Map III.19

Lopidea amorphae Knight 1923:65. (new species). Blatchley, 1926:837 (description). Knight, 1927:38 (distribution). Knight, 1941:90-91 (description, illustration, host plant). Froeschner, 1949:169 (list). Blinn and Yonke, 1985: (list, host plant). Henry and Wheeler, 1988:417 (catalog).

DIAGNOSIS: Distinguished from h. hesperus by its smaller size (total length of male, 6.0-6.3), linear to weakly fusiform second antennal segment and more slender, non-serrate ventral spicula (fig. III.96).

DISCUSSION: The color of h. amorphae is identical to h. hesperus, except some specimens are distinctly yellowish, which is never seen in h. hesperus. Setae very short and sparse, in some specimens giving a glabrous appearance. Setal color varies from pale yellow to black. In yellowish specimens especially, most of the setae are pale, but some dark setae are always present on the embolium and cuneus.

This subspecies occurs in the prairie provinces from western Illinois and Wisconsin, west to Wyoming and Colorado (Map III.19). Collection records from May 18 to July 21 with 92% in June and July. The only confirmed breeding record is Amorpha fruiticosa.

SPECIMENS EXAMINED:

Colorado: Douglas Co.: Head of Highline Canal; Waterton; Larimer Co.: Ft. Collins; **Illinois:** Carroll Co.: Savannah, ex. sweet clover; Cass Co.: Beardstown; Hancock Co.: Hamilton; Henderson Co.: Oquawka; Jackson Co.: Grand Tower, ex. grass; Union Co.: Anna; **Iowa:** Clinton Co.: Clinton; Scott Co.: Pleasant Valley; **Kansas:** McPherson Co.: Rice Co.:; **Minnesota:** Olmsted Co.:; Ramsey Co.: St. Paul; **Missouri:** Boone Co.: Columbia; Holt Co.: Big Lake St. Prk., ex. *Gleditsia triacanthos*; **Oklahoma:** Marshall Co.: Lake Texoma; Payne Co.: Stillwater, sweeping weeds; **South Dakota:** Brookings Co.: Hendricks Lake; Roberts Co.: Lake Traverse, 12 mi SE Sisseton; **Wisconsin:** Clark Co.: Warden Township; **Wyoming:** Goshen Co.: Torrington.

Lopidea incurva Knight

Figures III.45, III.97; Map III.20

Lopidea incurva Knight, 1918:214 (new species). Blatchley, 1926:842-843 (description, host plant). Knight, 1927:38 (distribution). Watson, 1928:39 (list, host plant). Knight, 1941:88 (description, illustration, host plant). Froeschner, 1949:168 (list, host plant). Slater, 1950:49 (illustration). Wheeler and Henry 1976:1101 (biology, nymphs). Akingbohungbe, 1983:39 (testicular follicles). Wheeler et al., 1983:140 (list, host plant). Blinn and Yonke, 1985:81 (list, host plant). Henry and Wheeler 1988:421 (catalog).

DIAGNOSIS: Recognized by its yellow and brown dorsal coloration; C or U-shaped right paramere with narrow, pointed arms (fig. III.45).
DESCRIPTION: Small to medium sized species, length 4.6-5.3, parallel sided. Vertex flat to weakly concave; frons

moderately protruding, broadly rounded; eyes moderately large, not or just reaching frons-tylus suture; eye-antennal fossa distance very short, less than width of antennal segment II; head very short, buccula not extending past collar; antennae slender, cylindrical, short, ratio length antennal segment II - head width 1.3-1.4; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe absent; tergal process relatively long, broad, apex narrowed to blunt point (fig. III.45d).

Genitalia (figs. III.45, III.97): Right paramere robiniae type; dorsal arm short, vertical; ventral arm with apex strongly curved dorsally, dorsal margin of ventral arm weakly dentate; apex sharply pointed, occasionally with secondary tooth; basal arm vestigial or absent. Left paramere narrow; lateral flange narrow, tapered ventrally with dorsal margin concave; medial flange narrow, straight, situated dorsally. Dorsal spicula short, broad, weakly curved; narrowed and strongly serrate distally; basal sclerite large, quadrate, process very short. Ventral spicula short, slender, evenly curved; bifurcate at middle; secondary arm less than half length of primary arm; primary arm weakly serrate apically.

COLOR AND VESTITURE: General coloration yellow-brown. Head pale yellow to brown; antennae yellowish brown to black; rostrum yellowish brown. Coxae and trochanters pale yellow, some infuscation; femora, tibiae and tarsi yellowish brown to dark fuscous. Venter yellow; genital capsule brown to fuscous. Pronotum variably brown, anterior and lateral margins yellow; calli spotted to solid black. Scutellum and hemelytra brown, lateral margins of corium and cuneus, and embolium yellow. Dorsum with very short, strongly inclined black setae; setae occasionally pale on yellow areas.

FEMALE: Same size as male, length 4.7-5.4; macropterous.

TYPE: **HOLOTYPE** M, Lopidea incurva Knight: **Missouri**, Atchison Co., Langdon, 17 July, 1904 (CU).

DISTRIBUTION: Widely distributed in the eastern states from Nebraska and Louisiana east to Ontario, Pennsylvania and North Carolina (Map III.20).

DISCUSSION: Collection records from 1 June to 20 August with 80% in July. Lopidea incurva breeds only on Gleditsia triacanthos (Fabaceae). Wheeler and Henry (1976) provided detailed biological information on this species and described the egg and fifth-instar nymph.

SPECIMENS EXAMINED:

CANADA: Ontario: Amherstburg, ex. locust; Bradford, ex. Gleditsia; Jerseyville, ex. honey locust; Tillsonburg, ex. honey locust.

USA: **District of Columbia:** Washington; **Illinois:** Edgar Co.: Kansas; Jersey Co.: Ford Co.: Paxton, ex. honey locust; Grafton, ex. Gleditsia; McClean Co.: Bloomington, ex. locust; Marshall Co.: Darwin, ex. Gleditsia; Piatt Co.: Monticello, ex. Gleditsia sp.; **Indiana:** Cass Co.: Logansport; Crawford Co.: Alton; Delaware Co.: Muncie; Dubois Co.: Dubois; Howard Co.:; Jackson Co.: Fountain Bluff; Marion Co.:; **Iowa:** Lee Co.: Donnelson; Story Co.: Ames, ex. Gleditsia sp.; Warren Co.: 1.5 mi E Hartford; **Kansas:** Atchison Co.: Effingham; Douglas Co.: Lawerence; Riley Co.: Clearwater; Manhattan; **Louisiana:** De Soto Co.: Logansport; **Missouri:** Boone Co.: ex. Gleditsia triacanthos; Callaway Co.: Tucker Prairie; Vernon Co.: 4 mi W Montvallo; Wayne Co.: Williamsville; **Nebraska:** Richardson Co.: Falls City, ex. locust; **North Carolina:** Wake Co.: Raleigh, ex. Gleditsia triacanthos; **Pennsylvania:** Dauphin Co.: Harrisburg, ex. Gleditsia triacanthos; Washington Co.: Washington, ex. Gleditsia triacanthos; **Wisconsin:** Dane Co.:

ex. honey locust.

Lopidea instabilis (Reuter)

Figures III.46, III.47, III.98; Map III.21

Lomatopleura instabile Reuter 1909:72 (new species).

Lomatopleura instabile var. marginalis Reuter 1909:72 (new variety).

Lopidea marginalis: Knight 1923:508 (description, illustration). Blatchley, 1926:838 (description). Pimentel and Wheeler, 1973:661 (list, host plant). Reid et al., 1976:563 (host plant). Wheeler and Henry, 1977:152 (list). Messina, 1978:139, 141 (list). Akingbohungbe, 1983:39 (testicular follicles). Wheeler et al., 1983:141 (list). Blinn and Yonke, 1985:81-82 (list, host plant). Henry and Wheeler 1988:421 (catalog). **NEW SYNONYMY**

Lopidea instabilis: Knight 1917:455. Hussey, 1922a:17 (list, host plant). Knight 1923:508 (description, illustration). Knight, 1927:39 (distribution, host plant). Knight, 1941:91 (description, illustration, host plant). Froeschner, 1949:167 (distribution). Wheeler and Henry, 1977:152 (list). Henry and Smith, 1979:214 (list). Wheeler et al., 1983:141 (list). Blinn and Yonke, 1985:81 (list). Henry and Wheeler 1988:421 (catalog).

Lopidea instabile: Blackman 1918:136 (host plant). Blatchley, 1926:837-838 (description, distribution, host plant). McClain, 1984:143-148 (color, predation, host).

Lopidea hesperus: Knight 1962:36 (description, discussion) (miss id, really rubella)

Lopidea rubella Knight 1965:13 (new species). Henry and Wheeler 1988:424 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Recognized by its S-shaped (fig. III.46) or C-shaped (fig. III.47) right paramere, narrow left paramere and strongly fusiform second antennal segment.

DESCRIPTION: Medium sized species, length 5.3-6.1, sides distinctly arcuate. Vertex flat to weakly convex; frons broadly rounded, moderately protruding; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance small, less than width antennal segment II; head long, buccula separated from collar; antennae thick, distinctly fusiform, ratio antennal segment II - width head 1.7-1.8; rostrum just reaching metacoxae.

Genital Capsule: Sensory lobe absent; tergal process short, apex weakly expanded, squared or bluntly rounded (figs. III.46d, III.47d).

Genitalia (figs. III.46, III.47, III.98): Right paramere with ventral arm absent or vestigial (i. instabilis) or present as a long, tapering arm, curved medially, apex variably dentate (i. rubella); dorsal arm sickle-shaped, cylindrical, evenly tapered and curved dorsally, lateral margin of apex toothed; basal arm absent. Left paramere narrow, strongly angled; lateral flange absent or extremely reduced (i. instabilis), or short, narrow and tapered ventrally (i. rubella); medial flange situated dorsally, short, narrow, dorsal surface evenly curved to acute ventral angle, ventral surface concave. Dorsal spicula long, straight, thick, margins strongly serrate; basal sclerite large, quadrate, process well developed. Ventral spicula long, weakly and evenly curved, thick basally, bifurcate and abruptly narrowed at middle; secondary arm half length of primary arm; both arms serrate apically.

COLOR AND VESTITURE: General coloration red and fuscous. Head red; antennae red to black; rostrum reddish brown. Coxae, trochanters and femora solid red, often infuscated;

tibiae and tarsi reddish fuscous to black. Venter red; genital capsule infuscated. Pronotum red, with occasional infuscation on disk; calli red to dark fuscous. Scutellum red to dark fuscous. Hemelytra red, clavus and medial area of corium variably fuscous; embolium frequently white. Dorsum with short, strongly inclined, black setae.

FEMALE: Slightly larger than male, length 5.3-6.5; macropterous.

TYPE: **LECTOTYPE** M, Lomatopleura instabile Reuter: **Maryland**, Glen Echo, 20 July (USNM) (here designated).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea rubella Knight: Florida: Seminole Co., Sanford, 17 April, 1927, E.D. Ball (USNM). Types of Lomatopleura instabile var marginalis Reuter not examined.

DISCUSSION: Reuter described Lomatopleura instabile from two specimens, one from Washington, D.C., the other from Maryland. I found a single male in the USNM with following label: Glen Echo, 20-7, Md / TYPE Lomatopleura marginalis Reut. (hand written). The data on this specimen agree with that given by Reuter for Lomatopleura instabile, and the hand handwriting on the second label agrees with H.H. Knight's. It appears that Reuter sent one of the specimens on which he based L. instabile back to Knight. Knight subsequently raised Reuter's variety i. marginalis to species rank and meant to use the returned type specimen of i. instabile as the type of i. marginalis. I have selected the male specimen mentioned above as the lectotype of Lomatopleura instabile Reuter and here designate it as such. The specimen is deposited in the USNM and I have attached a red label to it with the following information: LECTOTYPE, Lomatopleura instabile Reuter, det. A. Asquith. Knight's designation of this specimen as the type of L. marginalis was never published and therefore never validated.

I am basing the synonymy of *marginalis* with *instabilis* on the identical external morphology and vesicae. Knight distinguished *marginalis* by its pale embolium, but then noted that in some specimens the embolium is red as in *instabilis*. There is no geographic pattern to the distribution of those populations containing individuals with a white embolium and this character is quite variable even within some populations. Knight also noted that the right paramere of these two species were also different and in his illustration of *marginalis* the ventral arm is absent while that of *instabilis* is small but clearly present. In > 90% of specimens of *instabilis* I examined, the ventral arm was absent or appeared only as a vestigial bump on the basal-ventral angle was present. Occasionally, however, some specimens have small to moderately developed ventral arms. It appears that Knight figured one of these types in his illustration of *instabilis*. There is no clear geographic pattern to the presence of the vestigial ventral arms, but they appeared to be more common in specimens from the Northeast.

I am synonymizing *L. rubella* with *L. instabilis* but retaining them as distinct subspecies, as there are consistent differences in the parameres and they appear to have allopatric or parapatric distributions. Although the parameres of *rubella* are distinct from those of *instabilis* in that they always have a well developed ventral arm on the right paramere and a developed lateral flange on the left paramere, the spiculae are identical and there are no differences in external morphology. In addition, the occasional appearance of a small ventral arm in some *instabilis* specimens suggests an incomplete dichotomy of this character between these nominal species and supports my synonymy. These are probably, however, the most differentiated entities within North American Lopidea that I am recognizing as subspecies.

Lopidea instabilis instabilis (Reuter)
Figure III.46; Map III.21

DIAGNOSIS: Recognized by its fusiform antennae, arcuate form and sickle-shaped right paramere (fig. III.46).
DISTRIBUTION: Wide spread in eastern North America from Wyoming and Montana, east to Maine and south to Texas and Virginia (Map III.21).
DISCUSSION: Collection records are from 20 May to 6 September with 80% in July and August. This species is frequently collected from clover and alfalfa. The only confirmed breeding records are for alfalfa and wild liquorice, Glycorrhiza tepidota. Knight (1927) records it as breeding on Solidago. L. instabilis has also been recorded as feeding on aphid mummies.
SPECIMENS EXAMINED:
CANADA: **Ontario:** Belleville, ex. Spirea; Bell's Corner; Chatterton; Constance Bay; Foxboro, ex. Solidago; Kingston, ex. Solidago; Madoc; Merivale; North Bay; Otter Lake; St. Lawerence Isl. Nat'l. Pk.; Tweed; **Quebec:** Gatineau; Hudson Heights; Kazubazua; Laniel; Magog; Richmond; Rigaud; St. Agathe; St. Jean; St. Rose' 20 mi NW Montreal; Shawville; Thurso; Wolf Lake.
USA: **Arkansas:** Crawford Co.: ex. soybean; Marion Co.: Bull Shoals; Montgomery Co.:; Washington Co.:; **Colorado:** Arapahoe Co.: Denver; **Connecticut:** Hartford Co.: Glastonburg; Wethersfield; Litchfield Co.: Cornwall; Salisbury; New London Co.: Colchester; Pachaug For.; Tolland Co.: Storrs; **Illinois:** Union Co.: La Rue; **Iowa:** Allamakee

Co.: 3 mi E Waterville; Clay Co.: Peterson; Story Co.: Ames; Woodbury Co.: Sioux City; **Kentucky**: Carter Co.: Gregoryville; **Maine**: Penobscott Co.: Old Town; York Co.:; **Maryland**: Frederick Co.: Hagertown; **Massachussetts**: Hampden Co.: Springfield; Suffolk Co.: Boston; Worcester Co.: New Braintree; Winchendon; **Michigan**: Allegan Co.: Allegan St. For.; Hopkins; Barry Co.: Yankee Springs Game Area; Cheboygan Co.: Douglas Lake; Clinton Co.: Rose Lake Wildlife Exp.St.; Dickson Co.:; Grand Traverse Co.: Williamsburg; Iron Co.:; Marquette Co.: Michigamme; Otsego Co.:; **Minnesota**: Aitkin Co.: Tamarack; Cass Co.:; Chisago Co.: Taylors Falls; Clearwater Co.: Itasca St. Pk.; Dakota Co.: Hastings; Hennepin Co.: Ft. Snelling; Minneapolis; Itasca Co.: Grand Rapids; Lake Co.: Basswood Lake; Two Harbors; Nicolet Co.: St. Peter; Olmstead Co.:; Pine Co.: Willow River, ex. Myrica asplonifolia; Ramsey Co.:; St. Louis Co.: Eaglenest; Traverse Co.: Brown's Valley; Washington Co.: Grey Cloud Isl.; Newport; Winona Co.: Whitewater St. Pk.; **Missouri**: Barry Co.: Cassville; Table Rock Lake; Camden Co.: Camdenton; Carter Co.: 12 mi W Ellsinore; Gasconade Co.: Swiss, ex. red clover; Maries Co.: Vicky; Moniteau Co.:, ex. alfalfa; Newton Co.: Neosho; Pettis Co.: Friendly Prairie; St. Genevieve Co.: 6 mi E Farmington; Shannon Co.: Eminance; Winona; Stoddard Co.: Dexter; Stone Co.:; Wayne Co.: 3 mi N Wappapello; **Montana**: Gallatin Co.: Bozeman; Musselshell Co.: Musselshell; **Nebraska**: Dakota Co.: Sioux City; **New Hampshire**: Belknap Co.: Alton; Barnstead; Carroll Co.: Conway; Coos Co.: Gorham; Grafton Co.: Holderness; Merrimack Co.: Webster; Rockingham Co.: Nottingham; Strafford Co.: New Durham; **New York**: Cattaraugus Co.: Gowanda; Salamauca; Columbia Co.: Chatham; Essex Co.: Keene Valley; Underwood; Genesee Co.: Bergen Swamp; Putnam Co.: Carmel; Rensselaer Co.: Rensselaerville; Suffolk Co.: Long Isl.; Tompkins Co.:

Ithaca, ex. alfalfa; _Westchester Co._: Lake Waccabuc; White Plains; **North Dakota:** _Bottineau Co._: Bottineau, ex. _Caragana_; Roosevelt Nat'l. Pk.; _Stark Co._: Dickenson; _Co.?_: Little Missouri River; **Pennsylvania:** _Centre Co._: Pine Grove Mills; _Pike Co._: Greeley; **Oklahoma:** _Latimer Co._: Wilburton; _Le Flore Co._: Page; _McCurtain Co._: Broken Bow; _Pittsburgh Co._: Quinton; **Rhode Island:** _Washington Co._: Kingston; **South Dakota:** _Fall River Co._: Hot Springs, 3500 ft; _Jackson Co._: Interior, ex. _Glycorrhiza tepidota_; _Lawerence Co._: Rouboix; Spearfish, Black Hills; _Pennington Co._: Rapid City; Pactola Lake, Black Hills, ex. vetch; **Tennessee:** _Co.?_: Coal Creek; **Texas:** _Bosque Co._: 3 mi W Laguna Pk.; _Kerr Co._: Kerrville; **Vermont:** _Windsor Co._: Woodstock; **Virginia:** _Arlington Co._: Glencarlyn; _Fairfax Co._: Arlington; Falls Church; Great Falls; **Wisconsin:** _Clark Co._: Warden Township; _Dane Co._: Blue Mounds; Madison; _Douglas Co._:; _Dunn Co._: Colfax; _Iowa Co._: 2 mi NE Clyde; _Jefferson Co._: Aztalan; _Price Co._: 10 mi E Fifield, Flambeau River; _Sawyer Co._: Stonegate; _Washbum Co._:; _Wood Co._: Wisconsin Rapids; **Wyoming:** _Big Horn Co._: Basin; _Converse Co._: Douglas; _Custer Co._: Custer; _Platte Co._: Wheatland; _Sheridan Co._: Sheridan.

Lopidea instabilis rubella NEW STATUS

Figure III.47; Map III.21

Lopidea rubella Knight 1965:13 (new species). Henry and Wheeler 1988:424 (catalog).

DIAGNOSIS: Similar to _L. i. instabilis_ with arcuate hemelytra and fusiform antennae. Easily distinguished from _i. instabilis_ by the presence of a ventral arm on the right paramere (fig. III.47), the presence of the lateral flange on the left paramere and its southeastern distribution.

DISTRIBUTION: Restricted to the southern Appalachian Mountains and coastal plain of the southeastern U.S. (Map III.21).

DISCUSSION: L. i. rubella also differs from i. instabilis by having the head and pronotum always solid red. The hemelytra are also much less infuscated and I have seen no specimens with white embolia. Collection records are from 18 May to 3 August with 85% in July and August. Taken at a light trap and collected on Tephrosia sp. (Fabaceae). This may indeed be a true host plant, since two of the three species in this genus are restricted to the southeastern states as is rubella. Blatchley (1926) was referring to this subspecies when he recorded Xolisma fruticosa as a host of instabile in Florida.

SPECIMENS EXAMINED:

Alabama: Cullman Co.: Garden City, 7 July (KU); DeKalb Co.: Crossville, 4 July, ex. Tephrosia sp., (TxA&M); **Florida:** Seminole Co.: Sanford, 14 May; **Georgia:** ??Co.: Spring Creek, 18-21 May (Cornell); **North Carolina:** Macon Co.: Highlands, 12 July, at light trap (CNC); Mitchell Co.: S. Pines, 10 June (AMNH); Transylvania Co.: Lake Toxaway, 12 July (AMNH); Co.??: Wayah Bald, 10 August (CNC); **Tennessee:** Franklin Co.: Sewanee, 3 August (KU); Grundy Co.: Monteagle, 3 August (KU); Hamilton Co.: Chattanooga, 4 July (AMNH); Montgomery Co.: Clarksville, 15 July (KU).

Lopidea intermedia Knight

Figures III.48, III.99; Map III.22

Lopidea intermedia Knight, 1918:210 (new species). Knight and Schaffner, 1968:76 (distribution, host plant). Henry and Wheeler 1988:421 (catalog).

DIAGNOSIS: Recognized by its unusually long tergal process; distinguished from media by the spine-like process on the angle of the left paramere (fig. III.48); distinguished from confraterna by its erect, narrow, medial flange of the right paramere.

DESCRIPTION: Small to medium sized species, length 4.5-5.0, linear. Vertex flat to weakly concave; frons weakly protruding, narrowly rounded; eyes small, just short of frons-tylus suture; eye-antennal fossa distance small, equal to width antennal segment II; head long, buccula separated from collar; antennae linear, slender, short, ratio length antennal segment II - head width 1.3-1.4; rostrum reaching metacoxae.

Genital Capsule: Sensory lobe absent; tergal process very long, slender, apex curved ventrally, blunt or bifurcate (fig. III.48d).

Genitalia (figs. III.48, III.99): Right paramere media type; dorsoapical margin weakly tapered ventrally, serrate; ventroapical angle bluntly rounded; medial flange strongly expanded as a narrow, erect, serrate process; dorsal flange present as three short teeth, not connected basally; basal arm situated dorsally, long, evenly tapered to acute apex, oriented with axis of paramere. Left paramere with dorsal margin of angle greatly expanded as erect, vertical, spine-like process; lateral flange short, narrowly rounded; medial flange long, straight, evenly tapered to bluntly rounded apex. Dorsal spicula long, slender, strongly curved, margins minutely serrate; basal sclerite large, triangular, process well developed. Ventral spicula long, very slender, weakly curved; bifurcate at distal third; secondary arm half the length of primary arm; primary arm minutely serrate apically.

COLOR AND VESTITURE: General coloration red and fuscous. Head red; antennae red to dark reddish fuscous. Legs red to dark reddish fuscous; trochanters paler. Venter red. Pronotum red; calli fuscous to black. Scutellum fuscous. Hemelytra red; clavus, medial area of corium and membrane fuscous. Dorsum with medium length, inclined setae; setae yellow on red areas and dark on fuscous areas.

FEMALE: Slightly larger than male, length 5.0-5.1; macropterous.

TYPE: **HOLOTYPE** M, Lopidea intermedia Knight: **Texas**, Bexar Co., Helotes, 1 July, 1917, H.H. Knight (CU).

DISTRIBUTION: Know only from south-central Texas (Map III.22).

DISCUSSION: This species is closely related to confraterna, as both share the erect, spine-like process on the angle of the left parameres. It is clearly different from confraterna, however, in having an erect medial flange on the right paramere. The two known collection records are from May and July. Knight (1918) noted that both adults and nymphs were abundant on a stream side, blue- flowering weed at the type locality.

SPECIMENS EXAMINED:

Texas: Bexar Co.: Helotes, 1 July (USNM, CAS); Bosque Co.: 2 mi W Iredell, 17 May (TexA&M); 3 mi S Iredell, 5 July (USNM).

Lopidea lateralis Knight

Figures III.49, III.100; Map III.8

Lopidea lateralis Knight 1918:174 (new species). Henry and Wheeler 1988:421 (catalog).

DIAGNOSIS: This species has a distinct dorsal color pattern of black or dark fuscous on the clavus and corium and ivory white embolium. Also recognized by the strongly submacropterous females.

DESCRIPTION: Medium to large species, length 5.8-6.5, linear. Head broad; vertex flat or weakly concave; frons weakly produced, broadly rounded; eyes small, ventral margin not reaching frons-tylus suture; eye-antennal fossa distance small, $\leq$ width of antennal segment II; head long, buccula separated from collar; antennae linear, long, ratio antennal segment II - head width 1.7-1.9; rostrum reaching to mesocoxae or slightly beyond.

Genital Capsule: Sensory lobe weakly developed; tergal process short, very narrow, dorsal edge minutely crenulate, apex blunt, swollen, weakly curved ventrally (fig. III.49d).

Genitalia (III.49, III.100): Right paramere media type; apex curved dorsally; dorsoapical margin with serrate; medial flange, short, erect, serrate process; dorsal flange a long, serrate process; basal arm very long, slender, oriented with axis of paramere, apex narrowed to sharp point. Left paramere short; lateral flange short, curved ventrally, ventral margin of apex bluntly rounded; medial flange very broad, apex strongly curved ventrally. Dorsal spicula long, slender, strongly curved, serrate apically; basal sclerite well developed, process short. Ventral spicula elongate, bifurcate at distal third; primary arm shorter than secondary arm; both arms serrate at apices.

COLOR AND VESTITURE: General coloration dark fuscous and white. Head red; antennae black; rostrum dark fuscous. Appendages and venter black. Pronotum fuscous to black; narrow lateral area of disk red, margins white. Scutellum fuscous to black. Hemelytra dark fuscous to black; lateral edge of corium and cuneus and embolium ivory white. Dorsum with short, inclined to semi-erect, black setae.

FEMALE: Macropterous forms linear, same size as males, length 5.9-6.2. Submacropterous form most common; oval in outline, short, length 4.6-5.2; hemelytra not exceeding tip of abdomen.

TYPE: **HOLOTYPE** M, Lopidea lateralis Knight: **Arizona**, Pima Co., Mt. Lemon, Santa Catalina Mts., July 26, 1917, H.H. Knight (CU).

DISTRIBUTION: Occurs at high elevations in Arizona and southern New Mexico (Map III.8).

DISCUSSION: Collection records from May 28 to September 15 with 85% in July and August. Host plant unknown. Collected on Vicia (Fabaceae), Draba (Brassicaceae) and Rubus (Rosaceae).

SPECIMENS EXAMINED:

Arizona: Apache Co.: McNary; Rt. 666. Mountain Meadow at Alpine Summit; Paradise; Cochise Co.: Barfoot Park; Deer Park, 8000 ft; Moose Canyon, 8700 ft, ex. Draba aurea; Chiracahua Mts., Rustler's Park, 7500 ft, ex. Vicia pulchella; Southwest Research Station; Coconino Co.: Flagstaff, 7000 ft; San Francisco Mts., 1 mi E Schultz Pass Rd., Hwy 180; Williams, 7000 ft; Gila Co.: Winkleman; Graham Co.: Pine Crest; Shannon, Graham Mts.; Pima Co.: Bear Wallow, Santa Catalina Mts., 8000 ft; Mt. Lemmon, Santa Catalina Mts., 9000 ft; Sabino Canyon, 7000 ft; **New Mexico:** Catron Co.: Willow Creek, Mogollon Mt., 25 mi E Alma; Otero Co.: Cloudcroft; 4 mi E Cloudroft.

Lopidea lathyri Knight

Figures III.50, III.101; Map III.23

Lopidea _lathyrae_ Knight, 1923:66 (new species). Blatchley, 1926:838-839 (description).
Lopidea _lathyri_: Knight, 1941:91 (description, illustration, host plant). Froeschner, 1049:169 (list). Strickland, 1953:200 (list). Kelton, 1980:233 (description, illustration, distribution, host plant). Akingbohungbe, 1983:39 (testicular follicles). Blinn and Yonke, 1985:81 (list). Henry and Wheeler 1988:421 (catalog).

DIAGNOSIS: Recognized by its black-red or black-yellow dorsal coloration, with pale setae on light colored areas and dark setae on black areas. Also identified by the L-shaped right paramere (fig. III.50) and its northern distribution.
DESCRIPTION: Medium sized species, length 5.7-6.6, linear, parallel-sided. Vertex flat; frons flat, protruding only slightly; eyes large, reaching below frons-tylus suture; eye-antennal fossa distance < width antennal segment II; head short, buccula touching or just separated from collar; antennae linear, ratio length antennal segment II-width head > 1.8; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe almost absent, a weak vertical ridge; tergal process short, straight (fig. III.50d).

Genitalia (figs. III.50, III.101): Right paramere _robiniae_ type; ventral arm thick, apex curved dorsomedially, medial surface with small denticles; dorsal arm long, erect, vertical, tapering to narrow point or weakly furcate, sometimes slightly recurved towards base of paramere; basal arm very short, apex blunt or furcate, directed apicoventrally. Left paramere narrow; lateral flange situated ventrally, apex broadly rounded; medial flange situated dorsally, fused with lateral flange for most of length, extremely. Dorsal spicula very short, thick, strongly curved, distal third strongly serrate; basal sclerite well developed, subrectangular, process small but distinct. Ventral spicula slender, bifurcate; secondary arm very slender, short, less than half the length of primary arm, margins entire; primary arm evenly narrowed, minutely serrate apically.

COLOR AND VESTITURE: General coloration black-red or black-yellow. Head orange-red; antennae black. Coxae bicolored, bases fuscous, yellow to white distally; trochanters rufous to white; femora and tibiae fuscous to black, apices of tibiae paler. Ventral surface rufous to deep red; genital capsule fuscous to black. Pronotum rufous, medial aspect of posterior lobe fuscous; calli black. Scutellum fuscous. Hemelytra red or yellow, clavus and medial aspect of corium fuscous, membrane dark fuscous. Dorsum with inclined, pale yellow setae on light colored areas and dark setae on fuscous areas.

TYPE: **HOLOTYPE** M, Lopidea lathyrae Knight: **Minnesota**, Anoka Co., July 6, 1919, H.H. Knight (UMN).

DISTRIBUTION: This species occurs in the northern prairies and savannahs from eastern Alberta to northern Illinois (Map III.23).

DISCUSSION: Collection records from June 26 to October 5 with 90% in July and August. Recorded breeding on Lathyrus venosus (Knight, 1923), also collected on vetch and alfalfa.

SPECIMENS EXAMINED:

CANADA: Ontario: Emmo; Nestor Falls; One Sided Lake, ex vetch; Port Arthur; 20 mi N Red Lake Rd.; **Manitoba:** Aweme, N Criddle; Beausejeur; Carberry; Falcoma, ex vetch; Falcon Lake, ex vetch; Pilot Mound; 5 mi SW Shilo, Tamarack bog; Virden; West Hawk Lake, ex. vetch; **Saskatchewan:** Amsterdam; Christopher Lake; Neilburg; Prince Albert; Torch River, ex.

Amelanchier alnifolia; White Fox, ex. Medicago sativa; Willow Bunch.

USA: Illinois: Cook Co.: Palos Park; **Iowa:**; **Minnesota:** Aitkin Co.: Aitkin; Anoka Co.: ex Lathyrus venosus; Cass Co.: Cass Lake, light trap; Clearwater Co.: Shevlin; Crow Wing Co.: Brainerd; Nisawa; Hennepin Co.: Ft. Snelling; Hubbard Co.: Laporte; Itasca Co.: Bengal; Itasca Park; White Fish Lake; Kanabec Co.: Mora; Lake Co.: Basswood Lake; Marshall Co.: Middle River; Mille Lacs Co.:; Morrison Co.: Sullivan, Squaw Pt. Resort; Olmsted Co.:; Otter Tail Co.: Fergus Falls; Polk Co.: East Grand Forks, ex sweet clover; Crookston; Ramsey Co.: Turtle Lake, ex Lathyrus venosus; Roseau Co.:; Saint Louis Co.: Eaglesnest; **North Dakota:** Bottineau Co.: 10 mi S Antler, ex sweet clover; Lake Metigoshe; Turtle Mts.; Cass Co.: Fargo; Cavalier Co.:; **Wisconsin:** Rock Co.: Milton; Washburn Co.: Spooner.

Lopidea major Knight
Figures III.51, III.102; Map III.16

Lopidea major Knight 1918:215 (new species). Henry and Wheeler 1988:421 (catalog).

Lopidea texana Knight 1918:215. (new species). Henry and Wheeler 1988:425 (catalog). **NEW SYNONYMY**

Lopidea polingorum Knight 1965:13 (new species). Henry and Wheeler 1988:423 (catalog). **NEW SYNONYMY**

Lopidea matamorensis Knight and Schaffner 1972:111 (new species). **NEW SYNONYMY**

DIAGNOSIS: Recognized by its large size; broad, convex pronotum; short, sparse setae, and the large, expanded dorsal flange of the right paramere (fig. III.51).

DESCRIPTION: Large species, length 6.6-7.5; broadly linear. Vertex flat to weakly concave; frons weakly protruding, broadly rounded; eyes large, reaching frons-tylus suture; eye-antennal fossa distance small, less than width antennal segment II; Head short, buccula not separated from collar; antennae thick, weakly fusiform, ratio length antennal segment II - head width 1.6-1.7; rostrum just reaching mesocoxae. Pronotum very broad, distinctly convex.

Genital Capsule: Sensory lobe absent or weakly developed as a vertical ridge; tergal process very long, slender, straight, evenly tapered from base (fig. III.51d).

Genitalia (figs. III.51, III.102): Right paramere large, <u>media</u> type; apex narrowed from broad base, dorsoapical margin with long, thick erect flange; medial flange narrow, erect, apex expanded and serrate; dorsal flange extremely large, expanded as a thick, vertical arm, apex usually dentate; basal arm long, narrow, oriented with axis of paramere and weakly curved ventrally. Left paramere narrow, abreptly constricted just distad of angle; lateral flange long, apex evenly rounded and strongly curved ventrally; medial flange long, evenly narrowed, strongly curved ventrally. Dorsal spicula short, slender, distal half sinuous, strongly serrate; basal sclerite large, triangular, process very long. Ventral spicula long, evenly curved, bifurcate at middle, arms very slender, of equal length; primary arm weakly serrate apically; secondary arm minutely serrate at apex or not.

COLOR AND VESTITURE: General coloration bright red and black. Head red; antennae black, segment I occasionally dark red; rostrum dark reddish brown. Coxae and trochanters dark red to fuscous; femora dark red, fuscous dorsally; tibiae and tarsi reddish fuscous to black. Venter red. Pronotum bright red; calli occasionally lightly infuscated. Scutellum and hemelytra red; medial border of clavus and membrane fuscous to black. Dorsum with very sparse, short, inclined, black setae.

FEMALE: Same size as male, length 6.9-7.6; antennal segment II distinctly fusiform; macropterous.

TYPE: **HOLOTYPE** M, *Lopidea major* Knight: **Texas**, Bexar Co., San Antonia, 5 June, 1896, Marlatt (CU).

TYPES OF SYNONYMS: **HOLOTYPE** M, *Lopidea texana* Knight: **Texas**, Travis Co., Austin, C.T. Brues (CU). **HOLOTYPE** M, *Lopidea polingorum* Knight: **Texas**, Jefferson Davis Co., Ft, Davis, Davis Mts., 5000 ft., 27-28 July-August, O.C. Poling (USNM). **HOLOTYPE** M, *Lopidea matamorensis* Knight and Schaffner: **Mexico**, **Queretaro**, 14 mi. E Landa de Matamoros, 23-24 July, 1970, at light (USNM).

DISTRIBUTION: Occurs east of the Mexican Plateau, from North Texas to Queretaro, Mexico (Map III.16).

DISCUSSION: The proposed synonymy of *texana*, *polingorum* and *matamorensis* with *major* is based on the identical structure of the male genitalia. Knight (1918) distinguished *texana* from *major* by some undescribed difference between the parameres. In his illustrations, Knight (1918) shows a basal arm on the right paramere of *texana* but not on *major*. The parameres of the holotype of *major* also have a basal arm, however, which differs only slightly from that of *texana*. These species were described on the same page of the same publication, with the description of *major* appearing first. Knight (1965) distinguished *polingorum* from *texana* by its smaller size and the vertical, anterior margin of the pronotum. The anterior margin of the pronotum of *major* is recurved dorsally by varying degrees, and the specimens on which *polingorum* was based simply represent one extreme. The label on the holotype reads *Lopidea polingi*, but was published as *polingorum*. Knight and Schaffner (1972) distinguished matamorensis from texana by its darker color and some undescribed detail of the parameres. Specimens from Mexico are slightly larger and darker, with the apex of the right paramere narrower and the medial flange very slender. Collection records are from 23 March to 24 July with 88% in April and May. The only two breeding records are both from Sophora secundiflora (Fabaceae).

SPECIMENS EXAMINED:

MEXICO: Queretaro: 14 mi E Landa de Matamoros.

USA: Texas: Bandera Co: 12 mi W Medina; Bexar Co.: San Antonio, ex. legume; Brewster Co.: 10 mi N Alpine, 3800 ft, ex. Sophora secundiflora; Duval Co.: Freer; Edwards Co.: 23 mi SE Rocksprings; Frio Co.: 2 mi S Moore; Jefferson Davis Co.: Ft. Davis, Davis Mts., 5000 ft.; Kimble Co.: 1 mi E Junction; Llano Co.: 4 mi N Kingsland; Real Co.: 5 mi E Leakey; 4 mi N Vance; Sutton Co.: Sonora, ex. Sophora segundiflora; Terrell Co.: Sanderson; Travis Co.: Austin; Zilker Park; Uvalde Co.: Cline; 1.3 mi NW Uvalde; 7 mi S Uvalde; ? Co.: Del Rio.

Lopidea marginata Uhler

Figures III.52, III.103; Map III.17

Lopidea marginata Uhler, 1894:249 (new species). Gillete and Baker, 1895:30 (list). Van Duzee, 1914:28 (list). Knight, 1962:32 (illustration, discussion). Henry and Wheeler 1988:421 (catalog).

Lopidea drakei Knight 1962:30. (new species). Henry and Wheeler 1988:419 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Almost identical in appearance to nigridia; distinguished by the generally smaller size, less protuberant frons in lateral view and absence of an elongate dorsal spine at the apex the right paramere (fig. III.52). L. becki, ute, and garyyae are similar in size and color but lack dark, erect setae on the head and pronotum.

DESCRIPTION: Small to moderate-size species, length 4.8-5.7, parallel sided. Vertex flat; frons narrowly rounded, strongly protruding; eyes small, not reaching to frons-tylus suture in frontal view; eye-antennal fossa distance less than width of antennal segment II; head length variable, buccula just separated to widely separated from collar; antennae slender, cylindrical, ratio length antennal segment II-width head = 1.5-1.8; rostrum reaching to meso or metacoxae.

Genital Capsule: Sensory lobe weakly developed, a broadly rounded ridge; tergal process short, straight, thin (fig. III.52d).

Genitalia (figs. III.52, III.103): Right paramere davisi type; apex serrate, apical margin weakly reflexed medially; medial flange long, narrow serrate flange, parallel with margin of paramere; dorsal flange relatively long, narrow, erect or angled ventromedially; basal arm short, relatively thick, directed ventrally, apex dentate. Left paramere short; lateral flange with apex broad, evenly rounded; medial flange short, extremely narrow. Dorsal spicula short, lanceolate, serrate and weakly curved apically; basal sclerite very small, process vestigial or absent. Ventral spicula long, slender, sinuous, apex serrate.

COLOR AND VESTITURE: General coloration red or red and white. Head red to cream; antennae and legs rufous to piceous. Dorsal color pattern variable, from solid brick-red with slight infuscation on the clavus, to light red with lateral area of corium, embolium and cuneus pale white.

Dorsum with sub-erect to erect, black setae, prominent on head and pronotum.

FEMALE: Slightly larger than male, length 5.3-5.9; macropterous.

TYPE: **LECTOTYPE** M, Lopidea marginata Uhler (here designated): **California**, Marin Co., CAS Type No. 548 (CAS).

TYPE OF SYNONYM: **HOLOTYPE** M, Lopidea drakei Knight: **Oregon**, Benton Co., Corvallis, June 26, 1926, C.J. Drake (USNM).

DISTRIBUTION: This species occurs in the coastal and interior mountain ranges of western North America from southern British Columbia south to Baja California Norte. It is also found in the Ochoco and Blue Mountains of Oregon, east to the western slopes of the Rocky Mountains in Idaho. I have examined two small series from Graham Co., Arizona. These are typical marginata based on habitus, vestiture and male genitalia, and may represent a disjunct population (Map III.17).

DISCUSSION: Uhler described marginata from "a few" specimens collected in San Julio, Baja California. Knight (1962) claimed that he examined the type of marginata in the CAS in 1931. I have examined a male specimen in the CAS that bears the following information: Marin Co. CAL[ifornia]./ Uhler TYPE/ M/ LECTOTYPE marginata/ Lopidea marginata Uhler/ CAS Type No. 548. A female specimen from the same locality bears an ALLOTYPE label and another male specimen bears a PARATYPE label. Uhler did not designate type specimens in his original description, nor did Knight designate a lectotype in his publication. The orange LECTOTYPE, ALLOTYPE and PARATYPE labels were probably added by E.P. Van Duzee. I was unable to locate specimens from the Baja California locality. In the original description Uhler also mentions that he examined specimens from California, Arizona, Colorado and the eastern United States. The specimens in the

CAS generally fit Uhler's description of marginata and it is likely that Uhler did examine these specimens for his description. To stabilize the concept of this species and avoid confusion regarding its identity, I have selected the specimen bearing the lectotype label in the CAS (CAS Type No. 548) as the lectotype of L. marginata and I have affixed a label to the specimen indicating this. I have also designated the other two specimens bearing the allotype and paratype labels (CAS Type Nos. 549 and 550) as paralectotypes.

The proposed synonymy of drakei with marginata is based on the identical genitalic structure of the males. Knight (1962) distinguished drakei from marginata by the "position and form" of the arms of the right paramere, and the red margins of the hemelytra. There is very little variation in the right paramere among the specimens from Washington to Baja California that I have examined. The differences in the right paramere that Knight (1962) referred to are small, infraspecific variations. The color of drakei does indeed differ from that of the marginata types, but this represents variation in dorsal color pattern along a North-South cline. Individuals from British Columbia, Washington and Oregon are uniformly red with some fuscous; in northern California some populations have individuals with white on the embolium and in southern California individuals have white on the clavus, outer aspect of the corium, embolium and cuneus.

Two females found in the CAS collected from Claremont, Cal., coll. Baker, are identified as Lopidea indentata Uhler, determined by Uhler. This appears to be a Uhler manuscript name and is not valid.

Collection records are from April 20 to August 21 with 92% in May to July. L. marginata appears to breed almost elusively on Lotus spp. (Fabaceae). Of 36 host records 53%

are _Lotus_ and all confirmed breeding records are on _Lotus_.
SPECIMENS EXAMINED:
MEXICO: Baja California Norte: 38 km. E Rt. 1 to Parque San Pedro Martir, 1500 ft, ex. _Lotus scoparius_; 53 km. W Punta Prieta, twd Bahia Los Angeles, 1350 ft, ex. _Lotus scoparius_; 4 km W Parque San Pedro Martir, ex. _Ephedra californica_; 41 km W Parque San Pedro Martir, ex. _Lotus corniculatus_.
USA: Arizona: _Graham Co._: Graham Mts., rt. 366, ex. _Lotus rigidus_; **California:** _Alameda Co._: Oakland; hills back of oakland; _Butte Co._: Oroville, ex. _Quercus wislizenii_; _Calaveras Co._: Mokelumne Hill; Murphy's, 2000 ft; _Contra Costa Co._: Antioch; Mt. Diablo; Stagecoach Cmpgd., Mt. Diablo St. Pk., 2200 ft; _El Dorado Co._: 5 mi. S Kyburz; _Humboldt Co._: Kneeland; _Inyo Co._: Big Pines Camp, ex. _Ceanothus divericatus_; _Kern Co._: Mt. Pinos, 8000 ft; _Los Angeles Co._: Camp Baldy; Claremont, ex. _Eriogonum_ sp.; 7 mi SW Elsinore; Griffith Park, LA River, Los Feliz Rd.; 33 mi E La Canada, 7220 ft, ex. _Ceanothus cordulatus_; Little Rock, Mohave Desert; Los Flores Cyn.; Mt. Wilson Rd.; Pasadena; Playa del Rey; Tanbark Flat, ex. _Ceanothus_; ex. _Lotus_; ex. _Quercus_; _Madera Co._: Bass Lake, 3000 ft, ex. _Astragalus_; _Marion Co._: Lagunitas; _Mariposa Co._: & mi. N Fish Camp, 7000 ft; Glacier Pt., Yosemite Nat. Pk., 7214', ex. _Abies_; _Mendocino Co._: Piercy, on Hwy 101; _Modoc Co._: 7 mi. NE Alturas, 4750 ft; _Monterey Co._: Arroyo Seco; Bryson; Paraiso Springs; Paraiso Hot Springs, 1400 ft; Tassajara Hot Springs; _Orange Co._: El Toro, ex. _Lotus scoparius_; Irvine; Laguna Beach; Laguna Canyon; Newport Bay; San Juan Canyon, ex. _Eriogonum fasiculatum_; _Riverside Co._: 4 mi. S Banning; Mt. Diablo, ex. _Lotus scoparius_; near Hemet, ex. _Lotus scoparius_; Hemet Reservoir, San Jacinto Mts.; below Idyllwild, ex. _Lotus scoparius_; 6 mi W Marietta, Santa Rosa Plateau, 2000 ft; Menifee Valley, 1800 ft, ex. _Lotus_

scoparius; ex. Cryptantha sp.; Menifee Valley, ex. Adenostoma; Palms to Pines Hwy, ex. Larrea sp.; 1.5 mi W Perris, ex. Eriogonum; Perris, ex. Lotus scoparius; Ribbonwood, San Jacinto Mts.; Riverside, ex. Lotus scoparius; ex. Lotus scoparius; ex. Lotus scoparius; ex. Eriogonum sp.; ex. Salvia sp.; San Jacinto, ex. Lotus scoparius; Soboba Springs; Strawberry Canyon, Rt. 74, ex. Eriogonum; Temescal Canyon; Tenaja Cmpgd.; 5 mi S Winchester; Sacramento Co.: Sacramento; San Bernardino Co.: Colton; Oak Glen; Pine Lake; 1 mi N Pioneertown; 2 km N Pioneertown; Providence Mts. St. Rec. Area, 4300 ft, ex. Lotus rigidus; 2 mi E Wrightwood, 5150 ft; San Diego Co.: Alpine; Dulzura; Fall Brook; Mt. Palomar; 3 mi E Poway; Ramona; 11 mi E Ramona; Rancho Santa; San Diego; Solano Beach; 2 mi. W Warner Springs, ex. Eriogonum; San Louis Obispo Co.: Baywood Park, ex. Solanum; Mts. W La Panza; Pdy Cyn.; Nacimiento Dam; Reservior Canyon; 6 mi E Santa Margarita; San Mateo Co.: Crystal Lakes; Santa Barbara Co.: Bluff Camp, San Rafael Mnts; 6 mi E Buellton; Canon del Refugio; Gaviota Pass; Goleta; 4 mi E Los Prietos; Santa Ynez Mts.; Upper Oso Cmpgd., off Rt. 154, 1000 ft, ex. Lotus junceus & Salvia leucophylla; Santa Ynez Mts.; Vic. Sta. Ynez R., chaparral, 1100 ft; 3 mi E Zaca Prk., 4300 ft; Santa Cruz Co.: Loma Prieta; Tuolumne Co.: Strawberry; Sutter Co.: Mysvlle Buttes, ex. Lotus; Tehama Co.: Mill Creek; Tulare Co.: Mt. Home; Sequoia Nat'l Prk, 2000-3000 ft; Ventura Co.: Moorpark; 4 mi S Rincon, ex. Lotus & Eriogonum; Sespe Canyon; Yolo Co.: Rumsey; 2 mi N Rumsey; 2 mi W Rumsey; 2 mi NE Rumsey; 4 mi NE Rumsey; Co.?:
14 mi E Santa Maria; Nipomo; Tehachapi; Whittier; Coffee Camp, ex. Lotus scoparius; **Idaho:** Idaho Co.: State Creek R.S.; **Oregon:** Benton Co.: Corvallis, ex. Lotus corniculatus; Mary's Peak, 2500 ft, ex. Lotus crassifolius;

8 mi S Philomath; Jefferson Co.: Culver City; Lane Co.: Heceta; Linn Co.: HJA Experimental Forest; Lincoln Co.: Saddleback Mt.; Wheeler Co.: 2 mi W Mitchell, ex. Fabaceae; 2 mi W Mitchell, ex. *Lupinus* sp.; ex. legume; **Washington:** Yakima Co.: Satus Pass, July 9, 1935, R.H. Beamer, 2M; Co.?: Rochester.

Lopidea media (Say)

Figures III.53, III.104; Map III.22

Capsus medius Say 1832:22 (new species).

Lopidea media: Uhler 1872:412. Uhler, 1875:838 (list). Uhler, 1876:414 (list). Uhler, 1878a:406 (list). Uhler, 1978b:506 (list). Van Duzee, 1887:70 (list). Harring, 1892:27 (list). Osborn, 1893:123 (list). Uhler, 1894:249 (list). Van Duzee, 1894:176 (list). Gillete and Baker, 1895:30 (list). Crevecoeur, 1905:233 (list). Heidemann, 1905:48 (ist). Moore, 1907:163 (list). Yucker, 1907:59 (list). Smith, 1910:161 (list). Parshley, 1914:141 (list). Knight, 1918:210 (illustration, distribution, host plant). Hussey, 1922a:17-18 (list). Hussey, 1922b:32 (list). Knight, 1923:505 (description, illustration, host plant). Blatchley, 1926:841-842 (description, discussion). Watson, 1928:39 (list, host plant). Knight, 1941:90 (description, illustration, host plant). Froeschner, 1949:169 (list). Strickland, 1953:200 (list, host plant). Kelton, 1959:29, 64 (illustration). Knight, 1962:37-38 (distribution, discussion). Wheeler and Henry, 1977:152 (list, host plant). Messina, 1978:139, 141 (biology, host plant). Henry and Smith, 1979:214 (list). Kelton, 1980:233-234 (description, illustration, distribution, host plant). Akingbohungbe, 1983:39 (testicular follicles). McPherson et al., 1983:37

(list). Wheeler et al., 1983:141 (list, host plant). Blinn and Yonke, 1985:82 (list, host plant), Wheeler and Hoebeke, 1985:358 (host plant). Henry and Wheeler 1988:422 (catalog).
Capsus floridanus: Walker 1873:97 (new species). Knight 1962:37 (synonymized with media). Henry 1985:1127 (confirmation of Knight's synonymy).
Lopidea floridana: Distant 1904:108 Blatchley, 1926:843 (description, discussion).

DIAGNOSIS: Easily recognized by its deeply concave vertex and long, slender, tergal process (fig. III.53). Distinguished from confraterna and intermedia by the lack a spine-like process on the angle of the left paramere.
DESCRIPTION: Medium sized species, length 5.3-6.9; parallel sided. Vertex deeply concave; frons narrowly rounded, weakly protruding; eyes large, reaching to or below frons-tylus suture; eye-antennal fossa distance, almost contiguous; head moderately long, buccula just separated from collar; antennae slender, cylindrical, ratio length antennal segment II-head width 1.8; rostrum reaching meso or metacoxae.

Genital Capsule: Sensory lobe absent; tergal process long, narrow, apex square or rounded, weakly curved ventrally (fig. III.53d).

Genitalia (figs. III.53, III.104): Right paramere media type; apex of paramere weakly curved ventrally, dorsoapical margin only weakly serrate, dorsal margin of apex with long, narrow, vertical flange, apex with 3-4 large curved teeth; medial flange present as weakly raised, dentate surface; dorsal flange short, narrow, erect vertical flange, apex dentate; basal arm long slender, sinuous, situated dorsally and oriented with axis of paramere, evenly tapered to narrowly pointed apex, occasionally with secondary tooth near apex. Left paramere very broad, angle broad and weakly expanded vertically; lateral flange short, very broad, apex square; or broadly rounded; medial flange well separated from lateral flange, long, extremely narrow. Dorsal spicula long, slender, distal third strongly curved, apex weakly dentate; Basal sclerite large, triangular, process well developed. Ventral spicula long, slender, bifurcate at distal third; secondary arm, half length of primary arm; margins of both arms entire.

COLOR AND VESTITURE: General coloration yellowish red. Head red; antennae black, segment I occasionally red; rostrum yellowish or reddish brown. Coxae, trochanters and femora yellowish red to light fuscous; tibiae and tarsi black. Venter yellow to red; genital capsule infuscated. Pronotum red to yellow; calli fuscous to black. Scutellum reddish fuscous. Hemelytra yellow to red; clavus and medial aspect of corium variably fuscous. Dorsum with short, strongly inclined setae. Setae usually pale, but occasionally black on dark fuscous areas and cuneus.

FEMALE: Slightly larger than male, length 5.3-6.5; macropterous.

TYPE: **NEOTYPE** M, <u>Capsus</u> <u>medius</u> Say (here designated): **Illinois**, <u>Ogle Co.</u>, Castle Rock, Grand Detour, 2 July, 1932, Dozier and Mohr (INHS).

DISTRIBUTION: One of the most widely distributed <u>Lopidea</u> in North America. Found from Utah and Montana, east to Newfoundland and south to Texas and Florida (Map III.22).

DISCUSSION: Because the original Say specimens have been lost or destroyed, I have designated a neotype to fix the concept of <u>Lopidea</u> <u>media</u>. Although Say (1832) described <u>Capsus</u> <u>medius</u> from Indiana, I examined no material from Indiana, and the specimen I selected as the neotype was collected in Illinois. <u>L</u>. <u>media</u> is unusual in that it is very widely distributed but shows almost no variation in the male genitalia so common in other species. There is slight variation in the number of teeth on the flanges of the right paramere and the length of the secondary arm of the ventral spicula. The only clear pattern of geographic variation is that specimens from west of the Rocky Mountains in Utah and western Colorado are consistently orange-yellow in color with a white embolium. Collection records are from 23 April to 16 September with 82% in June and July. *L. media* has been collected from more than 25 genera of plants. I have seen several confirmed breeding records on *Chrysothamnus nauseosus* (Asteraceae) west of the Rocky Mountains. In the East, I have seen teneral specimens collected from *Hydrangea arborescens* (Hydrangeaceae), *Tradescantia* sp. (Commelinaceae) and *Solidago* sp. (Asteraceae). Knight (1923) recorded this species breeding on *Solidago rugosa*, and Wheeler and Hoebeke (1985) found nymphs and adults on *Physocarpus opulifolius* (L.). This species frequently comes to black lights.

SPECIMENS EXAMINED:

CANADA: *Alberta*: Lethbridge; Mannyberries; Medicine Hat; *Ontario*: Barrie; Chalk River; Dashwood, ex. *Salix*; Dryden, ex. *Rubus*; Effingham; Fergus; Gatineau Pk., ex. grass; Grand Bend, ex. *Salix*; Guelph; Hespeler; Ingleside; Iperwash; Lake of Bays, Mer Bleue; Norway Point; Newry; North Bay; Oakland; Orillia; Ottawa; Parry Sound; Petrolia; Strathroy; Tillsonburg, ex. *Salix*; Woodstock, ex. *Salix*; *Quebec*: Cap Rouge; Fabre; Garacefield; Hudson Heights; Hull; Kazabazua; Kirk's Ferry, light trap; Knowlton; Lac Megantic; Lac Mercier; Lac Mondor, St. Flore, at light; Ladysmith, ex. spruce; Laniel, ex. *Solidago*; Levis; Magog; Minerva; Otter Lake; Quinze Lake; Quyon, ex. willow; St. Agathe; *Manitoba*: 5 mi SW Shilo, at light; Turtle Mts.; *New Brunswick*: Bathurst; Berwick; Kouchibouguac Nat'l. Pk., ex. *Spiraea*;

Petersville, ex. Solidago; Nova Scotia: Kentville; Saskatchewan: Willow Bunch; Wood Mt.; Rock Glen.

USA: **Arkansas:** Benton Co.: Garfield; Hempstead Co.:; Johnson Co.: 8 mi N Clarksville; Logan Co.: Magazine Mt.; Mississippi Co.: ex. Xanthium; Montgomery Co.: Ida; Polk Co.:; Sebastian Co.: Witcherville; Washington Co.: light trap; Yell Co.: 3 mi W Havana; **Colorado:** Arapahoe Co.: Englewood; Boulder Co.: Boulder, Valmont Butte, 5300 ft; Douglas Co.: Perry Park; Waterton; Garfield Co.: Glenwood Springs, 5000 ft.; Jefferson Co.: Chatfield Park; La Plata Co.: 16 km E Bayfield, ex. Ceonothus fendleri; Larimer Co.: Ft. Collins; 5 mi SE Laporte; Moffat Co.: Axial, 20 mi N Meeker, 6600 ft.; ex. Chrysothamnus nauseosus; Maybell; District of Columbia: Washington; **Connecticut:** Coventry Co.: Engreville Dam; New Haven Co.: Branford; Cheshire; Orange; Oxford; Waterbury; New London Co.: Stonington; Volumtown; Wequetequeck; Tolland Co.: Mansfield;

Illinois: Bureau Co.: Princeton; Champaign Co.: Urbana, at light; Cook Co.: Palos Park; Gallatin Co.: Shawneetwon; Jackson Co.: Gorham, Fountain Bluff; Grand Tower; Jo Daviess Co.: Galena, ex. Corylus; Johnson Co.: Goreville; Kankakee Co.: Kankakee; La Salle Co.: Starved Rock; Mercer Co.: Keithsburg, ex. Tradescantia sp.; Ogle Co.: Castle Rock, Grand Detour; Oregon; Pope Co.: Dixon Springs; Golconda, ex. Catalpa; Rock Island Co.: Moline; Tazewell Co.: Lilly; Vermilion Co.: Muncie; Oakwood; **Iowa:** Boone Co.: Ledges St. Pk.; Hamilton Co.: Stratford; Iowa Co.: 1 mi S Amana; Muscatine Co.: Muscatine; Story Co.: Ames; Woodbury Co.: Sioux City; **Kansas:** Bourbon Co.: Bourbon, 800 ft.; Douglas Co. Lawerence:; Hodgman Co.: Linn Co.:; Miami Co.: Montgomery Co.: Coffeyville; Riley Co.:; Scott Co.: Scott's St. Pk.; **Kentucky:**

McCracken Co.: Paducah; **Maine:** Aroostook Co.: Ft. Kent; Cumberland Co.: Portland; Lincoln Co.: 3 mi SE Demariscott; Penobscott Co.: Orono; **Maryland:** Montgomery Co.: Plummer's Island; Prince George's Co.: Beltsville; Hyattsville; Laurel; **Massachusetts:** Essex Co.: Pigeon Cove; Hampshire Co.: Amherst; Middlesex Co.: Lexington; **Michigan:** Alger Co.: Autrain; Alpena Co.: Alpena St. Pk.; Barry Co.: Hickory Corners; Bartow Co.: Cassville; Berrien Co.: Benton Harbor; Charlevoix Co.: Boyne City; Cheboygen Co.: Douglas Lake; Emmet Co.: 1 mi S Pellston; Gogebic Co.: Ironwood; Houghton Co.: Alston; Ingham Co.: Aurelius; East Lansing; Iosco Co.: St. Game Ref.; Jackson Co.:; Kalamazoo Co.: Gull Lake Biol. St.; Livingstone Co.: George Reserve, light trap; Manistee Co.:; Marquette Co.: Watson; Mason Co.:; Mecosta Co.: .5 mi E Ramus; Midland Co.:; Missaukee Co.:; Monroe Co.: Petersburg; Montgomerey Co.:; Montmorency Co.: Atlanta; Newago Co.: ex. moist meadow; Oakland Co.: Birmingham; Otsego Co.: Vanderbilt; Presque Isle Co.:; Roscommon Co.: Houghton Lake; Saginaw Co.: Alicia; Shiawassee Co.: Owosso; Washtenaw Co.: Ann Arbor, at light; Wayne Co.:; Wexford Co.: Cadillac; **Minnesota:** Crow Wing Co.: Nisswa; Hennepin Co.:; Lake Co.: Lake Isabella; Pine Co.: Willow River; Ramsey Co.: New Brighton; Red Rock; St. Anthony's Park; St. Louis Co.: Eaglesnest; Traverse Co.:; Wabasha Co.: Lake City; Winona Co.:; **Mississippi:** Holmes Co.: Durant; Lafayette Co.: Oxford; Oktibbeha Co.: Adaton, black light; **Missouri:** Audrain Co.: 3 mi N Sturgeon, ex. Asclepias syrieca; Bollinger Co.: Duck Crk. Wildlf. Ref.; Boone Co.: Ashland; Butler Co.: 10 mi NW Poplar Bluff; Callaway Co.: Tucker Prairie; Cape Girardeau Co.: ex. Lespedeza; Carter Co.: Big Springs St. Pk.; Van Buren; Crawford Co.: Steelville, ex. Prunus hortulana, wild plum; Henry Co.: 2 mi W Calhoun, at light; Columbia; Gasconade Co.:; Jackson Co.: Kansas City;

Maries Co.:; Ozark Co.: Tecumseh; Ralls Co.: Indian Creek Cmpgd., at light; Randolph Co.: 1 mi E Moberly; St. Clair Co.:; Wayne Co.: Mingo Wldlf. Ref.; 3 mi N Wappapello; **Montana:** Big Horn Co.: Crow Agency; Gallatin Co.: Bozeman, 4800 ft.; Park Co.:; Yellowstone Co.:; **Nebraska:** Dixon Co.: Sioux City; **New Hampshire:** Carroll Co.: Ossipee; Coos Co.: Glen House; Lancaster; Mt. Washington; Grafton Co.: Franconia; **New Jersey:** Bergen Co.: Ramsey; Essex Co.: Paterson; Middlesex Co.:; Sussex Co.: Baleville; Union Co.: Westfield; **New York:** Albany Co.: Rensselaerville, Hyuck Preserve; Bronx Co.: New Rochelle; Erie Co.: Colden; Elmo; Hamburg; Spring Brook; Essex Co.: Lake Placid; Whiteface Mountain; Cattaraugus Co.: Otto; Rock City; Franklin Co.: Saranan Lake; Norfolk Co.: Dover; Orange Co.: Tuxedo; Richmond Co.: Staten Island; Tompkins Co.: Ithaca; **North Carolina:** Anson Co.: Morrow Mt. St. Pk.; Chatham Co.: Haywood; Cumberland Co.: Ft. Bragg; Haywood Co.:, ex. Hydrangia arborescens; Richmond Co.: Staten Isl.; Swain Co.: Nantahala Gorge; Wake Co.: Raleigh Falls Lk.; West Chester Co.: White Plains; **North Dakota:** Cass Co.: Fargo, light trap; Leonard; McKenzie Co.: Roosevelt Nat'l. Pk., N Unit, ex. Rhus, Salix sp.; Slope Co.:; **Oklahoma:** Canadian Co.: El Reno; Carter Co.: Ardmore; Latimer Co.: Wilburton; Leflore Co.: Summerfield; Osage Co.: Barteville, at light; Payne Co.: Stillwater, at light; Sequoyah Co.: Sallisaw; Tulsa Co.: Bixby, black light; Wagoner Co.: 5 mi N Wagoner; **Pennsylvania:**
Northampton Co.: Wind Gap; Philadelphia Co.: Philadelphia;

South Carolina: Greenville Co.: Greenville; Pickens Co.: Clemson; **South Dakota:** Lawrence Co.: Spearfish; Union Co.: 3 mi S Jefferson; **Tennessee:** Chester Co.: Rt. 100, i mi S Rt 22, ex. Alnus serrulata; Stewart Co.: Land Between the

Lakes, near Model; **Texas:** Hall Co.:; Hemphill Co.: Canadian, Panhandle Nat'l. Grasslands, at light; **Utah:** Cache Co.: Logan Canyon; Summit Co.: Coalville; Pine View; Toole Co.: Stansbury Mts., S Willow Cyn, ex. *Chrysothamnus nauseosus*; Uintah Co.: Vernal; White Rocks; Utah Co.: 1 mi NE Covered Bridge Canyon, 6000 ft., ex. *Rhus trilobata*; Provo, 4750 ft.; Vivian; **Vermont:** Orange Co.: Bradford; Windsor Co.: Ascutney; Woodstock; **Virginia:** Fairfax Co.: Newington; Giles Co.: Mountain Lake; Grayson Co.:, ex. *Aruncus aruncus*; **West Virginia:** Greenbrier Co.: Alvon; **Wisconsin:** Ashland Co.: 3 mi E Clam Lake; Bayfield Co.: Lake Namekagon; Clark Co.:; Dane Co.: Madison; Door Co.:; Douglas Co.: Superior; Kenosha Co.:; Langlade Co.: Antigo; Lincoln Co.: Merril; Marathon Co.:; Villas Co.: Tenderfoot Lake; Wood Co.: Cranmoor; Giffith St. Nursery; **Wyoming:** Albany Co.: Laramie; Platte Co.: Wheatland; Sheridan Co.: Kendrick: Sheridan, at light.

Lopidea minima Knight

Figures III.54, III.105; Map III.24

Lopidea minima Knight 1918:176 (new species). Henry and Wheeler 1988:422 (catalog).
Hadronema infans Van Duzee 1918:296 (new species).

DIAGNOSIS: Recognized by its small size (< 5.0); short, ovate, inornate right paramere (fig. III.54) and southwestern distribution.

DESCRIPTION: Small species, length 3.7-4.4, parallel-sided. Vertex weakly to strongly concave; frons flat, protruding only slightly; eyes large, reaching to or below frons-tylus suture; eye-antennal fossa distance very short, less than width antennal segment II; head short, buccula touching or slightly separated from collar; antennae cylindrical, very short, ratio length antennal segment II-width head $\leq$ 1.5; rostrum reaching anterior margin of metacoxae.

Genital Capsule: Sensory lobe absent; tergal process extremely short, thick, curved medially, apex blunt (fig. III.54d).

Genitalia (figs. III 54, III.105). Right paramere davisi type, short; apex weakly angled ventrally, broadly rounded, margins entire; medial flange present only as a denticulate surface; dorsal flange occasionally present as a single, short, blunt tooth; basal arm short, thick, oriented with axis of paramere. Left paramere extremely short; lateral flange short, apex broadly rounded; medial flange longer, angled ventrally, widely separated from lateral flange, basal angle with short but distinct dorsal expansion. Dorsal spicula short,very broad, linear, margins strongly serrate; basal sclerite large, process well developed. Ventral spicula short, slender, bifurcate on distal third; arms subequal in length, margins entire.

COLOR AND VESTITURE: General coloration red-fuscous. Head pale to reddish brown; antennae black; rostrum reddish brown. Legs dark fuscous to black; apices of coxae pale to reddish-brown. Pronotum red, occasionally reddish-brown; calli black. Scutellum fuscous to black. Hemelytra red, lightly infuscated medially. Dorsum with short, pale, decumbent setae, occasionally black on dark areas.

FEMALE: Same size as male, length 3.6-4.5; macropterous.

TYPE: **HOLOTYPE** M, Lopidea minima Knight: **Arizona**, Pima Co., Sabino Canyon, Santa Catalina Mts., 5500 ft, July 23, 1917, H.H. Knight (CU).

TYPE OF SYNONYM: HOLOTYPE M, Hadronema infans Van Duzee: **California**, Riverside Co., Palm Springs, May 22, 1917, E.P.

Van Duzee (CAS).

DISTRIBUTION: This species occurs in the desert regions of the southwestern United States and northern Mexico. I have examined specimens from southern California and Baja California Norte, east to southern Texas (Map III.24).

DISCUSSION: L. minima appears to breed exclusively on the desert shrub, Dalea spp. (Fabaceae). Collection records from February 21 to December 20. This species is propbably bivoltine, as 90% of the specimens I examined were collected either in early spring, March to May, or late summer in August and September (Table III.1).

SPECIMENS EXAMINED:

MEXICO: Baja California Norte: Arroyo Catarina, 35 mi. S El Progreso, ex. Dalea megalostachys; Bahia de Los Angeles; 13 mi N Punta Prieta, ex. Dalea; Pt. Refugio, Isl. Angel de la Guarda, ex. Dalea; 26 mi. S San Felipe; **Sonora:** Magdalena, ex. alfalfa; Navojoa; 8 mi. S Santa Ana, 680 m.. **USA: Arizona:** Cochise Co.: Montezuma Cyn.; 6 mi. W Montezuma Ps.; Round Valley Ref., 3 mi. NW Portal, sweeping; Navajo Co.: 15-20 mi. SW Show Low, 5200-6000 ft., ex. Dalea formosa; Pima Co.: Rosemont, N end Santa Rita Mts., 4400-6200 ft, ex. Stephanomeria pauciflora; Santa Catalina, ex. Encelia; Santa Rita Range Res., ex., mesquite; Santa Cruz Co.: Canelo, at light; Madera Cyn; Patagonia; Pena Blanca, 10 mi. W Nogales; Santa Rita, 4600 ft.; Yuma Co.: Fortuna Wash, ex. Hypris emoryi; Ligurta; Tuscon; Wellton; Yuma; **California:** Imperial Co.: Algodones Dunes, 3.5 mi. NW Glamis, ex. Dalea; Fish Springs, ex. desert verbenia; Glamis, 28 March 17 mi. NW Glamis, ex. Dalea emoryi; 4 mi NW Ocotillo Wells, 150 m., ex. Psorothamnus emoryi; 14 mi. NW Westmoreland, ex. Salvia; Inyo Co.: 2 mi. S Oasis, ex Dalea emoryi; Riverside Co.: 18 mi. W Blythe, ex. Dalea emoryi; Cathedral City; Chino Cyn.; Coachella Valley, 9 May;

Dead Indian Creek; Indio; 24 mi. S Indio; 5 mi. E Mecca, Box Cyn. Wash, ex. Dalea; Palm Spgs.; Thousand Palm Cyn.; San Diego Co.: Anza-Borrego St. Pk., 10.2 mi. NW Ocotillo, ex. Psorothamnus emoryi; Borrego Desert, nr. Narrows; **New Mexico:** Bernalillo Co.: Albuquerque; **Texas:** Brewster Co.: Big Bend Pk., Cooper's Store; 14 mi. E Marathon; Frio Co.: 2 mi. S Moore; 10 mi. N Pearsall; Presidio Co.: 2 mi. S Shaffer; Terrell Co.: 10 mi. E Sanderson; Uvalde Co.: 7 mi. N Sabinal.

Lopidea minor Knight

Figures III.55, III.106; Map III.25

Lopidea minor Knight 1918:213 (new species). Knight, 1927:39 (distribution, host plant). Knight, 1941:88 (description, illustration, host plant). Froeschner, 1949:169 (list). Wray, 1950:12 (list, host plant). Strickland, 1953:200 (list, host plant). Knight 1965:2 (illustration, distribution). Kelton, 1980:233 (description, illustration, distribution, host plant).

(discussion, distribution, illustration). Henry and Wheeler 1988:422 (catalog).

Lopidea petalostemi Knight 1965:3 (new species). Blinn and Yonke, 1985:82 (list, host plant). Henry and Wheeler 1988:423 (catalog). **NEW SYNONYMY**

Lopidea johnstoni Knight 1965:3 (new species). Henry and Wheeler 1988:421 (catalog). **NEW SYNONYMY**

Lopidea phlogis Knight 1965:3 (new species). Wheeler et al., 1983:141 (list host plant). Henry and Wheeler 1988:423 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Recognized by its small size (< 5.0mm), long, semi-erect setae and short, blunt tergal process. Distinguished from davisi by the apex of right paramere not strongly expanded vertically (fig. III.55).

DESCRIPTION: Small species, length 3.9-4.7; parallel-sided. Vertex flat; frons moderately protruding; eyes just short of or occasionally reaching frons-tylus suture; eye-antennal fossa distance = width antennal segment II; head, long, buccula separated from collar; antennal segment II cylindrical, very short, ratio length antennal segment II-width head $\leq$ 1.5; rostrum reaching metacoxae or beyond.

Genital Capsule: Sensory lobe absent; tergal process variable in shape, usually extremely short with apex blunt and slightly expanded, occasionally hooked apically; dorsal margin minutely crenulate (fig. III.55d).

Genitalia (figs. III.55, III.106): Right paramere davisi type; apex bluntly rounded, serrate; medial flange, vestigial, present only as a minutely dentate row, parallel with margin of paramere; dorsal flange present as single, short, thick tooth; basal arm short, extremely thick, angled ventrally. Left paramere short, narrow; lateral very flange short, apex broadly rounded; medial flange long, narrow. Dorsal spicula very short, lanceolate, both margins serrate; basal sclerite very small, process absent. Ventral spicula narrowly lanceolate, thick basally, abruptly constricted at middle and narrow for distally; apex minutely serrate.

COLOR AND VESTITURE: General coloration red. Head pale red; antennae fuscous to black; rostrum rufous to fuscous. Coxae fuscous, apices pale; trochanters pale; femora rufous to fuscous, apices pale; tibiae and tarsi black. Pronotum yellowish-red to brick-red, disk occasionally smoky; calli red to fuscous. Scutellum red or more commonly variably fuscous. Hemelytra yellowish-red to brick-red, clavus and medial aspect of corium occasionally infuscated, especially in yellowish specimens; some specimens with clavus, embolium and cuneus pale. Dorsum with long, semi-erect setae. Setal color variable, dark or light. Western populations with setae on pronotum usually stiffer and more erect than setae on hemelytra. Eastern populations with setae on pronotum usually short and pale.

FEMALE: Equal to or slightly larger than male, length 4.0-5.3. Wing development variable, usually sub-macropterous, with fore and hind wings reaching to 6th abdominal segment; fully macropterous individuals less common.

TYPE: **HOLOTYPE** M, Lopidea minor Knight: **Colorado**, 1385 (CU).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea petalostemi Knight: **Iowa**, Story Co., Ames, June 20, 1925, H.H. Knight (USNM). **HOLOTYPE** M, Lopidea johnstoni Knight: **Mississippi**, Alcorn Co., Corinth, May 25, 1931, H.G. Johnston (USNM). **HOLOTYPE** M, Lopidea phlogis Knight: **North Carolina**, Wake Co., Raleigh, June 18, 1942, C.S. Brimley (USNM).

DISTRIBUTION: This species has a wide distribution in North America east of the Rocky Mountains, from Alberta and Colorado, east to New York and Pennsylvania and south to Louisiana and Florida (Map III.25).

DISCUSSION: The proposed synonymies of petalostemi, johnstoni, and phlogis with minor are based on the identical structure of the male genitalia, size and pubescence. Knight (1965) distinguished the former three species from minor by the absence of "erect bristle-like hairs", and undescribed details of the parameres. All specimens of minor that I have examined have semi-erect to erect setae that vary in color from dark to light. I believe that Knight's description of "bristle-like hairs" referred to the erect setae when dark colored. There is very little variation in the genitalia, with the exception of the number and distribution of teeth on the apical angle of the right paramere. The slight variation in the right paramere and total length is clearly infraspecific variation, and the relative length of the rostrum, also used by Knight (1965) to distinguish _johnstoni_ is a function of the size of the specimen. Collection records from April 20 to September 14 with 90% in June to August. Breeds on _Phlox_ spp. (Polemoniaceae) and _Petalostemum_ spp. (Fabaceae).

SPECIMENS EXAMINED:

CANADA: Alberta: Castor; Drumheller; Eisenhower Jct.; Elkwater Pk.; Fisher Creek, A.F.S; Grande Prairie; Kananaskis; Lundbreck; Twin Butte, ex. _Hedysarum_; Wainwright; Waterton Lakes; Waterton Pk.; **British Columbia:** Canal Flat; **Manitoba:** Carberry; Millwood; Riding Mt. Nat'l. Pk.; Russell; St. Lazare; 3 mi S Shilo; 2 mi W Stockton, Sprue-Sand community; **Saskatchewan:** Asquith; Christopher Lake; Cut Knife, Atton's Lake; Duck Lake; Elbow; Kenosee; Killdeer; Lebret; Minton; Prince Albert; Rockglen; Saskatoon.

USA: Colorado: _Larimer Co._: Pinewood; **Florida:** _Gadsen Co._: Mt. Pleasant; **Illinois:** _Mason Co._: Sand Ridge St. For.; **Iowa:** _Cherokee Co._: Larrabee; _Story Co._: Ames; **Kansas:** _Montgomery Co._:; _Scott Co._:; **Louisiana:** _Natchitoches Par._: Kisatchie Nat'l. For.; **Minnesota:** _Waseka Co._: _Marshall Co._: Viking; _Polk Co._:; Waseka; **Mississippi:** _Alcorn Co._: Corinth; **Missouri:** _Benton Co._: Jct. Hwy 65 & 52; **New York:** _Tompkins Co._: Ithaca; **North Carolina:** _Wake Co._: Raleigh; **North Dakota:** _Slope Co._: Burn Coal Vein; _Stark Co._: Dickson; **Oklahoma:** _Crook Co._: 1.5 mi NE Keliyville; **Pennsylvania:** _Chester Co._: Serpentine Barrens, near Nottingham, ex. _Cerastium arvense_; **South Dakota:** _Fall River Co._: Oelrichs, ex. _Symphoricarpos_; _Hanken Co._: Philip; _Shanon Co._: Pine Ridge; **Virginia:** _Highland Co._: Head Waters, Rt. 250, ex.

Phlox subulata; **West Virginia:** *Grant Co.*: ex. *Phlox subulata*; **Wyoming:** *Crooh Co.*: Sundance; *Niobrara Co.*:.

Lopidea nicholella Knight

Figures III.56, III.107; Map III.16

Lopidea nicholella Knight 1965:2 (new species). Henry and Wheeler 1988:422 (catalog).

DIAGNOSIS: Recognized by its small, inornate right paramere (fig. III.56), and long, erect setae.

DESCRIPTION: Small species, length 4.3-4.6; linear. Vertex flat to weakly convex; frons moderately protruding, broadly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance small, equal to width antennal segment II; head long, buccula separated from collar; antennae linear, slender, short, ratio length antennal segment II-head width 1.2-1.4; rostrum reaching metacoxae or slightly beyond.

Genital Capsule: Sensory lobe absent; tergal process long, evenly tapered; dorsal margin minutely crenulate; typically heavily pigmented (fig. III.56d).

Genitalia (figs. III.56, III.107): Right paramere *davisi* type, short; apex weakly tapered ventrally to rounded angle; dorsoapical margin recurved medially, serrate for entire length; medial flange short, elongate, serrate, parallel with dorsal margin of paramere; dorsal flange absent or present as short, thick tooth, recurved medially; basal arm very short, tapered to blunt apex, oriented with axis of paramere and weakly angled ventrally. Left paramere broad; lateral flange extremely broad apically, bluntly rounded; medial flange very narrow, evenly curved. Dorsal spicula long, broad, sharply curved basally, apical margins weakly serrate; basal sclerite small, quadrate, process absent. Ventral spicula long, slender, abruptly constricted near middle, evenly and weakly curved; weakly serrate apically.

COLOR AND VESTITURE: General coloration pale, reddish green to red. Head yellowish green to red, carina and vitae at most weakly infuscated, tylus dark fuscous; antennae dark red to light fuscous, segment I paler; rostrum reddish brown. Coxae and trochanters red to pale; femora red to greenish fuscous, darker dorsally; tibiae dark red to light fuscous; tarsi red to black. Venter light green to pale red. Pronotum green to light red; calli variably infuscated. Scutellum and hemelytra green to light red; lateral margin of hemelytra pale in green specimens. Dorsum with long, semierect, pale setae; length variable.

FEMALE: Slightly larger than male, length 4.5-4.8; macropterous.

TYPE: **HOLOTYPE** M, Lopidea nicholella Knight: **Arizona**, Yavapai Co., Williams, 7000 ft, 15 June, 1925, A.A. Nichol (USNM).

DISTRIBUTION: Uncommon but widely distributed in the western states from western Colorado to the Cascade range in Oregon and south to the transverse ranges of southern California and northern Arizona (Map III.16).

DISCUSSION: Specimens from southern California have a distinct, solid red coloration, but are identical to other populations in all aspects including genitalia. Collections records are from 10 June to 20 September. In the Cascade mountains of Oregon, this species breeds only on Phlox diffusa. Nymphs first appear in late June or early July with adults persisting until late September.

SPECIMENS EXAMINED:

Arizona: Yavapai Co.: Williams, 7000 ft, 15 June; **California:** Los Angeles Co.: Tanbark Flat, 21 June, ex. Lotus (UCB); Tanbark Flat, 24 June, ex. Penstemon, (LACM); Tanbark Flat, 12 July, (UCD); **Colorado:** Mesa Co.: Col. Nat'l. Mont. Liberty Cap Trailhead, 6000 ft, 10 June, ex. Agropyron trachycalum (AMNH); **Oregon:** Harney Co.: T41S R35E S15, 15 July, ex. Lepidodactylon pungens (OSU); Lane Co.: HJA Exp. For., 11 mi NE Blue River, 4750 ft, 16 July - 2 September, ex. Phlox diffusa (OSU); **Utah:** Carbon Co.: Bryce Canyon Rec. Area, 8 mi NW Helper, 8000 ft, 9 July, ex. Cercocarpus ledifolius (AMNH).

Lopidea nigridia Uhler
Figures III.57, III.108; Map III.26

Lopidea nigridia Uhler, 1895:30 (new species). Asquith, 1990 (taxonomy and variation).

Lopidea nigridea: Van Duzee, 1914:28 (list). Van Duzee, 1916:241 (catalog). Van Duzee, 1917:384-385 (catalog). Van Duzee, 1921:127 (new subspecies). Knight, 1923:69 (illustration, discussion). Van Duzee, 1933:96 (note). Carvalho, 1958:87 (catalog). Knight, 1965: 8-10 (illustration). Akingbohungbe, 1972:842 (note). Henry and Wheeler, 1988:422 (catalog). McIver and Asquith, 1989 (biology).

Lopidea nigrida: Osborn, 1898:233 (list, **misidentification**).

DIAGNOSIS: Recognized by the long, erect, spine-like process of the dorsoapical angle of the right paramere (fig. III.57), and its erect, black setae.

DESCRIPTION: Medium sized species length 4.5-6.5, parallel sided or margins weakly arcuate. Vertex flat to weakly concave; frons weakly protruding, broadly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance $\geq$ width antennal segment II; head long, buccula separated from collar; antennae slender, cylindrical, ratio length antennal segment II - head width 1.6-1.8; rostrum reaching meso or metacoxae.

Genital Capsule: Sensory lobe absent or present as a weak vertical ridge. Tergal process long, narrow, apex sharply pointed (fig. III.57d).

Genitalia (figs. III.57, III.108): Right paramere davisi type; ventral angle of apex evenly rounded or with short serrate process, margin of apex serrate; dorsal angle expanded into elongate vertical spine-like process, often bifurcate apically; medial flange present as short serrate ridge parallel with margin of paramere; dorsal flange absent or present as a short tooth; basal arm long, thick, angled ventrally, apex dentate. Left paramere short, thick; lateral flange weakly narrowed, apex broadly rounded; medial flange short, very narrow, situated dorsally. Dorsal spicula short, lanceolate, serrate distally; basal sclerite large, quadrate, process vestigial or absent. Ventral spicula long, slender, evenly curved, weakly expanded at middle; apex entire or minutely serrate.

COLOR AND VESTITURE: General coloration red-fuscous or fuscous-white. Head pale, to red or fuscous; antennae red to black; rostrum reddish fuscous to black. Coxae, trochanters and femora red to dark reddish fuscous; tibiae and tarsi black. Venter reddish fuscous; genital capsule darker. Pronotum greyish fuscous to red; calli variably black. Scutellum reddish fuscous to black. Hemelytra light greyish fuscous to red; clavus and medial area of corium fuscous; embolium frequently pale. Dorsum with large, semi-erect to erect, black setae.

FEMALE: Larger than male, length 4.8-7.5; macropterous to weakly submacropterous.

TYPE: **LECTOTYPE** M, Lopidea nigridia Uhler: **Colorado:** Routt Co., Steamboat Springs, July, C.F. Baker, ex. Delphinium occidentale (USNM).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea aculeata Van Duzee: **Washington:** King Co., Seattle, 7 July, 1917, W.M. Giffard (CAS). **HOLOTYPE** M, Lopidea angustata Knight:, **California:** Contra Costa Co., Antioch, Sand Dunes, 4 June, 1942, H.A. Scullen (USNM). **HOLOTYPE** M, Lopidea audeni Knight: **British Columbia:** Midday Valley, Merritt, July 1925, K.F. Auden (USNM). **HOLOTYPE** M, Lopidea calcaria Knight: **Oregon:** Klamath Co., Crater Lake, South Rim, 29 July, 1930, H.A. Scullen (USNM). **HOLOTYPE** M, Lopidea chamberlini Knight: **Oregon:** Whitman N.F., 22 July, 1914, W.J. Chamberlin (USNM). **HOLOTYPE** M, Lopidea discreta Van Duzee: **California:** Fresno Co., Huntington Lake, 26 July 1919 7,000 ft., E.P. Van Duzee (CAS). **HOLOTYPE** M, Lopidea eriogoni Knight: **Oregon:** Lake Co., Drake Peak, 7850 ft., 26 July, 1930 (USNM). **HOLOTYPE** M, Lopidea fallax Knight: **California:** San Diego Co., below Mt. Springs, 11 June, 1915, H. Morrison (USNM). **HOLOTYPE** M, Lopidea nicholi Knight: **Washington**, Columbia Co., 7 August, 1920, A.A. Nichol (USNM). **HOLOTYPE** M, Lopidea flavicostata Knight and Schaffner: **California:** Camino, 10 July, 1965, H.H. Knight (USNM). **HOLOTYPE** M, Lopidea medleri Akingbuhungbe: **Wisconsin:** Eau Claire Co., Fairchild, 15 July, 1963, J.T. Medler (UWM). **HOLOTYPE** M, Lopidea nigridea hirta Van Duzee: **California:** San Miguel Isl., 20 May, 1919, E.P. Van Duzee (CAS). **HOLOTYPE** M, Lopidea rainieri Knight: **Washington:** Pierce Co., Mt. Rainier, 14 August, 1931, H.H. Knight (USNM). **HOLOTYPE** M, Lopidea rolfsi Knight: **Washington:** Yakima Co.: Mt. Adams, 3 August, 1930, A.R. Rolfs (USNM). **HOLOTYPE** M, Lopidea rubrofusca Knight: **Utah:**

San Juan Co., Monticello, 18 June, 1933, G.F. Knowlton (USNM). **HOLOTYPE** M, Lopidea sculleni Knight: **Oregon:** Baker Co., Cornucopia, 7100 ft, 25 July, 1936, H.A. Scullen (USNM). **HOLOTYPE** M, Lopidea serica Knight: **Colorado:** Boulder Co., Ft. Collins, 28 June, 1900 (USNM). **HOLOTYPE** M, Lopidea usingeri Van Duzee: **California:** Tuolumne Co., Oakland Rec. Camp, 20 July, 1927, R.L. Usinger (CAS). **HOLOTYPE** M, Lopidea wilcoxi Knight: **Washington:** Pierce Co., Mt. Rainier, 13 July, 1931, sunrise, 6318 ft, J. Wilcox (USNM). **HOLOTYPE** M, Lopidea yakima Knight: **Washington:** Thurston Co., Olympia, August, 1893 (USNM).

DISCUSSION: Lopidea nigridia is the most common and widely distributed species in western North America. Collection records are from 4 April to 1 September. West of the Rocky Mountains, this species feeds predominately on Lupinus (Fabaceae), and on Astragalus (Fabaceae) east of the Rockies. The biology of this species in eastern Oregon was described by McIver and Asquith (1989) and the taxonomy and variation was studied in detail by Asquith (1990a). This species is treated as polytypic, with three subspecies distinguished largely by dorsal color pattern and distribution.

Lopidea nigridia nigridia Uhler
Map III.26

Lopidea nigridia nigridia Uhler, 1895:30 (new subspecies). Asquith, 1990a (taxonomy and variation).

Lopidea nigridea nigridea: Van Duzee, 1921:128 (discussion). Henry and Wheeler, 1988:423 (catalog).

Lopidea rainieri Knight, 1965:8-9 (new species). Henry and Wheeler, 1988:423 (catalog).

<u>Lopidea</u> <u>sculleni</u> Knight, 1965:9 (new species). Henry and Wheeler, 1988:424 (catalog).
<u>Lopidea</u> <u>rolfsi</u> Knight, 1965:9 (new species). Akingbohungbe, 1972:842 (note). Henry and Wheeler, 1988:424 (catalog).
<u>Lopidea</u> <u>wilcoxi</u> Knight, 1965:11-12 (new species). Henry and Wheeler, 1988:425 (catalog).

DIAGNOSIS: <u>L</u>. <u>n</u>. <u>nigridia</u> Uhler is small to moderate in size, parallel sided, with a contrasting dorsal color pattern of smoky fuscous on the pronotum, scutellum, clavus and most of the corium and pale white on the outer corium, embolium and cuneus.
DISTRIBUTION: <u>L</u>. <u>n</u>. <u>nigridia</u> occurs along the western slopes of the Rocky Mountains, throughout the Great Basin from southern Nevada and Utah to southern British Columbia (Map III.26). It is the common form along the western slopes of the Cascade and northern Sierra Nevada Mountains and occurs west of these ranges through xeric, low elevation passes and river basins in California. <u>n</u>. <u>nigridia</u> also occurs throughout the coastal chaparral of southern California and into Baja California Norte. This subspecies inhabits the sage brush-steppe habitat of the Great Basin, xeric mountain slopes and dry lowlands. Its range appears to interdigitate with and superimpose on the ranges of the other two subspecies in some areas. However, the subspecies appear to be segregated by habitat in areas of sympatry, with <u>n</u>. <u>nigridia</u> inhabiting xeric shrub-steppe or chaparral habitats and the other subspecies occurring in more mesic conditions, usually at higher elevations.

<u>Lopidea</u> <u>nigridia</u> <u>aculeata</u> Van Duzee
Map III.26

Lopidea aculeata Van Duzee, 1917:271 (new species). Knight, 1965:11 (color, distribution). Henry and Wheeler, 1988:417 (catalog). Asquith, 1990a (taxonomy, variation),

Lopidea discreta Van Duzee, 1921:127 (new species). Carvalho, 1958:84 (catalog). Henry and Wheeler, 1988:419 (catalog).

Lopidea nigridea hirta Van Duzee, 1921:128, (new subspecies). Carvalho, 1958:87 (catalog). Henry and Wheeler, 1988:423 (catalog).

Lopidea fallax Knight, 1923:69 (new species). Van Duzee, 1933:96 (note); Carvalho, 1958:84 (catalog) Henry and Wheeler, 1988:420 (catalog).

Lopidea yakima Knight, 1923:69-70 (new species). Carvalho, 1958:88 (catalog). Henry and Wheeler, 1988:425 (catalog).

Lopidea nicholi Knight: 1923:70 (new species). Henry and Wheeler, 1988:422 (catalog). **NEW SYNONYMY**

Lopidea usingeri Van Duzee, 1933:96 (new species). Carvalho, 1958:88 (catalog). Henry and Wheeler, 1988:425 (catalog).

Lopidea audeni Knight, 1965:9-10 (new species). Henry and Wheeler, 1988:417 (catalog).

Lopidea eriogoni Knight, 1965:10 (new species). Henry and Wheeler, 1988:420 (catalog).

Lopidea calcaria Knight, 1965:11-12. (new species). Henry and

Wheeler, 1988:418 (catalog).

Lopidea chamberlini Knight, 1965:12-13. (new species, note). Henry and Wheeler, 1988:418 (catalog).

Lopidea angustata Knight, 1965:12 (new species). Henry and Wheeler, 1988:417 (catalog).

Lopidea rubrofusca Knight, 1965:13 (new species). Henry and Wheeler, 1988:424 (catalog).

Lopidea _flavicostata_ Knight and Schaffner, 1968:75 (new species). Henry and Wheeler, 1988:420 (catalog).

DIAGNOSIS: _L_. _n_. _aculeata_ Van Duzee is highly variable in size and coloration. It is usually larger than _n_. _nigridia_ and often larger than _n_. _serica_, but always more linear than the latter. In the mountains of British Columbia, Washington and Oregon it is solid red in dorsal coloration with more yellowish individuals found at lower elevations. In northern California individuals show some white along the embolium and cuneus and this pattern increases in distinctness and frequency in southern populations.

DISTRIBUTION: _L_. _n_. _aculeata_ occurs in the Cascade Mountains of British Columbia, Washington and Oregon, the eastern slopes of the coastal mountain ranges in these areas and in the Blue and Wallawa Mountains of Oregon and Washington (Map III.26). It occurs throughout the Coastal and Sierra Nevada Ranges of California. In southern California, however, the ranges of the _n_. _aculeata_ and _n_. _nigridia_ overlap, and specimens intermediate and distinct in color pattern occur.

DISCUSSION: The synonymy of _nicholi_ with _n_. _aculeata_ is based on the structure of the parameres and the dorsal color pattern. The holotype is a teneral specimen and the apex of the right paramere is folded medially, which is why Knight's (1923) illustration looks so different. The ventral angle of the right paramere also has serrate process, which is found only in _n_. _aculeata_.

Lopidea _nigridia_ _serica_ Knight

Map III.26

Lopidea serica Knight, 1923:69 (new species). Strickland, 1953:200 (list). Akingbohungbe, 1972:842 (note). Kelton, 1980:235 (description, illustration, distribution, host plant). Henry and Wheeler, 1988:424 (catalog). Asquith, 1990a (taxonomy, variation),
Lopidea medleri Akingbohungbe, 1972:840-842 (new species). Henry and Wheeler, 1988:422 (catalog).

DIAGNOSIS: L. n. serica Knight is larger, more robust, with the lateral margins usually arcuate and solid red in dorsal coloration, except for black on the calli and light infuscation on the clavus. Females are usually submacropterous, with the membrane of the hemelytra reduced and barely reaching the end of the abdomen.
DISTRIBUTION: L. n. serica occurs along the eastern slopes of the Rocky Mountains from Alberta to Colorado and east across the northern Great Plains to southern Manitoba Map (III.26). It appears to inhabit the mesic grasslands of the eastern Rocky Mountains and Short-grass Prairie systems. There are two interesting disjunct localities for n. serica in western Wisconsin and southeastern Yukon Territory and adjacent Alaska.

Lopidea picta Knight

Figures III.58, III.109; Map III.27

Lopidea picta Knight 1918:214 (new species). Henry and Wheeler, 1988:423 (catalog).
Lopidea oregona Hsiao 1942:160 (new species). Henry and Wheeler, 1988:423 (catalog). **NEW SYNONOMY.**
Lopidea calli Knight 1962:29 (new species). Henry and Wheeler, 1988:418 (catalog). **NEW SYNONOMY.**

Lopidea knowltoni Knight 1965:6 (new species). Knight, 1968:99 (list, host plant). Henry and Wheeler, 1988:421 (catalog). **NEW SYNONOMY.**

Lopidea utahensis Knight 1965:6 (new species). Henry and Wheeler, 1988:425 (catalog). **NEW SYNONOMY.**

Lopidea yampae Knight 1965:7 (new species). Kelton, 1980:232 (description, illustration, distribution, host plant). Henry and Wheeler, 1988:425 (catalog). **NEW SYNONOMY.**

DIAGNOSIS: Recognized by is its pale grey-green or fuscous-white coloration, erect, pale setae and extremely short, blunt tergal process (fig. III.58).

DESCRIPTION: Small species, length 4.57 - 5.18; broadly linear. Head broad, vertex weakly concave; frons narrowly to moderately rounded, weakly protruding; eyes large, reaching to or just short of frons-tylus suture; eye-antennal fossa distance slightly less than width of antennal segment II; antennae slender, cylindrical, short, ratio length antennal segment II-head width 1.4-1.5; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe well developed as narrowly rounded process; tergal process extremely short, thick angled ventrally (fig. III.58d).

Genitalia (figs. III.58, III.109): Right paramere short media type or narrow davisi type; apex rounded or angled, dorsoapical margin serrate; medial flange present as thick, elongate, serrate ridge, parallel with margin of paramere; dorsal flange present as one to 3 short teeth, not connected basally; basal arm narrow, very short. Left paramere short; lateral flange short, apex broadly rounded; medial flange thick, weakly curved ventrally. Dorsal spicula short, slender, slightly sinuous, weakly serrate apically; basal sclerite large, quadrate, process absent. Ventral spicula

short, broad, evenly narrowed distally, apex weakly serrate.
COLOR AND VESTITURE: Color highly variable from pale greyish green to black. Head white to fuscous, medial border of eyes always pale; jugae and lora also white; antennae light fuscous to black; rostrum reddish brown. Appendages pale to fuscous. Dorsum pale greyish greed to black; midstripe on scutellum, and embolium usually pale even in dark specimens. Dorsum with short, erect, pale setae.

TYPE: **HOLOTYPE** M, Lopidea picta Knight: **Colorado**, Pueblo Co., Pueblo, June 15, 1900, E.D. Ball. (CU).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea oregona Hsiao: **Oregon**, Grant Co., Seneca, June 11, 1935, J. Schuh (CAS). **HOLOTYPE** M, Lopidea calli Knight: **Utah**, San Juan Co., La Sal, A. Call Jr. (USNM). **HOLOTYPE** M, Lopidea knowltoni Knight: **Utah**, Pinion Canyon, June 24, 1933, G.F Knowlton, ex. Chrysothamnus (USNM). **HOLOTYPE** M, Lopidea utahensis Knight: **Utah**, Juab Co., Fernow Valley, June 6, 1940, R.W. Fautin (USNM). **HOLOTYPE** M, Lopidea yampae Knight: **Colorado**, Routt Co., Steamboat Springs, July 11, 1964, H.H. Knight, ex. Artemisia (USNM).

DISTRIBUTION: Lopidea picta is widely distributed in western North America east of the Cascade and Sierra Nevada Mountain Ranges. It occurs predominately in the Great Basin province, but is also found in the Short-Grass Prairie Province along the eastern slopes of the southern Rocky Mountains (Map III.27).

DISCUSSION: The proposed synonomy of oregona, calli, knowltoni, utahensis and yampae with picta is based on the identical structure of the vesicae, continuous variation in paramere structure and dorsal coloration, and common host plants. L. oregona, calli, utahensis and yampae were described from specimens that are almost solid black and represent the dark color extreme of variation in this species.

There is no clear geographic pattern in the distribution of the color forms of picta (Map III.27). Dark forms seem to be taken more commonly at higher elevations and further North. Some population have longer, more erect setae on the dorsum, and the males have longer setae on the ventral surface of the genital capsule. Specimens collected east of the Rockies are usually larger than western specimens. There is also clinal east-west variation in the size and shape of the right paramere. In eastern populations the right paramere is longer and more slender, becoming shorter and thicker in western populations (fig. III.58).

Lopidea picta ocurrs predominately on desert shrubs in the genera Artemisia and Chrysothamnus. Of 44 host records, 49% were Artemisia and 34.5% were Chrysothamnus; no other genus of plant was recorded more than once, although Knight (1968) reported collecting a large series on Chaenactus steviodes. The only confirmed breeding record is for Chrysothamnus nauseosus in southern Oregon. Collections records are from April 19 to July 22, with 93% from June and July.

SPECIMENS EXAMINED:

CANADA: Alberta: Iovine; **British Columbia:** 7 mi E Indian Reservation, Oliver.

USA: Arizona: Apache Co.: Eagar, Apache Nat'l. For., ex. Chrysothamnus; Coconino Co.: Flagstaff; Kaibab Nat'l. For., Rt. 64 SE Grand Cyn. Nat'l. Pk., ex Artemisia sp.; **California:** Inyo Co.: 5 mi S Crooked Crk., White Mt.; Lassen Co.: Doyle St. Wildlife Pres.; Mono Co.: Oasis; San Bernadino Co.: Apple Valley; Mohave River Forks Recreation Area, 9 mi S Hesperia, 2030 ft, ex Artemisia tridentata; Ord Mt., ex Senecio douglasii; Siskiyou Co.: Bray; Hornbroock, ex Chrysothamnus nauseosus, Artemisia; 5 mi S

MacDoel; 12 mi N Hwy. 89, Powder Hill Rd., ex Chrysothamnus viscidiflorus; Tulare Co.: 21 mi W Rt. 395 toward Kennedy Meadows, 5280 ft, ex Chrysothamnus parryi; **Colorado:** Archuleta Co.: Piedra, San Juan Nat'l. For., ex. Chrysothamnus; Chaffee Co.: Buena Vista, 7800 ft; Poncha Springs, 7500 ft; Grand Co.: Berthoud Pass; Gunnison Co.: Salida; Moffat Co.: Craig; Pueblo Co.: Pueblo; Rio Blanco Co.: W Evacuation Crk., 4 mi SE Colorado state border, ex Artemisia tridentata; Idaho: Butte Co.: 6 mi S Howe, ex Artemisia tridentata; ex Chrysothamnus viscidiflorus; ex Chrysothamnus viscidiflorus; 10 mi E Howe; Custer Co.: Stanley; Owyhee Co.: 6 mi SE Grasmere; **New Mexico:** Guadeloupe Co.: Cuervo; Rio Arriba Co.: Echo Amphitheater; Santa Fe Co.: Glorieta Pass, ex. Chrysothamnus; hills W Santa Fe; **Nevada:** Elko Co.: Carlin; 2.2 mi NE Cobre on NV Rt. 233, 5900 ft; 16 mi SE Elko on Rt. 227, 5600 ft, ex Lupinus; Wells; Eureka Co.: 28 mi W Eureka on Rt. 50, 6000 ft, ex Gutierezia sarathrae; 12 mi N Rt. 50 on Rt. 278, 5800 ft, ex Artemisia tridentata; ex Atriplex confertifolia; Humboldt Co.: 27 mi W Denio; Landers Co.: Smith Crk. Valley, 9 mi S Rt. 2, 6300 ft, mercury vapor light; Lyon Co.: Toiyabe Nat'l. For., 8 mi N Sweetwater Summit, 5940 ft, ex Chrysothamnus nauseosus; Nye Co.: 1 mi NE Belmont, 7300 ft, ex Artemisia sp.; 1 mi N Belmont, 7200 ft, ex Artemisia nova; 5.5 mi S Belmont, 6500 ft, ex Artemisia tridentata; 7300 ft, ex Artemisia tridentata; 3.5 mi SE Manhattan, Toiyabe Nat'l. For., 6170 ft, ex Artemisia tridentata; Mercury; 15.5 mi E Rt. 376 on Northumberland Mine Rd., 7000 ft; White Pine Co.: 8.3 mi N Hwy 50 on Steptoe Crk. Rd., 7500 ft, ex Artemisia sp.; **Oklahoma:** Cimarron Co.: Mexhoma, sweeping roadside; **Oregon:** Deschutes Co.: 2 mi E Redmond; Jackson Co.: Mt. Ashland; Siskiyou; Siskiyou Summit on old Hwy. 99, ex Chrysothamnus sp.; Siskiyou Summit on I-

5, ex Artemisia tridentata; .5 mi. S Siskiyou Summit on old Rt. 99, 4420 ft, ex Artemisia cana; 4300 ft, ex Artemisia cana; Hwy. 66, 9 mi E Ashland, ex Chrysothamnus sp.; Harney Co.: T41S, R36E, S8, ex Artemisia tridentata; T41S, R35E, S15, ex Chrysothamnus viscidiflorus; ex Chrysothamnus nauseosus; 3 mi S Hdq. Squaw Butte Experimental Station, ex Artemisia sp.; **Utah:** Carbon Co.: Minnie Maud Crk., 51.8 mi SW Myton, 6500 ft, ex Artemisia tridentata; Duchesne Co.: 23.7 mi S Myton, Wells Draw, 6000 ft, ex Artemisia tridentata; Garfield Co.: jct. Rts. 95 & 276, 4000 ft, ex Chrysothamnus nauseosus; Hatch, ex. Chrysothamnus; Red Canyon Camp, 11 mi. SE Panguitch, 7100 ft; Iron Co.: 4 mi N Beryl Jnct.; 12 mi NW Orton; San Juan Co.: 3 mi W Clay Hills Crossing, 5600 ft, ex Artemisia tridentata; ex Cryptantha flava; La Sal; 11 mi SE Monticello; Sevier Co.: Salt Gulch, 12 mi N Hwy. 24, 8000 ft, ex Chrysothamnus viscidiflorus; 11 mi W Sevier on Rt. 4, 6560 ft, ex Chrysothamnus sp.; 11 mi W Sevier on I-70, 6400 ft, ex Chrysothamnus viscidiflorus; 2.3 mi N I-70 on Rd. to Kanosh, 6980 ft, ex Artemisia sp.; 24.7 mi N Hwy. 24 on Hwy. 72, 7960 ft, ex Artemisia sp.; Uintah Co.: 5-10 mi SW Bonanza, Asphalt Wash, 5000-5600 ft, ex Chrysothamnus nauseosus; ex Amelanchier utahensis; ex Sarcobates vermiculatus; ex Artemisia tridentata; Washington Co.: 3 mi N Pine Valley; Wayne Co.: Hanksville; Co.?: Gooseberry, Fishlake Nat'l. For.; Long Hollow, Dixie Nat'l. For.; Collton; Steep Crk., Boulder Mt., 9500 ft; **Washington:** Franklin Co.:; **Wyoming:** Carbon Co.: Medicine Bow, 6600 ft; Hot Springs Co.: Thermopolis; Uinta Co.: Lyman.

Lopidea pteleae Knight and Schaffner

Figures III.59, III.110; Map III.13

Lopidea pteleae Knight and Schaffner, 1968:75 (new species). Henry and Wheeler, 1988:423 (catalog).

DIAGNOSIS: Very similar to salicis and heidemanni. Distinguished from salicis by the absence of a developed sensory lobe on the male genital capsule. Distinguished from heidemanni by the short first antennal segment and the short medial flange on the right paramere (fig. III.59).

DESCRIPTION: Small to medium sized species, length 5.3-5.8, sides weakly arcuate. Vertex flat to slightly concave; frons weakly protruding; eyes large, reaching to or slightly below frons-tylus suture; eye-antennal fossa distance short, < width antennal segment II; head long, buccula separated from collar by less than width of second antennal segment; antennae cylindrical, ratio antennal segment II- head width 1.6-1.7; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe on genital capsule not developed; tergal process extremely short, abruptly narrowed to a blunt, hooked apex (fig. III.59d).

Genitalia (figs. III.59, III.110): Right paramere media type; apex weakly narrowed, dorsoapical margin strongly serrate, teeth variable in size; medial flange present as short, raised dentate lobe; dorsal flange present as short, broad process, apex weakly serrate; basal arm long, slender, oriented with axis of paramere and angled slightly medially, apex weakly dentate. Left paramere broad; lateral flange short, apex broadly rounded; medial flange long, thick, curved ventrally. Dorsal spicula short, slender, weakly curved, apex entire or minutely dentate; basal sclerite large, process short. Ventral spicula short, slender, slightly expanded near middle, bifurcate just distal of expansion; primary arm strongly recurved, apex almost perpendicular to axis of spicula, apex minutely dentate; secondary arm sinuous, very slender, longer than primary arm, margins entire.

COLOR AND VESTITURE: General coloration red. Head red, medial border of eyes, jugum and gena rufous to white; antennae black; rostrum reddish brown. Appendages fuscous to black. Pronotum solid red, anterior margin of pronotum rarely pale; calli fuscous to black. Scutellum fuscous. Hemelytra red; clavus and medial aspect of corium occasionally infuscated. Dorsum with short, semi-erect, dark setae.

FEMALE: Same size as male, length 5.4-5.8; macropterous.

TYPE: **HOLOTYPE** M, Lopidea pteleae Knight and Schaffner: **Texas**, Burnet Co., Inks State Park, April 17, 1966, J.C. Schaffner (USNM).

DISTRIBUTION: Known only from the Edwards Plateau of south central Texas (Map III.13).

DISCUSSION: Collection records from April 1 to May 6 with 80% in April. Reported breeding on Ptelea trifoliata L. (Knight and Schaffner, 1968).

SPECIMENS EXAMINED:

Texas: Bosque Co.: 2 mi S Walnut Sprgs.; Burnet Co.: Inks St Pk.; Longhorn Cavern St. Pk.; Edwards Co.: 14 mi W Rock Springs; Frio Co.: 3 mi N Moore; Rt 35, 15mi N Pearsall, ex. Rosaceae; Gillespie Co.: Fredricksburg; Lange's Mill; Kerr Co.: Kerrville; Kimble Co.: Junction; Llano Co.: 13 mi W Llano; Somervell Co.: 10 mi W Glen Rose; Sutton Co.: Sonora; Co.?: E of Nueces River, Laguna, ex. Yucca.

Lopidea puella Van Duzee

Figures III.60, III.111; Map III.7

Lopidea puella Van Duzee 1921:126 (new species). Henry and Wheeler, 1988:423 (catalog).

DIAGNOSIS: Recognized by its small size, short, erect, black setae and strongly submacropterous females. Distinguished from fuscosa Van Duzee by its davisi type right paramere (fig. III.60).

DESCRIPTION: Small species, length 4.2-4.8; linear. Vertex flat; frons weakly protruding, narrowly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance short, equal to width antennal segment I; head relatively short, buccula touching or just separated from collar; antennae slender, linear, short, ratio length antennal segment II - head width 1.2-1.5; rostrum reaching to metacoxae or slightly beyond.

Genital Capsule: Sensory lobe absent; tergal process long, straight, apex tapered to sharp point (fig. III.60d).

Genitalia (figs. III.60, III.111): Right paramere davisi type; apex weakly tapered ventrally, ventral angle broadly rounded, apex strongly recurved medially, dorsoapical margin with short, digitiform process; medial flange indistinct, reduced to low raised ridge; dorsal flange present as short, wide serrate process; basal arm very short, thick, apex narrowly blunt or weakly dentate, orientation highly variable, from vertical to oriented with axis of paramere. Left paramere broad vertically; dorsal margin of angle expanded vertically; dorsal margin of base with horizontal, digitiform flange; lateral flange very short, tapered ventrally, ventral angle acutely rounded; medial flange very long, usually strongly recurved towards base of paramere. Dorsal spicula very long, narrow, evenly curved, apex serrate; basal sclerite very large, triangular, process very long. Ventral spicula very short, slender, straight, margins entire.

COLOR AND VESTITURE: General coloration fuscous and white. Head pale yellow to dirty white, midstripe of frons reddish brown; antennae reddish-brown to dark fuscous; rostrum reddish brown. Coxae yellowish fuscous, apices white; femora and tibiae yellowish fuscous, femora spotted with black; tarsi dark fuscous. Venter yellowish fuscous; genital capsule dark reddish brown. Pronotum greyish fuscous; lateral and anterior margins pale; calli dark fuscous. Scutellum grey to dark fuscous. Hemelytra greyish fuscous; embolium, cuneus and occasionally corial-claval suture pale. Dorsum with short, black, erect setae, prominent on head and pronotum.

FEMALE: Shorter than male, length 3.8-4.3; submacropterous, last abdominal segment visible from above; hind wings reaching to fifth abdominal tergite.

TYPE: **HOLOTYPE** M, _Lopidea_ _puella_ Van Duzee: **California**, _Monterey Co._, Bryson, May 18, 1920, E.P. Van Duzee (CAS).

DISTRIBUTION: Known only from the Coastal and Transverse mountain ranges of southern California (Map III.7).

DISCUSSION: Although few specimens are known, it is evident that there is variation in the shape of the right paramere among populations. No host plant information is available. Collection records from 18 May to 6 July.

SPECIMENS EXAMINED:

California: _Monterey Co._: Bryson, May 18 (CAS); _San Diego Co._: Laguna Mts., July 6 (KU); Mt. Laguna, June 21 (UCB); _Riverside Co._: Keen Camp, San Jacinto Mts., June 10 (UCB).

Lopidea _robiniae_ (Uhler)

Figures III.61, III.112; Map III.28

Capsus robiniae Uhler, 1861:24 (new species).
Lopidea media var. *robiniae*: Uhler, 1872:412. Van Duzee, 1887:70 (list). Wirtner, 1904:199 (list).
Lopidea robiniae: Van Duzee, 1916:44 (list). Leonard, 1916:49 (immatures). Knight, 1918b:211 (illustration, host plant). Knight, 1923:505 (description, illustration, host plant). Blatchley, 1926:839 (description). Watson, 1928:38 (list, host plant). Knight, 1941:89 (description, illustration, host plant). Froeschner, 1949:168 (list, host plant). Slater, 1950:50 (illustration). Pimentel and Wheeler, 1973:661 (list). Wheeler and Henry, 1977:150, 152 (list, host plant). Henry and Smith, 1979:214 (list). Akingbohungbe, 1983:39 (testicular follicles). McPherson et al., 1983:37 (list). Wheeler et al., 1983:141 (list, host plant). Snodgrass et al., 1984:853 (list, host plant). Blinn and Yonke, 1985:82 (list, host plant). Henry and Wheeler, 1988:423 (catalog).

DIAGNOSIS: Recognized by its brightly contrasting yellow-black dorsal color pattern and its distinctly C-shaped right paramere (fig. III.61).

DESCRIPTION: Medium to large species, length 5.9-6.6; sides weakly arcuate. Vertex flat to weakly concave; frons moderately protruding, narrowly rounded; eyes relatively short, not or just reaching frons-tylus suture; eye-antennal fossa distance short, less than width antennal segment II; head long, buccula distinctly separated from collar; antennae thick, cylindrical, ratio length antennal segment II - head width 1.7-1.9; rostrum reaching mesocoxae or just beyond.

Genital Capsule: Sensory lobe absent; tergal process thick, evenly tapered to sharp, ventrally hooked apex (fig. III.61d).

Genitalia (figs. III.61, III.112): Right paramere robiniae type; dorsal arm long, thick, vertical, apex strongly curved medially and horizontally, dorsomedial margin of apex with 2-4 short teeth; ventral arm short, flattened vertically, dorsal margin serrate; basal arm very short, vestigial, horizontal. Left paramere narrow; lateral flange short, extremely narrow, strongly tapered ventrally; medial flange situated dorsally, very narrow. Dorsal spicula long, wide basally, strongly narrowed distally, one margin strongly serrate distally; basal sclerite large, quadrate, process very short. Ventral spicula long, very slender, bifurcate at middle; secondary arm very slender, half to one third length of primary arm; primary arm weakly serrate apically.

COLOR AND VESTITURE: General coloration yellow and black. Head yellow; antennae dark reddish fuscous to black, distal segments lighter; rostrum yellowish brown. Coxae and trochanters white to yellow, some infuscation; femora yellowish fuscous; tibiae and tarsi dark fuscous to black. Venter yellow; genital capsule yellowish brown. Pronotum yellow, medial area variably fuscous; calli yellow to fuscous. Scutellum fuscous to black. Hemelytra yellow; clavus and medial area of corium and membrane dark fuscous to black. Dorsum with moderate length, inclined setae. Setae black on fuscous areas, pale on yellow areas.

FEMALE: Larger than male. length 5.9-7.0; macropterous.

TYPES: **LECTOTYPE** M, Capsus robiniae Uhler (here designated): (USNM). **PARALECTOTYPE** F, Capsus robiniae Uhler (here designated): (USNM).

DISTRIBUTION: Widely distributed in most of eastern North America, and west to Colorado (Map III.28).

DISCUSSION: Uhler (1861) did not designate a type in his description of robiniae. The specimens he examined were from

Maryland and one was taken on wild grape. I found two specimens in the USNM both identified as Capsus robiniae by Uhler. A male specimen with the following data labels 5823/ Capsus robiniae Uhler (in Uhler's handwriting). Although this specimen is in poor condition, it is the only male that I examined which had been identified as robiniae by Uhler, and the parameres are intact, allowing it to be unequivocally identified. I have chosen this specimen as the lectotype and I have attached a label with the following data: LECTOTYPE, Capsus robiniae Uhler, Det. A. Asquith. A single female bears the following label data: July, Grape/ P.R. Uhler Collection/ Capsus robiniae Uhler (in Uhler's handwriting)/ Capsus robiniae Uhler Det. Uhler (in Uhler's handwriting). This is apparently the female that Uhler mentioned in his description. I have selected this specimen as a paralectotype and attached a label with the following data: PARALECTOTYPE, Capsus robiniae Uhler, Det. A. Asquith. This species appears to breed exclusively on Robinia pseudoacacia (Fabaceae). Although it is one of the most common, widespread eastern species, there is little known of its biology. Collection records are from 25 May to 14 September with 95% in June to August.

SPECIMENS EXAMINED:

CANADA: Ontario: Bells Corners, ex. Robinia; Burtch, ex. Robinia; Clearcreek, ex. Robinia, 18 July; Dalston; Effingham, ex. Robinia pseudoacacia; Marmora, ex. Robinia psuedoacacia; Mt. Vernon, ex. Robinia; New Glasgow; Niagra, ex. Robinia; Simcoe; Tillsonburg, ex. Honey Locust; Turkey Point, ex. lupine; Vienna, ex. Robinia.

USA: Arkansas: Craighead Co.: ex. locust; Hempstead Co.:; Johnson Co.: Clarksville; Mississippi Co.: ex. locust; Washington Co.: ex. elm; **Colorado:** Douglas Co.: Waterton; **Connecticut:** Fairfield Co.: Westport; New Haven Co.:

Branford; New London Co.: Old Lyme; Tolland Co.: Kingsbury; **District of Columbia:** Washington; **Georgia:** Clarke Co.: Athens; Fannin Co.: Blue Ridge; Rabun Co.: Rabun Bald, 4600 ft.; Union Co.: Blainsville; **Illinois:** Alexander Co.: McClure, ex. Robinia pseudoacacia; Cook Co.: Chicago; Edwards Co.: Browns; Effingham Co.: Effingham; Gallatin Co.: Shawneetown; Hardin Co.: Elizabethtown; Jackson Co.: Carbondale; Jo Davies Co.: Galena, ex. Robinia pseudoacacia; Knox Co.: Galesburg; Lake Co.: Antioch, ex. Robinia pseudoacacia; McHenry Co.: Algonquin; Madison Co.: Alton, ex. Robinia pseudoacacia; Mason Co.: Bishop; Havana; Manito; Piatt Co.: Monticello, ex. Robinia pseudoacacia; Pulaski Co.: Mound City; Villa Ridge, ex. peach; Sangamon Co.: Springfield; Union Co.: Anna; Whiteside Co.: Union Grave; Williamson Co.: Stonefort, ex. black locust; **Indiana:** Rush Co.:; Tippecanoe Co.: West Lafayette, ex. Robinia pseudoacacia; **Iowa:** Johnson Co.: Iowa City, ex. Robinia sp.; Story Co.: Ames; Ledges St. Pk.; **Kansas:** Douglas Co.:; Riley Co.:; Sumner Co.: Crawey Springs; **Louisiana:** Madison Parish: Mound, ex Robinia pseudoacacia; **Maryland:** Anne Arundell Co.: Mayo; Odenton; Charles Co.: Marsh Hall; Montgomery Co.: Cabin John Run; Glen Echo; Great Falls; **Massachussetts:** Essex Co.: Beach Bluff, ex. locust; Beverly; **Michigan:** Cheboygan Co.:; Clinton Co.: Rose Lake Wild. Exp. St.; Ingham Co.: East Lansing; Isabella Co.:; Kalamazoo Co.: Gull Lake Biol. St.; Kent Co.: Grand Rapids; Midland Co.:; Sanilac Co.: Port Sanilac; **Mississippi:** Oktibbeha Co.: Starkville; Pontotoc Co.: 1 mi SE Ecru; Tishomingo Co.: Iuka; **Missouri:** Boone Co.: Columbia, ex. black locust; light trap; Callaway Co.: Tucker Prairie; Morgan Co.:; St Louis Co.: Jefferson Barracks Pk.; Vernon Co.: light trap; **New Hampshire:** Strafford Co.: Lee; **New Jersey:** Bergen Co.: Alpine; Mercer Co.: Mercerville; Middlesex Co.: New

Brunswick; Monmouth Co.: Oakhurst; Sussex Co.: Duttonville; **New York:** Cattaraugus Co.: Gowanda; Erie Co.: Lancaster; Genesee Co.: Batavia; Greene Co.: East Durham; Nassau Co.: Muttontown Pk., ex. *Quercus palustris*; Reslyn, ex. *Robinia pseudoacacia*; Ontario Co.: Honeyoye Falls; Orange Co.: Campbell Hall; Oswego Co.: Pulaski; Queens Co.: Flushing Meadow Corona Pk., ex. *Robinia pseudoacacia*; Suffolk Co.: Caumsett St. Pk, ex. *Robinia pseudoacacia*; Cold Springs Harbor; Tompkins Co.: Ithaca; Westchester Co.: Crugers; Wyoming Co.:; Co.??: Long Island; **North Carolina:** Ashe Co.: Mt. Jefferson; New River; Willets, Smoky Mts., 2000 ft.; Buncombe Co.: Asheville; Cherokee Co.: Junaluska; Graham Co.: Robbinsville; Haywood Co.: Sunburst; Jackson Co.: Balsam; Macon Co.: Wayah Gap; Madison Co.: Hot Springs; Mitchell Co.: Spruce Pines; Swain Co.:; Wake Co.: Raleigh, ex. black locust; **Oklahoma:** Le Flore Co.:; Mayes Co.: Spavinaw, ex. black locust; **Pennsylvania:** Bedford Co.:; Westmoreland Co.: Jeanette; Keystone St. Pk; **Rhode Island:** Washington Co.: Kingston; **South Carolina:** Greenville Co.: Greenville; Oconee Co.: Walhalla; **Tennessee:** Henderson Co.: Natchez Trace St. Pk.; Lauderdale Co.: Naukipoo, ex. *Robinia pseudoacacia*; **Vermont:** Addison Co.: Middlebury; **Virginia:** Fairfax Co.: Hylda Valley; Springfield; Faurquier Co.: Paris;

Giles Co.: Mt. Lake Biol. St.; Montgomery Co.: ex. locust; Roanoke Co.: Roanoke; Shenandoah Co.: Shenandoah Big Meadows; **West Virginia:** Greenbriar Co.: 2 mi E Ruppert; Jefferson Co.: Harper's Ferry; Morgan Co.: Berkeley St. Pk.; **Wisconsin:** Dane Co.: Madison; Lincoln Co.: Merril; Walworth Co.:; East Troy Co.:; Waupaca Co.: Waupaca; **Wyoming:** Co.??: Riverdale (AMNH).

Lopidea salicis Knight
Figures III.62, III.113; Map III.13

Lopidea salicis Knight, 1917:457 (new species). Knight, 1923:504 (description, illustration, host plant). Blatchley, 1926:843 (description). Knight, 1927:39 (distribution, host plant). Knight, 1941:89 (description, illustration, host plant). Froeschner, 1949:169 (list, host plant). Wheeler et al., 1983:141 (list, host plant). Blinn and Yonke, 1985:82 (list, host plant). Henry and Wheeler, 1988:424 (catalog).

DIAGNOSIS: Very similar to heidemanni and pteleae, distinguished by the presence of a small, cylindrical, well defined sensory lobe on the genital capsule.
DESCRIPTION: Medium sized species, length 5.7-6.8, elongate, parallel-sided. Vertex very narrow, flat; frons moderately protruding; eyes large, reaching to or beyond frons-tylus suture; eye-antennal fossa distance very short, < width of antennal segment III; head relatively long, buccula separated from collar by width of antennal segment III or less; antennae cylindrical, long, ratio length antennal II-width of head $\geq$ 2.0; rostrum reaching to mesocoxae. Anterior lobe of pronotum weakly transversely rugose; lateral margins slightly explanate.

Genital Capsule: Sensory lobe of genital capsule small but well developed cylindrical lobe; tergal process very short, abruptly narrowed to point (fig. III.62d).

Genitalia (figs. III.62, III.113): Right paramere media type; apex weakly tapered to bluntly rounded ventral angle, dorsoapical margin strongly serrate; medial flange present as short, erect, dentate lobe; dorsal flange present as short, wide serrate process; basal arm slender, elongate, oriented with axis of paramere. Left paramere large; lateral flange with apex broadly rounded; medial flange long, thick, weakly curved ventrally. Dorsal spicula short, margins serrate; basal sclerite small, quadrate, process well developed. Ventral spicula very long, curved, widest at middle, tapered distally, apex sparsely serrate.

COLOR AND VESTITURE: General coloration reddish black. Head red, medial margin of eyes rufous, jugum and gena occasionally pale; antennae black; rostrum fuscous. Coxae and trochanters rufous to fuscous; rest of appendages red to black. Pronotum yellowish red, lateral margins occasionally pale; calli fuscous to black. Scutellum dark fuscous. Hemelytra yellowish red to rufous; medial aspect of corium usually infuscated; embolium rarely pale. Dorsum with short, inclined setae, usually dark, especially on fuscous areas, but occasionally pale on light colored areas.

FEMALE: Slightly larger than male, size 5.9-7.0; antennae weakly tapered distally; macropterous.

TYPE: **HOLOTYPE** M, Lopidea salicis Knight: **New York**, Monroe Co., Honeoye Falls, June 27, 1916, H.H. Knight (USNM).

DISTRIBUTION: This species occurs from Minnesota, Colorado and Texas, northeast to New York and Ontario (Map III.13).

DISCUSSION: Collections records from April 25 to July 20 with 75% in May and June. Collected on Carya, Salix, Ulmus and Quercus. I have seen no confirmed breeding records, but Knight (1927) records it breeding on Ulmus.

SPECIMENS EXAMINED:

CANADA: Ontario: Ottawa; Sterling, ex. Ulmus americana.

USA: Arkansas: Washington Co.: ex oak; **Colorado:** Larimer Co.: Ft. Collins; **Illinois:** Jo Daviess Co.: Galena, ex. elm; Hardin Co.: Elizabethtown; Henderson Co.: Oquawka; Piatt Co.: White Heath; **Indiana:** Pike Co.: Rogers, at light; **Iowa:** Story Co.: Ames, ex. Ulmus; **Kansas:** Riley Co.:; **Minnesota:** Norman Co.:; Ramsey Co.: ex. Ulmus;

Missouri: Jackson Co.: Kansas City, ex. locust; Johnson Co.: Knob Noster St. Pk.; **New York:** Livingston Co.: Portage; Monroe Co.: Honeoye Falls; Rochester Jct.; Tompkins Co.: Ithaca; **Oklahoma:** Leflore Co.: Poteau, malaise trap; Noble Co.: Perry, ex. elm; Oklahoma Co.: Edmond, ex. post oak; Payne Co.: Ripley; **Pennsylvania:** Franklin Co.: Chambersburg; **Texas:** Bandera Co.: Lost Maples St. Pk.; **Wisconsin:** Dane Co.: Madison, at light.

Lopidea sayi Knight
Figures III.63, III.114; Map III.10

Lopidea sayi Knight, 1918:212 (new species). Blatchley, 1926:839 (description). Watson, 1928:39 (list). Knight, 1927:39 (distribution, host plant). Henry and Wheeler, 1988:424 (catalog).

DIAGNOSIS: Identified by the large, broadly rounded tergal process and the basally and medially reflexed apicodorsal margin of the right paramere (fig. III.63).
DESCRIPTION: Medium sized species, length 6.0-6.5; parallel sided. Vertex flat to weakly concave; frons narrowly rounded, weakly produced; eyes reaching to or just short of frons-tylus suture; eye-antennal fossa distance short, < width antennal segment II; head long, buccula separated from collar; antennae slender, cylindrical, long, ratio length antennal segment II - head width 2.0-2.2; rostrum reaching to mesocoxae.

Genital Capsule: Sensory lobe absent; tergal process extremely large, broadly rounded, dorsal margin with small flange (fig. III.63).

Genitalia (figs. III.63, III.114): Right paramere davisi type; apex broad, bluntly rounded; apicodorsal margin bluntly toothed, apicodorsal angle with thick, blunt spine-like process, strongly reflexed basally and medially; medial flange a short elongate ridge, parallel with apicodorsal margin of paramere; dorsal flange short, extremely thick basally, apex blunt dentate; basal arm vestigial. Left paramere with basal angle weakly expanded vertically; lateral flange short, apex broad and bluntly rounded; medial flange situated dorsally, long, thick. Dorsal spicula long, broad, weakly curved, margins strongly serrate distally; basal sclerite small, quadrate, process absent or vestigial. Ventral spicula very slender, bifurcate, arms subequal in length; primary arm evenly tapered, strongly serrate; secondary arm slender, one margin minutely serrate.

COLOR AND VESTITURE: General coloration yellow and brown. Head pale yellow; antennae black. Coxae pale yellow to brown; trochanters pale yellow; femora and tibiae brown to dark fuscous; tarsi dark fuscous. Venter yellow; genital capsule yellow fuscous. Pronotum yellow, posterior margin infuscated; calli fuscous. Scutellum fuscous. Hemelytra yellow, clavus and medial area of corium light fuscous; cuneus occasionally pale. Dorsum with medium length, inclined setae; usually black, occasionally pale on yellow areas of corium.

FEMALE: Unknown.

TYPE: **HOLOTYPE** M, Lopidea sayi Knight: **South Carolina**, Georgetown Co., Brown's Ferry, Savannah River, June 6, 1917, H.H. Knight (CU).

DISTRIBUTION: The distribution of this species is uncertain because of the paucity of specimens. It appears to be an eastern species known from South Carolina west to Iowa (Map III.10).

DISCUSSION: There is little information on host plants of this species. One specimen was collected on Gleditsia triacanthos. Collection records are from June 6 to July 21.

SPECIMENS EXAMINED:

Iowa: Clayton Co.: McGregor (FSCA); Story Co.: Ames (UA); **Maryland:** Montgomery Co.: Plummer's Isl., (USNM); **Missouri:** Vernon Co.: Montvallo, ex. Gleditsia triacanthos (USNM); **South Carolina:** Georgetown Co.: Savannah River, Brown's Ferry (USNM); **Virginia:** Fairfax Co.: N. Alexandria (USNM).

Lopidea scutata Knight

Figures III.64, III.15; Map III.7

Lopidea scutata Knight 1962:34 (new species). Knight, 1968:99 (list, host plant). Henry and Wheeler, 1988:424 (catalog).

DIAGNOSIS: This species is easily recognized by its greyish fuscous general coloration and ivory white or rufous scutellum. Also recognized by the large, dentate dorsal flange of the right paramere (fig. III.64).

DESCRIPTION: Small to medium sized species, length 4.3-5.1; linear, sides weakly arcuate. Vertex flat to weakly convex; frons broadly rounded, strongly protruding; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance greater than width antennal segment II but less than width antennal segment I; head relatively long, buccula just separated from collar; antennae slender, cylindrical, short, ratio length antennal segment II - head width less than or equal to 1.3; rostrum reaching to posterior margin of mesocoxae or to metacoxae. Pronotum strongly convex. Scutellum strongly swollen.

Genital Capsule: Sensory lobe absent; tergal process long, linear, very narrow, apex sharply pointed, dorsal margin minutely crenulate (fig. III.64).

Genitalia (figs. III.64, III.115): Right paramere media type; broad basally, abruptly narrowed distally and angled dorsally; apical margin weakly expanded and strongly serrate; medial flange well developed, erect serrate ridge; dorsal flange very large, broad, erect serrate process; basal arm very long, thick, situated dorsally. Left paramere short; lateral flange with apex rounded, curved ventrally; medial flange very short, thick, strongly curved ventrally. Dorsal spicula short, linear, strongly narrowed distally, margins serrate; basal sclerite large, process very long. Ventral spicula very long, strongly and evenly curved; bifurcate at middle; both arms of equal length, very narrow distally, margins serrate.

COLOR AND VESTITURE: General coloration greyish fuscous and white. Head white to rufous; antennae dark fuscous to black; rostrum reddish brown. Coxae pale, bases fuscous to black; trochanters pale; femora pale fuscous, ventral surfaces lighter; tibiae and tarsi fuscous to black. Pronotum light greyish fuscous, anterior margin pale; calli black. Scutellum solid white or occasionally rufous. Hemelytra greyish fuscous. Dorsum with very short, black, inclined setae; setae rarely pale.

FEMALE: Same size as male, length 4.3-5.1; macropterous.

TYPE: **HOLOTYPE** M, Lopidea scutata Knight: **Arizona**, Pima Co., Santa Catalina Mts., 3200 ft, April 25, 1926, A.A. Nichol (USNM).

DISTRIBUTION: Found in the Mohave and northern Chihuahuan deserts of California, Nevada, Utah and Arizona (Map III.7).

DISCUSSION: I have examined a single specimen collected near Bonanza, Utah, that is unusual in having long, pale setae on the dorsum. Collection records from March 22 to July 16 with 70% in April to June. It has been suggested that this species may occur on Pinus monophyla (Knight, 1968; D. Polhemus, pers. comm.), but there is no confirmed breeding record, and this would be a most unusual host for a Lopidea. I have seen two large series with some teneral specimens collected on Artemisia tridentata, and other series have been taken on Ephedra.

SPECIMENS EXAMINED:

Arizona: Coconino Co.: Flagstaff; Rt. 64, SE Grand Cyn. Nat'l. Pk., Kaibab Nat'l. For., ex. Atriplex canescens; Gila Co.: Roosevelt Dam; Graham Co.: Graham Mts., Rt. 766, T9S, R25E, 4600 ft, sweeping roadside vegetation; Pima Co.: Baboquivari Cyn.; Santa Catalina Mts.; Tuscon, Sabino Cyn., ex. Encelia farinosa; Yavapai Co.: Mud Tanks Mesa, George Crook Rd., 6500 ft.; **California:** Riverside Co.: Cactus Spg. Trail, between Hwy 74 & Horsethief Crk.; **Nevada:** Nye Co.: Mercury, ex. Pinus monophylla; **Utah:** Sevier Co.: Clear Crk. Narrows Summit, Rt. 4; 2.3 mi. N I-70 on Rd. to Kanosh, 6980 ft., ex. Artemisia; 2.4 mi. S Rt. 4 on Kanosh Rd., 7000 ft, ex. Artemisia tridentata; Tooele Co.: Johnson's Pass, ex. Juniperus utahensis; Uintah Co.: 5-10 mi. SW Bonanza, 5000-5600 ft., ex. Hedysarum borsale; ??? Co.: Gooseberry, Fish Lake Nat'l. For.

Lopidea staphyleae Knight
Figures III.65, III.116; Map III.29

Lopidea staphyleae Knight 1917:460 (new species). Hussey, 1922b:32 (list, host plant). Knight, 1923:507-508 (description, illustration, host plant). Blatchley, 1926:839-840 (description, distribution). Knight, 1941:90

(description, illustration, host plant). Froeschner, 1949:168 (list). Slater, 1950:49 (illustration). Davis, 1955:142 (illustration). Wheeler et al., 1983:141 (list, host plant). Blinn and Yonke, 1985:82 (list, host plant). Henry and Wheeler, 1988:424 (catalog).

Lopidea staphyleae staphyleae Knight 1917:460 (new variety). Blatchley, 1926:840 (description). Henry and Wheeler, 1988:424 (catalog).

Lopidea staphyleae sanguinea Knight 1917:460 (new variety). Knight, 1923:507-508 (description, host plant). Knight, 1927:39 (distribution, host plant). Henry and Wheeler, 1988:424 (catalog). **NEW SYNONYMY**

DIAGNOSIS: Recognized by its distinctly C-shaped right paramere (fig. III.65a-b), and its unusual left paramere (fig. III.65c).

DESCRIPTION: Medium sized to large species, length 6.0-6.6, sides weakly arcuate. Vertex flat to weakly concave; frons weakly protruding, broadly rounded; eyes large, reaching below frons-tylus suture; eye-antennal fossa distance very short, less than width antennal segment II; head short, buccula touching collar; antennae slender, cylindrical, long, ratio antennal segment II - head width 2.0-2.3; rostrum reaching mesocoxae or just beyond.

Genital Capsule: Sensory lobe absent; tergal process short, evenly tapered to pointed apex; usually folded medially so as to be not visible from lateral view (fig. III.65d).

Genitalia (figs. III.65, III.116): Right paramere robiniae type; dorsal extremely thick, oriented dorsomedially, apex weakly dentate; ventral arm horizontal, flattened vertically, apex weakly curved medially, dorsal angle weakly dentate. Left paramere short, strongly constricted just distad of angle; lateral flange very narrow, situated ventrally; medial flange strongly angled, thick, erect. Dorsal spicula long, broad, abruptly narrowed distally, margins strongly serrate distally; basal sclerite small, quadrate, process vestigial or absent. Ventral spicula long, thick, weakly curved; distal third flattened and greatly expanded; apical margins strongly serrate.

COLOR AND VESTITURE: General coloration yellow or less often red, and fuscous. Head pale yellow; antennae dark fuscous to black; rostrum yellowish brown. Coxae and trochanters yellow with infuscation; femora dark yellowish, fuscous; tibiae and tarsi black. Venter yellow; genital capsule yellow to yellowish brown. Pronotum yellow to light fuscous; calli fuscous to black. Scutellum fuscous to black. Hemelytra yellow or red; clavus and medial area of corium variably fuscous. Dorsum with short, inclined, black setae; setae often pale on yellow areas.

FEMALE: Larger than male, length 6.6-7.4; macropterous.

TYPE: **HOLOTYPE** M, Lopidea staphyleae Knight: **New York**, Genesee Co., Batavia, 29 July, 1916, H.H. Knight (USNM).

TYPE OF SYNONYM: **HOLOTYPE** M, Lopidea staphyleae sanguinea Knight: **Massachusetts**, Norfolk Co., Brookline, 4 July, (USNM).

DISTRIBUTION: Occurs in the central plains and northeastern states, from Minnesota and Texas east to New York and Virginia (Map III.29).

DISCUSSION: Lopidea staphyleae sanguinea was described as a red color variety of the nominal variety L. s. staphyleae. In the description, Knight (1917) noted that the parameres of s. sanguinea did not differ from s. staphyleae. I have also found that neither the parameres nor the vesicae differ between the two color forms and I am basing my synonymy on these observations. Although I have examined long series of the red color morph that are uniform and show little variation in color, I have also examined specimens that are intermediate between the yellow and red color forms. There is no clear geographic pattern to the occurrence of the color forms, although the red form might be more common in the northern part of the range of this species. Collection records from 22 April to 22 August with 88% in June and July. Most collection records and all breeding records are from Staphylea trifolia. Also collected from Salix, Juglans, Carya, sycamore and milkweed.

SPECIMENS EXAMINED:

CANADA: **Ontario:** Kingsville, ex. basswood; Prince Edward Co.

USA: **Illinois:** Boone Co.: Belvidere; Calhoun Co.: Hardin, ex. Staphylea trifolia; Cook Co.: Willow Springs; Jersey Co.: Champaign Co.: Homer Park; Grafton; Seymour; Urbana; Jackson Co.: Grand Tower; Jo Davies Co.: Apple River Canyon St. Pk.; McClean Co.: Bloomington; Macon Co.: Decatour; Mason Co.: Havana, Devil's Hole; Piatt Co.: Monticello; Pope Co.: Golconda; Pulaski Co.: Karnak; **Iowa:** Boone Co.: Ledges St. Pk., ex. Juglans nigra, Bladder nut; Clayton Co.: Strawberry Point; Linn Co.: Palisades-Kepler St. Pk.; Story Co.: Ames; **Kansas:** Douglas Co.: ex. Bladder nut; Montgomery Co.:; **Michigan:** Berrien Co.: Warren Pr.; **Minnesota:** Nicolet Co.: St. Peter; Ramsey Co.: Red Rock, Mississippi River; White Bear, Manitou Isl.; **Missouri:** Boone Co.: Columbia, ex. sycamore, ex. Staphylea trifolia; Jackson Co.: Atherton; Kansas City; Vernon Co.: 4 mi W Monticello; **New York:** Genesee Co.: Batavia; **Oklahoma:** Cherokee Co.: Tahlequah; Craig Co.: Hollow, ex. milkweed; McCurtain Co.: Broken Bow; Ottawa Co.: Wyandotte; **Virginia:** Fairfax Co.: Great Falls; **Wisconsin:** Dane Co.:.

Lopidea taurina Van Duzee

Figures III.66, III.67, III.117; Map III.30

Lopidea taurina Van Duzee, 1921:125 (new species). Knight, 1962:36 (illustration, distribution). Henry and Wheeler, 1988:424 (catalog).

Lopidea fuscina Knight, 1923:68 (new species). Henry and Wheeler, 1988:420 (catalog). **NEW SYNONOMY**

Lopidea taurula Knight, 1923:68 (new species). Henry and Wheeler, 1988:425 (catalog). **NEW SYNONOMY**

Lopidea nevadensis Knight, 1962:35 (new species). Henry and Wheeler, 1988:422 (catalog). **NEW SYNONOMY**

Lopidea malvastri Knight, 1962:35 (new species). Henry and Wheeler, 1988:421 (catalog). **NEW SYNONOMY**

DIAGNOSIS: Distinguished from all other far western species by the distinctly C-shaped right paramere (figs. III.66, III.67).

DESCRIPTION: Large species, length 5.6 - 6.9; sides weakly arcuate. Vertex flat; frons weakly produced; eyes short, not reaching frons-tylus suture; eye-antennal fossa distance less than width antennal segment II; head long, buccula separated from collar; antennae linear to weakly fusiform, ratio length antennal segment II-head width 1.8-1.9; rostrum reaching to apices of mesocoxae or to metacoxae.

Genital Capsule: Sensory lobe weakly produced, as vertical ridge; tergal process short, thick straight, weakly curved medially (fig. III.66d).

Genitalia (fig. III.66, III.67, III.117): Right paramere robiniae type; dorsal arm narrow, cylindrical, curved dorsomedially; ventral arm thick, cylindrical, curved medially; size of both arms variable; basal arm very short, narrow, angled ventrally and with axis of paramere. Left paramere extremely narrow; lateral flange vestigial; medial flange long, narrow, strongly angled. Dorsal spicula long, broadly lanceolate, margins strongly serrate; basal sclerite small, process absent. Ventral spicula long and narrow, linear, bifurcate at middle; secondary arm variable, from one third to two thirds length of primary arm; both arms very slender, apices minutely dentate.

COLOR AND VESTITURE: General coloration rufous to dark red. Head red; antennae light fuscous to black. Coxae and femora rufous to fuscous; tibiae and tarsi fuscous to black. Pronotum red; calli fuscous to black. Scutellum red to black. Hemelytra red; posterior half of clavus, medial aspect of corium and membrane often dark fuscous to black; rufous forms with embolium and lateral aspect of cuneus pale. Dorsum with short, inclined setae; color variable from entirely pale in southern populations to entirely black in northern populations.

TYPE: **HOLOTYPE** M, Lopidea taurina Van Duzee: **Oregon**, Jackson Co., Colestin, August 1, 1918, E.P. Van Duzee (CAS).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea fuscina Knight: **California**, Fresno Co., Los Gatos Canyon, divide to mouth of Mt. Diablo Range, June, 6-8, 1907, Bradley (CU). **HOLOTYPE** M, Lopidea taurula Knight: **Oregon**, Umatilla Co., Umatilla, June 24, 1882 (USNM). **HOLOTYPE** M, Lopidea malvastri Knight: **Wyoming**, Fremont Co., Dubois, July 31, 1931, H.H. Knight (USNM).

DISTRIBUTION: L. taurina occurs in the Coastal, Sierra Nevada and Cascade Mountain ranges from Los Angeles Co., California north to Puget Sound, Washington (Map III.30). It occurs east of the mountains in the northern Great Basin of Oregon, Idaho and Utah and east to the northern Rocky Mountains of Wyoming.

DISCUSSION: The proposed synonymies of *fuscina*, *taurina*, and *malvastri* with *taurula* are based on the identical structure of the left paramere, the similarity and pattern of variation of the right paramere and the continuous variation of the spiculae, dorsal coloration and setal color. There is only slight variation in the structure of the vesicae throughout the range of this species and it appears to be continuous variation. There is continuous and clinal variation in the dorsal color and vestiture that parallels that seen in other *Lopidea* species with similar distributions. Although there are sharp and distinct variations in the shape of the right paramere, these paramere types never occur sympatrically, but rather their ranges seem to abut one another along extensive contact zones. I interpret *L. taurina* as a polytypic species composed of three parapatric subspecies, *L. t. taurina* Van Duzee in the northern Coastal and Cascade mountains, *L. t. fuscina* Knight in the Sierra Nevadas of California and in western Nevada, and *L. t. taurula* Knight in the northern Great Basin of Oregon, Washington and Idaho.

Collection records are from May 31 to September 5 with 85% in June and July. This species has been recorded from *Alnus*, alfalfa, *Descuriana*, *Lathyrus* and *Solidago*. Although Knight (1962) collected a series from *Malvastrum coccineum*, he did not indicate if he observed them feeding or if there were nymphs present.

Lopidea taurina taurina Van Duzee **NEW STATUS**

Figure III.67b-c; Map III.30

Lopidea taurina Van Duzee 1921:125 (new species).

DIAGNOSIS: This subspecies is recognized by the combination of pale setae and extensive dark setae, especially on fuscous colored areas. Also recognized by the symmetric partial circle formed by the arms of the right paramere. (fig. III.67b-c).

DISTRIBUTION: L. t. taurina occurs from the Siskiyou Mountains along the California-Oregon border, north through the Coastal and Cascade Mountain ranges to southern British Columbia (Map III.30).

CANADA: British Columbia: Courtney.

UNITED STATES: Oregon: Deschutes Co.: Metolius River; Jackson Co.: Colestin; Moon Prairie; 0.5 mi S Siskiyou Summit, old Rt 99, 4430 ft, ex Lathyrus; Jefferson Co.: Allen Springs, Metolius River; House-on-the-Metolius, Camp Sherman; Klamath Co.: lower Annie Creek, ex grass; near Ft. Klamath fish hatchery, ex Alnus; 13 mi W Keno on Hwy 66, 4600 ft; head of Spring Creek; Upper Klamath Lake, three mile creek; Wasco Co.: The Dalles; **Washington:** Thurston Co.: Olympia; Puget; Yakima Co.: N. Yakima.

Lopidea taurina fuscina Knight **NEW STATUS**
Figure III.66; Map III.30

Lopidea fuscina Knight 1923:68 (new species).

DIAGNOSIS: This subspecies has predominately pale setae on the dorsum, especially in the southern part of its range. Also recognized by the long sinuous arms of the right paramere (fig. III.66).

DISTRIBUTION: L. t. fuscina occurs in the mountains of most of California and north western Nevada (Map III.30).

SPECIMENS EXAMINED:

California: Inyo Co.: Independence; Lone Pine; Lake Co.: Elizabeth; Lassen Co.: Hallelujah Jct.; Madera Co.: Coarsegold; Huntington Lake; Modoc Co.: Surprise Valley dunes, 5 mi SE Ft. Bidwell, ex. *Descuriania*; Nevada Co.: 2 mi S Grass Valley; Plumas Co.: 4 mi W Quincy; Big Meadow; Camp Baldy; Cushenberry Spring, San Bernadino Mts, 4000 ft; Santa Ana River, San Bernadino Mts, 6300 ft, ex *Solidago curfinus*; Shasta Co.: Lake Britton; Siskiyou Co.: 1 mi NW Bartle; Tulare Co.: Giant Forest; Tuolumne Co.: near Mather; Strawberry; Ventura Co.: 21 mi N Ojai; Sespe Canyon; Wheeler Springs; Yolo Co.: 6 mi N Rumsey; Co.?: Poso Chas Sharp; **Nevada:** Douglas Co.: Carson City; Ormsby Co.: Reno; Storey Co.:; Washoe Co.: Pyramid, ex *alfalfa*; Pyramid Lake; Verdi.

Lopidea taurina taurula Knight **NEW STATUS**

Figure III.67a; Map III.30

Lopidea taurula Knight, 1923:68 (new species).
Lopidea malvastri Knight 1962:35 (new species). NEW SYNONOMY

DIAGNOSIS: Recognized by the short arms of the right paramere, their lengths less than the vertical distance between their bases (fig. 67a). Also recognized by the predominately to entirely dark setae on the dorsum.
DISTRIBUTION: *Lopidea taurina taurula* occurs in the northern Great Basin province of Oregon, Washington and Idaho, and western Wyoming (Map III.30).
DISCUSSION: The proposed synonymy of *malvastri* with *t. taurula* is based on the identical structure of the male parameres and only dark setae on the dorsum. *L. malvastri* was described from a series taken in Dubois, Fremont Co., Wyoming. Knight (1962) distinguished this species from

taurula by the "structure" of the parameres. In all aspects of color, vestiture and paramere structure, however, these specimens agree with those from eastern Oregon, Washington and Idaho, including the type specimens of taurula.

SPECIMENS EXAMINED:

Idaho: Fremont Co.: St Anthony; Gooding Co.: Bliss; Owyhee Co.: Grandview; Payette Co.: Fruitland; **Oregon:** Harney Co.: 3 mi SE Burns; Umatilla Co.: Umatilla; **Washington:** Yakima Co.: Yakima City; **Wyoming:** Fremont Co.: Dubois.

Lopidea teton Knight

Figures III.68, III.118; Map III.31

Lopidea teton Knight, 1923:70 (new species). Knight, 1927:39 (distribution, host plant). Froeschner, 1949:168 (list). Slater, 1950:49 (illustration). Kelton, 1980:236-237 (description, illustration, distribution, host plant). Blinn and Yonke, 1985:82 (list). Henry and Wheeler, 1988:425 (catalog).

DIAGNOSIS: Recognized by its large, robust habitus; wide, convex pronotum; large, thick sensory lobe and the thick, erect vertical flange on the right paramere (fig. III.68).

DESCRIPTION: Medium to large species, length 5.2-6.4; elongate oval in outline. Vertex flat or weakly convex; frons weakly protruding, narrowly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance short, less than width of antennal segment II; Head moderately long; buccula just separated from collar; antennae linear, relatively short, ratio length antennal segment II-width head 1.4-1.6; rostrum reaching to mesocoxae. Pronotum broad, distinctly convex.

Genital Capsule: Sensory lobe present as a large and broadly rounded process; tergal process short, thick, strongly curved medially, dorsal margin minutely crenulate (fig. III.68).

Genitalia (figs. III.68, III.118): Right paramere davisi type; apex broadly rounded, dorsoapical margin reflexed medially, weakly serrate; medial flange much reduced, short, thick, dentate ridge; dorsal flange expanded as wide vertical process, apex bluntly serrate; basal arm extremely short, narrow, angled ventrally. Left paramere constricted just distad of angle; lateral flange expanded and broadly rounded apically; medial flange very narrow, strongly curved ventrally. Dorsal spicula long, broad, lanceolate, abruptly narrowed apically, margins entire; basal sclerite small, quadrate, process absent. Ventral spicula long, slender, sinuous, bifurcate at distal third; secondary arm short, almost perpendicular to primary axis of spicula; margins of both arms entire.

COLOR AND VESTITURE: General coloration red and black. Head red; antennae black; rostrum dark reddish brown. Legs dark fuscous to black; apices of coxae and femora pale. Ventral surface of abdomen red or rufous; genital capsule black. Pronotum dark red; calli and scutellum dark fuscous to black. Hemelytra red; clavus and medial area of corium infuscated. Dorsum with short, erect, black setae.

FEMALE: Slightly larger than male, length 5.6-6.5; lateral margins much more arcuate; antennal segment II distinctly tapered apically; macropterous to slightly submacropterous.

TYPE: HOLOTYPE M, Lopidea teton Knight: **Minnesota**, Norman Co., June 16, 1920, A.A. Nichol (USNM).

DISTRIBUTION: Widely distributed in the Great Plains from Alberta and Minnesota south to Texas, and west of the Rocky Mountains in Nevada and Arizona (Map III.31).

DISCUSSION: Although this species is widely distributed, it is uniform throughout its range. There is some size variation, however, as specimens from Arizona are consistently smaller than specimens east of the Rocky Mountains. Collection records are from April 17 to July 15 with 85% in May and June. The only confirmed breeding record is from Astragalus, and 55% of all host records are Astragalus. This species has been observed feeding on flowers, seeds, leaves and stems of Astragalus crassicarpus in Colorado.

SPECIMENS EXAMINED:

CANADA: Alberta: Calgary; Gilchrist Ranch, Aden; **Manitoba:** Aweme, N. Criddle, ex. Astragalus caryocarpus; **Saskatchewan:** Saskatoon; Willows.

USA: Arizona: Navajo Co.: 15 mi SW Show Low, 5200-6000 ft, at light, ex. Quercus arizonica; Yavapai Co.: 22.7 mi S Ash Fork on Rt. 89, ex. Berberis fremonti; **Colorado:** Arapahoe Co.: Denver; Chaffee Co.: Trout Creek Pass; Douglas Co.: Roxborough Rd., nr. Chatfield Park; El Paso Co.: Colorado Springs; Garden of the Gods; Jefferson Co.: Red Rocks Pk. near Morrison, 5600 ft, ex. Astragalus sp.; Larimer Co.: Ft. Collins; Teller Co.: Florrisant; Weld Co.: Pawnee Grassland, Nunn, ex. Astragalus drummundi; Central Plains Exp. St., 8 mi N Nunn, ex. Oxytropis serica flowers, ex. Astragalus crassicarpus, A. bisulcatus; Co.??: Mt. Evas, 9800 ft; **Iowa:** Hamilton Co.: Stanhope; Lyon Co.: Little Rock; Monona Co.: loess bluff by Turin; Story Co.: Ames; Winnebago Co.: 7 mi NW Thompson; Woodbury Co.: Sioux City; **Kansas:** Barber Co.: 16 mi W Hardtner; Cherokee Co.: Baxter Springs; Greenwood Co.: Hamilton, 3350 ft; Hamilton Co.:; Riley Co.:; **Missouri:** Newton Co.: Granby; **Montana:** 40 mi E Glacier Nat'l. Pk.; **Nebraska:** Cherry Co.: Valentine; Garden Co.: Crescent Lake Refuge; Hooker Co.:; **North Dakota:** Golden

Valley Co.: ex. Euphorbia esula; Co.??: Williston; **Oklahoma:** Latimer Co.: Red Oak; Love Co.: Lake Murray; Payne Co.: Stillwater; Roger Mills Co.: Cheyenne, ex. alfalfa; Woods Co.: Alva; **South Dakota:** Brookings Co.: Brookings; Haakon Co.: Philip; Pennington Co.: Badlands; Todd Co.: 15 mi S Mission; **Texas:** Brewster Co.: 3 mi NE Marathon; **Wyoming:** Crook Co.: Sundance, 4733 ft; Goshen Co.: Lagrange.

Lopidea ute Knight

Figures III.69, III.70, III.119, III.120; Map III.32

Lopidea ute Knight, 1923:70 (new species). Knight, 1927:37 (distribution, host plant). Henry and Wheeler, 1988:425 (catalog).

Lopidea stitti Knight, 1962:31 (new species). Henry and Wheeler, 1988:424 (catalog). **NEW SYNONYMY**

Lopidea becki Knight 1968:98 (new species). Henry and Wheeler, 1988:418 (catalog). **NEW SYNONYMY**

DIAGNOSIS: This species can be distinguished from all other western species by the dorsal lobe of the angle of the left paramere when it is present (fig. III.70c-c'). Also recognized by the basally recurved, thick dorsoapical process of the right paramere (figs. III.69, III.70). Distinguished from *L. nigridia* Uhler and *L. balli chelifer* Knight by the shorter, inclined dark setae on the hemelytra and absence of erect dark setae on the head and pronotum. *L. garryae* entirely lacks dark setae on the dorsum.

DESCRIPTION: Medium size species, length 0.54 - 0.63, parallel sided. vertex slightly concave, frons broadly rounded, weakly protruding; eyes small, not reaching frons-tylus suture; eye-antennal distance less than width of antennal segment II, head short, buccula touching or just separated from collar; antennae linear, length variable, ratio length antennal segment II-head width 1.4-1.8; rostrum long, reaching posterior apex of metacoxae.

Genital Capsule: Sensory lobe large, cylindrical. Tergal process short, narrow, straight (fig. 69d).

Genitalia (figs. III.69, III.70, III.119, III.120): Right paramere davisi type; ventroapical angle broadly rounded; dorsoapical angle with thick, serrate, digitiform process, semierect to strongly recurved basally; medial flange present as thick, elongate, serrate ridge, parallel with margin of paramere; basal arm, short, thick, angled ventrally. Left paramere narrow, angle with or without a thick, erect, vertical process; lateral flange, very narrow, situated ventrally; medial flange variably in length, straight, situated dorsally. Dorsal spicula short, broad weakly curved basally, strongly serrate distally; basal sclerite small, quadrate, process vestigial or absent. Ventral spicula long, thick, expanded at middle, with or without short secondary arm arising from medial expansion; apex broad, strongly serrate.

COLOR AND VESTITURE: General coloration red and white. Head pale or yellowish red; antennae reddish fuscous to black; rostrum dark reddish brown. Coxae and trochanters pale, variably infuscated; femora and tibiae red to fuscous; tarsi reddish fuscous to black. Pronotum red to reddish orange, anterior border ivory white; calli black. Scutellum light red, apex pale. Hemelytra red; embolium, lateral aspect of clavus and cuneus pale to ivory white. Dorsum with short, inclined pale or black setae, inconspicuous except on embolium and cuneus; pronotum almost glabrous, setae short.

FEMALE: Larger than male, length 5.8-6.6; macropterous.

TYPE: **HOLOTYPE** M, Lopidea ute Knight: **Colorado**, Routt Co., Steamboat Springs, July 15, 1894, C.F. Baker (CU).

TYPES OF SYNONYMS: **HOLOTYPE** M, Lopidea stitti Knight: **Arizona**, Pinal Co., Pinal Mt., June 1, 1941, Loyd L. Stitt (USNM). **HOLOTYPE** M, Lopidea becki Knight: **Nevada**, Nye Co., Mercury, June 14, 1965, E. Beck, H.H. Knight & J. Merino (USNM).

DISCUSSION: The proposed synonymies of stitti and becki with ute are based on the continuous variation of the parameres and the vesicae. L. ute exhibits clinal variation in the shape of the left paramere, and the development of the secondary arm of the ventral spicula. There is great variation in genitalia of this species and the geographic patterns described here need to be examined in more detail.

Northern populations in Wyoming, Idaho and Utah have a well developed vertical spine on the dorsal angle of the left paramere (fig. III.70) and the secondary arm of the ventral spicula is as long as the primary arm (fig. III.120). The spine of the left paramere and the secondary arm of the spicula are smaller in populations from southern Utah and Nevada. In eastern populations from Arizona, New Mexico and Colorado the spine is reduced to a short bump on the angle of the paramere and the secondary arm of the spicula is completely absent. Some populations in central Arizona with a reduced spine on the left paramere also have a small lobe midway along the ventral spicula from where the secondary arm typically arises.

Populations from Colorado, New Mexico and eastern Arizona, that lack the dorsal spine on the left paramere and the lobe on the ventral spicula agree with the type of L. ute Knight, whereas western populations that have the above characters agree with L. becki Knight. Specimens from central Arizona, however, are intermediate between the above forms. I have seen individuals with a spine on the paramere without a lobe on the spicula and vice versa.

Because of the pronounced geographic variation in the male genitalia, I interpret this species to be composed of two subspecies, Lopidea ute ute Knight and Lopidea ute becki Knight. The two subspecies appear to have discrete distributions over most their ranges, with L. u. ute in the southern Rocky Mountains of Colorado, New Mexico and southeastern Utah extending westward into eastern Arizona. L. u. becki occurs in southwestern Wyoming, southeastern Idaho, Utah, southeastern Nevada, and northwest Arizona.

Collection records are from 21 April to 18 August with 65% in June and July. I have no confirmed breeding records for this species, but I have seen teneral specimens apparently collected from Pinus monophylla; this would be an unusual host for a Lopidea and needs to be confirmed. Knight (1927) recorded this species from Sheperdia argentia, and Eriogonum (Knight, 1968).

Lopidea ute ute Knight **NEW STATUS**
Figures III.69, III.119; Map III.32

Lopidea ute Knight 1923:70 (new species).
Lopidea stitti Knight, 1962:31 (new species). Henry and Wheeler, 1988:424 (catalog).

DIAGNOSIS: Distinguished from L. u. becki by the absence of the vertical process on the angle of the left paramere (fig. III69c), the vertical or only weakly reflexed dorsoapical process of the right paramere (fig. III.a-b), and the vestigial or completely absent secondary arm of the ventral spicula (fig. III.119).

DISTRIBUTION: L. u. ute occurs in the southern Rocky Mountains of Colorado, New Mexico and southeastern Utah and eastern Arizona (Map III.32).

SPECIMENS EXAMINED:

Arizona: Coconino Co.: 3.5 mi S Sedona, 4200 ft, ex. Quercus turbinella; Gila Co.: 10.5 mi N Globe, ex mesquite; 30 mi N Globe; Old CCC Cmpgd., S Globe on Pioneer Pass Rd., 4700 ft; 2 mi W Miami, 3800 ft, ex oak; 8 mi SW jct. Rts. 87 & 188, Tonto Nat'l. For., ex Lonicera albiflora; Graham Co.: Stockton Pass, Pinaleno Mts., 5350 ft, ex Rhus trilobata; Navajo Co.: 15-20 mi SW Show Low, 5200-600 ft, at light; Yavapai Co.: 15.8 mi S Ash Fork, ex Quercus turbinella; N edge of Mayer; Mud Tanks Mesa, George Crooks Rd., 6500 ft, ex Cercocarpus montanus; 5 mi N Prescott Valley, 6000 ft, ex Rhus trilobata; 2 mi S Rt. 89, ex Cowania mexicana; 1 mi S Yarnell on Rt. 89, ex Rhus sp.; ex Quercus turbinella; **Colorado:** Garfield Co.: Baxter Pass, 8200 ft, ex Lupinus sp.; 15.8 mi N Loma; Montrose Co.: Black Cyn. of the Gunnison Nat'l. Mon.; **New Mexico:** Torrance Co.: Tajique; **Utah:** San Juan Co.: Buckboard Flat Camp, 7 mi W Monticello, 8800 ft.

Lopidea ute becki **NEW STATUS**

Figures III.70, III.120; Map III.32

Lopidea becki Knight 1968:98 (new species). Henry and Wheeler, 1988:418 (catalog).

DIAGNOSIS: Distinguished from L. u. ute by the presence of a vertical process on the angle of the left paramere (fig. III.70c-c'), the reflexed dorsoapical process of the right paramere (fig. III.70a-b'), and the well developed secondary arm of the ventral spicula (fig. III.120).

DISTRIBUTION: L. u. becki occurs in mountainous areas of southwestern Wyoming, southeastern Idaho, Utah, southeastern Nevada, and northeastern Arizona (Map III.32).

SPECIMENS EXAMINED:

Arizona: Mohave Co.: Halapai Mts., SE Kingman, 4000-6400 ft, ex Rhus trilobata; ex Quercus sp.; **Idaho:** Franklin Co.: Williams Cyn., mp 20, on ID St. Rt. 36, 8000 ft, ex Rudbeckia occidentalis; **Nevada:** Lincoln Co.: Beaver Dam St. Pk.; Nye Co.: Atomic Test Site, 2 mi W Tippapah Hwy., Mine Mt. Rd., 4400 ft, ex Cowania mexicana; Atomic Test Site, Shoshone Mts., 5200-6000 ft, ex Eriogonum sp.; Mercury; White Pine Co.: Lehman Crk. Cmpgd., Humboldt Nat'l. For., 7620 ft, ex Pinus monophylla; 7500 ft, ex Abies concolor; Wheeler Peak Rd., W Baker, Humboldt Nat'l. For., 8600 ft, ex Cercocarpus ledifolius; ex Pinus monophylla; 8800 ft, ex Pinus flexilis; Wheeler Peak Drive, 7000-10000 ft, ex Abies concolor; **Utah:** Juab Co.: Mt. Nebo Loop, Devils Kitchen, ex Lupinus sp.; Sampete Co.: Cottonwood Creek, 4.7 mi NE Fairview, 7000 ft, ex Amelanchier utahensis; 13 mi E Fairview on UT Rt. 31, 7500 ft, ex Conzya canadensis; Sevier Co.: Clear Crk. Narrows Summit on Rt. 4, 7400 ft; ex Pinus edulis; 7180 ft, ex Artemisia sp.; 2.4 mi S Rt. 4 on Kanosh Rd., 7190 ft, ex Juniperus sp.; ex Artemisia tridentata; ex Pinus edulis; 2.3 mi N I-70 on Rd. Kanosh, 6980 ft, ex Juniperus sp.; ex Quercus; ex Artemisia sp.; ex Cercocarpus ledifolius; Wasatch Co.: Dock Flat, 1 mi NE UT St. Rt. 40, 8000 ft, ex Symphoricarpos oreophiles; ex Crataegus douglasii; Uinta Nat'l. For., 2 mi N Rt 40, near Lodge Pole Cmpgd., 9000 ft, ex Symphoricarpus sp.; ex Populus trembuloides; ex Quercus gambelii; Weber Co.: 8 mi S Monte Cristo; **Wyoming:** Lincoln Co.: 15 mi S Afton, Salt River Pass, 7630 ft, ex Lupinus sp.

Lopidea wileyae Knight
Figures III.71, III.121; Map III.6

Lopidea wileyi Knight, 1923:71 (new species).
Lopidea wileyae Knight and Schaffner, 1968:76 (distribution). Henry and Wheeler, 1988:425 (catalog).

DIAGNOSIS: Recognized by its small size, contrasting red pronotum and dark hemelytra and the long, slender right paramere.
DESCRIPTION: Small species, length 4.1-5.0; linear. Vertex flat; frons weakly protruding, narrowly rounded; eyes small, not reaching frons-tylus suture; eye-antennal fossa distance large, greater than width antennal segment II; head long, buccula separated from collar; antennae linear, slender, ratio antennal segment II - width head 1.5-1.7; rostrum reaching metacoxae or beyond.

Genital Capsule: Sensory lobe weakly developed, broadly rounded; tergal process short, thick, abruptly narrowed basally, apex blunt (fig. III.71d).

Genitalia (figs. III.71, III.121): Right paramere media type, strongly narrowed distally; apex curved dorsally, dorsoapical angle with long, erect serrate process; medial flange present as well developed row of large, curved teeth, wide as entire apex of paramere; dorsal flange present as two small teeth, not connected basally; basal arm long, slender, situated dorsally, oriented with axis of paramere and weakly curved laterally. Left paramere short; lateral flange strongly expanded distally, apical margin weakly concave; medial flange long, narrow, strongly curved ventrally. Dorsal spicula of short, broad, straight; margins strongly serrate distally; basal sclerite small, triangular, process developed. Ventral spicula long, evenly and weakly curved; abruptly narrowed on distal third, weakly serrate apically.

COLOR AND VESTITURE: General coloration red and black. Head red; antennae black, segment I dark reddish fuscous; rostrum dark reddish brown. Coxae black, apices occasionally red; trochanters red; femora dark fuscous to black, apices red; tibiae and tarsi black. Venter red; genital capsule black. Pronotum red; calli light fuscous to black. Scutellum and hemelytra dark fuscous to black; embolium and cuneus occasionally red. Dorsum with sparse, inclined, black setae.

FEMALE: Slightly larger than male, length 4.2-5.2; macropterous or weakly submacropterous.

TYPE: **HOLOTYPE** M, Lopidea wileyi Knight: **Texas**, Eastland Co., 20 April, 1921, ex. Dogwood blossoms, G. Wiley (USNM).

DISTRIBUTION: Occurs along the east side of the Mexican plateau from central Texas south to San Louis Potosi, Mexico (Map III.6).

DISCUSSION: I have seen no confirmed breeding records for this species, but it has been collected on Ratibida columnaris and Condolia obovata. Collection records are from 30 March to 30 October with 60% in April-June.

SPECIMENS EXAMINED:

MEXICO: Coahuila: Los Pinos, 19 mi SE Saltillo, 6000 ft; 1 mi SE Saltillo; 11 mi NE Saltillo; **San Louis Potosi:** 10 mi S Rio Verde;

USA: Texas: Bexar Co.: Ft. Sam Houston, ex. Colubrina texensis; San Antonio; Brewster Co.: Marathon; Cameron Co.: Brownsville; Dimmit Co.: Carrizo Springs; Eastland Co.: ex. dogwood blossoms; Frio Co.: 2 mi N Pearsall; Hidalgo Co.: 10 mi NW Mission; Kimble Co.: TTU Center, Junction; S Llano River; La Salle Co.: Cotulla, ex. Ratibida columnaris and Condalia obovata; Live Oak Co.: 10 mi S George West; Pecos

Co.: 16 mi W Sanderson; San Patricio Co.: Welder Wildlife Ref., near Sinton; Uvalde Co.: Sabinal; ? Co.: 15 mi SE Langtry; Loyal Valley.

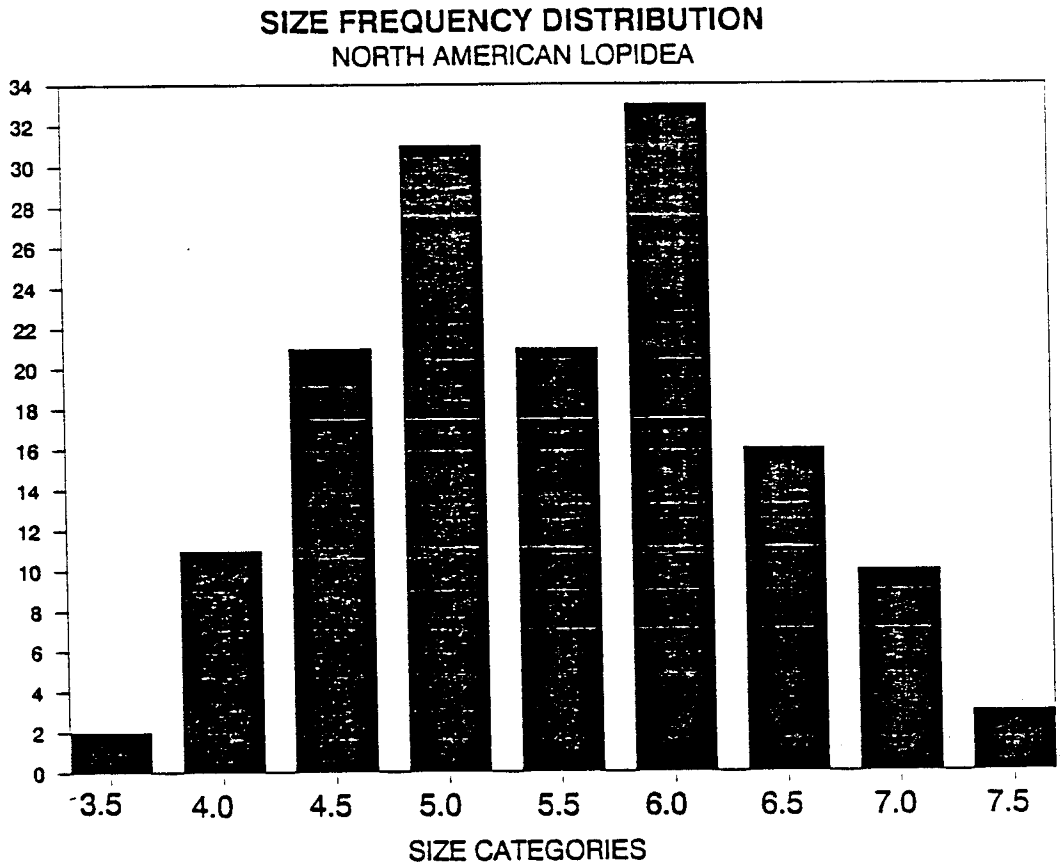

Figure III.1. Size frequency distribution of North American <u>Lopidea</u>. Data represent three specimens each of 48 species. X axis represents upper limits of 0.5mm size categories.

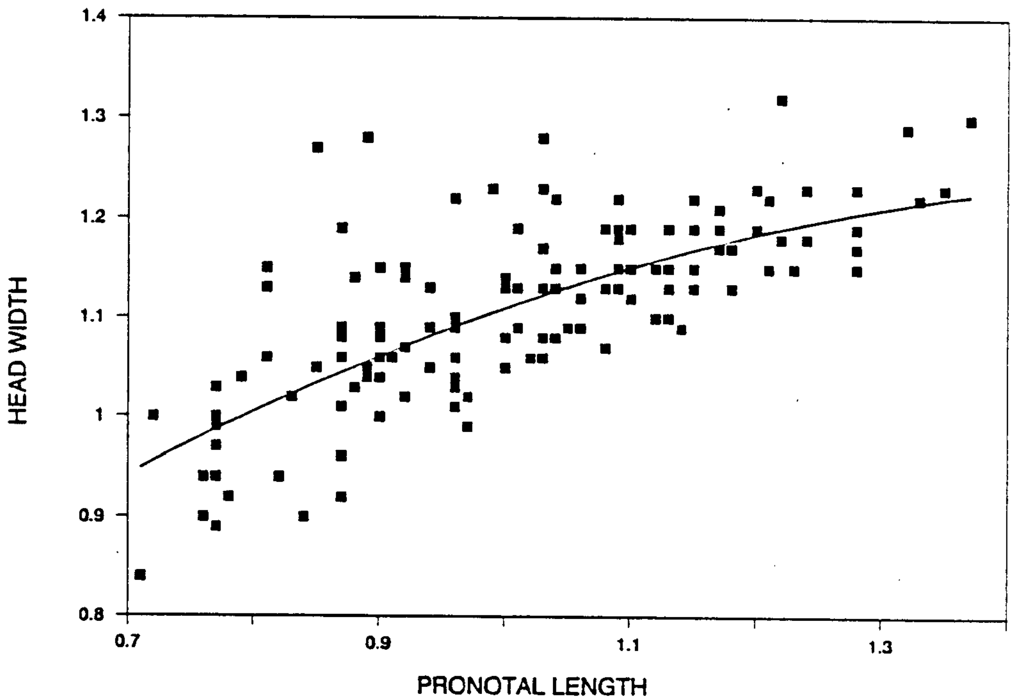

Figure III.2. Relationships between head width and pronotal length in 48 species of North American Lopidea.

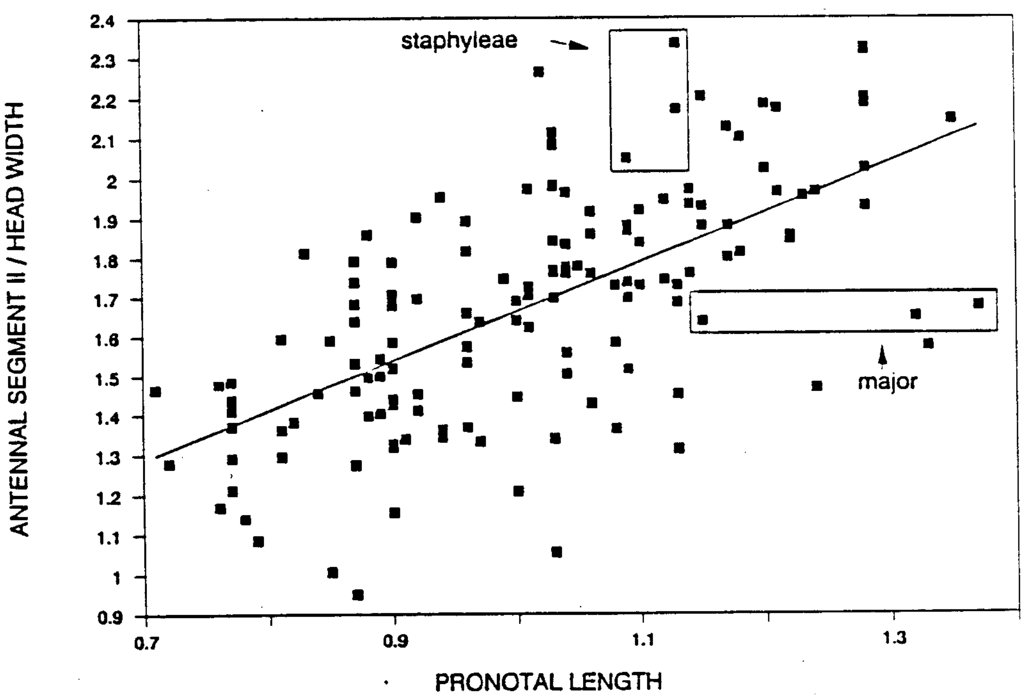

Figure III.3. Relationship between the ratio length antennal segment II/head width and pronotal length in 48 species of North American Lopidea. Boxes enclose species with distinctive ratios.

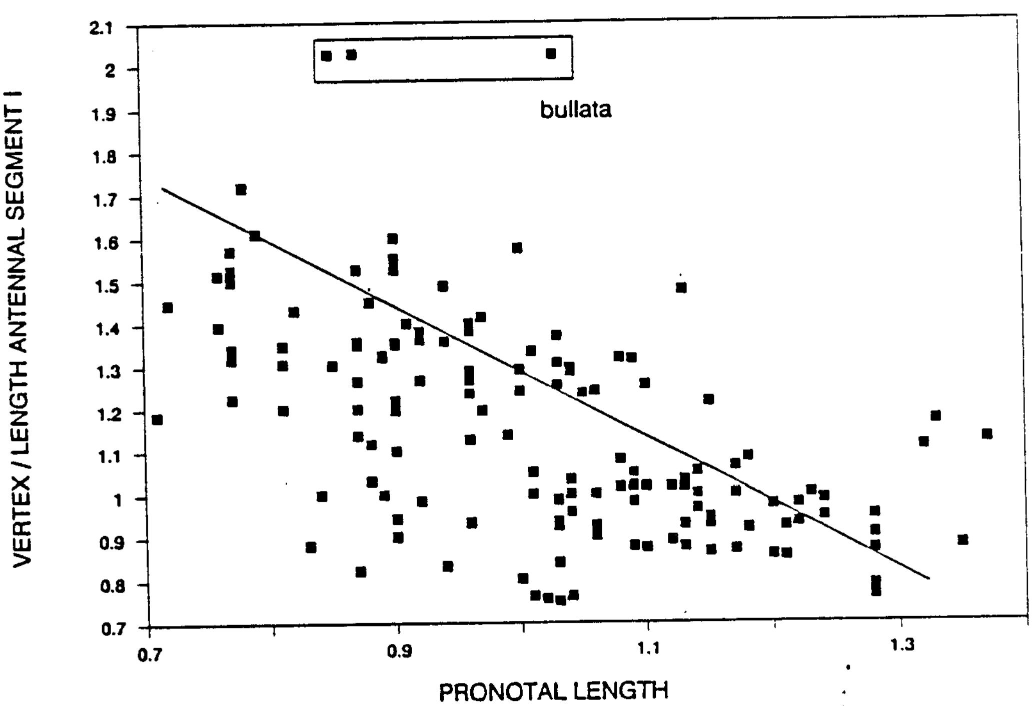

Figure III.4. Relationship between the ratio vertex width/length antennal segment I and pronotal length in 48 species of North American <u>Lopidea</u>. Box encloses the <u>L. bullata</u> which displays a distinctive ratio.

Figure III.5. Variation in the shape of the vertex in frontal view. A. _Lopidea_ _media_, concave vertex. A. _L_. _gainesi_, flat to weakly convex vertex.

Figure III.6. Variation in the shape of the frons in dorsal view. A. _Lopidea_ _garryae_, broadly rounded frons. B. _L_. _heidemanni_, narrowly rounded frons.

Figure III.7. Variation in the length of the head. Lateral view. A. _Lopidea_ _nigridia_, long head. B. _L_. _erimata_, short head.

Figure III.8. Variation in eye-antennal fossa distance. A. _Lopidea_ _bullata_, large distance. B. _L_. _media_, short distance.

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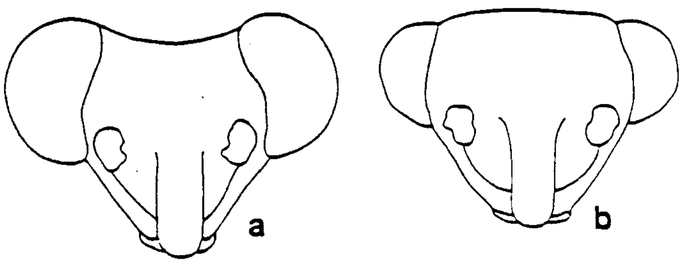

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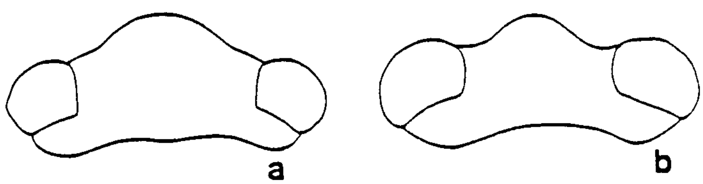

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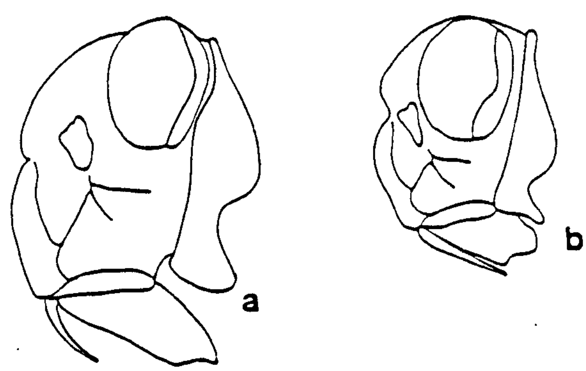

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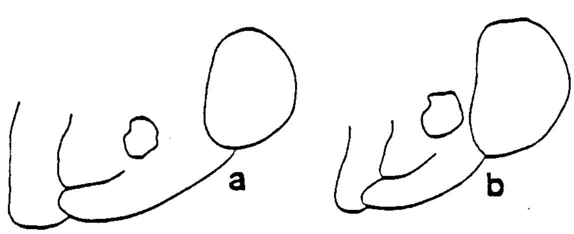

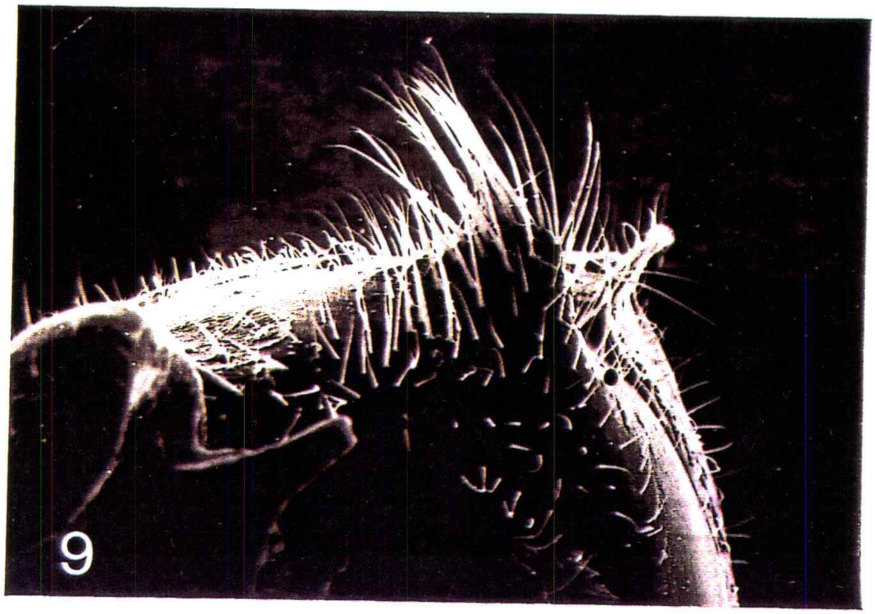

Figure III.9. Genital capsule of Lopidea salicis showing sensory lobe.

Figure III.10. Right paramere of <u>Lopidea</u> <u>davisi</u>. A. Lateral view. B. Medial view. ba = basal arm. df = dorsal flange.

Figure III.11. Right paramere of <u>Lopidea</u> <u>media</u>. A. Lateral view. B. Medial view. ba = basal arm. df = dorsal flange. mf = medial flange.

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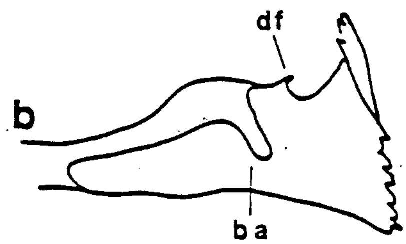

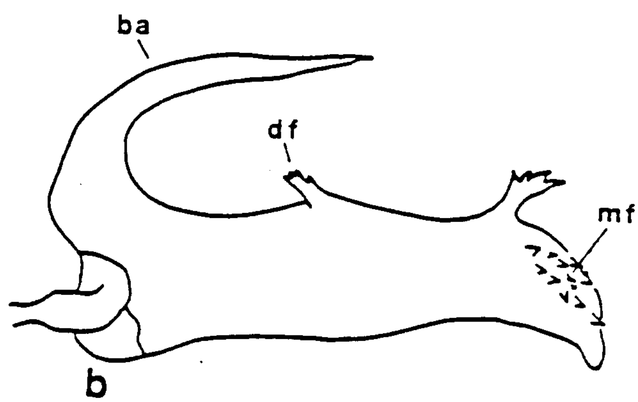

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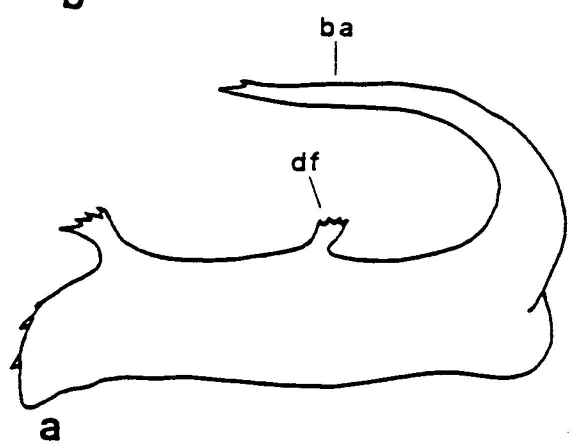
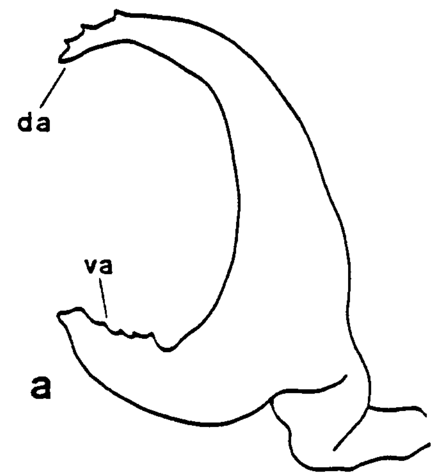


Figure III.12. Right paramere of _Lopidea robiniae_. A. Lateral view. B. Medial view. ba = basal arm. da = dorsal arm. va = ventral arm.

Figure III.13. Left parameres, medial view. A. _Lopidea confraterna_. B. _L_. _instabilis_.



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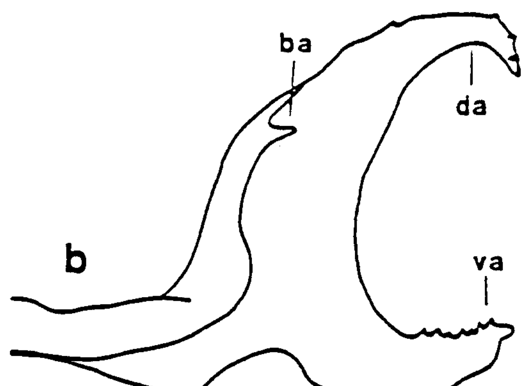

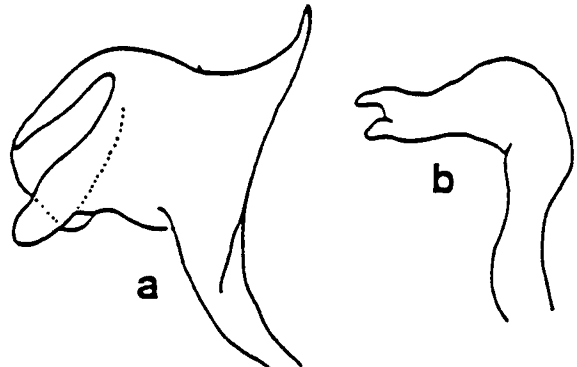

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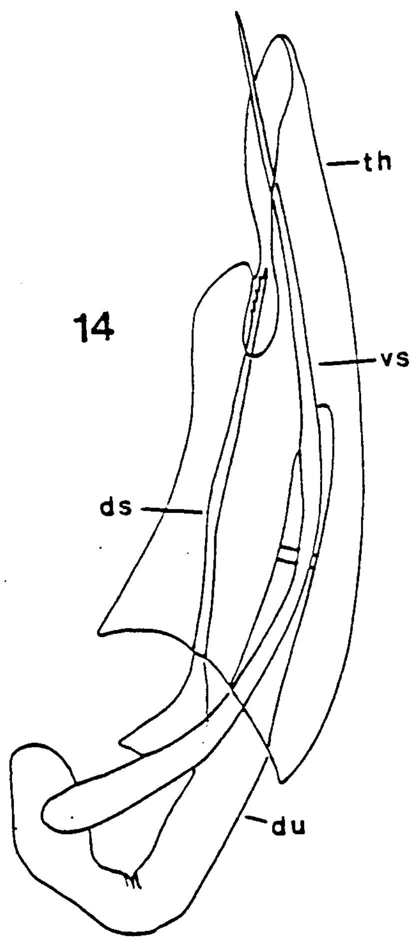

Figure III.14. Vesica of Lopidea nigridia, left lateral view. th = phallotheca. ds = dorsal spicula. vs = ventral spicula. du = ductus seminis.

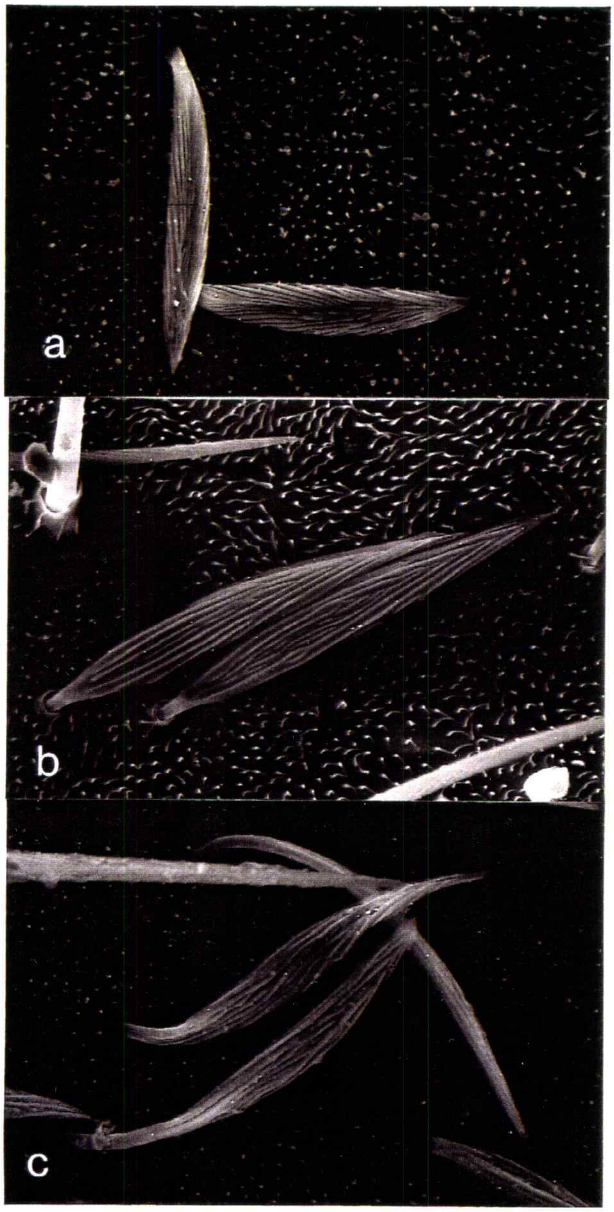

Figure III.15. Scale-like setae. A. Lopidea nigridia. B. Ilnacora malina. C. Ilnacorella sp.

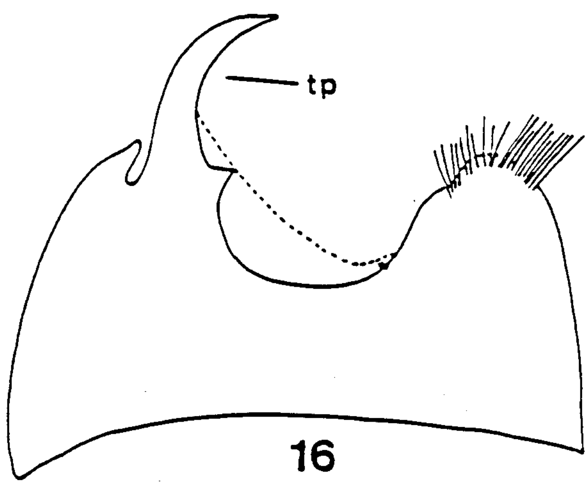

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Figure III.16. Genital capsule of <u>Lopidea</u> <u>nigridia</u>. Dorsal view. tp = tergal process.

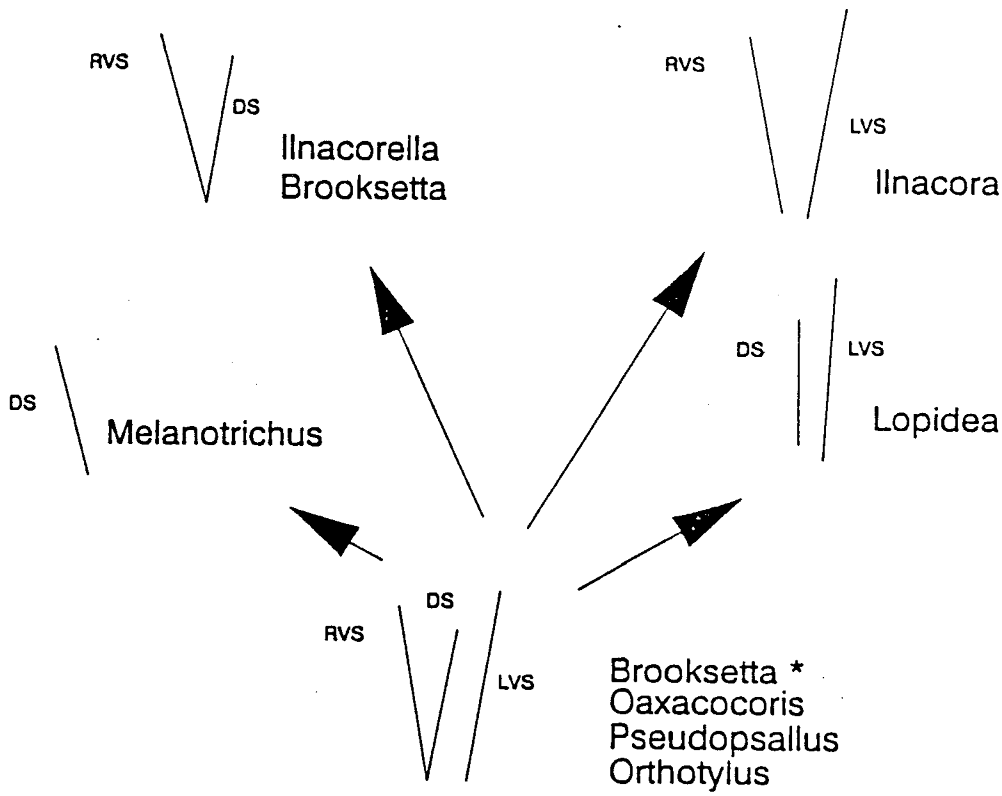


Figure III.17. Hypothesis of spiculae evolution in some orthotyline mirids, RVS = right ventral spicula. DS = right dorsal spicula. LVS = left ventral spicula. Brooksetta has an asterick to indicate that is has more than one spiculae configuration.

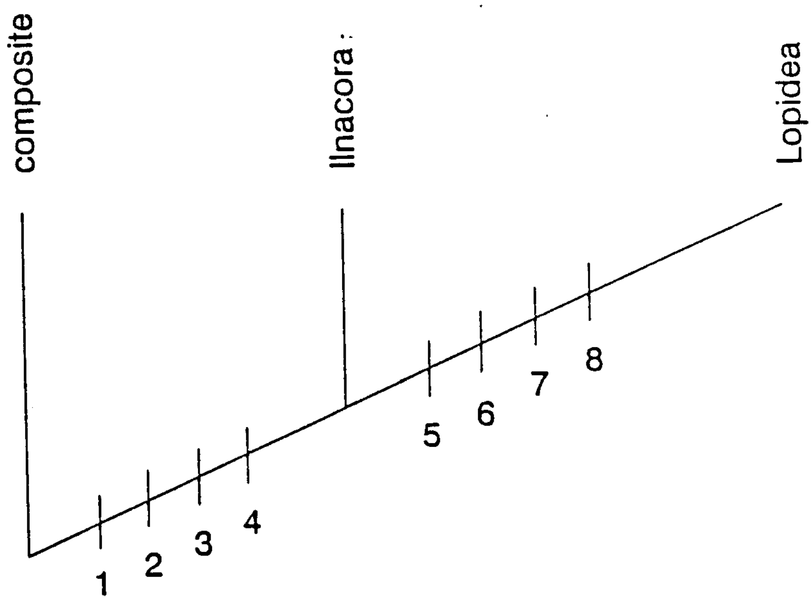
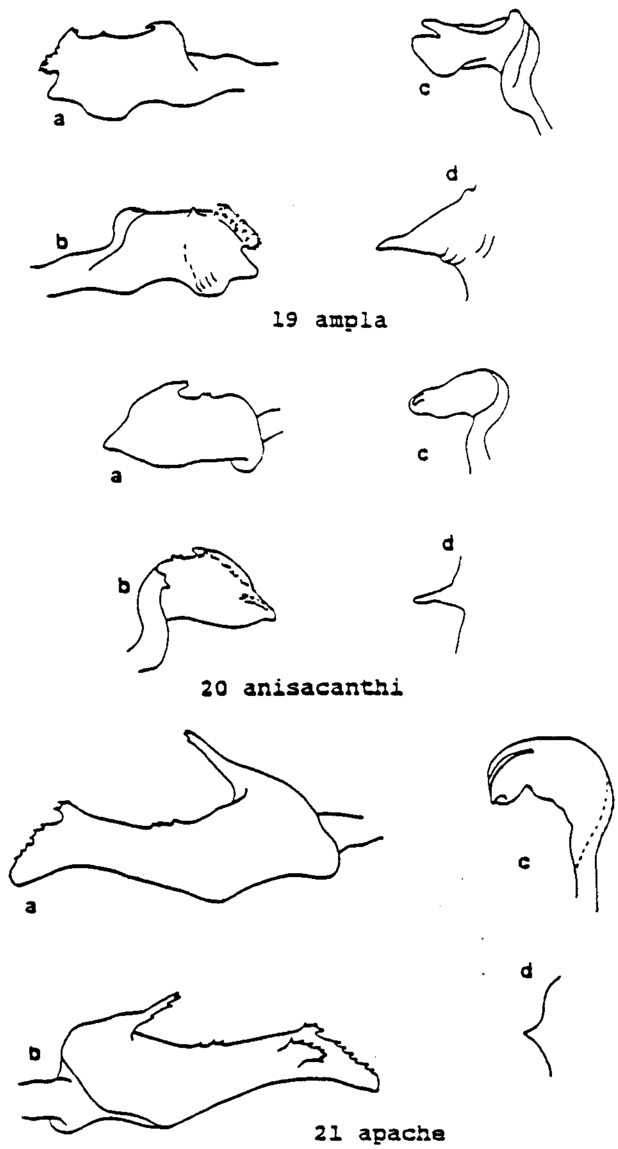
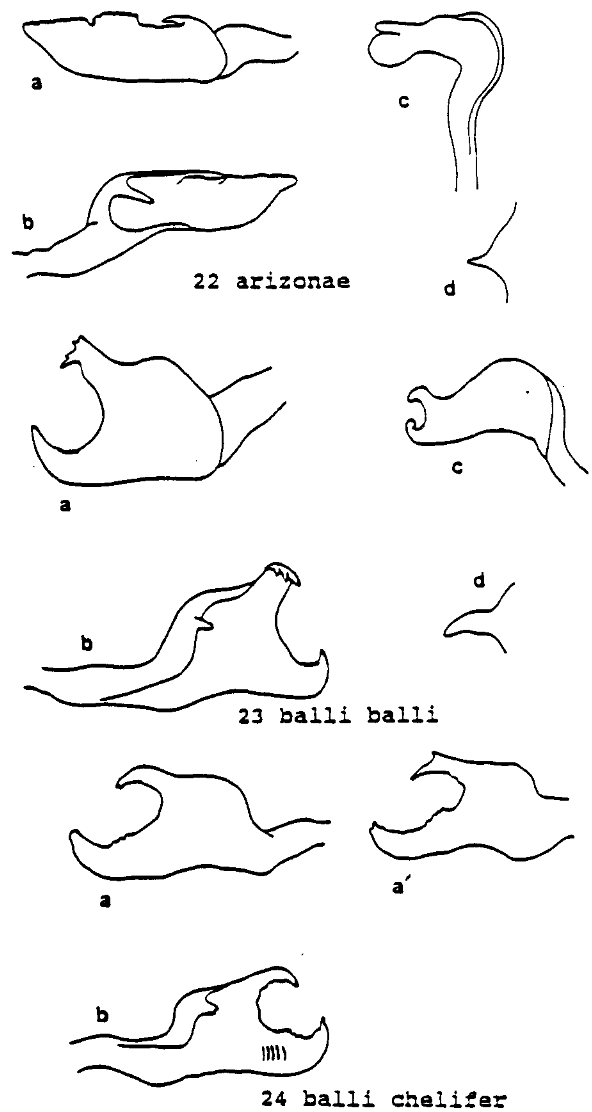


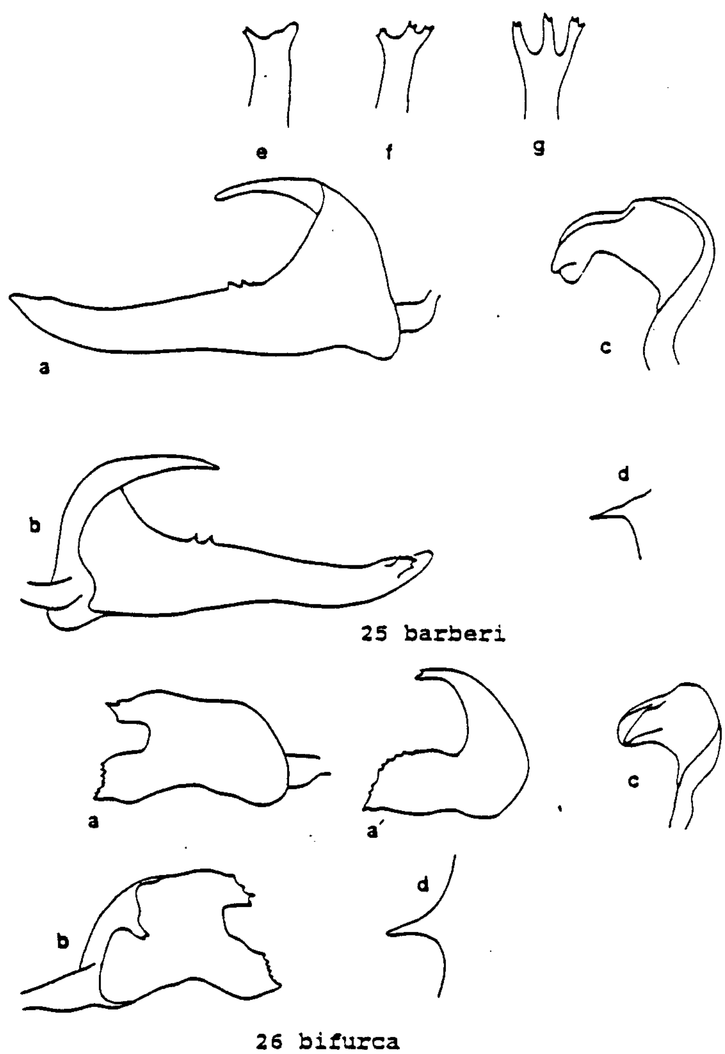
Figure III.18. Cladogram showing relationship of Lopidea and Ilnacora. Characters represent apomorphies listed in Table III.3. Outgroup represents a composite based on characters found in several related genera.



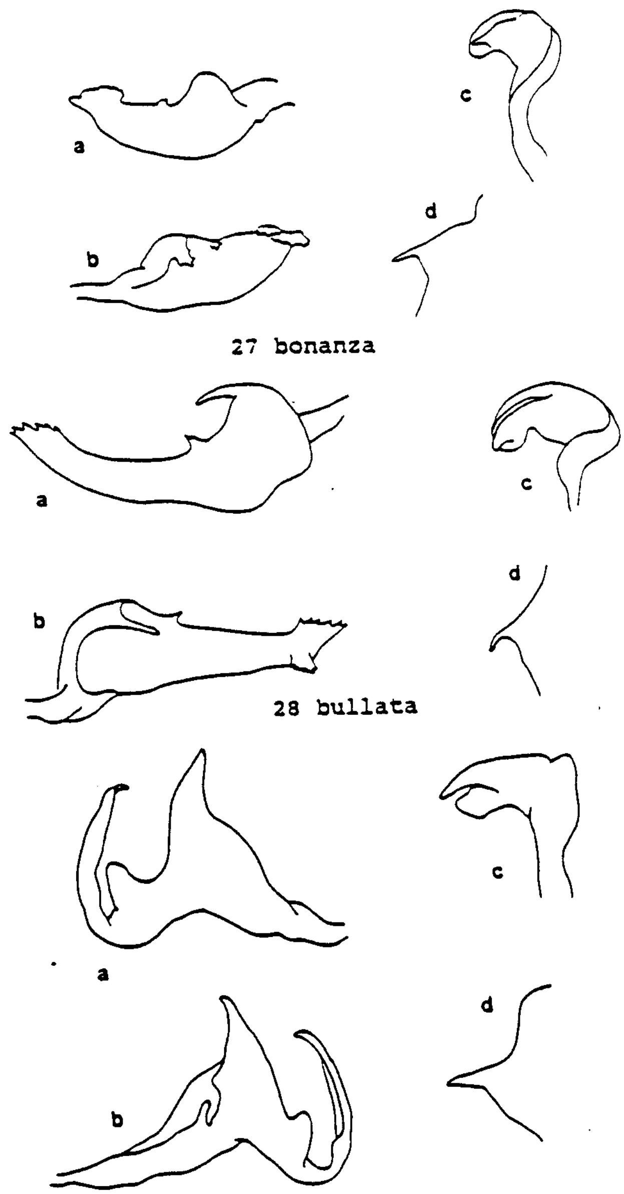
Figures III.19 - III.21. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.19. Lopidea ampla III.20. Lopidea anisacanthi III.21. Lopidea apache.



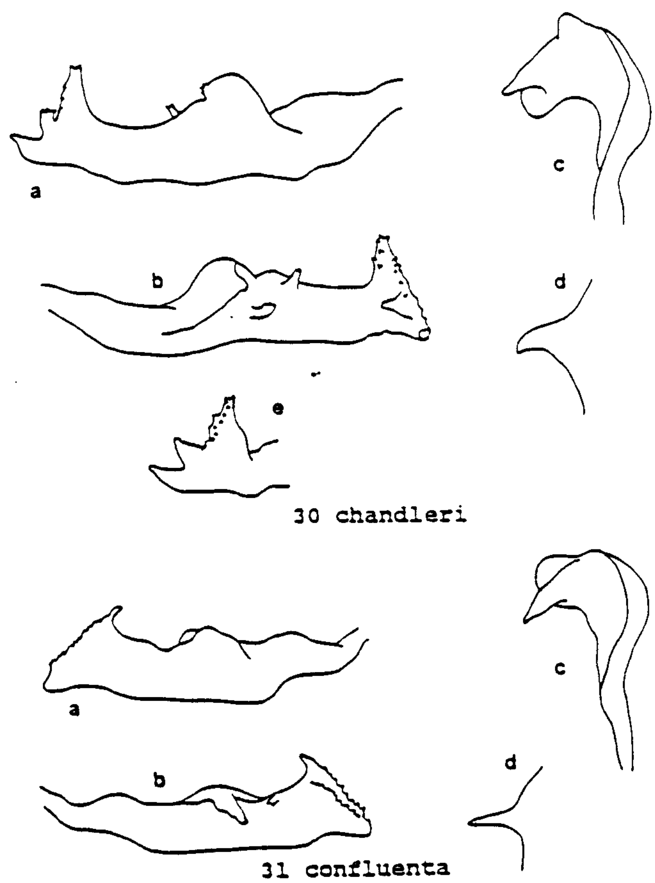
Figures III.22 - III.24. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.22. Lopidea arizonae III.23. Lopidea balli balli III.24. Lopidea balli chelifer.



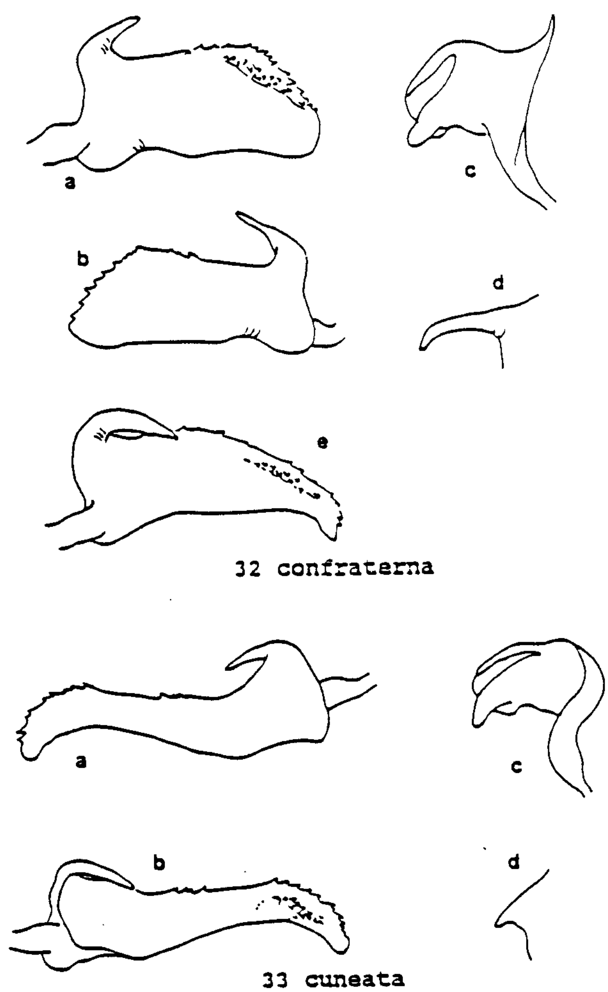
Figures III.25 - III.26. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. E-G. Variation in apex of right paramere; dorsal view. III.25. Lopidea barberi III.26. Lopidea bifurca.



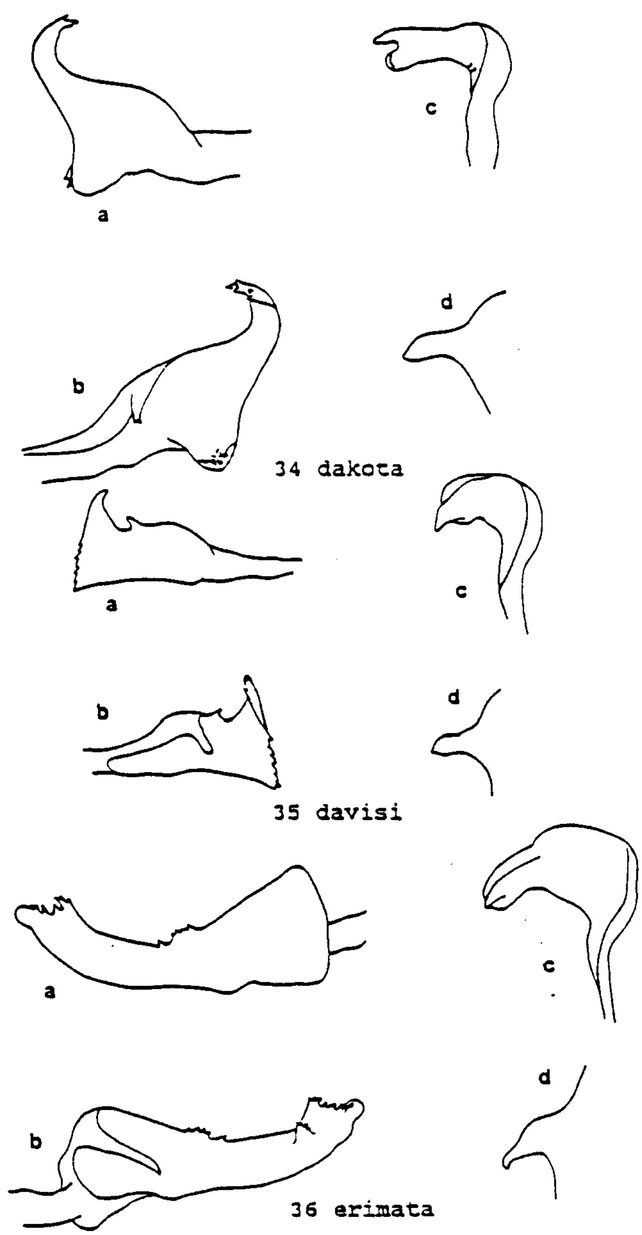
Figures III.27 - III.29. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.27. Lopidea bonanza III.28. Lopidea bullata III.29. Lopidea caesar.



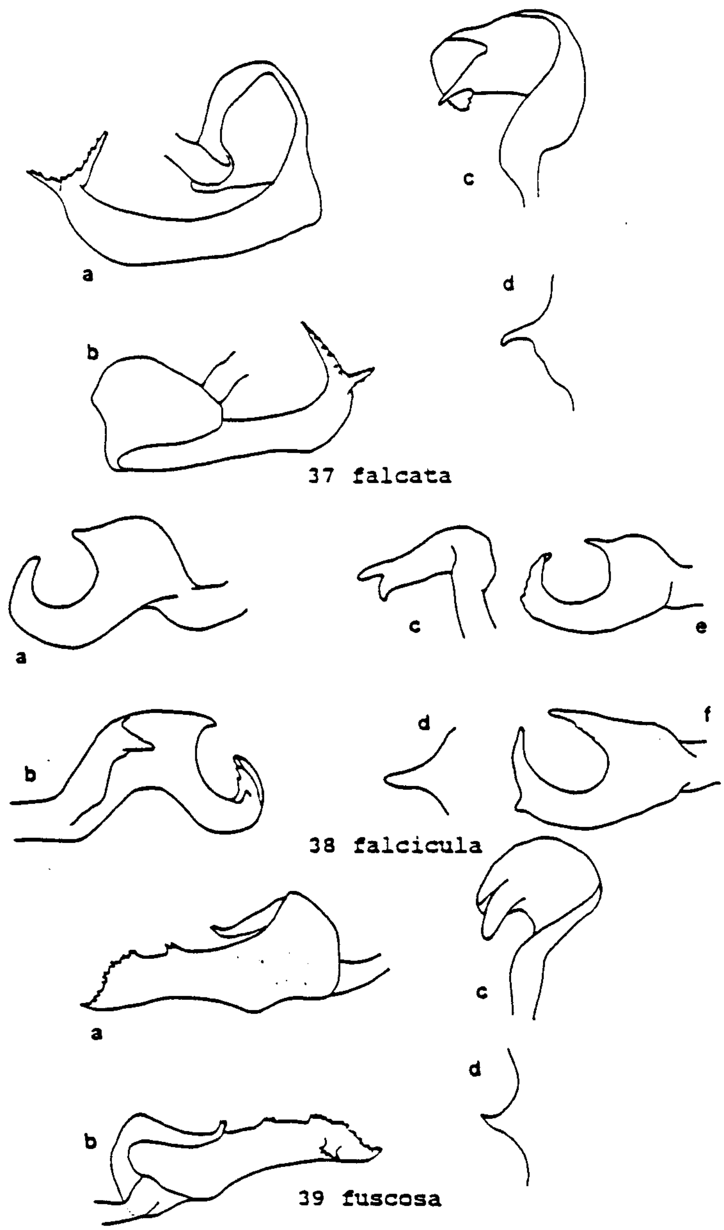
Figures III.30 - III.31. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. E. Apex of right paramere; posterior view. III.30. Lopidea chandleri III.31. Lopidea confluenta.



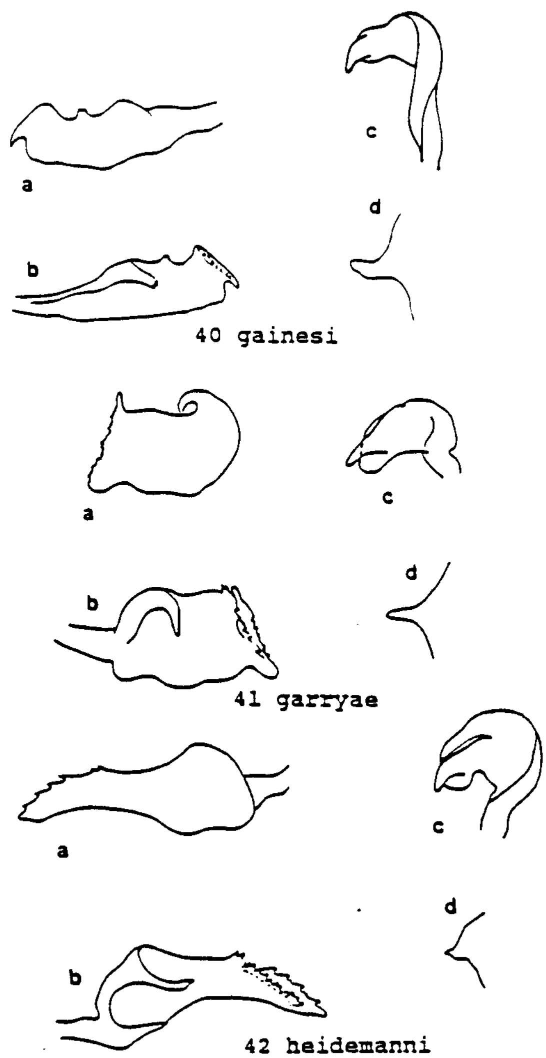
Figures III.32 - III.33. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. E. Right paramere; medial view. III.32. Lopidea confraterna III.33. Lopidea cuneata.



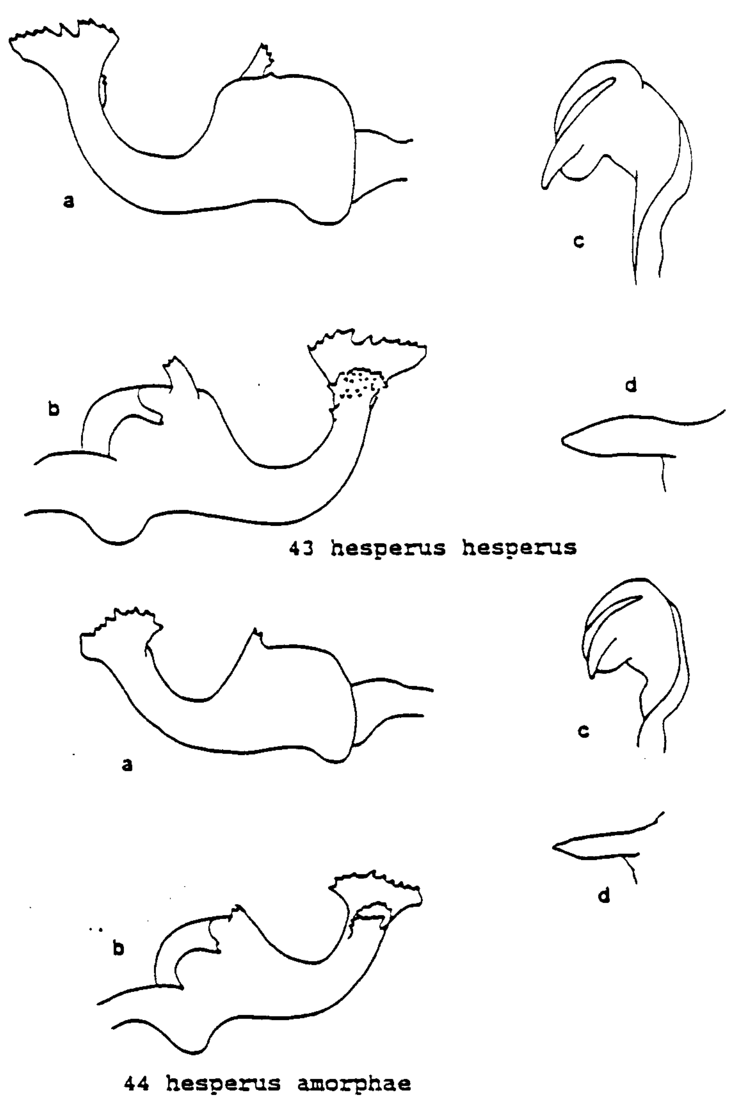
Figures III.34 - III.36. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.34. Lopidea dakota III.35. Lopidea davisi III.36. Lopidea erimata.



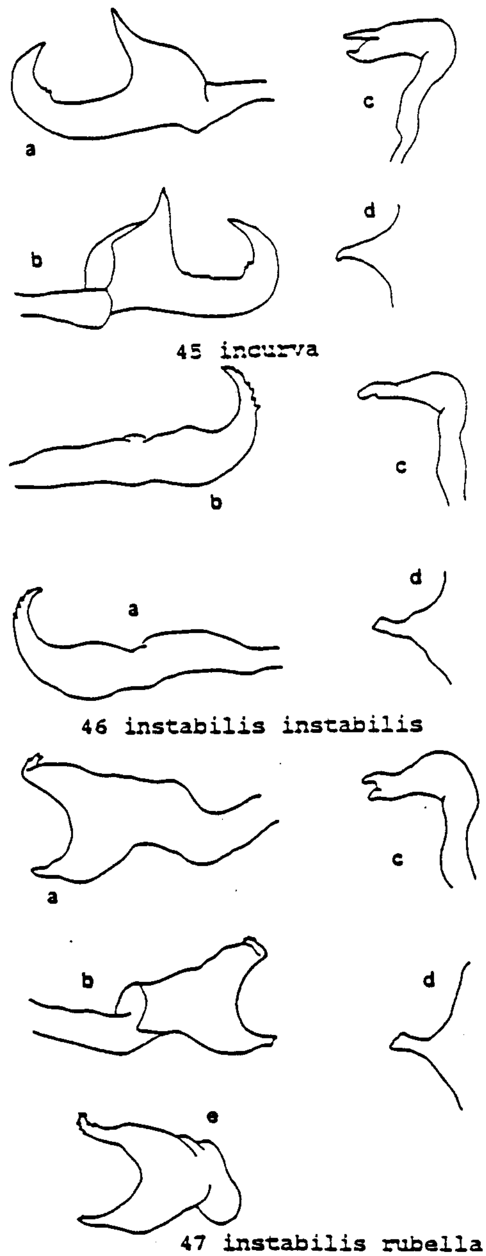
Figures III.37 - III.39. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. E-F. Right paramere; lateral view. III.37. Lopidea falcata III.38. Lopidea falcicula III.39. Lopidea fuscosa.



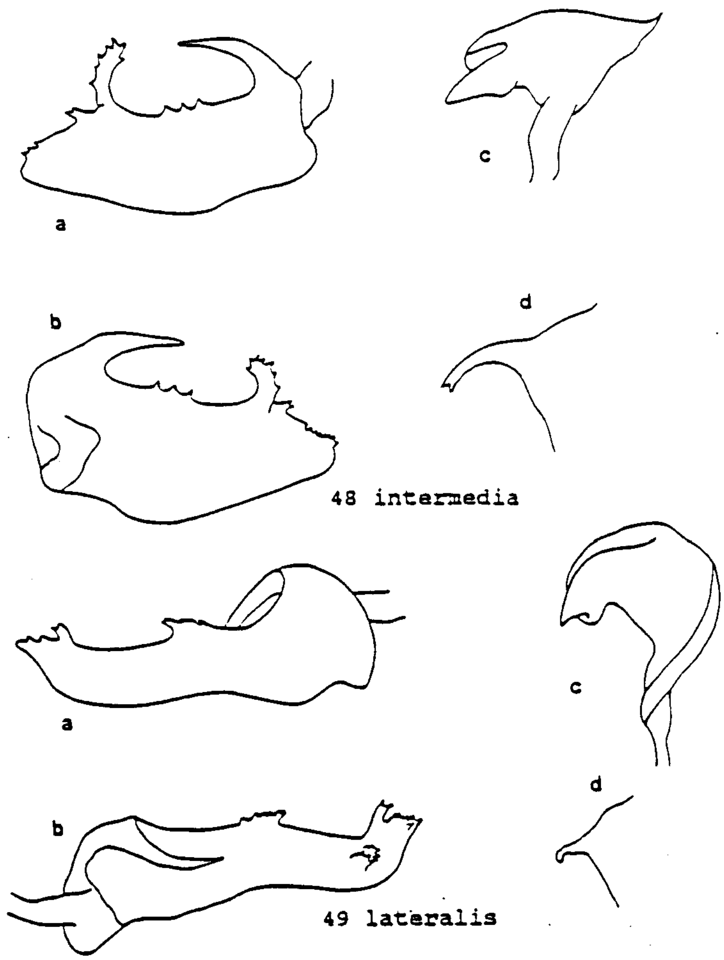
Figures III.40 - III.42. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.40. Lopidea gainesi III.41. Lopidea garryae III.42. Lopidea heidemanni.



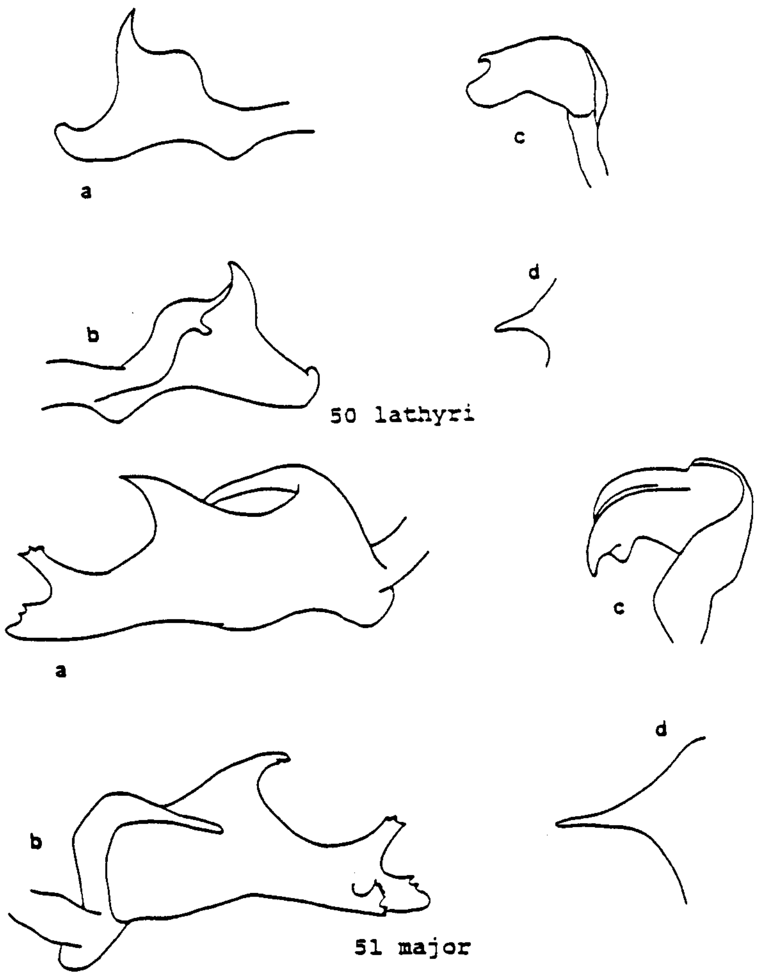
Figures III.43 - III.44. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.43. Lopidea hesperus hesperus III.44. Lopidea hesperus amorphae.



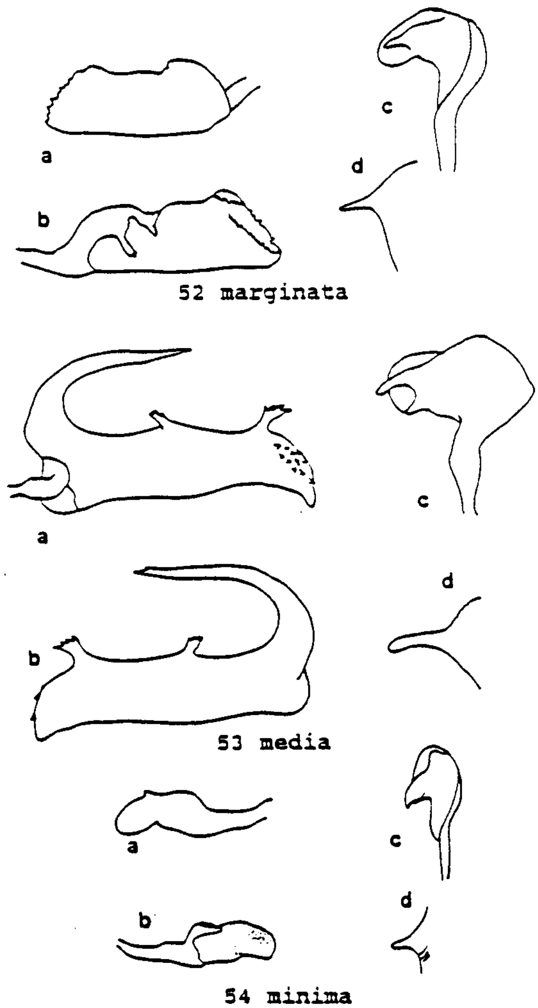
Figures III.45 - III.47. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. E. Right paramere; posterior view. III.45. Lopidea incurva III.46. Lopidea instabilis instabilis III.47. Lopidea instabilis rubella.



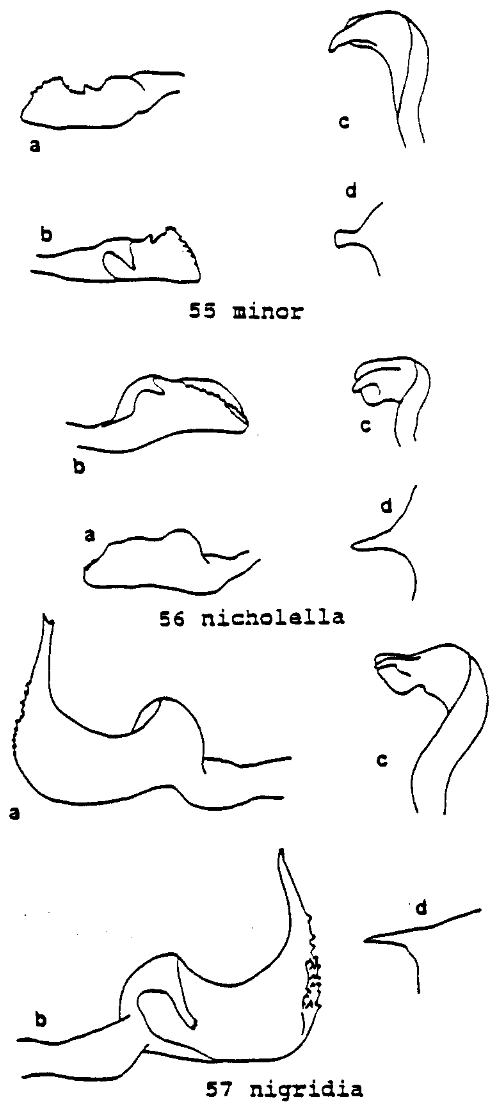
Figures III.48 - III.49. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.48. Lopidea intermedia III.49. Lopidea lateralis.



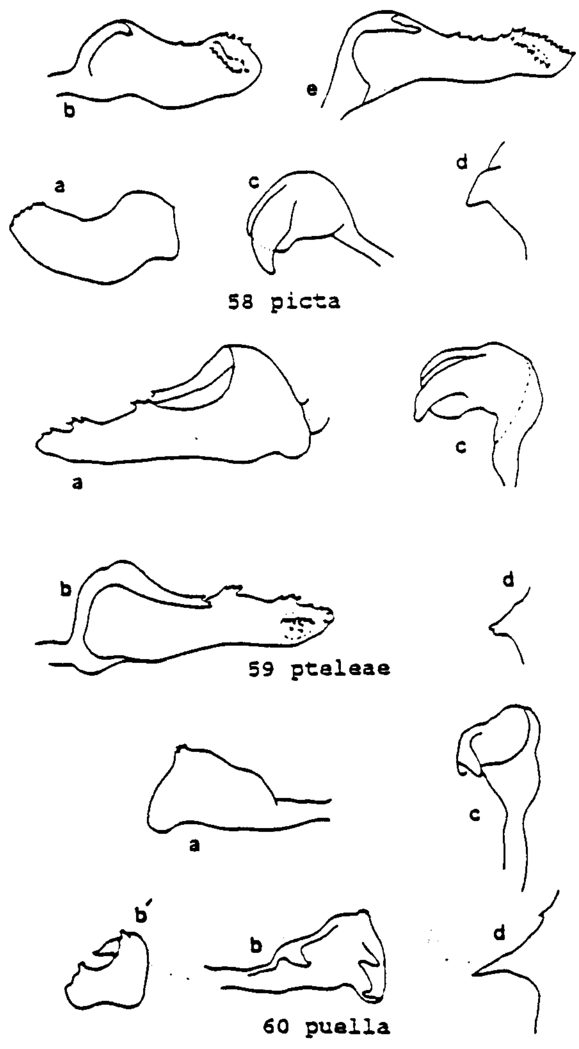
Figures III.50 - III.51. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.50. Lopidea lathyri III.51. Lopidea major.



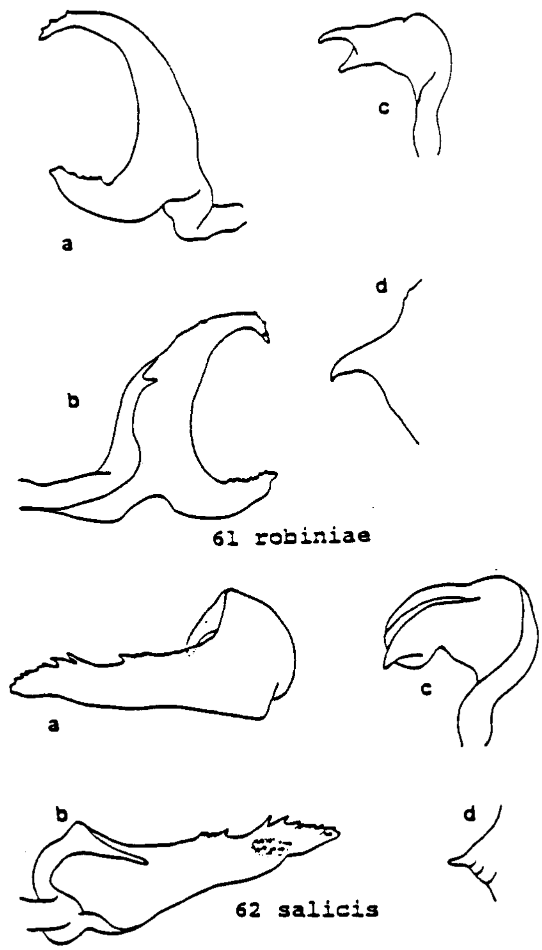
Figures III.52 - III.54. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.52. Lopidea marginata III.53. Lopidea media III.54. Lopidea minima.



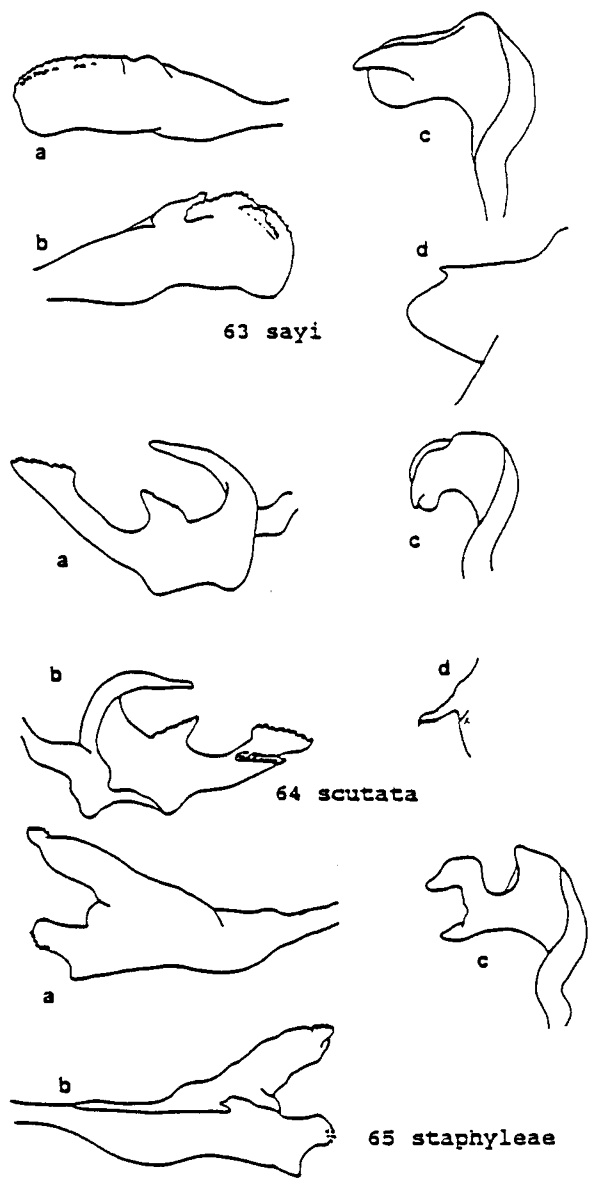
Figures III.55 - III.57. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.55. Lopidea minor III.56. Lopidea nicholella III.57. Lopidea nigridia.



Figures III.58 - III.60. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. B'. Right paramere; posterior view. C. Left paramere; medial view. D. Tergal process; lateral view. E. Right paramere; medial view. III.58. Lopidea picta III.59. Lopidea pteleae III.60. Lopidea puella.



Figures III.61 - III.62. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.61. Lopidea robiniae III.62. Lopidea salicis.



Figures III.63 - III.65. Male genitalia. A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view. III.63. Lopidea sayi III.64. Lopidea scutata III.65. Lopidea staphyleae.

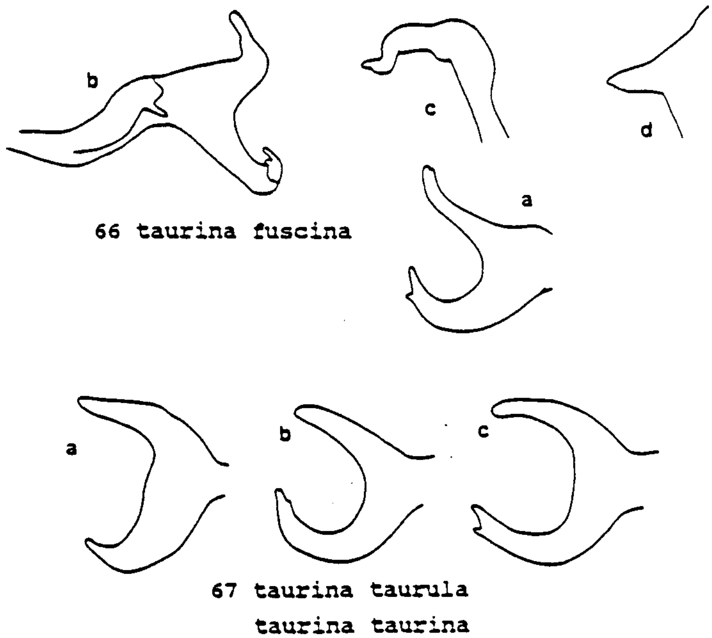


Figure III.66. Lopidea taurina fuscina A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view.
Figure III.67. A. Lopidea taurina taurina. Right paramere; lateral view. B-C. Lopidea taurina taurula. Right paramere; lateral view.

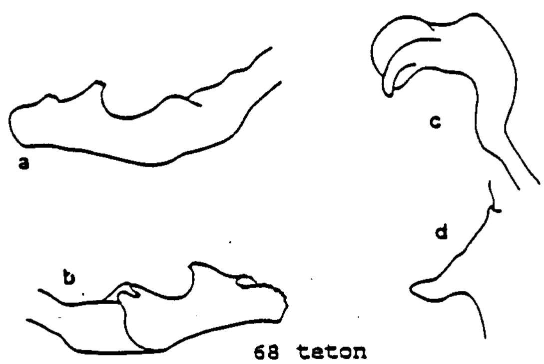
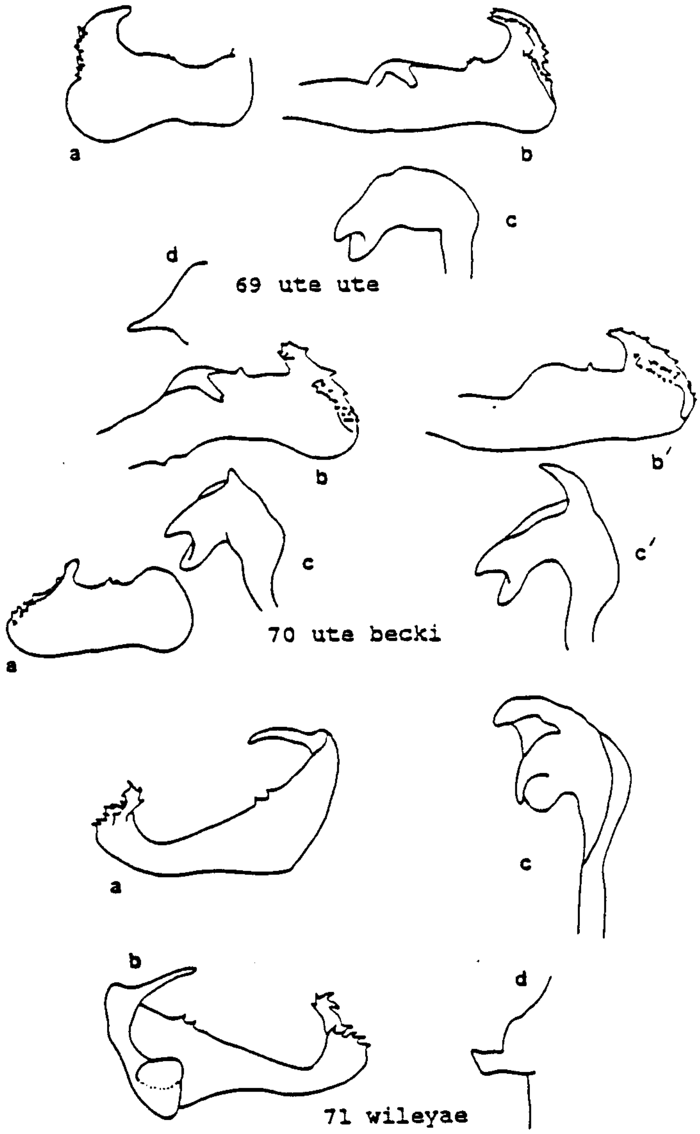
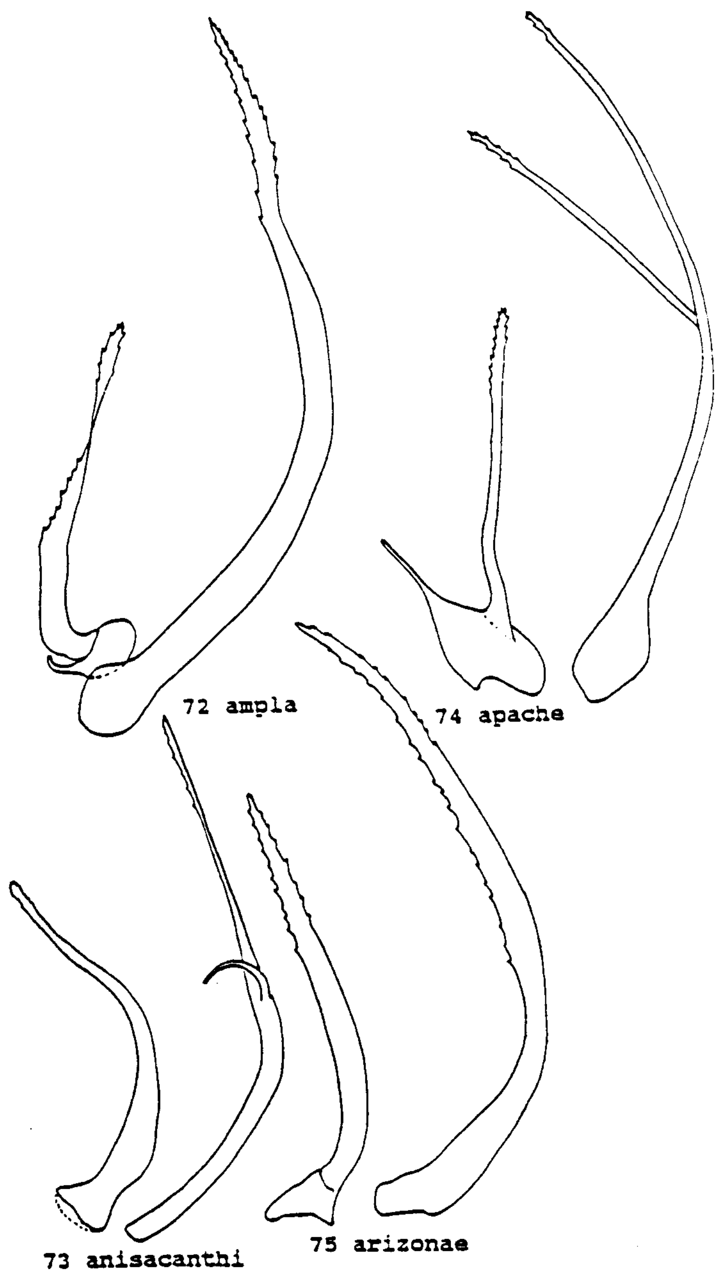


Figure III.68. Lopidea teton A. Right paramere; lateral view. B. Right paramere; medial view. C. Left paramere; medial view. D. Tergal process; lateral view.



Figures III.69 - III.71. Male genitalia. A. Right paramere; lateral view. B-B'. Right paramere; medial view. C-C'. Left paramere; medial view. D. Tergal process; lateral view. III.69. Lopidea ute ute III.70. Lopidea ute becki III.71. Lopidea wileyae.



Figures III.72 - III.75. Spiculae. III.72. Lopidea ampla III.73. Lopidea anisacanthi III.74. Lopidea apache III.75. Lopidea arizonae.

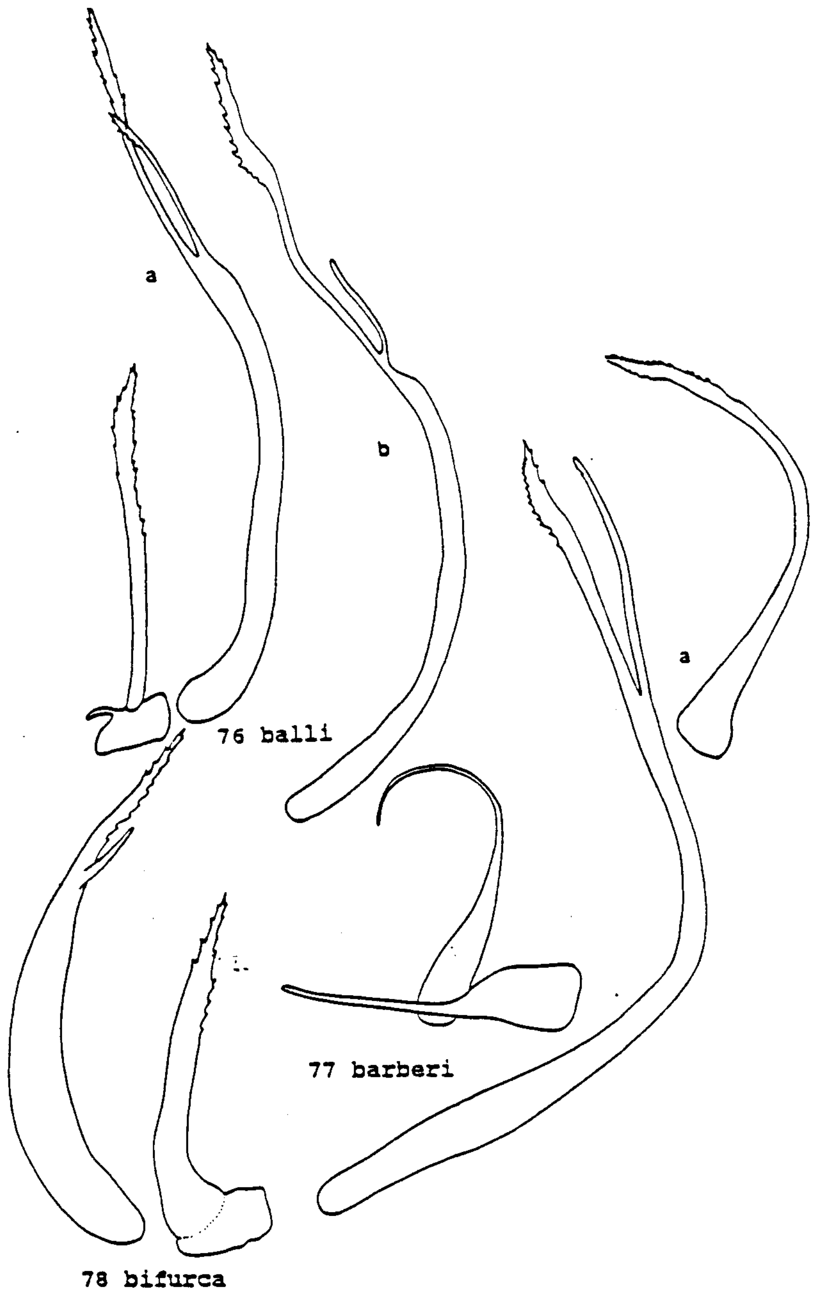
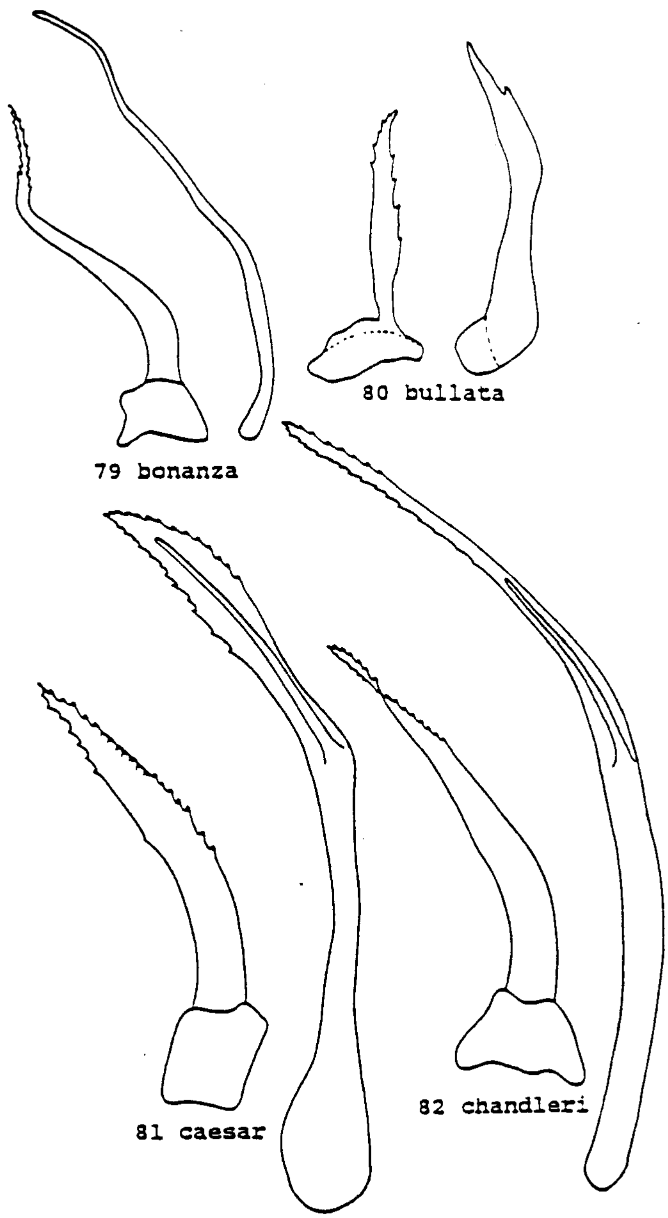
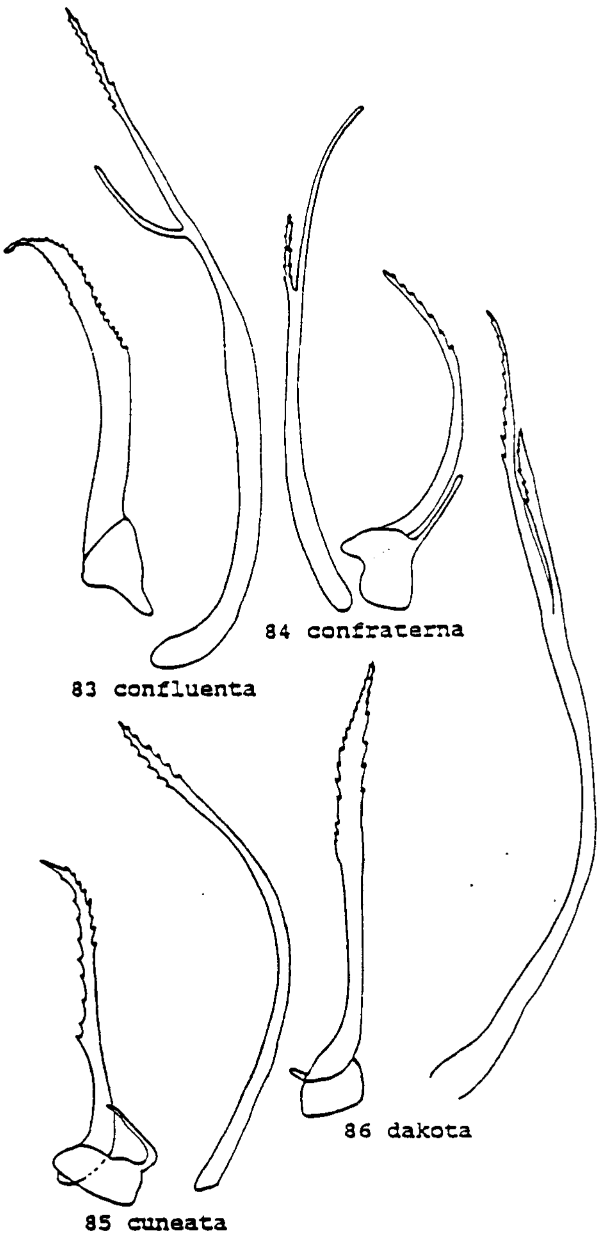


Figure III.76. Spiculae. A. Lopidea balli balli B. Lopidea balli chelifer.

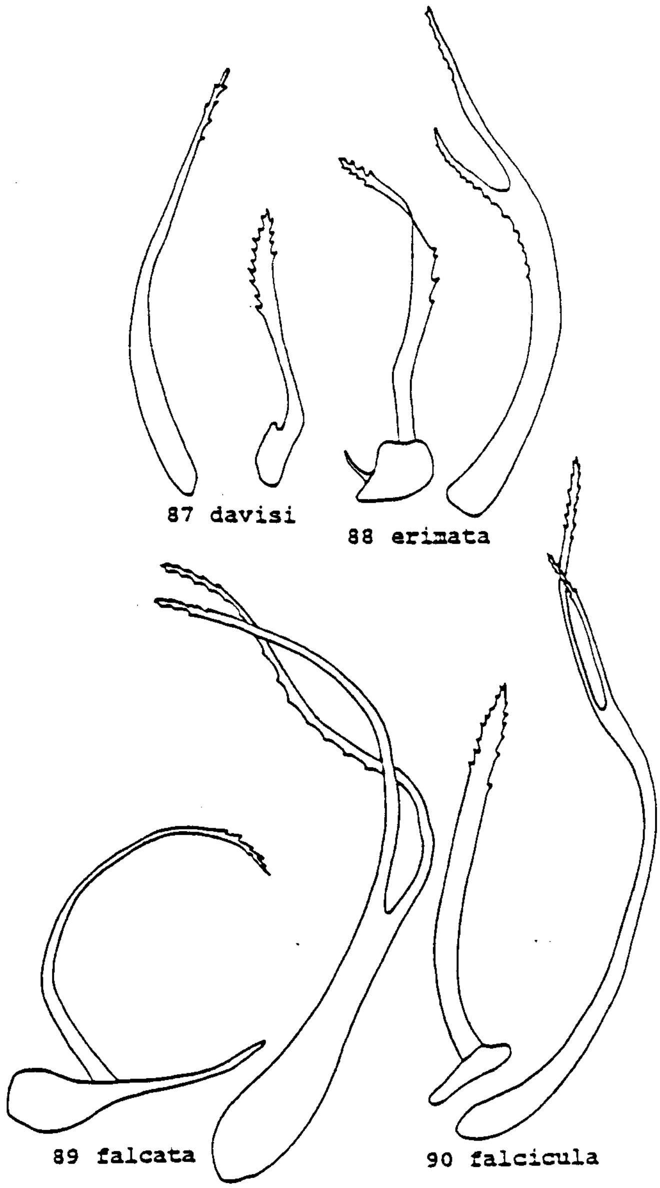
Figures III.77-III.78. Spiculae. III.77. Lopidea barberi A. Variation in dorsal spicula. III.78. Lopidea bifurca.



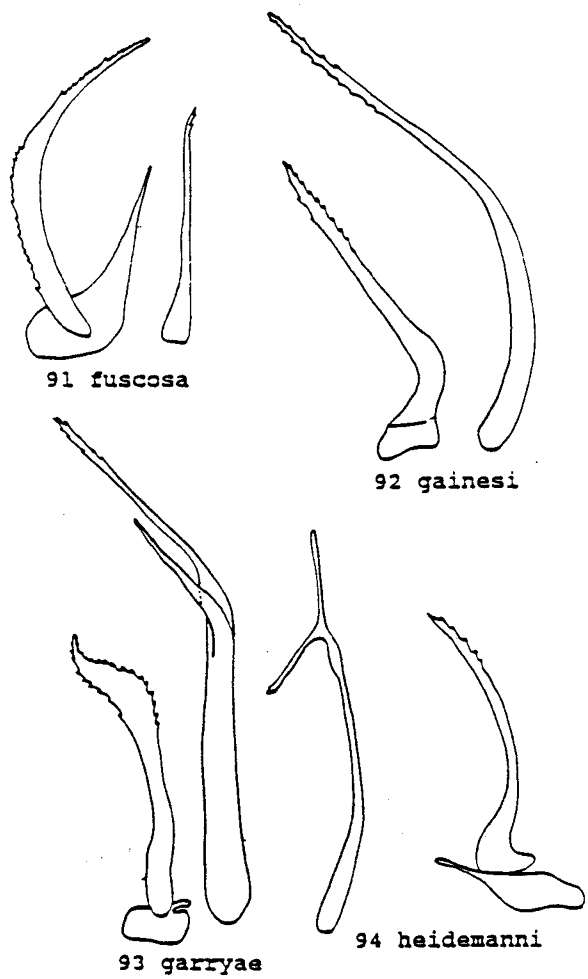
Figures III.79 - III.82. Spiculae. III.79. Lopidea bonanza III.80. Lopidea bullata III.81. Lopidea caesar III.82. Lopidea chandleri.



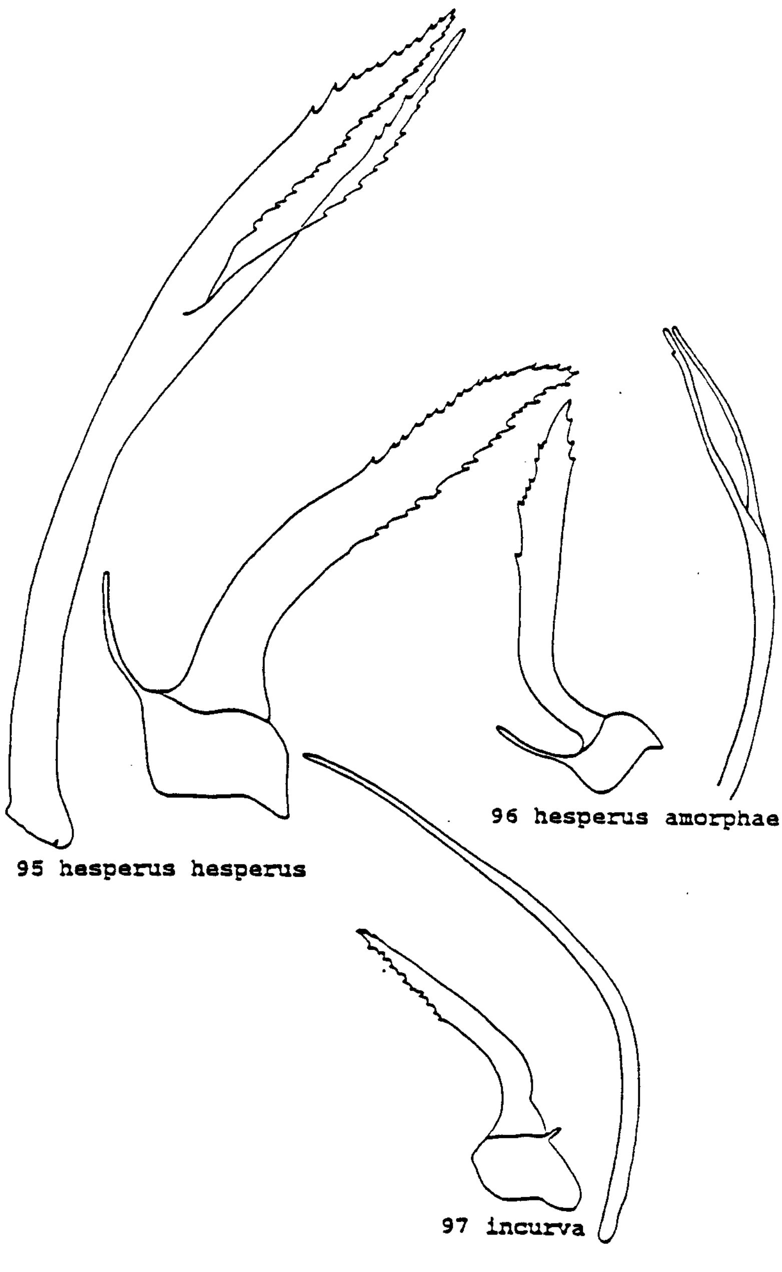
Figures III.83 - III.86. Spiculae. III.83. Lopidea confluenta III.84. Lopidea confraterna III.85. Lopidea cuneata III.86. Lopidea dakota.



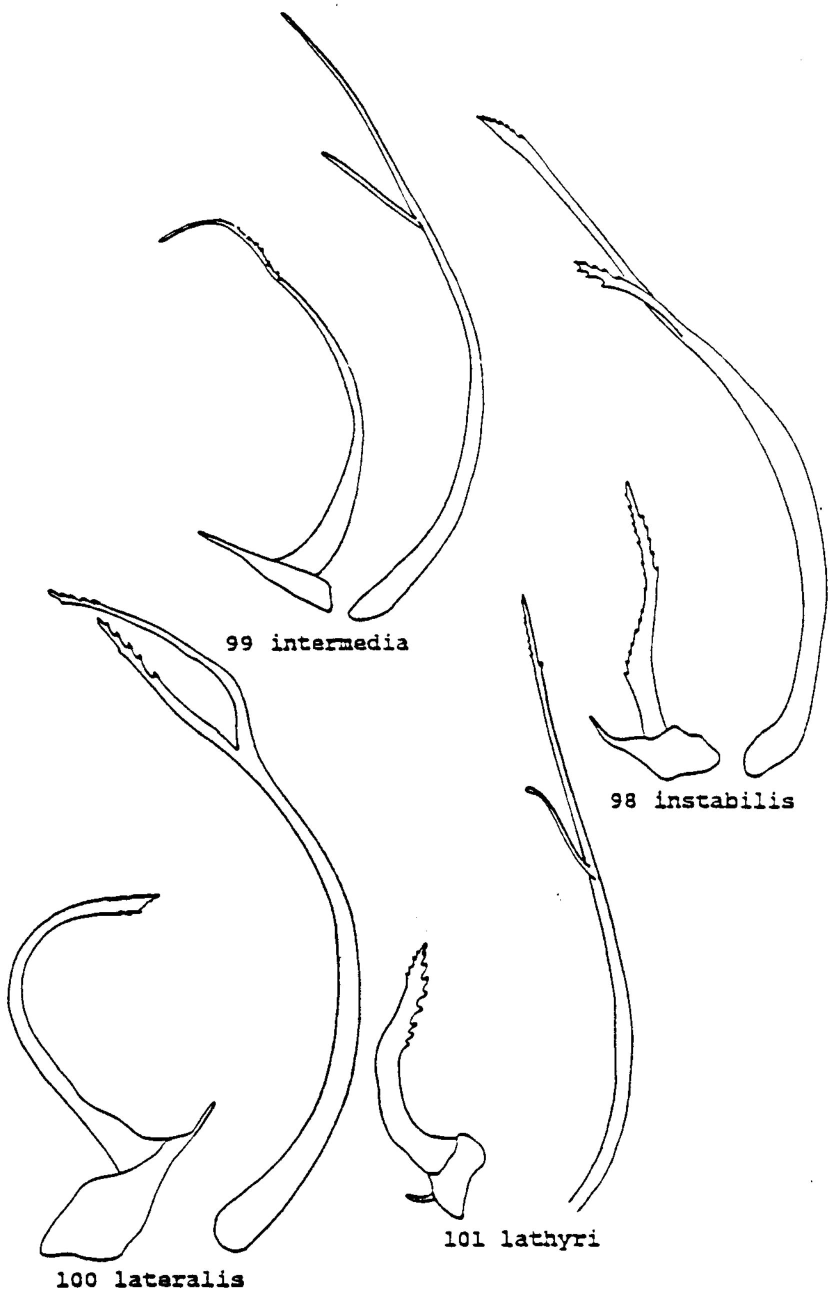
Figures III.87 - III.90. Spiculae. III.87. Lopidea davisi III.88. Lopidea erimata III.89. Lopidea falcata III.90. Lopidea falcicula.



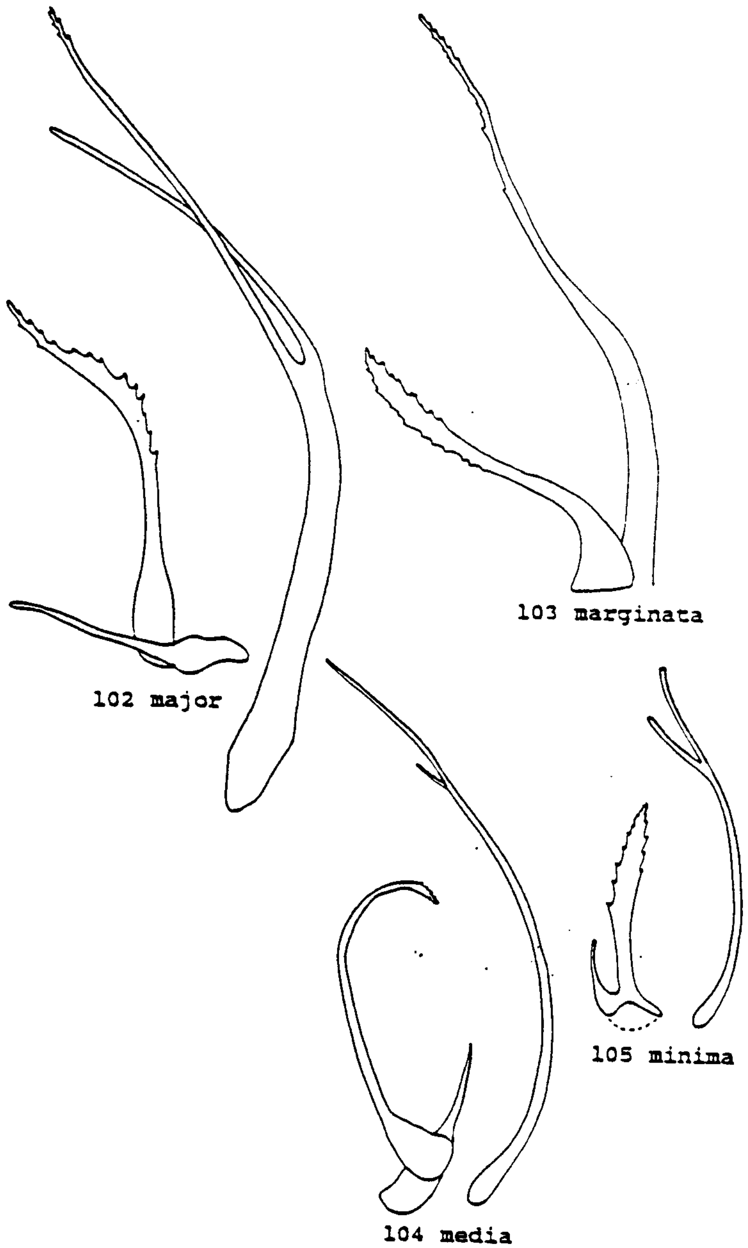
Figures III.91 - III.94. Spiculae. III.91. Lopidea fuscosa III.92. Lopidea gainesi III.93. Lopidea garryae III.94. Lopidea heidemanni.



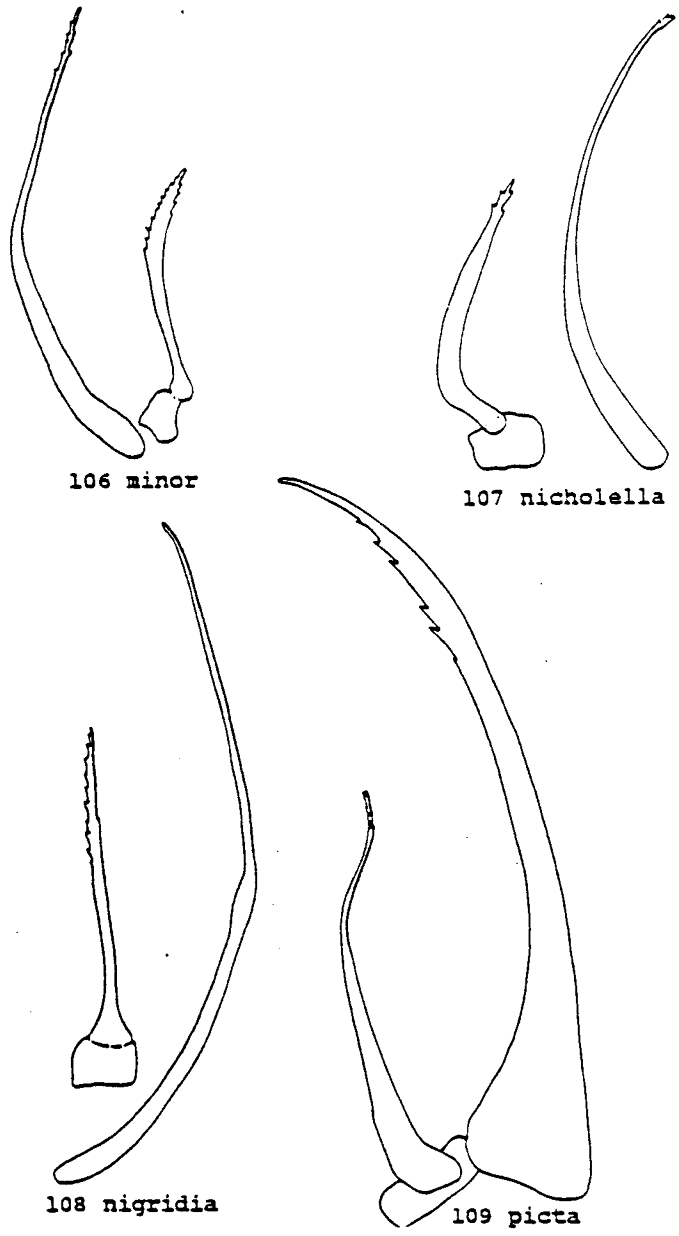
Figures III.95 - III.97. Spiculae. III.95. <u>Lopidea hesperus hesperus</u> III.96. <u>Lopidea hesperus amorphae</u> III.97. <u>Lopidea incurva</u>.



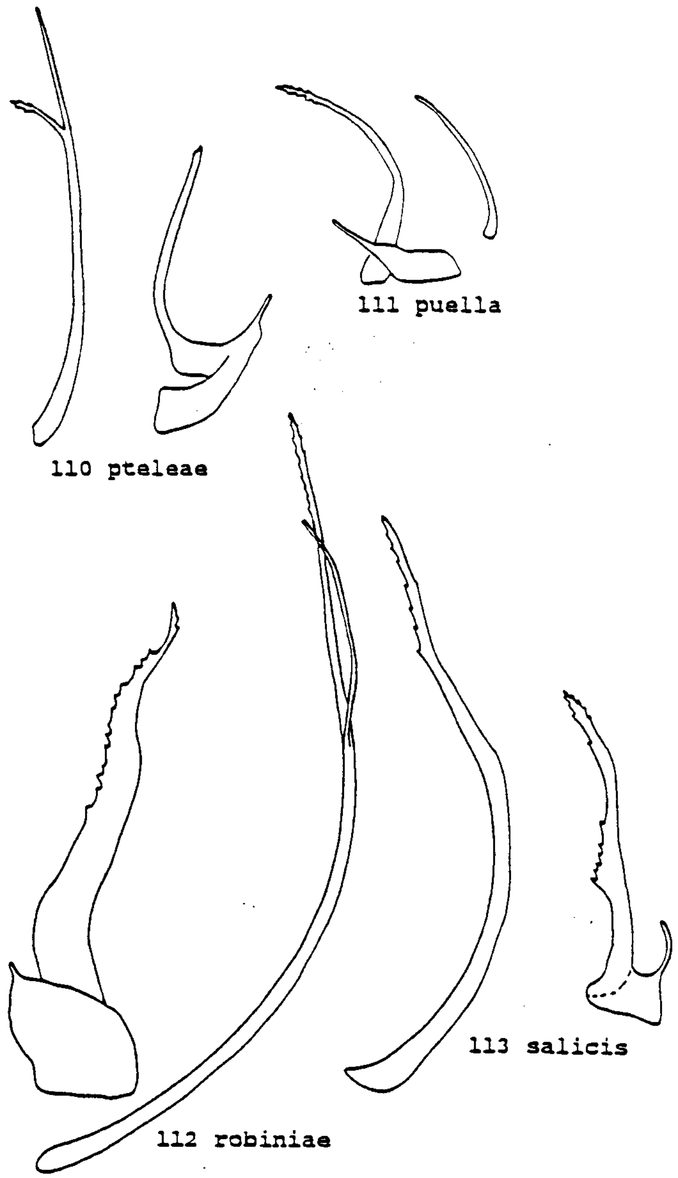
Figures III.98 - III.101. Spiculae. III.98. Lopidea instabilis III.99. Lopidea intermedia III.100. Lopidea lateralis III.101. Lopidea lathyri.



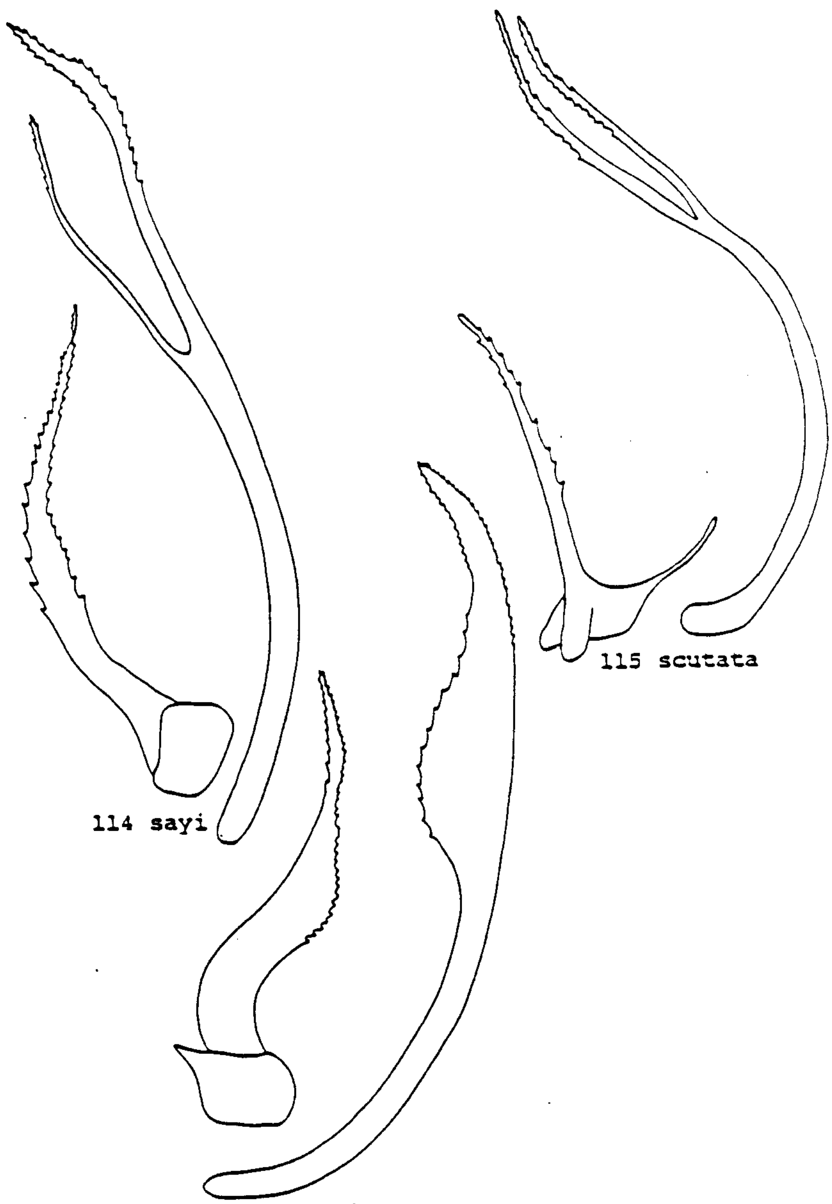
Figures III.102 - III.105. Spiculae. III.102. <u>Lopidea major</u> III.103. <u>Lopidea marginata</u> III.104. <u>Lopidea media</u> III.105. <u>Lopidea minima</u>.



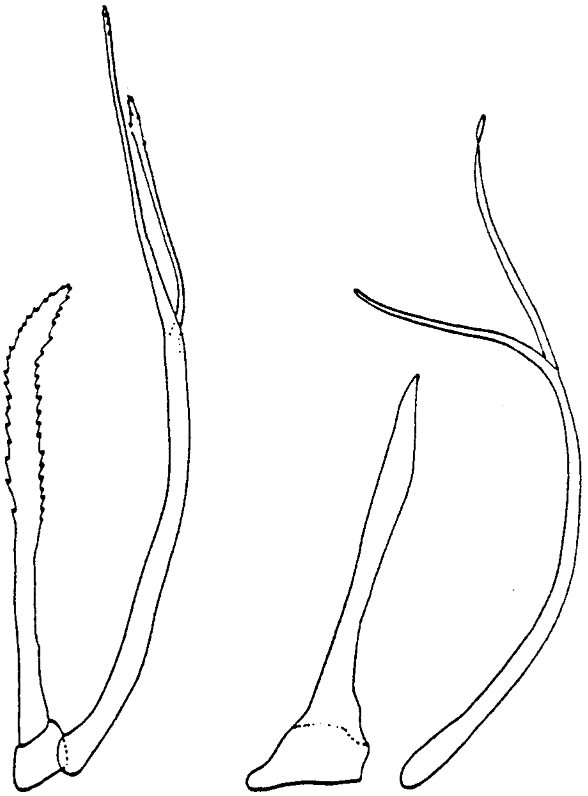
Figures III.106 - III.109. Spiculae. III.106. Lopidea minor III.107. Lopidea nicholella III.108. Lopidea nigridia III.109. Lopidea picta.



Figures III.110 - III.113. Spiculae. III.110. *Lopidea pteleae* III.111. *Lopidea puella* III.112. *Lopidea robiniae*. III.113. *Lopidea salicis*.

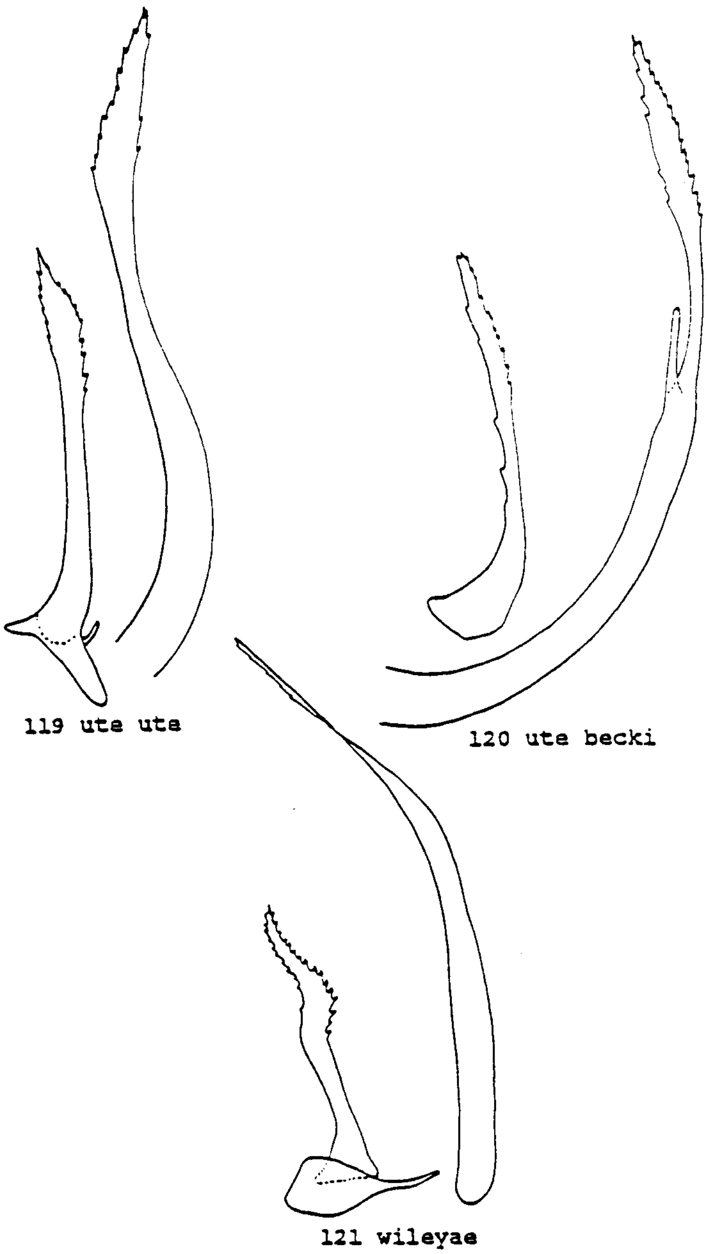


Figures III.114 - III.116. Spiculae. III.114. Lopidea sayi III.115. Lopidea scutata III.116. Lopidea staphyleae.

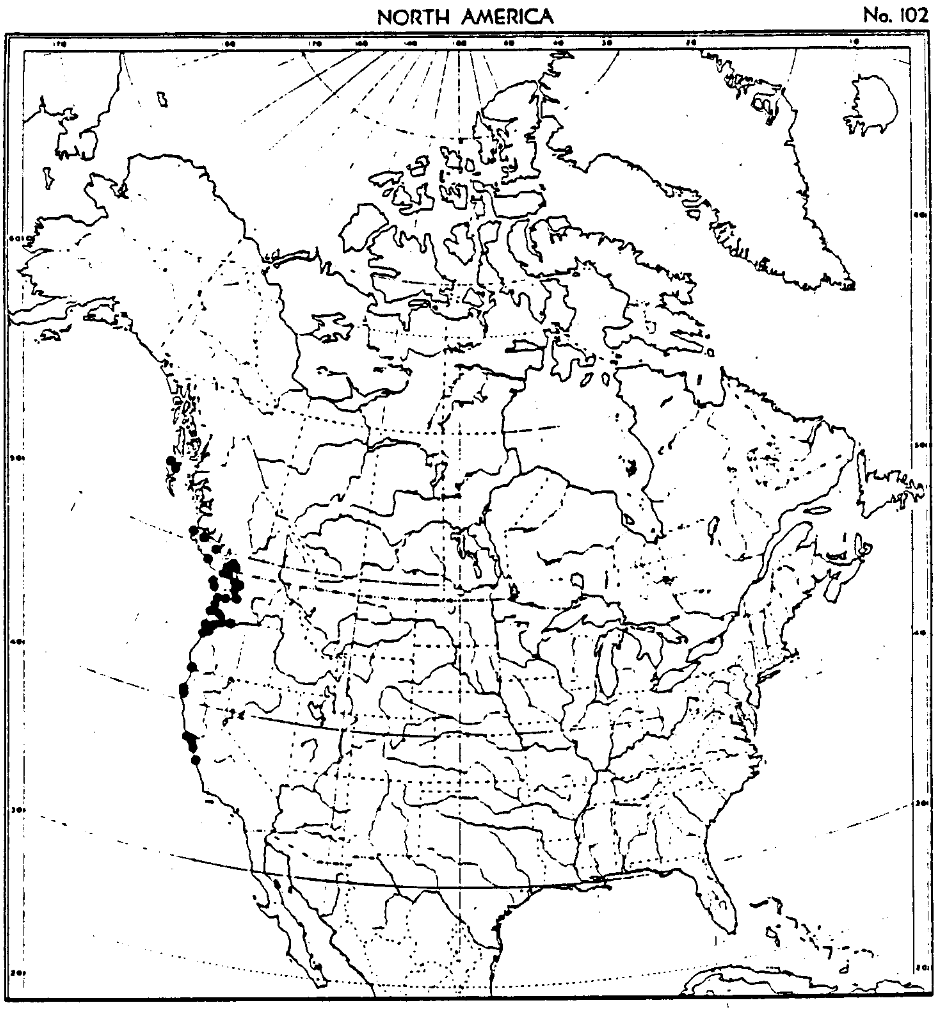


117 taurina   118 teton

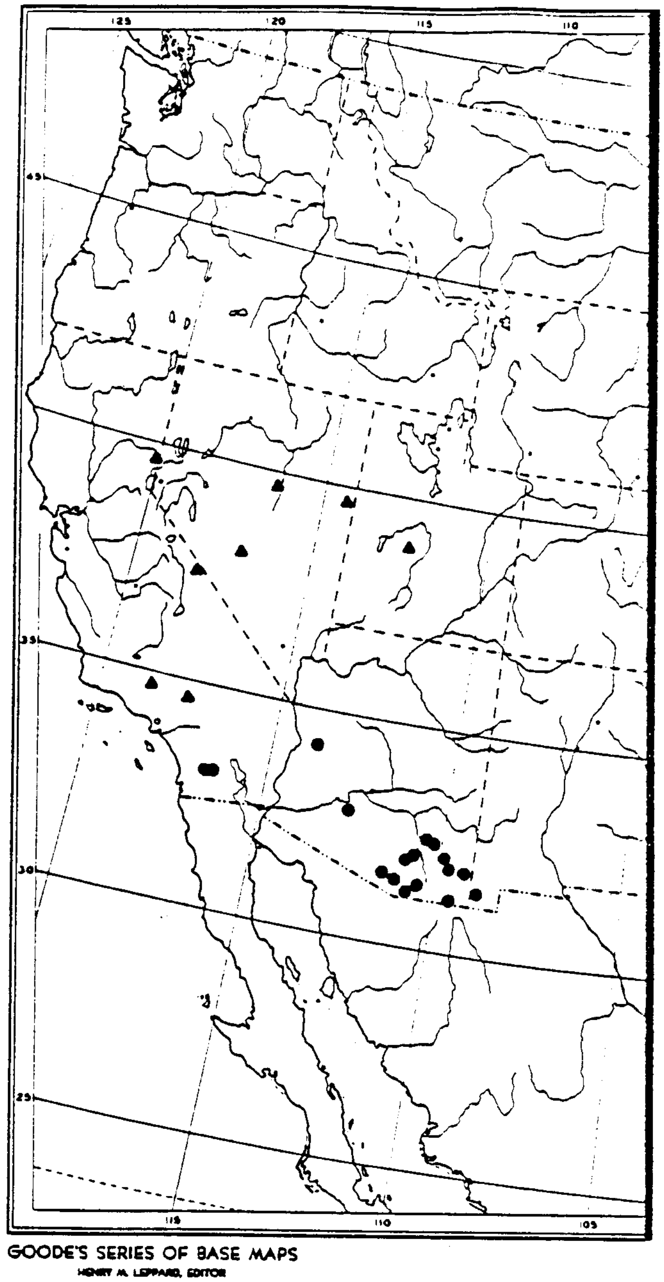
Figures III.117 - III.118. Spiculae. III.117. Lopidea taurina III.118. Lopidea teton.



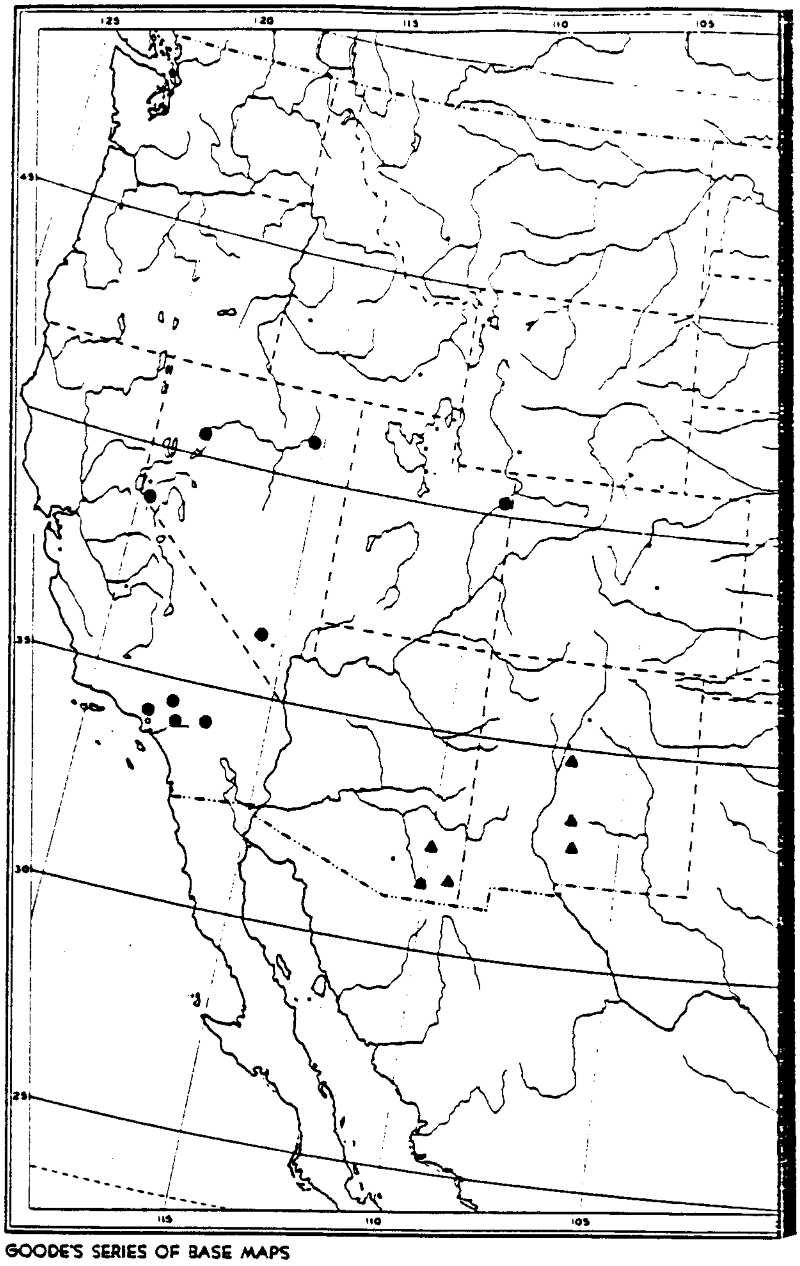
Figures III.119 - III.121. Spiculae. III.119. Lopidea ute ute III.120. Lopidea ute becki III.121. Lopidea wileyae.



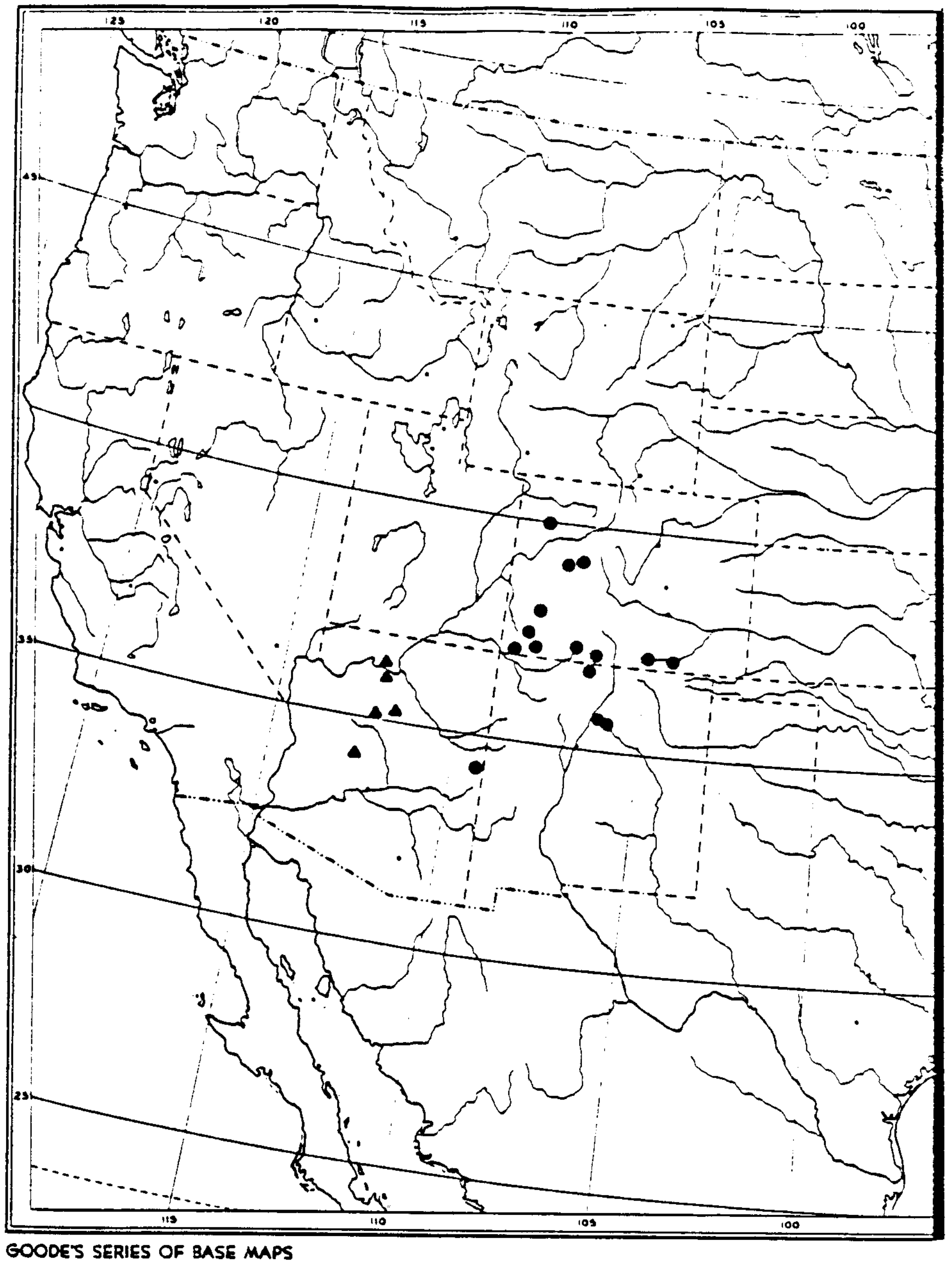
Map III.1. Distribution of Lopidea ampla.



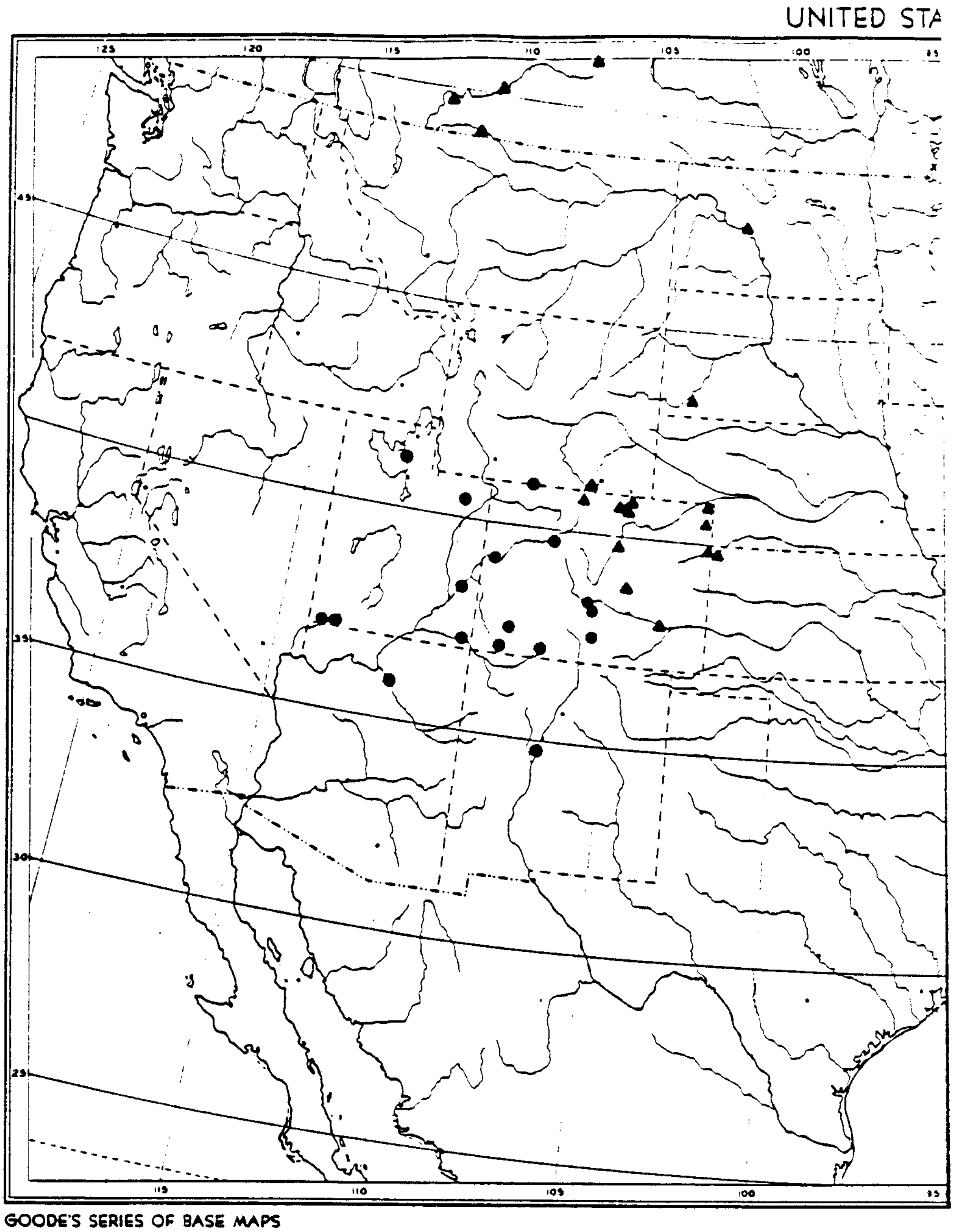
Map III.2. Distribution of Lopidea anisacanthi, circles. L. fuscosa, triangles.



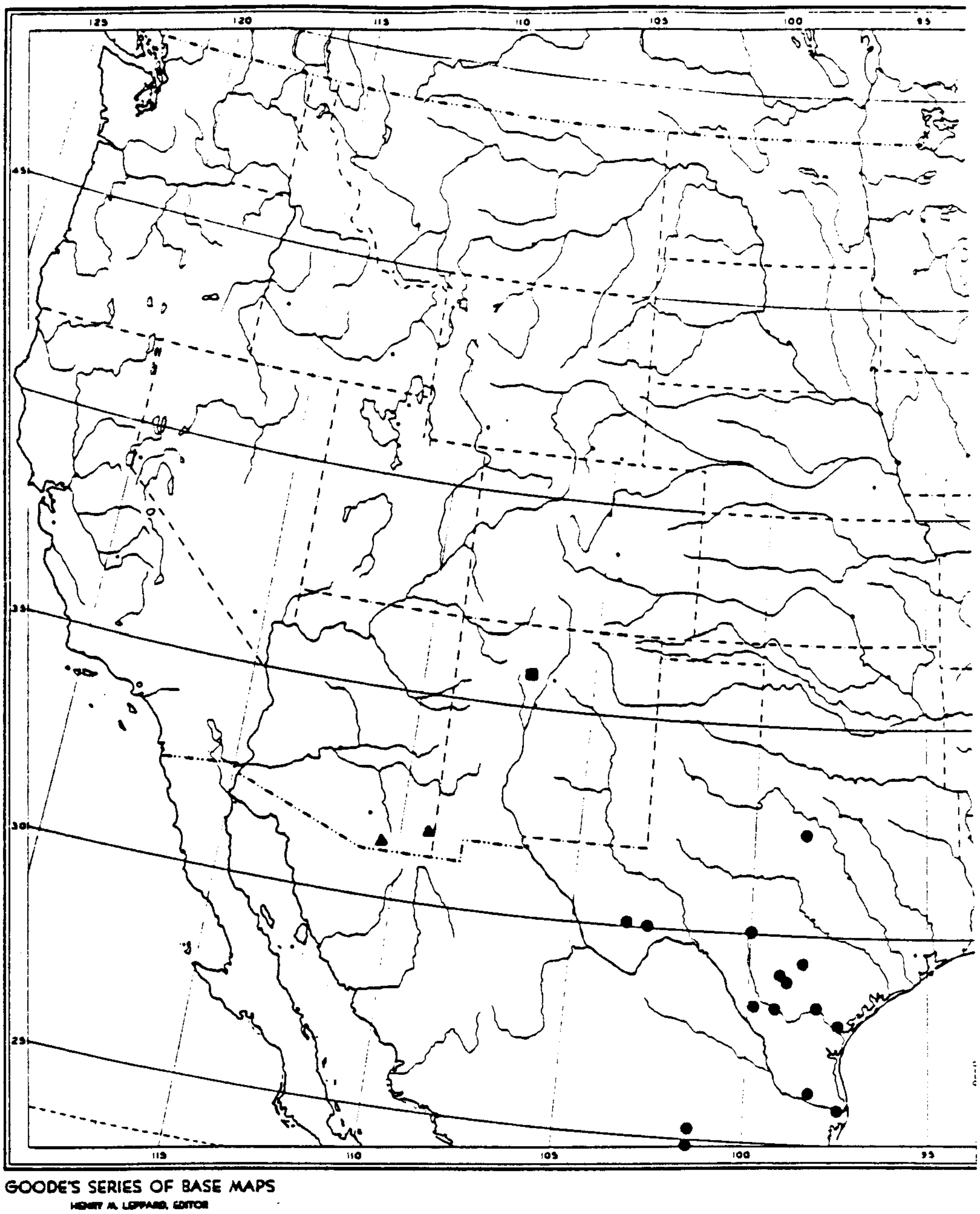
Map III.3. Distribution of Lopidea apache, triangles. L. bullata, circles.



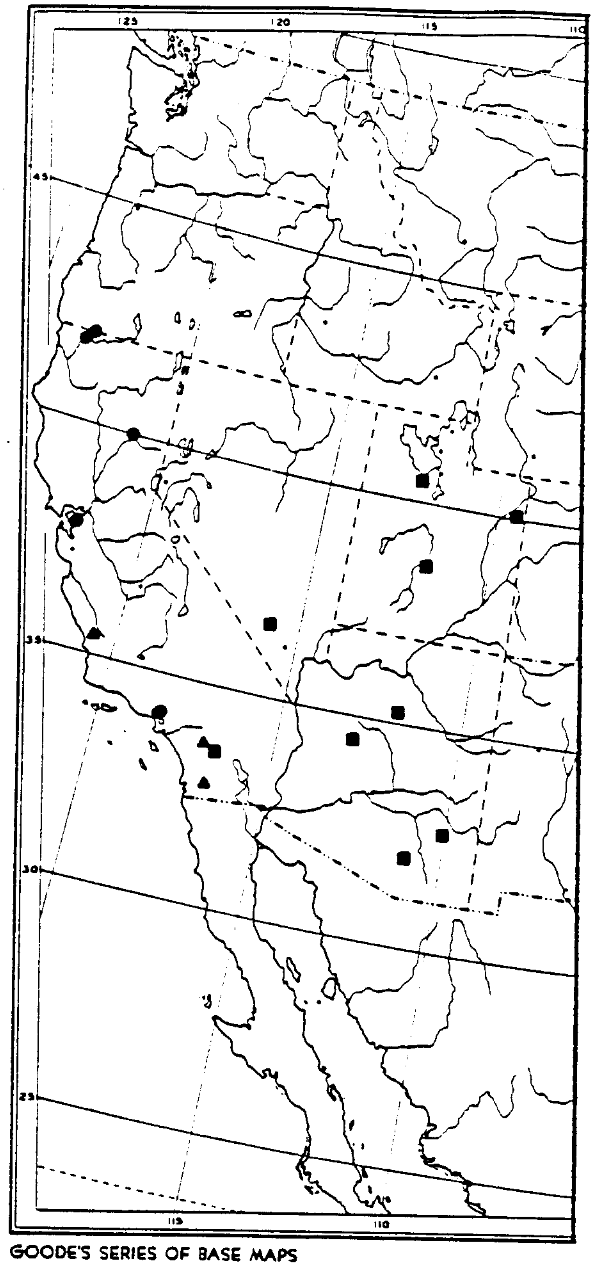
Map III.4. Distribution of <u>Lopidea</u> <u>arizonae</u>, triangles. <u>L.</u> <u>falcicula</u>, circles.



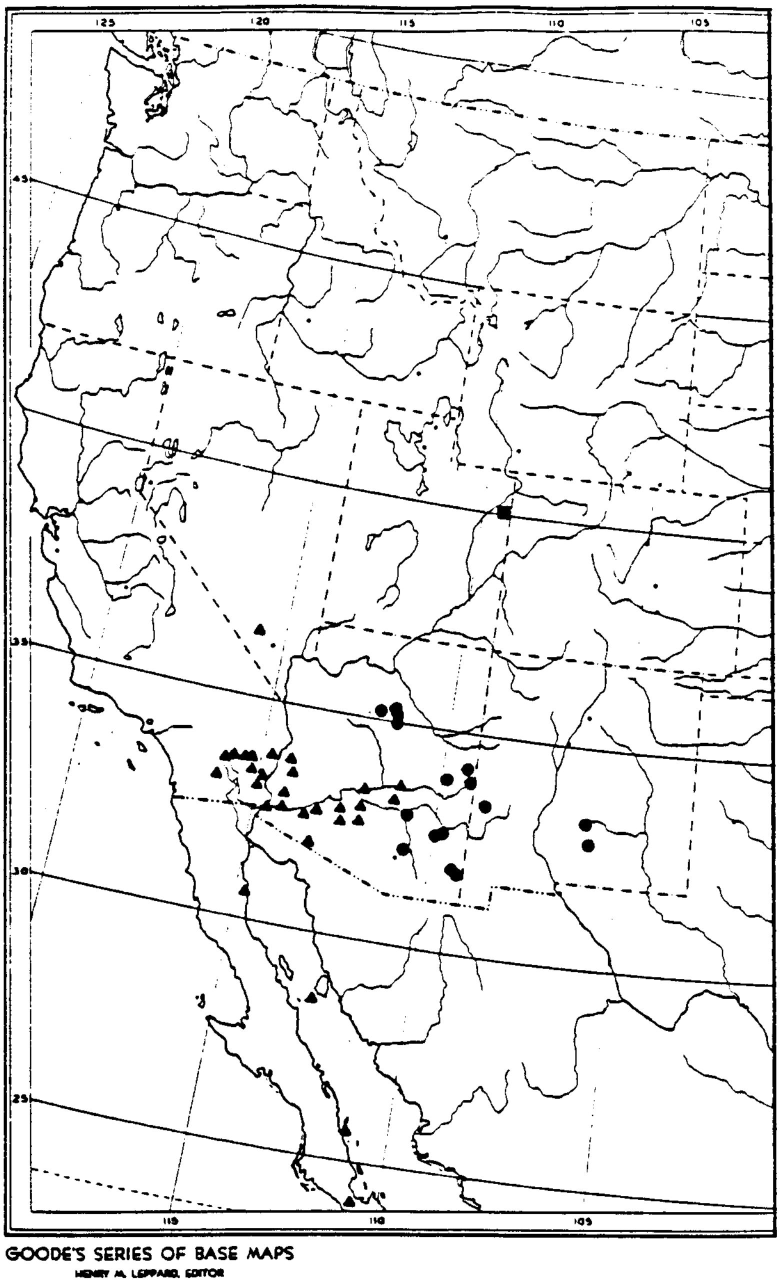
Map III.5. Distribution of Lopidea balli balli, triangles. L. b. chelifer, circles.



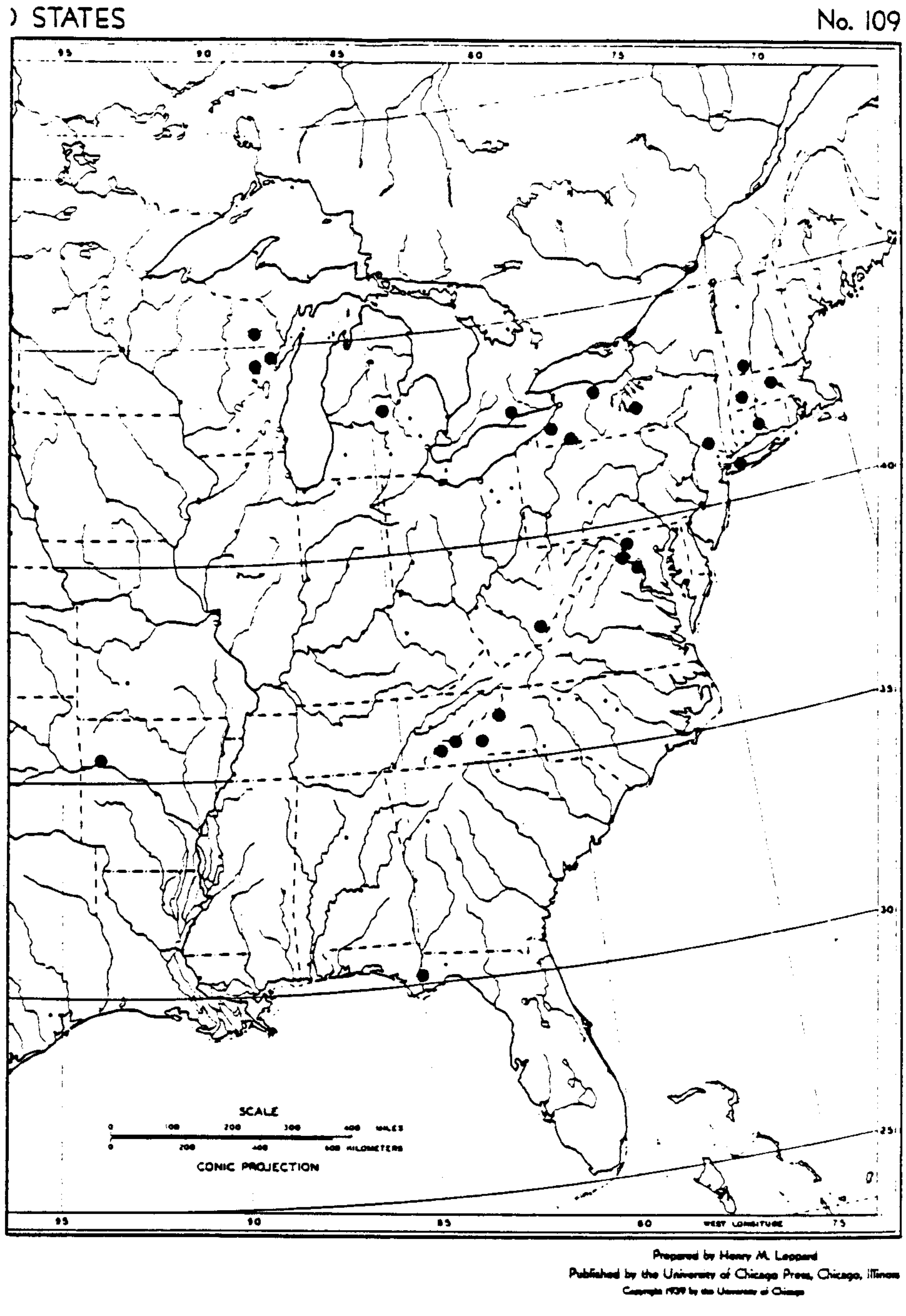
Map III.6. Distribution of Lopidea barberi, triangles. L. falcata, squares. L. wileyae, circles.



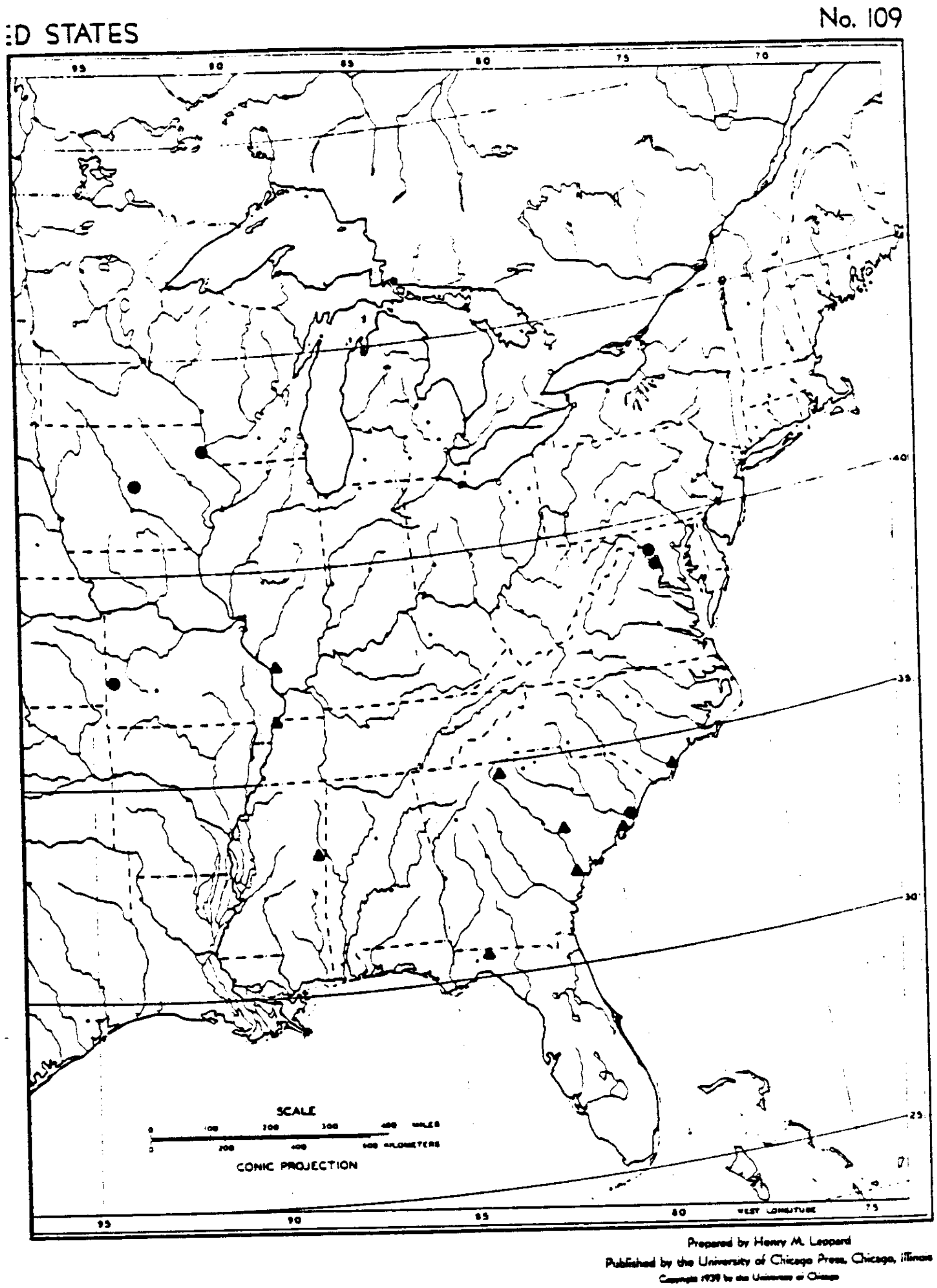
Map III.7. Distribution of Lopidea bifurca, circles. L. puella, triangles. L. scutata, squares.



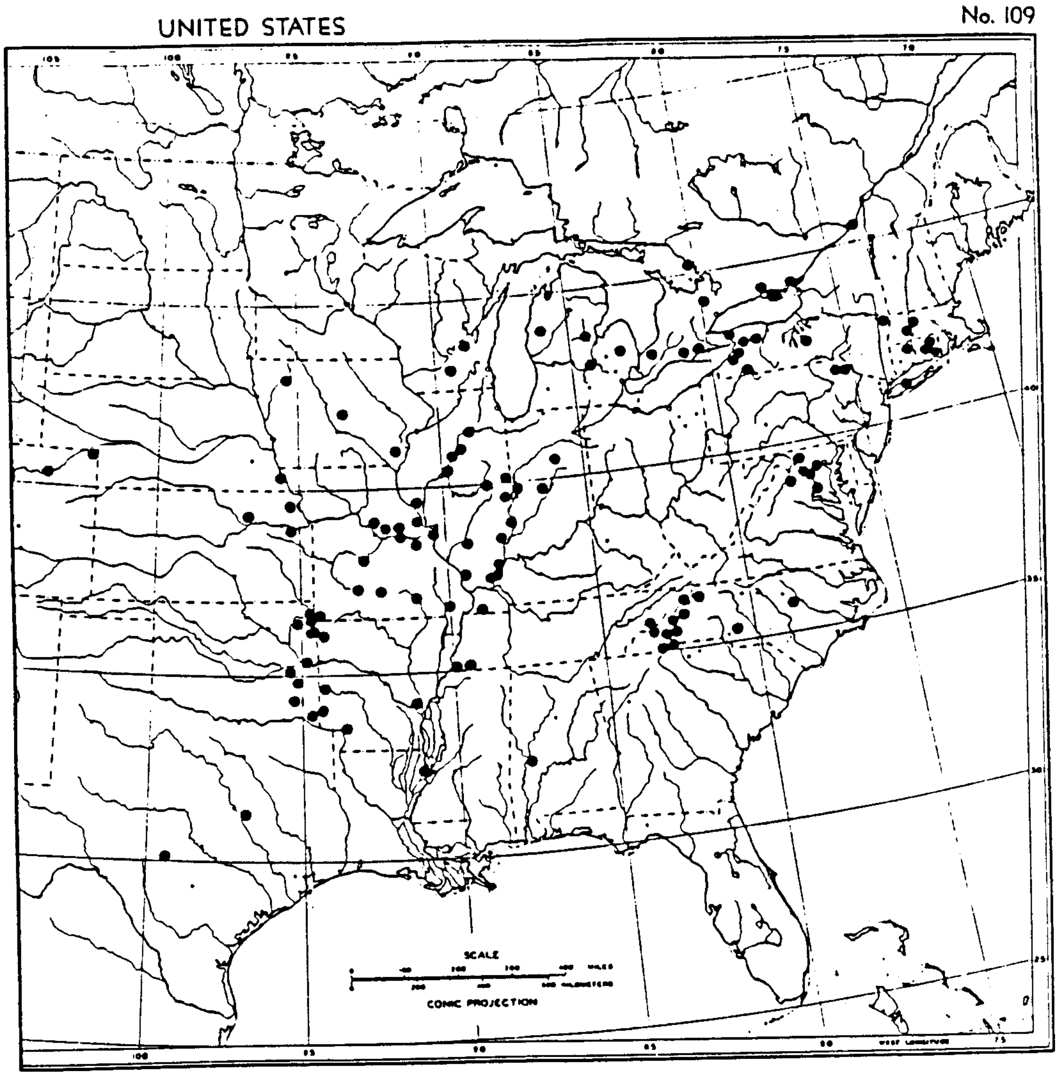
Map III.8. Distribution of Lopidea bonanza, squares. L. erimata, triangles. L. lateralis, circles.



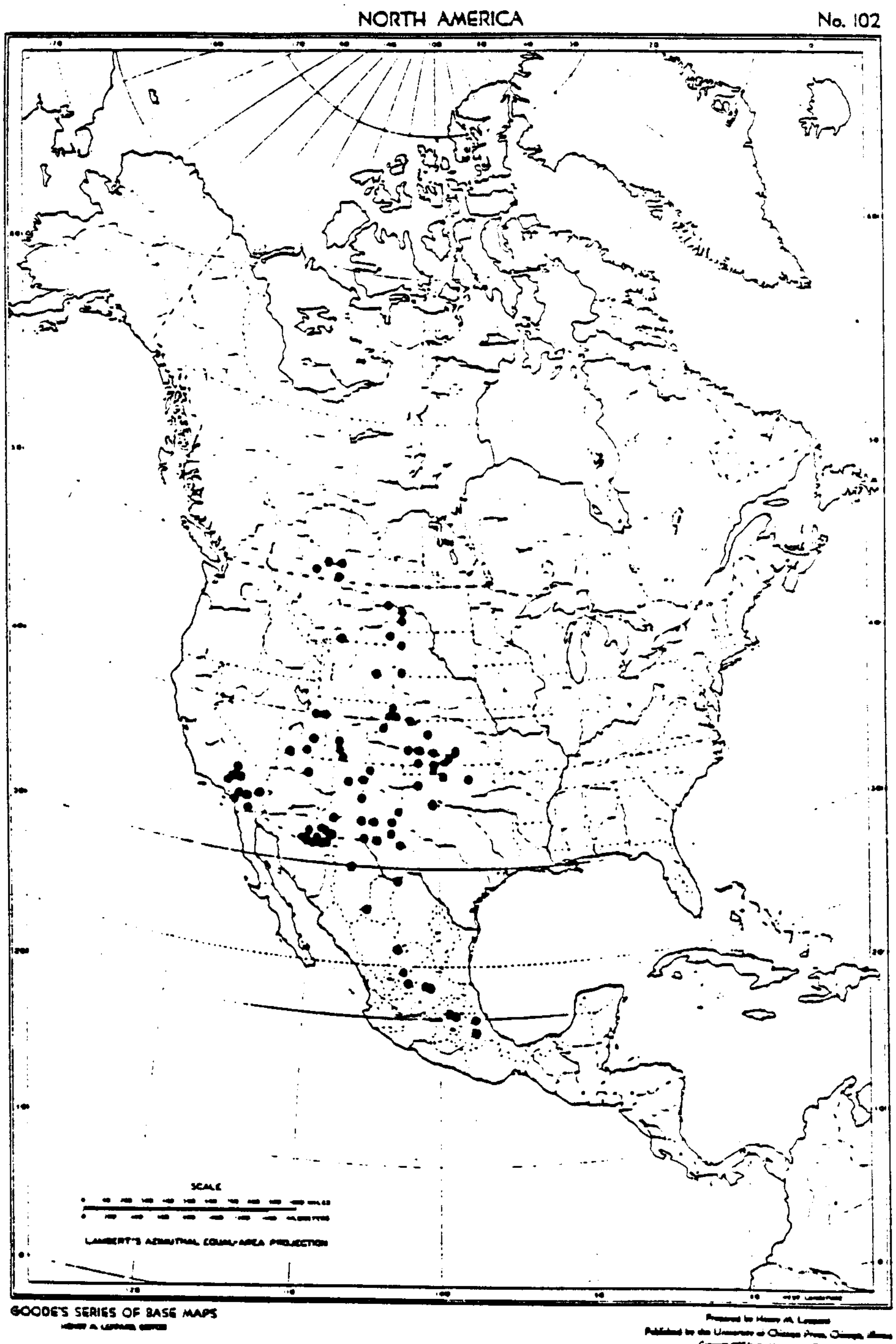
Map III.9. Distribution of <u>Lopidea caesar</u>.



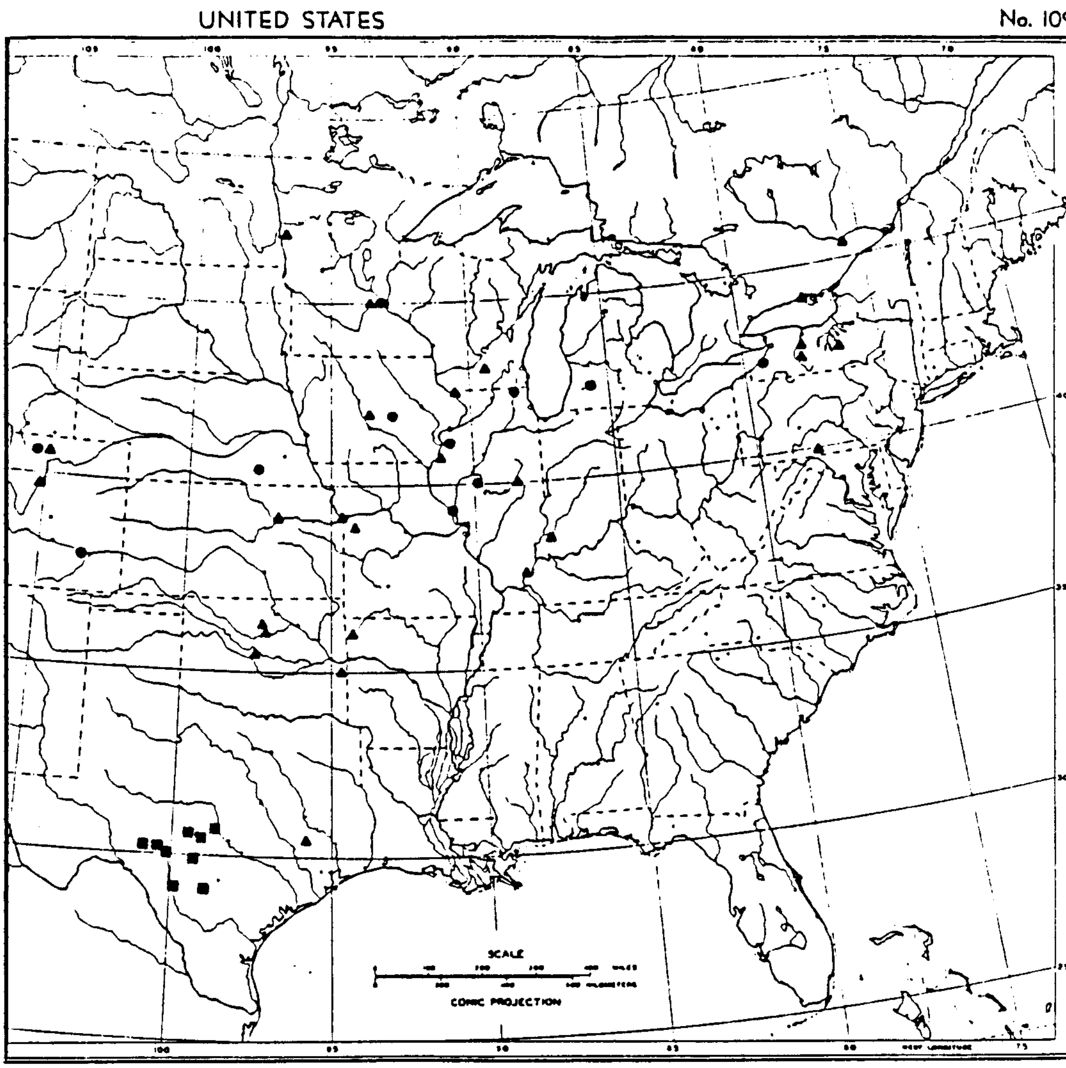
Map III.10. Distribution of Lopidea chandleri, triangles. L. sayi, circles.



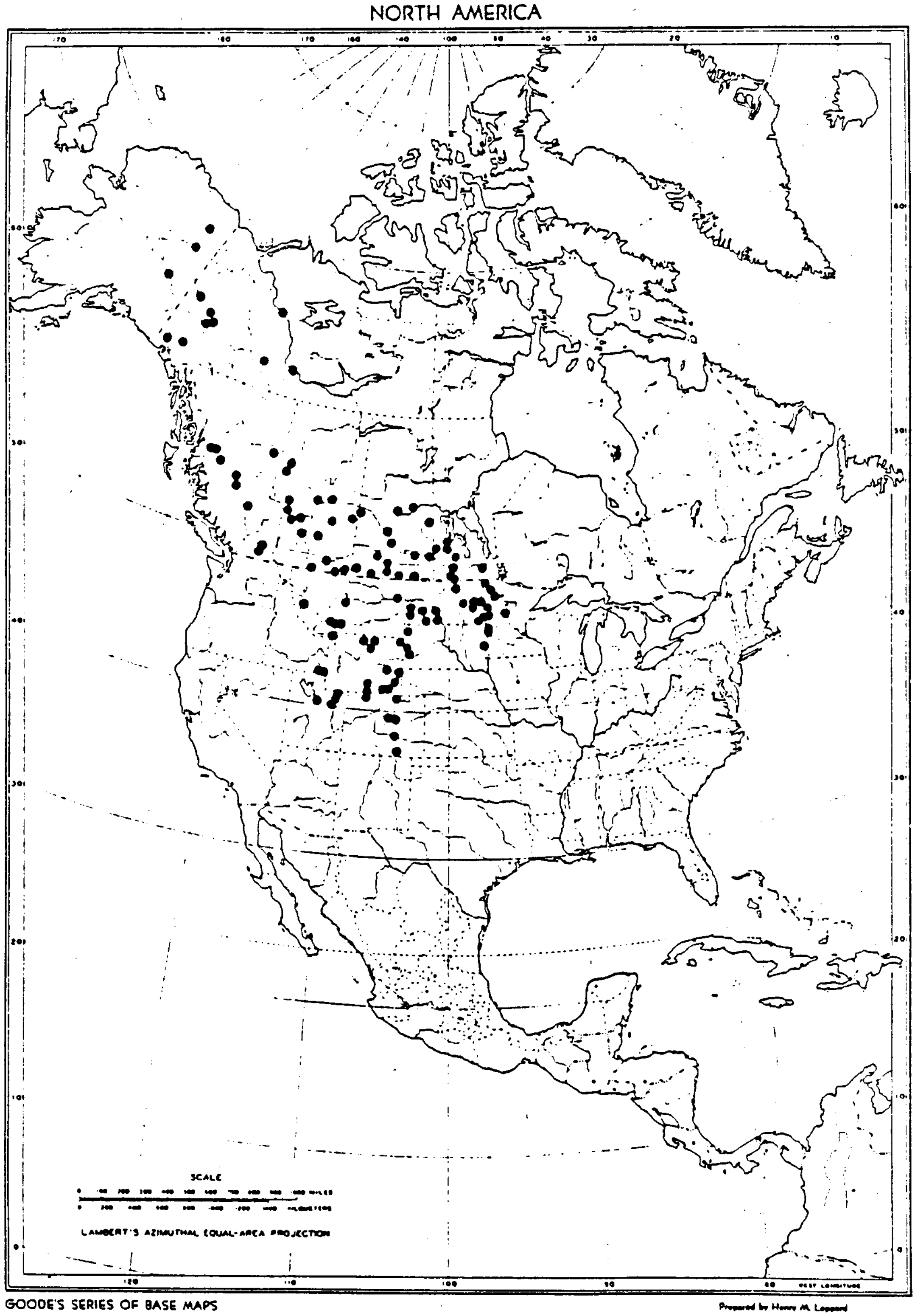
Map III.11. Distribution of Lopidea confluenta.



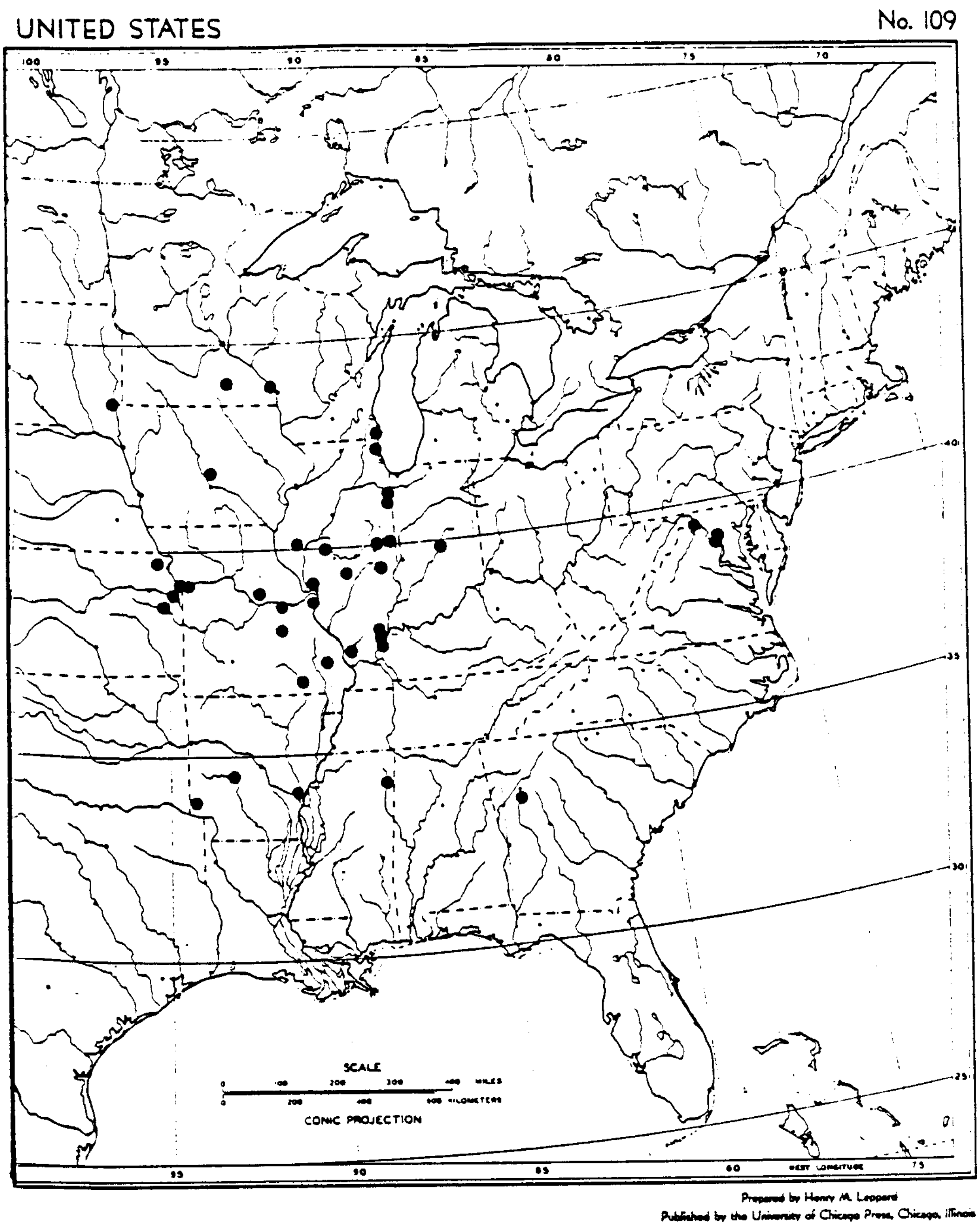
Map III.12. Distribution of Lopidea confraterna.



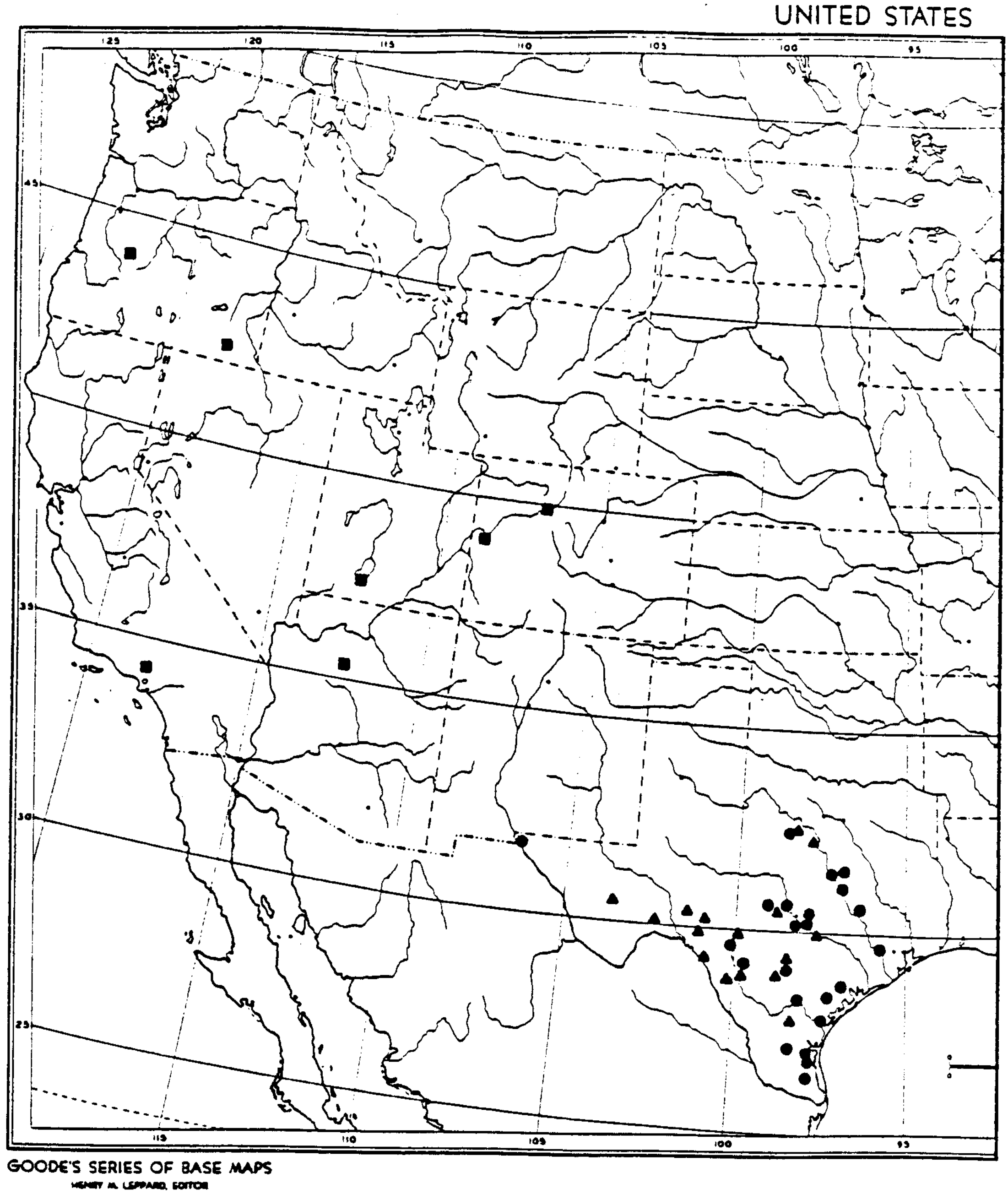
Map III.13. Distribution of Lopidea cuneata, circles. L. pteleae, squares. L. salicis, triangles.



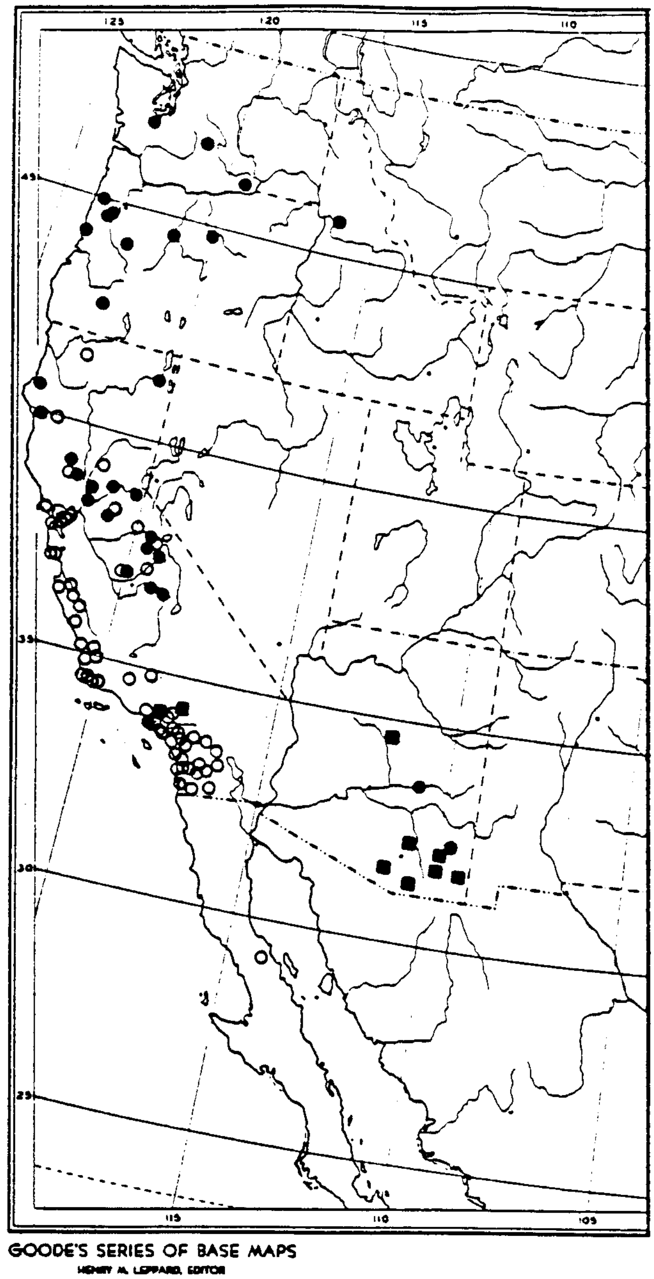
Map III.14. Distribution of Lopidea dakota.



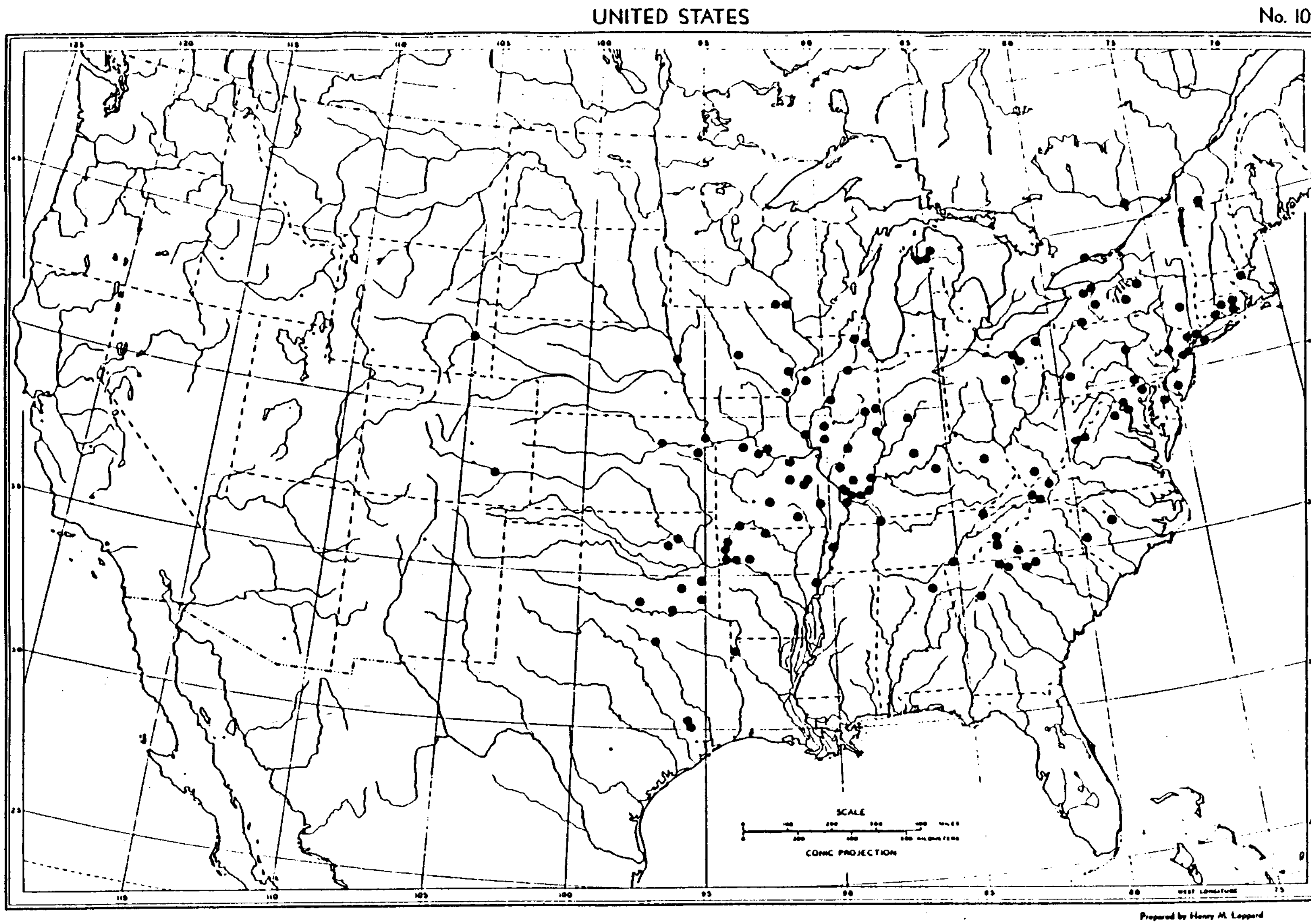
Map III.15. Distribution of Lopidea davisi.



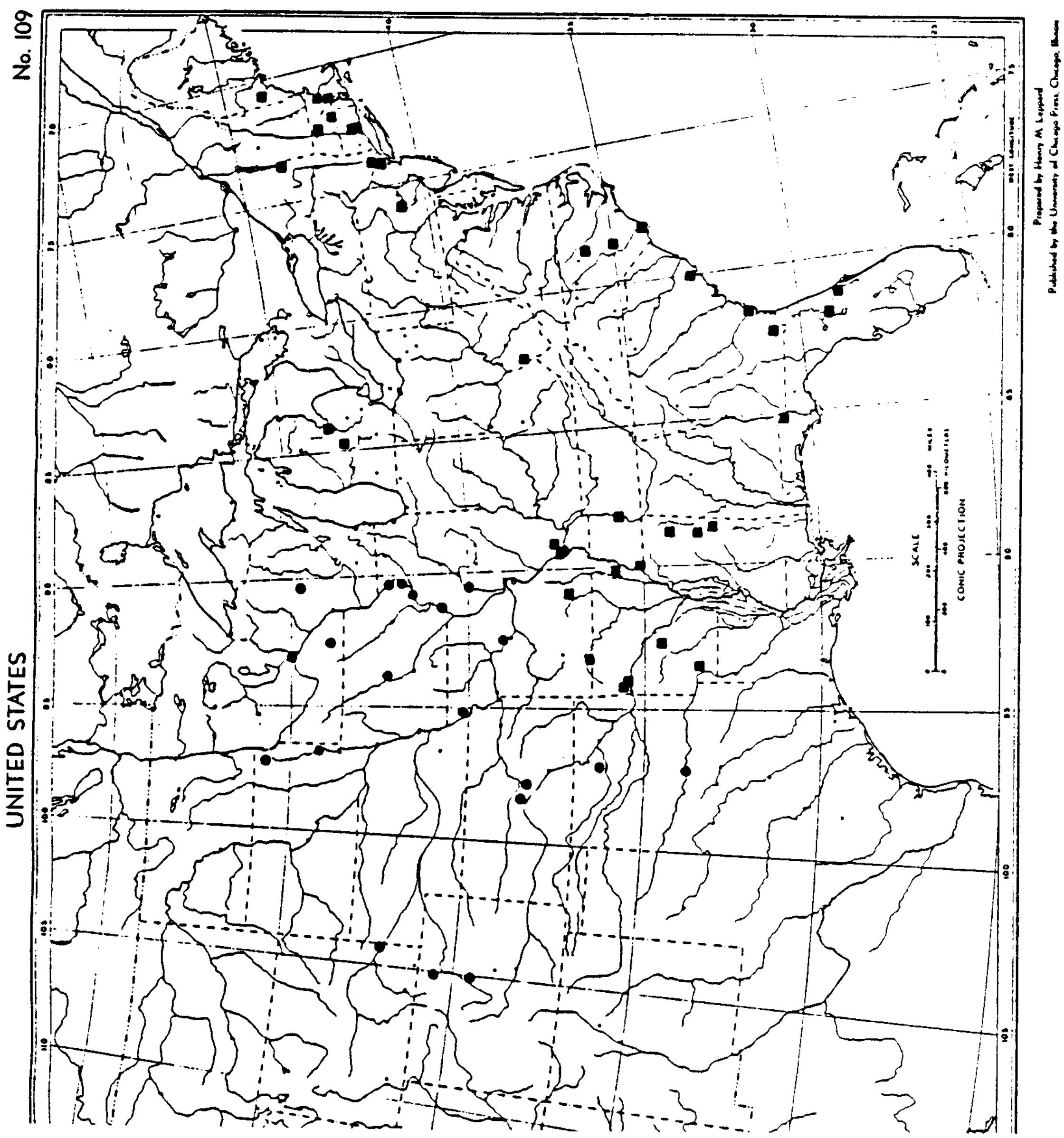
Map III.16. Distribution of Lopidea gainesi, circles. L. major, triangles. L. nicholella, squares.



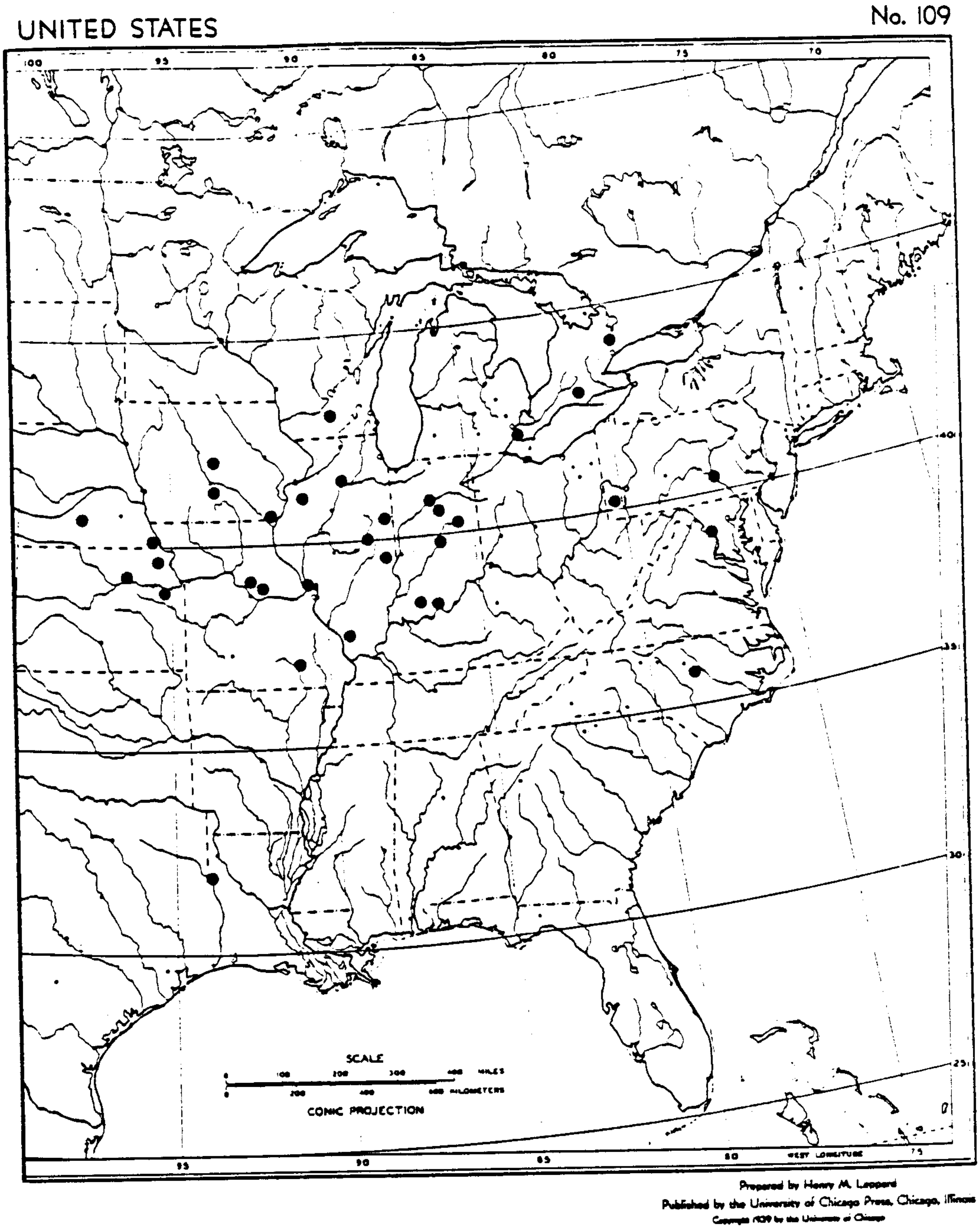
Map III.17. Distribution of Lopidea garryae, squares. L. marginata, circles; closed circles = red color form; open circles = red and white color form.



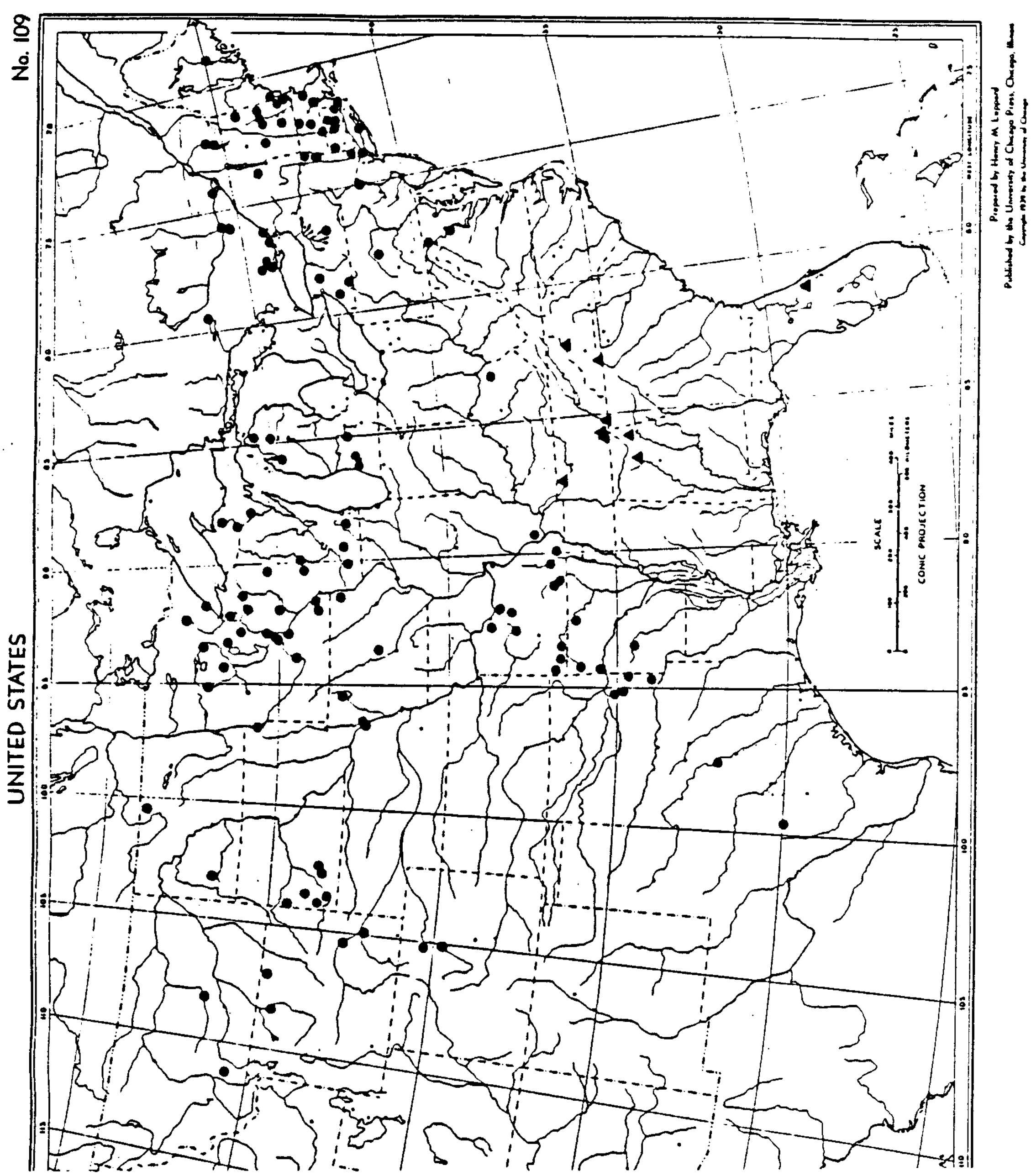
Map III.18. Distribution of Lopidea heidemanni.



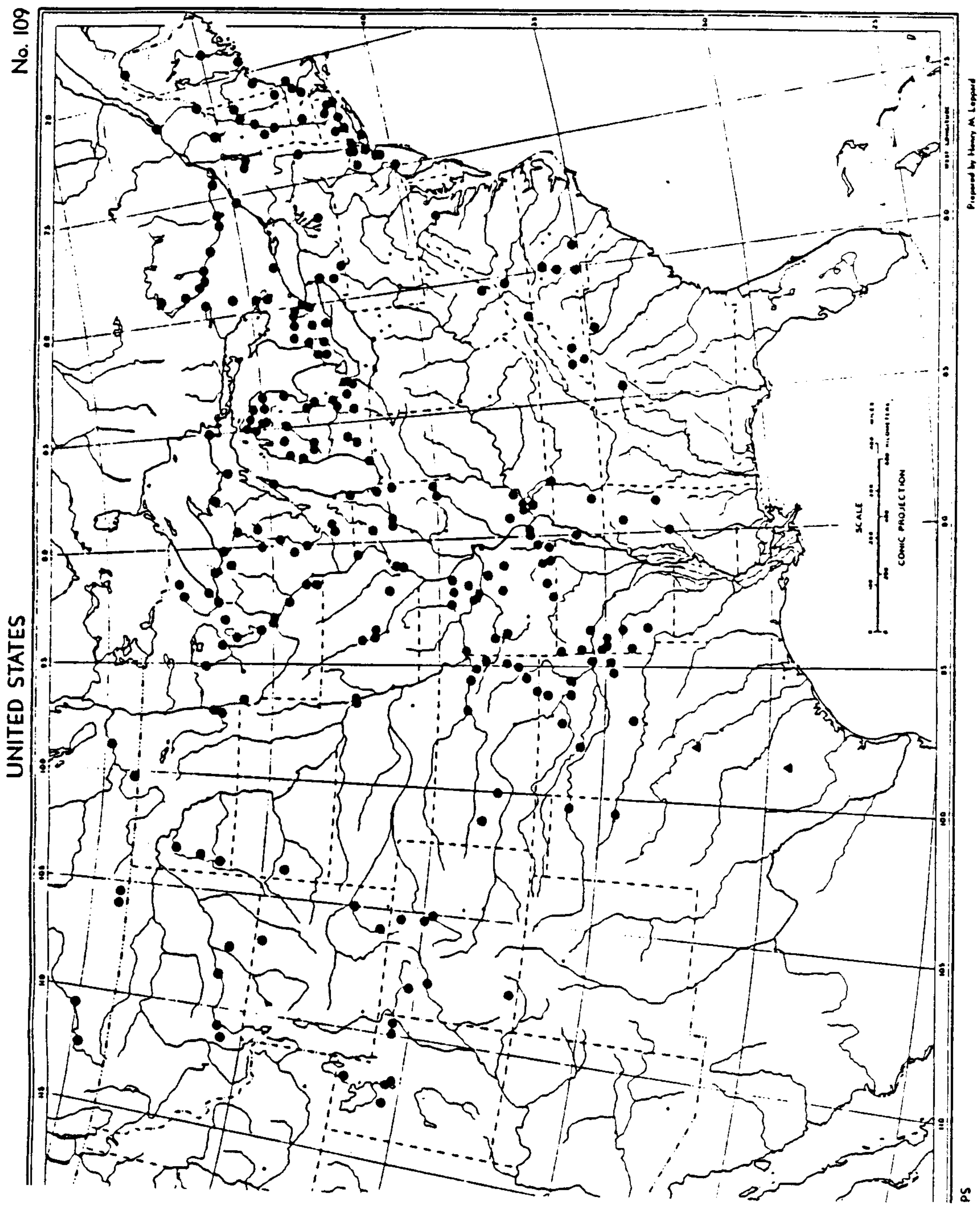
Map III.19. Distribution of Lopidea hesperus hesperus, squares. L. h. amorphae, circles.



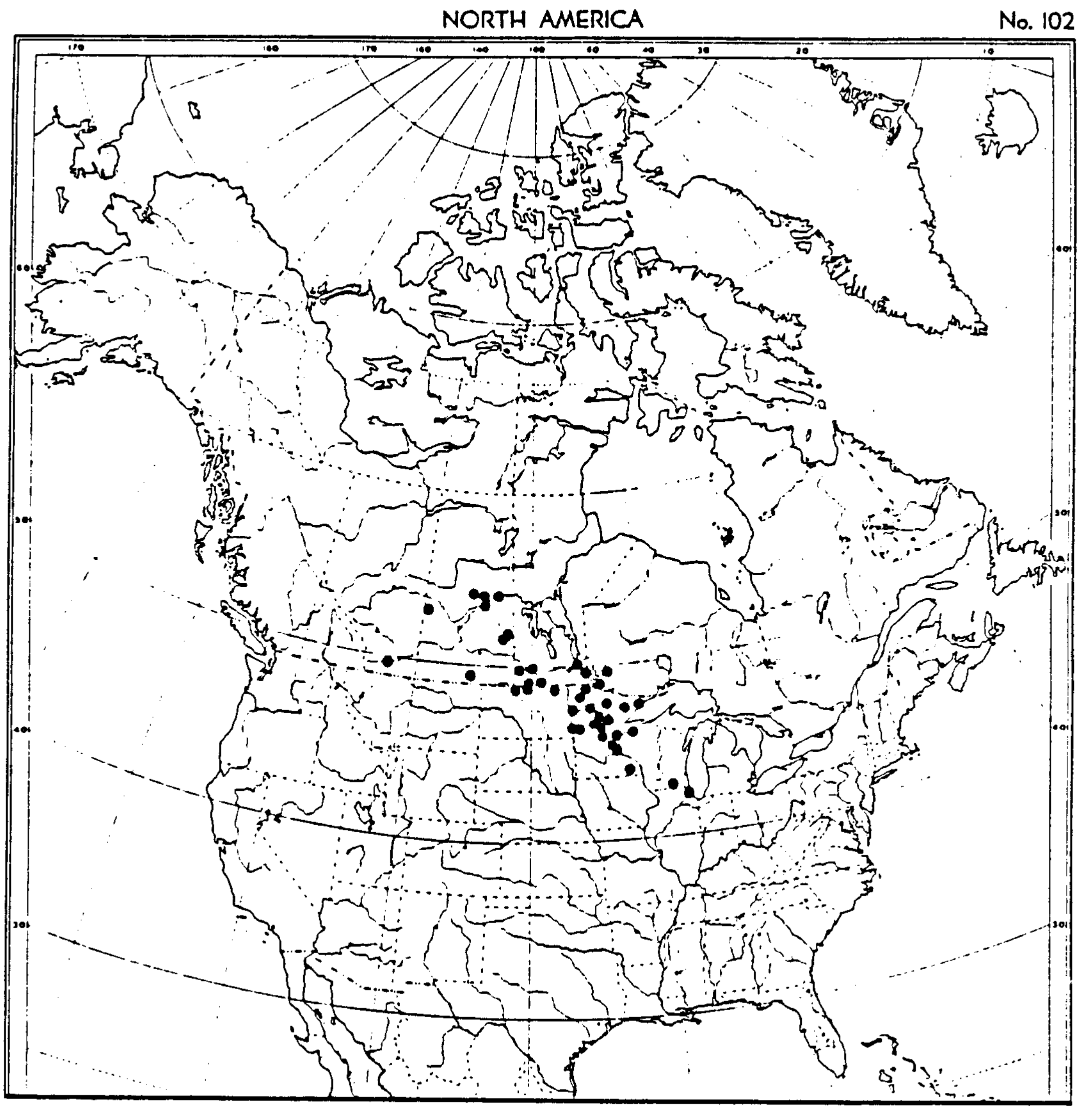
Map III.20. Distribution of Lopidea incurva.



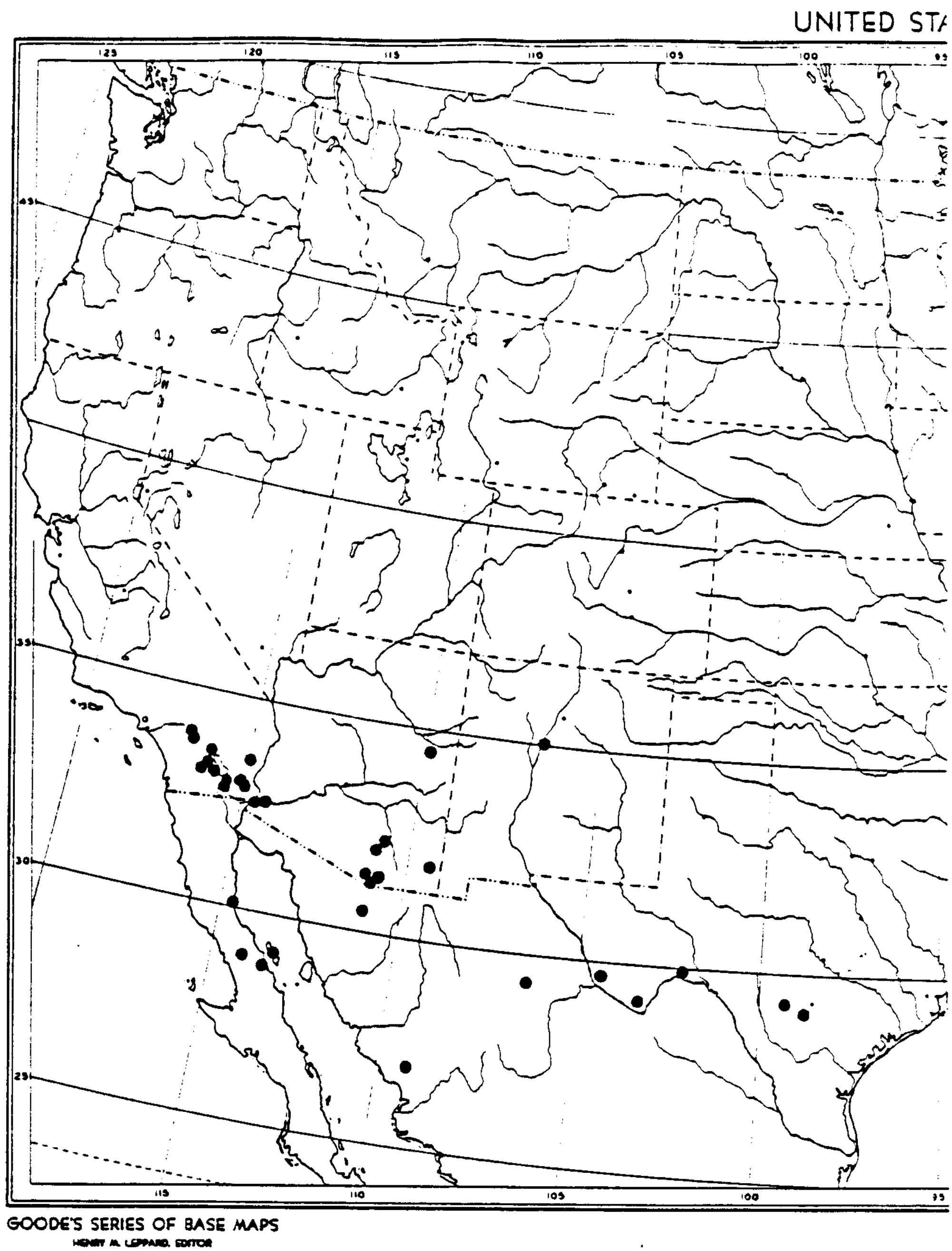
Map III.21. Distribution of <u>Lopidea</u> <u>instabilis</u> <u>instabilis</u>, circles. <u>L</u>. <u>i</u>. <u>rubella</u>, triangles.



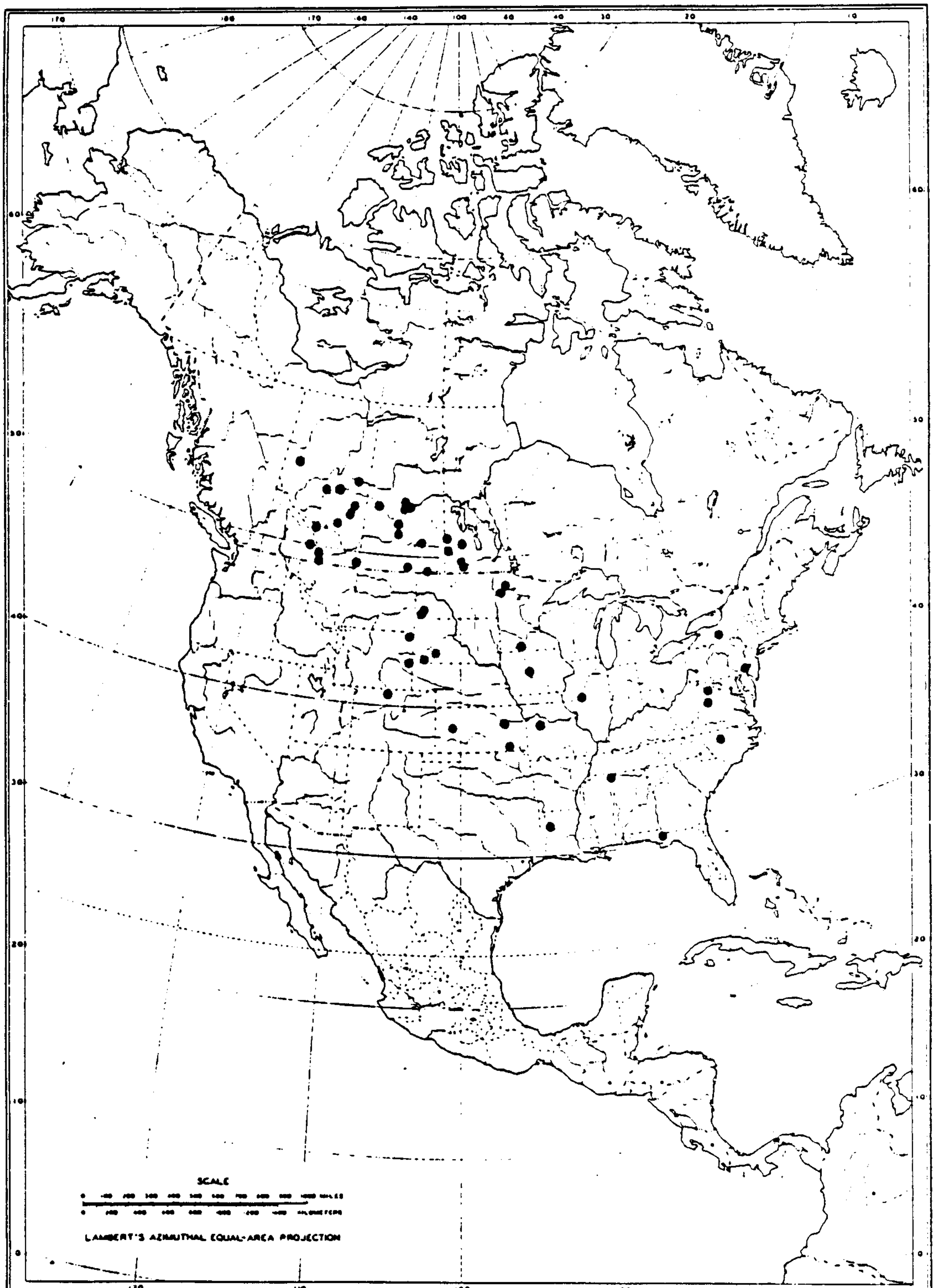
Map III.22. Distribution of Lopidea intermedia, triangles. L. media, circles.



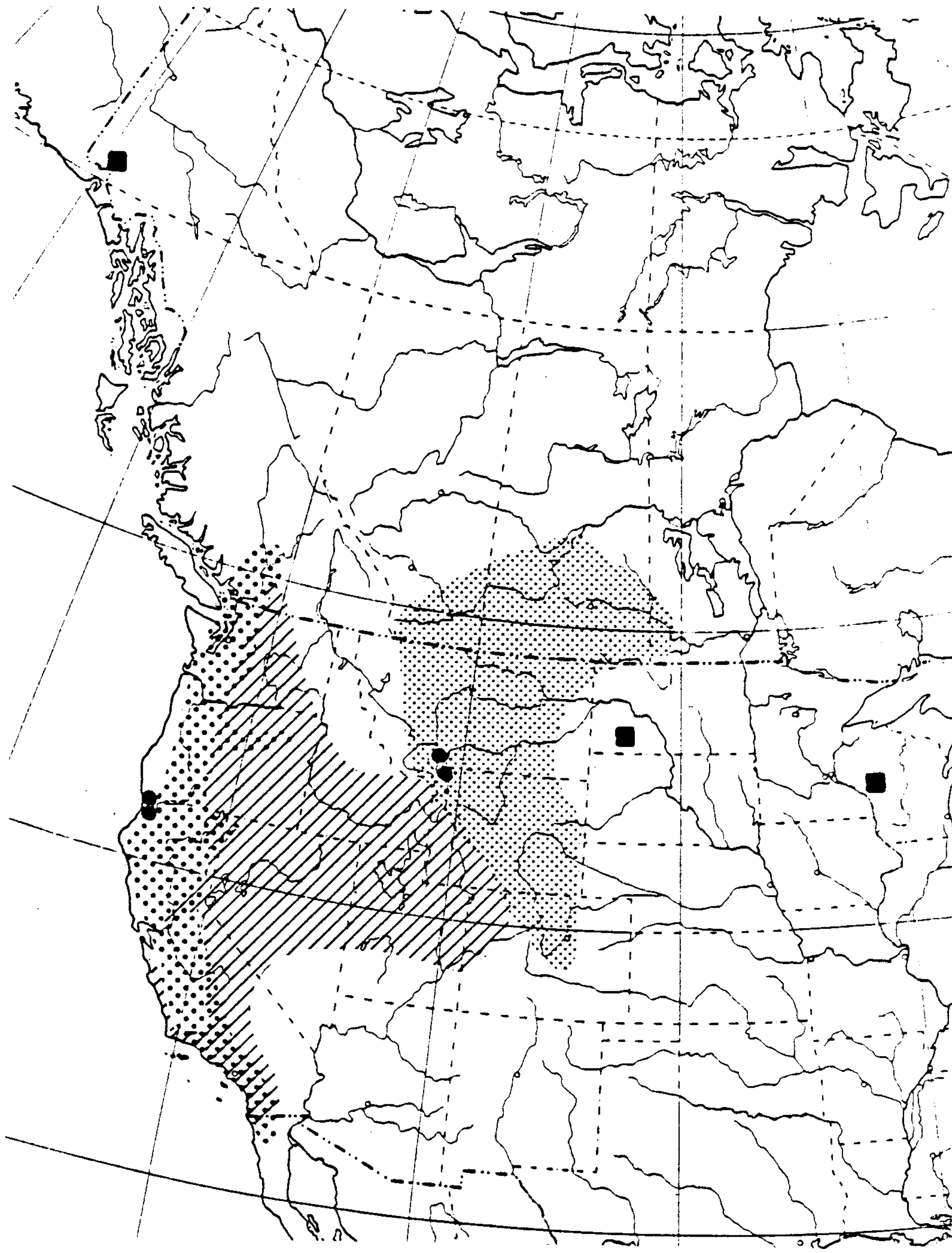
Map III.23. Distribution of Lopidea lathyri.



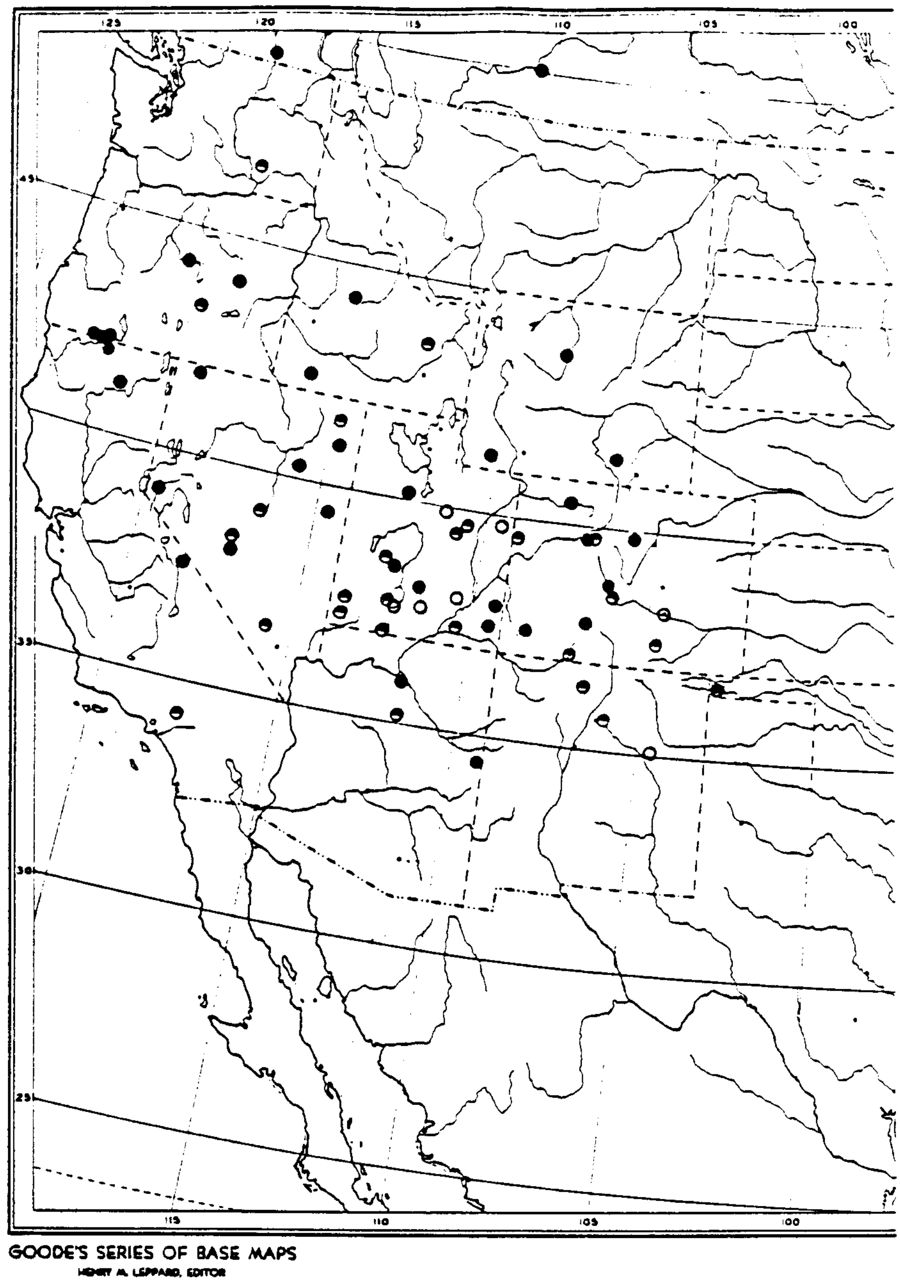
Map III.24. Distribution of Lopidea minima.



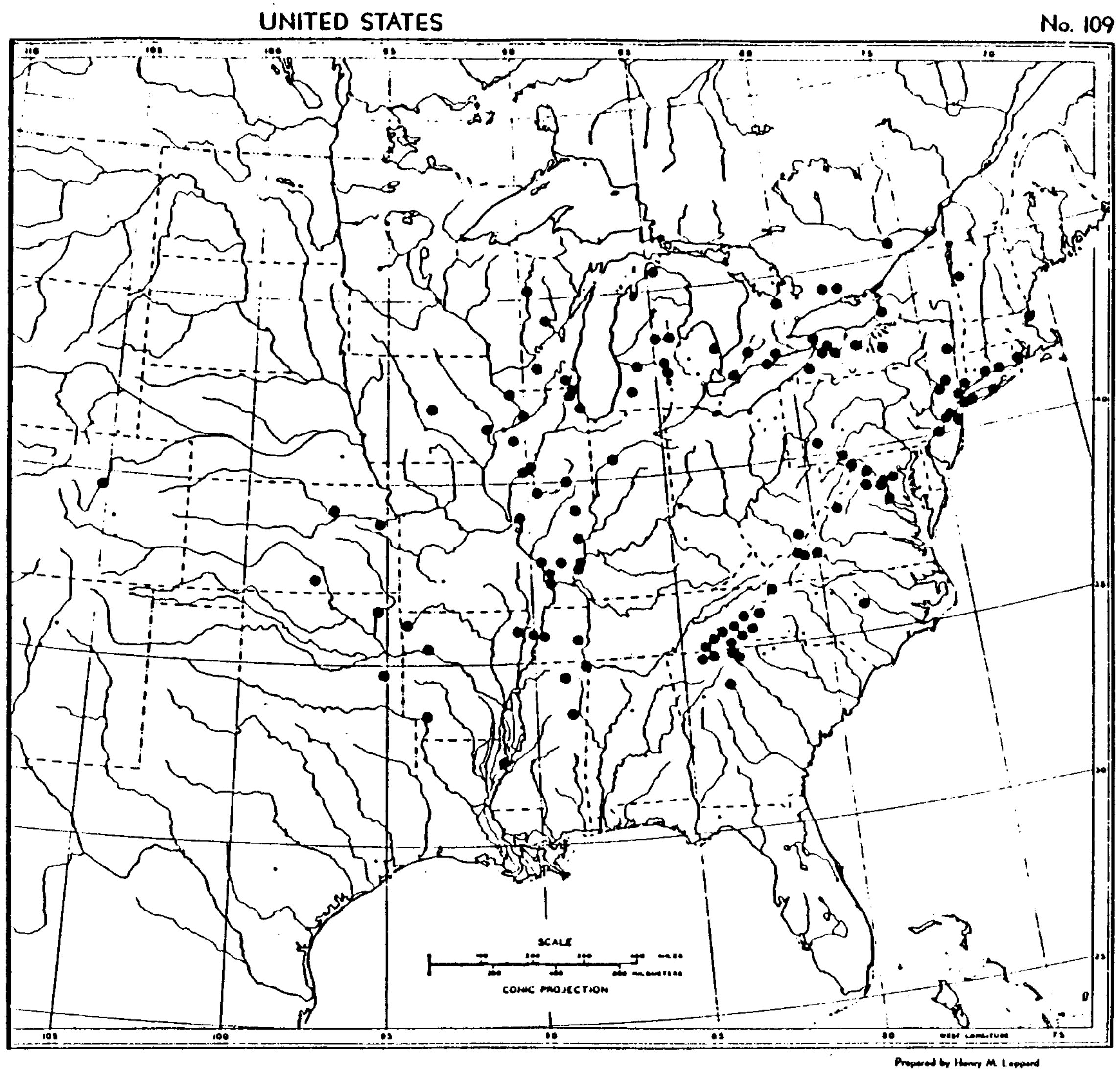
Map III.25. Distribution of Lopidea minor.



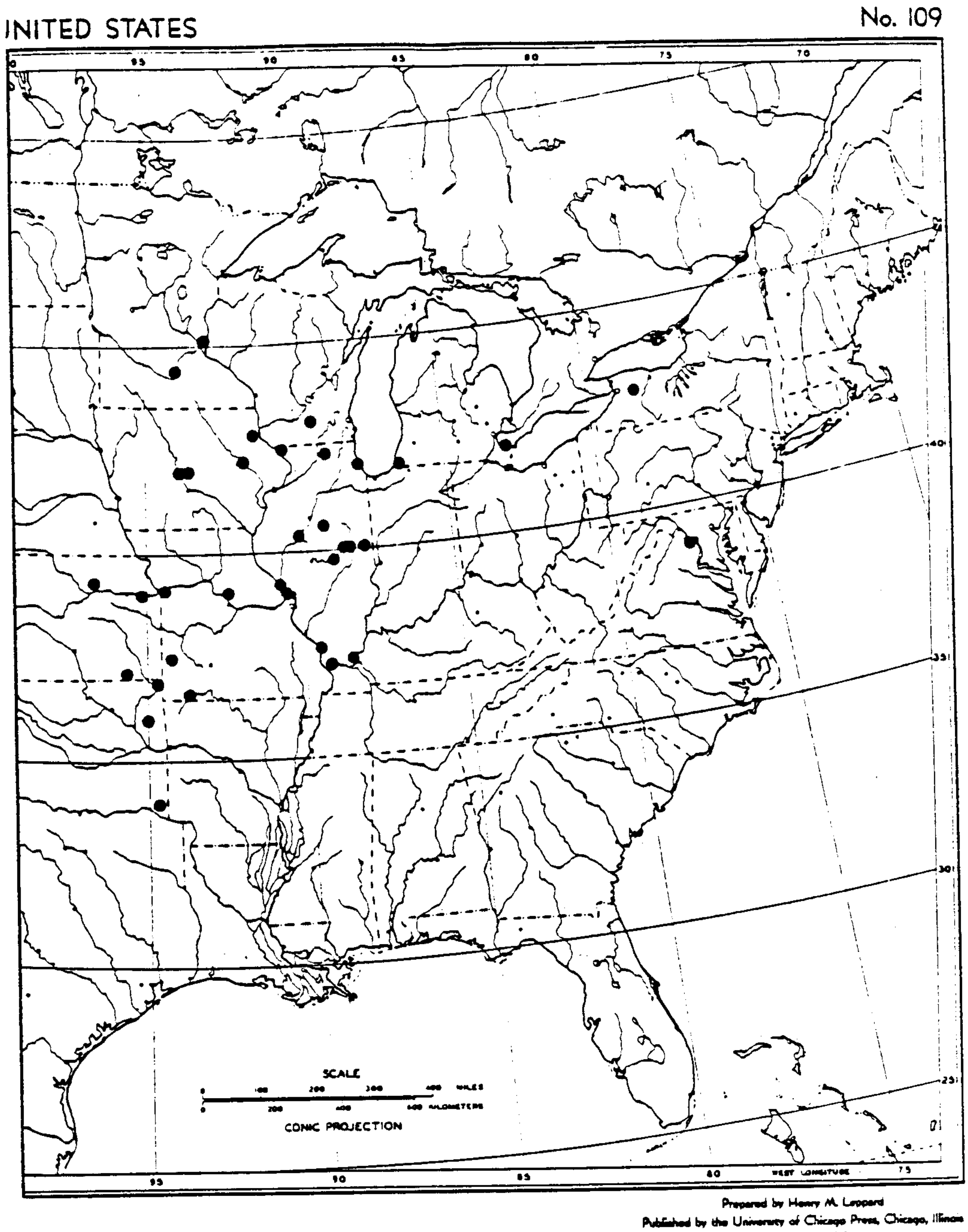
Map III.26. Distribution of Lopidea nigridia,



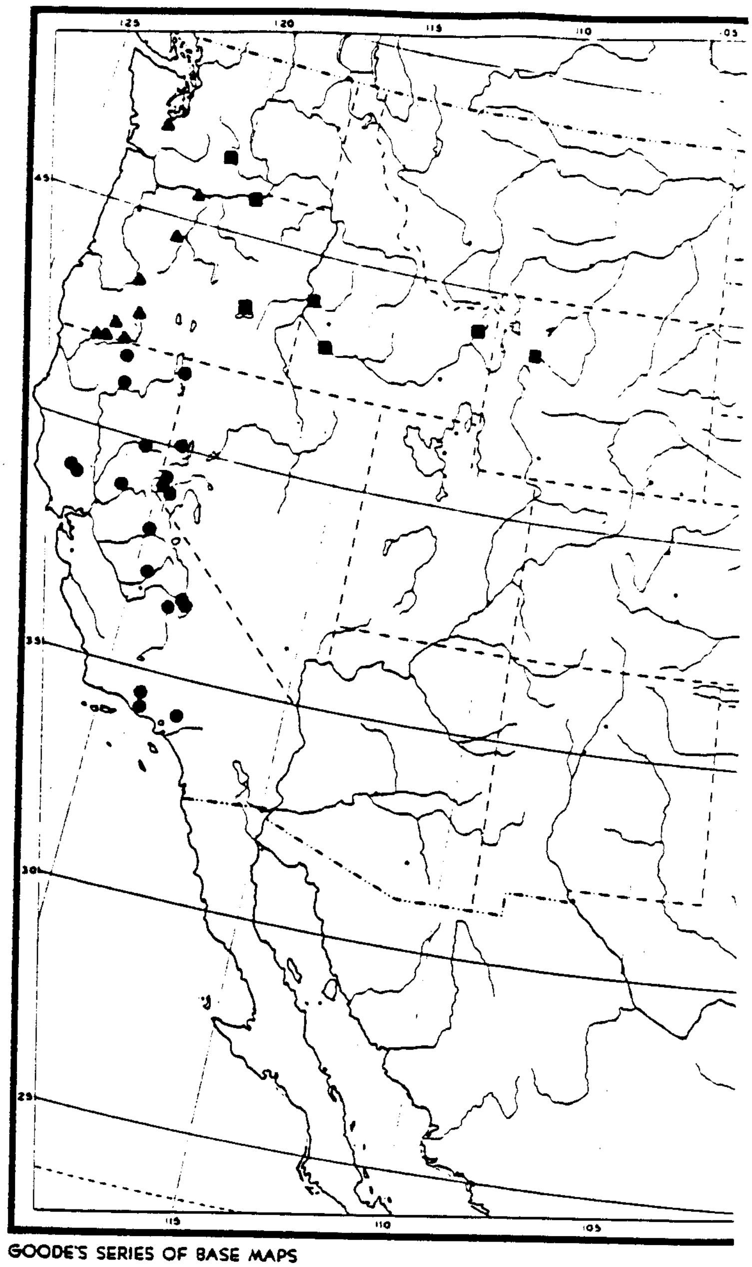
Map III.27. Distribution of Lopidea picta; open circles = pale color form; half closed circles = black and white color form; closed circles = black color form.



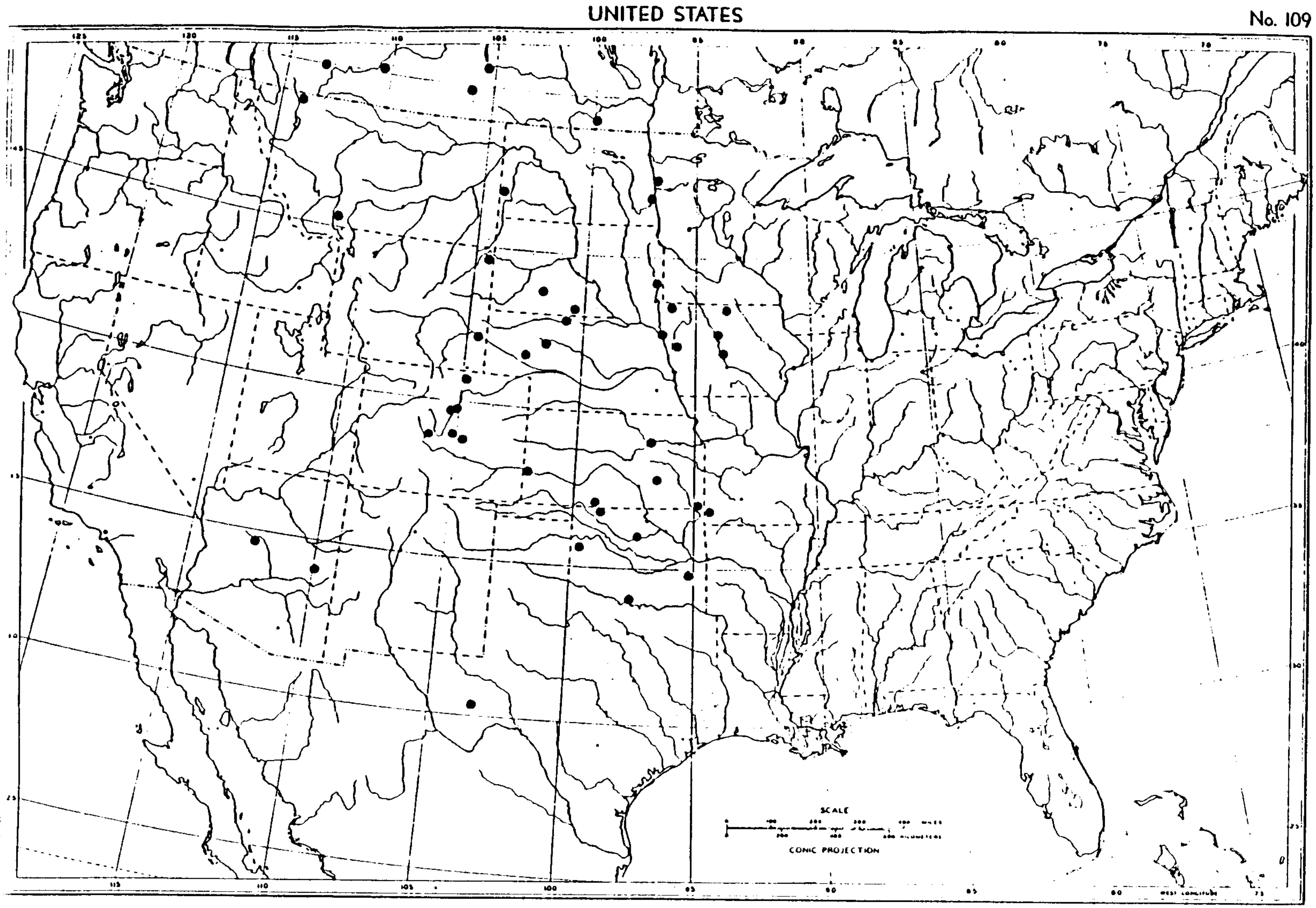
Map III.28. Distribution of Lopidea robiniae.



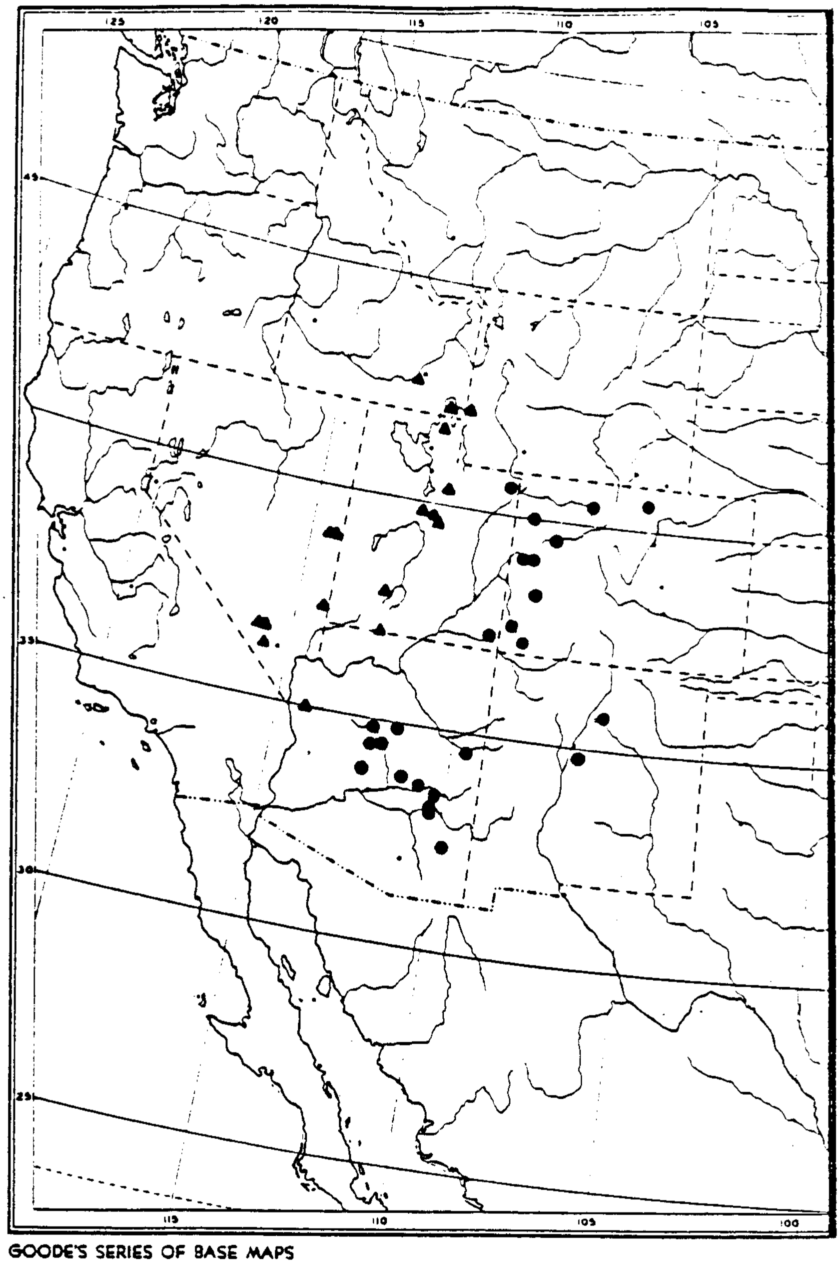
Map III.29. Distribution of <u>Lopidea</u> <u>staphyleae</u>.



Map III.30. Distribution of Lopidea taurina taurina, triangles. L. t. taurula, squares. L. t. fuscina, circles.



Map III.31. Distribution of Lopidea teton.



Map III.32. Distribution of Lopidea ute ute, circles. L. u. becki, triangles.

CHAPTER IV

EVOLUTION OF THE ORTHOTYLINE MIRID GENUS LOPIDEA: MORPHOLOGY, BIOGEOGRAPHY AND ECOLOGY

ABSTRACT

A cladistic analysis of 48 species of Lopidea revealed four monophyletic species groups. Reevaluation and addition of characters further revealed two additional monophyletic groups.

An analysis of 16 speciation events suggests that vicariance can account for at least 50% of species generation in Lopidea. The frequency of sympatric host plant speciation may be as high as 30% and speciation by peripheral isolation has been rare if it has occurred at all. Based on the distribution of polytypic species and allopatric sister taxa, seven zones of disjunction were identified for North American Lopidea.

It is hypothesized that breeding on composites is plesiomorphic in Lopidea and that host plant associated radiations have occurred on legumes, deciduous trees and the Polemoniaceae. The distributions of solid red and red/white or fuscous/white color forms of Lopidea are nonrandom, with a preponderance of the former color form occurring in eastern North America and the latter form being more common in the Great Basin and Southwest. The hypothesis is advanced that the distributions of color forms of these aposematic plant bugs reflects their relations as Mullerian mimics on a biogeographic scale.

INTRODUCTION

Hypotheses of generic and species relationships are requisites for examining the evolution of biogeographic and ecological patterns in insects. Our understanding of generic relationships in the Miridae (Heteroptera) is improving as research advances beyond alpha taxonomy in this diverse group (Schuh, 1974; 1984; Stonedahl and Schwartz, 1986; 1988; Stonedahl, 1988). Likewise, phylogenetic studies at the species level are accompanying generic revisions, providing support for the recognition of monophyletic species groups and group relationships (Stonedahl and Schwartz, 1986; Stonedahl and Schuh, 1986; Schuh and Schwartz, 1985; Schwartz, 1984). Largely because of our limited knowledge of distributions and host plant relationships for most genera, however, few ideas have been advanced regarding biogeographic patterns and the evolution of host plant preferences. Exceptions to this are the historical biogeographic study of the Indo-Pacific using monophyletic groups of Miridae by Schuh and Stonedahl (1986) and the examination of host plant evolution in the subfamily Dicyphinae by Cassis (1984).

This paper was initiated following a generic revision of the North American species of the orthotyline genus Lopidea Uhler (Asquith, 1990b). The information and methodology I use is essentially derived from synthesizing the morphological, distributional and host plant data presented in the former study, and the cladisticly derived hypothesis of species relationships presented here. The primary purposes of this study are 1) to identify monophyletic species groups based on morphology, 2) provide detailed evolutionary hypotheses of speciation patterns, and 3) illustrate ecological and biogeographic patterns for future work on Lopidea and for comparison with other groups of Miridae. I do not attempt a detailed comparison of some of the patterns shown by Lopidea with those available in the literature for a variety of other insects (i.e. mimicry and host plant evolution).

PHYLOGENETIC ANALYSIS AND INTRAGENERIC RELATIONSHIPS

I performed a cladistic analysis of 48 species of North American Lopidea using the 27 characters described in Table IV.1. Most of these characters were binary coded and for those that were multistate (12, 14, 19), three step transition series were established. Although I have identified Ilnacora as the sister group of Lopidea, I used a composite hypothetical ancestor for the outgroup in my analysis. Using Ilnacora as the outgroup did not significantly change the topology of the resulting trees, but Ilnacora possesses some apomorphies (loss of right dorsal spicula) that prevented polarization of some characters. Therefore I used a composite ancestor in which character states that were found in most of the related genera discussed in the previous section were coded as 0.

I used the IBM PC phylogenetic inference program HENNIG86 to analyze the character matrix in Table IV.2. My primary method of analysis in this program was the command mhennig*, which produces several initial trees and applies branch-swapping to each tree, retaining only the shortest trees. I also used the successive weighting option xs-w, which sets the characters' weight according to its fit to the trees. This program allowed me to approximate the most parsimonious solution (shortest trees) for the data and select among competing trees based on the consistency of the characters supporting them (Fitzhugh, 1989). This goal strives to reduce the number of character convergences and reversals in the tree, based on the assumption that evolution produces minimum convergence.

My analyses produced six trees, each of 117 steps, and from these I selected the three that showed the highest consistency indices. I then reduced these three trees so that alternative branching patterns were combined and unresolved, which produced the tree shown in Figure IV.1.

Most of the clades in this hypothesis are not supported by congruent characters and there is a large amount of character convergence and reversal (consistency index = 44, retention index = 83 for original trees). For example, character 0 (presence or absence of the basal process) changes states seven times and character 22 (length of tergal process) changes states six times. Even worse is character 19 (development of sensory lobe) which changes states 17 times and it represents the only support for some clades.

Because of this multiple character conflict, I chose to recognize only four species groups (fig. IV.2; Table IV.3) which are based on what I believe are strong, unambiguous characters.

Group A, the <u>media</u> group, is recognized by the slender, usually strongly curved dorsal spicula (character 1-1) and the long, slender, untapered tergal process (20-1). This is a small group of three rather slender species which feed on composites.

Group B, the <u>heidemanni</u> group, is recognized by the short, abruptly narrowed tergal process (23-1). This group contains six species which breed on deciduous trees.

Group C, the <u>davisi</u> group, is recognized by the short, rectangular right paramere (7-1) and the medial flange forming an elongate ridge (10-1), which has evolved independently in the ancestor of <u>heidemanni</u> and <u>cuneata</u>

(fig. IV.1). This is a large group of medium sized to small species found throughout North America. Its members feed predominately on herbaceous legumes, although several lineages have switched to other groups of plants (see Host Plant section below).

Group D, the robiniae group, is characterized by having the left paramere weakly to strongly narrowed and elongate (4-1), the dorsal position of the medial flange of the left paramere (5-1), C-shaped or L-shaped right paramere (8-1), and the tergal process weakly to strongly flattened vertically (21-1). This is a large group of large, robust species that feed on legumes throughout North America. The placement of staphyleae in this group is provisional. Although this species has a C-shaped right paramere, the shape of the dorsal arm is unlike that of the other species, and the dorsal position of the medial flange of the left paramere is clearly an independent derivation.

Two other problematic positions are the species scutata, and the clade including chandleri, hesperus and major. Because of its plesiomorphic characters, scutata was consistently placed at the base of the cladogram in all my analyses. However, based on some characters such as the large medial flange of the right paramere and its host plant being a desert composite, I believe that this species is probably closely related to others in the largely unresolved group further up the cladogram, in particular species such as fuscosa or bullata.

The clade containing chandleri, hesperus and major may not form a natural group. It is supported only by the inflated antennae which appear in the robiniae group and L. ampla, and in some analyses major was not grouped with chandleri and hesperus. Two lines of evidence suggest that these species probably arose from near the base of the robiniae group. 1) Because these species are legume feeders, moving them to the base of the robiniae group would mean that legume feeding arose only once in Lopidea rather than twice, obviously a more parsimonious solution (see Host Plant section). 2) The strongly inflated antennae (26-1) and flattened tergal process (21-1) also occur only in the robiniae group. Furthermore, the greatly elongate dorsal process of the right paramere of major, is somewhat intermediate to the condition which produces the dorsal arm found in the robiniae group.

TESTS FOR MODES OF SPECIATION

Because of the large number of species, particularly when compared to related orthotyline mirid genera, it would be of great interest to know something of the mechanism of speciation in Lopidea. What modes of speciation have produced this diversity? I used the approach of Lynch (1989) in trying to determine the relative frequency of three modes of speciation in the genus Lopidea.

1) The Peripheral Isolates Model or peripatric speciation, was proposed and championed by Mayr (1942; 1954; 1963; 1982). This model envisages a small population (usually a single deme) that becomes disjunct from the edge of the range of a large, panmictic mother population. It is this model that has produced most contemporary ideas on speciation (Eldredge and Gould, 1972) and precipitated the work on genetic variation, gene fixation and population genetics as they relate to speciation (Dobzhansky, 1951; Wright, 1956; Carson and Templeton, 1984).

2) The Vicariant Model of speciation ("dumbbell" model of White, 1978; allopatric model I of Wiley, 1981), is the mode supported most recently by vicariant biogeographers (Rosen, 1978; Nelson and Platnick, 1981). In contrast to

peripatric speciation, vicariant speciation does not require a small, peripheral population, rather a range can be separated into two or more relatively large populations, and speciation results.

3) Sympatric Speciation involves a shift in host or habitat use by different genotypes and is driven by disruptive or frequency dependent selection (Bush, 1969; 1975; Templeton, 1980; Wood, 1980; Wood and Guttman, 1982; Bush and Howard, 1986). Geographic separation of populations is not required and the reproductive isolation is promoted by the tendency of subpopulations to mate on different hosts or in different habitats (Diehl and Bush, 1989).

I have not discussed the parapatric speciation model (White, 1978) because the resulting pattern may be indistinguishable from vicariant speciation (Wiley, 1981). Detailed assumptions of the three models and the expected resulting patterns of distribution are provided by Lynch (1989) and I will not repeat them here. I will address the problem of dispersal, however, because it is frequently used by both proponents and opponents of the two models above. Although dispersal is a reality and we have evidence for rapid changes in species ranges, it can also be used to explain virtually any pattern of distribution. For example, if a new species begins as a small peripheral isolate and we assume 1) it immediately disperses and expands its range into areas not occupied by the mother species, this would produce a pattern similar to that resulting from vicariant speciation; or 2) it disperses back into the range of the mother species producing a distribution pattern reminiscent of sympatric speciation. For these reasons, I have chosen to ignore any assumptions of dispersal, and my tests are based on the present distribution data of species taken at face value.

The data used to test the frequency of different speciation modes in <u>Lopidea</u> are based on the distribution maps of species found in Asquith (1990b) and the hypotheses of species relationships proposed in this paper. I chose five "species groups" for which I am fairly confident of their monophyly, and I tabulated the frequency of speciation modes in each group. Attempting to look at speciation events deeper in the cladogram than species groups substantially increased the "noise" in distribution patterns, so that virtually all species groups are almost 100% sympatric with at least one other group. The following criteria were established for determining which mode was involved in each speciation event examined:

I) VICARIANT: 1). Ranges allopatric or only trivially sympatric along the edges of distributions. 2). The size of the range of the daughter species is greater than 5% of that of the larger species.

II) PERIPHERAL ISOLATE: 1). Ranges are allopatric or trivially sympatric. 2). The size of the range of the smaller species is less than 5% of that of the larger species.

III) SYMPATRIC: 1). Ranges are predominately sympatric.

Because no one has suggested how small the range of a peripheral isolate must be in order for peripatric speciation to occur, I have followed Lynch (1989) in using the arbitrary level of 5% of the mother species. If this value is too high, than the frequency of this mode will be overestimated.

"MINOR GROUP"

This group was not identified as monophyletic in my original analysis, because character 25 was interpreted as arising on the clade just below the divergence of this group

and then being lost in those species further up the clade (fig. IV.1). Character 25 actually is a synapomorphy for this group, and I reanalyzed
the relationship of the members by adding 2 additional characters to the data set. Character 27: Lateral flange of left paramere short, slightly narrowed, not much broader than base of medial flange. This character is shared only by minor and gainesi. Character 28: Medial flange of right paramere strongly reduced or vestigial. Although this state is also seen in minima, within the "minor group" it is shared only by minor and gainesi. This analysis then identified this group as monophyletic and produced the hypothesis shown in figure IV.3.

Separation of elements (1)(2) (minor and gainesi) appears to be vicariance (Table IV.4, fig. IV.3). Although the range of element 2 appears small, it is so only relative to the large range of element 1 (fig. IV.4). Furthermore, the area occupied by element 2, southcentral Texas, appears to be an area of endemism for Lopidea (see Biogeography section). This congruence with other species groups suggests a common cause for species separation rather than repeated coincidences of peripheral isolation in the same area. Separation of elements (1-2)(3) is clearly a case of vicariance (Table IV.4, fig. IV.3), as both elements have large ranges, one east of the Rocky Mountains and the other west of the mountains (fig. IV.4). Separation of elements (1-3)(4) appears to be sympatric speciation, as the ranges overlap by 98% (Table IV.4, fig. IV.3). This speciation event, however, occurs far down in the cladogram (level 3). If this is indicative of the age of the event, then more time has been available for substantial changes in the ranges of these elements.

"MEDIA GROUP"

Separation of elements (1)(2) is the most compelling case of peripheral isolation in my analysis (Table IV.4, fig. IV.5a). Element 2 (intermedia) is a strongly differentiated species, known only from two localities near the edge of the range of the more widely distributed sister species (1) (confraterna) (fig. IV.6). As in the "minor group", however, the area in which intermedia is isolated is common to several other species of Lopidea, which suggests vicariance rather than peripheral isolation. Although there is some degree of sympatry along the edges of the ranges, separation of elements (1-2)(3) is clearly attributable to vicariance (Table IV.4). Both elements occupy large ranges, one in eastern North America (3), and the other predominately in the Rocky Mountains and Southwest (1-2) (fig. IV.6).

HEIDEMANNI GROUP

In all my analyses, wileyae was consistantly recognized as the sister species of salicis because they both share a well developed sensory lobe (character 19-2) (figs. IV.1, IV.5b). Because of the multiple appearance of this character, however, I question my polarization of it. If its polarization is reversed, then these two species would be united only by plesiomorphic characters. Furthermore, in several aspects (extremely narrow, elongate right paramere), wileyae more closely resembles members of the species lateralis, falcata and barberi than those of the heidemanni group. For these reasons, I have chosen to exclude the speciation of wileyae from this analysis.

The terminal most speciation events (1)(2) and (1-2)(3) are the best examples of sympatric speciation in Lopidea (Table IV.4, fig. IV.5b). These three species (heidemanni, salicis, cuneata) are very similar in all aspects, their ranges overlap by 97% (fig. IV.7) and they apparently breed predominately on different species of deciduous trees (Asquith, 1990b). Although I have scored the separation of elements (4)(5) as peripheral isolations based on the established criteria, element 4 (pteleae) is again isolated in southcentral Texas with several other species. In addition, the ranges of elements 4 and 5 are small only when compared to elements 1-3; both species have ranges greater than 32,000 km^2.

"ROBINIAE" AND "INSTABILIS" GROUPS

These were identified as a single monophyletic group in my original analysis (fig. IV.1). I have reanalyzed this group using the same data, but eliminating all other species from the analysis (fig. IV.8). I also added three additional characters to the analysis. Character 28: Ventral arm flattened. I have interpreted this a derived condition in this analysis shared by balli, caesar, incurva, lathyri, and robiniae. Character 29: Dorsal coloration always yellow; shared by incurva and robiniae. Character 30: Breeding on trees; also shared by incurva and robiniae. The "instabilis" group (sensu strictu) was also recognized as monophyletic in the original analysis, but in the expanded analysis falcicula and taurina were also recognized as sister species (fig. IV.8).

Within the "instabilis group", all speciation events are clearly vicariant in nature, with sympatry of elements occurring only along the edges of the distributions (Table IV.4, fig. IV.9). I am least confident with my hypothesis of species relationships in the "robiniae group", and different relationships would substantially change the proposed modes of speciation (fig. IV.8). Separation of elements (1)(2), robiniae and incurva appears to be a clear case of sympatric speciation. The ranges of these two species overlap by 98% and they breed exclusively on two different species of leguminous trees (Asquith, 1990b). Separation of elements (1-2)(3) is attributable to vicariance, with element 3 (lathyri) occupying a large range predominately in the northern plains. 90% of the range of element 4 (caesar) lies within the range of element (1-3) and thus appears to be a case of sympatric speciation. Phenetically, however, caesar is most similar to elements 3 (lathyri) and 4 (balli). If caesar is truly most closely related to these species, than this speciation event is attributable to vicariance rather than sympatric speciation. Element 5 (balli) is clearly a vicariant species restricted to the Rocky Mountains and northwestern plains (fig. IV.8).

At least 50% of the sampled speciation events in Lopidea are attributable to the vicariant mode (Table IV.5). Because most, if not all the presumed examples of peripheral isolation are equally probable vicariant events, due to the congruent nature of their ranges, the frequency of vicariant speciation in Lopidea is more likely as high as 69%. The only species whose pattern of distribution strongly indicates peripheral isolation is intermedia (fig. IV.6). There are several examples that I believe to be sympatric speciation in Lopidea (Table IV.4). Actually, up to 31% of speciation might be attributable to this mode (Table IV.5). In all these cases, the sympatric species either breed on different host plants (heidemanni group) or one of the species breeds on a subset of the hosts used by the other species ("minor group").

The importance of vicariance in speciation in Lopidea is in contrast with the widely held view of speciation in most groups of animals (Eldredge and Gould, 1972; Bush, 1975; Mayr, 1982), but is in agreement with the data presented by others (Cracraft, 1982; Wiley and Mayden, 1985). Lynch (1989) found 71% of the 66 cases of vertebrate species events he examined were accounted for by vicariance. My estimates of 30% sympatric speciation in Lopidea is much higher than the 6% for vertebrates found by Lynch. In contrast to vertebrates, however, Lopidea meets all the criteria which have been suggested as requisite for sympatric speciation (Bush, 1975), namely that breeding and development occur on one or a few related host plants. Similar analyses of other phytophagous mirids is needed to examine the broad application of my conclusions for Lopidea that 1) vicariance is the predominant mode of speciation, 2) sympatric host plant speciation, while less common still plays a significant role in the multiplication of species, and 3) examples of peripheral isolation are extremely rare.

BIOGEOGRAPHY

Species of Lopidea range from the Arctic Circle in Alaska (dakota) to below 18^{o} north latitude in Guatemala (guatemalana Knight and Schaffner). In North America, the highest density of species (> 13 spp.) is found in the midwest where the prairie and eastern deciduous forest communities meet (fig. IV.10). The number of species declines rapidly further north and south. Two areas of high species diversity (> 10 spp.) in the West are the mountains of Southern California and the mountains of southern Arizona (fig. IV.10). The Edwards Plateau and surrounding area of Texas also has a relatively large number of species (7), in part due to its endemicity.

Examination of Figures IV.4 - IV.10 and the distribution maps of polytypic species in Asquith (1990b) shows seven zones of disjunction which separate allopatric sister species or subspecies of *Lopidea* (fig. IV.11). These zones coincide with similar zones of disjunction identified by Noonan (1988) for insect sister taxa and with several "suture zones" identified by Remington (1968) for a variety of plants and animals in North America (Table IV.6).

Zone 1 occurs only once in *Lopidea* and separates the subspecies *L. t. taurina* in the Cascade and Klamath Mountains from *L. t. fuscina*, predominately in the Sierra Nevadas. This corresponds to Remington's zone B, for which he listed 12 pairs of sister taxa exhibiting contact here.

Zone 2 separates the subspecies *L. n. aculeata* in Sierra-Cascade chain and west, from *L. n. nigridia* found predominately in the Great Basin. It also separates *L. t. taurina* in the Cascades from *L. t. taurula* in the northern Great Basin and Snake River Valley. This corresponds in part to zone 6 of Remington, although his definition and examples include a much broader area than I have defined. This also includes part of Noonan's zone 4, separating xeric lowlands of the Great Basin from the montane areas east and west.

Zone 3 is the most common disjunction and occurs between seven species and subspecies pairs of *Lopidea*. This zone actually includes two patterns of disjunction in *Lopidea* 1) separating Great Basin taxa from Rocky Mountain taxa, and 2) separating Rocky Mountain taxa from Plains or savannah taxa. This zone somewhat corresponds with Noonan's zone 2, which separated sister taxa immediately east and west of the Rocky Mountains and his zone 4, separating the Great Basin element. It also corresponds in part with Remington's zone 4, which he identified as the most "active" zone in North America (involving the most taxa).

Zone 4 involves only the subspecies *L. h. hesperus* in the eastern deciduous forests and *L. h. amorphae* in the prairies. This is similar to Remington's zone G, but he suggested this as a contact zone between Appalachian and Ozark/Ouachita forest taxa rather than deciduous forest and prairie taxa.

Zone 5 is similar to zone 4 and involves only the widely distributed subspecies L. i. instabilis, and L. i. rubella restricted to the southern Appalachians and possibly the Coastal Plain. L. chandleri is similar in that it also exhibits this southeastern distribution. This zone may correspond to the southeastern extension of Remington's zone 1.

Zone 6 separates the subspecies L. u. ute in the Rocky Mountains of Colorado and New Mexico and the Mogollon Plateau of Arizona from L. u. becki in the Wasatch Mountains in Utah, and smaller ranges in southeast Nevada and northwest Arizona. This zone was not recognized by either Noonan or Remington.

Zone 7 corresponds to the Central Texas Suture Zone (3) of Remington and the southern part of Noonan's zone 1. This zone reflects the Lopidea species endemic to the Edwards Plateau area (see Speciation section). Remington (1968) reviewed many of the examples of endemicity for this area and the proposed explanations. This area has also clearly been important in producing the present biogeographic patterns seen in Lopidea.

Recognition of these zones of disjunction are obviously limited by the resolution of distributional information for the species involved. I have illustrated these examples, however, in hope that it will elicit more detailed studies of the taxa involved in these areas and future workers might use these as a comparison for sister taxa of other Heteroptera, particularly mirids. Recognition of congruent zones of disjunction among this group of insects, would improve our predictive abilities and greatly increase our understanding of their evolution.

I have not attempted to analyze the distributions of Lopidea species in the strict terms of vicariance biogeography as proposed by Platnick and Nelson (1978) and Nelson and Platnick (1981). This method seeks to demonstrate the hierarchy of geographic areas by finding congruence among the species relationships and distributions of organisms. Although hierarchical relationships among areas occupied by Lopidea species are discernible, the results are conflicting. For example, three areas of endemism are evident in both the media group and the "minor group", 1) eastern North America, 2) western North America, and 3) southcentral Texas (figs. IV.4, IV.6). In the media group, southcentral Texas is the sister area of western North America whereas in the "minor group" southcentral Texas and eastern North America are sister groups (figs. IV.2, IV.3). Noonan (1988) also found a disorderly pattern of vicariance among other groups of North American insects and discussed the applicability of current cladistic biogeographic methods to most insects.

HOST PLANTS

Almost half (23 species) of all North American species of Lopidea are known to, or strongly suspected of, breeding on legumes (Asquith, 1990b). Smaller numbers of species are known to breed on composites (6 species), deciduous trees (5 species) and the family Polemoniaceae (4 species). This pattern is in sharp contrast to the host associations of related genera. Although the genera Pseudopsallus (Stonedahl and Schwartz, 1986) and Oaxacocoris (Schwartz and Stonedahl, 1987) have individual species that probably breed on legumes, most species of Ilnacora, Ilnacorella, Melanotrichus and Brooksetta feed on composites and the

Chenopodiaceae (Knight, 1963; Kelton, 1979; 1980). Many species of eastern North American *Orthotylus* also feed on deciduous trees, but the relation of *Orthotylus* to *Lopidea* is ambiguous. *Lopidea* appears to be the only genus among its relatives to have radiations on legumes and deciduous trees as host plants.

Because we have confident host plant associations for the majority of North American *Lopidea* species, and I have provided a cladistically derived hypothesis of species relationships, we can now begin to posit the evolution of host plant affinities within this genus. All species of the proposed sister group of *Lopidea*, *Ilnacora*, appear to breed on composites. If we propose that breeding on composites is also the primitive condition in *Lopidea*, then the history of major host plant switches in the genus probably resembles the pattern shown in figure IV.12a. In this hypothesis, composite breeding has been retained only in the *media* group (fig. IV.13) and the majority of unresolved species arising from near the base of the cladogram in figure IV.1. Legume breeding then evolved three times, once in the lineage leading to *hesperus* and *chandleri*, again in *erimata*, and again before the separation of the *davisi* and *robiniae* groups. Additional radiations occurred in the *heidemanni* group on deciduous trees, and in the "*minor* group" on to the family Polemoniaceae. As I pointed out earlier, however, the placement of the clade containing *hesperus* at the base of the cladogram is tenuous. If this clade is placed at the bifurcation of the *davisi* and *robiniae* groups, then legume breeding arose only twice, one time in the lineage leading to the groups just mentioned and again in *erimata*.

Alternatively, if we propose that legume breeding arose concurrently with the morphological evolution of the genus *Lopidea*, then composite breeding rather than legume breeding arose twice (fig. IV.12b). I favor the first scenario because of the preponderance of composite breeding in related genera, and the more primitive species of Lopidea feed predominately on composites and only one of these species, erimata, has switched to legumes.

Thus, there have been relatively few major host plant switches (different plant families) in Lopidea and related species tend to breed on related plants. A few examples do deviate from this pattern, however. Lopidea garryae breeds exclusively on the genus Garrya in the family Cornaceae and anisacanthi breeds only on Anisacanthus (Acanthaceae) (fig. IV.13).

COLOR PATTERNS

The bright red or yellow coloration appears to be a synapomorphy for Lopidea (Asquith, 1990b). All related genera have predominately green, pale or pale yellow species. Several species of Lopidea, however, have lost the bright coloration. Lopidea picta varies from solid black to entirely pale; nichollela, although occasionally red, is more often pale; bonanza is light green; and anisacanthi and bullata are often pale or greyish green. This loss of bright color has evolved independently several times, because these species belong to different clades, and their closest relatives are always brightly colored (figs. IV.1, IV.13).

As in other groups of insects (Brower, 1958; Turner, 1977), the bright coloration of Lopidea probably serves as a warning, announcing their distastefulness. McClain (1984) demonstrated that Lopidea instabilis is distasteful to the iguanine lizard Anolis, and that instabilis contains alkaloids similar to those in its host plants. McIver and Lattin (1990) also present evidence for aposematism in Lopidea nigridia Uhler. This species is more highly aggregated than other syntopic mirid species (McIver and

Asquith, 1989), and it is distasteful to some visually oriented arthropod predators (McIver and Lattin, 1990). These examples are further supported by the fact that at least one of the species that has lost the bright coloration (picta) is clearly palatable to arthropod predators (J. McIver, pers. comm.).

Among the brightly colored species, there are four recognizable patterns. 1) Predominately yellow, 2) predominately red, 3) red with pale lateral margins and cuneus, and 4) predominately dark fuscous with pale lateral margins. The yellow pattern occurs in relatively few species (ampla, staphyleae, incurva and lathyri). Several species are polymorphic for different color patterns (red vs. yellow in staphyleae) or the color patterns vary geographically. In at least one species, nigridia, all three of the non-yellow patterns are present, often as distinct geographic races (Asquith, 1990a).

I observed that the distributions of the different color forms did not appear to be random. The occurrence of mimicry systems involving aposematic insects like Lopidea are well known (Rettenmeyer, 1970; Waldbauer and Sheldon, 1971; Heal, 1981; Silberglied and Eisner, 1969; Owen, 1970; Turner, 1976), and often predators detect subtle differences in patterns between models and mimics (Brower et al., 1971; Rothschild, 1972). In order to advance the hypothesis that the distributions of the color forms of Lopidea might be due, in part, to mimicry, I tested the observed distributions of the different color forms against a random pattern.

Before proposing any selection as influencing a recognized pattern, we must first exclude the possibility of historical constraints. For example, if one species group occurs only in the Southwest, and this group displays only the red color pattern, then any preponderance of red forms in this area may be due largely to the phylogenetic constraints of that one species group. In Table IV.7 I have listed the number of species in each group that display each of the three color forms. In this analysis, I will not be concerned with the yellow color form because of its low frequency of occurrence. Each group has at least one species that displays each of the remaining color forms, with only two exceptions. The _media_ group does not display the fuscous-pale pattern, and the _robiniae_ group does not display the fuscous-pale pattern. Because of the constraints shown by these two groups, I have combined the red-pale and the fuscous-pale categories as one "contrasting" color pattern. By doing this, we can then make the assumption that all species groups have had the ability to produce both red and "contrasting" color forms.

I then compared the number of red and "contrasting" forms in two regions, 1) Eastern North America, including the Rocky Mountains, and 2) the Great Basin and Southwest, including southern California (Table IV.8). Very clearly, more red forms occur in eastern North America, and more "contrasting" forms occur in the west than would be expected by chance ($X^2 = 18.5$, $P < 0.001$, $N = 40$). This pattern is seen at three taxonomic levels. 1) More red species occur in the East (e.g. _teton_ and _davisi_) and more "contrasting" species occur in the West (e.g. _scutata_ and _ute_). 2) In _Lopidea nigridia_, one subspecies displays a fuscous-pale color pattern and is found predominately in the Great Basin area and another solid red subspecies occurs along the eastern slopes of the Rocky Mountains (Asquith, 1990a). 3) Several widely distributed species display the red pattern in the Rockies or eastern North America and the contrasting pattern in the Great Basin or Southwest (e.g. _media_, confraterna, and balli).

These patterns suggest that Lopidea may be an example of a large scale mimicry system, and would repay closer study. For example, of the three species that have been demonstrated to be distasteful thus far, instabilis (McClain, 1984), nigridia (McIver and Lattin, 1990) and marginata (McIver, pers. comm) only two, nigridia and marginata, are sympatric, and the color forms of these two species covary geographically, with the contrasting forms increasing in frequency in southern California (Asquith, 1990a; 1990b). Examination of species in related genera, more Lopidea species in different species groups, and more detailed studies of the frequencies of color forms and predator complexes in different areas would be fruitful in further illustrating evolutionary patterns in Lopidea.

TABLE IV.1. Descriptions of characters and character states used in the phylogenetic analysis of North American Lopidea species.

VESICA:

0) 0 - Basal process of dorsal spicula well developed.
   1 - Basal process vestigial or absent.
1) 0 - Dorsal spicula straight or weakly curved.
   1 - Dorsal spicula strongly curved.
2) 0 - Ventral spicula linear, not bifurcate.
   1 - Ventral spicula bifurcate.
3) 0 - If ventral spicula bifurcate, secondary arm long, at least half the length of primary arm.
   1 - Secondary arm short, less than half length of primary arm.

LEFT PARAMERE:

4) 0 - Left paramere flat and broad in vertical plane.
   1 - Left paramere narrowed and elongate.
5) 0 - Medial flange of left paramere situated medial of lateral flange.
   1 - Medial flange situated dorsal of lateral flange.
6) 0 - Angle of left paramere flat or only weakly expanded dorsally.
   1 - Angle of left paramere strongly produced as a spine -like process.

RIGHT PARAMERE:

7) 0 - Right paramere elongate, length greater than 3 times its middorsal height.
   1 - Right paramere short, roughly rectangular; length less than 3 times its middorsal height.
8) 0 - Right paramere elongate, length greater than 3 times its middorsal height.
   1 - Right paramere distinctly L-shaped or C-shaped.
9) 0 - Ventral arm flattened or narrowly rounded.
   1 - Ventral arm thickly rounded, as in hesperus.
10) 0 - Medial flange absent.
    1 - Medial flange if present, an elongate ridge.
11) 0 - Medial flange absent.
    1 - Medial flange if present, a narrow, erect process.
12) 0 - Dorsal flange expanded as long, erect process.
    1 - Dorsal flange present as a short, elevate process.
    2 - Dorsal flange present as short series of teeth or a single tooth.
13) 0 - Basal arm elongate, longer than middorsal height of paramere.
    1 - Basal arm shorter, less than middorsal height of paramere, or absent.
14) 0 - If paramere rectangular, dorsoapical angle not expanded.

TABLE IV.1 cont.

1 - If paramere rectangular, dorsoapical angle expanded as a vertical process.
2 - Vertical process weakly to strongly reflexed basally.

15) 0 - If paramere elongate, apex not curved dorsally.
1 - If paramere elongate, apex distinctly curved dorsally.

16) 0 - If paramere C-shaped, ventral arm flattened vertically, dorsal margin serrate to crenulate.
1 - If paramere C-shaped, ventral arm cylindrical, dorsal margin entire.

17) 0 - If paramere C-shaped, dorsal arm straight, vertical.
1 - Dorsal arm curved, at least apically.

18) 0 - If paramere C-shaped, ventral arm present.
1 - If paramere C-shaped, ventral arm vestigial or absent.

GENITAL CAPSULE:

19) 0 - Sensory lobe absent.
1 - Sensory lobe weakly developed.
2 - Sensory distinct as cylindrical process.

20) 0 - Tergal process long, slender and tapered.
1 - Tergal process long, apex blunt, as in <u>media</u>.

21) 0 - Tergal process long, slender and tapered.
1 - Tergal process flattened and broad vertically.

22) 0 - Tergal process long, slender and tapered.
1 - Tergal process short.

23) 0 - Tergal process long, slender and tapered.
1 - Tergal process extremely short, abruptly narrowed, as in <u>heidemanni</u>.

24) 0 - If tergal process short, apex pointed.
1 - If tergal process short, apex blunt.

25) 0 - Dorsal margin of tergal process smooth, at least not crenulate.
1 - Dorsal margin of tergal process minutely crenulate.

ANTENNAE:

26) 0 - Female antennae slender and cylindrical.
1 - Female antennae at least weakly fusiform.

SETAE:

27) 0 - Simple setae long, erect.
1 - Simple setae short, inclined.

TABLE IV.2. Character matrix for 48 species of *Lopidea* analyzed on HENNIG86.

SPECIES	VESICA	LEFT PARAMERE	RIGHT PARAMERE	GENITAL CAPSULE	ANTENNAE	SETAE
HYPO	0000	000	000000000000	0000000	0	0
ampla	101-	010	10010110----	00000-0	1	0
anisacanthi	1001	000	10010112----	0001010	0	1
apache	0000	000	0000110-1---	0001100	0	1
arizonae	101-	010	10010210----	0001000	0	1
balli	0000	110	01000-1--010	00100-0	1	1
barberi	0100	000	0000110-0---	1001000	0	1
bifurca	1001	000	01000-1--010	20000-0	0	1
bonanza	101-	000	10010110----	0001000	0	1
bullata	101-	000	0000110-0---	1001000	0	0
caesar	1000	110	01000-1--000	20100-0	1	1
chandleri	1001	001	0010101-1---	20100-0	1	1
confluenta	1001	000	10010111----	10000-0	0	1
confraterna	0001	001	0001020-1---	01000-0	0	1
cuneata	001-	000	0001020-1---	0001100	0	1
dakota	0000	110	01000-1---11	10100-0	1	0
davisi	101-	000	10010111----	0001011	0	1
erimata	1001	000	0000120-0---	1001000	0	0
falcata	0100	000	00001---0---	1001000	0	1
falcicula	1000	110	01000-1--110	10100-0	1	1
fuscosa	001-	000	0000110-1---	0001000	0	1
gainesi	101-	000	10010110----	0001011	0	0
garryae	1001	000	10010111----	2001010	0	1
heidemanni	0000	000	0001020-1---	1001100	0	1
hesperus	0000	000	0010101-0---	20110-0	1	1
incurva	101-	110	01000-1--000	0010000	0	1
instabilis	0001	110	01000-1--111	10100-0	1	1
intermedia	0101	001	0000120-1---	01000-0	0	1
lateralis	0100	000	0000110-0---	2001000	0	1
lathyri	1000	110	01000-1--000	00100-0	0	1
major	0000	000	0000100-1---	00000-0	1	1
marginata	101-	000	10010110----	10000-0	0	1
media	0101	000	0000110-1---	01000-0	0	1
minima	0000	000	10010-10----	0001010	0	1
minor	101-	000	10010110----	1001011	0	0
nicholella	101-	000	10010210----	0000011	0	0
nigridia	101-	000	10010211----	10000-0	0	0
picta	101-	000	0000121-0---	1001000	0	0
ptelae	0000	000	0000110-1---	0001110	0	1

TABLE IV.2 cont.

puella	011-	000	10011110----	00000-0	0	0
robiniae	1000	110	01000-1--010	10100-0	0	1
salicis	001-	000	0000120-1---	2001110	0	1
sayi	1000	000	10010112----	0010010	0	1
scutata	0000	000	0000100-0---	00000-0	0	1
staphyleae	101-	010	01000-1--010	0001000	0	1
taurina	1000	110	01000-1--110	00100-0	1	1
teton	1000	000	10010110----	2001010	1	0
ute	1001	011	10010212----	1001000	0	1
wileyae	001-	000	0000120-0---	1001100	0	1

TABLE IV.3. Species groups of North American *Lopidea* identified by a phylogenetic analysis (fig. IV.6) using characters given in Table IV.1.
(*L.* *staphyleae* and *wileyae* are marked by asterisks to indicate their provisional placements in their respective groups (See text for details).

SPECIES GROUPS					
media	*robiniae*		*heidemanni*	*davisi*	
	robiniae	*instabilis*		*minor*	*others*
media	*balli*	*instabilis*	*heidemanni*	*davisi*	*ampla*
confraterna	*lathyri*	*dakota*	*cuneata*	*minor*	*minima*
intermedia	*incurva*	*falcicula*	*salicis*	*gainesi*	*puella*
	robiniae	*taurina*	*pteleae*	*nicholella*	*confluenta*
	caesar		*wileyae* *		*bifurca*
	staphyleae *				*garryae*
					ute
					sayi
					davisi
					arizonae
					bonanza
					gainesi
					minor
					teton
					marginata
					nigridia
					anisacanthi

Table IV.4. Data and interpretation of speciation events in five species groups of *Lopidea*.

Sister Elements	Distributional Areas (km2)	Separation (km)	Overlap	Speciation Level	Mode
		media group			
(1)(2)	1604977:2011	C	<1%	1	II
(1-2)(3)	1606988:3193865	C	17%	2	I
		heidemanni group			
(1)(2)	2501995:599353	C	98%	1	S
(1-2)(3)	2513995:1246975	C	97%	2	S
(1-3)(4)	2589415:32180	150		3	II?
(1-3)(5)	2589415:56315	400		3	II?
		"*minor* group"			
(1)(2)	3973812:257440	300		1	I
(1-2)(3)	4231252:474655	60		2	I
(1-3)(4)	4705907:394205	C	98%	3	S?
		"*instabilis* group"			
(1)(2)	2429590:3946023	C	20%	1	I
(3)(4)	136765:378115	390		1	I
(1-2)(3-4)	5221145:514880	C	7%	2	I
		"*robiniae* group"			
(1)(2)	1604977:909085	C	98%	1	S
(1-2)(3)	1655258:1055978	C	5%	2	I
(1-3)(4)	1790819:1383740	C	96%	3	S?
(1-4)(5)	1917801:888972	C	4%	4	I

Table IV.5. Summary of hypotheses of speciation events in five *Lopidea* species groups.

Group	N	Mode of Speciation Vicariant	Peripheral	Sympatric
"media"	2	1	1	0
"minor"	3	2	0	1?
"heidemanni"	4	0	2?	2
"robiniae"	4	2	0	2?
"instabilis"	3	3	0	0
Total	16	8 (50%)	3 (18.8%)	5 (31.3%)

Table IV.6. Zones of disjunction identified for sister species and subspecies of North American _Lopidea_. These zones are compared to those identified by Remington (1968) and Noonan (1988). _heidemanni_ refers to the three sympatric eastern species which includes _heidemanni_.

Zone	Sister Taxa	Remington's Zone	Noonan's Zone
1	_taurina_ - _falcicula_	B	-
2	_n_. _aculeata_ - _n_. _nigridia_ _t_. _taurina_ - _t_. _taurula_	6 (in part)	4
3	_b_. _balli_ - _b_. _chelifer_ _n_. _nigridia_ - _n_. _serica_ _taurina_/_falcicula_ - _dakota_/_instabilis_ _media_ - _confraterna_ _nicholella_ - _minor_ "_heidemanni_" - _apache_	4	2,4
4	_h_. _hesperus_ - _h_. _amorphae_	G	-
5	_i_. _instabilis_ - _i_. _rubella_	1	-
6	_u_. _ute_ - _u_. _becki_	-	-
7	_confraterna_ - _intermedia_ _minor_ - _gainesi_ "_heidemanni_" - _pteleae_	3	1

Table IV.7. Comparison of the number of species displaying one of three different dorsal color patterns in five species groups of Lopidea. The color pattern of some species vary geographically and these species were counted twice. The "other*" species group is a composite of all species not placed in one of the four monophyletic species groups.

Color	Species Groups				
	media	heidemanni	davisi	robiniae	others*
Red	3	5	10	7	3
Red/Pale	1	1	5	3	2
Fuscous/Pale	0	1	3	0	4

Table IV.8. Comparison of the number of species in two regions that display either a predominately red dorsal coloration or contrasting red/fuscous with pale lateral margins. The region Eastern US includes the Rocky Mountains, and the Southwest includes southern California.

Region	Color Pattern	
	Red	Red/Fuscous and White
Eastern US	19	2
Great Basin & Southwest	4	15

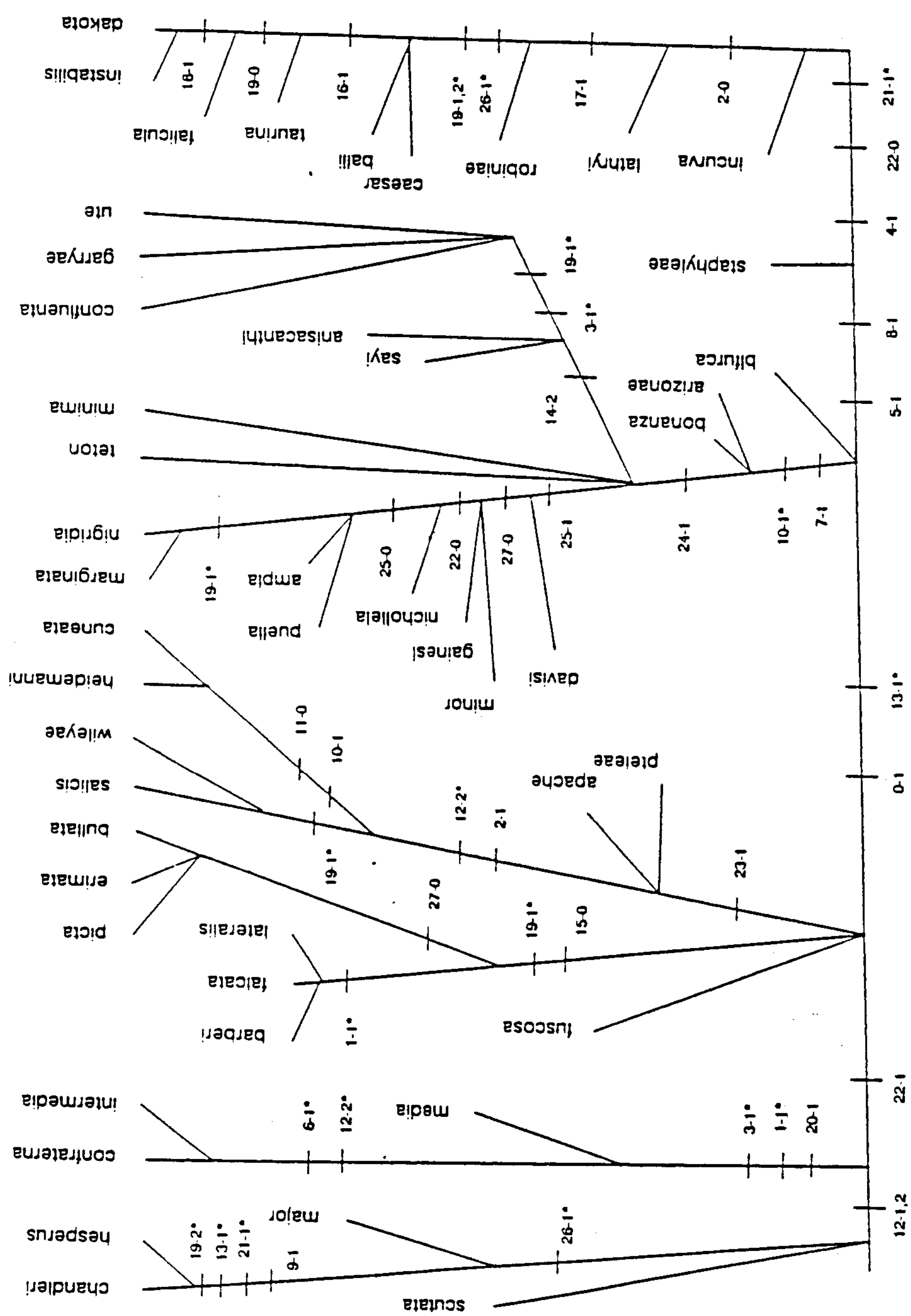


Figure IV.1. Cladogram for 48 species of North American Lopidea based on characters in Table IV.1. Numbers indicate characters and character states. Characters followed by an asterisk indicate homoplasies.

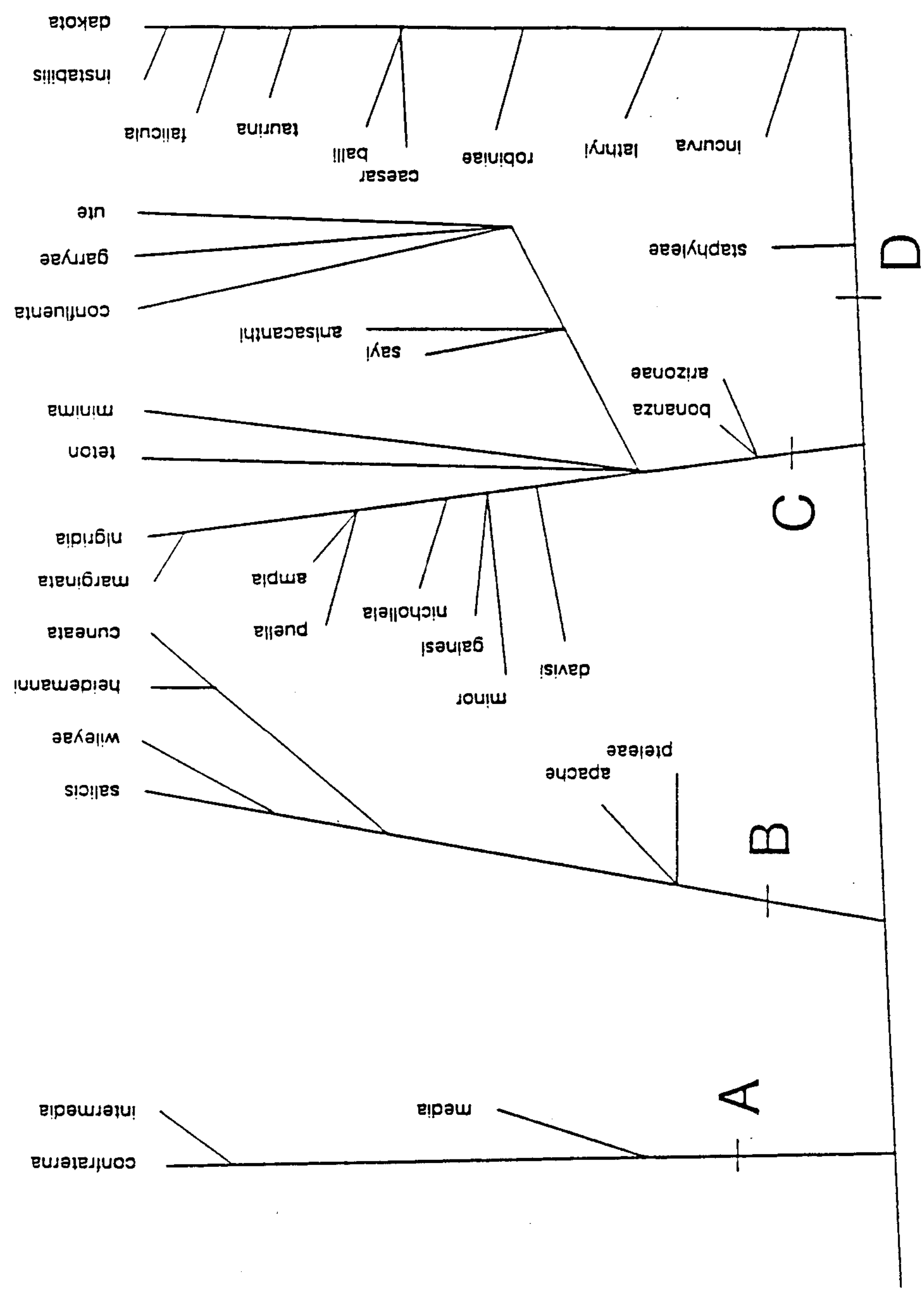


Figure IV.2. Partial cladogram derived from figure 1 showing monophyletic species groups. A = <u>media</u> group. B = <u>heidemanni</u> group. C = <u>davisi</u> group. D = <u>robiniae</u> group.

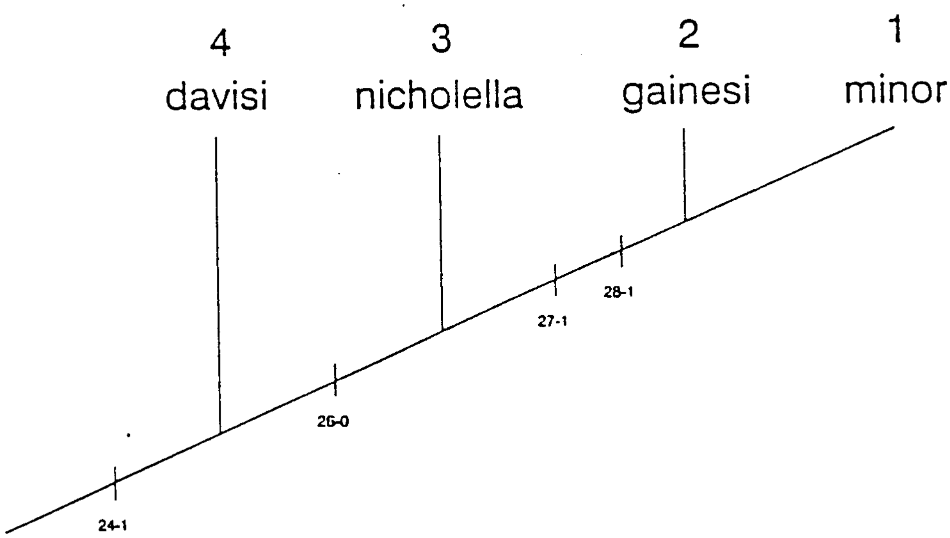


Figure IV.3. Cladogram showing species relationships and synapomorphies in the "minor group". Characters 27 and 28 are discussed in the text.

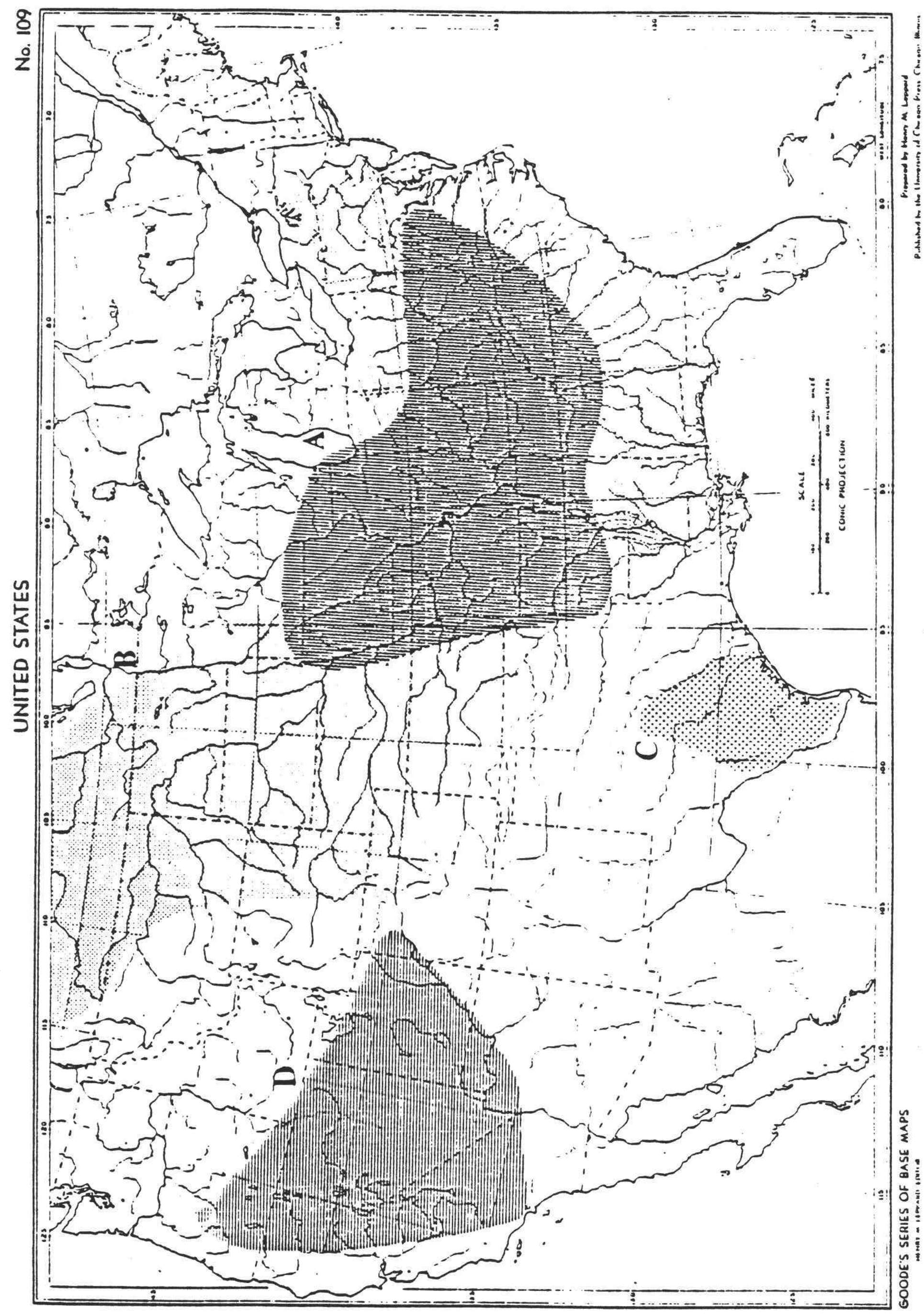


Figure IV.4. Distributions of Lopidea species in the "minor group." A = L. davisi. B = L. minor. C = L. gainesi. D = L. nicholella.

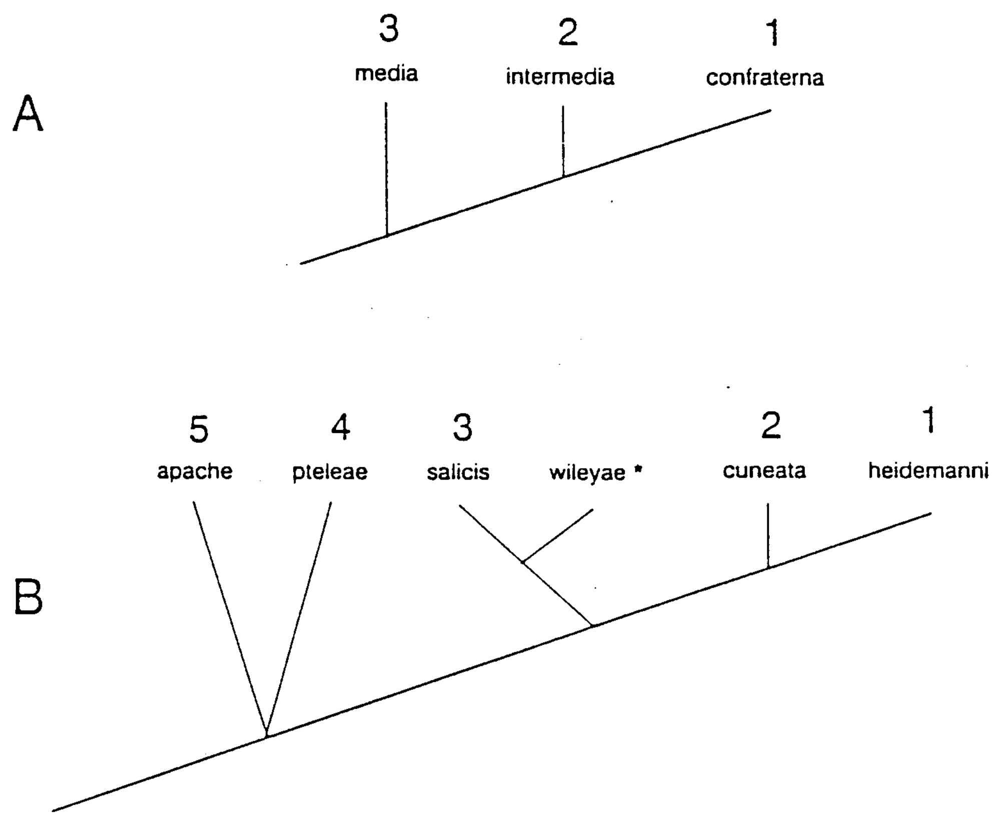


Figure IV.5. Cladograms depicting species relationships in the *media* group (A) and *heidemanni* group (B). The species *wileyae* is marked by an asterisk to indicate it provisional status in the *heidemanni* species group.

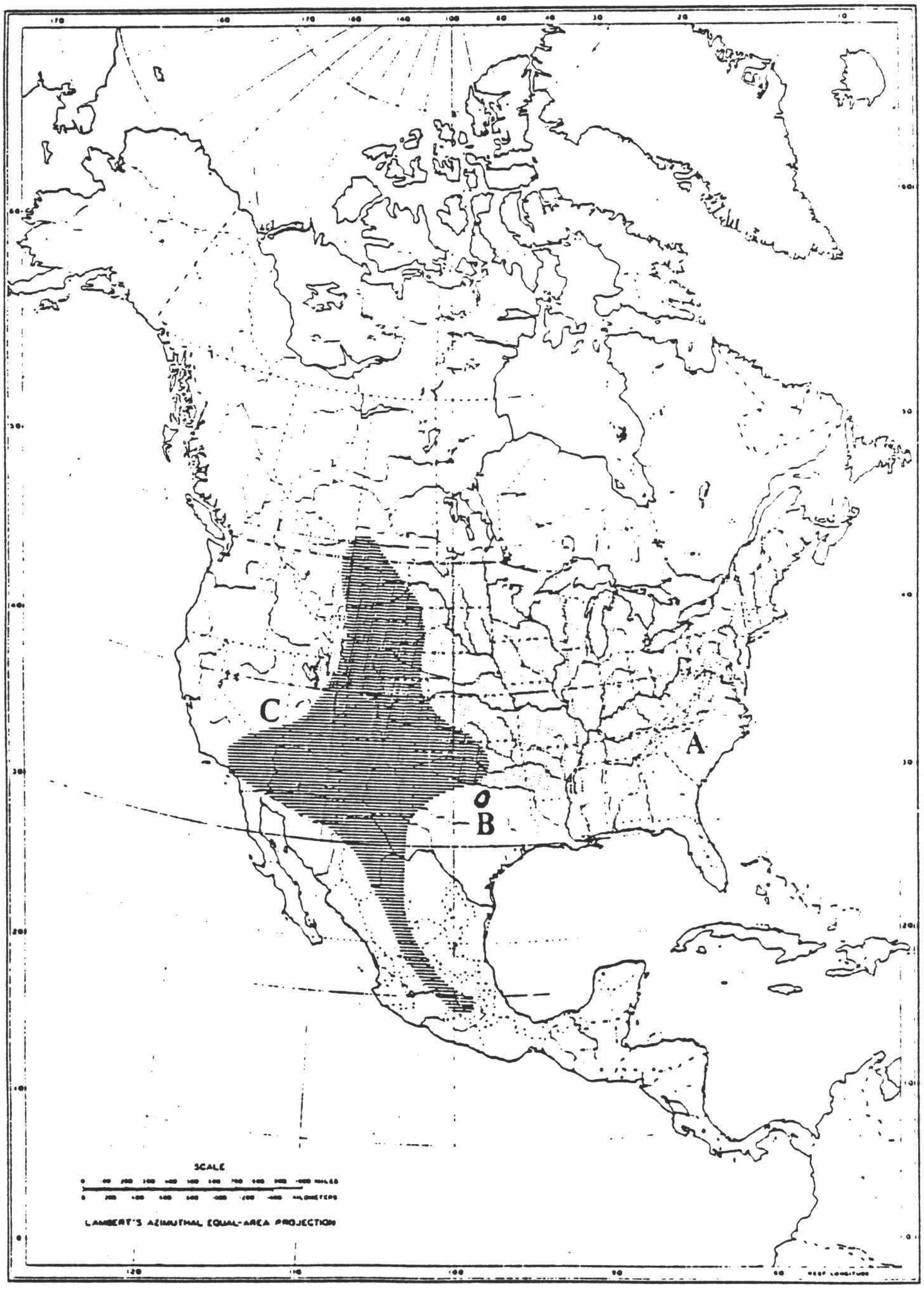


Figure IV.6. Distributions of Lopidea species in the media group. A = L. media. B = L. intermedia. C = L. confraterna.

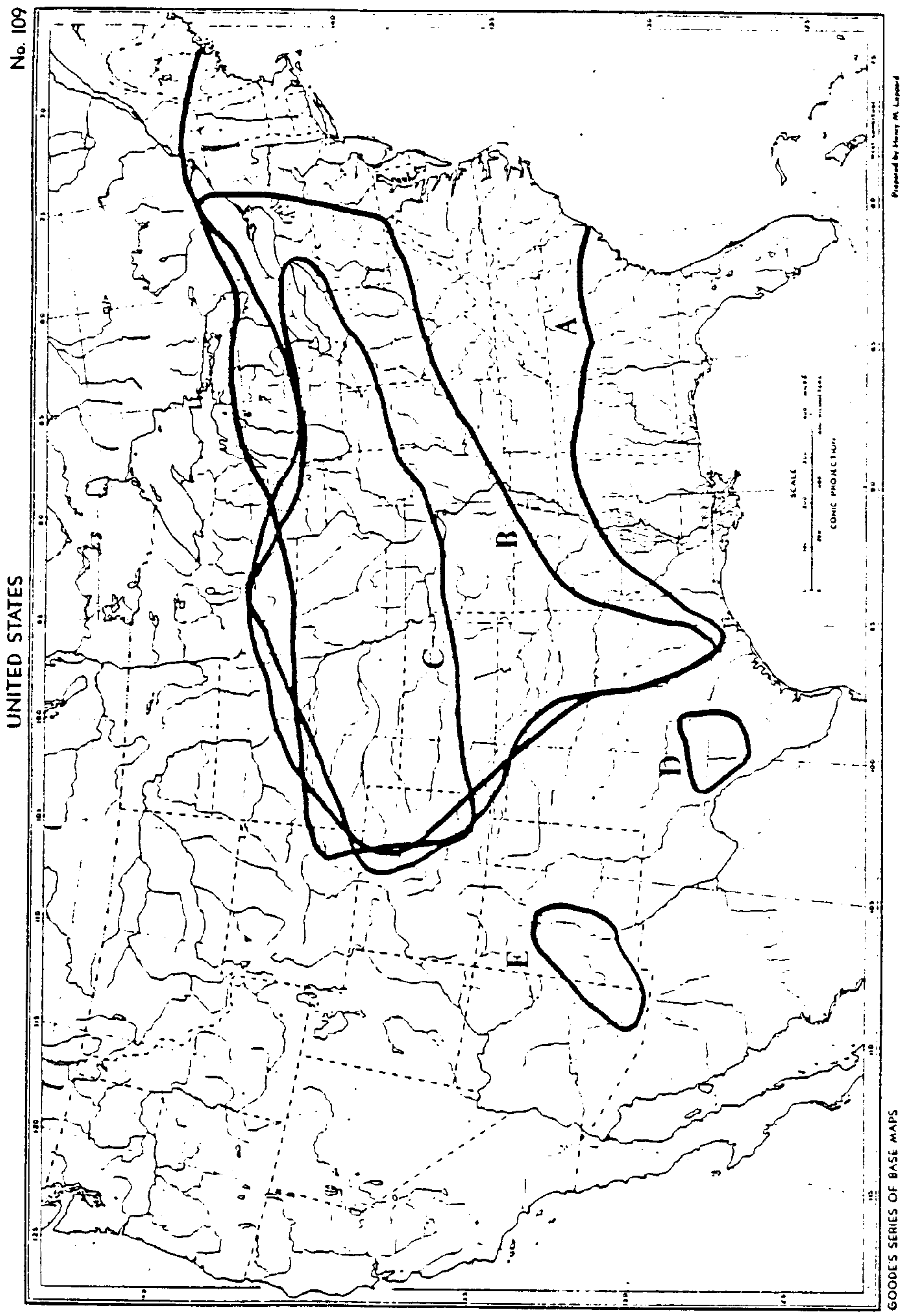


Figure IV.7. Distributions of Lopidea species in the heidemanni group. A = L. heidemanni. B = L. salicis. C = L. cuneata. D = L. pteleae. E = L. apache.

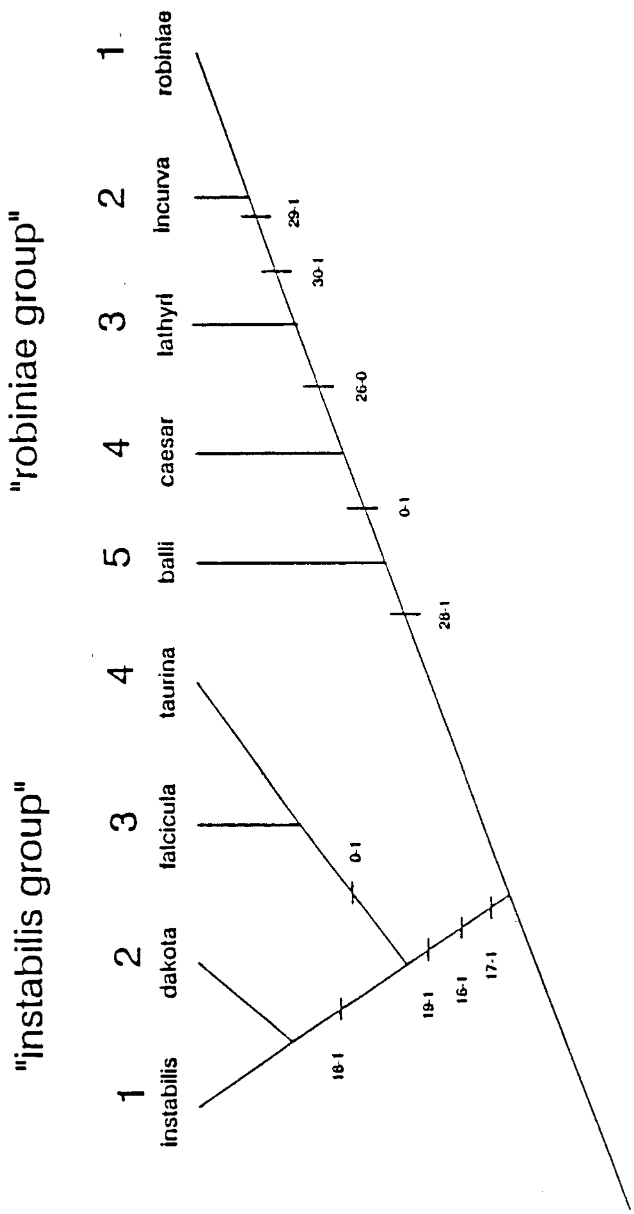


Figure IV.8. Cladogram depicting species relationships in the robiniae group (sensu strictu, see text) and the instabilis group. Characters 28-30 are discussed in the text.

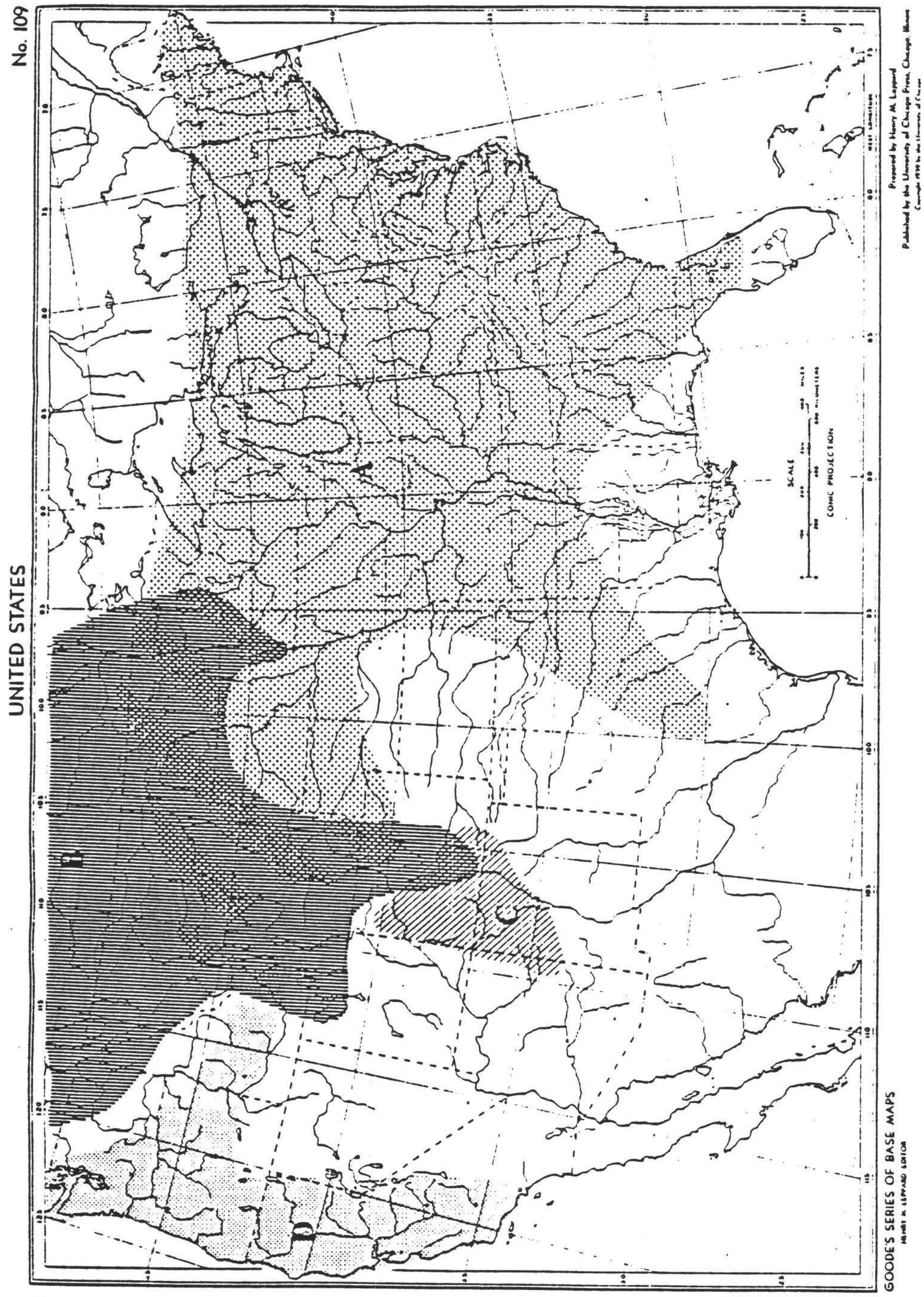


Figure IV.9. Distributions of Lopidea species in the instabilis group. A = L. instabilis. B = L. dakota. C = L. falcicula. D = L. taurina.

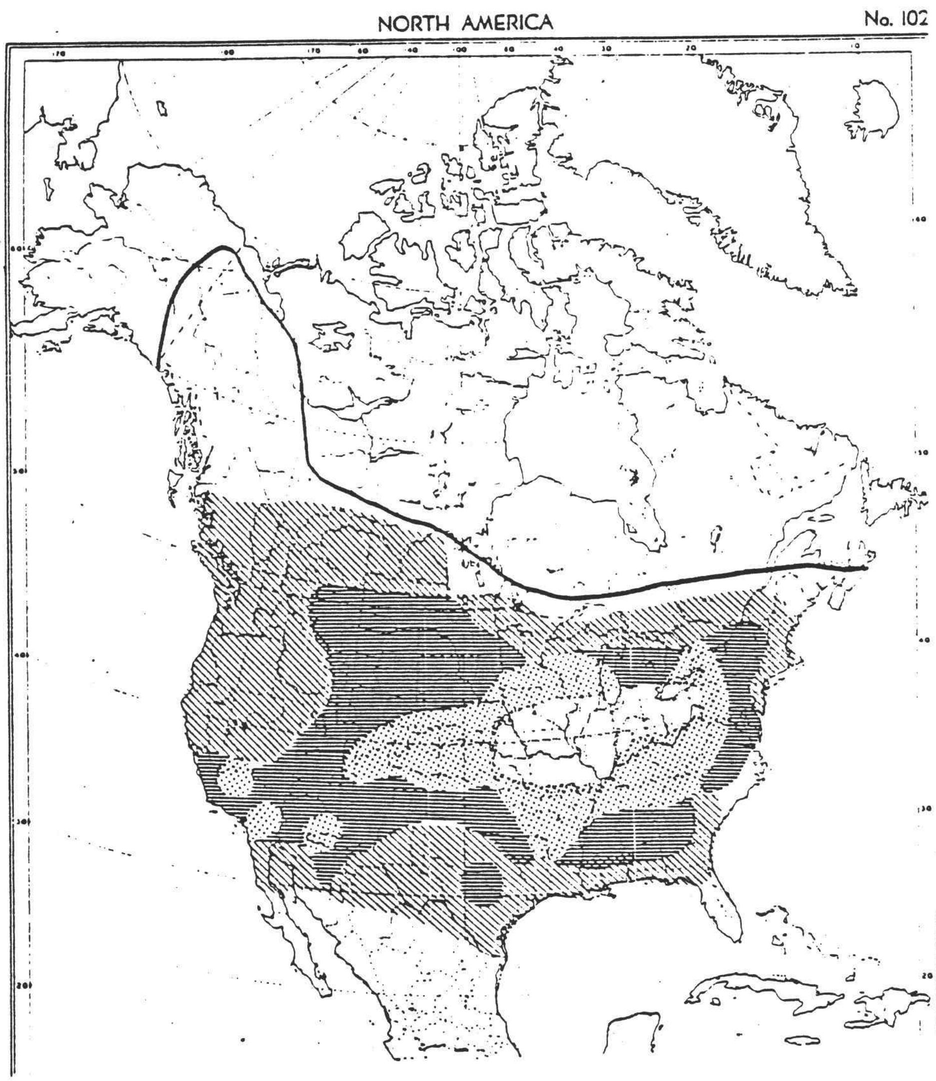


Figure IV.10. Map depicting species densities for Lopidea in North America. Small dots = $\geq$ 13 species. Large dots = 10-12 species. Horizontal lines = 7-9 species. Diagonal lines = 3-6 species. Solid line indicates northern limit of Lopidea species.

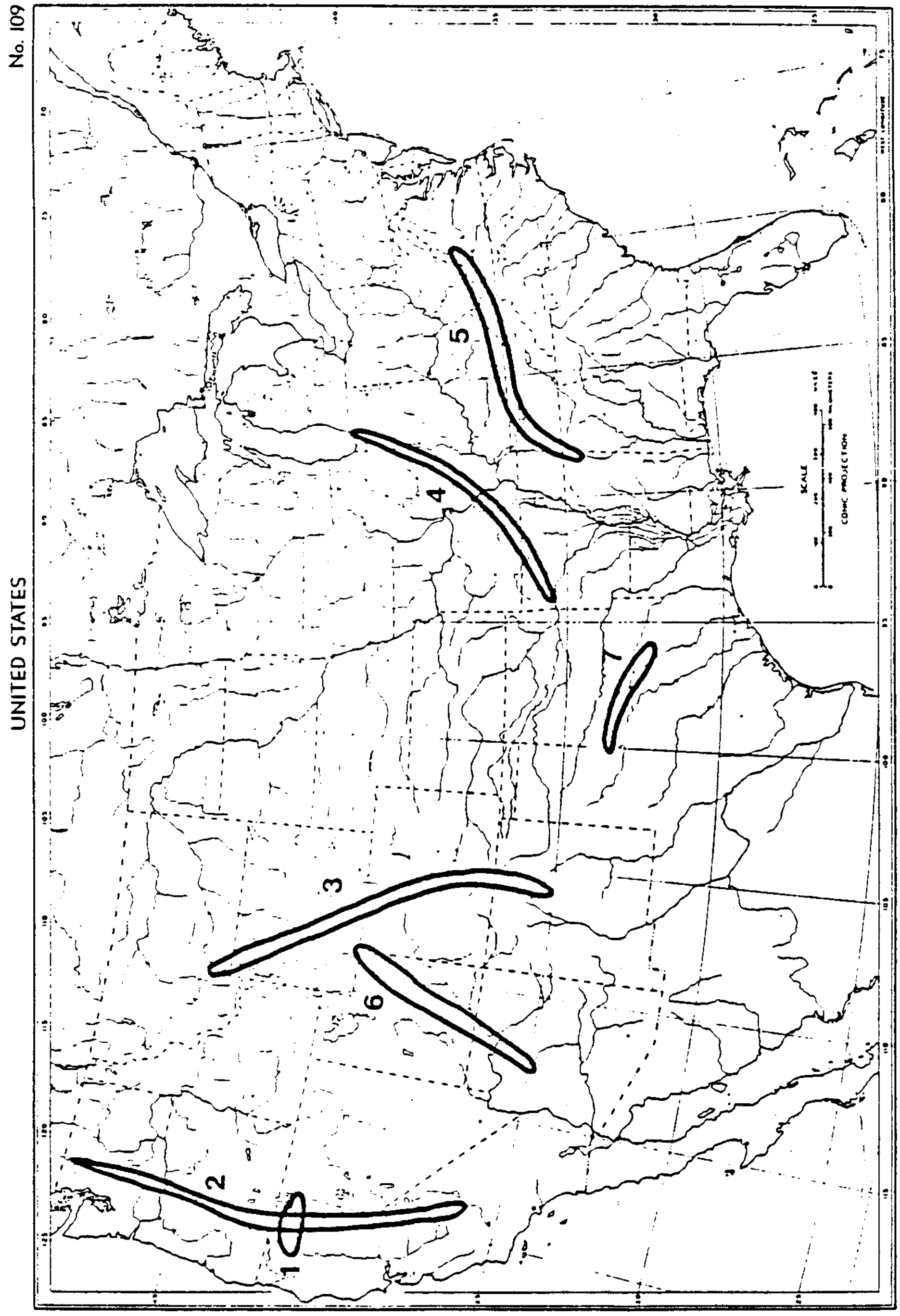


Figure IV.11. Six zones of disjunction based on subspecies and sister species of North American Lopidea. See text for discussion.

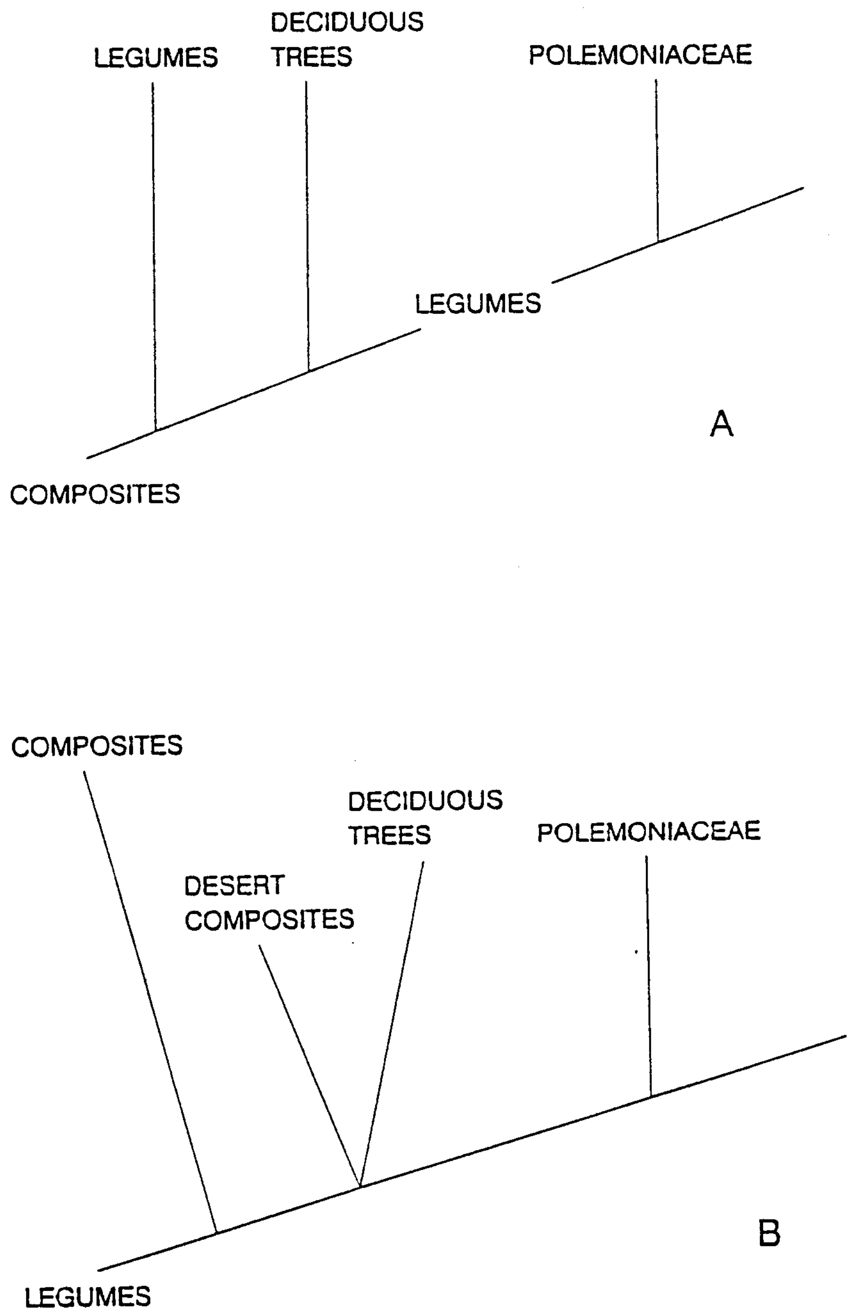


Figure IV.12. Hypotheses of host plant evolution in the genus Lopidea.

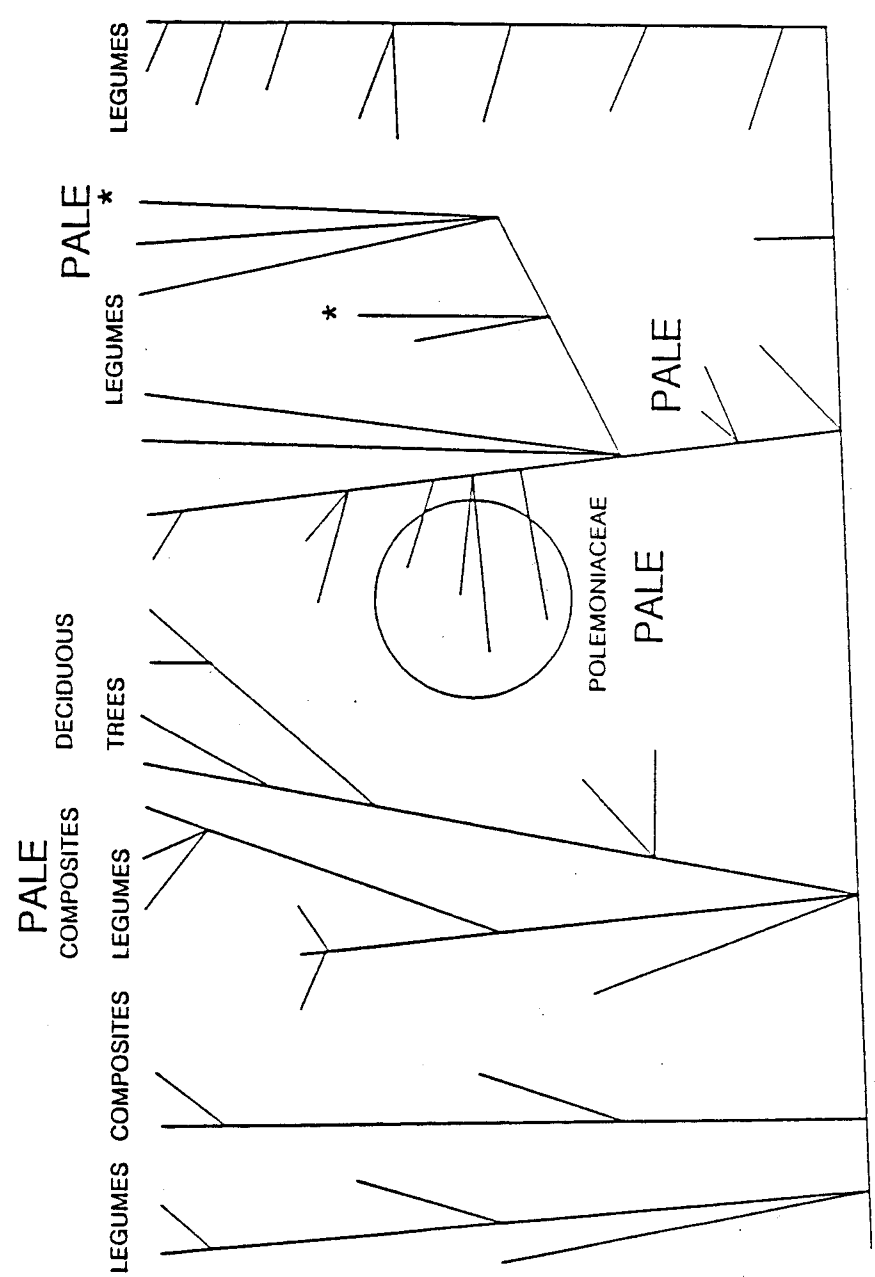


Figure IV.13. Distribution of host plants and pale colored species of Lopidea on cladogram represented in figure 1. Asterisks indicate unusual host plants. See text for discussion.

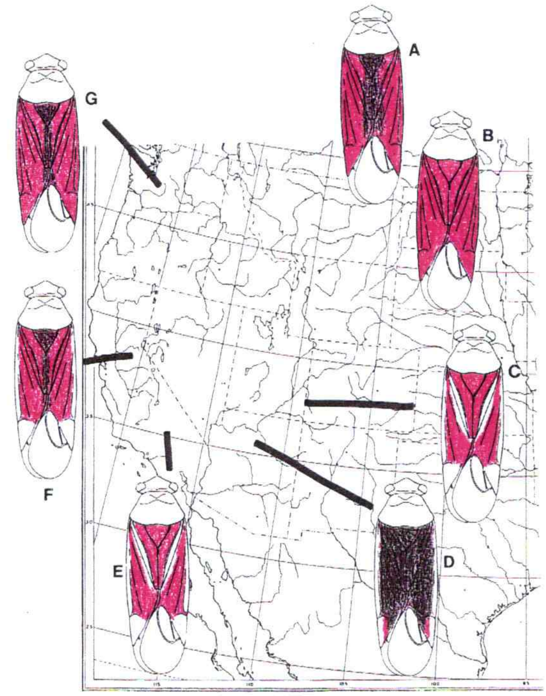


Figure IV.14. Several different color forms found in Lopidea and the areas in which they are found. A. L. teton found east of the Rockies. B = L. nigridia serica found east of the Rockies. C = L. balli chelifer in the southeastern Great Basin. D = L. lateralis in the mountains of the Southwest. E = L. marginata in southern California. F = L. nigridia aculeata in Sierra Nevada mountains of California. G = L. t. taurina in the Cascades of Oregon and Washington.

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